DEPARTMENT OF THE ARMY
BLUE GRASS ARMY DEPOT
431 BATTLEFIELD MEMORIAL HIGHWAY
RICHMOND, KENTUCKY40475-5060

24915-00-TKD-GGPT-20010

OPSEC Reviewed by RWR – No sensitive information was discovered

REPLY TO
ATTENTION OF:

February 20, 2014

Environmental Office

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

Commonwealth of Kentucky
Department for Environmental Protection
Division of Waste Management, Hazardous Waste Branch
ATTN: April J. Webb, P.E., Manager
200 Fair Oaks Lane, 2nd Floor
Frankfort, KY 40601

Subject: RCRA Research, Development & Demonstration Permit Revision 5

RE: RCRA RD&D Revision 5 Submission, 24915-000-GPE-GGPT-00001
Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP)
Blue Grass Army Depot, Richmond, Kentucky
EPA ID # KY8-213-820-105, AI 2805

Dear Mrs. Webb:

Attached is the RCRA RD&D Revision 5 submission. This submission is considered OPSEC sensitive and is being provided in hard copy for your review. Per our earlier discussions, this document is to be managed as Operations Security Sensitive due to the information contained within the document and is not for public release. A redacted version is also being submitted in both electronic and hard copy, which will be available for unrestricted release to the public. Bechtel Parsons Blue Grass appreciates your cooperation with this matter and looks forward to your comments on the document.

If you have any questions or require additional information, please do not hesitate to contact BGAD / BPBG Environmental Offices: Mr. Ramesh Melarkode at (859) 779-6268, or Mr. John McArthur at (859) 625-6447.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Sincerely,

Doug Omichinski
Project Manager
Bechtel Parsons Blue Grass
BGCAPP Operator

Lee G. Hudson
COL, LG
Commanding
BGCAPP Owner

Enclosure

Copies Furnished:

John McArthur, BPBG
Jeff Brubaker, PEO-ACWA
Amy McCracken, KDEP-DWM
Jeff Krejsa, PEO-ACWA
Ramesh Melarkode, BGAD

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Government Services Inc.

Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP)

Environmental Document

Research, Development, and Demonstration (RD&D) Permit Application

Contract W52P1J-09-C-0013
CDRL #A010

24915-000-GPE-GGPT-00001

This document did contain Operations Security (OPSEC) sensitive information. All OPSEC sensitive material has been removed. Information removed has been replaced with "(SENSITIVE INFORMATION REMOVED)" or the abbreviation "(SIR)." Persons with a need to know may apply to the Blue Grass Chemical Agent Destruction Pilot Plant Site Manager for release of sensitive information.

13 MAR 2014
Rev. 5 REWRITE
Final Page Is 181

prepared by
Bechtel Parsons Blue Grass Team (BPBGT)

prepared for
Program Executive Office –
Assembled Chemical Weapons Alternatives (PEO ACWA)

Rev.	Date	Issued for	Changes
5	13 MAR 2014	Approval	
4	JUN 2007	Use	

Approval:	**Date:**
Doug Omichinski, Project Manager	5-MAR-14
Rick Goetz, Deputy Project Manager	March 5, 2014

Blue Grass Chemical Agent-Destruction Pilot Plant
Resource Conservation and Recovery Act
Research Demonstration & Development Permit Application
Revision 5

Program Manager Assembled Chemical Weapons Alternatives

Blue Grass Chemical Agent-Destruction Pilot Plant

Submitted To:

Energy and Environment Cabinet

Kentucky Department for Environmental Protection

Division of Waste Management

200 Fair Oaks Lane, 2nd Floor

Frankfort, Kentucky 40601

Submitted By:

Blue Grass Army Depot

431 Battlefield Memorial Highway

Richmond, Kentucky 40475-5060

and

Bechtel Parsons Blue Grass

830 Eastern Bypass, Suite 106

Richmond, Kentucky 40475

VOLUME 1

Date: 13 MAR 2014

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Acronyms/Abbreviations

Acronym	Definition
ACS	agent collection system
ACWA	Assembled Chemical Weapons Alternatives
AEGL	Acute Exposure Guideline Level
AEL	airborne exposure limit
AFS	aluminum filtration system
ANS	agent neutralization system
AOC	Army Operations Center
APS	aluminum precipitation system
ARS	aluminum removal system
ASTM	ASTM International (formerly the American Society for Testing and Materials)
BGAD	Blue Grass Army Depot
BGCA	Blue Grass Chemical Activity
BGCAPP	Blue Grass Chemical Agent-Destruction Pilot Plant
BTRA	Bounding Transportation Risk Assessment
CCR	central control room
CCTV	closed-circuit television
CDC	Centers for Disease Control and Prevention
CHB	container handling building
CLA	chemical limited area
CMA	Chemical Materials Activity
CRM	contaminated rocket motor
CSB	control and support building
DAAMS	depot area air monitoring system
DE	destruction efficiency
decon	decontaminate
DoD	Department of Defense
DOT	Department of Transportation
DPE	demilitarization protective ensemble
DSA	demilitarization protective ensemble (DPE) support area
DSC	differential scanning calorimeter
EAR	Export Administration Regulation
EBH	energetics batch hydrolyzer
EC	emergency coordinator
ECF	entry control facility
ECR	explosive containment room
ECV	explosive containment vestibule

ENR	energetics neutralization reactor
ENS	energetics neutralization system
EOC	emergency operations center
EONC	enhanced on-site container
EPA	U.S. Environmental Protection Agency
FCC	facility construction certification
FCS	facility control system
FPS	facility protection system
GB	nerve agent sarin, isopropyl methyl phosphonofluoridate
GC-MSD/FPD	gas chromatograph – mass spectrography detector/flame photometric detector
GPL	general population limit
gpm	gallons per minute
H	blister agent mustard made by the Levinstein process, bis(2-chloroethyl) sulfide or 2,2'-dichlorodiethyl sulfide
HAZMAT	hazardous material
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	high-efficiency particulate air (filter)
HMRT	hazardous material (HAZMAT) response team
HPLC	high pressure liquid chromatograph
HSA	hydrolysate storage area
HVAC	heating, ventilating, and air-conditioning
HW	hazardous waste
HWMU	hazardous waste management unit
IBC	International Building Code
IC	Incident Commander
ICP	inductively coupled plasma
ICS	integrated control system
IMMS	instrument maintenance management system
IPA	isopropyl alcohol
ITAR	International Traffic in Arms Regulations
KAR	Kentucky Administrative Regulation
KDEP	Kentucky Department for Environmental Protection
KRS	Kentucky Revised Statute
MDB	munitions demilitarization building
MOA	memorandum of agreement
MPR	motor packing room
MPT	metal parts treater
MS	mass spectroscopy
MSD	mass spectrometer detector
MSDS	material safety data sheet

MSR	motor shipping room
MWS	munitions washout system
NCR	nose closure removal
NCRS	nose closure removal station
NRC	National Research Council
OJT	on-the-job training
OPSEC	operations security
OSHA	Occupational Safety & Health Administration
OTE	off-gas treatment (effluent) EBH/ENR system (EBH/HDC/ENS)
OTM	off-gas treatment system (MPT/ANS)
P&ID	piping and instrumentation diagram
PCB	polychlorinated biphenyl
PDCC	Project Document Control Center
P.E.	professional engineer
PFD	process flow diagram
PHS	projectile handling system
PMB	personnel and maintenance building
PMD	projectile/mortar disassembly
PPE	personal protective equipment
psi	pound per square inch
psia	pound per square inch, absolute
psig	pounds per square inch, gauge
PVDF	polyvinylidene fluoride
QA	quality assurance
QC	quality control
RCM	rocket cutting machine
RCRA	Resource Conservation and Recovery Act
RD&D	research, development, and demonstration
RDX	Research Department Explosive
RM	rocket motor
RO	reverse osmosis
RQ	reportable quantity
RSL	regional screening level
RSM	rocket shear machine
SCO	scene control officer
SCWO	supercritical water oxidation
SD	spent decon
SDG	standby diesel generator
SDS	spent decontaminant system
SFT	shipping and firing tube

SLHHRA	screening level human health risk assessment
SOP	standing operating procedure
SPB	supercritical water oxidation (SCWO) processing building
STA	supercritical water oxidation (SCWO) tank area
STEL	short-term exposure limit
SWMU	solid waste management unit
TAR	tank assessment report
TCLP	toxic characteristic leaching procedure
TMA	toxic maintenance area
TOC	total organic carbon
TOCDF	Tooele Chemical Agent Disposal Facility
TOX	thermal oxidizer
TRRP	technical risk reduction program
TSDF	treatment, storage, and disposal facility
TWA	time-weighted average
UN	United Nations
UNS	Unified Numbering System
UPA	unpack area
VSL	vapor screening level
VX	nerve agent, O-ethyl S-(2-diisopropylaminoethyl) methylphosphonothiolate
WPL	worker population limit
WRS	water recovery system
WSA	waste storage area
WTS	waste transfer station

Executive Summary

Updated RD&D Permit Application

This revision to the previously approved research, development, and demonstration (RD&D) permit application for the Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP) facility provides additional, updated information that has become available since approval of a previous version of this application. In addition, the format for this version of the permit application was updated to reflect and align with the eight topics that the U.S. Environmental Protection Agency (EPA) identifies for consideration when preparing a RD&D permit application.

Most of the updated information describes how the BGCAPP facility will be operated and includes a revised list of engineering drawings necessary to describe the BGCAPP operations. Several of the engineering drawings have been deemed operations security (OPSEC), International Traffic in Arms Regulations (ITAR), or Export Administration Regulation (EAR) sensitive due to the information contained on the drawings. Environmental regulatory personnel may obtain any sensitive engineering drawings for review at their convenience at the BGCAPP offices located at 830 Eastern Bypass, Suite 106, Richmond, KY 40475.

Please note that there are two Volumes of this application, this one, which is Volume 1 and a Volume 2, which contains the RCRA drawings that will be submitted in 2 separate phases. This drawing submission (Volume 2) should be considered Phase 1, with the Phase 2 submission coming in the first quarter 2014 and will contain the remainder of the drawings that require a PE stamp and have change documentation associated with them.

Purpose and Objectives of RD&D Program

Section 4-1 of the EPA's RD&D Guidance [EPA Guidance Manual for Research, Development, and Demonstration Permit Units Under 40 Code of Federal Regulations (CFR) Section 270-65, EPA/530-SW-86-008, July 1986], advises the applicant to consider eight topics when preparing the application. Table 1-1 lists the eight topics and cites the sections of the RD&D permit application where the topics are addressed. The RD&D program will include the processing of only the GB munitions in the Blue Grass Army Depot (BGAD) stockpile. The VX and H munitions, as well as any GB munitions not treated under the RD&D program will be processed under the Kentucky Hazardous Waste (KHW) Part B Permit.

The following subsections present additional details, including the justification for conducting the RD&D with hazardous waste, the measurements and observations used to determine success, safety and environmental considerations, and the success criteria that will be used to evaluate the results at each ramp-up rate.

Table 1-1 – Summary Table – Topics Recommended By EPA's Guidance Manual for RD&D Permit

Item[a]	Topic	Location in Permit Application
1	Purpose of Project	Provided in this Executive Summary (see above)
2	Minimum Quantities of Hazardous Waste Required to meet the RD&D Objectives	Table 2-1
3	Anticipated Environmental Releases	Section 6.2.1
4	Sampling and Analytical Procedures	Sections 1.0 and 3.0
5	Research Personnel Experience	Section 6.3 and Table 6-3
6	Emergency Response Procedures	Section 6.0
7	Facility Closure at Conclusion of Research	Section 7.0
8	Financial Responsibility for Closure	Section 8.0

[a] The section numbers correspond to the item numbers in the EPA's Guidance Manual for RD&D Permits

Updated Part A Form

The original and subsequent RD&D permit applications submitted by BGCAPP did include Part A forms, as does this revision. Please note the processes and processing rates included in this Part A form likely will change in the intervening years before BGCAPP waste processing actually begins and further updates to this form likely will be necessary.

Figure 1-A – Updated Part A of the Kentucky Hazardous Waste Application – BGCAPP Facility

Kentucky Energy and Environment Cabinet
Department for Environmental Protection
Division of Waste Management
200 Fair Oaks Line - Frankfort, Kentucky 40601

Part A of the Kentucky Hazardous Waste Permit Application

DO NOT WRITE IN THIS SPACE

Facility's EPA ID No.	K	Y	8	2	1	3	8	2	0	1	0	5

FOR OFFICIAL USE ONLY

☐ FIRST SUBMITTAL *(see INSTRUCTIONS)* ☒ REVISION ☐ RENEWAL PAGE 1 OF 14

Name of Facility: Blue Grass Chemical Agent Destruction Pilot Plant

1. Location of Facility: 431 Battlefield Memorial Highway

City: Richmond State: KY Zip Code: 40475-5001
County: Madison *See INSTRUCTIONS:* Latitude: 37º 42' 00" N Longitude: 84º 12' 30" W

2. Name of Land Owner: *See INSTRUCTIONS:* U.S. Department of the Army

Legal status of Land Owner: ☒ Federal (F) ☐ State (S) ☐County (C) ☐Indian (I)
☐ Municipal (M) ☐District (D) ☐Private (P)
☐ Other (O) specify: N/A
Land Owner's Mailing Address: 431 Battlefield Memorial Highway
City: Richmond State: KY Zip Code: 40475-5001
Facility Land Owner's Telephone Number: (859) 779-6246

3. Existing Facilities, provide the date operation began or construction commenced: 01/01/1941
(Month, Day, Year)

New Facilities, provide the date operation is expected to begin: N/A
(Month, Day, Year)

4. Facility Mailing Address: 431 Battlefield Memorial Highway

City: Richmond State: KY Zip Code: 40475-5001

5. Facility Contact Person: Ramesh Melarkode

Title: Environmental Manager Phone Number: (859) 779-6268
Facility Contact Person may be reached at ☐ Mailing Address ☒Location Address ☐ Other Specify: N/A
Street Address: 431 Battlefield Memorial Highway
City: Richmond State: KY Zip Code: 40475-5001

Facility's EPA ID Number											
K	Y	8	2	1	3	8	2	0	1	0	5

8. Name of Facility Operator: *See INSTRUCTIONS:* Bechtel Parsons Blue Grass

Type of Owner: ☒ Federal (F) ☐ State (S) ☐ County (C) ☐ Indian (I)
☐ Municipal (M) ☐ District (D) ☐ Private (P)
☐ Other (O) specify: N/A

Operator's Mailing Address: 830 Eastern By-Pass, Suite 106
City: Richmond State: KY Zip Code: 40475
Facility Operator's Telephone Number: (859) 625-1665

New Operator Assumed Responsibility for Facility on this Date: N/A

9. Name of Facility Owner: *See INSTRUCTIONS*: U.S. Department of the Army

Legal status of Land Owner: ☒ Federal (F) ☐State (S) ☐ County (C) ☐ Indian (I)
☐ Municipal (M) ☐ District (D) ☐ Private (P)
☐ Other (O) specify: N/A

Owner's Mailing Address: 431 Battlefield Memorial Highway
City: Richmond State: KY Zip Code: 40475-5001

Facility Owner's Telephone Number: (859) 779-6246

New Operator Assumed Responsibility for Facility on this Date: 01/01/1941
(Month, Day, Year)

10. SIC Codes: (1) 9711

Briefly describe the type of business conducted at this site: National Security (U.S. Army)

DEP-7058A (July 1997)

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11. PROCESS DESCRIPTION. *See Instructions*

Facility's EPA ID Number

K	Y	8	2	1	3	8	2	0	1	0	5

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	Container Handling Building (CHB)	PR	S01	9,500	G	1	UC	Store up to 53 EONCs, prior to movement into the MDB for processing. Further discussion is included on page 12 of this Part A.
4	Waste Storage Area (WSA) – Inside CLA	PR	S01	5,500	G	1	UC	Store various hazardous wastes inside the CLA prior to transfer to the Waste Transfer Station (WTS)
4	Waste Transfer Station (WTS) – Outside CLA	PR	S01	24,000	G	1	UC	Store various hazardous wastes outside of the CLA prior to transportation to final treatment/disposal facility
4	*Box Transfer Area, Room 1	PR	S01	1,500	G	1	UC	Store 8 boxes of 30 rocket motors per box
4	*Box Transfer Area, Room 2	PR	S01	1,500	G	1	UC	Store 8 boxes of 30 rocket motors per box
4	*Agent Neutralization System (ANS) Storage Area	PR	S01	2,750	G	1	UC	Store various secondary wastes as well as contingency storage for the SDS
4	*Tray/Container Transfer Room	PR	S01	550	G	1	UC	Store various secondary wastes
4	*Metal Parts Treater (MPT) Cooling Conveyor Storage Area	PR	S01	8,190	G	1	UC	Store up to one 20-cubic yard roll-off bin and various trays queued on conveyor
4	*Toxic Maintenance Area (TMA) Storage Area	PR	S01	5,500	G	1	UC	Store drums of various waste, contaminated equipment and/or leaking munitions

DEP - 7058A (July 1997)

*Unit(s) located in the MDB

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11. PROCESS DESCRIPTION. *See Instructions*

Facility's EPA ID Number

K	Y	8	2	1	3	8	2	0	1	0	5

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	*Explosive Containment Vestibule (ECV) Storage Area, ECV-1	PR	S01	275	G	1	UC	Store various process and secondary wastes
4	*Explosive Containment Vestibule (ECV) Storage Area, ECV-2	PR	S01	275	G	1	UC	Store various process and secondary wastes
4	*Unpack Area (UPA) No. 1, UPA-1	PR	S01	2,400	G	1	UC	Store munitions and various secondary wastes
4	*Unpack Area (UPA) No. 2, UPA-2	PR	S01	2,400	G	1	UC	Store munitions and various secondary wastes
4	*Motor Shipping Room (MSR) / Covered Loading Area	PR	S01	350	G	1	UC	Store up to 2 boxes of 30 rocket motors/box & 2 boxes of empty warhead shipping and firing tubes
4	*Motor Packing Room (MPR) Storage Area	PR	S01	350	G	1	UC	Store up to 2 boxes of 30 rocket motors/box & 2 boxes of empty warhead shipping and firing tubes
4	*Explosive Containment Room (ECR) Storage Area No. 1, ECR-1	PR	S01	55	G	1	UC	Store various secondary wastes
4	*Explosive Containment Room (ECR) Storage Area No. 2, ECR-2	PR	S01	55	G	1	UC	Store various secondary wastes

DEP - 7058A (July 1997)

*Unit(s) located in the MDB

11. PROCESS DESCRIPTION. *See Instructions*

Facility's EPA ID Number

K	Y	8	2	1	3	8	2	0	1	0	5

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	SCWO Processing Building (SPB) Storage Area	PR	S01	8,355	G	1	UC	Store AFS Filter Cake/Media and various secondary wastes in roll-off containers and drums
4	Hydrolysate Storage Area (HSA) Agent Hydrolysate Storage Tank – MT-HSS-0104	PR	S02	102,264	G	1	UC	Store agent hydrolysate prior to treatment in SPB
4	Hydrolysate Storage Area (HSA) Agent Hydrolysate Storage Tank – MT-HSS-0105	PR	S02	337,184	G	1	UC	Store agent hydrolysate prior to treatment in SPB
4	Hydrolysate Storage Area (HSA) Agent Hydrolysate Storage Tank – MT-HSS-0205	PR	S02	337,184	G	1	UC	Store agent hydrolysate prior to treatment in SPB
4	Hydrolysate Storage Area (HSA) Energetics Hydrolysate Storage Tank – MT-HSS-0604	PR	S02	313,433	G	1	UC	Store energetics hydrolysate prior to treatment in SPB
4	Hydrolysate Storage Area (HSA) Energetics Hydrolysate Storage Tank – MT-HSS-0704	PR	S02	313,433	G	1	UC	Store energetics hydrolysate prior to treatment in SPB
4	*Agent Holding Tank – MT-ACS-0105	PR	S02	1,451	G	1	UC	Stores drained agent prior treatment in the Agent Hydrolyzer(s)
4	*Agent Surge Tank – MT ACS-0106	PR	T01, S02	1,451	G	1	UC	Stores drained agent or agent spilled from the SDS prior to treatment in the Agent Hydrolyzer(s)

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*Unit(s) located in the MDB

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11. PROCESS DESCRIPTION. *See Instructions*

Facility's EPA ID Number

K	Y	8	2	1	3	8	2	0	1	0	5

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	*Agent Hydrolysate Sampling Tank – MT-ANS-0103	PR	S02	4,838	G	1	UC	Stores agent hydrolysate until sampling is performed, then releases cleared hydrolysate to the Agent Hydrolysate Storage Tank
4	*Agent Hydrolysate Sampling Tank – MT-ANS-0203	PR	S02	4,838	G	1	UC	Stores agent hydrolysate until sampling is performed, then releases cleared hydrolysate to the Agent Hydrolysate Storage Tank
4	*Agent Hydrolysate Sampling Tank – MT-ANS-0303	PR	S02	4,838	G	1	UC	Stores agent hydrolysate until sampling is performed, then released cleared hydrolysate to the Agent Hydrolysate Storage Tank
4	*Agent Neutralization Reactor – MV-ANS-0101	PR	T01	2,062	G	1	UC	Agent is neutralized before being sent to the Agent Hydrolysate Sampling Tank
4	*Agent Neutralization Reactor – MV-ANS-0201	PR	T01	2,062	G	1	UC	Agent is neutralized before being sent to the Agent Hydrolysate Sampling Tank
4	*Energetics Neutralization Reactor – MV-ENS-0101	PR	T01	3,070	G	1	UC	Energetics are neutralized before being released to the Energetics Hydrolysate Storage Tank
4	*Energetics Neutralization Reactor – MV-ENS-0102	PR	T01	3,070	G	1	UC	Energetics are neutralized before being released to the Energetics Hydrolysate Storage Tank
4	*Energetics Neutralization Reactor – MV-ENS-0103	PR	T01	3,070	G	1	UC	Energetics are neutralized before being released to the Energetics Hydrolysate Storage Tank
4	*Spent Decontamination System (SDS) Tank – MV-SDS-0101	PR	T01	7,735	G	1	UC	Spent decontamination solution from MDB sumps is collected and treated before being sampled and sent to the appropriate HSA tank

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11. PROCESS DESCRIPTION. *See Instructions*

Facility's EPA ID Number

K	Y	8	2	1	3	8	2	0	1	0	5

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	*Spent Decontamination System (SDS) Tank – MV-SDS-0201	PR	T01	7,735	G	1	UC	Spent decontamination solution from MDB sumps is collected and treated before being sampled and sent to the appropriate HSA tank
4	*Spent Decontamination System (SDS) Tank – MV-SDS-0301	PR	T01	7,735	G	1	UC	Agent wash water from the munitions washout process is collected and treated before being sent to the Agent Hydrolyzer(s)
4	*Hydrolysate Collection Tank – MT-EBH-1901	PR	S02	1,475	G	1	UC	Collects and stores hydrolysate generated in the EBHs before transferring hydrolysate to the ENRs for further treatment
4	*Energetics Batch Hydrolyzer (EBH) – MV-EBH-1101	PR	X99	2,651	J	1	UC	Receives sheared rocket warhead pieces and neutralizes energetics and residual agent
4	*Energetics Batch Hydrolyzer (EBH) – MV-EBH-1201	PR	X99	2,651	J	1	UC	Receives sheared rocket warhead pieces and neutralizes energetics and residual agent
4	*Energetics Batch Hydrolyzer (EBH) – MV-EBH-1301	PR	X99	2,651	J	1	UC	Receives sheared rocket warhead pieces and neutralizes energetics and residual agent
4	*Nose Closure Removal System (NCRS) – MY-NCR-0101	PR	X02	350	J	1	UC	Removes nose closures/lifting plugs from VX and GB projectiles
4	*Rocket Cutting Machine (RCM) Line 1 – MX-RHS-0113	PR	X02	1,140	J	1	UC	Separates rocket motors from rocket warheads
4	*Rocket Cutting Machine (RCM) Line 2 – MX-RHS-0114	PR	X02	1,140	J	1	UC	Separates rocket motors from rocket warheads.

DEP - 7058A (July 1997)

11. PROCESS DESCRIPTION. *See Instructions*

Facility's EPA ID Number

K	Y	8	2	1	3	8	2	0	1	0	5

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	*Rocket Shear Machine (RSM) – MY-RHS-0101	PR	X02	1,140	J	1	UC	Punches and drains the warhead, flushes the agent cavity and shears rocket warheads into segments
4	*Rocket Shear Machine (RSM) – MY-RHS-0102	PR	X02	1,140	J	1	UC	Punches and drains the warhead, flushes the agent cavity and shears rocket warheads into segments
4	*Metal Parts Treater (MPT) – ME-MPT-0101	PR	X03	11,770	J	1	UC	Thermal decontamination of metal parts and various secondary wastes
4	*Metal Parts Treater (MPT) – ME-MPT-0201	PR	X03	11,770	J	1	UC	Thermal decontamination of metal parts and various secondary wastes
4	*Munitions Washout System (MWS) – MZ-MWS-0101D	PR	X02	910	J	1	UC	Access the agent cavity and washout GB projectiles
4	*Munitions Washout System (MWS) – MZ-MWS-0101E	PR	X02	910	J	1	UC	Access the agent cavity and washout GB projectiles
4	*MWS Reject Table – MJ-MWS-0103	PR	S01	5	G	1	UC	Provides container storage for projectile rejects associated with the MWS
4	Bulk Waste Storage Area	PR	S01	185,000	G	1	UC	Provides container storage for off-site shipment of waste staged in tanker trucks as well as roll-off containers.

DEP - 7058A (July 1997)

Facility's EPA ID Number: K Y 8 2 1 3 8 2 0 1 0 5

11. PROCESS DESCRIPTION. *See Instructions*

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	SCWO Tank Area (STA) – RO Reject Tank – MT-RO-0106	PR	S02	78,970	G	1	UC	Store Reverse Osmosis (RO) Reject until waste is shipped off-site
4	SCWO Tank Area (STA) – RO Reject Tank – MT-RO-0206	PR	S02	78,970	G	1	UC	Store Reverse Osmosis (RO) Reject until waste is shipped off-site
4	SCWO Tank Area (STA) – SCWO Effluent Tank – MT-SCWO-0101	PR	S02	45,626	G	1	UC	Store SCWO Effluent until it can be processed through the RO System
4	SCWO Tank Area (STA) – SCWO Effluent Tank – MT-SCWO-0201	PR	S02	45,626	G	1	UC	Store SCWO Effluent until it can be processed through the RO System
4	SCWO Tank Area (STA) – SCWO Effluent Tank – MT-SCWO-0301	PR	S02	45,626	G	1	UC	Store SCWO Effluent until it can be processed through the RO System
4	SCWO Tank Area (STA) – RO Permeate Tank – MT-SWS-0101	PR	S02	54,002	G	1	UC	Store RO Permeate until it can be recycled back into the process to be used for make-up water
4	SCWO Tank Area (STA) – RO Permeate Tank – MT-SWS-0201	PR	S02	54,002	G	1	UC	Store RO Permeate until it can be recycled back into the process to be used for make-up water
4	SCWO Processing Building (SPB) – Aluminum Precipitation Reactor – MV-APS-0101	PR	T01	1,077	G	1	UC	Receives hydrolysate and through acidic addition, precipitates out the aluminum contained in the hydrolysate

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11. PROCESS DESCRIPTION. *See Instructions*

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	SCWO Processing Building (SPB) – Aluminum Precipitation Reactor – MV-APS-0102	PR	T01	1,077	G	1	UC	Receives hydrolysate and through acidic addition, precipitates out the aluminum contained in the hydrolysate
4	SCWO Processing Building (SPB) – Aluminum Filtration Unit – ML-AFS-1040	PR	X99	2,142	J	1	UC	Receives precipitated hydrolysate and filters out the aluminum before sending the filtrate to the SCWO for processing
4	SCWO Processing Building (SPB) – Aluminum Filtration Unit – ML-AFS-2040	PR	X99	2,142	J	1	UC	Receives precipitated hydrolysate and filters out the aluminum before sending the filtrate to the SCWO for processing
4	SCWO Processing Building (SPB) -- Reverse Osmosis (RO) Unit – ML-RO-0101	PR	X99	125,826	U	1	UC	Receives SCWO Effluent and removes dissolved solids to create RO Permeate (~70%) which is recycled as make-up water and RO Reject (~30%) which will be shipped off-site for disposal
4	SCWO Processing Building (SPB) -- Reverse Osmosis (RO) Unit – ML-RO-0201	PR	X99	125,826	U	1	UC	Receives SCWO Effluent and removes dissolved solids to create RO Permeate (~70%) which is recycled as make-up water and RO Reject (~30%) which will be shipped off-site for disposal
4	SCWO Processing Building (SPB) -- Reverse Osmosis (RO) Unit – ML-RO-0301	PR	X99	125,826	U	1	UC	Receives SCWO Effluent and removes dissolved solids to create RO Permeate (~70%) which is recycled as make-up water and RO Reject (~30%) which will be shipped off-site for disposal

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Facility's EPA ID Number

K	Y	8	2	1	3	8	2	0	1	0	5

11. PROCESS DESCRIPTION. *See Instructions*

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	SCWO Processing Building (SPB) -- SCWO Reactor – MV-SCWO-1030	PR	X99	1,231	J	1	UC	Receives filtered hydrolysates (energetics & agent) and treats the waste via Super Critical Water Oxidation
4	SCWO Processing Building (SPB) -- SCWO Reactor – MV-SCWO-2030	PR	X99	1,231	J	1	UC	Receives filtered hydrolysates (energetics & agent) and treats the waste via Super Critical Water Oxidation
4	SCWO Processing Building (SPB) -- SCWO Reactor – MV-SCWO-3030	PR	X99	1,231	J	1	UC	Receives filtered hydrolysates (energetics & agent) and treats the waste via Super Critical Water Oxidation
4	SCWO Processing Building (SPB) – Hydrolysate Blend Tank – MT-SCWO-0030	PR	S02	6,124	G	1	UC	Blending of agent hydrolysate, energetics hydrolysate and feed additives to feed to the SCWO reactors
4	SCWO Processing Building (SPB) – Hydrolysate Blend Tank – MT-SCWO-0031	PR	S02	6,124	G	1	UC	Blending of agent hydrolysate, energetics hydrolysate and feed additives to feed to the SCWO reactors
4	SCWO Processing Building (SPB) – Batch Hydrolysate Holding Tank – MT-SCWO-0032	PR	S02	6,124	G	1	UC	Provides temporary storage of hydrolysate batches whose composition is unacceptable for processing in the SCWO reactors
4	SCWO Processing Building (SPB) – Off-Spec Effluent Tank – MT-SCWO-0041	PR	T01	3,897	G	1	UC	Holds liquid effluent which does not meet the specification required for release to the RO units

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11. PROCESS DESCRIPTION. *See Instructions*

Facility's EPA ID Number

K	Y	8	2	1	3	8	2	0	1	0	5

Commercial Indicator	Unique Unit or Group Name	Legal Status Code	Process Codes	Process Design Capacity Of All Units Listed Under This Name	Unit of Measure	Number Of Individual Units In This Process	Operating Status Code	Description Of Process
4	SCWO Processing Building (SPB) – Emergency Relief Tank – MT-SCWO-0040	PR	T01	2,350	G	1	UC	In the event of an emergency shutdown, the SCWO reactor contents will be discharged to this tank. The distance from the bottom of the tank to the high-high liquid level is 25", the remainder of the tank volume is space for expansion. Liquid volume will not exceed the HHLL.
4	SCWO Processing Building (SPB) – Aluminum Filtration Feed Tank – MT-AFS-1010	PR	S02	917	G	1	UC	Receives energetics hydrolysate from the APRs and feeds to the AFS
4	SCWO Processing Building (SPB) – Aluminum Filtration Feed Tank – MT-AFS-2010	PR	S02	917	G	1	UC	Receives energetics hydrolysate from the APRs and feed to the AFS
4	SCWO Processing Building (SPB) – Aluminum Filtrate Tank – MT-AFS-1012	PR	S02	2,670	G	1	UC	Receives energetics hydrolysate from the AFS and feeds to the Hydrolysate Blend Tank(s)
4	Movement of Munitions from Hazardous Waste Storage Unit to Enhanced On-Site Container (EONC)	PR	T04	522	J	1	CN	1 EONC can hold 6 GB Projectile pallets, with 6 projectiles per pallet, totaling 36 projectiles per EONC, maximum. Each projectile contains 14.5 lb of agent per round, which totals 522 lbs/agent max, per EONC. GB Rockets total 321 lb/agent max, per EONC. One EONC transferred per hour equals a 522lb/hr "processing" rate.

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Facility's EPA ID Number											
K	Y	8	2	1	3	8	2	0	1	0	5

12. WASTE STREAM DESCRIPTION. *See Instructions.*

WASTE STREAM NUMBER	ESTIMATED ANNUAL WASTE AMOUNT	UNIT OF MEASURE	EPA WASTE NUMBERS	PROCESS CODES ASSOCIATED WITH THIS WASTE
1	883	**TONS**	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	X03; MPT Residues & Ash
2	2,950	**TONS**	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	S01, S02, and X99; Aluminum Precipitate
3	84,500	**TONS**	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	S02 and X99; Reverse Osmosis (RO) Reject (RO Permeate (~70%) is recycled back into the process)
4	8	**TONS**	D024, D037, and/or N001	S01 and X03; Agent Contaminated Munitions Dunnage
5	774	**TONS**	D024, D037	S01 and X03; Munitions dunnage
6	1078	**TONS**	D001, D003, D008	S01; Rocket Motors
7	15.3	**TONS**	D001, D002, D003, D004, D005, D006, D007, D008, D009, D010, D011, D022, D024, D027, D028, D029, D037, F001-F005, and/or N001	S01; Lab Wastes
8	5.2	**TONS**	D001, D002, D003, D004, D005, D006, D007, D008, D009, D010, D011, F001-F005, and/or N001	S01; Maintenance and Miscellaneous Wastes; Oils, Paints, Spent Solvents, Hydraulic Fluids, etc.
9	204	**TONS**	N001	S01; Agent Derived, Listed Secondary Wastes including PPE, DPE Suits, Spent Activated Carbon, HEPA Filters and Pre-filters, Trash, Concrete, Rags and Components/Parts/Tools from Operations, and Maintenance activities

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13. Existing Environmental Permits: K Y 8 2 1 3 8 2 0 1 0 5

Inter-State Regional Program [A]:
Single Well (FURS) [B]:
County Program [C]:
DOE Program [D]:
Other EPA Program [E]: specify:
EPA 404 (dredge or fill program) [F]:
USGS Program [G]:
Area Wells (FURS) [H]:
NOTIS [J]:
Superfund (CERCLA) [K]:
FATES [L]:
Municipal (city, town, etc.) Program [M]:
NPDES/KPDES (discharges to surface water) [N]: KY0020737; KYR10
PSD (Prevention of Significant Deterioration - Clean Air Act) [P]: Title V Permit—BGCAPP V-10-023 (Revision 1)
CDS [Q]:
RCRA (hazardous wastes) [R]: KY8-213-820-105
State Program [S]:
DOT Program [T]:
UIC (underground injection of fluids) [U]:
Intra-State Regional Program [W]:
Other Federal Program [X]: specify:
CICIS (OTS Chemicals in Commerce Information System) [Y]:
Other Non-Federal Programs [Z]: Water Withdraw Permit No. 1013

14. FACILITY STATUS:

☒ Waste is NOT received from off-site ☐ Accepts waste from any off-site source(s) [A]

☐ Accepts waste from only a restricted group of off-site sources(s) [R]:
Specify: N/A

15. PHOTOGRAPHS, DRAWING AND MAP - *See INSTRUCTIONS*

All existing facilities must include photographs (aerial or ground level) that clearly delineate all existing structures; existing storage, treatment or disposal areas; and sites of future treatment, storage or disposal areas. All existing facilities must include a drawing showing the general layout of the facility and a topographic map. The photographs, drawing and map must be attached to this form.

16. If the facility owner is also the facility operator, please skip this section and complete item 17 below.
Owner Certification - I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Lee G. Hudson, Colonel, LG, U.S. Army Commanding Officer

NAME (PRINT OR TYPE) SIGNATURE
DATE SIGNED

17. Operator Certification - I certify under penalty of law that I have personally examined and am familiar with the information

submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Doug Omichinski, Project Manager, BPBG

NAME (PRINT OR TYPE) SIGNATURE
DATE SIGNED

18. Land Owner Certification - I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Lee G. Hudson, Colonel, LG, U.S. Army Commanding Officer

NAME (PRINT OR TYPE) SIGNATURE
DATE SIGNED

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NOTES

The waste streams listed above in section 12, Waste Stream Description, are further described below. These waste streams are those that will be disposed of offsite. One waste stream (Rocket Motors) is still under evaluation with regards to the final disposition of this waste. There remains the possibility that these wastes will be disposed of onsite, but for accountability, this waste stream is listed in the waste stream list on page 12. When the final decision is made on the resolution of the disposal action, the Part A will be revised to reflect any changes.

1) Waste stream number 1 is the residues; including munition bodies, that are processed in the MPT. This also includes ash from the MPT as well as solids collected from the cyclone in the <90-day drums.
2) Waste stream number 2 is the solid residues coming out of the Aluminum Precipitation/Filtration System (APS/AFS), which include the waste filter media rolls from the AFS filter unit(s).
3) Waste stream number 3 is the RO Reject from the recycling of the SCWO effluent through the RO system. This is the ~30 percent of liquids from the SCWO treatment process that can no longer be used as process water.
4) Waste stream number 4 is the agent contaminated munitions dunnage, including the pallets, metal banding, and associated wastes.
5) Waste stream number 5 is the munitions dunnage that is not agent contaminated and includes the pallets, metal banding, and associated wastes.
6) Waste stream number 6 includes the rocket motors and shipping and firing tubes. This waste stream's final waste disposal determination has not been made yet (see intro paragraph above). Any changes will be reflected on future revisions to this document.
7) Waste stream number 7 includes the various laboratory wastes generated by monitoring/sampling activities associated with the operations process.
8) Waste stream number 8 includes the various maintenance and miscellaneous wastes, to include waste oils, fluids, paints, spent solvents, etc.
9) Waste stream number 9 includes agent-derived listed secondary wastes generated in the BGCAPP.

1.0 WASTE DESCRIPTION

1.1 Type and Quantity of Waste to be Processed

The BGCAPP eventually will treat munitions filled with two of the chemical agents stored at the BGCA (i.e., GB and VX). However, the RD&D permit applies only to the treatment of munitions containing the nerve agent GB.

Some GB 8-inch projectiles stored at the BGCA were sampled and analyzed during operations conducted in 1979. Samples of the agent in other munition types stored at BGCA have not been collected and analyzed. However, laboratory analytical data from other chemical agent-disposal facilities are available for the GB used in BGCA chemical munitions and material safety data sheets (MSDSs) for GB nerve agent have been provided in previous versions of this application. The source and extent of the chemical agent data for each munition type is described in the following subsections.

1.1.1 GB 115-mm Rockets

Table 1-4 provides the laboratory analytical data from sampling that was performed at the Tooele Chemical Agent Disposal Facility (TOCDF). Although the analytical data from the other chemical disposal facilities is not from the specific munitions stored by the Blue Grass Chemical Activity (BGCA) at the BGAD, it is representative of the GB nerve agent stored at the BGAD.

1.1.2 GB 8-Inch Projectiles

Table 1-5 provides the data from sampling and laboratory analysis that was performed on the GB 8-inch projectiles in storage at BGCA in 1979.

1.1.3 Energetics

1.1.3.1 Rocket Energetics

Rocket energetics consist of the following components:

1) Fuze composed of Research Department Explosive (RDX)
2) Detonator composed of lead azide and RDX
3) Burster composed of Comp B, which is a 60:40 mixture of RDX and trinitrotoluene (TNT)

1.1.3.2 Rocket Propellant

The rocket propellant consists of M-28, which is a mixture of the following components:

1) 60 percent nitrocellulose
2) 23.8 percent nitroglycerin
3) 9.9 percent triacetin
4) 2.6 percent diethylphthlate
5) 2 percent lead stearate
6) 1.7 percent 2-nitrodiphenylamine

1.1.4 Munitions Quantities and Agent Weights

Table 1-1 – Stored Munition Data

Munition	Agent Type	Type	Caliber	Quantity	Agent Weight (lb/munition)
M55	GB	Rocket	115 mm	51,716	10.7
M56	GB	Warhead	115 mm	24	10.7
M426	GB	Projectile	8 inch	3,977	14.5
Note: The munition quantities shown above include identified "leaker" munitions.					

Table 1-2 – Estimated Quantity of Waste Stored Per Munition Type

Munition Type	Munitions, Total No.	Agent Weight, lbs	% of GB Stockpile, %
GB M55/M56	51,740	553,620	90.57
GB Projectiles	3,977	57,660	9.43

Table 1-3– Waste Totals for GB Agent Campaign

Agent Campaign	Total Munition Waste, lbs
GB	8,462,230

1.2 Physical Description of Waste to be Processed

1.2.1 Waste Description

The hazardous wastes that the BGCAPP will treat under the RD&D permit consist of: GB-filled M55 rockets, M56 warheads, and 8-inch projectiles. Under the proposed RD&D permit, the GB munitions will be used to demonstrate the effectiveness of the BGCAPP treatment processes. The assembled munitions stored at BGCA contain both chemical agent and energetic materials (i.e., propellant and/or explosive charges).

Table 1-1 lists the types and quantities of the GB munitions in the BGCA chemical stockpile. Each type of chemical weapon is described in greater detail in the subsections below. The hazardous waste codes associated with each waste stream generated from processing these chemical weapons are provided in the Part A form submitted with this revised permit application (see Figure 1-A). Additionally, Table 1-3 contains the total wastes generation during the GB processing campaign.

Table 1-4 and Table 1-5, include the laboratory analytical data collected from waste analysis performed at demilitarization facilities at other Chemical Materials Activity (CMA) sites. The data include analytical results for organics (e.g., GB and energetics) and inorganics (i.e., metals) that comprise the agent fill and energetics/propellant for each munition type.

1.2.2 Projectiles

Projectiles are fired from guns or cannons. Projectiles have cylindrically-shaped, steel bodies with tapered noses, and chemical-filled projectiles have a hollow cylindrical tube (known as the “burster well”) running down its center. This tube holds the burster, an explosive charge that disperses the chemical agent upon detonation. The liquid agent itself is contained in the annular region between the burster well and the outer wall of the projectile. All projectiles stored at BGCA have a nose closure device installed instead of the fuze.

1.2.2.1 8-Inch Projectiles

The 8-inch (20.32-cm) projectile, designated as M426, has a mass of more than 90 kg and contains GB chemical agent. These projectiles are stored without a burster charge and have a nose closure attached at the top of the burster well.

1.2.2.2 Overpacked Leaker Projectiles

Currently, 26 leaking GB 8-inch projectiles have been overpacked at the BGAD. These munitions will be processed in the same manner as non-leaking projectiles after being removed from the overpack container.

1.2.3 M55 Chemical Rocket Assembly

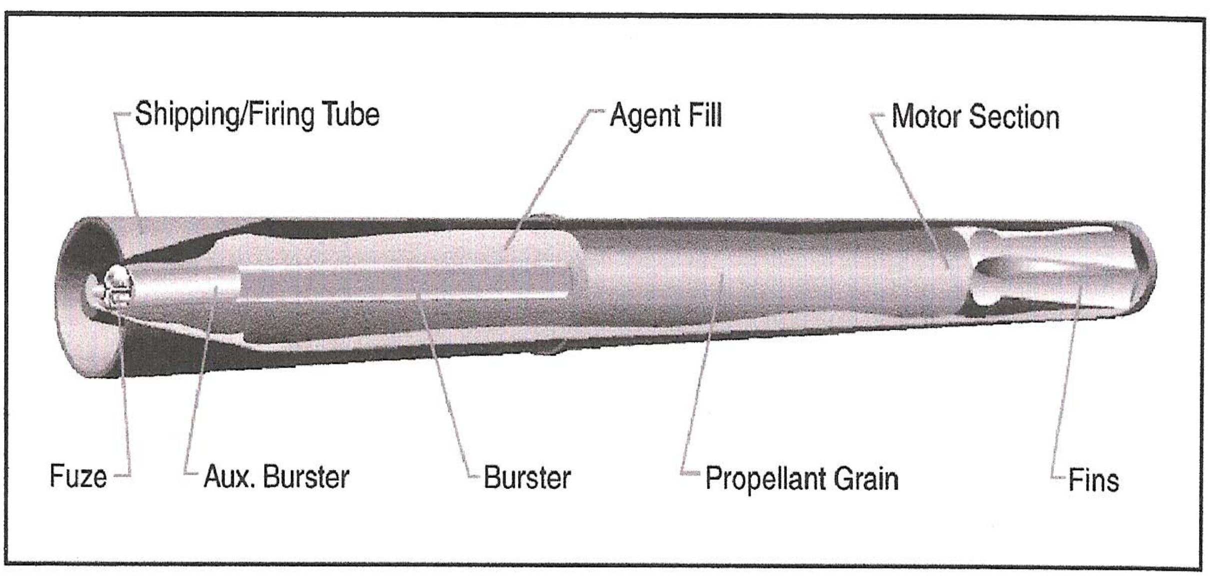
The M55 Chemical Rocket Assembly consists of a chemical agent-filled M56 Warhead Assembly attached to a M67 Rocket Motor Assembly. The M55 Chemical Rocket Assembly has a diameter of 115 millimeters (4.44 inches), is 78 inches long, and weighs 57 pounds [74 pounds in the M441 Shipping and Firing Container/Tube (SFT)]. The warhead is filled with either 10.7 pounds of GB or 10.0 pounds of VX. The rocket is an airborne weapon propelled by a mixture of a fuel and an oxidizer. The only rocket type in the chemical stockpile is the 115-mm diameter M55 Chemical Rocket Assembly. It consists of two sections:

- M56 Warhead Assembly: An aluminum-alloy warhead section, which contains the chemical agent, two bursters, and the fuze, and
- M67 Rocket Motor Assembly: A steel motor section, which contains the propellant grain, the igniter assembly, and the nozzle and fins.

The bursters are composed of Composition B (Comp B) explosive. The propellant is double-base M28 (nitroglycerin/nitrocellulose). Each M55 Rocket Assembly is stored in a fiberglass [reinforced with plastic) cylindrical container (shipping and firing container/tube (SFT)]. The container is closed at each end with a removable aluminum cap. Each cap is outfitted with a sampling plug. The rockets are stored in specially designed wooden pallets, which keep the rockets elevated from contact with the floor of the storage.

NOTE: Both GB and VX M55 rockets are part of the BGCA chemical stockpile, however, only the GB-filled rockets and warheads will be treated under the RD&D permit.

Figure 1-1 – 155-mm Rocket Diagram



1.2.3.1 M441 SFT Assembly

The rocket is stored in the M441 SFT assembly. The container tube is made of fiberglass-reinforced resin, either epoxy or polyester, and in some cases contains polychlorinated biphenyls (PCBs). There is an indexing ring on the outside of the tube toward the fore end of the rocket. There are end caps on each end made of aluminum and secured to the tube by pins. Each end cap has a sampling port.

PCB concentrations in the SFTs range from under 50 parts per million (ppm) to more than 2,000 ppm. The PCB concentrations are regulated under the Toxic Substances Control Act (TSCA) regulations and are subject to disposal requirements of 40 CFR 761.62(c).

Information provided in this section is based on a study by the U.S. Army Environmental Hygiene Agency (i.e., Hazardous Waste Study No. 37-26-1345-86 and -87), which sampled and analyzed SFTs in the Tooele Army Depot (now called the Deseret Chemical Depot) to determine the PCB concentration in the SFTs. This information has been used by the EPA as the basis for issuing the nationwide approval for incineration of PCBs at the four continental United States Chemical Demilitarization Incineration Facilities. The PCB aspects of the project are subject to regulation by the EPA Region 4. A separate environmental permit application has been prepared and submitted to EPA Region 4 to address the processing of the PCB-contaminated SFTs as part of the M55 “leaker” campaign.

1.2.3.2 M56 Warhead Assembly

The M56 Warhead Assemblies consist of a body, a burster well containing two bursters in series, a fuze adapter, and a point detonating fuze. The body is a hollow, thin-walled structure made of 6061 T6 alloy aluminum with a wall thickness of 0.058±0.012 inches. The burster well also is made from 6061 T6 alloy aluminum and is welded to the body at the nose end. Inside the rocket body, the burster well terminates in an aluminum rod. The rod has a cup shaped fitting on the end, which fits over the fill port in the base of the warhead. The rear burster consists of a low carbon steel tube, with painted exterior and filled with Composition B (or Tetrytol, although none are known to have this). The forward burster consists of a plastic tube filled with Composition B (or Tetrytol although none are known to have this). The fuze contains a booster made from research department explosive (RDX). Assembly of the fuze adapter to the warhead is made by coating the threads with either Pettman cement or sealing compound and then screwing it into the burster well. The fuze threads are also coated with either Pettman cement or sealing compound before the fuze is screwed into the fuze adapter. Chemical agent (GB or VX) was added to the warhead through a fill port in the base and then sealed inside by pressing two aluminum balls into the fill port. The balls are of two different aluminum hardness. The harder ball goes in first and then the softer ball. The softer ball is then pressed to produce a seal and is to be flush or below flush with the base of the warhead.

M56 Warheads Assemblies are similar to the M55 Chemical Rocket Assemblies except that the motor section has been removed; thus, M56 warheads contain agent and retain their bursters and fuzes but do not contain M28 propellant.

1.2.3.3 M67 Rocket Motor Assembly

The Rocket Motor Assembly consists of a case, M150 fin/nozzle assembly, M28 propellant, anti-resonance rod assembly (with M62 igniter assembly), and a fore closure. The case is a steel tube with a wall thickness of 0.096±0.008 inch, which is threaded on the interior of both ends. The M150 fin/nozzle assembly is attached to the motor case by coating the threads with either Pettman cement or sealing compound and then screwing the assembly into the body. The M28 propellant is a double-base cast grain per MIL-P-60071 specifications and weighs 19.25 pounds. It is installed by first bonding a spacer to aft end, adding the anti-resonance rod assembly, and then sliding the grain assembly into the motor case until the spacer rests on the M150 fin/nozzle assembly. Assembly of the rocket motor is completed by coating the threads of the fore closure with a sealing compound and then threading it into the body. When the closure is installed, it compresses a spring on the anti-resonance rod assembly to hold the propellant grain in place against the fin assembly. The warhead is assembled to the rocket motor by coating the threads with either Pettman cement or a sealing compound and then screwing the two components together.

1.2.3.4 Overpacked “Leaker” M55 Rockets

Currently, there are approximately 150 known, “leaker” munitions in storage at the BGAD, of which less than 100 are GB rockets and the remainders are H projectiles. Leaker GB 115-mm M55 rockets have been overpacked at BGCA and will be processed after they are removed from the overpack container as discussed in paragraph 3.3.3.1.3.

1.2.4 Secondary Wastes

Six major types of secondary waste will be generated at the BGCAPP; these wastes are described in the following subparagraphs.

1.2.4.1 Wood Pallets

All munitions are stored on wood pallets in the igloos. As munitions are transferred to the BGCAPP, wood pallets and metal straps not contaminated with agent [i.e., determined by enhanced onsite container (EONC) monitoring prior to opening], will be shipped off site for disposal or treatment in an appropriate facility. All wood pallets and other dunnage associated with leaking munitions will be treated as agent contaminated dunnage and will be processed as described in section 3, paragraph 3.3.3.2.

1.2.4.2 Agent-Contaminated Plastic and PPE

Plastic materials and PPE that are not contaminated with agent will be shipped off site for disposal or treatment in an appropriate facility. Plastic and PPE (plastic, rubber, and gas mask carbon filters) are assumed to be contaminated if they have been exposed to agent; they will be processed as described in section 3, paragraph 3.3.3.3.

1.2.4.3 Miscellaneous Agent-Contaminated Metal Parts

Miscellaneous agent-contaminated metal parts generated during the RD&D program are sent directly to the metal parts treater (MPT) for thermal treatment (i.e., a minimum of 1,000°F for 15 minutes) before they are shipped off site for disposal or treatment in an appropriate facility. These wastes will be processed as described in section 3, paragraph 3.3.3.4.

1.2.4.4 Agent-Contaminated Spent Activated Carbon

Agent-contaminated spent activated carbon from the heating, ventilating, and air conditioning (HVAC) filters that is generated during the RD&D program will be processed as described in section 3, paragraph 3.3.3.5.

1.2.4.5 Reverse Osmosis (RO) Brine Solution

The supercritical water oxidation (SCWO) effluent is a brine solution comprised primarily of sodium sulfate (Na2SO4), sodium chloride (NaCl), sodium fluoride (NaF), and sodium monophosphate (NaH2PO4). The RO Unit is designed to produce a water stream that is of sufficient quality to be recycled to the SCWO process (approximately 70 percent) and a wastewater stream (RO reject) that will be characterized and shipped for disposal or treatment in an appropriate facility. This process is discussed further in section 3, paragraph 3.3.1.4.

1.2.4.6 Other Secondary Wastes

During the RD&D program, other secondary wastes may be generated at the BGCAPP. As these waste streams are identified, they will be characterized prior to treatment. If they are contaminated with agent, either the wastes will be treated at the BGCAPP through the appropriate waste handling system, or decontaminated and shipped off site for disposal or treatment in an appropriate facility. If the waste is not contaminated with agent, the secondary waste will be shipped off site for disposal or treatment in an appropriate facility.

1.2.4.7 Laboratory Wastes

Various laboratory wastes will be generated during agent processing at the BGCAPP. These include typical laboratory wastes [e.g., solvents, glassware, towels/rags, personal protective equipment (PPE)]. The Kentucky hazardous waste code for GB (i.e., N001) will be attached to many of the laboratory waste streams due to contact with agent containing samples and wastes.

Wastes that are generated as a part of normal laboratory operations will be managed on-site as required in appropriate satellite accumulation areas (SAAs) or in other permitted waste storage areas such as the Waste Storage Area (WSA) or the Waste Transfer Station (WTS). All laboratory wastes will be sent off site for final disposal.

1.2.5 Process Wastes Generated During GB Campaign

Table 1-2 summarizes the estimated quantity of waste generated during the GB campaign. The waste streams will come from four primary sources:

1) MPT residues – This waste stream will consist of projectile bodies and rocket pieces consisting of steel as well as SFTs from Contaminated Rocket Motors after processing through the MPT, as well as any miscellaneous metal parts and secondary wastes that are generated during the treatment processes.
2) Aluminum filtration system (AFS) Precipitate – This waste stream will consist of the aluminum compounds precipitated and filtered out of the energetics hydrolysate generated from the treatment of rockets. This will primarily be in the form of a filter cake.
3) RO Reject Brine Solution – The treated hydrolysate from the SCWO units will be processed through the RO system to recycle as much water as possible back into the process. Waste brine solution will be shipped off site for disposal at a permitted treatment, storage, and disposal facility (TSDF). The recovered water will be recycled back into the process in lieu of makeup water or shipped off site to a permitted TSDF if necessary.

4) Rocket motors (RMs) – This waste stream consists of the rocket motors not associated with the “leakers”. These rocket motors will be separated from the rocket warhead but are not currently planned for processing in the BGCAPP. BGCAPP is currently working to identify a treatment process and location for this waste stream.

It is important to note that the RO system greatly reduces the amount of waste that will be generated for off-site disposal from BGCAPP during the life of the project and will be an integral part of BGCAPP’s waste minimization program. Table 1-6 below further illustrates the examples of the types of process wastes expected to be generated as well as the location and source of the wastes.

Table 1-4 – Analytical Data for GB in 155-mm Rockets

Compound (wt%)	Average	Maximum	Minimum
Agent GB	85.1	97.0	44.8
DIMP	4.5	10.8	2.7
TBA	5.6	5.9	5.5
DIU	0.9	2.4	0.4
DICDI	0.4	1.1	0.0
Metals (mg/kg)			
Aluminum	628.3	3205.0	10.0
Antimony	26.3	154.0	0.2
Arsenic	7.0	34.0	3.5
Barium	4.7	40.0	0.1
Beryllium	0.1	0.6	0.0
Boron	1135.8	4585.0	4.1
Cadmium	3.2	12.0	1.1
Chromium	3.2	12.0	1.1
Cobalt	2.5	8.9	0.1
Copper	13.4	120.0	1.7
Lead	9.8	46.0	0.6
Manganese	2.7	18.2	0.6
Mercury	0.1	0.2	0.0
Nickel	7.2	31.0	2.1
Selenium	16.3	92.0	0.4
Silver	1.2	6.2	0.1
Thallium	26.3	154.0	0.1
Tin	53.3	308.0	1.1
Vanadium	1.4	6.2	0.7
Zinc	28.8	172.0	5.4
Source: Tooele Chemical Agent Destruction Facility, 1996-1998			

Table 1-5 – Analytical Data for GB in 8-Inch Projectiles

Agent Lot No.	1034-54-1005	1034-62-1330
% GB	89.59	86.53
Metals, ppm		
Iron	102.43	521.27
Copper	<0.010	<0.008
Nickel	<0.019	<0.015
Aluminum	34.61	28.49
Source: Surveillance Program, Lethal Chemical Agents and Munitions (SUPLECAM) Report, 1979		

Table 1-6 – Examples of Primary Process Wastes

Primary Process Waste	Source Equipment	Room Name	Room Number	Room Category
SFTs	RCMs	ECV-1	07-103	A/B
SFTs	RCMs	ECV-2	07-106	A/B
Strainer Basket Waste	RSMs	ECR-1	07-104	A
Strainer Basket Waste	RSMs	ECR-2	07-105	A
Strainer Basket Waste	NCRM/CAMs	MWS	07-135	A
Accumulated MPT Ash	MPT	MPT	07-146	B
Ash in MPT Trays	MPT	MPT Cooling Conveyor	07-150	D
OTM Cyclone Ash	TOX/Cyclone	OTM Area	07-140	C

2.0 PROCESS ENGINEERING

This section describes the overall facility and its individual systems and components. Paragraph 2.1 describes the buildings and structures and the plant subsystems that constitute the complete facility to include building structures and systems/subsystems (e.g., the air pollution control systems) that capture contaminants that might be released from the processing equipment and activities within the buildings. Comparatively few of the buildings, structures, and systems store or treat hazardous waste, and only those so identified are subject to regulation under this RD&D permit.

Paragraph 2.2 describes the construction sequence and environmental compliance during construction, while Paragraphs 2.3 and 2.4 discuss the Independent Facility Construction Certification and Plant Systemization, respectively. Paragraph 2.5 discusses the Performance and Objectives of the RD&D Program while Paragraph 2.6 discusses operations subject to KHW regulations.

2.1 Facility Description

Most of the buildings that constitute the BGCAPP are support structures which are not used to manage or contain hazardous wastes and are not subject to regulation by the KDEP. The buildings in which hazardous wastes are stored and/or treated are designed to provide maximum protection to human health and the environment. Figure 2-2 shows the BGCAPP site plan.

2.1.1 Building and Structure Definitions

2.1.1.1 Pre-engineered Metal Buildings

These are metal buildings constructed of prefabricated steel columns and trusses and erected onsite. This type of building is covered with composite sheet metal siding (i.e., insulation sandwiched between inner and outer sheet metal) and is pre-painted to color and coating requirements. No architectural finishes, process, utility systems, or equipment are preinstalled.

2.1.1.2 Modular Buildings

These metal- and wood-framed buildings are of various lengths and widths that can be connected together on site. They are fabricated of sheet metal or aluminum siding for the exterior, and metal or wood studs with either gypsum board or paneling on the interior. To the maximum extent possible, all architectural finishes, process and utility systems, and some equipment will be preinstalled.

2.1.1.3 Field Fabricated Areas and Buildings

Various construction materials and pre-engineered bulk commodities are used to the maximum extent possible; however, some field fabrication is required. All architectural finishes, process, utility systems, and equipment are erected in place.

2.1.2 Buildings and Structures Containing Hazardous Waste Management Units

2.1.2.1 Container Handling Building (CHB)

1) Description – Permitted CHB used to store munitions received from storage igloos.
2) Method of Construction – Pre-engineered metal building.
3) Major Equipment – Enhanced onsite containers (EONCs)

2.1.2.2 Munitions Demilitarization Building (MDB)

1) Description – Pre-engineered building shell with an inner, field-fabricated reinforced concrete building that contains explosive containment rooms (ECRs).
2) Method of Construction – Field Fabrication
3) Major Equipment:
    a. Rocket cutting machine (RCM)
    b. Rocket shear machine (RSM)
    c. Metal parts treater (MPT)
    d. Energetics batch hydrolyzer (EBH)
    e. Agent neutralization reactors (ANR)
    f. Energetics neutralization reactors (ENR)
    g. Munition washout system (MWS)
    h. Nose Closure Removal System (NCRS)
    i. Off-gas treatment units (OTE and OTM)
    j. Material handling systems and components
    k. Blast gates and doors

2.1.2.3 SCWO Processing Building (SPB)

1) Description – Pre-engineered building. SCWO equipment and Tank Area.
2) Method of Construction – Pre-engineered metal building.
3) Major Equipment:
    a. SCWO units
    b. RO system
    c. Recycled water storage
    d. Aluminum Precipitation System (APS)
    e. Aluminum Filtration System (AFS)
    f. SCWO Tank Area (STA) and Storage Tanks

2.1.2.4 Hydrolysate Storage Tanks and Tank Area

1) Description – Large carbon steel tanks and liquid transfer equipment for the agent and energetics hydrolysate from the MDB. Serves as buffer storage for processing hydrolysate feeds to the SPB.
2) Method of Construction – Field Fabrication.
3) Major Equipment:
    a. Agent and energetic hydrolysate storage tanks
    b. Transfer pumps and ancillary piping systems

2.1.2.5 Modular Lab (LAB)

1) Description – Modular building used to house shift LAB personnel and to conduct procedures to support the neutralization operations and documentation requirements.
2) Method of Construction – Modular building.
3) Major Equipment – Laboratory instrumentation and hoods.

2.1.2.6 Waste Transfer Station (WTS)

1) Description – Container storage area with a sprung structure used for staging wastes generated in the BGCAPP prior to offsite shipment to final treatment/disposal facility. This area is outside the CLA.
2) Method of Construction – Field Fabrication
3) Major Equipment – Sprung storage structure and concrete pads

2.1.2.7 Waste Storage Area (WSA)

1) Description – Sprung structure located northeast of the MDB where various hazardous wastes will be stored prior to transfer of wastes to the WTS. This area is inside the CLA.
2) Method of Construction – Field Fabrication
3) Major Equipment – Sprung storage structure and concrete pads.

2.1.2.8 Bulk Waste Storage Area (BWSA)

1) Description – Two separate, but equal outdoor storage areas capable of storing hazardous wastes in tanker trucks. There will also be a concrete pad for roll-off container storage prior to the shipment of the wastes off-site.
2) Method of Construction – Field Fabrication
3) Major Equipment – Pre-engineered slab with secondary containment for tankers and roll-off containers.

2.1.3 MDB Cascade HVAC System Description

2.1.3.1 HVAC System Functions

The HVAC system of the MDB is an important system at the BGCAPP and is permitted in the BGCAPP Title V air permit as an air pollution control system. Proper operation of the HVAC system is required to maintain the negative pressure within the MDB while providing heating and air conditioning for toxic and nontoxic areas. The cascade HVAC system serves a fourfold purpose:

1) Maintain a negative pressure environment in the MDB.
2) Maintain the flow of air from areas of low contamination probability to areas of higher contamination probability.
3) Remove agent from the air prior to discharge to the atmosphere after the air stream has passed through other air pollution control systems including the off-gas treatment for the MPT (OTM) and the EBH (OTE).
4) Provide for human comfort.

The primary means of preventing the release or spread of contamination is through the use of cascaded pressure control. Toxic areas are maintained at a negative pressure with respect to atmospheric pressure. This arrangement ensures a flow of air from the areas with the least agent contamination to the areas with the most contamination in the MDB and ensures containment within the MDB.

The amount of air exhausted from or supplied to a room is higher in areas likely to be contaminated. This minimizes the spread of contamination and maintains the toxic boundaries. Air flow is controlled by modulating the supply air, by modulating the flow of exhaust air, and by setting dampers throughout the building.

2.1.3.2 Room Category Description

Each room in the MDB has a designated category rating (i.e., A, B, C, D, or E) based on the potential for agent contamination:

1. Routinely contaminated by either agent liquid or vapor (Category A).
2. High probability of agent vapor contamination resulting from routine operations (Category B).
3. Low probability of agent vapor contamination (Category C).
4. Not expected to be contaminated by agent (Category D).
5. Maintained at positive atmospheric pressure at all times to prevent contamination by agent. For example, the central control room (CCR) is maintained at a positive atmospheric pressure since it will remain occupied even in the event of an emergency (Category E).

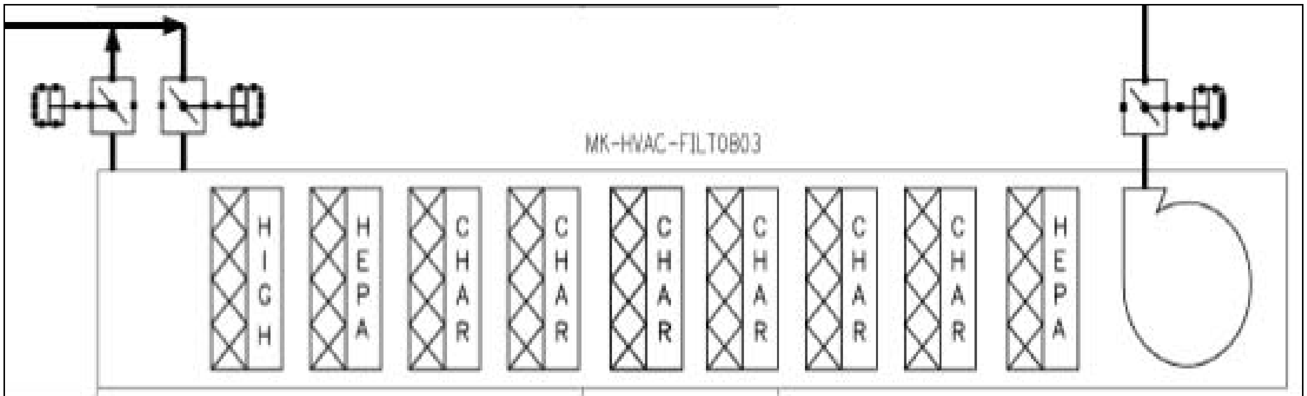
Only rooms with Category A, Category B, or Category C ratings are maintained under a continuous negative pressure by the HVAC system. All process components that involve agent or agent-contaminated materials are contained in the MDB, which is vented into HVAC filters that process all air drawn by the HVAC system. It is described here to support the assertion that the RD&D activities will be performed in a manner that is protective of human health and the environment. The HVAC system controls contaminants that might be released from the process whether as a point source or as a fugitive emission.

Each filter unit consists of the following stages:

1) A row of pre-filters, which remove the larger particulate matter
2) A row of high-efficiency particulate air (HEPA) filters, which remove very fine particulate matter
3) Six rows of carbon filters, which remove agent and other gaseous contaminants such as organic vapors

A final row of HEPA filters, which capture any particulate that may be released from the carbon filters. Figure 2-1 shows the typical configuration of an HVAC filter unit.

Figure 2-1 – MDB HVAC Filter Unit



- HIGH - Pre-filter
- HEPA - HEPA Filter
- CHAR - Activated Carbon Filter

2.1.4 Laboratory Filtration

The original design basis for the filtration of the laboratory included LAB filter bank housings to be used at the BGCAPP, similar to baseline incineration sites. Based on a 2009 review of applicable laboratory requirements, and a white paper titled “BGCAPP Laboratory Exhaust Filtration”, dated June 8, 2010, it was determined that the dual LAB filter banks were not necessary to provide filtration of the 14 lab fume hoods, as the BGCAPP LAB is not a “Surety” lab, but a research, development, test, and evaluation (RDTE) LAB, which would allow the filter bank requirement to be excepted.

The modification consisted of adding inline charcoal filters to the ventilation hoods in the lab, which would provide adequate, necessary filtration of the fume hoods in question. This design change was submitted to KDEP and approved via correspondence dated August 6, 2010 and the modified design has been incorporated in accordance with this approval. Additional requested information, including as-built drawings, the inspection schedule, and a revised site plan will be provided when these documents are prepared.

2.1.5 Buildings and Structures Not Containing Hazardous Waste Management Units (HWMUs)

2.1.5.1 Access Control Building (ACB)

The ACB is a freestanding building that will be located at the entrance of the BGAD and will be used to control access to the BGAD.

1) Description – Facility size and shape will depend on outcome of security requirement discussions with BGAD and recent security changes for installations.
2) Method of Construction – Modular or field fabricated (decision pending).
3) Major Equipment – SDG.

2.1.5.2 Badging Facility

1) Description – Houses security personnel who issue badges for site access.
2) Method of Construction – Prefabricated modular building.
3) Major Equipment – None.

2.1.5.3 Control and Support Building (CSB) and Integrated Control System (ICS)

1) Description – CCR and ICS used to operate BGCAPP, some storage and change facility, and breathing air auxiliary systems, and demilitarization protective ensemble (DPE) storage. The ICS includes all of the programming, graphics, wiring, and devices located throughout BGCAPP for the facility control system (FCS) and facility protection system (FPS).
2) Method of Construction – Pre-engineered metal building included as part of the MDB separated by an access way.
3) Major Equipment – CCR, consoles, and cabinets.

2.1.5.4 Entry Control Facility (ECF)

1) Description – Provides access to the new BGCAPP chemical limited area (CLA).
2) Method of Construction – Modular.
3) Major Equipment – SDG.

2.1.5.5 Gas Mask Storage Building (GSB)

1) Description – Modular building with no major systems or equipment. Its only requirement is to store gas masks within their storage requirements. Lighting and lockers are the only other known requirements.
2) Method of Construction – Modular building.
3) Major Equipment – None.

2.1.5.6 Maintenance Building (MB)

1) Description – Pre-engineered building with utility system. It is expected to house a shop area, tool crib, and a supply of operational material and spares. The maintenance shop has areas for welding, small metal fabrication, conduit bending, tool storage, and maintenance consumables and flammable material storage.
2) Method of Construction – Pre-engineered metal building.
3) Major Equipment – None.

2.1.5.7 Personnel Maintenance Building (PMB)

1) Description – Baseline facility expected to be a pre-engineered building with only utility systems being supplied. It will house the medical facilities, personnel lockers, showers, lunchroom, and equipment required to support operations.
2) Method of Construction – Pre-engineered metal building.
3) Major Equipment – None.

2.1.5.8 Personnel Support Building (PSB)

1) Description – Modular building with utility systems being supplied. Its primary purpose is to house operation, maintenance, and engineering employees that support the daily activities of the plant.
2) Method of Construction – Modular building.
3) Major Equipment – None.

2.1.5.9 Standby Diesel Generators (SDGs)2

1) Description – Diesel-fueled electrical power generators.
2) Method of Construction – Modular.
3) Major Equipment – SDGs.

2.1.5.10 Substation (SUB)

1) Description – An outdoor electrical switchyard constructed on the installation will furnish power to the site.
2) Method of Construction – Modular.
3) Major Equipment – Switchgear and transformers.

2.1.5.11 Utility Building (UB)

1) Description – Pre-engineered steel framed structure with composite siding and a roof deck over slab on grade. Houses plant utility systems and local control panels.
2) Method of Construction – Pre-engineered metal building.
3) Major Equipment:
    a. Package boilers and related auxiliary systems
    b. Compressors
    c. Chillers
    d. Motor control centers (MCCs)

2.1.5.12 Bulk Chemical Storage (BCS)

The BCS will provide tank storage for the following chemicals:

1) Sulfuric acid (H_2SO_4)
2) Sodium hypochlorite (NaOCl)
3) Sodium hydroxide (NaOH)
4) Phosphoric acid (H_3PO_4)
5) Isopropyl alcohol (C_3H_8O)
6) Liquid nitrogen

2.1.5.13 Temporary Construction Facilities

During construction, systemization, and possibly during pilot testing, the following temporary facilities will be provided to effectively manage and perform the construction of BGCAPP:

1) Field offices (trailers)
2) Warehouses – storage handling
3) Change houses

4) Fabrication shops
5) Welder's test shop
6) First Aid Trailer
7) Temporary toilet facilities

2.1.5.14 Vehicle Support Facility (VSF)

1) Description – The building will be used to service vehicles and contains an area for performing maintenance activities for uncontaminated equipment. On rare occasions, decontamination equipment from the BGCAPP may be brought to the VSF for repair. The building is expected to house a shop area, tool crib, and a supply of operational materials and spares. It includes a maintenance shop that has areas for welding, small metal fabrication, instrument calibration, tool storage, and storage space for maintenance consumables. The VSF is a metal framed structure on a concrete slab. It is located inside of the CLA. No hazardous waste, including energetics, agent or agent-contaminated materials, will be stored or processed in the VSF.
2) Method of Construction – Field fabricated.
3) Major Equipment – None

2.1.6 Plant Systems and Subsystems Not Containing Hazardous Waste Management Units

The following systems are an integral part of the plant, but they do not contain any hazardous waste management units. They are included here only to provide a complete description of the construction of the facility.

1) Process water system
2) Cooling water system
3) Compressed air and nitrogen
    a. Instrument air system
    b. Plant air system
    c. Life support air system
    d. Nitrogen supply system
4) Fire protection systems:
    a. Wet and/or dry pipe sprinkler system, through all permanent buildings
    b. Dry chemical system
    c. ECR deluge fire system
    d. CSB fire extinguishing medium (FEM) (inert gas) fire protection system
5) Fire detection systems for the following buildings:
    a. MDB
    b. Utility building (UB)
    c. SPB
    d. CHB
    e. LAB
    f. PMB
    g. CSB

   h. PSB
   i. ECF

6) Site communication systems (site communication meets all requirements of 401 Kentucky Administrative Regulation (KAR) 34:020)
   a. Site public address (PA) and paging system
   b. Closed-circuit television (CCTV) system
   c. Site radio system
   d. Agent alarm lights
7) HVAC steam and hot water supply system
8) Site utilities (above ground and underground)
9) Intrusion prevention system
   a. CCTV system
   b. Motion detectors

2.2 Construction Sequence

The construction sequence is described in the following two subsections.

2.2.1 Site Preparation

The following site-preparation activities were performed prior to the start of construction of the BGCAPP:

1) Installed the outer perimeter security fence, to include silt control specified by the BGCAPP Soil Erosion Management Plan (24915-00-G01-GGEN-00001).
2) Cleared and grubbed the site, and prepared the lay down areas surrounding the facility (including roads).
3) Brought the site to the proper grade and established drainage.
4) Installed the temporary construction roads, using the permanent plant road sub grade and base course, wherever possible.
5) Excavated and installed the sediment retention basins.
6) Installed the storm drain system.

Dust control procedures were implemented immediately upon site occupancy. Water trucks with water monitors were used as necessary to control dust during construction. These trucks or similar equipment also were used during site preparation for soil compaction activities.

2.2.2 Construction Sequence

The precise construction sequence was dependent on funding availability and on the conditions encountered during construction. The following tentative construction sequence is presented for information but does not reflect the status of completed units. (Many units listed below have been or are in the process of being completed.):

1) Access road and parking lot (ARP)
2) Site plan (SP)
3) Access control building (ACB)
4) Site utility systems underground (U/G)
5) Badging facility

6) Munitions demilitarization building (MDB)
7) Maintenance building (MB)
8) Control and support building (CSB)
9) Electrical substation (SS)
10) Utility block/building (UB)
11) MDB filter area (FIL)
12) Site utility systems – above ground (A/G)
13) Integrated process and facility control system (ICS)
14) Modular laboratory (LAB)
15) Container handling building (CHB)
16) SCWO processing building (SPB)
17) Hydrolysate storage area (HSA)
18) Entry control facility (ECF)
19) Personnel and maintenance building (PMB)
20) Standby diesel generators (SDGs)
21) Personnel support building (PSB)
22) Electronic security system (ESS)
23) Toxic maintenance building (TMB)
24) Gas mask storage building (GSB)

2.2.3 Environmental Compliance During Construction

The Safety and Health (S&H) construction safety plan includes specific details relating to compliance with federal, state, and BGAD environmental regulations. The BGCAPP will comply with the requirements of the RD&D permit version approved for the construction phase of the project. For example, approval of the RD&D permit is required prior to the start of construction of the HWMUs. Other items listed below provide the environmental regulatory framework in which BGCAPP is being constructed (i.e., in addition to the hazardous waste requirements contained in the RD&D permit).

1) Uncontaminated construction waste, including:
    a. Packing material
    b. Machinery components
    c. General household waste (e.g., food scraps, waste)
    d. Landscape waste
    e. Construction or demolition debris
2) Hazardous waste, including:
    a. Waste lubricating oil, motor fuel, hydraulic oils, and cutting oils
    b. Cleaning solvents such as those used by pipefitters, millwrights, and electricians
    c. Paint wastes (water- or oil-based) such as rags, slops, sludge, paint solvents, paint and varnish removers and strippers, and paint cans containing paint residue
3) Use, storage, transportation, and disposal of hazardous materials and hazardous wastes will comply with the BGAD, state, and federal requirements
4) Stormwater runoff control measures will comply with the KYR100000 permit for general construction sites

2.3 Facilities Construction Certification

During construction, a Professional Engineer (P.E.) licensed in Kentucky (or designee) will be present at the facility to verify the HWMUs are being built in accordance with the facility design. Before pilot testing with hazardous waste begins, a P.E. (licensed in Kentucky) will perform facilities construction certification (FCC) of each Kentucky-regulated hazardous waste building, area, and system. The P.E. will certify that each building, area, and system has been constructed as designed and in accordance with the RD&D permit. The FCC process is required by 401 KAR 38:030, which in this case is governed by 40 CFR 270.30 (l)(2)(i).

2.4 Systemization

The construction sequence described in paragraph 2.2 results in the individual subsystems being completed in a staged manner. As a subsystem is completed, it will be turned over to the Systemization Group who will test its mechanical ability, liquid and gas containment integrity, and numerous other functions. Systemization will be conducted using simulant and surrogate materials and no chemical agent or any agent-contaminated materials will be processed during systemization. Although the systemization phase of the program does not involve the processing of hazardous waste, it is the first part of the overall on-site RD&D program. The RD&D objective that begins during systemization is the assessment of the system's overall ability to function as an integrated unit and the identification of problems in the interfaces between the subsystems. It should be noted that although systemization does not involve the treatment of hazardous wastes, systemization may generate hazardous wastes (e.g., if sodium hydroxide is used during systemization of agent treatment systems, the waste from this activity will likely be a hazardous waste due to the characteristic of corrosivity). Hazardous wastes generated during systemization will be handled in the same manner as hazardous wastes generated during construction.

2.5 Performance of the RD&D Program – Pilot Testing

After all of the subsystems have been subjected to rigorous testing under the systemization program and the results of systemization have been deemed acceptable by the Army, Assembled Chemical Weapons Alternatives (ACWA), and Bechtel Parsons Blue Grass (BPBG), the program will move into the second on-site phase of the RD&D program, termed "pilot testing." Pilot testing starts by processing the munitions at very slow rates with a large amount of testing and verification taking place during the processing. Pilot testing will begin with the processing of GB rockets and projectiles at the rates shown in Table 2-1. It is anticipated that testing with the GB inventory will meet the system integration objectives of the RD&D program.

The bases for this conclusion are as follows:

- Table 2-1 shows that, during the RD&D program, GB munitions processing will begin slowly. As the system is validated and issues are identified and resolved, the processing rates will increase over a period of approximately 5 months. The 5-month period is based on an assumption that no major problems arise. The program schedule is designed to allow sufficient time to identify and overcome minor problems. If major problems arise during the RD&D period, the RD&D program may require the full 1-year period allowed by the RD&D regulations that is being requested in this permit application. It is the intent of BPBG to use the entire RD&D campaign to treat all GB agent containing munitions and associated wastes. Should operations take longer than the anticipated one year, BPBG may seek additional time as outlined in the Office of Solid Waste and Emergency Response (OSWER) Policy Directive for RD&D permits.

Table 2-1 – BGCAPP Pilot Testing Nominal Feed Rates

Week of RD&D	Nominal Throughput, %[a]		Rounds/Hr[b]		Rounds/Week[a]		Rounds/Month		Hazardous Waste Processed, kg[c]	
	Rockets	Projectiles	Rockets	Projectiles	Rockets	Projectiles	Rockets	Projectiles	Hourly	Monthly
1	1.0	0.0	18	0	18	0			257	
2	2.0	0.0	20	0	36	0			285	
3	4.0	0.0	20	0	72	0			285	
4	4.0	0.0	20	0	72	0	198		285	2,823
5	7.9	0.0	20	0	144	0			285	
6	11.9	0.0	20	0	216	0			285	
7	18.9	0.0	20	0	342	0			285	
8	37.5	0.0	20	0	680	0	1,382		285	19,706
9	37.5	0.0	20	0	680	0			285	
10	37.5	0.0	20	0	680	0			285	
11	37.5	0.0	20	0	680	0			285	
12	50.0	0.0	20	0	907	0	2,947		285	42,022
13	50.0	0.0	20	0	907	0			285	
14	50.0	0.0	20	0	907	0			285	
15	50.0	0.0	20	0	907	0			285	
16	75.0	0.0	20	0	1,360	0	4,081		285	58,192
17	75.0	0.0	20	0	1,360	0			285	
18	75.0	0.0	20	0	1,360	0			285	
19	75.0	0.0	20	0	1,360	0			285	
20	100.0	56.4	20	16	1,814	352	5,894	352	390	86,359
21	100.0	56.4	20	16	1,814	352			390	
22	100.0	56.4	20	16	1,814	352			390	
23	100.0	56.4	20	16	1,814	352			390	
24	100.0	56.4	20	16	1,814	352	7,256	1,408	390	112,726
25	28.6	105.8	20	16	518	660			390	
26[d]	0.0	0.0	0	0	0	0			0	
27-Test[e]	100.0	100.0	20	16	1,814	624			390	
28-Test[e]	100.0	100.2	20	16	1,814	625	4,146	1,909	390	71,675
TOTALS					25,904	3,669	25,904	3,669		393,503

[a] The feed rates shown for the RD&D program are nominal. Actual processing rates will be established on the basis of RD&D.
[b] These are the peak hourly rates that rockets (20/hr) and projectiles (16/hr) can be fed to the system. These rates do not necessarily correspond to the weekly peak operating rates because the plant can be operated to process agent and/or energetics even though no new munitions are being fed at the time.
[c] Based on 14.3 kg of hazardous waste per rocket and 6.6 kg agent per projectile.
[d] 12-day outage in preparation for performance test.
[e] Test refers to the performance test, which will fully demonstrate the process at full operating rate.

2.5.1 Quantities of Waste to be Treated

This section justifies the need for the proposed quantities of waste that are to be treated under this RD&D program. The EPA Guidance Manual for Research, Development, and Demonstration Permit Units under 40 CFR Section 270-65 (EPA/530-SW-86-008, July 1986), page 8, recommends the following limits on the amount of waste that is to be treated under an RD&D permit:

1. Treat a maximum of 15,000 kg of hazardous waste per month for experimental purposes.
2. Store a maximum of 15,000 kg of hazardous waste intended for experimental purposes at any time.
3. Treat a maximum of 400 kg of hazardous waste per hour in any experiment.

Table 2-1 presents the hourly, weekly, and monthly hazardous waste processing rates in the proposed RD&D program. These processing rates are nominal and will be increased only after the success criteria have been achieved as described in paragraphs 2.5.1.1 through 2.5.2. The following discussion relates to these three rates. Since BGCAPP is a full-scale pilot plant, it is necessary that the above recommended maximum monthly rate (i.e., 15,000 kg/month) be exceeded in order to demonstrate full integration of the systems being tested under the RD&D program. Table 2-1 also presents the nominal ramp-up rates (as a percentage of full operation) for the processing of projectiles and rockets.

2.5.1.1 Hourly Operating Rate

The hourly processing rates shown in Table 2-1 are based on the maximum design processing rate for the BGCAPP, which for GB are 20 rockets and 16 projectiles per hour. Each rocket contains a total of 14.3 kg of hazardous waste (chemical agent, propellant, and explosives); each projectile, 6.6 kg. This results in a maximum of (20 x 14.3) + (16 x 6.6) = 391.6 kg/hr. This peak is less than the 400 kg/hr that is allowed by the RD&D guidance. This is the maximum processing rate for the design during any hour of operation. This maximum value is not achieved until week 20, when the nominal throughput (Table 2-1, columns 2 and 3) is increased to 100 percent because of the feeding of GB projectiles in preparation for the performance test.

2.5.1.2 Quantity of Waste Stored

The EPA's Guidance Manual for RD&D recommends that no more than 15,000 kg of hazardous waste intended for experimental purposes be stored at any one time. Because the quantities of wastes to be treated under the RD&D program exceed the 15,000 kg listed, the quantities of wastes to be stored resultingly will be greater than 15,000 kg as well.

2.5.1.3 Monthly Processing Rates

Table 2-1 also shows the monthly processing rates, which are calculated assuming 4 weeks of operation per month. These values exceed the 15,000 kg recommended by the EPA's Guidance Manual for RD&D. The justification for exceeding the recommended monthly quantity is based on the need to increase the processing rate to the maximum design rate by ramping up in small stepwise increments.

As discussed in paragraph 3.2.1.1, to safely test the system's integration (including the human factors) at rates approaching the BGCAPP's full operating rate, the hazardous waste must be processed at rates exceeding the 15,000 kg per month.

The hazardous waste (i.e., munitions) processing rates in Table 2-1 are maximums based on the assumption that demonstrating integration of the BGCAPP processes will not identify any design issues that require correction. This is an improbable scenario and startup of a pilot plant like BGCAPP is expected to involve delays and stoppages. Hence, the most probable scenario will be a slower processing rate than requested. Regardless of the actual waste processing rates, the RD&D program will not compromise health or the environment. The following design and operating characteristics of the BGCAPP ensure protection of public health and the environment:

1) All agent-related processing is performed in the MDB, which is fully contained by the MDB HVAC system permitted under a Title V air permit. This is a proven system that maintains protection even if an upset or operating anomaly occurs.
2) The MDB HVAC system is monitored for agent on a near-real-time basis as required to demonstrate compliance with the Title V permit requirements.
3) Each batch of hydrolysate is tested and meets the target release levels for agent before it is transferred to the HSA.
4) The process' ability to achieve 99.9999 percent destruction efficiency (DE) for agent is demonstrated on the initial batches of agent processed in the ANR. This initial validation satisfies the requirements of paragraph 3.5.3. The testing is performed in accordance with the procedures described in the test plan.

In conclusion, the requested processing rates do not pose a risk to health or to the environment, and are essential to meeting the process integration objectives and requirements of the RD&D program.

2.5.2 Testing Schedule and Criteria for Increasing Processing Rates

Paragraph 3.1 explains the reasons for the processing rates proposed for the RD&D program. The explanation is based on the need to demonstrate process integration through research, which is discussed in paragraph 3.2.1. The increase in projectile and rocket processing rates will be based on achieving the applicable success criteria identified in paragraphs 3.2.1.1 through 3.2.1.5. If processes are operating as designed, batches of agent and energetics hydrolysate meet their respective target release levels, and the success criteria (identified in paragraphs 3.2.1.1 through 3.2.1.5) are satisfied for the processing rate, then the processing rate will be increased to the next higher rate. This approach recognizes human factors, provides safeguards at every step, maximizes safety/health and environmental protection and results in the safe and effective completion of the BGCAPP RD&D program.

2.6 Operation Subject to Regulation by KHW Part B Permit

During the design and construction phases of the BGCAPP program, the KHW Part B Permit Application will be prepared and submitted to KDEP. This application will be submitted at least 2 years before the end of pilot testing to allow KDEP/Division of Waste Management (DWM) to evaluate and approve the KHW Part B Permit. As shown in Table 2-1, a performance test will be conducted during the RD&D program. This performance test will provide final confirmation of the safety and environmental acceptability of the process. KDEP personnel will be present onsite during this testing and will be provided the raw analytical needed to evaluate success of the pilot/performance test. Due to the issues associated with facility shutdown following completion of testing, BGCAPP plans and requests that KDEP allow operations to continue pending approval of the Part B Permit or until KDEP notifies BGCAPP that it disapproves either the Part B Permit or the results of demonstration testing..

Figure 2-2 – BGCAPP Site Plan

(SIR)

3.0 RESEARCH PLAN

3.1 Pertinent Information for Proposed Operation of Experimental Waste Facility/Process

This section describes the overall process that will be used to perform the RD&D program that is covered under this permit application and presents the justification for this research. Section 3 explains how the process satisfies the requirements of Kentucky Revised Statute (KRS) 224.50-130 and how this process will meet environmental protection standards in accordance with 401 KAR 34.

The proposed facility is a full scale pilot plant that will be used to validate the National Research Council's (NRC's) requirement for research on process integration discussed in paragraph 3.3.1.5. Although some integration research of the BGCAPP can and will be conducted using surrogates and simulants, testing with live agents and agent-containing munitions is necessary to verify that the design will properly destroy the BGAD's chemical agent munitions stockpile. The overriding criterion that drives this design is that the facility be capable of performing the RD&D in a manner that is safe and protective of human health and the environment.

To this end, the BGCAPP is being designed and built to the same standards as a full scale treatment facility. For example, the blast-resistant containments, the highly filtered HVAC exhausts, and the numerous other protective systems that are necessary for a fully functional system also are necessary to ensure safety and environmental protection during the RD&D program. Because of this requirement, and because it is very difficult to add equipment after the treatment areas are contaminated with agent, the full facility must be built to support the RD&D program and then tested as one unit. As a result, the BGCAPP is described as a full scale, pilot plant. However, this RD&D permit application only is for the destruction of GB under the RD&D program.

The technology that is intended to be used by the BGCAPP was chosen to meet the requirement of KRS 224.50-130 (3a) and (4),which requires the technology to:

- Exist in an operational facility, or to have been demonstrated in a disposal program at a comparable scale, and
- Create less risk of release, acute or chronic health effect, or adverse environmental effect

This determination was made through an extensive testing, evaluation, and selection process that was documented and critiqued by internal Department of Defense (DoD) groups and independently reviewed by many National Research Council (NRC) panels. Table 3-1 lists the major reports in which the NRC panels chronicled and critiqued the progress of the evaluation and selection process.

The evaluation process first examined numerous alternative technologies (NRC 1993) and NRC 2002 and NRC 2002a identified two technologies that were subsequently demonstrated under the ACWA program. These evaluations (see Table 3-1) identified the General Atomics Total Solution (GATS) process, on which the BGCAPP design is based, as the one with lower hydrocarbon and carbon monoxide emissions. The final Environmental Impact Statement (EIS) for BGCAPP (December 2002) also discusses alternate technologies and draws the same conclusion.

The ability to destroy the chemical weapons stockpile will be assessed during the BGCAPP RD&D program. A KHW Part B Permit application will be submitted prior to completing the RD&D program to allow the KDEP and other regulators to further evaluate the process' safety and environmental compliance based upon the additional data collected during the RD&D demonstration test.

Table 3-1 – Major NRC Reports Relevant to Destruction of Weapons at BGAD

Report Date	Report Title
NRC 1993	Alternative Technologies for the Destruction of Chemical Agents and Munitions
NRC 1995	Review of Alternative Chemical Disposal Technologies
NRC 1999	Review and Evaluation of Alternative Technologies for Demilitarization of Assembled Chemical Weapons
NRC 2000	Evaluation of Demonstration Test Results of Alternative Technologies for Demilitarization of Assembled Chemical Weapons, a Supplemental Review for Demonstration II
NRC 2000a	Integrated Design of Alternative Technologies for Bulk-Only Chemical Agent Disposal Facilities
NRC 2001	Analysis of Engineering Design Studies for Demilitarization of Assembled Chemical Weapons at Pueblo Chemical Depot
NRC 2001a	Disposal of Neutralent Wastes
NRC 2002	Analysis of Engineering Design Studies for Demilitarization of Assembled Chemical Weapons at Blue Grass Army Depot, 2002
NRC 2002a	Update Engineering Design Studies for Demilitarization of Assembled Chemical Weapons at Blue Grass Army Depot
NRC 2004	Effects of Degraded Agent and Munition Anomalies
NRC 2005	Interim Design Assessment for the Blue Grass Chemical Agent Destruction Pilot Plant
NRC 2006	Review and Assessment of the Proposals for Design and Operation of Designated Chemical Agent Destruction Pilot Plants
NRC 2007	Review of Chemical Agent Secondary Waste Disposal and Regulatory Requirements
NRC 2008	Review and Assessment of Developmental Issues Concerning Metal Parts Treater Design for the Blue Grass Chemical Agent Destruction Pilot Plant
NRC 2008a	Review of Secondary Waste Disposal Planning for the Blue Grass and Pueblo Chemical Agent

Report Date	Report Title
	Destruction Pilot Plants
NRC 2009	Assessment of Explosive Destruction Technologies for Specific Munitions at the Blue Grass and Pueblo Chemical Agent Destruction Pilot Plants
NRC 2011	Assessment of Approaches for Using Process Safety Metrics at the Blue Grass and Pueblo Chemical Agent Destruction Pilot Plants
NRC 2012	The Blue Grass Chemical Agent Destruction Pilot Plant's Water Recovery System
NRC 2012a	Assessment of Agent Monitoring Strategies for the Blue Grass and Pueblo Chemical Agent Destruction Pilot Plants
NRC 2012b	Disposal Options for the Rocket Motors from Nerve Agent Rockets Stored at Blue Grass Army Depot
The NRC reports are available for purchase or download at www.nap.edu.	

3.2 Objective Statement & Experimental Design

3.2.1 Justification for Research

The BGCAPP ultimately will destroy all chemical weapons at the BGAD using alternative technologies. NRC panels reviewed the results of previous evaluations of alternative technologies in a series of reports listed in Table 3-1 and, in its last report, identified a process termed General Atomics Total Solution (GATS) as the most mature alternative process for use at the BGAD. The report suggested improvements in the design, but indicated that, although all of the individual processes are acceptable for application at the BGAD, RD&D must be performed to refine and demonstrate the integrated process before going to full operation. The BGCAPP design incorporates the design improvements identified by the NRC, and the BGCAPP RD&D program incorporates this integration research. The final stage of development is the testing and evaluation of the integrated process under a carefully developed RD&D program that is the purpose of this application.

The RD&D program to be conducted at the BGCAPP includes the following goals:

1. Conduct a thorough program of system integration including the conveyance of munitions and munition segments from one treatment location to the next to include the MPT treatment and release of the munition parts from the MDB.
2. Demonstrate that 99.9999 percent DE of GB agent can be achieved in the agent neutralization reactors (ANRs) as required by KRS 224.50-130.
3. Demonstrate that the energetics can be treated in the EBHs and the ENS.
4. Demonstrate that the MPT will thermally treat projectile bodies and solid residue from the EBH to a minimum of 1,000°F for a minimum of 15 minutes (i.e., the Army treatment standard for chemical agent destruction).

5. Demonstrate the performance of the SCWO reactor system.

The RD&D program described in this application is being conducted to demonstrate the agent and energetics destruction capabilities of the BGCAPP integrated process. As data are obtained from both ongoing equipment design and testing programs, data are fed back to the BGCAPP team so that the information can be used to improve and validate the plant processes. This data feedback will continue during the RD&D demonstration phase. However, no changes will be made that could increase risk or environmental releases and the expected outcome of the RD&D program will be further reductions in risk.

The present permit application requests approval for the BGCAPP to be built and operated as a full scale pilot plant to conduct a demonstration of the agent and energetics destruction capabilities as integrated plant processes. Much of the RD&D program will not involve hazardous wastes; the initial tests will be performed using simulants and surrogate materials. After the overall plant's performance, safety, environmental acceptability, and reliability have been established, the RD&D program will progress to initially include small amounts of agent; after demonstrated performance, increasingly larger amounts of agent and chemical munitions will be processed. At the conclusion of the research, the facility will have demonstrated that it is capable of operating at full capacity and the remainder of the stockpile will be processed under a Part B permit.

The information that is included in the RD&D permit compliance schedule (Appendix B to the RD&D Permit issued on 30 September 2005) includes the additional information that would be required in a Part B permit application for a hazardous waste treatment facility. Therefore, the submission of the compliance schedule items will be used for the completion of a Part B permit application.

Paragraph 3.2.3 presents a comprehensive overview of the activities to be performed under the RD&D permit. As shown in section 2, Table 2-1, the performance test is the transition from operation under the RD&D permit to operation under the full Resource Conservation and Recovery Act (RCRA) KHW Part B permit with activities prior to and including the performance test occurring under the RD&D permit.

3.2.1.1 System Integration

Conduct a thorough program of system integration including the conveyance of munitions and munition components from one part of the treatment process to the next up to and including the release of the munition residue from the MDB. System integration has two components:

1) Ability of the equipment to function as one unit with the actual wastes.
2) Maximizing the operators' proficiency under safe operating conditions.

Optimizing the operators' proficiency under carefully controlled and supervised conditions has traditionally not been considered as RD&D. However, such human factors research is essential to maximize safety and protect the environment; hence it has been made an important component of the BGCAPP RD&D process. Before hazardous waste (agent) operations begin, the operators are thoroughly trained in their duties and responsibilities through coursework, simulations, and actual hands-on experience with simulated munitions. Simulated equipment training hardware (SETH) munitions are constructed to have physical dimensions that are similar to the actual munitions, but they do not contain the chemical agent and energetics.

However, only operations conducted with actual munitions can provide the required operator experience and proficiency to verify that the process fully addresses human factors and, therefore, minimizes risk to human health and to the environment. The proficiency in handling and processing actual chemical munitions can only be achieved through slow and deliberate step rate changes in which the operators handle the actual munitions at initially very low rates with heightened direct supervision by management and system engineers. As the operators gain experience, the processing rates are increased in accordance with the ramp-up schedule in Table 2-1.

To ensure increased oversight by management and systems engineers, initial munition processing will occur only on the day shift. Night shift activities will concentrate on preventive and corrective maintenance activities, monitoring the EBH neutralization process and pre-staging of munitions for the next day of operations. The step changes in processing rates are typically scheduled in 4-week intervals to ensure each of the four rotating operations shifts have an opportunity to process munitions on day shift. The step rate changes also provide a logical progression which fosters systematic improvements in operator proficiency. The RD&D demonstration phase with agent munitions is required to demonstrate that the integrated BGCAPP facility and operators can proficiently process actual munitions as compared to the simulated munitions used in systemization. The step rate changes also allow protection of human health and the environment to be verified.

a. Justification for Conducting with Hazardous Waste – To establish successful system integration, all BGCAPP subsystems must operate as an integrated facility. This requires that the processing include agent, agent hydrolysate, energetics, energetics hydrolysate, munition components, dunnage, and secondary waste. Appropriate development of this process integration requires the processing of real munitions unique to BGAD.
b. Measurements and Observations Required – Process integration is considered to be achieved when the process successfully operates at the peak munitions processing rate in Table 2-1. Process integration is the overarching objective: it demonstrates the facility and operators can achieve the necessary results when operating as a unit and when treating the actual hazardous wastes at the peak processing rate. The criteria that are required to assess and demonstrate the integrated process are discussed in paragraphs 3.2.1.2 through 3.2.1.5.
c. Safety and Environmental – Maximum safety and environmental protection is achieved by performing this verification at an initially very slow rate during weeks 1 through 4 and stepwise increases in the processing rate as information is gathered. This slow ramp-up ensures adequate time to properly evaluate the agent and energetic destruction results and to verify the operators' levels of knowledge and performance ensure safe operation. Plant operating rates are progressively increased at the nominal rates shown in Table 2-1.
d. Success Criteria – Process integration is considered to be successful at each ramp-up rate when all operators are assessed to be proficient at their functions, and all exit streams meet the safety and environmental requirements as discussed in the following subsections.

3.2.1.2 Demonstrate 99.9999 Percent DE for GB

Demonstrate that 99.9999 percent DE can be achieved for GB agent in the agent neutralization reactors (ANRs) as required by KRS 224.50-13 and 401 KAR 34:350.

a. Justification for Conducting Operations with Hazardous Waste – Agent hydrolysis has been demonstrated to achieve the requisite 99.9999 percent DE for GB in the previous testing conducted by the Program Executive Office, Assembled Chemical Weapons Assessment (PEO ACWA). Agent destruction at the BGCAPP must be demonstrated using the BGCAPP equipment with the BGAD munitions as required by KRS 224.50-130(3)(a). This only can be demonstrated by conducting tests with the chemical agent (i.e., state listed hazardous waste).
b. Measurements and Observations Required – The GB drained from the munitions is stored in the agent collection system (ACS) until a sufficient quantity of agent has been accumulated for processing in the agent neutralization reactor (ANR). The agent is then transferred from the ACS to an ANR for hydrolysis and the hydrolysate is analyzed for GB. The DE is calculated using the equation presented in the BGCAPP RD&D Permit, Condition T-9, as outlined in paragraph 3.5.3. The number of ANS batches to be tested in this way will be established in the test plan, which will be submitted in accordance with the BGCAPP's compliance schedule.
c. Safety and Environmental – The hydrolysate batches processed in the ANRs are not released from the MDB until the analytical results demonstrate that the target release level has been met. The ANR vents to the MPT off-gas treatment system (OTM) and then to the MDB HVAC filter system before release to the atmosphere. These multiple layers of protection provide a high degree of safety and protection of the environment. A slow start of operation (as specified in the test plan) maximizes personnel safety and protection of the environment by minimizing the amount of agent in process while the initial batch of agent is neutralized.
d. Success Criteria – The process meets the 99.9999 percent DE as specified in paragraph 3.5.3.

3.2.1.3 Demonstrate EBH's Ability to Treat Rocket Energetics

Demonstrate that the rocket energetics can be treated in the EBHs and the ENS.

a. Justification for Conducting with Hazardous Waste – EBH performance has been demonstrated to achieve this objective using pieces of M61 (i.e., training) rockets with energetics during the technical risk reduction program (TRRP) for the EBH. The test also demonstrated that the hydrogen (H_2) levels could be maintained below 25 percent of the lower flammability limit (LFL). Although energetics neutralization has been demonstrated, it is necessary to verify and demonstrate these results with the BGCAPP equipment and BGAD munitions. This involves system integration and includes the transfer of the rocket warhead segments from the RSM to the EBHs and the transfer of the treated EBH solid residue from the EBH to the MPT. This objective can only be validated by treating agent-contaminated energetic-components of the leakers in the BGCA stockpile. This verification must be completed for all installed EBHs.
b. Measurements and Observations Required – The hydrogen (H_2) gas concentration must be monitored in the EBHs' vent gases to ensure H_2 gas concentration is below 25 percent of the LFL. The EBH and vent gas system will demonstrate the ability to safely control the increased hydrogen generation for each processing rate increase in the ramp-up schedule. Hydrolysate leaving each EBH batch goes to the

energetics neutralization reactors (ENRs) for further treatment. The solids leaving the EBHs go to the MPT. No specific measurements are made on the EBH solid residue except for observing that the mechanical equipment is operating properly under agent munition operations. The energetics hydrolysate is sampled in the ENR and tested to verify successful energetics and agent treatment.

c. Safety and Environmental – Maximum safety and environmental protection is achieved by verifying the system performance at a slow rate during weeks 1 through 4 and increases stepwise as the performance objectives are met. This slow ramp-up ensures adequate time to verify completion of energetics and agent hydrolysis and that the energetics hydrolysate meets the target release levels (i.e., for energetics and agent) before transfer to the HSA. The rocket feed rate is increased in accordance with the nominal feed rates shown in Table 2-1.

d. Success Criteria:
   - Hydrogen monitoring system works as designed at all rocket processing rates in each EBH.
   - EBH solids transfer system to the MPT continues to effectively transfer solids as the rocket feed rates increase.
   - Hydrolysate leaving the ENR meets the required energetics destruction and the agent target release level.

3.2.1.4 Demonstrate MPT's Ability to Treat Projectiles

Demonstrate that the MPT can thermally treat batches of projectile bodies to a minimum of 1,000°F for a minimum of 15 minutes.

a. Justification for Conducting with Hazardous Waste – TRRP testing with ACWA test equipment munitions have demonstrated that the MPT can thermally treat a full tray of projectiles to a minimum of 1,000°F for a minimum of 15 minutes. Thermal treatment in the MPT must be demonstrated to verify the previous results with actual munitions from the BGCA stockpile.

b. Measurements and Observations Required – Temperature measurements are performed to confirm the temperature profile previously demonstrated during systemization. Thermal dosimeters will be used to ensure 1,000°F will have been maintained for at least 15 minutes in accordance with DA performance standards for agent destruction.

c. Safety and Environmental – Slow initial operating rates ensure all material in the MPT achieves the appropriate temperature before it is removed from the MPT. The batch nature of the operation allows the time per batch or the power input to be increased to establish the operating conditions necessary to ensure proper decontamination of the metal. Air pollution is controlled for MPT off-gas by discharge through the OTM and then through the MDB HVAC filtration system.

d. Success Criteria – Verify by temperature measurements of the treated munition bodies that the projectile carcasses in the first trays of material have been exposed to a minimum of 1,000°F for a minimum of 15 minutes. This will be accomplished by the use of thermal dosimeters on the munition bodies.

3.2.1.5 Demonstrate Performance of SCWO Reactor System

a. Justification for Conducting with Hazardous Waste – Tests with the agent and energetic hydrolysates were performed under the PEO ACWA engineering design study (EDS) test program. Testing under the RD&D program is required to demonstrate the SCWO treatment of the blended hydrolysate. All materials fed to the SCWO have previously been tested for agent and verified to be below the target release level. Processing the hydrolysate ensures the SCWO effluent meets the expected performance criteria before the water is further treated in the WRS. Because the SCWO performance can be assessed early in the RD&D program, the hydrolysate can either be stored in the HSA or it can continue to be processed through the SCWO units while RD&D continues on the other upstream treatment units.

b. Measurements and Observations Required – The operating parameters of the SCWO reactors are monitored to verify that the equipment is performing properly. The SCWO effluent is analyzed for total organic carbon (TOC).
c. Safety and Environmental – SCWO has been demonstrated to have extremely low emissions. According to all available data, the air emissions from the SCWO do not require further treatment prior to release to the environment.
d. Success Criteria – Demonstration of successful treatment of organics in wastewater will be based on measurement of TOC at in the effluent stream.

3.2.2 Process Description

This section presents the overall processing sequence of the BGCAPP. The subsequent sections describe the individual process units.

The BGCAPP design combines proven, low-risk, Army-approved, NRC-recommended neutralization and SCWO technologies that have been successfully demonstrated for the PEO ACWA into an integrated plant for testing during the RD&D program. The demonstration of this integrated plant and the destruction processes is the subject of this permit application.

Chemical demilitarization of the BGCA stockpile occurs in the munitions demilitarization building (MDB) and subsequent treatment of the residual organic compounds occurs in the SCWO processing building (SPB). Section 6 describes the buildings and the high level of added safety and environmental protection that it offers.

The BGCAPP design is an integrated system that will be used to safely destroy the agent and energetics by the following environmentally acceptable procedure:

1) Agent and energetics access (mechanical).
2) Energetics removal and deactivation by hydrolysis.
3) Agent removal and neutralization by hydrolysis.
4) Post-treatment of agent/energetic hydrolysates using commercial-scale, solid-wall SCWO units.
5) Metal and other solids decontamination by heating to a minimum of 1,000°F for 15 minutes in the inductively heated MPTs.
6) Some secondary wastes (e.g., agent-contaminated pallets and PPE) will be treated by chemical decontamination. The chemically decontaminated residue will be disposed of at an off-site treatment, storage, and disposal facility (TSDF) or the residue will be treated in the MPT and then managed by appropriate means to minimize waste.
7) Spent activated carbon will be shipped off site for further treatment at a permitted TSDF.
8) Agent-contaminated, metallic secondary wastes (e.g., miscellaneous metal parts, metal reinforced hoses, piping, valves, and tools) that have not been chemically decontaminated will be processed through the MPT and then managed by appropriate means to minimize waste.

9) Secondary wastes that are not agent-contaminated will not be processed through the BGCAPP; they will be managed by appropriate means to minimize waste.

The process achieves the required 99.9999 percent (as a minimum) destruction of agent stored at the BGCA by neutralization via hydrolysis. Agent hydrolysis involves mixing the agent (GB) or agent-contaminated liquid in an enclosed vessel with hot caustic solution [i.e., sodium hydroxide (NaOH)]. Hydrolysis of the energetics also will be performed. Table 3-2 lists the types of hydrolysis to be used.

Table 3-2 – Hydrolysis Types to be Used at BGCAPP for GB

Hydrolysis Type	Agent
Hot sodium hydroxide solution	GB [nerve agent sarin: isopropyl methyl phosphonofluoridate ($C_4H_{10}FO_2P$)]
	Energetic materials (explosives and rocket propellants)

The munition bodies and other metallic components of the munitions are washed using high-pressure water and thermally treated in the MPT at a minimum of 1,000°F for a minimum of 15 minutes. The Army treatment standard for agent destruction is achieved by this treatment process and following this treatment the wastes may be either sent offsite for disposal or recycling (i.e., this thermal treatment meets the Army requirement for release to the public).

The facility has been designed to safely treat all chemical weapons, chemical warfare agent, and ancillary materials. However, certain ancillary (secondary) wastes may be decontaminated with sodium hydroxide (NaOH), sodium hypochlorite (NaOCl), or other appropriate decontamination (decon) solutions. These wastes, PPE, and other plastic/rubber items, will be decontaminated to the Airborne Exposure Limits (AELs) and then shipped off site to a permitted TSDF. If they cannot be decontaminated to the AELs, these wastes will be treated in the MPT before they are shipped off site for treatment or disposal in a permitted TSDF.

To the maximum extent possible, process liquid streams are recycled to conserve water and to prevent discharge to ground or surface water. Water is recycled via a water recovery system that produces water of a quality suitable for recycling back into the process during the pilot testing and operations phases.

Figure 3-1 is a process block flow diagram for the hazardous waste processing units. The figure shows the flow of munitions and other streams from the container handling building (CHB) through the various systems.

Figure 3-1 –General Process Block Flow Diagram

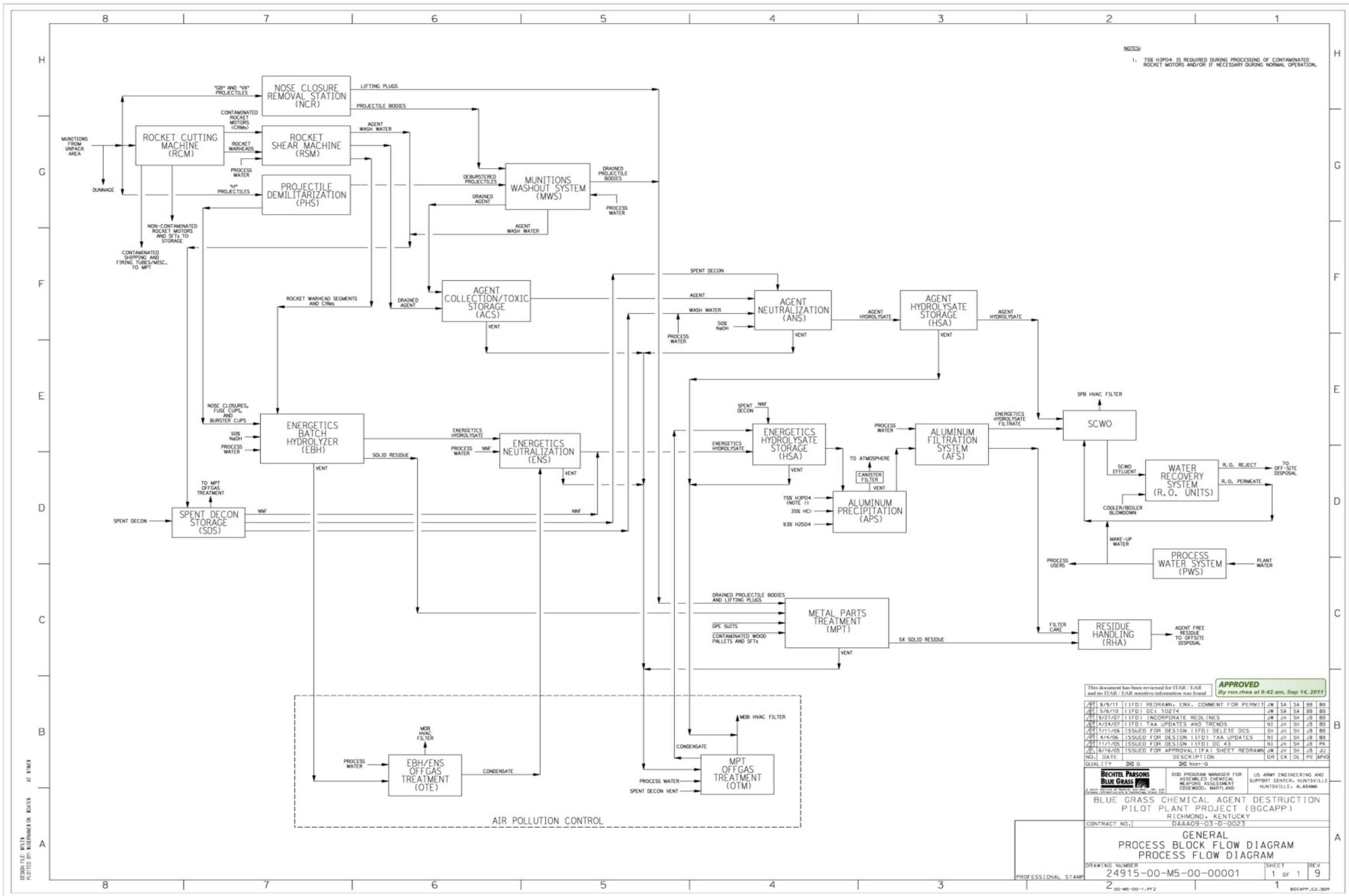


Figure 3-2 – Photograph of EONC

Palletized munitions are stored in "igloos" and are currently regulated under the BGAD hazardous waste storage permit. The location of each type of munition is well documented and a specific munition type required for testing can be easily located and transferred with minimum disturbance of the overall stockpile of munitions. Any munitions selected for testing will be transported in enhanced onsite containers (EONCs) from the storage igloos to the CHB.

The EONCs are airtight vessels that are specifically designed to contain munitions during transport from the BGCA storage igloos to the CHB. Figure 3-2 (shown above) is a photograph of an EONC. The EONC is a well-established design that has been used safely at the Tooele Chemical Agent Disposal Facility (TOCDF), the Anniston Chemical Agent Disposal Facility (ANCDF), Umatilla Chemical Agent Disposal Facility (UMCDF), and the Pine Bluff Chemical Agent Disposal Facility (PBCDF).

The EONC is received in the CHB, where it is stored until its contents are to be treated. At that time it is transferred to the west unpack area (UPA), which is under "Engineering Controls", and the air in the sealed EONC is monitored for agent. If agent monitoring indicates that the EONC does not contain leaking munitions, the EONC is opened, and the munitions are transferred to the appropriate conveyor line for treatment of that munition type.

If agent is detected in the EONC (indicating a leaking munition), the EONC is moved to an area under a higher level of Engineering Control, where it is opened and the munitions are processed by personnel wearing appropriate personal protective equipment (PPE). The munitions are removed from the EONC and placed on the appropriate processing conveyor line, passing through the explosive containment vestibule (ECV) or toxic maintenance area (TMA). The contaminated metal straps are transferred to the MPT for treatment. The contaminated wood pallets may either be treated on site by chemical decontamination or treated in the MPT and then shipped off site to a permitted TSDF. The EONC is then decontaminated and released for further use.

The treatment operations are performed using remote control systems. The specific treatment sequences for each type of munition and the operation of each unit within the system are discussed below. Briefly, the demilitarization of munitions results in the following components for treatment:

1) Liquid agent and agent-contaminated wash water.
2) Agent-contaminated wood/fiberglass/cardboard
3) Agent-contaminated metal
4) Explosive components (e.g., bursters, propellant and fuzes)
5) RMs and contaminated rocket motors (CRMs).

KDEP approval is not being sought to process agent for any purpose other than for RD&D. Processing agent under the RD&D program is the basis for assessing the system's performance and developing the engineering information that is the objective of the RD&D program.

The munitions processing is conducted in the MDB, which contains the systems that provide the following functions:

1) Remove energetic components and disassemble the munitions.
2) Drain the agent from the agent cavities.
3) Neutralize the agent (GB) by hydrolysis in hot caustic to a minimum of 99.9999 percent DE.
4) Neutralize the explosives and CRM propellant by hydrolysis to meet the 40 CFR 268 treatment standard for D003 waste streams (deactivation).

5) Place the RMs in containers for transport to storage and/or treatment, recycling or disposal.
6) Treat the agent-contaminated dunnage and most other agent-contaminated ancillary wastes either by thermal treatment in the MPT or by chemical decontamination. Chemical decontamination is the first choice for wood, PPE, other plastic/rubber wastes, and other organic materials. These materials will be decontaminated using NaOH, NaOCl, or other appropriate decontaminate solution to the AELs. Wastes that have been tested to meet AELs will be shipped offsite to a permitted TSDF.
7) Ship the spent activated carbon off site for further treatment at a permitted TSDF.
8) Thermally treat agent-contaminated metal parts and other agent-contaminated wastes in the MPT.

Before transferring agent and energetic hydrolysates from the MDB to the HSA, the hydrolysate will be analyzed for residual agent concentration. If the agent concentration is above the target release level, additional treatment will be required. If the agent concentration is below the target release level, the batches of agent and energetic hydrolysate are transferred to the HSAs and finally to the SPB for further treatment.

After demonstrating 99.9999 percent DE for agent hydrolysate, validated process controls and statistical testing may be used in lieu of analyzing all batches of agent hydrolysate. This alternative analytical approach will be submitted to KDEP as part of the Waste Analysis Plan (WAP) that is included in the RD&D Permit Compliance Schedule, Item # 18.

In the SPB, the pH of the energetics hydrolysate is adjusted in the aluminum precipitation system (APS). The dissolved aluminum compounds in the energetics hydrolysate are precipitated out of the hydrolysate in the APS and then physically separated from the hydrolysate in the aluminum filtration system (AFS). The AFS filtrate is blended with agent hydrolysate and fed to the SCWO system for treatment. The filter cake is shipped off site to a permitted TSDF.

Agent-contaminated waste streams will either be treated at a minimum of 1,000°F for a minimum of 15 minutes to destroy residual agent and energetics, if present, or these waste streams will be shipped off site after being decontaminated. All gas streams (including all exhaust air) are filtered through multiple banks of both particulate (HEPA) filters and activated carbon and are monitored for agent as required by the Title V air permit. The combination of liquid phase batch processing (with analysis of the contents prior to release) and air stream filtration systems (with near real time monitoring) minimize the risk to human health and the environment.

3.2.3 Performance Criteria

The main purpose of this RD&D is to demonstrate and evaluate the efficacy of the BGCAPP integrated processes. This will be done by operating the individual (proven) components (e.g., RSM and EBH) first with surrogates (during systemization) and then with agent-bearing wastes under the RD&D program. Using this approach, the efficiency and performance of the pilot plant and its integrated processes can be adequately assessed.

During the RD&D program, the integrated processes will be assessed for the capability to meet efficiency and performance criteria. The process will be tested to:

1) Demonstrate 99.9999 percent DE for agent via hydrolysis on the initial batches of agent processed.
2) Demonstrate sufficient destruction of energetics by hydrolysis to ensure the solids exiting the energetics neutralization system (ENS) meet the 401 KAR 37:040 treatment standard for D003 waste streams (Deactivation).

3) Validate the plant's anticipated overall hazardous waste characteristics (i.e., to assess the type of TSDF that is appropriate for each and to allow evaluation and acceptance by TSDFs) and generation rates.
4) Identify the operating parameters and ranges which will ensure successful operation of systems and processes and simultaneous compliance with applicable environmental standards.
5) Confirm procedures developed for operations include sufficient environmental compliance and hazardous waste management provisions to ensure regulatory compliance is maintained.
6) Verify that the MPT can treat the materials to a minimum of 1000°F for a minimum of 15 minutes.
7) Verify that the EBH performs as designed.
8) Verify proper operation of the SCWO system on actual hydrolysate.

The following sections discuss how these criteria will be met. Paragraph 3.5.3 presents the method to be used to demonstrate 99.9999 percent DE for agent. The remaining paragraphs show how the RD&D objectives will be met. Process-specific RD&D objectives and performance criteria are discussed throughout section 3.

3.2.3.2 Munitions Demilitarization Building (MDB)

Except for the processes listed below, all processes within the MDB perform mechanical processes on the munitions (e.g., punching, draining, washing, and shearing of the munitions):

a. EBH vents to the EBH off-gas treatment system (OTE).
b. Energetics Neutralization Reactors normally vent to the MPT Off-gas treatment (OTM), but may vent to the OTE if the OTM is unavailable or down for maintenance.
c. The Metal Parts Treaters (MPTs), and their associated inlet and outlet airlocks and conveyors all vent to the MPT Off-gas treatment system (OTM). In addition, the following also vent to the OTM: agent hydrolyzers, spent decontamination holding and agent washout treatment tanks, agent holding and surge tanks, and agent hydrolysate sampling tanks.

The emissions from these processes will proceed through various air pollution control systems (i.e., venturi scrubbers, thermal oxidizers) and then vent directly to the MDB HVAC filtration system.

3.2.3.3 Agent and Energetics Hydrolysate Storage

These storage tanks form a buffer between the treatment operations in the MDB and the SCWO process. The hydrolysates' vapor pressures are very low. However, as a precaution and to control possible vapors, the hydrolysate tanks are vented to a common header, which is routed back into the MDB to the discharge side of the OTM blowers.

3.2.3.4 SCWO Processing Building (SPB)

This building includes the Aluminum Removal System (ARS), SCWO reactors and the water recovery system as well as their associated tanks and tank systems. Waste materials entering this building will be analyzed and shown to be below the target release level for agent. Therefore, the emissions from these sources will pose no agent hazard, however, this processing may produce small quantities of other emissions. Extensive tests have been conducted on SCWO systems treating agent and energetics hydrolysates and hydrolysate simulants as part of the Program Manager for Alternative Technologies and Approaches (PMATA) and PEO ACWA programs. These tests were reviewed and evaluated by a number of National Research Council (NRC) panels. The panels' findings and conclusions and an extensive list of references containing the data on which their conclusions are based are presented in the reports that are listed in Table 3-1. These NRC reports concluded that the emissions from the General Atomics Design SCWO reactor were extremely low.

The SCWO system selected at BGAD has been successfully demonstrated at a scale comparable to that to be used at BGCAPP during extensive ACWA demonstrations/testing. The demonstrations were performed at increasingly longer time frames and culminated in a series of long-term tests, termed the 500-hour tests, on the materials that will be treated by SCWO at BGAD. These tests included GB, VX, and mustard hydrolysates and energetic hydrolysates and demonstrated consistently high levels of organic chemical destruction. The tests were documented and critiqued by internal DoD groups and independently reviewed by many NRC panels. Table 3-1 lists the major reports in which the NRC panels chronicled and critiqued the progress of the evaluation and selection process. The NRC cited the numerous internal government reports documenting the demonstration programs.

Based on the testing referenced above, the gas streams exiting the SCWO unit are typically very low in total hydrocarbons (less than 1 ppm). The CO concentration has been demonstrated to be consistently less than 2 ppm and particulates less than 4 mg/dry standard cubic meter (DSCM). Cadmium (Cd) + lead (Pb) are less than 0.015 mg/DSCM, and antimony (Sb) + Arsenic (As) + Beryllium (Be) + Chromium (Cr) are less than 0.045 mg/DSCM. Most of these values are at or below the lower limit of detection of the measurement method and below levels commonly found in ambient air, but are not intended to serve as target levels for SCWO gas stream exhaust. These results support the conclusion that the SCWO technology has a negligible impact on the environment.

The concentrations identified above were measured during the system demonstration programs. Although these levels demonstrate the system is safe and protective of the environment, these levels should not be identified as limits for the final system. The emission limits and performance of a risk assessment for the BGCAPP are both established as environmental requirements in the Title V air permit granted by the Commonwealth of Kentucky.

3.2.3.5 Polychlorinated Biphenyls (PCBs)

PCBs are part of the matrix found in the rocket SFTs. The SFTs may exit the BGCAPP processes with the rocket motors separated from the non-leaking agent-filled warheads or as part of the wastes generated during treatment of "leaker" rockets. These waste streams will be treated or disposed of at a permitted, offsite TSCA facility. A TSCA permit application has been prepared and submitted to EPA Region 4 for management of this waste.

3.3 Operating Parameters Monitoring & Frequency

3.3.1 Performance Test Plan

Effectiveness of Treatment [401 KAR 38:230, Section 1 & 40 CFR 270.23(d)]

The BGCAPP is an integrated facility whose effectiveness depends on the integrated processes, and not just the effectiveness of individual miscellaneous Subpart X (or other) treatment units. The sole function of the BGCAPP is destruction of the chemical agent and treatment or disposal of the associated energetics. The following text describes how the performance of the BGCAPP Subpart X treatment units is evaluated:

3.3.1.1 Hydrolysis of Agent and Energetics

Destruction of GB to a 99.9999 percent DE has been demonstrated at bench scale. Temperature and reaction time ensure energetics and aluminum components are dissolved, with primary neutralization of energetics occurring within the EBH(s). A further discussion of achievement of the 99.9999 percent DE can be found in sections 3.2.1.3 and 3.3.2.

3.3.1.2 MPT and Thermal Treatment

The U.S. Army cites a temperature of 1000°F for at least 15 minutes as a performance-based standard for the destruction of chemical agents. The MPT is an inductive thermal treatment unit designed, tested, and demonstrated to meet this military unique chemical agent treatment standard. This standard (previously referred to as XXXXX or 5X) has been used for more than 30 years and, when met, allows the release of the treated item or waste to the public. Treatment of metallic and other solid wastes, including secondary wastes, potentially contaminated with chemical agent at BGCAPP will occur in the MPT. To demonstrate achievement of the performance standard, thermal dosimeters will be applied to munition bodies and other metal parts after liquid agent has been removed. These dosimeters will be located on the outside and inside of the munition bodies and will “pop” when the pre-determined criteria (1000^{o}F for 15 minutes) has been achieved. Further information regarding the success criteria for thermal treatment can be found in section 3.2.1.5.

3.3.1.3 SCWO

BGCAPP SCWO units treat both energetics and agent hydrolysate and effectively mineralizes any remaining organics in these wastes. The SCWO has treated (at the scale employed at the BGCAPP) industrial wastewater in Japan and agent hydrolysate during tests for the U.S. Army at Corpus Christi, TX. In both instances, the technology was extremely effective in treating organics. Treatment of the highly corrosive hydrolysate at Corpus Christi produced an effluent that was essentially devoid of any organics (i.e., TOC <10 ppm). Establishment of a performance standard will occur during RD&D Testing associated with the GB Agent campaign. Further information regarding the success criteria for the SCWO can be found in section 3.2.1.5.

3.3.1.4 RO/Water Recovery

Following SCWO treatment of hydrolysate the RO system treats, recovers, and recycles (in the SCWO) the majority of the resulting wastewater (approximately 70 percent). The BGCAPP will ship the RO reject off site to appropriately licensed and permitted RCRA facility(s). The bases for selection of the off-site RCRA facility(s) will be the characteristics of the waste and the permits of the receiving facility(s). The RO unit is a proven technology for removing contaminants like salts from water. The U.S. Army and others have repeatedly demonstrated the RO's treatment effectiveness by treating wastewaters ranging from brackish water to industrial waste streams while meeting a wide variety of water quality requirements. RO Unit effluent will be evaluated and a performance standard established during RD&D Testing associated with the GB Agent campaign.

3.3.1.5 Process Integration

Process integration involves many individual units and systems performing together to achieve the desired goal of final munitions demilitarization and agent/energetics destruction. This can best be measured by the successful completion of the deliberate ramping up of munitions processing during the GB campaign to the successful demonstration test at full rate. This full scale demonstration will be accompanied by the achievement of the 99.9999 percent DE at the exit of hydrolysate from the ANS. These two components (achievement of full scale throughput and attainment of the 99.9999 percent DE) will demonstrate that all individual processes are working as designed from the onset of munitions processing in the ANS to waste streams exiting the RO unit.

3.3.2 99.9999 Percent DE Demonstration Testing

The 99.9999 percent DE is accomplished in the ANS. Demonstration testing will be performed during the RD&D phase of operations for nerve agent GB. The ANS is in a Category A room in the ACS. The room has containment sumps to collect accidental agent spills. The major components of the ANS includes: two jacketed hydrolyzers (2,062 gallons each) and three sampling tanks (4,838 gallons each).

The hydrolyzers neutralize the agent, using process water and caustic and allow sampling of hydrolysate. The sampling tanks are used to store treated hydrolysate while awaiting laboratory analysis confirming agent destruction. The transfer of hydrolysate into the sampling tank allows use of the hydrolyzer for processing another batch. The contents of the sampling tanks are agitated to maintain uniform mixing and allow collection of representative samples for laboratory analysis. After sampling, the sampling system is flushed with heated process water to remove any remaining agent hydrolysate.

The ANS performs the following functions:

1) Neutralizes agent GB with caustic
2) Processes agent contaminated spent decontamination and wash water
3) Cools the hydrolysate from reaction temperature to 100°F for sampling
4) Holds hydrolysate until sample analyses confirm the 99.9999 percent agent DE is achieved. GB hydrolysates are sampled in the agent hydrolysate sampling tanks
5) Transfers cleared hydrolysate (i.e., 99.9999 percent DE) to the agent hydrolysate storage tanks
6) Reprocesses failed hydrolysate in the agent hydrolyzers until 99.9999 percent DE is achieved

3.3.3 Waste Processing Sequences

The following sections provide the processing sequence for each waste. Each unit operation is described in greater detail in subsequent subsections.

3.3.3.1 GB Nerve Agent Munitions

3.3.3.1.1 GB 8-Inch Projectile (no energetics are associated with this munition)

1) Remove the pallet of projectiles from the EONC
2) Load the projectiles into a tray
3) Convey the tray to the nose closure removal (NCR) and munitions washout system (MWS)
4) Via robot, transfer each individual projectile to the nose closure removal station (NCRS) and remove the lifting plug from the nose
5) Via robot, transfer the individual projectiles from the NCRS and load them into the MWS module, nose-down
6) Hydraulically collapse the burster well into the projectile's agent cavity
7) Gravity-drain the agent through the nose of the projectile
8) Wash out the agent cavity using high-pressure water
9) Send the drained agent and washout water to storage tanks in the agent neutralization room (see paragraph 3.3.4.11 for a discussion of the ANS)
10) Replace each washed munitions body into its tray
11) Convey the tray of washed projectiles to the MPT for thermal treatment

3.3.3.1.2 GB 8-inch Leaking Munition Processing Sequence

1) The overpacked GB projectiles will be removed from the EONC in the UPA
2) The munition will be transferred to the TMA where they will be manually unpacked and placed on a tray on the conveyor system for processing through the MWS.
3) In the ECV, the overpacked projectiles are manually unpacked and placed on the conveyor system for transfer to the PMD for processing.
4) The empty overpack containers will be taken to the TMA for chemical decontamination or thermal decontamination in the MPT prior to offsite recycling or disposal at a permitted TSDF.

3.3.3.1.3 GB M55 Rockets

The majority of the M55 rockets are stored in the BGCA igloos on pallets in SFTs. These rockets are termed "nonleakers." A small number of the M55 rockets have been overpacked because of leaks that were identified during routine agent monitoring in the igloos; these rockets are termed "leakers". Paragraph A of this subsection (Nonleaker Rocket Processing Sequence) presents the processing sequence for the nonleakers; paragraph B [Processing Sequence for Leakers (Rockets)], the overpacked rockets (also termed "leakers").

A. Nonleaker Rocket Processing Sequence

The motors from the nonleaker M55 rockets have also been called “rocket motors” (RMs). The processing sequence for the nonleaker rockets is as follows:

1) Remove the pallet of rockets from the EONC (UPA)
2) Place each rocket individually onto the rocket input assembly, which conveys it through the airlock to the ECV and to the RCM. The RCM separates the rocket into three pieces: the warhead, the warhead’s SFT, and the RM
3) Transfer the RM (still contained in its section of the SFT) to a container approved for intra-installation transportation for further treatment at another location on BGAD or an offsite TSDF yet to be determined
4) Transfer the warhead’s SFT to a container for disposal at a permitted TSCA landfill
5) Convey the rocket warhead to the punch-and-drain station of the RSM in the ECR
6) Punch holes in the top and bottom of the rocket warhead agent cavity with the punch-and-drain station
7) Drain the agent through the lower clamp. Send the drained agent into an agent storage tank in the agent neutralization room (see paragraph 3.3.4.11 for a discussion of the ANS)
8) Introduce high-pressure water. Flush the agent cavity (the optimum flush duration, pressure and flow rate will be evaluated during simulant, surrogate, and agent testing in the RD&D program), maintaining suction at a slightly higher flow rate than the inflow
9) Send the washout water to a storage tank in the agent neutralization room
10) Move the rocket warhead to the shear station for cutting
11) Cut the warhead portion into segments. The warhead includes the fuze, the burster, and the washed agent cavity
12) Send the warhead segments to the EBHs
13) Send the energetics hydrolysate from the EBH to the ENS for further hydrolysis, as required
14) Sample and analyze the energetics hydrolysate to verify that it no longer exhibits the characteristic of reactivity and that the agent concentration is below the target release level for agent before transfer to the HSA
15) Transfer the energetics hydrolysate from the HSA to the APS and the AFS in the SPB
16) Chemically precipitate the aluminum and then remove the precipitate by filtration. The aluminum precipitate is characterized and sent offsite to a permitted disposal facility. Send the filtrate to the SCWO for further treatment
17) Send solid material (rocket sections and pieces) from the EBHs through the MPT for thermal treatment at a minimum of 1,000°F for a minimum of 15 minutes

B. Processing Sequence for Leakers (Rockets)

The leakers are classified into two categories: known and unknown. The known leakers are those that were identified through monitoring in the BGCA igloos and are stored in the igloos in overpacks. The unknown leakers include those that did not arrive in the UPA as leakers but were later identified as such in the EONC or in the RCM.

The known leakers will be processed at the end of each agent campaign at BGCAPP.

The unknown leakers will be accumulated in the ECVs and then processed in a leaker campaign, or these previously unknown leakers will be overpacked and sent back to the leaker storage igloo for processing during the known leaker rocket campaign. The processing sequences for both known and unknown leakers are presented below:

1) For known overpacked leakers (stored in the igloos in overpacks):
    a. The EONCs of overpacked rockets are monitored for agent in the UPA. If agent monitoring indicates that the EONC does not contain any leaking overpacks, the EONC is opened and the overpacks are transferred to the ECV.
    b. In the ECV, the rocket overpack is opened manually by operations personnel in PPE and the rocket is removed from the overpack. The rocket is placed on the RCM conveyor system in the ECV.
2) For unknown leakers (leakers that are not overpacked and are identified in EONCs and at the RCM):
    a. Leaking rocket(s) may be detected during agent monitoring of EONCs in the UPA. EONCs found to contain previously unknown leakers will be transported to the EONC leaker airlock so the leakers can be removed from the EONC and sent to the ECV. Personnel in appropriate PPE will place each potentially contaminated rocket onto the RCM conveyor system.
    b. A previously unknown leaker may also be detected when monitoring for agent at the RCM or while observing the RCM. Leakers identified or found at the RCM may either be stored for a short duration, overpacked, and sent back to the igloo for later processing; or the leaker may be processed immediately if the number of stored leakers in the ECV is sufficient to justify stopping normal rocket processing to process the stored leakers. Personnel in appropriate PPE will place the leakers onto the RCM conveyor system.
3) The RCM separates the leaking rocket into three pieces: warhead, warhead's SFT, and CRM.
4) The warhead is processed in one of the two ECRs, as discussed in paragraph 3.3.4.6.4.
5) The agent-contaminated SFT is removed from the conveyor in the ECV and transferred to the TMA for chemical decontamination and disposal at an off-site permitted TSCA TSDF or the SFT may be thermally treated in the MPT.
6) The CRM is conveyed to the ECR for processing at the RSM, which shears the rocket motor into four (approximately) 8-inch pieces and the tailfin.
7) The tailfin section and the segments of rocket propellant are transferred to and processed in separate EBHs.
8) The energetics hydrolysate is sent from the EBHs to the ENS for further hydrolysis.
9) Before the energetics hydrolysate is transferred to the HSA, it is sampled and analyzed to verify that it no longer exhibits the characteristic of reactivity and that the agent concentration is below the target release level for agent. This is accomplished by use of the ASTM E680 Standard, *Test Method for Drop Weight Impact Sensitivity of Solid-Phase Hazardous Materials* and works with both solid and liquid waste samples.
10) The energetics hydrolysate is transferred from the HSA to the APS and AFS in the SPB

11) In the APS and AFS, aluminum is chemically precipitated from the energetics hydrolysate and the precipitate is removed by filtration. The aluminum precipitate is characterized and sent off site to a permitted disposal facility. The filtrate is sent to the SCWO for further treatment.

12) Solid material (rocket sections and pieces) from the EBHs is sent through the MPT for thermal treatment at a minimum of 1,000°F for a minimum of 15 minutes.

3.3.3.1.4 GB M56 Warheads

The GB M56 warheads will be processed and treated following the steps outlined in subparagraph A of paragraph 3.3.3.1.3, except that (because they have no rocket motors) it will not be necessary to cut and remove the rocket motor in the RCM.

3.3.3.2 Wood Pallets

Wood pallets not exposed to a leaking munition will not be processed through the BGCAPP and will be managed by appropriate methods to promote waste minimization. The quantity of agent-contaminated wood pallets and miscellaneous non-contaminated dunnage is reflected on the Part A Application (see Figure 1-A).

All pallets and other dunnage associated with leaking munitions will be tested following Army-approved methods. If they are contaminated, they will be treated by chemical decontamination. The decontaminated wastes will be managed by appropriate means to minimize waste. If chemical decontamination does not prove successful, the contaminated material will be treated in the MPT.

3.3.3.3 Agent-Contaminated Plastic and PPE

Plastic materials that are not contaminated with agent will be managed by appropriate methods to promote waste minimization without any further treatment at BGCAPP. Plastic and PPE are assumed to be contaminated if they have been exposed to agent. Agent-contaminated plastic material (e.g., personnel protective ensembles, aprons, and gloves) generated during the RD&D program will be chemically decontaminated. If chemical decontamination is not successful, the material will be treated in the MPT. The decontaminated residue will be sent off-site to a permitted TSDF for treatment/disposal.

3.3.3.4 Miscellaneous Agent-Contaminated Metal Parts (e.g., banding, pumps, and pipe)

Metal material and parts not contaminated with agent will be appropriately managed to minimize waste without any further treatment at BGCAPP. Agent-contaminated metal material and parts generated during the RD&D program will be chemically decontaminated. If chemical decontamination is not successful or efficient, the material will be treated in the MPT. The decontaminated residue will be appropriately managed to minimize waste.

3.3.3.5 Spent Activated Carbon

Agent-contaminated spent activated carbon will be shipped off site for further treatment and/or disposal at a permitted TSDF.

Spent activated carbon not contaminated with agent will be managed to minimize waste.

3.3.3.6 Spent Decontamination Solution (SDS)

SDS that is generated during the RD&D program will be processed as follows:

1) Pump the SDS from sumps in the Category A or Category B areas to the SDS storage tanks. Liquid in the sumps in the Category C areas will be characterized and, based on the results of the characterization; the sumps will either be pumped to the SDS storage tanks or will be managed by other appropriate means
2) Sample and analyze the SDS in the SDS tanks to verify that it is below the target release level for agent
    a. If the agent concentration is below the target release level for agent, send the SDS to the HSA for further treatment in the SPB
    b. If the residual agent concentration is above the target release level for agent, treat the SDS in the SDS tank with caustic and resample or send the SDS to the ANR for further treatment

3.3.4 Munitions Unpacking

EONCs containing munitions are moved from the CHB to the UPA of the MDB for processing. Before the EONC is opened (in the UPA) to access the munitions, the air in the sealed EONC is monitored for agent. If agent is detected, the EONC will not be opened until it is transported to the EONC leaker airlock, which is designed to handle the opening of the container as described in paragraph 3.2.2. If no agent is detected, the EONC will be opened in the UPA and the munitions will be unloaded for processing. Unburstered projectiles are loaded onto a munition tray; the tray is placed on a conveyor and moved to the NCR/MWS station. Rockets are loaded onto the rocket input assembly and conveyed into the ECV where the RCM begins the processing of the rockets.

In addition to the RCM operations, the overpacked rockets and overpacked projectiles are removed from the overpacks and placed on their respective conveyors for processing as described in paragraphs 3.3.4.2. Overpacked unburstered projectiles are loaded onto a munition tray for processing through the nose closure removal station (NCRS) as described in paragraph 3.3.4.4.

The following subsections describe the munitions unpacking subsystems.

3.3.4.1 Projectile Input Subsystem

The 8-inch GB projectiles are unpacked in the UPA, placed onto the projectile feed conveyor, and transferred through the ECV and into the ECR for reverse assembly by the NCRS.

The projectile feed conveyor is a combination of a roller-type conveyor and an airlock assembly with a series of doors. The doors provide for an airlock into the ECV and provide a negative pressure in the ECV preventing air from flowing into the UPA.

3.3.4.2 Rocket Input Subsystem

M55 rockets are unpacked on the receiving table in the UPA, placed onto the rocket input assembly, and conveyed to the ECV for processing on the RCM. Following RCM processing, the rocket warheads are conveyed into the ECR through a munition access blast gate for processing by the RSM. The plant has two RCMs and two RSMs: each has its own rocket input system, and one RCM is located in each ECV and one RSM is located in each ECR.

3.3.4.3 Dunnage/Secondary Waste

The main component of the dunnage is the wood pallets on which the munitions were stored and transported. Most of the wood pallets are not agent-contaminated and can be segregated in the UPA and not managed as a RCRA hazardous waste. Pallets that are associated with leaker munitions will be processed as described in paragraph 3.3.3.2.

Other agent-contaminated (or potentially agent-contaminated) secondary waste, such as PPE and plastic, will be managed as described in paragraphs 3.3.3.3 through 3.3.3.4.

Spent activated carbon will be managed as described in paragraph 3.3.3.5.

3.3.4.4 Nose Closure Removal Station

The NCRS removes the nose closures from the unburstered nerve agent projectiles by unscrewing them from the nose of the projectile and placing them in a storage bin or tray. After the nose closures have been removed from each projectile, a robot transfers the projectile from the NCR station to the MWS station. The removed nose closures are placed on munitions trays and processed through the MPT.

3.3.4.5 Munition Washout System

At the MWS, the projectile is inverted, placed into one of the MWS modules that contain a cavity access machine. A ram is hydraulically forced into the projectile, collapsing the burster well into the agent cavity as shown in Figure 3-3. The agent drains by gravity and is fed to the agent storage tank in the ANS. The washout nozzle array (nozzles providing high-pressure water jets) is integrated into the shaft of the burster well ram, and provide the high-pressure water sprays to clean and flush the cavity. After flushing the cavity, the projectile is placed back on the munition tray and transferred to the MPT. If for any reason, a projectile cannot be processed, there is a reject table (Subpart I permitted storage area) in proximity to the MWS where rejects can be managed until they can be further processed manually.

Figure 3-3 – Projectile with Crushed Burster Tube

3.3.4.6 Rocket Handling System (RHS) (Drawing 24915-07-M5-RHS-00001)

The RHS stations (to include the RSM and RCM) and processing are described below.

3.3.4.6.1 RCM

The RCM's design is based on a commercially available pipe cutter. The whole rocket, inside the SFT, is placed into the RCM, which clamps the motor end into a rotating chuck. A cutting wheel cuts through the SFT and then through the rocket at the point between the warhead and the rocket motor as the chuck rotates. After the wheel cuts through the rocket, the warhead's SFT is removed from the warhead and sent out of the MDB. The warhead is sent to the ECR and the rocket motor (if not contaminated) is packaged for transport out of the MDB.

3.3.4.6.2 RSM

The RSM demilitarizes the M55 rocket warheads and CRMs. The RSM extracts agent from rockets in a punch, drain, and wash station, and then shears them into segments to access the energetics for neutralization in the EBH. Drained agent extracted at the RSM is pumped directly into the agent storage tanks; all agent washout water is pumped to the spent decontamination solution (SDS) storage tanks and agent surge tank. From the storage tanks, the agent and flush material are pumped to the ANS for agent neutralization. The rocket warheads are processed at the RSM after being removed from their fiberglass SFTs. The RSM used at the BGCAPP is similar to the RSM used at baseline operations, but it has been modified to process warheads that have been removed from the SFT to include a high-pressure flushing step that washes residual agent from the agent cavity and removes any gelled agent. A fully automated, hydraulically powered RSM is installed in each ECR.

3.3.4.6.3 Punch/Drain and Wash Station

The punch/drain and wash station clamps the warhead while the warhead is punched, drained, and washed out. To reduce residual agent in the rocket warhead cavity, and therefore minimize the amount of agent processed in the EBH, the baseline RSM punch-and-drain station has been modified to include a pressurized water spray system.

The sprays remove the residual agent and dissolve solidified material that does not drain during the punch-and-drain cycle. The high-pressure water flush system improves cleaning of the rocket warhead while minimizing changes to the baseline RSM system.

The flush rate is maintained at less than the drain rate capacity, assisted by vacuum, to avoid pressurizing the warhead.

3.3.4.6.4 Rocket Shear Station

The warhead, with the agent cavity drained and washed, is conveyed from the punch/drain and wash station to the rocket shear station. Shearing is necessary to open the interior of the agent cavity for improved decontamination, to open the interior of the burster for improved explosive neutralization, and to cut the warhead into smaller sections that can be safely placed into the EBHs. When processing the CRMs, cutting the CRM propellant into smaller pieces also exposes more surface area to the hot caustic in the EBH, increasing the rate of hydrolysis.

The rocket shear station has an optical sensor that reads the position of a pusher arm that moves the rocket forward for shearing. The sensor output identifies the location of each cut that the blade will make. The rocket is progressively positioned under the blade, which shears the warhead and rocket motor in a predefined pattern.

The solid material from the rocket shear station is transferred to the EBH for further processing.

3.3.4.7 Dunnage Treatment

Dunnage will be managed in accordance with the procedures described in paragraphs 3.3.3.2 through 3.3.3.5.

3.3.4.8 Energetics Batch Hydrolyzer

Explosives and CRM propellant contained in the rockets are treated in EBHs as shown in the PFD for the EBH system. The EBH is a large steam-heated inclined drum similar in shape to a traditional cement mixer.

After the M55 rockets and M56 warheads are drained of agent and sheared in the RSM, the segments are placed in the EBHs for processing. The EBH drum is partially filled with hot NaOH solution. During rocket processing, sheared rocket segments are placed in the rotating drum where the energetics are dissolved and hydrolyzed. Rocket warhead segments and fin assemblies (containing aluminum) are fed and processed separately from the steel-casing CRM segments in the EBHs. Aluminum in the rocket segments is hydrolyzed while the propellant in the steel-cased CRM segments is hydrolyzed in separate EBHs.

Hydrogen gas generated by the reaction of aluminum with sodium hydroxide is monitored, and an air or nitrogen purge is provided to ensure hydrogen levels are maintained below 25 percent of the lower flammability limit (LFL). The EBH room is designed as an ECR.

After the first EBH is charged, the second and third EBHs can receive energetics. Following completion of energetics treatment in the first EBH, the solid residues are separated from the liquid hydrolysate and transferred to the MPT for thermal decontamination. The hydrolysate is transferred to the ENRs for final energetics destruction and confirmation of destruction. Samples may be taken to verify that the hydrolysate is below the target release level for agent or statistical methods may be used to establish minimum operating parameters that if met, ensure destruction of energetics to a target release level. Following confirmation of destruction, the energetics hydrolysate is transferred to the energetic hydrolysate storage tanks in the HSA. If the residual agent concentration is above the target release level or the required minimum operating parameters are not achieved, additional reaction time will be required in the ENRs before transfer to the HSA.

Headspace gases from the EBHs and ENRs are sent to their respective, dedicated air pollution control devices (i.e., EBH off-gas is sent to the OTE and ENR off-gas is sent to the OTM) and then conveyed via piping to the MDB HVAC filtration system.

3.3.4.9 ENS

The energetics hydrolysate is not released from the MDB until it has been tested for agent and verified to have met all requirements for release from engineering controls. The hydrolysate is transferred to the energetic hydrolysate storage tanks in the HSA. If the residual agent concentration is above the target release level, additional reaction time will be required in the ENRs before transfer to the HSA.

Headspace gases from the ENRs are sent to an air pollution control device (i.e., MPT off-gas treatment system [OTM]) and then conveyed via piping to the MDB HVAC filtration system.

3.3.4.10 Aluminum Precipitation System (APS)/Aluminum Filtration System (AFS)

The energetics hydrolysate is transferred from the HSA to the APS in the SPB, where pH of the hydrolysate is adjusted to precipitate the aluminum compounds before it is sent to the AFS to filter and remove the precipitated aluminum compounds.

The AFS filtrate is transferred to the SCWO feed tanks for blending with the agent hydrolysate. The filter cake is managed in a Subpart I permitted container storage area (likely roll-off boxes) until it can be removed and disposed at a permitted TSDF.

3.3.4.11 Agent Neutralization by Hydrolysis

The agent drained from the munitions, as well as the wash liquid from the drain-and-wash operation, is hydrolyzed in the ANS reactors. Hot NaOH solution will be used to neutralize GB agent.

In the neutralization process, the agent will be destroyed to at least 99.9999 percent on a mass basis (i.e., the mass of agent entering the ANS versus mass of agent leaving the hydrolysis system). Paragraph 3.5.2 discusses how the DE is determined.

3.3.4.12 MPT, MPT Cooling System (MCS), and Off-gas Treatment System (OTM)

Washed munition bodies from MWS, EBH solid residues, and secondary wastes are thermally decontaminated in the MPT units. These items are placed on trays and are conveyed to the MPT; the chamber is sealed, purged with nitrogen gas, and inductively heated until all components have been thermally treated to a minimum of 1,000°F for a minimum of 15 minutes.

The MCS cools the trays exiting the MPT to a temperature which allows safe handling.

The OTM (i.e., an air pollution control device included in the Title V air permit) receives the offgases from the MPT and the vent gases from the ACS, ANS, ENS, and SDS tank systems before the offgases are conveyed via piping to the MDB HVAC filtration system.

The following subsections describe these three systems.

3.3.4.13 MPT

The MPT thermally decontaminates munitions bodies and other materials using inductive heating and superheated steam. Air is excluded from the system through the use of airlocks and nitrogen purges.

Projectiles and other materials are placed in trays on a conveyor for processing. The conveyor carries them through the first MPT door into the inlet airlock. The tray is staged in the inlet airlock, which is purged with nitrogen, until other trays in the MPT have completed processing and been moved downstream. The tray is conveyed through the gate into MPT zone 1, where it is held until it reaches the desired initial temperature. It is then moved into MPT zone 2 where it is further heated for a sufficient time to ensure the complete mass of material has achieved a minimum of 1,000°F for a minimum of 15 minutes. After these conditions have been achieved, the tray from zone 2 is moved into the exit airlock where it is kept for a sufficient period to ensure it has cooled in the nitrogen atmosphere which prevents the formation of dioxins and related compounds. This type of sequential operation allows for continuous treatment of trays of material while ensuring that the material in each tray has been heated to a minimum of 1,000°F for a minimum of 15 minutes.

3.3.4.14 OTM

The OTM (a component of the permitted air pollution control system) is designed to remove air pollutants from the MPT offgas and from the vent gases of the ACS, ANS, ENS, and SDS tank systems.

The OTM consists of the following equipment:

- Two thermal oxidizers (TOXs)
- Two cyclones
- A common wet venturi scrubber system
- Filters and blowers

Each MPT has its own TOX and cyclone and the offgas from the two MPTs is combined prior to further treatment in the scrubber system and filter before discharge to the MDB HVAC filtration system.

The TOX unit is a flamed thermal oxidizer that oxidizes organics that may be present in the MPT, ANS room tanks, and ENS offgases. It is designed to handle a wide variety of materials such as halogenated organics, methane, hydrocarbons, ammonia, carbon monoxide, and hydrogen.

The TOX unit handles the following input streams:

1) Air feed to the oxidizing section to ensure the residual oxygen level in the unit effluent is at least 5 percent.
2) Fine mist of water to the oxidizing section to maintain the operating temperature at 2,000°F with capability to operate at 2,200°F if the gas feed has a higher heating value. A 2,200°F temperature is required when contaminated wood pallets and SFTs from the rocket handling system are processed in the MPT.
3) Natural gas to maintain the operating temperature at 2,000°F (or 2,200°F) if the heating value in the gas feed is not sufficient to maintain the operating temperature.
4) Fine mist of water to the cooling section to maintain the exit temperature at 1,200°F.

The TOX consists of two sections, an oxidizing section, and a quench section. The oxidizing section has a minimum gas residence time of 2 seconds at a minimum temperature of 2,000°F.

The MPT cyclone removes ash and other large particulate matter from the TOX unit effluent gases and discharges the gases to the combined scrubber system.

The venturi/scrubber system is a combination of a venturi impaction scrubber that captures particulates and rapidly quenches the hot gases, followed by an absorption tower that captures acid gases. Caustic solution is added to the system to maintain pH and neutralize the captured acids.

The OTM off-gas filter removes residual particulate matter greater than 3 microns in diameter. This filter also is a demister, removing fine mist that may pass through the scrubber tower's demister system.

The gas reheater reheats the OTM outlet gases to maintain the relative humidity of the blower effluent stream below 55 percent to avoid condensation in the HVAC ducts. The treated offgases from the OTM then go to the MDB HVAC filtration system.

3.3.4.15 OTE

The OTE (a component of the permitted air pollution control system) is designed to scrub the offgases from the EBH and to remove contaminants from the ENS exhaust stream.

The OTE consists of the following equipment:

- EBH Scrubber Tower
- EBH Offgas Filters
- Air Reheaters, Blowers and Pumps
- Scrubber Recirculation Surge Tank & Chilled Water Cooler
- A Sulfuric Acid Day Tank and Metering Pump

The Offgas Treatment for the ENS (OTE) scrubs the exhaust gas from the Energetics Batch Hydrolyzers (EBH) to remove contaminants (primarily ammonia) in the exhaust stream via scrubbing with a sub-cooled, acidic solution. After the ammonia is removed, the exhaust gas passes through a filter to remove any particulates greater than 3 microns in diameter with a removal efficiency of 99.9 percent. Post filtration, the air stream passes through a heater to raise the temperature before it goes to the exhaust blower and is sent to the MDB HVAC Filter at an acceptable temperature and relative humidity. Excess scrubber liquid is sent to the Energetics Neutralization Reactors (ENRs).

3.3.4.16 Decontamination Solution Supply and Spent Decontamination Solution Capture/Storage System

Decontamination solution is used in the following activities:

1) Wash down and decontaminate agent spills
2) Decontaminate equipment
3) Decontaminate PPE that may have been contaminated during toxic area entries

Decontamination solution is applied to an area of contamination, and then rinsed with water after allowing sufficient contact time. The wash water drains to sumps in the MDB.

The decontamination solution is based on NaOH, NaOCl, soap and water or other decontamination solutions. Decontamination solutions will be evaluated and selected based on overall performance, safety/health of workers, and environmental impacts.

The SDS is managed as described in paragraph 3.3.3.6.

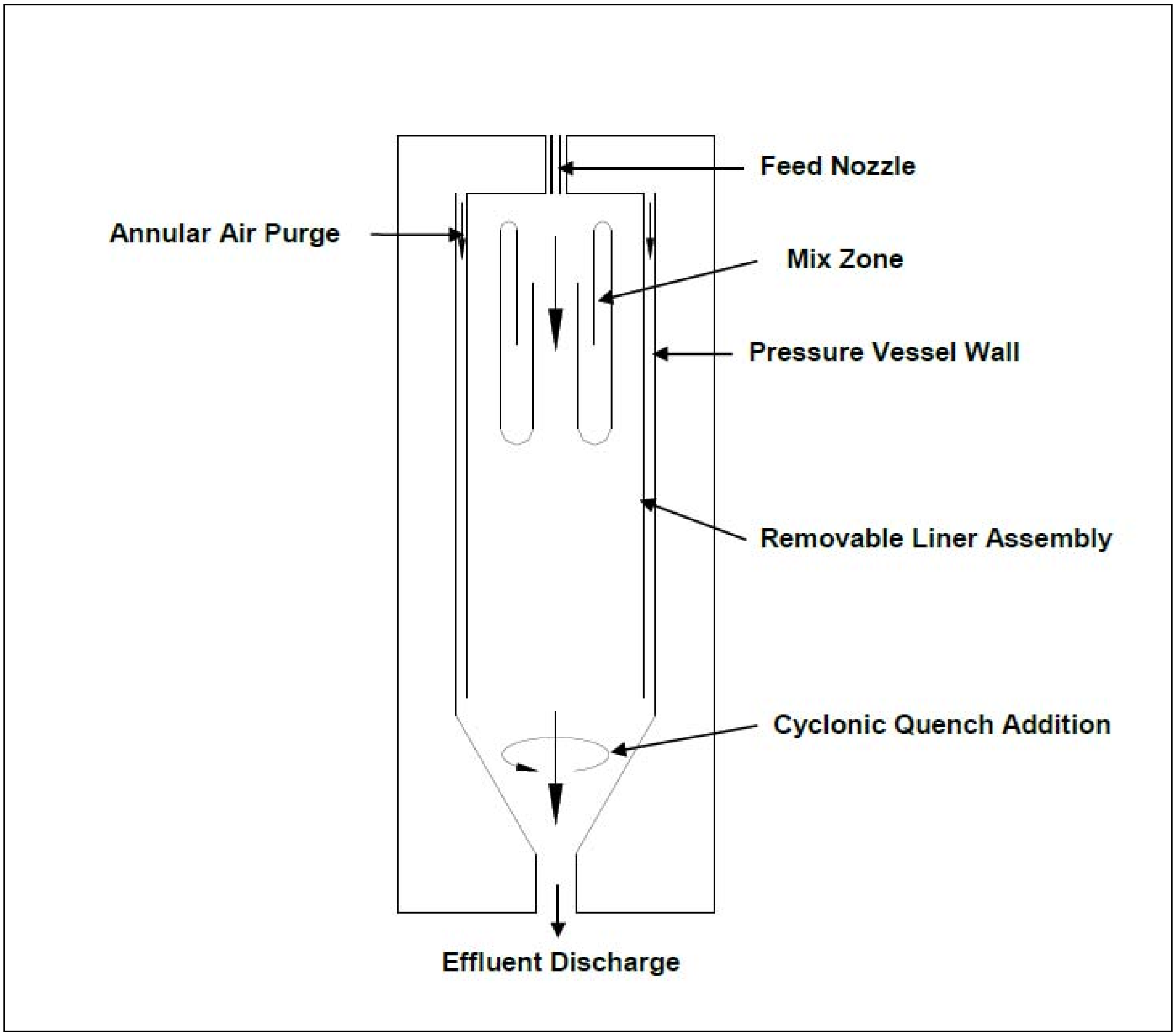
3.3.4.17 SCWO Units

The SCWO units are used to treat the agent and energetics hydrolysates and spent decontamination fluid. Various waste streams may be processed through the SCWO units either individually or as blends. All materials fed to the SCWO units will have agent concentrations previously verified as below the target release level for agent; therefore, the SCWO and downstream operations do not require engineering controls.

The SCWO process is based on the unique properties of water at conditions above its thermodynamic critical point of 374°C (705°F) and 3,206 pound per square inch, absolute (psia). At these supercritical conditions, organic materials and oxidant gases are generally completely miscible in water and the elevated pressure increases the mixture density in the reactor, thus allowing rapid and complete oxidation reactions. Tests conducted as part of the TRRP have provided data on the appropriate ratios of caustic and salt transport additives. The SCWO TRRP reports have been submitted to KDEP as required by the RD&D Permit, Compliance Schedule Item No. 1.

The SCWO reactor is a vertical down-flow high-pressure cylindrical vessel. Its general configuration is shown in Figure 3-4. A replaceable annular liner is fitted into the vessel as shown. A small flow of air or nitrogen is maintained in the annulus between the liner and the pressure vessel to inhibit the ingress of process fluid into the annulus.

Figure 3-4 – Schematic of an SCWO Reactor



***Note**: This figure is presented as a general illustration of the functioning of a SCWO reactor. It does not accurately depict the interior details of the BGCAPP SCWO reactors.*

The material to be reacted (hydrolysate or spent decontamination solution) along with air is pumped through the feed-nozzle at the top of the reactor. The feed material will be supplemented with additional organic feed (supplemental fuel) in order to increase its heating value, as required to maintain an autogenous reaction. Isopropyl alcohol (IPA), fuel oil, or kerosene may be used as supplemental fuels at the BGCAPP, if necessary.

During system startup, an electric feed pre-heater heats the SCWO reactor to the fuel initiation temperature at the nominal operating pressure of about 3,400 pounds per square inch (psi). At this point, flows of oxidant and fuel are begun, and reaction is initiated. Oxidation of the fuel brings the SCWO system to the full operating temperature before the hydrolysate is introduced. After the hydrolysate flow is initiated, fuel flow is reduced to accommodate the heat released by hydrolysate oxidation. As the hydrolysate feed rate is ramped up to the target throughput, the fuel, water, and air flow rates are adjusted as required to maintain the desired operating conditions.

In the SCWO reactor, the organic constituents of the waste are converted to carbon dioxide (CO_2), water (H_2O), nitrogen (N_2), or nitrous oxide (N_2O), and sulfates and phosphates (if sulfur or phosphorus is present in the feed). Halogens are converted to their respective acids. The acids react with the caustic to form sodium salts such as sodium chloride (NaCl), sodium fluoride (NaF), monosodium phosphate (NaH_2PO_4), and sodium sulfate (Na_2SO_4), depending on the agent being processed. The salts are not soluble in the supercritical fluid and they are carried through the reaction zone (from the injector to the quench region) as solids or as slurries. At the bottom of the reactor, quench water is introduced, lowering the temperature below the critical point and converting the supercritical fluid to a liquid into which the salts dissolve. All of the reaction products flow out the bottom of the SCWO reactor.

The quenched reactor effluent is passed through a series of heat exchangers to cool it to near-ambient temperature, passed through a high-pressure gas/liquid separator (GLS), and then passed through pressure reduction control valves. The gas stream and the liquid stream are depressurized separately. The liquid stream goes to a second GLS to further remove gases that were soluble at high pressure, principally residual CO_2. The gas is combined with the main gas stream exiting the high-pressure GLS. The SCWO aqueous effluent exits the bottom of the low-pressure gas/liquid separator and is pumped to the SCWO effluent tank for storage before it is transferred to the RO system.

During upset conditions, the SCWO effluent is diverted to the Off-Spec Effluent Tank (MV-SCWO-0041), and not to the tanks in the STA. The Off-Spec Effluent tanks are located in the SPB and air emissions are controlled by the SPB HVAC system.

3.3.4.18 Reverse Osmosis (RO)

The RO unit processes the effluent from the SCWO units. SCWO effluent is first processed in the feed preparation subsystem, consisting of a clarifier for removing suspended solids, a multimedia filter, and a cartridge filter. The effluent, following this preparation step, is then fed to an RO unit for brine concentration. The RO unit creates a permeate stream, which is of suitable quality for reuse in the SCWO system and a slurry rejected by the RO unit. Reject from the RO unit is combined with residues from the clarifier and filters and blow-down from processing units, stored in the RO reject tanks, and then shipped off site to a permitted TSDF.

RO permeate is introduced into the SCWO reactor near the bottom to reduce the SCWO effluent's temperature to below the critical point and results in the re-solution of the inorganic constituents to allow discharge from the reactor.

3.4 Environmental Parameters Monitoring and Frequency

3.4.1 Groundwater Protection Plan--Groundwater Monitoring [401 KAR 34:060, Section 1 & 40 CFR 264.90(b)(2)]

Groundwater monitoring requirements are not applicable. The BGCAPP is not a land based disposal unit. The facility was designed to contain and control all releases, thereby preventing impacts to the groundwater. Although the BGCAPP does receive wastes that contain free liquids (i.e., projectile and rocket warheads containing chemical agent), the design and hazard prevention procedures of the facility are extremely detailed and provide a high level of protection for the environment and general public, eliminating the requirement for groundwater monitoring in the vicinity of the facility.

In addition, the BGCAPP facility does not contain any identified solid waste management units (SWMUs) that require groundwater monitoring.

3.4.2 RCRA Organic Air Emissions

Franklin Engineering prepared the BGCAPP screening level human health risk assessment (SLHHRA) and the BGAD provided the SLHHRA to KDEP as a separate submittal. The SLHHRA demonstrates the hazardous constituents of concern released from the following points, which constitute the only emission points for hazardous waste processes, will not cause human health effects:

1) MDB HVAC stacks
2) SPB HVAC stack

The BGCAPP is a heavily robotic and mechanized operation, designed for additional protection of the operators. Under normal conditions (e.g., nonleaking munitions), the operators do not contact the wastes (chemical agents and energetics) because the wastes are contained in the munitions. In the case of leaking munitions, all agent operations take place in an area with the environment controlled by a negative pressure ventilation system (with air pollution control systems such as the OTM and OTE and final air stream treatment using HEPA filters and carbon adsorption). The BGCAPP monitors the air discharged from the ventilation system for agent. In addition, operators who deal with leaking munitions are trained to handle the munitions and wear PPE suitable for the risk associated with the task being performed.

Two or more BGCAPP personnel perform manual tasks involving wastes and CCR operators observe (via CCTV) all worker entries into areas that are possibly agent-contaminated.

Compliance with the requirements of 40 CFR 264.1030-1080 (RCRA Organic Air Emission Standards) are demonstrated as follows for wastes managed and treated in the BGCAPP:

1) 40 CFR 264.1030 – Subpart AA – Air Emission Standards for Process Vents:The BGCAPP does not treat or recycle hazardous wastes via any of the processes listed in Subpart AA. Therefore, Subpart AA requirements do not apply to the BGCAPP.
2) 40 CFR 264.1050 – Subpart BB – Air Emission Standards for Equipment Leaks: The BGCAPP does manage hazardous wastes in various types of equipment listed in Subpart BB, 264.1050(b). It is expected energetics hydrolysate and GB hydrolysate will contain less than 10 percent organics by weight. However, VX hydrolysate is expected to contain greater than 10 percent organics by weight. All wastes treated during the RD&D campaign are expected to contain less than 10 percent organics by weight.
3) 40 CFR 264.1080 – Subpart CC – Air Emission Standards for Tanks, Surface Impoundments, and Containers:

a. The BGCAPP does manage hazardous wastes in various containers and tanks as well as Subpart X miscellaneous treatment units, as outlined in Subpart CC, 40 CFR 264.1082. These hazardous wastes will be managed in a combination of both permitted and <90-day accumulation containers and tanks as well as various Subpart X miscellaneous treatment units. BGCAPP expects those units that handle hazardous wastes with a Volatile Organic (VO) concentration of at least 500 ppmw will require emission controls as required in 40 CFR 264.1082(c)(2).
b. To demonstrate compliance with Subpart CC, the hazardous waste (Agent GB) will be treated to reduce the VO concentration of the waste in accordance with the applicable provisions of 40 CFR 264.1082(c)(2-4). This reduction in VO will occur for agent waste in the Agent Neutralization Reactors (ANRs). Energetics will simultaneously undergo treatment in the EBHs and ENRs.
c. The hydrolysates resulting from the initial treatment of each of these waste streams undergoes secondary treatment in the Super Critical Water Oxidation (SCWO) reactor(s), further reducing the total organics to less than 10 ppm TOC. The resulting liquid waste stream (termed Reverse Osmosis (RO) reject) is sent off-site for final disposal. All necessary controls required for regulated tanks and containers (e.g., carbon filtration on tank vents) will be applied where necessary.

3.4.2.2 Waste in Containers

The BGCAPP uses approved Department of Transportation (DOT) containers to store hazardous wastes in permitted container storage while meeting the container Level 1 control requirements of EPA air emissions (Subpart CC) standards. Containers are not equipped with pumps, compressors, pressure relief devices, sampling connections, valves, flanges and connectors, or piping and are therefore not subject to Subpart BB requirements. Temporary storage of some hazardous wastes may occur during operations (e.g., bagged agent-derived wastes or storage of liquid wastes in portable tanks). However, the BGCAPP places hazardous wastes in DOT approved waste containers prior to transport off site.

Although stored containers have only very limited quantities of free liquids, the container storage areas comply with the secondary containment requirements for storing containers filled with free liquids. Containers of agent-derived secondary wastes packaged for offsite shipment and treatment/disposal are headspace monitored and packaged to eliminate free liquids.

The Part A (contained in the Executive Summary of this permit application) identifies the waste streams managed/stored in containers (S01).

3.4.2.3 Waste in Tank Systems

The BGCAPP waste storage tanks were fabricated from carbon steel or chemical-resistant alloys (e.g., Hastelloy® or stainless steel), which through testing and use at other sites have been shown to be compatible with agent and energetics hydrolysates, spent decontamination solutions, and brines (e.g., RO reject). Fabrication of BGCAPP tanks includes additional shell thickness as a corrosion allowance and general corrosion should not become a critical factor during the life of the BGCAPP facility. The BGCAPP will perform non-destructive tank testing as necessary. Tank Assessment Reports (TARs) for the tanks used to store hydrolysates, spent decontamination solutions, and/or waste brine solutions were prepared and provided to KDEP in response to RD&D permit Compliance Schedule Item 8. Any remaining TARs for tanks identified subsequent to the Project's response to Compliance Schedule Item 8 will be provided to KDEP upon completion.

The HSA and SCWO tank area (STA) waste storage tanks will contain liquids that are agent-derived (N001) and corrosive (D002). Secondary containment capable of containing the contents of the largest tank surrounds these waste tanks (as is provided for the process/storage tanks inside the MDB and SPB). However, because these storage tanks are located outdoors, the associated containments can also capture a 25-year/24-hour storm event and have adequate “freeboard” to prevent “topping” during or following this type of heavy rainfall event (i.e., sufficient freeboard to prevent topping if both of these events occur simultaneously).

Each treatment or storage tank system (e.g., SDS, ANS, and ENS) processes a single waste stream, eliminating the possibility of waste stream incompatibilities.

The Part A identifies the waste volumes treated or stored in tanks (T01 or S02). All Subpart J-regulated tanks in the HSA and STA will contain carbon filtration on the tank vents as necessary, which serve as Level 2 controls required by Subpart CC.

3.4.2.4 Waste in Miscellaneous Treatment Units

The majority of the miscellaneous treatment units at the BGCAPP provide for reverse assembly of and access to chemical agents in munitions. The reverse assembly/treatment units include the MWS, nose closure removal system (NCRS), PMD, RSM, and RCM). Section 3.3 of this Permit Application describes these units in detail. The demonstration of the effectiveness of these reverse assembly/treatment units is the capability to provide the required reverse assembly while maintaining the expected throughput rate. Subpart X units in the SPB vent to the interior of the SPB, then are vented through the emergency relief tank room, and then out through the SPB HVAC system.

Five miscellaneous treatment units [i.e., MPT, EBH, RO Unit, APS/AFS, and SCWO] provide waste processing and treatment. Laboratory analyses and operating parameters evaluated to determine the effectiveness of this treatment include:

1) Temperature of at least 1000°F and hold time of at least 15 minutes for MPT (i.e., the criteria established by the U.S. Army for thermal treatment of all chemical agents for safe release to the public)
2) Temperature and reaction time ensure energetics and aluminum components are dissolved and primary neutralization of energetics occurs (i.e., criteria for EBH operation to be established during RD&D testing)
3) Total dissolved solids (TDS) will meet target levels as developed during RD&D testing for the RO System and APS/AFS Systems
4) Total organic carbon (TOC) analysis for the SCWO effluent

3.4.3 Environmental Protection Standards Compliance

The requirements of KAR 30:031 regulate the three mechanisms for contaminant release from a TSDF:

1) Discharge to surface water
2) Contamination of soil and groundwater
3) Release to the atmosphere

The BGCAPP is a completely enclosed facility with no discharges to surface water, ground, or groundwater. Although the potential to release contaminants to the air does exist at this facility, control measures have been designed and constructed to control emissions. The following discussion addresses those aspects of KAR 30.031 that relate to the first two mechanisms for contaminant release. The discharges to the atmosphere and how the BGCAPP designed and constructed control measures comply with and exceed all of the regulatory requirements are discussed in addressing the requirements of 401 KAR 30:031, Section 9.

3.4.3.2 KAR 30:031 Section 2 – Floodplains

The BGCAPP is not located in a floodplain.

3.4.3.3 KAR 30:031 Section 3 – Endangered Species

As discussed in the Destruction of Chemical Munitions at Blue Grass Army Depot (BGAD), Kentucky, Final Environmental Impact Statement (EIS) (December 2002), the area of construction was surveyed and the BGCAPP was sited so that it did not impact any endangered species. Final site determination was analyzed in a National Environmental Protection Act (NEPA) document prepared in 2004.

3.4.3.4 KAR 30:031 Section 4 – Surface Waters

The BGCAPP is a zero-discharge facility; it does not discharge to surface waters.

3.4.3.5 KAR 30:031 Section 5 – Groundwater

The BGCAPP is totally enclosed. All hazardous waste storage tanks will be constructed to meet the requirements of 401 KAR 34:190 and are provided with secondary containment designed and operated to contain 100 percent of the capacity of the largest tank and the additional capacity to contain the precipitation from a 25-year, 24-hour storm (5.3 inches).

3.4.3.6 KAR 30:031 Section 6 – Application to Land Use for the Production of Food Chain Crops

The BGCAPP does not apply waste to the land or dispose of any waste on the land.

3.4.3.7 KAR 30:031 Section 7 – Land Disposal of PCBs

The BGCAPP will send all PCB waste only to EPA permitted TSCA treatment and disposal facilities.

3.4.3.8 KAR 30:031 Section 8 – Disease

The BGCAPP will not process pathogenic or other biological wastes.

3.4.3.9 KAR 30:031 Section 9 – Air

1) Open burning of wastes – The BGCAPP will not perform open burning of any wastes.
2) KRS Chapter 224, Air Pollution Regulations – The BGCAPP will comply with all requirements of KRS Chapter 224 or administrative regulations promulgated pursuant thereto. A Kentucky Title V air permit (No V-10-023) has been issued to BGCAPP.

3.4.3.10 KAR 30:031 Section 10 – Safety

1) Explosive gases – Waste processing that may generate explosive gases is described in paragraph 3.2.1.3. Additional information will be provided to KDEP in sufficient time before the start of construction of the affected treatment units.
2) Fires – No waste will be disposed of on land; therefore, the types of fires covered by this paragraph cannot occur.
3) Access – Access to all of the BGCA CLA is controlled and monitored by security. The BGCA is surrounded by a heavy chain link fence topped by barbed wire. The BGCAPP will be surrounded by a double fence topped with barbed wire. The BGCAPP can be accessed through the manned ECF. The CLA will be continuously monitored by armed guards performing roving patrols throughout the area.

3.4.3.11 KAR 30:031 Section 11 – Public Nuisance

The BGCAPP is within the confines of the BGAD and is located a significant distance inside a secure, military facility and away from any public view or contact. It poses no public nuisance.

3.4.3.12 KAR 30:031 Section 12 – Wetlands

The BGCAPP is not located in a wetland.

3.4.3.13 KAR 30:031 Section 13 – Karst

All operations will be performed in enclosed buildings with no run-on or runoff.

3.4.3.14 KAR 30:031 Section 14 – Compliance

BGCAPP will comply with the applicable requirements of KRS 224, 401 KAR, and the BGCAPP Permit. Regulated units within BGCAPP will be managed in accordance with 401 KAR Chapter 34 "Standards for Owners and Operators of Hazardous Waste Storage, Treatment and Disposal Facilities." Each regulated area or unit is discussed below with the appropriate regulatory requirements from 401 KAR Chapter 34.

3.4.3.14.1 Container Storage

This section describes the areas in which BGCAPP will manage containers of hazardous waste and some of the types of containers managed, and briefly describes the hazardous waste. Containers listed below and additional containers selected and used during systemization and the RD&D program at BGCAPP meet the definition and requirements of 401 KAR 38:005, 401 KAR 34:180, and 401 KAR 38:150.

3.4.3.14.2 Hazardous Waste Containers

Several different containers will be used to manage, store, and transport hazardous waste within BGCAPP, in addition to the munitions themselves. Several of these containers are described below, but this listing is not all inclusive. As additional types of containers are identified, they will be incorporated into BGCAPP procedures in compliance with 401 KAR 34:180 and 401 KAR 38:150. Only compatible wastes will be containerized together.

A. Single Round Container (SRC)

M55 rockets that have been found to be leaking are containerized in a single round container (SRC). The SRC was specifically developed to contain the M-55 in a substantial steel shell, which has been subjected to a helium leak test as part of the acceptance process. Leaking M-55 rockets, which were containerized before the development of the SRC, are stored in a modified M-1 container. The modified M-1 is a heavy steel cylinder bolted on with a gasket seal with eight bolts. All munitions are stored on specialized pallets designed to store the overpacked unit securely.

B. M16 Series Overpack Container

The M16 series containers are cylindrical steel containers designed to be air tight, designated for the over-pack of projectiles. Overpacked 155-mm projectiles are stored in wooden “egg crates” specifically designed to store the M16 overpack container.

C. M10 Series Overpack Container

The M10 series container is a cylindrical steel container that is designed to be airtight and is designated for use as an overpack container for leaking or deteriorated M16 containers and as an overpack container for 8-inch projectiles.

D. Intermediate Bulk Containers (IBCs)

IBCs may be used throughout the process to collect various liquid waste streams. Each IBC will have a capacity of 300 gallons with nominal dimensions of 42 by 48 by 41 inch (LxWxH). IBCs are manufactured from various materials including carbon steel, stainless steel and polymers in accordance with DOT regulations.

E. Enhanced Onsite Container (EONC)

The Department of the Army uses EONCs to store and transport the munitions and bulk containers for the time period immediately preceding demilitarization activities. The EONC is designed to provide vapor tight containment of agent; all seals on the containers are impervious to agent and are able to withstand decontamination solutions; and air monitoring can be performed of the headspace within the EONCs. The EONC will provide secondary containment for the munitions or containers stored within. The EONCs and any components mounted on the surface will fit within an envelope that is 8.5 feet by 8.5 feet by 12 feet high. The combined weight of the EONC and munition holding trays will not exceed 26,000 pounds (Figure 3-2).

F. Commonly Used Containers

There will be many different types of containers used for storage and transportation at BGCAPP. See Figure 3-9 for a listing of the most commonly used container types expected to be utilized at BGCAPP.

3.4.3.14.3 Container Management

Containers at BGCAPP will be managed in accordance with 401 KAR 38:005, 401 KAR 34:180 and 401 KAR 38:150. Munitions destined for demilitarization are described in section 3.0. The munitions are transported to the container handling building (CHB) for storage prior to processing during the RD&D program. Munitions will be transported from the hazardous waste storage igloos to the CHB as a permitted activity, as outlined in the Part A (see Figure 1-A). Details of the transfer of custody have yet to be determined, however, BGCAPP personnel will be responsible for the physical movement of the EONCs once the waste munitions have been loaded into the EONC.

Each truck can transport one EONC of munitions. The number of trucks per day and the loading configuration in the EONCs will vary depending on the specific schedule of research activities. EONC movement from the CHB to the munitions demilitarization building (MDB) continues 24 hours/day, 7 days/week.

When the truck enters the BGCAPP site, it will move to an off-loading area at the CHB. A bridge crane or similar device will be used to unload the EONC. All containers present in the CHB will contain the same agent because the facility will process only one chemical agent at a time. In accordance with the Kentucky Hazardous Waste regulation 401 KAR 34:180 Section 5, the vapor space of the EONCs containing waste that remain in the CHB for more than 1 week will be monitored using an agent monitor port in the EONC on a weekly basis. This monitoring for agent vapor is in lieu of the RCRA required visual inspections of the containers (munitions).

Wastes generated during the RD&D program and construction will be placed in containers whose materials of construction are compatible with the waste. The selection of a container will be made on a case-by-case basis consistent with generator knowledge of the waste stream. In cases of uncertainty, the stream’s pH or other relevant parameters will be evaluated and the container material selected on the basis of this analysis. All waste containers will always be kept closed during storage except when adding or removing waste.

Containers will be handled in a manner to avoid rupturing or leaking. Container handling will be performed with drum dollies, forklifts, overhead cranes, or other means, as appropriate. A goal of the RD&D demonstration will be to evaluate the safety, suitability and integration of the container handling procedures within the overall process.

Development of container management will continue throughout systemization and the RD&D program.

3.4.3.14.4 Hazardous Waste Container Storage Areas

Several locations within BGCAPP will have permitted container storage areas. These areas will be designed, constructed and managed in accordance with all applicable standards of 401 KAR 38:005, 401 KAR 34:180, and 401 KAR 38:150. The Part A form; included in the Executive Summary section of this Application (Figure 1-A), summarizes the areas within BGCAPP to be permitted for container storage; more detailed descriptions follow.

A. CHB

The CHB is a steel-frame building with insulated metal roofing and insulated siding panels. A side loader truck will be used to move the EONCs into the CHB and also to transfer them to the UPA.

The EONC storage area is sized to store 53 EONCs.

Permitted storage will be limited to the storage of containers inside of EONCs. The EONC meets secondary containment requirements of 401 KAR 34:180, Section 6 for the munitions contained within.

The floor of the CHB is constructed of reinforced concrete. The CHB-MDB transition structure is metal siding with a reinforced concrete floor. The number of construction and expansion joints will be kept to a minimum. All joints between floors and walls will be covered and sealed.

B. MDB

Wastes stored in some of these MDB areas will include both munitions and secondary wastes. The Part A provided with this revision to the RD&D permit application includes additional waste storage details for each of these areas including both process and secondary wastes managed in each area (see Figure 1-A). The MDB is the primary treatment facility in the chemical weapons destruction process and includes the following permitted storage areas:

1) UPAs

Containers and munitions will be brought from the CHB into the MDB via the UPAs. Each UPA is a transition area between the CHB and the hazardous waste processing in the MDB. Permitted storage will be limited to the storage of containers inside of EONCs or on secondary containment pallets. The EONC meets secondary containment requirements of 401 KAR 34:180, Section 6 for the munitions contained within. This area will also provide a means to monitor the EONCs for leakers, provides an unpack station, and provides a means to return empty EONCs to the CHB for temporary storage. The floor of each UPA is constructed of reinforced concrete. The number of construction and expansion joints will be kept to a minimum. In this area, the floor, sumps and curbs will be coated with an applied material that provides a flexible liner. There is a 4,800-gallon storage capacity to include both munitions and secondary wastes.

2) Explosive Containment Vestibules (ECVs)

Munitions will be stored on the conveyors in these rooms and the munitions will also be stored on the reject systems located in these rooms. In addition, leaking or reject projectiles that have been placed in overpacks may be stored on the floor in these rooms. Storage of projectiles or rockets, in or out of EONCs, will not exceed the maximum number allowable determined by the net explosive weight. Secondary containment will be provided by a coated, reinforced concrete floor, sumps, and perimeter curbs/walls. The number of construction and expansion joints has been kept to a minimum. In this area, the floor, sumps and curbs will be coated with an applied material that provides a flexible, external liner. There is a 550-gallon (total) storage capacity for secondary wastes in these two ECVs. If necessary, spill containment pallets also may be used.

3) Explosive Containment Rooms (ECRs)

Munitions containing explosives (projectiles with bursters and rockets) are processed in ECRs. The number of projectiles in an explosive contaminant room at any time is limited by the explosive force contained in the aggregate projectiles as determined by the net explosive weight. Munitions will be stored on the conveyors in this room and the munitions will also be stored on the reject systems located in this room. In addition, leaking projectiles that have been placed in overpacks may be stored on the floor in this room. Secondary containment will be provided by a coated and reinforced concrete floor, sumps, and perimeter curbs/walls. The number of construction and expansion joints will be kept to a minimum in this area. In this area, the floor, sumps and curbs will be coated with an applied material that provides a flexible, external liner. There is a 110-gallon (total) storage capacity for secondary wastes in these two ECRs. If necessary, spill containment pallets also may be used.

4) Tray/Container Transfer Room

Miscellaneous secondary waste will be stored in this area until it is removed for disposal. Typical containers include 55-gallon drums, plastic bags, and boxes. There is a 550-gallon storage capacity for secondary wastes in this area.

5) ANS Room

Miscellaneous secondary waste will be stored in this room until it is removed for disposal. The room may also be used to store spent decontamination solution (SDS) on a contingency basis. Typical containers include IBCs, 55-gallon drums, plastic bags, and boxes. There is a 2,750-gallon storage capacity for secondary wastes as well as contingency SDS storage in this area.

6) Motor Packing Room (MPR)

Separated rocket motors will be stored in this room prior to transfer from the building for storage or treatment/disposal. In addition to the rocket motors, empty SFT segments removed from the warheads will also be stored here. Typical containers include DOT-approved shipping boxes. There is a 350-gallon storage capacity for the storage of 2 boxes of rocket motors and 2 boxes of empty SFTs in this area.

7) Motor Shipping Room (MSR)/Covered Loading Area

Separated rocket motors will be stored in this room prior to transfer from the building for storage or treatment/disposal. In addition to the rocket motors, empty SFT segments removed from the warheads will also be stored here. There is a 350-gallon storage capacity for the storage of 2 boxes of rocket motors and 2 boxes of empty SFTs in this area.

8) Box Transfer Areas 1 and 2

Separated rocket motors will be stored in these rooms prior to transfer from the facility for storage or treatment/disposal. In addition to the rocket motors, empty SFT segments removed from the warheads will also be stored here. There is a 3,000-gallon (total) storage capacity for 36 boxes of rocket motors in these 2 areas.

C. SPB Area

Miscellaneous secondary waste will be stored in this area until it is removed for disposal. Typical containers include rolloff bins, 55-gallon drums, plastic bags, and boxes. There is an 8,550-gallon storage capacity for AFS filter cake and secondary wastes in this area.

D. Waste Storage Area

Various liquid and solid hazardous wastes will be stored in this area until it is transferred to the WTS for eventual off-site disposal. Typical containers include rolloff bins and 55-gallon drums. There is a 5,500-gallon storage capacity for various process and secondary wastes in this area. This area will include a sprung structure that will house 32 single stacked 55-gallon drums. Liquid containment will be provided by the use of portable containment pallets whenever liquids are stored in this area.

E. Waste Transfer Station

Various liquid and solid hazardous wastes will be stored in this area in drums and other container types as necessary. This area is permitted for 24,000 gallons and will be sized to contain approximately 176 single stacked 55 gallon drums. Drums may be double stacked if necessary, which accounts for the requested permitted storage capacity. This area will include a sprung structure to allow for heating and ventilation. Fire protection and communication systems will also be included. Liquid containment will be provided by the use of portable containment pallets whenever liquids are stored in this area.

F. Bulk Waste Storage Area

Various liquid and solid hazardous wastes will be stored in this area primarily in tanker trucks and roll-off containers. The tanker storage area includes two separate but equal permitted storage areas capable of storing 80,000 gallons each. This will include the storage of approximately sixteen, 5,000-gallon tankers of hazardous waste (RO Reject) in each area. These areas are pre-engineered concrete and will include appropriate secondary containment as required in Subpart I. There also will be an additional concrete pad that will be used to store roll-off containers with a permitted capacity of 25,000 gallons. Wastes stored in this area include filter cake, filter media, shipping and firing tubes, as well as munitions and metallic components that will be shipped off-site for recycling. Total storage capacity for these areas totals 185,000 gallons. Appropriate fire protection and communication systems will be included.

3.4.3.14.5 Hazardous Waste Tank Storage Areas

Tank systems within BGCAPP will be permitted for storage of hazardous wastes. These tank systems are located outside, within the MDB, and within the SPB and will be designed, constructed, and operated in accordance with all applicable standards of 401 KAR 38:005, 401 KAR 34:190 and 401 KAR 38:160.

3.4.3.14.6 Hazardous Waste Treatment Units

Numerous hazardous waste treatment units will be used to destroy the chemical weapons stockpile at BGCAPP. These treatment units will be installed during the construction phase of the RD&D program. Each hazardous waste treatment unit will be designed, constructed, and operated in accordance with the applicable standards from 401 KAR Chapter 34 (Standards for Owners and Operators of Hazardous Waste Storage, Treatment and Disposal Facilities).

See section 2, paragraph 2.1.2 for the process description of these treatment units. Materials of construction and dimensions of miscellaneous treatment units will be provided to KDEP in sufficient time before the start of construction of the miscellaneous treatment units to allow full evaluation of their adequacy.

3.4.3.14.7 Waste Transfer Station

Wastes generated in the MDB will be containerized for eventual off-site shipment. Before these wastes are shipped off-site, they will be transferred out of the MDB to the Waste Transfer Station (WTS), which is located east of the MDB in the proximity of the firewater storage tanks. Here, the wastes will be stored until they are loaded for off-site shipment to a permitted TSDF. There is a 24,000-gallon storage capacity for process and secondary wastes in this area.

3.4.3.15 401 KAR 38:230 Section 1 (4) – Effectiveness of Treatment

See paragraph 3.1, for a list of the National Research Council (NRC) Reports, which evaluated the various technologies and identified neutralization by hydrolysis to be an effective and safe method for treating the chemical agent and the energetics that are stored at BGAD. The NRC reports are prepared by committees selected for their experience and knowledge of the subject matter being evaluated and were heavily peer-reviewed prior to publication. All reports identified in Table 3-1 (as well as numerous other reports) have identified neutralization followed by SCWO as appropriate treatment technologies for BGCAPP. A nerve agent (i.e., other than GB) has previously been destroyed using caustic hydrolysis.

3.4.3.16 401 KAR 38:230 Section 1 (5) – Air Emissions, Additional Information

Sources of agent emissions are contained within the MDB by the HVAC system and potential airborne agent must pass through the MDB HVAC filtration system, which is described in section 2, paragraph 2.1.3 and are removed. As indicated, the MDB HVAC filtration system has been used at all of the chemical demilitarization facilities with a highly successful record of performance for the past 30 years.

3.4.3.17 401 KAR 34:190 and 401 KAR 38:160 – Tank Systems

This section presents additional information on the tank systems. Part A of this application (Figure 1-A) lists the tanks and their aggregate volumes. All tanks are maintained at essentially ambient pressure and temperature. All agent and agent-contaminated storage tanks are kept inside the MDB and headspace emissions from these tanks are vented through the off-gas treatment and MDB HVAC filtration systems.

3.4.3.18 401 KAR 34:190 Section 3(1) – Assessment of New Tank System's Integrity

The assessment of adequacy of the tank systems design was performed by an independent P.E. and the resulting TARs were submitted to KDEP, for review and approval prior to starting installation of each hazardous waste tank system. All tanks that recently have been identified as Subpart J-regulated tank systems currently are undergoing a Tank Assessment Report (TAR) review and preparation by the TAR subcontractor. These TARs will be provided to KDEP upon their completion. Underground storage tanks will not be used for hazardous wastes at BGCAPP and tanks storing hazardous waste are located above ground only.

3.4.3.19 401 KAR 34:190 Section 3 – Description of Tank System Installation and Testing Plans and Procedures

An independent, qualified installation inspector or an independent, qualified registered professional engineer will inspect each new tank system prior to placing a new tank system in service. Inspection will include evaluation of the following items:

1) Welds to ensure the absence of breaks
2) Integrity to ensure the absence of punctures and cracks
3) Integrity of the protective coatings to ensure it has not been scraped through or otherwise removed in locations
4) Lack of corrosion
5) Other structural damage or inadequate construction/installation.

Discrepancies identified by inspection will be repaired by appropriate methods and tank systems will not be placed into service without satisfactory inspection results and repairs (if needed).

Hazardous waste tanks and associated ancillary equipment will be tested for tightness to liquid and vapor before being placed into use. Identified discrepancies will be repaired by and the tank systems will not be placed into service until applicable inspections have been satisfactorily completed.

Ancillary equipment will be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.

3.4.3.20 401 KAR 38:160 Section 2 – Dimensions and Capacity of Each Tank

The capacity and number of hazardous waste tanks is specified in the Part A permit application. The tank dimensions were submitted to KDEP in the TARs submitted prior to beginning BGCAPP tank construction.

1) Description of Feed Systems, Safety Cutoff, Bypass Systems, and Pressure Controls – This information will be submitted to KDEP 24 months prior to the receipt of hazardous waste as specified in the BGCAPP RD&D Permit KY8-213-820-105, Appendix B.
2) Diagram of Piping, Instrumentation, and Process Flow – The piping and instrumentation diagram (P&IDs) will be submitted to KDEP 24 months prior to the receipt of hazardous waste as specified in the BGCAPP RD&D Permit KY8-213-820-105, Appendix B.

3.4.3.21 401 KAR 34:190 Section 4 – Containment and Detection of Releases

Plans and Description of Design, Construction, and Operation of Secondary Containment System

Assessment information on the containment design was submitted to KDEP either as part of a system-specific TAR [e.g., Hydrolysate Storage Area (HSA) tanks] or a part of a TAR specifically addressing the containment (e.g., MDB Horizontal Concrete). KDEP subsequently evaluated and approved these TARs to include calculations comparing the minimum required containment volumes and volume provided by the containment design.

3.4.3.22 401 KAR 34:190 Section 4(4)&(5) – Requirements for External Liner, Vault, Double-Walled Tank or Equivalent Device

External liners provide the secondary containment for the BGCAPP new tank systems in this permit application. The following subparagraphs summarize how these containments comply with environmental regulations:

a. The design of secondary containments for the BGCAPP tank system(s) includes capacities that exceed the maximum capacity of the largest tank within its boundary. The volumes for these secondary containments are provided in the PE certified TARs previously submitted to KDEP
b. Roofs over the BGCAPP tank systems prevent run-on or infiltration into secondary containments except for the outdoor hazardous waste tank systems (i.e., STA and HSA). The secondary containments for these outdoor tank systems are of sufficient capacity to contain the largest tank and run-on/precipitation from a 25-year, 24-hour rainfall event with adequate allowance for “freeboard” (i.e., sufficient freeboard to prevent topping due to wind action if both a leak of the largest tank in the containment and the 25-year, 24-hour rainfall event occur simultaneously)
c. These secondary containments are free of cracks or gaps
d. These secondary containments are all designed to surround the tanks and cover all the surrounding soils and prevent contact with tank wastes if leaks from the tanks occur
e. These secondary containments are lined with coating materials, compatible with the wastes stored, and are effective as proven at other waste management facilities

NOTE: The secondary containment system in the MDB and SPB are currently being re-evaluated with respect to the extent of waterstop used during the construction of each building. BPBG expects to apply external, retrofit waterstop in some areas as well as re-coat some of these areas. When the extent of condition is determined and final measures selected, those modifications will be outlined in the white paper previously discussed between BPBG and KDEP. These changes also will be captured in the next RCRA RD&D Permit Revision (Rev. 6).

Category A and Category B sumps are part of the SDS tank system. As such, the sumps are double-walled and have metal liners. An ultrasonic level detection sensor detects the presence of liquid in the sump. The capacitance probe detects fluid in the interstitial area between the inner and outer sump walls. This is the leak detection method for leaks occurring in primary sumps. These sumps meet the regulatory requirements for an open-surface tank because these sumps routinely receive/store agent-derived decontamination solutions during PPE decontamination following entry of personnel into the Category A and Category B areas. CCR operators pump wastes reaching these sumps to the SDS. If an operator identifies a leak from the outer sump wall to the inner sump wall, the BGCAPP removes the sump from service for repair.

Containments in Category A and Category B areas slope so that liquid spills or leaks in the containment drain to the sump(s). The sumps in these areas incorporate leak detection sensors instrumented to sound an alarm in the CCR. The CCR operator responsible for the area with the leak detection alarm can take actions needed to investigate the leak, identify the cause of the leak, and initiate appropriate corrective action (e.g., begin repairs, remotely initiate a pumping of the liquid in the sump to the SDS or to the agent collection/toxic storage tanks). Category C and D sumps and sumps in outdoor hazardous waste tank areas are lined but may not have alarms or stationary, instrumented pumps to drain the sumps. Tank systems in these areas are inspected daily, and leaks identified, reported, contained, and repaired/removed consistent with 40 CFR 264.193(c)(4).

HVAC Condensate is generated by Recirculating Cooling Units (RCUs) in Category C and Category D areas, in the same manner that condensate is generated in Category A and Category B areas. However, the management of the condensate streams in Category C and Category D areas will differ from that in Category A and Category B areas. For those RCUs located in Category C areas, the condensate will be drained to Category C sumps. These sumps are connected to the MDBs Spent Decontamination System (SDS), and will be emptied within 24 hours of accumulation of wastes. Category D sumps are inspected daily and the results documented on the applicable inspection forms. If any wastes are discovered in these sumps, the wastes will be removed as soon as possible, within 24 hours, and properly disposed. Also, based on the configuration of these sumps, a check valve on the sump line combined with the top feeding of the SDS tanks would not allow for any agent contaminated SDS liquids to flow back into the sumps. MINICAMS® monitoring is continuous in the Category C areas and would detect the presence of any agent containing liquids/wastes in these sumps.

3.4.3.23 401 KAR 34:190 Section 4(6) – Secondary Containment and Leak Detection Requirements for Ancillary Equipment

Piping and fittings are either above ground and will be visually inspected for leaks daily or will be equipped with leak detection. All piping and fittings containing agent or agent-contaminated liquids are located in the MDB, which has engineering controls for liquids, monitoring for agent vapors, and closed circuit TV surveillance allowing remote observations of areas for the detection of leaks.

3.4.3.24 401 KAR 34:190 Sections 5 and 6: Controls and Practices to Prevent Spills and Overflows

The BGCAPP tanks and tank systems are equipped with multiple layers of protection to minimize the possibility that the hazardous wastes or treatment reagents will cause any elements of a tank system to rupture, leak, corrode, or otherwise fail.

3.4.3.24.1 Wastes or Treatment Reagents Will Not Cause Damage:

The TARs previously submitted to KDEP certified the design of all the hazardous waste tank systems in this Permit Application. These TARs provided information on the tank systems, including the associated secondary containments and ancillary equipment. These PE certified TARs provide independent assurances that the tank systems can function without releasing wastes to the environment and that hazardous waste or treatment residues placed in the tank system do not cause any element of the system to rupture, leak, corrode, or otherwise fail.

These tanks have fixed roofs and, with the exception of the STA and HSA tank systems, the associated secondary containment sumps and the secondary containment system are located indoors without the additional capacity required to capture precipitation. The volumes of the secondary containments for the outdoor HSA and STA provide adequate volume to contain the largest tank, provide capacity for a 25-year, 24-hour rainfall event and sufficient freeboard (i.e., sufficient freeboard to prevent topping) to address overtopping by wave or wind action.

3.4.3.24.2 Spill and Overfill Prevention Controls:

Operation of BGCAPP tanks incorporates controls and follows practices designed to prevent spills and overflows. These tank systems have spill prevention controls such as check valves and tight shutoff valves. Lines that are below the liquid level in the tank incorporate one or more check valves to prevent backflow from downstream equipment that might cause overfilling.

All tanks also have overfill controls, including level transmitters, high level and high-high level alarms, and automatic feed cutoffs. The overfill controls consist of level sensors that are observed and controlled by operators in the CCRs located in the CSB and the SPB. Trained operators and supervisors staff these CCRs when the process is operational. In addition to these level controls, tank design incorporates the following automatic protective features:

1) On high level reading, an alarm sounds in the CCR
2) On high-high level, the ICS shuts off power to the feed pump
3) On tanks with high-high-high level sensors, waste feed valves to those tanks are automatically shut
4) Every tank is in a spill containment whose volume is adequate to hold the liquid from the largest tank. Each tank is equipped with an overflow line or pressure relief that leads to the sump in the containment

3.4.3.24.3 Calibration and Testing of Tank Control Equipment:

Calibration and testing of the level indicators and shutdowns occurs at a minimum of once per year or based on manufacturer’s recommendations. BGCAPP maintenance verifies the calibration of the level indicators, checking against the inventory records for each tank to ensure accuracy, and the BGCAPP tests the alarms and automatic feed cutoffs each month to ensure operation as designed.

3.4.3.24.4 Inspection Schedule and Procedure:

Plant operators conduct daily inspections of overfill controls, tanks, data from monitoring and leak detection equipment, construction materials, and the area surrounding the tank systems. Inspections of the tank systems within the Category A and Category B areas (within the MDB) may be conducted from observation areas around the systems or during worker entries into these areas. Scheduling of these inspections may be less than daily based on worker entry schedules. Worker entries will not be conducted solely for tank system inspections (i.e., due to inherent risks). CCR operators also can use CCTV to conduct inspections of the Category A and Category B areas within the MDB on a weekly basis. The basis for the frequency of inspection is the rate of possible deterioration of equipment and the probability of an environmental or human health incident if the deterioration, malfunction, or operator error goes undetected between inspections. The BGCAPP conducts daily inspections of areas subject to spills, such as loading and unloading areas when in use. Figure 3-6 and Figure 3-7 also identify examples of the types of “Inspection Criteria” used for these tank system inspections.

The following paragraphs summarize the criteria and regulatory requirements for these inspections.

a. The aboveground portions of each tank system are inspected daily for signs of external corrosion or releases of waste – 40 CFR 264.195.
b. Overfill controls are visually inspected monthly, when waste is present in the tank system. The inspection consists of visual observation of the external overfill controls for evidence of deterioration or malfunction. A reading of the level sensors and transmitters associated with overfill control is obtained daily by operators – 40 CFR 264.195(a).
c. The BGCAPP hazardous waste tank systems outside the Category A and Category B areas in the MDB (including tank shell and bottom, piping and valves, pumps, tank supports, and construction materials, area around the tank, and secondary containment system) are visually inspected once daily to detect corrosion, erosion, or signs of waste releases – 40 CFR 264.195(b).
d. BGCAPP personnel monitor the temperature, pressure, and flow/level during transfer operations. BGCAPP personnel also conduct daily inspections of leak detection equipment, such as the level indicators in the sumps. The data gathered from monitoring is reviewed at least daily to ensure tank systems are operating in accordance with design specifications – 40 CFR 264.195(b).
e. The BGCAPP personnel inspect hazardous waste tank area sumps, trenches, and secondary containments at least daily. The inspection consists of a visual observation (i.e., using CCTV and instrument readings) of the sumps, trenches, secondary containment, and readings of the level indicators in the sumps – 40 CFR 264.195(b).
f. The tank systems within the Category A and Category B areas in the MDB are inspected weekly – 40 CFR 264.195(c) and (d).
g. The BGCAPP does not provide external cathodic protection for the hazardous waste tanks; therefore, inspections of this item are not required.

The BGCAPP complies with the requirements of 40 CFR 264.196 if a leak or spill occurs in the tank system.

3.5 Monitoring Methods, Regulatory Determinations and Sampling and Analytical Procedures

3.5.1 Headspace Monitoring for >1 Vapor Screening Level (VSL) Waste

Headspace monitoring is used to meet U.S. Army requirements for characterizing agent-derived, secondary wastes to determine whether the wastes can be transported off-site in accordance with U.S. Army policy and regulations. The process used to characterize and/or monitor, and transport secondary wastes off-site for commercial treatment or disposal is described in the following paragraphs. Included is a discussion of relevant U.S. Army guidance and the Bounding Transportation Risk Assessment (BTRA).

3.5.1.1 Definitions of Airborne Exposure Limits (AELs)

AELs are unique military standards for exposure of unprotected workers and the general population to chemical agents. These airborne, time weighted average (TWA) standards are based upon recommendations of the Centers for Disease Control and Prevention (CDC) promulgated in the Federal Register[1,2] and incorporated into U.S. Army regulations[3]. The AELs are the allowable, average concentrations in air for workplace and general population exposures. AELs include worker population limits (WPLs), short-term exposure limits (STELs), and general population limits (GPLs). Basis of AELs is exposure to a concentration for a set duration (time). The TWA is the average concentration of a chemical agent for a specified duration or length of time. Specific definitions for the AELs are as follows:

1) WPL is an 8 hour TWA. Exposure below the WPL is safe and not expected to produce any adverse health effect. This is the TWA airborne concentration for exposure of unmasked worker for an 8 hour workday, 40 hour week, for 30 years without adverse effect.
2) STEL is the maximum concentration for exposure of unprotected chemical workers for up to 15 minutes continuously. The number of exposures allowed for a worker at the STEL is dependent on the chemical agent. For GB exposure, the STEL should not exceed 15 minutes and should not occur more than 4 times per day with each successive exposure separated by at least 60 minutes.
3) GPL is a 24-hour TWA for nerve agents (GB). Basis for the GPL is exposure for 7 days per week for a 70-year lifetime.

Table 3-3 provides the AEL values for the chemical agent (GB) stored and processed at the BGCAPP under this RD&D permit.

3.5.1.2 VSL and Agent Contamination in Secondary Wastes

U.S. Army policy, regulations, and procedures require evaluation of the waste for the presence and degree of agent contamination prior to transport of non-liquid secondary wastes from the BGCAPP site[3,4,5]. The evaluation or assessment process for chemical agent in wastes involves monitoring the agent concentration in the air above the contained waste (i.e., headspace) or use of generator knowledge. VSL determinations are the result of monitoring the headspace above an item contained in an enclosed space (i.e., limiting the incoming air – preventing significant dilution). The BGCAPP monitors and reports the results of headspace monitoring in terms of VSLs. The VSL value depends on the chemical agent being headspace monitored. The VSL concentration for GB is 1×10^{-4} mg/m^3.

VSL concentrations determined from headspace monitoring are reported in multiples of the VSL (e.g., 5 VSL, 150 VSL) or simply less than or greater than or equal to one VSL (<1 or ≥1 VSL). The VSL measurements from waste characterization monitoring can then be used to assess (i.e., using risk assessment techniques) whether a waste should be released (i.e., based on the amount of risk) for off-site shipment to an appropriately permitted, commercial TSDF or must be decontaminated and re-monitored.

The BGCAPP may use generator knowledge (perhaps supported by previous headspace monitoring of waste samples or wastes from the same type activity) to characterize secondary waste (e.g., PPE, pumps, absorbent) for the presence of agent ≥1 VSL secondary waste streams but must apply consistent segregation practices to separate wastes or waste streams based on potential hazard. The BGCAPP maintains records to document and support generator knowledge. Documentation used to support generator knowledge can include:

1) Logbook entries
2) Known absence of liquid agent
3) Suspected or known agent contamination of waste(s)
4) Systems worked on
5) Type of waste material(s) (e.g., PPE, metals parts, rags) and decontamination or disassembly accomplished
6) Airborne agent monitoring results (e.g., for airlocks, life support systems, room agent) associated with activity generating the waste(s)

Headspace monitoring can initially establish a waste characterization that, if verified by subsequent repeated headspace monitoring, may serve as a basis for generator knowledge. For example, maintenance activities (i.e., on non-agent systems) generating metals parts and PPE from areas without liquid agent present could be, based on previous monitoring data, established as having a range (e.g., ≥1 to <32 VSL). Therefore, generator knowledge without requiring headspace monitoring of each waste container may be used as a basis for waste shipment.

3.5.1.3 Headspace Monitoring Methods

MINICAMS® and Depot Area Air Monitoring System (DAAMS) are the two air monitoring methods used for VSL headspace monitoring at the BGCAPP.

The MINICAMS® is an automatic air monitoring system that collects compounds on a solid sorbent trap, thermally desorbs compounds from the trap into a capillary gas chromatography column for separation, and detects the compounds with a flame-photometric detector. The MINICAMS® is a lightweight portable, near real time, low level monitor for chemical agent with alarm capability.

The DAAMS is a portable air sampling unit designed to draw a controlled volume of air through a glass tube filled with collection material (e.g., Tenax™ GC). As the air passes through the solid sorbent tube, agent is collected. After sampling is complete, the monitoring technician removes the tube from the sample line and sends it to the onsite laboratory for analysis. The airborne agent concentration calculation uses the known sampling volume collected during air sampling.

3.5.1.4 Requirements for Headspace Monitoring

U.S. Army policy and regulation, headspace air monitoring (i.e., for waste characterization), and off-site transport requirements include[6]:

1) Monitoring after a minimum hold time
2) Attaining and maintaining a minimum temperature throughout the hold time

3) Determining the minimum air volume for monitoring (based upon the air monitoring method/procedure used)
4) Prior to monitoring, verifying wastes have no occluded spaces (i.e., dismantle, decontaminate, flush, rinse, and drain items with cavities)
5) Verifying composition of the material being monitored does not interfere with the headspace monitoring (e.g., carbon)
6) Eliminating free liquids (i.e., bagged waste must have an absorbent pad placed inside the bag and bagged waste must be double-bagged)
7) Minimizing dilution air during monitoring (i.e., monitoring of bagged wastes is performed by making a small hole in the bag only large enough to insert the sampling wand)
8) Conducting representative monitoring of wastes (i.e., bags in drums must be individually monitored or, if monitored inside the drum, the bags are open to allow air circulation)
9) Placing absorbent pads in the bottom of each drum
10) Verifying sufficient volume is present for monitoring (i.e., item monitored is bagged or contained within space with sufficient volume to permit sample air to be withdrawn)

NOTE: Minimum hold time and temperature for headspace monitoring established based upon data collected by the BGCAPP.

NOTE: Personnel trained and certified to operate and maintain the sampling devices perform headspace monitoring. Air monitoring equipment calibrated and calibration methods approved before use. The BGCAPP Laboratory Quality Assurance Manual contains the specific requirements for training/certification of monitoring personnel and calibration of the air monitoring equipment.

3.5.1.5 Secondary Wastes

Secondary wastes are not process wastes but are instead agent-derived wastes (e.g., due to contact with liquid agent or agent-contaminated liquids or aerosols) that are generated during maintenance, operations, and closure activities. The National Research Council (NRC), in “Review of Chemical Agent Secondary Waste Disposal and Regulatory Requirements” (2007), recommended to the CMA that offsite shipment and disposal of ≥1 STEL (equivalent to 1 VSL) secondary wastes be pursued[5]. The CMA has implemented a secondary waste management policy based on this NRC recommendation. Based upon the CMA policy, secondary wastes can be treated and disposed off-site at an appropriately permitted, commercial TSDF; thereby allowing 100 percent devotion of the BGCAPP operations to destruction of the chemical weapon stockpile[4].

3.5.1.6 Bounding Transportation Risk Assessment (BTRA)

The U.S. Army Chemical Materials Activity, “Bounding Transportation Risk Assessment for >1 VSL Waste” (BTRA), September 2008[6], defines the conditions under which ≥1 VSL agent-contaminated secondary waste can be shipped to an appropriately permitted, commercial TSDF (i.e., incinerator) with various levels of risk (i.e., negligible and marginal). The BTRA was prepared to identify and assess the potential risks to members of the public due to accidents during transport of hazardous waste. The levels of risk in the BTRA are based upon:

1) Average headspace readings in a truckload of 55-gallon or 95-gallon containers
2) Number of shipments to be made
3) Distance to an appropriately permitted, commercial TSDF

4) The BTRA includes secondary wastes contaminated with the chemical agents treated at the BGCAPP.

The objective of the BTRA was to provide a framework for assessing and controlling risks to TSDF workers and the public arising from ≥1 VSL waste shipments. The BTRA applies to secondary wastes or closure wastes leaving a chemical demilitarization facility and creates continuity and consistency in the risk criteria applied to secondary waste shipments. The bounding conditions determine the level of public risk based on:

1) Agent concentrations and/or agent quantity per drum
2) Distance and number of shipments during the shipment operation

An "Information Package" is prepared prior to U.S. Army approval of offsite shipment of secondary waste [e.g., waste profile, monitoring plans and standing operating procedures (SOPs), waste segregation and packaging SOPs, transportation plans, health and safety approach].

3.5.1.7 Off-site Shipments

Off-site shipments of secondary wastes must comply with DOT regulations found in 49 CFR 100-185. The demilitarization facility is required to[6]:

1) Package, in 55-gallon or 95-gallon polyethylene drums, secondary wastes with headspace monitoring results ≥1 VSL. Use polyethylene drums as waste containers for direct feed into an appropriately permitted, commercial TSDF incinerator. Direct waste feed prevents additional TSDF worker exposure
2) Allow a maximum of eighty 55-gallon or fifty-one 95-gallon drums per vehicle (as defined in the BTRA)[7]
3) Palletize and shrink wrap waste drums and place the palletized drums into the cargo area without stacking the pallets
4) Ensure the cargo areas for shipments are climate controlled (i.e., <70°F)

Additional shipping requirements are included in the BTRA[6]. Table 3-4 summarizes the bounding conditions for secondary wastes shipments for each of the three chemical agents treated at the BGCAPP. The BTRA indicates that relatively high agent concentrations in individual drums result in negligible risks; however, the CMA accepted and implemented a CDC recommendation not to exceed a ceiling headspace monitoring value for any waste container within a waste shipment. The ceiling concentration for GB as 500 VSL[6].

References

1) 53 Federal Register (FR) 8504 (15 March 1988) (corrected in 53 FR 11002, 4 April 1988), Final Recommendations for Protecting Human Health and Safety Against Potential Adverse Effects of Long-term Effects of Long-term Exposure to Low Doses of Agents: GA, GB, VX, Mustard Agent (H, HD, and HT), and Lewisite (L).
2) 68 FR 54460 (17 September 2003)(corrected in 68 FR 58348, 9 October 2003), Final Recommendations for Protecting Human Health from Potential Adverse Effects of Exposure to Agents GA (Tabun), GB (Sarin), and VX.
3) Department of Army Pamphlet 385-61, Toxic Chemical Agent Safety Standards, 17 December 2008.
4) CMA Memorandum, Requirements for Implementation of the U.S. Army Chemical Agency (CMA) Bounding Transportation Risk Analysis (TRA) for Shipment of Greater Than 1 Vapor Screening Level (VSL) Chemical Agent Contaminated Secondary Waste, 15 September 2008.
5) National Research Council (NRC), Review of Chemical Agent Secondary Waste Disposal and Regulatory Requirements, National Academy Press, 2007.
6) Chemical Materials Agency (CMA), Final Bounding Transportation Risk Assessment for >1 Vapor Screening Level (VSL) Waste, September 2008.

Table 3-3 – AELs for GB

Chemical Agent	WPL (mg/m^3)	STEL (mg/m^3)	GPL (mg/m^3)
GB	$3x10^{-5}$	$1x10^{-4}$	$1x10^{-6}$

NOTES:

1) 53 Federal Register (FR) 8504 (15 March 1988) (corrected in 53 FR 11002, 4 April 1988), Final Recommendations for Protecting Human Health and Safety Against Potential Adverse Effects of Long-term Effects of Long-term Exposure to Low Doses of Agents: GA, GB, VX, Mustard Agent (H, HD, and HT), and Lewisite (L).
2) 68 FR 54460 (17 September 2003)(corrected in 68 FR 58348, 9 October 2003), Final Recommendations for Protecting Human Health from Potential Adverse Effects of Exposure to Agents GA (Tabun), GB (Sarin), and VX.

Table 3-4 – Summary of Bounding Conditions for GB

Shipment of GB Secondary Wastes						
		55-gallon Drum Shipments		95-gallon Drum Shipments		
Shipping Distance (miles)	Hazard Severity	Headspace Concentration (VSL)	Number of Shipments	Headspace Concentration (VSL)	Number of Shipments	Risk Level
3,000	Negligible	<250	894	<390	894	Low
	Marginal	250 to 3,100	8	390 to 4,900	8	Low
2,000	Negligible	<250	1,341	<390	1,341	Low
	Marginal	250 to 3,100	13	390 to 4,900	13	Low
1,000	Negligible	<250	2,683	<390	2,683	Low
	Marginal	250 to 3,100	26	390 to 4,900	26	Low
500	Negligible	<250	5,366	<390	5,366	Low
	Marginal	250 to 3,100	53	390 to 4,900	53	Low

As recommended by the CDC and implemented by the U.S. Army, waste containers with the following VSL reading or greater are not shipped offsite without further decontamination: 500 VSL for GB. Based on CMA Memorandum, Requirements for Implementation of the U.S. Army Chemical Agency (CMA) Bounding Transportation Risk Analysis (TRA) for Shipment of Greater Than 1 Vapor Screening Level (VSL) Chemical Agent Contaminated Secondary Waste, 15 September 2008.

3.5.2 99.9999 percent DE Calculation Method

DE will be calculated according to the equation described in BGCAPP permit KY8-213-820-105, Condition T-9.

3.5.3 Sampling & Analytical Procedures

3.5.3.1 Sampling Methods

The BGCAPP collects non-routine samples for analysis if waste characterization using process knowledge is not possible. For liquid wastes, U.S. EPA-approved sampling methods are used and sampling activities conform to SW-846 requirements.

3.5.3.1.1 Frequency of Analysis

Analysis, testing, and monitoring of each waste stream occurs for the initial batch or batches of each agent destroyed at the BGCAPP. Analyses, tests, and monitoring of these waste streams are performed at least annually (to ensure the waste analyses and testing is accurate and up-to-date) and analyses are repeated as often as necessary to ensure the characterization of each waste stream is accurate and up-to-date. This means that an analysis of a waste is necessary if any of the following circumstances occur:

a. The BGCAPP becomes aware of a change in the process that produces the waste
b. The BGCAPP becomes aware that a waste was inadvertently mixed with another waste
c. The BGCAPP determines through analysis a waste no longer matches the expected characteristics
d. A change occurred to the hazardous waste regulations that apply to that waste

3.5.3.1.2 Process Knowledge

BGCAPP personnel use process (generator) knowledge (perhaps in conjunction with air monitoring) to determine whether solid wastes such as PPE, components/parts, glassware, and disposable items may be contaminated with chemical agent. The BGCAPP also uses generator knowledge to characterize non-agent wastes. These items may also be placed into an enclosed volume of air (e.g., within a plastic bag) where the headspace above these items is air monitored until the appropriate U.S. Army decontamination level is attained which could require additional decontamination.

3.5.3.1.3 Analytical and Air Monitoring Methods

For each waste stream listed in Table 3-5, Table 3-6 shows appropriate sampling equipment and methods for sampling and analysis of wastes based on the waste stream media. Table 3-7 provides the specific analytical, testing, and monitoring methods, and techniques used to make waste determinations with the rationale and the basis for selecting the method(s) for each waste stream. The headspace air monitoring approach for agent-derived waste characterization is described in paragraph 3.5.1.

Table 3-5 – BGCAPP Wastes, Designations and Characterizations

Waste Material	EPA/KY Waste Number	RCRA Hazardous Waste Regulatory Citations (401 KAR; 40 CFR)	Basis for Designation
Munition Remnants Residues, Particulates and Ash from MPT	Toxicity (D004, D005, D006, D007, D008, D009, D010, and/or D011)	31:030, Section 5; and 261.24	Wastes may contain increased concentrations of RCRA regulated metals due to concentrating effect of processes. Laboratory analyses performed initially to characterize these wastes.
	N001	31:010; 261.3(a)(2)(iv); and 261.3(c)(2)(i); and 31:040 Section 7, Nerve Agent	Waste is agent-derived and therefore carries the waste number for the agent.
APS/AFS Precipitate (filter cake)	Toxicity (D004, D005, D006, D007, D008, D009, D010, and/or D011)	31:030, Section 5; and 261.24	Wastes may contain increased concentrations of RCRA regulated metals due to concentrating effect of processes. Laboratory analyses performed initially to characterize these wastes.
	N001	31:010; 261.3(a)(2)(iv); and 261.3(c)(2)(i); and 31:040 Section 7, Nerve Agent	Waste is agent-derived and therefore carries the waste number for the agent.

Waste Material	EPA/KY Waste Number	RCRA Hazardous Waste Regulatory Citations (401 KAR; 40 CFR)	Basis for Designation
Reject Waste Stream from RO Unit	Toxicity (D004, D005, D006, D007, D008, D009, D010, and/or D011)	31:030, Section 5; and 261.24	Wastes may contain increased concentrations of RCRA regulated metals due to concentrating effect of RO processes. Laboratory analyses performed initially to characterize these wastes.
	N001	31:010; 261.3(a)(2)(iv); and 261.3(c)(2)(i); and 31:040 Section 7, Nerve and Blister Agents	Waste is agent-derived and therefore carries the waste numbers for the agent.
Contaminated Dunnage	Toxicity (D024 and/or D037)	31:030, Section 5; and 261.24	Preservatives for dunnage may contain contaminants above regulatory levels.
	N001	31:010; 261.3(a)(2)(iv); and 261.3(c)(2)(i); and 31:040 Section 7, Nerve and Blister Agents	Identify agent-contaminated dunnage using generator knowledge and headspace air monitoring.
Munitions Dunnage (non-contaminated)	Toxicity (D024 and/or D037)	31:030, Section 5; and 261.24	Preservatives for dunnage may contain contaminants above regulatory levels.
Non contaminated Rocket Motors	Ignitability (D001)	31:030, Section 2; and 261.21	Rocket propellant is ignitable, reactive, and may contain lead.
	Reactivity (D003)	31:030, Section 4; and 261.23	
	Toxicity (D008)	31:030, Section 5; and 261.24	
Agent Contaminated / Derived KY Hazardous Waste (PPE, Agent Contaminated or Derived KY Wastes: Carbon and HEPA/Pre-filters, Trash, Rags, and Components/Parts from Operations and Maintenance Activities)	N001	31:010; 261.3(a)(2)(iv); and 261.3(c)(2)(i); and 31:040 Section 9, Nerve and Blister Agents	Waste from these activities mixed with or derived from Kentucky listed wastes N001.
Laboratory Wastes	Ignitability (D001)	31:030, Section 2; and 261.21	Laboratory wastes generated from onsite chemical analysis may exhibit these characteristics and/or
	Corrosivity (D002)	31:030, Section 3; and 261.22	

Waste Material	EPA/KY Waste Number	RCRA Hazardous Waste Regulatory Citations (401 KAR; 40 CFR)	Basis for Designation
	Reactivity (D003)	31:030, Section 4; and 261.23	toxicity. Changes in reagents or procedures can change the Laboratory wastes.
	Toxicity (D004, D005, D006, D007, D008, D009, D010, D011, D022, D024, D027, D028, D029, and/or D037)	31:030, Section 5; and 261.24	
	Listed Processes (F001–F005)	31:040, Section 2; and 261.31	Spent solvents from the Laboratory may be listed hazardous wastes—depending on the solvents used.
	N001	31:010; 261.3(a)(2)(iv); and 261.3(c)(2)(i); and 31:040 Section 7, Nerve and Blister Agents	These wastes also may be mixed with/derived from Kentucky listed wastes N001
Maintenance and Miscellaneous Wastes: (Oils, Hydraulic Fluids, Paints, and Spent Solvents)	Ignitability (D001)	31:030, Section 2; and 261.21	Wastes generated may exhibit the characteristics of ignitability, corrosivity, reactivity, or toxicity due to chemical composition of materials used.
	Corrosivity (D002)	31:030, Section 3; and 261.22	
	Reactivity (D003)	31:030, Section 4; and 261.23	
	Toxicity (D004, D005, D006, D007, D008, D009, D010, and/or D011)	31:030, Section 5; and 261.24	
	Listed Processes (F001–F005)	31:040, Section 2; and 261.31	
	Possibly N001	31:010; 261.3(a)(2)(iv); and 261.3(c)(2)(i); and 31:040 Section 9, Nerve and Blister Agents	Waste from these activities may be mixed agent-derived wastes and become Kentucky listed wastes N001.

Table 3-6 – Typical Sampling Methods and Equipment

Waste Type	Sampling Method [1,2]	Equipment [1]
Extremely viscous liquid	ASTM standard D140/D140-09	Tubing or trier
Crushed or powdered material	ASTM standard D346-04(2010)	Tubing, trier, auger, scoop, or shovel
Soil or rock-like material	ASTM standard D420-98(2003)	Tubing, trier, auger, scoop, or shovel
Soil-like material	ASTM standard D1452-09	Tubing, trier, auger, scoop, or shovel
	ASTM standard D5633-04(2008)	
	ASTM standard D5451-93(2008)	
Fly ash-like material	ASTM standard C311-07	Tubing, trier, auger, scoop, or shovel
Containerized liquid waste	SW-846	Coliwasa or tubing
Liquid waste in tanks	Tap	Sample bottle

1. The methods and equipment used at the BGCAPP may differ from those on this table as outlined by the BGCAPP Laboratory Monitoring and Analytical plans or individual laboratory operating procedures
2. American Society for Testing and Materials, annual book of ASTM standards, Volumes 04-03, 04-08, 05-05, Philadelphia, PA

Table 3-7 – Analytical Test Methods and Rationale

Waste Stream	Waste Parameter(s) and Analytical/Test Method	Media Type	Rationale
Energetics/Chemical Agent Hydrolysate and Spent Decontamination Solution [1]	Chemical agent to 99.9999 percent DE as determined by site-specific method developed for chemical agent hydrolysate	Liquid	Waste characterization obtained at beginning of GB destruction campaign.
	Ignitability tested using Pensky Martin Closed-Cup Method 1010A, SW-846		Ignitability tested in initial batches of each agent campaign.
	Corrosive nature of wastes verified by pH Method 9040C, SW-846		Nature of waste virtually assures pH of waste >12.5 units.
	Toxic Characteristic Leaching Procedure (TCLP)-Method 1311, SW-846; and Eight (8) RCRA Toxic Metals by Method 6010C		RCRA metals tested in initial batches of each agent campaign.
MPT Residue, Particulates, and Ash1	TCLP - Method 1311, SW-846; and Eight (8) RCRA Toxic Metals by Method 6010C	Solid	Characterization of RCRA metals in these solid residues is required to ensure appropriate waste management and off-site treatment/disposal.
APS/AFS Filter Cake[1]	TCLP - Method 1311, SW-846; and Eight (8) RCRA Toxic Metals by Method 6010C	Sludge/Filter Cake	Characterization of RCRA metals in this sludge is required to ensure appropriate waste management and off-site treatment/disposal.
RO Reject Waste Stream/Brine[1]	TCLP - Method 1311, SW-846; and Eight (8) RCRA Toxic Metals by Method 6010C	Liquid/Sludge	Characterization of RCRA metals in this liquid is initially required to ensure appropriate waste management and off-site treatment/disposal. However, generator knowledge is expected to be sufficient after initial waste determinations.

Waste Stream	Waste Parameter(s) and Analytical/Test Method	Media Type	Rationale
Agent Contaminated Dunnage	Derived from/mixed with Kentucky N001. These wastes are screened using headspace air monitoring of waste in compliance with site procedures using near real time monitoring instrument - MINICAMS® or DAAMS. Department of Army (DA) decontamination level (identified through headspace monitoring) is used to manage these wastes.	Solid	Concern with possible presence of agent is due to leaking munitions. Headspace screening can be used to assess this concern and safely manage this waste.
	TCLP - Method 1311, SW-846; with m-Creol and Pentachlorophenol by SW-846 Method 8041A following preparation using Technique 3510 or 3580		Characterization of RCRA (Toxicity) constituents (D024 and D037) in these solids is required to ensure appropriate waste management and off-site treatment/disposal.
Munitions Dunnage (not chemical agent contaminated)	TCLP - Method 1311, SW-846; with m-Creol and Pentachlorophenol by SW-846 Method 8041A following preparation using Technique 3510 or 3580.	Solid	Presence of these contaminants suspected due to use as preservative for the dunnage.
Non contaminated Rocket Motors[2, 3]	TCLP - Method 1311, SW-846; and Lead by Method 6010C.	Solid	Propellant may contain lead.
PPE, Spent Activated Carbon HEPA Filters and Pre-filters, Trash, Rags and Components/Parts from Operations and Maintenance activities[3]	May be mixed with/derived from Kentucky listed waste (N001). Generator knowledge and headspace monitoring are used to assess the presence of agent.	Solid	May be mixed with/derived from Kentucky listed waste. Current DA secondary waste requirements necessitate headspace monitoring (to determine whether agent is present) and compliance with BTRA prior to shipment off-site to an appropriately permitted, commercial TSDF.

Waste Stream	Waste Parameter(s) and Analytical/Test Method	Media Type	Rationale
Laboratory Wastes and Spent Solvents[3]	Ignitability (D001) tested using Pensky-Martin Closed-Cup - Method 1010A, SW-846.	Liquid	Ignitable determination may be needed for some waste mixtures or generator knowledge may be sufficient without analysis.
	Corrosivity (D002) tested using pH electrometric measurement - Method 9040C, SW-846.		Corrosive nature of hydrolysate samples may result in some laboratory wastes having pH >12 units.
	Toxicity Characteristic (D004, D009, D011, and D022 and other volatile solvents listed under Toxicity Characteristic) - analyzed by TCLP - Method 1311, SW-846; Eight (8) RCRA Toxic Metals - Methods 3010A and 6020A, SW-846; and Volatiles by Methods 5030B and 8260B, SW-846.		Characterization of RCRA metals and volatiles in these wastes needed to ensure appropriate waste management and off-site treatment and/or disposal. However, generator knowledge is expected to be sufficient after initial waste determinations.
	Volatiles (F001-F005) by Methods 5030B and 8260B, SW-846		Spent solvents are analyzed when generator knowledge is not sufficient to determine hazard identification. These wastes, after analysis, could be added to the Laboratory waste containers.
Oils, Hydraulic Fluids, Paints, and Spent Solvents[3]	Ignitability (D001) tested using Pensky-Martin Closed-Cup - Method 1010A, SW-846.	Liquid	Ignitable determination may be needed for some waste mixtures or generator knowledge may be sufficient without analysis.
	TCLP - Method 1311, SW-846; and Eight (8) RCRA Toxic Metals by Method 6010C.		RCRA metals contamination of these liquids is expected and analysis of individual products - especially paints - is necessary.
	Volatiles (F001-F005) by Methods 5030B and 8260B, SW-846		Spent solvents from operations and maintenance tasks are characterized for treatment/disposal using generator knowledge and analysis when generator knowledge is not sufficient.

1. Waste is agent-derived based on generator knowledge.
2. Waste is reactive and ignitable based on generator knowledge.
3. Generator knowledge used to determine whether waste is agent-derived.

3.6 Equipment Inspection Procedures and Frequency

3.6.1 Equipment Maintenance and Inspection Schedule

3.6.1.1 Equipment Requirements

3.6.1.1.1 Internal Communications

The BGCAPP maintains an internal communications system consisting of hard-wired telephones, two-way hand held radios, cellular phones, a public address system, and audible signals. This system provides a combination of voice and signal information throughout the facility to employees and BGAD Security.

3.6.1.1.2 External Communications

The BGCAPP maintains an external communications system consisting of hard-wired telephones; two-way hand held radios, and cellular phones. This system provides redundant communication channels to summon security, and emergency response from the BGCA operations center (OC). Additional emergency response resources are coordinated through the BGCA OC as needed.

3.6.1.1.3 Emergency Equipment

The BGCAPP maintains portable fire extinguishers as required by the National Fire Protection Association (NFPA) in all buildings, access gates, motorized material handling equipment, and storage areas. Critical chemical demilitarization areas (i.e., much of the MDB) are equipped with deluge fire suppression. Additionally, the BGCAPP buildings have fire suppression sprinkler systems and the site has exterior fire hydrants located to provide fire water to fire response personnel. Table 6-1 lists typical BGCAPP Emergency Response Equipment.

In chemical agent handling areas, the BGCAPP provides pre-positioned decontamination equipment for emergency and routine decontamination wash downs. Engineering controls are designed to contain the spent decontamination material or other agent-derived liquid wastes for collection and processing in the ANS.

3.6.1.1.4 Water for Fire Control

The BGCAPP maintains two 250,000 gallon fire water tanks with pumps that provide fire suppression water to building sprinkler systems and specific chemical agent processing areas. Each of the tanks is designed to maintain a 25,000-gallon reserve, equaling a total reserve of 50,000 gallons. The fire water pumps operate at 2,500 gallons per minute (gpm) with a rated pressure of 100 psi. Critical chemical agent handling areas also have deluge fire suppression that delivers 2 gpm/ft^2. Additionally, this system uses a valve system to allow direct access to the BGAD water system for additional fire water, if needed.

The site also employs a separate fire hydrant system supplied by the BGAD water system throughout the plant area. These hydrants are outside the BGCAPP buildings and readily accessible by responding fire personnel.

3.6.1.1.5 General Inspection Requirements

The scheduled inspections of the BGCAPP waste storage and treatment tanks, Subpart X systems, and the container storage areas include containers/tanks/Subpart X systems, containment, safety, emergency, and operating equipment needed to prevent, detect, or respond to environmental or human health hazards. The BGCAPP Project Document Control Center (PDCC) maintains the completed inspections and other related documents.

3.6.1.1.6 Types of Problems

Figure 3-5, Figure 3-6, and Figure 3-7 identify the criteria used during container storage, tank system, Subpart X, and liquid loading and unloading station inspections.

3.6.1.1.7 Frequency of Inspection

The "Inspection Frequency" columns in Figure 3-5, Figure 3-6, and Figure 3-7 provide the frequency of inspection for containers, tank systems, Subpart X units, and liquid loading stations. Basis for selection of these frequencies was the rate of possible deterioration of equipment and the probability of an environmental or human health incident if the deterioration, malfunction, or operator error goes undetected between inspections. The BGCAPP performs daily inspections of areas subject to spills, such as loading and unloading areas, when in use.

3.6.1.2 Specific Process Inspection Requirements

3.6.1.2.1 Container Inspections

The BGCAPP conducts weekly inspections of containers in storage areas for deterioration, corrosion, spills, and evidence of leakage. In addition, containers are inspected initially and weekly thereafter for tightness of closure devices in compliance with 40 CFR 264 Subpart CC. These weekly inspections include a visual inspection for obstructions and proper maintenance of aisle space between the rows of palletized containers. Figure 3-5 shows a typical inspection checklist for container inspection activities.

3.6.1.2.2 Tank System Inspections

The BGCAPP conducts daily inspections of waste tank and Subpart X systems. The inspections address:

- Overfill and spill control equipment
- Aboveground portions of the tank and Subpart X systems
- Data gathered from monitoring and leak detection equipment
- Construction materials
- The area immediately surrounding the externally accessible portion of the tank and Subpart X systems as well as the secondary containment system.

Figure 3-6 shows a typical inspection checklist for the tank system and Subpart X inspection activities.

Figure 3-7 provides the typical inspection checklist for liquid loading/unloading areas, when in use.

3.6.1.2.3 Waste Pile Inspections

Not applicable. The BGCAPP does not have any waste piles.

3.6.1.2.4 Surface Impoundment Inspections

Not applicable. The BGCAPP does not have any surface impoundments.

3.6.1.2.5 Incinerator Inspections

Not applicable. The BGCAPP does not have any incinerators.

3.6.1.2.6 Landfill Inspections

Not applicable. The BGCAPP does not have any landfills.

3.6.1.2.7 Land Treatment Inspections

Not applicable. The BGCAPP does not have any land treatment units.

3.6.1.2.8 Remedial Action

The BGCAPP facility/area currently has no SWMUs or corrective actions identified. Figure 3-8 presents a typical log the BGCAPP maintains, showing the remedial actions required if deficiencies are identified during routine inspections. Section 6 describes the BGCAPP emergency response plans and section 7.0 describes the closure of the BGCAPP.

3.6.1.2.9 Inspection Log

An inspection summary log tracks observations made during inspections. This form includes the following:

1) Dates and times of inspections
2) Name(s) of inspector(s)
3) Observations made
4) Date and nature of repairs or remedial actions taken

Figure 3-8 contains a typical log.

3.6.1.3 Waiver of Preparedness and Prevention Requirements

Not applicable. A waiver of preparedness and prevention requirements is not requested or sought

Figure 3-5 – Typical Weekly Inspection – Containers

BGCAPP Area(s)	**Date**	**Time**	**Inspector(s)**

Inspected (√)	**Item**	**Regulatory Citation**	**Inspection Criteria**	**Corrective Action Required (Yes/No)** (if Yes, describe)	**Deficiency (Describe)**
Hazardous Waste Container Storage					
	Inventory	262.34	Check container fill date (90 day or 365 day limit not exceeded).		
	Container Label	262.31	Label legible, each container labeled, and marked with words “Hazardous Waste”.		
	Container Condition	264.171	Evidence or signs of corrosion, leaks, or other deterioration. A leaking container must be repaired or the contents transferred to a container in good condition.		
	Container Closed	264.173(a)	Bungs, plugs, caps, seals, or other closure devices are tightly closed.		
	Aisle Space	264.35	Sufficient space (min 30”) to inspect containers and for access with emergency equipment.		
	Incompatible Wastes	264.171 264.176	Placed on a containment pallet and separated from other wastes by at least 4 feet.		
	Secondary Containment	264.175	Evidence or signs of cracks, gaps, mars, scuffs, or other deterioration.		
	Loading, Unloading, and Transfer Areas (inspect daily when in use)	264.15(b)(4)	Evidence or signs of leaks, spills, and integrity of the area.		
Security					
	Fences, Gates, and Locks	264.14	Evidence of gaps, holes, or damage to fence. Downed or damaged fence or gate posts. Erosion gaps and/or holes under the fence/gate. Vandalism, open or missing locks.		
	Perimeter Warning Signs	264.14	Presence of warning signs on fences and gates. Visible and legible.		
	Security of Process Areas	264.14	Doors locked to prevent unauthorized entry when buildings or processes are not in use.		
ADDITIONAL COMMENTS:					

Figure 3-6 – Typical Daily Inspection Tanks, Subpart X (Miscellaneous) Systems

BGCAPP Area(s):				**Date:**	**Time:**	**Inspector(s):**
Hazardous Waste Tanks and Subpart X Systems						

Inspected (√)	**Item**	**Regulatory Citation**	**Inspection Criteria**	**Corrective Action Required (Yes/No)** (if Yes, describe)	**Deficiency (Description) Corrective Action Completed**
	Overfill, Spill Prevention, and Waste Feed Cutoff Systems	262.194	Operating in accordance with design specifications and operating procedures.		
	Aboveground Portions of Tank System	264.193(f)(1) 264.194(c)(1)	Evidence of corrosion, leaks, or spills. Any leaks or spills must be reported immediately to the CCR.		
	Data from Monitoring Equipment (e.g., temperature, pressure, level gauges)	264.195(b)	Operating in accordance with design specifications and operating procedures.		
	Data from Leak Detection Equipment or Level Indicating Devices	264.195[1]	Operating in accordance with design specifications and operating procedures, and calibration is current.		
	Ancillary Equipment (in area immediately surrounding the system, including secondary containment)	264.193(f) 264.194(c)(2)	Evidence or signs of corrosion, releases, leaks, or spills of hazardous waste. Any leaks or spills must be reported immediately to the CCR.		
	Ancillary Equipment Not in Secondary Containment	264.195	Evidence or signs of corrosion, releases, leaks, or spills of hazardous waste. Any leaks or spills must be reported immediately to the CCR.		
	Piping, Pumps, Flanges, and Connectors	Contingency Plan	Check for potential leaks[1].		

	Loading, Unloading, Transfer, and Sample Connection Systems	Contingency Plan	Capped, plugged, or blind-flanged when not in use.		
	Incompatible Ignitable/Reactive	264.17 264.198 264.199	Incompatible waste separated from ignition sources. No ignitable or reactive waste stored in tank. No ignitable or incompatible wastes stored in the same tank system.		
	Air Emission Air Pollutant Emissions (tanks)	264.200 264.1084	Tank is not heated to a temperature greater than design temperature. Tank is open only for routine inspection, maintenance, or other normal operations.		
Loading/Unloading/Transfer Area					
	Vehicle	Contingency Plan	Wheel chocks available. Fire extinguisher present, current inspection date, and adequate pressure.		
	Secondary Containment	264.193	Evidence or signs of cracks, gaps, mars, scuffs, or other deterioration. Stormwater accumulation must be removed as soon as it is possible, but in any case within 24 hours.		
	Spill Cleanup and Decontamination Equipment and Supplies	Contingency Plan	Check for adequate inventory and condition of required decontamination/spill cleanup equipment and supplies.		
Security					
	Fences, Gates, and Locks	264.14	Evidence of gaps, holes, or damage to fence. Downed or damaged fence or gate posts. Erosion gaps and/or holes under the fence/gate. Vandalism, open or missing locks.		
	Perimeter Warning Signs	264.14	Presence of warning signs on fences and gates. Visible and legible.		
	Security of Process Areas	264.14	Doors locked to prevent unauthorized entry when buildings or processes are not in use.		
ADDITIONAL COMMENTS:					

Notes:

1 Record equipment name, tag number, and date of discovery for leaking sources. Confirmatory monitoring is required within 5 calendar days. Use “Monthly Subpart BB Equipment Monitoring and Follow-up” checklist to document leak and repair confirmation monitoring. Place a weatherproof tab on the leaking equipment that is marked with equipment identification or tag number and the date evidence of leak was discovered.

Figure 3-7 – Typical Daily Inspection Liquid Loading Stations

BGCAPP Area(s):	**Date:**	**Time:**	**Inspector(s):**

Inspected (√)	**Item**	**Regulatory Citation**	**Inspection Criteria**	**Corrective Action Required (Yes/No)** (if Yes, describe)	**Deficiency (Description) Corrective Action Completed**
Liquid Waste Loading Station					
	Loading, Unloading, and Transfer Connections	Contingency Plan	Capped, plugged, or blind-flanged when not in use.		
	Associated Piping, Valves, Pumps, Flanges, and Connections	264.195(b)(1)	Operating in accordance with design specifications and operating procedures. Immediately report any leaks to CCR and tag the leaking equipment.[1]		
	Aboveground Portions of Liquid Waste Loading Dock System	264.195(b)(1)	Evidence or signs of releases, leaks, or spills. Immediately report any leaks, spills, or releases to the CCR and tag the leaking equipment.[1]		
Loading/Unloading/Transfer Area					
	Vehicle	Contingency Plan	Wheel chocks available. Fire extinguisher present, current inspection date and adequate pressure.		
	Containment	264.193	Evidence of corrosion, leaks, or spills. Any leaks or spills must be immediately reported to the CCR.		
	Secondary Containment	264.193	Evidence or signs of cracks, gaps, mars, scuffs, or other deterioration. Storm water accumulation must be removed as soon as it is possible, but in any case within 24 hours.		
	Spill Cleanup and Decontamination Equipment and Supplies	Contingency Plan	Check for adequate inventory and condition of required decontamination/spill cleanup equipment and supplies.		
Security					

	Fences, Gates, and Locks	264.14	Evidence of gaps, holes, or damage to fence. Downed or damaged fence or gate posts. Erosion gaps and/or holes under the fence/gate. Vandalism, open or missing locks.		
	Perimeter Warning Signs	264.14	Presence of warning signs on fences and gates. Visible and legible.		
	Security of Process Areas	264.14	Doors locked to prevent unauthorized entry when buildings or processes are not in use		
ADDITIONAL COMMENTS:					

NOTE:
[1] Record equipment name, tag number, and date of discovery for leaking sources. Confirmatory monitoring is required within 5 calendar days. Use “Monthly Subpart BB Equipment Monitoring and Follow-up” checklist to document leak and repair confirmation monitoring. Place a weatherproof tab on the leaking equipment that is marked with equipment identification or tag number and the date evidence of leak was discovered.

Figure 3-8 – Typical Inspection Log

Time/Date	Inspector(s)	BGCAPP Area(s) Inspected	Observation Made	Date/Nature of Repair(s) or Remedial Action(s)

Figure 3-9 – Commonly Used Hazardous Waste Containers

CAPACITY (gallons)	DESCRIPTION	UNITED NATIONS (UN) MARKINGS
350	Open head steel/poly intermediate bulk container	UN 31A/31H1/31H2
110	Open head steel drum	UN 1A2
95	Open head polyethylene salvage drum	UN 1H2
85	Open head steel salvage drum	UN 1A2
85	Open head polyethylene salvage drum	UN 1H2
55	Open head steel salvage drum	UN 1A2
55	Closed head steel drum	UN 1A1
55	Closed head polyethylene drum	UN1H1
55	Open head steel drum	UN 1A2
55	Open head polyethylene drum	UN 1H2
30	Closed head steel drum	UN 1A1
30	Closed head polyethylene drum	UN 1H1
30	Open head steel drum	UN 1A2
15	Closed head polyethylene drum	UN 1H1
8	Open head steel pail	UN 1A2
5	Open head polyethylene pail	UN 1H2
5	Closed head polyethylene pail	UN 1H1
1	Open head polyethylene pail	UN 1H2

Table 3-8 – Tank Summary

Process Code	Room #	Tank System – Number of Tanks and Capacity [1]	Waste Managed	Waste Codes	Range for Specific Gravity of Waste (@ Operating Temperature unless otherwise specified)	Dimensions	Range for Operating Temperatures (°F)	Range for Operating Pressure (psig)	Materials of Construction	Tank ID#	PFDs (24915-)	P&IDs (24915-)	Comments
Hydrolysate Storage Area (HSA)													
S02	HSA	Agent Hydrolysate Storage Tank with Agitator 1 × 102,264 gallons Working volume: 1 x 92,217 gal	Agent Hydrolysate from ANS	D002, and/or N001	~ 1.05 to 1.29 [2,] ~ 0.94 to 1.14 [3] @ 77°F	24 ft diameter, 32 ft height	~ 70 to 110 [2, 3]	~ 32.88 to 40.18[2,3]	Carbon steel	MT-HSS-0104	11-M5-HSS-00001	11-M6-HSS-00001	Calc 11-M6C-HSS-00003
S02	HSA	Agent Hydrolysate Storage Tank 2 × 337,184 gallons Working volume: 2 x 308,791 gal	Agent Hydrolysate from ANS	D002, and/or N001	~ 1.05 to 1.29 [2] ~ 0.94 to 1.14 [3] @ 77°F	38.5 ft diameter, 40.0 ft height	~ 70 to 110 [2,3]	~32.88 to 40.18[2,3]	Carbon steel	MT-HSS-0105, MT-HSS-0205	11-M5-HSS-00001	11-M6-HSS-00004/ -00007	Calc 11-M6C-HSS-00002
S02	HSA	Energetics Hydrolysate Storage Tank 2 × 313,433 gallons Working volume: 2 x 287,209 gal	Energetics Hydrolysate from ENS	D002, and/or N001	~ 1.11 to 1.35 [4]	37 ft diameter, 40 ft height	~ 70 to 154 [4]	~ 54.27 to 66.33 [4]	Carbon steel	MT-HSS-0604, MT-HSS-0704	11-M5-HSS-00002	11-M6-HSS-00010/ -00012	Calc 11-M6C-HSS-00001
Agent Collection / Toxic Storage Tanks													
S02	07-123	Agent Holding Tank 1 × 1,451 gallons Working volume: 1 x 1,200 gal	Agent drained from RSM and MWS	D002, and/or N001	~ 0.91 to 1.11 [6] ~ 1.16 to 1.42 [7] ~ 0.98 to 1.20 [5]	5.5 ft diameter, 8.25 ft height	~ 70 to 84 [5, 6, 7]	~12.18 to 44.58[5,6] ~ 12.18 to 14.88 [7]	Polyvinylidene Fluoride (PVDF)-lined Carbon Steel	MT-ACS-0105, MT-ACS-0106	07-M5-ACS-00001	07-M6-ACS-00003/ -00002	Calc 07-M6C-ACS-00003 Calc 07-M6C-ACS-00002
S02	07-123	Agent Surge Tank 1 x 1,451 gallons Working volume: 1 x 1,200 gal	Incidental Spill Residues & Decontamination Solution	D002, and/or N001	~ 1.09 [5] ~ 1.01 [6] ~ 1.29 [7]	5.5 ft diameter, 8.25 ft height	~ 100 to 194 [6,7] ~100 to 160 [5]	~ 3 to 15 [5,6,7]	Polyvinylidene Fluoride (PVDF)-lined Carbon Steel	MT-ACS-0106	07-M5-ACS-00001	07-M6-ACS-00002	Calc 07-M6C-ACS-00002, Data Sheet 07-MTD-ACS-00002
SCWO Tank Area (STA)													
S02	STA	RO Reject Tank 2 × 78,970 gallons Working volume: 2 x 73,842 gal	RO Reject	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	~ 0.89 to 1.12 [5] ~ 0.89 to 1.16 [6] ~ 0.89 to 1.14 [7]	21 ft diameter, 32 ft height	~ 99 to 121 [5, 6, 7]	~0.42 to 17.08[5,6,7]	Carbon steel w/epoxy lining	MT-RO-0106, MT-RO-0206	10-M5-RO-00002	10-M6-RO-00010/ -00011	Calc 10-M5C-RO-00002, Calc 10-M6C-RO-00009

Process Code	Room #	Tank System – Number of Tanks and Capacity [1]	Waste Managed	Waste Codes	Range for Specific Gravity of Waste (@ Operating Temperature unless otherwise specified)	Dimensions	Range for Operating Temperatures (°F)	Range for Operating Pressure (psig)	Materials of Construction	Tank ID#	PFDs (24915-)	P&IDs (24915-)	Comments
S02	STA	SCWO Effluent Tank 3 × 45,626 gallons Working volume: 3 x 41,878 gal	SCWO effluent	N001	~ 0.90 to 1.10 [5, 7] ~ 0.90 to 1.11 [6]	18 ft diameter, 26 ft height	~ 81 to 154 [5, 6, 7]	~ 0.42 to 17.08 [5, 6, 7]	Carbon steel	MT-SCWO-0101, MT-SCWO-0201, MT-SCWO-0301	10-M5-RO-00002	10-M6-RO-00013/ -00014/ -00015	Calc 10-M5C-RO-00002, Calc 10-M6C-SCWO-00100
S02	STA	RO Permeate Tank 2 × 54,002 gallons Working volume: 2 x 49,352 gal	RO permeate	N001	~ 0.89 to 1.09 [5,6,7]	20 ft diameter, 24 ft height	~ 99 to 121 [5, 6, 7]	~ 13.98 to 17.08 [5, 6, 7]	Carbon steel w/epoxy lining	MT-SWS-0101, MT-SWS-0201	10-M5-RO-00002	10-M6-RO-00016	Calc 10-M5C-RO-00002, Calc 10-M6C-SCWO-00102
Spent Decontamination System (SDS)													
T01	07-123	Spent Decontamination System Treatment Tank 3 ×7,735 gallons Working volume: 3 x 6,463 gal	Spent Decontamination, Sumps, Agent washout from MWS and RSM	D002, and/or N001	~ 0.89 to 1.10 [5,6,7]	10 ft diameter, 13 ft height	~ 70 to 119 [5] ~ 70 to 121 [6] ~ 70 to 160 [7]	~ 5.88 to 21.48 [5, 6] ~ 11.28 to 21.48 [7]	PVDF-lined carbon steel	MV-SDS-0101, MV-SDS-0201, MV-SDS-0301	07-M5-SDS-00001	07-M6-SDS-00001/ -00002/ -00003	Calc 07-M6C-SDS-00004
Agent Neutralization System (ANS)													
T01	07-123	Agent Neutralization Reactor 2 × 2,062 gallons	Neutralized Agent/ Hydrolysate	D002, and/or N001	~ 0.89 to 1.20 [5] ~ 0.89 to 1.11 [6] ~ 0.90 to 1.41 [7]	6 ft diameter, 9 ft height	~ 70 to 106 [5] ~ 70 to 110 [6] ~ 70 to 160 [7]	~ 17.58 to 175.48 [5, 6,7]	Carbon steel clad w/UNS N10276, Jacket Carbon steel	MV-ANS-0101, MV-ANS-0201	07-M5-ANS-00001/ -00002	07-M6-ANS-00001/ -00002	Calc issued for cancellation (11/11/04), Data sheet: 07-MVD-ANS-00001
T01	07-123	Agent Hydrolysate Sampling Tank 3 × 4,838 gallons	Neutralized agent / hydrolysate from agent hydrolyzers	D002, and/or N001	~ 0.96 to 1.18 [5] ~ 1.03 to 1.29 [6] ~ 0.94 to 1.14 [7]	9 ft diameter, 9 ft height	~ 90 to 110 [5] ~ 90 to 213 [6, 7]	~ 32.88 to 40.18 [5, 6, 7]	316L SS	MT-ANS-0103, MT-ANS-0203, MT-ANS-0303	07-M5-ANS-00001/ -00002	07-M6-ANS-00011/ -00012/ -00013	Calc 07-M6C-ANS-00001
Energetics Neutralization System (ENS)													
T01	07-119	Energetics Neutralization Reactor 3 × 3,070 gallons	Energetics Hydrolysate from EBH	D002, and/or N001	~ 0.95 to 1.43 [5, 6], ~ 0.91 to 1.23 [7], ~ 0.90 to 1.43 [8]	7 ft diameter, 12 ft height	~ 81 to 259 [5,6] ~ 82 to 243 [7] ~ 79 to 236 [8]	~ 22.8 to 88.3 [5, 6, 7,] ~ 57.18 to 88.3 [8]	Carbon steel w/UNS N02200 clad Jacket Carbon steel	MV-ENS-0101, MV-ENS-0102, MV-ENS-0103	07-M5-ENS-00001	07-M6-ENS-00005/ -00006/ -00007	Data sheet 07-MVD-ENS-00001

Process Code	Room #	Tank System – Number of Tanks and Capacity [1]	Waste Managed	Waste Codes	Range for Specific Gravity of Waste (@ Operating Temperature unless otherwise specified)	Dimensions	Range for Operating Temperatures (°F)	Range for Operating Pressure (psig)	Materials of Construction	Tank ID#	PFDs (24915-)	P&IDs (24915-)	Comments
Energetics Batch Hydrolyzer (EBH)													
X99	07-111	Energetics Batch Hydrolyzer Discharge (GB) 3 x 2,651 pounds/hour Discharge (VX) 3 x 3,200 pounds/hr Sequential operation	Sheared rocket warhead pieces	D003, and/or N001		7.5 ft diameter, 10.03 ft length		~181 to 150 @ 375°F	UNS S32205	MV-EBH-1101, MV-EBH-1201, MV-EBH-1301	07-M5-EBH-00001	07-M6-EBH-01035/ -01036/ -01037	Data sheet 07-M6D-EBH-00034
S02	07-111	Hydrolysate Collection Tank 1 × 1,475 gallons Working Volume: 1 x 1,293 gal	Energetics Hydrolysate	D002, and/or N001	~ 1.11 to 1.49 [5, 6] ~ 0.94 to 1.49 [7]	6.83 ft diameter, 6.33 ft height	~205 to 265 [5, 6] ~ 177 to 273 [7] ~ 178 to 277 [8]	~ 0.42 to 0.52 [5, 6, 7, 8]	UNS S32205	MT-EBH-1901	07-M5-EBH-00001, Sheet 1	07-M6-EBH-01085	Calc 07-M6C-EBH-00024, Data Sheet 07-M6D-EBH-00019
SCWO Processing Building (SPB)													
S02	10-102	Aluminum Filtration Feed Tank 2 × 1,584 gallons Working volume: 2 x 1,300 gal	Energetics Hydrolysate from APS	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	~ 1.06 to 1.30 [5] ~ 1.01 to 1.23 [6] ~ 0.92 to 1.12 [7]	7 ft diameter, 5 ft 2 in height	~ 99 to 121 [5, 6, 7]	~ 71.31 to 87.15 [5,6,7]	316L SS	MT-AFS-1010, MT-AFS-2010	10-M5-AFS-00001, Sheet 1	10-M6-AFS-00001/ -00002	Calc 10-M6C-AFS-00006, Data sheet 10-M6D-AFS-00001
S02	10-102	Aluminum Filtrate Tank 1 × 4,136 gallons Working volume: 1 x 3,450 gal	Energetics Hydrolysate filtrate	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	~ 1.04 to 1.27 [5, 6] ~ 0.93 to 1.13 [7]	9 ft diameter, 10 ft height	~ 99 to 121 [5, 6, 7]	~ 0.52 to -0.42 [5, 6, 7]	316L SS	MT-AFS-1012	10-M5-AFS-00001, Sheet 1	10-M6-AFS-00003	Calc 10-M6C-AFS-00001, Data sheet 10-M6D-AFS-00005
T01	10-102	Aluminum Precipitation Reactor 2 x 1,077 gallons Working volume: 2 x 930 gal	Energetics Hydrolysate	N001		5 ft diameter, 9 ft height	~ 110 to 140		UNS N10276	MV-APS-0101, MV-APS-0102	10-M5-APS-00001, Sheet 1	10-M6-APS-00001/ -00002/ -00004	Calc issued for cancellation (3/27/06), Data Sheet 10-MVD-APS-00003

Process Code	Room #	Tank System – Number of Tanks and Capacity [1]	Waste Managed	Waste Codes	Range for Specific Gravity of Waste (@ Operating Temperature unless otherwise specified)	Dimensions	Range for Operating Temperatures (°F)	Range for Operating Pressure (psig)	Materials of Construction	Tank ID#	PFDs (24915-)	P&IDs (24915-)	Comments
X99	10-102	Aluminum Filtration Unit Discharge (GB) 2 x 2,142 pounds/hour Filtrate; 2 x 439 Pounds/hour Cake Discharge (VX) 2 x 2143 Pounds/hour Filtrate; 358 pounds/hour Cake	Precipitated Energetics Hydrolysate	N001		15 ft length, 10 ft width, 10 ft height			LDX 2101 Duplex SS	ML-AFS-1040, ML-AFS-2040	24915-10-M5-AFS-00001	24915-10-M6-AFS-00001/ -00002	
X99	10-111	RO Unit Discharge (GB) 3 x 87,8924 gallons/day Permeate; 3 x 37,934 gallons/day Reject Discharge (VX) 3 x 62,017 Gallons/day Permeate; 3 x 26,836 gallons/day Reject	SCWO Effluent	D002, and/or N001		16.67 ft length, 6.3 ft width, 6.16 ft height		~ 60 to 100 @ 110F	316L SS	ML-RO-0101, ML-RO-0201, ML-RO-0301	10-M5-RO-00001, Sheet 1	10-M6-RO-00013/ -00014/ -00015	Data Sheet 10-M5D-RO-00002

Process Code	Room #	Tank System – Number of Tanks and Capacity [1]	Waste Managed	Waste Codes	Range for Specific Gravity of Waste (@ Operating Temperature unless otherwise specified)	Dimensions	Range for Operating Temperatures (°F)	Range for Operating Pressure (psig)	Materials of Construction	Tank ID#	PFDs (24915-)	P&IDs (24915-)	Comments
Supercritical Water Oxidation (SCWO)													
X99	10-101	SCWO Reactor Feed (GB) 3 x 1,231 pounds/hour Feed (VX) 3 x 1,217 pounds/hour	AFS Filtrate	N001		7.625 in diameter, 10 ft length	~ 1200 to 1250	~ 3400 to 4300 @ 1100°F	Carbon Steel	MV-SCWO-1030, 2030, 3030	10-M5-SCWO-00001	10-M0-SCWO-01013/ -02013/ -03013	Calc 10-M6C-SCWO-00001, Data Sheet 10-M6D-SCWO-00017
S02	10-101	Hydrolysate Blend Tank 2 × 6,124 gallons Working volume: 2 x 5,845 gal	Energetics Hydrolysate	D002, and/or N001	~ 1.02 to 1.24 [5] ~ 1.02 to 1.25 [6] ~ 0.94 to 1.14 [7]	8 ft diameter, 17 ft height	~ 99 to 121 [5, 6] ~ 99 to 122 [7]	~ 19.76 to 26.98 [5,6,7]	316L SS	MT-SCWO-0030, 0031	10-M5-RO-00001 Sheet 3	10-M6-SCWO-00013/ -00015	Calc 10-M6C-SCWO-00016, Data sheet 10-M6D-SCWO-00002
S02	10-101	Batch Hydrolysate Holding Tank 1 × 6,124 gallons Working volume: 1 x 5,845 gal	Hydrolysate blend tank	D002, and/or N001	~ 1.02 to 1.24 [5, 6] ~ 0.94 to 1.14 [7]	8 ft diameter, 17 ft height	~ 99 to 121 [5, 6, 7]	~ 22.08 to 26.98 [5,6,7]	316L SS	MT-SCWO-0032	10-M5-SCWO-00001 Sheet 3	10-M6-SCWO-00020	Calc 10-M6C-SCWO-00016, Data sheet 10-M6D-SCWO-00002
T01	10-101	Off-Spec Effluent Tank 1 × 3,897 gallons Working volume: 1 x 3,619 gal	Failed batches from SCWO	N001	~ 1.02 to 1.24 [9]	8 ft diameter, 2 ft height	~ 95 to 121 [9]	~ 19.76 to 26.98 [9]	316L SS	MT-SCWO-0041	10-M5-SCWO-00001 Sheet 3	10-M6-SCWO-00014	Calc 10-M6C-SCWO-00037, Data sheet 10-M6D-SCWO-00006
T01	10-103	Emergency Relief Tank 1 x 11,053 gallons [10] RCRA Regulated Volume: 2,350 gal	Emergency pressure relief from SCWO	N001		8 ft diameter, 27 ft height	~ 77 to 125		316L SS	MV-SCWO-0040	24915-10-M5-SCWO-00001, Sheet 3		Calc 10-M6C-SCWO-00018

NOTES:
[1] Working capacities as shown on the Part A form DEP 7058A
[2] VX Hydrolysate
[3] H Hydrolysate
[4] GB or VX Energetics Hydrolysate
[5] GB
[6] VX
[7] H
[8] Rockets
[9] Off-normal throughput
[10] Volume from tank bottom to the High-High Liquid Level (25" from bottom of tank to HHLL) which is the maximum liquid volume of the tank. Remaining volume is for expansion.

4.0 QUALITY ASSURANCE (QA)/QUALITY CONTROL (QC) PLAN

4.1 Calibration Procedures & Frequency

The BGCAPP currently operates under the BGCAPP Quality Management Plan (24915-000-G01-GAM-00008) for overall construction site QA/QC procedures. This plan addresses project specific training, design criteria, site audits and inspections, and QA/QC recordkeeping among others. The QA/QC procedures with respect to waste demilitarization and monitoring are more closely associated with the BGCAPP Laboratory Quality Assurance Manual which is currently under development and includes specific requirements for training/certification of monitoring personnel and calibration of air monitoring equipment.

Tools, gauges, instruments, and other sampling measuring and test equipment used for data generation or collection activities that affect quality must be controlled and, at specified periods, calibrated to maintain performance within specified limits. Procedures will be developed for calibration of operations equipment in the future (to include schedules and frequency for calibration). Maintenance personnel will conduct calibration using certified equipment and/or standards with known valid relationships to nationally recognized performance standards. Maintenance personnel will use similar instrument response for calibration of equipment for which no nationally recognized standard exists. Laboratory procedures will define calibration and maintenance requirements for laboratory equipment Records of calibration will be maintained and be traceable to the instrument.

4.1.1 Field Instrument Calibration

Chemical agent sampling and analysis will not require field instruments. If the sampling team uses field instruments for any reason, BGCAPP will perform and document calibration as specified in the manufacturer's manual.

4.1.2 Laboratory Instrument Calibration

Calibration procedures for a specific laboratory instrument consist of initial calibrations (three to five points), initial calibration verifications (ICVs), and continuing calibration verifications (CCVs). The SOP for chemical agent analyses will describe the calibration procedures, their frequency, acceptance criteria, and the conditions under which recalibration will be required. If available, the initial calibration will use an independently prepared calibration standard to verify calibration.

For each instrument, the Laboratory will maintain a logbook that will contain the following information:

1) Instrument identification
2) Serial number
3) Date of calibration
4) Name of analyst
5) Calibration solution analyzed
6) Samples associated with the calibration

4.2 Internal QC Checks

Internal QC checks currently in place for construction activities include quality inspections of applicable construction efforts, identifying and documenting nonconforming conditions, ensuring non-conformances are corrected, maintaining a tracking system for nonconformance reports (NCRs), performing surveillance and oversight activities, exercising stop/suspend work authority when necessary, and ensuring that facility construction meets technical and quality requirements of governing documents. These overarching goals will be applicable for personnel training/certification and calibration of monitoring instruments and will be discussed further in the BGCAPP Laboratory Quality Assurance Manual. A general overview of QC checks is described below.

4.2.1 Field QC Checks

Sampling personnel will not use portable field instruments for this project.

4.2.2 Laboratory QC Checks

Prior to conducting the chemical agent sampling program, the laboratory will have SOPs and a QC program in place. The QC program will ensure the reliability and validity of the analyses performed. Each SOP will include a QC section that addresses the minimum requirements for the procedure. The internal QC checks for these SOPs include the following:

1) Method blanks
2) Instrument blanks
3) Matrix Spike (MS)/ Matrix Spike Duplicates (MSDs)
4) Surrogate spikes
5) Laboratory duplicates
6) Laboratory Control Sample (LCS)

The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. The laboratory will reanalyze any samples analyzed in nonconformance with the QC criteria, if sufficient volume is available. Sampling personnel will collect sufficient volumes of samples to allow for reanalysis when necessary.

5.0 RECORDKEEPING & DATA REPORTING

Due to the waste being processed, the recordkeeping and reporting associated with waste processing and plant operations at BGCAPP are complex and extensive. Records are maintained to demonstrate environmental regulatory, international treaty, and contractual compliance. In addition, data, to include video, is maintained for possible review should questions arise concerning the actions of personnel operating the plant when confronted with processing, emergency incident or safety/agent exposure challenges. To address these requirements, data collection, recordkeeping and reporting involves electronic processing data; electronic recordkeeping for laboratory analytical results; and hard copy documents.

5.1 Waste Processing: Monitoring, Control, and Analysis of Data

5.1.1 Facility Control System (FCS)

The FCS provides automatic continuous control of BGCAPP during steady state operating conditions; a combination of both manual and automatic control of BGCAPP during transient conditions (e.g., startup and shutdown); capability for manual intervention at the operator's discretion; and automatic data acquisition and recording of FCS input/output (I/O), events, and messages. The FCS interfaces via hardware connection and/or data links. The primary function of the FCS will be to monitor and control the process systems, process support systems, and facility control systems that are located within BGCAPP. The FCS will have a data historian, data archiving, and perform functions on the server to include export of historical data to other systems and software [e.g., American Standard Code for Information Interchange Exchange (ASCII) text files, Microsoft Office Access and Excel]. The FCS also allows data calculations and manipulation on the collected data for integration, average, maximum/minimum, material balance, efficiency calculations, etc.

BGCAPP personnel will use these FCS data archiving, exporting and calculating functions during waste processing. The use of the FCS will involve the capture, export, and any calculations associated with the process monitoring data being collected (e.g., temperature, reaction time). The following subsections present a general description of the FCS and the uses that will be made of it during waste processing.

5.1.2 General Description of the FCS

BGCAPP personnel can operate the FCS from two major operations locations: a CCR located in the CSB, and from the local control room (LCR) located in the SCWO Process Building (SPB). These locations contain consoles for the BGCAPP operators. Each console houses FCS operator workstations (OWSs) consisting of video display units (VDUs), keyboards, and pointing devices; CCTV monitor displays; auxiliary panel to house stop pushbuttons, keyboard, video, and mouse (KVM) switches; printers; and other accessories necessary to perform automatic or manual control and monitoring tasks.

The FCS provides automatic control for the following functions:

1) Display overall BGCAPP operating information
2) Control process, utilities, and facility equipment
3) Alert CCR personnel to out-of-tolerance process conditions

4) Prevent BGCAPP system equipment damage resulting when process excursions beyond predetermined limits occur (equipment shutdown)
5) Display information from BGCAPP analyzers that monitor potentially contaminated areas
6) Provide sufficient information to the operator to verify required control system operation during automatic operation
7) Prevent agent/waste feed when the system is outside of permitted operating ranges
8) Log the sequence of alarm and operator actions
9) Time-stamp and store process parameter values at predetermined intervals

   NOTE: This includes the time and temperature for the EBHs and the time, temperature, and pressure for the ENRs.

10) Provide scheduled and on-demand reports of BGCAPP operation

The FCS provides manual control for the following:

1) Operate BGCAPP system equipment
2) Initiate automatic operation of equipment after meeting the preconditions
3) Monitor control system parameters during automatic operation including the EBH and ENR during processing of “leaker” rockets
4) Respond to out-of-tolerance conditions and prevent the occurrence of conditions that invoke equipment protection, personnel safety interlocks, or that result in automatic shutdown in accordance with 29 CFR 1910 and MIL STD 882D
5) Place equipment into semi-automatic or manual control mode and control the equipment manually when required by certain process or environmental permit conditions and support of BGCAPP maintenance operations
6) Isolate equipment failures or malfunctions that have caused shutdown conditions to occur
7) Coordinate all BGCAPP activities associated with munitions disposal, including those not directly involved with the process
8) Provide direction for activities within the secured area in the event of an upset condition, incident, or contingency
9) Capability to select equipment to be in service, and operational sequence; change the mode of control; change the set points of operation and alarm, allow local operation, etc.

5.1.3 Data Acquisition and Recording

The design of the FCS includes Data Acquisition and Recording capabilities for the following functions:

1) Collect process data, process alarms, equipment alarms, and operator’s entries
2) Provide time-stamp and storage for process parameters at selected intervals
3) Provide the CCR operator with real-time and historical trends
4) Prepare operational reports for the BGCAPP process
5) Provide software tools for process data analysis
6) Provide long term and permanent data storage
7) Interface with the FPS and with several programmable logic controllers (PLCs) located throughout BGCAPP to collect process data, alarms, and operator’s entries
8) Reply to data queries from external system

5.1.4 Alarm Management

The following are the standard alarm capabilities of the control software:

1) Analog inputs provide warnings for high (HIGH), low (LOW), high absolute (HIGH-HIGH), low absolute (LOW-LOW), rate of change, input out of range high/failure, and input out of range low/failure
2) System provides temporarily suppression of an alarm based on operator request or a calculation of an external point
3) System can assign different priorities to alarms. Sound horns, colored text display and print of alarms, acknowledge requirements (e.g., authorized type of user to acknowledge alarms), and sort on alarm summary displays will be based on alarm priority

Alarm and messaging management has the following attributes:

1) The system can suppress individual alarms but logs the date and time of the alarm suppression and the user identification of the person suppressing the alarm
2) Assists with diagnosis of situations where a large number of alarms occur in a very short time
3) Integrates with the other human-machine interface displays such that the operator uses minimal keystrokes or mouse clicks to navigate to the display most relevant to the alarm
4) Provides alarm capabilities for discrete devices (such as interlock execution, command/status discrepancies, invalid state)
5) Provides alarms based on events and faults in sequence programs
6) Provides system generated alarms, such as failure of equipment, equipment diagnostic warnings and alerts, and communication problems
7) Provides the ability to embed alarms and messages within given graphic displays
8) Provides information needed to distinguish between alarms, informational messages, and messages requiring response from operators
9) Annunciates both with audible and visual alarming and has multiple colors for alarms and messages to aid in prioritizing alarms
10) Acknowledges visual and audible alarms and remains “on” until the alarm resets or the alarm condition clears
11) Displays a summary of current alarms to include alarm tag identification, description, limits for the alarm, current value at the time of the alarm went active, current status (e.g., active, acknowledged, unacknowledged, return to normal), time and date of occurrence. Alarm control software can also sort the alarms by occurrence, priority, suppressed alarms, and process area/unit

5.1.5 Waste Processing: Data Archiving and Analysis

The BGCAPP ICS has a single, fault-tolerant historian for archiving data from various integrated systems and FCS subsystems. The laboratory historian is independent of the ICS historian. There will be a redundant ICS historian server to support FCS continuous and batch data archival, sequence of events, online and offline history retrieval, and FPS data archival functionality. The historian server will have sufficient memory capacity and computing power to perform periodic, on demand, and by exception history archival, batch historian, report generation and will have the capability to interface with external devices. The historian server will be capable of performing all OWS functions.

5.1.5.1 Continuous Historian

A configurable, real-time, and historical data collection package supports data analysis, trending, logging, and reporting. The system can store at least 3 years of data in the online history at a rate of 10,000 points every 10 seconds.

The FCS provides the following data logging functions:

1) Log analog variables, including calculated analog values, by either time configurable or upon change in value (based on percent of range)
2) Log critical event occurrence for safety related events
3) Log all alarms, such as those for changes in equipment status
4) Log all operator actions, such as set-point changes, configuration changes, alarm acknowledgement and inhibit, and changes in operating modes
5) Log running averages for selected data
6) Export historical data to other systems and software, such as ASCII text files, and Microsoft Office Access and Excel
7) Import historical data and events from other systems, such as FPS, open database connectivity systems, and PLCs
8) Import and merge FPS sequence of events with FCS events. Log FPS events with the original time-stamp provided by the FPS
9) Data calculation and manipulation of the collected data to include integration, average, maximum/minimum, material balance, efficiency calculations.

The system can provide time stamping of all alarms and critical events down to a resolution of 50 milliseconds. The FPS logs data with a time and date stamp, and the actions of an operator with the operator’s identification.

The FPS plots trend data versus time on the real time and historical trend displays with minimum of eight points represented by different colors. User customizable data includes trend characterization, collection, storage, and use.

5.1.5.2 Batch Historian

The batch historian tracks the batch process data, alarm and event data, quality data, recipe formula data, produced lot, calculated data, and manual entries with audit trail, stage, batch, and lot identification with date. FCS can also place time stamps on all data for a given lot. The system provides a tool to compare historical data of one lot/batch against other different lots/batches.

Each batch automatically produces an end-of-batch report that, in addition to each lot data specified above, retains the total operational sequence chronologically with date and time.

1) Offline History Storage – The system can transfer and back up historical data (from continuous and batch historians) to removable media for long-term historical data storage. The system provides this data archiving for all data types and the system can recall and display any data backed up on removable media. The system was designed for automatic scheduled backups of data (i.e., based either on a fixed time each day and/or when the disk is full) into storage media. The entire database can be backed up either manually or automatically to execute an incremental backup (i.e., back up only the data that have been changed since the last backup), or to back up daily or during a specified time interval.

2) Data Collection and Storage – Online storage media provide historical data storage and retrieval. If a process point is not available, the system enters an unavailable code into the history file.
    a. The system stores the value of any of the following parameters in the online history storage:
        - Process I/O values
        - Device status
        - Sequence alarms and events (e.g., start, stop, malfunction, forced step)
        - Agent/air monitoring values and status
        - Calculated value
        - Controller set point
        - Controller output
    b. The system supports the following historical data collection rates for the above items:
        - 1, 5, 10, 15-second snapshot
        - 1, 2, 5-min snapshot
        - 5- or 6-min average
        - 1-hr average
        - Shift average
        - Daily average
        - Monthly average

5.1.6 Equipment Calibration

Instrument Maintenance Management Server provides asset management of the diverse instruments connected to the ICS. Typical functions of this subsystem include, but are not limited to, the following:

1) Retrieve digital data residing in highway-addressable remote transducer-capable field instruments connected to the ICS. These data contain information, such as, manufacturer brand, model and serial number; factory settings; default instrument range and calibration span values, etc. In addition, the system can retrieve digital information of the current values of process data measured by the instrument in engineering units; instrument self-diagnostic test results, statistics, etc.
2) Store retrieved data in a common database. The database may contain different instances of the same instrument, reflecting a history of the modifications performed to the instrument
3) Display useful diagnostic screens that represent the current and historical status of the instrument
4) Alarm if the diagnostic status of the instrument indicates failure
5) Perform remote upload, download, and online calibration of field instruments through IMMS display screens
6) Automatically sense smart instruments and buildup databases of data points collected from these instruments
7) Import/export field instrument databases

8) Interface with BGCAPP maintenance software for automatic work order generation upon instrument maintenance management system (IMMS) sensing failed instruments via object linking and embedding for process control
9) Serve engineer and maintenance workstations, as well as, remote clients (minimum 10 clients inclusive)
10) Provide interface to connect hand-held calibration device (Fluke or equal) for uploading and downloading maintenance data

5.1.7 Batch Control

The batch control portion of the FCS includes a batch management system that provides the following capabilities:

1) Automatically calculates operating parameters based on selected recipes
2) Create records for each batch, controls batch recipe, and stores the records
3) Support mixing and tracking of BGCAPP agent and energetic hydrolysate batches
4) Automatically collects data on the amount of materials used in each batch
5) Warn operators if real-time batch process information for processing parameters fall outside of specifications
6) Provide diagnoses to operators if a batch function fails or does not start
7) Transfer a process batch into a safe/exception status when processing of a batch does not conform to routine processing parameters and/or procedures
8) Allocate and arbitrates the coordination of common resources
9) Allows a batch operation to automatically continue, hold, or abort after a system fault
10) Provide capability to issue a message requiring an operator action
11) Provide capability to schedule the processing of batches
12) Configure user-defined reports for processing of batches

5.2 Electronic Recordkeeping for Laboratory Analyses

The BGCAPP ICS has a single, fault-tolerant historian for archiving data from various integrated systems and FCS subsystems --- discussed above. The laboratory historian is independent of this historian. Laboratory analytical results will be captured from the analytical instrumentation and archived in this historian and hardcopy analytical reports can be printed from this electronic system.

5.3 Recordkeeping for Hardcopy Documents

The PDCC uses Citrix (an electronic platform/software) to access InfoWorks (software) stored electronic versions of project hardcopy documents. This software (InfoWorks) provides the ability to archive and retrieve electronic versions of BGCAPP hardcopy documents. The combination of Citrix and InfoWorks provides for a secure database for these hardcopy documents. Examples of documents that will be stored using this combination of electronic software include:

1) Operator inspection or maintenance check sheets for rounds
2) Environmental inspections of container storage, tank systems, and Subpart X units by BGCAPP personnel
3) Hazardous waste manifests
4) Copies of regulatory inspections
5) Photographs and videos of operations and existing site conditions
6) Compiled Daily Operating Records

6.0 SAFETY PLAN

6.1 Human Health & Environmental Effects Criteria

AELs are unique military standards for exposure of unprotected workers and the general population to chemical agents. These airborne TWA standards are based upon recommendations of the CDC promulgated in the Federal Register[1,2] and incorporated into U.S. Army regulations[3]. The AELs are the allowable, average concentrations in air for workplace and general population exposures. AELs include WPLs, STELs, and GPLs. Basis of AELs is exposure to a concentration for a set duration (time). The TWA is the average concentration of a chemical agent for a specified duration or length of time. Specific definitions for the AELs are as follows:

WPL is an 8 hour TWA. Exposure below the WPL is safe and not expected to produce any adverse health effect. This is the TWA airborne concentration for exposure of unmasked worker for an 8 hour workday, 40 hour week, for 30 years without adverse effect.

STEL is the maximum concentration for exposure of unprotected chemical workers for up to 15 minutes continuously. The number of exposures allowed for a worker at the STEL is dependent on the chemical agent. For GB exposure, the STEL should not exceed 15 minutes and should not occur more than 4 times per day with each successive exposure separated by at least 60 minutes.

GPL is a 24 hour TWA for nerve agents (GB) and a 12 hour TWA. Basis of this GPL are exposures for 7 days per week and a 70-year lifetime.

6.1.1 Use and Selection of PPE

Hazard identification; routes of exposure (inhalation, skin absorption, ingestion, or injection); and performance of the PPE material as a barrier to potential hazards determines the selection of PPE to be worn during agent operations. Other factors in the selection process include matching the PPE to work requirements and task-specific conditions, task duration, and potential for heat stress. Health hazard assessments and job task analyses for any hazardous operation consider these factors. Selecting the appropriate level of dress also includes the requirements provided in DA PAM 385-61 and those required for handling explosive munitions or components.

The following subparagraphs list the PPE levels for normal munitions operations and support activities. Normal munitions operations and support activities include routine maintenance, calibration, adjustments, and processing in BGCAPP demilitarization systems, as well as leaker processing. The BGCAPP upgrades PPE levels, as operating or emergency conditions require. The health and safety professionals involved with PPE selection recognize that PPE must be compatible with the agent that may be present, compatible with electro-explosive devices, and resistant to other industrial chemicals, that may be present.

a. Occupational Safety & Health Administration (OSHA) Level A is DPE or comparable commercially available encapsulating suits worn during normal munitions and support operations in HVAC Category A, Category A/B, and Category B areas. Fully encapsulating, Level A protection is worn in Category B rooms unless the hazard of dermal exposure to agent is known not to exist.
b. OSHA Level B protection provides the same level of respiratory protection as Level A but does not incorporate an encapsulating suit and instead uses chemical resistant suits (not fully encapsulating) and other items of PPE such as aprons, hoods, and

gloves. Level B protection is worn only if the dermal exposure hazard does not require full dermal protection.

c. OSHA Level C provides very limited dermal protection and is used only in areas with a very limited potential for release of airborne hazardous materials and only with continuous air monitoring present. This level of protection (e.g., air purifying respirator) when used in environments that could contain agent is precautionary and allows for safe evacuation. It is not normally used where an agent hazard is known to exist. This level of PPE can also be used for protection against industrial hazards (i.e., acid gases) if cartridges and PPE fabrics are properly selected.
d. OSHA Level D provides no protection for respiratory exposure to agent or an industrial chemical, so BGCAPP personnel use Level D only if a respiratory exposure cannot exist. Examples of OSHA Level D protection include maintenance coveralls and street clothes.

When responding to a chemical agent release, the required level of protection is determined for each emergency response activity and situation. However, for known or suspected agent liquid or vapor releases, OSHA Level A or B protection is required.

When responding to an industrial chemical release, the Scene Control Officer (SCO), with assistance/approval of the Safety representative, selects the correct level of PPE. The MSDSs for the chemical involved, National Institute for Occupational Safety and Health (or “NIOSH”) guidance, the DOT Emergency Response Guidebook, and BGCAPP emergency response procedures are references used in making this selection. The PPE selection made by the SCO also considers the work requirements of the entry, to ensure the durability of the PPE is appropriate for that work.

6.2 Emergency Response Procedures

6.2.1 Definition of a Release

Currently, KDEP has indicated any detectable agent is considered a release regardless of the location of the detected agent. However, by necessity, accessing and disassembly of chemical munitions at BGCAPP will involve the release of liquid and airborne agent into process areas within the MDB and, if each detectable release of agent within the MDB must be reported, the public would be unduly alarmed and processing of agent would be hindered and delayed unnecessarily.

The MDB design prevents the release of agent outside of engineering controls and allows the processing of agent munitions without significant danger to workers, the public or the environment. Therefore, a revised definition of an “agent release” is needed for BGCAPP agent operations due to the nature of the chemical agent demilitarization work activities that will be performed within the MDB and the extensive engineering controls inherent in the MDB design.

The following definition of an environmental release of chemical agent is proposed for the BGCAPP facility:

"An environmental release of chemical agent would include the release of either liquid or airborne chemical agent outside of engineering controls (i.e., outside of ventilation controls and outside of a building or containment). For purposes of this definition, hydrolysate (i.e., liquid waste generated during the neutralization of agent) would not be included as liquid chemical agent and the definition of liquid chemical agent would be limited to chemical agent that has not undergone chemical reaction/destruction. Airborne (i.e., aerosol or vapors) environmental releases of chemical agent would include instances of confirmed detections of chemical agent outside of engineering controls at a concentration in excess of the agent's short term exposure limit (STEL)."

The standard definition for environmental releases and reportable quantities for other contaminants will continue to be applied.

6.2.2 Emergency Response Procedures

The BGCAPP fire alarm system panel is hard-wired to the BGAD Fire Department providing nearly instantaneous notification (i.e., of a BGCAPP fire) to the BGAD Fire Department. The implementation of the Contingency Plan occurs in the following specific situations at the discretion of the BGCAPP Incident Commander:

1) A fire or explosion occurs at or on the route to the BGCAPP
2) A fire threatens the BGCAPP or the route to the facility
3) A fire or potential explosion involving the BGCAPP or the route to the facility threatens off-site areas
4) Use of water or chemical fire suppressant on a fire could result in contaminated run-off
5) An imminent danger exists that an explosion could occur, causing a safety hazard due to flying fragments or shock waves
6) An imminent danger exists of an airborne or liquid release of hazardous constituents from the BGCAPP
7) A spill of hazardous material or wastes results in a fire, explosion, or potential fire or explosion
8) A spill of hazardous material or wastes is contained on-site, but may potentially contaminate soils, groundwater, or surface water resources

Emergency response begins with the notification of BGCAPP CCR personnel of an emergency condition involving a release of hazardous waste or hazardous waste constituents into a secondary containment, the environment or outside of engineering controls. This notification initiates the following emergency response activities:

1) The BGCAPP Plant Shift Manager notifies the BGCA Operations Center/Emergency Coordinator (OC/EC) that an emergency exists, provides available information on the situation, and assumes responsibilities as the BGCAPP Incident Commander
2) After making this notification, the BGCAPP Incident Commander directs the BGCAPP SCO and the BGCAPP Hazardous Material Response Team (HMRT) Leader to gather information, and plan the emergency response to mitigate the source, and contain, cleanup, store, and dispose of released material and cleanup/decontamination residues

3) BGCAPP HMRT personnel, wearing appropriate PPE (the Safety Officer provides assistance in PPE selection) for the waste or waste constituents released, mobilize to the emergency response location and respond to the release of hazardous waste or hazardous waste constituents. If the release, spill, or leak is into secondary containment, the Incident Commander informs the BGCA OC/EC the event is not reportable unless an air release requiring reporting is a possibility

The first priority in the emergency response (i.e., assuming that no injured personnel or personnel otherwise unable to clear the area remain behind) is to stop the release.

If the emergency involves a leaking container, the leak is to be stopped by transferring the waste into a container(s) or tank(s) that is in good condition and compatible with the material being transferred. If transfer is not immediately possible, the leak or spill is to be contained until waste can be placed into the appropriate container(s)/tank(s). Containment in a permitted storage area is adequate to ensure hazardous waste does not reach the environment; however, further containment may be advisable to limit the cleanup required and can be accomplished using best available materials (e.g., absorbent pigs, absorbents, or dirt/other materials can be used to construct temporary dikes).

If the emergency involves a tank system, the feed to the tank is to be stopped, and the source of the leak, spill, or release is to be identified. The containment provided for all permitted BGCAPP process and storage tanks is adequate to contain the waste; however, if possible, the release should be stopped (e.g., using process controls, plug kit, or transfer into another tank system).

If a release from a tank or container occurs outside of secondary containment, unprotected personnel are to be evacuated to an upwind location. Personnel wearing the appropriate PPE contain the spill and prevent further leakage at the source of the spill. Spilled process waste solutions are to be transferred to another tank, a portable tank, or into containers. Other liquid wastes, solid wastes, or contaminated media are to be transferred into containers or portable tanks. The containerized waste materials are stored temporarily prior to disposal.

If the emergency involves a fire or explosion, the response consists of removing any injured personnel and isolating or removing other wastes in the area. For significant fires or explosions, the BGCAPP HMRT Leader establishes a safe “stand-off” distance and monitors the situation while awaiting additional support from the BGAD Fire Department and BGAD HMRT. HMRT personnel are not placed at risk.

If the emergency involves an air release of contaminants, the BGCAPP MDB HVAC system may mitigate the release (i.e., if the emergency occurs inside the MDB). Release of agent into the atmosphere (e.g., outside the MDB) may require the activation of the BGAD Chemical Accident or Incident Response and Assistance (CAIRA) Plan and the BGCAPP HMRT performs monitoring of the release using MINICAMS® and the in-place air monitoring systems (DAAMS), or other air monitoring equipment.

In the event that wastes mix with water (e.g., firefighting water), the BGCAPP uses sorbent materials and/or containment equipment and devices to control the contamination. BGCAPP HMRT personnel place sorbent materials directly on the waste to prevent further spread and to aid in recovery and/or construct berms of earthen or sorbent materials downstream of the spill or release to contain larger waterborne spills.

NOTE: The BGCAPP designed the containments in the MDB to have sufficient volume to contain fire water released during a 15–20 minute firefighting event with the additional volume needed to contain leakage from the largest tank or container within the firefighting zone.

After initial emergency response to a liquid release, follow-on actions may include:

1) Perform inspection and decontamination (with appropriate decontamination solutions and/or water) of the release area
2) Repeat the decontamination procedure until cleanup is satisfactory if observation or monitoring indicates the presence of contaminants
3) Collect the released chemical, spent decontamination solution, and any contaminated water for temporary storage prior to disposal. Place any contaminated sorbents, earthen materials, or other containment devices in DOT approved containers, and store to await disposal. Do not leave uncontained contaminated materials at the spill site
4) Use a portable pump or the installed sump pump to remove as much of the spilled/leaked waste as possible. Use squeegees, absorbents, and/or a wet-dry vacuum (with HEPA filter) to remove the remaining spilled/leaked waste, and any wastes in secondary containments, within 24 hours of detecting the leak
5) Remove other wastes from a leaking tank system to prevent further spills or leaks of hazardous waste or to allow inspection and repair of the tank system within 24 hours from detection of the leak

The Incident Commander notifies the BGCAPP Environmental Department if hazardous waste removal within 24 hours of detection is not possible. If the BGCAPP Incident Commander determines the release affects or may affect the environment beyond the BGCAPP boundary, at any time during the emergency response, he/she notifies the BGCA OC/EC.

An incidental release is a release of hazardous waste or hazardous waste constituents, including agent, where the substance can be absorbed, can be neutralized, or can otherwise be controlled by BGCAPP personnel in the immediate release area, at the time of the release.

In the event of an incidental release of hazardous waste or hazardous constituents at the BGCAPP:

1) The Incident Commander directs the BGCAPP HMRT to mitigate the source, and to contain, clean up, and temporarily store the wastes
2) As soon as practicable, the BGCAPP Incident Commander notifies the BGCAPP Site Manager of the incidental release and of the actions taken to mitigate the release
3) BGCAPP HMRT personnel place spilled liquid, solid waste, and contaminated residuals into containers and temporarily store the wastes prior to disposal
4) BGCAPP HMRT personnel place contaminated sorbents, earthen materials, or other containment devices in DOT approved containers, and store the wastes prior to disposal or treatment. BGCAPP personnel remove other contaminated materials from the spill site and decontaminate the materials for reuse or disposal as wastes

6.2.3 Release Notifications

The BGCAPP Plant Shift Manager or his delegate receives a report from the first observer or supervisor of a fire, explosion, or release of hazardous material/hazardous material constituent on or near the BGCAPP. The BGCAPP Plant Shift Manager or his delegate assumes the responsibilities of the BGCAPP Incident Commander and assesses the situation, determines the appropriate response, and notifies the BGCA OC/EC of the incident. The BGCAPP coordinates and requests support from the BGCA OC/EC for emergencies governed by the BGCAPP Contingency Plan, and for response to releases/spills beyond the BGCAPP's capability. The BGCA OC/EC oversees BGCAPP emergency response activities, makes notification to state and local agencies, and determines whether to request support from organizations outside the BGAD.

The BGCAPP Plant Shift Manager or his delegate makes the initial response or requests assistance from the BGAD. Public address announcement, two-way radio, cellular phone, and/or audible alarm notify BGCAPP personnel throughout the plant of the emergency. The announcement or signal contains information for plant employees regarding response, evacuation, or additional instructions. Should a site evacuation be necessary, employees will exit the site via evacuation routes found in Figure 6-2 and in accordance with guidance from the OC.

6.2.4 Release Reporting Requirements

BGCAPP personnel prepare a written follow-up report in addition to the verbal notifications initiated by the BGCA OC/EC. All emergencies that require the implementation of the BGCAPP Contingency Plan or that involve the release of a hazardous waste equal to or exceeding a reportable quantity (RQ) require a written report within 15 days to KDEP, Division of Waste Management. The BGCAPP provides to the BGAD Commander the written report for submittal to KDEP (with a copy of the report sent to the Administrator for U.S. EPA Region 4):

Energy and Environment Cabinet
Director, Division of Waste Management
Department for Environmental Protection
200 Fair Oaks Lane, 2nd Floor
Frankfort, KY 40601

The report includes the following information:

1) Name, address, and telephone number of the owner or operator
2) Name, address, and telephone number of the facility
3) Date, time, and type of incident
4) Name and quantity of material(s) involved
5) The extent of injuries, if any
6) An assessment of actual or potential hazards to human health or the environment, if applicable
7) Estimated quantity and disposition of recovered material resulting from the incident

The BGCAPP places a record of all emergencies requiring implementation of the Contingency Plan in the Facility Operating Record.

Any leaks, spills or other releases within the MDB are not subject to reporting due to the controls designed into this building (e.g., lined concrete containments, containment curbing, door thresholds and HVAC with extensive air emission controls) that prevent the environmental release of liquids or vapors to the environment. Figure 6-1, Table 6-1, and Figure 6-2 (which follow) are examples of forms used to collect information for Incident Reports, a listing of BGCAPP Emergency Response Equipment and an Emergency Response Agency Notification List.

Figure 6-1 – Incident Report

Name, address, and phone number of owner or operator

____

____

____

Name, address, and phone number of facility

____

____

____

____

Date, time, and type of incident (e.g., fire, explosion)

____

____

____

____

Name and quantity of material(s) involved

____

____

____

____

Extent of injuries (if any)

____

____

____

____

Assessment of actual or potential hazards to human health or the environment (if applicable)

____

____

____

____

Figure 6-2 – BGCAPP Evacuation Routes

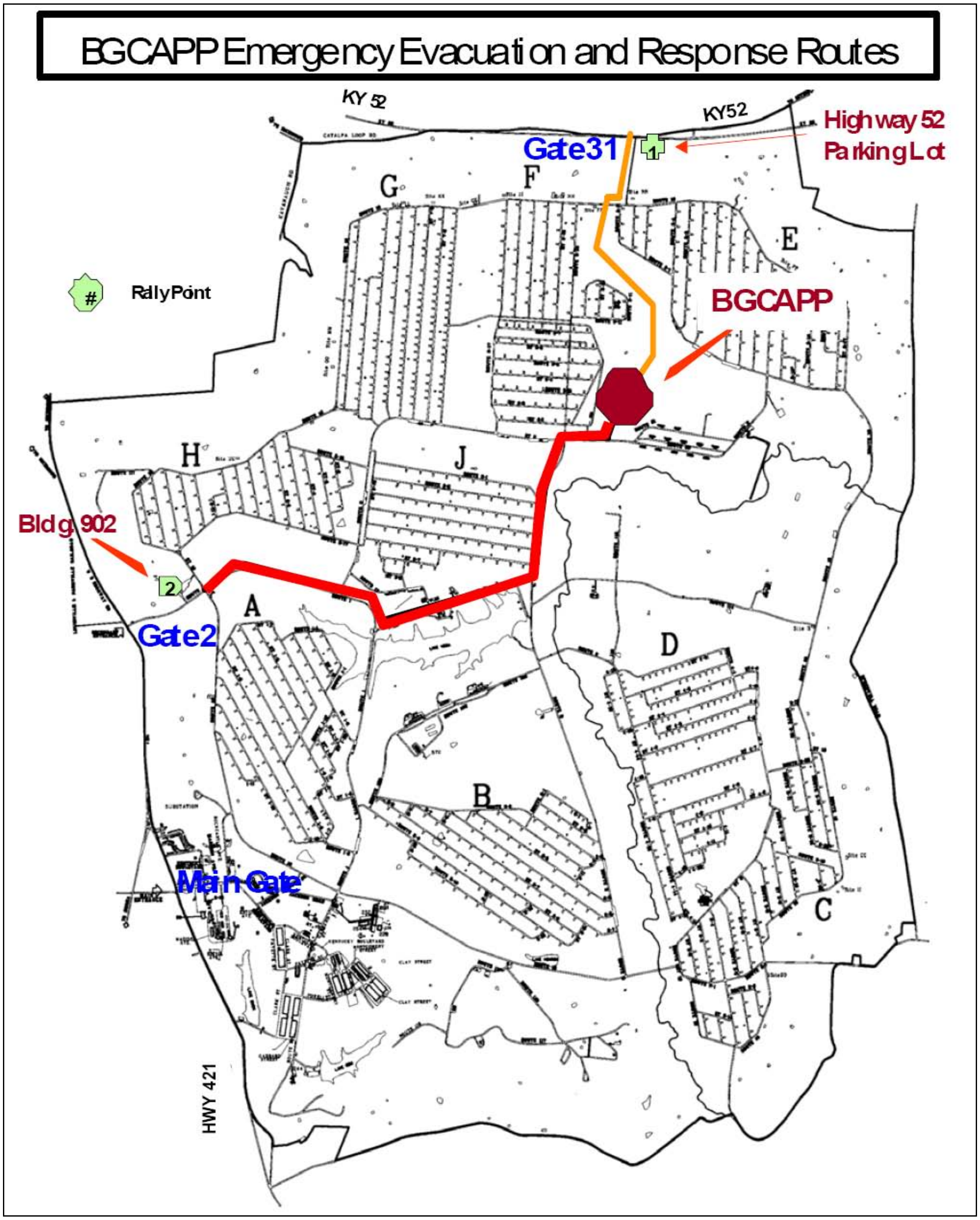


Table 6-1 – Typical BGCAPP Emergency Response Equipment

Emergency Equipment	
Description	**Location**
Fire Engine/HAZMAT Response[1]	BGAD Fire Department
Drum Plug Kit	Drum Storage Areas
Fire Extinguishers	Throughout Facility
Fire Hydrants	Throughout Facility
Pick-up Trucks	Throughout Facility
Absorbent Sheets/Bags/Pads	Throughout Facility
Containment Booms	Throughout Facility
Granular Absorbent	Throughout Facility
Ambulance	PMB
PPE	CSB/MDB/PMB/Laboratory
Sumps and containment curbs	All chemical agent handling areas
Spill Kits	Throughout Facility
Emergency Medical Treatment Facility	PMB
Emergency Response Trailer[2]	PMB

NOTES:
[1] BGAD Fire Department equipment in the BGAD spill prevention control and countermeasure (SPCC)/Installation Spill Contingency Plan (ISCP).
[2] BGCAPP emergency response trailer and vehicle contain spill response materials for industrial spills and emergency/rescue equipment including entry suits and self-contained breathing apparatus (SCBA).

Table 6-2 – Emergency Response Agency Notification List

Agency[a]	Phone Number
BGAD Fire Department[b]	911 (from facility phone) (859) 779-6911 (from off-post or cell phone)
Kentucky Department of Environmental Protection (KDEP), Environmental Response Team	(502) 564-2380 (Monday-Friday, 0730-1530)[c] (800) 928-2380 (24 hr)
Kentucky Emergency Response Commission (ERC)[c]	(800) 255-2587 (502) 564-7815
National Response Center	(800) 424-8802 (D.C. area) (202) 267-2675
Madison County 911 Center and Central Dispatch	(859) 624-4776
Local Emergency Planning Committee[e]	(859) 624-4787
State Fire Marshall[f]	(502) 564-3626
Motor Vehicle Enforcement[g]	(502) 564-3276
U.S. EPA, Region 4, 24-hr Spill Reporting[h]	(404) 562-8700
U.S. Coast Guard, 8th District, Marine Safety	(504) 589-6261
U.S. Army Environmental Center (optional)	(410) 436-4714
HQDA (DAEN-2CE)-AOC [i]	(703) 697-0218
CHEMTREC (Information Only)	(800) 424-9300

NOTES:

[a] *Agency notifications are only made by the BGAD Environmental Office*.

[b] The fire department having jurisdiction must be notified. The BGAD onsite fire department is designated as the fire department with jurisdiction.

[c] Notify both the KDEP and Kentucky Emergency Response Coordinator of a release at or above the reportable quantity (RQ).

[d] The NRC notifies the U.S. Coast Guard and U.S. EPA (includes chemical surety and toxic gases).

[e] 911 should notify adjoining jurisdictions if they are at risk. Notify the following jurisdictions, if required:

- Clark County (859) 744-2111
- Estill County (606) 723-2201
- Fayette County (859) 258-3600
- Garrard County (859) 792-3023
- Jackson County (606) 287-8305
- Jessamine County (859) 887-5447
- Rockcastle County (606) 256-2195

[f] If a fire hazard exists, the State Fire Marshall must also be notified; therefore, when reporting to KDEP and Kentucky ERC, tell them to notify the State Fire Marshall of the fire hazard.

[g] Notify Motor Vehicle Enforcement if hazardous material was released on public roadway, or if motor vehicle enforcement assistance is needed.

[h] The NRC notifies U.S. EPA Region 4. The BGAD may also notify Region 4.

[i] Notify the U.S. Army Operations Center (AOC) in a crisis only.

NOTE: In Kentucky, the following specific RQs apply to petroleum products. Notify state and local agencies of a release at or above following RQs:

Diesel:	Federal	=	Any quantity that poses any threat to water
	KY RQ	=	75 gallons on land or water
All other petroleum products:	Federal	=	Any quantity that poses any threat to water

KY RQ = 25 gallons on land or water

6.3 Personnel Qualifications or Training

6.3.1 Training

The purpose of BGCAPP operations is the treatment and destruction of chemical agents and associated explosives. The chemical agents are Kentucky listed hazardous wastes and KDEP permits the facility under the RCRA. As required by RCRA, BGCAPP personnel receive specialized training if their job requires performance of waste management and/or emergency response activities. These job activities include generating, handling, storing, treating, disposing, or responding to releases of hazardous waste. Their training will also address health hazards, PPE, workplace controls, spills/emergencies (i.e., to include fires, explosions, severe weather and other possible emergencies during BGCAPP operations), and handling/storage.

The Training Department prepares a Job & Task Analysis and this analysis serves as the basis for developing the Training Program for BGCAPP. The Job & Task Analysis takes each job duty and breaks it down to the task level. The evaluation assesses each task to determine if hazardous wastes or hazardous materials are managed while performing the task. After this determination is complete, the Training Department develops the level and type of training based upon the tasks performed and hazards encountered by the worker.

Table 6-3 provides a table with job titles and the hazardous waste and hazardous material training requirements.

6.3.1.1 Training Courses

Each person expected to be involved in hazardous waste management activities receives Initial Hazardous Waste Operations and Emergency Response (HAZWOPER) training. Employees must successfully complete this initial training within six months after the date of their employment or assignment to a new position involving hazardous waste management at BGCAPP. New employees or employees transferred to new positions do not work unsupervised prior to successful completion of the initial training and an on-the-job supervised training period.

Facility personnel involved in hazardous waste management activities must successfully complete an annual review of their initial training. Training may include classroom instruction, on-the- job training (OJT), hands on exercises, practical exercises (e.g., donning/doffing PPE.), or a combination of these delivery methods. Implementation of training falls into five groups:

1) New Employee and Visitors Site Orientation – Any individual who is temporarily at the BGCAPP site must complete an orientation that includes site rules, safety, surety, and emergency response procedures. All new and transferring employees must also attend the site orientation training. The Human Resources Department has a program that notifies the Training Department and other impacted organizations of visitors and new or transferring employees prior to their start date.
2) Initial Workforce Training – Initial workforce training is required before personnel perform the tasks associated with their job position without supervision. The basis of workforce training is the Job & Task Analysis performed for that job position. For the operations phase of the project, workforce training includes qualification and certification. Operations personnel are qualified within six months of hire.
3) Follow-on Training – The Training Department prepares OJT and/or classroom training as the systemization and operations activities identify needs or areas for improvement.

4) Cross training – Cross training is required to qualify an employee for a new or second job position (e.g., backup for other personnel). BGCAPP requires the completion of cross training within six months of the assignment to the new position. Employees cannot work without direct supervision until their cross training is complete.
5) Refresher Training – The Training Department offers annual refresher training complying with the requirements of 29 CFR 1910.120 and 40 CFR 264.16. Any personnel involved in hazardous waste management activity will successfully complete an annual review of the initial training.

Training Department maintains training records using the Compliance Suite®. In addition, the Project Document Control Center receives training records for entry and retention in the InfoWorks® system. Training Department also receives and maintains documentation of employee training received from off-site organizations. BGCAPP maintains training records of current employees until closure of the facility. Training records for former employees are retained for three years from the date the employee last worked at BGCAPP.

6.3.1.2 Training Course Descriptions

The Training Department makes available employee training records for regulatory agency review during normal business hours. The following paragraphs provide descriptions of the general types of training provided to BGCAPP employees.

1) New Employee Orientation -- New employee orientation is required before any employee gains access to the site. This course provides the new employee with an understanding of environmental, safety and health, and special job site requirements. Specifically, it provides the employee the knowledge and information necessary to identify the environmental and safety hazards in their work environment, and to apply the preventive measures and techniques to eliminate or reduce environmental incidents and the exposure to illness and injury; and introduces employees to the Zero Accident Philosophy and explains how BGCAPP strives to achieve this goal.

Elements addressed are:

a. Management commitment
b. Incident investigation
c. Safe behavior overview
d. Injury/illness reporting
e. General project/facility rules
f. STARRT/AHA/JSA (types of analyses preformed to identify hazards)
g. Emergency procedures
h. Lock-out and tag-out
i. Personal protective equipment
j. Confined spaces
k. Safe Access to elevated work areas
l. Hazard Communication
m. Quality & Environmental Awareness
n. Compressed gas cylinders
o. Housekeeping
p. Back injury prevention
q. Fire prevention and protection
r. Workers' compensation
s. Safety, Toolbox meetings
t. Excavations and trenching

u. Fall protection/prevention
v. Industrial Relations
w. Barricades
x. Hand power tool safety

2) HAZWOPER Initial Training 29 CFR 1910.120 (40 Hours) – This course is not required by RCRA but BGCAPP. The purpose of this course is to ensure awareness and promote safety among employees potentially exposed to chemical hazards in the work-site. The objective is to ensure employees operate in the safest possible manner in situations where contact with potentially hazardous materials is likely. The training objectives are to control or eliminate the potential hazards and/or losses and protect the health and safety of workers, the public, and the environment. This course provides employees:

a. An understanding of hazardous materials/wastes handling, identification, and human responses to exposure
b. The importance of the Health and Safety Plan (HSP)
c. Knowledge of what to do in case of site emergencies (i.e., Site Emergency Response Plan)
d. Appropriate safety methods and work practice controls
e. Ability to recognize signs and labels that are used to alert personnel of danger involving hazardous material/waste
f. Understanding how to prevent environmental releases and knowledge of site/stack air monitoring and regulatory requirements for air monitoring
g. Site control methods for confinement, management, and cleanup to protect the public and the environment

3) HAZWOPER Refresher 29 CFR 1910.120 (8 Hours) – This refresher course is required by RCRA but addresses PCBs as well. General site workers managing hazardous or PCB wastes or potentially exposed to hazardous substances or health hazards, attend this course. Only employees completing the 40 hour training course may take the refresher course. Topics covered include:

a. HAZWOPER regulations
b. Safety and health plans
c. Hazardous chemicals
d. Safety hazards
e. Air monitoring
f. Medical surveillance
g. Site control
h. Decontamination
i. PPE including respiratory equipment

4) HAZWOPER Supervisor/ Management 29 CFR 1910.120 (8 hours) – The Supervisor and Management training requirement applies to all onsite managers and supervisors directly responsible for, or who supervise employees performing hazardous waste operations. Supervisor/management personnel must have completed at least 24 hours of hazardous waste training prior to receiving the supervisor/management training.

5) First Responder Awareness Level 29 CFR 1910.120(q)(6)(i) – The First Responder Awareness Level training applies to all BPBG employees and is required for access to the site. This training provides employees with the knowledge and information needed if they observe or discover spilled/released hazardous substance. First responders at the Awareness Level shall receive annual refresher training of sufficient content and duration to maintain their competencies, or shall demonstrate competency in those areas at least yearly.
6) First Responder Operations Level 29 CFR 1910.120(q)(6)(ii) (8 hours) – The First Responder Operations Level training applies to employees designated to provide the initial response to spilled/released hazardous substance and protect near-by persons, property, or the environment. First responders at the operations level shall receive annual refresher training of sufficient content and duration to maintain their competencies, or shall demonstrate competency in those areas at least yearly.
7) Technician Level 29 CFR 1910.120(q)(6)(iii) (24 hours) – The Technician Level training applies to those individuals designated to respond to spilled/released hazardous substances, to stop the spill/release. These employees are trained in accordance with paragraph (q)(6) of 29 CFR 1910.120 and receive annual refresher training of sufficient content and duration to maintain their competencies, or shall demonstrate competency in those areas at least yearly.
8) DOT Requirements – Hazardous Material Employee 49 CFR 172.704 -- DOT training is required for employees involved in the receiving, shipping, storing, or managing hazardous material (HAZMAT) or hazardous waste (HW). Employees involved in these HAZMAT activities include any person who directly affects HAZMAT or HW transportation safety including a person who:
    a. Loads, unloads, or handles HAZMAT/HW
    b. Prepares HAZMAT/HW for transportation
    c. Is responsible for safety of transporting HAZMAT/HW
    d. Operates a vehicle used to transport HAZMAT/HW

NOTES:

1) 53 Federal Register (FR) 8504 (15 March 1988) (corrected in 53 FR 11002, 4 April 1988), Final Recommendations for Protecting Human Health and Safety Against Potential Adverse Effects of Long-term Effects of Long-term Exposure to Low Doses of Agents: GA, GB, VX, Mustard Agent (H, HD, and HT), and Lewisite (L).
2) 68 FR 54460 (17 September 2003)(corrected in 68 FR 58348, 9 October 2003), Final Recommendations for Protecting Human Health from Potential Adverse Effects of Exposure to Agents GA (Tabun), GB (Sarin), and VX.
3) Department of Army Pamphlet 385-61, Toxic Chemical Agent Safety Standards, 17 December 2008.

Table 6-3 – Training Matrix

Job Title	New Employee Site Orientation	HAZWOPER – 40 Hr	HAZWOPER –Refresher 8 Hr	HAZWOPER – Supervisor/ Management 8 Hr	First Responder Awareness & Annual Refresher	First Responder Operations & Annual Refresher	Technician Level & Annual Refresher	DOT	RCRA & Annual Refresher
Environmental Manager	X	X	X	X	X	X		X	X
Environmental Compliance Manager	X	X	X	X	X	X		X	X
Environmental Permitting Manager	X	X	X	X	X	X		X	X
Waste Manager	X	X	X	X	X	X		X	X
Environmental Compliance Specialist	X	X	X		X	X	X	X	X
Environmental Engineer	X	X	X		X	X		X	X
Emergency Preparedness Manager	X	X	X	X	X	X	X		X
Plant Safety Engineer	X	X	X	X	X	X	X		X
Additional Safety Personnel									
Deputy Plant Manager	X	X	X		X				
Operations Manager	X	X	X		X	X			X
Plant Shift Manager	X	X	X	X	X	X			X
Inside/Outside Supervisor	X	X	X	X	X		X		X
Control Room Supervisor	X	X	X	X	X		X		X
Control Room Operator	X	X	X	X	X	X			X
Inside/Outside Utility Operator	X	X	X		X	X			X
CHB/UPA Supervisor	X	X	X		X	X			X
CHB/UPA Operator	X	X	X		X	X			X
Munitions Transporter	X	X	X		X		X	X	X
TMA Supervisor	X	X	X		X	X			X
TMA Operator	X	X	X		X	X			X
SCWO Supervisor	X	X	X		X	X			X
SCWO Operator	X	X	X		X	X			X
SCWO Control Room Operator	X	X	X		X	X			X
Bulk Chemical Operator	X	X	X		X	X			X
DSA Supervisor	X	X	X		X	X			X
DSA Operator	X	X	X		X	X			X

Job Title	**New Employee Site Orientation**	**HAZWOPER – 40 Hr**	**HAZWOPER –Refresher 8 Hr**	**HAZWOPER – Supervisor/ Management 8 Hr**	**First Responder Awareness & Annual Refresher**	**First Responder Operations & Annual Refresher**	**Technician Level & Annual Refresher**	**DOT**	**RCRA & Annual Refresher**
Residue Operators	X	X	X		X		X	X	X
Bin Truck Operator	X	X	X		X	X		X	X
RM Operator	X	X	X		X	X			X
PMB Attendant	X	X	X		X	X			
Maintenance Manager	X	X	X		X	X			X
Maintenance Manager	X	X	X	X	X	X			X
Maintenance Technician	X	X	X		X	X			X
Warehouse Personnel	X	X	X		X		X	X	X
Laboratory Manager	X	X	X	X	X				X
LAB Training Coordinator	X	X	X		X				X
LAB Supply Specialist	X	X	X		X				X
Administrator	X	X	X		X				X
LAB Safety Specialist	X	X	X		X	X			X
Monitoring Branch Manager	X	X	X	X	X	X			X
Deputy Monitoring Branch Manager	X	X	X	X	X	X			X
Monitoring Shift Lead	X	X	X	X	X	X			X
MINICAMS® Technician	X	X	X		X	X			X
DAAMS Technician	X	X	X		X	X			X
Monitoring Instrument Technician	X	X	X		X	X			X
Operations Branch Manager	X	X	X	X	X	X			X
Deputy Operations Branch Manager	X	X	X	X	X	X			X
Wet Chemist	X	X	X		X	X			X
Agent Chemist	X	X	X		X	X			X
Laboratory information management system (LIMS) Administrator/ Specialist	X	X	X		X				
LIMS Information Security and Technology Specialist	X	X	X						
Statistician	X	X	X		X				

Job Title	New Employee Site Orientation	HAZWOPER – 40 Hr	HAZWOPER –Refresher 8 Hr	HAZWOPER – Supervisor/ Management 8 Hr	First Responder Awareness & Annual Refresher	First Responder Operations & Annual Refresher	Technician Level & Annual Refresher	DOT	RCRA & Annual Refresher
GC-MSD- Purge and Trap (P&T) Operator	X	X	X		X	X			X
Programmer	X	X	X		X				
Chemical Technician	X	X	X		X	X			X
Data Technician	X	X	X		X				
ICP-MS Operator	X	X	X		X	X			X
HPLC Operator	X	X	X		X	X			X
DSC Operator	X	X	X		X	X			X
Senior Chemist	X	X	X		X	X			X
IC Operator	X	X	X		X	X			X
Operations Shift Lead	X	X	X	X	X	X			X
GC-MSD/FPD Operator	X	X	X		X	X			X
Hazardous Waste Technician	X	X	X		X		X		X
HPLC Operator	X	X	X		X	X			X
Sampling Technician	X	X	X		X	X			X
QA/QC Manager	X	X	X		X				X
Senior QC Specialist	X	X	X		X				X
QC Specialist	X	X	X		X				X

7.0 CLOSURE PLAN

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7.1 BGCAPP Closure Process

The BGCAPP includes permitted hazardous waste management units (HWMUs) providing container storage, tank storage and treatment, and miscellaneous (Subpart X) treatment. Following elimination of the chemical weapons stockpile at the BGCA by treatment of chemical agents and explosives, the BGCAPP will "clean close" the HWMUs under the provisions of this plan. The objective of "clean closure" is to remove RCRA hazardous wastes from a HWMU to eliminate the possibility of future releases in a manner protective of human health and the environment. The BGCAPP will achieve "clean closure" by removal, demolition, or decontamination of equipment, areas, and facilities.

BGCAPP entry into closure activities will include the entire facility and other units at the facility will not continue to operate except to treat or store decontamination residues/solutions and other secondary wastes generated during closure. Therefore, the BGCAPP does not anticipate any partial closures. If partial closures are needed, the BGCAPP will revise the hazardous waste management permit in accordance with 401 KAR 34:070, Section 3 and 40 CFR 264.112.

The performance standard (40 CFR 264.111, Closure performance standard) for closure of the facility requires the following:

1) Minimize need for further maintenance or post closure care
2) Control, minimize, or eliminate escape of hazardous waste or its constituents from the closed facility to the extent necessary to protect human health and the environment
3) Comply with the closure provisions of Commonwealth of Kentucky environmental regulations (which incorporate by reference Federal requirements)

Specifics for BGCAPP compliance with the performance standard for HWMUs are as follows:

1) The basis for "clean closure" of HWMUs that have stored or treated "liquid" chemical agent (i.e., HWMUs in the MDB) is disassembly and removal of equipment, and demolition of facilities and structures. BGCAPP closure includes MPT treatment or off-site shipment for treatment and/or disposal of removed materials and equipment. Demolition wastes (from these areas) will be characterized for off-site shipment and shipped to appropriately permitted, commercial TSDFs for further treatment or disposal
2) The basis for "clean closure" of HWMUs that have not stored or treated "liquid" agent is meeting the regional screening levels (RSLs) for the waste constituent(s) of concern. The final rinse or wipe samples of surfaces within tanks and Subpart X units must be less than RSLs for waste constituents of concern in final rinse samples or non-detect for waste constituents of concern from wipe samples

NOTE: The term "liquid" chemical agent is used in this section to indicate the storage, treatment, or other management of chemical agent and is used to differentiate from other wastes that may be agent derived but which do not contain detectable agent concentrations (i.e., above those concentrations occurring after treatment at a 99.9999 percent DE).

The BGCAPP will treat and/or dispose of closure wastes from waste storage areas and treatment units (i.e., areas and units not contaminated with "liquid" agent) only in a facility approved to accept the waste.

The BGCAPP will base the clean closure of permitted units on decontamination, disassembly, removal, and/or demolition. The permitted units are separated into two broad groups (i.e., those potentially contaminated with "liquid" agent, and those not contaminated with "liquid" agent), with different closure tasks required for each group. The BGCAPP will perform demolition of HWMUs within the MDB (assumed to have a history of potential contamination with "liquid" agent). The MDB HVAC carbon banks, filters, and ductwork will be demolished with the MDB. The closure of the other permitted systems (i.e., those without a history of contamination with "liquid" agent) will include using decontamination, wipe and rinsate samples, and closure in place if sampling confirms areas/systems can be "clean closed."

7.2 Procedures to Close

The Army adopted the risk-based worker and community AELs and Acute Exposure Guideline Levels (AEGLs) for agents (Department of Army Pamphlet 385-61, Toxic Chemical Agent Safety Standards, 17 December 2008). AELs are concentrations for specific exposure durations that reflect health-based risks for chemical agent exposures to humans via inhalation. AEGLs are concentrations used to assess the health-based risks associated with acute exposures during emergencies.

The BGCAPP will use monitoring of airborne concentrations of chemical agents to determine the appropriate level of PPE for BGCAPP closure workers and to ensure the general population is not at risk due to airborne agent concentrations. In areas where monitoring cannot be performed, mathematical modeling will be used. A comparison of the expected agent concentrations to the STEL, WPL, and GPL will be used in making these determinations.

7.2.1 Closure of BGCAPP Permitted HWMUs with History of Possible "Liquid" Agent Contamination (i.e., in MDB)

The BGCAPP's closure objectives include the demolition of areas potentially exposed to agent contamination (e.g., ductwork, plenums, and liquid agent management areas) and the removal of non-agent waste constituents in other waste management areas.

The closure of BGCAPP permitted HWMUs in the MDB will be accomplished using removal of equipment and demolition of the entire facility, to include the concrete pad and foundation materials. The BGCAPP will characterize the waste materials resulting from the demolition of the MDB and ship these wastes offsite for disposal in an appropriately permitted, commercial TSDF. The layout of the MDB lends itself to closure in three phases – All areas of the MDB are capable of isolation in terms of power and utilities. The agent systems are equipped with flushing ports to facilitate removal of agent contamination from these systems, and are located only within Category A areas. In addition, the BGCAPP planned and designed the flow of closure and secondary wastes during closure such that the mechanical aids, doorways, and conveyors will be available for the sequencing of these three phases, ultimately leading to RCRA closure of the MDB. Figure 7-1 shows the MDB zones or areas in these three closure phases.

A brief summary of each phase is as follows:

1) Phase I will include the western quadrant of the MDB, which includes, but is not limited to, the ECVs, ECRs, MPR, MSR, UPA-1, and the EONC transfer airlocks

2) Phase II will be started while Phase I is being finished. Phase II includes the south central quadrant of the MDB, which includes, but is not limited to, the DPE Corridor, ENS room, secondary heat transfer room, and ANS room
3) Phase III will be completed after Phase II and will include the balance of the MDB (i.e., the eastern quadrant). This includes, but is not limited to, the MWS room, TMA, airlocks, OTE/OTM area, MPT room, and UPA 2

The BGCAPP will take the following steps to release areas and systems in the MDB for demolition:

1) Certify the MDB (by a qualified PE) and operate under the provisions of 40 CFR 264.1100 (Subpart DD) as a containment building. Manage solid items removed from the areas of potential liquid agent contamination within the MDB. The identification and use of the MDB as a containment building allows:
    a. Management of agent-derived non-liquid hazardous wastes within the MDB outside of containers without labeling
    b. Increased efficiency of the removal tasks and improved safety of closure workers
    c. Containerization and removal of closure wastes from within the MDB on a routine schedule to ensure the 90-day limitation imposed by 40 CFR 262.34, Accumulation time, is not exceeded
2) Dismantle, remove process systems, and characterize the removed items/wastes for offsite shipment and treatment/disposal at a RCRA TSDF
3) Remove and appropriately dispose of wastes contained within BGCAPP tank systems based upon generator knowledge and analytical waste characterization
4) Remove and resize RCRA waste management tanks and associated ancillary equipment located within the MDB for processing in the MPT
5) Characterize the wastes from the removal of the ductwork and HVAC filter units prior to demolition

7.2.2 Closure of BGCAPP Permitted HWMUs without History of "Liquid" Agent Contamination (i.e., areas and systems outside the MDB)

In these non-agent HWMUs, the BGCAPP will decontaminate the containment surfaces/equipment and close in place. The BGCAPP will use pressure washing as the primary decontamination method with other decontamination methods used as needed (e.g., steam cleaning and air washing).

RCRA decontamination of container storage or treatment of HWMUs not potentially contaminated with "liquid" agent, including the containment systems and sumps, will include the following activities:

1) Waste removal from the containment area, and disposal of waste at an approved facility
2) Visual inspection of containment systems
3) Dry mechanical cleaning of container storage floors and walls (by scraping, vacuuming, and/or sweeping)
4) Repair of cracks, gaps, or damage to containment, of unsealed areas, and of damage to the liner (caused by previous closure operations) prior to beginning use of liquids for cleaning
5) Low-volume pressure washing/rinsing (with possible use of non-ionic surfactant detergent, if required)
6) Two subsequent low-pressure ambient-temperature water rinses

7) Sampling and analysis of final rinsate to confirm effectiveness of RCRA decontamination
8) If decontamination is not effective, return to low-volume pressure washing step above and repeat wash/rinse cycle
9) Repeat sampling and analysis of final rinsate to determine whether RCRA decontamination was effective

If decontamination is still not effective after the second waste/rinse cycle, the BGCAPP will develop alternate decontamination methods and inform KDEP of the revised approach.

The BGCAPP will demonstrate clean closure of HWMUs without liquid agent contamination by collecting final rinse samples (i.e., for containments) and wipe samples (i.e., from within tanks and Subpart X units). Bases for analyses performed are the waste inventory stored or wastes processed in a given area, and the analyses will take into account the nature of the treatment and spill or release history. SCWO reactors and the MPT provide destructive treatment, and the BGCAPP will not evaluate these units for the presence of organic hazardous wastes but will decontaminate and perform wipe sampling/analysis for inorganic hazardous wastes (e.g., metals) as appropriate. For these HWMUs, achieving “clean closure” will be demonstrated when containment rinse samples are analyzed and do not contain waste constituents above the RSLs; and when wipe samples for tanks and Subpart X units are non-detect for the waste constituents of concern. The waste storage and treatment areas that the BGCAPP will sample and analyze for waste constituent contamination include:

1) STA and SPB Storage Area
2) ARS
3) RO Unit
4) WTA
5) WSA
6) HSA
7) CHB (only if history indicates agent contamination is potentially present)

7.3 Closure Date & Schedule

Closure of the MDB will include the three phases or MDB areas shown in Figure 7-1. The sequence of closures for the container storage areas facilitates storage of wastes generated during closure activities, with the WTA and WSA closed last. Closure of the other permitted units will follow the path of chemical agent and munitions through the CHB and MDB, with the STA and SPB closed after the MDB but prior to the WTA and WSA. The BGCAPP will update the schedule of closure activities when the BGCAPP notifies KDEP of the closure start (at least 45 days prior to initiation of closure).

The current BGCAPP closure schedule indicates closure will exceed two years. The long duration of these closure activities is necessary due to the:

1) High visibility and toxicity of the wastes being treated at this facility dictating a safe and error-free closure, a situation requiring a careful and methodical approach to facility closure
2) Size and complexity of the facility being closed
3) Number of units and amount of closure information and data that must be compiled into a PE closure certification report

Figure 7-2 provides a schedule for the BGCAPP closure by area/phase. The BGCAPP will also update the schedule of closure activities when the BGCAPP notifies KDEP of the initiation of closure.

7.4 Disposition of Residues

Hazardous wastes and closure residues may be treated onsite or sent offsite for treatment and/or disposal. These closure wastes and residues will not be disposed onsite and only facilities with appropriate permits will be used to treat or dispose of closure wastes. In addition, metallic wastes that have been treated in the MPT may be recycled. Facilities have not yet been identified for closure waste treatment and disposal contracts due to the number of intervening years before closure begins.

7.5 Quantity of Waste

The maximum waste inventory in storage at the BGCAPP at closure would be the total volume of wastes stored in containers and tanks. The total of 1,766,283 gallons for these units is the maximum hazardous waste inventory for the BGCAPP facility.

Table 7-1 provides the maximum waste inventory (by HWMU) remaining at the BGCAPP when closure begins. There will be a maximum of 63,089 gallons of waste remaining in the container storage areas and a maximum of 1,703,194 gallons remaining in storage tanks.

7.6 Procedures to Decontaminate Equipment

The U.S. Army will not formally identify the BGCAPP facility end-state until near the end of agent destruction operations. Therefore, the plan for closure of the entire facility is incomplete. Currently, the BGCAPP plan is to remove the equipment from the MDB and demolish the entire structure, including the concrete foundation and pad. The BGCAPP also plans to decontaminate and leave in place, for transfer to the BGAD, the tank systems associated with the storage of hydrolysate and other permitted structures and associated containments/equipment [i.e., CHB, SPB (to include the Water Recovery System, ARS, and SCWO Reactors), STA, WSA, and WTA].

7.6.1 Criteria for Determining Contamination

The BGCAPP will use two approaches for the closure of BGCAPP hazardous waste management systems and areas. These approaches are:

1) Wipe and rinse sampling for facilities and structures without a history of “liquid” agent contamination, and continued decontamination until RSL concentrations are attained for closure samples
2) Disassembly of equipment and demolition of facilities and structures in the MDB where a history of possible “liquid” agent contamination exists

Table 7-2 contains the criteria for determining whether contamination exists in a facility without a history of “liquid” agent contamination.

7.6.2 Description of Decontamination Procedures Including Clean-up Materials, Equipment, and Residues

The procedures used to decontaminate the areas and facilities with and without a history of "liquid" agent contamination will be similar. Following waste removal, decontamination methods will probably include washing (i.e., low- and high-pressure washing) and steam treatment. Other decontamination methods (e.g., heated air wash, bleach, hydrogen peroxide, surfactants) may also be used. The greatest amount of liquid clean-up waste is water, and decontamination equipment includes steam generators and pressure cleaners that produce contaminated water. Closure activities also generate secondary wastes (e.g., used PPE, wipes, and other trash/waste), and these wastes may be agent contaminated/derived.

7.6.3 Procedures for Disposal of Soil, Rinse Water, etc.

The agent contaminated secondary closure wastes will be thermally treated (i.e., MPT treatment or incineration) and/or disposed in an offsite RCRA hazardous waste landfill. Generation of chemical agent contaminated soils during closure of the BGCAPP is not anticipated. Hazardous wastes that are not agent derived will be shipped offsite to facilities that will use disposal and treatment methods that include landfill, deep well injection, or incineration. Demolition wastes that are not agent contaminated or otherwise a hazardous waste will be disposed of in either a Class D or demolition landfill. Contracts for disposal/treatment of wastes generated during closure have not yet been established as the scheduled beginning of Closure activities is nine to 10 years in the future.

7.6.4 Proposed Procedures/Means to Demonstrate Decontamination Has Been Effective

The BGCAPP will use analytical results from rinse and wipe sampling of surfaces exposed to contamination (i.e., for areas and systems without a history of "liquid" agent contamination) to determine the decontamination effectiveness for HWMUs. Mass demolition and removal of closure wastes will demonstrate effective decontamination of waste management areas, equipment, and facilities with a history of possible "liquid" agent contamination.

7.6.5 Closure of Container Storage Areas

The BGCAPP will perform the closure of permitted container storage areas in accordance with 40 CFR 264.178, to include:

1) Removing wastes and containers from the permitted storage area
2) Analysis of rinsates for permitted container storage in areas without a history of "liquid" agent storage
3) Continuing cleaning and decontaminating until closure criteria (RSLs) are met
4) Off-site shipment of cleaning/demolition wastes for appropriate disposal and/or treatment for MDB permitted container storage areas with a history of "liquid" agent contamination

The estimated inventory provided earlier in this section contains the maximum estimate for container storage areas, conservatively estimated to be 63,089 gallons based on the volume or weight of stored hazardous waste being highest at closure.

7.6.6 Closure of Tank Systems

The RCRA permitted tank systems at the BGCAPP have secondary containments that are lined with impervious materials compatible with the wastes stored in the tank systems. Therefore, contamination of soils beneath the containments is not expected, and the integrity of the containments over the operating life of the facility will be confirmed by review of records and physical inspection. No effort is expected to be required to sample or remove such soils (absent any evidence of a breach in the containment system) and, therefore, the requirements of 40 CFR 264.197(b) for post-closure care would not be applicable and “clean closure” can be certified.

Closure of the BGCAPP MDB tank systems (i.e., systems with a history of possible liquid agent contamination) will require removal of visible waste residues and will be accomplished by flushing and cleaning (i.e., using power washing/steam), followed by visual inspection of tank systems including ancillary equipment and tank interiors. The BGCAPP will remove and treat agent tank systems, tanks, and ancillary equipment in the MPT prior to subsequent offsite treatment and/or disposal. For permitted tank systems (i.e., systems without history of “liquid” agent contamination), the BGCAPP will use generator knowledge (in most instances) to characterize the materials generated during closure and after cleaning and visual inspection, and the BGCAPP will perform wipe sampling for waste constituents to demonstrate the surfaces have been sufficiently decontaminated for closure.

The BGCAPP will remove and demolish MDB containments and tank systems, including ancillary equipment. For tank systems without a history of “liquid” agent contamination (i.e., systems and areas not in the MDB), the BGCAPP will clean the systems prior to rinse sampling of the containments. The basis for BGCAPP closure of these containments is achievement of the RSLs for waste constituents previously stored in these tank systems. These tank systems and containments (outside the MDB) will remain in place after closure of the BGCAPP.

The estimated inventory provided in this section includes a maximum tank storage volume of 1,703,194 gallons. This estimate assumes the hazardous waste quantities in tank storage will be highest as closure begins.

7.6.7 Closure of Subpart X Units

BGCAPP Subpart X units include both those units with a history of possible “liquid” agent contamination (i.e., units in the MDB) and those without a history of “liquid” agent contamination (i.e., units in the SPB). The BGCAPP will apply to these Subpart X units the same criteria and approach used for closure of tanks and container storage areas. This approach includes:

1) Wastes and waste constituents will be removed from all Subpart X units (i.e., to include associated air pollution control equipment such as the MPT scrubber)
2) Wastes and waste residues will be characterized and shipped off site for appropriate final treatment and/or disposal
3) Containments (i.e., in areas other than the MDB) will be cleaned and monitored to determine whether cleaning and decontamination was effective. Containments in the MDB will be demolished and the demolition wastes removed, containerized, and shipped offsite for treatment/disposal
4) The BGCAPP will use disassembly, removal, and demolition for units in areas with a history of “liquid” agent contamination, and rinsate and wipe sampling for analysis of units in areas without a history of “liquid” agent contamination (i.e., outside the MDB)

5) The BGCAPP will disassemble the Subpart X units (located within the MDB) and remove the waste for shipment offsite to an appropriate facility
6) Subpart X units outside the MDB will be closed in-place

7.7 Time to Close

Estimates of the MDB closure activity durations indicate it will require more than 2 years for complete closure of the entire BGCAPP facility. The BGCAPP therefore requests KDEP approve a closure schedule of two years for the BGCAPP. The BGCAPP will request (i.e., in accordance with the requirements of 401 KAR 34:070, Section 4(2) and 40 CFR 264.113) an extension to this schedule if the closure requires additional time.

Table 7-1 – Maximum Inventory of Wastes at Beginning of Closure

Hazardous Waste Management Unit	Location/ Room #	Volume (gal)	Waste Name	Waste Code(s)	Notes
Container Handling Building (CHB)	CHB	0	N/A	N/A	
Waste Storage Area (WSA) – Inside the CLA	WSA	5,500	Secondary Waste and Filter cake	D001, D002, D003, D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	
Waste Transfer Station (WTS) – Outside the CLA	WTS	24,000	Secondary Waste and Filter cake	D001, D002, D003, D004, D005, D006, D007, D008, D009, D010, D011, F001–F005, and/or N001	
Storage in Box Transfer Area, Room 1	07-165	0	N/A	N/A	
Storage in Box Transfer Area, Room 2	07-166	0	N/A	N/A	
Agent Neutralization System (ANS) Storage Area	07-123	0	N/A	N/A	
Tray/Container Transfer Room	07-124	0	N/A	N/A	
Metal Parts Treater (MPT) Cooling Conveyor Storage Area	07-150	8,190	Secondary Waste	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	
Toxic Maintenance Area (TMA) Storage Area	07-125	5,500	Secondary Waste	D001, D002, D004, D005, D006, D007, D008, D009, D010, D011, F001–F005, and/or N001	

Hazardous Waste Management Unit	Location/ Room #	Volume (gal)	Waste Name	Waste Code(s)	Notes
Explosive Containment Vestibule (ECV) Storage Area, ECV-1	07-103	0	N/A	N/A	
Explosive Containment Vestibule (ECV) Storage Area, ECV-2	07-106	0	N/A	N/A	
Unpack Area (UPA) No. 1	07-101	0	N/A	N/A	
Unpack Area (UPA) No. 2	07-128	0	N/A	N/A	
Motor Shipping Room (MSR) Covered Loading Area (for NCRM)	07-167	0	N/A	N/A	
Motor Packing Room (MPR) Storage (for RM)	07-163	0	N/A	N/A	
Explosive Containment Room (ECR) Storage Area No. 1	07-104	0	N/A	N/A	
Explosive Containment Room (ECR) Storage Area No. 2	07-105	0	N/A	N/A	
SCWO Processing Building (SPB) Storage Area	10-102	8,355	Secondary Waste Filter cake Brine	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	Filter cake and media stored in area at start of closure. Use for storage of closure waste prior to off-site shipment.
Hydrolysate Storage Area (HSA)	HSA	1,457,544	Hydrolysate	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	Hydrolysate stored at start of closure.

Hazardous Waste Management Unit	Location/ Room #	Volume (gal)	Waste Name	Waste Code(s)	Notes
Agent Collection/Toxic Storage Tanks	07-123	0	N/A	N/A	
SCWO Tank Area (STA)	STA	427,073	Brine	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	Effluent and RO Reject & Permeate stored at the beginning of closure.
Spent Decontamination System (SDS) Tanks	07-123	28,788	Decontamination solutions	D002, and/or N001	Decontamination solutions from the end of operations and beginning of closure.
Agent Neutralization System (ANS)	07-123	0	N/A	N/A	
Energetics Neutralization System (ENS)	07-119	0	N/A	N/A	
Munitions Washout System (MWS)	07-135	0	N/A	N/A	
Nose Closure Removal System (NCRS)	07-104	0	N/A	N/A	
Projectile Mortar/Disassembly Machine (PMD)	07-104	0	N/A	N/A	
Rocket Cutting Machine (RCM) Line 1	07-104	0	N/A	N/A	
Rocket Shear Machine (RSM), Line 1	07-104	0	N/A	N/A	
Rocket Cutting Machine (RCM) Line 2	07-105	0	N/A	N/A	
Rocket Shear Machine (RSM), Line 2	07-105	0	N/A	N/A	

Hazardous Waste Management Unit	Location/ Room #	Volume (gal)	Waste Name	Waste Code(s)	Notes
Metal Parts Treater (MPT)	07-146	0	Secondary Waste	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	Used for treatment of closure generated waste. Waste remaining on conveyor at start of closure and in waste storage area.
Energetics Batch Hydrolyzer (EBH)	07-111	0	N/A	N/A	
Reverse Osmosis (RO) Unit	10-102	0	RO Reject and RO Permeate	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	Unit continues operation during closure.
Aluminum Filtration System (AFS)	10-102	5,000	Filter cake Brine Neutralized Energetics Hydrolysate	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	Unit continues operation during closure.
Supercritical Water Oxidation (SCWO) Reactors	10-101	0	Decontamination solutions and wastes	D004, D005, D006, D007, D008, D009, D010, D011, and/or N001	Unit will not store waste, but will continue to operate during closure. Used to treat some decontamination solutions and wastes.

Table 7-2 – Clean Closure Criteria for Final Rinse and Soil Samples

					Clean Closure Criteria	
Constituent of Concern	**Sample Container**	**Preservation**	**Hold Time**	**SW-846 Test Method[1]**	**Soil [3] RSL (ppm)**	**Tap Water [3] RSL (ppm)**
GB				MINICAMS/DAAMS	<1VSL[2]	
Arsenic	P	HNO_3 to pH<2	6 mos.	Method 6020	1.6	0.000045
Barium	P	HNO_3 to pH<2	6 mos.	Method 6020	190,000.00	7.3
Cadmium	P	HNO_3 to pH<2	6 mos.	Method 6020	800.0	0.018
Chromium	P	HNO_3 to pH<2	6 mos.	Method 6020		0.0000000
Lead	P	HNO_3 to pH<2	6 mos.	Method 6020	800.0	0.0000000
Mercury	P, G	HNO_3 to pH<2	28 days	Method 6020	34.0	0.00057
Selenium	P	HNO_3 to pH<2	6 mos.	Method 6020	5,100.00	0.18
Silver	P	HNO_3 to pH<2	6 mos.	Method 6020	5,100.00	0.18
Acetone	G	Cool to 4 deg. C	7 days	Methods 5031/8260	630,000.00	22.0
Benzene	G	Cool to 4 deg. C	14 days	Methods 5031/8260	5.4	0.00041
2-Butanone (MEK)	G	Cool to 4 deg. C	7 days	Methods 5031/8260	200,000.0	7.1
Carbon disulfide	G	Cool to 4 deg. C	14 days	Methods 5031/8260	3,700.0	1.0
Chloroform	G	Cool to 4 deg. C	14 days	Methods 5031/8260	1.5	0.00019
1,4-Dichlorobenzene	G	Cool to 4 deg. C	14 days	Methods 5031/8260	12.0	0.00043
1,1-Dichloroethylene	G	Cool to 4 deg. C	14 days	Methods 5031/8260	1,100.0	0.34
1,2-Dichloroethylene	G	Cool to 4 deg. C	14 days	Methods 5031/8260	9,200.0	0.33
Ethyl Benzene	G	Cool to 4 deg. C	14 days	Methods 5031/8260	27.0	0.0015
Methanol	G	Cool to 4 deg. C	7 days	Methods 5031/8260	310,000.0	18.0
Methylene Chloride (Dichloromethane)	G	Cool to 4 deg. C	14 days	Methods 5031/8260	53.0	0.0048
Methyl Isobutyl Ketone (MIBK)	G	Cool to 4 deg. C	14 days	Methods 5031/8260	53,000.0	2.0
Nitrobenzene	G	Cool to 4 deg. C	14 days	Methods 5031/8260	24.0	0.00012
Tetrachloroethylene	G	Cool to 4 deg. C	14 days	Methods 5031/8260	2.6	0.00011
Toluene	G	Cool to 4 deg. C	14 days	Methods 5031/8260	2.6	0.00011

					Clean Closure Criteria	
Constituent of Concern	**Sample Container**	**Preservation**	**Hold Time**	**SW-846 Test Method[1]**	**Soil [3] RSL (ppm)**	**Tap Water [3] RSL (ppm)**
Trichloroethylene	G	Cool to 4 deg. C	14 days	Methods 5031/8260	14.0	0.002
Xylenes	G	Cool to 4 deg. C	14 days	Methods 5031/8260	2,700.00	0.2
Cresol	G	Cool to <6 deg. C and adjust pH to <2 with H_2SO_4, HCL or $NAHSO_4$	14 days	Methods 3510/8041	91,000.00	0.93
Pentachlorophenol	G	Cool to <6 deg. C and adjust pH to <2 with H_2SO_4, HCL or $NAHSO_4$	14 days	Methods 3510/8041	9.0	0.00056
Nitroglycerine	G	Cool to <6 deg. C	40 days	Methods 3535/8095	62.0	0.0037
RDX	G	Cool to <6 deg. C	40 days	Methods 3535/8095		0.000000
TNT	G	Cool to <6 deg. C	40 days	Methods 3535/8095	79.0	0.0022
2,4,6-Trinitrophenyl Methylnitramine	G	Cool to <6 deg. C	40 days	Methods 3535/8095		
Calcium hypochlorite	G	NA	ASAP	Method 9040		5.0-9.0
Sodium hypochlorite	G	NA	ASAP	Method 9040		5.0-9.0
Sodium hydroxide	G	NA	ASAP	Method 9040		5.0-9.0

FOOTNOTES:

[1] EPA= ENVIRONMENTAL PROTECTION AGENCY, SW-846 METHODS.

[2] Headspace air monitoring for characterization of wastes and areas were described earlier in section 3, monitoring equipment used is either near real-time (MINICAMS®) or laboratory analysis of agent collected on absorbent tube (DAAMS) usually within a few hours of collection. Thus sample container, preservation, or hold time are not at issue. Laboratory procedures developed prior to initial agent operations will provide details of this monitoring.

[3] Regional Screening Levels, which have recently been suggested by EPA as replacements for PRG's.

Figure 7-1 – BGCAPP Closure Phases

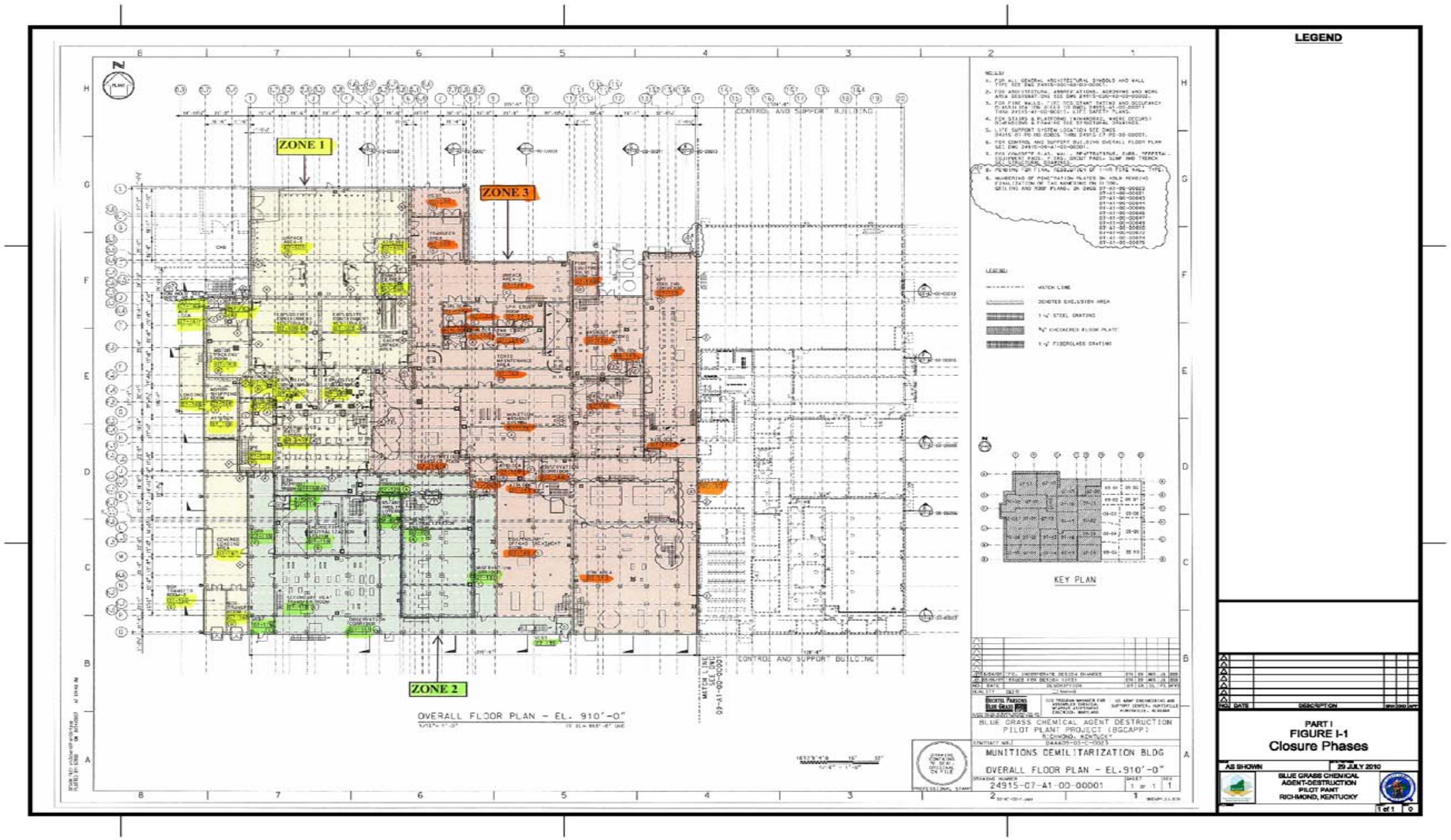
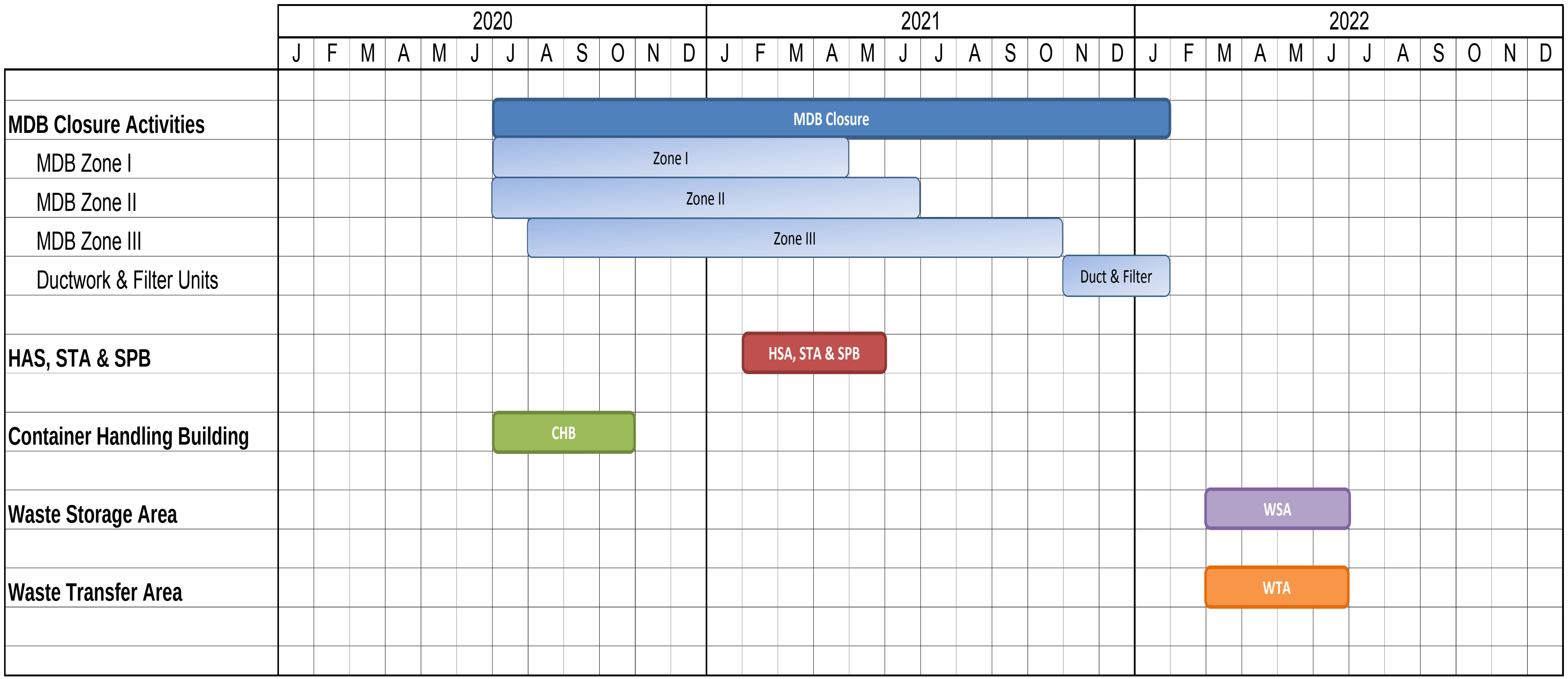


Figure 7-2 – BGCAPP Closure Schedule



8.0 FINANCIAL RESPONSIBILITY

8.1 Financial Assurance for Closure

The Federal government owns the BGCAPP and surrounding property, therefore no financial assurance is necessary.

8.2 Liability Coverage

The Federal government owns the BGCAPP and surrounding property, therefore no liability coverage is necessary.

9.0 SIGNATORIES

9.1 Owner Address

The BGCAPP is located on property owned by the Federal government/U.S. Army and the Army organization responsible for managing this property is the BGAD. The signatory for this organization is the Commander of BGAD located at the following address:

Commander, Blue Grass Army Depot
431 Battlefield Memorial Highway
Richmond, Kentucky 40475-5901

9.2 Operator Address

The BGCAPP operator is the Bechtel Parsons Blue Grass Team (BPBGT). The responsible signatory for this commercial organization is the General Manager located at the following address:

Project Manager, Bechtel Parsons Blue Grass
830 Eastern Bypass, Suite 106
Richmond, Kentucky 40475

9.3 Public Notice Information

This application is a revision to the original RD&D Permit application submitted by BGCAPP. The original RD&D Permit Application was presented to the public during a two-hour meeting open to the public on January 22, 2004 between 6 and 8 p.m. The meeting was held at the following location:

Carl D. Perkins Conference Center
Eastern Kentucky University
Kit Carson Drive, Richmond, Kentucky

In the future, BGCAPP may schedule and hold a public meeting to present this permit application revision (Revision No. 5). However, whether this public meeting will occur and the location, date, and time of this public meeting have not been established.

Blue Grass Chemical Agent-Destruction Pilot Plant
Resource Conservation and Recovery Act
Research Demonstration & Development Permit Application
Revision 5

Submitted To:

Energy and Environment Cabinet

Kentucky Department for Environmental Protection

Division of Waste Management

200 Fair Oaks Lane, 2nd Floor

Frankfort, Kentucky 40601

Submitted By:

Blue Grass Army Depot

431 Battlefield Memorial Highway

Richmond, Kentucky 40475-5060

and

Bechtel Parsons Blue Grass

830 Eastern Bypass, Suite 106

Richmond, Kentucky 40475

VOLUME 2

Date: 13 MAR 2014

Phase 1 RCRA Drawings

Document	Sheet	Description	Rev	Rev Date	System
24915-00-M6-00-00010	1	NON-FACILITY SPECIFIC SYMBOLS AND LEGEND P AND ID	4	2/4/2012	General
24915-00-M6-00-00011	1	NON-FACILITY SPECIFIC SYMBOLS AND LEGEND P AND ID	4	1/11/2011	General
24915-00-M6-00-00012	1	NON-FACILITY SPECIFIC SYMBOLS AND LEGEND P AND ID	3	2/4/2012	General
24915-00-M6-00-00013	1	NON-FACILITY SPECIFIC SYMBOLS AND LEGEND P AND ID	3	2/4/2012	General
24915-00-M6-00-00014	1	NON-FACILITY SPECIFIC SYMBOLS AND LEGEND P AND ID	3	2/4/2012	General
24915-00-M6-00-00015	1	NON-FACILITY SPECIFIC SYMBOLS AND LEGEND P AND ID	1	10/5/2007	General
24915-07-M5-MPT-00001	1	MDB METAL PARTS TREATMENT PROCESS FLOW DIAGRAM - REVS. A-C WERE 07-M5-TMP-00001	9	9/25/2013	MPT
24915-07-M5-OTM-00001	1	MDB OFFGAS TREATMENT MPT PROCESS FLOW DIAGRAM - REVS. A-C WERE 07-M5-QGM-00001 SHT 1 OF 4	10	9/18/2013	OTM
24915-07-M6-OTM-00001	1	MDB MPT THERMAL OXIDIZER UNIT LN 1 PID	8	5/23/2012	OTM
24915-07-M6-OTM-00002	1	MDB MPT THERMAL OXIDIZER UNIT - LN 2 PID	4	5/23/2012	OTM
24915-07-M6-OTM-00011	1	MDB MPT OFFGAS VENT VALVING PID	7	1/15/2009	OTM
24915-07-M6-OTM-00013	1	MDB SCRUBBER RECIRCULATION COOLERS PID	8	5/23/2012	OTM
24915-07-MVD-SDS-00001	0	SPENT DECON HOLDING-AGENT WASHOUT TREATMENT TANKS MV-SDS-0101, 0201, 0301	2	9/3/2010	SDS
24915-10-M5-SCWO-00001	0	SPB SCWO PROCESS FLOW DIAGRAM - 10 SHEETS	11	8/21/2013	SCWO
24915-10-M6-SCWO-00013	1	SPB HYDROLYSATE BLEND TANK 1 PID	7	9/24/2012	SCWO
24915-10-M6-SCWO-00014	1	SPB OFF-SPEC TANK AND PRESS. RELIEF VESSEL PID	6	9/24/2012	SCWO
24915-10-M6-SCWO-00015	1	SPB HYDROLYSATE BLEND TANK 2 PID	7	9/24/2012	SCWO

Document	Sheet	Description	Rev	Rev Date	System
24915-10-M6-SCWO-00016	1	SPB HP AIR DISTRIBUTION PID	6	10/22/2012	SCWO
24915-10-M6-SCWO-00018	1	SPB AGENT-ENRGTCS HYDROLYSATE DIST HDR PID	6	10/22/2012	SCWO
24915-10-M6-SCWO-00019	1	SPB PRESSURE RELIEF HEADERS PID	6	10/22/2012	SCWO
24915-10-M6-SCWO-00020	1	SPB BATCH HYDROLYSATE HOLDING TANK PID	6	9/24/2012	SCWO
24915-10-M6-SCWO-00025	1	SPB CONDENSATE COLLECTION POT PID	6	10/22/2012	SCWO
24915-10-M6-SCWO-00026	1	SPB REACTOR BLOWDOWN AND PRESS RELIEF HDR PID	6	10/22/2012	SCWO
24915-10-M6-SCWO-00029	1	SPB HYROL BATCH TANK HEATER P&ID	4	9/24/2012	SCWO
24915-10-M6-SCWO-00030	1	SPB HYROL BLEND TANK HEATERS 1 AND 2 PID	4	9/24/2012	SCWO
24915-10-M6-SCWO-01012	1	SPB TRAIN 1 QUENCH WATER AND HYDROL FEED PID	7	7/1/2013	SCWO
24915-10-M6-SCWO-01013	1	SPB TRAIN 1 REACTOR PID	7	7/1/2013	SCWO
24915-10-M6-SCWO-01014	1	SPB TRAIN 1 EFFLUENT COOLING PID	7	7/1/2013	SCWO
24915-10-M6-SCWO-01015	1	SPB TRAIN 1 GAS-LIQUID SEPARATION PID	7	7/1/2013	SCWO
24915-10-M6-SCWO-01019	1	SPB TRAIN 1 TOC SAMPLE ANALYZER PID	4	10/22/2012	SCWO
24915-10-M6-SCWO-02012	1	SPB TRAIN 2 QUENCH WATER AND HYDROL FEED PID	4	7/1/2013	SCWO
24915-10-M6-SCWO-02013	1	SPB TRAIN 2 REACTOR PID	4	7/1/2013	SCWO
24915-10-M6-SCWO-02014	1	SPB TRAIN 2 EFFLUENT COOLING PID	4	7/1/2013	SCWO
24915-10-M6-SCWO-02015	1	SPB TRAIN 2 GAS-LIQUID SEPARATION PID	4	7/1/2013	SCWO
24915-10-M6-SCWO-02019	1	SPB TRAIN 2 TOC SAMPLE ANALYZER PID	3	10/22/2012	SCWO
24915-10-M6-SCWO-03012	1	SPB TRAIN 3 QUENCH WATER AND HYDROL FEED PID	4	7/1/2013	SCWO

Document	Sheet	Description	Rev	Rev Date	System
24915-10-M6-SCWO-03013	1	SPB TRAIN 3 REACTOR PID	4	7/1/2013	SCWO
24915-10-M6-SCWO-03014	1	SPB TRAIN 3 EFFLUENT COOLING PID	4	7/1/2013	SCWO
24915-10-M6-SCWO-03015	1	SPB TRAIN 3 GAS-LIQUID SEPARATION PID	4	7/1/2013	SCWO
24915-10-M6-SCWO-03019	1	SPB TRAIN 3 TOC SAMPLE ANALYZER PID	3	10/22/2012	SCWO
24915-07-B2-MPT-00001	0	MPT INTERFACE CONNECTION DRAWING – 20 SHEETS	4	7/22/2010	MPT
24915-07-M6-ANS-00020	1	MDB AGENT HYDROLYSATE SAMPLER PID	9	5/16/2011	ANS
24915-07-M6-EBH-00001	1	MDB EBH BLAST DOORS (FIRST LEVEL) P AND ID	4	2/15/2012	EBH
24915-07-M6-EBH-00002	1	MDB EBH BLAST DOORS (SECOND LEVEL) P AND ID	4	2/13/2012	EBH
24915-07-M6-EBH-01005	1	EBH CONDENSATE TANK PID	9	5/6/2010	EBH
24915-07-M6-EBH-01006	1	EBH STM-WTR AND CHILLED SEC. LOOP PID	9	5/6/2010	EBH
24915-07-M6-EBH-01018	1	EBH NITROGEN SUPPLY PID	4	2/3/2009	EBH
24915-07-M6-EBH-01021	1	EBH UNIT 1 FEED VALVES PID	5	5/6/2010	EBH
24915-07-M6-EBH-01022	1	EBH UNIT 2 FEED VALVES PID	5	5/6/2010	EBH
24915-07-M6-EBH-01023	1	EBH UNIT 3 FEED VALVES PID	5	5/6/2010	EBH
24915-07-M6-EBH-01030	1	EBH CAUSTIC HEATER PID	9	5/6/2010	EBH
24915-07-M6-EBH-01035	1	EBH UNIT 1 PID	11	1/31/2013	EBH
24915-07-M6-EBH-01036	1	EBH UNIT 2 PID	7	1/31/2013	EBH
24915-07-M6-EBH-01037	1	EBH UNIT 3 PID	8	1/31/2013	EBH
24915-07-M6-EBH-01085	1	EBH HYDROLYSATE COLLECTION PID	10	5/24/2011	EBH
24915-07-M6-ENS-00001	1	MDB ENR FEED 50 PERCENT CAUSTIC PID	7	7/6/2011	ENS
24915-07-M6-ENS-00025	1	MDB ENR FEED OTE CONDENSATE P&ID	5	5/16/2007	ENS
24915-07-M6-MCS-00001	1	MDB MPT COOLING SYSTEM - LINE 1 PID	6	9/10/2012	MCS
24915-07-M6-MCS-00002	1	MDB MPT COOLING SYSTEM - LINE 2 PID	6	9/10/2012	MCS

Document	Sheet	Description	Rev	Rev Date	System
24915-07-M6-OTE-00007	1	MDB EBH SCRUBBER RECIRC PUMP PID	8	2/8/2012	OTE
24915-07-M6-PHS-00051	1	MDB PROJECTILE INPUT CONVEYOR PIPING AND INSTRUMENT DIAGRAM	5	7/6/2009	PHS
24915-07-M6-RHS-00051	1	MDB ROCKET PROCESSING SYSTEM DWG1-LN1 PID	4	8/12/2009	RHS
24915-07-M6-RHS-00052	1	MDB ECV CONVEYOR DWG 1 - LINE 1 PID	5	10/8/2012	RHS
24915-07-M6-RHS-00053	1	MDB ECV CONVEYORS DWG 2 - LINE 1 PID	5	12/22/2010	RHS
24915-07-M6-RHS-00056	1	MDB ROCKET SHEAR MACHINE - LINE 1 PID	7	10/8/2012	RHS
24915-07-M6-RHS-00059	1	MDB ROCKET PROCESSING SYSTEM DWG1-LN2 PID	4	8/12/2009	RHS
24915-07-M6-RHS-00060	1	MDB ECV CONVEYORS DWG 1 - LINE 2 PID	6	10/8/2012	RHS
24915-07-M6-RHS-00061	1	MDB ECV CONVEYORS DWG 2 - LINE 2 PID	7	10/8/2012	RHS
24915-07-M6-RHS-00064	1	MDB ROCKET SHEAR MACHINE - LINE 2 PID	7	10/8/2012	RHS
24915-07-M6-RHS-00069	1	MDB SFT BOX LOAD CONVEYOR PIPING AND INSTRUMENT DIAGRAM	2	3/1/2007	RHS
24915-07-M6-RHS-00070	1	MDB MOTOR BOX LOAD AND BUFFER CONVEYORS PID	3	8/12/2009	RHS
24915-07-M6-RHS-00071	1	MDB BUFFER AND TRANSFER CONVEYORS P&ID	2	3/1/2007	RHS
24915-07-M6-RHS-00072	1	MDB MONITORING AIRLOCK AND CONVEYOR PID	6	10/8/2012	RHS
24915-07-M6-RHS-00074	1	MDB FULL CONTAINER OUTPUT CONVEYOR P&ID	2	3/1/2007	RHS
24915-07-M6-RHS-00075	1	MDB MOTOR-SFT EMPTY BOX INPUT CONVEYOR P&ID	2	3/1/2007	RHS
24915-07-M6-RHS-00076	1	MDB MPR INLET AIRLOCK AND CONVEYOR PID	6	10/8/2012	RHS
24915-07-M6-RHS-00077	1	MDB RSM-1 HYDRAULIC SYSTEM SHT-1 P&ID	3	10/8/2012	RHS
24915-07-M6-RHS-00078	1	MDB RSM-1 HYDRAULIC SYSTEM SHT-2 P&ID	2	10/8/2012	RHS

Document	Sheet	Description	Rev	Rev Date	System
24915-07-M6-RHS-00079	1	MDB RSM-2 HYDRAULIC SYSTEM SHT-1 P&ID	2	10/8/2012	RHS
24915-07-M6-RHS-00080	1	MDB RSM-2 HYDRAULIC SYSTEM SHT-2 P&ID	2	10/8/2012	RHS
24915-07-M6-RHS-00081	1	MDB RCM CUTTER AND TABLE ASSEMBLY LN-1 PID	5	10/8/2012	RHS
24915-07-M6-RHS-00082	1	MDB RCM SFT REMOVAL ASSEMBLY LN-1 PID	5	10/8/2012	RHS
24915-07-M6-RHS-00083	1	MDB RCM ROTATING CONVEYOR LN-1 PID	4	10/8/2012	RHS
24915-07-M6-RHS-00084	1	MDB RCM CUTTER AND TABLE ASSEMBLY LN-2 PID	3	10/8/2012	RHS
24915-07-M6-RHS-00085	1	MDB RCM SFT REMOVAL ASSEMBLY LN-2 PID	4	10/8/2012	RHS
24915-07-M6-RHS-00086	1	MDB RCM ROTATING CONVEYOR LN-2 PID	4	10/15/2012	RHS
24915-07-M6-SDS-00010	1	MDB SPENT DECON SAMPLER PIPING AND INSTRUMENT DIAGRAM	10	8/8/2012	SDS
24915-07-M6-SDS-00011	1	MDB CAT-A SUMP PUMPS DISTRIBUTION HDR PIPING AND INSTRUMENT DIAGRAM	3	3/12/2007	SDS
24915-07-M6-SDS-00012	1	MDB CAT-B SUMP PUMPS DISTRIBUTION HDR PIPING AND INSTRUMENT DIAGRAM	5	4/14/2011	SDS
24915-07-M6-SDS-00013	1	MDB CAT-C SUMP PUMPS DISTRIBUTION HDR PIPING AND INSTRUMENT DIAGRAM	4	6/10/2009	SDS
24915-07-M6-THS-00001	1	MDB TMA LOAD AND INPUT AIRLOCK/CONVEYOR PID	7	2/27/2012	THS
24915-07-M6-THS-00002	1	MDB TMA TRANSFER CONVEYORS PID	7	2/27/2012	THS
24915-07-M6-THS-00004	1	MDB TMA OUTPUT AIRLOCK/CONVEYOR PID	6	2/27/2012	THS
24915-07-M6-THS-00005	1	MDB TURNTABLE CONVEYOR NO. 3 PID	5	1/24/2012	THS
24915-07-M6-THS-00006	1	MDB MPT BUFFER CONVEYOR PID	5	2/27/2012	THS
24915-07-M6-THS-00007	1	MDB TURNTABLE CONVEYOR NO. 2 PID	5	1/24/2012	THS
24915-07-M6-THS-00008	1	MDB TRAY INUPT CONVEYORS PID	3	7/23/2009	THS
24915-07-M6-THS-00009	1	MDB TRAY INPUT AIRLOCK/CONVEYOR NO. 1 PID	6	2/27/2012	THS

Document	Sheet	Description	Rev	Rev Date	System
24915-07-M6-THS-00010	1	MDB TRAY TRANSFER CONVEYOR PID	5	2/27/2012	THS
24915-07-M6-THS-00011	1	MDB TRAY INPUT AIRLOCK/CONVEYOR NO. 2 PID	5	2/27/2012	THS
24915-07-M6-THS-00012	1	MDB PROJECTILE BUFFER CONVEYOR PID	5	2/27/2012	THS
24915-07-M6-THS-00013	1	MDB TURNTABLE CONVEYOR NO. 1 PID	4	1/24/2012	THS
24915-07-M6-THS-00015	1	MDB RESIDUE BUFFER CONVEYOR PID	5	2/27/2012	THS
24915-07-M6-THS-00016	1	MDB MWS INPUT AIRLOCK/CONVEYOR PID	6	2/27/2012	THS
24915-07-M6-THS-00019	1	MDB TRAY TRANSFER COOLING CONVEYOR LN 1 PID	5	2/27/2012	THS
24915-07-M6-THS-00020	1	MDB TRAY TRANSFER COOLING CONVEYOR LN 2 PID	5	2/27/2012	THS
24915-07-M6-THS-00021	1	MDB TRAY BUFFER COOLING CONVEYORS PID	3	2/27/2012	THS
24915-07-MTD-ACS-00001	0	AGENT HOLDING TANK MT-ACS-0105	1	11/3/2009	ACS
24915-07-MTD-ACS-00002	0	AGENT SURGE TANK MT-ACS-0106	1	11/3/2009	ACS
24915-07-MTD-ANS-00001	0	AGENT HYDROLYSATE SAMPLING TANKS MT-ANS-0103, 0203, 0303	2	11/12/2009	ANS
24915-10-DB-00-00014	1	SPB PERIMETER FOOTINGS AND SLAB SECTIONS AND DETAILS	2	9/24/2012	SPB
24915-10-DBC-00-00004	0	GAS BOTTLE CANOPY, SUPPORT, EQUIPMENT AND MISC FDN CALCS (SPB)	D	2/1/2010	SPB
24915-10-M6-RO-00007	1	SPB MULTIMEDIA FILTERS PID	2	8/6/2011	RO
24915-10-M6-RO-00008	1	SPB MULTIMEDIA FILTERS PID	2	8/6/2011	RO
24915-10-M6-RO-00017	1	SPB RO PERMEATE PUMPS PID	2	8/25/2009	RO
24915-10-M6-RO-00021	1	SPB SCWO EFFLUENT CAUSTIC DAY TK AND PUMP PID	3	5/22/2012	RO
24915-10-M6-RO-00022	1	SPB CANISTER FILTER AND RO UNIT 0101 PID	3	8/6/2011	RO
24915-10-M6-RO-00023	1	SPB CANISTER FILTER AND RO UNIT 0201 PID	3	8/6/2011	RO
24915-10-M6-RO-00024	1	SPB CANISTER FILTER AND RO UNIT 0301 PID	3	8/6/2011	RO
24915-10-M6-SCWO-00021	1	SPB SOLID FEED ADDITIVES PID	7	4/26/2012	SCWO

Document	Sheet	Description	Rev	Rev Date	System
24915-10-M6-SCWO-00022	1	SPB HCL AND NAOH FEED ADDITIVES PID	6	1/26/2012	SCWO
24915-10-M6-SCWO-00023	1	SPB H2S04 FEED ADDITIVES PID	6	1/26/2012	SCWO
24915-10-M6-SCWO-00024	1	SPB FLUSH WATE HEATER PID	5	1/26/2012	SCWO
24915-10-M6-SCWO-00027	1	SPB GAS EFFLUENT DUCT HEATER PID	5	10/22/2012	SCWO
24915-10-M6-SCWO-01011	1	SPB TRAIN 1 REACTOR FUEL FEED PID	7	7/1/2013	SCWO
24915-10-M6-SCWO-01016	1	SPB TRAIN 1 GAS ANALYZER SYSTEM PID	6	1/26/2012	SCWO
24915-10-M6-SCWO-01017	1	SPB TRAIN 1 FEED WATER AND PREHEATER PID	7	7/1/2013	SCWO
24915-10-M6-SCWO-02011	1	SPB TRAIN 2 REACTOR FUEL FEED PID	4	7/1/2013	SCWO
24915-10-M6-SCWO-03011	1	SPB TRAIN 3 REACTOR FUEL FEED PID	4	7/1/2013	SCWO
24915-11-DBC-00-00002	0	HSA MAT FOUNDATION CONTAINMENT CAPACITY EVALUATION	C	7/12/2012	HSS
24915-11-M6-HSS-00006	1	HSA ORG HYDRO PUMPS AND SUMP PUMP TR-1 PID	5	6/11/2012	HSS
24915-11-M6-HSS-00009	1	HSA ORGANIC HYDROLYSATE PUMPS TRAIN 2 PID	3	6/12/2012	HSS

NAMING CONVENTIONS DRAWING NUMBERS (NOTE 1)

24915-07-M6-MPTC-00001

- BGCAPP PROJECT NUMBER
- FACILITY CODE
- DOCUMENT TYPE
- SYSTEM LOCATOR
- DRAWING SEQUENTIAL NUMBER

DOCUMENT TYPE (NOTE 1)

M2	CATALYST & CHEMICAL SUMMARY
M4	HEAT AND MATERIAL BALANCE
M5	FLOW DIAGRAM
M6	P&ID
MJ	MATERIAL HANDLING
MO	MULTIPURPOSE DRAWING

EQUIPMENT NUMBERS

07-MP-MPTC-0001A

- FACILITY CODE
- COMPONENT IDENTIFIER
- SYSTEM LOCATOR
- SEQUENCE NUMBER
- SUFFIX

VALVE NUMBERS

V 14 A A

- VALVE (MANUAL OR CHECK)
- SEQUENCE NUMBER
- SUFFIX FOR MULTIPLE TRAINS
- SECONDARY SUFFIX FOR TRAINS WITHIN MULTIPLE TRAINS

VALVE SIZE IS THE LINE SIZE, OR IS SHOWN ON THE P&ID.

VALVE SEQUENCE NUMBERS FOR EACH FACILITY (BLDG OR AREA) WILL START AT V1, V2 ETC; AND WILL BE UNIQUE FOR EACH FACILITY FOR FULL DESCRIPTION OF VALVE NUMBERING PROCEDURE, SEE STANDARD COMPONENT NUMBERING PROCEDURE, SDN-24915-000-GPP-GEC-00003

IN LINE/SPECIALTY COMPONENT NUMBERS

PIPING SPECIALTY NUMBERS

SC 12 A A

- PREFIX
- SEQUENCE NUMBER
- SUFFIX FOR MULTIPLE TRAINS
- SECONDARY SUFFIX FOR TRAINS WITHIN MULTIPLE TRAINS

EACH PIPING SPECIALTY ITEM SHALL HAVE ONE OF THE FOLLOWING PREFIXES:

SC- HOSE, HOSE CONNECTIONS
SH- ENGINEERED SUPPORTS
SJ- EXPANSION JOINTS
SN- FOR ANY KIND OF STRAINER
SM- FOR ALL OTHER MISCELLANEOUS PIPING SPECIALLTY ITEMS

EACH PIPING SPECIALTY ITEM NUMBER IS UNIQUE AND WILL NOT BE REPEATED REGARDLESS OF THE FACILITY CODE

FOR FULL DESCRIPTION OF PIPING SPECIALTY ITEM NUMBERING PROCEDURE, SEE STANDARD COMPONENT NUMBERING PROCEDURE: SDN-24915-000-GPP-GEC-00003

MODULE NUMBERS

07-MX-ENS-0101

- FACILITY CODE
- COMPONENT GROUP CODE
- SYSTEM LOCATOR
- SEQUENCE NUMBER

FOR FULL DESCRIPTION OF MODULE NUMBERING PROCEDURE, SEE STANDARD COMPONENT NUMBERING PROCEDURE: SDN-24915-000-GPP-GEC-00003

PIPING IDENTIFICATION

07- CHPS-1001-2"-W-HC

- EMBEDDED FACILITY CODE (NOT VISIBLE)
- FLUID SERVICE CODE
- SEQUENCE NUMBER
- LINE SIZE
- PIPING MATERIAL CLASS
- INSULATION CODE (IF APPLICABLE)
  - PP- PERSONNEL PROTECTION
  - HC- HEAT CONSERVATION
  - EM- EXPANDED METAL
  - ET- ELECTRIC TRACE
  - IC- INSULATION COLD

PROCESS FLOW

MAIN PROCESS FLOW

SECONDARY PROCESS FLOW

ELECTRIC TRACING
(NOTE 5)

P&ID CONNECTORS

OFF PAGE PIPING CONNECTORS

OPEN DRAIN

BOUNDARIES

BREAK POINT

TYPES OF BOUNDARIES:

PIPE CLASS CHANGE
QUALITY LEVEL
SEISMIC CATEGORY
AGENT CONTAMINATION CATEGORY AREA
CLOSURE WASTE TYPE
CLOSURE WASTE PACKAGE NO.
SYSTEM TURNOVER NO.
OP MAINT PACKAGE
DIV OF RESPONSIBLITY INTERFACE & OTHER (e.g. VENDOR)
ABOVE GROUND/BELOW GROUND
ROOM NAME
ROOM NUMBER

VENDOR/MODULE PACKAGE

RESPONSIBILITY BOUNDARY (RICHMOND/PASCO, RICHMOND/GA, ETC.)

BUILDING/AREA BOUNDARY 4 1

EQUIPMENT/PIPING/ INSTRUMENTS SHOWN IN PHANTOM ARE SHOWN ON ANOTHER DRAWING

T TIE-IN POINT (NEW PIPE TO EXISTING PIPE)

FLUID SERVICE CODES

ACS	= AGENT
ACSD	= DILUTED AGENT
ACSH	= AGENT HYDROLYSATE SAMPLE
AF	= ANTI-FOAM CHEMICAL INJECTION
AG	= ANALYZER GAS
AIN	= ACID INJECTION
ANH	= AGENT NEUTRALIZATION HYDROLYSATE
ANT	= ANTI-SCALANT CHEMICAL INJECTION
ATM	= ATMOSPHERIC REFERENCE AIR
BFW	= BOILER FEED WATER
BH	= BLENDED HYDROLYSATE
BIS	= BISULFITE CHEMICAL INJECTION
BLCH	= SODIUM HYPOCHLORITE SOLUTION (5.5% BLEACH)
BR	= BRINE
CA	= COMBUSTION AIR
CAS	= COMPRESSED AIR
CHR	= HVAC CHILLED WATER RETURN
CHS	= HVAC CHILLED WATER SUPPLY
CHPR	= PROCESS CHILLED WATER RETURN
CHPS	= PROCESS CHILLED WATER SUPPLY
CI	= CHEMICAL INJECTION
CP	= COAGULANT AND POLYMER CHEMICAL INJECTION
CSFW	= COLD HP SCWO FEED WATER
CU	= CLARIFIER UNDERFLOW
CWPR	= PROCESS COOLING WATER RETURN
CWPS	= PROCESS COOLING WATER SUPPLY
DCN	= DECON SOLUTION (1% CAUSTIC OR 5.5% NaOCL)
DMWL	= LOW PRESSURE DEMINERALIZED WATER
DMWH	= HIGH PRESSURE DEMINERALIZED WATER (600 PSI)
DS	= DUNNAGE SLURRY
ECB	= EVAPORATIVE COOLER BLOWDOWN
EH	= ENERGETICS HYDROLYSATE
ENH	= ENERGETICS NEUTRALIZATION HYDROLYSATE
EV	= EVAPORATOR/CRYSTALLIZER VAPOR
FG	= FLUE GAS
FOR	= FUEL OIL RETURN
FOS	= FUEL OIL SUPPLY
FPW	= FILTER PRESS WATER (FROM FILTER PRESS)
FWS	= FIRE WATER (SUPPLY)
GEA	= GAS EFFLUENT ANALYSIS
HCH	= HYPOCHLORITE CHEMICAL INJECTION
HCL	= HYDROCHLORIC ACID
HCSE	= HIGH PRESSURE (HP) COOLED SCWO EFFLUENT
HE	= HELIUM
HHSE	= HOT HP SCWO EFFLUENT
HPA	= HIGH PRESSURE AIR
HPAF	= HP AIR FOR SCWO FEED/PURGE
HPAR	= HP AIR TO REACTOR
HPCD	= HP AIR RECEIVER CONDENSATE
HPCS	= HP CARBON SLURRY
HPF	= HP FUEL
HPGE	= HP GAS EFFLUENT
HPH	= HP HYDROLYSATE
HPHR	= HIGH PRESSURE HYDRAULIC FLUID RETURN
HPHS	= HIGH PRESSURE HYDRAULIC FLUID SUPPLY
HPLR	= HP LIQUID RELIEF
HPPA	= HP PURGE AIR
HPQW	= HP QUENCH WATER
HPRB	= HP REACTOR BLOWDOWN
HPRH	= HP RELIEF HEADERS/LINES
HSFW	= HOT HP SCWO FEED WATER
HWR	= HVAC HOT WATER RETURN
HWS	= HVAC HOT WATER SUPPLY
HWPR	= PROCESS HOT WATER RETURN
HWPS	= PROCESS HOT WATER SUPPLY
HYD	= HYDROGEN GAS
HYPD	= HYDRALUIC FLUID DRAIN
HYPR	= HYDRUALIC FLUID RETURN
HYPS	= HYDRAULIC FLUID SUPPLY
IA	= INSTRUMENT AIR
IPA	= ISOPROPYL ALCOHOL
LCSE	= LOW PRESSURE SCWO EFFLUENT
LOR	= LUBE OIL RETURN
LOS	= LUBE OIL SUPPLY
LPCD	= LOW PRESSURE AIR COMPRESSOR/ RECEIVER CONDENSATE
LPCS	= LOW PRESSURE CARBON SLURRY
LPGE	= LOW PRESSURE GAS EFFLUENT
LPH	= LOW PRESSURE AGENT HYDROLYSATE
LPQW	= LOW PRESSURE QUENCH WATER
LPRH	= LOW PRESSURE RELIEF HEADER
LSS	= LIFE SUPPORT AIR
LW	= LAB WASTE
MPTC	= METAL PARTS TREATER CONDENSATE
MWW	= HIGH PRESSURE (11,000 PSI) WASHOUT WATER
NAHH	= 50% CAUSTIC
NAHL	= 1% CAUSTIC
NAHM	= 18% CAUSTIC
NCD	= NON-CONTAMINATED DRAIN
NG	= NATURAL GAS
NITG	= NITROGEN GAS (80 PSIG)
NITM	= NITROGEN GAS (240 PSIG)
NITL	= NITROGEN LIQUID
NITH	= NITROGEN GAS (400 PSIG)
ONH	= OFF-NORMAL HYDROLYSATE
OSE	= OFF-SPEC EFFLUENT
OTE	= EBH/HDC/ENS OFFGAS
OTEC	= OTE CONDENSATE
OTM	= MPT/ANS OFFGAS
PHC	= pH CORRECTION CHEMICAL INJECTION
PHOS	= PHOSPHORIC ACID
PLA	= PLANT AIR
PLW	= PLANT WATER
PLWH	= HIGH PRESSURE PLANT WATER
PMW	= PMB WASTE WATER
POT	= POTABLE WATER
POTT	= TEMPERED POTABLE WATER
PWS	= PROCESS WATER
RA	= ROOM AIR
RAH	= ROOM AIR HOT
ROP	= REVERSE OSMOSIS PERMEATE
ROR	= REVERSE OSMOSIS REJECT
RW	= RECOVERED WATER
SAN	= SANITARY SEWER (WATER)
SAS	= SULFURIC ACID
SCS	= SPENT CARBON SOLUTION
SCWE	= SCWO EFFLUENT
SCWF	= SCWO BLENDED HYDROLYSATE FEED
SCWW	= SCWO WATER
SDS	= SPENT DECONTAMINATION SOLUTION
SEG	= SCRUBBER EXHAUST GAS
SHTR	= SECONDARY HEAT TRANSFER RETURN
SHTS	= SECONDARY HEAT TRANSFER SUPPLY
SSRW	= SPB SOFTENER REGENERATION WASTE STREAM
SSW	= SPB SOFTENED WATER
STM	= STEAM
STMB	= STEAM BOILER BLOWDOWN
STMC	= STEAM CONDENSATE
STMH	= SUPER HEATED STEAM
USW	= UB SOFTENED WATER

MISCELLANEOUS ABBREVIATIONS

A/M	= AUTOMATIC/MANUAL
AG	= ABOVEGROUND
AHU	= AIR HANDLING UNIT
ASD	= ADJUSTABLE SPEED DRIVER
ATM	= ATMOSPHERE
CAM	= CAVITY ACCESS MACHINE
CO	= CLEANOUT
COS	= CHANGEOVER STATION
CSC	= CAR SEALED CLOSED
CSO	= CAR SEALED OPEN
CTA	= COMMONTROUBLE ALARM
DE	= DE-ENERGIZED
DEO	= DE-ENERGIZED OPEN
DIFF	= DIFFERENTIAL
EL	= ELEVATION
EO	= ENERGIZED OPEN
ET	= ELECTRIC TRACED
F/S/R	= FORWARD/STOP/REVERSE
FC	= FAIL CLOSED
FCS	= FACILITY CONTROL SYSTEM
FDC	= FLOOR DRAIN CONTAMINATED
FDNC	= FLOOR DRAIN NON-CONTAMINATED
FL	= FAIL LAST POSITION
FO	= FAIL OPEN
FP	= FULL PORT
FPS	= FACILITY PROTECTION SYSTEM
FV	= FULL VACUUM
FWD	= FORWARD
HC	= HOSE CONNECTION
HPV	= HIGH POINT VENT
I.D.	= INSIDE DIAMETER
LC	= LOCKED CLOSED
LPD	= LOW POINT DRAIN
LO	= LOCKED OPEN
LOR	= LOCAL/OFF/REMOTE
LT	= LOCKED THROTTLED
MAINT BP	= MAINTENANCE BY-PASS
MH	= MANHOLE (SEWER/SUMP)
MOV	= MOTOR OPERATED VALVE
MW	= MANWAY (VESSELS)
NC	= NORMALLY CLOSED
NNF	= NORMALLY NO FLOW
NO	= NORMALLY OPEN
O/C	= OPEN/CLOSE
REV	= REVERSE
S/S	= START/STOP
SC	= SAMPLE CONNECTION
S/D	= SHUTDOWN
SO	= STEAMOUT
SP	= SET POINT
ST	= STEAM TRACED
STD	= STANDARD
STM	= STEAM
THD	= THREADED CONNECTION
TSO	= TIGHT SHUTOFF
T-T	= TANGENT-TO-TANGENT
TW	= THERMOWELL
TYP	= TYPICAL
U/D	= UP/DOWN
UC	= UTILITY CONNECTION
UG	= UNDERGROUND
US	= UTILITY STATION
VB	= VORTEX BREAKER
VIB	= VIBRATION
VFD	= VARIABLE FREQUENCY DRIVE
Z	= S/D BY FPS
*	= VENDOR SUPPLIED

GENERAL NOTES:

1. REFER TO SDN-24915-000-GPP-GEG-00004 FOR DOCUMENT NUMBERING INSTRUCTIONS, INFORMATION ON DOCUMENT TYPE, SYSTEM LOCATOR AND FACILITY CODE ARE PROVIDED IN THE SDN.
2. DELETED.
3. AGENT CONTAMINATION CATEGORY AREAS:
   - A- AREAS THAT HAVE ROUTINE CONTAMINATION, EITHER LIQUID OR VAPOR.
   - B- AREAS WITH HIGH PROBABILITY OF AGENT VAPOR CONTAMINATION RESULTING FROM ROUTINE OPERATIONS.
   - C- AREAS WITH LOW PROBABILITY OF AGENT VAPOR CONTAMINATION.
   - D- AREAS THAT ARE UNLIKELY TO EVER HAVE AGENT CONTAMINATION.
   - E- AREAS KEPT FREE OF ANY CHANCE OF AGENT CONTAMINATION BARRING A MAJOR EVENT.
4. DELETED.
5. ELECTRIC TRACING WILL INDICATE REQUIRED TEMPERATURE IF OTHER THAN 40°F (FREEZE PROTECTION).
6. INSULATION/ELECTRIC TRACING FOR PUMPS/COMPRESSORS/ROTATING EQUIPMENT SHALL BE CONSISTENT WITH CORRESPONDING SUCTION AND DISCHARGE LINES.
7. FOR TERMINATION OF ELECTRIC HEAT TRACING NEAR WALL PENETRATIONS, SEE THE ELECTRICAL HEAT TRACING PLAN. 4 2

BASED ON PUEBLO P&ID 24852-M6-M00-M0001 REV.B

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4 (2)	01/31/12	IFC, INCORPORATED DCN-350 & -696	PEB	JDC	SA	BBB	BBB
3 (8)	10/04/07	IFC, ADDED NOTE 6, UPDATED SYMBOLS, CHGD Q LEVEL	JP	JLL	PEB	JB	TAV
2 (5)	05/10/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JP	JSM	PEB	JB	BBB
1 (13)	10/31/05	IFD INCORPORATE DESIGN DEVELOPMENT	RJ	JLL	PEB	JB	PGK
0	01/10/05	ISSUED FOR DESIGN (IFD)	JP	EW	PEB	JB	JU

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

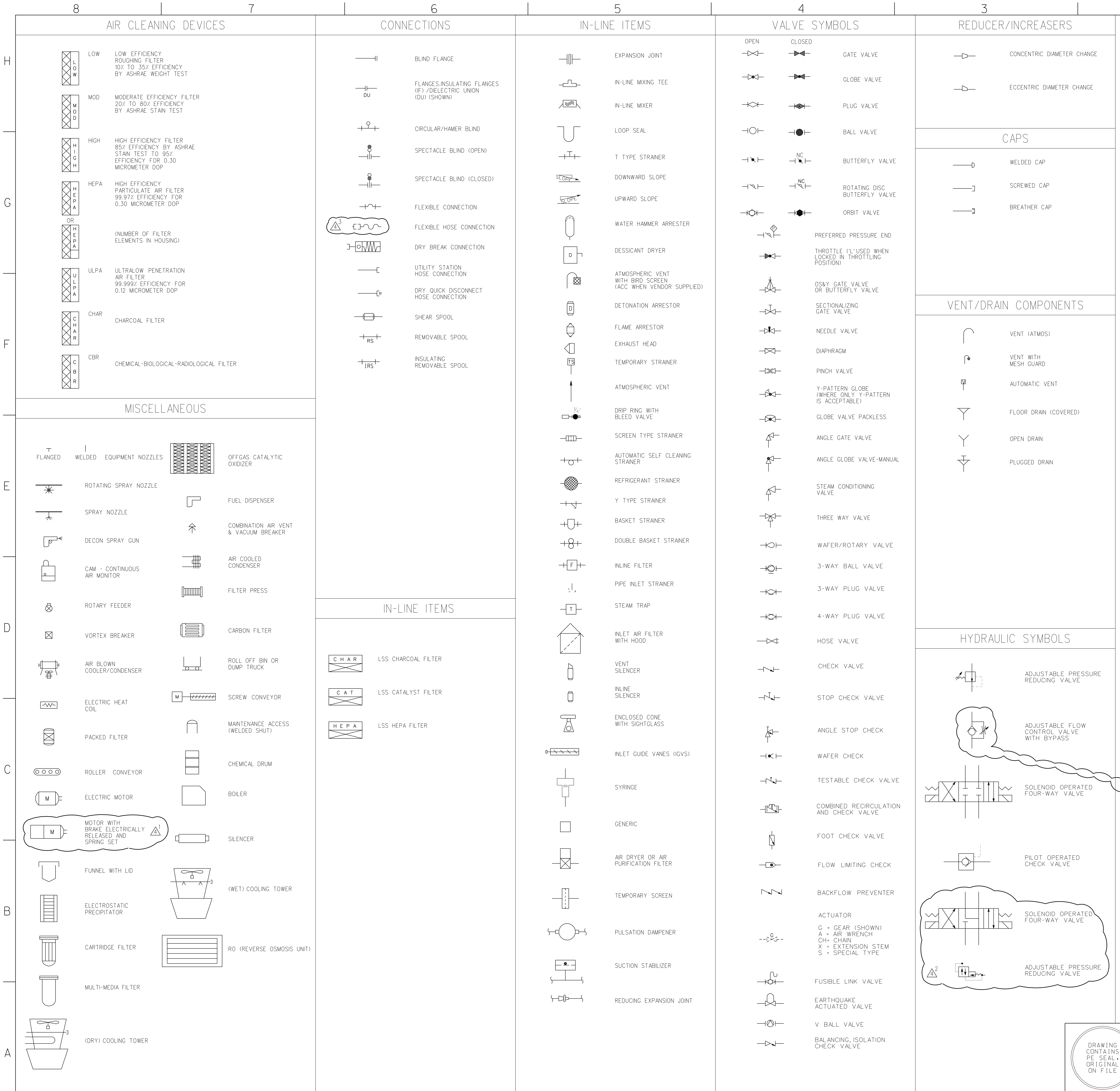
BGCAPP - NON FACILITY SPECIFIC SYMBOLS AND LEGEND PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-00-M6-00-00010 | SHEET 1 OF 1 | REV 4

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

BGCAPP_DGN.BDR

00M00010.pid 02/01/12
DESIGN FILE: DGNSPEC$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
PLOTTED BY: USER$ ON DATE$$$$$$ AT SYTIME USING COLOR$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$



GENERAL NOTES:

1. SEE 24915-00-M6-00-00010.
2. LIQUID LINES CONTAINING AGENT SHALL HAVE DOUBLE DRAIN/VENT VALVES WITH QUICK DISCONNECTS. THIS REQUIREMENT ALSO APPLIES TO AGENT VAPOR LINES WHERE LIQUID MAY BE PRESENT. ALL OTHER DRAIN/VENT VALVES CAN BE PLUGGED.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	01/07/11	IFC, INCORPORATED DCN-198	PEB	MDV	SA	BBB	BBB
3	10/04/07	IFC, UPDATED SYMBOLS, CHANGED Q LEVEL	JP	JLL	PEB	JB	TAV
2	05/10/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JP	JSM	PEB	JB	BBB
1	10/31/05	IFD INCORPORATE DESIGN DEVELOPMENT	RJ	JLL	PEB	JB	PGK
0	01/10/05	ISSUED FOR DESIGN (IFD)	JP	EW	PEB	JB	JU

QUALITY ☐ Q ☒ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

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PROFESSIONAL STAMP

BGCAPP - NON FACILITY SPECIFIC SYMBOLS AND LEGEND PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-00-M6-00-00011 | SHEET 1 OF 1 | REV 4

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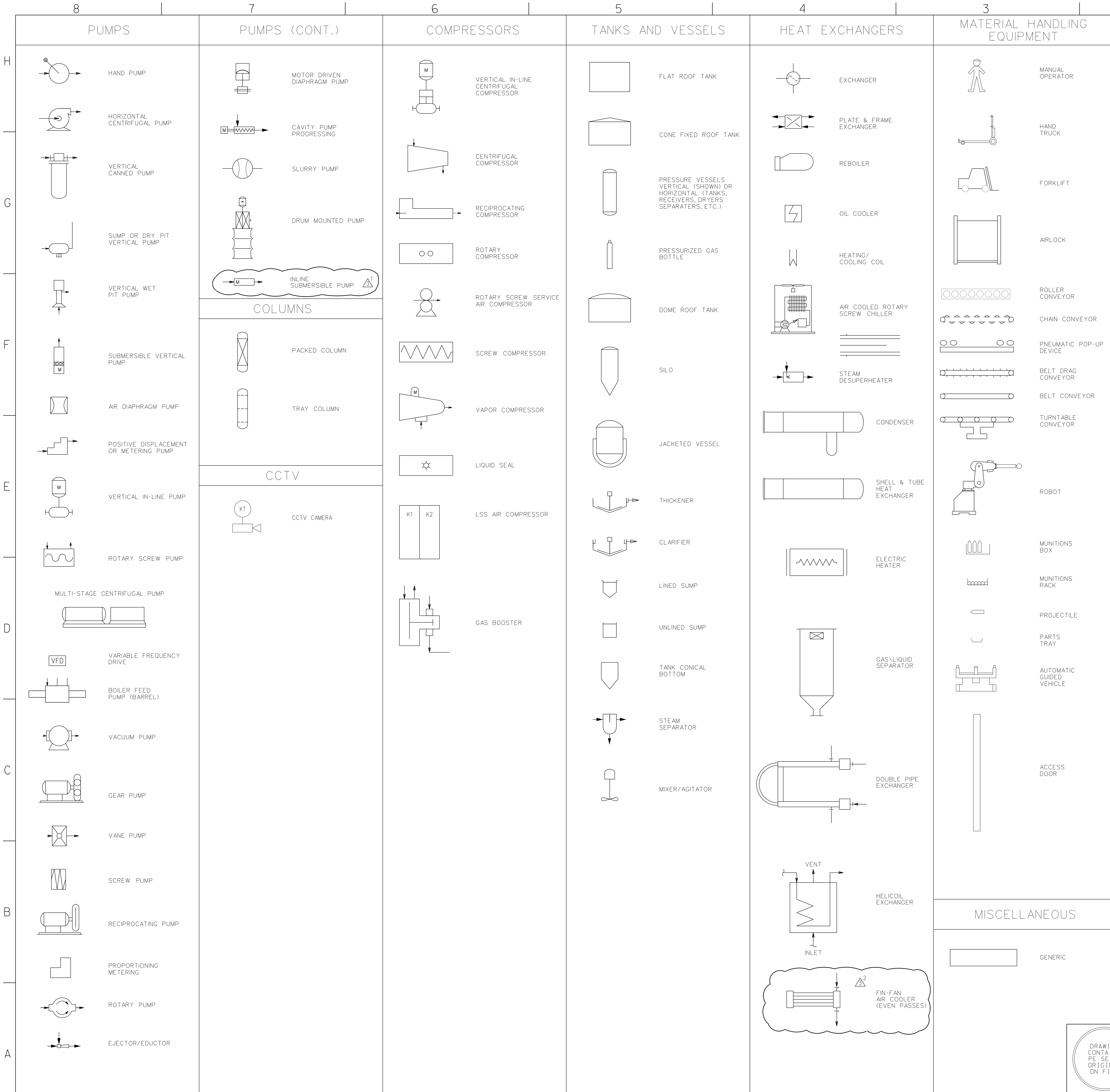

GENERAL NOTES:

1. SEE 24915-00-M6-00-00010.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

BASED ON PUEBLO P&ID 24852-M6-M00-M0004 REV.C

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	01/31/12	IFC, INCORPORATED DCN-696	PEB	JDC	SA	BBB	BBB
2	10/04/07	ISSUED FOR CONSTRUCTION (IFC), CHANGED Q LEVEL	JP	JLL	PEB	JB	TAV
1	10/31/05	IFD INCORPORATE DESIGN DEVELOPMENT	RJ	JLL	PEB	JB	PGK
0	01/10/05	ISSUED FOR DESIGN (IFD)	JP	EW	PEB	JB	JU

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

BGCAPP - NON FACILITY SPECIFIC SYMBOLS AND LEGEND PIPING & INSTRUMENT DIAGRAM

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DRAWING NUMBER 24915-00-M6-00-00012 | SHEET 1 OF 1 | REV 3

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INSTRUMENT LINE SYMBOLS

- INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
- PNEUMATIC SIGNAL (TUBING)
- PNEUMATIC SIGNAL (HOSE)
- ELECTRIC SIGNAL
- HYDRAULIC SIGNAL
- CAPILLARY TUBE
- GUIDED ELECTROMAGNETIC, RADAR SONIC SIGNAL, OR CONDUCTIVITY PROBE
- ELECTROMAGNETIC, RADAR OR SONIC SIGNAL (NOT GUIDED)
- INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
- MECHANICAL LINK

TYP. INSTRUMENT TO PROCESS CONNECTIONS (ANY VARIABLE)

- DIRECT CONNECTION
- CAPILLARY FILLED SYSTEM WITH DIAPHRAGM SEAL
- IN-LINE DEVICE
- ELECTROMAGNETIC OR SONIC
- DIRECT CONNECTION WITH PURGE (AIR) (NOTE 5) — P, IA
- ATTACHED TO PROCESS PIPE BUT DOES NOT PENETRATE

CONDITIONING SYMBOLS

I/I TYPICAL SYMBOL

E/P	VOLTAGE TO PNEUMATIC
I/P	CURRENT TO PNEUMATIC
R/I	RESISTOR TO CURRENT
E/I	VOLTAGE TO CURRENT
P/I	PNEUMATIC TO CURRENT
E/E	VOLTAGE BOOSTER
I/I	CURRENT TO CURRENT ISOLATER

FUNCTION SYMBOLS

- LOCAL (FIELD) MOUNTED INSTRUMENT OR DEVICE
- CONTROL ROOM, NORMALLY INACCESSIBLE OR BEHIND PANEL INSTRUMENT OR DEVICE
- CONTROL ROOM INSTRUMENT OR DEVICE
- FIELD PANEL INSTRUMENT OR DEVICE
- NORMALLY INACCESSIBLE OR BEHIND FIELD PANEL INSTRUMENT OR DEVICE
- CONTROL ROOM SHARED DISPLAY INDICATES INFORMATION ACCESSIBLE TO OPERATOR FOR MONITORING AND CONTROL
- SOFTWARE SHARED FUNCTION NOT DISPLAYED TO OPERATOR
- LOCAL PANEL PLC SHARED DISPLAY INDICATES INFORMATION ACCESSIBLE TO OPERATOR FOR MONITORING AND CONTROL
- FIRE CONTROL PANEL (2)
- SOFTWARE LOGIC INTERLOCK
- DIRECT DIGITAL CONTROL (DDC) SHARED DISPLAY INDICATES INFORMATION ACCESSIBLE TO OPERATOR FOR MONITORING AND CONTROL
- DIRECT DIGITAL CONTROL (DDC) SOFTWARE LOGIC INTERLOCK
- HARDWARE LOGIC INTERLOCK

∫	INTEGRATE
√	SQUARE ROOT EXTRACTOR
1:3	GAIN OR ATTENUATE (INPUT:OUTPUT)
Σ	ADD OR SUMMATION
AVG	AVERAGE
Δ	DIFFERENCE
÷	DIVIDE
X	MULTIPLY
f(x)	CHARACTERIZE
<	LOW SELECTOR
>	HIGH SELECTOR
± + −	BIAS
REV	REVERSE
DIR	DIRECT
Σ	MATHEMATIC CALCULATION FUNCTION
SEL	SELECT

INSTRUMENT NUMBERING

PDSHH

SEQUENCE CODE

1 3 - J Q - B F W - P D S H H 0 0 0 1 A

- PREFIX
- SEQUENCE NUMBER
- SUFFIX
- SYSTEM LOCATOR CODE
- COMPONENT GROUP CODE
- FACILITY CODE

MISCELLANEOUS SYMBOLS AND EXAMPLES

- PILOT LIGHT
- SIGNAL CONTINUATION ON THE SAME DRAWING. THE POINTER ON THE CIRCLE INDICATES THE DIRECTION TO THE PAIR POINT ON THE DRAWING
- DAMPENER

FLOW

- FIT, FE — FLOW ORIFICE WITH DIFFERENTIAL TYPE FLOW TRANSMITTER (CORNER TAPS, FLANGE TAPS OR PIPE TAPS)
- FIT, FE — VENTURI TUBE OR FLOW NOZZLE WITH DIFFERENTIAL TYPE FLOW TRANSMITTER
- FIT, FE — SINGLE PORT PITOT OR PITOT - VENTURI TUBE WITH DIFFERENTIAL TYPE FLOW TRANSMITTER
- FIT, FE — AVERAGING PITOT TUBE WITH DIFFERENTIAL TYPE FLOW TRANSMITTER
- FIT, FQI — POSITIVE DISPLACEMENT FLOW TRANSMITTER WITH LOCAL TOTALIZER
- FIT, FE — TURBINE OR PROPELLER TYPE FLOW ELEMENT (TRANSMITTER INTEGRAL TO FLOW ELEMENT)
- FIT, FE — VORTEX OR SWIRL METER TYPE FLOW ELEMENT (TRANSMITTER REMOTE MOUNTED)
- TIT, FIT, FE — VORTEX OR SWIRL METER MULTI-VARIABLE TYPE FLOW ELEMENT (TRANSMITTER INTEGRAL TO FLOW ELEMENT) (NOTE 6)
- FI — VARIABLE AREA FLOW INDICATOR WITH INTEGRAL VALVE
- FIT — VARIABLE AREA FLOW TRANSMITTER WITH INTEGRAL VALVE
- FIT, FE, M — MAGNETIC TYPE FLOW ELEMENT (TRANSMITTER INTEGRAL TO FLOW ELEMENT)
- FIT, FE, M — MAGNETIC TYPE FLOW ELEMENT (TRANSMITTER REMOTE MOUNTED)
- DIT, TIT, FIT, FE — CORIOLIS MULTI-VARIABLE TYPE FLOW ELEMENT (TRANSMITTER INTEGRAL TO FLOW ELEMENT)
- FIT, FE — CORIOLIS TYPE FLOW ELEMENT (TRANSMITTER REMOTE MOUNTED)
- DIT, DE — CORIOLIS DENSITY METER (3)
- FIT, FE, T — THERMAL TYPE FLOW ELEMENT (TRANSMITTER REMOTE MOUNTED)
- FG — FLOW SIGHT GLASS
- FO — FLOW RESTRICTION ORIFICE
- FX — FLOW STRAIGHTENER
- FE, FIT, INTEGRAL — INTEGRAL FLOW ORIFICE ASSEMBLY WITH DIFFERENTIAL TRANSMITTER (ONE SINGLE UNIT)
- FIT, FE — CLAMP-ON ULTRASONIC
- FIT, FE — ULTRASONIC (INLINE)
- FQI — POSITIVE DISPLACEMENT LOCAL FLOW TOTALIZER WITH AUTO VALVE SHUT OFF

GENERAL NOTES:

1. THE SYMBOLS AND LEGEND SHOWN ARE BASED ON ISA STANDARD, ANSI/ISA-S5.1-1984 R1992) "INSTRUMENTATION SYMBOLS AND IDENTIFICATION" AND STANDARD ISA-S5. 3-1983 "GRAPHIC SYMBOLS FOR DISTRIBUTED CONTROL/SHARED DISPLAY INSTRUMENTATION, LOGIC AND COMPUTER SYSTEMS.
2. ALL INSTRUMENT PROCESS CONNECTION (IMPULSE) LINES ARE UNDERSTOOD TO HAVE SINGLE PIPING CLASS ROOT VALVES. ROOT VALVES ARE SHOWN ON APPROPRIATE INSTALLATION DETAIL DRAWING BUT NOT ON P&ID.
3. TEXT LOCATION AROUND INSTRUMENTATION SYMBOLS ARE:
   - J1: INSTRUMENT FUNCTION CODE, E.G., PDISH
   - J2: UNIQUE LOOP NUMBER
   - J3: FUNCTION (E.G. √) OR DEVICE DESIGNATION (I/P, P/I, I/I, P/H, ETC.)
   - Z: Z DESIGNATES SAFETY ITEM
   - J4: MISC. DESCRIPTION (E.G. J, K, R & D, A (AUTO), H (HAND), SEL (SELECT), O (OPEN), C (CLOSE), ETC.
   - *: DENOTES INSTRUMENT SUPPLIED WITH EQUIPMENT PACKAGE.
4. NORMAL OPERATION MEANS PLANT EQUIPMENT IS IN OPERATING MODE FOR A CONTINUOUS OR BATCH PROCESS.
5. THE FOLLOWING ABBREVIATIONS DENOTE THE TYPES OF POWER SUPPLY AND PURGE FLUID:
   - IA - AIR SUPPLY
   - ES - ELECTRIC SUPPLY
   - WS - WATER SUPPLY
   - NS - NITROGEN SUPPLY
   - GS - GAS SUPPLY
6. EXAMPLES OF USE OF TANGENTIAL INSTRUMENT CIRCLES TO DENOTE A SINGLE INSTRUMENT WITH TWO VARIABLES AND/OR TWO FUNCTIONS:
   TWO VARIABLES - "TIT" FOR TOP BALLOON AND "FIT" IN THE BOTTOM - MULTI-VARIABLE VORTEX FLOW METER.
   TWO FUNCTIONS - "LIT" FOR TOP BALLOON AND "LIC" IN THE BOTTOM - A DUAL FUNCTION LEVEL INSTRUMENT, ONE A TRANSMITTER, ONE A CONTROLLER.
7. THE UPPER IMPULSE LINE IS OMITTED IF LEVEL IS MEASURED USING ATMOSPHERIC PRESSURE AS REFERENCE.
8. TEST POINTS NOT ASSOCIATED WITH AN INSTRUMENT TAG.
9. TP/PP MAY BE USED IN THE CASE OF A HOT TAP TESTING DEVICE WHERE NO THERMOWELL EXISTS (CLEAN SYSTEMS ONLY).
10. TRANSMITTERS WITH FLAT DIAPHRAGM SEAL TO HAVE CALIBRATION RINGS WITH VENT AND DRAIN VALVES. CABLIBRATION RINGS ARE SHOWN ON RESPECTIVE INSTALLATION DETAIL DRAWINGS BUT NOT ON P&ID.

BASED ON PUEBLO P&ID 24852-M6-M00-M0005 REV. A

REFERENCE DRAWINGS

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DRAWING NUMBER 24915-00-M6-00-00013 | SHEET 1 OF 1 | REV 3

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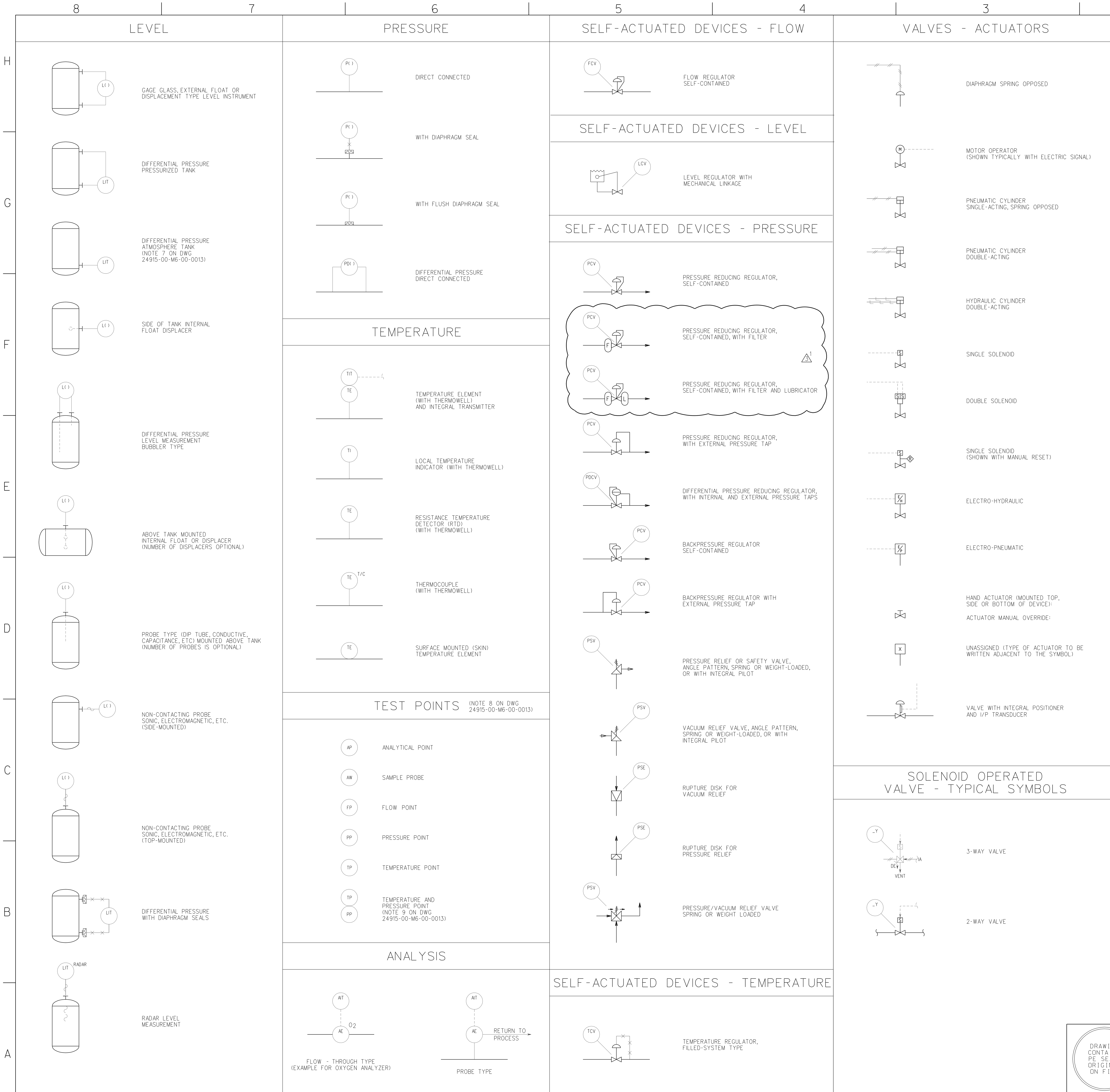

GENERAL NOTES:
1. SEE 24915-00-M6-00-00013.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

BASED ON PUEBLO P&ID 24852-M6-M00-M0006 REV.A

REFERENCE DRAWINGS

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2	10/04/07	IFC, UPDATED SYMBOL, CHANGED Q LEVEL	JP	JLL	PEB	JB	TAV
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PROFESSIONAL STAMP

DRAWING NUMBER 24915-00-M6-00-00014 | SHEET 1 OF 1 | REV 3

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GENERAL NOTES:

1. THE INSTRUMENT LEGEND IS BASED ON ISA-S5.1-1984, INSTRUMENTATION SYMBOLS AND IDENTIFICATION STANDARD (ISA). EXCEPTIONS SPECIFIC TO BGCAPP ARE NOTED IN THIS LEGEND: REFER TO THE ISA STANDARD FOR FURTHER DETAILS AND CLARIFICATION. THE COMPONENT FUNCTIONAL IDENTIFIER FOR AN INSTRUMENT CONSISTS OF LETTERS DERIVED FROM THE INSTRUMENT LEGEND SHEET AND THESE NOTES. THE FIRST LETTER IS SELECTED ACCORDING TO MEASURED OR INITIATION VARIABLE. SUCCEEDING LETTERS IDENTIFY FUNCTIONS PERFORMED. MODIFYING LETTER MAY BE USED TO MODIFY EITHER A FIRST LETTER OR SUCCEEDING LETTERS AS APPLICABLE.

2. PILOT OR INDICATOR LIGHTS ARE NORMALLY NOT SHOWN ON P&IDs. ESPECIALLY THOSE LIGHTS ASSOCIATED WITH HAND SWITCHES. HOWEVER, THE FOLLOWING EXCEPTIONS APPLY:
   - WHEN A PILOT LIGHT IS PART OF AN INSTALLED LOOP, IT SHOULD BE DESIGNATED BY A FIRST LETTER, FOLLOWED BY THE SUCCEEDING LETTER "L".
   - STATUS INDICATOR LIGHTS ASSOCIATED WITH VALVE STATUS SWITCHES USED IN FIRE SYSTEM MAY USE THE DESIGNATION "ZL".
   - SPECIFIC CASES WHERE THE PILOT LIGHT IS ESSENTIAL FOR EXPLAINING SPECIAL FUNCTION OR LOCATION OF THE LIGHT. ALSO USED AS VALVE LIMIT SWITCH INDICATION IN PROGRAMMABLE ELECTRONIC SYSTEM (PES).

3. WHEN "A" IS USED FOR ANALYSIS VARIABLES NOT ASSIGNED FIRST LETTER DESIGNATORS, THE FOLLOWING TERMS MAY BE PLACED OUTSIDE THE INSTRUMENT CIRCLE TO DENOTE THE SPECIFIC MEASURED VARIABLES, FOR EXAMPLE:
   - H - DISSOLVED HYDROGEN
   - NO_X - NITROGEN OXIDE
   - CO - CARBON MONOXIDE
   - H_2 - GASEOUS HYDROGEN
   - pH - pH
   - Na - SODIUM
   - TRB - TURBIDITY

4. MODIFYING LETTERS SHALL HAVE THE FOLLOWING MEANING:
   (EXAMPLES GIVEN WITH POSITION SWITCH, ZS)
   - ZSH - HIGH, UP, RASIED, EXTENDED ON, ENERGIZED, VERICAL, INFLATED, CLAMPED.
   - ZSL - LOW, DOWN, LOWERED, RETRACTED, OFF, HORIZONTAL, DEFLATED, UNCLAMPED.
   - ZSO - DESIGNATES POSITION SWITCH OPEN
   - ZSC - DESIGNATES POSITION SWITCH CLOSED

5. THE LETTER "Z" WHICH FOLLWS A MEASURED VARIABLE REPRESENTS FINAL CONTROL ELEMENT, OTHER THAN CONTROL VALVES, SUCH AS HYDRAULIC COUPLING, VARIABLE SPEED MOTOR/DEVICE, ETC.

6. "FO" DESIGNATES FLOW RESTRICTION ORIFICE.

7. BURNER/COMBUSTION "B" SHALL BE USED FOR ALL FIRE PROTECTION AND BURNER/COMBUSTION APPLICATIONS.

8. A TEST POINT IS A PROCESS CONNECTION TO WHICH NO INSTRUMENT IS PERMANENTLY CONNECTED, BUT WHICH IS INTENDED FOR TEMPORARY, INTERMITTENT OR FUTURE CONNECTION OF AN INSTRUMENT.
   - AP - ANALYTICAL POINT
   - PP - PRESSURE POINT
   - AW - SAMPLE PROBE
   - TP - TEMPERATURE POINT

   NOTE: TP/PP MAY BE USED IN THE CASE OF A HOT TAP TESTING DEVICE WHERE NO THERMOWELL EXISTS (UTILITY SYSTEM ONLY). WHERE THERMOWELL IS USED FOR TEST POINT, IT MUST HAVE AN INSTRUMENT TAG.

9. INTEGRAL INDICATORS WILL BE PROVIDED WITH TRANSMITTERS ONLY WHEN SPECIFIED ON THE APPLICABLE INSTRUMENT DATA SHEET.

10. "X" IS USED TO REPRESENT ANY "SPECIAL" VARIABLES AND MAY BE DEFINED AS REQUIRED.

11. PSE - DESIGNATES RUPTURE DISKS OR PRESSURE AND VACUUM RELIEF DEVICE.
    PSV - DESIGNATES RELIEF VALVES.

12. THE DESIGNATION "D" REPRESENTS HVAC CONTROL DAMPERS.

13. ANY FIRST LETTER, WHEN COMBINED WITH MODIFYING LETTER "F" (RATIO), "M" (MOMENTARY), "Q" (TOTALIZER) OR "K" (TIME RATE OF CHANGE), REPRESENTS A SINGLE MEASURED VARIABLE AND IS CONSIDERED THE SAME AS A FIRST LETTER ONLY VARIABLE.

14. USING "X" AS A MODIFIER DESIGNATES AN ACCESSORY PURCHASED WITH AN INSTRUMENT SYSTEM, SUCH AS A SAMPLE CONDITIONING SYSTEM.

15. ALL TEMPERATURE ELEMENTS UNLESS SPECIFIED ARE RTD TYPE. THERMOCOUPLES SHALL BE IDENTIFIED AS "T/C" OR "SKIN T/C".

16. "HS" IS USED FOR MANUAL COMMAND FROM FCS/FPS SUCH AS OPEN/CLOSE/START/ STOP ETC. "HS" IS USED FOR COMMAND TO ALLOW LOCAL OPERATION OF VARIOUS FIELD DRIVES.

INSTRUMENT CODE LETTER IDENTIFICATION

FIRST LETTER / SUCCEEDING LETTERS (* FUNCTION IDENTIFIER COMBINATION IS NOT USED - NOTE 13)

MEASURED OR INITIATING VARIABLE (NOTE 1)	SYMBOL	SENSING DEVICE: PRIMARY ELEMENT	SENSING DEVICE: BLIND TRANS-MITTER (NOTE 9)	DISPLAY DEVICE: INDI-CATOR	DISPLAY DEVICE: RECORDER	DISPLAY DEVICE: INTGR. INDI-CATOR	DISPLAY DEVICE: ALARM HIGH	DISPLAY DEVICE: ALARM HIGH HIGH	DISPLAY DEVICE: ALARM LOW	DISPLAY DEVICE: ALARM LOW LOW	DISPLAY DEVICE: ALARM HIGH LOW (COMB)	CONTROL DEVICE: CONTROL STATION	CONTROL DEVICE: CTRLR.	CONTROL DEVICE: CONTROL DAMPER (NOTE 12)	CONTROL DEVICE: SELF-ACTUATED VALVE	CONTROL DEVICE: CONTROL VALVE	CONTROL DEVICE: FINAL CONTROL ELEMENT (NOTE 5)	SWITCH: HIGH	SWITCH: HIGH HIGH	SWITCH: LOW	SWITCH: LOW LOW	SWITCH: HIGH LOW (COMB)	MISCELLANEOUS DEVICE: LOCAL OBSERV. GLASS	MISCELLANEOUS DEVICE: TEST POINT (NOTE 8)	MISCELLANEOUS DEVICE: RELAY/ COMPUTE
TYPICAL SYMBOLS	( )	( )E	( )T	( )I	( )R	(Q)I	( )AH	( )AHH	( )AL	( )ALL	( )AHL	( )K	( )C	( )D	( )CV	( )V	( )Z	( )SH	( )SHH	( )SL	( )SLL	( )SHL	( )G	( )P	( )Y
ANALYSIS (NOTE 3)	A	AE	AT	AI	AR	*	AAH	AAHH	AAL	AALL	AAHL	AK	AC	*	*	AV	AZ	ASH	ASHH	ASL	ASLL	ASHL	*	AP	AY
BURNER COMBUSTION (NOTE 7)	B	BE	BT	BI	BR	*	*	BAHH	BAL	BALL	*	*	BC	BD	*	*	*	BSH	BSHH	BSL	BSLL	BSHL	BG	BP	BY
CONDUCTIVITY	C	CE	CT	CI	CR	*	CAH	CAHH	CAL	CALL	CAHL	CK	*	*	*	CV	CZ	CSH	CSHH	CSL	CSLL	CSHL	*	CP	CY
DENSITY	D	DE	DT	DI	DR	*	DAH	DAHH	DAL	DALL	DAHL	DK	DC	*	*	DV	DZ	DSH	DSHH	DSL	DSLL	DSHL	*	DP	DY
VOLTAGE (EMF)	E	EE	ET	EI	ER	*	EAH	EAHH	EAL	EALL	EAHL	EK	EC	*	*	*	EZ	ESH	ESHH	ESL	ESLL	ESHL	*	*	EY
FLOW RATE (NOTE 6)	F	FE	FT	FI	FR	FQI	FAH	FAHH	FAL	FALL	FAHL	FK	FC	FD	FCV	FV	FZ	FSH	FSHH	FSL	FSLL	FSHL	FG	FP	FY
FLOW RATIO	FF	FE	FT	FFI	FFR		FFSH		FFSL			FFK	FFC		*			FFSH	FFSHH	FFSL	FFSLL	FFSHL			
HAND (MANUAL) (NOTE 16)	H	*	*	HI	*	*	*	*	*	*	HA	HK	HC/HIC	HD	HCV	HV	HZ	*	*	*	*	HS	*	*	HY
CURRENT	I	IE	IT	II	IR	*	IAH	IAHH	IAL	IALL	IAHL	IK	IC	ID	*	*	IZ	ISH	ISHH	ISL	ISLL	ISHL	*	*	IY
POWER	J	JE	JT	JI	JR	JQI	JAH	JAHH	JAL	JALL	JAHL	JK	JC	*	*	*	JZ	JSH	JSHH	JSL	JSLL	JSHL	*	*	JY
TIME	K	*	KT	KI	*	KQI	KAH	KAHH	KAL	KALL	KAHL	*	KC	*	*	*	KZ	KSH	KSHH	KSL	KSLL	KSHL	*	*	KY
LEVEL	L	*	LT	LI	LR	*	LAH	LAHH	LAL	LALL	LAHL	LK	LC	*	LCV	LV	LZ	LSH	LSHH	LSL	LSLL	LSHL	LG	LP	LY
MOISTURE	M	ME	MT	MI	MR	*	MAH	MAHH	MAL	MALL	MAHL	MK	MC	MD	*	*	MZ	MSH	MSHH	MSL	MSLL	MSHL	*	MP	MY
PRESSURE OR VACUUM	P	*	PT	PI	PR	*	PAH	PAHH	PAL	PALL	PAHL	PK	PC	*	PCV	PV	PZ	PSH	PSHH	PSL	PSLL	PSHL	*	PP	PY
PRESSURE DIFFERENTIAL	PD	*	PDT	PDI	PDR	*	PDAH	PDAHH	PDAL	PDALL	*	PDK	PDC	*	PDCV	PDV	PDZ	PDSH	PDSHH	PDSL	PDSLL	PDSHL	*	PP	*
QUANTITY OR EVENT	Q	QE	QT	QI	QR	QQI	QAH	QAHH	QAL	QALL	QAHL	QK	QC	*	*	*	QZ	QSH	QSHH	QSL	QSLL	QSHL	*	*	QY
SPEED OR FREQUENCY	S	SE	ST	SI	SR	*	SAH	SAHH	SAL	SALL	SAHL	SK	SC	*	*	*	SZ	SSH	SSHH	SSL	SSLL	SSHL	*	*	SY
TEMPERATURE	T	TE	TT	TI	TR	*	TAH	TAHH	TAL	TALL	TAHL	TK	TC	TD	TCV	TV	TZ	TSH	TSHH	TSL	TSLL	TSHL	*	TP	TY
TEMPERATURE DIFFERENTIAL	TD	*	*	TDI	TDR	*	TDAH	TDAHH	TDAL	TDALL	*	*	TDC	*	TDCV	TDV	TDZ	TDSH	TDSHH	TDSL	TDSLL	TDSHL	*	*	*
MULTI-VARIABLE	U	*	*	UI	UR	*	UAH	UAHH	UAL	UALL	UAHL	*	UC	*	*	UV	UZ	USH	USHH	USL	USLL	USHL	*	*	UY
VIBRATION / MECH. ANALYSIS	V	VE	VT	VI	VR	*	VAH	VAHH	VAL	VALL	VAHL	VK	VC	*	*	*	VZ	VSH	VSHH	VSL	VSLL	VSHL	*	VP	VY
WEIGHT	W	WE	WT	WI	WR	WQI	WAH	WAHH	WAL	WALL	WAHL	WK	WC	*	*	*	WZ	WSH	WSHH	WSL	WSLL	WSHL	*	*	WY
USER DEFINED (NOTE 10)	X	XE	XT	XI	XR	XQI	XAH	XAHH	XAL	XALL	XAHL	XK	XC	XD	*	XV	XZ	XSH	XSHH	XSL	XSLL	XSHL	XG	XP	XY
EVENT/STATE OR PRESENCE	Y	YE	YT	YI	YR	*	*	*	*	*	*	*	YC	*	*	YV	YY	YSH	YSHH	YSL	YSLL	YSHL	*		YY
POSITION (NOTE 4)	Z	ZE	ZT	ZI(L)	ZR	*	ZAH	ZAHH	ZAL	ZALL	ZAHL	*	ZC	*	*	*	ZZ	ZSH	ZSHH	ZSL	ZSLL	ZSHL	*	*	ZY

BASED ON PUEBLO P&ID 24852-M6-M00-M0007 REV.A

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
1	10/04/07	IFC, DELETED REFERENCE, CHANGED Q LEVEL	JP	JLL	PEB	JB	TAV
0	01/10/05	ISSUED FOR DESIGN (IFD)	JP	EW	PEB	JB	JU

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

BGCAPP - NON FACILITY SPECIFIC SYMBOLS AND LEGEND PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-00-M6-00-00015 | SHEET 1 OF 1 | REV 1

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

BGCAPP_DGN.BDR

00M00015.pid 10/05/07
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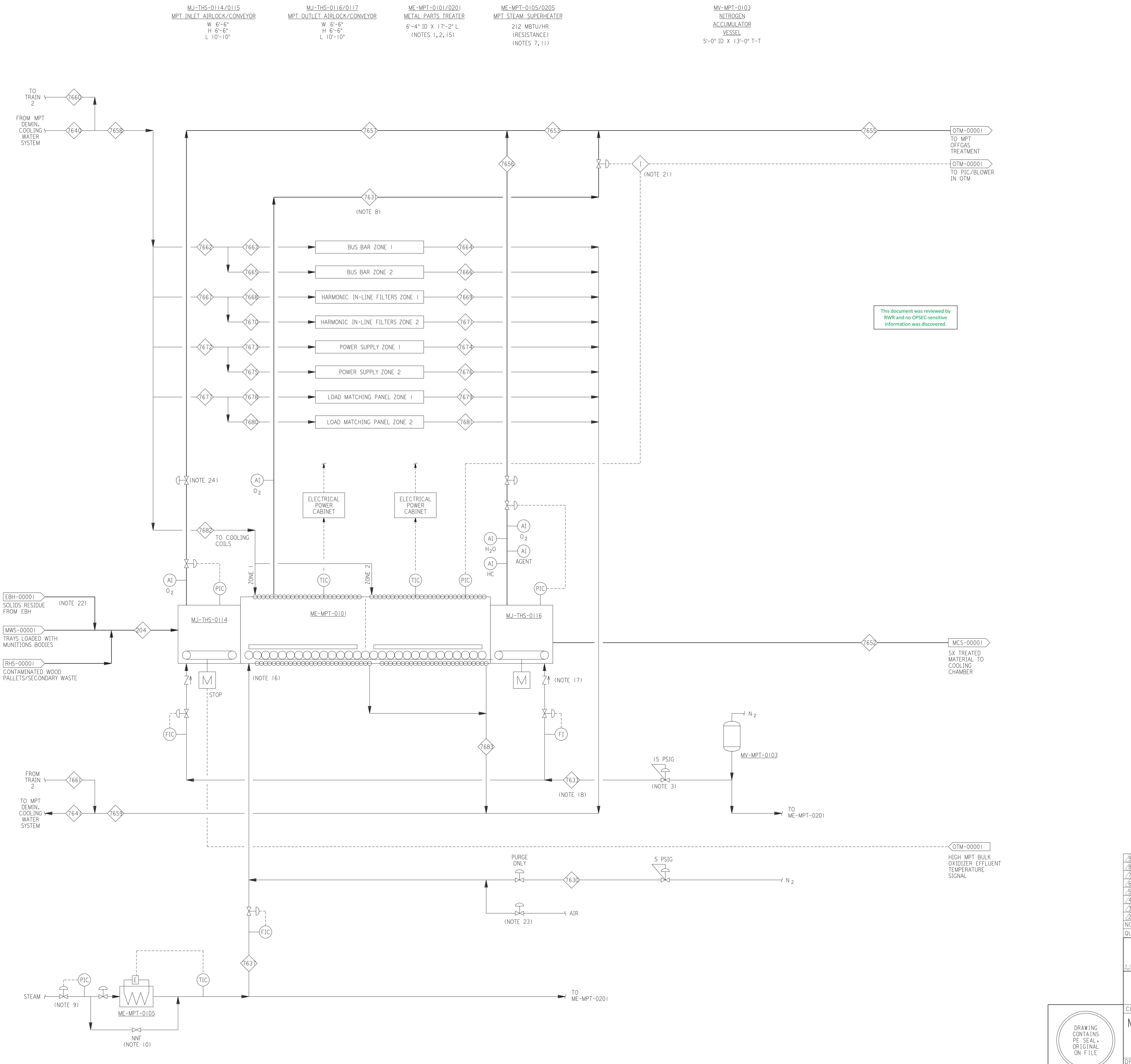

NOTES:

1. MUNITIONS AND MISCELLANEOUS METAL PARTS TEMPERATURE TO BE VERIFIED WITH OPTICAL PYROMETER AND INTERLOCKED WITH DISCHARGE DOOR OF MPT SO THAT TIME AND TEMPERATURE REQUIREMENTS ARE SATISFIED BEFORE DISCHARGING MUNITIONS TRAY.
2. METAL PARTS TREATER RECEIVES MATERIALS PLACED IN ONE MUNITIONS TRAY PER BATCH. BATCH CYCLE TIME IS 120 MINUTES.
3. PURGE AIRLOCK WITH NITROGEN AT THE END OF HEATING CYCLE, PRIOR TO MONITORING FOR AGENT PRESENCE. VAPORIZATION OF AGENT IS ASSUMED NOT TO OCCUR IN THE AIRLOCKS DURING THE PURGING CYCLE.
4. DELETED
5. DELETED
6. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
7. STEAM SUPERHEATER IS SIZED TO SUPPLY BOTH MPT'S. THE TWO MPT STEAM SUPERHEATERS ARE LINKED WITH TIE-INS.
8. ASPEN EQUILIBRIUM CALCULATIONS INDICATE NEGLIGIBLE AMOUNTS OF TDG. LAB DATA IS NOT AVAILABLE TO VERIFY THE ASPEN CALCULATIONS.
9. FOR EMERGENCY USE ONLY TO ISOLATE THE STEAM SYSTEM.
10. FOR SHUTDOWN ONLY.
11. MBTU/HR = 1,000 BTU/HR
12. DELETED
13. DELETED
14. DELETED.
15. THE LENGTH INCLUDES ONE FOOT FOR EACH GATE.
16. STEAM DISTRIBUTOR INSIDE TREATER.
17. EACH AIRLOCK HAS TWO NITROGEN DISTRIBUTORS.
18. MPT OUTLET/AIRLOCK CONVEYOR PURGING IS REQUIRED FOR:

    40 MIN TO COOL THE AIRLOCK GASES TO MONITORING TEMPERATURE; FLOW REQUIRED IS 575.00 LB/HR

    20 MIN TO CREATE AN INERT ATMOSPHERE: FLOW REQUIRED IS 183.24 LB/HR
19. DELETED
20. EQUIPMENT SIZING DATA FOR DESIGN SHOWN ON THIS SHEET IS BASED ON REV. 3, SHEET 3 OF 4 OF THE MASS AND ENERGY BALANCES. DUE TO THE PROGRESS OF THE DESIGN AND ITS EFFICACY TO MEET THE REQUIREMENTS, THE SIZES WILL NOT BE REVISED.
21. PRESSURE CONTROLLER WILL RESET SETPOINT ON OTM PRESSURE CONTROLLER IF NEGATIVE PRESSURE IN MPT CANNOT BE MAINTAINED.
22. SOLIDS RESIDUE IS ESTIMATED TO BE 15-22 LB/HR AVERAGE WHICH IS INCLUDED IN THE AVERAGE CASES IN THE BALANCES.
23. AIR TO BE PROVIDED DURING SECONDARY WASTE PROCESSING WHEN NEEDED.
24. MAXIMUM FLOW OF INLET AIRLOCK IS 583 LB/HR. OCCURS DURING A POWER OUTAGE.
25. SHEET REDRAWN, INCORPORATED DCN-090. PLACEMENT OF PE STAMP - DRAWING REFERENCED IN BGCAPP'S TSCA PERMIT APPLICATION.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
9	9/24/13	(IFD) SEE NOTE 25	PEB	BDT	SA	KMR	KMR
8 3	9/25/08	(IFD) DCN-00027, -00039	JW	SA	SA	BB	BB
7 6	10/1/07	(IFD) INCORPORATE REDLINES	JW	JH	SH	JB	BB
6 6	1/11/07	ISSUED FOR DESIGN (IFD) TREND #00139	RY	JH	SH	JB	BB
5 2	4/19/06	ISSUED FOR DESIGN (IFD) ADD NOTE 20	FJ	JH	SH	JB	BB
4 5	4/4/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	FJ	JH	SH	JB	BB
3 7	12/1/05	(IFD) MUN. COOLING, LL FROM NECDF, ENS	FJ	JH	SH	JB	PK
2 8	5/11/05	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JB	JU

QUALITY ☒ Q ☐ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING METAL PARTS TREATMENT PROCESS FLOW DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M5-MPT-00001 | SHEET 1 OF 8 | REV 9

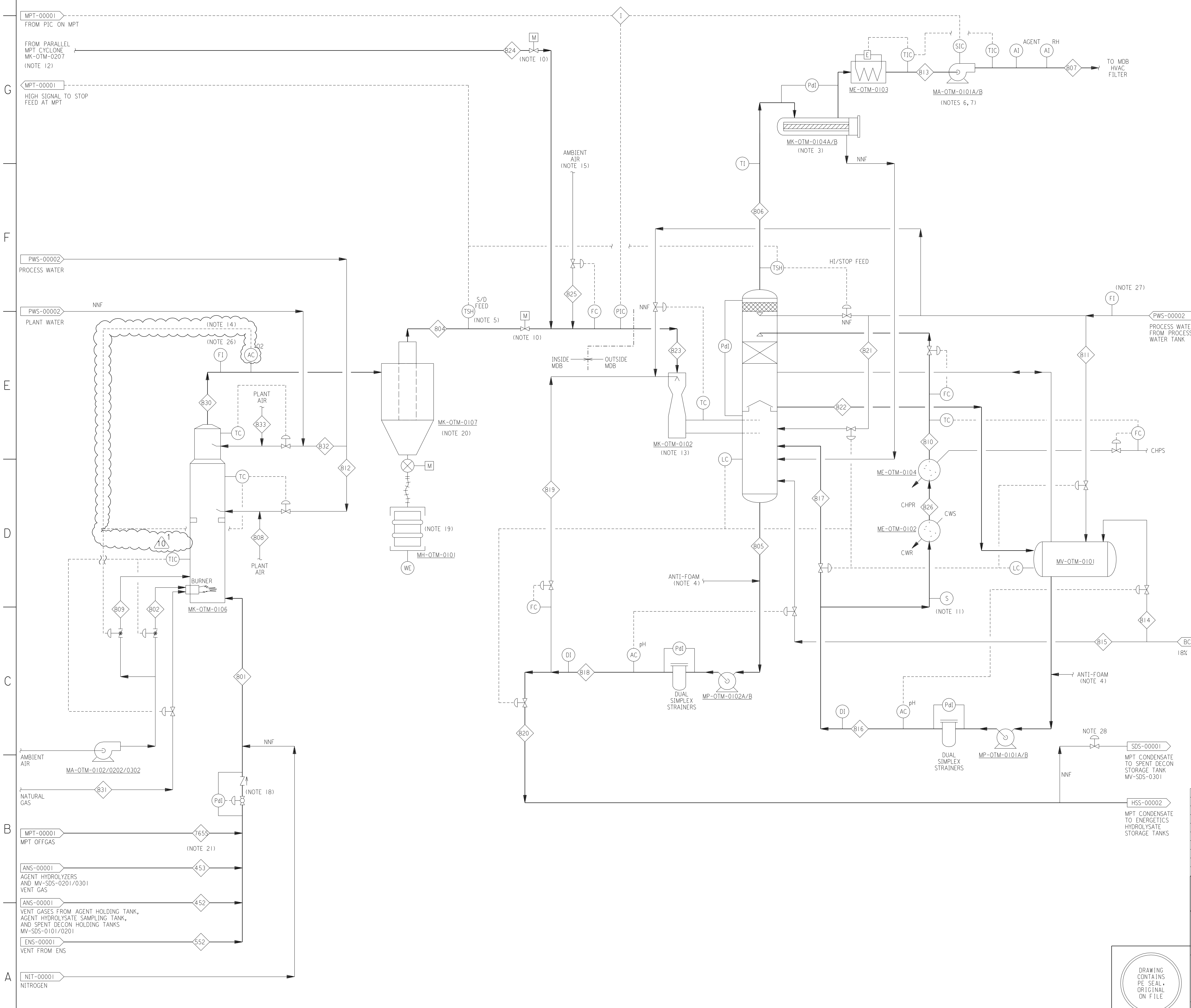
07-M5-MPT-1-1.PFZ
BGCAPP_E2.BDR

DESIGN FILE: S:\2D\pr\07-M5-MPT-1-1.pfz AT 11:46:28 AM
PLOTTED BY: 53497 ON 9/24/2013

S:/2D/pr/07-M5-MPT-1-1.pfz 9/24/2013 11:46:28 AM

MA-OTM-0102/0202/0302 COMBUSTION AIR FANS MOTOR HP: 20	MK-OTM-0106/0206 MPT THERMAL OXIDIZER UNIT UPPER SECTION: 4'-6.5" ID REFRACTORY LOWER SECTION: 7'-0.5" ID REFRACTORY OVERALL: 22'-1.19" T-T REFRACTORY	MK-OTM-0107/0207 MPT CYCLONE 2'-9.25" ID X 15'-2" F/F	MH-OTM-0101 CYCLONE DRUM SCALE	MK-OTM-0102 MPT VENTURI/SCRUBBER TOWER (NOTE 13)	ME-OTM-0102 MPT SCRUBBER RECIRCULATION COOLER 6.6 MMBTU/HR (NOTE 9)	ME-OTM-0104 MPT SCRUBBER RECIRCULATION TRIM COOLER 4.1 MMBTU/HR (NOTE 9)	MV-OTM-0101 MPT SCRUBBER RECIRCULATION SURGE TANK WORKING CAPACITY: 1500 GAL	MP-OTM-0102A/B MPT VENTURI RECIRCULATION PUMP & SPARE 175 GPM	MP-OTM-0101A/B MPT SCRUBBER RECIRCULATION PUMP & SPARE 300 GPM	MK-OTM-0104A/B MPT FILTER AND SPARE (NOTE 3)	MA-OTM-0101A/B MPT BLOWER AND SPARE MOTOR HP: 150

ME-OTM-0103
MPT AIR REHEATER
67.8 MBTU/HR
(NOTE 9)



This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

NOTES:

1. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
2. DELETED
3. FILTERS TO BE SIZED FOR REMOVAL OF PARTICLES GREATER THAN 3 MICRONS IN DIAMETER AT AN EFFICIENCY OF 100% AND PARTICLES LESS THAN 3 MICRONS IN DIAMETER AT AN EFFICIENCY OF 96%.
4. PROVIDE CONNECTION ONLY FOR ANTI-FOAM INJECTION.
5. STOP THE FEED OF MUNITIONS TO THE MPT ON HIGH TEMPERATURE.
6. VARIABLE SPEED DRIVE.
7. EMERGENCY POWER SUPPLY.
8. DELETED
9. MMBTU/HR = 1,000,000 BTU/HR
   MBTU/HR = 1,000 BTU/HR
10. VALVES ARE PROVIDED FOR ISOLATION.
11. SAMPLE CONNECTION.
12. THE PARALLEL PROCESS TRAINS CONVERGING AT STREAM 823 ARE FUNCTIONALLY IDENTICAL. THE SECOND TRAIN IS NOT SHOWN FOR THE SAKE OF READABILITY.
13. SEE VENDOR SUBMITTAL 24915-307-V1A-MKAS-00011 FOR DIMENSIONS.
14. THE OXYGEN ANALYZER ENSURES THAT RESIDUAL OXYGEN LEVEL IN THE THERMAL OXIDIZER EFFLUENT IS AT LEAST 5%.
15. MAKE-UP AIR MAY BE NECESSARY FOR OFF-NORMAL CONDITIONS OR START-UP. THE MAXIMUM FLOWRATE IS 1100 ACFM.
16. DELETED
17. DELETED
18. NON-RETURN VALVE INSTALLED FOR FLASH BACK PROTECTION.
19. CYCLONE ASH WILL BE SHIPPED OFF TO HAZARDOUS WASTE DISPOSAL SYSTEM.
20. CYCLONE IS ALSO REQUIRED FOR CLOSURE ACTIVITIES.
21. FLAME ARRESTOR SHALL BE PROVIDED BY THERMAL OXIDIZER VENDOR.
22. DELETED
23. DELETED
24. DELETED
25. EQUIPMENT SIZING DATA FOR DESIGN SHOWN ON THIS SHEET IS BASED ON REV. 3, SHEET 3 OF 4 AND REV. 4, SHEET 4 OF 4 OF THE MASS AND ENERGY BALANCES. DUE TO THE PROGRESS OF THE DESIGN AND ITS EFFICACY TO MEET THE REQUIREMENTS, THE SIZES WILL NOT BE REVISED. THIS NOTE DOES NOT APPLY TO THE THERMAL OXIDIZER.
26. MAXIMUM FLOW TO PROVIDE MINIMUM TWO SECONDS RESIDENCE TIME IN THERMAL OXIDIZER.
27. FLOW INDICATOR IS ON INDIVIDUAL PROCESS LINE AND NOT ON TOTAL.
28. IF THERMAL OXIDIZER SHUTS DOWN, AN INTERLOCK WILL BE PROVIDED TO RE-ROUTE MPT CONDENSATE TO SPENT DECON STORAGE TANK (MV-SDS-0301) TO PREVENT POTENTIALLY AGENT CONTAMINATED MPT CONDENSATE TO BE SENT TO HYDROLYSATE STORAGE TANKS.
29. PLACEMENT OF PE STAMP - DRAWING REFERENCED IN BGCAPP'S TSCA PERMIT APPLICATION.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
10	8/22/13	(IFD) INCORP. DCN-1030, SEE NOTE 29	BDT	JAW	SA	KMR	KMR
9	9/22/11	(IFD) INCORPORATE VENDOR DATA FOR TOX	JAW	BT	SA	BB	BB
8	9/1/10	(IFD) INCORPORATE DCR-20021	JW	SA	SA	BB	BB
7	10/1/07	(IFD) INCORPORATE REDLINES	JW	JH	SH	JB	BB
6	1/11/07	ISSUED FOR DESIGN (IFD) TREND #00139	RY	JH	SH	JB	BB
5	4/19/06	ISSUED FOR DESIGN (IFD) ADD NOTE 25	FJ	JH	SH	JB	BB
4	4/4/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	FJ	JH	SH	JB	BB
3	12/1/05	(IFD) MUN. COOLING, LL FROM NECDF, ENS	FJ	JH	SH	JB	PK

QUALITY ☒ Q ☒ Non-Q

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US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING OFFGAS TREATMENT MPT PROCESS FLOW DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M5-OTM-00001 | SHEET 1 OF 4 | REV 10

07-M5-OTM-1-1.PFZ

BGCAPP_E2.BDR

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PLOTTED BY: $USERNAME$ ON $DATE$ AT $TIME$

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MA-OTM-0202
COMBUSTION AIR FAN LN 2

MOTOR HP	: 20 HP
RATED FLOW	: 1580 SCFM
RATED DELTA P	: 1.3 PSI
MATERIAL OF CONST	: CS HOUSING/ALUMINUM WHEEL

MA-OTM-0302
COMBUSTION AIR FAN SPARE

MOTOR HP	: 20 HP
RATED FLOW	: 1580 SCFM
RATED DELTA P	: 1.3 PSI
MATERIAL OF CONST	: CS HOUSING/ALUMINUM WHEEL

MB-OTM-0201
BURNER LN 2

MAX CAPACITY	: 8.0 MMBTU/HR
COMB AIR FLOW	: 1280 SCFM
COMB AIR DELTA P	: 26 IN WATER
MATERIAL OF CONST	: IRON HOUSING/REFRACTORY BLOCK NOTE 26

MK-OTM-0206
MPT THERMAL OXIDIZER LN 2

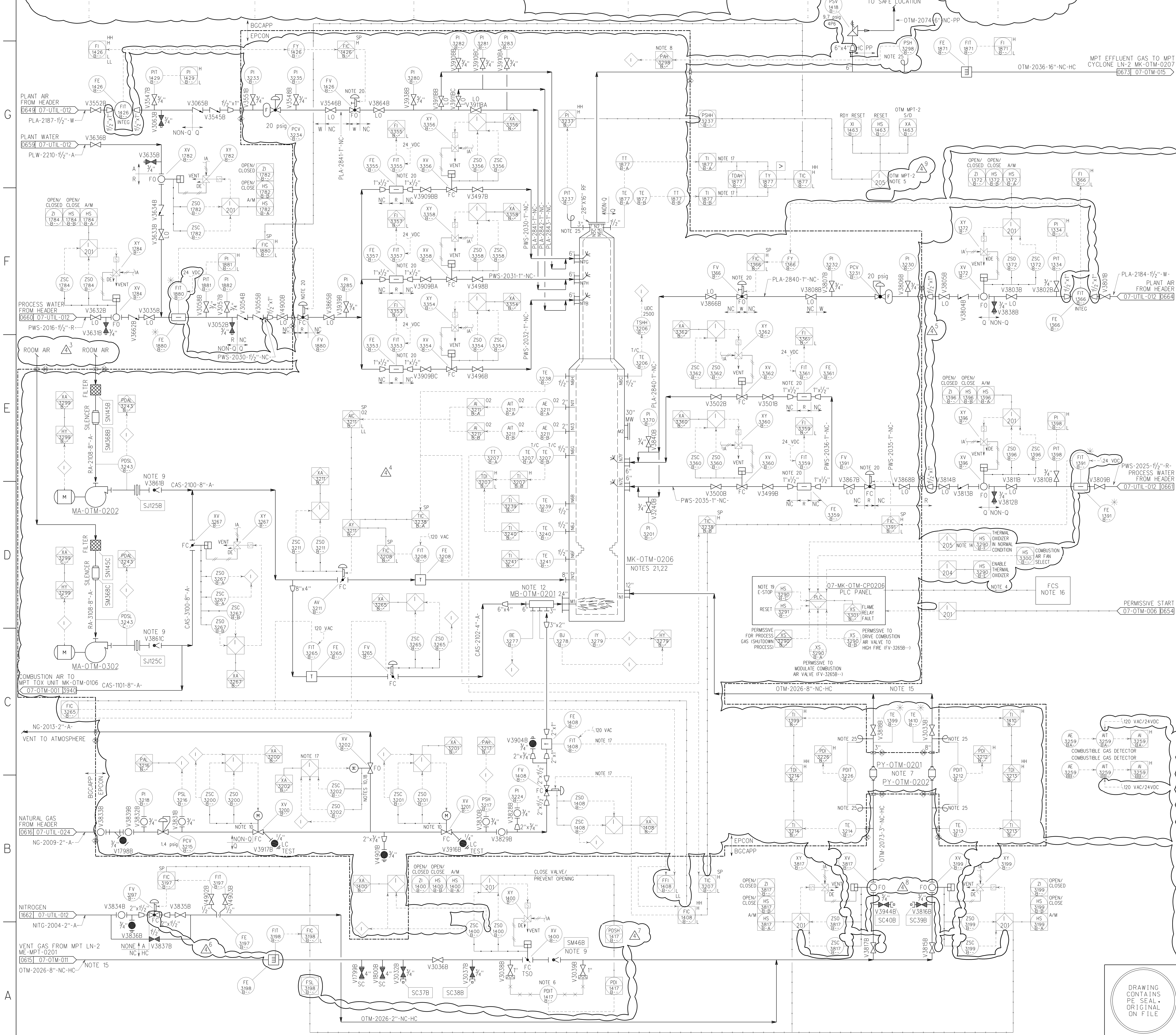
I.D.	: 4.48/6.98 FT
T-T	: 7.15/13.92 FT
DESIGN PRESSURE	: 14.9 PSIG/7.12 PSIA
DESIGN TEMP (SHELL)	: 400 °F
DESIGN TEMPERATURE (INTERNAL)	: 2250 °F
MATERIAL OF CONST	: CS W/RUBY SR BRICK NOTE 27

PY-OTM-0201
3" FLAME ARRESTOR LN 2

LENGTH	: 18"
NO. OF TUBES	: 4
DESIGN PRESSURE	: 14.9 PSIG
DESIGN TEMPERATURE	: 1050 °F
MATERIAL OF CONST	: SS HOUSING/800H TUBES

PY-OTM-0202
8" FLAME ARRESTOR LN 2

LENGTH	: 18"
NO. OF TUBES	: 18
DESIGN PRESSURE	: 14.9 PSIG
DESIGN TEMPERATURE	: 1050 °F
MATERIAL OF CONST	: SS HOUSING/800H TUBES



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. A HEARTBEAT IS MONITORED BETWEEN THE PLC AND FCS ON THE ETHERNET NETWORK. IF THE HEARTBEAT FAILS, THE PRIMARY PLC FAILS, OR ANY PORTION OF THE NETWORK BETWEEN THE PRIMARY PLC AND FCS FAILS, THE SECONDARY PLC WILL ASSUME CONTROL OF THE PROCESS.
5. MPT-2 IS SHUTDOWN ON HIGH-HIGH OUTLET PRESSURE FROM MPT TOX UNIT (MK-OTM-0206).
6. LOW SIDE OF PDIT IS DOWNSTREAM OF BLOCK VALVE XV-1400B--. PDIT INDICATES IF DOWNSTREAM PRESSURE IS EQUAL TO OR GREATER THAN UPSTREAM PRESSURE. VALVE CLOSES IF THIS OCCURS.
7. ALL REQUIRED FLAME ARRESTORS ARE TO BE PROVIDED BY TOX VENDOR.
8. BURNER CANNOT BE LIT UNLESS AN MPT BLOWER IS RUNNING AS SIGNIFIED BY PAH-3298B-- NOT IN ALARM CONDITION.
9. CHECK VALVES ARE LOW CRACKING PRESSURE WAFER CHECK TYPE.
10. XV-3202B-- CANNOT BE OPENED UNLESS XV-3201B-- AND XV-3200B-- ARE CLOSED.
11. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-OTM-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
12. BURNER MANAGEMENT SYSTEM (BMS) CONTROLS ARE PART OF VENDOR SUPPLIED PACKAGE.
13. HARD-WIRED INTERLOCK FOR BMS IS DEPICTED AS ⟨I⟩
14. HIGH-HIGH OVERHEAD TEMPERATURE OF SCRUBBER INITIATES ABNORMAL SHUTDOWN OF TOX VIA REMOVAL OF HY-3290B-F SIGNAL FROM FCS.
15. PROVIDE BREAKOUT FLANGES AT ELBOWS FOR POTENTIAL CLEAN OUT OF HEADER.
16. FCS COMMUNICATION LINK WILL BE PROVIDED TO DISPLAY ALL VENDOR COMMUNICATIONS, PROCESS VARIABLES AND ALARMS IN THE FCS.
17. FCS I/O SIGNALS ARE HARDWIRED TO FIELD INSTRUMENTS VIA THE PLC PANEL.
18. ALARM IS ACTIVATED IF VALVE XV-3202B-- IS NOT CLOSED.
19. E-STOP HS-3290B-C WILL CLOSE NATURAL GAS BLOCKING VALVES XV-3200B-- AND XV-3201B--, AND OPEN NATURAL GAS VENT VALVE XV-3202B--.
20. FLOW METERS FE-3353B--, FE-3355B--, FE-3357B--, FE-3359B--, AND FE-3361B-- ARE SUPPLIED IN PIPING MATERIAL CLASS R INSTEAD OF NC AS JUSTIFIED IN CALCULATION 24915-307-VIA-MBT0-00191. CONTROL VALVES FV-1366B-- AND FV-1426B-- ARE SUPPLIED IN PIPING MATERIAL CLASS W INSTEAD OF NC, AND FV-1391B-- AND FV-1880B-- ARE SUPPLIED IN PIPING MATERIAL CLASS R INSTEAD OF NC BASED ON THE RESULTS OF THIS SAME CALCULATION.
21. NOZZLES N3, N4, N5A, N5B, N7A, N7C, N7D, AND N8 ARE NOT DEPICTED SINCE THEY ARE BRICKED OVER.
22. USE OF EXPANDED METAL TO PROTECT PERSONNEL FROM TOX SURFACES GREATER THAN 140°F WAS WAIVED IN ACCORDANCE WITH SDDR 24915-307-YDA-MBT0-10018.
23. REV. 4, INCORPORATED DCN-279, -504, -722, -784, AND 831; SDDR 24915-307-YDA-MBT0-10006 AND 24915-307-YDA-MBT0-10007; AND HTL-1273, -6490, -6528, -6531, -6548, AND -6573.
24. FOR ADDITIONAL DETAILS ON MATERIALS OF CONSTRUCTION FOR THE INDIVIDUAL COMPONENTS, SEE 24915-11-00316.
25. TRANSMITTER OR SWITCH TO BE LOCATED REMOTELY TO ENABLE ADEQUATE HEAT DISSIPATION.
26. FOR DETAILS OF MATERIALS OF CONSTRUCTION FOR BURNER MB-OTM-0201, SEE SUBMITTAL 24915-307-VIA-MBT0-00188.
27. FOR DETAILS OF MATERIALS OF CONSTRUCTION FOR TOX MK-OTM-0206, SEE SUBMITTAL 24915-307-VIA-MBT0-00226.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-07-M5-OTM-00001 REV.7
BASED ON BLUE GRASS MSD 24915-07-N0-OTM-00001 REV.6
BASED ON VENDOR SUBMITTAL 24915-307-VIA-MBT0-00085

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	05/17/12	IFC, SEE NOTE 23	BDT	JAW	SA	KMR	KMR
3	01/15/09	IFC, ADD HTL 1270-1277,1279,1280,1339,1340 VEN DATA	JLL	PEB	BM	BBB	BBB
2	07/03/07	IFC, REDRAWN TO INCORP VENDOR DATA, TREND #139	JSM	JLL	PEB	JB	BBB
1	11/29/06	ISSUED FOR DESIGN (IFD), ADD MODEL REVIEW COMMENT	JSM	JLL	PEB	JB	BBB
0	09/19/06	ISSUED FOR DESIGN (IFD)	JSM	JLL	PEB	JB	BBB

QUALITY ☒ Q ☒ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING MPT THERMAL OXIDIZER UNIT - LN 2 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-OTM-00002 | SHEET 1 OF 1 | REV 4

BGCAPP_DGN.BDR

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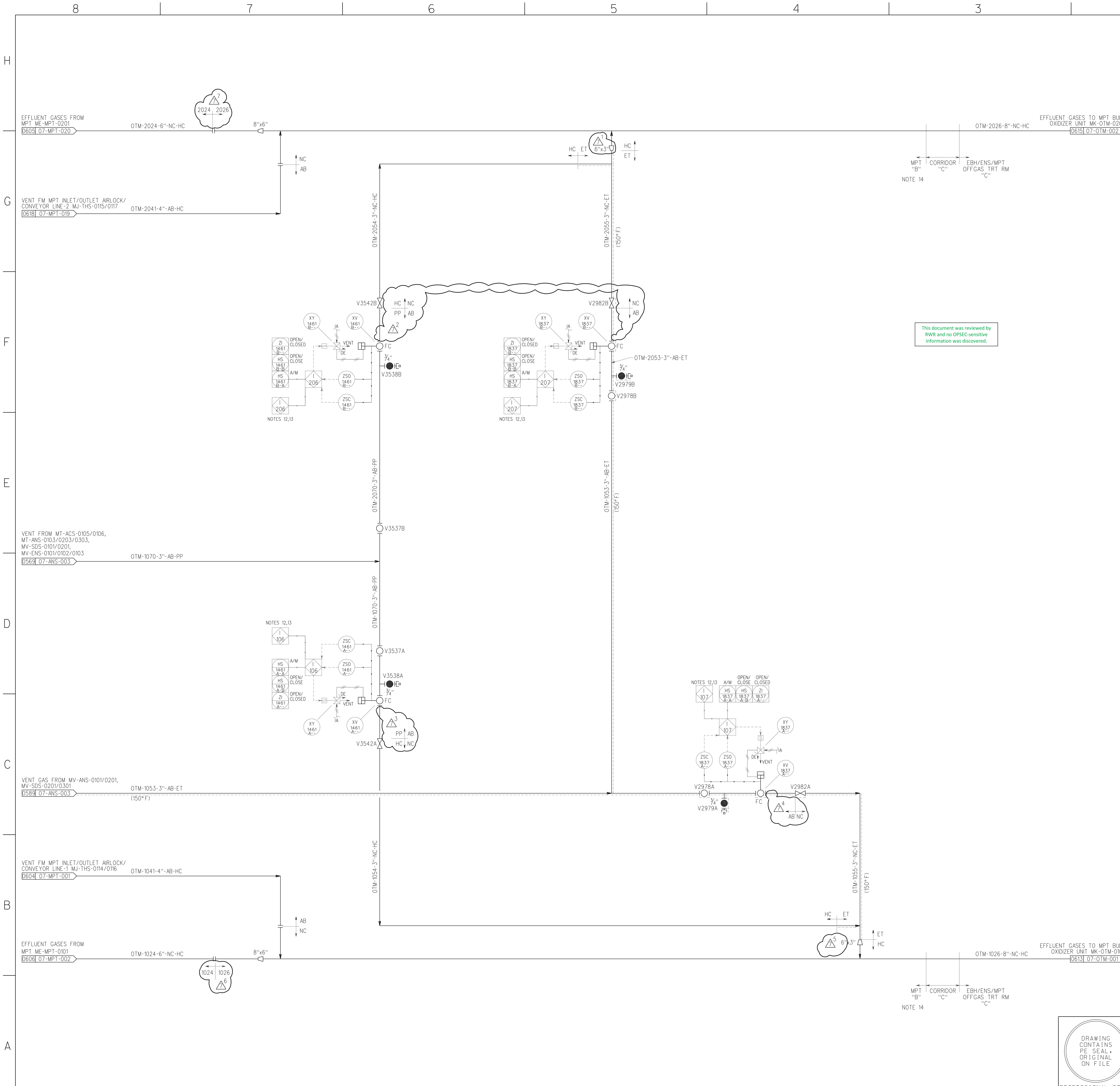

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. DELETED.
6. DELETED.
7. DELETED.
8. DELETED.
9. DELETED.
10. DELETED.
11. DELETED.
12. FROM BULK OXIDIZER SHUTDOWN.
13. WHEN OXYGEN LEVEL IN ANS HEADER IS > 3%, CLOSE VALVES TO PROCESS AND OPEN VENT TO HVAC SYSTEM (DRAWING 24915-07-M6-ANS-00003).
14. PIPING CONNECTIONS ARE IN ROOM 07-146 (MPT ROOM).
15. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-OTM-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-07-M5-OTM-00001 REV.7
BASED ON BLUE GRASS MSD 24915-07-NO-OTM-00001 REV.6

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
7 [8]	01/15/09	IFC,RELOCATED SPEC BREAKS & ADDED PIPING CHANGES	JLL	PEB	BM	BBB	BBB
6 [14]	07/03/07	IFC, REMOVED CHECK VALVES, TREND #139	JSM	JLL	PEB	JB	BBB
5 [6]	11/22/06	IFD, ADDED MODEL REVIEW COMMENTS	JSM	JLL	PEB	JB	BBB
4 [17]	09/19/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
3 [12]	05/04/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
2 [13]	02/22/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
1 [9]	01/13/06	IFA, ADD DC-1, GC 3613,3614, DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	PGK
0	01/11/05	ISSUED FOR DESIGN (IFD)	JSM	JLL	PEB	JB	JU

QUALITY ☒ Q ☐ Non-Q

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US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING MPT OFFGAS VENT VALVING PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-OTM-00011 | SHEET 1 OF 1 | REV 7

BGCAPP_DGN.BDR

07MOTM011.pid 01/14/09
DESIGN FILE: DGNSPEC
PLOTTED BY: USER ON DATE AT SYTIME USING COLOR

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ME-OTM-0102
MPT SCRUBBER RECIRCULATION COOLER

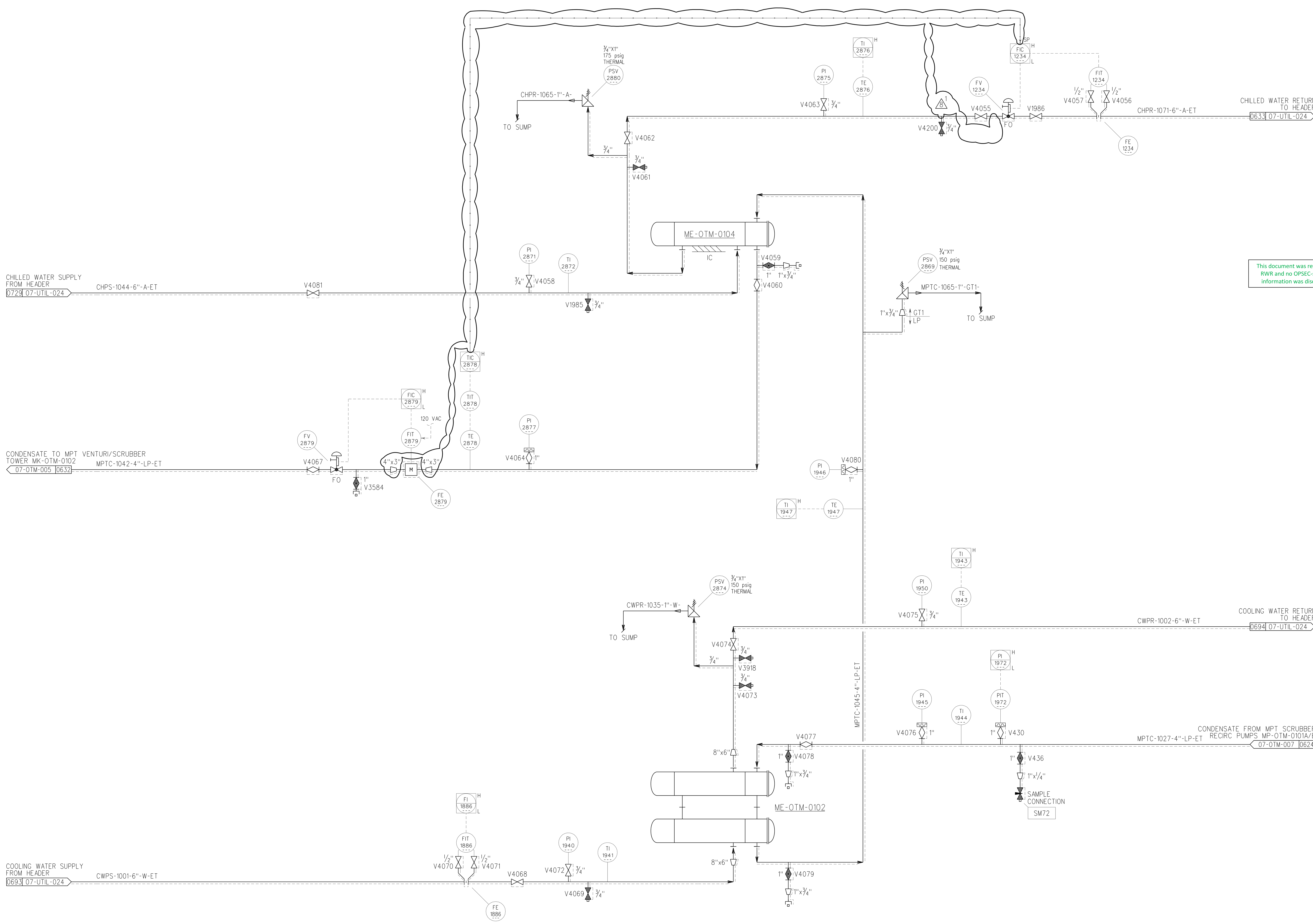
DUTY	: 6.6 MMBTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG
DESIGN TEMP (SHELL)	: 140 °F
DESIGN PRESS (TUBE)	: 150 PSIG
DESIGN TEMP (TUBE)	: 175 °F
MATERIAL OF CONST (SHELL)	: CS
MATERIAL OF CONST (TUBE)	: UNS-N10276
TRIM (SHELL)	: TRIM-1028-0"-W-
TRIM (TUBE)	: TRIM-1024-0"-LP-
	:

ME-OTM-0104
MPT SCRUBBER RECIRC TRIM COOLER

DUTY	: 4.1 MMBTU/HR
DESIGN PRESS (SHELL)	: 175 PSIG
DESIGN TEMP (SHELL)	: 125 °F
DESIGN PRESS (TUBE)	: 150 PSIG
DESIGN TEMP (TUBE)	: 125 °F
MATERIAL OF CONST (SHELL)	: CS
MATERIAL OF CONST (TUBE)	: UNS-N10276
TRIM (SHELL)	: TRIM-1029-0"-A-
TRIM (TUBE)	: TRIM-1026-0"-LP-
	:

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. DELETED.
6. ALL EQUIPMENT AND PIPING SHOWN ON THIS DRAWING ARE LOCATED OUTDOORS.
7. DELETED.



BASED ON BLUE GRASS PFD 24915-07-M5-OTM-00001 REV.7							
BASED ON BLUE GRASS MSD 24915-07-N0-OTM-00001 REV.6							
REFERENCE DRAWINGS							

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
8 [1]	05/17/12	IFC, INCORPORATED DCN-784	BDT	JAW	SA	KMR	KMR
7 [7]	01/15/09	IFC,INC HTL 1297-1299,ADDED VENDR DATA, REVISD PSV	JLL	PEB	BM	BBB	BBB
6 [8]	07/03/07	IFC, MOVED COOLER NOZZLE AND FIT, TREND #139	JSM	JLL	PEB	JB	BBB
5 [20]	11/22/06	IFD, ADDED MODEL REVIEW COMMENTS	JSM	JLL	PEB	JB	BBB
4 [9]	09/19/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
3 [9]	05/02/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
2 [9]	02/22/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
1 [19]	01/13/06	IFA, ADD DC-1, DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING SCRUBBER RECIRCULATION COOLERS PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-OTM-00013 | SHEET 1 OF 1 | REV 8

BGCAPP_DGN.BDR

07MOTM013.pid 05/21/12
DESIGN FILE: DGNSPEC$$$$
PLOTTED BY: USER$ ON DATE$$$$$ AT SYTIME USING COLOR$$$$

MS-SCWO-0020
FLUSH WATER HEATER
DUTY: 0.26 MMBTU/HR

MF-SCWO-0030/0031
HYDROLYSATE BLEND TANK 1/2
AGITATOR
MOTOR HP: 1.5 EA.

MX-SCWO-1000
MX-SCWO-2000
MX-SCWO-3000
MX-SCWO-4000
HIGH PRESSURE AIR
COMPRESSOR SYSTEM
CAPACITY: 555 SCFM EA.

MH-SCWO-0001
FEED ADDITIVE
WEIGH HOPPER
WORKING VOLUME: 5.1 CU FT

MH-SCWO-0002/0003
FEED ADDITIVE
SCREW CONVEYOR NO. 1/NO. 2
CAPACITY: 10.1 FT³/HR EA.

MH-SCWO-0004
BULK BAG
UNLOADER
CAPACITY: 2,000 LB BAG

MH-SCWO-0005
AUTOMATED BULK BAG
ADAPTER DISPENSER
CAPACITY: 5.5 CU FT

MP-SCWO-0034 A/B
HCl SCWO FEED
ADDITIVE METERING PUMP
CAPACITY: 1.2 GPM

MP-SCWO-0035 A/B
H2SO4 SCWO FEED
ADDITIVE METERING PUMP
CAPACITY: 0.4 GPM

MT-SCWO-0030/0031
HYDROLYSATE
BLEND TANK 1/2
WORKING VOLUME:
5510 GAL

MP-SCWO-0030/0031
LP BLEND
PUMP 1/2
CAPACITY: 20.3 GPM EA.

MT-SCWO-0032
BATCH HYDROLYSATE
HOLDING TANK
WORKING CAPACITY:
4,860 GAL

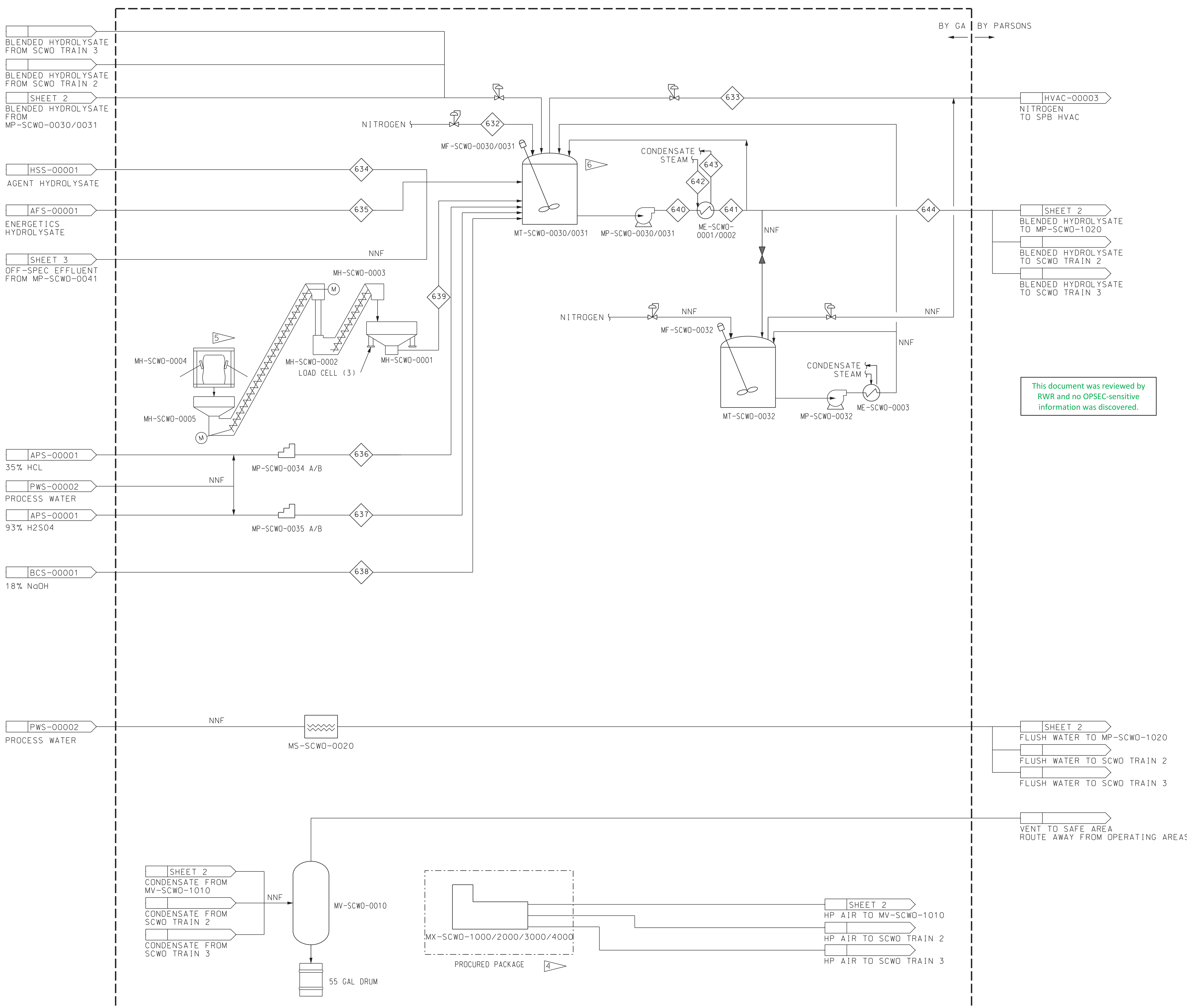
MP-SCWO-0032
BATCH HYDROLYSATE
PUMP
CAPACITY: 20.3 GPM

ME-SCWO-0001/0002
HYDROLYSATE BLEND
TANK 1/2 HEATER
DUTY: 0.73 MMBTU/HR

ME-SCWO-0003
BATCH HYDROLYSATE
HOLDING TANK HEATER
DUTY: 0.73 MMBTU/HR

MV-SCWO-0010
HP CONDENSATE
COLLECTION POT
CAPACITY: 32 GAL

MF-SCWO-0032
BATCH HYDROLYSATE HOLDING
TANK AGITATOR
MOTOR HP: 1.5



NOTES:

1. XXX REPRESENTS M&EB STREAM NUMBERS.
2. REFERENCE THE SCWO P&ID FOR EQUIPMENT-SPECIFIC QUALITY DESIGNATIONS AND ADDITIONAL CONTROL DETAILS.
3. THREE SCWO TRAINS ARE PLANNED TO PROCESS BLENDED HYDROLYSATE FEED.
4. PACKAGE WILL CONSIST OF FOUR HIGH PRESSURE AIR COMPRESSOR UNITS.
5. BULK BAGS OF NaCl OR SULFUR WILL BE DELIVERED TO THE SOLIDS FEED SYSTEM BY OPERATIONS VIA FORKLIFT.
6. THE SCWO SYSTEM IS EQUIPPED WITH TWO HYDROLYSATE BLEND TANKS. DURING NORMAL OPERATION, THE BLEND TANKS ALTERNATE SERVICE AT 12-HR INTERVALS. ONE TANK IS USED TO FEED THE OPERATING SCWO UNITS WHILE THE OTHER TANK IS BEING USED IN THE PREPARATION OF THE NEXT BLENDED FEED BATCH. BATCH PREPARATION OCCURS APPROXIMATELY AS FOLLOWS:

   0-3 HRS: SUPPLY AGENT/ENERGETICS HYDROLYSATE TO THE BLEND TANK AND BEGIN MIXING & HEATUP
   3-4 HRS: MIX & HEAT TANK CONTENTS
   4-8 HRS: SAMPLE & ANALYZE TANK CONTENTS COMPLETE HEATING
   8-10 HRS: INTRODUCE FEED ADDITIVES
   10-12 HRS: IDLE/MARGIN/POTENTIAL ADDITIONAL ANALYSIS

7. NNF = NORMALLY NO FLOW.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

CDM Apvd

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2013.08.15 14:08:37 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC - ADDED PE STAMP	JG	SY	KD	NW	VN
10	05-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
5	10-18-05	IFD-(SHEET REDRAWN) UPDATED MEB DATA & EQPT DETAIL	JG	SV	KD	NW	VN
4	8-11-05	IFA-(SHEET REDRAWN) INCORP. DC43B & N2 BLANKETING	JG	SV	KD	NW	DJ
3	5-23-05	IFD-INCORPORATED IDS COMMENTS AND TRRP RESULTS	JG	SV	KD	NW	DJ
2	7-12-04	IFD-UPDATED CASE 3	JG	SV	KD	NW	DJ
1	7-7-04	IFD-INCORPORATED COMMENTS, ADDED EQUIP SPECS	JG	SV	KD	NW	DJ
0	5-7-04	IFD-UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

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US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING SCWO PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 1 OF 10 | REV 11

BGCAPP_D3.BDR

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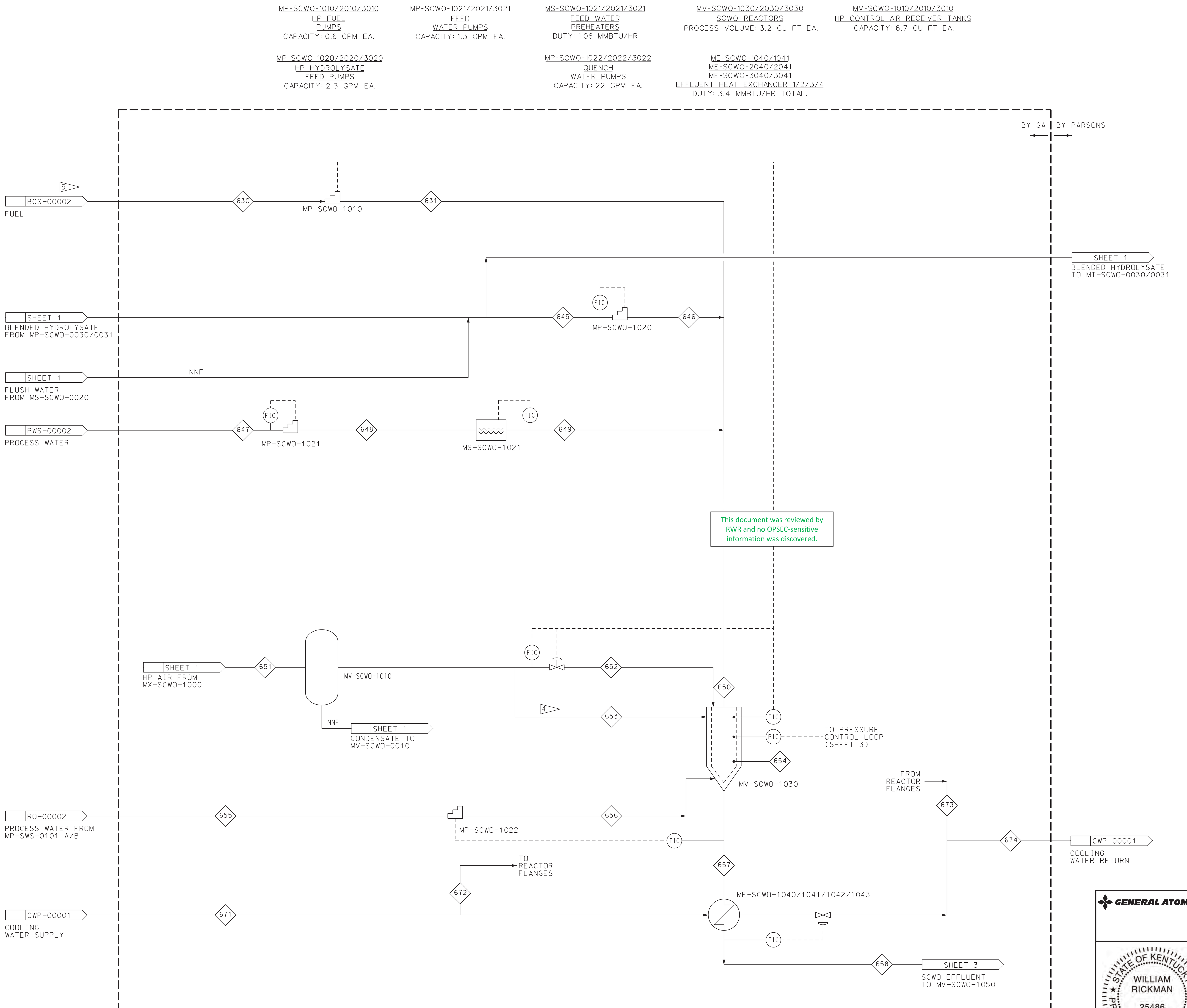

NOTES:

1. DRAWING REPRESENTS A SINGLE SCWO TRAIN. THREE IDENTICAL SCWO TRAINS ARE PROVIDED.
2. XXX REPRESENTS M&EB STREAM NUMBERS.
3. REFERENCE THE SCWO P&ID FOR EQUIPMENT-SPECIFIC QUALITY DESIGNATIONS AND ADDITIONAL CONTROL DETAILS.
4. AIR SUPPLY FOR REACTOR LINER PURGE.
5. NNF = NORMALLY NO FLOW.

CDM Apvd

cn=Issued by Judy Dishon, o=Configuration / Data Management, ou=General Atomics, email=Judy.dishon@ga.com, c=US
2013.08.15 14:11:00 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC - ADDED PE STAMP	JG	SY	KD	NW	VN
10	05-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
5	10-18-05	IFD-(SHEET REDRAWN) UPDATED MEB DATA & EQPT DETAIL	JG	SV	KD	NW	VN
4	8-11-05	IFA-(SHEET REDRAWN) INCORP. DC43B & N2 BLANKETING	JG	SV	KD	NW	DJ
3	5-23-05	IFD-INCORPORATED IDS COMMENTS AND TRRP RESULTS	JG	SV	KD	NW	DJ
2	7-12-04	IFD-UPDATED CASE 3	JG	SV	KD	NW	DJ
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0	5-7-04	IFD-UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

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US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)

RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING SCWO PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-SCWO-00001

SHEET 2 OF 10

REV 11

BGCAPP_D3.BDR

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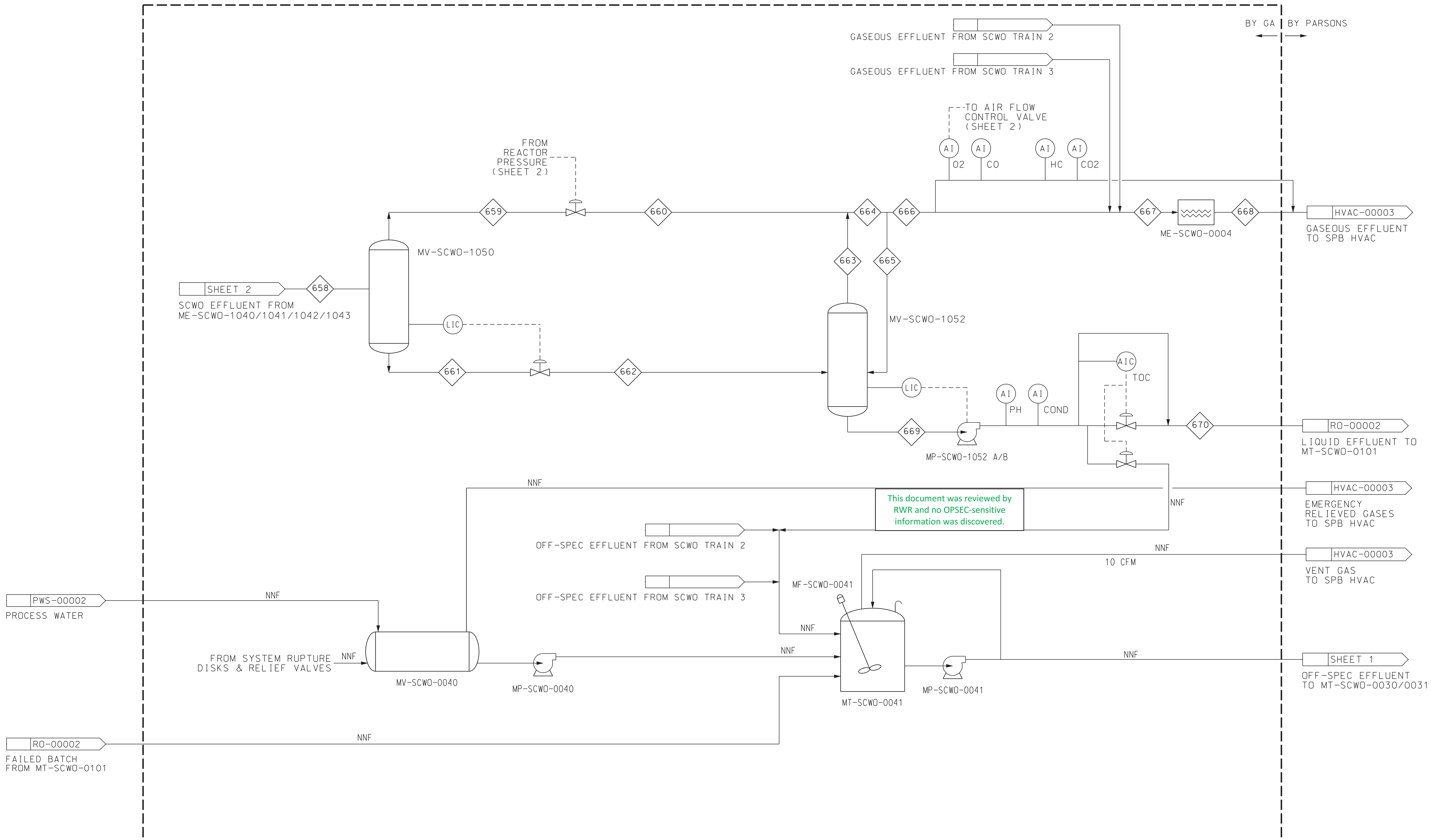
MF-SCWO-0041 OFF-SPEC EFFLUENT TANK AGITATOR	MV-SCWO-1050/2050/3050 HP GAS/LIQUID SEPARATORS	MV-SCWO-1052/2052/3052 LP GAS/LIQUID SEPARATORS	MP-SCWO-1052 A/B MP-SCWO-2052 A/B MP-SCWO-3052 A/B LIQUID EFFLUENT PUMPS	MT-SCWO-0041 OFF-SPEC EFFLUENT TANK	MP-SCWO-0041 OFF-SPEC EFFLUENT PUMP	MV-SCWO-0040 EMERGENCY RELIEF TANK	MP-SCWO-0040 EMERGENCY RELIEF TANK TRANSFER PUMP	ME-SCWO-0004 GAS EFFLUENT DUCT HEATER
MOTOR HP: 1.5	PROCESS VOLUME: 4.7 CU FT EA.	PROCESS VOLUME: 31.2 CU FT EA.	CAPACITY: 25.1 GPM EA.	WORKING CAPACITY: 2,259 GAL	CAPACITY: 18.8 GPM	WORKING CAPACITY: 10,420 GAL	CAPACITY: 14.3 GPM	DUTY: 0.04 MMBTU/HR



NOTES:

1. DRAWING REPRESENTS A SINGLE SCWO TRAIN. THREE IDENTICAL. SCWO TRAINS ARE PROVIDED.
2. XXX REPRESENTS M&EB STREAM NUMBERS.
3. REFERENCE THE SCWO P&ID FOR EQUIPMENT-SPECIFIC QUALITY DESIGNATIONS AND ADDITIONAL CONTROL DETAILS.
4. THE FOLLOWING EQUIPMENT ON THIS SHEET SERVES THE SCWO SYSTEM IN ITS ENTIRETY AND WILL NOT BE PROVIDED ON A PER-TRAIN BASIS:
   - ME-SCWO-0004
   - MV-SCWO-0040
   - MP-SCWO-0040
   - MT-SCWO-0041
   - MP-SCWO-0041
   - MF-SCWO-0041
5. NNF = NORMALLY NO FLOW.

CDM Apvd

cn=Issued by Judy Dishon, o=Configuration / Data Management, ou=General Atomics, email=Judy.dishon@ga.com, c=US
2013.08.15 14:11:22 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC - ADDED PE STAMP	JG	SY	KD	NW	VN
10	05-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
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0	5-7-04	IFD-UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING SCWO PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 3 OF 10 | REV 11

BGCAPP_D3.BDR

...\24915-10-M5-SCWO-00001s03_10.d 5/6/2010 7:20:49 AM

CASE 1: GB BLENDED HYDROLYSATE FEED BASE CASE

STREAM NUMBER		630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650
LINE DESCRIPTION		LP Fuel	HP Fuel	Nitrogen Blanket In	Nitrogen Blanket Out	Agent Hydrolysate	Energetic Hydrolysate	35% HCl Solution	Sulfur	18% NaOH Solution	NaCl Additive	Blended Hydrolysate to Heater Inlet	Blended Hydrolysate from Heater Outlet	Steam to Blended Hydrolysate Heater	Condensate from Blended Hydrolysate Heater	Blended Hydrolysate to Header	LP Blended Hydrolysate Feed	HP Blended Hydrolysate Feed	LP Feed Water	HP Feed Water	Feed Water After Preheater	Combined Nozzle Feed
TEMPERATURE	F	77	78.4	70	110	77	50	77	77			59.2	110	327.9	327.9	109.9	109.9	106.5				101.9
PRESSURE	PSIA	44.23	3665	14.48	14.23	64.23	54.23	44.23	44.23			39.23	39.23	100	100	39.23	39.23	3665				3665
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	0.508	0.507	(0.757)	(1.088)	1.607	3.707	0.072	0.005			16.088	16.161	(33.975)	0.993	5.387	1.796	1.774				2.254
*** VAPOR PHASE ***																						
DENSITY	LB/FT3			0.071	0.063									0.22								
VISCOSITY	cP			0.018	0.018									0.015								
*** LIQUID PHASE ***																						
DENSITY	LB/FT3	52.742	52.866			66.5	72.07	73.03	50			70.88	70.56		56.368	70.56	70.56	71.41				68.11
VISCOSITY	cP	1.074	1.056			1.55	8	2				1.301	0.798		0.151	0.778	0.778	0.802				0.834
MOLECULAR WEIGHT		32.992	32.992	28.013	27.168	19.94	21.544	21.891	32.066			21.089	21.089	18.015	18.015	21.089	21.089	21.089				22.64
ENTHALPY	MM BTU/HR	-0.833	-0.832	0	-0.001	-5.442	-12.409	-0.204	0.028			-54.341	-53.935	-2.546	-2.951	-17.979	-5.993	-5.988				-6.82
VAPOR																						
H2O	LB/HR			0	0.238									449.074								
IPA	LB/HR			0	0.001									0								
CO2	LB/HR			0	0.004									0								
HCL	LB/HR			0	0									0								
Sulfur	LB/HR			0	0									0								
NAOH	LB/HR			0	0									0								
IPMPANA	LB/HR			0	0									0								
MPA-NA2	LB/HR			0	0									0								
DIPU	LB/HR			0	0									0								
O2	LB/HR			0	0.009									0								
N2	LB/HR			3.243	3.880									0								
ARGON	LB/HR			0	0									0								
H2	LB/HR			0	0									0								
N2O	LB/HR			0	0									0								
AMMONIA	LB/HR			0	0									0								
NH4CL	LB/HR			0	0									0								
(NH4)2SO4	LB/HR			0	0									0								
TBA	LB/HR			0	0									0								
CH3F	LB/HR			0	0									0								
CH2F2	LB/HR			0	0									0								
CLOFORM	LB/HR			0	0									0								
C3H7F	LB/HR			0	0									0								
IMPA	LB/HR			0	0									0								
NANO2	LB/HR			0	0									0								
NANO3	LB/HR			0	0									0								
SODIUM FORMATE	LB/HR			0	0									0								
SODIUM ACETATE	LB/HR			0	0									0								
NA3PO4	LB/HR			0	0									0								
NACL	LB/HR			0	0									0								
NAF	LB/HR			0	0									0								
NAHSO4	LB/HR			0	0									0								
NA2SO4	LB/HR			0	0									0								
NAH2PO4	LB/HR			0	0									0								
NA2HPO4	LB/HR			0	0									0								
NAHCO3	LB/HR			0	0									0								
NA2CO3	LB/HR			0	0									0								
HF	LB/HR			0	0									0								
ALUMINUM	LB/HR			0	0									0								
NICKEL	LB/HR			0	0									0								
COPPER	LB/HR			0	0									0								
IRON	LB/HR			0	0									0								
H3PO4	LB/HR			0	0									0								
AL2O3	LB/HR			0	0									0								
MN2O3	LB/HR			0	0									0								
NIO	LB/HR			0	0									0								
CUO	LB/HR			0	0									0								
FE2O3	LB/HR			0	0									0								
TIO2	LB/HR			0	0									0								
AL(OH)3	LB/HR			0	0									0								
C10H22S	LB/HR			0	0									0								
TOTAL VAPOR	LB/HR	0.0	0.0	3.2	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	449.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)																						
H2O	LB/HR	75.574	75.574			751.032	1711.156	27.318	0			7489.608	7489.608		449.074	2496.536	832.179	832.179				907.753
IPA	LB/HR	139.308	139.308			2.706	0	0	0			8.116	8.116		0	2.705	0.902	0.902				140.21
CO2	LB/HR	0	0			0	0.006	0	0			0.005	0.005		0	0.002	0.001	0.001				0.001
HCL	LB/HR	0	0			0	0	14.709	0			0	0		0	0	0	0				0
Sulfur	LB/HR	0	0			0	0	0	7.88			23.64	23.64		0	7.88	2.627	2.627				2.627
NAOH	LB/HR	0	0			16.557	0	0	0			1.262	1.262		0	0.421	0.14	0.14				0.14
IPMPANA	LB/HR	0	0			65.382	0	0	0			196.146	196.146		0	65.382	21.794	21.794				21.794
MPA-NA2	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
DIPU	LB/HR	0	0			1.128	0	0	0			3.384	3.384		0	1.128	0.376	0.376				0.376
O2	LB/HR	0	0			0	0.009	0	0			0	0		0	0	0	0				0
N2	LB/HR	0	0			0.654	0.017	0	0			0.103	0.103		0	0.034	0.011	0.011				0.011
ARGON	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
H2	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
N2O	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
AMMONIA	LB/HR	0	0			0	0.012	0	0			0.036	0.036		0	0.012	0.004	0.004				0.004
NH4CL	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
(NH4)2SO4	LB/HR	0	0			0	1.68	0	0			5.04	5.04		0	1.68	0.56	0.56				0.56
TBA	LB/HR	0	0			1.725	0	0	0			5.175	5.175		0	1.725	0.575	0.575				0.575
CH3F	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
CH2F2	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
CLOFORM	LB/HR	0	0			0.045	0	0	0			0.135	0.135		0	0.045	0.015	0.015				0.015
C3H7F	LB/HR	0	0			0.021	0	0	0			0.063	0.063		0	0.021	0.007	0.007				0.007
IMPA	LB/HR	0	0			0.345	0	0	0			1.035	1.035		0	0.345	0.115	0.115				0.115
NANO2	LB/HR	0	0			0	8.622	0	0			25.866	25.866		0	8.622	2.874	2.874				2.874
NANO3	LB/HR	0	0			0	0.027	0	0			0.081	0.081		0	0.027	0.009	0.009				0.009
SODIUM FORMATE	LB/HR	0	0			0	24.774	0	0			74.322	74.322		0	24.774	8.258	8.258				8.258
SODIUM ACETATE	LB/HR	0	0			0	3.108	0	0			9.324	9.324		0	3.108	1.036	1.036				1.036
NA3PO4	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
NACL	LB/HR	0	0			0	116.133	0	0			419.132	419.132		0	139.711	46.57	46.57				46.57
NAF	LB/HR	0	0			15.768	0	0	0			47.304	47.304		0	15.768	5.256	5.256				5.256
NAHSO4	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
NA2SO4	LB/HR	0	0			0	276.987	0	0			830.961	830.961		0	276.987	92.329	92.329				92.329
NAH2PO4	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
NA2HPO4	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
NAHCO3	LB/HR	0	0			0	0.294	0	0			0.882	0.882		0	0.294	0.098	0.098				0.098
NA2CO3	LB/HR	0	0			0	0.021	0	0			0.063	0.063		0	0.021	0.007	0.007				0.007
HF	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
ALUMINUM	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
NICKEL	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
COPPER	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
IRON	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
H3PO4	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
AL2O3	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
MN2O3	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
NIO	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
CUO	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
FE2O3	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
TIO2	LB/HR	0	0			0	0	0	0			0	0		0	0	0	0				0
AL(OH)3	LB/HR	0	0			0	0.012	0	0			0.036	0.036		0	0.012	0.004	0.004				0.004
C10H22S	LB/HR	0	0			1.779	0	0	0			5.337	5.337		0	1.779	0.593	0.593				0.593
TOTAL LIQUID	LB/HR	214.9	214.9	0.0	0.0	857.142	2142.9	42.027	7.9	0.0	0.0	9147.1	9147.1	0.0	449.1	3049.0	1016.3	1016.3	0.0	0.0	0.0	1231.2
AVERAGE FLOW	LB/HR	214.9	214.9	3.2	4.1	857.1	2142.9	42.0	7.9	0.0	0.0	9147.1	9147.1	449.1	449.1	3049.0	1016.3	1016.3	0.0	0.0	0.0	1231.222
INSTANTANEOUS FLOW	LB/HR	214.9	214.9	3.2	11.7	12000.0	12000.0	504.3	94.6	0.0	0.0	9147.1	9147.1	449.1	449.1	3049.0	1016.3	1016.3	0.0	0.0	0.0	1231.2
NOTES				1		1	1	1	1	1	1					2						

STREAM NUMBER		651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674
LINE DESCRIPTION		HP Air from Compressor	HP Reaction Air	Liner Purge Air	Pre-Quench Reaction Products	LP Quench Water	HP Quench Water	Quenched Effluent	Cooled Effluent	HP Gas Effluent from HP GLS	LP Gas Effluent from HP GLS	HP Liquid Effluent from HP GLS	LP Liquid Effluent from HP GLS	Gaseous Effluent from LP GLS	Recombined Gaseous Effluent	Liquid Return to LP GLS	Gaseous Effluent	Inlet to Gas Effluent Heater	Outlet from Gas Effluent Heater	Liquid Effluent	Liquid Effluent to RO	Cooling Water Supply	Cooling Water to Reactor Flange	Cooling Water from Reactor Flange	Cooling Water Return
TEMPERATURE	F	70	70	70	1200	77	77.9	266	140	140	45	140	139.6	139.6	97.4	97.4	97.4	97.4	110	139.6	139.5	90	90	106	119.1
PRESSURE	PSIA	3665	3665	3415	3415	54.23	3415	3415	3415	3415	14.23	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	104.23	104.23	84.23	84.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	(1.969)	(1.788)	(0.099)	(10.679)	21.680	21.465	80.792	40.203	(1.519)	(298.458)	28.838	1375.744	(178.119)	3701.655	0.020	(491.29)	(1473.871)	(1057.324)	24.748	24.748	135.162	9.028	9.058	136.025
*** VAPOR PHASE ***																									
DENSITY	LB/FT3	17.12	17.921	16.822	4.922			4.337	15.311	15.311	0.078	15.311	0.063	0.063	0.07		0.07	0.07	0.069						
VISCOSITY	cP	0.026	0.018	0.018	0.039			0.027	0.019	0.019	0.017	0.019	0.018	0.018	0.018		0.018	0.018	0.018						
*** LIQUID PHASE ***																									
DENSITY	LB/FT3					62.227	62.85	57.524	60.785			60.785	60.431		62.02	62.02				60.431	60.431	62.137	62.137	61.933	61.743
VISCOSITY	cP					0.765	0.758	0.206	0.452			0.452	0.46		0.634	0.634				0.459	0.459	0.677	0.677	0.589	0.528
MOLECULAR WEIGHT		28.966	28.966	28.863	25.283	18.022	18.022	19.317	19.317	29.704	29.704	18.602	18.602	28.633	29.345	18.017	29.433	29.433	29.433	18.238	18.238	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-0.041	-0.041	-0.002	-6.506	-73.828	-73.72	-80.214	-81.973	-0.766	-0.776	-81.207	-81.206	-1.055	-1.831	-0.067	-1.764	-5.292	-5.272	-80.218	-80.218	-458.921	-30.655	-30.583	-456.971
VAPOR																									
H2O	LB/HR	0	0	0	1089.365			27.055	3.373	2.530	2.530	0.843	86.363	86.363	88.893		88.893	266.679	266.679						
IPA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CO2	LB/HR	1.169	1.111	0.058	343.728			246.265	236.668	177.501	177.501	59.167	165.108	165.108	342.609		342.609	1027.827	1027.827						
HCL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
Sulfur	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NAOH	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
IPMPANA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
MPA-NA2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
DIPU	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
O2	LB/HR	468.136	444.988	23.148	70.05			91.179	90.461	67.845	67.845	22.615	25.342	25.342	93.187		93.187	279.561	279.561						
N2	LB/HR	1526.972	1451.467	75.505	1452.302			1502.031	1504.717	1128.538	1128.538	376.179	399.174	399.174	1527.712		1527.712	4583.136	4583.136						
ARGON	LB/HR	26.06	24.771	1.289	24.771			25.609	25.762	19.322	19.322	6.441	6.735	6.735	26.057		26.057	78.171	78.171						
H2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
N2O	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
AMMONIA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NH4CL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
(NH4)2SO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
TBA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CH3F	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CH2F2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CLOFORM	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
C3H7F	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
IMPA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NANO2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NANO3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
SODIUM FORMATE	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
SODIUM ACETATE	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NA3PO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NACL	LB/HR	0	0	0	46.592			0	0	0	0	0	0	0	0		0	0	0						
NAF	LB/HR	0	0	0	5.269			0	0	0	0	0	0	0	0		0	0	0						
NAHSO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NA2SO4	LB/HR	0	0	0	105.05			0	0	0	0	0	0	0	0		0	0	0						
NAH2PO4	LB/HR	0	0	0	16.432			0	0	0	0	0	0	0	0		0	0	0						
NA2HPO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NAHCO3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NA2CO3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
HF	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
ALUMINUM	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NICKEL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
COPPER	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
IRON	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
H3PO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
AL2O3	LB/HR	0	0	0	0.003			0	0	0	0	0	0	0	0		0	0	0						
MN2O3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NIO	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CUO	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
FE2O3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
TIO2	LB/HR	0	0	0	0.102			0	0	0	0	0	0	0	0		0	0	0						
AL(OH)3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
C10H22S	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
TOTAL VAPOR	LB/HR	2022.3	1922.337	100.0	3153.7	0.0	0.0	1892.1	1861.0	1395.7	1395.7	465.2	682.7	682.7	2078.5	0.0	2078.5	6235.4	6235.4	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)																									
H2O	LB/HR					10816.05	10816.05	11878.36	11902.042			11902.04	11816.52	9.824	9.824	9.824				11816.52	11816.52	67368.25	4500	4500	67368.25
IPA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
CO2	LB/HR					0	0	97.521	107.118			107.118	1.177		0.001	0.001				1.177	1.177	0	0	0	0
HCL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
Sulfur	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NAOH	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
IPMPANA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
MPA-NA2	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
DIPU	LB/HR					0	[illegible]	[illegible]	[illegible]			0	0		0	0				0	0	0	0	0	0
O2	LB/HR					0	[illegible]	[illegible]	[illegible]			2.737	0.011		0	0				0.011	0.011	0	0	0	0
N2	LB/HR					0	[illegible]	[illegible]	[illegible]			23.090	0.095		0	0				0.095	0.095	0	0	0	0
ARGON	LB/HR					0	[illegible]	[illegible]	[illegible]			0.298	0.003		0	0				0.003	0.003	0	0	0	0
H2	LB/HR					0	[illegible]	[illegible]	[illegible]			0	0		0	0				0	0	0	0	0	0
N2O	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
AMMONIA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NH4CL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
(NH4)2SO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
TBA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
CH3F	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
CH2F2	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
CLOFORM	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
C3H7F	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
IMPA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NANO2	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NANO3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
SODIUM FORMATE	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
SODIUM ACETATE	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NA3PO4	LB/HR					0.001	0.001	0.001	0.001			0.001	0.001		0	0				0.001	0.001	0	0	0	0
NACL	LB/HR					1.344	1.344	47.936	47.936			47.936	47.936		0	0				47.936	47.936	0	0	0	0
NAF	LB/HR					0.153	0.153	5.422	5.422			5.422	5.422		0	0				5.422	5.422	0	0	0	0
NAHSO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NA2SO4	LB/HR					3.006	3.006	108.056	108.056			108.056	108.056		0	0				108.056	108.056	0	0	0	0
NAH2PO4	LB/HR					0.014	0.014	16.446	16.446			16.446	16.446		0	0				16.445	16.445	0	0	0	0
NA2HPO4	LB/HR					0.574	0.574	0.574	0.574			0.574	0.574		0	0				0.574	0.574	0	0	0	0
NAHCO3	LB/HR					0.133	0.133	0.133	0.133			0.133	0.133		0	0				0.138	0.138	0	0	0	0
NA2CO3	LB/HR					0.003	0.003	0.003	0.003			0.003	0.003		0	0				0.003	0.003	0	0	0	0
HF	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
ALUMINUM	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NICKEL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
COPPER	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
IRON	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
H3PO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
AL2O3	LB/HR					0	0	0.003	0.003			0.003	0.003		0	0				0.003	0.003	0	0	0	0
MN2O3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NIO	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
CUO	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
FE2O3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
TIO2	LB/HR					0	0	0.102	0.102			0.102	0.102		0	0				0.102	0.102	0	0	0	0
AL(OH)3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
C10H22S	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
TOTAL LIQUID	LB/HR	0.0	0.0	0.0	0.0	10821.3	10821.3	12182.8	12214.0	0.0	0.0	12214.0	11996.5	9.8	9.8	9.8	0.0	0.0	0.0	11996.5	11996.5	67368.3	4500.0	4500.0	67368.3
AVERAGE FLOW	LB/HR	2022.3	1922.337	100.00	3153.66	10821.28	10821.28	14074.9	14074.9	1395.7	1395.7	12679.2	12679.2	692.5	2088.3	9.8	2078.5	6235.4	6235.4	11996.5	11996.5	67368.3	4500.0	4500.0	67368.3
INSTANTANEOUS FLOW	LB/HR	2022.3	1922.337	100.0	3153.7	10821.3	10821.3	14074.9	14074.9	1395.7	1395.7	12679.2	12679.2	692.5	2088.3	9.8	2078.5	6235.4	6235.4	11996.5	11996.5	67368.3	4500.0	4500.0	67368.3
NOTES																		4	4						

1 - Represents feed to hydrolysate blend tanks
2 - Represents blended hydrolysate flow to three SCWO trains.
3 - Represents flow from three SCWO trains.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

GENERAL NOTES:

1. ALL INFORMATION AND CALCULATIONS USED IN THE DETERMINATION OF STREAM DATA MAY BE FOUND IN THE "MASS AND ENERGY BALANCES FOR THE SCWO SYSTEM", CALC. NO. 24915-10-M4-SCWO-00001, REV. 11, MAY 2010.
2. THE INSTANTANEOUS FLOW RATES FOR STREAMS 634, 635 ASSUME THE DELIVERY OF A 12-HR SUPPLY OF AGENT/ENERGETICS HYDROLYSATE TO THE BLEND TANK (BASED ON THE SUPPLY TO 3 SCWO TRAINS AT THE NOMINAL PROCESSING RATE OF 1,000 LB/HR) IN 3-HRS.
3. THE INSTANTANEOUS FLOW RATES OF STREAMS 636, 637 CORRESPOND TO THE DELIVERY OF A 12-HR SUPPLY OF EACH FEED ADDITIVE IN 1-HR.

CDM Apvd

cn=Issued by Judy Dishon, o=Configuration / Data Management, ou=General Atomics, email=Judy.dishon@ga.com, c=US
2013.08.15 14:11:55 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC (ADDED PE STAMP)	JG	SY	KD	NW	VN
10	05-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
5	10-18-05	IFD-(SHEET REDRAWN) UPDATED MEB DATA & EQPT DETAIL	JG	SV	KD	NW	VN
4	8-11-05	IFA-(SHEET REDRAWN) INCORP. DC43B & N2 BLANKETING	JG	SV	KD	NW	DJ
3	5-23-05	IFD, INCORPORATED IDS COMMENTS AND TRRP RESULTS	JG	SV	KD	NW	DJ
2	7-12-04	IFD, UPDATED CASE 3	JG	SV	KD	NW	DJ
1	7-7-04	IFD, INCORPORATED COMMENTS, ADDED EQUIP SPECS	JG	SV	KD	NW	DJ
0	5-7-04	IFD, UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

SCWO PROCESSING BUILDING
SCWO
PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-SCWO-00001

SHEET 4 OF 10

REV 11

BGCAPP_D3.BDR

CASE 2: VX BLENDED HYDROLYSATE FEED BASE CASE

STREAM NUMBER		630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650
LINE DESCRIPTION		LP Fuel	HP Fuel	Nitrogen Blanket In	Nitrogen Blanket Out	Agent Hydrolysate	Energetic Hydrolysate	35% HCl Solution	93% H2SO4 Solution	18% NaOH Solution	NaCl Additive	Blended Hydrolysate to Heater Inlet	Blended Hydrolysate from Heater Outlet	Steam to Blended Hydrolysate Heater	Condensate from Blended Hydrolysate Heater	Blended Hydrolysate to Header	LP Blended Hydrolysate Feed	HP Blended Hydrolysate Feed	LP Feed Water	HP Feed Water	Feed Water After Preheater	Combined Nozzle Feed
TEMPERATURE	F	77	78.4	77.4	110	77	50	77	77		80	58.4	110	327.9	327.9	109.9	109.9	112				107
PRESSURE	PSIA	44.23	3665	14.48	14.23	64.23	54.23	44.23	44.23		14.23	39.23	39.23	100	100	39.23	39.23	3665				3665
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	0.445	0.444	(0.753)	(0.881)	1.453	3.707	0.066	0.022		0.044	15.891	16.023	(34.400)	1.004	5.341	1.780	1.781				2.215
*** VAPOR PHASE ***																						
DENSITY	LB/FT3			0.071	0.065									0.22								
VISCOSITY	cP			0.018	0.018									0.015								
*** LIQUID PHASE ***																						
DENSITY	LB/FT3	52.742	52.866			73.54	72.07	73.03	113.69		81	72.66	72.06		56.368	72.06	72.06	72.03				68.52
VISCOSITY	cP	1.074	1.056			6.57	8	2	21			1.225	0.75		0.151	0.75	0.75	0.737				0.769
MOLECULAR WEIGHT		32.992	32.992	28.013	27.184	22.596	20.805	21.891	74.807		58.442	21.522	21.522	18.015	18.015	21.522	21.522	21.522				22.745
ENTHALPY	MM BTU/HR	-0.729	-0.729	0	-0.001	-4.954	-12.837	-0.188	-0.077		-0.077	-54.636	-54.226	-2.574	-2.984	-18.075	-6.025	-6.016				-6.744
VAPOR																						
H2O	LB/HR			0	0.192									454.077								
IPA	LB/HR			0	0									0								
ETHANOL	LB/HR			0	0									0								
CO2	LB/HR			0	0									0								
HCL	LB/HR			0	0									0								
H2SO4	LB/HR			0	0									0								
NAOH	LB/HR			0	0									0								
MPA-NA2	LB/HR			0	0									0								
DIPU	LB/HR			0	0									0								
DIPA	LB/HR			0	0									0								
RSSR	LB/HR			0	0									0								
EMPA-NA	LB/HR			0	0									0								
RS-NA	LB/HR			0	0									0								
O2	LB/HR			0	0.012									0								
N2	LB/HR			3.206	3.23									0								
ARGON	LB/HR			0	0									0								
H2	LB/HR			0	0									0								
N2O	LB/HR			0	0									0								
AMMONIA	LB/HR			0	0									0								
NH4CL	LB/HR			0	0									0								
(NH4)2SO4	LB/HR			0	0									0								
NANO2	LB/HR			0	0									0								
NANO3	LB/HR			0	0									0								
SODFORM	LB/HR			0	0									0								
SODACET	LB/HR			0	0									0								
NA3PO4	LB/HR			0	0									0								
C21H36	LB/HR			0	0									0								
NACL	LB/HR			0	0									0								
NAHCO3	LB/HR			0	0									0								
NA2CO3	LB/HR			0	0									0								
NAHSO4	LB/HR			0	0									0								
NA2SO4	LB/HR			0	0									0								
NAH2PO4	LB/HR			0	0									0								
NA2HPO4	LB/HR			0	0									0								
HF	LB/HR			0	0									0								
H3PO4	LB/HR			0	0									0								
SULFUR	LB/HR			0	0									0								
ALUMINUM	LB/HR			0	0									0								
IRON	LB/HR			0	0									0								
NICKEL	LB/HR			0	0									0								
COPPER	LB/HR			0	0									0								
SILICON	LB/HR			0	0									0								
CALCIUM	LB/HR			0	0									0								
AL2O3	LB/HR			0	0									0								
FE2O3	LB/HR			0	0									0								
NIO	LB/HR			0	0									0								
CUO	LB/HR			0	0									0								
AL(OH)3	LB/HR			0	0									0								
SIO2	LB/HR			0	0									0								
CAO	LB/HR			0	0									0								
TIO2	LB/HR			0	0									0								
DICDI	LB/HR			0	0									0								
DCCDI	LB/HR			0	0									0								
TOTAL VAPOR	LB/HR	0.0	0.0	3.2	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	454.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)																						
H2O	LB/HR	66.21	66.21			648.995	1789.371	25.155	1.414		0	7435.019	7435.019		454.077	2478.34	826.113	826.113				892.323
IPA	LB/HR	122.046	122.046			0	0	0	0		0	0	0		0	0	0	0				122.046
ETHANOL	LB/HR	0	0			2.043	0	0	0		0	6.128	6.128		0	2.043	0.681	0.681				0.681
CO2	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
HCL	LB/HR	0	0			0	0	13.545	0		0	0	0		0	0	0	0				0
H2SO4	LB/HR	0	0			0	0	0	18.791		0	0	0		0	0	0	0				0
NAOH	LB/HR	0	0			33.156	0	0	0		0	8.914	8.914		0	2.971	0.99	0.99				0.99
MPA-NA2	LB/HR	0	0			6.915	0	0	0		0	20.745	20.745		0	6.915	2.305	2.305				2.305
DIPU	LB/HR	0	0			0.045	0	0	0		0	0.135	0.135		0	0.045	0.015	0.015				0.015
DIPA	LB/HR	0	0			0.201	0	0	0		0	0.603	0.603		0	0.201	0.067	0.067				0.067
RSSR	LB/HR	0	0			4.263	0	0	0		0	12.789	12.789		0	4.263	1.421	1.421				1.421
EMPA-NA	LB/HR	0	0			67.611	0	0	0		0	202.833	202.833		0	67.611	22.537	22.537				22.537
RS-NA	LB/HR	0	0			87.891	0	0	0		0	263.673	263.673		0	87.891	29.297	29.297				29.297
O2	LB/HR	0	0			0	0.012	0	0		0	0.001	0.001		0	0	0	0				0
N2	LB/HR	0	0			0.039	0.021	0	0		0	0.106	0.106		0	0.035	0.012	0.012				0.012
ARGON	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
H2	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
N2O	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
AMMONIA	LB/HR	0	0			0	0.018	0	0		0	0.054	0.054		0	0.018	0.006	0.006				0.006
NH4CL	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
(NH4)2SO4	LB/HR	0	0			0	1.554	0	0		0	4.662	4.662		0	1.554	0.518	0.518				0.518
NANO2	LB/HR	0	0			0	7.047	0	0		0	21.141	21.141		0	7.047	2.349	2.349				2.349
NANO3	LB/HR	0	0			0	0.024	0	0		0	0.072	0.072		0	0.024	0.008	0.008				0.008
SODFORM	LB/HR	0	0			0	20.238	0	0		0	60.714	60.714		0	20.238	6.746	6.746				6.746
SODACET	LB/HR	0	0			0	2.541	0	0		0	7.623	7.623		0	2.541	0.847	0.847				0.847
NA3PO4	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
C21H36	LB/HR	0	0			3.231	0	0	0		0	9.693	9.693		0	3.231	1.077	1.077				1.077
NACL	LB/HR	0	0			0	95.103	0	0		28.545	436.078	436.078		0	145.359	48.453	48.453				48.453
NAHCO3	LB/HR	0	0			0	0.117	0	0		0	0.351	0.351		0	0.117	0.039	0.039				0.039
NA2CO3	LB/HR	0	0			0	0.012	0	0		0	0.036	0.036		0	0.012	0.004	0.004				0.004
NAHSO4	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
NA2SO4	LB/HR	0	0			0	226.788	0	0		0	762.004	762.004		0	254.001	84.667	84.667				84.667
NAH2PO4	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
NA2HPO4	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
HF	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
H3PO4	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
SULFUR	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
ALUMINUM	LB/HR	0	0			0.000	0	0	0		0	0.000783	0.000783		0	0.000261	8.70E-05	8.70E-05				8.70E-05
IRON	LB/HR	0	0			0.003	0	0	0		0	0.01	0.01		0	0.003	0.001	0.001				0.001
NICKEL	LB/HR	0	0			0.000	0	0	0		0	9.00E-06	9.00E-06		0	3.00E-06	1.00E-06	1.00E-06				1.00E-06
COPPER	LB/HR	0	0			0.000	0	0	0		0	0.000252	0.000252		0	8.40E-05	2.80E-05	2.80E-05				2.80E-05
SILICON	LB/HR	0	0			0.018	0	0	0		0	0.054	0.054		0	0.018	0.006	0.006				0.006
CALCIUM	LB/HR	0	0			0.021	0	0	0		0	0.063	0.063		0	0.021	0.007	0.007				0.007
AL2O3	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
FE2O3	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
NIO	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
CUO	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
AL(OH)3	LB/HR	0	0			0	0.012	0	0		0	0.036	0.036		0	0.012	0.004	0.004				0.004
SIO2	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
CAO	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
TIO2	LB/HR	0	0			0	0	0	0		0	0	0		0	0	0	0				0
DICDI	LB/HR	0	0			0.429	0	0	0		0	1.287	1.287		0	0.429	0.143	0.143				0.143
DCCDI	LB/HR	0	0			2.28	0	0	0		0	6.84	6.84		0	2.28	0.76	0.76				0.76
TOTAL LIQUID	LB/HR	188.3	188.3	0.0	0.0	857.1	2142.9	38.7	20.2	0.0	28.5	9261.7	9261.7	0.0	454.1	3087.2	1029.1	1029.1	0.0	0.0	0.0	1217.329
AVERAGE FLOW	LB/HR	188.3	188.3	3.2	3.4	857.1	2142.9	38.7	20.2	0.0	28.5	9261.7	9261.7	454.1	454.1	3087.2	1029.1	1029.1	0.0	0.0	0.0	1217.3
INSTANTANEOUS FLOW	LB/HR	188.3	188.3	3.2	10.8	12000.0	12000.0	696.6	363.7	0.0	513.8	9261.7	9261.7	454.1	454.1	3087.2	1029.1	1029.1	0.0	0.0	0.0	1217.3
NOTES				1		1	1	1	1	1	1					2						

STREAM NUMBER		651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674
LINE DESCRIPTION		HP Air from Compressor	HP Reaction Air	Liner Purge Air	Pre-Quench Reaction Products	LP Quench Water	HP Quench Water	Quenched Effluent	Cooled Effluent	HP Gas Effluent from HP GLS	LP Gas Effluent from HP GLS	HP Liquid Effluent from HP GLS	LP Liquid Effluent from HP GLS	Gaseous Effluent from LP GLS	Recombined Gaseous Effluent	Liquid Return to LP GLS	Gaseous Effluent	Inlet to Gas Effluent Heater	Outlet from Gas Effluent Heater	Liquid Effluent	Liquid Effluent to RO	Cooling Water Supply	Cooling Water to Reactor Flange	Cooling Water from Reactor Flange	Cooling Water Return
TEMPERATURE	F	70	70	70	1200	77	77.9	356	140	140	45	140	139.4	139.4	95.6	95.6	95.6	95.6	110	139.4	139.4	90	90	106	119.1
PRESSURE	PSIA	3665	3665	3415	3415	54.23	3415	3415	3415	3415	14.23	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	104.23	104.23	84.23	84.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	(2.053)	(1.959)	(0.099)	(11.053)	12.899	12.771	42.134	32.904	(1.685)	(332.901)	20.300	1381.701	(182.603)	0.000	0.021	(535.285)	(1605.855)	(1629.128)	15.833	15.832	134.166	9.028	9.058	135.023
*** VAPOR PHASE ***																									
DENSITY	LB/FT3	17.845	17.845	16.822	4.999			11.019	15.41	15.41	0.078	15.41	0.063	0.063	0.07		0.07	0.07	0.069						
VISCOSITY	cP	0.026	0.026	0.026	0.035			0.024	0.019	0.019	0.017	0.019	0.018	0.018	0.018		0.018	0.018	0.018						
*** LIQUID PHASE ***																									
DENSITY	LB/FT3					62.225	62.848	54.83	60.216			60.216	59.879		62.039	62.039				59.881	59.885	62.137	62.137	61.933	61.743
VISCOSITY	cP					0.765	0.758	0.137	0.456			0.456	0.465		0.644	0.644				0.465	0.465	0.677	0.677	0.589	0.528
MOLECULAR WEIGHT		28.863	28.863	28.863	25.546	18.023	18.023	20.09	20.09	29.822	29.822	18.934	18.934	28.342	29.349	18.017	29.436	29.436	29.436	18.377	18.377	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-0.045	-0.043	-0.002	-6.51	-43.923	-43.859	-50.517	-52.38	-0.901	-0.912	-51.479	-51.442	-1.009	-1.921	-0.072	-1.849	-5.547	-5.523	-50.504	-50.504	-455.54	-30.655	-30.583	-453.605
VAPOR																									
H2O	LB/HR	0	0	0	1079.207			106.946	3.632	2.724	2.724	0.908	88.674	88.674	91.398		91.398	274.194	274.194						
IPA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
ETHANOL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CO2	LB/HR	1.27	1.212	0.058	362.543			303.122	295.158	221.368	221.368	73.789	140.463	140.463	361.831		361.83	1085.49	1085.49						
HCL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
H2SO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NAOH	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
MPA-NA2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
DIPU	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
DIPA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
RSSR	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
EMPA-NA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
RS-NA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
O2	LB/HR	508.724	485.576	23.148	80.869			102.091	102.290	76.717	76.717	25.572	27.293	27.293	104.01		104.01	312.03	312.03						
N2	LB/HR	1659.361	1583.856	75.505	1586.622			1641.832	1647.557	1235.668	1235.668	411.889	426.397	426.397	1662.065		1662.066	4986.198	4986.198						
ARGON	LB/HR	28.319	27.031	1.289	27.031			27.994	28.132	21.099	21.099	7.033	7.219	7.219	28.318		28.3	84.9	84.9						
H2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
N2O	LB/HR	0	0	0	0.594			0.59	0.535	0.401	0.401	0.134	0.192	0.192	0.593		0.593	1.779	1.779						
AMMONIA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NH4CL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
(NH4)2SO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NANO2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NANO3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
SODFORM	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
SODACET	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NA3PO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
C21H36	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NACL	LB/HR	0	0	0	48.449			0	0	0	0	0	0	0	0		0	0	0						
NAHCO3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NA2CO3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NAHSO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NA2SO4	LB/HR	0	0	0	109.181			0	0	0	0	0	0	0	0		0	0	0						
NAH2PO4	LB/HR	0	0	0	20.487			0	0	0	0	0	0	0	0		0	0	0						
NA2HPO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
HF	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
H3PO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
SULFUR	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
ALUMINUM	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
IRON	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NICKEL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
COPPER	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
SILICON	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CALCIUM	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
AL2O3	LB/HR	0	0	0	0.002			0	0	0	0	0	0	0	0		0	0	0						
FE2O3	LB/HR	0	0	0	0.002			0	0	0	0	0	0	0	0		0	0	0						
NIO	LB/HR	0	0	0	0.000			0	0	0	0	0	0	0	0		0	0	0						
CUO	LB/HR	0	0	0	0.000			0	0	0	0	0	0	0	0		0	0	0						
AL(OH)3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
SIO2	LB/HR	0	0	0	0.006			0	0	0	0	0	0	0	0		0	0	0						
CAO	LB/HR	0	0	0	0.01			0	0	0	0	0	0	0	0		0	0	0						
TIO2	LB/HR	0	0	0	0.296			0	0	0	0	0	0	0	0		0	0	0						
DICDI	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
DCCDI	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
TOTAL VAPOR	LB/HR	2197.7	2097.7	100.0	3315.3	0.0	0.0	2182.6	2077.3	1558.0	1558.0	519.3	690.2	690.2	2248.2	0.0	2248.2	6744.6	6744.6	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)																									
H2O	LB/HR					6434.823	6434.823	7407.084	7510.398			7510.398	7422.632	10.511	10.511	10.511				7422.632	7422.632	66871.91	4500	4500	66871.91
IPA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
ETHANOL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
CO2	LB/HR					0	0	59.479	67.443			67.443	0.77	0.001	0.001	0.001				0.771	0.771	0	0	0	0
HCL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
H2SO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NAOH	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
MPA-NA2	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
DIPU	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
DIPA	LB/HR					0	[illegible]	[illegible]	[illegible]			[illegible]	0		0	0				0	0	0	0	0	0
RSSR	LB/HR					0	[illegible]	[illegible]	[illegible]			[illegible]	0		0	0				0	0	0	0	0	0
EMPA-NA	LB/HR					0	[illegible]	[illegible]	[illegible]			[illegible]	0		0	0				0	0	0	0	0	0
RS-NA	LB/HR					0	[illegible]	[illegible]	[illegible]			[illegible]	0		0	0				0	0	0	0	0	0
O2	LB/HR					0	[illegible]	[illegible]	[illegible]			[illegible]	0.007		0	0				0.007	0.007	0	0	0	0
N2	LB/HR					0	0	[illegible]	[illegible]			[illegible]	0.062		0	0				0.062	0.062	0	0	0	0
ARGON	LB/HR					0	0	0.326	0.188			0.188	0.002		0	0				0.002	0.002	0	0	0	0
H2	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
N2O	LB/HR					0	0	0.004	0.059			0.059	0.001		0	0				0.001	0.001	0	0	0	0
AMMONIA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NH4CL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
(NH4)2SO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NANO2	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NANO3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
SODFORM	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
SODACET	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NA3PO4	LB/HR					0.001	0.001	0.001	0.001			0.001	0.001		0	0				0.001	0.001	0	0	0	0
C21H36	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NACL	LB/HR					0.864	0.864	49.313	49.313			49.313	49.313		0	0				49.313	49.313	0	0	0	0
NAHCO3	LB/HR					0.064	0.064	0.067	0.067			0.067	0.067		0	0				0.067	0.067	0	0	0	0
NA2CO3	LB/HR					0.001	0.001	0	0			0	0		0	0				0	0	0	0	0	0
NAHSO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NA2SO4	LB/HR					1.937	1.937	111.118	111.118			111.118	111.118		0	0				111.118	111.118	0	0	0	0
NAH2PO4	LB/HR					0.006	0.006	20.493	20.493			20.493	20.493		0	0				20.493	20.493	0	0	0	0
NA2HPO4	LB/HR					0.373	0.373	0.373	0.373			0.373	0.373		0	0				0.373	0.373	0	0	0	0
HF	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
H3PO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
SULFUR	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
ALUMINUM	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
IRON	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NICKEL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
COPPER	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
SILICON	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
CALCIUM	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
AL2O3	LB/HR					0	0	0.002	0.002			0.002	0.002		0	0				0.002	0.002	0	0	0	0
FE2O3	LB/HR					0	0	0.002	0.002			0.002	0.002		0	0				0.002	0.002	0	0	0	0
NIO	LB/HR					0	0	0.000	0.000			0.000	0.000		0	0				0.000	0.000	0	0	0	0
CUO	LB/HR					0	0	0.000	0.000			0.000	0.000		0	0				0.000	0.000	0	0	0	0
AL(OH)3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
SIO2	LB/HR					0	0	0.006	0.006			0.006	0.006		0	0				0.006	0.006	0	0	0	0
CAO	LB/HR					0	0	0.01	0.01			0.01	0.01		0	0				0.01	0.01	0	0	0	0
TIO2	LB/HR					0	0	0.296	0.296			0.296	0.296		0	0				0.296	0.296	0	0	0	0
DICDI	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
DCCDI	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
TOTAL LIQUID	LB/HR	0.0	0.0	0.0	0.0	6438.1	6438.1	7670.8	7776.1	0.0	0.0	7776.1	7605.2	10.5	10.5	10.5	0.0	0.0	0.0	7605.2	7605.2	66871.9	4500.0	4500.0	66871.9
AVERAGE FLOW	LB/HR	2197.7	2097.7	100.0	3315.299	6438.1	6438.1	9853.370	9853.4	1558.0	1558.0	8295.4	8295.4	700.7	2258.7	10.5	2248.2	6744.6	6744.6	7605.2	7605.2	66871.9	4500.0	4500.0	66871.9
INSTANTANEOUS FLOW	LB/HR	2197.7	2097.7	100.0	3315.3	6438.1	6438.1	9853.4	9853.4	1558.0	1558.0	8295.4	8295.4	700.7	2258.7	10.5	2248.2	6744.6	6744.6	7605.2	7605.2	66871.9	4500.0	4500.0	66871.9
NOTES																		4	4						

1 - Represents feed to hydrolysate blend tanks
2 - Represents blended hydrolysate flow to three SCWO trains.
3 - Represents flow from three SCWO trains.

GENERAL NOTES:

1. ALL INFORMATION AND CALCULATIONS USED IN THE DETERMINATION OF STREAM DATA MAY BE FOUND IN THE "MASS AND ENERGY BALANCES FOR THE SCWO SYSTEM", CALC. NO. 24915-10-M4-SCWO-00001, REV. 11, MAY 2010.
2. THE INSTANTANEOUS FLOW RATES OF STREAMS 634, 635 ASSUME THE DELIVERY OF A 12-HR SUPPLY OF AGENT/ENERGETICS HYDROLYSATE TO THE BLEND TANK (BASED ON THE SUPPLY TO 3 SCWO TRAINS AT THE NOMINAL PROCESSING RATE OF 1,000 LB/HR) IN 3-HRS.
3. THE INSTANTANEOUS FLOW RATES OF STREAMS 636, 637, 639 CORRESPOND TO THE DELIVERY OF A 12-HR SUPPLY OF EACH FEED ADDITIVE IN 40 MINUTES.

CDM Apvd

cn=Issued by Judy Dishon, o=Configuration / Data Management, ou=General Atomics, email=Judy.dishon@ga.com, c=US
2013.08.15 14:12:17 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC (ADDED PE STAMP)	JG	SY	KD	NW	VN
10	5-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
5	10-18-05	IFD-(SHEET REDRAWN) UPDATED MEB DATA & EQPT DETAIL	JG	SV	KD	NW	VN
4	8-11-05	IFA-(SHEET REDRAWN) INCORP. DC43B & N2 BLANKETING	JG	SV	KD	NW	DJ
3	5-23-05	IFD, INCORPORATED IDS COMMENTS AND TRRP RESULTS	JG	SV	KD	NW	DJ
2	7-12-04	IFD, UPDATED CASE 3	JG	SV	KD	NW	DJ
1	7-7-04	IFD, INCORPORATED COMMENTS, ADDED EQUIP SPECS	JG	SV	KD	NW	DJ
0	5-7-04	IFD, UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT
EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE
HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

SCWO PROCESSING BUILDING SCWO PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 5 OF 10 | REV 11

BGCAPP_D3.BDR

Case 3 H blended hydrolysate feed base case

STREAM NUMBER		630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651
LINE DESCRIPTION		LP Fuel	HP Fuel	Nitrogen Blanket In	Nitrogen Blanket Out	Agent Hydrolysate	Energetic Hydrolysate	35% HCl Solution	93% H2SO4 Solution	18% NaOH Solution	NaCl Additive	Blended Hydrolysate to Heater Inlet	Blended Hydrolysate from Heater Outlet	Steam to Blended Hydrolysate Heater	Condensate from Blended Hydrolysate Heater	Blended Hydrolysate to Header	LP Blended Hydrolysate Feed	HP Blended Hydrolysate Feed	LP Feed Water	HP Feed Water	Feed Water After Preheater	Combined Nozzle Feed	HP Air from Compressor
TEMPERATURE	F	77	78.4	70	110	77	50			77	80	66.5	110	327.9	327.9	109.9	109.9	110.7				105.7	70
PRESSURE	PSIA	44.23	3665	14.48	14.23	64.23	54.23			29.23	14.23	39.23	39.23	100	100	39.23	39.23	3665				3665	3665
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	0.576	0.575	(0.903)	(1.208)	2.868	2.915			0.840	0.028	19.967	20.059	(36.102)	1.054	6.753	2.251	2.225				2.781	(2.205)
*** VAPOR PHASE ***																							
DENSITY	LB/FT3			0.072	0.065									0.22									17.845
VISCOSITY	cP			0.018	0.018									0.015									0.026
*** LIQUID PHASE ***																							
DENSITY	LB/FT3	52.742	52.866			65.2	64.16			74.69	81	65.94	65.64		56.368	64.99	64.99	65.75				63.53	
VISCOSITY	cP	1.074	1.056			0.68	8			3		1.35	1.045		0.151	1.045	1.045	1.045				0.728	
MOLECULAR WEIGHT		32.992	32.992	28.013	27.125	19.672	18.81			19.993	58.442	19.403	19.403	18.015	18.015	19.403	19.403	19.403				20.883	28.863
ENTHALPY	MM BTU/HR	-0.945	-0.944	0	-0.002	-9.415	-9.867			-2.844	-0.049	-66.504	-66.074	-2.702	-3.132	-22.025	-7.342	-7.331				-8.275	-0.048
TOTAL VAPOR	LB/HR	0.0	0.0	3.9	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	476.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2360.9
TOTAL LIQUID	LB/HR	243.87	243.87	0	0	1500	1500.001	0	0	503.199	18.069	10561.366	10561.366	0	476.551	3520.445	1173.482	1173.482	0	0	0	1417.35	0
AVERAGE FLOW		243.9	243.9	3.9	4.7	1500.0	1500.0	0.0	0.0	503.2	18.1	10561.4	10561.4	476.6	476.6	3520.4	1173.5	1173.5	0.0	0.0	0.0	1417.4	2360.9
INSTANTANEOUS FLOW		243.9	243.9	3.9	12.2	12000.0	12000.0	0.0	0.0	6038.4	216.8	10561.4	10561.4	476.6	476.6	3520.4	1173.5	1173.5	0.0	0.0	0.0	1417.4	2360.9
NOTES				1		1	1	1	1	1	1					2							

STREAM NUMBER		652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674
LINE DESCRIPTION		HP Reaction Air	Liner Purge Air	Pre-Quench Reaction Products	LP Quench Water	HP Quench Water	Quenched Effluent	Cooled Effluent	HP Gas Effluent from HP GLS	LP Gas Effluent from HP GLS	HP Liquid Effluent from HP GLS	LP Liquid Effluent from HP GLS	Gaseous Effluent from LP GLS	Recombined Gaseous Effluent	Liquid Return to LP GLS	Gaseous Effluent	Inlet to Gas Effluent Heater	Outlet from Gas Effluent Heater	Liquid Effluent	Liquid Effluent to RO	Cooling Water Supply	Cooling Water to Reactor Flange	Cooling Water from Reactor Flange	Cooling Water Return
TEMPERATURE	F	70	70	1200	77	77.9	383	140	140	45	140	139.4	139.4	95.6	95.6	95.6	95.6	110	139.4	139.4	90	90	106	119.2
PRESSURE	PSIA	3665	3415	3415	54.23	3415	3415	3415	3415	14.23	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	104.23	104.23	84.23	84.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	(2.112)	(0.099)	(12.640)	13.486	13.352	46.537	34.988	(1.805)	(356.184)	21.489	1479.116	(195.506)	4284.913	0.023	(572.846)	(1718.539)	(1743.445)	16.729	16.728	161.824	9.028	9.058	162.8643
*** VAPOR PHASE ***																								
DENSITY	LB/FT3	17.845	16.822	4.85			10.63	15.395	15.395	0.078	15.395	0.063	0.063	0.07		0.07	0.07	0.069						
VISCOSITY	cP	0.026	0.026	0.035			0.025	0.019	0.019	0.017	0.019	0.018	0.018	0.018		0.018	0.018	0.018						
*** LIQUID PHASE ***																								
DENSITY	LB/FT3				62.221	62.844	54.366	60.802			60.802	60.384		62.04	62.04				60.385	60.389	62.137	62.137	61.933	61.74
VISCOSITY	cP				0.765	0.758	0.122	0.451			0.451	0.46		0.644	0.644				0.46	0.46	0.677	0.677	0.589	0.527
MOLECULAR WEIGHT		28.863	28.863	24.591	18.023	18.023	19.96	19.96	29.805	29.805	18.794	18.794	28.325	29.332	18.017	29.419	29.419	29.419	18.231	18.231	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-0.046	-0.002	-8.043	-45.92	-45.852	-53.967	-56.242	-0.958	-0.969	-55.284	-55.244	-1.077	-2.046	-0.077	-1.969	-5.908	-5.883	-54.244	-54.244	-549.446	-30.655	-30.583	-547.099
TOTAL VAPOR	LB/HR	2260.9	100.0	3678.2	0.0	0.0	2378.4	2222.6	1666.9	1666.9	555.6	739.0	739.0	2406.0	0.0	2406.0	7217.9	7217.9	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL LIQUID	LB/HR	0	0	0	6730.619	6730.619	8130.493	8286.272	0	0	8286.272	8102.905	11.269	11.269	11.269	0	0	0	8102.905	8102.905	80657.04	4500	4500	80657.04
AVERAGE FLOW		2260.9	100.0	3678.2	6730.6	6730.6	10508.9	10508.9	1666.9	1666.9	8841.9	8841.9	750.3	2417.2	11.3	2406.0	7217.9	7217.9	8102.9	8102.9	80657.0	4500.0	4500.0	80657.0
INSTANTANEOUS FLOW		2260.9	100.0	3678.2	6730.6	6730.6	10508.9	10508.9	1666.9	1666.9	8841.9	8841.9	750.3	2417.2	11.3	2406.0	7217.9	7217.9	8102.9	8102.9	80657.0	4500.0	4500.0	80657.0
NOTES																	4	4						

1 - Represents feed to hydrolysate blend tanks
2 - Represents blended hydrolysate flow to three SCWO trains.
3 - Represents flow from three SCWO trains.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

GENERAL NOTES:

1. ALL INFORMATION AND CALCULATIONS USED IN THE DETERMINATION OF STREAM DATA MAY BE FOUND IN THE "MASS AND ENERGY BALANCES FOR THE SCWO SYSTEM", CALC. NO. 24915-10-M4-SCWO-00001, REV. 11, MAY 2010.
2. THE INSTANTANEOUS FLOW RATES OF STREAMS 634, 635 ASSUME THE DELIVERY OF A 12-HR SUPPLY OF AGENT/ENERGETICS HYDROLYSATE TO THE BLEND TANK (BASED ON THE SUPPLY TO 3 SCWO TRAINS AT THE NOMINAL PROCESSING RATE OF 1,000 LB/HR) IN 3-HRS.
3. THE INSTANTANEOUS FLOW RATES OF STREAMS 638, 639 CORRESPOND TO THE DELIVERY OF A 12-HR SUPPLY OF EACH FEED ADDITIVE IN 1-HR.

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NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC (ADDED PE STAMP)	JG	SY	KD	NW	VN
10	5-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
5	10-18-05	IFD-(SHEET REDRAWN) UPDATED MEB DATA & EQPT DETAIL	JG	SV	KD	NW	VN
4	8-11-05	IFA-(SHEET REDRAWN) INCORP. DC43B & N2 BLANKETING	JG	SV	KD	NW	DJ
3	5-23-05	IFD, INCORPORATED IDS COMMENTS AND TRRP RESULTS	JG	SV	KD	NW	DJ
2	7-12-04	IFD, UPDATED CASE 3	JG	SV	KD	NW	DJ
1	7-7-04	IFD, INCORPORATED COMMENTS, ADDED EQUIP SPECS	JG	SV	KD	NW	DJ
0	5-7-04	IFD, UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)

RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING SCWO PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 6 OF 10 | REV 11

BGCAPP_D3.BDR

GENERAL NOTES:

1. ALL INFORMATION AND CALCULATIONS USED IN THE DETERMINATION OF STREAM DATA MAY BE FOUND IN THE "MASS AND ENERGY BALANCES FOR THE SCWO SYSTEM", CALC. NO. 24915-10-M4-SCWO-00001, REV. 11, MAY 2010.

CASE 4: PRE-IGNITION CASE

STREAM NUMBER		630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646
LINE DESCRIPTION		LP Fuel	HP Fuel	Nitrogen Blanket In	Nitrogen Blanket Out	Agent Hydrolysate	Energetic Hydrolysate	35% HCl Solution	93% H2SO4 Solution	18% NaOH Solution	NaCl Additive	Blended Hydrolysate to Heater Inlet	Blended Hydrolysate from Heater Outlet	Steam to Blended Hydrolysate Heater	Condensate from Blended Hydrolysate Heater	Blended Hydrolysate to Header	LP Blended Hydrolysate Feed	HP Blended Hydrolysate Feed
TEMPERATURE	F																	
PRESSURE	PSIA																	
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)																	
*** VAPOR PHASE ***																		
DENSITY	LB/FT3																	
VISCOSITY	cP																	
*** LIQUID PHASE ***																		
DENSITY	LB/FT3																	
VISCOSITY	cP																	
MOLECULAR WEIGHT																		
ENTHALPY	MM BTU/HR																	
VAPOR																		
H2O	LB/HR																	
IPA	LB/HR																	
N2	LB/HR																	
O2	LB/HR																	
ARGON	LB/HR																	
CO2	LB/HR																	
NAF	LB/HR																	
NAHCO3	LB/HR																	
NACL	LB/HR																	
NA2CO3	LB/HR																	
NA2SO4	LB/HR																	
NAH2PO4	LB/HR																	
NA2HPO4	LB/HR																	
NA3PO4	LB/HR																	
TOTAL VAPOR	LB/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)																		
H2O	LB/HR																	
IPA	LB/HR																	
N2	LB/HR																	
O2	LB/HR																	
ARGON	LB/HR																	
CO2	LB/HR																	
NAF	LB/HR																	
NAHCO3	LB/HR																	
NACL	LB/HR																	
NA2CO3	LB/HR																	
NA2SO4	LB/HR																	
NAH2PO4	LB/HR																	
NA2HPO4	LB/HR																	
NA3PO4	LB/HR																	
TOTAL LIQUID	LB/HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE FLOW	LB/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INSTANTANEOUS FLOW	LB/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOTES																		

STREAM NUMBER		647	648	649	650	651	652	653	654	655	656	657	658	659	660
LINE DESCRIPTION		LP Feed Water	HP Feed Water	Feed Water After Preheater	Combined Nozzle Feed	HP Air from Compressor	HP Reaction Air	Liner Purge Air	Pre-Quench Reaction Products	LP Quench Water	HP Quench Water	Quenched Effluent	Cooled Effluent	HP Gas Effluent from HP GLS	LP Gas Effluent from HP GLS
TEMPERATURE	F	77	77.9	1000	1000	70	70	70	631.7	77	77.9	383	140	140	45
PRESSURE	PSIA	99.23	3665	3665	3665	3665	3665	3415	3415	54.23	3415	3415	3415	3415	14.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	1.301	1.288	(2.033)	(2.033)	(0.432)	(0.338)	(0.099)	14.624	3.408	3.374	11.211	8.682	(0.392)	(75.188)
*** VAPOR PHASE ***															
DENSITY	LB/FT3			5.328	5.328	17.85	17.85	16.826	8.301			10.161	14.588	14.588	0.076
VISCOSITY	cP			0.03	0.03	0.026	0.026	0.026	0.026			0.026	0.02	0.02	0.017
*** LIQUID PHASE ***															
DENSITY	LB/FT3	62.267	62.928						41.305	62.247	62.87	55.007	61.509		
VISCOSITY	cP	0.913	0.902						0.07	0.913	0.904	0.137	0.468		
MOLECULAR WEIGHT		18.015	18.015	18.015	18.015	28.863	28.863	28.863	20.835	18.022	18.022	19.213	19.213	28.857	28.857
ENTHALPY	MM BTU/HR	-4.433	-4.427	-3.54	-3.54	-0.009	-0.007	-0.002	-3.664	-11.603	-11.586	-15.238	-15.869	-0.003	-0.006
VAPOR															
H2O	LB/HR			650	650	0	0	0	602.197			31.49	0.739	0.554	0.554
IPA	LB/HR			0	0	0	0	0	0			0	0	0	0
N2	LB/HR			0	0	349.136	273.631	75.505	273.271			341.888	344.217	258.163	258.163
O2	LB/HR			0	0	107.038	83.889	23.148	83.713			103.823	106.320	79.740	79.740
ARGON	LB/HR			0	0	5.959	4.67	1.289	4.67			5.869	5.867	4.401	4.401
CO2	LB/HR			0	0	0.267	0.209	0.058	0.209			0.267	0	0	0
NAF	LB/HR			0	0	0	0	0	0			0	0	0	0
NAHCO3	LB/HR			0	0	0	0	0	0			0	0	0	0
NACL	LB/HR			0	0	0	0	0	0			0	0	0	0
NA2CO3	LB/HR			0	0	0	0	0	0			0	0	0	0
NA2SO4	LB/HR			0	0	0	0	0	0			0	0	0	0
NAH2PO4	LB/HR			0	0	0	0	0	0			0	0	0	0
NA2HPO4	LB/HR			0	0	0	0	0	0			0	0	0	0
NA3PO4	LB/HR			0	0	0	0	0	0			0	0	0	0
TOTAL VAPOR	LB/HR	0.0	0.0	650.0	650.0	462.4	362.4	100.0	964.1	0.0	0.0	483.3	457.1	342.9	342.9
LIQUID (including dissolved gases)															
H2O	LB/HR	650	650						47.803	1700.76	1700.76	2319.269	2350.02		
IPA	LB/HR	0	0						0	0	0	0	0		
N2	LB/HR	0	0						0.36	0	0	6.888	4.559		
O2	LB/HR	0	0						0.177	0	0	3.038	0.541		
ARGON	LB/HR	0	0						0.01	0	0	0.090	0.092		
CO2	LB/HR	0	0						0	0	0	0	0.267		
NAF	LB/HR	0	0						0	0.024	0.024	0.024	0.024		
NAHCO3	LB/HR	0	0						0	0.021	0.021	0.021	0.021		
NACL	LB/HR	0	0						0	0.211	0.211	0.211	0.211		
NA2CO3	LB/HR	0	0						0	0.001	0.001	0.001	0.001		
NA2SO4	LB/HR	0	0						0	0.473	0.473	0.473	0.473		
NAH2PO4	LB/HR	0	0						0	0.002	0.002	0.002	0.002		
NA2HPO4	LB/HR	0	0						0	0.09	0.09	0.09	0.09		
NA3PO4	LB/HR	0	0						0	0	0	0	0		
TOTAL LIQUID	LB/HR	650	650	0	0	0	0	0	48.35	1701.582	1701.582	2330.108	2356.3	0	0
AVERAGE FLOW	LB/HR	650.0	650.0	650.0	650.0	[illegible]	[illegible]	[illegible]	[illegible]	1701.6	1701.6	2813.4	2813.4	342.9	342.9
INSTANTANEOUS FLOW	LB/HR	650.0	650.0	650.0	650.0	[illegible]	[illegible]	[illegible]	[illegible]	1701.6	1701.6	2813.4	2813.4	342.9	342.9
NOTES															

STREAM NUMBER		661	662	663	664	665	666	667	668	669	670	671	672	673	674
LINE DESCRIPTION		HP Liquid Effluent from HP GLS	LP Liquid Effluent from HP GLS	Gaseous Effluent from LP GLS	Recombined Gaseous Effluent	Liquid Return to LP GLS	Gaseous Effluent	Inlet to Gas Effluent Heater	Outlet from Gas Effluent Heater	Liquid Effluent	Liquid Effluent to RO	Cooling Water Supply	Cooling Water to Reactor Flange	Cooling Water from Reactor Flange	Cooling Water Return
TEMPERATURE	F	140	139.6	139.6	94.9	94.9	94.9	94.9	110	139.6	139.5	90	90	106	117.5
PRESSURE	PSIA	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	104.23	104.23	84.23	84.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	5.752	293.325	(38.581)	883.215	0.005	(118.076)	(354.229)	(364.963)	4.736	4.736	51.446	9.028	9.058	51.755
*** VAPOR PHASE ***															
DENSITY	LB/FT3	14.588	0.06	0.06	0.068		0.068	0.068	0.066						
VISCOSITY	cP	0.02	0.019	0.019	0.019		0.019	0.019	0.019						
*** LIQUID PHASE ***															
DENSITY	LB/FT3	61.509	61.376		62.057	62.057				61.376	61.379	62.137	62.137	61.933	61.766
VISCOSITY	cP	0.468	0.476		0.741	0.741				0.476	0.476	0.783	0.783	0.657	0.584
MOLECULAR WEIGHT		18.372	18.372	26.913	28.252	18.016	28.329	28.329	28.329	18.022	18.022	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-15.866	-15.866	-0.11	-0.116	-0.016	-0.101	-0.302	-0.297	-15.771	-15.771	-174.563	-30.635	-30.563	-173.861
VAPOR															
H2O	LB/HR	0.185	19.368	19.368	19.922		19.922	59.766	59.766						
IPA	LB/HR	0	0	0	0		0	0	0						
N2	LB/HR	86.054	90.594	90.594	348.757		348.757	1046.271	1046.271						
O2	LB/HR	26.580	27.110	27.110	106.850		106.850	320.550	320.550						
ARGON	LB/HR	1.467	1.557	1.557	5.958		5.958	17.874	17.874						
CO2	LB/HR	0	0.264	0.264	0.264		0.264	0.792	0.792						
NAF	LB/HR	0	0	0	0		0	0	0						
NAHCO3	LB/HR	0	0	0	0		0	0	0						
NACL	LB/HR	0	0	0	0		0	0	0						
NA2CO3	LB/HR	0	0	0	0		0	0	0						
NA2SO4	LB/HR	0	0	0	0		0	0	0						
NAH2PO4	LB/HR	0	0	0	0		0	0	0						
NA2HPO4	LB/HR	0	0	0	0		0	0	0						
NA3PO4	LB/HR	0	0	0	0		0	0	0						
TOTAL VAPOR	LB/HR	114.3	138.9	138.9	481.8	0.0	481.8	1445.3	1445.3	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)															
H2O	LB/HR	2350.02	2330.837	2.3	2.3	2.3				2330.837	2330.837	25641.79	4500	4500	25641.79
IPA	LB/HR	0	0		0	0				0	0	0	0	0	0
N2	LB/HR	4.559	0.019		0	0				0.019	0.019	0	0	0	0
O2	LB/HR	0.541	0.011		0	0				0.011	0.011	0	0	0	0
ARGON	LB/HR	0.092	0.001		0	0				0.001	0.001	0	0	0	0
CO2	LB/HR	0.267	0.003		0	0				0.003	0.003	0	0	0	0
NAF	LB/HR	0.024	0.024		0	0				0.024	0.024	0	0	0	0
NAHCO3	LB/HR	0.021	0.021		0	0				0.021	0.021	0	0	0	0
NACL	LB/HR	0.211	0.211		0	0				0.211	0.211	0	0	0	0
NA2CO3	LB/HR	0.001	0.001		0	0				0.001	0.001	0	0	0	0
NA2SO4	LB/HR	0.473	0.473		0	0				0.473	0.473	0	0	0	0
NAH2PO4	LB/HR	0.002	0.002		0	0				0.002	0.002	0	0	0	0
NA2HPO4	LB/HR	0.09	0.09		0	0				0.09	0.09	0	0	0	0
NA3PO4	LB/HR	0	0		0	0				0	0	0	0	0	0
TOTAL LIQUID	LB/HR	2356.3	2331.693	2.3	2.3	2.3	0	0	0	2331.693	2331.693	25641.79	4500	4500	25641.79
AVERAGE FLOW	LB/HR	2470.6	2470.6	141.2	484.1	2.3	481.8	1445.3	1445.3	2331.7	2331.7	25641.8	4500.0	4500.0	25641.8
INSTANTANEOUS FLOW	LB/HR	2470.6	2470.6	141.2	484.1	2.3	481.8	1445.3	1445.3	2331.7	2331.7	25641.8	4500.0	4500.0	25641.8
NOTES								1	1						

1 - Represents flow from three SCWO trains.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

CDM Apvd

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2013.08.15 14:13:08 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC (ADDED PE STAMP)	JG	SY	KD	NW	VN
10	05-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
5	10-18-05	IFD-(SHEET REDRAWN) UPDATED MEB DATA & EQPT DETAIL	JG	SV	KD	NW	VN
4	8-11-05	IFA-(SHEET REDRAWN) INCORP. DC43B & N2 BLANKETING	JG	SV	KD	NW	DJ
3	5-23-05	IFD, INCORPORATED IDS COMMENTS AND TRRP RESULTS	JG	SV	KD	NW	DJ
2	7-12-04	IFD, UPDATED CASE 3	JG	SV	KD	NW	DJ
1	7-7-04	IFD, INCORPORATED COMMENTS, ADDED EQUIP SPECS	JG	SV	KD	NW	DJ
0	5-7-04	IFD, UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group, Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING
SCWO
PROCESS FLOW DIAGRAM

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED
PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 7 OF 10 | REV 11

BGCAPP_D2.BDR

GENERAL NOTES:

1. ALL INFORMATION AND CALCULATIONS USED IN THE DETERMINATION OF STREAM DATA MAY BE FOUND IN THE "MASS AND ENERGY BALANCES FOR THE SCWO SYSTEM", CALC. NO. 24915-10-M4-SCWO-00001, REV. 11, MAY 2010.

CASE 5: IGNITION CASE

STREAM NUMBER		630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646
LINE DESCRIPTION		LP Fuel	HP Fuel	Nitrogen Blanket In	Nitrogen Blanket Out	Agent Hydrolysate	Energetic Hydrolysate	35% HCl Solution	93% H2SO4 Solution	18% NaOH Solution	NaCl Additive	Blended Hydrolysate to Heater Inlet	Blended Hydrolysate from Heater Outlet	Steam to Blended Hydrolysate Heater	Condensate from Blended Hydrolysate Heater	Blended Hydrolysate to Header	LP Blended Hydrolysate Feed	HP Blended Hydrolysate Feed
TEMPERATURE	F	77	78.5															
PRESSURE	PSIA	44.23	3665															
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)																	
*** VAPOR PHASE ***																		
DENSITY	LB/FT3																	
VISCOSITY	cP																	
*** LIQUID PHASE ***																		
DENSITY	LB/FT3	53.313	53.439															
VISCOSITY	cP	1.218	1.194															
MOLECULAR WEIGHT		32.992	32.992															
ENTHALPY	MM BTU/HR	-0.145	-0.145															
VAPOR																		
H2O	LB/HR																	
IPA	LB/HR																	
N2	LB/HR																	
O2	LB/HR																	
ARGON	LB/HR																	
CO2	LB/HR																	
NAF	LB/HR																	
NAHCO3	LB/HR																	
NACL	LB/HR																	
NA2CO3	LB/HR																	
NA2SO4	LB/HR																	
NAH2PO4	LB/HR																	
NA2HPO4	LB/HR																	
NA3PO4	LB/HR																	
TOTAL VAPOR	LB/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)																		
H2O	LB/HR	13.19	13.19															
IPA	LB/HR	24.314	24.314															
N2	LB/HR	0	0															
O2	LB/HR	0	0															
ARGON	LB/HR	0	0															
CO2	LB/HR	0	0															
NAF	LB/HR	0	0															
NAHCO3	LB/HR	0	0															
NACL	LB/HR	0	0															
NA2CO3	LB/HR	0	0															
NA2SO4	LB/HR	0	0															
NAH2PO4	LB/HR	0	0															
NA2HPO4	LB/HR	0	0															
NA3PO4	LB/HR	0	0															
TOTAL LIQUID	LB/HR	37.504	37.504	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE FLOW	LB/HR	37.5	37.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INSTANTANEOUS FLOW	LB/HR	37.5	37.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOTES																		

STREAM NUMBER		647	648	649	650	651	652	653	654	655	656	657	658	659	660
LINE DESCRIPTION		LP Feed Water	HP Feed Water	Feed Water After Preheater	Combined Nozzle Feed	HP Air from Compressor	HP Reaction Air	Liner Purge Air	Pre-Quench Reaction Products	LP Quench Water	HP Quench Water	Quenched Effluent	Cooled Effluent	HP Gas Effluent from HP GLS	LP Gas Effluent from HP GLS
TEMPERATURE	F	77	77.9	1000	928.9	70	70	70	1200	77	77.9	383	140	140	45
PRESSURE	PSIA	99.23	3665	3665	3665	3665	3665	3415	3665	54.23	3415	3415	3415	3415	14.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	1.301	1.288	(2.033)	(1.879)	(0.446)	(0.352)	(0.099)	(3.885)	5.894	5.835	14.087	11.078	(0.361)	(70.251)
*** VAPOR PHASE ***															
DENSITY	LB/FT3			5.328	6.099	17.85	17.85	16.826	4.568			10.42	14.991	14.991	0.077
VISCOSITY	cP			0.03	0.028	0.026	0.026	0.026	0.039			0.025	0.019	0.019	0.017
*** LIQUID PHASE ***															
DENSITY	LB/FT3	62.267	62.928							62.247	62.87	54.869	61.256		
VISCOSITY	cP	0.913	0.902							0.913	0.904	0.136	0.467		
MOLECULAR WEIGHT		18.015	18.015	18.015	18.473	28.863	28.863	28.863	20.941	18.022	18.022	18.878	18.878	29.332	29.332
ENTHALPY	MM BTU/HR	-4.433	-4.427	-3.54	-3.685	-0.01	-0.008	-0.002	-3.764	-20.068	-20.038	-23.79	-24.739	-0.112	-0.115
VAPOR															
H2O	LB/HR			650	663.19	0	0	0	692.345			31.403	0.755	0.566	0.566
IPA	LB/HR			0	24.314	0	0	0	0			0	0	0	0
N2	LB/HR			0	0	360.486	284.981	75.505	284.981			349.355	353.438	265.078	265.078
O2	LB/HR			0	0	110.517	87.369	23.148	29.112			49.991	51.424	38.568	38.568
ARGON	LB/HR			0	0	6.153	4.864	1.289	4.864			6.031	6.062	4.547	4.547
CO2	LB/HR			0	0	0.276	0.218	0.058	53.635			53.693	21.069	15.801	15.801
NAF	LB/HR			0	0	0	0	0	0			0	0	0	0
NAHCO3	LB/HR			0	0	0	0	0	0			0	0	0	0
NACL	LB/HR			0	0	0	0	0	0			0	0	0	0
NA2CO3	LB/HR			0	0	0	0	0	0			0	0	0	0
NA2SO4	LB/HR			0	0	0	0	0	0			0	0	0	0
NAH2PO4	LB/HR			0	0	0	0	0	0			0	0	0	0
NA2HPO4	LB/HR			0	0	0	0	0	0			0	0	0	0
NA3PO4	LB/HR			0	0	0	0	0	0			0	0	0	0
TOTAL VAPOR	LB/HR	0.0	0.0	650.0	687.5	477.4	377.4	100.0	1064.9	0.0	0.0	490.5	432.7	324.6	324.6
LIQUID (including dissolved gases)															
H2O	LB/HR	650	650							2941.41	2941.41	3602.352	3633		
IPA	LB/HR	0	0							0	0	0	0		
N2	LB/HR	0	0							0	0	11.131	7.048		
O2	LB/HR	0	0							0	0	2.269	0.836		
ARGON	LB/HR	0	0							0	0	0.122	0.091		
CO2	LB/HR	0	0							0	0	0	32.624		
NAF	LB/HR	0	0							0.042	0.042	0.042	0.042		
NAHCO3	LB/HR	0	0							0.036	0.036	0.037	0.037		
NACL	LB/HR	0	0							0.365	0.365	0.365	0.365		
NA2CO3	LB/HR	0	0							0.001	0.001	0	0		
NA2SO4	LB/HR	0	0							0.817	0.817	0.817	0.817		
NAH2PO4	LB/HR	0	0							0.004	0.004	0.004	0.004		
NA2HPO4	LB/HR	0	0							0.156	0.156	0.156	0.156		
NA3PO4	LB/HR	0	0							0	0	0	0		
TOTAL LIQUID	LB/HR	650	650	[illegible]	[illegible]	[illegible]	[illegible]	0	0	2942.831	2942.831	3617.296	3675.02	0	0
AVERAGE FLOW	LB/HR	650.0	650.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1064.9	2942.8	2942.8	4107.8	4107.8	324.6	324.6
INSTANTANEOUS FLOW	LB/HR	650.0	650.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1064.9	2942.8	2942.8	4107.8	4107.8	324.6	324.6
NOTES															

STREAM NUMBER		661	662	663	664	665	666	667	668	669	670	671	672	673	674
LINE DESCRIPTION		HP Liquid Effluent from HP GLS	LP Liquid Effluent from HP GLS	Gaseous Effluent from LP GLS	Recombined Gaseous Effluent	Liquid Return to LP GLS	Gaseous Effluent	Inlet to Gas Effluent Heater	Outlet from Gas Effluent Heater	Liquid Effluent	Liquid Effluent to RO	Cooling Water Supply	Cooling Water to Reactor Flange	Cooling Water from Reactor Flange	Cooling Water Return
TEMPERATURE	F	140	139.4	139.4	97.3	97.3	97.3	97.3	110	139.4	139.4	90	90	106	118.3
PRESSURE	PSIA	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	104.23	104.23	84.23	84.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	8.379	347.110	(45.424)	891.709	0.005	(119.212)	(357.636)	(362.895)	7.341	7.341	72.814	9.028	9.058	73.264
*** VAPOR PHASE ***															
DENSITY	LB/FT3	14.991	0.062	0.062	0.069		0.069	0.069	0.068						
VISCOSITY	cP	0.019	0.019	0.019	0.018		0.018	0.018	0.019						
*** LIQUID PHASE ***															
DENSITY	LB/FT3	61.256	61.377		62.022	62.022				61.377	61.381	62.137	62.137	61.933	61.755
VISCOSITY	cP	0.467	0.477		0.721	0.721				0.477	0.477	0.783	0.783	0.657	0.58
MOLECULAR WEIGHT		18.303	18.303	28.167	28.942	18.017	29.026	29.026	29.026	18.023	18.023	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-24.627	-24.635	-0.214	-0.328	-0.016	-0.312	-0.937	-0.933	-24.437	-24.437	-247.07	-30.635	-30.563	-246.05
VAPOR															
H2O	LB/HR	0.189	20.731	20.731	21.297		21.297	63.891	63.891						
IPA	LB/HR	0	0	0	0		0	0	0						
N2	LB/HR	88.359	95.379	95.379	360.457		360.457	1081.371	1081.371						
O2	LB/HR	12.856	13.684	13.684	52.252		52.252	156.756	156.756						
ARGON	LB/HR	1.516	1.605	1.605	6.152		6.152	18.456	18.456						
CO2	LB/HR	5.267	37.578	37.578	53.379		53.379	160.137	160.137						
NAF	LB/HR	0	0	0	0		0	0	0						
NAHCO3	LB/HR	0	0	0	0		0	0	0						
NACL	LB/HR	0	0	0	0		0	0	0						
NA2CO3	LB/HR	0	0	0	0		0	0	0						
NA2SO4	LB/HR	0	0	0	0		0	0	0						
NAH2PO4	LB/HR	0	0	0	0		0	0	0						
NA2HPO4	LB/HR	0	0	0	0		0	0	0						
NA3PO4	LB/HR	0	0	0	0		0	0	0						
TOTAL VAPOR	LB/HR	108.2	169.0	169.0	493.5	0.0	493.5	1480.6	1480.6	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)															
H2O	LB/HR	3633	3612.458	2.34	2.34	2.34				3612.458	3612.458	36292.3	4500	4500	36292.3
IPA	LB/HR	0	0		0	0				0	0	0	0	0	0
N2	LB/HR	7.048	0.029		0	0				0.029	0.029	0	0	0	0
O2	LB/HR	0.836	0.008		0	0				0.008	0.008	0	0	0	0
ARGON	LB/HR	0.091	0.001		0	0				0.001	0.001	0	0	0	0
CO2	LB/HR	32.624	0.314		0	0				0.314	0.314	0	0	0	0
NAF	LB/HR	0.042	0.042		0	0				0.042	0.042	0	0	0	0
NAHCO3	LB/HR	0.037	0.037		0	0				0.037	0.037	0	0	0	0
NACL	LB/HR	0.365	0.365		0	0				0.365	0.365	0	0	0	0
NA2CO3	LB/HR	0	0		0	0				0	0	0	0	0	0
NA2SO4	LB/HR	0.817	0.817		0	0				0.817	0.817	0	0	0	0
NAH2PO4	LB/HR	0.004	0.004		0	0				0.004	0.004	0	0	0	0
NA2HPO4	LB/HR	0.156	0.156		0	0				0.156	0.156	0	0	0	0
NA3PO4	LB/HR	0	0		0	0				0	0	0	0	0	0
TOTAL LIQUID	LB/HR	3675.02	3614.231	2.34	2.34	2.34	0	0	0	3614.231	3614.231	36292.3	4500	4500	36292.3
AVERAGE FLOW	LB/HR	3783.2	3783.2	171.3	495.9	2.3	493.5	1480.6	1480.6	3614.2	3614.2	36292.3	4500.0	4500.0	36292.3
INSTANTANEOUS FLOW	LB/HR	3783.2	3783.2	171.3	495.9	2.3	493.5	1480.6	1480.6	3614.2	3614.2	36292.3	4500.0	4500.0	36292.3
NOTES								1	1						

1 - Represents flow from three SCWO trains.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

CDM Apvd

cn=Issued by Judy Dishon, o=Configuration / Data Management, ou=General Atomics, email=Judy.dishon@ga.com, c=US
2013.08.15 14:14:19 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC (ADDED PE STAMP)	JG	SY	KD	NW	VN
10	5-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
5	10-18-05	IFD-(SHEET REDRAWN) UPDATED MEB DATA & EQPT DETAIL	JG	SV	KD	NW	VN
4	8-11-05	IFA-(SHEET REDRAWN) INCORP. DC43B & N2 BLANKETING	JG	SV	KD	NW	DJ
3	5-23-05	IFD, INCORPORATED IDS COMMENTS	JG	SV	KD	NW	DJ
2	7-12-04	IFD, UPDATED CASE 3	JG	SV	KD	NW	DJ
1	7-7-04	IFD, INCORPORATED COMMENTS, ADDED EQUIP SPECS	JG	SV	KD	NW	DJ
0	5-7-04	IFD, UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT
EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE
HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING
SCWO
PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 8 OF 10 | REV 11

BGCAPP_D3.BDR

GENERAL NOTES:

1. ALL INFORMATION AND CALCULATIONS USED IN THE DETERMINATION OF STREAM DATA MAY BE FOUND IN THE "MASS AND ENERGY BALANCES FOR THE SCWO SYSTEM", CALC. NO. 24915-10-M4-SCWO-00001, REV. 11, MAY 2010.

CASE 6: IDLE CASE

STREAM NUMBER		630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646
LINE DESCRIPTION		LP Fuel	HP Fuel	Nitrogen Blanket In	Nitrogen Blanket Out	Agent Hydrolysate	Energetic Hydrolysate	35% HCl Solution	93% H2SO4 Solution	18% NaOH Solution	NaCl Additive	Blended Hydrolysate to Heater Inlet	Blended Hydrolysate from Heater Outlet	Steam to Blended Hydrolysate Heater	Condensate from Blended Hydrolysate Heater	Blended Hydrolysate to Header	LP Blended Hydrolysate Feed	HP Blended Hydrolysate Feed
TEMPERATURE	F	77	78.5															
PRESSURE	PSIA	44.23	3665															
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)																	
*** VAPOR PHASE ***																		
DENSITY	LB/FT3																	
VISCOSITY	cP																	
*** LIQUID PHASE ***																		
DENSITY	LB/FT3	53.313	53.439															
VISCOSITY	cP	1.218	1.194															
MOLECULAR WEIGHT		32.992	32.992															
ENTHALPY	MM BTU/HR	-0.922	-0.921															
VAPOR																		
H2O	LB/HR																	
IPA	LB/HR																	
N2	LB/HR																	
O2	LB/HR																	
ARGON	LB/HR																	
CO2	LB/HR																	
NAF	LB/HR																	
NAHCO3	LB/HR																	
NACL	LB/HR																	
NA2CO3	LB/HR																	
NA2SO4	LB/HR																	
NAH2PO4	LB/HR																	
NA2HPO4	LB/HR																	
NA3PO4	LB/HR																	
TOTAL VAPOR	LB/HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)																		
H2O	LB/HR	83.791	83.791															
IPA	LB/HR	154.455	154.455															
N2	LB/HR	0	0															
O2	LB/HR	0	0															
ARGON	LB/HR	0	0															
CO2	LB/HR	0	0															
NAF	LB/HR	0	0															
NAHCO3	LB/HR	0	0															
NACL	LB/HR	0	0															
NA2CO3	LB/HR	0	0															
NA2SO4	LB/HR	0	0															
NAH2PO4	LB/HR	0	0															
NA2HPO4	LB/HR	0	0															
NA3PO4	LB/HR	0	0															
TOTAL LIQUID	LB/HR	238.246	238.246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE FLOW	LB/HR	238.2	238.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INSTANTANEOUS FLOW	LB/HR	238.2	238.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOTES																		

STREAM NUMBER		647	648	649	650	651	652	653	654	655	656	657	658	659	660
LINE DESCRIPTION		LP Feed Water	HP Feed Water	Feed Water After Preheater	Combined Nozzle Feed	HP Air from Compressor	HP Reaction Air	Liner Purge Air	Pre-Quench Reaction Products	LP Quench Water	HP Quench Water	Quenched Effluent	Cooled Effluent	HP Gas Effluent from HP GLS	LP Gas Effluent from HP GLS
TEMPERATURE	F	77	77.9	77.9	78.1	70	70	70	1200	77	77.9	383	140	140	45
PRESSURE	PSIA	99.23	3665	3665	3665	3665	3665	3415	3415	54.23	3415	3415	3415	3415	14.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	1.301	1.288	1.288	1.843	(2.332)	(2.239)	(0.099)	(11.436)	10.033	9.933	43.592	31.811	(1.961)	(385.406)
*** VAPOR PHASE ***															
DENSITY	LB/FT3					17.85	17.85	16.826	4.789			10.585	15.331	15.331	0.078
VISCOSITY	cP					0.018	0.018	0.018	0.041			0.025	0.019	0.019	0.017
*** LIQUID PHASE ***															
DENSITY	LB/FT3	62.267	62.928	62.928	60.071					62.247	62.87	54.776	60.936		
VISCOSITY	cP	0.913	0.902	0.902	0.945					0.913	0.904	0.135	0.46		
MOLECULAR WEIGHT		18.015	18.015	18.015	20.513	28.863	28.863	28.863	25.35	18.022	18.022	20.435	20.435	29.745	29.745
ENTHALPY	MM BTU/HR	-4.433	-4.427	-4.427	-5.348	-0.051	-0.049	-0.002	-5.47	-34.16	-34.109	-39.566	-41.318	-0.89	-0.903
VAPOR															
H2O	LB/HR					0	0	0	918.999			169.597	4.17	3.128	3.128
IPA	LB/HR					0	0	0	0			0	0	0	0
N2	LB/HR					1885.88	1810.375	75.505	1810.375			1868.093	1874.392	1405.794	1405.794
O2	LB/HR					578.17	555.022	23.148	184.934			205.319	206.720	155.040	155.040
ARGON	LB/HR					32.199	30.906	1.289	30.906			31.735	32.047	24.035	24.035
CO2	LB/HR					1.444	1.386	0.058	340.721			302.154	287.602	215.701	215.701
NAF	LB/HR					0	0	0	0			0	0	0	0
NAHCO3	LB/HR					0	0	0	0			0	0	0	0
NACL	LB/HR					0	0	0	0			0	0	0	0
NA2CO3	LB/HR					0	0	0	0			0	0	0	0
NA2SO4	LB/HR					0	0	0	0			0	0	0	0
NAH2PO4	LB/HR					0	0	0	0			0	0	0	0
NA2HPO4	LB/HR					0	0	0	0			0	0	0	0
NA3PO4	LB/HR					0	0	0	0			0	0	0	0
TOTAL VAPOR	LB/HR	0.0	0.0	0.0	0.0	2497.7	2397.7	100.0	3285.9	0.0	0.0	2576.9	2404.9	1803.7	1803.7
LIQUID (including dissolved gases)															
H2O	LB/HR	650	650	650	733.791					5006.902	5006.902	5756.304	5921.731		
IPA	LB/HR	0	0	0	154.455					0	0	0	0		
N2	LB/HR	0	0	0	0					0	0	17.787	11.488		
O2	LB/HR	0	0	0	0					0	0	2.763	1.362		
ARGON	LB/HR	0	0	0	0					0	0	0.461	0.148		
CO2	LB/HR	0	0	0	0					0	0	38.625	53.177		
NAF	LB/HR	0	0	0	0					0.071	0.071	0.071	0.071		
NAHCO3	LB/HR	0	0	0	0					0.061	0.061	0.064	0.064		
NACL	LB/HR	0	0	0	0					0.622	0.622	0.622	0.622		
NA2CO3	LB/HR	0	0	0	0					0.002	0.002	0	0		
NA2SO4	LB/HR	0	0	0	0					1.391	1.391	1.391	1.391		
NAH2PO4	LB/HR	0	0	0	0					0.006	0.006	0.006	0.006		
NA2HPO4	LB/HR	0	0	0	0					0.266	0.266	0.266	0.266		
NA3PO4	LB/HR	0	0	0	0					0	0	0	0		
TOTAL LIQUID	LB/HR	650	650	650	888.246	0	0	0	0	5009.32	5009.32	5818.36	5990.33	0	0
AVERAGE FLOW	LB/HR	650.0	650.0	650.0	888.2	2497.7	2397.7	100.0	3285.9	5009.3	5009.3	8395.3	8395.3	1803.7	1803.7
INSTANTANEOUS FLOW	LB/HR	650.0	650.0	650.0	888.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5009.3	5009.3	8395.3	8395.3	1803.7	1803.7
NOTES															

STREAM NUMBER		661	662	663	664	665	666	667	668	669	670	671	672	673	674
LINE DESCRIPTION		HP Liquid Effluent from HP GLS	LP Liquid Effluent from HP GLS	Gaseous Effluent from LP GLS	Recombined Gaseous Effluent	Liquid Return to LP GLS	Gaseous Effluent	Inlet to Gas Effluent Heater	Outlet from Gas Effluent Heater	Liquid Effluent	Liquid Effluent to RO	Cooling Water Supply	Cooling Water to Reactor Flange	Cooling Water from Reactor Flange	Cooling Water Return
TEMPERATURE	F	140	137.5	137.5	93.2	93.2	93.2	93.2	110	137.5	137.4	90	90	106	119
PRESSURE	PSIA	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	104.23	104.23	84.23	84.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	17.144	1517.719	(201.321)	4567.618	0.023	(610.641)	(1831.923)	(1901.662)	11.836	11.836	126.793	9.028	9.058	127.600
*** VAPOR PHASE ***															
DENSITY	LB/FT3	15.331	0.063	0.063	0.07		0.07	0.07	0.068						
VISCOSITY	cP	0.019	0.019	0.019	0.018		0.018	0.018	0.018						
*** LIQUID PHASE ***															
DENSITY	LB/FT3	60.936	61.411		62.066	62.066				61.411	61.415	62.137	62.137	61.933	61.744
VISCOSITY	cP	0.46	0.485		0.754	0.754				0.485	0.485	0.783	0.783	0.657	0.576
MOLECULAR WEIGHT		18.824	18.824	28.216	29.268	18.018	29.35	29.35	29.35	18.024	18.024	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-40.428	-40.383	-0.974	-1.878	-0.078	-1.799	-5.398	-5.367	-39.486	-39.486	-430.23	-30.635	-30.563	-428.407
VAPOR															
H2O	LB/HR	1.043	95.149	95.149	98.277		98.277	294.831	294.831						
IPA	LB/HR	0	0	0	0		0	0	0						
N2	LB/HR	468.598	480.038	480.038	1885.832		1885.832	5657.496	5657.494						
O2	LB/HR	51.680	53.032	53.032	208.072		208.072	624.216	624.219						
ARGON	LB/HR	8.012	8.157	8.157	32.192		32.192	96.577	161.283						
CO2	LB/HR	71.900	124.618	124.618	340.319		340.319	1020.957	1020.954						
NAF	LB/HR	0	0	0	0		0	0	0						
NAHCO3	LB/HR	0	0	0	0		0	0	0						
NACL	LB/HR	0	0	0	0		0	0	0						
NA2CO3	LB/HR	0	0	0	0		0	0	0						
NA2SO4	LB/HR	0	0	0	0		0	0	0						
NAH2PO4	LB/HR	0	0	0	0		0	0	0						
NA2HPO4	LB/HR	0	0	0	0		0	0	0						
NA3PO4	LB/HR	0	0	0	0		0	0	0						
TOTAL VAPOR	LB/HR	601.2	761.0	761.0	2564.7	0.0	2564.7	7694.1	7758.8	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)															
H2O	LB/HR	5921.731	5827.624	11.494	11.494	11.494				5827.624	5827.624	63196.86	4500	4500	63196.86
IPA	LB/HR	0	0		0	0				0	0	0	0	0	0
N2	LB/HR	11.488	0.048		0	0				0.048	0.049	0	0	0	0
O2	LB/HR	1.362	0.01		0	0				0.01	0.01	0	0	0	0
ARGON	LB/HR	0.148	0.003		0	0				0.003	0.003	0	0	0	0
CO2	LB/HR	53.177	0.46	0.001	0.001	0.001				0.46	0.461	0	0	0	0
NAF	LB/HR	0.071	0.071		0	0				0.071	0.071	0	0	0	0
NAHCO3	LB/HR	0.064	0.064		0	0				0.064	0.064	0	0	0	0
NACL	LB/HR	0.622	0.622		0	0				0.622	0.622	0	0	0	0
NA2CO3	LB/HR	0	0		0	0				0	0	0	0	0	0
NA2SO4	LB/HR	1.391	1.391		0	0				1.391	1.391	0	0	0	0
NAH2PO4	LB/HR	0.006	0.006		0	0				0.006	0.006	0	0	0	0
NA2HPO4	LB/HR	0.266	0.266		0	0				0.266	0.266	0	0	0	0
NA3PO4	LB/HR	0	0		0	0				0	0	0	0	0	0
TOTAL LIQUID	LB/HR	5990.326	5830.565	11.495	11.495	11.495	0	0	0	5830.565	5830.567	63196.86	4500	4500	63196.86
AVERAGE FLOW	LB/HR	6591.6	6591.6	772.5	2576.2	11.5	2564.7	7694.1	7758.8	5830.6	5830.6	63196.9	4500.0	4500.0	63196.9
INSTANTANEOUS FLOW	LB/HR	6591.6	6591.6	772.5	2576.2	11.5	2564.7	7694.1	7758.8	5830.6	5830.6	63196.9	4500.0	4500.0	63196.9
NOTES								1	1						

1 - Represents flow from three SCWO trains.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC (ADDED PE STAMP)	JG	SY	KD	NW	VN
10	5-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
5	10-18-05	IFD-(SHEET REDRAWN) UPDATED MEB DATA & EQPT DETAIL	JG	SV	KD	NW	VN
4	8-11-05	IFA-(SHEET REDRAWN) INCORP. DC43B & N2 BLANKETING	JG	SV	KD	NW	DJ
3	5-23-05	IFD, INCORPORATED IDS COMMENTS	JG	SV	KD	NW	DJ
2	7-12-04	IFD, UPDATED CASE 3	JG	SV	KD	NW	DJ
1	7-7-04	IFD, INCORPORATED COMMENTS, ADDED EQUIP SPECS	JG	SV	KD	NW	DJ
0	5-7-04	IFD, UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

CDM Apvd

cn=Issued by Judy Dishon, o=Configuration / Data Management, ou=General Atomics, email=Judy.dishon@ga.com, c=US
2013.08.15 14:14:58 -07'00'

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group, Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING
SCWO
PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-SCWO-00001

SHEET 9 OF 10

REV 11

BGCAPP_D3.BDR

GENERAL NOTES:

1. ALL INFORMATION AND CALCULATIONS USED IN THE DETERMINATION OF STREAM DATA MAY BE FOUND IN THE "MASS AND ENERGY BALANCES FOR THE SCWO SYSTEM", CALC. NO. 24915-10-M4-SCWO-00001, REV. 11, MAY 2010.

2. THIS CASE IS FOR THROUGHPUT AND AVAILABILITY ANALYSIS (TAA) EVALUATION PURPOSES ONLY. IT IS NOT TO BE USED FOR EQUIPMENT SIZING. THIS CASE INVOLVES THE CONTINUOUS DILUTION OF THE ENERGETICS HYDROLYSATE WITH WATER TO ENSURE THAT SUFFICIENT VOLUME OF ENERGETICS HYDROLYSATE IS AVAILABLE THROUGHOUT THE PLANNED GB OPERATIONAL CAMPAIGN.

OFF-NORMAL THROUGHPUT EVALUATION CASE (2)

STREAM NUMBER		630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650
LINE DESCRIPTION		LP Fuel	HP Fuel	Nitrogen Blanket In	Nitrogen Blanket Out	Agent Hydrolysate	Energetic Hydrolysate	35% HCl Solution	93% H2SO4 Solution	18% NaOH Solution	Sulfur Additive	Blended Hydrolysate to Heater Inlet	Blended Hydrolysate from Heater Outlet	Steam to Blended Hydrolysate Heater	Condensate from Blended Hydrolysate Heater	Blended Hydrolysate to Header	LP Blended Hydrolysate Feed	HP Blended Hydrolysate Feed	LP Feed Water	HP Feed Water	Feed Water After Preheater	Combined Nozzle Feed
TEMPERATURE	F	77	78.4	70	110	77	50	77	77	77	80	59.2	110	327.9	327.9	109.9	109.9	106				101.2
PRESSURE	PSIA	44.23	3665	14.48	14.23	64.23	54.23	44.23	44.23	29.23	14.23	39.23	39.23	100	100	39.23	39.23	3665				3665
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	0.562	0.561	(0.818)	(1.157)	1.607	3.003	0.207	0.089	0.938	0.049	17.392	17.469	(37.220)	0.872	5.851	1.950	1.927				2.458
*** VAPOR PHASE ***																						
DENSITY	LB/FT3			0.071	0.063									0.22								
VISCOSITY	cP			0.018	0.018									0.015								
*** LIQUID PHASE ***																						
DENSITY	LB/FT3	52.742	52.866			66.5	68.45	73.03	113.69	74.69	147.3	70.48	70.17		70.17	70.17	70.17	71.02				67.74
VISCOSITY	cP	1.074	1.056			1.55	6	2	21	3		1.224	0.753		0.754	0.754	0.754	0.78				0.814
MOLECULAR WEIGHT		32.992	32.992	28.013	27.164	19.94	20.46	21.891	74.807	19.993	32.06	20.709	21.01	18.015	18.015	20.709	20.709	21.01				22.15
ENTHALPY	MM BTU/HR	-0.921	-0.92	0	-0.001	-5.442	-10.023	-0.59	-0.309	-3.177	0.085	-59.169	-58.726	-2.785	-3.229	-19.575	-6.525	-6.521				-7.42
VAPOR																						
H2O	LB/HR			0	0.253									491.303								
IPA	LB/HR			0	0									0								
CO2	LB/HR			0	0.002									0								
HCL	LB/HR			0	0									0								
H2SO4	LB/HR			0	0									0								
NAOH	LB/HR			0	0									0								
IPMPANA	LB/HR			0	0									0								
MPA-NA2	LB/HR			0	0									0								
DIPU	LB/HR			0	0									0								
O2	LB/HR			0	0.006									0								
N2	LB/HR			3.486	4.111									0								
ARGON	LB/HR			0	0									0								
H2	LB/HR			0	0									0								
N2O	LB/HR			0	0									0								
AMMONIA	LB/HR			0	0									0								
NH4CL	LB/HR			0	0									0								
(NH4)2SO4	LB/HR			0	0									0								
TBA	LB/HR			0	0									0								
CH3F	LB/HR			0	0									0								
CH2F2	LB/HR			0	0									0								
CLOFORM	LB/HR			0	0									0								
C3H7F	LB/HR			0	0									0								
IMPA	LB/HR			0	0									0								
NANO2	LB/HR			0	0									0								
NANO3	LB/HR			0	0									0								
SODIUM FORMATE	LB/HR			0	0									0								
SODIUM ACETATE	LB/HR			0	0									0								
NA3PO4	LB/HR			0	0									0								
NACL	LB/HR			0	0									0								
NAF	LB/HR			0	0									0								
NAHSO4	LB/HR			0	0									0								
NA2SO4	LB/HR			0	0									0								
NAH2PO4	LB/HR			0	0									0								
NA2HPO4	LB/HR			0	0									0								
NAHCO3	LB/HR			0	0									0								
NA2CO3	LB/HR			0	0									0								
HF	LB/HR			0	0									0								
ALUMINUM	LB/HR			0	0									0								
NICKEL	LB/HR			0	0									0								
COPPER	LB/HR			0	0									0								
IRON	LB/HR			0	0									0								
H3PO4	LB/HR			0	0									0								
AL2O3	LB/HR			0	0									0								
MN2O3	LB/HR			0	0									0								
NIO	LB/HR			0	0									0								
CUO	LB/HR			0	0									0								
FE2O3	LB/HR			0	0									0								
TIO2	LB/HR			0	0									0								
AL(OH)3	LB/HR			0	0									0								
C10H22S	LB/HR			0	0									0								
TOTAL VAPOR	LB/HR	0.0	0.0	3.5	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	491.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)																						
H2O	LB/HR	83.614	83.614			751.032	1406.643	78.942	5.658	460.81	0	8254.356	8254.356		490.809	2751.452	917.151	917.151				1000.765
IPA	LB/HR	154.129	154.129			2.706	0	0	0	0	0	8.117	8.117		0	2.706	0.902	0.902				155.031
CO2	LB/HR	0	0			0	0.003	0	0	0	0	0.002	0.002		0	0.001	0	0				0
HCL	LB/HR	0	0			0	0	42.508	0	0	0	0	0		0	0	0	0				0
H2SO4	LB/HR	0	0			0	0	0	75.174	0	0	0	0		0	0	0	0				0
NAOH	LB/HR	0	0			16.557	0	0	0	101.153	0	29.303	29.303		0	9.768	3.256	3.256				3.256
IPMPANA	LB/HR	0	0			65.382	0	0	0	0	0	196.146	196.146		0	65.382	21.794	21.794				21.794
MPA-NA2	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
DIPU	LB/HR	0	0			1.128	0	0	0	0	0	3.384	3.384		0	1.128	0.376	0.376				0.376
O2	LB/HR	0	0			0	0.006	0	0	0	0	0	0		0	0	0	0				0
N2	LB/HR	0	0			0.654	0.009	0	0	0	0	0.114	0.114		0	0.038	0.013	0.013				0.013
ARGON	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
H2	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
N2O	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
AMMONIA	LB/HR	0	0			0	0.006	0	0	0	0	0.018	0.018		0	0.006	0.002	0.002				0.002
NH4CL	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
(NH4)2SO4	LB/HR	0	0			0	0.942	0	0	0	0	2.826	2.826		0	0.942	0.314	0.314				0.314
TBA	LB/HR	0	0			1.725	0	0	0	0	0	5.175	5.175		0	1.725	0.575	0.575				0.575
CH3F	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
CH2F2	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
CLOFORM	LB/HR	0	0			0.045	0	0	0	0	0	0.135	0.135		0	0.045	0.015	0.015				0.015
C3H7F	LB/HR	0	0			0.021	0	0	0	0	0	0.063	0.063		0	0.021	0.007	0.007				0.007
IMPA	LB/HR	0	0			0.345	0	0	0	0	0	1.035	1.035		0	0.345	0.115	0.115				0.115
NANO2	LB/HR	0	0			0	4.842	0	0	0	0	14.526	14.526		0	4.842	1.614	1.614				1.614
NANO3	LB/HR	0	0			0	0.015	0	0	0	0	0.045	0.045		0	0.015	0.005	0.005				0.005
SODIUM FORMATE	LB/HR	0	0			0	13.908	0	0	0	0	41.724	41.724		0	13.908	4.636	4.636				4.636
SODIUM ACETATE	LB/HR	0	0			0	1.746	0	0	0	0	5.238	5.238		0	1.746	0.582	0.582				0.582
NA3PO4	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
NACL	LB/HR	0	0			0	65.196	0	0	0	49.578	399.993	399.993		0	133.331	44.442	44.442				44.444
NAF	LB/HR	0	0			15.768	0	0	0	0	0	47.724	47.724		0	15.768	5.256	5.256				5.256
NAHSO4	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
NA2SO4	LB/HR	0	0			0	155.499	0	0	0	0	793.108	793.108		0	264.369	88.123	88.123				88.123
NAH2PO4	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
NA2HPO4	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
NAHCO3	LB/HR	0	0			0	0.165	0	0	0	0	0.495	0.495		0	0.165	0.055	0.055				0.055
NA2CO3	LB/HR	0	0			0	0.012	0	0	0	0	0.036	0.036		0	0.012	0.004	0.004				0.004
HF	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
ALUMINUM	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
NICKEL	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
COPPER	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
IRON	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
H3PO4	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
AL2O3	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
MN2O3	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
NIO	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
CUO	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
FE2O3	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
TIO2	LB/HR	0	0			0	0	0	0	0	0	0	0		0	0	0	0				0
AL(OH)3	LB/HR	0	0			0	0.009	0	0	0	0	0.027	0.027		0	0.009	0.003	0.003				0.003
C10H22S	LB/HR	0	0			1.779	0	0	0	0	0	5.337	5.337		0	1.779	0.593	0.593				0.593
Sulfur											7.88	23.64	23.64			23.64	7.88	7.88				7.88
TOTAL LIQUID	LB/HR	237.7	237.7	0.0	0.0	857.1	1649.0	121.5	80.8	562.0	57.5	9832.6	9832.6	0.0	490.8	3293.1	1097.7	1097.7	0.0	0.0	0.0	1335.5
AVERAGE FLOW	LB/HR	237.7	237.7	3.5	4.4	857.1	1649.0	121.5	80.8	562.0	57.5	9832.6	9832.6	491.3	490.8	3293.1	1097.7	1097.7	0.0	0.0	0.0	1335.5
INSTANTANEOUS FLOW	LB/HR	237.7	237.7	3.5	11.7	12000.0	12000.0	2914.8	1940.0	13487.1	1379.0	9832.6	9832.6	491.3	490.8	3293.1	1097.7	1097.7	0.0	0.0	0.0	1335.5
NOTES				1		1	1	1	1	1	1					2						

STREAM NUMBER		651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674
LINE DESCRIPTION		HP Air from Compressor	HP Reaction Air	Liner Purge Air	Pre-Quench Reaction Products	LP Quench Water	HP Quench Water	Quenched Effluent	Cooled Effluent	HP Gas Effluent from HP GLS	LP Gas Effluent from HP GLS	HP Liquid Effluent from HP GLS	LP Liquid Effluent from HP GLS	Gaseous Effluent from LP GLS	Recombined Gaseous Effluent	Liquid Return to LP GLS	Gaseous Effluent	Inlet to Gas Effluent Heater	Outlet from Gas Effluent Heater	Liquid Effluent	Liquid Effluent to RO	Cooling Water Supply	Cooling Water to Reactor Flange	Cooling Water from Reactor Flange	Cooling Water Return
TEMPERATURE	F	70	70	70	1200	77	77.9	266	140	140	45	140	139.5	139.5	97.2	97.2	97.2	97.2	110	139.5	139.5	90	90	106	119
PRESSURE	PSIA	3665	3665	3415	3415	54.23	3415	3415	3415	3415	14.23	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	104.23	104.23	84.23	84.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	(2.162)	(1.972)	(0.099)	(11.775)	23.685	23.451	88.466	43.905	(1.666)	(327.326)	31.441	1506.695	(197.825)	4059.998	0.022	(542.778)	(1628.333)	(1651.932)	26.963	26.963	145.887	9.028	9.058	146.8154
*** VAPOR PHASE ***																									
DENSITY	LB/FT3	17.12	17.921	16.822	4.885			4.338	15.322	15.322	0.078	15.322	0.063	0.063	0.07		0.07	0.07	0.069						
VISCOSITY	cP	0.026	0.026	0.026	0.039			0.027	0.019	0.019	0.017	0.019	0.018	0.018	0.018		0.018	0.018	0.018						
*** LIQUID PHASE ***																									
DENSITY	LB/FT3					62.166	62.787	57.611	60.855			60.855	60.487		62.02	62.02				60.488	60.488	62.137	62.137	61.933	61.744
VISCOSITY	cP					0.766	0.758	0.206	0.452			0.452	0.459		0.635	0.635				0.459	0.459	0.677	0.677	0.589	0.528
MOLECULAR WEIGHT		28.966	28.966	28.863	25.145	18.036	18.022	19.311	19.311	29.72	29.72	18.585	18.592	28.578	29.342	18.017	29.43	29.43	29.43	18.226	18.226	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-0.044	-0.044	-0.002	-7.151	-80.518	-80.4	-87.538	-89.477	-0.845	-0.856	-88.602	-88.601	-1.136	-1.992	-0.073	-1.919	-5.757	-5.735	-87.538	-87.538	-495.335	-30.655	-30.583	-495.335
VAPOR																									
H2O	LB/HR	0	0	0	1200.08			29.704	3.594	2.695	2.695	0.898	94.248	94.248	96.944		96.944	290.832	290.832						
IPA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CO2	LB/HR	1.284	1.226	0.058	373.549			268.725	256.952	192.714	192.7142	64.238	179.643	179.643	372.357		372.357	1117.071	1117.071						
HCL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
H2SO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NAOH	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
IPMPANA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
MPA-NA2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
DIPU	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
O2	LB/HR	514.078	490.93	23.148	81.369			102.313	101.529	76.147	76.147	25.382	28.358	28.358	104.505		104.505	313.515	313.515						
N2	LB/HR	1676.824	1601.319	75.505	1601.844			1649.216	1652.147	1239.111	1239.111	413.037	438.134	438.134	1677.245		1677.245	5031.735	5031.735						
ARGON	LB/HR	28.618	27.329	1.289	27.329			28.112	28.293	21.220	21.220	7.073	7.395	7.395	28.615		28.615	85.845	85.845						
H2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
N2O	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
AMMONIA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NH4CL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
(NH4)2SO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
TBA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CH3F	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CH2F2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CLOFORM	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
C3H7F	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
IMPA	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NANO2	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NANO3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
SODIUM FORMATE	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
SODIUM ACETATE	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NA3PO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NACL	LB/HR	0	0	0	44.466			0	0	0	0	0	0	0	0		0	0	0						
NAF	LB/HR	0	0	0	5.435			0	0	0	0	0	0	0	0		0	0	0						
NAHSO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NA2SO4	LB/HR	0	0	0	100.579			0	0	0	0	0	0	0	0		0	0	0						
NAH2PO4	LB/HR	0	0	0	16.432			0	0	0	0	0	0	0	0		0	0	0						
NA2HPO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NAHCO3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NA2CO3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
HF	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
ALUMINUM	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NICKEL	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
COPPER	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
IRON	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
H3PO4	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
AL2O3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
MN2O3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NIO	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
CUO	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
FE2O3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
TIO2	LB/HR	0	0	0	0.102			0	0	0	0	0	0	0	0		0	0	0						
AL(OH)3	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
C10H22S	LB/HR	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
TOTAL VAPOR	LB/HR	2220.8	2120.8	100.0	3451.2	0.0	0.0	2078.1	2042.5	1531.9	1531.9	510.6	747.8	747.8	2279.7	0.0	2279.7	6839.0	6839.0	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)																									
H2O	LB/HR					11794.03	11794.03	12964.4	12990.51			12990.51	12897.16	10.786	10.786	10.786				12897.16	12897.16	72713.68	4500	4500	72713.68
IPA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
CO2	LB/HR					0	0	104.882	116.655			116.655	1.25	0.001	0.001	0.001				1.25	1.25	0	0	0	0
HCL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
H2SO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NAOH	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
IPMPANA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
MPA-NA2	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
DIPU	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
O2	LB/HR					0	0	2.204	2.988			2.988	0.012		0	0				0.012	0.012	0	0	0	0
N2	LB/HR					0	0	28.133	25.202			25.202	0.104		0	0				0.104	0.097	0	0	0	0
ARGON	LB/HR					0	0	0.506	0.325			0.325	0.003		0	0				0.003	0.003	0	0	0	0
H2	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
N2O	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
AMMONIA	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NH4CL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
(NH4)2SO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
TBA	LB/HR					0	0	0	[illegible]			[illegible]	[illegible]		0	0				0	0	0	0	0	0
CH3F	LB/HR					0	0	0	[illegible]			[illegible]	[illegible]		0	0				0	0	0	0	0	0
CH2F2	LB/HR					0	0	0	[illegible]			[illegible]	[illegible]		0	0				0	0	0	0	0	0
CLOFORM	LB/HR					0	0	0	[illegible]			[illegible]	[illegible]		0	0				0	0	0	0	0	0
C3H7F	LB/HR					0	0	0	[illegible]			[illegible]	[illegible]		0	0				0	0	0	0	0	0
IMPA	LB/HR					0	0	0	[illegible]			[illegible]	[illegible]		0	0				0	0	0	0	0	0
NANO2	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NANO3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
SODIUM FORMATE	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
SODIUM ACETATE	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NA3PO4	LB/HR					0.002	0.002	0.002	0.002			0.002	0.002		0	0				0.002	0.002	0	0	0	0
NACL	LB/HR					4.314	4.314	48.799	48.799			48.779	48.779		0	0				48.779	48.779	0	0	0	0
NAF	LB/HR					0.49	0.49	5.925	5.925			5.925	5.925		0	0				5.925	5.925	0	0	0	0
NAHSO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NA2SO4	LB/HR					9.65	9.65	110.229	110.229			110.229	110.229		0	0				110.229	110.229	0	0	0	0
NAH2PO4	LB/HR					0.044	0.044	16.475	16.475			16.475	16.475		0	0				16.475	16.475	0	0	0	0
NA2HPO4	LB/HR					1.843	1.843	1.843	1.843			1.843	1.843		0	0				1.843	1.843	0	0	0	0
NAHCO3	LB/HR					0.426	0.426	0.443	0.443			0.443	0.443		0	0				0.443	0.443	0	0	0	0
NA2CO3	LB/HR					0.01	0.01	0	0			0	0		0	0				0	0	0	0	0	0
HF	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
ALUMINUM	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NICKEL	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
COPPER	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
IRON	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
H3PO4	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
AL2O3	LB/HR					0	0	0.002	0.002			0.002	0.002		0	0				0.002	0.002	0	0	0	0
MN2O3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
NIO	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
CUO	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
FE2O3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
TIO2	LB/HR					0	0	0.102	0.102			0.102	0.102		0	0				0.102	0.102	0	0	0	0
AL(OH)3	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
C10H22S	LB/HR					0	0	0	0			0	0		0	0				0	0	0	0	0	0
Sulfur																									
TOTAL LIQUID	LB/HR	0.0	0.0	0.0	0.0	11810.8	11810.8	13283.9	13319.5	0.0	0.0	13319.5	13082.3	10.8	10.8	10.8	0.0	0.0	0.0	13082.3	13082.3	72713.7	4500.0	4500.0	72713.7
AVERAGE FLOW	LB/HR	2220.8	2120.8	100.0	3451.2	11810.8	11810.8	15362.0	15362.0	1531.9	1531.9	13830.1	13830.1	758.6	2290.5	10.8	2279.7	6839.0	6839.0	13082.3	13082.3	72713.7	4500.0	4500.0	72713.7
INSTANTANEOUS FLOW	LB/HR	2220.8	2120.8	100.0	3451.2	11810.8	11810.8	15362.0	15362.0	1531.9	1531.9	13830.1	13830.1	758.6	2290.5	10.8	2279.7	6839.0	6839.0	13082.3	13082.3	72713.7	4500.0	4500.0	72713.7
NOTES																		4	4						

1 - Represents feed to hydrolysate blend tanks
2 - Represents blended hydrolysate flow to three SCWO trains.
3 - Represents flow from three SCWO trains.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

CDM Apvd

cn=Issued by Judy Dishon, o=Configuration / Data Management, ou=General Atomics, email=Judy.dishon@ga.com, c=US
2013.08.15 14:15:30 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC (ADDED PE STAMP)	JG	SY	KD	NW	VN
10	5-24-10	IFC-INCORPORATED SULFUR ADDITION	JG	SY	KD	NW	VN
9	12-19-08	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	SY	KD	NW	VN
8	2-8-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
7	1-23-07	IFC-INCORPORATED UPDATED M&EB DATA & REVISED CAPACITIES	JG	MD	KD	NW	VN
6	8-9-06	IFD-UPDATED MEB DATA, EQUIP DETAIL & DCS DELETION	JG	SV	KD	NW	VN
5	10-18-05	IFD-(SHEET REDRAWN) UPDATED MEB DATA & EQPT DETAIL	JG	SV	KD	NW	VN
4	8-11-05	IFA-(SHEET REDRAWN) INCORP. DC43B & N2 BLANKETING	JG	SV	KD	NW	DJ
3	5-23-05	IFD, INCORPORATED IDS COMMENTS	JG	SV	KD	NW	DJ
2	7-12-04	IFD, UPDATED CASE 3	JG	SV	KD	NW	DJ
1	7-7-04	IFD, INCORPORATED COMMENTS, ADDED EQUIP SPECS	JG	SV	KD	NW	DJ
0	5-7-04	IFD, UPDATED W/ CURRENT M&EB DATA	JG	SV	KD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT
EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE
HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

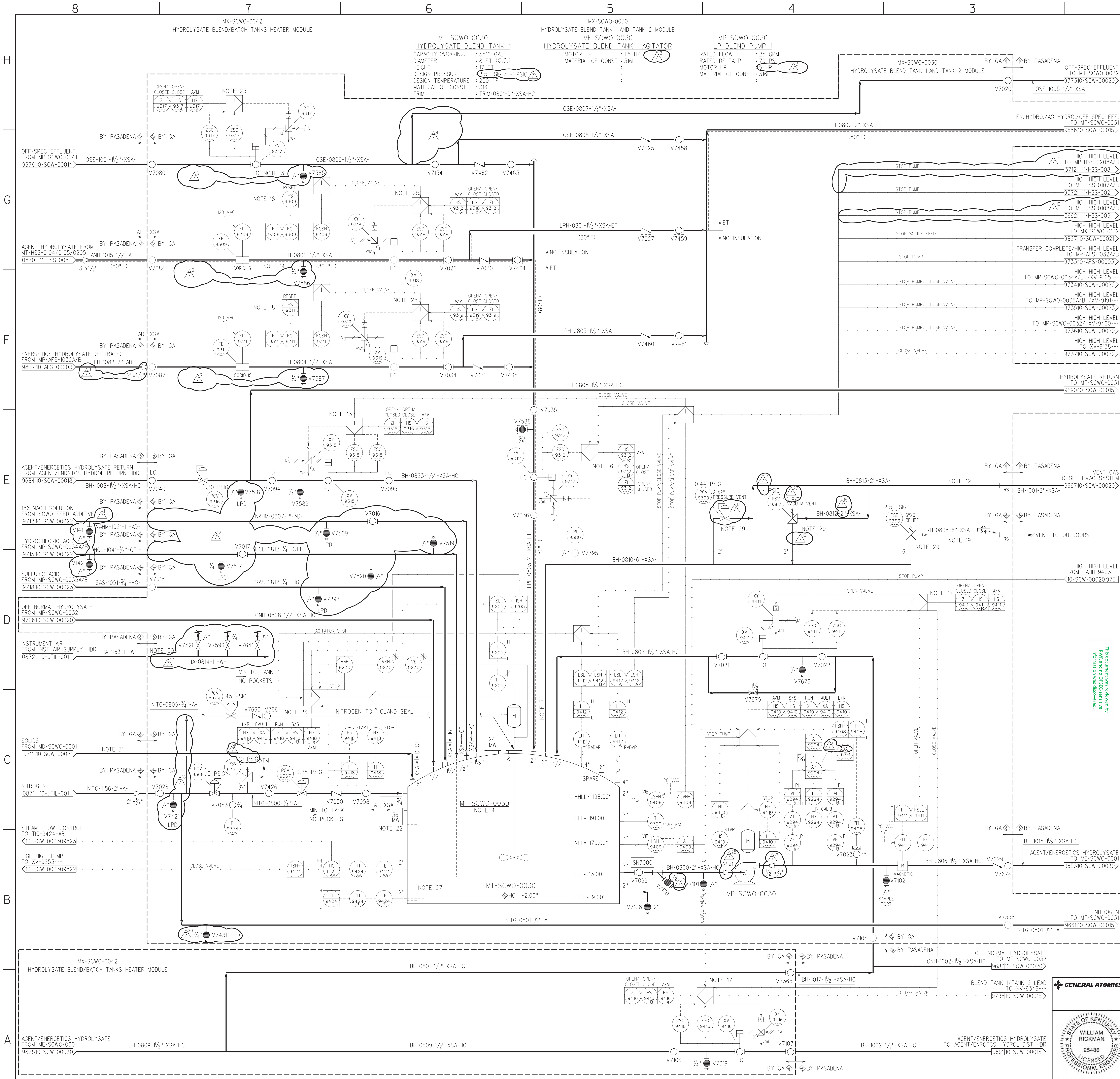
SCWO PROCESSING BUILDING
SCWO
PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-SCWO-00001

SHEET 10 OF 10

REV 11

BGCAPP_D3.BDR



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
3. THE FOLLOWING VALVE(S) ARE NORMALLY CLOSED:
   XV-9317---
4. AGITATOR SHUTOFF WHEN LIQUID LEVEL DROPS TO 6 INCHES ABOVE AGITATOR BLADE (WHICH IS 25 INCHES FROM TANK BOTTOM). AGITATOR START SETPOINT IS 34 INCHES FROM TANK BOTTOM.
6. PROGRAM AN INTERLOCK BETWEEN XV-9312--- AND XV-9419--- (SEE PID 24915-M6-SCWO-00015) TO ENSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
7. LOCATE THE NITROGEN INTAKE AND OUTLET VENT NOZZLES AT THE FURTHEST POSSIBLE DISTANCE APART ON TANK TOP TO MITIGATE ACCUMULATION OF POTENTIALLY COMBUSTIBLE GASES.
9. ✳ DENOTES VENDOR SUPPLIED.
13. PROGRAM XV-9315--- AND XV-9423--- (SEE PID 24915-10-M6-SCWO-00015) TO ENSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME, EXCEPT DURING TRANSITIONS BETWEEEN BLEND PUMPS 1 AND 2. 7 23
14. ELECTRICALLY TRACE AND INSULATE TO MAINTAIN A MINIMUM TEMPERATURE OF 80°F.
15. DESIGN SHALL INCLUDE WELDED PIPE (JOINTS) TO MAXIMUM EXTENT PRACTICAL, FLANGE SHIELDS AROUND FLANGED FITTINGS, AND DRIP-PROOF TRAYS BELOW FITTINGS AND OTHER POTENTIAL LEAK SOURCES. DESIGN TO INCLUDE SECONDARY CONTAINMENT TO CAPTURE FLANGE AND VALVE LEAKS.
16. DENOTES DESIGN RESPONSIBILITY LABEL.
17. PROGRAM XV-9411--- AND XV-9416--- TO ENSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME, EXCEPT DURING TRANSITIONS BETWEEN BLEND TANK RECIRCULATION AND FEEDING OF REACTORS. 7 24
18. FQI-9309--- AND FQI-9311--- TO BE SPECIFIED AND PROGRAMMED TO AUTOMATICALLY RESET TO ZERO UPON BATCH INITIALIZATION.
19. DO NOT POCKET, LINE ROUTING TO CONFORM TO FINAL EQUIPMENT LAYOUT.
21. ELECTRICAL AREA CLASSIFICATION:
    UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)
22. LOCATE MANWAY TO ALLOW MANUAL SPRAY DOWN OF TANK (INTERNAL).
25. NO MORE THAN ONE OF THE THREE VALVES: XV-9317---, XV-9318--- AND XV-9319--- SHALL BE OPEN AT ANY TIME.
26. NITROGEN GAS SEAL.
27. FOUR INTERNAL BAFFLES @ 90° INTERVALS.
28. HEATER ME-SCWO-0001 HAS BEEN MOVED TO PID DRAWING 24915-10-M6-SCWO-00030.
29. LOCATE VALVES AS CLOSE TO TANK SURFACE AS POSSIBLE. 7 25
30. A COMMON INSTRUMENT AIR HEADER AS SHOWN ENTERING THE MODULE AT ZONE D-8 SERVICES BOTH HYDROLYSATE BLEND TANK 1 AND TANK 2 COMPONENTS. ALSO, A COMMON NITROGEN HEADER AS SHOWN ENTERING THE MODULE AT ZONE C-8 SERVICES BOTH BLEND TANK 1 AND TANK 2.
31. SOLID CONNECTION DUCT TO TOP OF ASSOCIATED BLEND TANK.
34. PROGRAM AN INTERLOCK BETWEEN XV-9416 (FEED VALVE TO SCWO REACTOR) AND XV-9312 (OFF-SPEC EFFLUENT, AGENT HYDROLYSATE, ENERGETICS HYDROLYSATE), XV-9165 (HCL), XV-9138 (NAOH), XV-9191 (H2SO4), XV-9400 (OFF-NORMAL HYDROLYSATE), AND MD-SCWO-0001 (SLIDE GATE). IF XV-9416 IS OPEN, ALL CITED FEED VALVES MUST BE CLOSED.
36. NOTES 2, 5, 8, 10, 11, 12, 20, 23, 24, 32 ,33 AND 35 ARE DELETED. 7 26

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Records / Configuration Management, email=Judy.Dishon@ga.com, c=US
2012.08.15 09:09:42 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7 (29)		IFC (INCORPORATES DCN-439)	NL	WR	KWD	KWD	VN
6	11-15-10	IFC (RELIEF PIPING REMOVED PER DCN240 & PE STAMPED)	NL	WR	KWD	KWD	VN
5	05-25-10	IFC (UPDATED TO INCLUDE SULFUR FEED ADDITIVE)	NL	SY	KWD	DNW	VN
4	01-20-09	IFC (INCORPORATES BPBGT COMMENTS AND SSHA RECOMMENDATIONS)	NL	JL	KWD	DNW	VN
3	06-06-07	IFC (ADDED HOLD 1 & HOLD 2)	NL	MD	KWD	DNW	VN
2	03-14-07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08-07-06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10-21-05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING HYDROLYSATE BLEND TANK 1 PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-SCWO-00013 | SHEET 1 OF 1 | REV 7

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MX-SCWO-0040
RELIEF TANK MODULE

MV-SCWO-0040
EMERGENCY RELIEF TANK

CAPACITY (WORKING)	: 10,420 GAL
DIAMETER	: 8 FT (OD)
LENGTH	: 27 FT
DESIGN PRESSURE	: 65 PSIG/FV
DESIGN TEMPERATURE	: 200 °F
MATERIAL OF CONST	: 316L
TRIM	: TRIM-0803-0"-XSA-

ASME CODE STAMPED VESSEL

MP-SCWO-0040
EMERGENCY RELIEF TANK TRANSFER PUMP

RATED FLOW	: 20 GPM
RATED DELTA P	: 15 PSI
MOTOR HP	: 1 HP
MATERIAL OF CONST	: 316/316L

MX-SCWO-0041
OFF-SPEC TRAIN MODULE

MT-SCWO-0041
OFF-SPEC EFFLUENT TANK

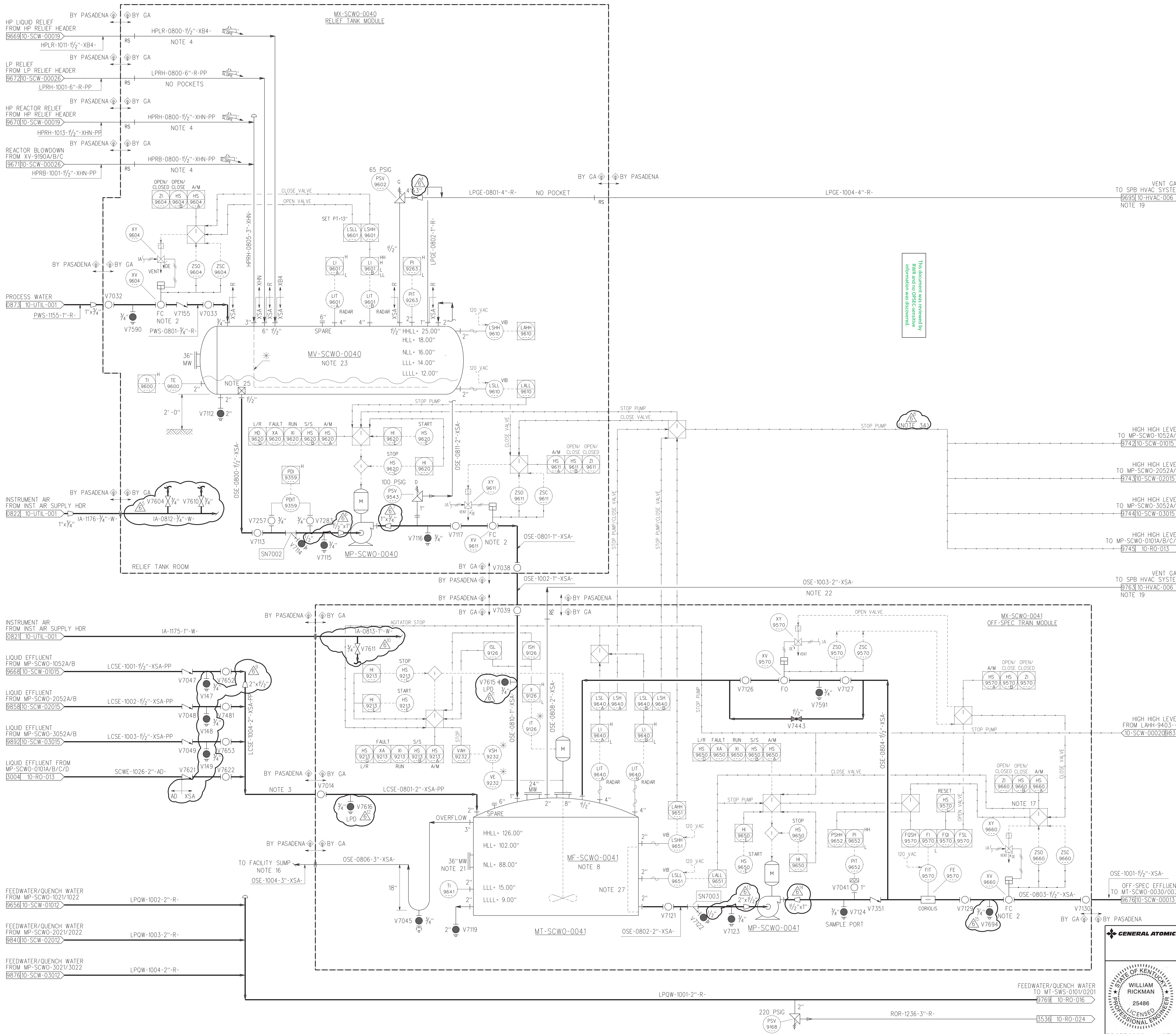
CAPACITY (WORKING)	: 2700 GAL
DIAMETER	: 8 FT (OD)
HEIGHT	: 12 FT
DESIGN PRESSURE	: ATM / -6 INCHES W.C.
DESIGN TEMPERATURE	: 190 °F
MATERIAL OF CONST	: 316L
TRIM	: TRIM-0804-0"-XSA-

MP-SCWO-0041
OFF-SPEC EFFLUENT PUMP

RATED FLOW (DESIGN)	: 25 GPM
RATED DELTA P	: 20 PSI
MOTOR HP	: 3 HP
MATERIAL OF CONST	: 316/316L

MF-SCWO-0041
OFF-SPEC EFFLUENT TANK AGITATOR

MOTOR HP	: 1.5 HP
MATERIAL OF CONST	: 316L



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV-9604---
   XV-9660---
   XV-9611---
3. FINAL ROUTING OF HEADERS TO CONFORM TO EQUIPMENT LAYOUT.
4. LP RELIEF, HP RELIEF AND HP REACTOR BLOWDOWN PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, AND WITH NO POCKETS.
8. AGITATOR SHUTOFF WHEN LIQUID LEVEL DROPS TO 6 INCHES ABOVE AGITATOR BLADE (WHICH IS 18 INCHES FROM THE TANK BOTTOM). AGITATOR START SET POINT IS 25 INCHES FROM TANK BOTTOM.
9. SCWO EMERGENCY RELIEF SYSTEM TO BE DESIGNED TO HANDLE SIMULTANEOUS RELIEF FROM SCWO OPERATING TRAINS. TANK VENT TO BE SIZED LARGE ENOUGH TO PREVENT UNACCEPTABLE SUPERIMPOSED BACK PRESSURE ON ANY UPSTREAM RELIEF DURING WORST-CASE RELIEVING EVENT.
10. ✳ DENOTES VENDOR SUPPLIED.
16. TO BE HARD PIPED TO FACILITY SUMP.
17. PROGRAM AN INTERLOCK BETWEEN XV-9660--- AND XV-9570--- TO ENSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME, EXCEPT WHEN A MINIMUM FLOW BY-PASS CONDITION OCCURS.
18. DENOTES DESIGN RESPONSIBILITY LABEL.
19. VENT LINE FINAL POINT OF CONNECTION TO SPB HVAC SYSTEM NOT TO BE HARD PIPED.
21. LOCATE MANWAY TO ALLOW MANUAL SPRAY DOWN OF TANK (INTERNAL).
22. DO NOT POCKET.
23. RELIEF TANK FLANGES SHALL BE RATED FOR THE DESIGN TEMPERATURE AND PRESSURE OF ASSOCIATED PIPING. INSTRUMENTATION SHALL BE RATED FOR 150 PSIG AND 200°F.
24. BY-PASS OF PSV-9602 IS PROVIDED TO ALLOW SAFE AND QUICK RELIEF WITHOUT EXCEEDING THE FLOW CAPABILITIES OF THE HVAC SYSTEM (PER GOV'T #4714).
25. VORTEX BREAKER TO BE PROVIDED.
26. PSV-9543 SET POINT DEPENDENT UPON FINAL PUMP SELECTION, STEEP PUMP FLOW CURVE REQUIRED.
27. FOUR INTERNAL BAFFLES @ 90° INTERVALS.
32. DESIGN SHALL INCLUDE WELDED PIPE (JOINTS) TO MAXIMUM EXTENT PRACTICAL, FLANGE SHIELDS AROUND FLANGED FITTINGS, AND DRIP-PROOF TRAYS BELOW FITTINGS AND OTHER POTENTIAL LEAK SOURCES. DESIGN TO INCLUDE SECONDARY CONTAINMENT TO CAPTURE FLANGE AND VALVE LEAKS.
34. ONLY THOSE PUMPS PUMPING TO THE OFF-SPEC TANK (MT-SCWO-0041) SHALL SHUT DOWN UPON HIGH-HIGH TANK LEVEL.
35. NOTES 5, 6, 7, 11, 12, 13, 14, 15, 20, 28, 29 ,30, 31 AND 33 ARE DELETED. HOLDS 2 AND 3 HAVE BEEN RESOLVED.

This document was reviewed by RWA and no OPSEC-sensitive information was discovered.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001
REFERENCE DRAWINGS

RCM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Records / Configuration Management, email=Judy.Dishon@ga.com, c=US
2012.08.15 09:13:29 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INCORPORATES DCN-439)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/20/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
3	06/06/07	IFC (REMOVED HOLD 3, ADDED HOLD 4, REVISED LINE CLASS)	JEM	MD	KWD	DNW	VN
2	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/07/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/21/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING OFF-SPEC TANK & PRESS. RELIEF VESSEL PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-SCWO-00014 | SHEET 1 OF 1 | REV 6

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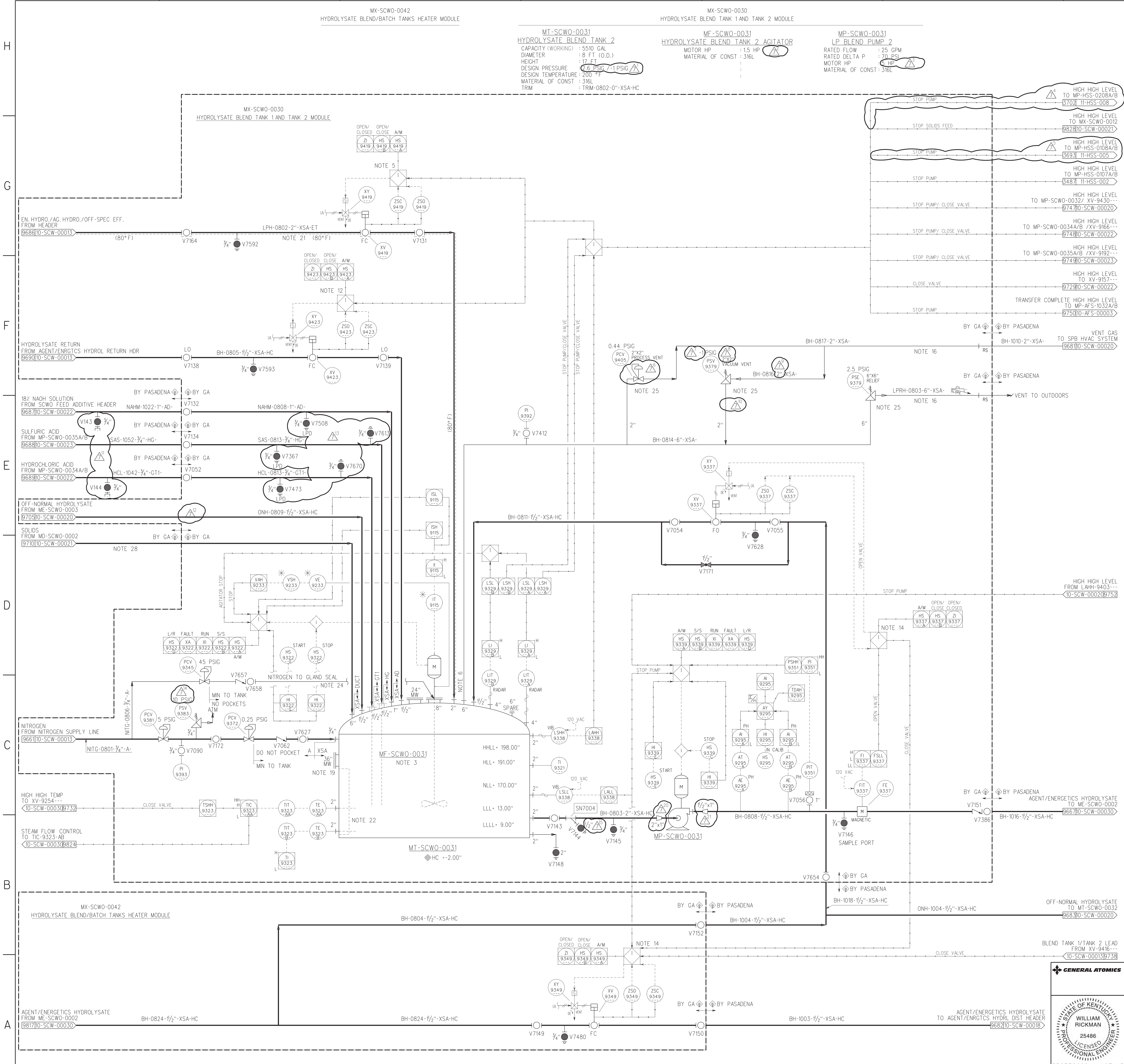

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
24915-00-M6-00-00010
24915-00-M6-00-00011
24915-00-M6-00-00012
24915-00-M6-00-00013
24915-00-M6-00-00014
24915-00-M6-00-00015

3. AGITATOR SHUTOFF WHEN LIQUID LEVEL DROPS TO 6 INCHES ABOVE AGITATOR BLADE (WHICH IS 25 IN. FROM TANK BOTTOM). AGITATOR START SETPOINT IS 34 IN. FROM TANK BOTTOM.

5. PROGRAM AN INTERLOCK BETWEEN XV-9419--- AND XV-9312--- (SEE PID 24915-10-M6-SCWO-00013) TO ENSURE THAT BOTH ARE NOT OPEN AT THE SAME TIME.

6. LOCATE THE NITROGEN INTAKE AND OUTLET VENT NOZZLES AT THE FURTHEST POSSIBLE DISTANCE APART ON TANK TOP TO MITIGATE ACCUMULATION OF POTENTIALLY COMBUSTIBLE GASES.

8. ✳ DENOTES VENDOR SUPPLIED.

12. PROGRAM XV-9423--- AND XV-9315--- (SEE PID 24915-M6-SCWO-00013) TO ENSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME, EXCEPT DURING TRANSITIONS BETWEEN BLEND PUMPS 1 AND 2. 7 16

13. DESIGN SHALL INCLUDE WELDED PIPE (JOINTS) TO MAXIMUM EXTENT PRACTICAL, FLANGE SHIELDS AROUND FLANGED FITTINGS, AND DRIP-PROOF TRAYS BELOW FITTINGS AND OTHER POTENTIAL LEAK SOURCES. DESIGN TO INCLUDE SECONDARY CONTAINMENT TO CAPTURE FLANGE AND VALVE LEAKS.

14. PROGRAM XV-9337--- AND XV-9349--- TO ENSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME, EXCEPT DURING TRANSITIONS BETWEEN BLEND TANK RECIRCULATION AND FEEDING OF REACTORS. 7 17

15. DENOTES DESIGN RESPONSIBILITY LABEL.

16. DO NOT POCKET, LINE ROUTING TO CONFORM TO FINAL EQUIPMENT LAYOUT.

18. ELECTRICAL AREA CLASSIFIFCATION:
UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)

19. LOCATE MANWAY TO ALLOW MANUAL SPRAY DOWN OF TANK (INTERNAL).

21. ELECTRICALLY TRACE AND INSULATE TO MAINTAIN A MINIMUM TEMPERATURE OF 80 °F.

22. FOUR INTERNAL BAFFLES @ 90° INTERVALS.

23. HEATER ME-SCWO-0002 HAS BEEN MOVED TO PID DRAWING 24915-10-M6-SCWO-00030.

24. NITROGEN GAS SEAL.

25. LOCATE VALVES AS CLOSE TO TANK SURFACE AS POSSIBLE. 7 18

27. A COMMON INSTRUMENT AIR HEADER AS SHOWN ENTERING THE MODULE ON 24915-M6-SCWO-00013, ZONE B-8 SERVICES BOTH HYDROLYSATE BLEND TANK 1 AND TANK 2 COMPONENTS.

28. SOLID CONNECTION DUCT TO TOP OF ASSOCIATED BLEND TANK.

31. PROGRAM AN INTERLOCK BETWEEN XV-9349 (FEED VALVE TO SCWO REACTOR) AND XV-9419 (OFF-SPEC EFFLUENT, AGENT HYDROLYSATE, ENERGETICS HYDROLYSATE), XV-9166 (HCL), XV-9157 (NAOH), XV-9192 (H2SO4), XV-9430 (OFF-NORMAL HYDROLYSATE), AND MD-SCWO-0002 (SLIDE GATE). IF XV-9349 IS OPEN, ALL CITED FEED VALVES MUST BE CLOSED.

33. NOTES 2, 4, 7, 9, 10, 11, 17, 20, 26, 29, 30 AND 32 ARE DELETED. 7 19

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Records / Configuration Management, email=Judy.Dishon@ga.com, c=US
2012.08.15 11:41:05 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7 (21)		IFC (INCORPORATES DCN-439)	NL	WR	KWD	KWD	VN
6	11/15/10	IFC (RELIEF PIPING REMOVED PER DCN240 & PE STAMPED)	NL	WR	KWD	KWD	VN
5	05/25/10	IFC (UPDATED TO INCLUDE SULFUR FEED ADDITIVE)	NL	SY	KWD	DNW	VN
4	01/20/09	IFC (INCORPORATES BPBGT COMMENTS AND SSHA RECOMMENDATIONS)	NL	JL	KWD	DNW	VN
3	06/06/07	IFC (ADDED HOLD 1 & HOLD 2)	NL	MD	KWD	DNW	VN
2	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/07/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING HYDROLYSATE BLEND TANK 2 PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-SCWO-00015 | SHEET 1 OF 1 | REV 7

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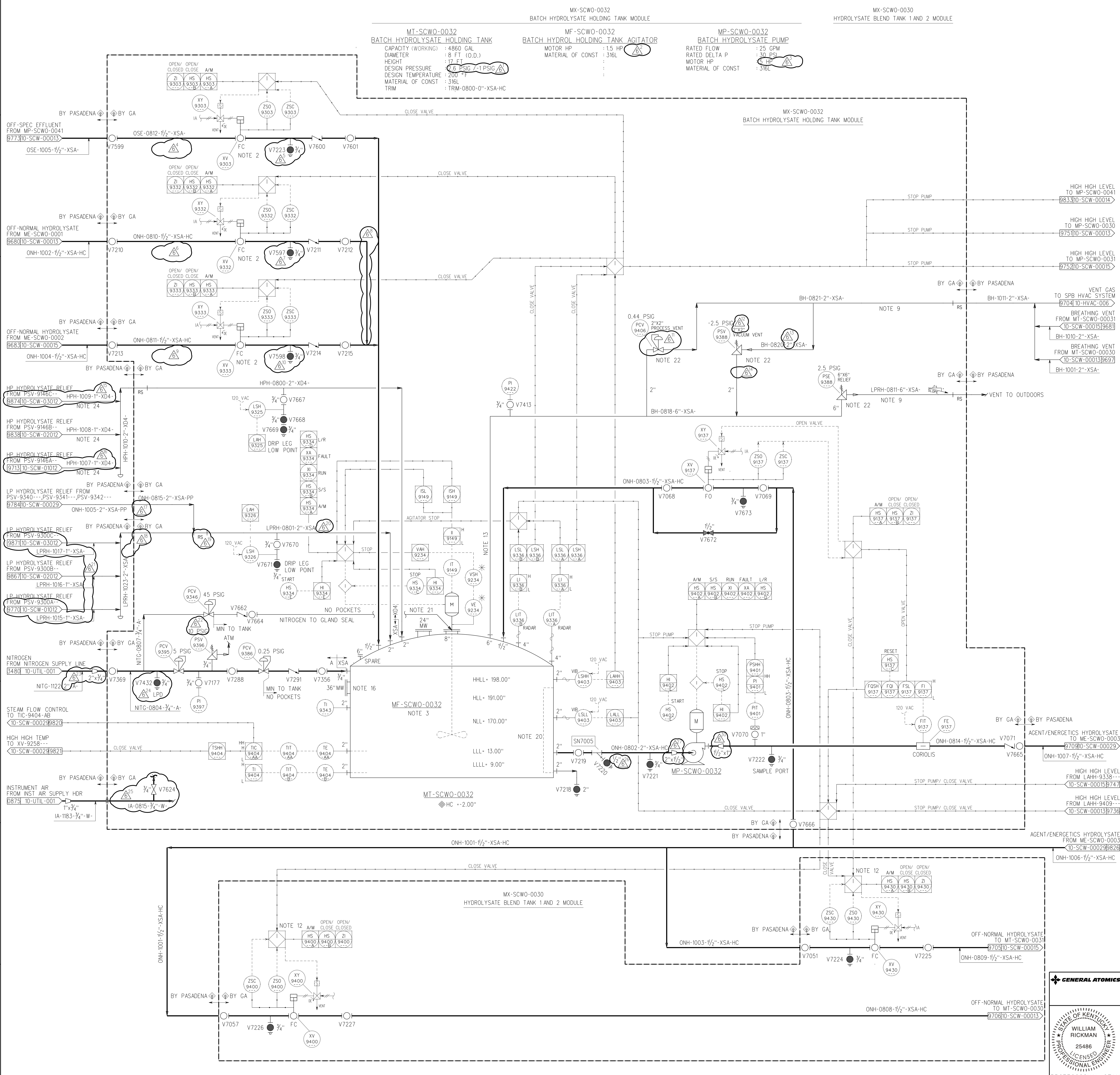

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV-9332---
   XV-9333---
   XV-9303---
3. AGITATOR SHUTOFF WHEN LIQUID LEVEL DROPS TO 6 INCHES ABOVE AGITATOR BLADE (WHICH IS 25 IN. FROM TANK BOTTOM). AGITATOR START SETPOINT IS 34 IN. FROM TANK BOTTOM.
5. ✳ DENOTES VENDOR SUPPLIED.
9. DO NOT POCKET, LINE ROUTING TO CONFORM TO FINAL EQUIPMENT LAYOUT.
10. DENOTES DESIGN RESPONSIBILITY LABEL.
11. DESIGN SHALL INCLUDE WELDED PIPE (JOINTS) TO MAXIMUM EXTENT PRACTICAL, FLANGE SHIELDS AROUND FLANGED FITTINGS, AND DRIP-PROOF TRAYS BELOW FITTINGS AND OTHER POTENTIAL LEAK SOURCES. DESIGN TO INCLUDE SECONDARY CONTAINMENT TO CAPTURE FLANGE AND VALVE LEAKS.
12. VALVES XV-9430--- AND XV-9400--- ARE TO BE SPECIFIED AS SLOW ACTING VALVES ON THE RESPECTIVE DATASHEET. ALSO, PROGRAM XV-9430---, XV-9400--- AND XV-9137--- TO ENSURE THAT NO MORE THAN ONE VALVE IS OPEN AT ANY TIME, EXCEPT WHEN XV-9137--- IS REQUIRED TO OPEN DURING A MINIMUM FLOW CONDITION.
13. LOCATE THE NITROGEN INTAKE AND OUTLET VENT NOZZLES AT THE FURTHEST POSSIBLE DISTANCE APART ON TANK TOP TO MITIGATE ACCUMULATION OF POTENTIALLY COMBUSTIBLE GASES.
15. ELECTRICAL AREA CLASSIFICATION:
    UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)
16. LOCATE MANWAY TO ALLOW MANUAL SPRAY DOWN OF TANK (INTERNAL).
19. HEATER ME-SCWO-0003 HAS BEEN MOVED TO P&ID 24915-10-SCWO-00029.
20. FOUR INTERNAL BAFFLES @ 90° INTERVALS.
21. NITROGEN GAS SEAL.
22. LOCATE VALVES AS CLOSE TO TANK SURFACE AS POSSIBLE. 6 28
24. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL CONTAINMENT AND/OR SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE LEAK OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS.
28. NOTES 4, 6, 7, 8, 14, 17, 18 23, 25, 26 AND 27 ARE DELETED. HOLDS 1 AND 3 HAVE BEEN RESOLVED.

This document was reviewed by RWR and no OPSEC-sensitive information was discovered.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INCORPORATES DCN-439)	NL	WR	KWD	KWD	VN
5	01-20-09	IFC (RELIEF PIPING REMOVED PER DCN240 & PE STAMPED)	NL	WR	KWD	KWD	VN
4	01-20-09	IFC (INCORPORATES BPBGT COMMENTS AND SSHA RECOMMENDATIONS)	NL	JL	KWD	DNW	VN
3	06-06-07	IFC (REMOVED HOLD 1, ADDED HOLD 2 & HOLD 3)	NL	MD	KWD	DNW	VN
2	03-14-07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08-07-06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10-19-05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING BATCH HYDROLYSATE HOLDING TANK PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-SCWO-00020 | SHEET 1 OF 1 | REV 6

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BECHTEL PARSONS BLUE GRASS	Project Number	Document Number	Rev	Date	Sheet of
	24915	24915-07-MVD-SDS-00001	2	9/2/2010	1 11

Project, Client, Location	Document Title
Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP) Project	**SPENT DECON HOLDING/AGENT WASHOUT TREATMENT TANKS MV-SDS-0101/0201/0301**

☐ In-House Review ☐ Client Approval ☐ Quotation ☑ All Data Sheets Attached

☑ Purchase ☐ Construction ☐ Design ☐ Revised Data Sheets Only Attached

QUALITY: ☑ **Q** ☐ **NON-Q**

TOXIC CATEGORY ☑ **A** ☐ **B** ☐ **A/B** ________ **OTHER**

REV	DATE	BY	CHK	DL	PROJ ENGR	QA	APPR		REMARKS
0	02/25/09	SC	BM	BM	BBB	JW			Issued for Purchase
1	10/14/09	SC	SS	SA	BBB	JW			Issued for Purchase (added page 6 & 7 to include seismic data)
2	09/02/10	SC sc	BM	SA SA	BBB	JW			Issued for Purchase (changes shown by clouds or bars) (incorporated vendor data and SDDR 24915-000-YDA-MVSC-10008) (included changes associated with RFI-WES-003, RFI-DMP-023, RFI-DMP-024, RFI-DMP-025 and SDDR 24915-000-YDA-MVSC-10001)

APPROVED

by: Kevin M. Regan, PE, CHMM
BPBG Environmental Manager

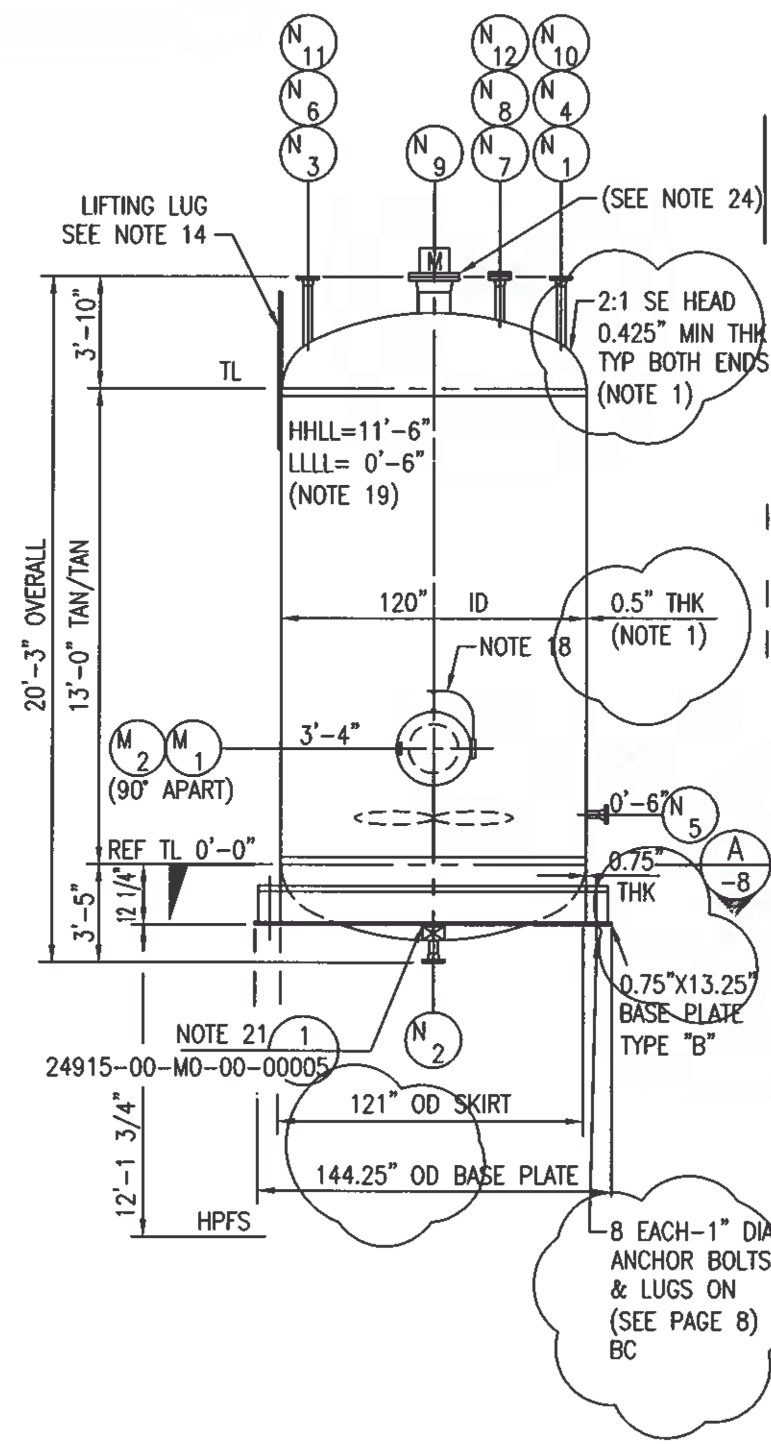
Design changes must be incorporated into as-built drawings submitted to KDEP at the completion of construction

This sheet is a record of each issue or revision to the subject specification. Each time the specification is to be changed, only the new or revised sheets must be issued. The exact sheets changed and the nature of the change should be noted in the Remarks column; however, these remarks are not part of the specification. The revised data sheets shall become part of the original specification and shall be compiled within their entirety.

DC- DT-

FILE NAME: MVSDS0101

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP SPENT DECON HOLDING/AGENT WASHOUT TREATMENT TANKS MV-SDS-0101	SHEET 2 OF 11	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MVD-SDS-00001	REV 2



ONE REQD MV-SDS-0101

SEE SHEET 9 FOR TRUE ORIENTATION

CODE:	ASME SECT VIII DIV 1 (CODE CONSTR. ONLY)
CODE CERT REQD NO	CODE STAMP NO
NATIONAL BOARD REGISTRATION:	NO
OPR PRESS (INT)	0.2-0.4 PSIG AT 108 °F
DES PRESS. (INT)	14.9 PSIG AT 135 °F
DES PRESS. (EXT)	FULL VAC PSIG AT 135 °F
MIN DESIGN METAL TEMP	(-)1 °F AT 14.9 PSIG
CRSN ALLOW SHELL =1/16"	HEADS =1/16" NOZZ =1/16"
LIQUID LEVEL FOR DESIGN: FULL	AT SP GR 1.07
SEISMIC DESIGN:	SEE NOTE 10
WIND DESIGN:	SEE NOTE 11
MAWP 14.9 & FV	PSIG AT 135 °F LIMITED BY N/A
MAP N&C	108 PSIG AT AMB TEMP LIMITED BY N5
SHOP HYD	19.4 PSIG AT 70 °F MIN HORIZ POSN
FIELD HYD NEW	N/A PSIG AT 70 °F MIN OPR POSN
FIELD HYD CORR	N/A PSIG AT 70 °F MIN OPR POSN
PWHT (PER CODE)	RADIOGRAPHY (FULL)
JOINT EFF: SHELL (PER CODE)	HEADS (PER CODE)
ALLOW STRESS	20,000 PSI AT DESIGN TEMP 135°F
MATERIALS: SHELL	SA-516-70 (SEE NOTE 20)
HEADS	SA-516-70 (SEE NOTE 20)
SUPPORTS	SA-36
INTERNALS	CS (NOTE 20) TRAYS N/A
BOLTS (INT)	N/A NUTS N/A
BOLTS (EXT)	SA-193-B7 NUTS SA-194-2H
FLANGES	SA-105
NOZZLE NECKS	SA-106B (A516-70 rolled for manways)
GASKETS	NOTE 23
CAPACITY (WORKING)	5200 GAL
FAB WT 18,400 (NOTE 1 & 15) LB	EMPTY WT 18,400 (NOTE 1 & 15) LB
TRAY WT N/A LB	PACKING WT N/A LB
OPR WT 88,300 (NOTE 1 & 15)LB	TEST WT 99,400 (NOTE 1 & 15) LB
PAINTING	SEE NOTE 12
INSULATION	NONE
FIREPROOFING	NONE

ACCESSORIES BY FABRICATOR:	YES	NO
VESSEL DAVIT MARK No.		X
LADDER & PLATFORM CLIPS		X
PIPE SUPPORT AND PIPE GUIDE CLIPS		X
INSULATION SUPPORTS		X
FIREPROOFING SUPPORTS		X
VORTEX BREAKER	X	
LIFTING AND GROUNDING LUGS	X	

NOZZLE SCHEDULE

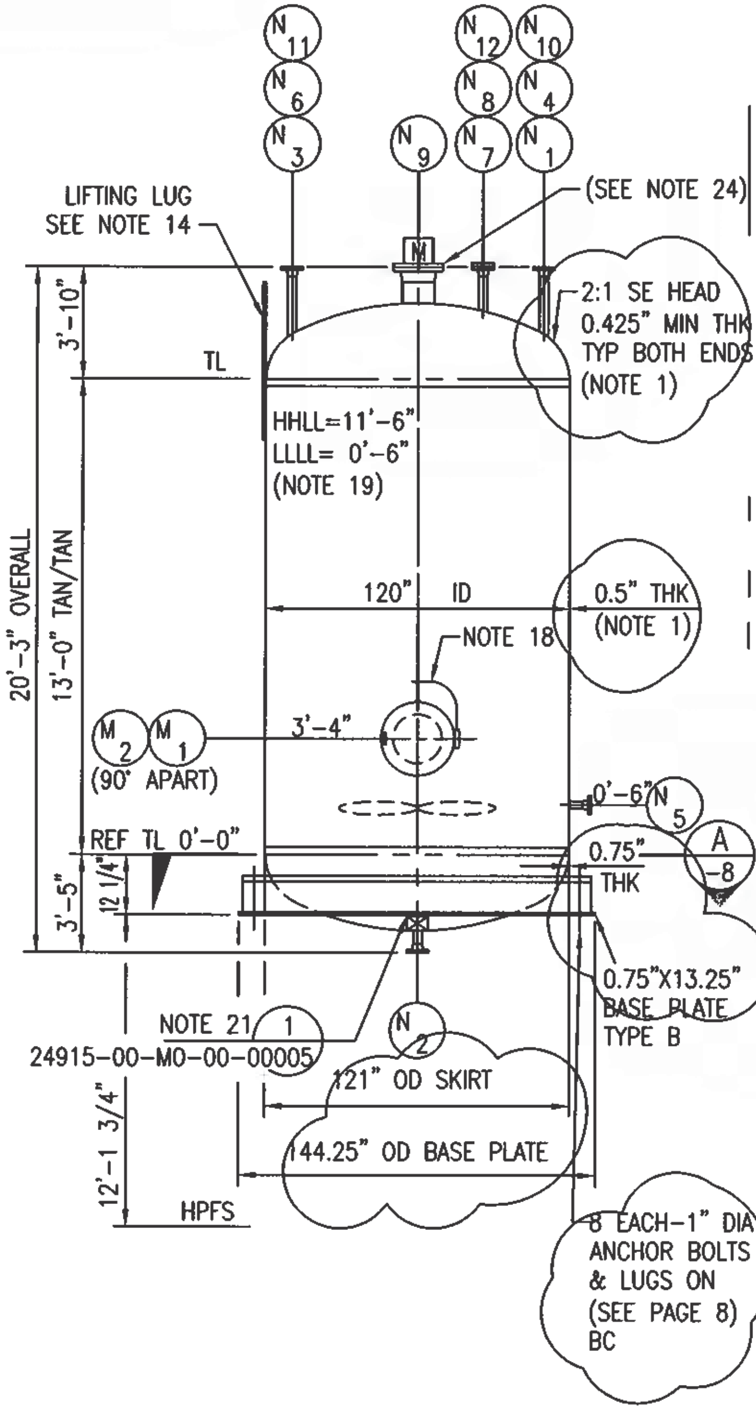
ITEM	No.	SIZE	PROJ	RATING	SERVICE
M1,M2	2	36"	6'-0"	150#	MH W/ BF & DAVIT
N1	1	3"	SEE ELEV	150#	INLET, CATEGORY A
N2	1	3"	SEE ELEV	150#	OUTLET
N3	1	8"	SEE ELEV	150#	LEVEL TRANS. (RADAR TYPE)
N4	1	2"	SEE ELEV	150#	LSHH
N5	1	2"	5'-9"	150#	LSLL
N6	1	2"	SEE ELEV	150#	NITROGEN INLET/VENT
N7	1	2"	SEE ELEV	150#	RECYCLE LINE
N8	1	2"	SEE ELEV	150#	SPARE W/ BF (NOTE 26)
N9	1	14"	SEE ELEV	150#	AGITATOR
N10	1	2"	SEE ELEV	150#	INLET, CATEGORY B
N11	1	2"	SEE ELEV	150#	INLET, CATEGORY C
N12	1	4"	SEE ELEV	150#	PSV

FLANGE: RFWN FINISH: 125-250 AARH

(NOTE #7)

FILE NAME: MVSDS0101B

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP SPENT DECON HOLDING/AGENT WASHOUT TREATMENT TANKS MV-SDS-0201/0301	SHEET 3 OF 11	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MVD-SDS-00001	REV 2



ONE REQD MV-SDS-0201
ONE REQD MV-SDS-0301

SEE SHEETS 10 & 11 FOR TRUE ORIENTATION

CODE: ASME SECT VIII DIV 1 (CODE CONSTR. ONLY)			
CODE CERT REQD NO	CODE STAMP NO		
NATIONAL BOARD REGISTRATION: NO			
OPR PRESS (INT)	0.2-0.4 PSIG AT	77-145 °F	
DES PRESS. (INT)	14.9 PSIG AT	170 °F	
DES PRESS. (EXT)	FULL VAC PSIG AT	170 °F	
MIN DESIGN METAL TEMP	(-)1 °F AT	14.9 PSIG	
CRSN ALLOW SHELL =1/16"	HEADS =1/16"	NOZZ =1/16"	
LIQUID LEVEL FOR DESIGN: FULL	AT SP GR 1.07		
SEISMIC DESIGN: SEE NOTE 10			
WIND DESIGN: SEE NOTE 11			
MAWP 14.9 & FV PSIG AT 170 °F LIMITED BY N/A			
MAP N&C 108 PSIG AT AMB TEMP LIMITED BY N5			
SHOP HYD	19.4 PSIG AT	70 °F MIN HORIZ POSN	
FIELD HYD NEW	N/A PSIG AT	70 °F MIN OPR POSN	
FIELD HYD CORR	N/A PSIG AT	70 °F MIN OPR POSN	
PWHT	(PER CODE)	RADIOGRAPHY (FULL)	
JOINT EFF: SHELL	(PER CODE)	HEADS (PER CODE)	
ALLOW STRESS 20,000 PSI AT DESIGN TEMP 170°F			
MATERIALS: SHELL	SA-516-70 (SEE NOTE 20)		
HEADS	SA-516-70 (SEE NOTE 20)		
SUPPORTS	SA-36		
INTERNALS	CS (NOTE 20)	TRAYS	N/A
BOLTS (INT)	N/A	NUTS	N/A
BOLTS (EXT)	SA-193-B7	NUTS	SA-194-2H
FLANGES	SA-105		
NOZZLE NECKS	SA-106B (A516-70 rolled for manways)		
GASKETS	NOTE 23		
CAPACITY (WORKING)	5200 GAL		
FAB WT 18,400 (NOTE 1 & 15) LB	EMPTY WT 18,400 (NOTE 1 & 15) LB		
TRAY WT N/A LB	PACKING WT N/A LB		
OPR WT 88,300 (NOTE 1 & 15) LB	TEST WT 99,400 (NOTE 1 & 15) LB		
PAINTING	SEE NOTE 12		
INSULATION	2" PERSONNEL PROTECTION BY OTHERS		
FIREPROOFING	NONE		

ACCESSORIES BY FABRICATOR:	YES	NO
VESSEL DAVIT MARK No.		X
LADDER & PLATFORM CLIPS		X
PIPE SUPPORT AND PIPE GUIDE CLIPS		X
INSULATION SUPPORTS	X	
FIREPROOFING SUPPORTS		X
VORTEX BREAKER	X	
LIFTING AND GROUNDING LUGS	X	

NOZZLE SCHEDULE

ITEM	No.	SIZE	PROJ	RATING	SERVICE
M1,M2	2	36"	6'-0"	150#	MH W/ BF & DAVIT
N1	1	3"	SEE ELEV	150#	INLET, CATEGORY A
N2	1	3"	SEE ELEV	150#	OUTLET
N3	1	8"	SEE ELEV	150#	LEVEL TRANS. (RADAR TYPE)
N4	1	2"	SEE ELEV	150#	LSHH
N5	1	2"	5'-9"	150#	LSLL
N6	1	2"	SEE ELEV	150#	NITROGEN INLET/VENT
N7	1	2"	SEE ELEV	150#	RECYCLE LINE
N8	1	2"	SEE ELEV	150#	AGENT WASHOUT
N9	1	14"	SEE ELEV	150#	AGITATOR
N10	1	2"	SEE ELEV	150#	INLET, CATEGORY B
N11	1	2"	SEE ELEV	150#	INLET, CATEGORY C
N12	1	4"	SEE ELEV	150#	PSV

FLANGE: RFWN FINISH: 125-250 AARH

(NOTE #7)

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP SPENT DECON HOLDING/AGENT WASHOUT TREATMENT TANKS MV-SDS-0101/0201/0301	SHEET 4 OF 11	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MVD-SDS-00001	REV 2

NOTES

1. THE VESSEL SUPPLIER SHALL DESIGN, FURNISH, FABRICATE, INSPECT, TEST AND DELIVER THE VESSEL IN ACCORDANCE WITH THIS DATA SHEET, ATTACHED SPECIFICATIONS, AND STANDARDS. VESSEL SHALL BE DESIGNED IN ACCORDANCE WITH SPECIFIED DESIGN REQUIREMENTS, SEE NOTE 10 AND 11.
2. ALL DIMENSIONS ARE FROM REF LINE, EXCEPT AS SHOWN.
3. NOZZLES AND MANHOLES SHALL HAVE SAME DESIGNATION AS SHOWN ON THIS DRAWING.
4. BOLT HOLES SHALL STRADDLE THE VERTICAL CENTERLINES OF THE VESSEL FOR NOZZLES ON THE SHELL AND PLANT NORTH-SOUTH, EAST-WEST CENTERLINES FOR NOZZLES ON THE HEADS.
5. ALL ATTACHMENTS WELDED TO VESSEL PRESSURE PARTS SHALL BE SAME MATERIAL AS PRESSURE PART, UNLESS OTHERWISE NOTED.
6. VESSEL SHALL BE THOROUGHLY CLEANED INSIDE AND OUTSIDE, SHALL BE FREE FROM RUST, LOOSE SCALE, SLAG, WELD SPLATTER AND FOREIGN MATTER PRIOR TO SHOP HYDROTEST, AND SHALL BE THOROUGHLY DRIED AFTER HYDROTEST.
7. PROJECTION OF RADIAL NOZZLES ARE FROM VESSEL CENTER LINE TO EXTREME FACE OF FLANGE.
8. ALL VESSEL COMPONENTS SHALL BE FURNISHED IN ACCORDANCE WITH STANDARDS LISTED BELOW.
9. ITEMS WITH (*) ARE VESSEL FABRICATOR RESPONSIBILITY.
10. SEISMIC FORCES SHALL BE PER SPECIFICATION 24915-000-3PS-SV00-00001, SPECIFICATION FOR SEISMIC PROTECTION OF EQUIPMENT. THE VESSEL IS LOCATED INSIDE THE MDB BUILDING (ANS ROOM 123). PER TABLE 1, APPLICABLE CODES AND IMPORTANCE FACTORS, SEISMIC PROTECTION SHALL BE IN ACCORDANCE WITH ICC INTERNATIONAL BUILDING CODE (IBC) 2000, SEISMIC DESIGN FOR BUILDINGS (SEISMIC GROUPS IIIH AND IIIE).
11. THE GENERAL PROJECT SPECIFICATION, 24915-000-3PS-G000-00001, PROVIDES PROJECT DETAILS AND DESIGN CONDITIONS FOR THE SITE. THIS VESSEL IS PART OF THE MUNITIONS DEMILITARIZATION BUILDING (MDB) AND IS INSTALLED INSIDE THE BUILDING (ROOM 123) AND WILL NOT BE SUBJECT TO SITE CONDITIONS SUCH AS WIND, PRECIPITATION, SNOW, ETC. OTHER GENERAL REQUIREMENTS FOR EQUIPMENT, MATERIAL, AND/OR SERVICES REQUIRED AS DEFINED IN THE SPECIFICATION APPLY.
12. ALL EXTERIOR BARE CARBON STEEL SURFACES SHALL BE PAINTED IN ACCORDANCE WITH SPECIFICATION 24915-000-3PS-AFPS-00001, SPECIAL COATINGS - METAL.
13. VESSEL SUPPLIER SHALL SUPPLY GROUNDING LUGS IN ACCORDANCE WITH STANDARD 24915-00-M0-00-00006. GROUNDING LUGS WITH DIMENSIONS SHALL BE CLEARLY CALLED OUT ON SUPPLIER DRAWINGS.
14. VESSEL SUPPLIER SHALL DESIGN AND INSTALL A MINIMUM OF TWO LIFTING LUGS FOR USE DURING LOADING, UNLOADING AND PLACING EQUIPMENT ON ITS FOUNDATION. DESIGN SHALL INCLUDE REQUIRED PIN, SHACKLE SIZE AND MAXIMUM SLOPE OF LIFTING CABLE AND LIFTING LUG PLANE. HOLE IN LIFTING LUG SHALL BE DRILLED OR MACHINED, DO NOT FLAME CUT. LIFTING LUG (AND PAD IF REQUIRED) SHALL BE THE SAME MATERIAL AS THE SHELL. LIFTING LUG SHALL NOT BE REMOVED AFTER INSTALLATION. EQUIPMENT SUPPLIER SHALL PERMANENTLY MARK ON THE LIFTING LUG WITH 1" MINIMUM HIGH LETTERS - "DO NOT REMOVE". SUPPLIER'S DRAWINGS SHALL PROVIDE LIFTING LUG DESIGN AND LOAD AND ANNOTATE EACH LUG WITH ITS LOAD CAPACITY.
15. VESSEL SUPPLIER SHALL PROVIDE FABRICATION, EMPTY, OPERATING, TEST AND INDIVIDUAL WEIGHTS OF HEAD, SHELL AND EQUIPMENT CENTER OF GRAVITY.
16. VESSEL SUPPLIER SHALL IDENTIFY ALL MATERIALS OF CONSTRUCTION (INCLUDING GASKETS) BY WEIGHT OR VOLUME.

REFERENCES

STD NO.	DESCRIPTION
24915-00-M0-00-00001	PRESSURE VESSEL TOLERANCES
24915-00-M0-00-00002	STD BOLT HOLE ORIENT
24915-00-M0-00-00003	INSULATION & FP SUPPORTS
24915-00-M0-00-00004	VESSEL ABBREVIATIONS & SYMBOLS
24915-00-M0-00-00005	VORTEX BREAKERS
24915-00-M0-00-00006	GROUNDING CONN FOR VESSELS & TKS
24915-00-M0-00-00008	SKIRT AND BASE DETAILS

REFERENCES

SPEC NO.	DESCRIPTION
24915-000-3PS-AFPS-00001	SPECIAL COATINGS - METAL
24915-000-3PS-G000-00001	GENERAL PROJECT REQUIREMENTS
24915-000-3PS-HXYQ-00001	QUALITY ASSURANCE
24915-000-3PS-MV00-00001	PRESSURE VESSELS
24915-000-3PS-NLLG-00001	INTERNAL TANK LINING
24915-000-3PS-SV00-00001	SEISMIC PROTECTION OF EQUIPMENT

NOTES CONTINUED

17. ALL EXTERNAL BOLTS AND STUDS SHALL BE ASSEMBLED WITH ANTI-SEIZE LUBRICANT. SEE PRESSURE VESSEL SPECIFICATION.
18. VESSEL SUPPLIER SHALL DESIGN AND FABRICATE MANHOLE DAVIT FOR REMOVAL OF MANHOLE COVER.
19. LIQUID LEVELS ARE FROM BOTTOM TANGENT LINE UNLESS OTHERWISE NOTED.
10. VESSEL FABRICATOR SHALL SPRAY OR LAMINATE LINE VESSEL IN ACCORDANCE WITH SPECIFICATION 24915-000-3PS-NLLG-00001, INTERNAL TANK LINING.
21. VESSEL FABRICATOR SHALL PREPARE ALL INTERNAL CARBON STEEL SURFACES FOR LINING PER NACE RP0178, FABRICATION DETAILS, SURFACE FINISH REQUIREMENTS, AND PROPER DESIGN CONSIDERATIONS FOR TANKS AND VESSELS TO BE LINED FOR IMMERSION SERVICE. LINING MATERIAL SHALL BE HEAT RESISTANT POLY-VINYLIDENE DIFLUORIDE (PVDF) FOR 250°F SERVICE.
22. NOZZLES SMALLER THAN 2" SHALL BE 304/304L STAINLESS STEEL. NOZZLES SMALLER THAN 2" CANNOT BE LINED. ISOLATION KIT REQUIRED.
23. THREE SETS OF SPARE GASKETS FOR NOZZLES WITH BLIND FLANGES SHALL BE SUPPLIED BY VESSEL FABRICATOR. GASKETS SHALL BE FLAT RING, PTFE, 1/8" THK, CL 150.
24. AGITATOR SHALL BE PROVIDED BY VESSEL VENDOR. REFER TO DATASHEET 24915-07-M5D-SDS-00001, SPENT DECON HOLDING/AGENT WASHOUT TREATMENT TANK AGITATORS.
25. THE VESSEL DATA SHEET IS FOR THREE VESSELS. SPARE NOZZLE N8 IS PROVIDED FOR MV-SDS-0101. HOWEVER, THE SPARE NOZZLE FOR MV-SDS-0201/0301 IS USED FOR AGENT WASHOUT FROM MP-MWS-0102A/B OR MP-RHS-0104/0106.
26. ALL BOLTS, NUTS AND WASHERS USED FOR EQUIPMENT IN TOXIC CATEGORIES "A" & "B" SHALL HAVE BOLTS NO SMALLER THAN 1/4". BOLTS ARE SIZED SO THAT PPE WEARERS CAN HANDLE THEM.
27. SPENT DECON HOLDING/WASHOUT TREATMENT TANKS, MV-SDS-0101/0201/0301, ARE REFERENCED ON P&ID 24915-07-M6-SDS-00001, 00002, AND 00003 RESPECTIVELY.
28. INSULATE DOWN TO THE BASE-PLATE KEEPING CLEARANCE AROUND THE ANCHOR BOLTS.
29. VESSEL MAWP IS THE DESIGN PRESSURE.

SEISMIC STRESSES IN SDS VESSELS SUPPORTED ON/FROM PLATFORMS

TABLE 1 SHOWS THE SEISMIC STRESSES (S11 AND S22) IN THE TWO ORTHOGONAL DIRECTIONS AT THE LOCATIONS SHOWN IN FIGURE 1 BASED OFF VESSEL INFORMATION PROVIDED BY THE VENDOR. THESE STRESSES ACT IN BOTH TENSION AND COMPRESSION. THE SEISMIC STRESSES SHOWN IN TABLE 1 WERE COMBINED WITH THE ~~ASME OPERATIONAL~~ STRESSES BY THE VENDOR AND TABLE 3 SHOWS THE NECESSARY DESIGN CHANGE TO THE VESSELS FROM THE VENDOR TO ACCOUNT FOR THE SEISMIC STRESSES. THE BUYER HAS PERFORMED SEISMIC ANALYSIS ON THE UPDATED VESSEL INFORMATION (TABLE 3), AND DETERMINED THERE ARE NO INCREASES TO THE ACCELERATION OF THE CENTER OF GRAVITY OF THE VESSELS. THEREFORE, THE SEISMIC STRESSES IN TABLE 1 ARE A BOUNDING CONDITION PROVIDED THE VESSELS ARE FABRICATED AS DESCRIBED IN TABLE 3.

TABLE 1: S11 AND S22 SEISMIC STRESSES FOR MV-SDS-0101/0201/0301

LOCATION	S11 (KSI)	S22 (KSI)
TOP TANGENT LINE	0.5	0.5
BOTTOM TANGENT LINE	2.5	1.5
SKIRT LINE	4.0	1.0
AT TOP OF LUG	8.75	7.5

Table 2: ACCELERATION OF COG FOR MV-SDS-0101/0201/0301

Vessel	Acceleration at COG (%g)		
	X	Y	Z
MV-SDS-0101	0.226	0.17	0.251
MV-SDS-0201	0.226	0.17	0.251
MV-SDS-0301	0.226	0.17	0.251

General Note:
The 'X' direction is East-West
The 'Y' direction is North-South
The 'Z' direction is vertical

* PLEASE NOTE THAT WHERE THESE ACCELERATIONS WILL PRODUCE LOWER LOADS THAN THOSE DERIVED FROM THE SEISMIC PROTECTION OF EQUIPMENT SPECIFICATION, THE VALUE FROM THE SEISMIC PROTECTION SPEC. IS TO BE USED FOR THE DESIGN OF THE VESSELS' INTERNALS AND ANCHORAGES OF THE VESSELS TO THE STEEL FRAME.

FIGURE 1: LOCATION & ORIENTATION OF STRESSES

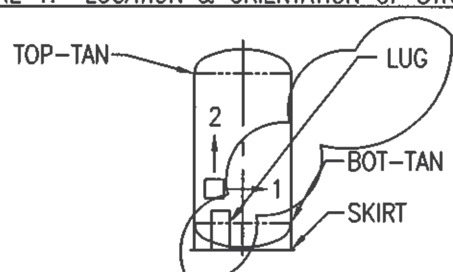
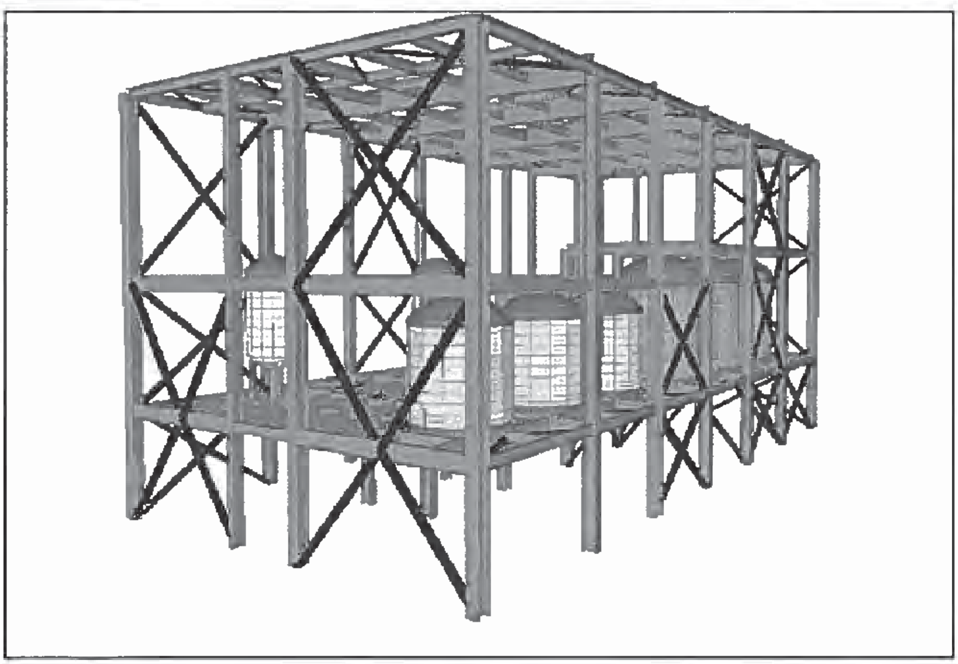


TABLE 3: UPDATED VESSEL INFORMATION FROM VENDOR

VESSEL TAG NO.	CENTER OF GRAVITY (IN) *			OPERATING WEIGHT (LBS)	SHELL THICKNESS (IN)	HEAD THICKNESS (IN)	SKIRT THICKNESS (IN)
	X	Y	Z				
MV-SDS-0101	-1.96	-0.03	61.55	88,300	0.5	.5	.75
MV-SDS-0201	-1.96	-0.03	61.55	88,300	0.5	.5	.75
MV-SDS-0301	-1.96	-0.03	61.55	88,300	0.5	.5	.75

* THE CENTER OF GRAVITY IS BASED ON A STANDARD COORDINATE SYSTEM.
THE POSITIVE X,Y,Z DIRECTIONS ARE EAST, NORTH, AND UP THE ~~VESSEL (OUT OF THE PAGE)~~, RESPECTIVELY.
THE ORIGIN IS AT THE INTERSECTION OF THE VESSEL CENTERLINE AND REFERENCE PLANE (LOWER TANGENT LINE).

FIGURE 2: MODEL SHOWING THE ANS PLATFORM



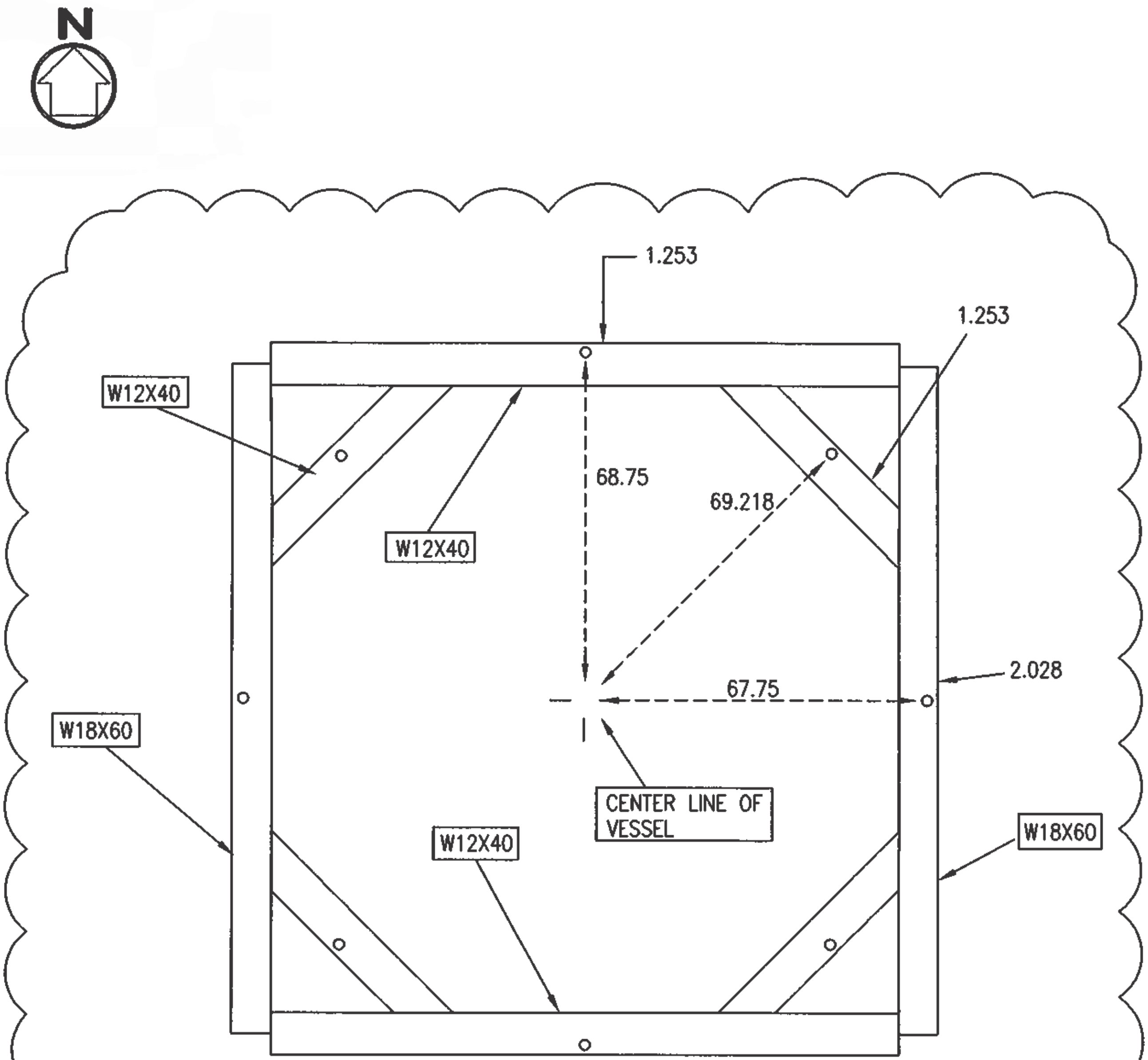
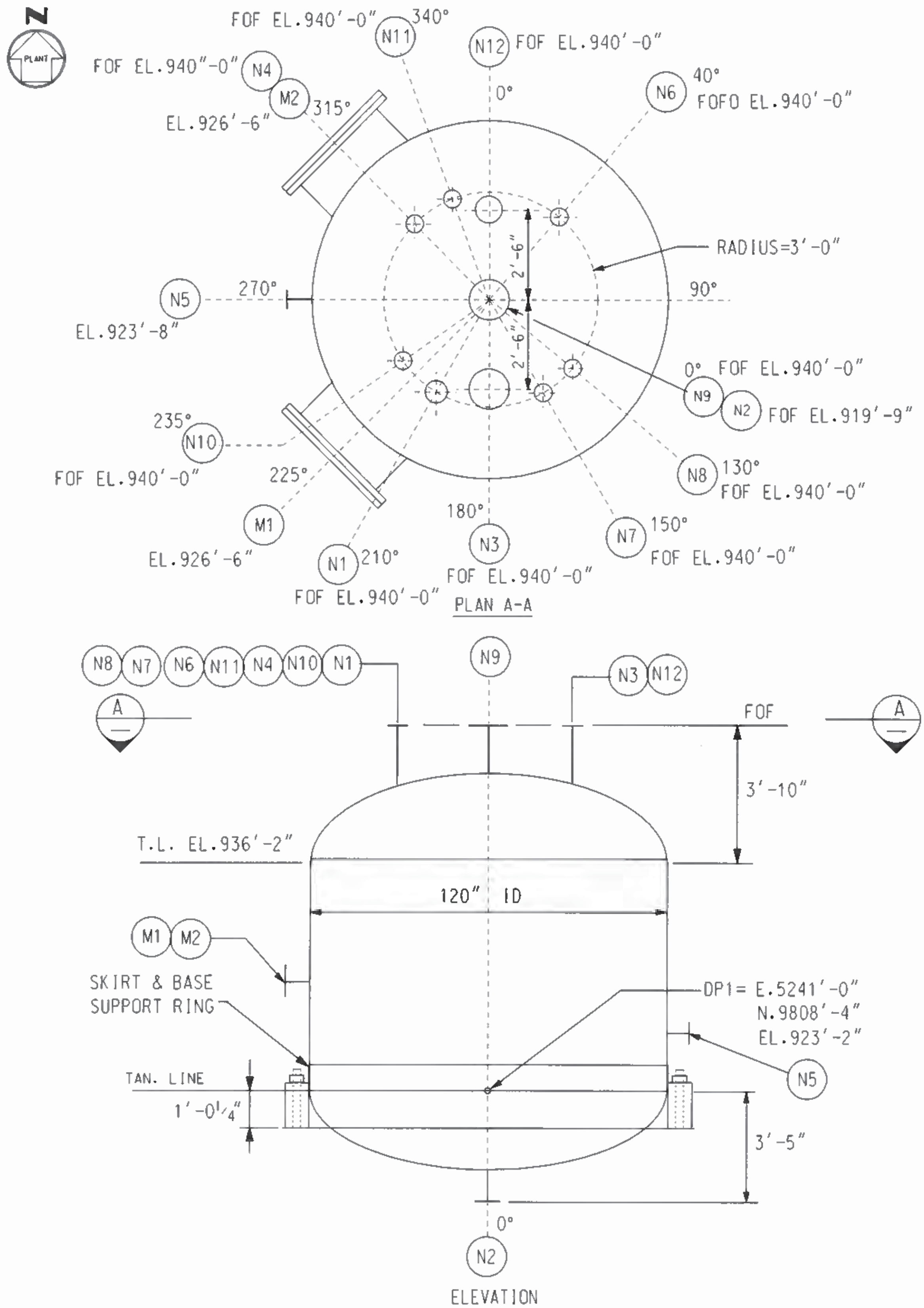


FIGURE 3: PLAN VIEW OF VESSEL SUPPORT FRAMING WITH BOLT PATTERN (TYP.)

NOTE: ALL UNITS USED ARE IN INCHES

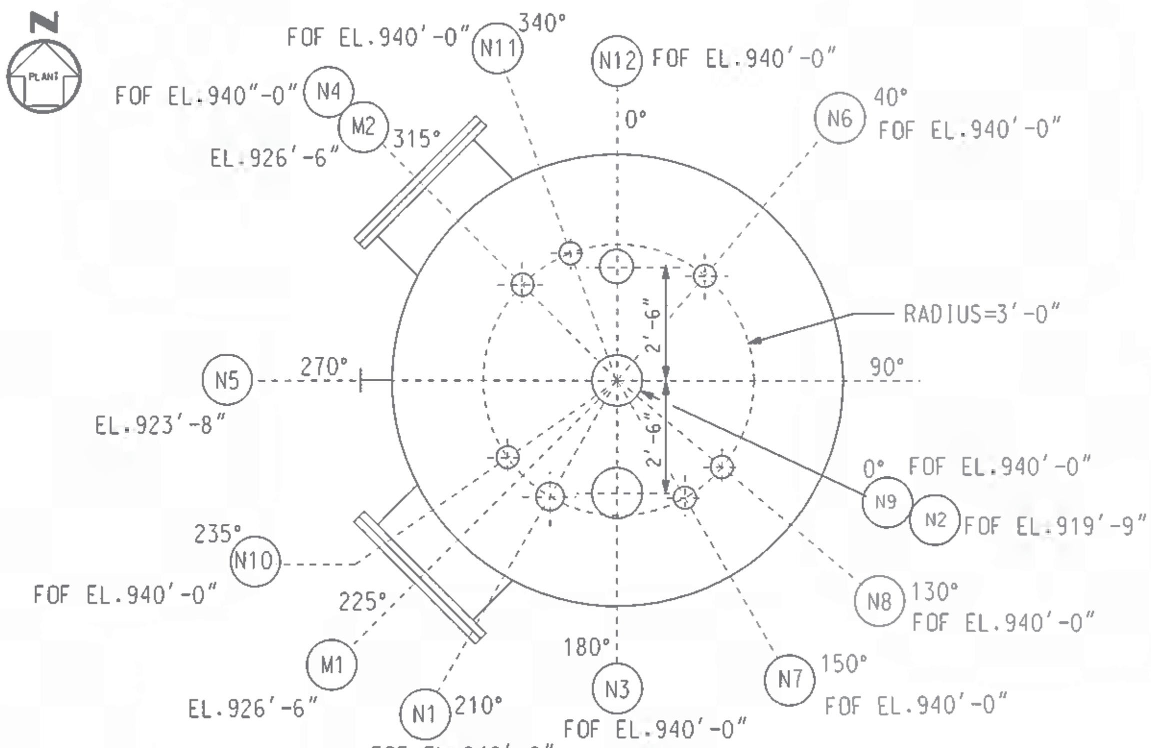
FILE NAME: 07-MV-SDS-0101-s9 r2.dgn

DATA SHEET	TITLE BGCAPP SPENT DECON HOLDING/AGENT WASHOUT TREATMENT TANKS 07-MV-SDS-0101	SHEET 9 OF 11	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MVD-SDS-00001	REV 2

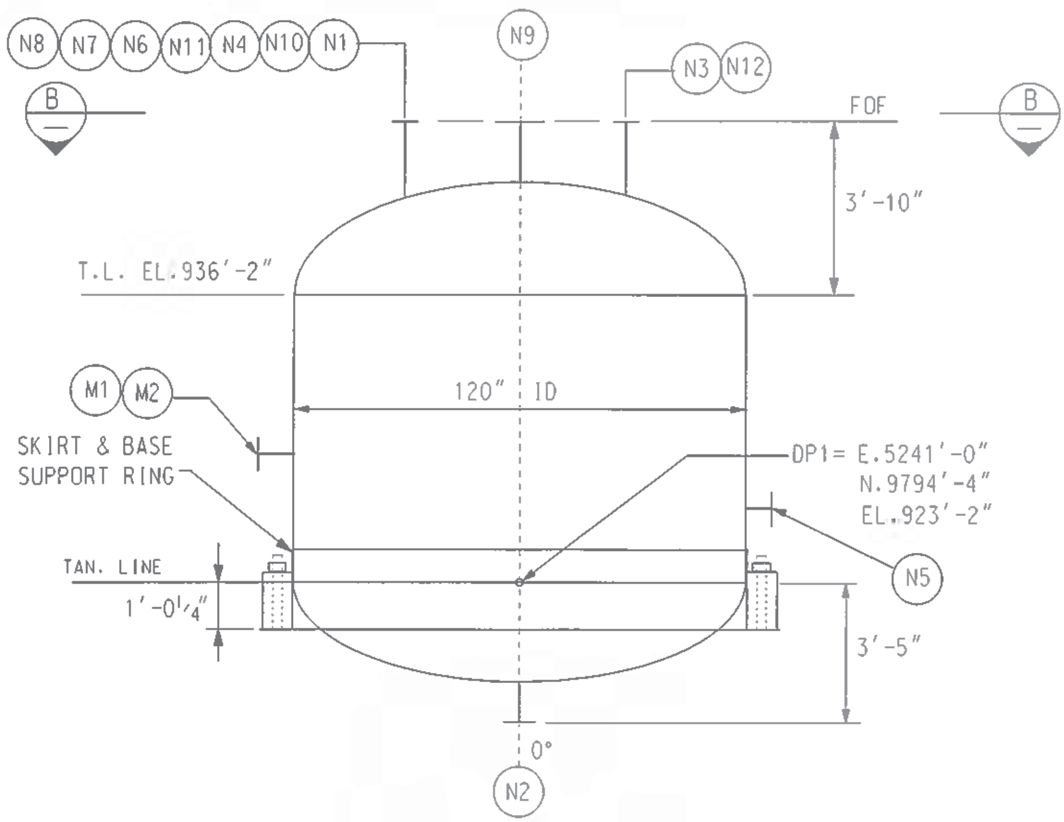


FILE NAME: 07-MV-SDS-0201-s10 r2.dgn

DATA SHEET	TITLE BGCAPP SPENT DECON HOLDING/AGENT WASHOUT TREATMENT TANKS 07-MV-SDS-0201	SHEET 10 OF 11	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MVD-SDS-00001	REV 2



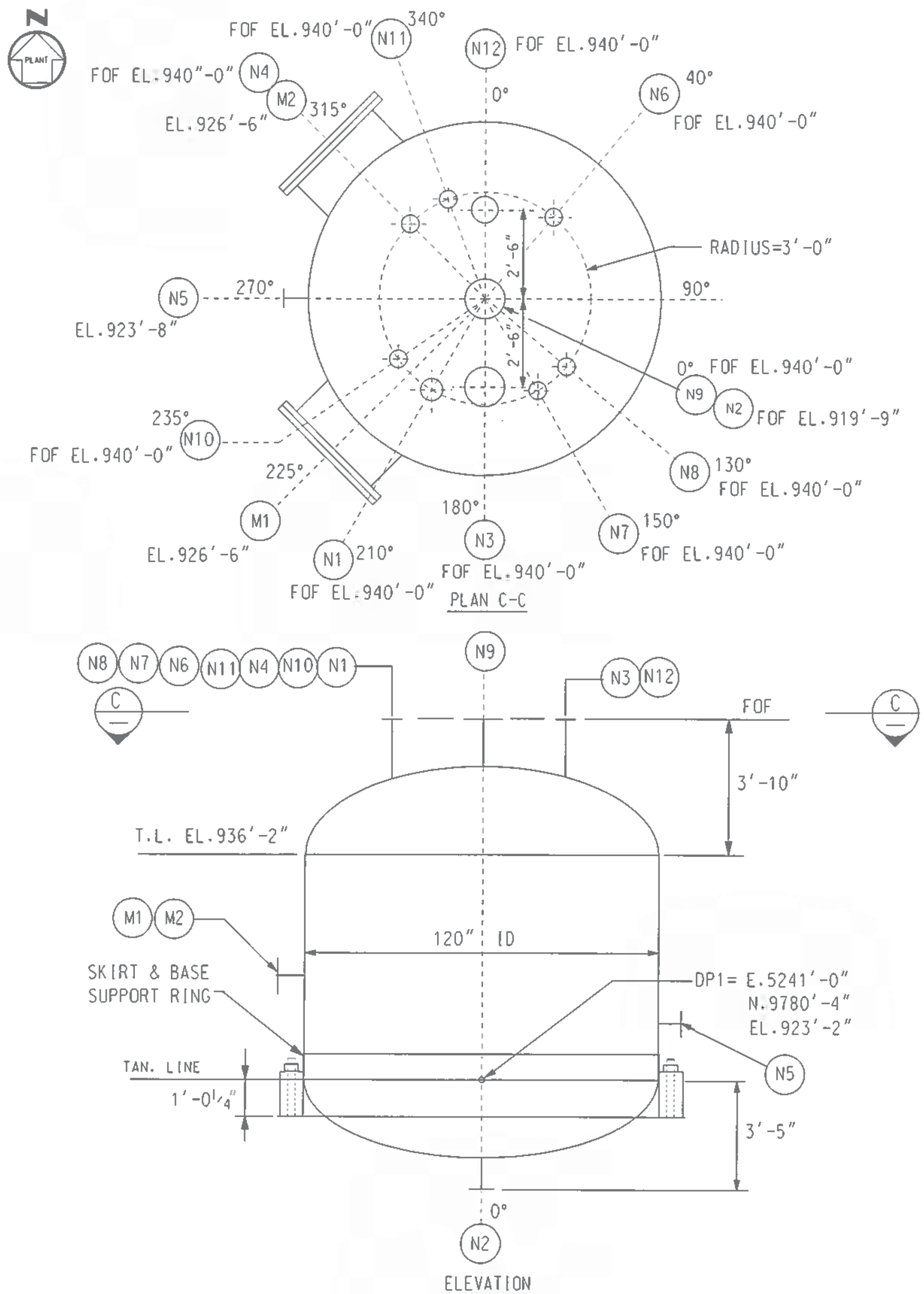
PLAN B-B



ELEVATION

FILE NAME: 07-MV-SDS-0301-s11 r2.dgn

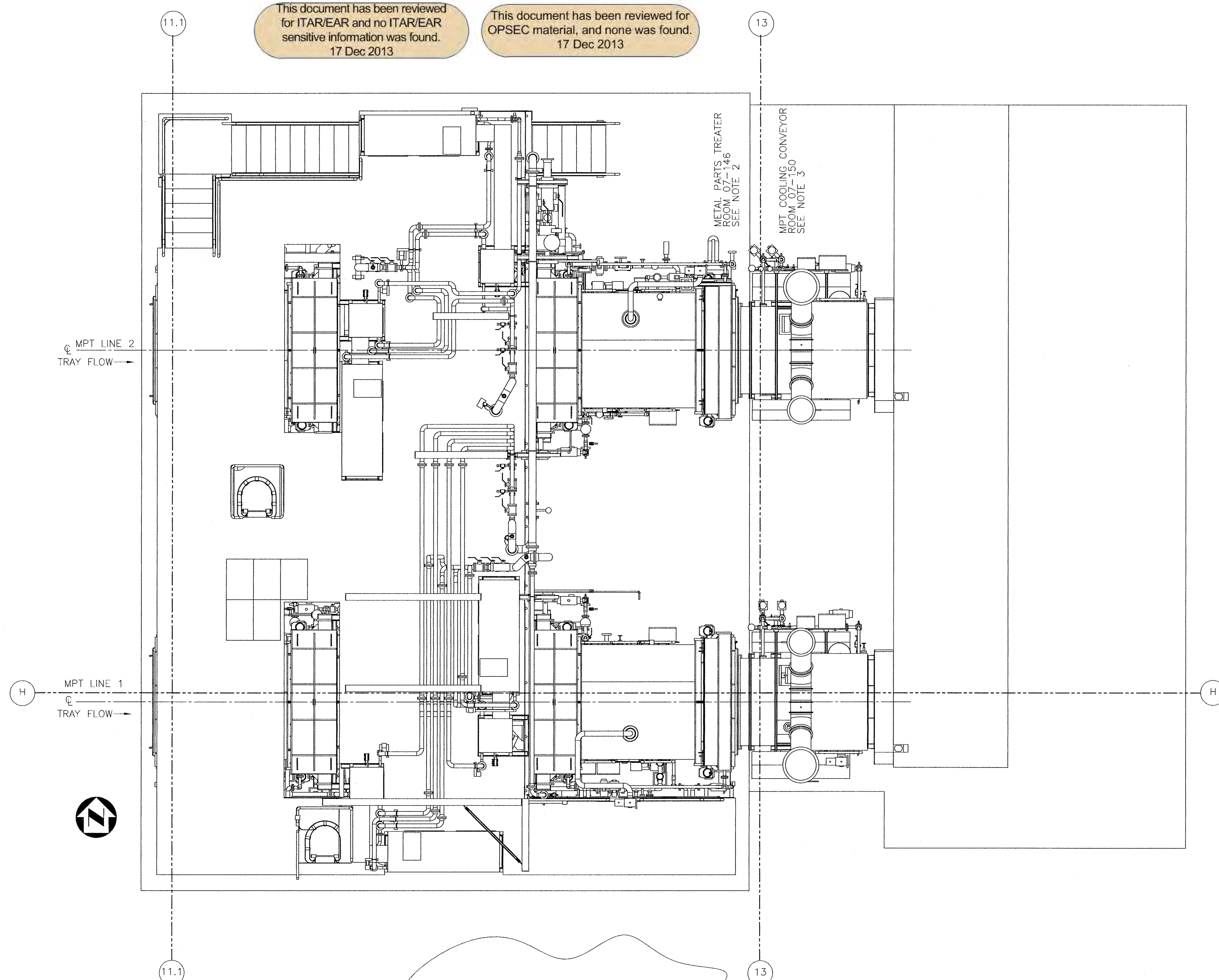
DATA SHEET	TITLE BGAPP SPENT DECON HOLDING/AGENT WASHOUT TREATMENT TANKS 07-MV-SDS-0301		SHEET 11 OF 11	PROJECT NUMBER 24915
			DOCUMENT NUMBER 24915-07-MVD-SDS-00001	REV 2



...\07-MV-SDS-0301-s11 r2.dgn 8/16/2010 2:46:26 PM

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



4 MPT ICD LAYOUT

GENERAL NOTES: (UNLESS OTHERWISE NOTED)

1. THE MPT CHAMBER DIMENSIONS SHOWN ARE AT COLD STATE (ROOM TEMPERATURE). AT 1500°F, THE CHAMBER WILL GROW APPROXIMATELY 2" IN LENGTH AND 1" IN DIAMETER. EACH CHAMBER LINE (CHAMBER AND OUTLET CONVEYOR) WILL GROW APPROXIMATELY 4" IN LENGTH.
2. REFER TO 24915-07-B2-MPT-00001 SHEET 2 FOR DETAILS ON METAL PARTS TREATER ROOM (07-146).
3. REFER TO 24915-07-B2-MPT-00001 SHEET 11 FOR DETAILS ON MPT COOLING CONVEYOR ROOM (07-150).
4. REFER RO 24915-07-B2-MPT-00001 SHEET 12 FOR DETAILS ON STEAM SUPERHEATER SKID ASSY (LOCATED IN ROOM 07-148).
5. REFER TO 24915-07-B2-MPT-00001 SHEET SHEET 15, 16 & 17 FOR INTERFACE DATA.
6. REFER TO 24915-07-B2-MPT-00001 SHEET 18 FOR BLOCK FLOW DIAGRAM.
7. REFER TO 24915-07-B2-MPT-00001 SHEET 19 FOR MPT SYSTEM DESCRIPTION.
8. EXTERNAL INTERFACES ARE DENOTED WITH A DIAMOND. X X.X
9. E 7, E 17, C 9, C 18

   THESE JUNCTION BOXES ARE LOCATED IN RM 07-148.
10. E 8.1, E 9.1, E 18.1, E 19.1, C 23, C 24, C 25, C 26, C 27, C 29

    P 2.17, P 2.18, P 2.19, P 2.20, P 6.17, P 6.18, P 6.19, P 6.20

    THESE JUNCTION BOXES AND PIPE ICD'S ARE LOCATED IN RM 07-150.
11. C 28, C 30

    THESE JUNCTION BOXES ARE LOCATED IN RM 07-135.
12. REFER TO DRAWING 24915-07-B2-MPT-00001 SHEET 20 FOR GROUND PIPE SUPPORT LOCATIONS.
13. THESE ICD'S ARE TO BE FIELD LOCATED.

    P 1.7, P 3.9, P 5.7, P 7.9
14. REASON FOR DRAWING REVISION IS AS FOLLOWS: REVISED TO INCORPORATE DCN-087, DCN-088, DCN-089, DCN-097, DCN-114 AND TO INCORPORATE ECR BGCAPP-MPT-959.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM	JEM	SM	JB	GR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY GEORGE T. FRATER 25510 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

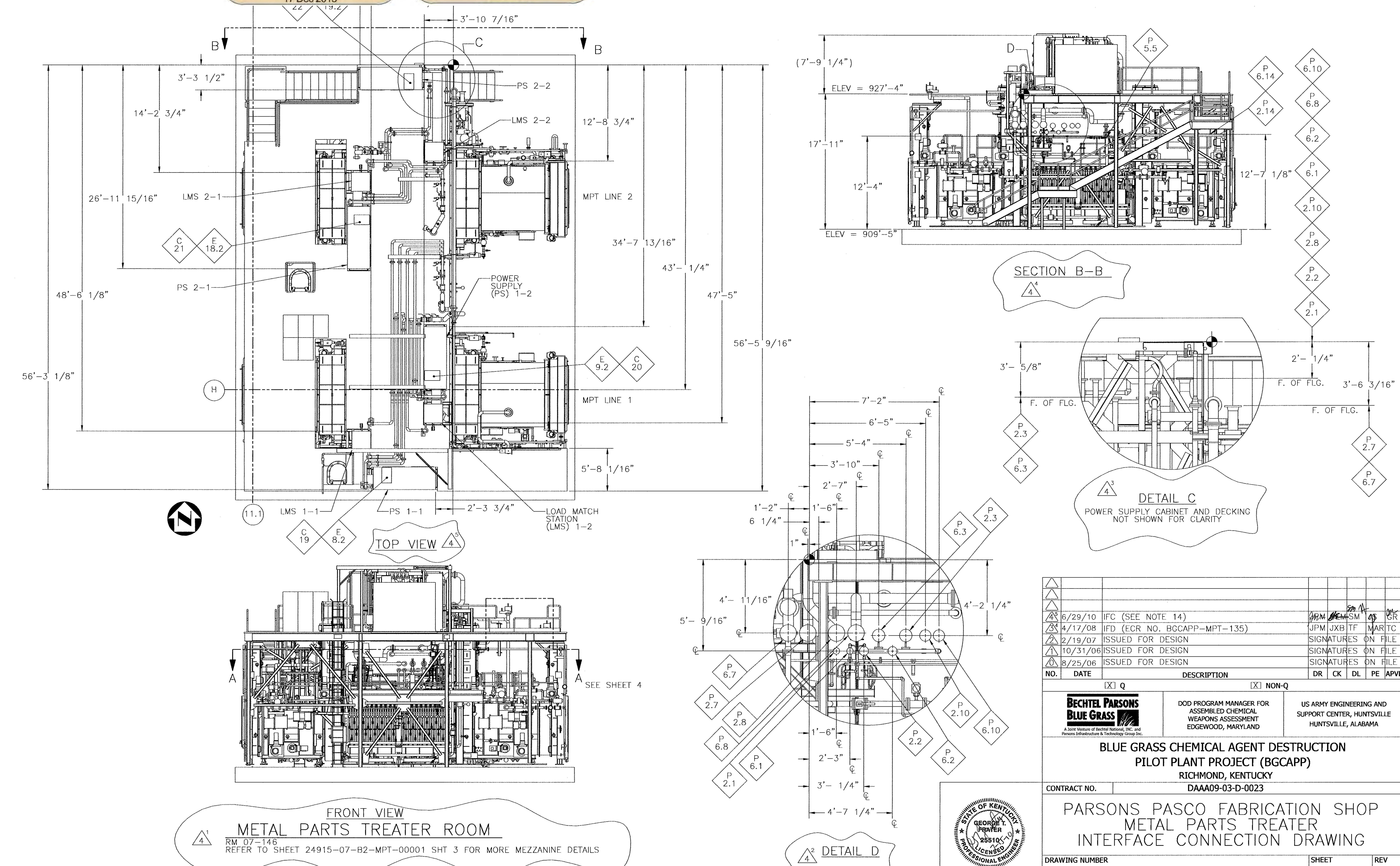
PARSONS PASCO FABRICATION SHOP
METAL PARTS TREATER
INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001 | SHEET 1 OF 20 | REV 4

22X34 'D' SIZE
MPT FAB DRAWINGS 4.03

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM	~~BEM~~	SM	JS	GR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY GEORGE T. PRATER 25510 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

PARSONS PASCO FABRICATION SHOP METAL PARTS TREATER INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 2 OF 20

REV 4

22X34 'D' SIZE MPT FAB DRAWINGS 4.02

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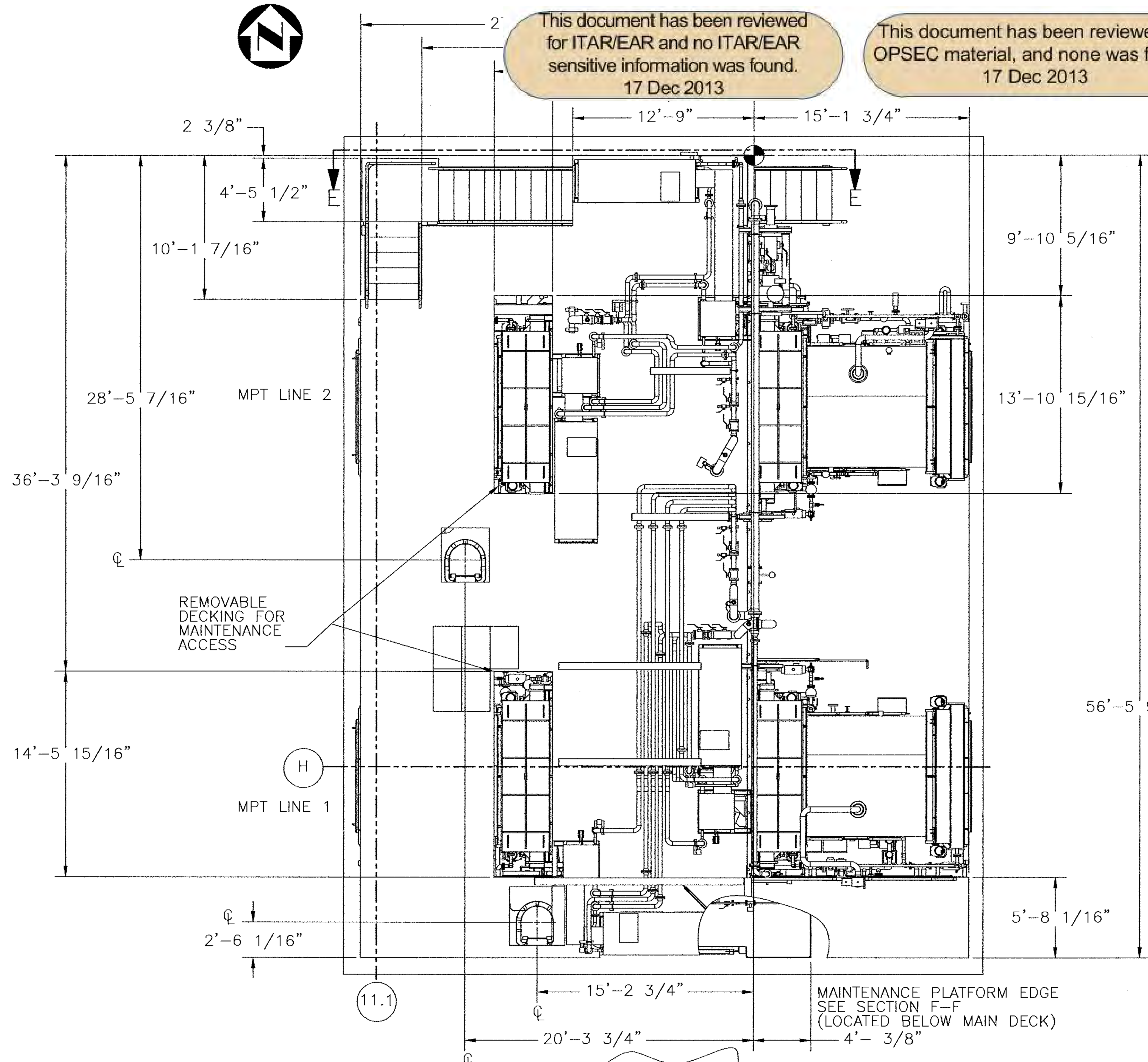
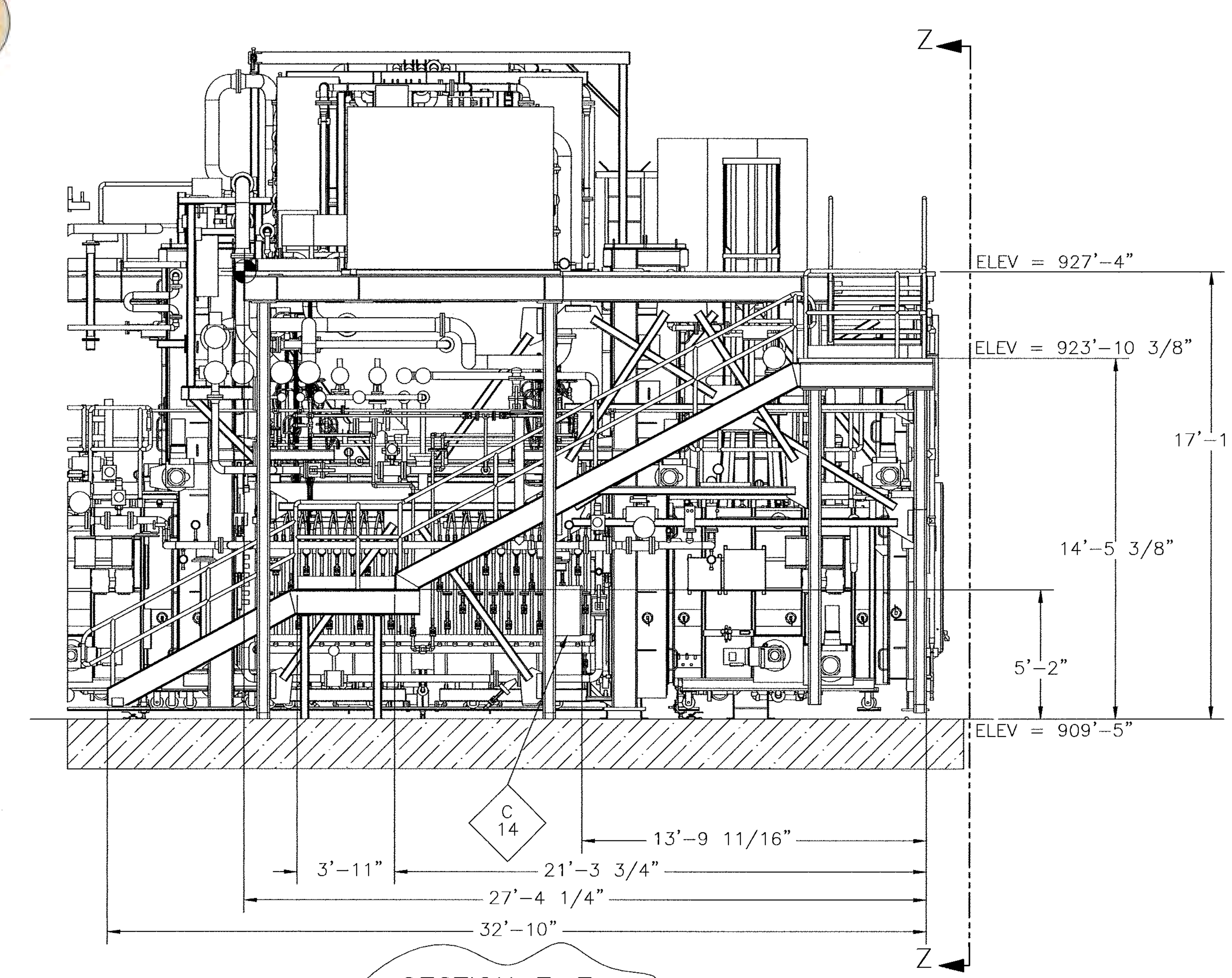
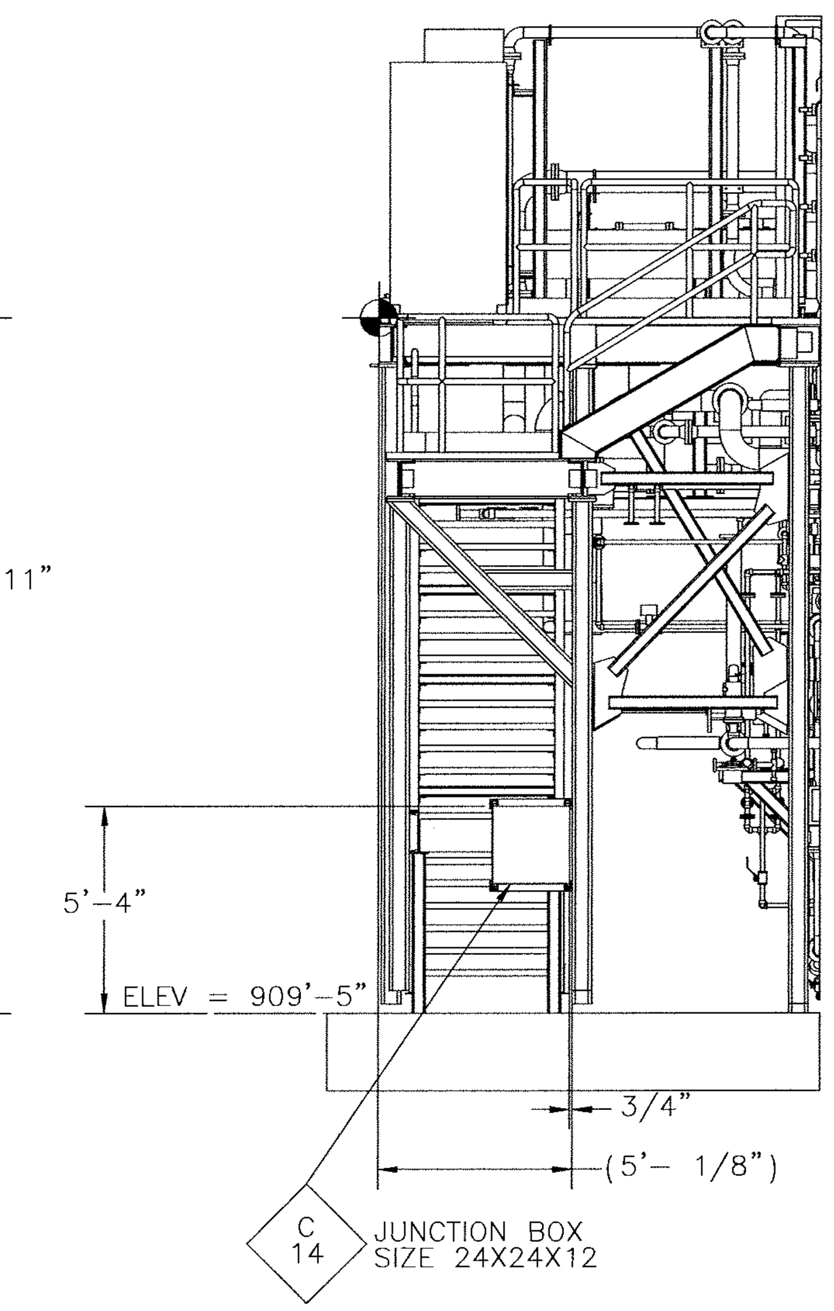


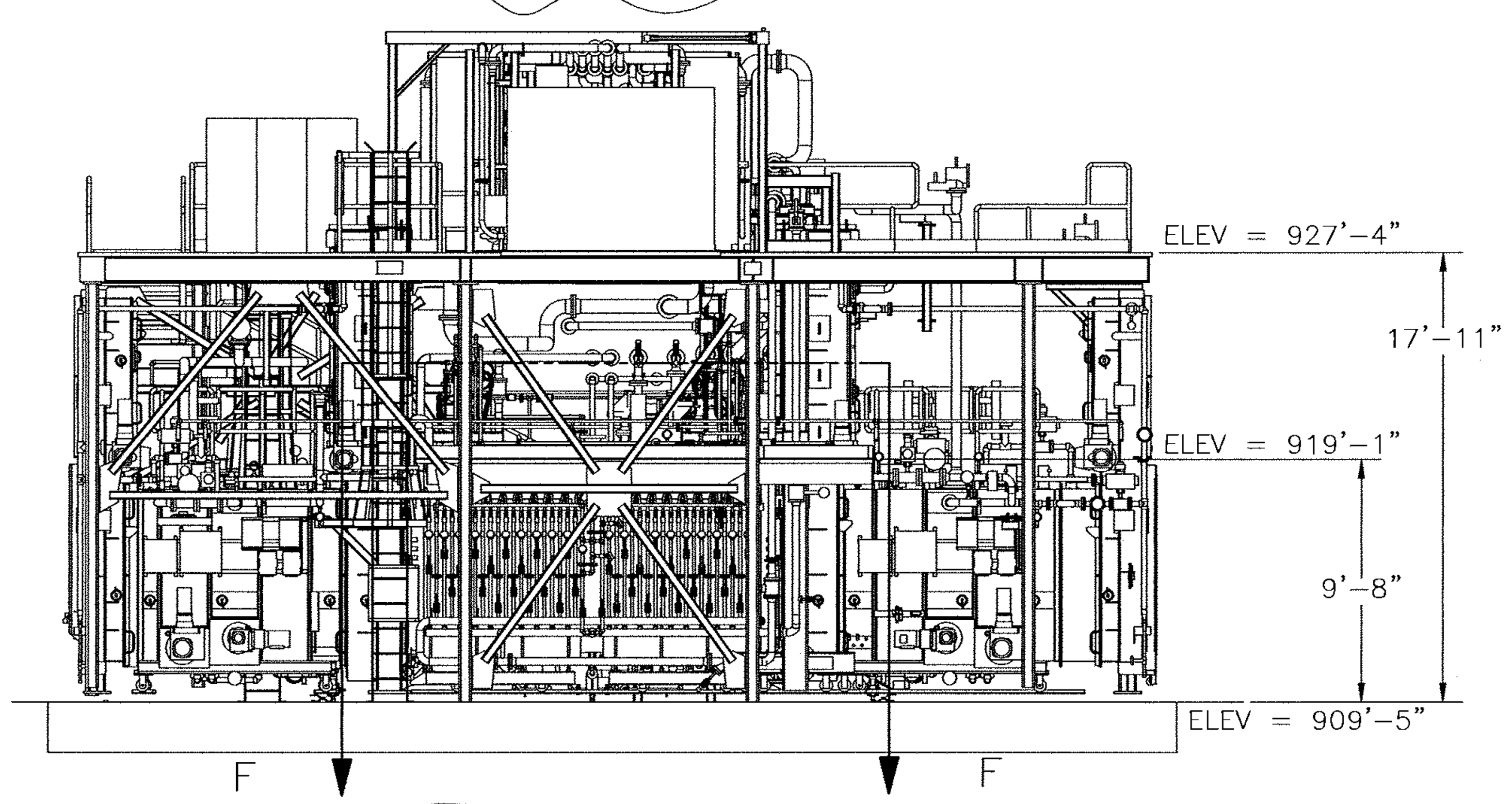
TOP VIEW



SECTION E-E

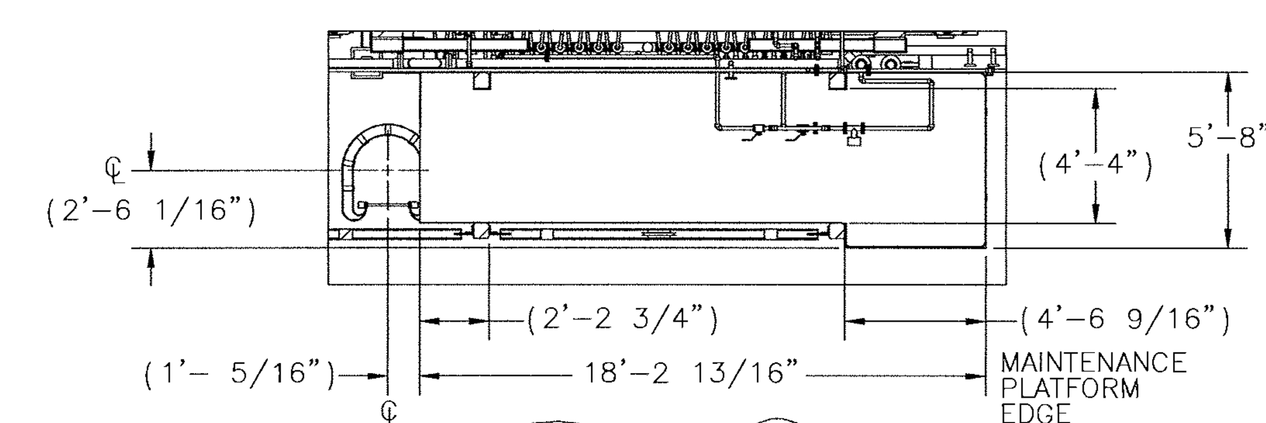


SECTION Z-Z



FRONT VIEW

METAL PARTS TREATER ROOM



SECTION F-F

MAINTENANCE PLATFORM

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
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3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
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1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

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CONTRACT NO. DAAA09-03-D-0023

PARSONS PASCO FABRICATION SHOP
METAL PARTS TREATER
INTERFACE CONNECTION DRAWING

STATE OF KENTUCKY GEORGE T. FRAYER 25510 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 3 OF 20

REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.02

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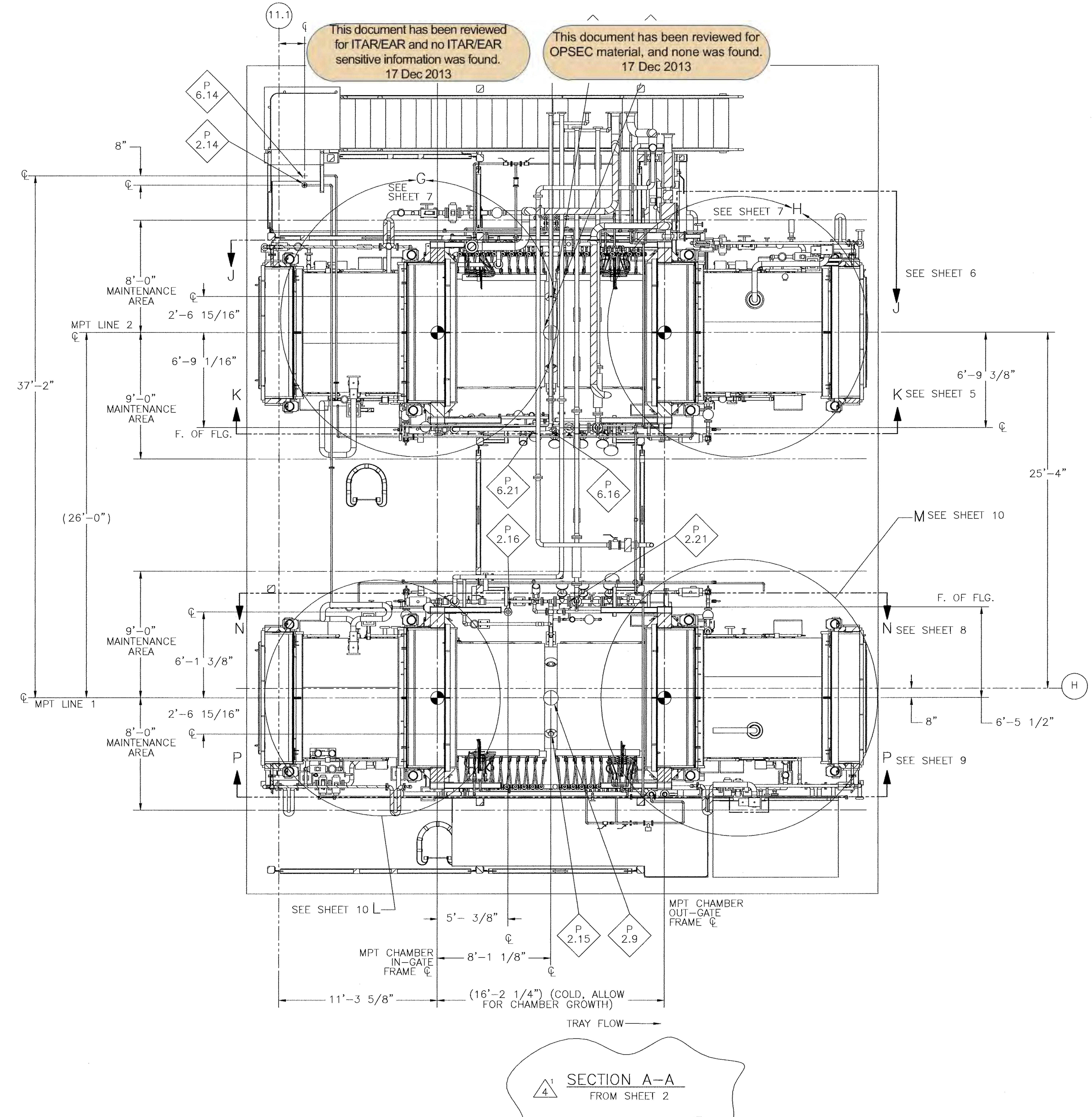

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0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

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STATE OF KENTUCKY GEORGE T. FRATER 25510 LICENSED PROFESSIONAL ENGINEER

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DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 4 OF 20

REV 4

22X34 'D' SIZE MPT FAD DRAWINGS 4.02

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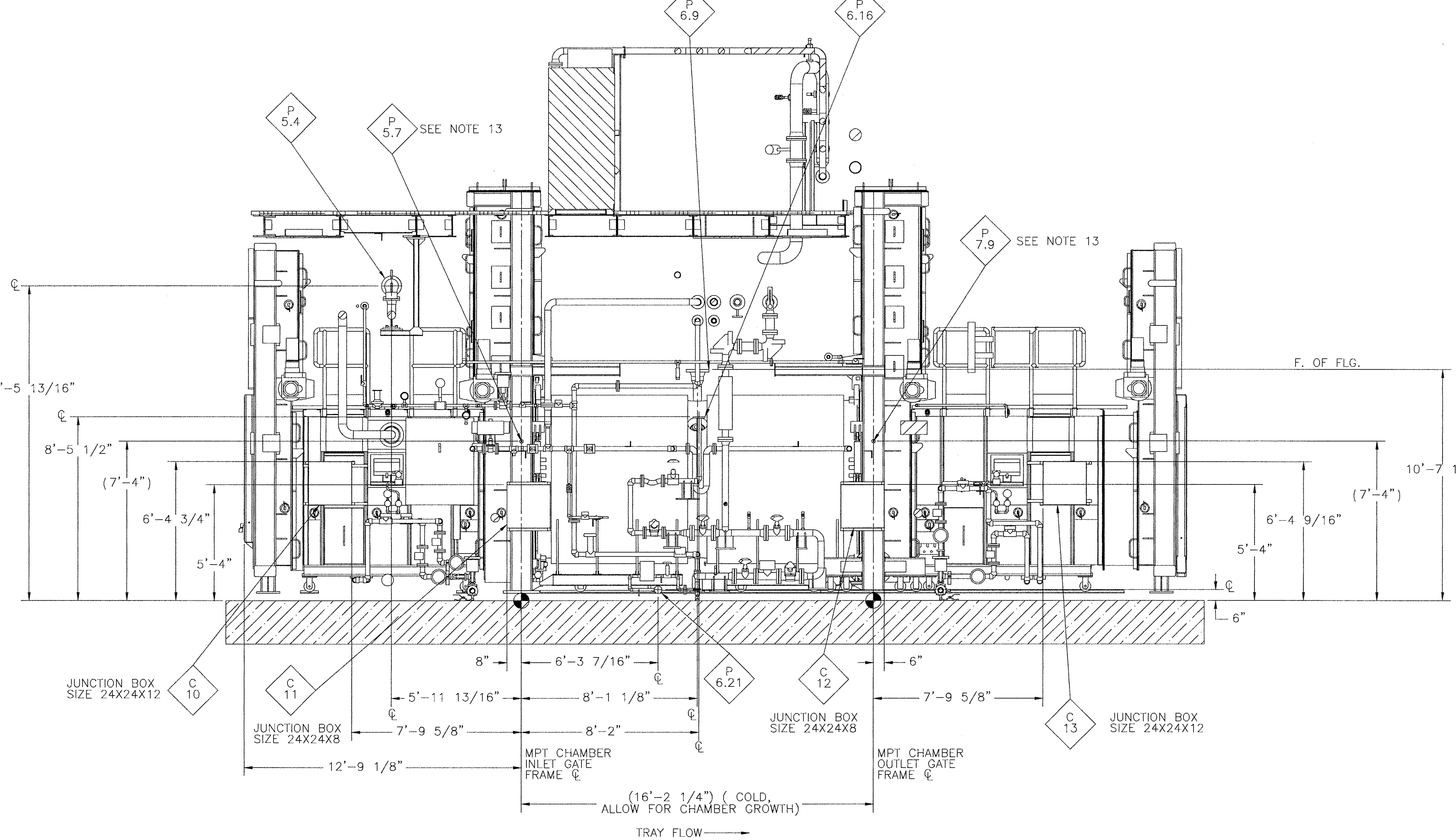

4

SECTION K-K

SECTION DEPTH EXTENDS TO CHAMBER ℄ FOR CLARITY
LINE 2 LOOKING NORTH
FROM SHEET 4

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)			SM		GR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
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CONTRACT NO. DAAA09-03-D-0023

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PARSONS PASCO FABRICATION SHOP METAL PARTS TREATER INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 5 OF 20

REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.02

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17 Dec 2013

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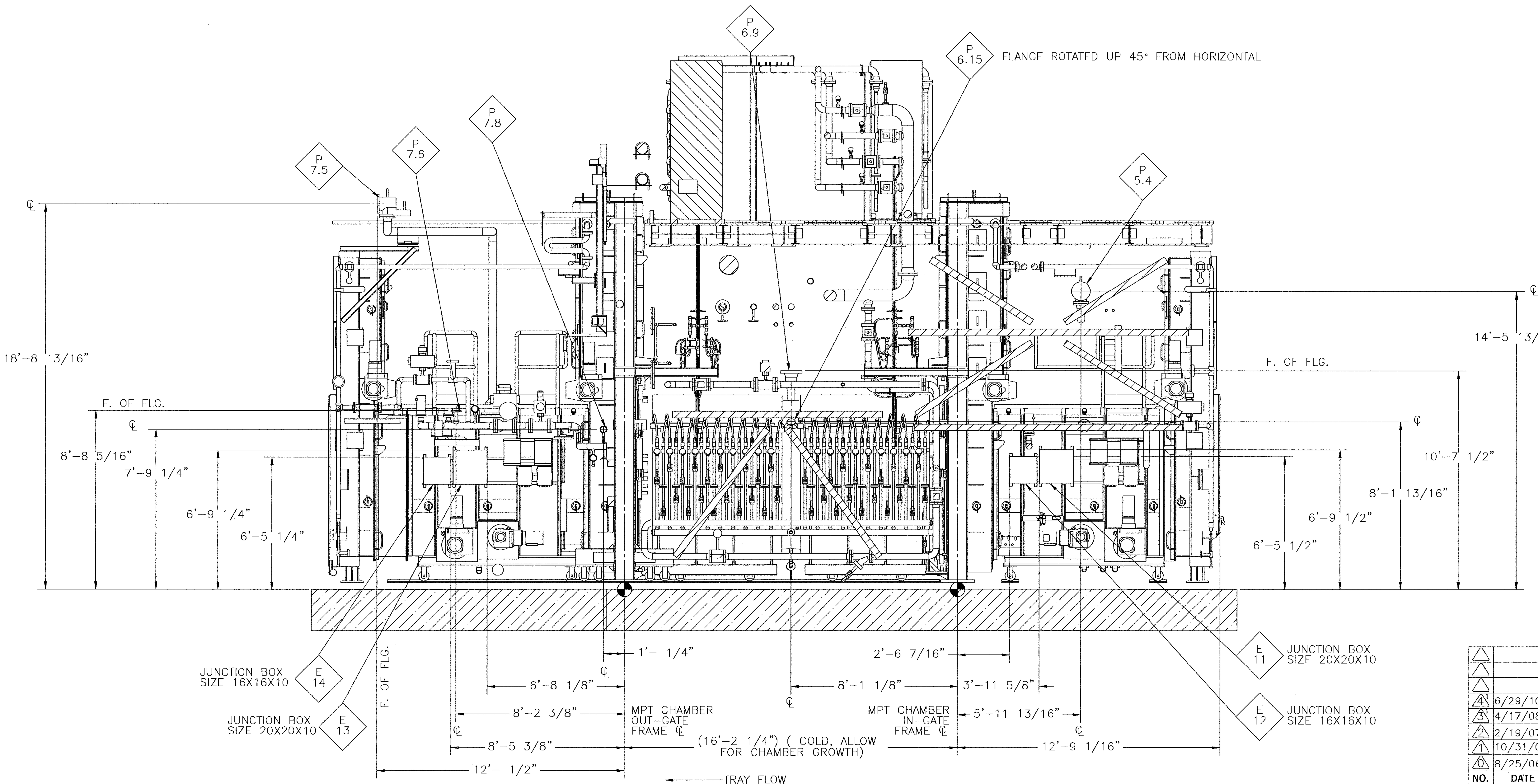

4

SECTION J-J
SECTION DEPTH EXTENDS TO CHAMBER ℄ FOR CLARITY
LINE 2 LOOKING SOUTH
FROM SHEET 4

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM	BEM	SM	JQ	GR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

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HUNTSVILLE, ALABAMA

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CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
GEORGE T. FRATER
25510
LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

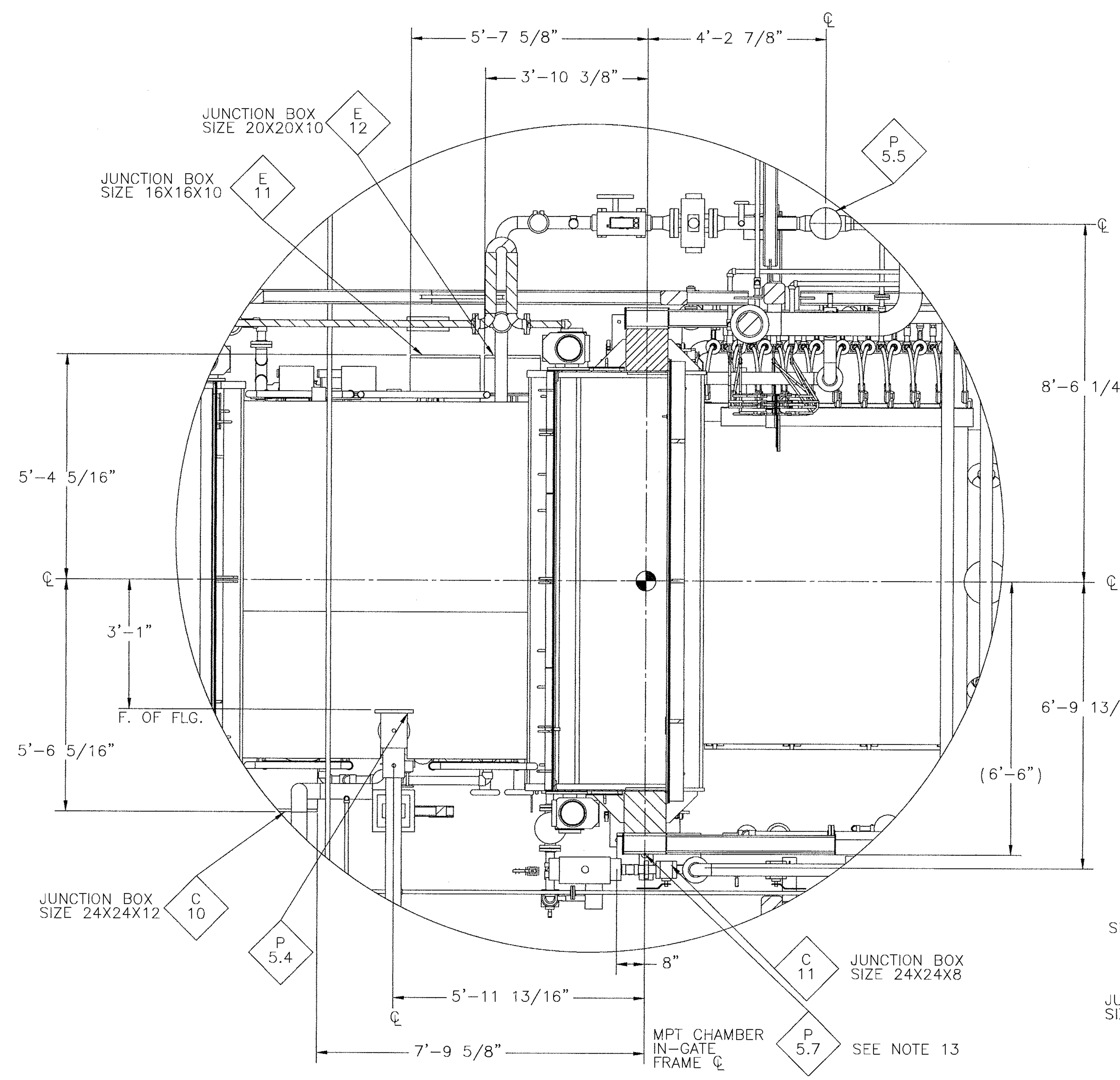
PARSONS PASCO FABRICATION SHOP
METAL PARTS TREATER
INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 6 OF 20

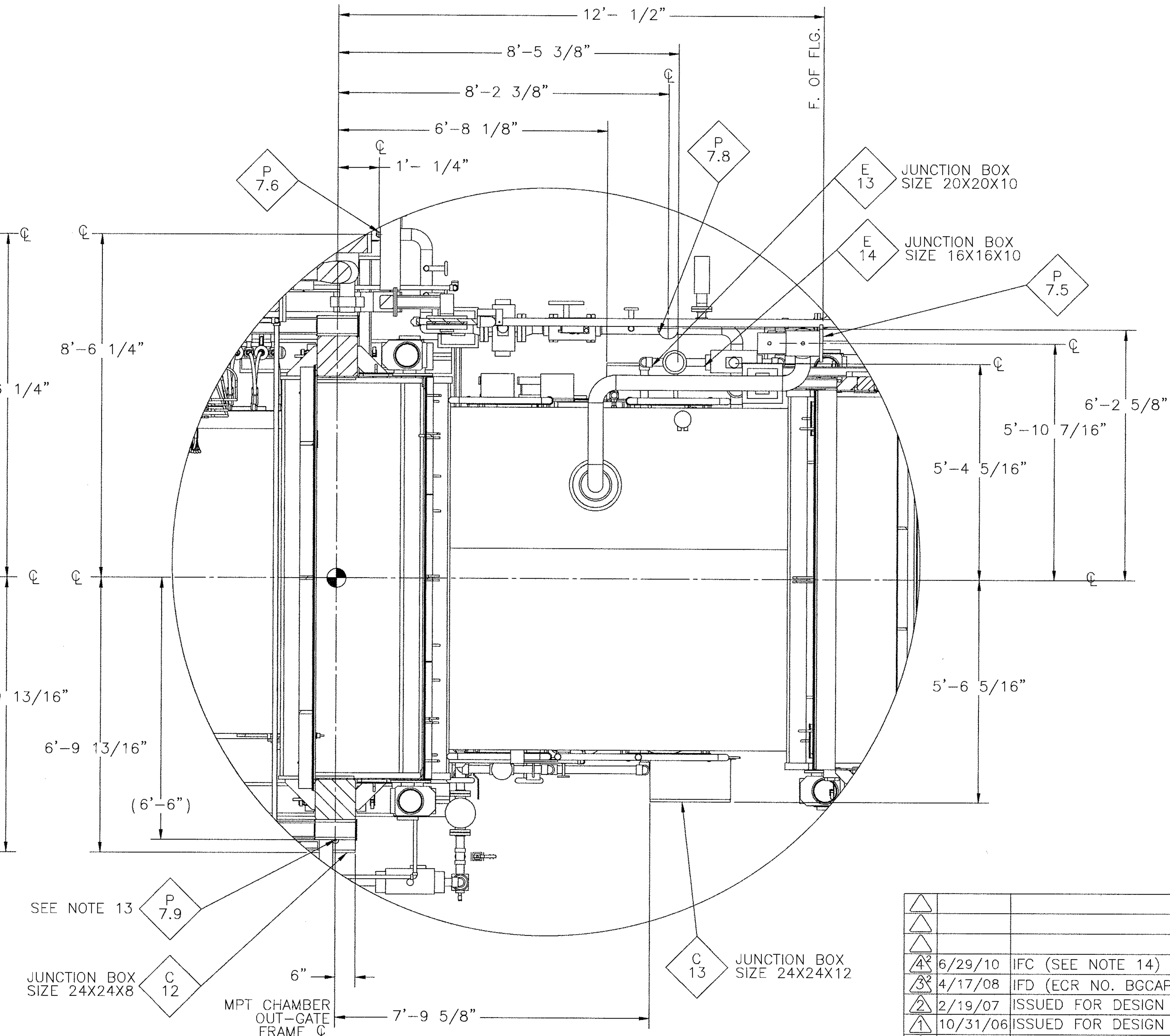
REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.02



TRAY FLOW

4 DETAIL G
INLET AIRLOCK LINE 2 FROM SHEET 4



4 DETAIL H
OUTLET AIRLOCK LINE 2 FROM SHEET 4

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
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3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
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0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

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CONTRACT NO. DAAA09-03-D-0023

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PROFESSIONAL STAMP

PARSONS PASCO FABRICATION SHOP METAL PARTS TREATER INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001
SHEET 7 OF 20
REV 4

22X34 'D' SIZE MPT FAD DRAWINGS 4.02

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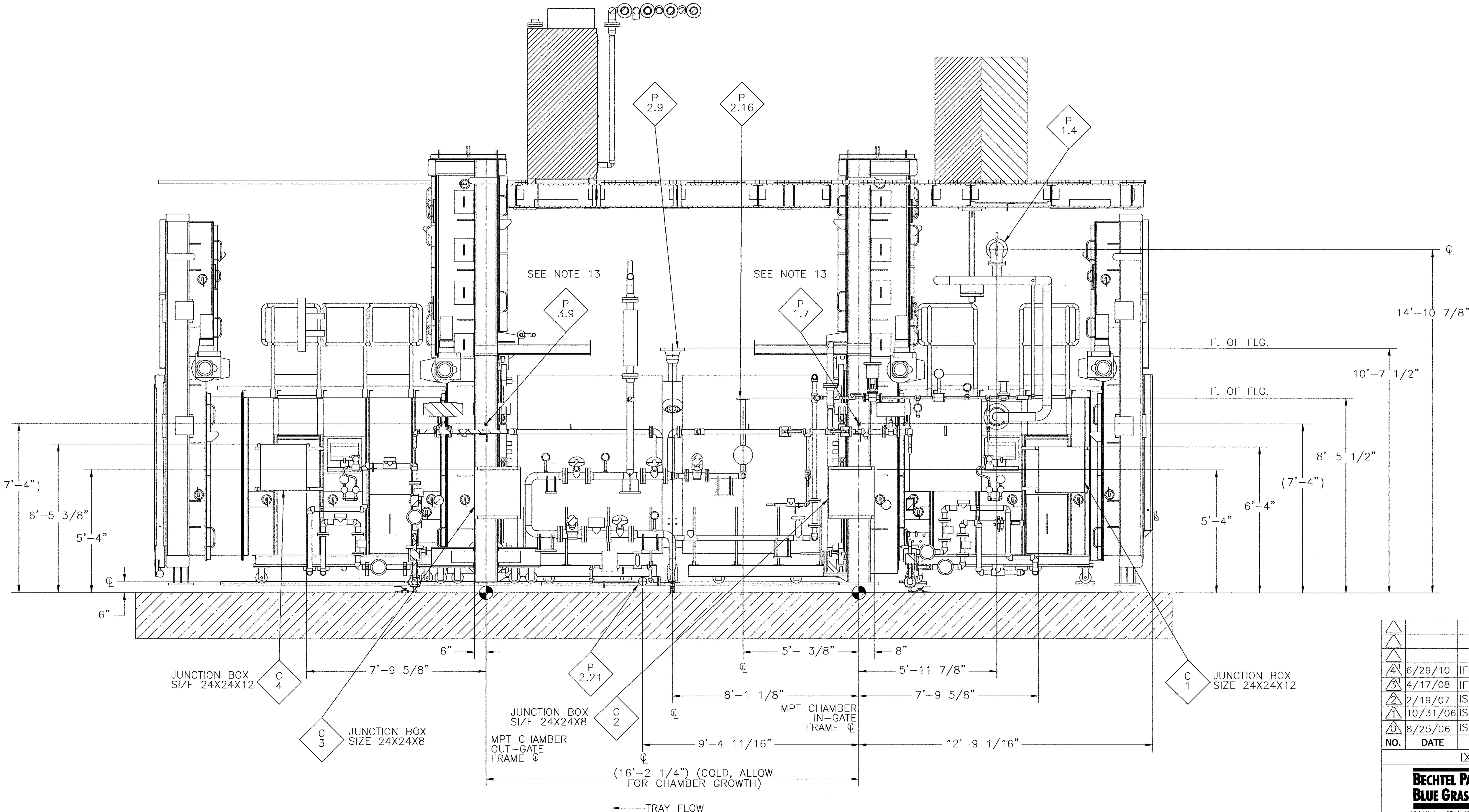

4

SECTION N-N

SECTION DEPTH EXTENDS TO CHAMBER ℄ FOR CLARITY
LINE 1 LOOKING SOUTH
FROM SHEET 4

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM		SM		GR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
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CONTRACT NO. DAAA09-03-D-0023

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PARSONS PASCO FABRICATION SHOP METAL PARTS TREATER INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 8 OF 20

REV 4

22X34 'D' SIZE
MPT FAB DRAWINGS 4.02

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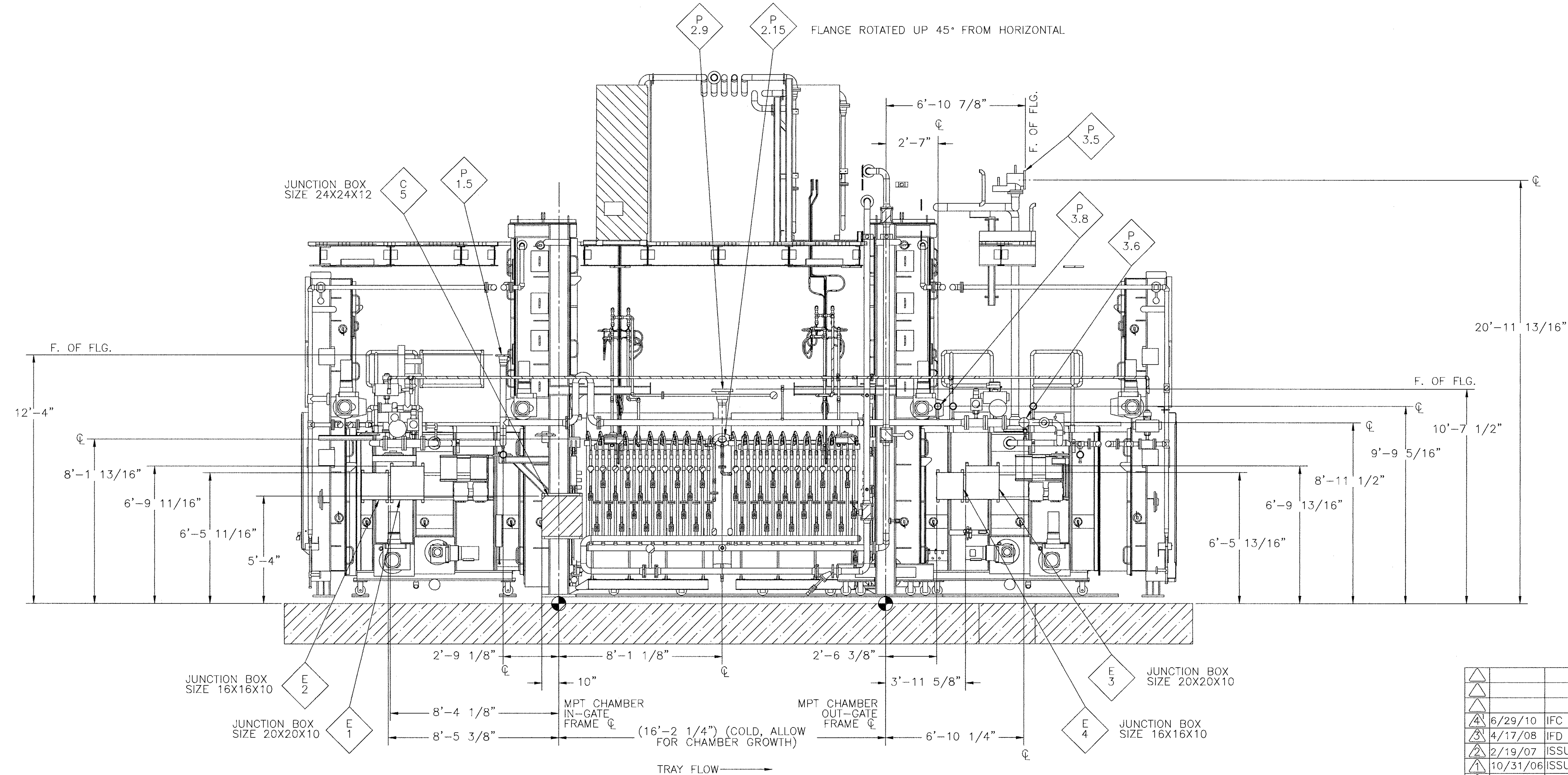

4 SECTION P–P

SECTION DEPTH EXTENDS TO CHAMBER ℄ FOR CLARITY
LINE 1 LOOKING NORTH
FROM SHEET 4

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)			SM		GR
3	4/17/08	IFD (ECR NO. BGCAPP–MPT–135)	JPM	JXB	TF	MAR	TC
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0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

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METAL PARTS TREATER
INTERFACE CONNECTION DRAWING

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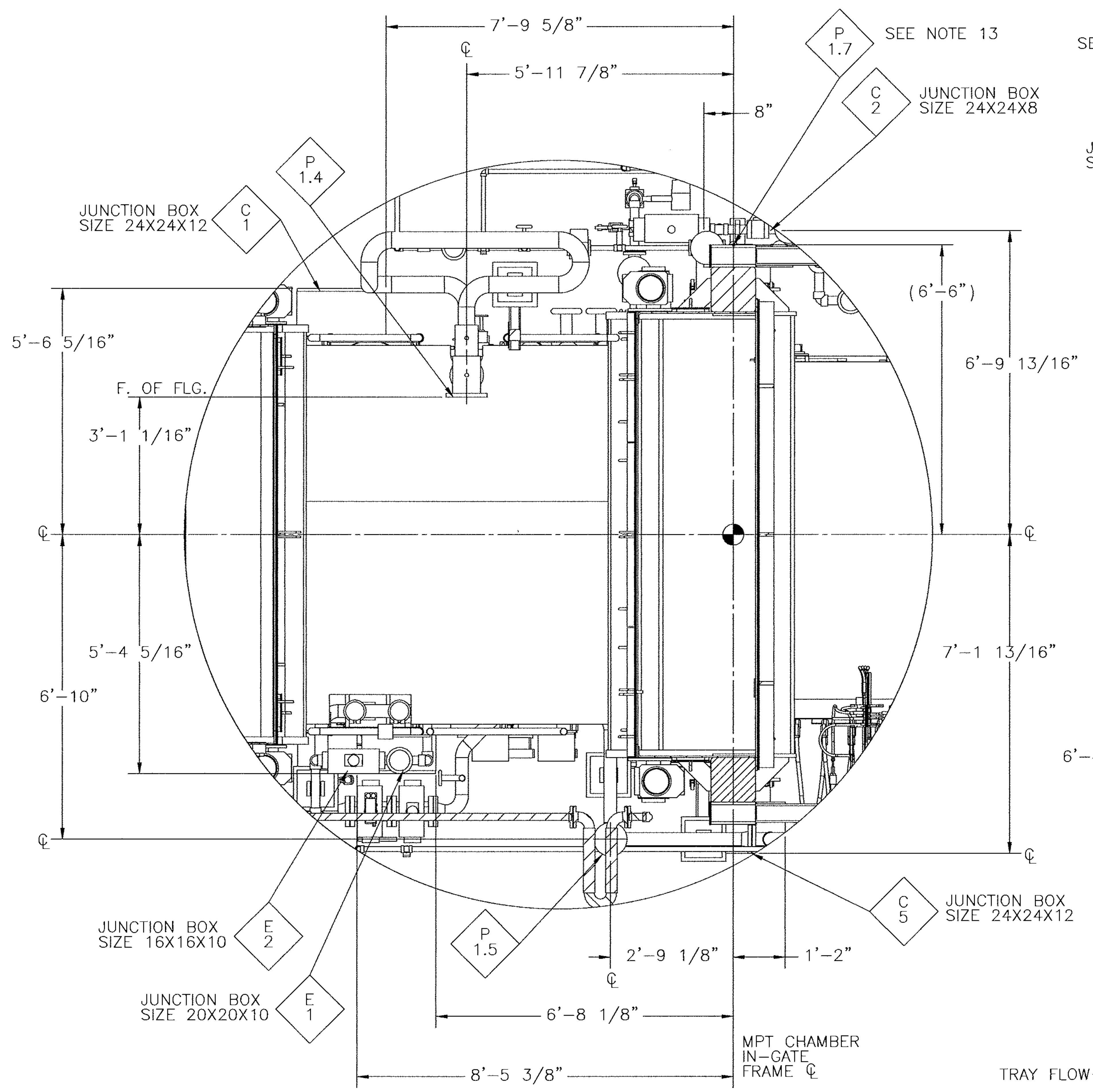
PROFESSIONAL STAMP

DRAWING NUMBER 24915–07–B2–MPT–00001

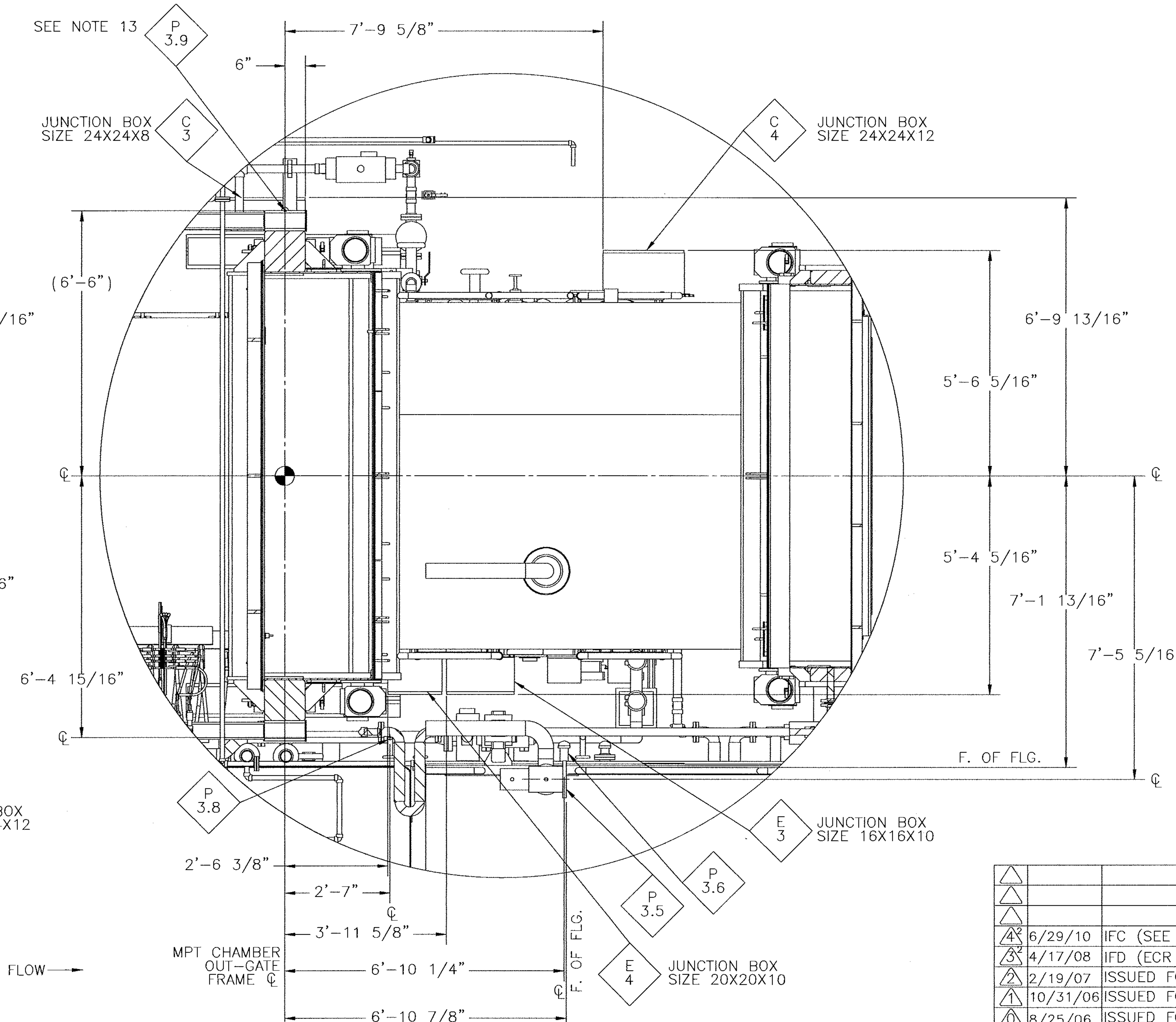
SHEET 9 OF 20

REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.02



DETAIL L
4 INLET AIRLOCK LINE 1 FROM SHEET 4



DETAIL M
4 OUTLET AIRLOCK LINE 1 FROM SHEET 4

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
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RICHMOND, KENTUCKY

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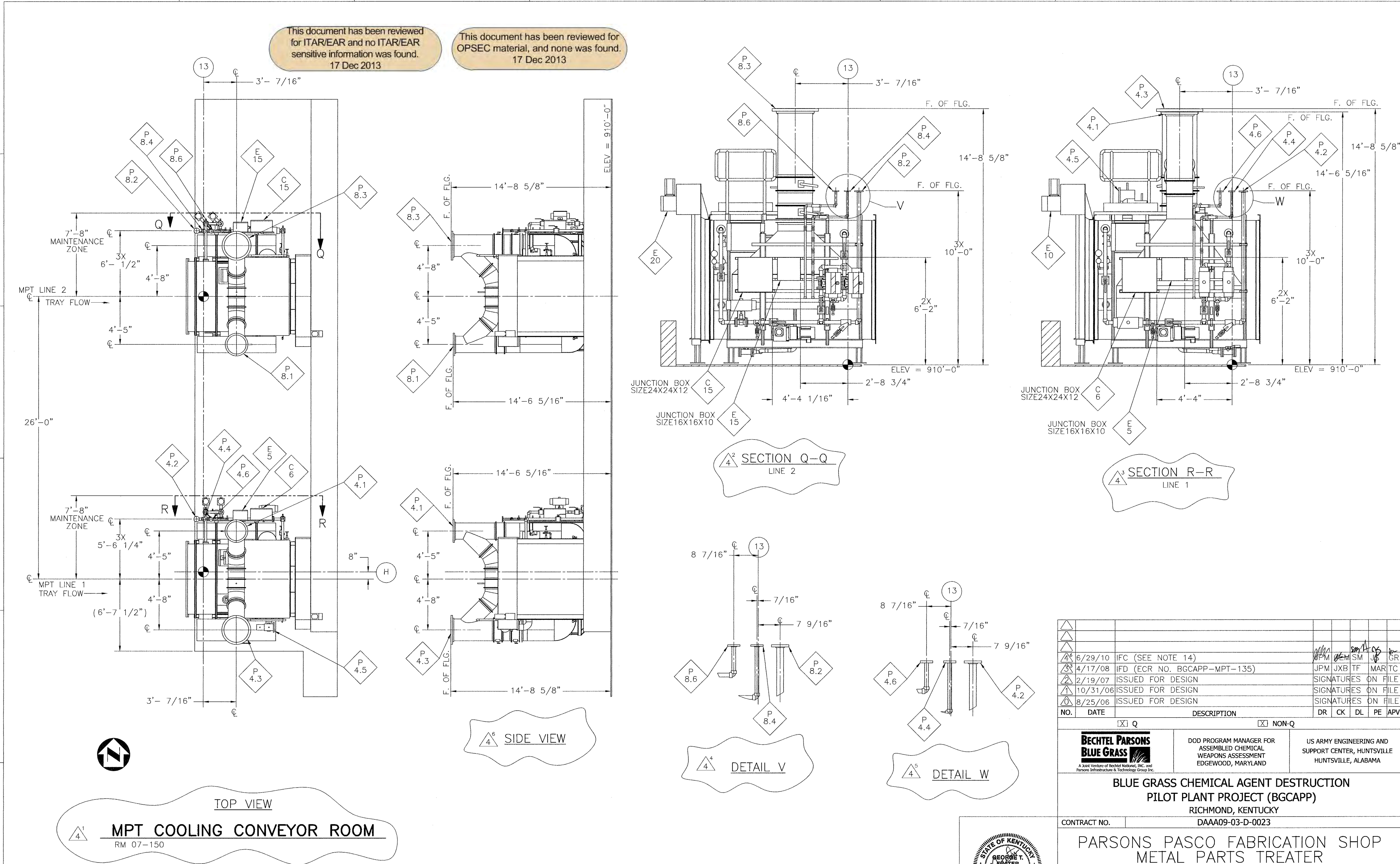
DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 10 OF 20

REV 4

22X34 'D' SIZE
MPT FAB DRAWINGS 4.02



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3	4/17/08	IFD (ECR NO. BGCAPP–MPT–135)	JPM	JXB	TF	MAR	TC
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SHEET 11 OF 20

REV 4

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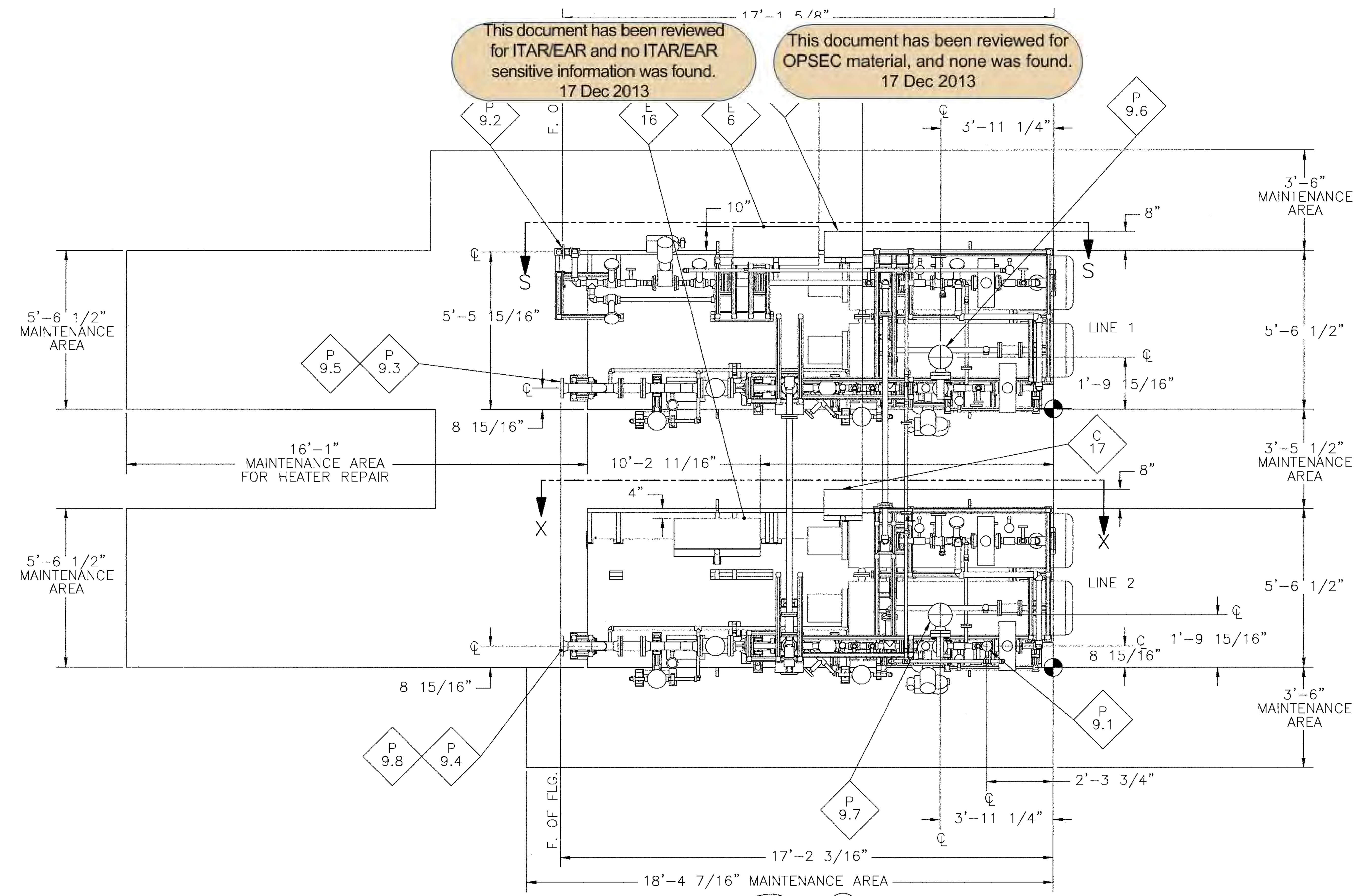
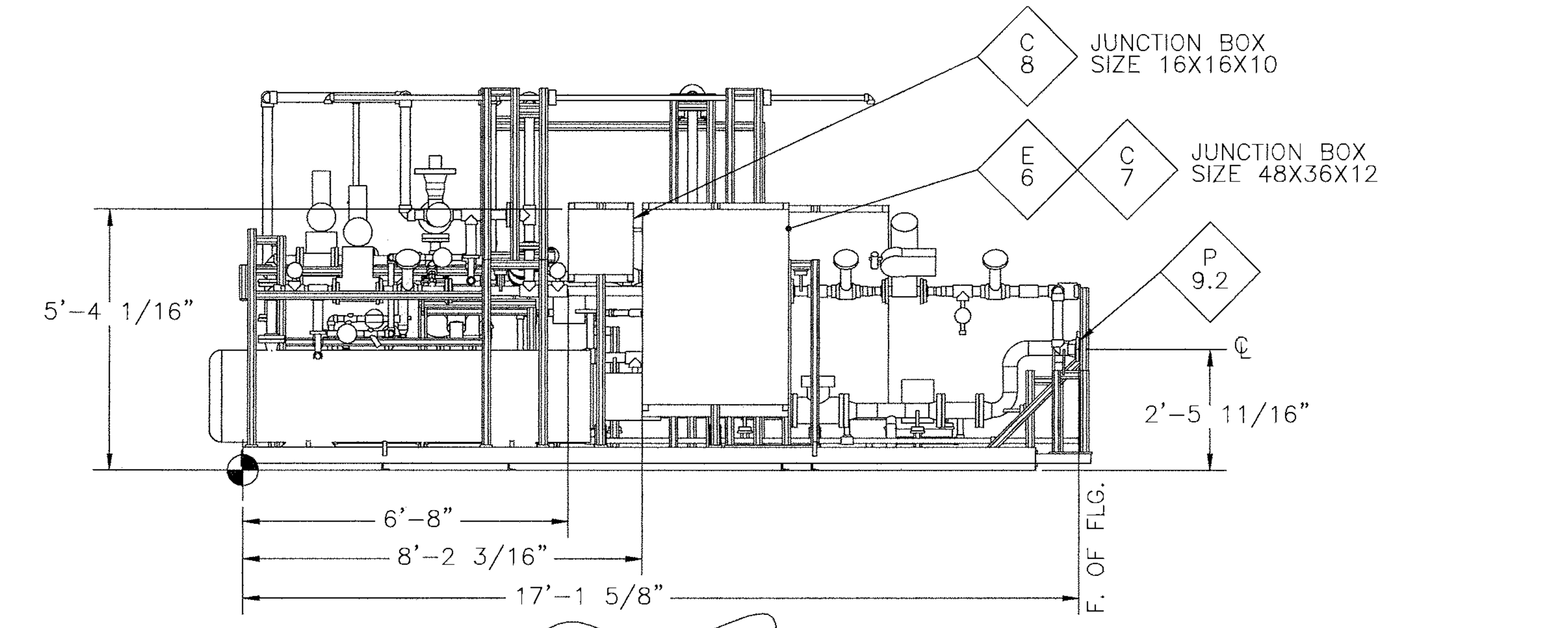
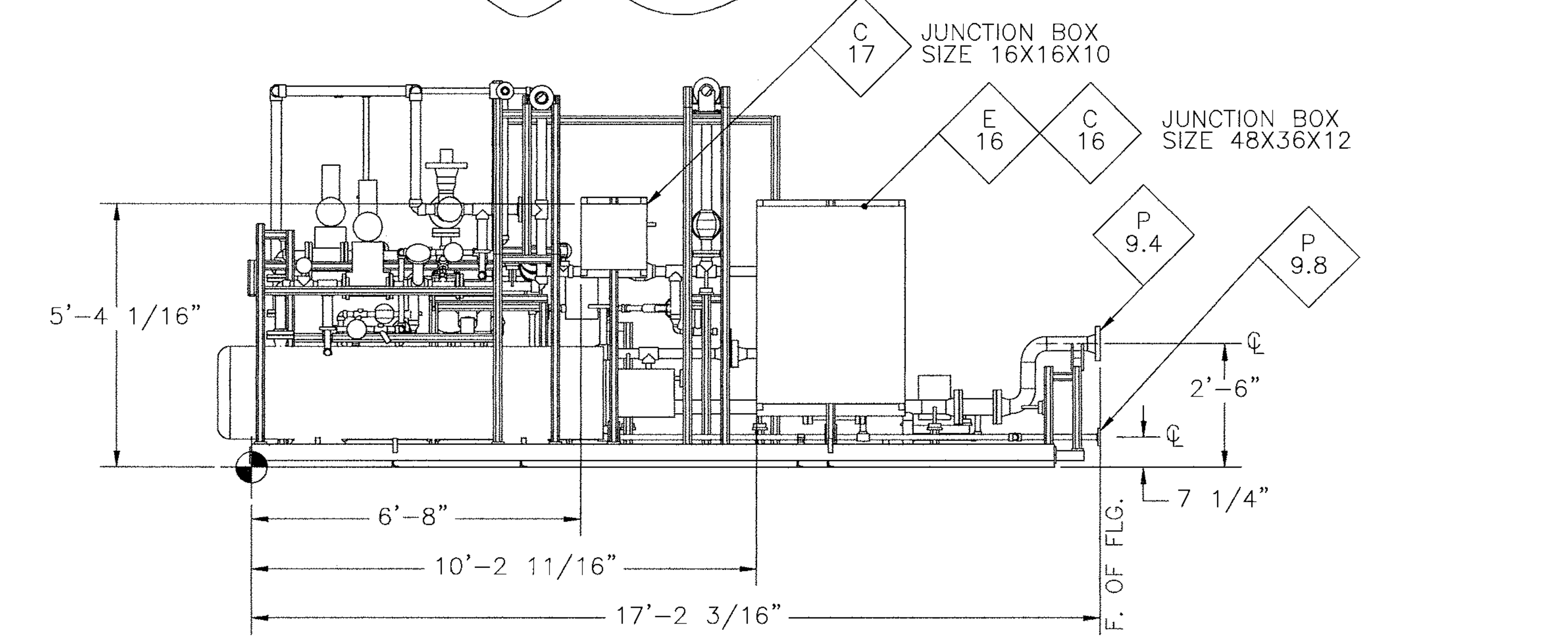
MPT FAB DRAWINGS 4.03



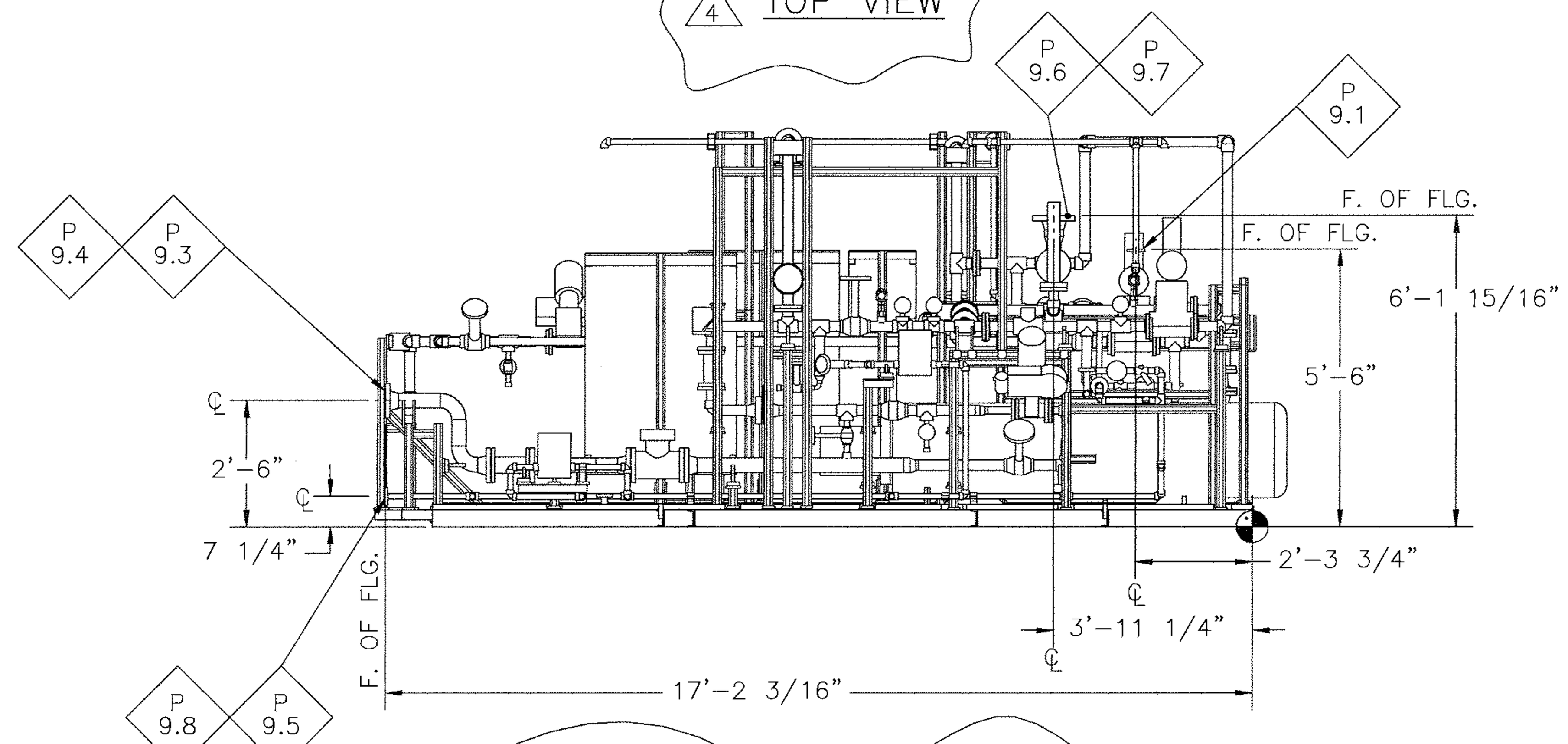
4 TOP VIEW

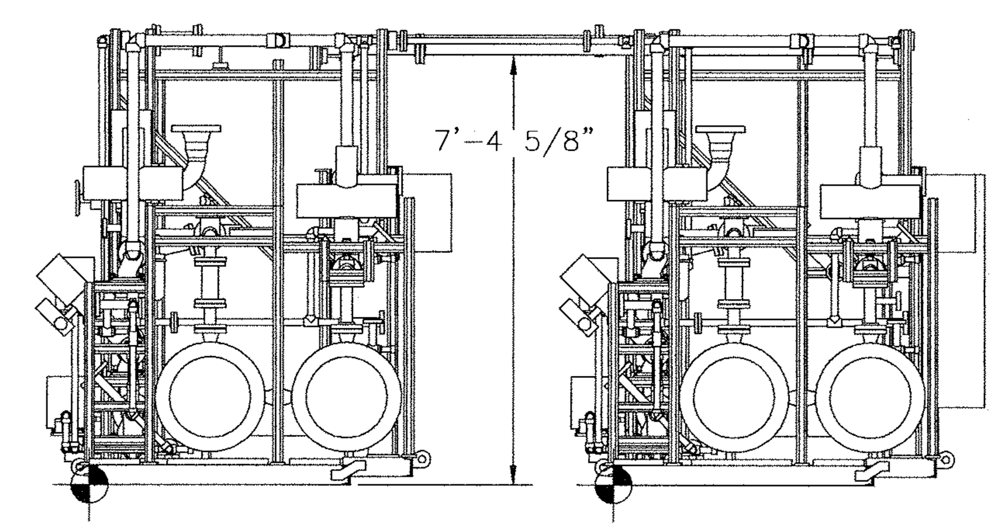


4 SECTION S-S
LINE 1



4 SECTION X-X
LINE 2





4 SIDE VIEW

4 FRONT VIEW

STEAM SUPERHEATER SKID ASSY
LOCATED IN RM 07-148

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM		SM		GR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
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PROFESSIONAL STAMP

PARSONS PASCO FABRICATION SHOP METAL PARTS TREATER INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001 | SHEET 12 OF 20 | REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.02

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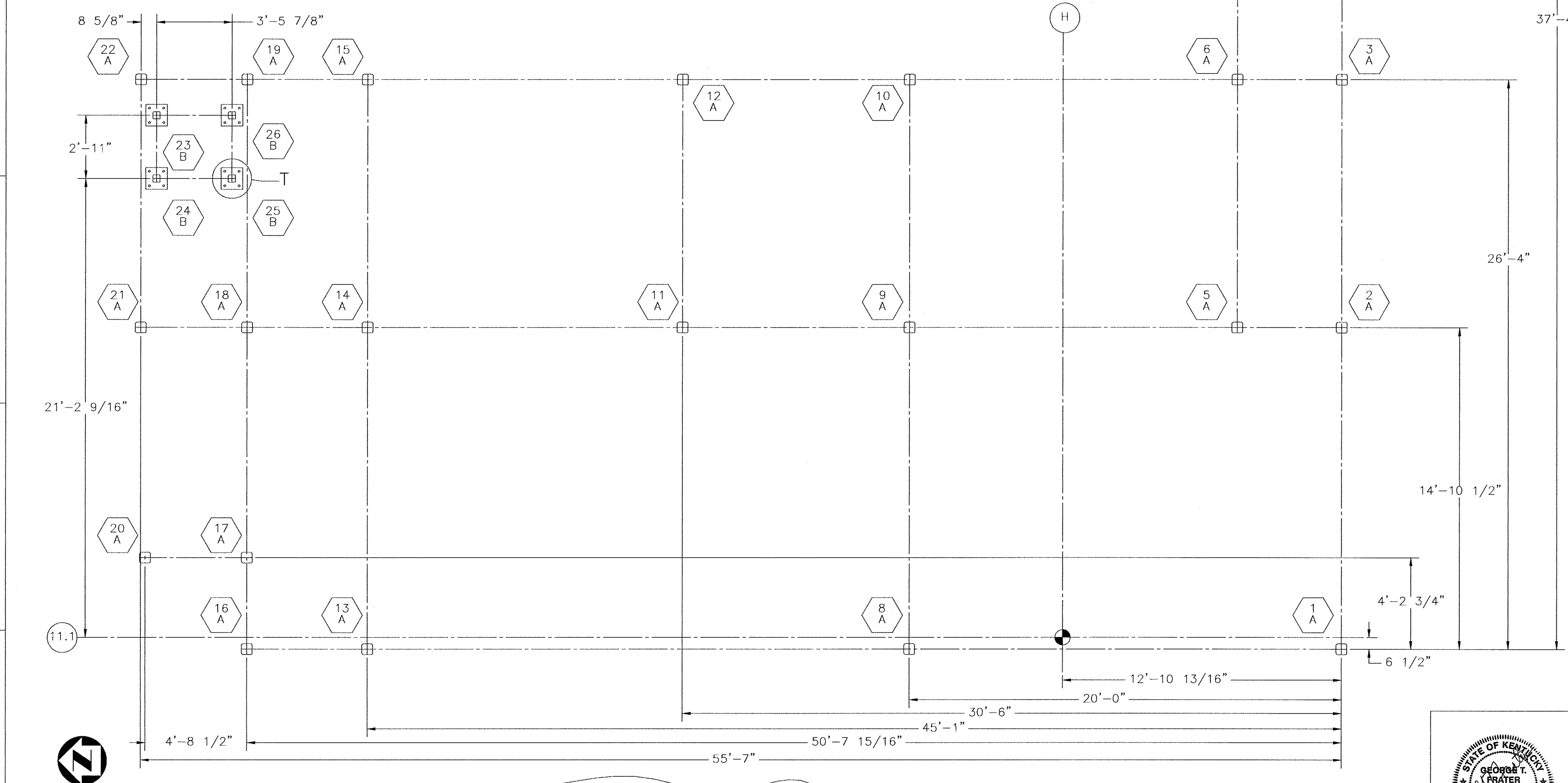
	AXIAL FORCE (KIPS)							SHEAR FORCE (KIPS)		MOMENT (KIP-FT)		AXIAL MOMENT (KIP-FT)			
COLUMN NO.	DEAD LOAD	LIVE LOAD	VERTICAL SEISMIC LOAD	LATERAL SEISM N	S					ABOUT NS	ABOUT EW			COLUMN FOOTING ELEV	
1	-5.326	-5.430	-0.213	-0.437	0.437	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	910'-0"	
2	-6.452	-4.990	-0.258	-0.578	0.578	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	909'-5"	
3	-5.552	-4.678	-0.222	-0.209	0.209	6.137	-6.137	0.216	2.974	-0.020	-0.081	-0.010	0.036	909'-5"	
4	-2.901	-2.750	-0.116	-0.030	0.030	0.010	-0.010	0.113	0.043	0.001	-0.274	-0.057	0.003	910'-0"	
5	-13.642	-14.105	-0.546	0.555	-0.555	0.186	-0.186	0.189	0.180	-0.048	0.038	-0.006	0.011	909'-5"	
6	-7.876	-7.760	-0.315	-0.037	0.037	0.219	-0.219	0.213	0.180	-0.043	-0.082	-0.006	0.003	909'-5"	
7	-2.969	-2.799	-0.119	0.028	-0.028	0.023	-0.023	0.113	0.049	-0.002	-0.274	-0.057	0.005	910'-0"	
8	-9.821	-11.515	-0.393	0.143	-0.143	-0.539	0.539	0.096	0.075	0.009	0.116	0.000	0.000	909'-8"	
9	-13.923	-16.789	-0.557	-0.696	0.696	0.105	-0.105	0.437	0.092	0.011	0.043	0.014	0.000	909'-8"	
10	-7.583	-6.164	-0.303	-3.538	3.538	0.322	-0.322	1.650	0.098	0.010	-0.361	-0.014	0.000	909'-8"	
11	-16.788	-17.740	-0.672	0.509	-0.509	0.252	-0.252	0.436	0.091	0.010	0.043	-0.004	0.000	909'-8"	
12	-4.411	-4.950	-0.176	3.682	-3.682	-0.094	0.094	1.654	0.085	0.014	-0.406	0.029	0.001	909'-8"	
13	-8.540	-9.676	-0.342	-6.293	6.293	-3.597	3.597	1.436	0.167	-0.114	0.402	0.145	0.009	909'-8"	
14	-12.458	-12.152	-0.498	-4.446	4.446	-0.067	0.067	1.087	2.267	-0.091	-0.021	-0.012	0.155	909'-8"	
15	-5.700	-5.420	-0.228	-4.957	4.957	3.147	-3.147	1.118	2.048	-0.106	-0.227	-0.011	0.015	909'-5"	
16	-0.097	0.364	-0.004	5.799	-5.799	0.223	-0.223	1.651	0.065	0.045	0.454	0.096	0.013	910'-0"	
17	-2.661	-4.282	-0.106	0.987	-0.987	-1.302	1.302	0.509	0.326	0.155	0.515	0.042	0.010	910'-0"	
18	-5.491	-5.210	-0.220	4.097	-4.097	0.675	-0.675	1.102	0.199	0.130	0.199	-0.014	-0.088	909'-8"	
19	-3.040	-2.608	-0.122	4.756	-4.756	-0.136	0.136	1.201	0.050	0.040	-0.213	0.028	-0.004	909'-8"	
20	-0.928	-2.172	-0.037	0.225	-0.225	-0.076	0.076	0.188	0.024	0.346	0.242	0.051	0.025	910'-0"	
21	-3.468	-1.513	-0.139	0.215	-0.215	-0.105	0.105	0.109	0.049	0.064	0.021	-0.034	0.002	909'-8"	
22	-2.700	-1.506	-0.108	0.122	-0.122	0.105	-0.105	0.106	0.049	0.064	-0.039	-0.003	-0.016	909'-8"	
23	-0.092	-0.316	-0.004	0.104	-0.104	0.098	-0.098	0.027	-0.003	-0.014	-0.013	-0.010	-0.018	909'-3 11/16"	SEE NOTE 2
24	-0.590	-2.820	-0.024	-0.112	0.112	-0.139	0.139	0.039	-0.006	-0.018	0.016	-0.009	-0.028	909'-3 11/16"	SEE NOTE 2
25	-0.450	-2.305	-0.018	0.255	-0.255	1.506	-1.506	0.037	0.105	0.035	-0.011	-0.009	-0.028	909'-2 11/16"	SEE NOTE 2
26	-0.225	-0.808	-0.009	-0.238	0.238	-1.454	1.454	0.029	0.076	0.027	0.013	-0.010	-0.018	909'-2 11/16"	SEE NOTE 2

NOTES:

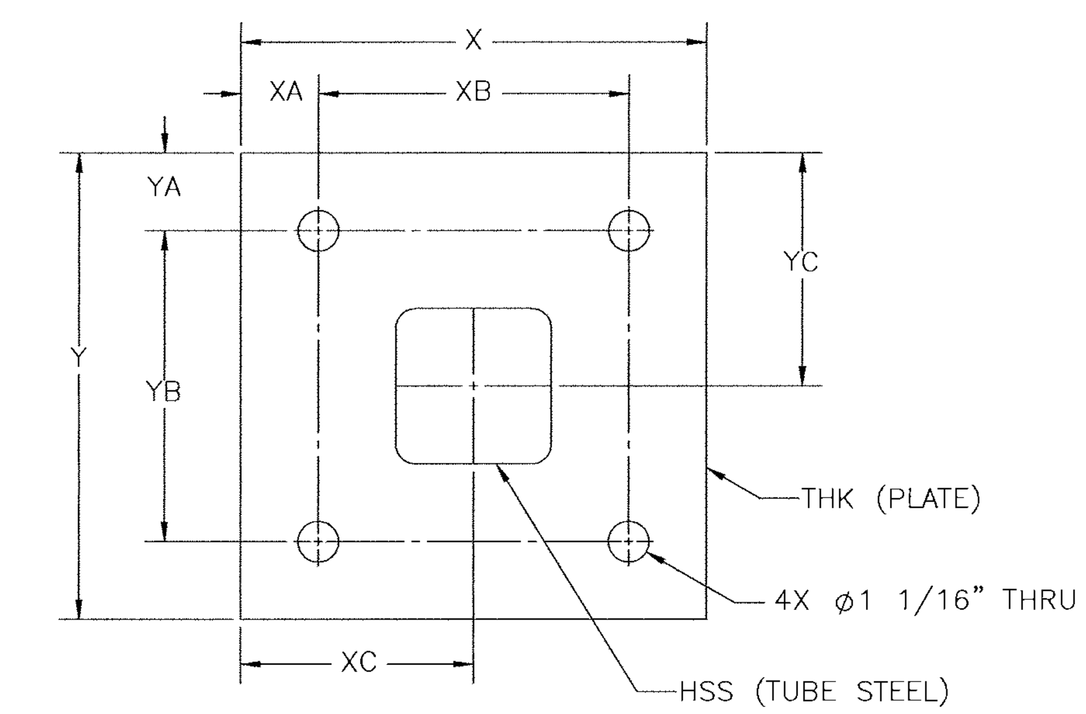
1. NUMBER IN SYMBOL DENOTES COLUMN NUMBER. LETTER DENOTES BASEPLATE NAME. (111 / XX)
2. COLUMNS 23, 24, 25 AND 26 ARE FOR STAIR REST PLATFORM. GIVEN COLUMN FOOTING ELEVATIONS ARE FOR BOTTOM OF STEEL (BOS).

BASEPLATE DETAILS

NAME	X	XA	XB	XC	Y	YA	YB	YC	THK	HSS
A	TUBE STEEL FIELD WELDED TO EMBED PLATE									6X6X1/2
B	12"	2"	8"	6"	12"	2"	8"	6"	1/2"	4X4X1/2



4 MPT MEZZANINE COLUMN LOCATIONS



4 DETAIL T
FOOTING DETAIL

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM		SM		CK
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY GEORGE T. FRATER 25510 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

PARSONS PASCO FABRICATION SHOP METAL PARTS TREATER INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001
SHEET 13 OF 20
REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.02

BGCAPP MPT EQUIPMENT LOADING						
EQUIPMENT NAME	BASE PLATE NUMBER	DEAD WEIGHT (LBF)	SE			
INLET AIRLOCK IN-GATE	1	10630				
	2	10630				
INLET AIRLOCK	3	5766	321	723	2649	24915-07-MJ-MPT-00159
	4	5766	321	723	2649	
	5	5766	321	723	2649	
	6	5766	321	723	2649	
MAIN CHAMBER & IN-GATE	7	18858	792	5444	2056	B
	8	18858	792	5444	2056	
MAIN CHAMBER & OUT-GATE	9	18858	792	5444	2056	24915-07-MJ-MPT-00161
	10	18858	792	5444	2056	
OUTLET AIRLOCK	11	6100	335	754	3224	24915-07-MJ-MPT-00160
	12	6100	335	754	3224	
	13	6100	335	754	3224	
	14	6100	335	754	3224	
OUTLET AIRLOCK-OUTGATE	15	10630	447	670	3007	C
	16	10630	447	670	3007	
COOLING CHAMBER	17	3403	143	580	4323	A
	18	3403	143	580	4323	
	19	3403	143	580	4323	
	20	3403	143	580	4323	
COOLING CHAMBER OUT-GATE	21	1818	62	172	1377	A
	22	1818	62	172	1377	
COIL CART RAILS (PER WHEEL)	–	630	<630		–	24915-07-MJ-MPT-00239

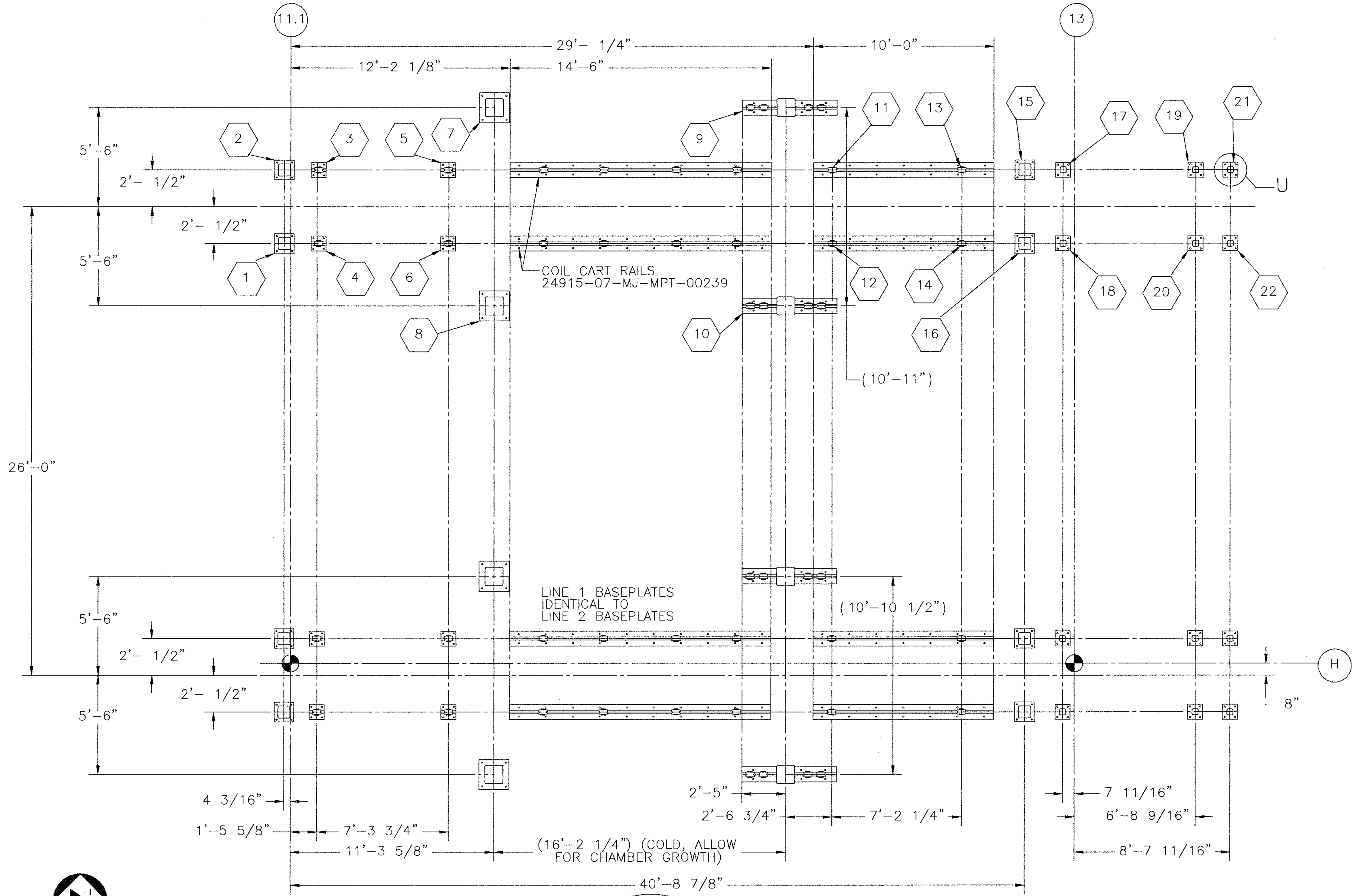
This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

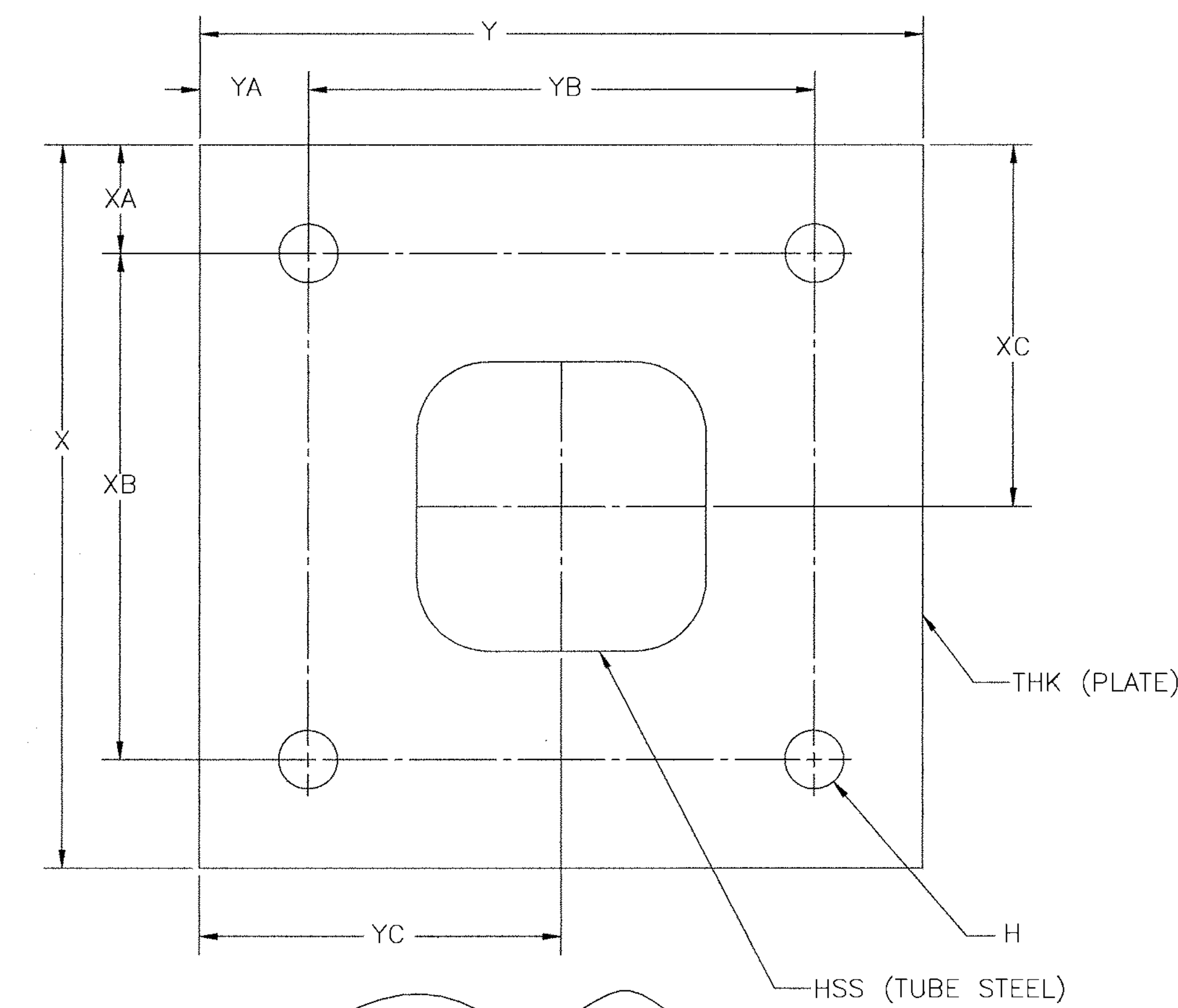
BASEPLATES 3 THRU 6 ARE LOCATED ON RAILS TO ALLOW FOR APPROX. 1" OF CHAMBER EXPANSION

BASEPLATES 9 THRU 14 ARE LOCATED ON RAILS TO ALLOW FOR APPROX. 4" OF CHAMBER EXPANSION

BASEPLATE DETAILS											
STYLE	THK	HSS	H	X	XA	XB	XC	Y	YA	YB	YC
A	1/2"	4X4X3/8	ø15/16"	10"	1 1/2"	7"	5"	10"	1 1/2"	7"	5"
B	1 1/2"	12X12X3/8	ø7/8"	1'-8"	2"	1'-4"	10"	1'-8"	2"	1'-4"	10"
C	1"	8X8X3/8	ø13/16"	1'-1"	1 1/2"	10"	6 1/2"	1'-1"	1 1/2"	10"	6 1/2"



MPT EQUIPMENT FOOTING LOCATIONS
BASEPLATE DETAIL
BASEPLATES 1-16 BOS ELEV = 909'-9"
BASEPLATES 17-22 BOS ELEV = 910'-1"
ALLOWING FOR 1" OF GROUT UPON INSTALLATION



DETAIL U
BASEPLATE DETAIL

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM		SM		
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY GEORGE T. FRATER 25518 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

PARSONS PASCO FABRICATION SHOP
METAL PARTS TREATER
INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 14 OF 20

REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.02

INTERFACE CONTROL DOCUMENT - MPT PIPING INTERFACE DATA (100% submittal)

MDB ROOM LOCATION: rm. # 07-146, top of floor elev. 910'-0"

SHIPPING WEIGHT:

TO ROOM: (BTU/HR):

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

IP	Int = I / Ext - E	DESCRIPTION	ICD DRA							LINE CONNECTION	PIPING LINE NO NOTE 4	FLOW NORMAL	FLOW MAXIMUM	FLOW I/C*	PRESSURE (PSIG) OPER	PRESSURE (PSIG) DESIGN	TEMPERATURE (F) OPER	TEMPERATURE (F) DESIGN	REM.
P1	E	MPT Inlet Airlock/Conveyor Line 1 Module, MX-MPT-0101B	24915-07-B2-MPT																
P1.1	I	Instrument Air to MJ-THS-0114		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	150# RF	IA-1111-1"-W	2 SCFM	5 SCFM	C	125	150	115	125	
P1.2	I	N2 to MJ-THS-0114		24915-07-M6-MPT-00012	NITG		2	A	CS	150# RF	NITG-1009-2"-A	0/183/378 LB/H	575 LB/H	C/I	15	150	77	125	
P1.4	E	Pressure Relief outlet to Room Air Return Register	24915-07-B2-MPT-00001 SHT 8, 10	24915-07-M6-MPT-00001	OTM		6	(A)	CS	150# RF	(OTM-1037-6"-A-PP)	0	575 LB/H	I	0	0	200	1150	
P1.5	E	Purge Gas outlet to Bulk Oxidizer	24915-07-B2-MPT-00001 SHT 9, 10	24915-07-M6-MPT-00001	OTM		4	AB	CS	150# RF	OTM-1022-4"-AB-HC	177/758 LB/H	758 LB/H	C/I	-0.6	15	467	1150	
P1.6	I	Purge gas from MPT Outlet Airlock		27915-07-M6-MPT-00001	OTM		3	AB	CS	150# RF	OTM-1022-3"-AB-HC	177/360/575 LB/H	575 LB/H	C/I	-0.62	15	550	1150	
P1.7	E	N2 to MJ-THS-0114	24915-07-B2-MPT-00001 SHT 8, 10	24915-07-M6-MPT-00012	NITG		1	SA	SS	NOTE 5	NITG-1239-1"-A	30 SCFM	37.5 SCFM	I	80	150	77	125	
P2	E	Metal Parts Treater Line 1 Module, MX-MPT-0101A	24915-07-B2-MPT-00001 SHT 6	24915-07-M6-MPT-00002															
P2.1	E	Instrument Air to MX-MPT-0101A/B/C	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00001	IA		1	W	CS	150# FF	IA-1112- 2"-W	2 SCFM	5 SCFM	C	125	150	115	125	
P2.2	E	N2 to ME-MPT-0101	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00002	NITG		2	A	CS	150# FF	NITG-1102-2"-A	36 SCFM	183 SCFM	I	5	150	77	125	
P2.3	E	Superheated Steam to ME-MPT-0101	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00002	STMH		3	BCA	1 1/4 CR-1/2MO	300# RF	STMH-1002-3"-BCA-HC	250 LB/H	250 LB/H	C	3	40	1040	1150	
P2.7	E	Demin Water Supply to ME-MPT-0101 & Power Supply Unit	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00004	DMWL		6	R	SS 316	150# RF	DMWL-1101-6"-R	253.6 GPM	253.6 GPM	C	49.5	70	60 - 70	70	NOTE 2
P2.8	E	Demin Water Return from ME-MPT-0101 & Power Supply Unit	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00004	DMWL		6	R	SS 316	150# RF	DMWL-1118-6"-R	253.6 GPM	253.6 GPM	C	9	70	90	90	
P2.9	E	Outlet gas to Bulk Oxydizer Unit	24915-07-B2-MPT-00001 SHT 4,8 & 9	24915-07-M6-MPT-00002	OTM		6	NC	INCOLOY 800H	300# RF	OTM-1024-6"-NC-HC	485 LB/H	509	C	-0.9	15	1100	1200	
P2.10	E	N2 TO MX-MPT-0101A/B/C	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00013	NITG		3	A	CS	150# RF	NITG-1009-3"-A	366 LB/H	1172 LB/H	I	15	150	77	125	
P2.11	I	Vent Gas from MPT In-gate		24915-07-M6-MPT-00002	OTM		2	AB	CS	150# RF	OTM-1167-2"-AB-HC	0 LB/Hr	TBD	I	0	15	200	650	
P2.12	I	Vent Gas from MPT Out-gate		24915-07-M6-MPT-00002	OTM		2	AB	CS	150# RF	OTM-1168-2"-AB-HC	0 LB/Hr	TBD	I	0	15	550	650	
P2.13	I	N2 to ~~Pyrometer~~ MC top Window Purge		24915-07-M6-MPT-00002	NITG		1/2"	A	CS	150# RF	NITG-1028-1/2"-A	0 SCFM	0 SCFM	NA	15	150	77	125	
P2.14	E	Plant Air to ME-MPT-0101	24915-07-B2-MPT-00001 SHT 2, 4	24915-07-M6-MPT-00002	PLA		1"	W	CS	150#RF	PLA-1273-1"-W	NOTE 1	NOTE 1	I					
P2.15	E	Pressure Transmitter Nozzle	24915-07-B2-MPT-00001 SHT 4, 9	24915-07-M6-MPT-00002			1"	NC	INCONEL 600	300#RF		NA	NA	NA	1	40	1040	1150	
P2.16	E	MPT Steam bypass to Bulk Oxidyzer	24915-07-B2-MPT-00001 SHT 4, 8	24915-07-M6-MPT-00002	STMH		2"	NC	INCOLOY 800H	300#RF	OTM-1077-2"-NC-HC	250 LB/H	250 LB/H	C	1	40	1040	1150	
P2.17	E	Demin Water Supply to ME-MPT-CP0107 Unit (Room 07-150)	NA	24915-07-M6-MPT-00018	DMWL		1-1/2"	R	SS 316	150# RF	DMWL-1030-1-1/2"-R	15 GPM	15 GPM	C	49.5	70	60 - 70	70	NOTE 2, 3
P2.18	E	Demin Water Supply to ME-MPT-CP0108 Unit (Room 07-150)	NA	24915-07-M6-MPT-00018	DMWL		1-1/2"	R	SS 316	150# RF	DMWL-1031-1-1/2"-R	15 GPM	15 GPM	C	49.5	70	60 - 70	70	NOTE 2, 3
P2.19	E	Demin Water Return from ME-MPT-CP0107 Unit (Room 07-150)	NA	24915-07-M6-MPT-00018	DMWL		1-1/2"	R	SS 316	150# RF	DMWL-1032-1-1/2"-R	15 GPM	15 GPM	C	9	70	80	80	NOTE 2, 3
P2.20	E	Demin Water Return from ME-MPT-CP0108 Unit (Room 07-150)	NA	24915-07-M6-MPT-00018	DMWL		1-1/2"	R	SS 316	150# RF	DMWL-1033-1-1/2"-R	15 GPM	15 GPM	C	9	70	80	80	NOTE 2, 3
P2.21	E	MPT Steam Trap at bottom of Main Chamber	24915-07-B2-MPT-00001 SHT 4, 8	24915-07-M6-MPT-00002	STMC		1"	A	CS	150# RF	STMC-1151-"-A-PP	MINIMUM	MINIMUM	I	4	10	1000	1150	
P3	E	MPT Outlet Airlock/Conveyor Line 1 Module, MX-MPT-010C	24915-07-B2-MPT-00001 SHT 6	24915-07-M6-MPT-00003															
P3.1	I	Instrument Air to MJ-THS-0116		24915-07-M6-MPT-00003	IA		1	W	CS	150# RF	IA-1112-1"-W	2 SCFM	5 SCFM	C	125	150	115	125	
P3.2	I	N2 to MJ-THS-0116		24915-07-M6-MPT-00013	NITG		2	A	CS	150# RF	NITG-1010-2"-A	0/183 LB/H	575 LB/H	C/I	15	150	77	125	
P3.4	I	Purge Gas Outlet to Inlet Airlock OTM		24915-07-M6-MPT-00003	OTM		3	AB	CS	150# RF	OTM-1022-3"-AB-HC	177/360/575 LB/H	575 LB/H	C/I	-0.62	15	550	1150	
P3.5	E	Pressure Relief outlet to Room Air Return Register	24915-07-B2-MPT-00001 SHT 9,10	24915-07-M6-MPT-00003	OTM		6	(A)	CS	150# RF	(OTM-1038-6"-AB-PP)	0	575 LB/H	I	0	0	550	1150	
P3.6	E	Agent Monitor sampling Process Connection		24915-07-M6-MPT-00003	OTM		2"	AB	CS	150# RF	NA	NA	NA	NA	NA	NA	NA	NA	
~~P3.7~~	~~E~~	~~Agent Monitor sampling Process Connection~~		~~24915-07-M6-MPT-00003~~	~~OTM~~		~~2"~~	~~AB~~	~~CS~~	~~150# RF~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	
P3.8	E	Agent Monitor sampling Return		24915-07-M6-MPT-00003	OTM		3/4"	AB	CS	150# RF	OTM-1060-3/4-AB-HC	NA	NA	NA	NA	NA	NA	NA	
P3.9	E	N2 to MJ-THS-0116	24915-07-B2-MPT-00001 SHT 8, 10	24915-07-M6-MPT-00013	NITG		1	SA	SS	NOTE 5	NITG-1226-1"-A	26 SCFM	32.5 SCFM	I	80	150	77	125	
P4	E	MPT Cooling Chamber line 1 MJ-THS-0136	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00001															
P4.1	E	Outlet gas to MPT Cooling Conveyor Blower MA-MCS-0101	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00001	RA		18	A	CS	150#RF	RA-1102-18"-A-ET	8969 SCFN	8969 SCFN	C	-0.58	15	117	150	
P4.2	E	Plant Water	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00001	PWS		2	R	SS 316	150# RF	PWS-1235-2"-R	7.5 gpm	7.5 gpm	I	120	200	77	125	
P4.3	E	Inlet air to MPT Cooling Conveyor	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00001	RA		24	A	CS	150# RF	RA-1101-24"-A-	8969 SCFM	8969 SCFM	I	-0.3	15	77	125	
P4.4	E	Instrument Air to MJ-THS-0136	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00001	IA		1	W	CS	150# RF	IA-1135-1"-W	2 SCFM	2 SCFM	C	125	150	115	125	
~~P4.5~~	~~I~~	~~Pressure Relief Vent~~	~~24915-07-B2-MPT-00001 SHT 11~~	~~24915-07-M6-MCS-00001~~	RA		~~6"~~	~~A~~	~~CS~~	~~150# RF~~	~~NA~~	~~0~~	~~TBD~~	~~I~~	~~1" H2O~~		~~77~~	~~125~~	
P4.6	E	Plant Air to MJ-THS-0136 Window Purge	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00001	W		1	W	CS	150# RF	PLA-1321-1"-W	4 SCFM	4 SCFM	I	125	150	80	125	
P5	I	MPT Inlet Airlock/Conveyor Line 2 Module, MX-MPT-0201B	24915-07-B2-MPT-00001 SHT 5	24915-07-M6-MPT-00019															
P5.1	I	Instrument Air to MJ-THS-0115		24915-07-M6-MPT-00019	IA		1	W	CS	150# RF	IA-2111-1"-W	2 SCFM	5 SCFM	C	125	150	115	125	
P5.2	I	N2 to MJ-THS-0115		24915-07-M6-MPT-00014	NITG		2	A	CS	150# RF	NITG-2009-2"-A	0/183/378 LB/H	575 LB/H	C/I	15	150	77	125	
P5.4	E	Pressure Relief outlet to Room Air Return Register	24915-07-B2-MPT-00001 SHT 5,6 & 7	24915-07-M6-MPT-00019	OTM		6	(A)	CS	150# RF	(OTM-2037-6"-A-PP)	0	575 LB/H	I	0	0	200	1150	
P5.5	E	Purge Gas outlet to Bulk Oxidizer	24915-07-B2-MPT-00001 SHT 2, 7	24915-07-M6-MPT-00019	OTM		4	AB	CS	150# RF	OTM-2041-4"-AB-HC	177/758 LB/H	758 LB/H	C/I	-0.6	15	467	1150	
P5.6	I	Purge gas from MPT Outlet Airlock		27915-07-M6-MPT-00019	OTM		3	AB	CS	150# RF	OTM-2022-3"-AB-HC	177/360/575 LB/H	575 LB/H	C/I	-0.62	15	550	1150	
P5.7	E	N2 to MJ-THS-0115	24915-07-B2-MPT-00001 SHT 5, 7	24915-07-M6-MPT-00014	NITG		1	SA	SS	NOTE 5	NITG-2289-1"-A	30 SCFM	37.5 SCFM	I	80	150	77	125	
P6	E	Metal Parts Treater Line 2 Module, MX-MPT-0201A	24915-07-B2-MPT-00001 SHT 5	24915-07-M6-MPT-00019															
P6.1	E	Instrument Air to MX-MPT-0201A/B/C	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00019	IA		1	W	CS	150# RF	IA-2112-1"-W	2 SCFM	5 SCFM	C	125	150	115	125	
P6.2	E	N2 to ME-MPT-0201	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00020	NITG		2	A	CS	150# RF	NITG-2102-2"-A	36 SCFM	183 SCFM	I	5	150	77	125	
P6.3	E	Superheated Steam to ME-MPT-0201	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00020	STMH		3	BCA	1 1/4 CR-1/2MO	300# RF	OTM-2022-4"-AB-HC	250 LB/H	250 LB/H	C	3	40	1040	1150	
P6.7	E	Demin Water Supply to ME-MPT-0201 & Power Supply Unit	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00022	DMWL		6	R	SS 316	150# RF	DMWL-2101-6"-R	253.6 GPM	253.6 GPM	C	49.5	70	60 - 70	70	NOTE 2
P6.8	E	Demin Water Return from ME-MPT-0201 & Power Supply Unit	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00022	DMWL		6	R	SS 316	150# RF	DMWL-2118-6"-R	253.6 GPM	253.6 GPM	C	9	70	90	90	
P6.9	E	Outlet gas to Bulk Oxydizer Unit	24915-07-B2-MPT-00001 SHT 4, 5 & 6	24915-07-M6-MPT-00020	OTM		6	NC	INCOLOY 800H	300# RF	OTM-2024-6"-NC-HC	485 LB/H	509	C	-0.9	15	1100	1200	
P6.10	E	N2 to MX-MPT-0201A/B/C	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00015	NITG		3	A	CS	150# RF	NITG-2009-3"-A	366 LB/H	1172 LB/H	I	15	150	77	125	
P6.11	I	Vent Gas from MPT In-gate		24915-07-M6-MPT-00002	OTM		2	AB	CS	150# RF	OTM-2167-2"-AB-HC	0 LB/Hr	TBD	I	0	15	200	650	
P6.12	I	Vent Gas from MPT Out-gate		24915-07-M6-MPT-00020	OTM		2	AB	CS	150# RF	OTM-2168-2"-AB-HC	0 LB/Hr	TBD	I	0	15	550	650	
P6.13	I	N2 to ~~Pyrometer~~ MC top Window Purge		24915-07-M6-MPT-00020	NITG		1/2"	A	CS	150# RF	NITG-2026-1/2"-A	0 SCFM	0 SCFM	NA	15	150	77	125	
P6.14	E	Plant Air to ME-MPT-0101	24915-07-B2-MPT-00001 SHT 2	24915-07-M6-MPT-00020	PLA		1"	W	CS	150#RF	PLA-2273-1"-W	NOTE 1	NOTE 1	I					
P6.15	E	Pressure Transmitter Nozzle	24915-07-B2-MPT-00001 SHT 2, 4	24915-07-M6-MPT-00020			1"	NC	INCONEL 600	300#RF		NA	NA	NA	1	40	1040	1150	
P6.16	E	MPT Steam bypass to Bulk Oxidyzer	24915-07-B2-MPT-00001 SHT 4, 6	24915-07-M6-MPT-00020	STMH		2"	NC	INCOLOY 800H	300#RF	OTM-2077-2"-NC-HC	250 LB/H	250 LB/H	C	1	40	1040	1150	
P6.17	E	Demin Water Supply to ME-MPT-CP0207 Unit (Room 07-150)	NA	24915-07-M6-MPT-00018	DMWL		1-1/2"	R	SS 316	150# RF	DMWL-2030-1-1/2"-R	15 GPM	15 GPM	C	49.5	70	60 - 70	70	NOTE 2, 3
P6.18	E	Demin Water Supply to ME-MPT-CP0208 Unit (Room 07-150)	NA	24915-07-M6-MPT-00018	DMWL		1-1/2"	R	SS 316	150# RF	DMWL-2031-1-1/2"-R	15 GPM	15 GPM	C	49.5	70	60 - 70	70	NOTE 2, 3
P6.19	E	Demin Water Return from ME-MPT-CP0207 Unit (Room 07-150)	NA	24915-07-M6-MPT-00018	DMWL		1-1/2"	R	SS 316	150# RF	DMWL-2032-1-1/2"-R	15 GPM	15 GPM	C	9	70	80	80	NOTE 2, 3
P6.20	E	Demin Water Return from ME-MPT-CP0208 Unit (Room 07-150)	NA	24915-07-M6-MPT-00018	DMWL		1-1/2"	R	SS 316	150# RF	DMWL-2033-1-1/2"-R	15 GPM	15 GPM	C	9	70	80	80	NOTE 2, 3
P6.21	E	MPT Steam Trap at bottom of Main Chamber	24915-07-B2-MPT-00001 SHT 4, 5	24915-07-M6-MPT-00020	STMC		1"	A	CS	150# RF	STMC-2151-"-A-PP	MINIMUM	MINIMUM	I	4	10	1000	1150	
P7	I	MPT Outlet Airlock/Conveyor Line 2 Module, MJ-THS-0117	24915-07-B2-MPT-00001 SHT 5	24915-07-M6-MPT-00021															
P7.1	I	Instrument Air to MJ-THS-0117		24915-07-M6-MPT-00021	IA		1	W	CS	150# RF	IA-2112-1"-W	2 SCFM	5 SCFM	C	125	150	115	125	
P7.2	I	N2 to MJ-THS-0117		24915-07-M6-MPT-00015	NITG		2	A	CS	150# RF	NITG-2010-2"-A	0/183 LB/H	575 LB/H	C/I	15	150	77	125	
P7.4	I	Purge Gas Outlet to Inlet Airlock OTM		24915-07-M6-MPT-00021	OTM		3	AB	CS	150# RF	OTM-2022-3"-AB-HC	177/360/575 LB/H	575 LB/H	C/I	-0.62	15	550	1150	
P7.5	E	Pressure Relief outlet to Room Air Return Register	24915-07-B2-MPT-00001 SHT 6, 7	24915-07-M6-MPT-00021	OTM		6	(A)	CS	150# RF	(OTM-2038-6"-AB-PP)	0	575 LB/H	I	0	0	550	1150	
P7.6	E	Agent Monitor sampling Process Connection	24915-07-B2-MPT-00001 SHT 6, 7	24915-07-M6-MPT-00021	OTM		2"	AB	CS	150# RF	NA	NA	NA	NA	NA	NA	NA	NA	
~~P7.7~~	~~E~~	~~Agent Monitor sampling Process Connection~~		~~24915-07-M6-MPT-00021~~	~~OTM~~		~~2"~~	~~AB~~	~~CS~~	~~150# RF~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	
P7.8	E	Agent Monitor sampling Return	24915-07-B2-MPT-00001 SHT 6, 7	24915-07-M6-MPT-00021	OTM		3/4"	AB	CS	150# RF	OTM-2060-3/4-AB-HC	NA	NA	NA	NA	NA	NA	NA	
P7.9	E	N2 to MJ-THS-0117	24915-07-B2-MPT-00001 SHT 5, 7	24915-07-M6-MPT-00015	NITG		1	SA	SS	NOTE 5	NITG-2226-1"-A	26 SCFM	32.5 SCFM	I	80	150	77	125	
P8	E	MPT Cooling Chamber Line 2, MJ-THS-0137	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00002															
P8.1	E	Outlet gas to MPT Cooling Conveyor Blower MA-MCS-0201	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00002	RA		18	A	CS	150# RF	RA-2102-18"-A-ET	8969 SCFN	8969 SCFN	C	-0.58	15	117	150	
P8.2	E	Plant Water	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00002	PWS		2	R	SS 316	150# RF	PWS-2235-2-R"	7.5 GPM	7.5 GPM	I	120	200	77	125	
P8.3	E	Inlet air to MPT Cooling Conveyor	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00002	RA		24	A	CS	150# RF	RA-2101-24"-A-	8969 SCFM	8969 SCFM	I	-0.3	15	77	125	
P8.4	E	Instrument Air to MJ-THS-0137	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00002	IA		1	W	CS	150# RF	IA-2134-1"-W	2 SCFM	TBD	C	125	150	115	125	
~~P8.5~~	~~I~~	~~Pressure Relief Vent~~	~~24915-07-B2-MPT-00001 SHT 11~~	~~24915-07-M6-MCS-00002~~	RA		~~6"~~	~~A~~	~~CS~~	~~150# RF~~	~~NA~~	~~0~~	~~TBD~~	~~I~~	~~1" H2O~~		~~77~~	~~125~~	
P8.6	E	Plant Air to MJ-THS-0137 Window Purge	24915-07-B2-MPT-00001 SHT 11	24915-07-M6-MCS-00002	W		1	W	CS	150# RF	PLA-2321-1"-W	4 SCFM	4 SCFM	I	125	150	80	125	
P9	E	MPT Steam Superheater modules	24915-07-B2-MPT-00001 SHT 12	24915-07-M6-MPT-00007															
P9.1	E	Instrument Air to MX-MPT-0102 and -0202	24915-07-B2-MPT-00001 SHT 12	24915-07-M6-MPT-00007	IA		1	W	CS	150# RF	IA-1029-1"-W-	2 SCFM	2 SCFM	C	125	150	115	125	
P9.2	E	Steam to Superheater modules, MX-MPT-0102 and -0202	24915-07-B2-MPT-00001 SHT 12	24915-07-M6-MPT-00007	STM		2	A	CS	150#RF	STM-1004-2"-A-HC	500 LB/H	550 LB/H	C	86	150	328	375	
P9.3	E	Superheated Steam to MPT Line 1	24915-07-B2-MPT-00001 SHT 12	24915-07-M6-MPT-00007	STMH		3	BCA	1 1/4 CR-1/2MO	300#RF	STMH-1001-3"-BCA-HC	250 LB/H	250 LB/H	C	1	40	1040	1150	
P9.4	E	Superheated Steam to MPT Line 2	24915-07-B2-MPT-00001 SHT 12	24915-07-M6-MPT-00007	STMH		3	BCA	1 1/4 CR-1/2MO	300#RF	STMH-2002-3"-BCA-HC	250 LB/H	250 LB/H	C	1	40	1050	1150	
P9.5	E	To Sump Line 1	24915-07-B2-MPT-00001 SHT 12	24915-07-M6-MPT-00007	STMC		1	A	CS	150#RF	STMC-1011-1"-A-PP	10 LB/H	30 LB/H	C	1	150	213	250	
P9.6	E	Pressure Relief Outlet line 1	24915-07-B2-MPT-00001 SHT 12	24915-07-M6-MPT-00007	STMH		4	BCA	1 1/4 CR-1/2MO	300#RF	STMH-1019-4"-BCA-PP	0 LB/Hr	1504 LB/H	I	0	0	1050	1150	
P9.7	E	Pressure Relief Outlet line 2	24915-07-B2-MPT-00001 SHT 12	24915-07-M6-MPT-00007	STMH		4	BCA	1 1/4 CR-1/2MO	300#RF	STMH-2019-4"-BCA-PP	0 LB/Hr	1504 LB/H	I	0	0	1050	1150	
P9.8	E	To Sump Line 2	24915-07-B2-MPT-00001 SHT 12	24915-07-M6-MPT-00007	STMC		1	A	CS	150#RF	STMC-2011-1"-A-PP	10 LB/H	30 LB/H	C	1	150	213	250	

* I= Internal, E= External, EST=ESTIMATED, TBD=TO BE DETERMINED, NA=NOT APPLICABLE I/C*=INTERMITTENT/CONTINUOUS

NOTE
1. Plant Air to ME-MPT-0101 and -0201 are used for secondary waste operation. Air flow rate will be defined at job site by the operating team.
2. Process data of Demin Water Supply to MPT shall be finalyzed by Process & Mechanical process group in Richmond, KY.
3. ICD point of the Demin water to/from MPT Inline filters will be designed by BGCAPP piping group.
4. Piping Line no. and Material Class: ( ) indicates piping interface data at outlet side of pressure relief valve.
5. Compression Fitting.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM	[illegible]	SM	JPJ	CR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

PARSONS PASCO FABRICATION SHOP
METAL PARTS TREATER
INTERFACE CONNECTION DRAWING

STATE OF KENTUCKY GEORGE T. FRATER 25510 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 15 OF 20

REV 4

INTERFACE CONTROL DOCUMENT - MPT ELECTRICAL INTERFACE DATA (100% submittal)

MDB ROOM LOCATION: rm. # 07-146, top of floor elev. 910'-0"

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

...RICAL INTERFACE

IP	Int = I Ext - E	DESCRIP...				
E1		MPT Line 1 Power FJB-Inlet, 07-MX-MPT-TBP-0101B				
E1.1	E	Motor & Brake Power from Servo Control Panel	480	3	60	
E1.2	E	Motor Power from MCC VFD	480	3	60	3
E2		MPT Line 1 Feedback FJB-Inlet, 07-MX-MPT-TBF-0101B				
E2.1	E	Motor Feedback from Servo Control Panel	24VDC			
E3		MPT Line 1 Power FJB-Outlet, 07-MX-MPT-TBP-0101C				
E3.1	E	Motor & Brake Power from Servo Control Panel	480	3	60	
E3.2	E	Motor Power from MCC VFD	480	3	60	3
E4		MPT Line 1 Feedback FJB-Outlet, 07-MX-MPT-TBF-0101C				
E4.1	E	Motor Feedback from Servo Control Panel	24VDC			
E5		MPT Line 1 Cooling Chamber Power FJB, 07-MX-MCS-TBP-0101				
E5.1	E	Motor Power From MCC VFD	480	3	60	3
E6		Steam Super Htr Control Panel Line-1, 07-ME-MPT-CP0105				
E6.1	E	Power Feed	480	3	60	(100)
E7		MPT Line 1 Servo Drive Control Panel ME-MPT-CP0109 (Installed in room 07-148)				
E7.1	E	480 VAC Power Feed	480	3	60	200A
E7.2	E	120V UPS Power Feed	120	1	60	15A
E7.3	E	Motor & Brake Power to MPT Line 1 Power FJB-Inlet	480	3	60	
E7.4	E	Motor & Brake Power to MPT Line 1 Power FJB-Outlet	480	3	60	
E7.5	E	Feedback to Line 1 Feedback FJB-Inlet	24VDC			
E7.6	E	Feedback to Line 1 Feedback FJB-Oulet	24VDC			
E8		MPT Line 1 Heater Power Supply Zone 1				
E8.1	E	Power Feed from Facility to line Filter Cabinet ME-MPT-CP0107 (Installed in room 07-150)	480	3	60	540 KVA
E8.2	E	Power Feed From line Filter Cabinet to Power Supply, ME-MPT-CP0101	480	3	60	540 KVA
E9		MPT Line 1 Heater Power Supply Zone 2				
E9.1	E	Power Feed from Facility to line Filter Cabinet ME-MPT-CP0108 (Installed in room 07-150)	480	3	60	540 KVA
E9.2	E	Power Feed From line Filter Cabinet to Power Supply, ME-MPT-CP0103	480	3	60	540 KVA
E10		MPT Line 1 Cooling Chamber Out-gate Power				
E10.1	E	Motor Power From Servo Control Panel	120	1	60	

IP	Int = I Ext - E	SERVICE	VOLTS	PH	HZ	KVA OR (KW)
E11		MPT Line 2 Power FJB-Inlet, 07-MX-MPT-TBP-0201B				
E11.1	E	Motor & Brake Power from Servo Control Panel	480	3	60	
E11.2	E	Motor Power from MCC VFD	480	3	60	3
E12		MPT Line 2 Feedback FJB-Inlet, 07-MX-MPT-TBF-0201B				
E12.1	E	Motor Feedback from Servo Control Panel	24VDC			
E13		MPT Line 2 Power FJB-Outlet, 07-MX-MPT-TBP-0201C				
E13.1	E	Motor & Brake Power from Servo Control Panel	480	3	60	
E13.2	E	Motor Power from MCC VFD	480	3	60	3
E14		MPT Line 2 Feedback FJB-Outlet, 07-MX-MPT-TBF-0201C				
E14.1	E	Motor Feedback from Servo Control Panel	24VDC			
E15		MPT Line 2 Cooling Chamber Power FJB, 07-MX-MCS-TBP-0201				
E15.1	E	Motor Power From MCC VFD	480	3	60	3
E16		Steam Super Htr Control Panel Line-2, 07-ME-MPT-CP0205				
E16.1	E	Power Feed	480	3	60	(100)
E17		MPT Line 2 Servo Drives Control Panel ME-MPT-CP0209 (Installed in room 07-148)				
E17.1	E	480 VAC Power Feed	480	3	60	200A
E17.2	E	120V UPS Power Feed	120	1	60	15A
E17.3	E	Motor & Brake Power to MPT Line 2 Power FJB-Inlet	480	3	60	
E17.4	E	Motor & Brake Power to MPT Line 2 Power FJB-Outlet	480	3	60	
E17.5	E	Feedback to Line 1 Feedback FJB-Inlet	24VDC			
E17.6	E	Feedback to Line 1 Feedback FJB-Oulet	24VDC			
E18		MPT Line 2 Heater Power Supply Zone 1				
E18.1	E	Power Feed from Facility to line Filter Cabinet ME-MPT-CP0207 (Installed in room 07-150)	480	3	60	540 KVA
E18.2	E	Power Feed From line Filter Cabinet to Power Supply, ME-MPT-CP0201	480	3	60	540 KVA
E19		MPT Line 2 Heater Power Supply Zone 2				
E19.1	E	Power Feed from Facility to line Filter Cabinet ME-MPT-CP0208 (Installed in room 07-150)	480	3	60	540 KVA
E19.2	E	Power Feed From line Filter Cabinet to Power Supply, ME-MPT-CP0203	480	3	60	540 KVA
E20		MPT Line 2 Cooling Chamber Out-gate Power				
E20.1	E	Motor Power From Servo Control Panel	120	1	60	

* I= Internal, E= External, EST=ESTIMATED, TBD=TO BE DETERMINED, NA=NOT APPLICABLE I/C*=INTERMITTENT/CONTINUOUS

4

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM	JEM	SM	JS	GR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY GEORGE T. PRATER 25510 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

PARSONS PASCO FABRICATION SHOP
METAL PARTS TREATER
INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 16 OF 20

REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.03

INTERFACE CONTROL DOCUMENT - MPT CONTROL INTERFACE DATA (100% submittal)

MDB ROOM LOCATION: rm. # 07-146, top of floor elev. 910'-0"

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

IP	Int = I Ext - E	DESCRIPTION				
C1		**MPT Line-1 Inlet Airlock I&C FJB, 07-EJ-FCS-TBF-6111**				
C1.1	E	Controls - To FCS (AI, AO, DI, DO, TC)				
C1.2	E	Controls - To Servo Control Panel (AI)	24 VDC			
C1.3	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C1.4	I	Controls - To Device Power Panel (Field Instrument Power, 120VAC)	120VAC	1	60	
C1.5	E	Controls - To Servo Control Panel (E-Stop)	24 VDC			
C2		**MPT Line-1 Main Chamber I&C FJB #1, 07-EJ-FCS-TBF-6112**				
C2.1	E	Controls - To FCS (AI, DI, DO, TC)	24VDC			
C2.2	E	Controls - To Servo Control Panel (AI)	24 VDC			
C2.3	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C2.4	E	Controls - To Servo Control Panel (E-Stop Circuit)	24 VDC			
C3		**MPT Line-1 Main Chamber I&C FJB #2, 07-EJ-FCS-TBF-6116**				
C3.1	E	Controls - To FCS (AI, DI, DO, TC)	24VDC			
C3.2	E	Controls - To Servo Control Panel (AI)	24 VDC			
C3.3	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C3.4	E	Controls - To Servo Control Panel (E-Stop Circuit)	24 VDC			
C4		**MPT Line-1 Outlet Airlock I&C FJB, 07-EJ-FCS-TBF-6113**				
C4.1	E	Controls - To FCS (AI, AO, DI, DO, TC)	24VDC			
C4.2	E	Controls - To Servo Control Panel (AI)	24 VDC			
C4.3	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C4.4	I	Controls - To Device Power Panel (Field Instrument Power, 120VAC)	120VAC	1	60	
C4.5	E	Controls - To Servo Control Panel (E-Stop)	24 VDC			
C5		**MPT Line-1 Mezzanine I&C FJB, 07-EJ-FCS-TBF-6115**				
C5.1	E	Controls - To FCS (AI, AO, DI, DO, TC)	24VDC			
C5.2	E	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C6		**MPT Line-1 Cooling Chamber I&C FJB, 07-EJ-FCS-TBF-6114**				
C6.1	E	Controls - To FCS (AI, DI, DO)	24 VDC			
C6.2	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C6.3	E	Controls - To Servo Control Panel (E-Stop Circuit)	24 VDC			
C7		**Steam Super Htr Control Panel Line-1, 07-ME-MPT-CP0105**				
C7.1	E	Controls - To FCS (AO, DI, DO)	24VDC			
C8		**Steam Superheater Line 1 I&C FJB, 07-EJ-FCS-TBF-6117**				
C8.1	E	Controls - To FCS (AI, AO, DI, DO)	24VDC			
C9		**MPT Servo Drives Control Panel Line 1 ME-MPT-CP0109 (Installed in room 07-148)**				
C9.1	E	Controls - To Inlet Airlock I&C FJB (AI)	24VDC			
C9.2	E	Controls - To Inlet Airlock I&C FJB (Instrument Power, 24 VDC)	24VDC			
C9.3	E	Controls - To Inlet Airlock I&C FJB (Instrument Power, 120 VAC)	120VAC	1	60	
C9.4	E	Controls - To Inlet Airlock I&C FJB (E-Stop Circuit)	24VDC			
C9.5	E	Controls - To Main Chamber I&C FJB # 1 (AI)	24VDC			
C9.6	E	Controls - To Main Chamber I&C FJB # 1 (Instrument Power, 24 VDC)	24VDC			
C9.7	E	Controls - To Main Chamber I&C FJB # 1 (E-Stop Circuit)	24VDC			
C9.8	E	Controls - To Main Chamber I&C FJB # 2 (AI)	24VDC			
C9.9	E	Controls - To Main Chamber I&C FJB # 2 (Instrument Power, 24 VDC)	24VDC			
C9.10	E	Controls - To Main Chamber I&C FJB # 2 (E-Stop Circuit)	24VDC			
C9.11	E	Controls - To Outlet Airlock I&C FJB (AI)	24VDC			
C9.12	E	Controls - To Outlet Airlock I&C FJB (Instrument Power, 24 VDC)	24VDC			
C9.13	E	Controls - To Outlet Airlock I&C FJB (Instrument Power, 120 VAC)	120VAC	1	60	
C9.14	E	Controls - To Outlet Airlock I&C FJB (E-Stop Circuit)	24VDC			
C9.15	E	Controls - To Mezzanine I&C FJB (Instrument Power, 24 VDC)	24VDC			
C9.16	E	Controls - To Cooling Chamber I&C FJB # 1 (Instrument Power, 24 VDC)	24VDC			
C9.17	E	Controls - To Cooling Chamber I&C FJB # 1 (E-Stop Circuit)	24VDC			
C9.18	E	Controls - To FCS	24VDC			
C19		**MPT Htr Zone 1, Control Panel Line-1, 07-ME-MPT-CP0101**				
C19.1	E	Controls - To FCS (AI, AO, DI, DO)	24VDC			
C20		**MPT Htr Zone 2 Control Panel Line-1, 07-ME-MPT-CP0103**				
C20.1	E	Controls - To FCS (AI, AO, DI, DO)	24VDC			
C23		**MPT Line Filter Instrumentation Line 1 - Zone 1 ME-MPT-CP0107 (Installed in room 07-150)**				
C23.1	E	Controls - To FCS (AI, TC)	24VDC			
C24		**MPT Line Filter Instrumentation Line 1 - Zone 2 ME-MPT-CP0108 (Installed in room 07-150)**				
C24.1	E	Controls - To FCS (AI, TC)	24VDC			
C27		**MPT Line 1 Instrument Power Panel 07-EJ-MPT-TBC-6100**				
C27.1	E	Power	120VAC	1	60	
C27.2	E	Controls - To Inlet Airlock I&C FJB (24VDC) (C1.3)	24VDC			
C27.3	E	Controls - To Inlet Airlock I&C FJB (120VAC) (C1.4)	120VAC	1	60	
C27.4	E	Controls - To Main Chamber I&C FJB #1 (24VDC) (C2.3)	24VDC			
C27.5	E	Controls - To Main Chamber I&C FJB #2 (24VDC) (C3.3)	24VDC			
C27.6	E	Controls - To Outlet Airlock I&C FJB (24VDC) (C4.3)	24VDC			
C27.7	E	Controls - To Outlet Airlock I&C FJB (120VAC) (C4.4)	120VAC	1	60	
C27.8	E	Controls - To Mezzanine I&C FJB (24VDC) (C5.2)	24VDC			
C27.9	E	Controls - To Cooling Chamber I&C FJB (24VDC) (C6.2)	24VDC			
C27.10	E	Controls - To In-Gate I&C FJB (24VDC) (C28.2) In MWS room 07-135	24VDC			
C28		**MPT Line 1 Inlet In-Gate FJB 07-EJ-FCS-TBC-6118 (Installed in MWS room 07-135)**				
C28.1	E	Controls - To FCS (DI)	24VDC			
C28.2	I	Instrument Power Controls - To Servo Panel (AI)	24VDC			
C28.3	I	E-Stop to the Servo Drive Control Panel ME-MPT-CP0109 (Installed in room 07-148)	24VDC			

		SERVICE	VOLTS	PH	HZ	KVA OR (KW)
		Inlet Airlock I&C FJB, 07-EJ-FCS-TBF-6121				
		FCS (AI, AO, DI, DO, TC)	24VDC			
C10.2	E	Controls - To Servo Control Panel (AI)	24 VDC			
C10.3	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C10.4	I	Controls - To Device Power Panel (Field Instrument Power, 120VAC)	120VAC	1	60	
C10.5	E	Controls - To Servo Control Panel (E-Stop)	24 VDC			
C11		**MPT Line-2 Main Chamber I&C FJB #1, 07-EJ-FCS-TBF-6122**				
C11.1	E	Controls - To FCS (AI, DI, DO, TC)	24VDC			
C11.2	E	Controls - To Servo Control Panel (AI)	24 VDC			
C11.3	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C11.4	E	Controls - To Servo Control Panel (E-Stop Circuit)	24 VDC			
C12		**MPT Line-2 Main Chamber I&C FJB #2, 07-EJ-FCS-TBF-6126**				
C12.1	E	Controls - To FCS (AI, DI, DO, TC)	24VDC			
C12.2	E	Controls - To Servo Control Panel (AI)	24 VDC			
C12.3	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C12.4	E	Controls - To Servo Control Panel (E-Stop Circuit)	24 VDC			
C13		**MPT Line-2 Outlet Airlock I&C FJB, 07-EJ-FCS-TBF-6123**				
C4.1	E	Controls - To FCS (AI, AO, DI, DO, TC)	24VDC			
C4.2	E	Controls - To Servo Control Panel (AI)	24 VDC			
C4.3	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C4.4	I	Controls - To Device Power Panel (Field Instrument Power, 120VAC)	120VAC	1	60	
C4.5	E	Controls - To Servo Control Panel (E-Stop)	24 VDC			
C14		**MPT Line-2 Mezzanine I&C FJB, 07-EJ-FCS-TBF-6125**				
C14.1	E	Controls - To FCS (AI, AO, DI, DO, TC)	24VDC			
C14.3	E	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C15		**MPT Line-2 Cooling Chamber I&C FJB, 07-EJ-FCS-TBF-6124**				
C15.1	E	Controls - To FCS (AI, DI, DO)	24 VDC			
C15.2	I	Controls - To Device Power Panel (Field Instrument Power, 24 VDC)	24 VDC			
C15.3	E	Controls - To Servo Control Panel (E-Stop Circuit)	24 VDC			
C16		**Steam Super Htr Control Panel Line-2, 07-ME-MPT-CP0205**				
C16.1	E	Controls - To FCS (AO, DI, DO)	24VDC			
C17		**Steam Superheater Line 2 I&C FJB, 07-EJ-FCS-TBF-6127**				
C17.1	E	Controls - To FCS (AI, AO, DI, DO)	24VDC			
C18		**MPT Servo Drives Control Panel Line 2 ME-MPT-CP0209 (Installed in room 07-148)**				
C18.1	E	Controls - To Inlet Airlock I&C FJB (AI)	24VDC			
C18.2	E	Controls - To Inlet Airlock I&C FJB (Instrument Power, 24 VDC)	24VDC			
C18.3	E	Controls - To Inlet Airlock I&C FJB (Instrument Power, 120 VAC)	120VAC	1	60	
C18.4	E	Controls - To Inlet Airlock I&C FJB (E-Stop Circuit)	24VDC			
C18.5	E	Controls - To Main Chamber I&C FJB # 1 (AI)	24VDC			
C18.6	E	Controls - To Main Chamber I&C FJB # 1 (Instrument Power, 24 VDC)	24VDC			
C18.7	E	Controls - To Main Chamber I&C FJB # 1 (E-Stop Circuit)	24VDC			
C18.8	E	Controls - To Main Chamber I&C FJB # 2 (AI)	24VDC			
C18.9	E	Controls - To Main Chamber I&C FJB # 2 (Instrument Power, 24 VDC)	24VDC			
C18.10	E	Controls - To Main Chamber I&C FJB # 2 (E-Stop Circuit)	24VDC			
C18.11	E	Controls - To Outlet Airlock I&C FJB (AI)	24VDC			
C18.12	E	Controls - To Outlet Airlock I&C FJB (Instrument Power, 24 VDC)	24VDC			
C18.13	E	Controls - To Outlet Airlock I&C FJB (Instrument Power, 120 VAC)	120VAC	1	60	
C18.14	E	Controls - To Outlet Airlock I&C FJB (E-Stop Circuit)	24VDC			
C18.15	E	Controls - To Mezzanine I&C FJB (Instrument Power, 24 VDC)	24VDC			
C18.16	E	Controls - To Cooling Chamber I&C FJB # 1 (Instrument Power, 24 VDC)	24VDC			
C18.17	E	Controls - To Cooling Chamber I&C FJB # 1 (E-Stop Circuit)	24VDC			
C18.18	E	Controls - To FCS	24VDC			
C21		**MPT Htr Zone 1, Control Panel Line-2, 07-ME-MPT-CP0201**				
C21.1	E	Controls - To FCS (AI, AO, DI, DO)	24VDC			
C22		**MPT Htr Zone 2 Control Panel Line-2, 07-ME-MPT-CP0203**				
C22.1	E	Controls - To FCS (AI, AO, DI, DO)	24VDC			
C25		**MPT Line Filter Instrumentation Line 2 - Zone 1 ME-MPT-CP0207 (Installed in room 07-150)**				
C25.1	E	Controls - To FCS (AI, TC)	24VDC			
C26		**MPT Line Filter Instrumentation Line 2 - Zone 2 ME-MPT-CP0208 (Installed in room 07-150)**				
C26.1	E	Controls - To FCS (AI, TC)	24VDC			
C29		**MPT Line 2 Instrument Power Panel 07-EJ-MPT-TBC-6101**				
C29.1	E	Power	120VAC	1	60	
C29.2	E	Controls - To Inlet Airlock I&C FJB (24VDC) (C10.3)	24VDC			
C29.3	E	Controls - To Inlet Airlock I&C FJB (120VAC) (C10.4)	120VAC	1	60	
C29.4	E	Controls - To Main Chamber I&C FJB #1 (24VDC) (C11.3)	24VDC			
C29.5	E	Controls - To Main Chamber I&C FJB #2 (24VDC) (C12.3)	24VDC			
C29.6	E	Controls - To Outlet Airlock I&C FJB (24VDC) (C13.3)	24VDC			
C29.7	E	Controls - To Outlet Airlock I&C FJB (120VAC) (C13.4)	120VAC	1	60	
C29.8	E	Controls - To Mezzanine I&C FJB (24VDC) (C14.2)	24VDC			
C29.9	E	Controls - To Cooling Chamber I&C FJB (24VDC) (C15.2)	24VDC			
C27.10	E	Controls - To In-Gate I&C FJB (24VDC) (C30.2) In MWS room 07-135	24VDC			
C30		**MPT Line 2 Inlet In-Gate FJB 07-EJ-FCS-TBC-6128 (Installed in MWS room 07-135)**				
C30.1	E	Controls - To FCS (DI)	24VDC			
C30.2	E	Instrument Power Controls - Servo Panel (AI)	24VDC			
C30.3	E	E-Stop to the Servo Drive Control Panel ME-MPT-CP0209 (Installed in room 07-148)	24VDC			

* I= Internal, E= External, EST=ESTIMATED, TBD=TO BE DETERMINED, NA=NOT APPLICABLE I/C*=INTERMITTENT/CONTINUOUS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM	GEM	SM	JB	GR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF		MAR TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY GEORGE T. FRATER 25510 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

PARSONS PASCO FABRICATION SHOP
METAL PARTS TREATER
INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 17 OF 20

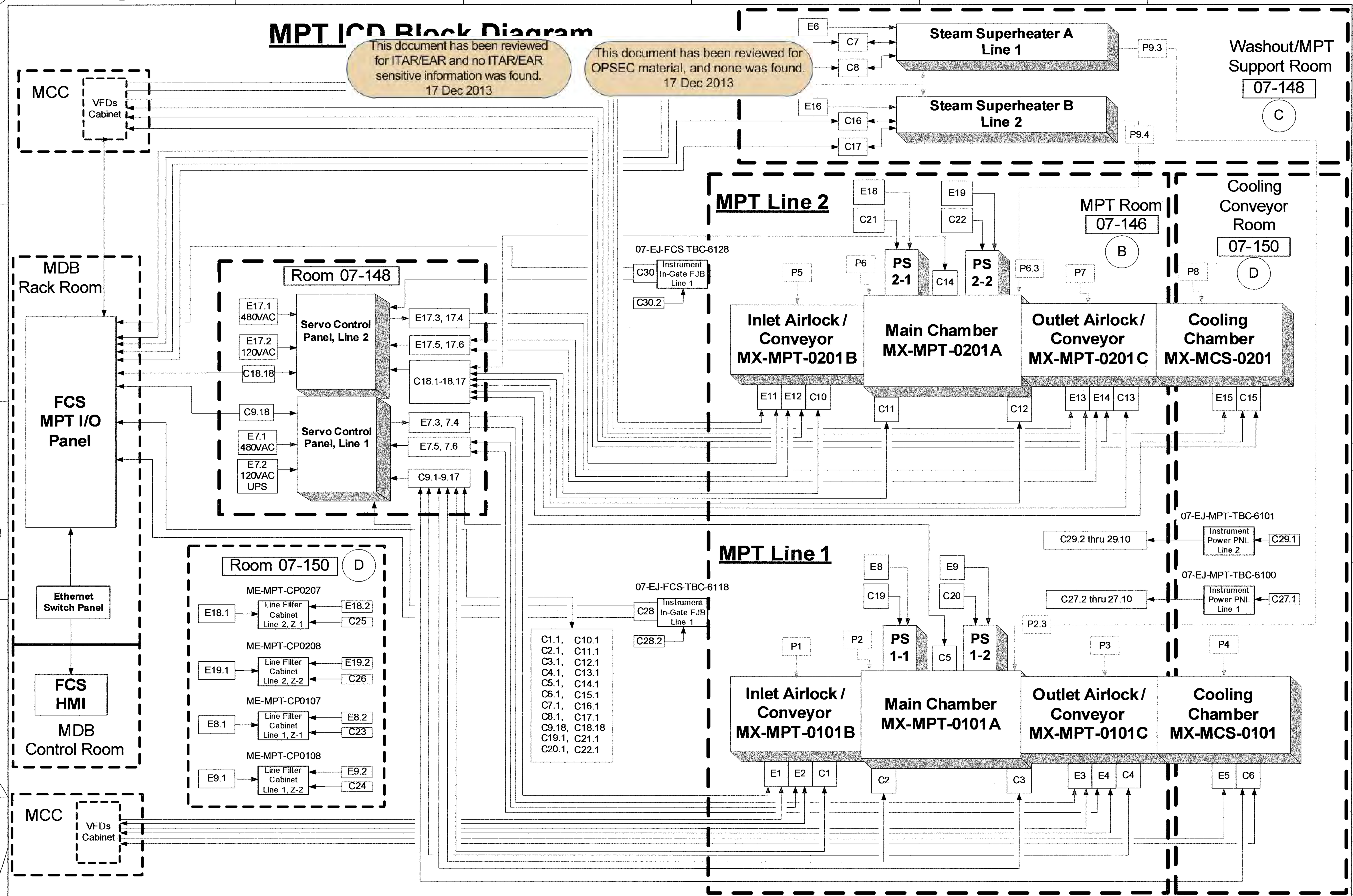
REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.03

MPT ICD Block Diagram

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM		SM		
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES	ON	FILE		
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES	ON	FILE		
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES	ON	FILE		

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RICHMOND, KENTUCKY

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PARSONS PASCO FABRICATION SHOP
METAL PARTS TREATER
INTERFACE CONNECTION DRAWING

STATE OF KENTUCKY
GEORGE T. FRATER
25510
LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 18 OF 20

REV 4

22X34 'D' SIZE
MPT FAD DRAWINGS 4.02

Module #	Name	Room	Description
MX-MPT-0101B	MPT Inlet Airlock/Conveyor Line 1 Module	07-146	The MPT Inlet Airlock/Conveyor Line 1 will be connected to the Turntable Conveyor No.2 provided by Pasadena Design (External Interface) and is connected to the MPT Line 1 module (Internal Interface). Outlet gas pipe wil ... from the Inlet Airlock will be piped to room air r
MX-MPT-0101A	Metal Parts Treater Line 1 Module	07-146	This MPT module is connected betwe ... e fed from the Steam Superheater module t ... ber steam bypass will be piped to the MP ... ace). The MPT will be heated by the Power supply/Control units which are located on the Mezzanine in the MPT room (internal interface). Nitrogen purge will be piped to the MPT chamber from the Nitrogen main line (external interface). Plant air will be piped to the Nitrogen line to the MPT chamber (external).
MX-MPT-0101C	MPT Outlet Airlock/Conveyor Line 1 Module	07-146	The MPT Outlet Airlock/Conveyor Line 1 will be connected to the MPT Line 1 module (Internal Interface) and the MPT Cooling Chamber line 1 (External Interface) through wall. Outlet gas pipe will be connected to the MPT Inlet Airlock/Conveyor Line 1 (internal interface). Pressure vacuum and relief valve from the Outlet Airlock will be piped to room air return register. (External Interface).
MX-MCS-0101	MPT Cooling Chamber Line 1 Module	07-150	The MPT Cooling Chamber is installed in the Cooling Conveyor room (07-150). The cooling chamber is connected with the Tray transfer Cooling conveyors provided by Pasadena (External Interface). Outlet gas pipe will be connected to the blowers and vented outside (External Interface). Plant water will be connected to the fog and deluge line pipes (external interface)
MX-MPT-0201B	MPT Inlet Airlock/Conveyor Line 2 Module	07-146	The MPT Inlet Airlock/Conveyor Line 2 will be connected to the Turntable Conveyor No.2 provided by Pasadena Design (External Interface) and is connected to the MPT Line 2 module (Internal Interface). Outlet gas pipe will be connected to the MPT Outlet Airlock/Conveyor Line 2 and MPT Main chamber. (Internal Interface). Pressure vacuum and relief valve from the Inlet Airlock will be piped to room air return register. (External Interface).
MX-MPT-0201A	Metal Parts Treater Line 2 Module	07-146	This MPT module is connected between the MPT Inlet Airlock/conveyor Module and the MPT Outlet Airlock/conveyor Module (internal interface). The Superheated steam will be fed from the Steam Superheater module through wall (external interface). Outlet gas from the MPT will be piped to the MPT Bulk Oxidizer unit (External Interface). The Main Chamber steam bypass will be piped to the MPT outlet gas line (external interface). Demineralized cooling water will be piped to the MPT chamber and power supply unit (external interface). The MPT will be heated by the Power supply/Control units which are located on the Mezzanine in the MPT room (internal interface). Nitrogen purge will be piped to the MPT chamber from the Nitrogen main line (external interface). Plant air will be piped to the Nitrogen line to the MPT chamber (external).
MX-MPT-0201C	MPT Outlet Airlock/Conveyor Line 2 Module	07-146	The MPT Outlet Airlock/Conveyor Line 2 will be connected to the MPT Line 2 module (Internal Interface) and the MPT Cooling Chamber line 2 (External Interface) through wall. Outlet gas pipe will be connected to the MPT Bulk Oxidizer Unit (External Interface). Pressure vacuum and relief valve from the Outlet Airlock will be piped to room air return register. (External Interface).
MX-MCS-0201	MPT Cooling Chamber Line 2 Module	07-150	The MPT Cooling Chamber is installed in the Cooling Conveyor room (07-150). The cooling chamber is connected with the Tray transfer Cooling conveyors provided by Pasadena (External Interface). Outlet gas pipe will be connected to the blowers and vented outside (External Interface). Plant water will be connected to the fog and deluge line pipes (external interface)
MX-MPT-0102 and MX-MPT-0202	MPT Steam Superheater Modules	07-148	The Steam Superheater Module consists of two Superheater units located in the MWS/MPT Support Room. Plant steam header is piped to the MPT Steam Superheater Module (External Interface) and two superheated steam pipes will be connected to line 1 and 2 of the MPTs (External Interface).
ME-MPT-CP0109	MPT Servo Drives Control Panel Line 1	07-148	The Servo Drives Control Panel for Line 1 will contain the Servo Drive System, including amplifiers, which drive the MPT Line 1 Servo Motors.
ME-MPT-CP0209	MPT Servo Drives Control Panel Line 2	07-148	The Servo Drives Control Panel for Line 2 will contain the Servo Drive System, including amplifiers, which drive the MPT Line 2 Servo Motors.
ME-MPT-CP-107	MPT Zone 1 Heater control panel Line Filter Panel Line 1	07-150	The Zone 1 Heater control panel Line Filter Panel Line 1 will be installed in the MPT Cooling conveyor room. Demin water supply and return pipes will be connected to the main demin water pipe (external interface). Pasco will provide equipment only.
ME-MPT-CP-108	MPT Zone 2 Heater control panel Line Filter Panel Line 1	07-150	The Zone 2 Heater control panel Line Filter Panel Line 1 will be installed in the MPT Cooling conveyor room. Demin water supply and return pipes will be connected to the main demin water pipe (external interface). Pasco will provide equipment only.
ME-MPT-CP-207	MPT Zone 1 Heater control panel Line Filter Panel Line 2	07-150	The Zone 1 Heater control panel Line Filter Panel Line 2 will be installed in the MPT Cooling conveyor room. Demin water supply and return pipes will be connected to the main demin water pipe (external interface). Pasco will provide equipment only.
ME-MPT-CP-208	MPT Zone 2 Heater control panel Line Filter Panel Line 2	07-150	The Zone 2 Heater control panel Line Filter Panel Line 2 will be installed in the MPT Cooling conveyor room. Demin water supply and return pipes will be connected to the main demin water pipe (external interface). Pasco will provide equipment only.

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4	6/29/10	IFC (SEE NOTE 14)	JPM	JEM	SM	JG	GR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

PARSONS PASCO FABRICATION SHOP METAL PARTS TREATER INTERFACE CONNECTION DRAWING

STATE OF KENTUCKY GEORGE T. FRATER 25510 LICENSED PROFESSIONAL ENGINEER 7-15-10

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 19 OF 20

REV 4

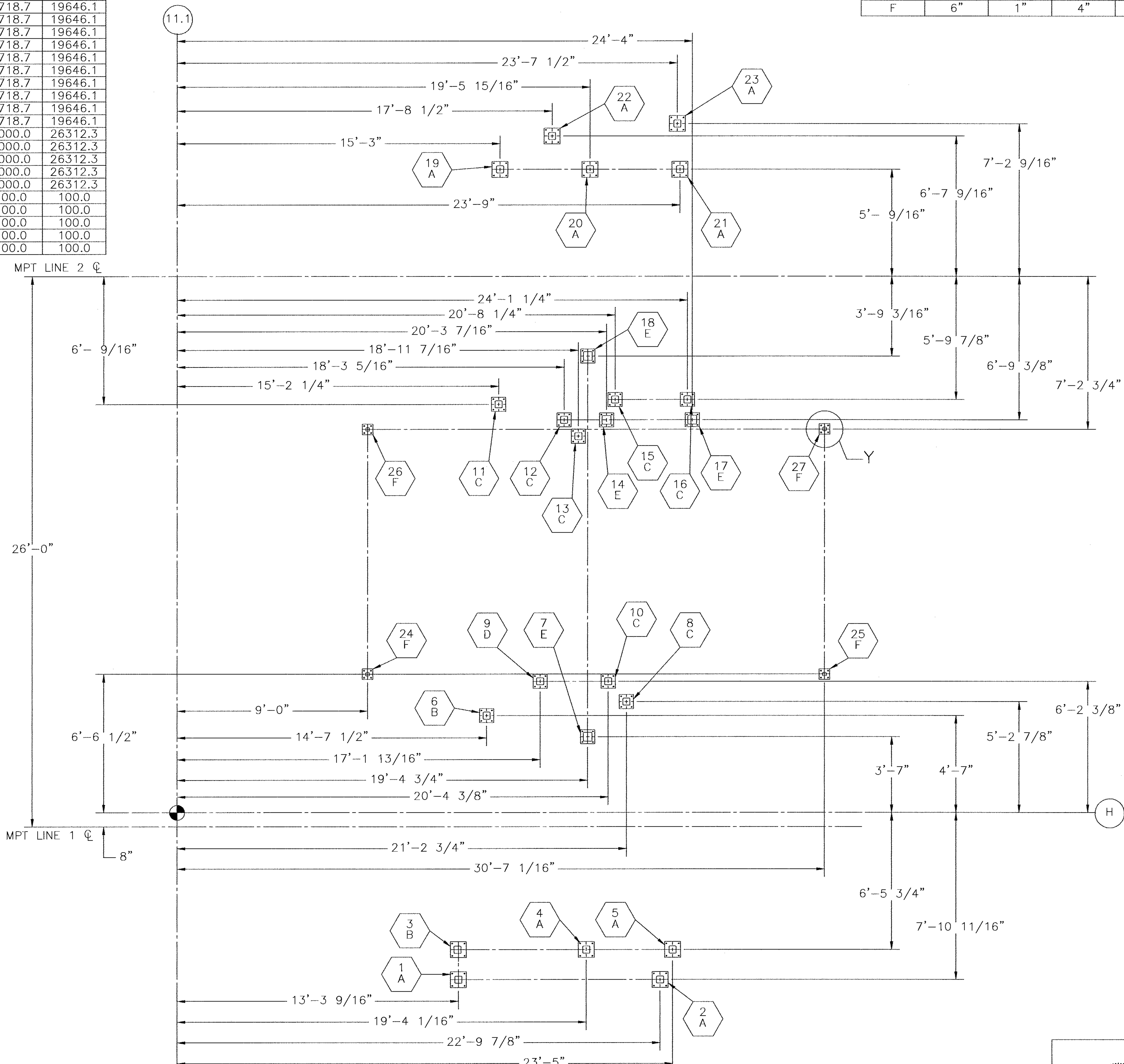
22X34 'D' SIZE
MPT FAD DRAWINGS 4.02

PIPE SUPPORT LOADS						
BASEPLATE NO.	FORCE (LBF)			MOMENT (IN-LBF)		
	X	Y (VERTICAL)	Z	X	Y	Z
1	100.0	1055.8	100.0	22262.1	1000.0	[illegible]
2	100.0	1055.8	100.0	22262.1	1000.0	[illegible]
3	100.0	1055.8	100.0	22262.1	1000.0	[illegible]
4	100.0	1055.8	100.0	22262.1	1000.0	26312.3
5	100.0	1055.8	100.0	22262.1	1000.0	26312.3
6	943.2	1291.0	654.2	10836.8	2718.7	19646.1
7	943.2	1291.0	654.2	10836.8	2718.7	19646.1
8	943.2	1291.0	654.2	10836.8	2718.7	19646.1
9	943.2	1291.0	654.2	10836.8	2718.7	19646.1
10	943.2	1291.0	654.2	10836.8	2718.7	19646.1
11	943.2	1291.0	654.2	10836.8	2718.7	19646.1
12	943.2	1291.0	654.2	10836.8	2718.7	19646.1
13	943.2	1291.0	654.2	10836.8	2718.7	19646.1
14	943.2	1291.0	654.2	10836.8	2718.7	19646.1
15	943.2	1291.0	654.2	10836.8	2718.7	19646.1
16	943.2	1291.0	654.2	10836.8	2718.7	19646.1
17	943.2	1291.0	654.2	10836.8	2718.7	19646.1
18	100.0	1055.8	100.0	22262.1	1000.0	26312.3
19	100.0	1055.8	100.0	22262.1	1000.0	26312.3
20	100.0	1055.8	100.0	22262.1	1000.0	26312.3
21	100.0	1055.8	100.0	22262.1	1000.0	26312.3
22	100.0	1055.8	100.0	22262.1	1000.0	26312.3
23	100.0	475.0	100.0	4821.2	100.0	100.0
24	100.0	475.0	100.0	4821.2	100.0	100.0
25	100.0	475.0	100.0	4821.2	100.0	100.0
26	100.0	475.0	100.0	4821.2	100.0	100.0
27	100.0	475.0	100.0	4821.2	100.0	100.0

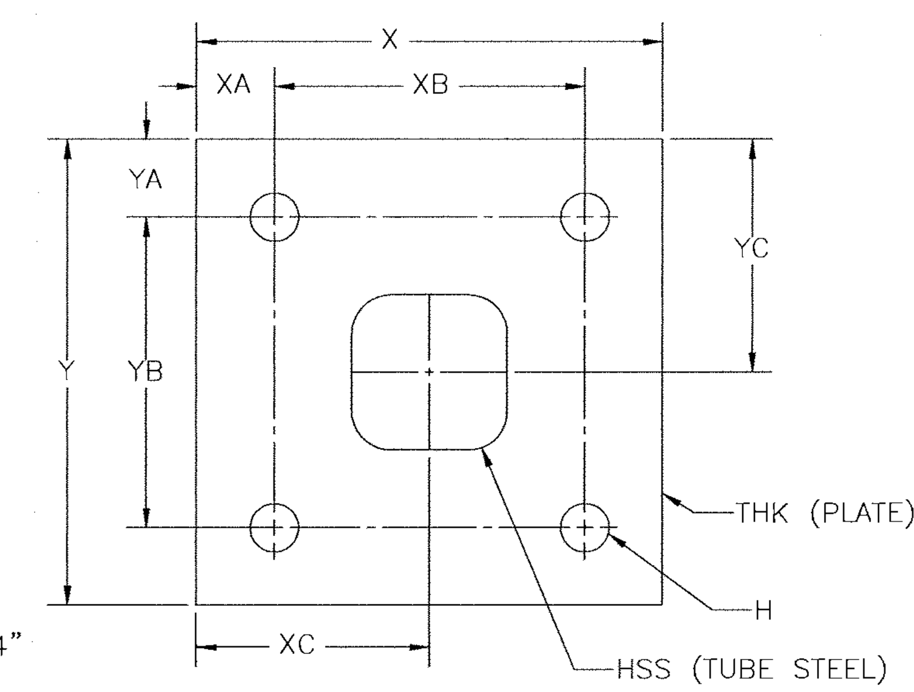
This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

BASEPLATE DETAILS											
TYPE	X	XA	XB	XC	Y	YA	YB	YC	THK	H	HSS
A	9"	1"	7"	4 1/2"	9"	1"	7"	4 1/2"	5/8"	ø9/16"	4X4X1/4
B	9"	1"	7"	4"	9"	1"	7"	4 1/2"	5/8"	ø9/16"	4X4X1/4
C	8"	1"	6"	4"	8"	1"	6"	4"	1/2"	ø9/16"	4X4X1/4
D	8"	1"	6"	4"	8"	1"	6"	4"	3/4"	ø9/16"	4X4X1/4
E	8"	1"	6"	4"	8"	1"	6"	4"	1/2"	ø9/16"	5X5X1/4
F	6"	1"	4"	3"	6"	1"	4"	3"	1/2"	ø5/8"	2X2X1/4



GROUND PIPE SUPPORT LOCATIONS



DETAIL Y

ELEVATION DETAILS	
BASEPLATE NO.	ELEV (BOS)
1	909'-4 5/8"
2	909'-4 5/8"
3	909'-4 1/4"
4	909'-4 1/4"
5	909'-4 1/4"
6	909'-1 9/16"
7	909'-1 5/8"
8	909'-1 3/8"
9	909'-1 1/8"
10	909'-1 1/8"
11	909'-2 5/8"
12	909'-2 5/8"
13	909'-2 5/8"
14	909'-2 1/4"
15	909'-2 5/8"
16	909'-2 5/8"
17	909'-2 3/4"
18	909'-3 1/8"
19	909'-5 7/8"
20	909'-5 7/8"
21	909'-5 7/8"
22	909'-5 15/16"
23	909'-5 5/8"
24	909'-2 7/16"
25	909'-2 7/16"
26	909'-2 1/8"
27	909'-2 7/16"

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	6/29/10	IFC (SEE NOTE 14)	JPM		SM	JS	UR
3	4/17/08	IFD (ECR NO. BGCAPP-MPT-135)	JPM	JXB	TF	MAR	TC
2	2/19/07	ISSUED FOR DESIGN	SIGNATURES ON FILE				
1	10/31/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				
0	8/25/06	ISSUED FOR DESIGN	SIGNATURES ON FILE				

[X] Q [X] NON-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY GEORGE T. FRATER 25510 LICENSED PROFESSIONAL ENGINEER

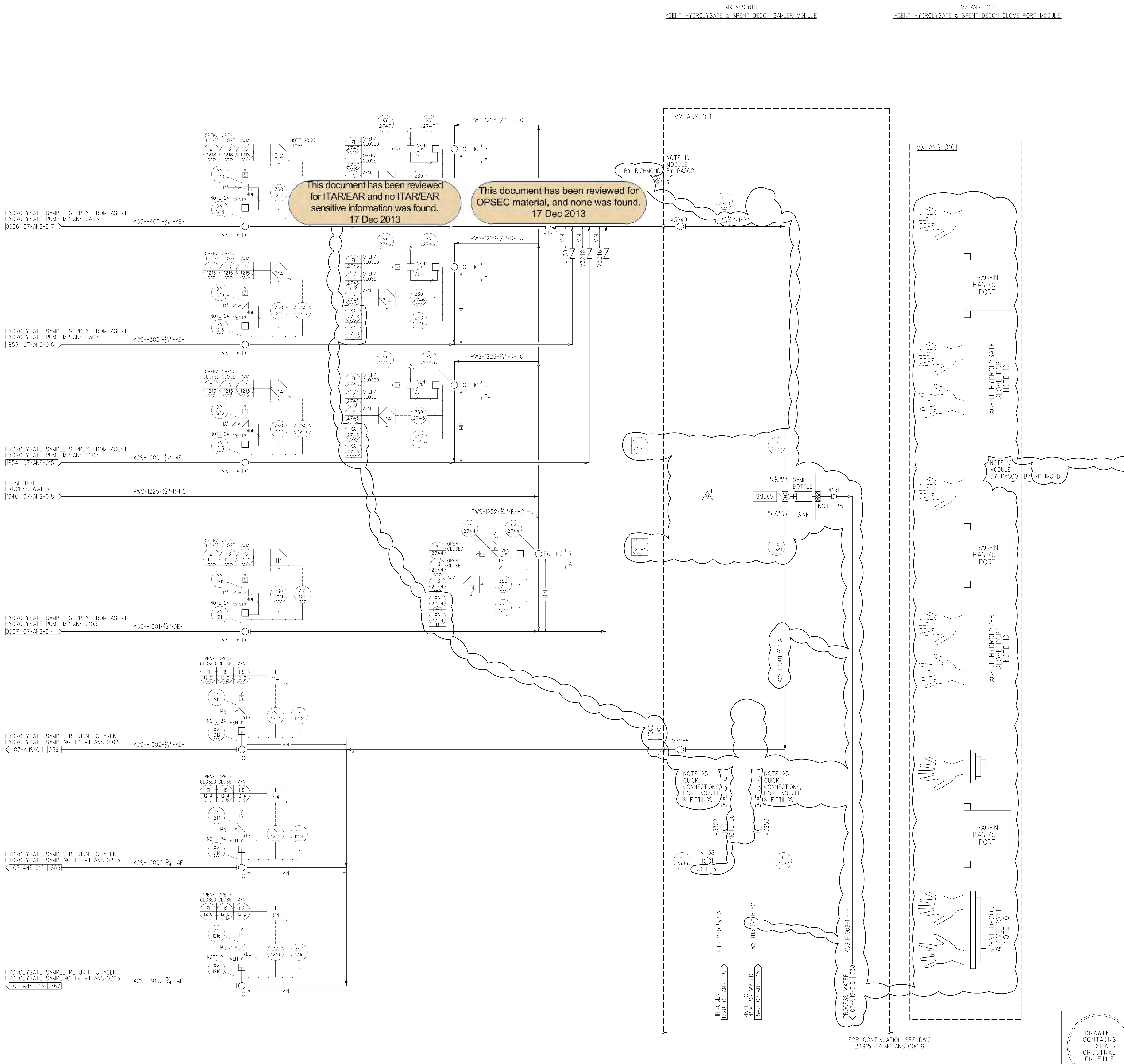
PROFESSIONAL STAMP

PARSONS PASCO FABRICATION SHOP METAL PARTS TREATER INTERFACE CONNECTION DRAWING

DRAWING NUMBER 24915-07-B2-MPT-00001

SHEET 20 OF 20

REV 4



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. DELETED.
6. DELETED.
7. DELETED.
8. DELETED.
9. DELETED.
10. LOCATE GLOVE PORTS NEAR THE BAG-IN BAG-OUT PORT SUCH THAT SAMPLES CAN BE READILY PLACED ONTO THE BAG-IN BAG-OUT PORT.
11. ALL THREE AGENT HYDROLYSATE SAMPLING TANKS WILL SHARE ONE SAMPLER.
12. DELETED.
13. DELETED.
14. DELETED.
15. DELETED.
16. DELETED.
17. DELETED.
18. DELETED.
19. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE PHYSICALLY LOCATED ON MODULE AND ARE DESIGNED, PROCURED AND FABRICATED BY PASCO.
20. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-ANS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
21. DELETED.
22. DELETED.
23. DELETED.
24. THE FLUSHING OF THE INLET PORTION OF THE SAMPLE LINE REQUIRES THAT THE SOURCE PUMP MP-ANS-0103, MP-ANS-0203, MP-ANS-0303 OR MP-ANS-0403 BE SHUT OFF DURING THE FLUSHING PERIOD OF 15 MINUTES. FLUSHING OF THE DOWNSTREAM PORTION OF THE LINE CAN BE DONE WITH THE PUMP RUNNING.
25. QUICK CONNECTION, HOSE, NOZZLE AND FITTINGS TO BE SPECIFIED AND PURCHASED BY OPERATIONS DURING SYSTEMIZATION.
26. LINE TO BE FLUSHED WITH PWS AT THE END OF EACH SAMPLING RUN TO CLEAN ANY AGENT HYDROLYSATE FROM THE HEADER. AFTER LINES 1001, 2001, 3001 HAVE BEEN FLUSHED, THE LINE 4001 MUST BE FLUSHED DOWNSTREAM TO CLEAR SUBHEADER.
27. ONLY ONE TANK MAY BE SAMPLED AT A TIME.
28. SINK DRAIN TO INCLUDE 4" SS MESH BASKET INSERT.
29. IF ANY SAMPLE SUPPLY VALVE HAS BEEN OPENED AND THEN CLOSED, THE FOLLOWING PERMISSIVE SEQUENCE IS REQUIRED FOR ANY OTHER SAMPLE SUPPLY VALVE TO BE OPENED: THE FLUSH VALVES MUST BE OPENED, FLUSH FOR A PERIOD OF TIME (TBD BY OPS DURING STARTUP) AS VERIFIED BY A FLUSH TIMER, AND THE FLUSH VALVES SHALL BE CLOSED.
30. VALVES V1138 AND V3322 ARE ¾" BODY WITH INTEGRAL REDUCERS TO MATCH ½" PIPE SIZE.

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-07-M5-ANS-00002 REV.8
BASED ON BLUE GRASS MSD 24915-07-NO-ANS-00002 REV.5

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
9 [1]	04/12/11	IFC, INCORP. DCN-248,365,DCR-200,230,HTL-5452,5446	JDC	PEB	SA	BBB	BBB
8 [2]	08/07/08	IFC, HTL-985,986,990,993	PEB	JP	BM	BBB	BBB
7 [3]	06/13/08	IFC, ADD PIPING CHANGES	PEB	JP	BM	BBB	BBB
6 [11]	05/29/07	IFC, ADD PIPING AND PASCO COMMENTS	SF	JLL	PEB	JB	BBB
5 [11]	02/07/07	ISSUED FOR DESIGN (IFD), ADD PASCO CHANGES	SF	JLL	PEB	JB	BBB
4 [15]	09/25/06	IFD, ADD GOV COMMENT, DESIGN DEVELOPMENT	SF	JLL	PEB	JB	BBB
3 [13]	05/03/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	SF	JLL	PEB	JB	BBB
2 [15]	09/14/05	ISSUED FOR DESIGN (IFD)	HT	JLL	PEB	JB	JU

QUALITY ☒ Q ☐ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING AGENT HYDROLYSATE SAMPLER PIPING & INSTRUMENT DIAGRAM

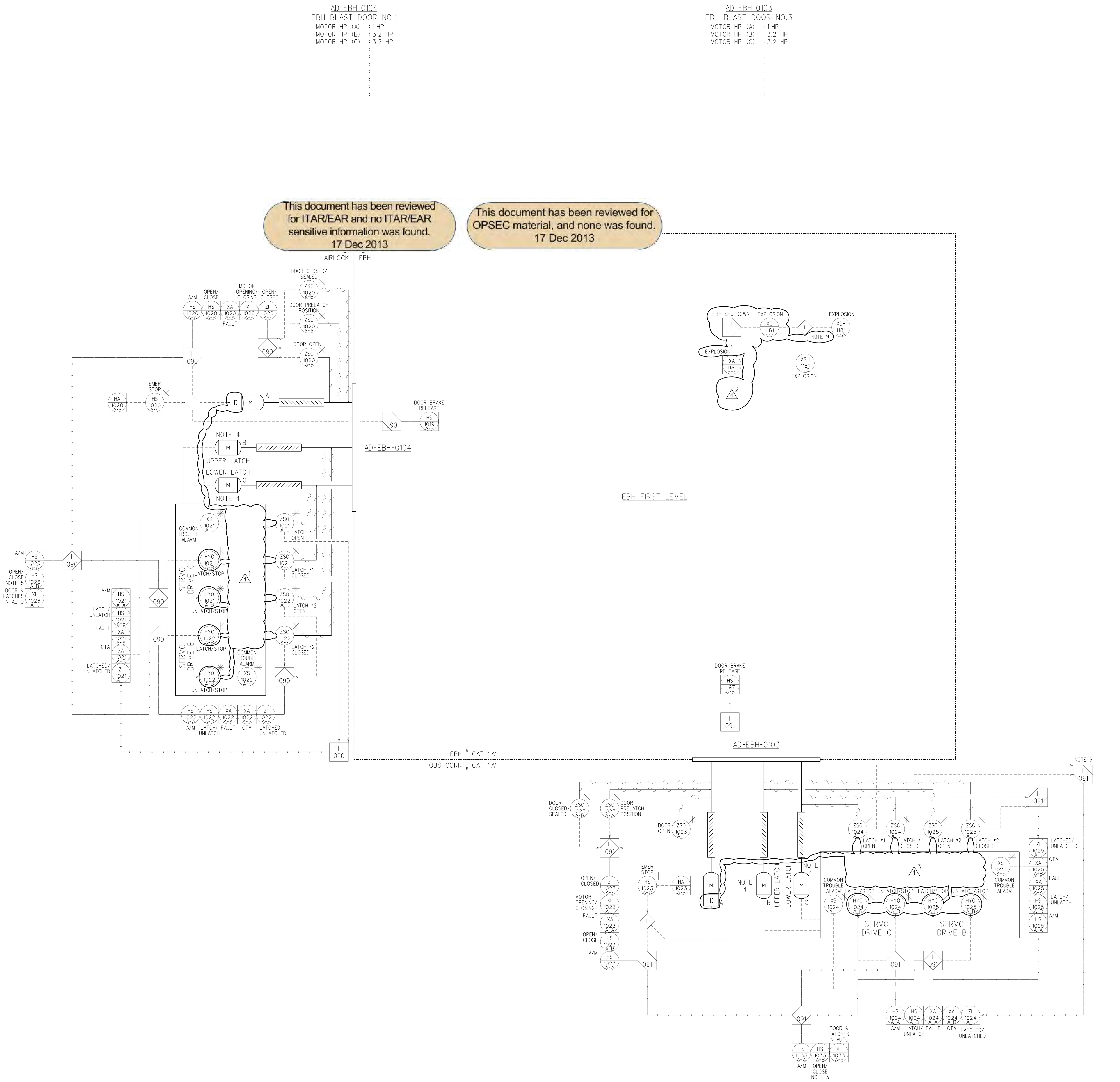
DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-ANS-00020 | SHEET 1 OF 1 | REV 9

BGCAPP_DGN.BDR

07MANS020.pid 05/12/11
DESIGN FILE: DGNSPEC
PLOTTED BY: USER$ ON DATE$ AT SYTIME USING COLOR

.../3d/mp/dwgs/pid/07mans020.pid 5/12/2011 12:53:01 PM



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
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3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. SERVO DRIVE CONTROLLER SHALL BE LOCATED OUTSIDE OF CATEGORY A AND A/B AREA.
5. WHEN DOOR AND LATCHES ARE IN AUTO MODE, OPEN COMMAND SHALL UNLATCH AND OPEN THE DOOR AND CLOSE COMMAND SHALL CLOSE AND LATCH THE DOOR.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-EBH-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. EMERGENCY STOP SWITCH TO BE PROVIDED LOOSE BY BLAST DOOR SUPPLIER. IT SHALL BE MOUNTED IN A CONTROL BOX.
8. OPENING OF ANY EBH DOORS SHOULD PLACE THE ROBOTS IN MAINTENANCE MODE.
9. EXPLOSION DETECTORS IN SERIES.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	01/30/12	IFC, INCORPORATED DCN-676, DCR-135, YDA-ADDH-10031	MDV	GM	SA	BBB	BBB
3	02/13/09	IFC, ADDED INSTRUMENTATION & BLAST SENSOR	PEB	JLL	BM	BBB	BBB
2	03/09/07	IFC, ADDED INTERLOCK TAG NO., HOME POSITION	RZ	JLL	PEB	JB	BBB
1	05/03/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☒ Q ☐ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

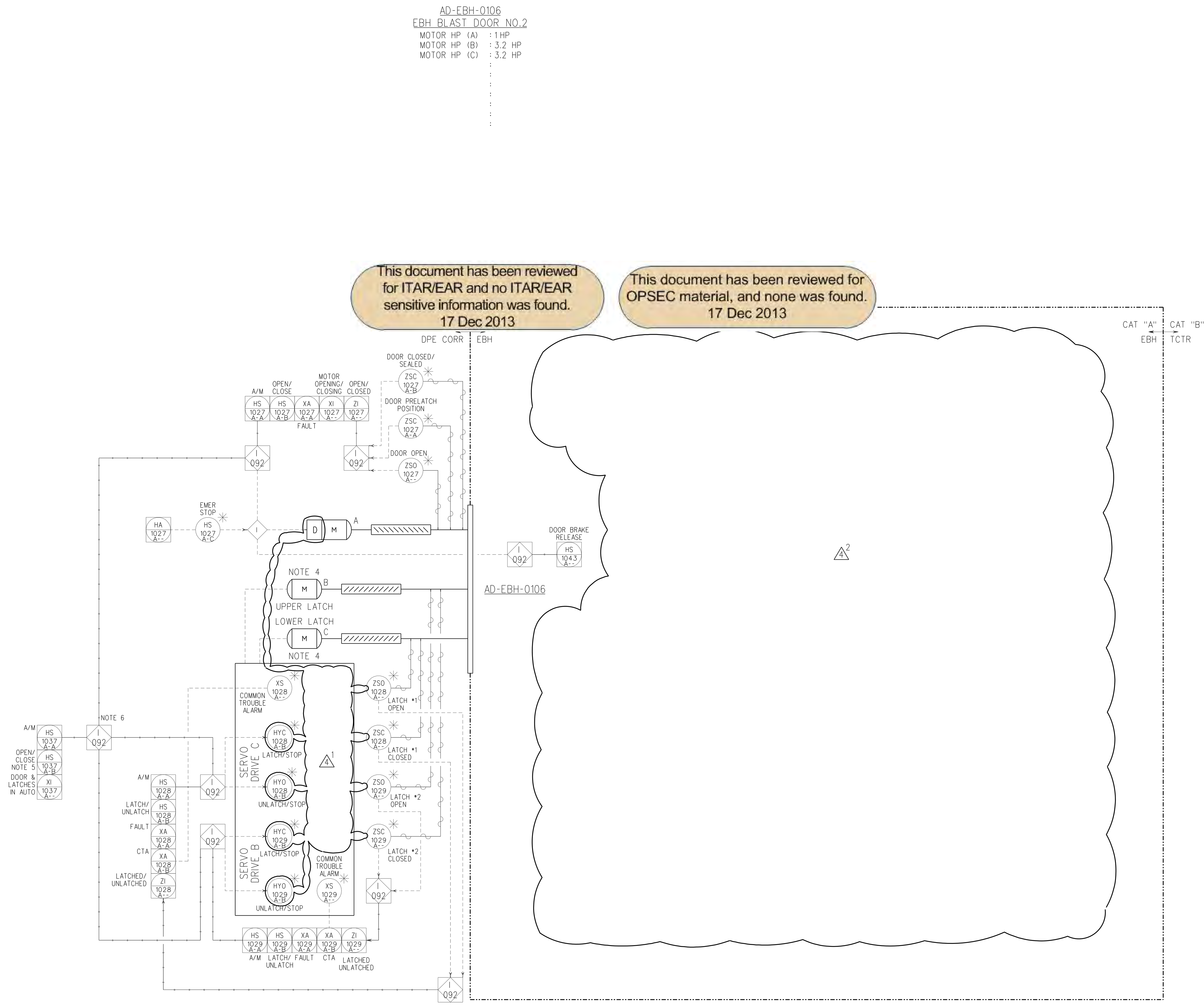
MUNITIONS DEMILITARIZATION BUILDING EBH BLAST DOORS (FIRST LEVEL) PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-EBH-00001 | SHEET 1 OF 1 | REV 4

BGCAPP_DGN.BDR

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

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3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. SERVO DRIVE CONTROLLER SHALL BE LOCATED OUTSIDE OF CATEGORY A AND A/B AREA.
5. WHEN DOOR AND LATCHES ARE IN AUTO MODE, OPEN COMMAND SHALL UNLATCH AND OPEN THE DOOR AND CLOSE COMMAND SHALL CLOSE AND LATCH THE DOOR.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-EBH-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. EMERGENCY STOP SWITCH TO BE PROVIDED LOOSE BY BLAST DOOR SUPPLIER. IT SHALL BE MOUNTED IN A CONTROL BOX.
8. OPENING OF ANY EBH DOORS SHOULD PLACE THE ROBOTS IN MAINTENANCE MODE.
9. DELETED.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	01/30/12	IFC, INCORPORATED DCN-549, -676, YDA-ADDH-10031	MDV	GM	SA	BBB	BBB
3	02/13/09	IFC, ADDED INSTRUMENTATION AND DCN-73	PEB	JLL	BM	BBB	BBB
2	03/09/07	IFC, ADDED INTERLOCK TAG NO., HOME POSITION	RZ	JLL	PEB	JB	BBB
1	05/03/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☒ Q ☐ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING EBH BLAST DOORS (SECOND LEVEL) PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-EBH-00002 | SHEET 1 OF 1 | REV 4

BGCAPP_DGN.BDR

07mebh002.pid 01/30/12
DESIGN FILE: DGNSPEC$$$
PLOTTED BY: USER$ ON DATE$$$ AT SYTIME USING COLOR$$$

.../3d/mp/dwgs/pid/07mebh002.pid 1/30/2012 3:35:43 PM

MX-EBH-1010
CONDENSATE COLLECTION MODULE

ME-EBH-1903 CONDENSATE COOLER

DUTY	: 168,000 BTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG/FV
DESIGN TEMP (SHELL)	: 375 °F
DESIGN PRESS (TUBE)	: 150 PSIG
DESIGN TEMP (TUBE)	: 150 °F
MATERIAL OF CONST (SHELL)	: CARBON STEEL
MATERIAL OF CONST (TUBE)	: COPPER
TRIM (SHELL)	: TRIM-0901-0"-A-HC
TRIM (TUBE)	: TRIM-0902-0"-AD-

MT-EBH-1902 CONDENSATE TANK

WORKING VOLUME	: 390 GAL
DIAMETER	: 4 FT (OD)
HEIGHT	: 114 IN
DESIGN PRESSURE	: ATM
DESIGN TEMPERATURE	: 225 °F
MATERIAL OF CONST	: 316SS
TRIM	: TRIM-0900-0"-R-HC

ME-EBH-1909 CONDENSATE HEATER

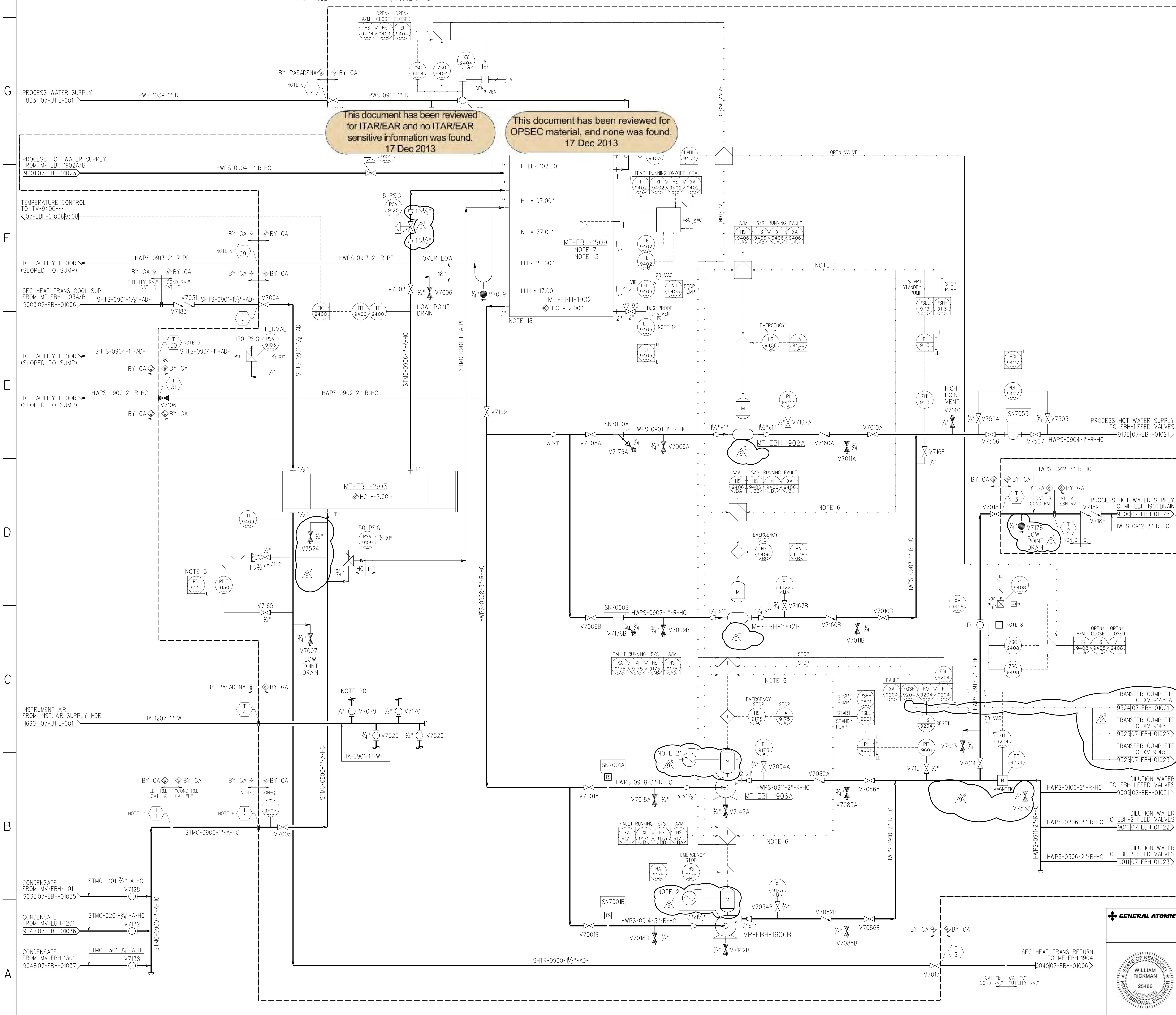
DUTY	: 51 KW
DESIGN TEMPERATURE	: 225 °F
MATERIAL OF CONST	: MFR. STD.

MP-EBH-1902A/B CONDENSATE PUMP & SPARE

RATED FLOW	: 10 GPM
RATED DELTA P	: 62 PSI
MOTOR HP	: 1 HP
MATERIAL OF CONST	: 316SS

MP-EBH-1906A/B DILUTION WATER PUMP & SPARE

RATED FLOW	: 80 GPM
RATED DELTA P	: 18 PSI
MOTOR HP	: 3 HP
MATERIAL OF CONST	: 316SS



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS.
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. EQUIPMENT SHOWN IS LOCATED IN EBH EQUIPMENT ROOM, 07-113, CAT "B" AREA.
3. DELETED.
4. CONDENSATE TANK NORMAL OPERATING TEMPERATURE 185°F.
5. PDIT TO MONITOR PRESSURE BETWEEN SECONDARY COOLING LOOP AND CONDENSATE RETURN LINE.
6. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 10 SECONDS, THE "LEAD" PUMP WILL STOP. IF THE "STANDBY" PUMP DOES NOT REACH THE NORMAL SET POINT WITHIN ANOTHER 5 SECONDS, BOTH THE "LEAD AND "STANDBY" PUMPS WILL STOP. IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR PRESSURE TO FALL BELOW NORMAL.
7. ME-EBH-1909 IS USED FOR SYSTEM START-UP AND MAKE-UP WATER HEATING.
8. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV-9408
   XV-9404
9. PER ICD DOC. NO. 24915-07-B2-EBH-00004.
10. DELETED.
11. MP-EBH-1902 A/B FINAL PUMP SELECTION SHALL PROVIDE A STEEP PERFORMANCE CURVE (SHUT-OFF HEAD SHALL BE A MINMUM OF 125% OF NORMAL OPERATING HEAD). PUMP IS TO BE SHUT DOWN ON HIGH-HIGH PRESSURE WHICH IS ASSUMED TO BE ASSOCIATED WITH MINIMUM FLOW CONDITION.
12. MP-1906 A/B TO START UPON TANK HIGH LIQUID LEVEL TO PUMP EXCESS CONDENSATE TO MH-1901 DRAIN VIA XV-9408.
13. ME-EBH-1909 HEATER IS LOCATED BELOW TANK LOW LEVEL. IF LIQUID LEVEL FALLS BELOW HEATER LEVEL, BUILT-IN OVER TEMPERATURE SWITCH WILL SHUT DOWN HEATER.
14. PER ICD DOC. NO. 24915-07-B2-EBH-00012.
15. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
16. DELETED.
17. DELETED.
18. DELETED.
19. XV-9404 TO OPEN UPON CONDENSATE LOW LIQUID LEVEL TO RESTORE LIQUID LEVEL TO THE MARGINAL LEVEL.
20. INSTRUMENT AIR LINES ARE 'NON-Q'.
21. ACTIVE COOLING OF PUMP SEALS NOT REQUIRED FOR PROCESS TEMPERATURE < 250°F. 9 10
22. HIGH POINT VENT VALVES AND LOW POINT DRAIN VALVES ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED.
23. ✳ DENOTES VENDOR PROVIDED.

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001

REFERENCE DRAWINGS

CM Aprvd

cn=Issued by Miguel Batobato, c=US, o=General Atomics, ou=Configuration Management 2010.04.27 14:23:36 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
9 (10)		IFC (INCORP. AS-BUILT MODULE CHANGES)	NL	CA	KM	NW	VN
8	01/16/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
7	07/03/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	CA	KM	NW	VN
6	12/21/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
5	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
4	02/07/06	ISSUED FOR DESIGN - REDRAWN	EM	CA	DG	NW	VN
3	08/19/05	ISSUED FOR APPROVAL - DC#43B	EM	CA	DG	NW	VN
2	01/21/05	ISSUED FOR DESIGN	EM	CA	BW	NW	VN
1	01/04/05	ISSUED FOR DESIGN	EM	CA	BW	NW	VN
0	11/18/04	ISSUED FOR DESIGN	EM	CA	BW	NW	VN

QUALITY ☒ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH CONDENSATE TANK PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-EBH-01005

SHEET 1 OF 1

REV 9

BGCAPP_DGN.BDR

07MEBH1005.pid 03/16/10

...\dwgs\pid\07mebh1005.pid 3/16/2010 7:26:30 AM

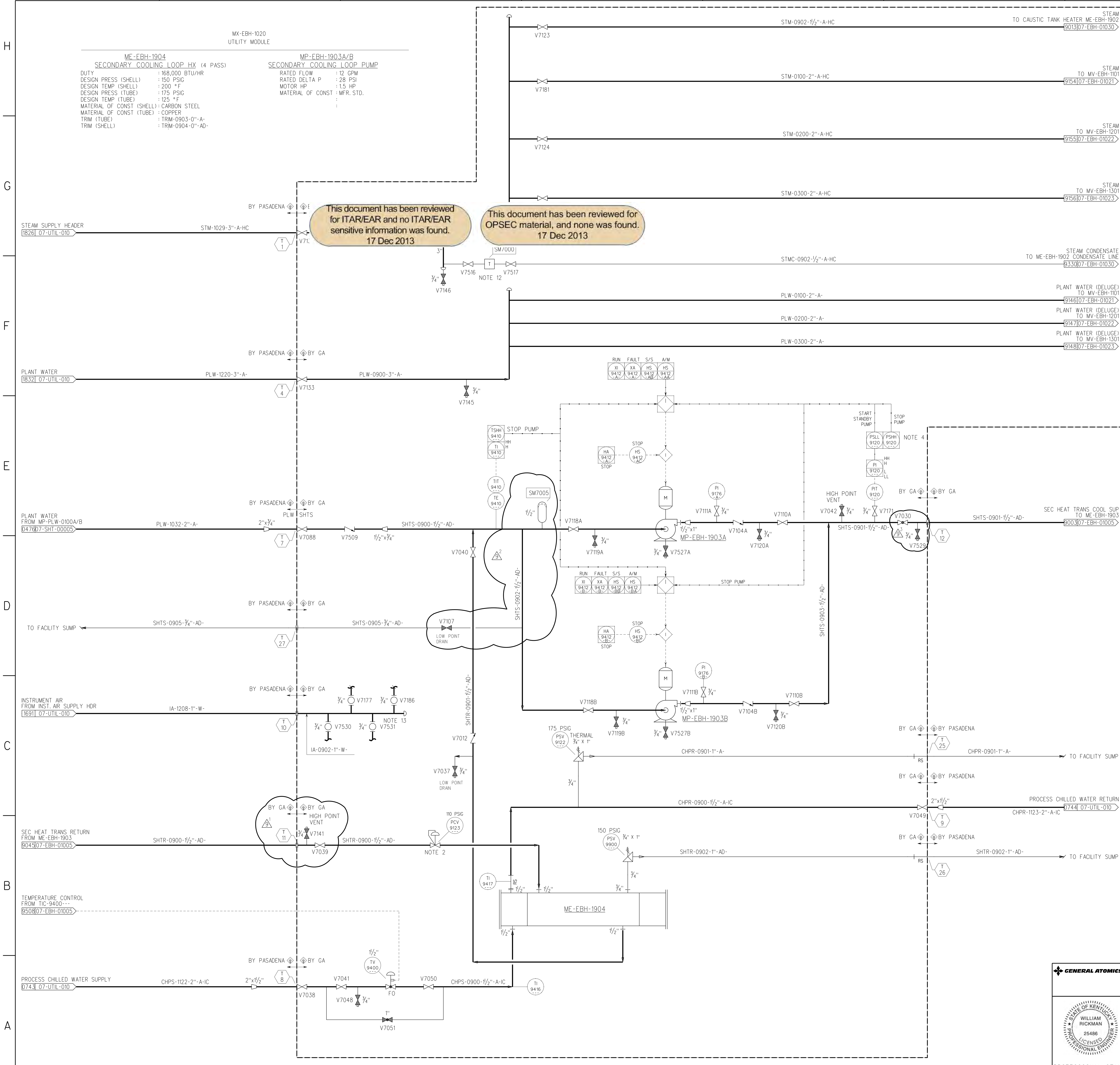
MX-EBH-1020
UTILITY MODULE

ME-EBH-1904
SECONDARY COOLING LOOP HX (4 PASS)

DUTY	: 168,000 BTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG
DESIGN TEMP (SHELL)	: 200 °F
DESIGN PRESS (TUBE)	: 175 PSIG
DESIGN TEMP (TUBE)	: 125 °F
MATERIAL OF CONST (SHELL)	: CARBON STEEL
MATERIAL OF CONST (TUBE)	: COPPER
TRIM (TUBE)	: TRIM-0903-0"-A-
TRIM (SHELL)	: TRIM-0904-0"-AD-

MP-EBH-1903A/B
SECONDARY COOLING LOOP PUMP

RATED FLOW	: 12 GPM
RATED DELTA P	: 28 PSI
MOTOR HP	: 1.5 HP
MATERIAL OF CONST	: MFR. STD.



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This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS.
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. BACK PRESSURE REGULATOR MAINTAINS SYSTEM PRESSURE GREATER THAN CONDENSATE RETURN PRESSURE.
4. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 5 SECONDS, THE "LEAD" PUMP WILL STOP. IF THE "STANDBY" PUMP DOES NOT REACH THE NORMAL SET POINT WITHIN ANOTHER 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP. IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR PRESSURE TO FALL BELOW NORMAL.
7. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
11. EQUIPMENT SHOWN IS LOCATED ON EBH EQUIPMENT ROOM PLATFORM, CAT "C" AREA.
12. STEAM TRAP HAS INTEGRAL WYE STRAINER AND BLOWOFF VALVE PER PIPING MATERIAL CLASS A.
13. INSTRUMENT AIR LINES ARE 'NON-Q'.
14. HIGH POINT VENT VALVES AND LOW POINT DRAIN VALVES ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED.
15. NOTES 3, 5, 6, 8, 9 AND 10 HAVE BEEN DELETED.

CM Aprvd

Issued By Jordan Finkelstein
cn=Issued By Jordan Finkelstein, o=General Atomics, ou=Configuration Management, email=jordan.finkelstein@ga.com, c=US
2010.04.27 13:07:05 -07'00'

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
9		IFC (INCORP. AS-BUILT MODULE CHANGES)	NL	CA	KM	NW	VN
8	01/16/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
7	07/03/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	CA	KM	NW	VN
6	12/19/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
5	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
4	02/07/06	ISSUED FOR DESIGN	EM	CA	DG	NW	VN
3	08/19/05	ISSUED FOR APPROVAL - DC#43B	EM	CA	DG	NW	VN
2	01/21/05	ISSUED FOR APPROVAL	EM	CA	BW	NW	VN
1	01/04/05	ISSUED FOR DESIGN	EM	CA	BW	NW	VN
0	11/18/04	ISSUED FOR DESIGN	EM	CA	BW	NW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH STM/WTR AND CHILLED SEC. LOOP PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-EBH-01006 | SHEET 1 OF 1 | REV 9

BGCAPP_DGN.BDR

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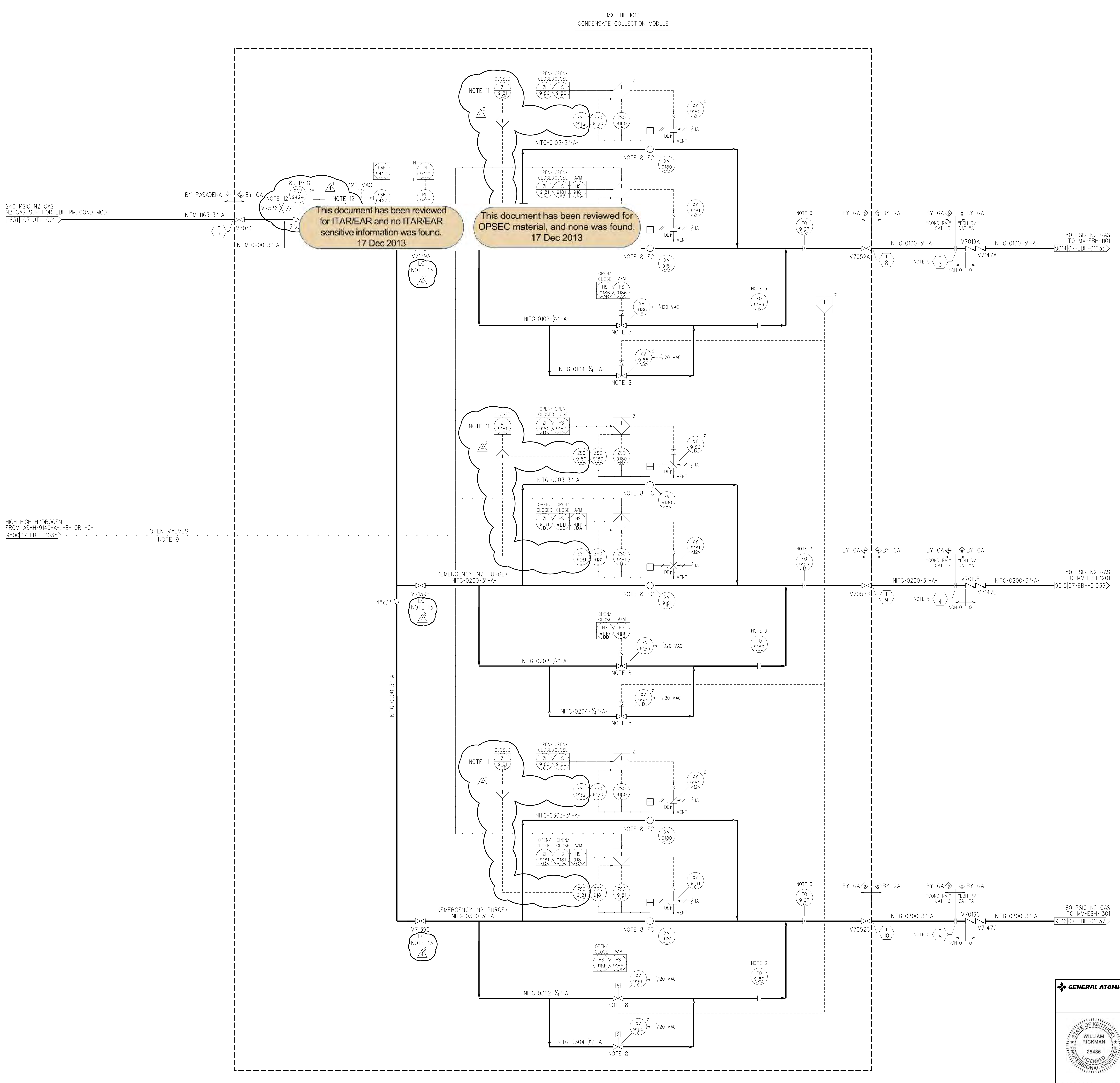

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS.
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. DELETED.
3. FO-9107-A-, FO-9107-B- AND FO-9107-C- SIZED FOR 3000 SCFM. FO-9189-A-, FO-9189-B- AND FO-9189-C- SIZED FOR 50 SCFM.
4. SEE 24915-07-M6-EBH-01035 FOR NITROGEN PURGE OPERATION.
5. PER ICD DOC. NO. 24915-07-B2-EBH-00012.
6. SOLENOID VALVES:
   XV-9186-A-
   XV-9185-A-
   XV-9186-B-
   XV-9185-B-
   XV-9186-C-
   XV-9185-C-
   TO BE SPECIFIED AS FAIL OPEN.
7. DENOTES DESIGN RESPONSIBILITY LABEL.
8. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV-9186-A
   XV-9185-A
   XV-9186-B
   XV-9185-B
   XV-9186-C
   XV-9185-C
   XV-9180-A
   XV-9181-A
   XV-9180-B
   XV-9181-B
   XV-9180-C
   XV-9181-C
9. ONLY THE VALVES OF THE TWO OPERATING EBH'S WILL OPEN ON THE PURGE SIGNAL INITIATED BY THE FCS OR FPS. 4
10. EQUIPMENT SHOWN IS LOCATED IN THE EBH EQUIPMENT ROOM, 07-113, CAT "B" AREA.
11. FCS AND FPS VALVE STATUS TO BE WIRED IN SERIES AND USED TO CONTROL HVAC DAMPERS HD8741A-- AND HD8741B-- IN THE EVENT OF NITROGEN PURGING.
12. PILOT VALVE CONNECTION FOR PRESSURE REDUCING REGULATOR. 4
13. FOR SAFETY, BLOCK VALVES SHALL BE LOCKED CLOSED DURING MAINTENANCE, AND LOCKED OPEN AFTER MAINTENANCE TO ENSURE AVAILABILITY OF EBH PURGE.

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001

REFERENCE DRAWINGS

Signature Valid
RELEASED by Norbil Espiritu
General Atomics
Configuration Management
2009/01/16

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4		IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
3	07/03/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	CA	KM	NW	VN
2	12/19/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
1	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
0	02/07/06	ISSUED FOR DESIGN	EM	CA	DG	NW	VN

QUALITY ☒ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH NITROGEN SUPPLY PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-EBH-01018 | SHEET 1 OF 1 | REV 4

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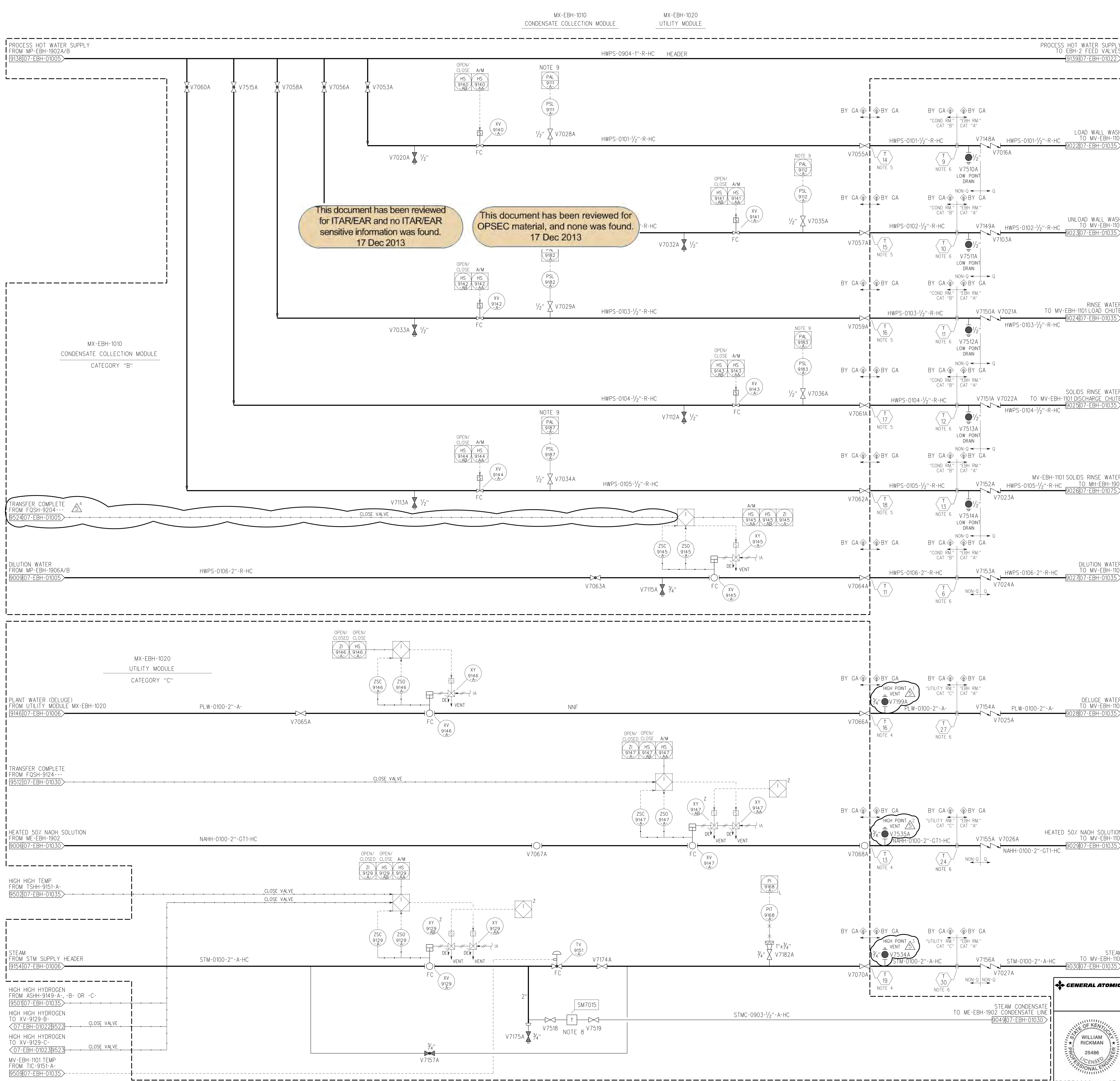

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
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   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
4. PER ICD DOC. NO. 24915-07-B2-EBH-00005.
5. PER ICD DOC. NO. 34915-07-B2-EBH-00004.
6. PER ICD DOC. NO. 24915-07-B2-EBH-00012.
7. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
8. STEAM TRAP HAS INTEGRAL WYE STRAINER AND BLOWOFF VALVE PER PIPING MATERIAL CLASS A.
9. PAL IS TIED TO SOLENOID VALVE POSITION AND WILL ONLY ALARM IF SOLENOID VALVE IS OPEN AND LINE PRESSURE REMAINS LOW OR IF SOLENOID VALVE IS CLOSED AND PRESSURE REMAINS HIGH.
10. HIGH POINT VENT VALVES AND LOW POINT DRAIN VALVES ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED. 5
11. NOTES 2 AND 3 HAVE BEEN DELETED.

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001
REFERENCE DRAWINGS

CM Aprvd

cn=Issued by Miguel Batobato, c=US, o=General Atomics, ou=Configuration Management 2010.05.04 14:28:28 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5		IFC (INCORP. HIGH POINT VENTS)	NL	CA	KM	NW	VN
4	01/15/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
3	07/03/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	CA	KM	NW	VN
2	12/19/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
1	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
0	02/07/06	ISSUED FOR DESIGN	EM	CA	DG	NW	VN

QUALITY ☒ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH UNIT 1 FEED VALVES PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY ★ WILLIAM RICKMAN ★ 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-EBH-01021 | SHEET 1 OF 1 | REV 5

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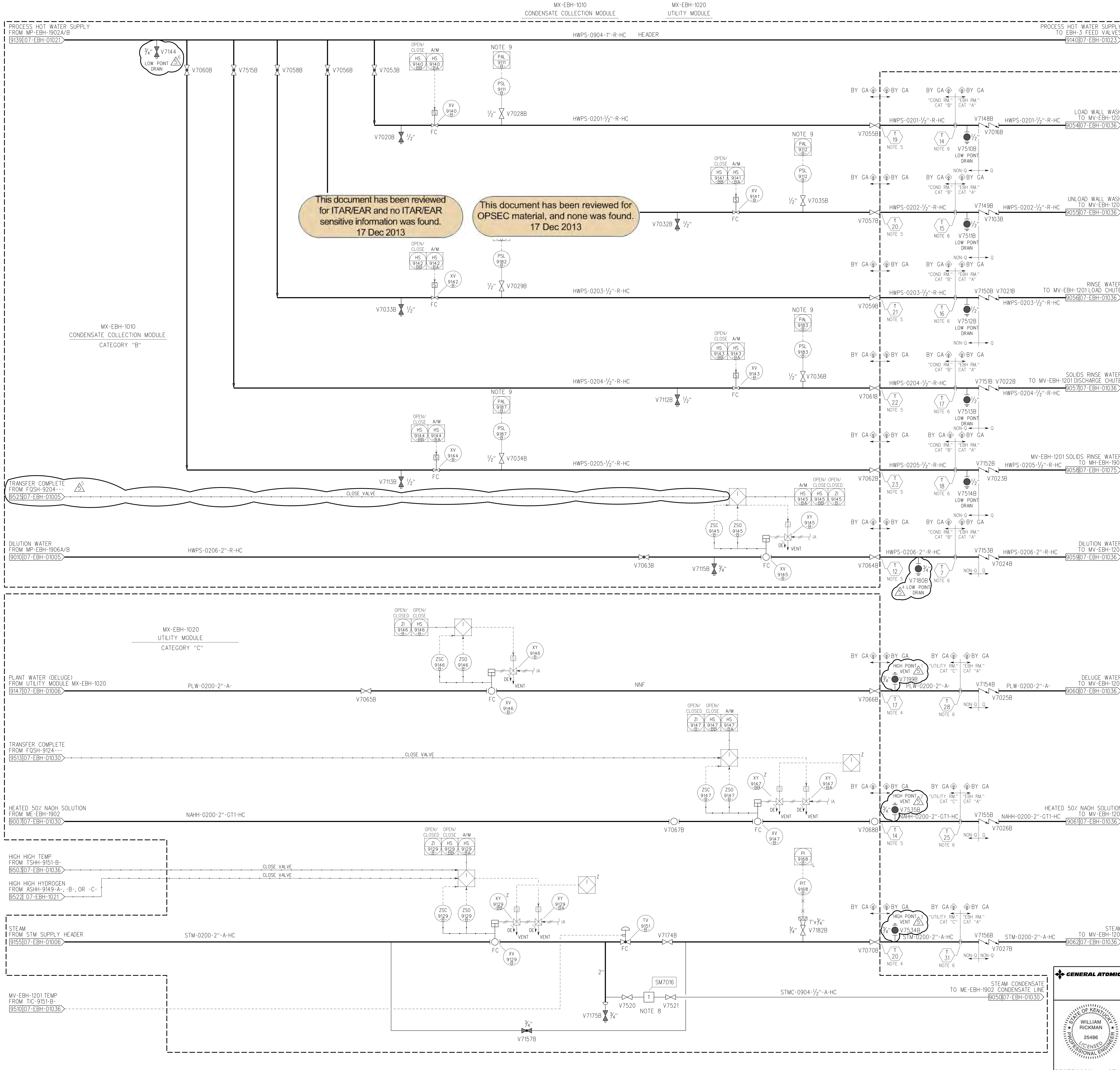

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
4. PER ICD DOC. NO. 24915-07-B2-EBH-00005.
5. PER ICD DOC. NO. 24915-07-B2-EBH-00004.
6. PER ICD DOC. NO. 24915-07-B2-EBH-00012.
7. DENOTES DESIGN RESPONSIBILITY LABEL.
8. STEAM TRAP HAS INTEGRAL WYE STRAINER AND BLOWOFF VALVE PER PIPING MATERIAL CLASS A.
9. PAL IS TIED TO SOLENOID VALVE POSITION AND WILL ONLY ALARM IF SOLENOID VALVE IS OPEN AND LINE PRESSURE REMAINS LOW, OR IF SOLENOID VALVE IS CLOSED AND PRESSURE REMAINS HIGH.
10. HIGH POINT VENT VALVES AND LOW POINT DRAIN VALVES ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED.
11. NOTES 2 AND 3 HAVE BEEN DELETED.

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001

REFERENCE DRAWINGS

CM Aprvd

cn=Issued By Norbil Espiritu, c=US, o=Configuration Management, ou=General Atomics 2010.05.04 13:44:12 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
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4	01/15/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
3	07/03/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	CA	KM	NW	VN
2	12/20/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
1	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
0	02/07/06	ISSUED FOR DESIGN	EM	CA	DG	NW	VN

QUALITY ☒ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING EBH UNIT 2 FEED VALVES PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-EBH-01022 | SHEET 1 OF 1 | REV 5

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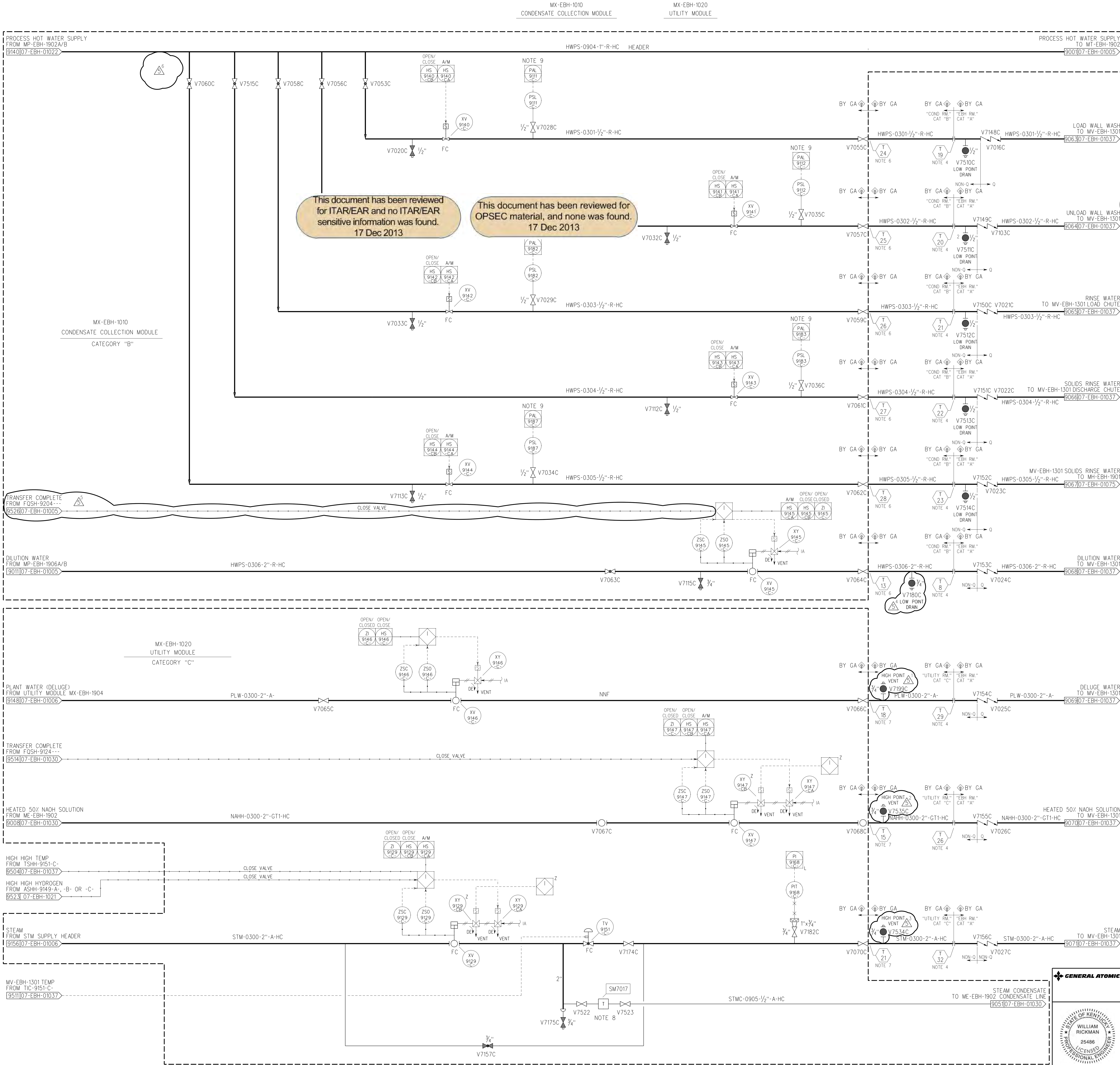

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
4. PER ICD DOC. NO. 24915-07-B2-EBH-00012.
5. DENOTES DESIGN RESPONSIBILITY LABEL.
6. PER ICD DOC. NO. 24915-07-B2-EBH-00004.
7. PER ICD DOC. NO. 24915-07-B2-EBH-00005.
8. STEAM TRAP HAS INTEGRAL WYE STRAINER AND BLOWOFF VALVE PER PIPING MATERIAL CLASS A.
9. PAL IS TIED TO SOLENOID VALVE POSITION AND WILL ONLY ALARM IF SOLENOID VALVE IS OPEN AND LINE PRESSURE REMAINS LOW OR IF SOLENOID VALVE IS CLOSED AND PRESSURE REMAINS HIGH.
10. HIGH POINT VENT VALVES AND LOW POINT DRAIN VALVES ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED.
11. NOTES 2 AND 3 HAVE BEEN DELETED.

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001

REFERENCE DRAWINGS

CM Aprvd

cn=ISSUED by: Shawn Kelly, c=US, o=General Atomics, ou=Configuration Management 2010.05.04 13:53:04 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5		IFC (INCORP. HIGH POINT VENTS)	NL	CA	KM	NW	VN
4	01/15/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
3	07/03/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	CA	KM	NW	VN
2	12/20/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
1	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
0	02/07/06	ISSUED FOR DESIGN	EM	CA	DG	NW	VN

QUALITY ☒ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING EBH UNIT 3 FEED VALVES PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-EBH-01023 | SHEET 1 OF 1 | REV 5

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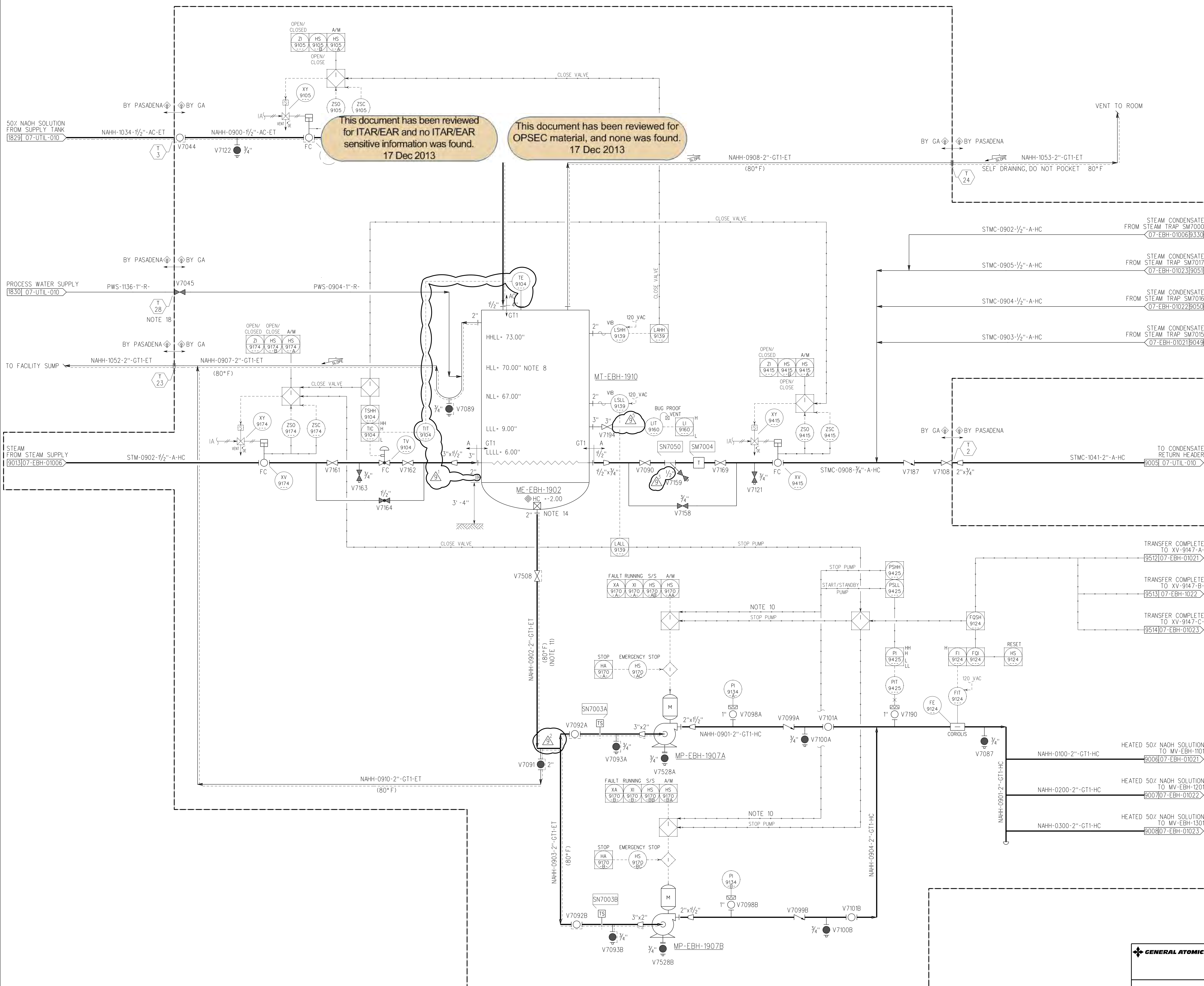
MX-EBH-1020
UTILITY MODULE

MT-EBH-1910 CAUSTIC TANK		ME-EBH-1902 CAUSTIC HEATER		MP-EBH-1907A/B CAUSTIC PUMP	
WORKING VOLUME	: 456 GAL	DESIGN PRESSURE	: 150 PSIG/FV	RATED FLOW	: 47 GPM
DIAMETER	: 4.5 FT (OD)	DESIGN TEMPERATURE	: 375 °F	RATED DELTA P	: 14 PSI
T-T	: 7 FT	DUTY	: 205,000 BTU/HR	MOTOR HP	: 3 HP
DESIGN TEMPERATURE	: 300 °F	MATERIAL OF CONST	: UNS N 06600	MATERIAL OF CONST	: UNS N 10276
DESIGN PRESSURE	: ATM	TRIM	: TRIM-0906-0"-GT1-		:
MATERIAL OF CONST	: UNS S32205		:		:
TRIM	: TRIM-0905-0"-GT1-HC		:		

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
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   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. EQUIPMENT SHOWN IS LOCATED ON EBH EQUIPMENT ROOM PLATFORM, CAT "C" AREA.
8. CAUSTIC TANK SIZE LIMITATION ALLOWS A TWO MINUTE RESPONSE TIME BETWEEN HIGH AND HIGH-HIGH LEVEL. OPERATOR TO MONITOR TANK FILLING OPERATION TO ENSURE HIGH LEVEL IS NOT EXCEEDED.
9. ME-EBH-1902 SIZED TO HEAT CAUSTIC TO OPERATING TEMPERATURE IN 2 HOURS.
10. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 10 SECONDS, THE "LEAD" PUMP WILL STOP. IF THE "STANDBY" PUMP DOES NOT REACH THE NORMAL SET POINT WITHIN ANOTHER 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP. IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START WITHOUT WAITING FOR PRESSURE TO FALL BELOW NORMAL.
11. CAUSTIC SERVICE PIPING DEAD LEGS TO BE ELECTRICALLY TRACED.
12. CAUSTIC PUMP MP-EBH-1907 A/B DOES NOT START UNLESS CAUSTIC TANK, MT-EBH-1910, IS FILLED TO NORMAL LEVEL AND HEATED TO THE TRANSFER TEMPERATURE. CAUSTIC TANK MAKE UP DOES NOT BEGIN UNTIL CAUSTIC TRANSFER COMPLETE.
13. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
14. VORTEX BREAKER TO BE PROVIDED.
18. TIE-IN NUMBER SHOWN ON ICD DOC. NO. 24915-07-B2-EBH-00005.
19. HIGH POINT VENTS AND LOW POINT DRAINS ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED.
20. NOTES 3, 4, 5, 6, 7, 15, 16 AND 17 HAVE BEEN DELETED.

Issued By Jordan Finkelstein
cn=Issued By Jordan Finkelstein, o=General Atomics, ou=Configuration Management, email=jordan.finkelstein@ga.com, c=US
2010.05.04 13:36:38 -07'00'

CM Aprvd

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
9		IFC (RELOCATED TE-9104 ON CAUSTIC TANK)	NL	CA	KM	NW	VN
8	01/16/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
7	07/03/07	IFC (SHEET REDRAWN - INCORP. DESIGN DEVELOPMENT)	NL	CA	KM	NW	VN
6	12/21/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
5	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
4	02/07/05	ISSUED FOR DESIGN - REDRAWN	EM	CA	DG	NW	VN
3	08/19/05	ISSUED FOR APPROVAL - DC#43B	EM	CA	DG	NW	VN
2	01/21/05	ISSUED FOR DESIGN	EM	CA	BW	NW	VN
1	01/04/05	ISSUED FOR DESIGN	LL	CA	BW	NW	VN
0	11/17/04	ISSUED FOR DESIGN	LL	CA	BW	NW	VN

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH CAUSTIC HEATER PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-EBH-01030 | SHEET 1 OF 1 | REV 9

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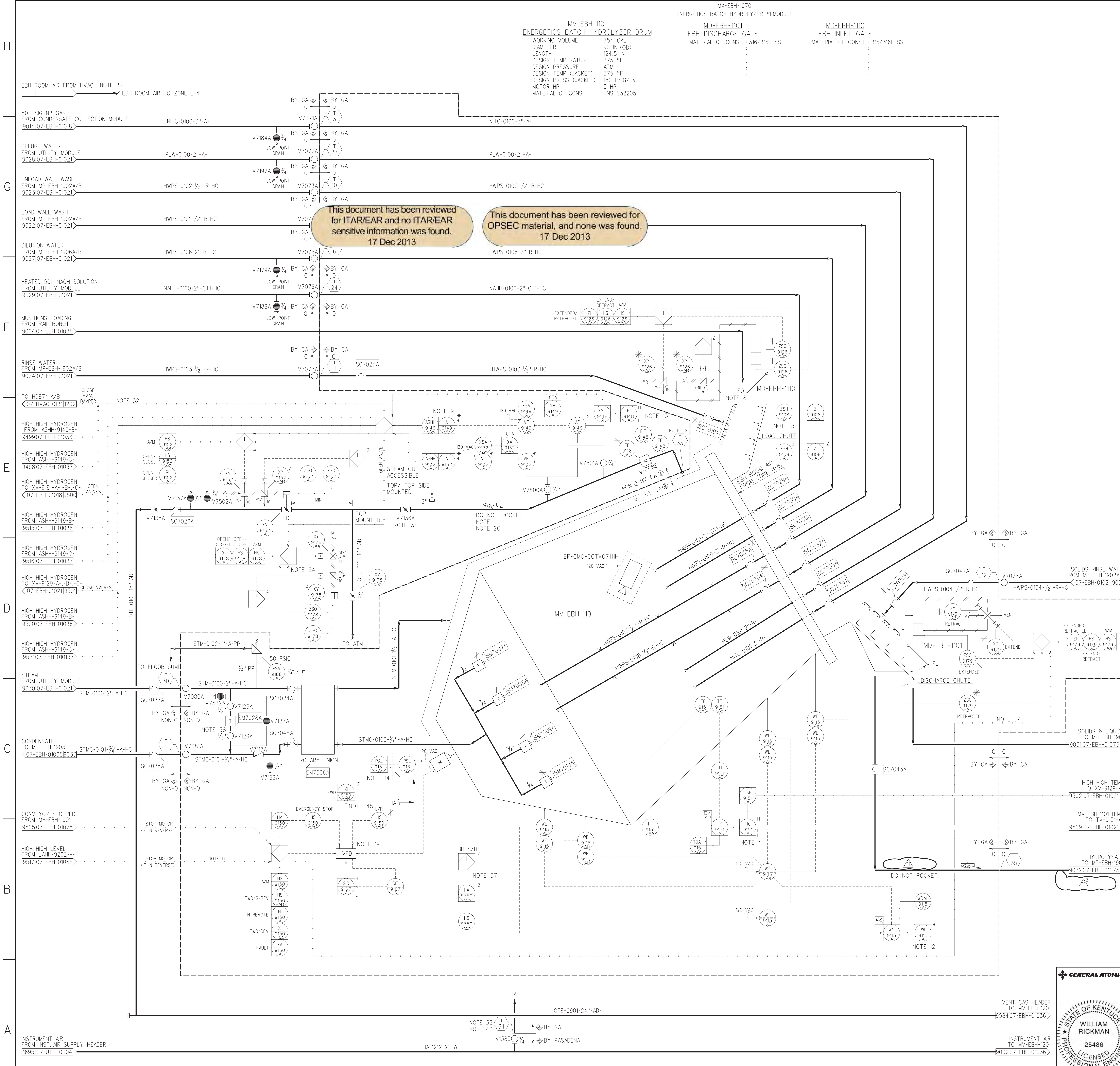

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
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   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. EQUIPMENT SHOWN IS LOCATED IN EBH ROOM, CAT "A" AREA.
5. BIN-IN-POSITION SWITCH.
8. MUNITION LOADING POINT FROM TRANSFER ROBOT.
9. STOP MUNITIONS FEED ON HIGH H2 ALARM (AE-9149-A-) AND PURGE EBH ON HIGH-HIGH H2 ALARM (AE-9149-A-, WITH BACKUP AE-9132-A- AT HIGHER SETPOINT).
10. EBH CONTROLS LOCATED OUTSIDE OF EBH ROOM.
11. LINE HAS TWO FLOW RATES DEPENDING ON MUNITIONS CAMPAIGN, AS ROCKET WARHEADS REQUIRE HIGHER VENTILATION RATE THAN H PROJECTILES.
12. EBH WEIGHT SIGNAL USED FOR BATCH LEVEL CONTROL VIA WALL WASH SPRAY.
13. UPON LOSS OF EBH REACTOR VENTILATION FLOW DURING LOADING OR PROCESSING OF WHs:
    a.) MUNITION FEED HALTS.
    b.) VENTILATION DAMPER (XV-9152-A-) CLOSES AND XV-9178A-- OPENS.
    c.) OXYGEN (FROM ROOM AIR) IS PURGED FROM REACTOR BY INTRODUCTION OF NITROGEN GAS AT HIGH FLOW RATE (3000 SCFM FOR ONE MINUTE).
    d.) FOLLOWING OXYGEN PURGE, EBH INLET GATE (MD-EBH-1110) CLOSES AND NITROGEN FLOW RATE IS REDUCED TO TRICKLE FLOW (50 SCFM) UNTIL OTE IS RESTORED TO MAINTAIN INERT, OXYGEN-FREE ATMOSPHERE WITHIN THE REACTOR.
    e.) UPON RESTORATION OF THE OFF-GAS TREATMENT SYSTEM AND PRIOR TO VENTILATION DAMPER OPENING, HYDROGEN WILL BE PURGED FROM THE REACTOR WITH AN INCREASE IN FLOW OF NITROGEN GAS (3000 SCFM FOR ONE MINUTE) FOR SIX VOLUME CHANGES.
14. DRIVE MOTOR PURGE PANEL, TYPE Z.
17. IF THE HYDROLYSATE COLLECTION TANK REACHES HIGH-HIGH LEVEL AND THE EBH IS UNLOADING (DRAINING HYDROLYSATE), THE FCS SHALL STOP THE EBH MOTOR.
18. ✳ DENOTES VENDOR SUPPLIED.
19. VFD IS BY PASADENA.
20. INCLUDE FLANGED CONNECTIONS IN OTE VENT PIPING FOR EASE OF ASSEMBLY AND DISASSEMBLY.
21. ELECTRICAL AREA CLASSIFICATION:
    CLASS 1, DIVISION 1, GROUP B, INSIDE EBH DRUM
    CLASS 1, DIVISION 2, GROUP B, OUTSIDE EBH DRUM
22. PER ICD DOC. NO. 24915-07-B2-EBH-00001.
24. XV-9178-A- TO OPEN WHEN XV-9152-A- CLOSES TO PREVENT THE BUILD-UP OF HYDROGEN IN THE EBH VENT LINE.
27. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
32. NITROGEN PURGE SIGNAL IS PROVIDED TO HVAC TO CONTROL ROOM AIR FLOW TO MAINTAIN NEGATIVE PRESSURE IN EBH ROOM DURING PURGE.
33. QUALITY LEVEL BOUNDARY FROM Q TO NON-Q REQUIRED AT THE END USER DEVICE WHEN THE END USER DEVICE IS Q.
34. DISCHARGE GATE TO BE INTERLOCKED CLOSED DURING LOADING AND PROCESSING TO MAINTAIN AIR CIRCULATION THROUGH EBH DRUM.
36. V7136A POSITION SHALL BE ADJUSTED AS NEEDED TO BALANCE THE VENT FLOW BETWEEN THE EBHs AND TO REDUCE THE TOTAL VENT FLOW RATE DURING THE H CAMPAIGN.
37. UPON EMERGENCY SHUTDOWN SIGNAL FROM OPERATOR, ALL EBH OPERATIONS CEASE EXCEPT FOR DRUM ROTATION, AND NITROGEN PURGE IS INITIATED FOR EBHs PROCESSING ROCKETS AND TURNING IN FORWARD DIRECTION.
38. STEAM TRAP HAS INTEGRAL WYE STRAINER AND BLOWOFF VALVE PER PIPING MATERIAL CLASS A.
39. SEE HVAC PIDS 24915-07-M6-HVAC-00131 AND 24915-07-M6-HVAC-00132.
40. INSTRUMENT AIR LINES ARE 'NON-Q'.
41. EBH MUST BE ABOVE LOW TEMPERATURE ALARM SETPOINT TO INITIATE MUNITIONS FEED. STOP MUNITIONS FEED BELOW LOW-LOW TEMPERATURE SETPOINT. EBH MUST OPERATE AT NORMAL SETPOINT FOR SPECIFIED TIME BEFORE DISCHARGE OF RESIDUES AND HYDROLYSATE. TEMPERATURE BELOW NORMAL SETPOINT DEAD BAND STOPS HYDROLYSIS TIMER UNTIL TEMPERATURE IS RESTORED.
42. HIGH POINT VENT VALVES AND LOW POINT DRAIN VALVES ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED.
43. LOADING OF AN EBH IS PROHIBITED IF A FULL BATCH HAS ALREADY BEEN LOADED.
44. LOADING OF EBH DURING LEAKER AND CONTAMINATED ROCKET PROCESSING SHALL ONLY BE DONE UNDER SUPERVISORY CONTROL AS AN ADDITIONAL PROTECTION TO PREVENT MIXING OF ROCKET MOTORS AND WARHEADS IN AN EBH.
45. "EBH ACTIVE" IDENTIFIER FOR FPS SHUTDOWN NITROGEN PURGE.
46. NOTES 3, 4, 6, 7, 15, 16, 23, 25, 26, 28, 29, 30, 31 AND 35 HAVE BEEN DELETED.

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.01.17 09:28:18 -08'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
11		IFC (INCORP. FCR-1393)	NL	CA	KM	NW	VN
10	03/18/11	IFC (INCORP. DCN-217)	NL	CA	KM	NW	VN
9	05/04/10	IFC (INCORP. AS-BUILT MODULE CHANGES)	NL	CA	KM	NW	VN
8	01/15/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
7	07/03/07	IFC (SHEET REDRAWN - INCORP. DESIGN DEVELOPMENT)	NL	CA	KM	NW	VN
6	12/20/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
5	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
4	02/07/06	ISSUED FOR DESIGN	EM	CA	DG	NW	VN
3	08/19/05	ISSUED FOR APPROVAL - DC#43B	EM	CA	DG	NW	VN
2	01/21/05	ISSUED FOR DESIGN	EM	CA	BW	NW	VN
1	01/04/05	ISSUED FOR DESIGN	EM	CA	BW	NW	VN
0	11/18/04	ISSUED FOR DESIGN	EM	CA	BW	NW	VN

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH UNIT 1 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-EBH-01035 | SHEET 1 OF 1 | REV 11

BGCAPP_DGN.BDR

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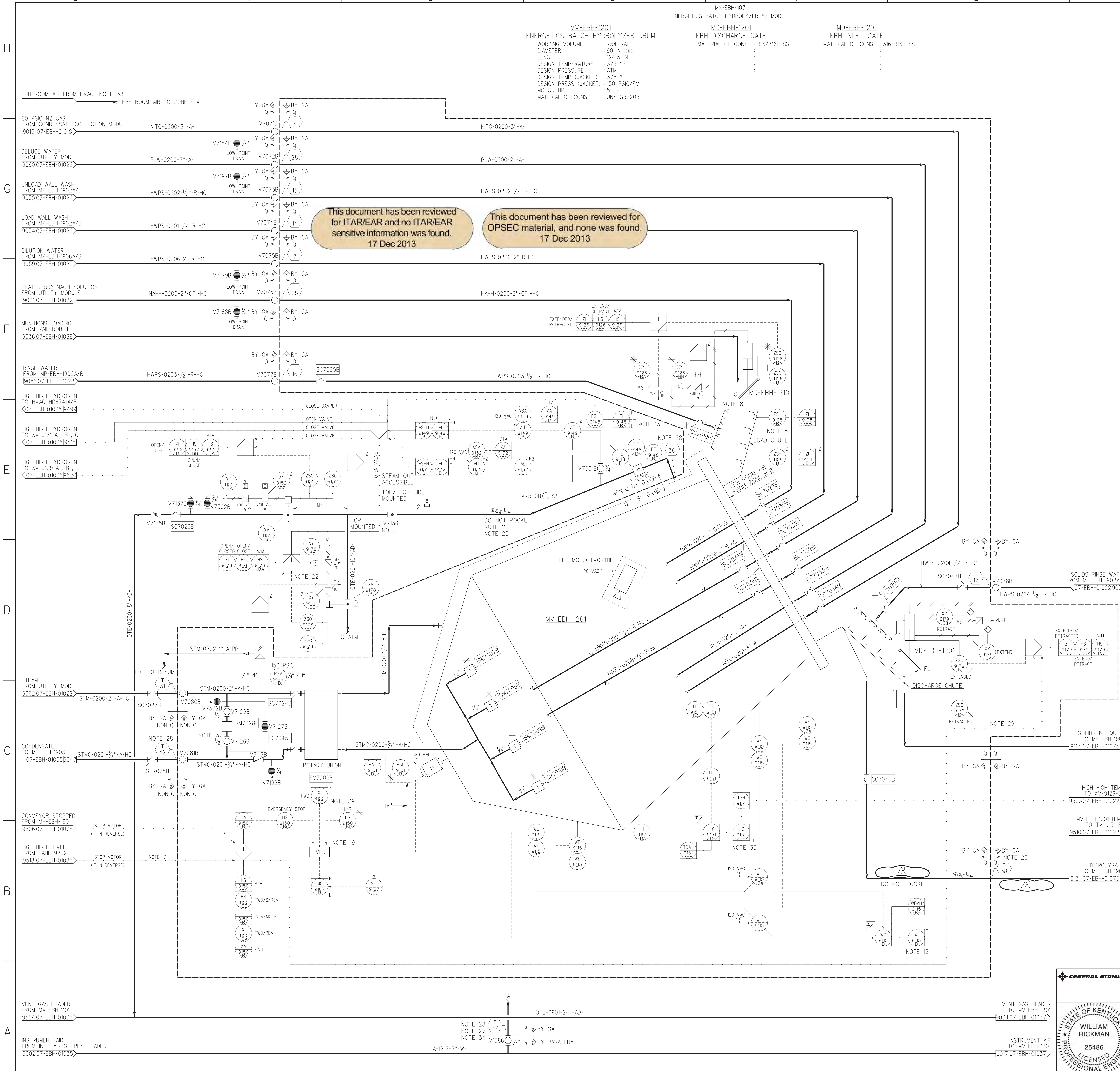

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. EQUIPMENT SHOWN IS LOCATED IN EBH ROOM, CAT "A" AREA.
5. BIN-IN-POSITION SWITCH.
8. MUNITION LOADING POINT FROM TRANSFER ROBOT.
9. STOP MUNITIONS FEED ON HIGH H2 ALARM (AE-9149-B-) AND PURGE EBH ON HIGH-HIGH H2 ALARM (AE-9149-B-, WITH BACKUP AE-9132-B- AT HIGHER SETPOINT).
10. EBH CONTROLS LOCATED OUTSIDE OF EBH ROOM.
11. LINE HAS TWO FLOW RATES DEPENDING ON MUNITIONS CAMPAIGN, AS ROCKET WARHEADS REQUIRE HIGHER VENTILATION RATE THAN H PROJECTILES.
12. EBH WEIGHT SIGNAL USED FOR BATCH LEVEL CONTROL VIA WALL WASH SPRAY.
13. UPON LOSS OF EBH REACTOR VENTILATION FLOW DURING LOADING OR PROCESSING OF WHs:
    a.) MUNITION FEED HALTS.
    b.) VENTILATION DAMPER (XV-9152-B-) CLOSES AND XV-9178-B- OPENS.
    c.) OXYGEN (FROM ROOM AIR) IS PURGED FROM REACTOR BY INTRODUCTION OF NITROGEN GAS AT HIGH FLOW RATE (3000 SCFM FOR ONE MINUTE).
    d.) FOLLOWING OXYGEN PURGE, EBH INLET GATE (MD-EBH-1210) CLOSES AND NITROGEN FLOW RATE IS REDUCED TO TRICKLE FLOW (50 SCFM) UNTIL OTE IS RESTORED TO MAINTAIN INERT, OXYGEN-FREE ATMOSPHERE WITHIN THE REACTOR.
    e.) UPON RESTORATION OF THE OFF-GAS TREATMENT SYSTEM AND PRIOR TO VENTILATION DAMPER OPENING, HYDROGEN WILL BE PURGED FROM THE REACTOR WITH AN INCREASE IN FLOW OF NITROGEN GAS (3000 SCFM FOR ONE MINUTE) FOR SIX VOLUME CHANGES.
14. DRIVE MOTOR PURGE PANEL, TYPE Z.
17. IF THE HYDROLYSATE COLLECTION TANK REACHES HIGH-HIGH LEVEL AND THE EBH IS UNLOADING (DRAINING HYDROLYSATE), THE FCS SHALL STOP THE EBH MOTOR.
18. ✳ DENOTES VENDOR SUPPLIED.
19. VFD IS BY PASADENA.
20. INCLUDE FLANGED CONNECTIONS IN OTE VENT PIPING FOR EASE OF ASSEMBLY AND DISASSEMBLY.
21. ELECTRICAL AREA CLASSIFICATION:
    CLASS 1, DIVISION 1, GROUP B, INSIDE EBH DRUM
    CLASS 1, DIVISION 2, GROUP B, OUTSIDE EBH DRUM
22. XV-9178-B- TO OPEN WHEN XV-9152-B- IS CLOSED TO PREVENT THE BUILDUP OF HYDROGEN IN THE EBH VENT LINE.
24. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
27. QUALITY LEVEL BOUNDARY FROM Q TO NON-Q REQUIRED AT THE END USER DEVICE WHEN THE END USER DEVICE IS Q.
28. TIE-IN NUMBERS SHOWN ON ICD DOC. NO. 24915-07-B2-EBH-00001.
29. DISCHARGE GATE TO BE INTERLOCKED CLOSED DURING LOADING AND PROCESSING TO MAINTAIN AIR CIRCULATION THROUGH EBH DRUM.
31. V7136B POSITION SHALL BE ADJUSTED AS NEEDED TO BALANCE THE VENT FLOW BETWEEN THE EBHs AND TO REDUCE THE TOTAL VENT FLOW RATE DURING THE H CAMPAIGN.
32. STEAM TRAP HAS INTEGRAL WYE STRAINER AND BLOWOFF VALVE PER PIPING MATERIAL CLASS A.
33. SEE HVAC PIDS 24915-07-M6-HVAC-00131 AND 24915-07-M6-HVAC-00132.
34. INSTRUMENT AIR LINES ARE 'NON-Q'.
35. EBH MUST BE ABOVE LOW TEMPERATURE ALARM SETPOINT TO INITIATE MUNITIONS FEED. STOP MUNITIONS FEED BELOW LOW-LOW TEMPERATURE SETPOINT. EBH MUST OPERATE AT NORMAL SETPOINT FOR SPECIFIED TIME BEFORE DISCHARGE OF RESIDUES AND HYDROLYSATE. TEMPERATURE BELOW NORMAL SETPOINT DEAD BAND STOPS HYDROLYSIS TIMER UNTIL TEMPERATURE IS RESTORED.
36. HIGH POINT VENT VALVES AND LOW POINT DRAIN VALVES ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED.
37. LOADING OF AN EBH IS PROHIBITED IF A FULL BATCH HAS ALREADY BEEN LOADED.
38. LOADING OF EBH DURING LEAKER AND CONTAMINATED ROCKET PROCESSING SHALL ONLY BE DONE UNDER SUPERVISORY CONTROL AS AN ADDITIONAL PROTECTION TO PREVENT MIXING OF ROCKET MOTORS AND WARHEADS IN AN EBH.
39. "EBH ACTIVE" IDENTIFIER FOR FPS SHUTDOWN NITROGEN PURGE.
40. UPON EMERGENCY SHUTDOWN SIGNAL FROM OPERATOR, ALL EBH OPERATIONS CEASE EXCEPT FOR DRUM ROTATION, AND NITROGEN PURGE IS INITIATED FOR EBHs PROCESSING ROCKETS AND TURNING IN FORWARD DIRECTION.
41. NOTES 3, 4, 6, 7, 15, 16, 23, 25, 26 AND 30 HAVE BEEN DELETED.

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.01.17 09:52:34 -08'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7		IFC (INCORP. FCR-1393)	NL	CA	KM	NW	VN
6	03/18/11	IFC (INCORP. DCN-217)	NL	CA	KM	NW	VN
5	05/04/10	IFC (INCORP. AS-BUILT MODULE CHANGES)	NL	CA	KM	NW	VN
4	01/15/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
3	07/03/07	IFC (SHEET REDRAWN - INCORP. DESIGN DEVELOPMENT)	NL	CA	KM	NW	VN
2	12/20/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
1	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
0	02/07/06	ISSUED FOR DESIGN	EM	CA	DG	NW	VN

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)

RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH UNIT 2 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-EBH-01036 | SHEET 1 OF 1 | REV 7

BGCAPP_DGN.BDR

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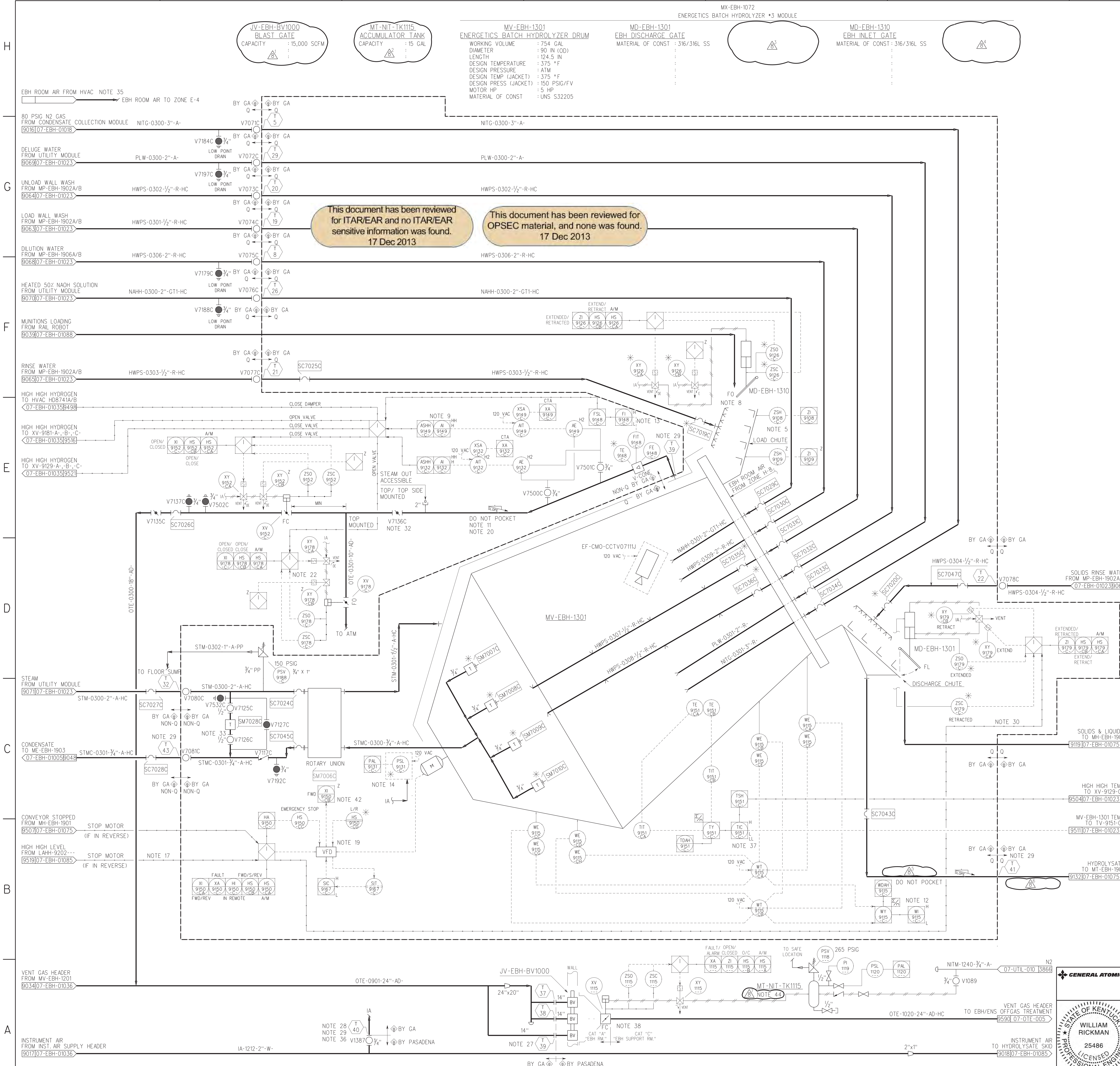

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. EQUIPMENT SHOWN IS LOCATED IN EBH ROOM, CAT "A" AREA.
5. BIN-IN-POSITION SWITCH.
8. MUNITION LOADING POINT FROM TRANSFER ROBOT.
9. STOP MUNITIONS FEED ON HIGH H2 ALARM (AE-9149-C-) AND PURGE EBH ON HIGH-HIGH H2 ALARM (AE-9149-C-, WITH BACKUP AE-9132-C- AT HIGHER SETPOINT).
10. EBH CONTROLS LOCATED OUTSIDE OF EBH ROOM.
11. LINE HAS TWO FLOW RATES DEPENDING ON MUNITIONS CAMPAIGN, AS ROCKET WARHEADS REQUIRE HIGHER VENTILATION RATE THAN H PROJECTILES.
12. EBH WEIGHT SIGNAL USED FOR BATCH LEVEL CONTROL VIA WALL WASH SPRAY.
13. UPON LOSS OF EBH REACTOR VENTILATION FLOW DURING LOADING OR PROCESSING OF WH's:
    a.) MUNITION FEED HALTS.
    b.) VENTILATION DAMPER (XV-9152-C-) CLOSES AND XV-9178-C- OPENS.
    c.) OXYGEN (FROM ROOM AIR) IS PURGED FROM REACTOR BY INTRODUCTION OF NITROGEN GAS AT HIGH FLOW RATE (3000 SCFM FOR ONE MINUTE).
    d.) FOLLOWING OXYGEN PURGE, EBH INLET GATE (MD-EBH-1310) CLOSES AND NITROGEN FLOW RATE IS REDUCED TO TRICKLE FLOW (50 SCFM) UNTIL OTE IS RESTORED TO MAINTAIN INERT, OXYGEN-FREE ATMOSPHERE WITHIN THE REACTOR.
    e.) UPON RESTORATION OF THE OFF-GAS TREATMENT SYSTEM AND PRIOR TO VENTILATION DAMPER OPENING, HYDROGEN WILL BE PURGED FROM THE REACTOR WITH AN INCREASE IN FLOW OF NITROGEN GAS (3000 SCFM FOR ONE MINUTE) FOR SIX VOLUME CHANGES.
14. DRIVE MOTOR PURGE PANEL, TYPE Z.
17. IF THE HYDROLYSATE COLLECTION TANK REACHES HIGH-HIGH LEVEL AND THE EBH IS UNLOADING (DRAINING HYDROLYSATE), THE FCS SHALL STOP THE EBH MOTOR.
18. ✳ DENOTES VENDOR SUPPLIED.
19. VFD IS BY PASADENA.
20. INCLUDE FLANGED CONNECTIONS IN OTE VENT PIPING FOR EASE OF ASSEMBLY AND DISASSEMBLY.
21. ELECTRICAL AREA CLASSIFICATION:
    CLASS 1, DIVISION 1, GROUP B, INSIDE EBH DRUM
    CLASS 1, DIVISION 2, GROUP B, OUTSIDE EBH DRUM
22. XV-9178-C- TO OPEN WHEN XV-9152-C- IS CLOSED TO PREVENT THE BUILDUP OF HYDROGEN IN THE EBH VENT LINE.
24. DENOTES DESIGN RESPONSIBILITY LABEL.
27. PER ICD DOC. NO. 24915-07-B2-EBH-00012.
28. QUALITY LEVEL BOUNDARY FROM Q TO NON-Q REQUIRED AT THE END USER DEVICE WHEN THE END USER DEVICE IS Q.
29. TIE-IN NUMBERS SHOWN ON ICD DOC. NO. 24915-07-B2-EBH-00001.
30. DISCHARGE GATE TO BE INTERLOCKED CLOSED DURING LOADING AND PROCESSING TO MAINTAIN AIR CIRCULATION THROUGH EBH DRUM.
32. V7136C POSITION SHALL BE ADJUSTED AS NEEDED TO BALANCE THE VENT FLOW BETWEEN THE EBHs AND TO REDUCE THE TOTAL VENT FLOW RATE DURING THE H CAMPAIGN.
33. STEAM TRAP HAS INTEGRAL WYE STRAINER AND BLOWOFF VALVE PER PIPING MATERIAL CLASS A.
35. SEE HVAC PIDS 24915-07-M6-HVAC-00131 AND 24915-07-M6-HVAC-00132.
36. INSTRUMENT AIR LINES ARE 'NON-Q'.
37. EBH MUST BE ABOVE LOW TEMPERATURE ALARM SETPOINT TO INITIATE MUNITIONS FEED. STOP MUNITIONS FEED BELOW LOW-LOW TEMPERATURE SETPOINT. EBH MUST OPERATE AT NORMAL SETPOINT FOR SPECIFIED TIME BEFORE DISCHARGE OF RESIDUES AND HYDROLYSATE. TEMPERATURE BELOW NORMAL SETPOINT DEAD BAND STOPS HYDROLYSIS TIMER UNTIL TEMPERATURE IS RESTORED.
38. ISOLATION VALVE XV-1115 CLOSES UPON A SIGNAL FROM THE EBH ROOM SMOKE DETECTORS OR EXPLOSION DETECTORS AND WILL BE REOPENED MANUALLY FROM THE FCS CONTROL PANEL.
39. HIGH POINT VENT VALVES AND LOW POINT DRAIN VALVES ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED.
40. LOADING OF AN EBH IS PROHIBITED IF A FULL BATCH HAS ALREADY BEEN LOADED.
41. LOADING OF EBH DURING LEAKER AND CONTAMINATED ROCKET PROCESSING SHALL ONLY BE DONE UNDER SUPERVISORY CONTROL AS AN ADDITIONAL PROTECTION TO PREVENT MIXING OF ROCKET MOTORS AND WARHEADS IN AN EBH.
42. "EBH ACTIVE" IDENTIFIER FOR FPS SHUTDOWN NITROGEN PURGE.
43. UPON EMERGENCY SHUTDOWN SIGNAL FROM OPERATOR, ALL EBH OPERATIONS CEASE EXCEPT FOR DRUM ROTATION, AND NITROGEN PURGE IS INITIATED FOR EBHs PROCESSING ROCKETS AND TURNING IN FORWARD DIRECTION.
44. PROCUREMENT AND INSTALLATION OF MT-NIT-TK1115, AND ASSOCIATED INSTRUMENTS PSV1118---, PI1119---, AND PSL1120--- WILL BE BY HVAC SUBCONTRACTOR. N2 TUBING FROM V1089 TO THE N2 TANK WILL BE FURNISHED AND INSTALLED BY THE HVAC SUBCONTRACTOR. TUBING FROM MT-NIT-TK1115 TO 07-EBH-XV1115--- WILL BE BY CONTRACTOR. 8
45. NOTES 3, 4, 6, 7, 15, 16, 23, 25, 26, 31 AND 34 HAVE BEEN DELETED.

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001
REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.01.17 10:18:20 -08'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
8		IFC (INCORP. FCR-1393, FCN-145, & DCN-565)	NL	CA	KM	NW	VN
7	03/18/11	IFC (INCORP. DCN-217)	NL	CA	KM	NW	VN
6	12/10/10	IFC (INCORP. VENT ISOLATION VALVE CHANGES PER DCR105)	NL	CA	KM	NW	VN
5	05/04/10	IFC (INCORP. AS-BUILT MODULE CHANGES & VENT ISOLATION VALVE)	NL	CA	KM	NW	VN
4	01/15/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
3	07/03/07	IFC (SHEET REDRAWN - INCORP. DESIGN DEVELOPMENT)	NL	CA	KM	NW	VN
2	12/20/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
1	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
0	02/07/06	ISSUED FOR DESIGN	EM	CA	DG	NW	VN

QUALITY ☒ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH UNIT 3 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-EBH-01037 | SHEET 1 OF 1 | REV 8

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MX-EBH-1140
HYDROLYSATE COLLECTION MODULE

MF-EBH-1901
HYDROLYSATE TANK AGITATOR

MOTOR HP	: 7.5 HP
MATERIAL OF CONST	: UNS N 10276
	: UNS S 32205
	:

MT-EBH-1901
HYDROLYSATE COLLECTION TANK

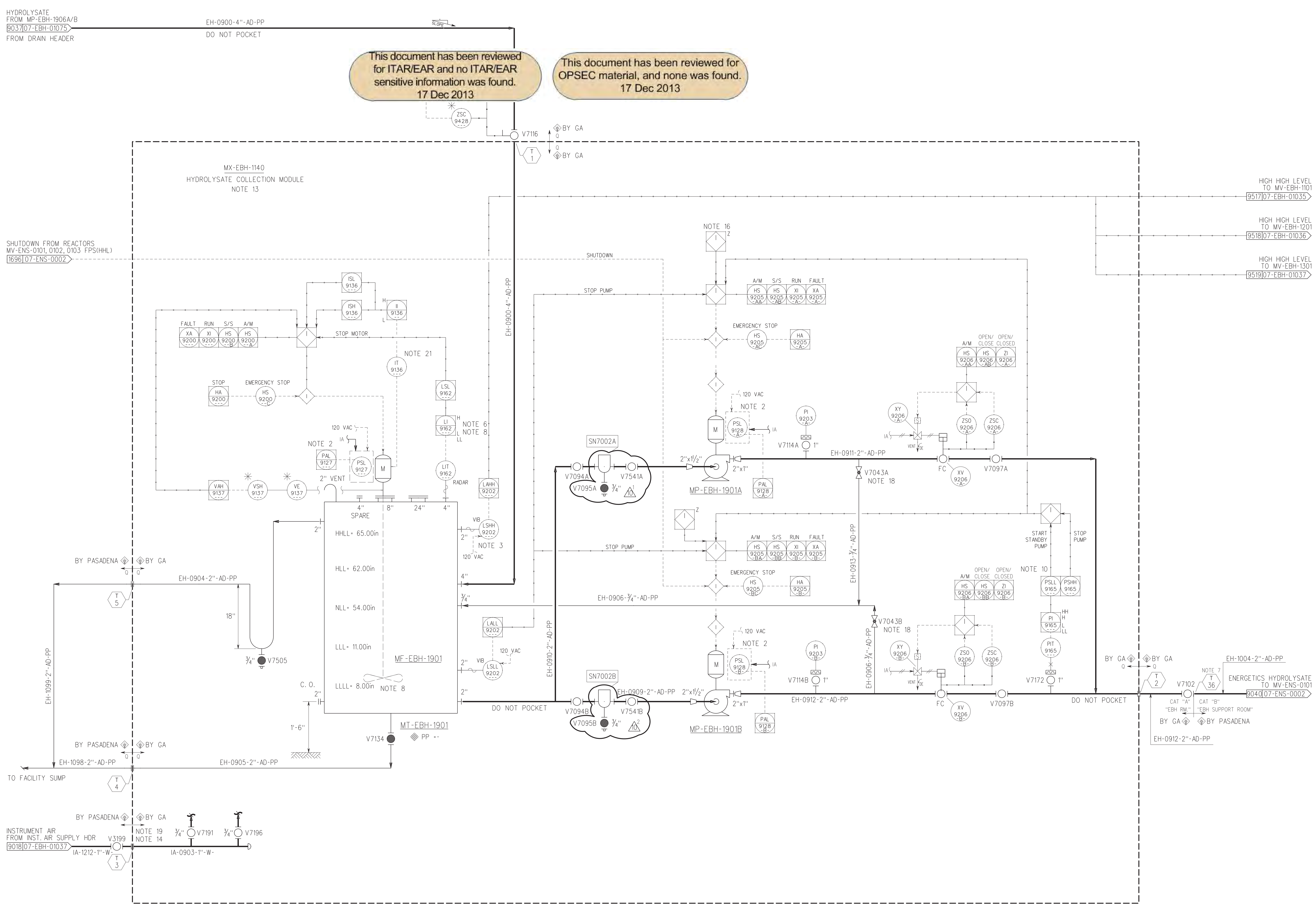
WORKING VOLUME	: 889 GAL
DIAMETER	: 82 IN
HEIGHT	: 76 IN
DESIGN PRESSURE	: ATM
DESIGN TEMPERATURE	: 275 °F
MATERIAL OF CONST	: UNS S32205
TRIM	: TRIM-0909-0"-AD-PP

MP-EBH-1901A/B
HYDROLYSATE TRANSFER PUMP

RATED FLOW	: 40 GPM
MOTOR HP	: 7.5 HP
RATED DELTA P	: 64 PSI
MATERIAL OF CONST	: UNS N 10276

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. MOTOR PURGE PANEL, TYPE Z.
3. HALT EBH DRAIN ON HIGH-HIGH TANK LEVEL.
6. EBH-1/2/3 DRUM UNLOAD CANNOT BEGIN UNLESS MT-EBH-1901 LIQUID LEVEL IS BELOW LOW LIQUID LEVEL SETPOINT.
7. PER ICD DOC. NO. 24915-07-B2-EBH-00012.
8. AGITATOR SHUTOFF WHEN LIQUID LEVEL DROPS TO 6 INCHES ABOVE AGITATOR BLADE.
10. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 10 SECONDS, THE "LEAD" PUMP WILL STOP.
    IF THE "STANDBY" PUMP DOES NOT REACH THE NORMAL SET POINT WITHIN ANOTHER 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP.
    IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR PRESSURE TO FALL BELOW NORMAL.
11. DENOTES DESIGN RESPONSIBILITY LABEL.
13. ELECTRICAL AREA CLASSIFICATION:
    CLASS 1
    DIVISION 2
    GROUP B
14. QUALITY LEVEL BOUNDARY FROM Q TO NON-Q REQUIRED AT THE END USER DEVICE WHEN THE END USER DEVICE IS Q.
16. REFER TO 24915-07-J3-FPS-00002, SHEET 1 FOR FPS SHUTDOWN LOGIC.
17. EQUIPMENT SHOWN IS LOCATED IN THE EBH ROOM, CATEGORY "A" AREA.
18. MINIMUM FLOW VALVES TO BE LOCKED TO PREVENT FULL OPENING.
19. INSTRUMENT AIR LINES ARE 'NON-Q'.
20. HIGH POINT VENT VALVES AND LOW POINT DRAIN VALVES ARE SW VALVES. OPEN ENDS ARE CAPPED RATHER THAN PLUGGED.
21. CURRENT TRANSMITTER LOCATED IN MCC.
22. NOTES 4, 5, 9, 12 AND 15 HAVE BEEN DELETED.

BASED ON BLUE GRASS PFD 24915-07-M5-EBH-00001

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
10		IFC (INCORP. DCN-216)	NL	CA	KM	NW	VN
9	04/27/10	IFC (INCORP. AS-BUILT MODULE CHANGES)	NL	CA	KM	NW	VN
8	01/15/09	IFC (INCORP. VENDOR DATA & GOV'T COMMENTS)	NL	CA	KM	NW	VN
7	07/03/07	IFC (SHEET REDRAWN - INCORP. DESIGN DEVELOPMENT)	NL	CA	KM	NW	VN
6	12/20/06	ISSUED FOR CONSTRUCTION (INCORP. INT. DESIGN COMMENTS)	NL	CA	KM	NW	VN
5	05/03/06	ISSUED FOR DESIGN (INCORPORATES COMMENTS)	EM	KM	RB	NW	VN
4	02/07/06	ISSUED FOR DESIGN	EM	CA	DG	NW	VN
3	08/19/05	ISSUED FOR APPROVAL - DC#43B	EM	CA	DG	NW	VN
2	01/21/05	ISSUED FOR DESIGN	EM	CA	BW	NW	VN
1	01/03/05	ISSUED FOR DESIGN	EM	CA	BW	NW	VN
0	11/18/04	ISSUED FOR DESIGN	EM	CA	BW	NW	VN

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH HYDROLYSATE COLLECTION PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-EBH-01085 SHEET 1 OF 1 REV 10

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

RCM Apvd

cn=Issued By Norbil Espiritu, o=General Atomics, ou=Configuration Management, email=norbil.espiritu@ga.com, c=US
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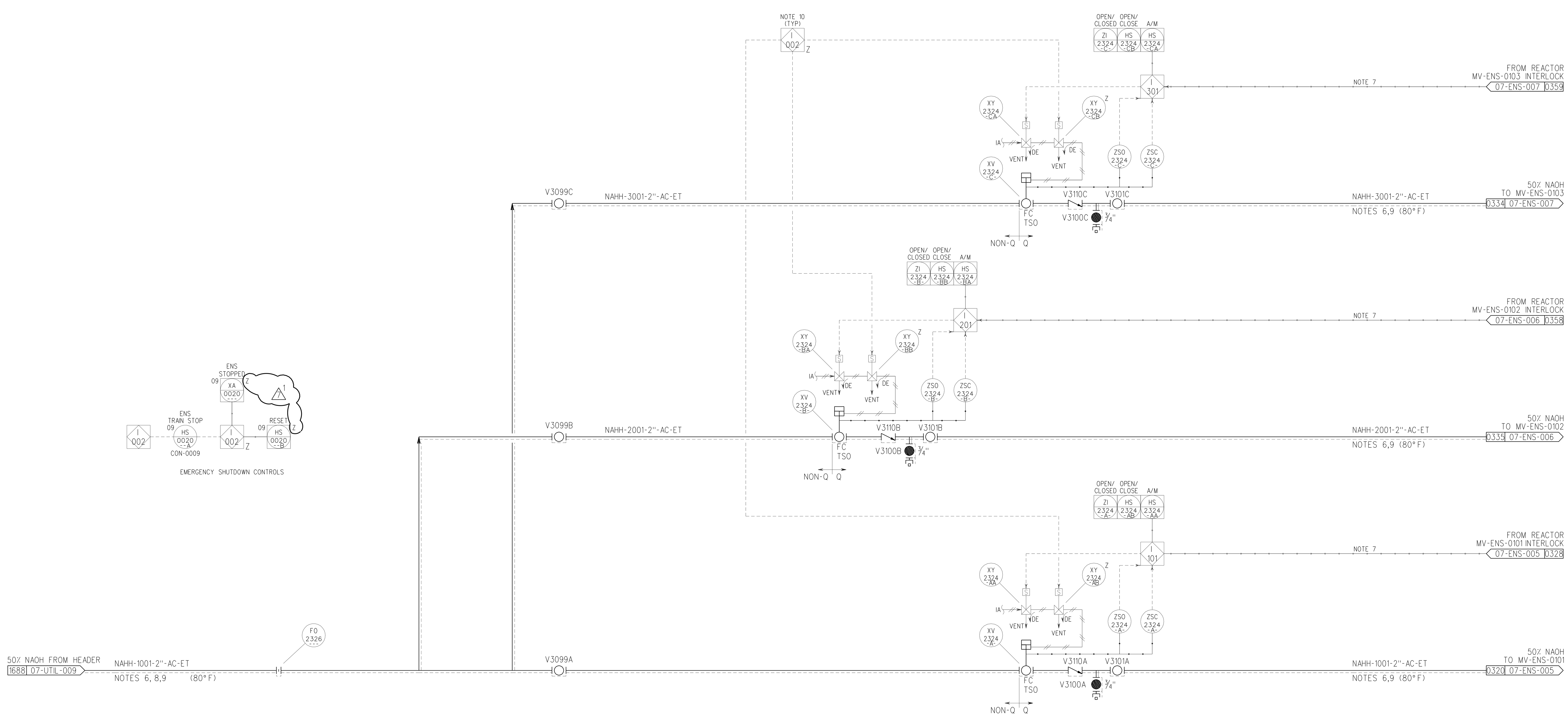
This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. THERE ARE THREE ENERGETICS NEUTRALIZATION REACTORS. ONLY ONE ENR IS FILLING AT A TIME OR ONLY ONE ENR IS DRAINING AT A TIME.
6. PIPING TO BE STRESS RELIEVED.
7. ON ENERGETICS NEUTRALIZATION REACTOR HIGH-HIGH LEVEL; OR HIGH-HIGH TEMPERATURE, OR ENERGETICS NEUTRALIZATION REACTOR RECIRCULATION LOW FLOW, OR ENR AGITATOR SHUTDOWN: CAUSTIC FEED VALVES XV-2324-A-/-B-/-C- WILL BE CLOSED.
8. 50% NaOH IS ADDED IN THE EVENT OF TWO POSITIVE TEST RESULTS FOR AGENT OR ENERGETICS FROM THE SAMPLING SYSTEM.
9. ~~50% CAUSTIC LINE TO BE ELECTRIC TRACED TO MAINTAIN THE TEMPERATURE AT 80°F~~ INDEPENDENT DUAL HEAT TRACE TAPE AND CONTROLS REQUIRED FOR 50% CAUSTIC LINES (NAHH).
10. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-ENS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".



BASED ON BLUE GRASS MSD 24915-07-N0-ENS-00001 REV. 5

BASED ON BLUE GRASS PFD 24915-07-M5-ENS-00001 REV. 8

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
7	06/22/11	IFC, INCORPORATED DCR-200, HTL-6124, I&C COMMENTS	JDC	PEB	SA	BBB	BBB
6	01/23/09	IFC, GOV. COMMENT 7691, ADD INST. INTERLOCK	PEB	JLL	BM	BBB	BBB
5	05/08/07	IFC, ADD INSTRUMENTATION ACTION	SF	JLL	PEB	JB	BBB
4	09/21/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	SF	JLL	PEB	JB	BBB
3	05/02/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	SF	JLL	PEB	JB	BBB
2	10/31/05	IFD ADD DESIGN DEVELOPMENT	HT	JLL	PEB	JB	PGK
1	10/03/05	ISSUED FOR APPROVAL (IFA)	HT	JLL	PEB	JB	JU
0	11/29/04	ISSUED FOR DESIGN (IFD)	FA	JLL	PEB	JB	JU

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL. ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING ENR FEED 50% CAUSTIC PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-ENS-00001

SHEET 1 OF 1 REV 7

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07MENS001.pid 06/23/11
DESIGN FILE: DGNSPEC$$
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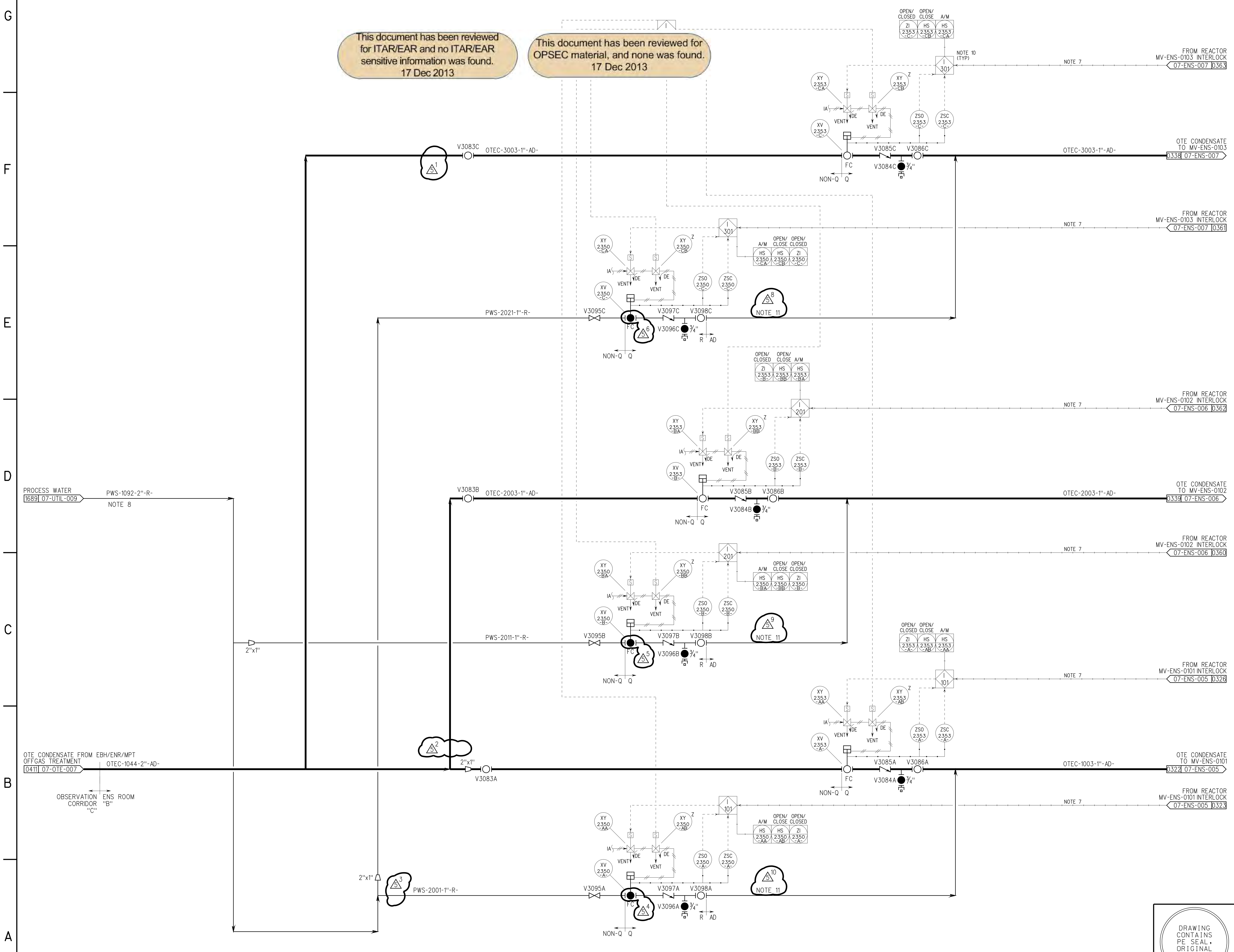
GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. THERE ARE THREE NEUTRALIZATION REACTORS, ONLY ONE ENR IS FILLING AT A TIME OR ONLY ONE ENR IS DRAINING AT A TIME.
6. DELETED.
7. ON ENERGETICS NEUTRALIZATION REACTOR HIGH-HIGH LEVEL; OR HIGH-HIGH TEMPERATURE, OR ENERGETICS NEUTRALIZATION REACTOR RECIRCULATION LOW FLOW, OR ENR AGITATOR SHUTDOWN: FEED VALVES XV-2353-A-/-B-/-C- AND XV-2350-A/-B/-C WILL BE CLOSED.
8. PROCESS WATER TO BE USED FOR MAINTENANCE ONLY, DURING WHICH THE RESPECTIVE OTE CONDENSATE ISOLATION VALVE (XV-2353-A-/-B-/-C-) WILL BE CLOSED AND THE PROCESS WATER VALVE (XV-2350-A-/-B-/-C-) WILL BE OPENED.
9. VALVES SHALL BE INTERLOCKED SO THAT ONLY THE PROCESS WATER VALVE OR THE OTE CONDENSATE VALVE TO A GIVEN REACTOR CAN BE OPEN AT THE SAME TIME.
10. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-ENS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
11. REACTOR CIRCULATION LOOP TO BE DRAINED AND FLUSHED UPON COMPLETION OF A BATCH CYCLE. 5 7



5	05/08/07	ISSUED FOR CONSTRUCTION (IFC), ADDING PIPING MARKS	SF	JLL	PEB	JB	BBB
4	09/21/06	IFD, ADD GOVT COMMENT, DESIGN DEVELOPMENT	SF	JLL	PEB	JB	BBB
3	05/02/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	SF	JLL	PEB	JB	BBB
2	10/31/05	IFD ADD DESIGN DEVELOPMENT	HT	JLL	PEB	JB	PGK
1	10/03/05	ISSUED FOR APPROVAL (IFA)	HT	JLL	PEB	JB	JU
0	11/29/04	ISSUED FOR DESIGN (IFD)	FA	JLL	PEB	JB	JU
NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD

QUALITY ☒ Q ☒ Non-Q

BASED ON BLUE GRASS PFD 24915-07-M5-ENS-00001 REV.6
BASED ON BLUE GRASS MSD 24915-07-NO-ENS-00001 REV.5

REFERENCE DRAWINGS

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE

PROFESSIONAL STAMP

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)

RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING ENR FEED OTE CONDENSATE PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-ENS-00025 SHEET 1 OF 1 REV 5

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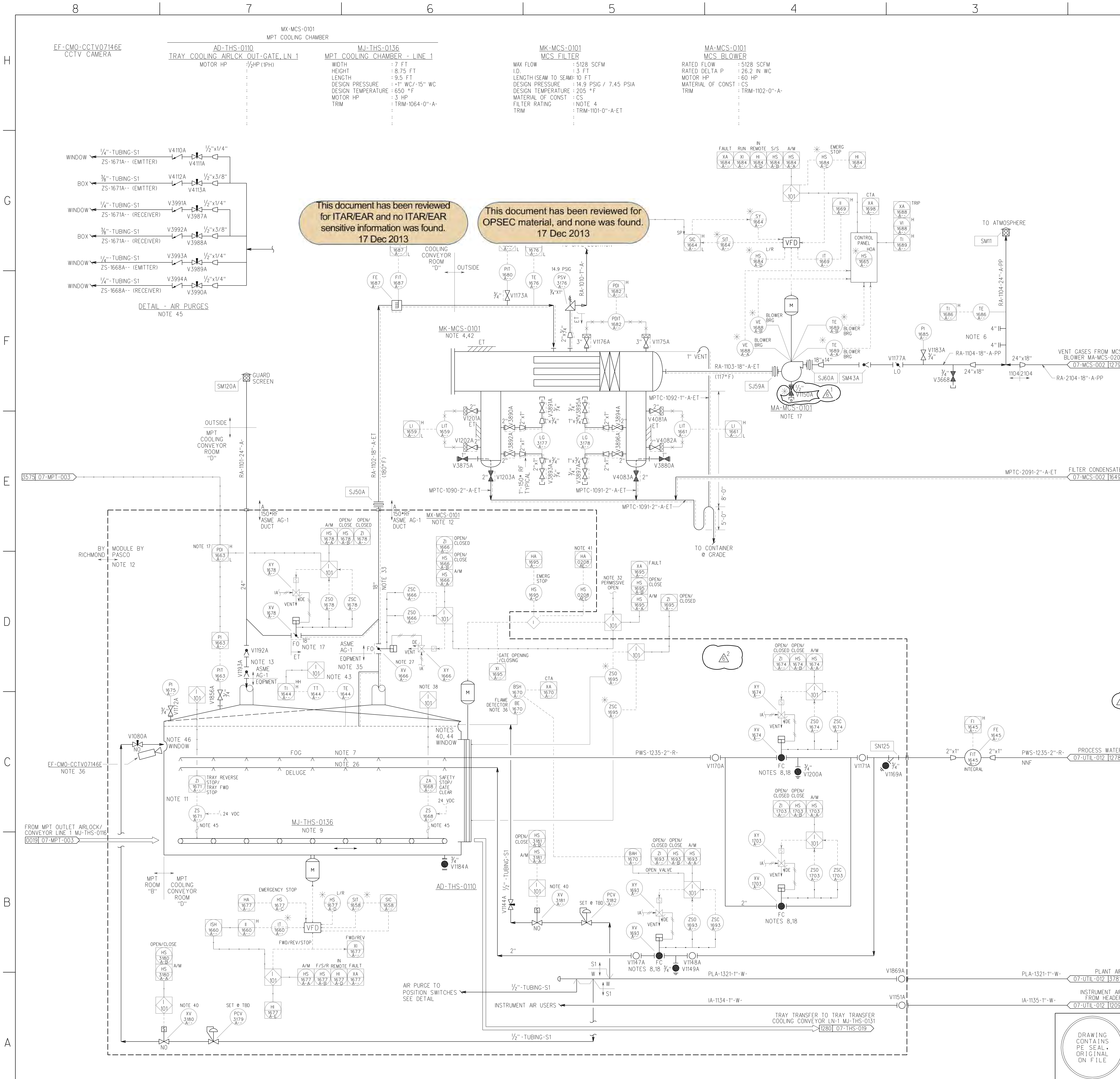


GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. PARTICULATE FILTERS ARE TO REMOVE PARTICLES 1 MICRON AND LARGER.
5. DELETED.
6. SAMPLE CONNECTIONS ARE AT SAME PLANE, 90° APART.
7. SEVENTEEN (17) FOG TYPE NOZZLES ARE TO BE USED. EACH NOZZLE IS TO BE A BETE PJ40 ¼" NPT OR EQUAL, AND SHALL HAVE A CAPACITY OF 0.44 GPM AT 100 PSIG. THE NOZZLES ARE TO BE PROVIDED AS DETAILED IN DRAWING 24915-07-MJ-MPT-00108. THE WATER IS SHUT OFF WHEN THERE IS NO TRAY IN THE CHAMBER.
8. LOCATE XV-1674A--, XV-1703A-- AND XV-1693A-- AS CLOSE TO CHAMBER AS POSSIBLE.
9. INLET PLENUM HAS 2 SPLITTER VANES. TOTAL AREA OF OUTLET IS 2 FT HEIGHT X 5 FT LONG.
10. DELETED.
11. CONNECT INLET END OF COOLING CHAMBER DIRECTLY TO OUTLET AIRLOCK OUT-GATE AND WALL.
12. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE PHYSICALLY LOCATED ON MODULE AND ARE DESIGNED, PROCURED AND FABRICATED BY PASCO.
13. CHECK VALVES ARE LOW CRACKING PRESSURE TYPE FLANGED. REMOVE INTERNALS TO ALLOW CASCADE AIR FLOW FROM COOLING CHAMBER TO OUTLET AIRLOCK.
14. DELETED.
15. DELETED.
16. DELETED.
17. BLOWER MA-MCS-0101 WILL CONTINUE TO OPERATE WHEN THE TRAY IS BEING MOVED FROM THE OUTLET AIRLOCK TO THE MPT COOLING CHAMBER. WHEN THE MPT OUTLET AIRLOCK OUT-GATE, AD-MPT-0104, IS CLEARED TO OPEN, THE COOLING CHAMBER AIR BYPASS VALVE IS OPENED, THE OUT-GATE IS OPENED AND TRAY IS TRANSFERRED TO THE MPT COOLING CHAMBER. WHEN THE TRANSFER OPERATION IS COMPLETE, THE OUT-GATE IS CLOSED, THE AIR BYPASS VALVE IS CLOSED AND THE COOLING FLOW BEGINS.
18. WATER SPRAY CAN NOT OPERATE IF MPT OUTLET AIRLOCK OUT-GATE IS OPEN.
19. DELETED.
20. DELETED.
21. DELETED.
22. DELETED.
23. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-MCS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
24. DELETED.
25. MULTIPLE BLOWER PARAMETERS AVAILABLE ON MULTI-FUNCTION DISPLAY.
26. SIX (6) DELUGE TYPE NOZZLES ARE TO BE USED. EACH NOZZLE IS TO BE A BETE ⅜" WL3 OR EQUAL, AND SHALL HAVE A CAPACITY OF 4.61 GPM AT 100 PSIG. THE NOZZLES ARE TO BE PROVIDED AS DETAILED IN DRAWING 24915-07-MJ-MPT-00107. THE WATER IS SHUT OFF UNLESS A FLAME IS DETECTED.
27. ADD MINIMUM FLOW STOP TO XV-1666A-- TO ALLOW THE N2 PURGE FROM THE OUTLET AIRLOCK TO BE REMOVED AS THE TRAY IS TRANSFERRED.
28. DELETED.
29. DELETED.
30. DELETED.
31. DELETED.
32. TRAY COOLING AIRLOCK OUT-GATE TO BE INTERLOCKED CLOSED IF MPT OUTLET AIRLOCK OUT-GATE IS OPEN.
33. OUTLET LINE ELECTRIC TRACING IN FIELD, DESIGN BY RICHMOND.
34. DELETED.
35. HIGH POINT VENT TO REMOVE ACCUMULATED PROCESS GASES.
36. FLAME DETECTOR CAN ONLY BE OPERATED WHEN FOG NOZZLES ARE NOT IN OPERATION.
37. DELETED.
38. TRAY COOLING AIRLOCK OUT-GATE CANNOT BE CLOSED UNLESS ZA-1668A-- INDICATES TRAY IS CLEAR OF DOOR.
39. DELETED.
40. WHEN THE TRAY IS TRANSFERRED IN THE COOLING CHAMBER (OPEN-GATE), THE AIR PURGE SOV'S FOR CAMERA AND FLAME DETECTOR ARE TO BE OPENED. THE PURGE VALVE IS TO BE CLOSED AFTER TRAY IS TRANSFERRED OUT OF THE COOLING CHAMBER (TBD TIME DELAY).
41. EMERGENCY STOP PUSH BUTTON ON FLEXIBLE CORD IS PROVIDED IN THE MPT COOLING CONVEYOR ROOM.
42. SUMP SIZES ARE 12" DIAMETER x 30" LONG AND 16" DIAMETER x 30" LONG.
43. HIGH-HIGH TEMPERATURE OF COOLING CHAMBER TEMPERATURE TI-1644A-- SHALL OPEN FOGGING VALVE XV-1674A--
44. PLANT AIR PURGE TO INSIDE OF WINDOW (PURGE AIR INTO CHAMBER).
45. PLANT AIR PURGE TO THE POSITION SWITCH WINDOWS. DETAIL SHOWN IN "DETAIL AIR PURGES".
46. AIR PURGE TO DOME SHAPED WINDOW. VENT AIR TO ROOM.
47. DELETED.

BASED ON BLUE GRASS PFD 24915-07-M5-MCS-00001 REV.1
BASED ON BLUE GRASS MSD 24915-07-NO-MCS-00001 REV.0
REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
6	08/16/12	IFC, INCORPORATED DCN-959	PEB	JAW	SA	KMR	KMR
5	04/30/12	IFC, INCORPORATED DCN-620, -673 AND -736	MBH	PEB	SA	KMR	KMR
4	02/24/11	IFC, INCORPORATED DCN-111, 112, 114, 138, GC-8172	PEB	BM	SA	BBB	BBB
3	03/11/09	IFC, PER DCN-77, 86, HTL-1623, ELEC COMMTS, CAD ERR	JLL	PEB	BM	BBB	BBB
2	09/25/08	IFC, REVISED PER DCN-00024, 43, 46, 54, 58	PEB	REB	BM	BBB	BBB
1	08/02/07	ISSUED FOR CONSTRUCTION (IFC), PASCO COMMENTS	JSM	JLL	PEB	JB	BBB
0	08/28/06	IFD, ADD GOV COMMENTS, HAZOP, DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

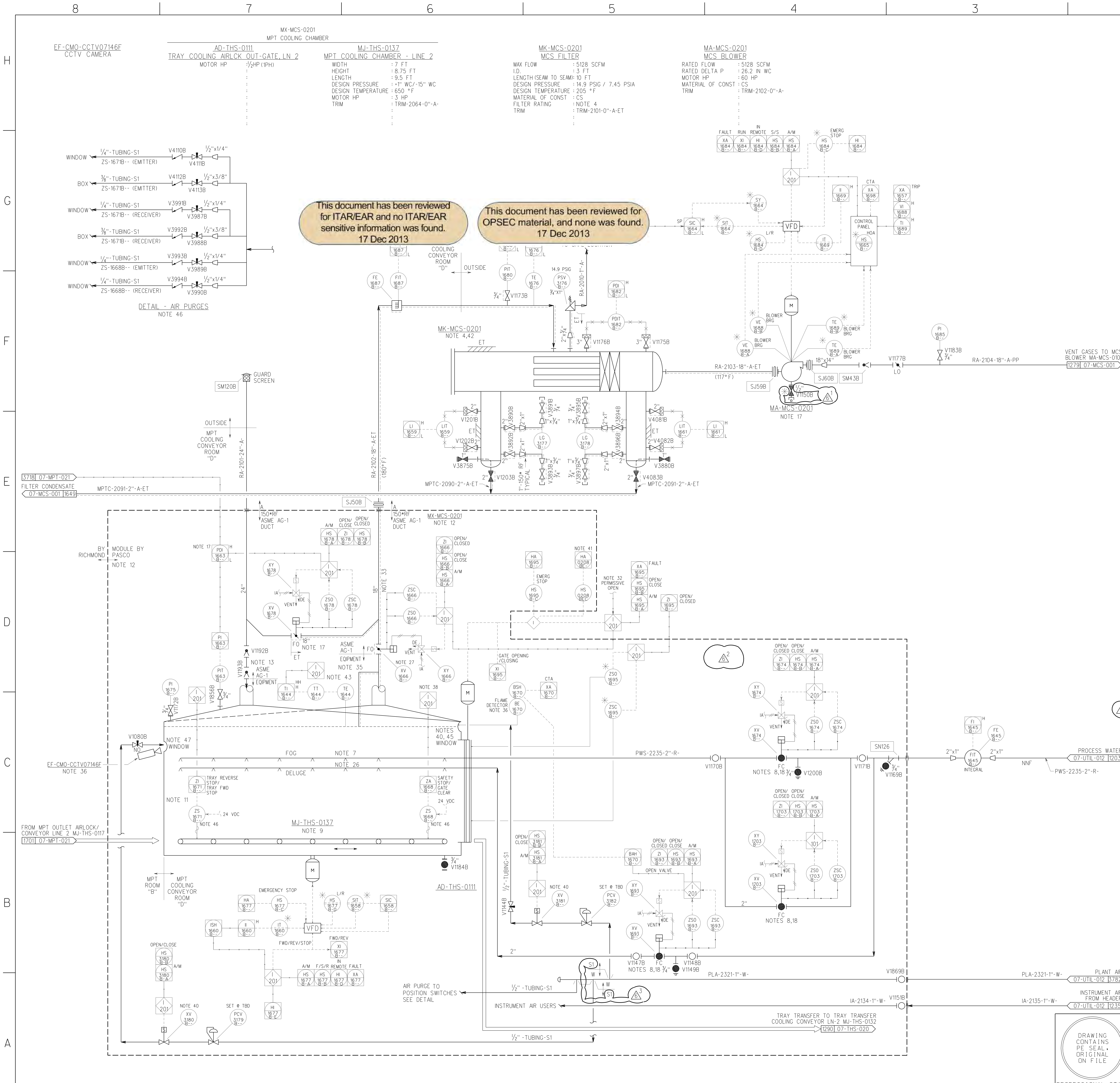
MUNITIONS DEMILITARIZATION BUILDING
MPT COOLING SYSTEM - LINE 1
PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-MCS-00001 | SHEET 1 OF 1 | REV 6

BGCAPP_DGN.BDR

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. PARTICULATE FILTERS ARE TO REMOVE PARTICLES 1 MICRON AND LARGER.
5. DELETED.
6. DELETED.
7. SEVENTEEN (17) FOG TYPE NOZZLES ARE TO BE USED. EACH NOZZLE IS TO BE A BETE PJ40 1/4" NPT OR EQUAL, AND SHALL HAVE A CAPACITY OF 0.44 GPM AT 100 PSIG. THE NOZZLES ARE TO BE PROVIDED AS DETAILED IN DRAWING 24915-07-MJ-MPT-00189. THE WATER IS SHUT OFF WHEN THERE IS NO TRAY IN THE CHAMBER.
8. LOCATE XV-1674B--, XV-1703B-- AND XV-1693B-- AS CLOSE TO CHAMBER AS POSSIBLE.
9. INLET PLENUM HAS 2 SPLITTER VANES. TOTAL AREA OF OUTLET IS 2 FT HEIGHT X 5 FT LONG.
10. DELETED.
11. CONNECT INLET END OF COOLING CHAMBER DIRECTLY TO OUTLET AIRLOCK OUT-GATE AND WALL.
12. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE PHYSICALLY LOCATED ON MODULE AND ARE DESIGNED, PROCURED AND FABRICATED BY PASCO.
13. CHECK VALVES ARE LOW CRACKING PRESSURE TYPE FLANGED. REMOVE INTERNALS TO ALLOW CASCADE AIR FLOW FROM COOLING CHAMBER TO OUTLET AIRLOCK.
14. DELETED.
15. DELETED.
16. DELETED.
17. BLOWER MA-MCS-0201 WILL CONTINUE TO OPERATE WHEN THE TRAY IS BEING MOVED FROM THE OUTLET AIRLOCK TO THE MPT COOLING CHAMBER. WHEN THE MPT OUTLET AIRLOCK OUT-GATE, AD-MPT-0204, IS CLEARED TO OPEN, THE COOLING CHAMBER AIR BYPASS VALVE IS OPENED, THE OUT-GATE IS OPENED AND TRAY IS TRANSFERRED TO THE MPT COOLING CHAMBER. WHEN THE TRANSFER OPERATION IS COMPLETE, THE OUT-GATE IS CLOSED, THE AIR BYPASS VALVE IS CLOSED AND THE COOLING FLOW BEGINS.
18. WATER SPRAY CAN NOT OPERATE IF MPT OUTLET AIRLOCK OUT-GATE IS OPEN.
19. DELETED.
20. DELETED.
21. DELETED.
22. DELETED.
23. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-MCS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
24. DELETED.
25. MULTIPLE BLOWER PARAMETERS AVAILABLE ON MULTI-FUNCTION DISPLAY.
26. SIX (6) DELUGE TYPE NOZZLES ARE TO BE USED. EACH NOZZLE IS TO BE A BETE 3/8" WL3 OR EQUAL, AND SHALL HAVEA CAPACITY OF 4.61 GPM AT 100 PSIG. THE NOZZLES ARE TO BE PROVIDED AS DETAILED IN DRAWING 24915-07-MJ-MPT-00107. THE WATER IS SHUT OFF UNLESS A FLAME IS DETECTED.
27. ADD MINIMUM FLOW STOP TO XV-1666B-- TO ALLOW THE N2 PURGE FROM THE OUTLET AIRLOCK TO BE REMOVED AS THE TRAY IS TRANSFERRED.
28. DELETED.
29. DELETED.
30. DELETED.
31. DELETED.
32. TRAY COOLING AIRLOCK OUT-GATE TO BE INTERLOCKED CLOSED IF MPT OUTLET AIRLOCK OUT-GATE IS OPEN.
33. OUTLET LINE ELECTRIC TRACING IN FIELD, DESIGN BY RICHMOND.
34. DELETED.
35. HIGH POINT VENT TO REMOVE ACCUMULATED PROCESS GASES.
36. FLAME DETECTOR CAN ONLY BE OPERATED WHEN FOG NOZZLES ARE NOT IN OPERATION.
37. DELETED.
38. TRAY COOLING AIRLOCK OUT-GATE CANNOT BE CLOSED UNLESS ZA-1668B-- INDICATES TRAY IS CLEAR OF DOOR.
39. DELETED.
40. WHEN THE TRAY IS TRANSFERRED IN THE COOLING CHAMBER (OPEN-GATE), THE AIR PURGE SOV'S FOR CAMERA AND FLAME DETECTOR ARE TO BE OPENED. THE PURGE VALVE IS TO BE CLOSED AFTER TRAY IS TRANSFERRED OUT OF THE COOLING CHAMBER (TBD TIME DELAY).
41. EMERGENCY STOP PUSH BUTTON ON FLEXIBLE CORD IS PROVIDED IN THE MPT COOLING CONVEYOR ROOM.
42. SUMP SIZES ARE 12" DIAMETER x 30" LONG AND 16" DIAMETER x 30" LONG.
43. HIGH-HIGH TEMPERATURE OF COOLING CHAMBER TEMPERATURE TI-1644B-- SHALL OPEN FOGGING VALVE XV-1674B--.
44. DELETED.
45. PLANT AIR PURGE TO INSIDE OF WINDOW (PURGE AIR INTO CHAMBER).
46. PLANT AIR PURGE TO THE POSITION SWITCH WINDOWS. DETAIL SHOWN IN "DETAIL AIR PURGES".
47. AIR PURGE TO DOME SHAPED WINDOW VENT AIR TO ROOM.
48. DELETED.

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-07-M5-MCS-00001 REV.1
BASED ON BLUE GRASS MSD 24915-07-N0-MCS-00001 REV.0

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
6	08/16/12	IFC, INCORPORATED DCN-959	PEB	JAW	SA	KMR	KMR
5	04/30/12	IFC, INCORPORATED DCN-620, -673 AND -736	MBH	PEB	SA	KMR	KMR
4	02/24/11	IFC, INCORPORATED DCN-111, 112, 114, 138, GC 8172	PEB	BM	SA	BBB	BBB
3	04/22/09	IFC, PER DCN-77, 86, HTL-1623, GC-8149, 8150	JLL	PEB	BM	BBB	BBB
2	09/25/08	IFC, REVISED PER DCN-00024, 43, 54	PEB	REB	BM	BBB	BBB
1	08/02/07	ISSUED FOR CONSTRUCTION (IFC), PASCO COMMENTS	JSM	JLL	PEB	JB	BBB
0	09/19/06	ISSUED FOR DESIGN (IFD)	JSM	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING MPT COOLING SYSTEM - LINE 2 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-MCS-00002 | SHEET 1 OF 1 | REV 6

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07MCS002.pid 08/28/12
DESIGN FILE: DGNSPEC
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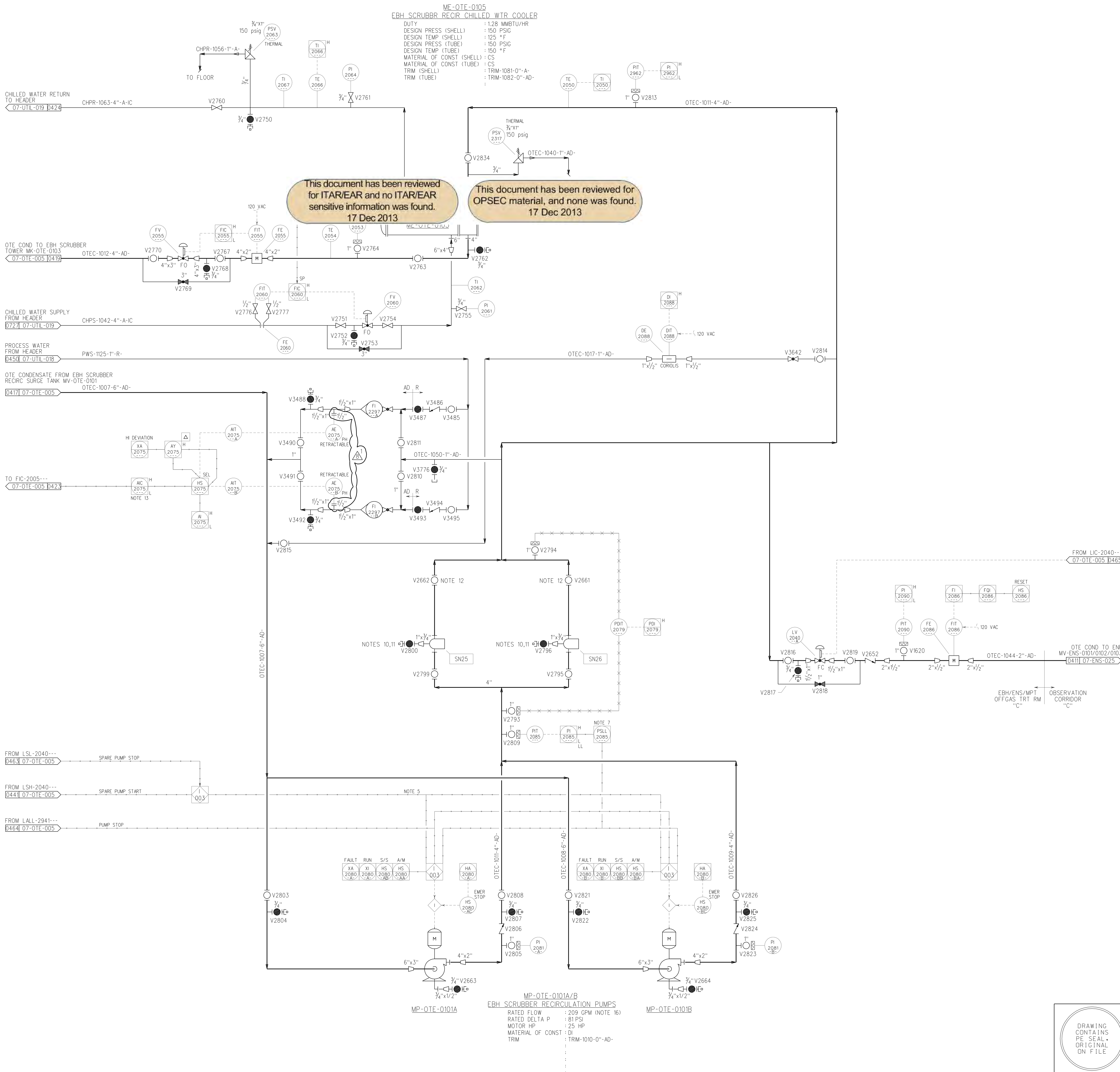

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. HLL WILL AUTOMATICALLY START SPARE PUMP. STOP SPARE PUMP ON LOW LIQUID LEVEL.
6. DELETED.
7. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW NORMAL FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. IF PRESSURE DOES NOT RETURN TO NORMAL WITHIN 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 10 SECONDS, THE "LEAD" PUMP WILL STOP. IF THE "LEAD" PUMP BECOMES DEENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR THE PRESSURE TO FALL BELOW NORMAL. DURING SYSTEMIZATION THE TIME REQUIREMENT MAY BE ADJUSTED AS NECESSARY BASED ON EXPERIENCE.
8. DELETED.
9. DELETED.
10. LESSONS LEARNED ITEM ANWP1284ACS DUAL SIMPLEX FILTERS.
11. SELECT STRAINER MESH TO PROTECT SPRAY NOZZLES AT EBH SCRUBBER TOWER.
12. OUTLET VALVE OF CLEAN FILTER MUST BE OPENED BEFORE CLOSING OUTLET VALVE OF DIRTY FILTER.
13. ONE PH ANALYZER USED TO RESET FIC-2005--- VIA AIC-2075---, OTHER TO INDICATE ONLY.
14. DELETED.
15. DELETED.
16. PUMP CAPACITY INCLUDES 5 GPM FOR DENSITY METER DE-2088--- AND 5 GPM FOR pH ANALYZERS AE-2075--A, --B.
17. DELETED.
18. DELETED.
19. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-OTE-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-07-M5-OTE-00001 REV.9
BASED ON BLUE GRASS MSD 24915-07-N0-OTE-00001 REV.6

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
8 [1]	01/23/12	IFC, INCORPORATED DCN-465	JAW	PEB	SA	BBB	BBB
7 [3]	06/07/11	IFC, INCORPORATED DCN-366	JAW	PEB	SA	BBB	BBB
6 [4]	11/13/08	IFC, ADDED VENDOR DATA, MODEL REVIEW COMMENTS	PEB	JP	BM	BBB	BBB
5 [20]	05/16/07	ISSUED FOR CONSTRUCTION (IFC), TREND 139	JSM	JLL	PEB	JB	BBB
4 [23]	09/19/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
3 [13]	05/01/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
2 [13]	10/25/05	IFD ADD DESIGN DEVELOPMENTS, COMMENTS	JSM	JLL	PEB	JB	PGK
1 [26]	09/20/05	ISSUED FOR APPROVAL (IFA)	JSM	JLL	PEB	JB	JU

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING EBH SCRUBBER RECIRC PUMP PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-OTE-00007 | SHEET 1 OF 1 | REV 8

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07MOTE007.pid 02/03/12
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PLOTTED BY: USER$ ON DATE$$$$$$ AT SYTIME USING COLOR$$$$$$$$

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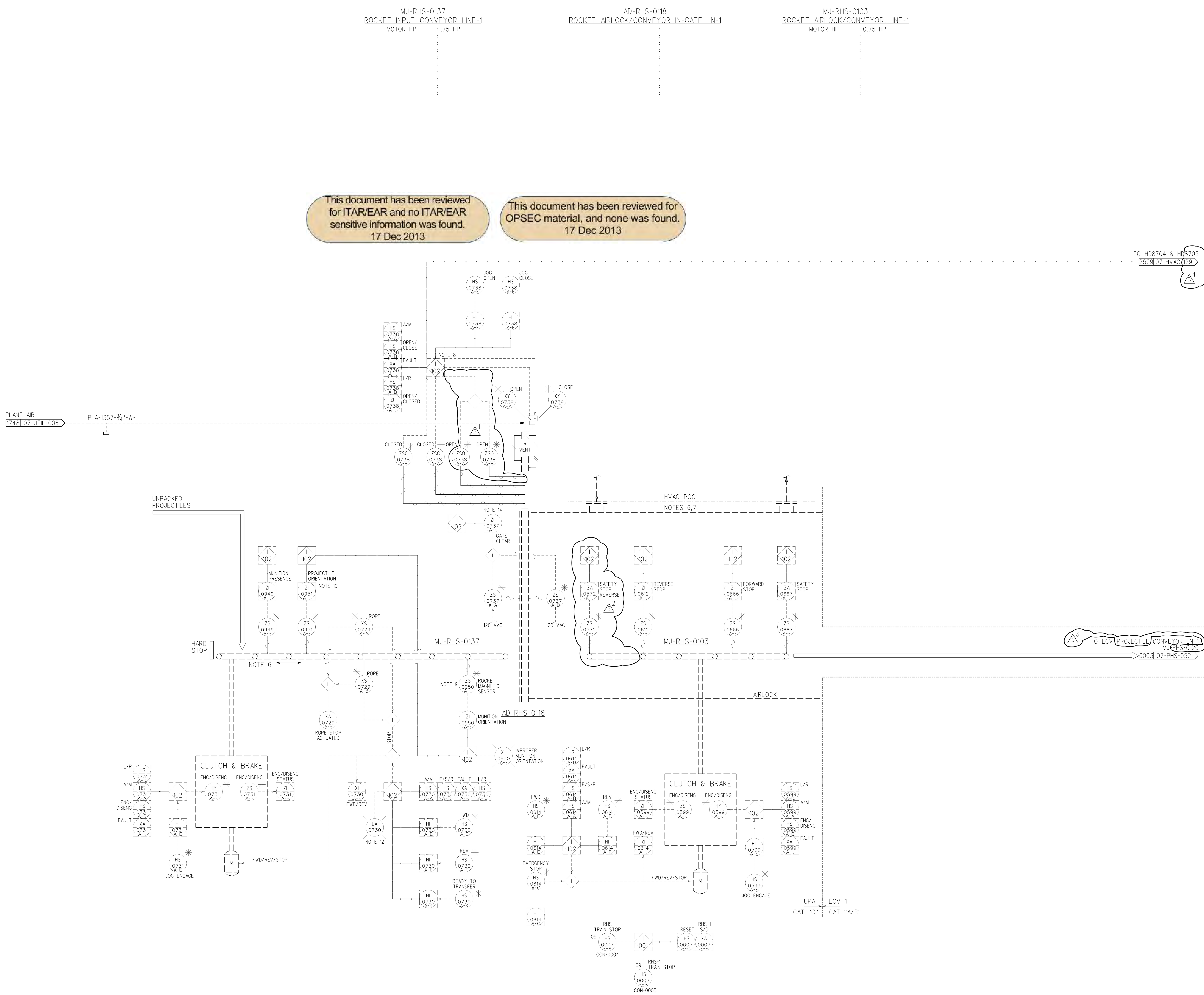
This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.
17 Dec 2013

This document has been reviewed for OPSEC material, and none was found.
17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. SEE P&ID 24915-07-M6-RHS-00051 FOR INSTRUMENT DETAILS.
6. EQUIPMENT SHOWN DOTTED AND ASSOCIATED INSTRUMENTS ARE ALSO SHOWN ON DRAWING 24915-07-M6-RHS-00051.
7. INSTRUMENTATION AND VALVING SHOWN ON HVAC DRAWING NUMBER 24915-07-M6-HVAC-00129.
8. INLET GATE AD-RHS-0118 SHALL BE INTERLOCKED WITH OUTLET GATE AD-RHS-0107. A TIMER PREVENTS INLET GATE FROM OPENING AFTER OUTLET GATE AD-RHS-0107 CLOSES UNTIL THE AIRLOCK HAS GONE THROUGH PROPER AIR CHANGES.
9. NOT USED DURING PROJECTILE CAMPAIGN.
10. PROJECTILE ORIENTATION SWITCH TO BE ENABLED DURING PROJECTILE CAMPAIGN
11. REVISIONS TO THIS DRAWING BY OPERATIONS AFTER IFC ISSUE SHOULD ALSO BE REFLECTED ON DRAWING 24915-07-M6-RHS-00051.
12. WARNING LIGHT IS INTERLOCKED TO TURN ON 10 SECONDS BEFORE CONVEYOR MOTOR STARTS AND TURN OFF WHEN MOTOR STOPS.
13. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-PHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
14. GATE CLEAR SWITCHES SHOWN ON AIRLOCK GATE ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.
15. BOTH ZSO SHALL BE WIRED IN SERIES. BOTH ZSO NEED TO BE ACTIVATED TO SHOW GATE OPENED POSITION.

BASED ON BLUE GRASS P&ID 24915-07-M6-PHS-00001 REV.0
REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	06/30/09	IFC,REVISED PER HTL-879,-881,CORRECTED DESTINATION	JLL	PEB	BM	BBB	BBB
4	02/14/07	IFC, CLARIFIED INSTR SUPP W/EQUIP, ADDED NOTE 14	RZ	JLL	PEB	JB	BBB
3	11/02/06	IFD, ADDED GOV COMMENTS AND INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
2	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
1	04/19/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPEMENT	RZ	JLL	PEB	JB	BBB
0	03/07/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING PROJECTILE INPUT CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-PHS-00051 SHEET 1 OF 1 REV 5

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07MPHS051.pid 07/02/09
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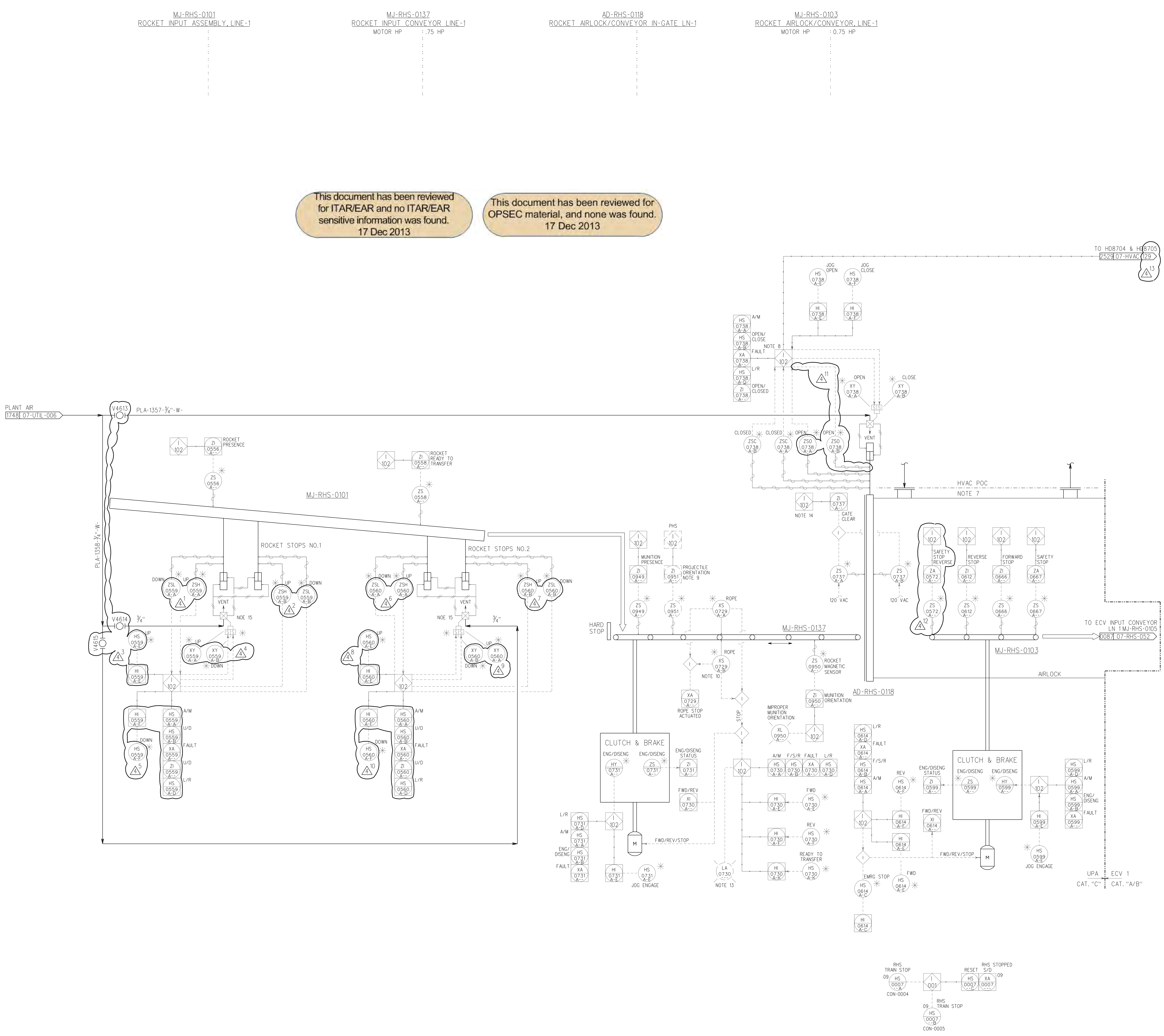

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELAY START WARNING DEVICES ARE PROVIDED ON ALL REMOTELY CONTROLLED CONVEYOR LINES AS SHOWN ON THE CONTROL SYSTEM INPUT/OUTPUT REPORT.
5. FOR CONVEYOR LAYOUT/LOCATION, SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
6. TRAIN STOP EMERGENCY PUSH BUTTONS DETAILS TO BE PROVIDED LATER.
7. INSTRUMENTATION AND VALVING SHOWN ON HVAC DRAWING NUMBER 24915-07-M6-HVAC-00129.
8. INLET GATE AD-RHS-0118 SHALL BE INTERLOCKED WITH OUTLET GATE AD-RHS-0107. A TIMER PREVENTS INLET GATE FROM OPENING AFTER OUTLET GATE AD-RHS-0107 CLOSES UNTIL THE AIRLOCK HAS GONE THROUGH PROPER AIR CHANGES.
9. PROJECTILE PRESENCE SWITCH ZS-0951A-- ALSO SHOWN ON DWG 24915-07-M6-PHS-00051 WILL BE INOPERABLE DURING ROCKET CAMPAIGN.
10. DURING THE ROCKET CAMPAIGN THE ROPE SWITCH ON THE WEST SIDE OF THE CONVEYOR SHALL BE DEACTIVATED.
11. DELETED.
12. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
13. WARNING LIGHT SHALL BE OPERATIONAL DURING PROJECTILE PROCESSING ONLY.
14. GATE CLEAR SWITCHES SHOWN ON AIRLOCK GATE ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.
15. 4-WAY DIRECTIONAL PNEUMATIC CONTROL VALVE, 3 POSITIONS, SOLENOID OPERATED, SPRING CENTERED, CENTER BLOCKED.

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.9
BASED ON BLUE GRASS P&ID 24915-07-M6-RHS-00001 REV.0
REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	08/11/09	IFC, ADD HTL-879/881, REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
3	02/14/07	IFC, CLAR INSTR SUPP W/EQUIP, REVISED ROCKET STOP	RZ	JLL	PEB	JB	BBB
2	11/07/06	IFD, ADDED GOV. COMMENTS AND ROCKET STOPS	RZ	JLL	PEB	JB	BBB
1	05/04/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	03/13/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING ROCKET PROCESSING SYSTEM DWG1-LN1 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00051 | SHEET 1 OF 1 | REV 4

BGCAPP_DGN.BDR

07MRHS051.pid 08/11/09
DESIGN FILE: DGNSPEC
PLOTTED BY: USER$ ON DATE$ AT SYTIME USING COLOR

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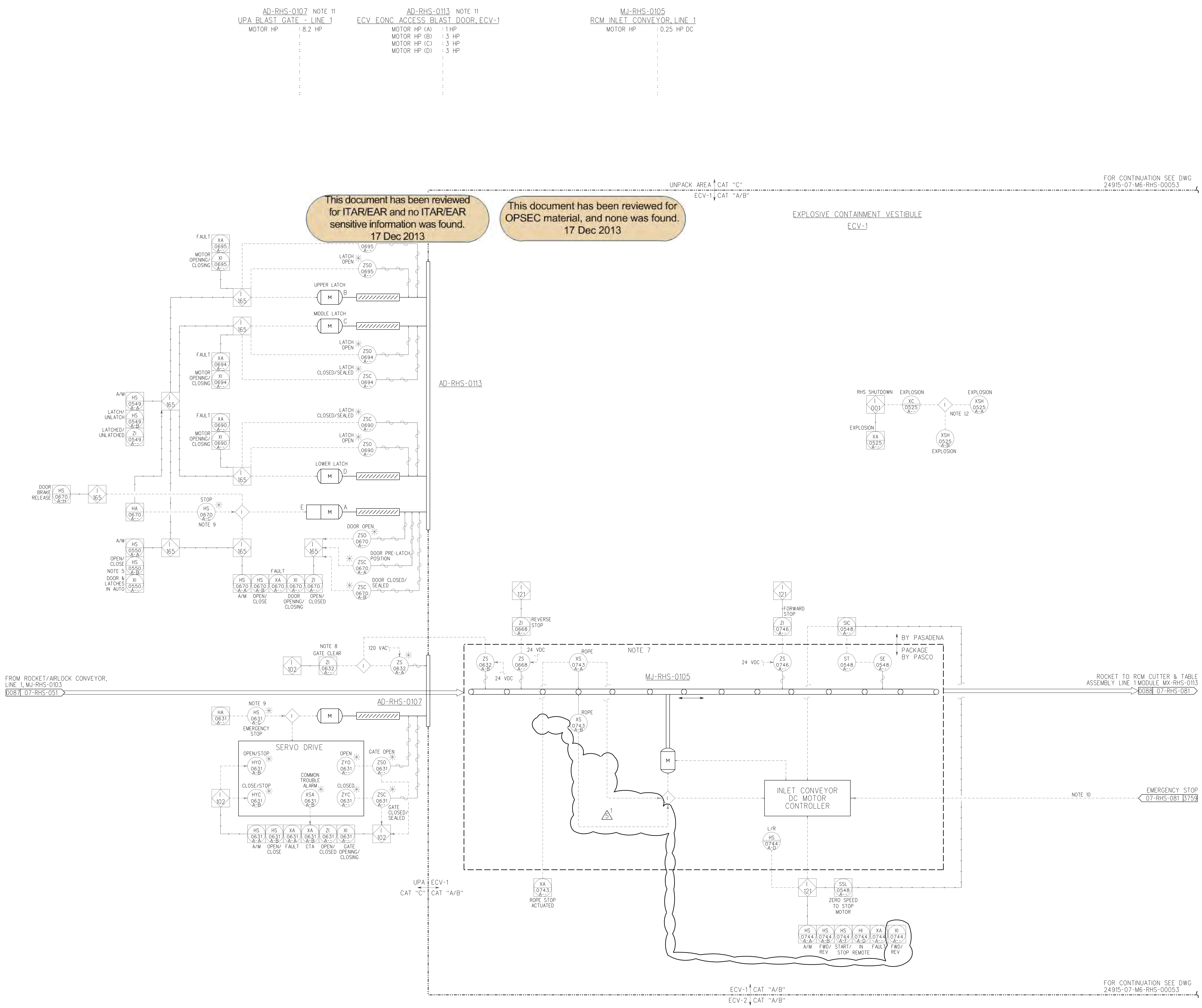

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. WHEN DOOR AND LATCHES ARE IN AUTO MODE, OPEN COMMAND SHALL UNLATCH AND OPEN THE DOOR AND CLOSE COMMAND SHALL CLOSE AND LATCH THE DOOR.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. ALL COMPONENTS INSIDE DASHED LINE WILL BE DESIGNED, PROCURED AND FABRICATED BY PASCO.
8. GATE CLEAR SWITCHES SHOWN ON BLAST GATE ARE PHYSICALLY LOCATED ON THE ADJACENT CONVEYORS.
9. EMERGENCY STOP SWITCHES SHALL BE PROVIDED BY THE GATE/DOOR VENDOR MOUNTED SEPARATELY IN A CONTROL BOX AND SHIPPED LOOSE TO BE INSTALLED IN THE FIELD.
10. ONE PANEL MOUNT EMERGENCY STOP PUSH BUTTON AND ONE REMOTE HANDHELD CONTROL WITH UMBILICAL CABLE ARE INSTALLED AT FIELD JUNCTION BOX EJ-FCS-TBF-6214.
11. BLAST GATE AD-RHS-0107 AND BLAST DOOR AD-RHS-0113 AND ALL ASSOCIATED INSTRUMENTS, MOTORS AND COMPONENTS ARE "Q".
12. EXPLOSION DETECTORS IN SERIES.

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.9

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	09/26/12	IFC, INCORPORATED DCN-302, -417	GM	JDC	SA	KMR	KMR
4	12/21/10	IFC, INCORPORATED DCR-135, DCN-163, -170, -214	PEB	MDV	SA	BBB	BBB
3	08/11/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
2	06/11/07	IFC, ADDED SERVO DRIVES & INTERLOCK NUMBERS	IT	JP	PEB	JB	BBB
1	11/07/06	IFD, INTERLOCK TAG NO. AND NOTE 7 ADDED	RZ	JLL	PEB	JB	BBB
0	03/13/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☒ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING ECV CONVEYOR DWG 1 - LINE 1 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00052 | SHEET 1 OF 1 | REV 5

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07MRHS052.pid 09/26/12
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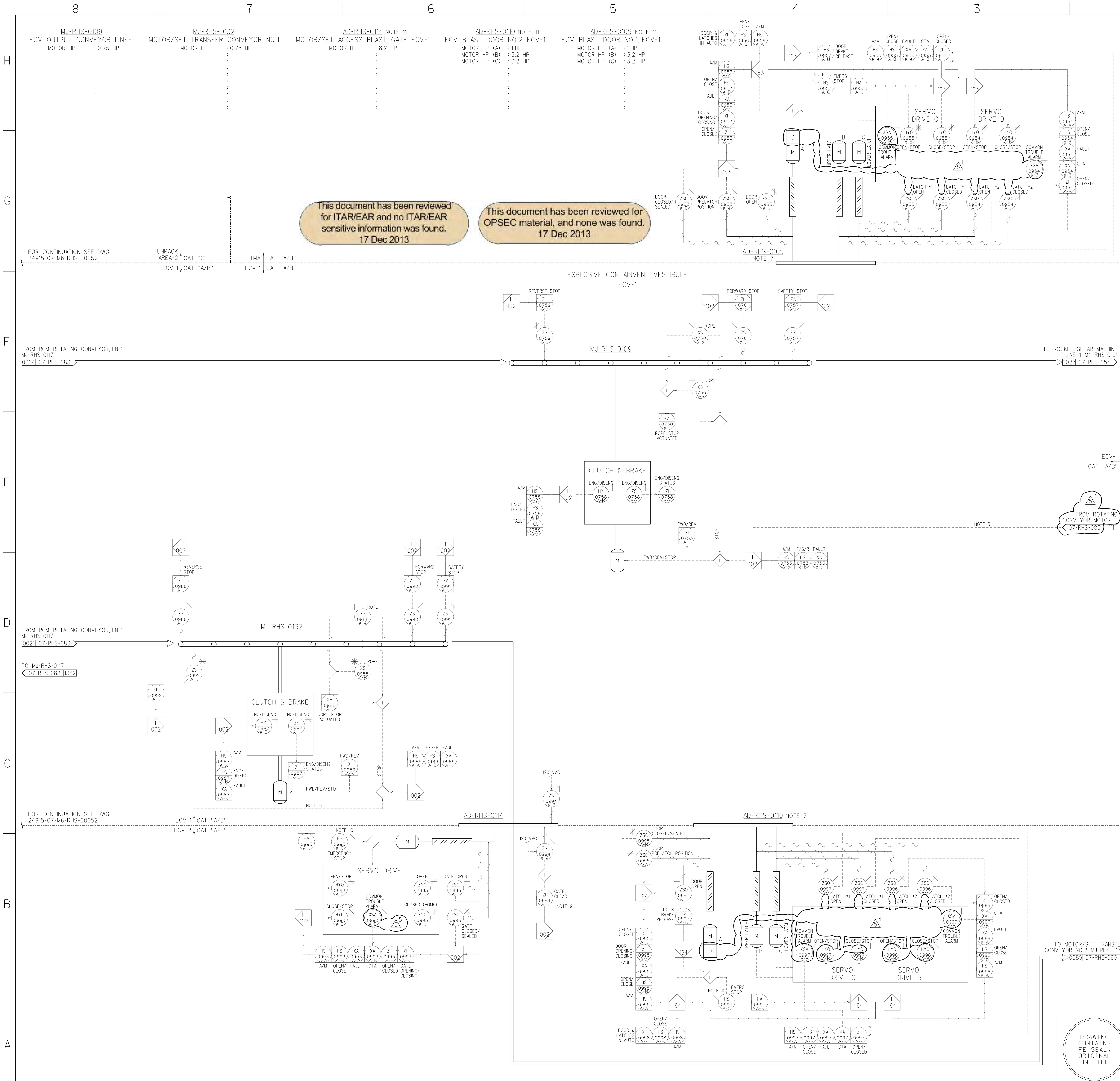
This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. CONVEYOR MJ-RHS-0109 MOTOR SHALL BE INTERLOCKED WITH SERVO ENCODER POSITION ON RCM ROTATING CONVEYOR (P&ID: 24915-07-M6-RHS-00083) TO PREVENT ITS MOTOR RUNNING IN REVERSE DIRECTION WHEN TURNTABLE MJ-RHS-0117 IS NOT IN NORTH-SOUTH ALIGNMENT. 5 2
6. CONVEYOR MJ-RHS-0132 MOTOR SHALL BE HARDWIRE INTERLOCKED WITH SWITCH ZS-0992A-- TO PREVENT ITS MOTOR RUNNING IN REVERSE (EAST) DIRECTION IF TURNTABLE MJ-RHS-0117 IS NOT AT EAST-WEST ORIENTATION.
7. WHEN DOOR AND LATCHES ARE IN AUTO MODE, OPEN COMMAND SHALL UNLATCH AND OPEN THE DOOR AND CLOSE COMMAND SHALL CLOSE AND LATCH THE DOOR.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
9. GATE CLEAR SWITCHES SHOWN ON BLAST GATE ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.
10. EMERGENCY STOP SWITCHES SHALL BE PROVIDED BY THE GATE/DOOR VENDOR MOUNTED SEPARATELY IN A CONTROL BOX AND SHIPPED LOOSE TO BE INSTALLED IN THE FIELD.
11. BLAST GATE AD-RHS-0114 AND BLAST DOORS AD-RHS-0109/0110 AND ALL ASSOCIATED INSTRUMENTS, MOTORS AND COMPONENTS ARE "Q".

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.9

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	12/21/10	IFC, INCORPORATED DCN-167, DCR-221,SDDR ADOH-10031	PEB	MDV	SA	BBB	BBB
4	08/11/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
3	02/14/07	IFC, ADDED INTERLOCK TAG NO AND NOTES 9,10	RZ	JLL	PEB	JB	BBB
2	11/07/06	IFD, INTERLOCK TAG NO. ADDED, SEE NOTE	RZ	JLL	PEB	JB	BBB
1	05/04/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	03/13/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☒ Q ☒ Non-Q

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US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING ECV CONVEYORS DWG 2 - LINE 1 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00053 | SHEET 1 OF 1 | REV 5

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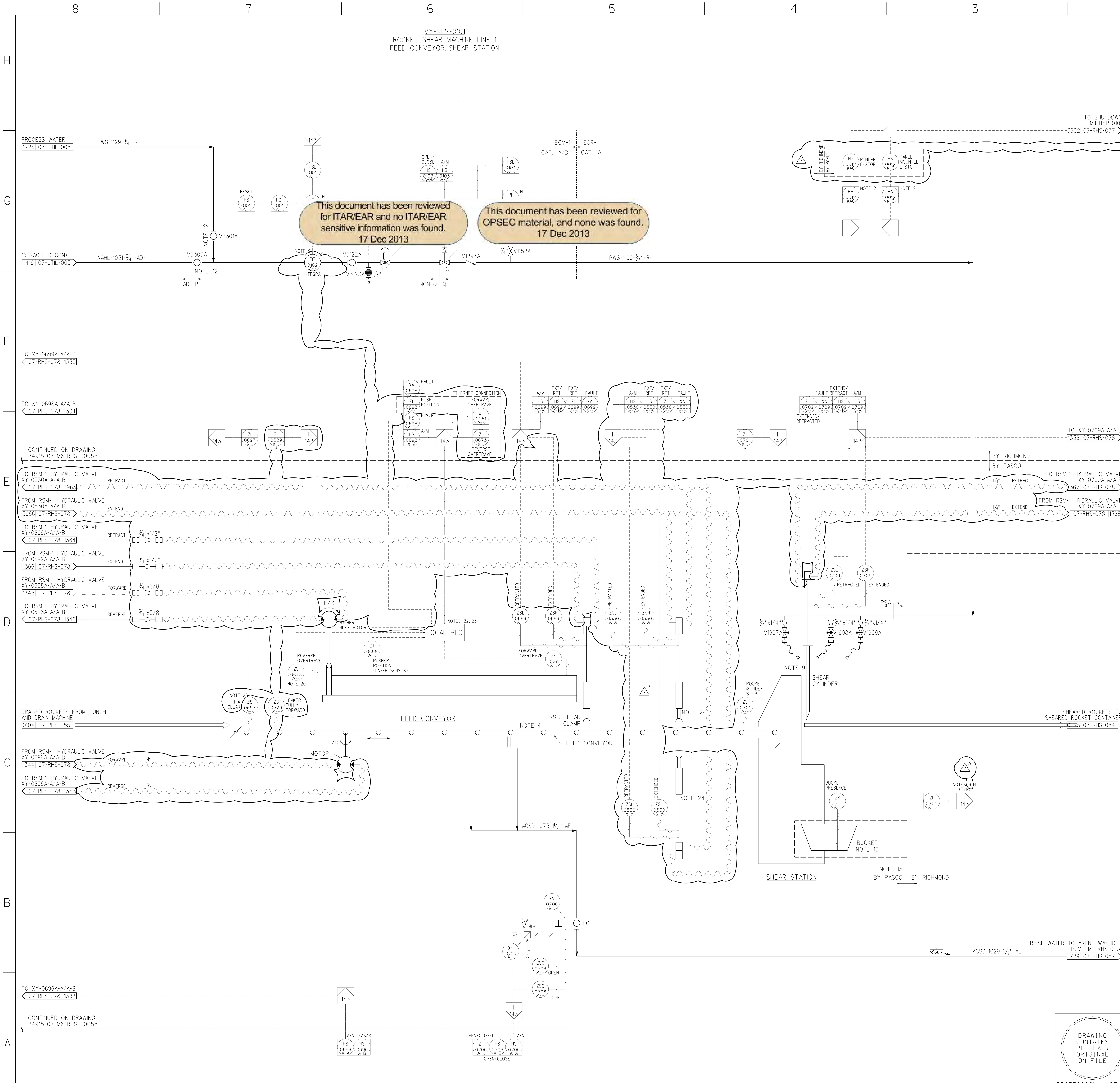

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. ROCKET INDEX STOP IS COMPRISED OF CYLINDERS TO LOCATE ROCKET FOR THE 1ST CUT (FUZE).
5. ISOLATION VALVE IS LOCATED ADJACENT TO ECR WALL. MINIMUM PIPING BETWEEN ECR WALL AND ISOLATION VALVE.
6. THE NUMBER OF ROCKETS IS COUNTED BY THE FCS AND ARCHIVED BY PDAR. THE COUNT IS INCREMENTED UPON COMPLETION OF THE SHEAR CYCLE. THE TOTALIZER IS DISABLED WHEN OPERATED MANUALLY.
7. DELETED.
8. FOR CONVEYOR LAYOUT/LOCATION, SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
9. SHEAR BLADE OPERATION SHALL BE INTERLOCKED WITH FIT-0102A-- AND BUCKET PRESENT SWITCH ZS-0705A--.
10. BUCKET PROVIDED BY GENERAL ATOMICS AND WILL BE REMOVED ROBOTICALLY.
11. DELETED.
12. 1% NAOH IS USED DURING THE GB CAMPAIGN, WATER IS USED DURING THE M55 VX CAMPAIGN.
13. DELETED.
14. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
15. DASHED LINE IS SCOPE LIMIT. DESIGN, PROCUREMENT AND FABRICATION INSIDE OF DASHED LINES ARE BY PASCO.
16. DOORS AND GATES ARE INTERLOCKED TO REMAIN CLOSED DURING HAZARDOUS OPERATION.
17. ONLY LINES ACSD-1075-1½"-AC, ACSD-1029-1½"-AE AND PWS-1199-3/4"-R ARE "Q" ON THIS DRAWING.
18. ALL HYDRAULIC LINES BETWEEN MANIFOLD AND HYDRAULIC COMPONENTS ARE FIELD ROUTE.
19. DELETED.
20. INDEX PUSHER IS INTERLOCKED SUCH THAT THE FINAL PUSH POSITION OF THE ROCKET INTO THE CONTAINER SHALL BE ALLOWED ONLY UPON COMPLETION OF THE ROCKET SHEAR SEQUENCE.
21. THE PANEL MOUNTED E-STOP, PENDANT E-STOP, AND LOCAL E-STOP WILL ALSO BE USED TO SHUT DOWN THE WATER JET PUMPS AND ROBOT.
22. A FWD/REV COMMAND IS ISSUED FROM THE FCS FOR THE PUSHER INDEX ASSEMBLY MOTOR, BUT THE CONTROL LOGIC RESIDES IN THE LOCAL PLC FOR CONTROLLING THE PUSHER INDEX ASSEMBLY MOTOR BY MONITORING THE LASER TRANSMITTER AND OVERTRAVEL POSITION SWITCHES.
23. THE LASER TRANSMITTER, SOLENOIDS FOR THE PUSHER INDEX ASSEMBLY MOTOR, REV OVERTRAVEL, AND FWD OVERTRAVEL POSITION SWITCHES ARE WIRED TO THE LOCAL PLC AND ARE SENT BACK TO THE FCS OVER AN ETHERNET COMMUNICATIONS LINK FOR DISPLAY AND CONTROL ON THE FCS HMI.
24. THE SFT RING STOP CYLINDERS ARE USED DURING THE LEAKER CAMPAIGN ONLY. THEY WILL BE USED TO STOP THE LEAKER FROM ENTERING TOO FAR INTO THE SHEAR STATION.
25. ZS-0697A-- IS USED TO INDICATE IF THE PIA IS CLEAR FOR THE WH CAMPAIGN. DURING THE LEAKER CAMPAIGN ZS-0697A-- WILL BE MOVED FARTHER BACK ON THE FEED CONVEYOR TO INDICATE THT THE PIA IS CLEAR DURING THE LEAKER CAMPAIGN.

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.9

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
7 (3)	09/26/12	IFC, INCORPORATED DCN-323, -539, -620, -783	GM	JDC	SA	KMR	KMR
6 (2)	12/21/10	IFC, INCORPORATED DCN-197, -199, -211, -212	PEB	MDV	SA	BBB	BBB
5 (4)	05/06/10	IFC, INCORPORATED HTL-5965, -66, -67, -1193	PEB	MDV	SA	BBB	BBB
4 (6)	08/11/09	IFC, GC 7677, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
3 (19)	06/15/07	ISSUED FOR CONSTRUCTION (IFC), TREND 192	KW	JP	PEB	JB	BBB
2 (12)	11/07/06	IFD, ADDED GOV. COMMENTS, VALVES & FLOW METER	RZ	JLL	PEB	JB	BBB
1 (5)	05/04/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	03/13/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING ROCKET SHEAR MACHINE - LINE 1 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00056 | SHEET 1 OF 1 | REV 7

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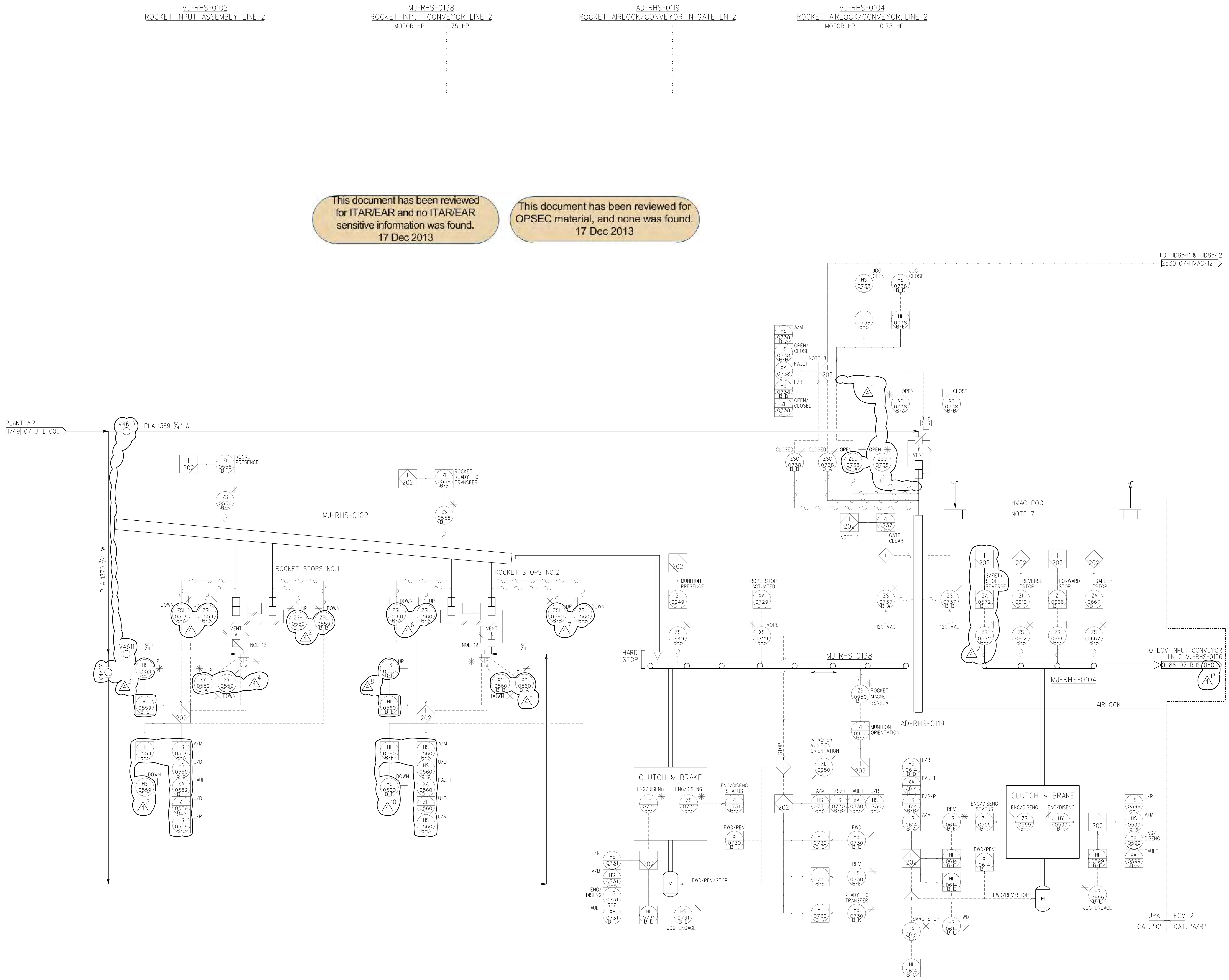

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELAY START WARNING DEVICES ARE PROVIDED ON ALL REMOTELY CONTROLLED CONVEYOR LINES AS SHOWN ON THE CONTROL SYSTEM INPUT/OUTPUT REPORT.
5. FOR CONVEYOR LAYOUT/LOCATION, SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
6. TRAIN STOP EMERGENCY PUSH BUTTONS DETAILS TO BE PROVIDED LATER.
7. INSTRUMENTATION AND VALVING SHOWN ON HVAC DRAWING NUMBER 24915-07-M6-HVAC-00121.
8. INLET GATE AD-RHS-0119 SHALL BE INTERLOCKED WITH OUTLET GATE AD-RHS-0108. A TIMER PREVENTS INLET GATE FROM OPENING AFTER OUTLET GATE AD-RHS-0108 CLOSES UNTIL THE AIRLOCK HAS GONE THROUGH PROPER AIR CHANGES.
9. DELETED.
10. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
11. GATE CLEAR SWITCHES SHOWN ON AIRLOCK GATE ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.
12. 4-WAY DIRECTIONAL PNEUMATIC CONTROL VALVE, 3 POSITIONS, SOLENOID OPERATED, SPRING CENTERED, CENTER BLOCKED.

BASED ON BLUE GRASS P&ID 24915-07-M6-RHS-00007 REV.0

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4 (13)	08/11/09	IFC, GC 7723, HTL-879/881, ADD REVISED DESIGN REQ.	JLL	PEB	BM	BBB	BBB
3 (5)	02/14/07	IFC, CLAR INSTR SUPP W/EQUIP, REVISED ROCKET STOP	RZ	JLL	PEB	JB	BBB
2 (8)	11/07/06	IFD, ADDED GOV. COMMENTS AND ROCKET STOPS	RZ	JLL	PEB	JB	BBB
1 (2)	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	03/13/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT
EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE
HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING ROCKET PROCESSING SYSTEM DWG1-LN2 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00059 | SHEET 1 OF 1 | REV 4

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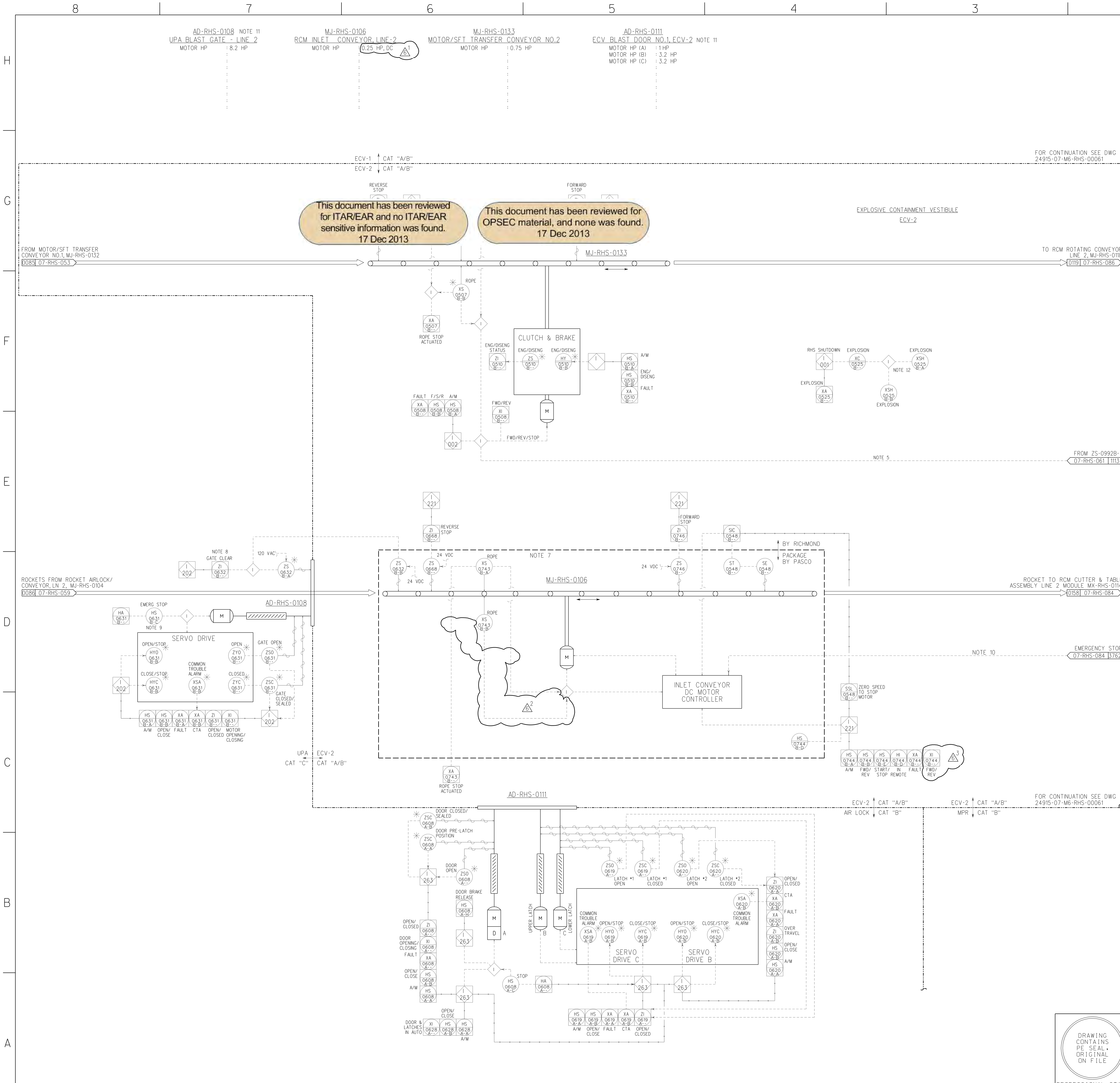
This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. CONVEYOR MJ-RHS-0133 MOTOR SHALL BE HARDWIRE INTERLOCKED WITH SWITCH ZS-0992B-- ON CONVEYOR MJ-RHS-0134 (P&ID 24915-07-M6-RHS-00061) TO PREVENT ITS MOTOR RUNNING IN FORWARD (WEST) DIRECTION IF TURNTABLE MJ-RHS-0118 IS NOT AT EAST-WEST ORIENTATION.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. ALL COMPONENTS INSIDE DASHED LINE WILL BE DESIGNED, PROCURED AND FABRICATED BY PASCO.
8. GATE CLEAR SWITCHES SHOWN ON BLAST DOOR ARE PHYSICALLY LOCATED ON THE ADJACENT CONVEYORS.
9. EMERGENCY STOP SWITCHES SHALL BE PROVIDED BY THE GATE/DOOR VENDOR MOUNTED SEPARATELY IN A CONTROL ROOM BOX AND SHIPPED LOOSE TO BE INSTALLED IN THE FIELD.
10. ONE PANEL MOUNT EMERGENCY STOP PUSH BUTTON AND ONE REMOTE HANDHELD CONTROL WITH UMBILICAL CABLE ARE INSTALLED AT FIELD JUNCTION BOX EJ-FCS-TBF-6224.
11. AD-RHS-0108, AD-RHS-0111 AND ALL ASSOCIATED INSTRUMENTS, MOTORS, AND COMPONENTS ARE "Q".
12. EXPLOSION DETECTORS IN SERIES.

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.9

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
6	09/26/12	IFC, INCORPORATED DCN-302, -417	GM	JDC	SA	KMR	KMR
5	12/21/10	IFC, INC. DCN-163, 170,214,DCR-135,221,SDDR-ADDH-10031	PEB	MDV	SA	BBB	BBB
4	08/11/09	IFC, GC 7724, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
3	06/21/07	IFC, CONVEYOR DRIVE CHANGED TO SERVO	IT	JP	PEB	JB	BBB
2	11/07/06	IFD, ADDED GOV. COMMENTS, INTERLOCK TAG NO., NOTE 7	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	03/13/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☒ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING ECV CONVEYORS DWG 1 - LINE 2 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00060 | SHEET 1 OF 1 | REV 6

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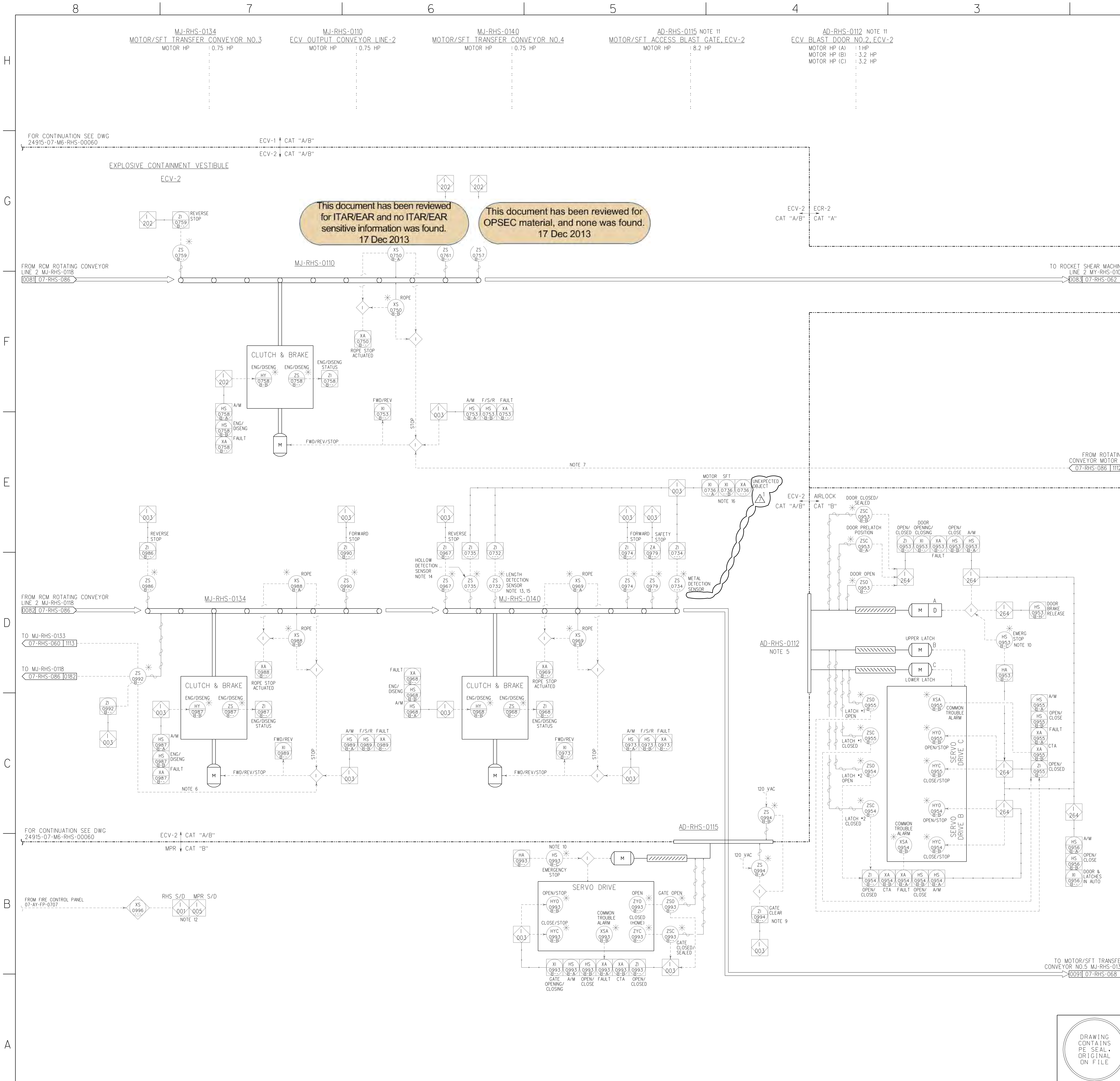

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION, SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. WHEN DOOR AND LATCHES ARE IN AUTO MODE, OPEN COMMAND SHALL UNLATCH AND OPEN THE DOOR AND CLOSE COMMAND SHALL CLOSE AND LATCH THE DOOR.
6. CONVEYOR MJ-RHS-0134 MOTOR SHALL BE HARDWIRE INTERLOCKED WITH SWITCH ZS-0992B-- TO PREVENT ITS MOTOR RUNNING IN REVERSE DIRECTION (EAST) IF TURNTABLE MJ-RHS-0118 IS NOT AT EAST-WEST ORIENTATION.
7. CONVEYOR MJ-RHS-0110 MOTOR SHALL BE INTERLOCKED WITH SERVO ENCODER POSITION ON RCM ROTATING CONVEYOR (P&ID: 24915-07-M6-RHS-00086) TO PREVENT ITS MOTOR RUNNING IN REVERSE DIRECTION WHEN TURNTABLE MJ-RHS-0118 IS NOT IN NORTH-SOUTH ALIGNMENT.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
9. GATE CLEAR SWITCHES SHOWN ON BLAST GATE ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.
10. EMERGENCY STOP SWITCHES SHALL BE PROVIDED BY THE GATE/DOOR VENDOR MOUNTED SEPARATELY IN A CONTROL BOX AND SHIPPED LOOSE TO BE INSTALLED IN THE FIELD.
11. BLAST GATE AD-RHS-0115 AND BLAST DOOR AD-RHS-0112 AND ALL ASSOCIATED INSTRUMENTS, MOTORS AND COMPONENTS ARE "Q".
12. FIRE CONTROL PANEL WILL SEND SIGNAL TO RHS S/D AND MPR S/D.
13. DELETED.
14. HOLLOW DETECTION SENSOR SHALL BE A LASER TYPE AND SHALL BE AS SPECIFIED ON 07-MJ-RHS-00036.
15. LENGTH SENSOR PROVIDED BY VENDOR SHALL FAIL TO FALSE POSITION (i.e. LENGTH NOT DETECTED).
16. SENSOR TRUTH TABLE FOR MUNITIONS IS SHOWN IN MATRIX BELOW.

SENSOR / MUNITIONS	PRESENCE (FWD STP)	LENGTH	METAL	HOLLOW
MOTOR	X	X	X	-
SFT	X	-	-	X
UNEXPECTED OBJECT	X	-	X	-

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.9

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
7	09/26/12	IFC, INCORPORATED DCN-287	GM	JDC	SA	KMR	KMR
6	12/21/10	IFC, INCORPORATED DCN-167 & DCR-221	PEB	MDV	SA	BBB	BBB
5	05/06/10	IFC, DCR-51, HTL-1035, -1220 & -1063, SDDR-31	PEB	GM	SA	BBB	BBB
4	08/11/09	IFC, HTL-1661, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
3	02/14/07	IFC, ADDED INTERLOCK TAG NO AND NOTES 9,10	RZ	JLL	PEB	JB	BBB
2	11/07/06	IFD, INTERLOCK TAG NO. ADDED, ROPE SWITCH CHANGED	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	03/13/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE

PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING ECV CONVEYORS DWG 2 - LINE 2 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00061 | SHEET 1 OF 1 | REV 7

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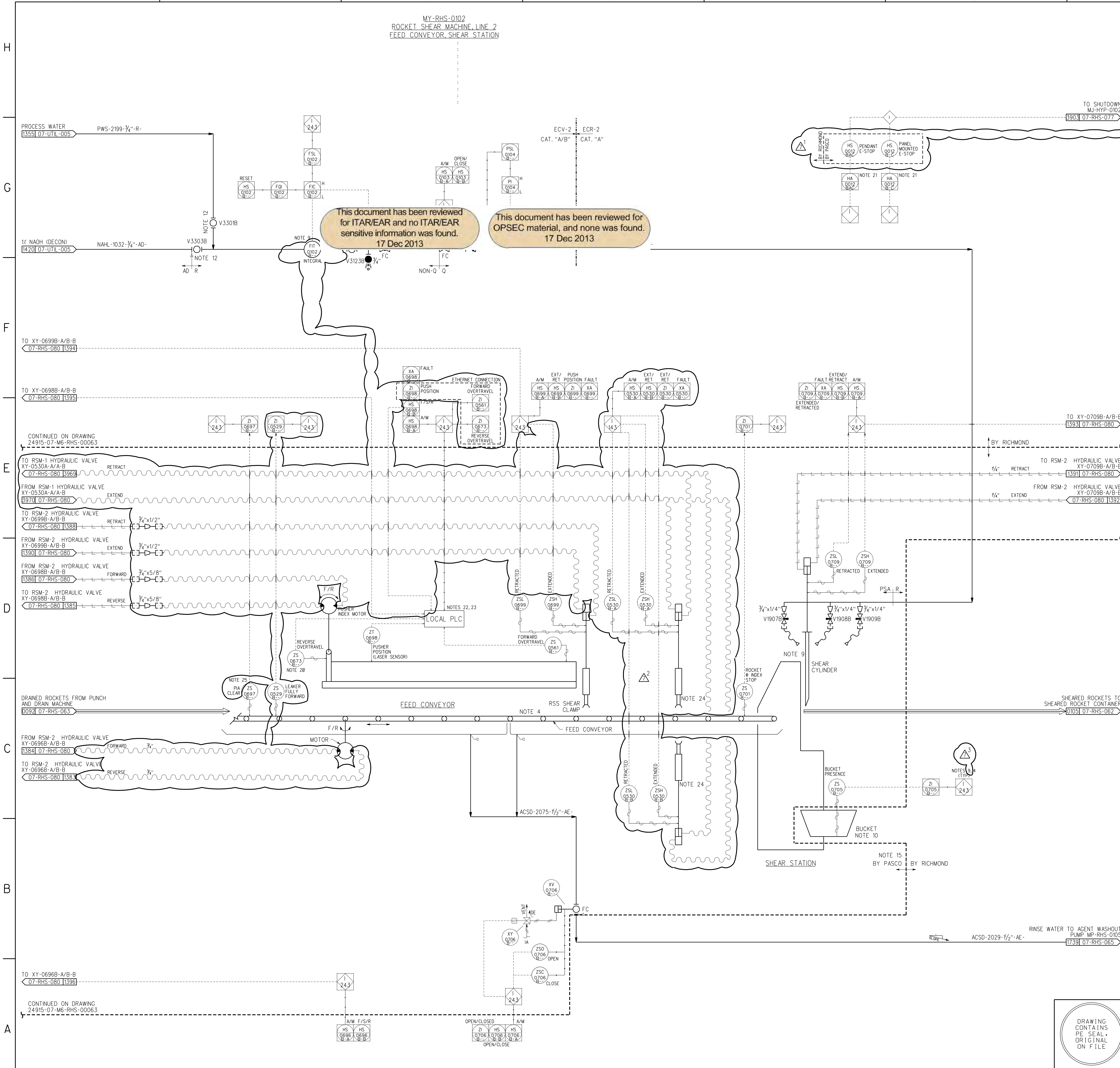

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. ROCKET INDEX STOP IS COMPRISED OF CYLINDERS TO LOCATE ROCKET FOR THE 1ST CUT (FUZE).
5. ISOLATION VALVE IS LOCATED ADJACENT TO ECR WALL. MINIMUM PIPING BETWEEN ECR WALL AND ISOLATION VALVE.
6. THE NUMBER OF ROCKETS IS COUNTED BY THE FCS AND ARCHIVED BY PDAR. THE COUNT IS INCREMENTED UPON COMPLETION OF THE SHEAR CYCLE. THE TOTALIZER IS DISABLED WHEN OPERATED MANUALLY.
7. DELETED.
8. FOR CONVEYOR LAYOUT/LOCATION, SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
9. SHEAR BLADE OPERATION SHALL BE INTERLOCKED WITH FIT-0102B-- AND BUCKET PRESENT SWITCH ZS-0705B--.
10. BUCKET PROVIDED BY GENERAL ATOMICS AND WILL BE REMOVED ROBOTICALLY.
11. DELETED.
12. 1% NAOH IS USED DURING THE GB CAMPAIGN, WATER IS USED DURING THE M55 VX CAMPAIGN.
13. DELETED.
14. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
15. DASHED LINE IS SCOPE LIMIT. DESIGN, PROCUREMENT AND FABRICATION INSIDE OF DASHED LINES ARE BY PASCO.
16. DOORS AND GATES ARE INTERLOCKED TO REMAIN CLOSED DURING HAZARDOUS OPERATION.
17. DELETED.
18. ALL HYDRAULIC LINES BETWEEN MANIFOLD AND HYDRAULIC COMPONENTS ARE FIELD ROUTE.
19. DELETED.
20. INDEX PUSHER IS INTERLOCKED SUCH THAT THE FINAL PUSH POSITION OF THE ROCKET INTO THE CONTAINER SHALL BE ALLOWED ONLY UPON COMPLETION OF THE ROCKET SHEAR SEQUENCE.
21. THE PANEL MOUNTED E-STOP, PENDANT E-STOP, AND LOCAL E-STOP WILL ALSO BE USED TO SHUT DOWN THE WATER JET PUMPS AND ROBOT.
22. A FWD/REV COMMAND IS ISSUED FROM THE FCS FOR THE PUSHER INDEX ASSEMBLY MOTOR, BUT THE CONTROL LOGIC RESIDES IN THE LOCAL PLC FOR CONTROLLING THE PUSHER INDEX ASSEMBLY MOTOR BY MONITORING THE LASER TRANSMITTER AND OVERTRAVEL POSITION SWITCHES.
23. THE LASER TRANSMITTER, SOLENOIDS FOR THE PUSHER INDEX ASSEMBLY MOTOR, REV OVERTRAVEL, AND FWD OVERTRAVEL POSITION SWITCHES ARE WIRED TO THE LOCAL PLC AND ARE SENT BACK TO THE FCS OVER AN ETHERNET COMMUNICATIONS LINK FOR DISPLAY AND CONTROL ON THE FCS HMI.
24. THE SFT RING STOP CYLINDERS ARE USED DURING THE LEAKER CAMPAIGN ONLY. THEY WILL BE USED TO STOP THE LEAKER FROM ENTERING TOO FAR INTO THE SHEAR STATION.
25. ZS-0697B-- IS USED TO INDICATE IF THE PIA IS CLEAR FOR THE WH CAMPAIGN. DURING THE LEAKER CAMPAIGN ZS-0697B-- WILL BE MOVED FARTHER BACK ON THE FEED CONVEYOR TO INDICATE THT THE PIA IS CLEAR DURING THE LEAKER CAMPAIGN.

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.9

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
7 (3)	09/26/12	IFC, INCORPORATED DCN-323, -539, -620, -783	GM	JDC	SA	KMR	KMR
6 (2)	12/21/10	IFC, INCORPORATED DCN-197, -199, -211, -212	PEB	MDV	SA	BBB	BBB
5 (6)	05/10/10	IFC, INCORPORATED HTL-5965, -1060, -66, -67, -1193	PEB	MDV	SA	BBB	BBB
4 (6)	08/11/09	IFC, GC 7677, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
3 (19)	06/25/07	ISSUED FOR CONSTRUCTION (IFC), TREND 192	JF	JP	PEB	JB	BBB
2 (10)	11/07/06	IFD, ADDED GOV. COMMENTS, VALVES & FLOW METER	RZ	JLL	PEB	JB	BBB
1 (6)	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	03/13/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☒ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING ROCKET SHEAR MACHINE - LINE 2 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00064 | SHEET 1 OF 1 | REV 7

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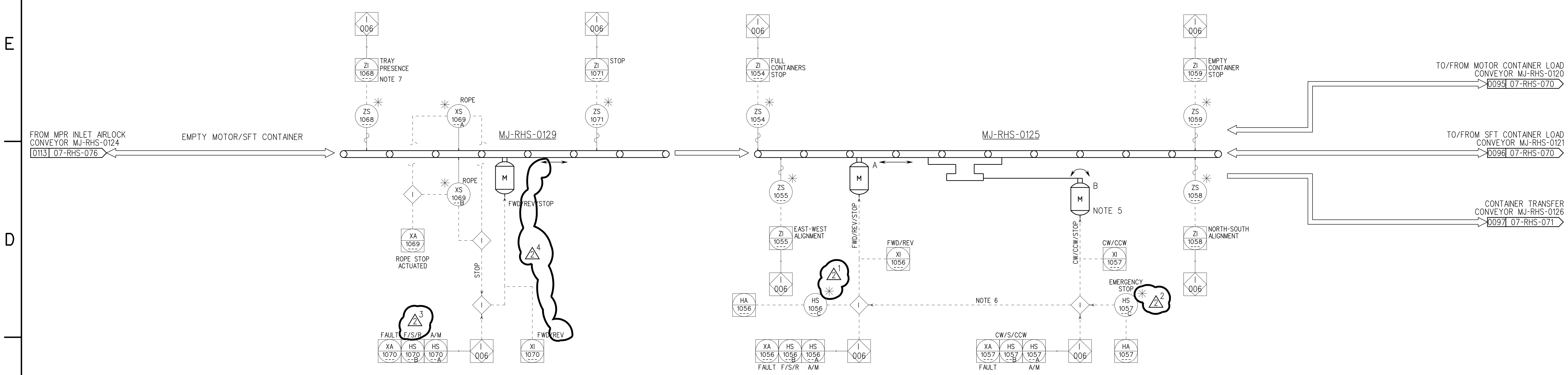
07MRHS064.pid 09/27/12
DESIGN FILE: DGNSPEC
PLOTTED BY: USER$ ON DATE$ AT SYTIME USING COLOR

MJ-RHS-0129
EMPTY CONTAINER INLET CONVEYOR
MOTOR HP : 2 HP

MJ-RHS-0125
CONTAINER TURNTABLE
MOTOR HP (A) : 2 HP
MOTOR HP (B) : 0.75 HP

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIAL HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00002.
5. MOTOR SHALL BE PROVIDED WITH INTEGRAL BRAKE.
6. CONVEYOR MOTOR AND TURNTABLE MOTOR SHALL BE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION.
7. TRAY PRESENCE SWITCH ZS-1068--- WILL BE USED TO TRACK TRAYS BEFORE THEY MOVE TO TURNTABLE.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".



BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.8
BASED ON BLUE GRASS EQUIPMENT GENERAL ARRANGEMENT
24915-07-MJ-00002 REV.H
REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	02/14/07	IFC, ADDED REVERSE DIRECTOIN TO CONVEYOR	RZ	JLL	PEB	JB	BBB
1	11/07/06	ISSUED FOR DESIGN (IFD), INTERLOCK TAG NO. ADDED	RZ	JLL	PEB	JB	BBB
0	04/19/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

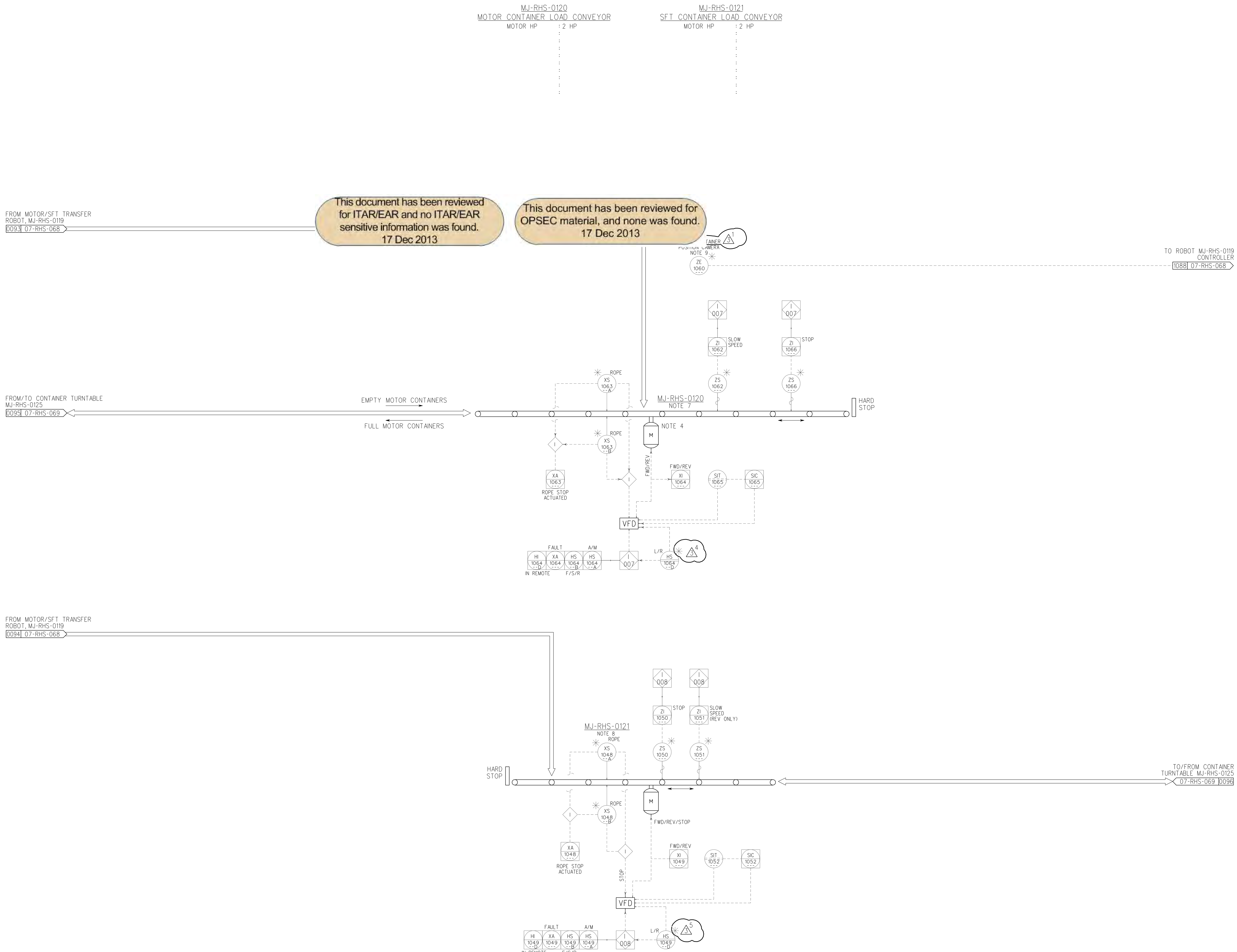
DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING SFT BOX LOAD CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00069 | SHEET 1 OF 1 | REV 2

BGCAPP_DGN.BDR

07MRHS069.pid 03/01/07
DESIGN FILE: S:\3D\msp\DWGS\PID\07mrhs069.pid
PLOTTED BY: p0073208 01-MAR-2007 AT 09:11 USING Color Table= S:\3DStds\ge\edelplotOrg\bw.ctb & Pen Table= S:\3DStds\ge\edelplotOrg\Bluegrass_F.tbl



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELAY START WARNING DEVICES ARE PROVIDED ON ALL REMOTELY CONTROLLED CONVEYOR LINES AS SHOWN ON THE CONTROL SYSTEM ON THE CONTROL SYSTEM INPUT/OUTPUT REPORT.
5. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. FORWARD DIRECTION FOR THIS CONVEYOR IS EASTERLY DIRECTION.
8. FORWARD DIRECTION FOR THIS CONVEYOR IS SOUTHERLY DIRECTION.
9. VISION CONTROL WILL BE USED TO IDENTIFY MOTOR PLACEMENT LOCATION ON MOTOR CONTAINER LOAD CONVEYOR. VISION CAMERA WILL BE PROVIDED BY THE ROBOT SUPPLIER
10. ROBOT MJ-RHS-0119 SHALL BE INTERLOCKED BY ROBOT SUPPLIER WITH CAMERA ZE1060--- TO STOP ROBOT UPON POSITION CAMERA FAILURE.

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.0
BASED ON BLUE GRASS EQUIPMENT GENERAL ARRANGEMENT 24915-07-MJ-00002 REV.H

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	08/11/09	IFC, HTL-854, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
2	02/14/07	IFC, ADDED VISION CONTROL, NOTE 9	RZ	JLL	PEB	JB	BBB
1	11/07/06	ISSUED FOR DESIGN (IFD), INTERLOCK TAG NO. ADDED	RZ	JLL	PEB	JB	BBB
0	04/19/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING MOTOR BOX LOAD & BUFFER CONVEYORS PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00070 | SHEET 1 OF 1 | REV 3

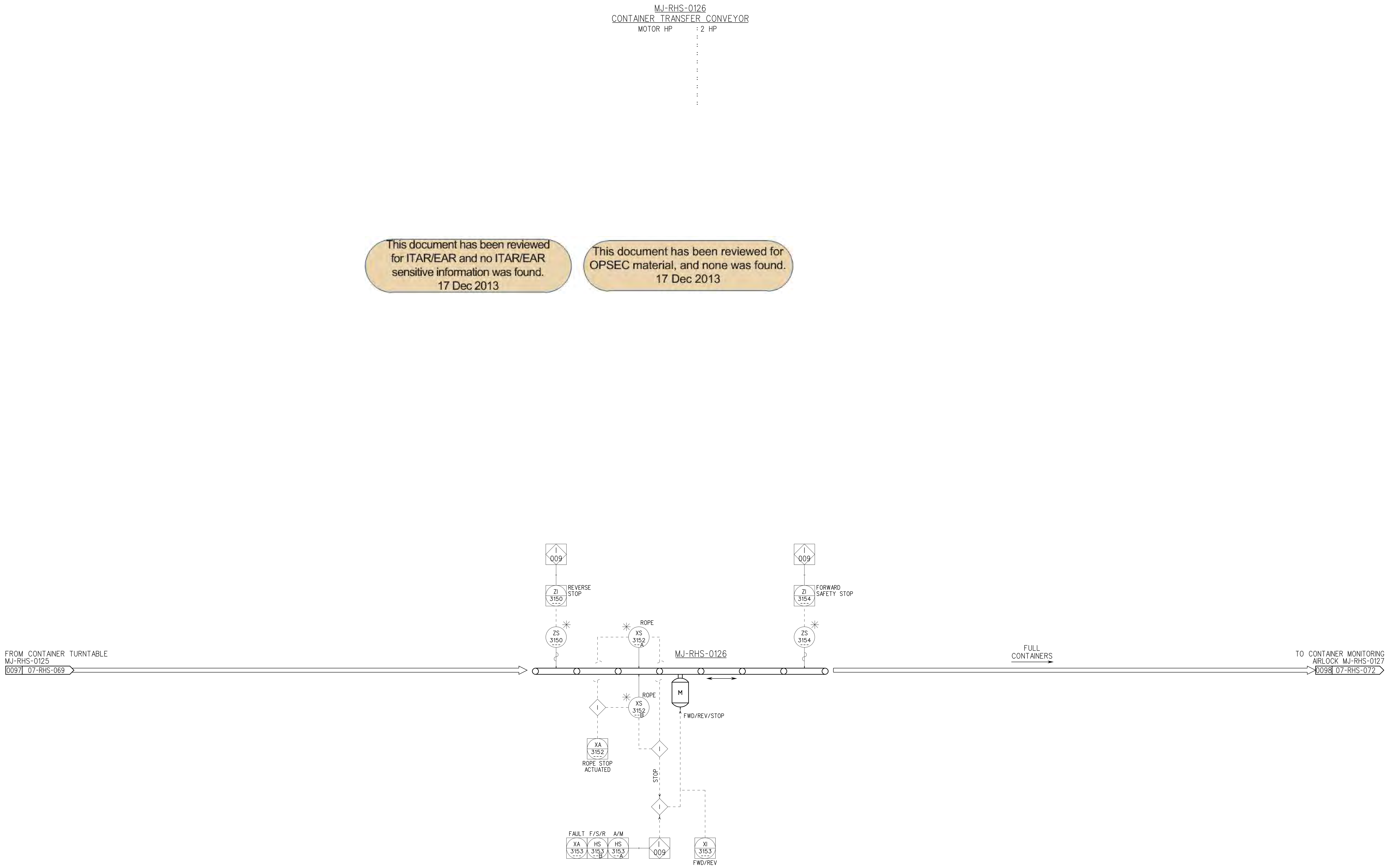
BGCAPP_DGN.BDR

07MRHS070.pid 08/11/09
DESIGN FILE: DGNSPEC
PLOTTED BY: USER$ ON DATE$ AT SYTIME USING COLOR

.../3d/mp/dwgs/pid/07mrhs070.pid 8/11/2009 2:06:00 PM

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV 8
BASED ON BLUE GRASS EQUIPMENT GENERAL ARRANGEMENT
24915-07-MJ-00002 REV.H

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	02/14/07	ISSUED FOR CONSTRUCTION (IFC), CHANGES PFD REV.	RZ	JLL	PEB	JB	BBB
1	11/07/06	ISSUED FOR DESIGN (IFD), INTERLOCK TAG NO. ADDED	RZ	JLL	PEB	JB	BBB
0	04/19/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING BUFFER AND TRANSFER CONVEYORS PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

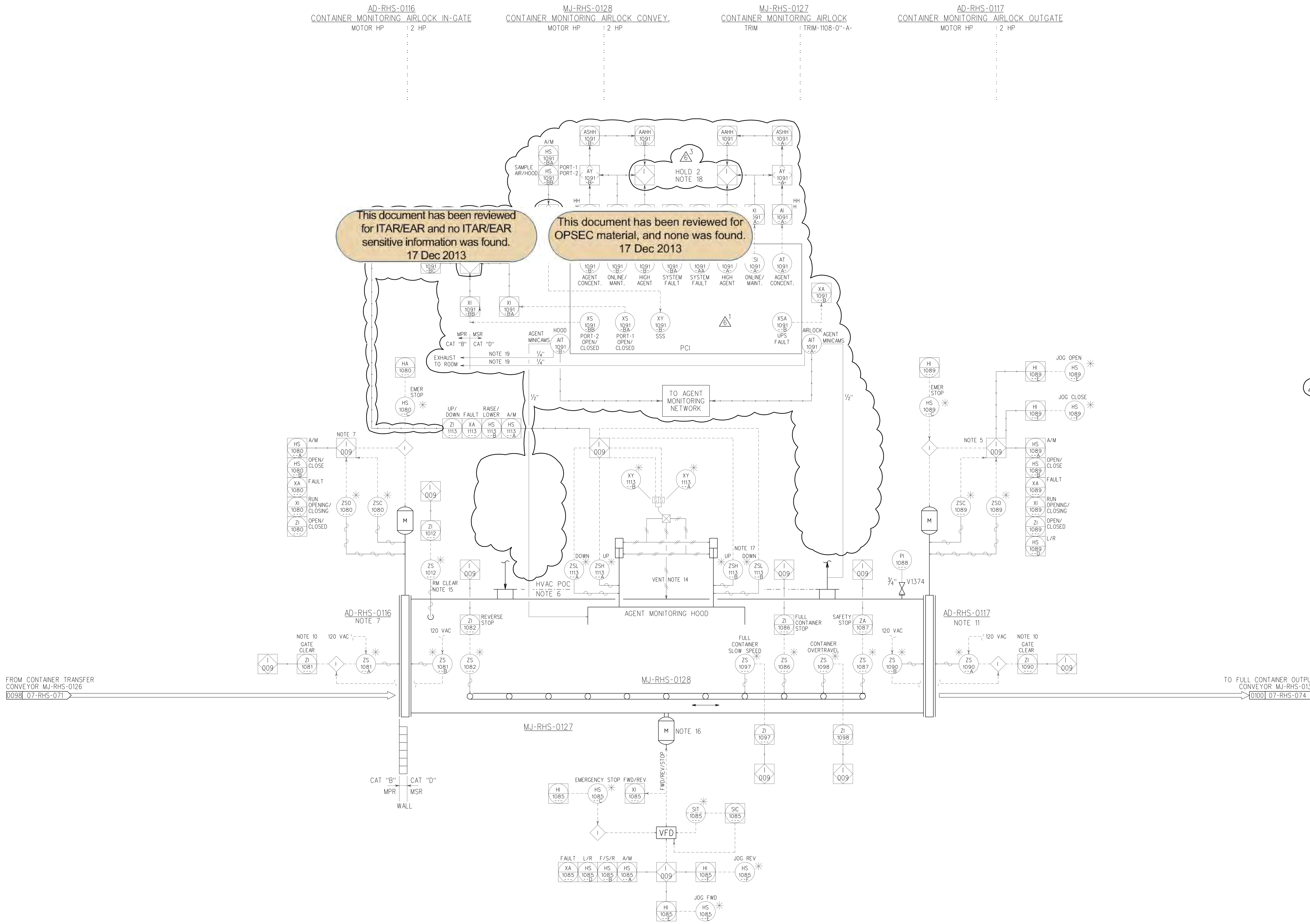
DRAWING NUMBER 24915-07-M6-RHS-00071 | SHEET 1 OF 1 | REV 2

BGCAPP_DGN.BDR

07MRHS071.pid 03/01/07
DESIGN FILE: S:\3D\mp\DWGS\PID\07mrhs071.pid
PLOTTED BY: p0073208 01-MAR-2007 AT 09:11 USING Color Table= S:\3DStds\ge\edelplotDrg\bw.ctb & Pen Table= S:\3DStds\ge\edelplotDrg\Bluegrass_F.tbl

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. INLET GATE AD-RHS-0116 SHALL BE INTERLOCKED WITH OUTLET GATE AD-RHS-0117 TO PREVENT THEM FROM OPENING SIMULTANEOUSLY. AIRLOCK GATES ARE INTERLOCKED WITH A TIMER.
6. INSTRUMENTATION AND VALVING SHOWN ON HVAC DRAWING NUMBER 24915-07-M6-HVAC-00126. STOP BOTH THE VENTILATION INFLOW AND OUTFLOW DURING MONITORING, BY CLOSING BOTH THE AIR INLET DAMPER AND THE AIR OUTLET PRESSURE CONTROL DAMPER.
7. AIRLOCK IN-GATE AD-RHS-0116 SHALL BE INTERLOCKED WITH MPR INLET AIRLOCK OUT-GATE AD-RHS-0121 OF MPR INLET AIRLOCK (MJ-RHS-0123) ON P&ID 24915-07-M6-RHS-00076 TO PREVENT ONE GATE FROM OPENING WHILE THE OTHER GATE IS OPEN.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
9. CONTAINER MONITORING AIRLOCK OUT-GATE (AD-RHS-0117) IS INTERLOCKED CLOSED IF AGENT HIGH HIGH ALARM IS ACTIVATED.
10. GATE CLEAR SWITCHES SHOWN ON AIRLOCK GATE ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.
11. CONTAINER MONITORING AIRLOCK OUTLET GATE AD-RHS-0117 SHALL BE INTERLOCKED CLOSED UNTIL CLEARED BY AGENT MONITORING.
12. AGENT MONITOR SHALL BE CONFIGURED TO MEASURE H, GB OR VX DEPENDING ON CAMPAIGN.
13. DELETED.
14. SOLENOID VALVE SHALL VENT INTO AIRLOCK.
15. THROUGH BEAM SENSOR TO ENSURE RM'S ARE BELOW HOOD ELEVATION.
16. CONVEYOR MOTOR SHALL BE INTERLOCKED WITH THE MONITORING HOOD POSITION SUCH THAT THE CONVEYOR CANNOT MOVE UNLESS THE HOOD IS IN THE UP POSITION.
17. FEEDBACK STATUS OF THE HOOD IN EITHER UP OR DOWN POSITION SHALL BE PROVIDED TO THE FCS AT ALL TIMES.
18. HOLDS 1 AND 2 FOR INTERLOCK TAG NUMBERS.
19. SAMPLE RETURNS FROM MINICAMS ARE INCLUDED IN SAMPLE HEAT TRACE BUNDLES, BY I&C.

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.9

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
6	09/26/12	IFC, INCORPORATED DCN-813	GM	JDC	SA	KMR	KMR
5	08/02/11	IFC, INCORPORATED DCN-271, 405 & HTL-1211	PEB	GM	SA	BBB	BBB
4	08/11/09	IFC, HTL-846, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
3	06/25/07	IFC, ADDED DOOR/AGENT MONITOR INTERLOCK	JF	JP	PEB	JB	BBB
2	11/07/06	ISSUED FOR DESIGN (IFD), INTERLOCK TAG NO. ADDED	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	04/19/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING MONITORING AIRLOCK AND CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00072 | SHEET 1 OF 1 | REV 6

BGCAPP_DGN.BDR

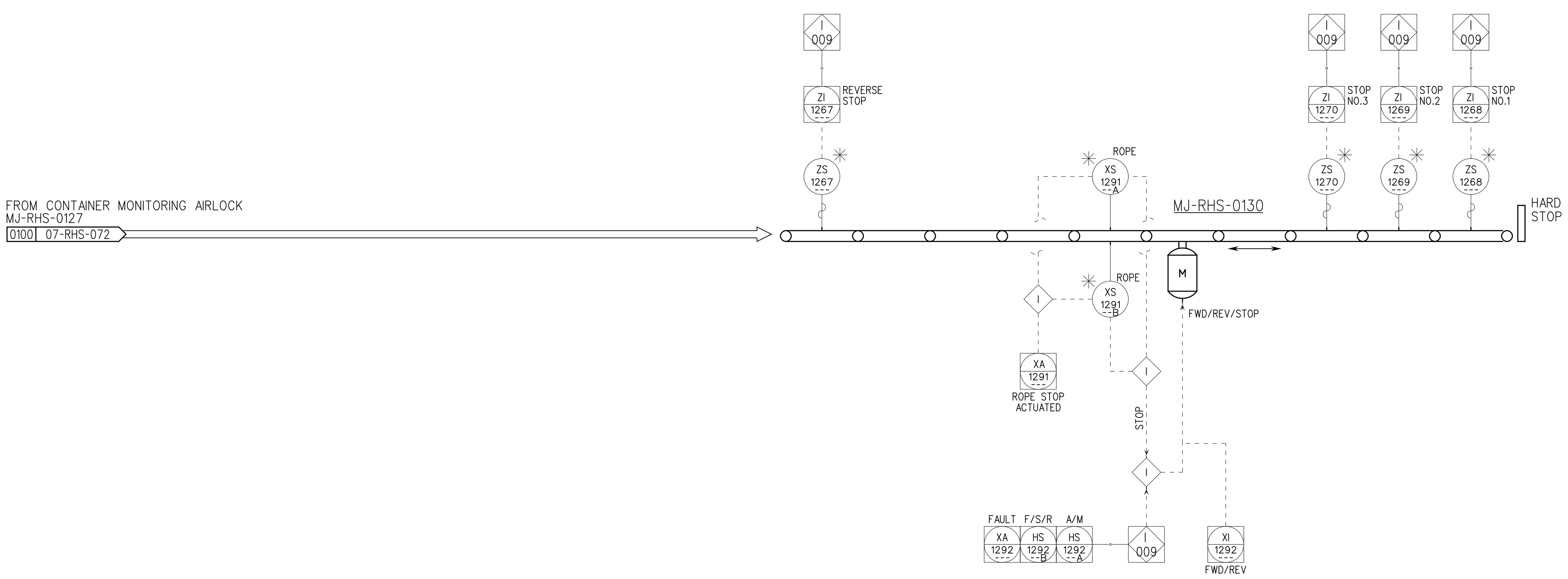
07MRHS072.pid 09/26/12
DESIGN FILE: DGNSPEC
PLOTTED BY: USER$ ON DATE$ AT SYTIME USING COLOR

.../3d/mp/dwgs/pid/07mrhs072.pid 9/26/2012 4:51:45 PM

MJ-RHS-0130
FULL CONTAINER OUTPUT CONVEYOR
MOTOR HP : 2 HP

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIAL HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00002.
5. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV. 8
BASED ON BLUE GRASS EQUIPMENT GENERAL ARRANGEMENT
24915-07-MJ-00002 REV.H
REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	02/14/07	ISSUED FOR CONSTRUCTION (IFC), CHANGES PFD REV.	RZ	JLL	PEB	JB	BBB
1	11/07/06	ISSUED FOR DESIGN (IFD), INTERLOCK TAG NO. ADDED	RZ	JLL	PEB	JB	BBB
0	04/19/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING
FULL CONTAINER OUTPUT CONVEYOR
PIPING & INSTRUMENT DIAGRAM

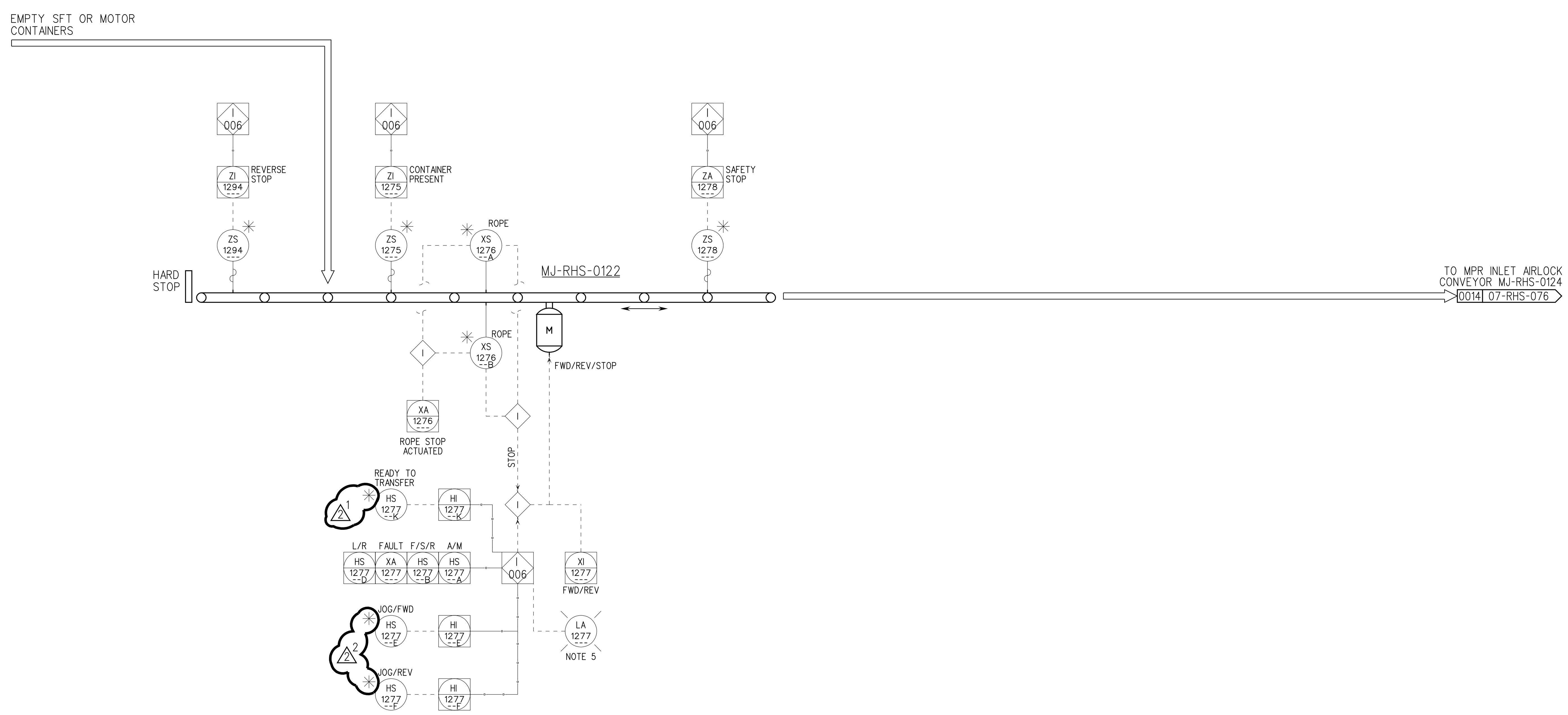
DRAWING NUMBER 24915-07-M6-RHS-00074 SHEET 1 OF 1 REV 2

BGCAPP_DGN.BDR

MJ-RHS-0122
EMPTY CONTAINER LOADING CONVEYOR
MOTOR HP : 2 HP

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. WARNING LIGHT IS INTERLOCKED TO TURN ON 10 SECONDS BEFORE CONVEYOR MOTOR STARTS AND TURN OFF WHEN MOTOR STOPS.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV 8
BASED ON BLUE GRASS EQUIPMENT GENERAL ARRANGEMENT
24915-07-MJ-00002 REV.H
REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	02/14/07	IFC, CLARIFIED INSTR SUPP W/EQUIPMENT	RZ	JLL	PEB	JB	BBB
1	11/07/06	ISSUED FOR DESIGN (IFD), INTERLOCK TAG NO. ADDED	RZ	JLL	PEB	JB	BBB
0	04/19/06	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL. ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING MOTOR/SFT EMPTY BOX INPUT CONVEYOR PIPING & INSTRUMENT DIAGRAM

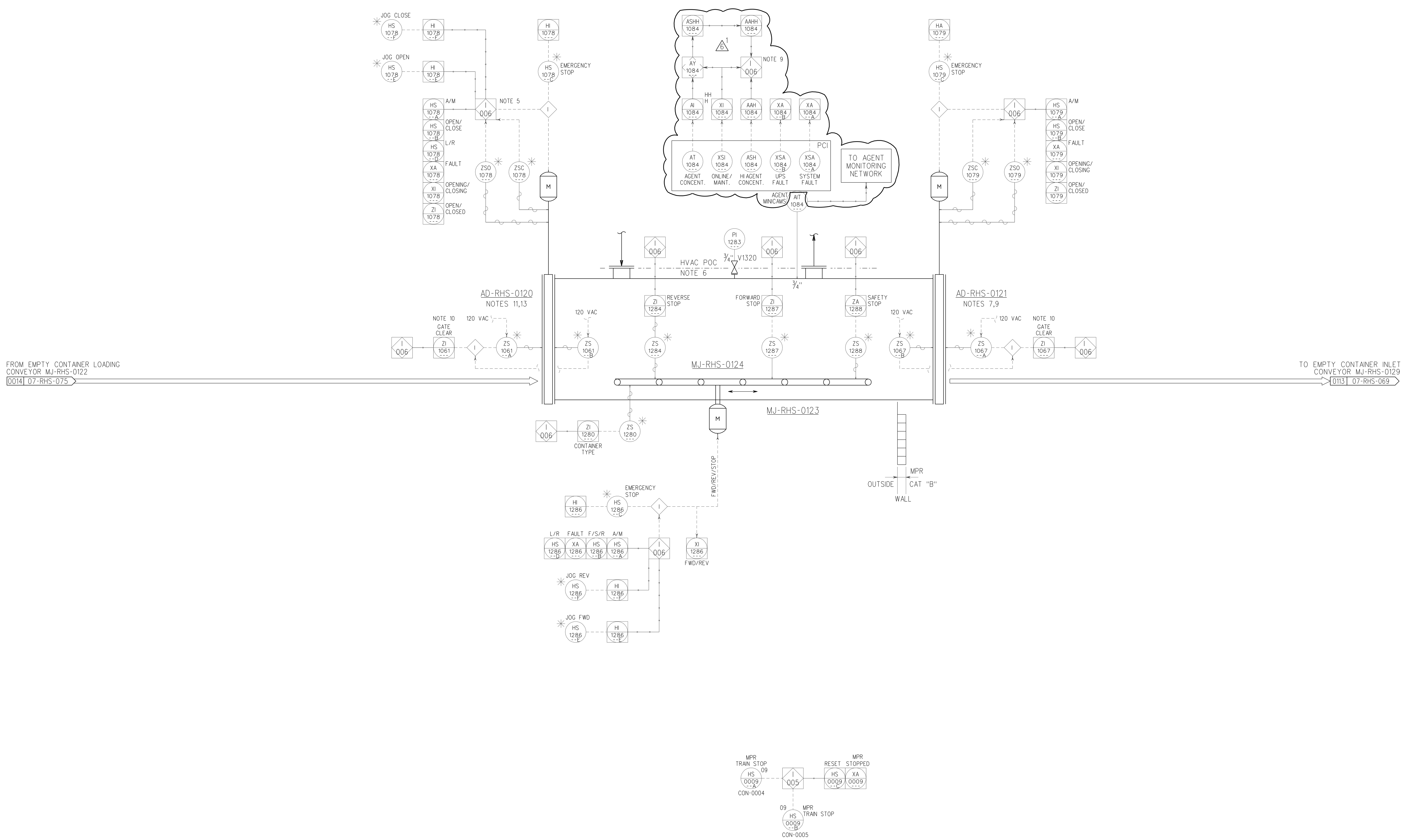
DRAWING NUMBER 24915-07-M6-RHS-00075 | SHEET 1 OF 1 | REV 2

BGCAPP_DGN.BDR

AD-RHS-0120 MPR INLET AIRLOCK IN-GATE	MJ-RHS-0124 MPR INLET AIRLOCK CONVEYOR	MJ-RHS-0123 MPR INLET AIRLOCK	AD-RHS-0121 MPR INLET AIRLOCK OUT-GATE
MOTOR HP : 2 HP	MOTOR HP : 2 HP	TRIM : TRIM-1107-0"-A-	MOTOR HP : 2 HP

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. MPR INLET AIRLOCK IN-GATE AD-RHS-0120 SHALL BE INTERLOCKED WITH MPR INLET AIRLOCK OUT-GATE AD-RHS-0121 TO PREVENT THEM FROM OPENING SIMULTANEOUSLY. AIRLOCK GATES ARE INTERLOCKED WITH A TIMER.
6. INSTRUMENTATION AND VALVES SHOWN ON HVAC DRAWING NUMBER 24915-07-M6-HVAC-00126.
7. MPR INLET AIRLOCK OUT-GATE AD-RHS-0121 SHALL BE INTERLOCKED WITH CONTAINER MONITORING AIRLOCK IN-GATE AD-RHS-0116 OF CONTAINER MONITORING AIRLOCK (MJ-RHS-0127) ON P&ID 24915-07-M6-RHS-00072 TO PREVENT ONE GATE TO OPEN WHILE THE OTHER GATE IS OPEN.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
9. MPR INLET AIRLOCK OUT-GATE (AD-RHS-0121) IS INTERLOCKED CLOSED IF AGENT IS DETECTED IN MOTOR PACKING ROOM 07-163.
10. GATE CLEAR SWITCHES SHOWN ON AIRLOCK GATE ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.
11. MPR INLET AIRLOCK INLET GATE AD-RHS-0120 SHALL BE INTERLOCKED CLOSED UNTIL CLEARED BY AGENT MONITORING.
12. SWITCHES ZS-1284--- AND ZS-1287--- ON MPR INLET AIRLOCK CONVEYOR ARE USED FOR TRAY TRACKING.
13. MPR INLET AIRLOCK INLET GATE AD-RHS-0120 SHALL BE INTERLOCKED CLOSED WITH TRAY TRACKING WHEN IT INDICATES TRAY IS PRESENT.
14. AGENT MONITOR SHALL BE CONFIGURED TO MEASURE H, GB OR VX DEPENDING ON CAMPAIGN.

BASED ON BLUE GRASS PFD 24915-07-M5-RHS-00001 REV.9

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
6	09/26/12	IFC, INCORPORATED DCN-813	GM	JDC	SA	KMR	KMR
5	10/05/10	IFC, INCORPORATED DCR-200, HTL-5972	PEB	MDV	SA	BBB	BBB
4	08/11/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
3	06/25/07	IFC, ADDED DOOR/AGENT MONITOR INTERLOCK	JF	JP	PEB	JB	BBB
2	11/07/06	IFD, INTERLOCK TAG NO. AND AGENT MONITORING ADDED	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	04/19/06	ISSUED FOR REVIEW (IFD)	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

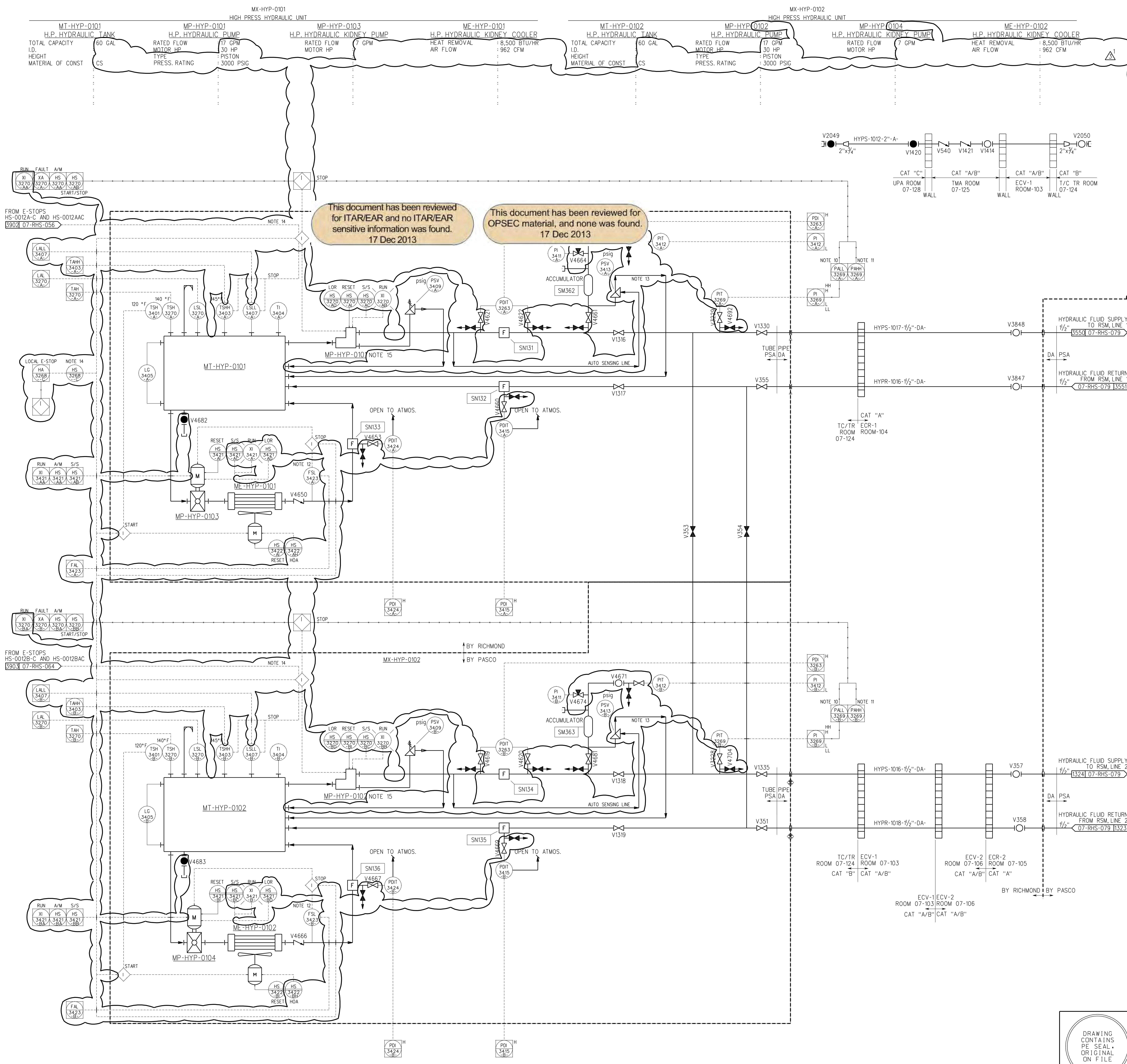
MUNITIONS DEMILITARIZATION BUILDING MPR INLET AIRLOCK AND CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00076 | SHEET 1 OF 1 | REV 6

BGCAPP_DGN.BDR



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINE ARE COMPLETELY PASCO SCOPE.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. HOLD PENDING RESOLUTION OF INSTRUMENT LOGIC.
8. DELETED.
9. INSTRUMENTATION DESIGN REQUIRES VERIFICATION TO FINAL TRRP TEST RESULTS.
10. WHEN THE SUPPLY PRESSURE STAYS BELOW THE MINIMUM SET-POINT FOR A PREDETERMINED AMOUNT OF TIME, THE MAIN HPU PUMP WILL BE SHUTDOWN.
11. WHEN THE SUPPLY PRESSURE STAYS ABOVE THE MAXIMUM SET-POINT FOR A PREDETERMINED AMOUNT OF TIME, THE MAIN HPU PUMP WILL BE SHUTDOWN.
12. ON A LOW FLOW CONDITION THE LOW FLOW SWITCH IS HARD-WIRED TO THE MOTOR STARTER AND SHUTS DOWN THE KIDNEY PUMP.
13. ON PUMP SHUTDOWN THE AUTO ACCUMULATOR VALVE RELIEVES THE PRESSURE FROM THE ACCUMULATOR BACK INTO THE RESERVOIR FOR SAFE SHUTDOWN CONDITIONS.
14. THE PANEL MOUNTED E-STOP, PENDANT E-STOP, AND LOCAL E-STOP WILL ALSO BE USED TO SHUTDOWN THE WATER JET PUMPS AND ROBOT.
15. CHECK VALVE INTEGRAL TO PUMP.

REFERENCE DRAWINGS

THIS DRAWING SPLIT TO 07-M6-RHS-00079

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	09/26/12	IFC, INCORPORATED DCN-323, -539, -687, -758	GM	JDC	SA	KMR	KMR
2	01/07/11	IFC, REDRAWN, INCORPORATED DCN-197, -198 & -212	PEB	MDV	SA	BBB	BBB
1	08/11/09	IFC, HTL-1207, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
0	06/15/07	ISSUED FOR CONSTRUCTION (IFC)	KW	JP	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

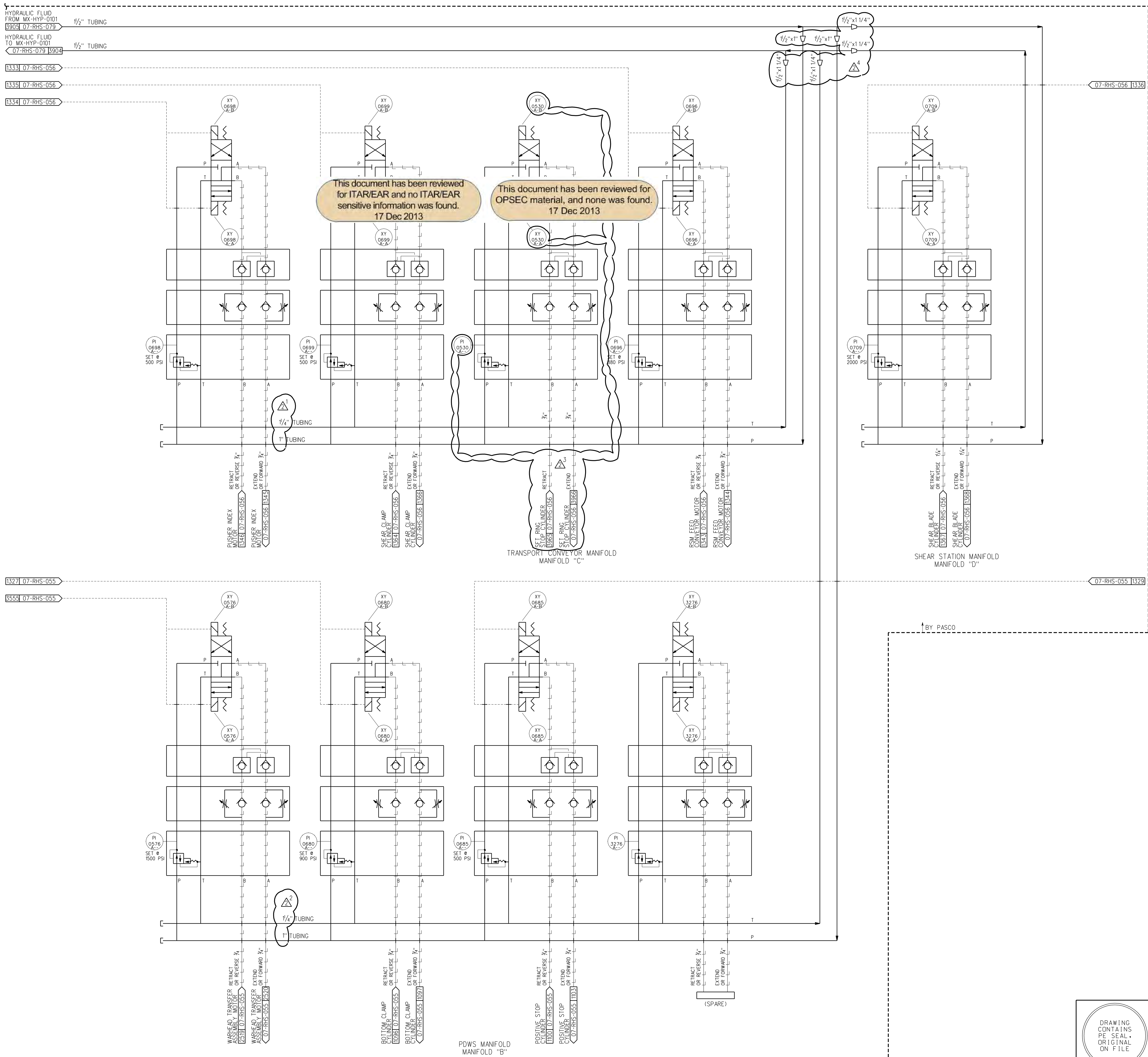
CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING RSM-1 & RSM-2 HYDRAULIC SYS. SHT-1 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00077 | SHEET 1 OF 1 | REV 3

BGCAPP_DGN.BDR



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINE ARE COMPLETELY PASCO SCOPE.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. DELETED. 2 5

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2 5	09/26/12	IFC, INCORPORATED DCN-323, -783	GM	JDC	SA	KMR	KMR
1	01/07/10	IFC, REDRAWAN, INCORPORATED DCN-198, -199	PEB	MDV	SA	BBB	BBB
0	06/15/07	ISSUED FOR CONSTRUCTION (IFC)	KW	JP	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING RSM-1 HYDRAULIC SYSTEM SHT-2 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00078 | SHEET 1 OF 1 | REV 2

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

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07MRHS078.pid 09/27/12
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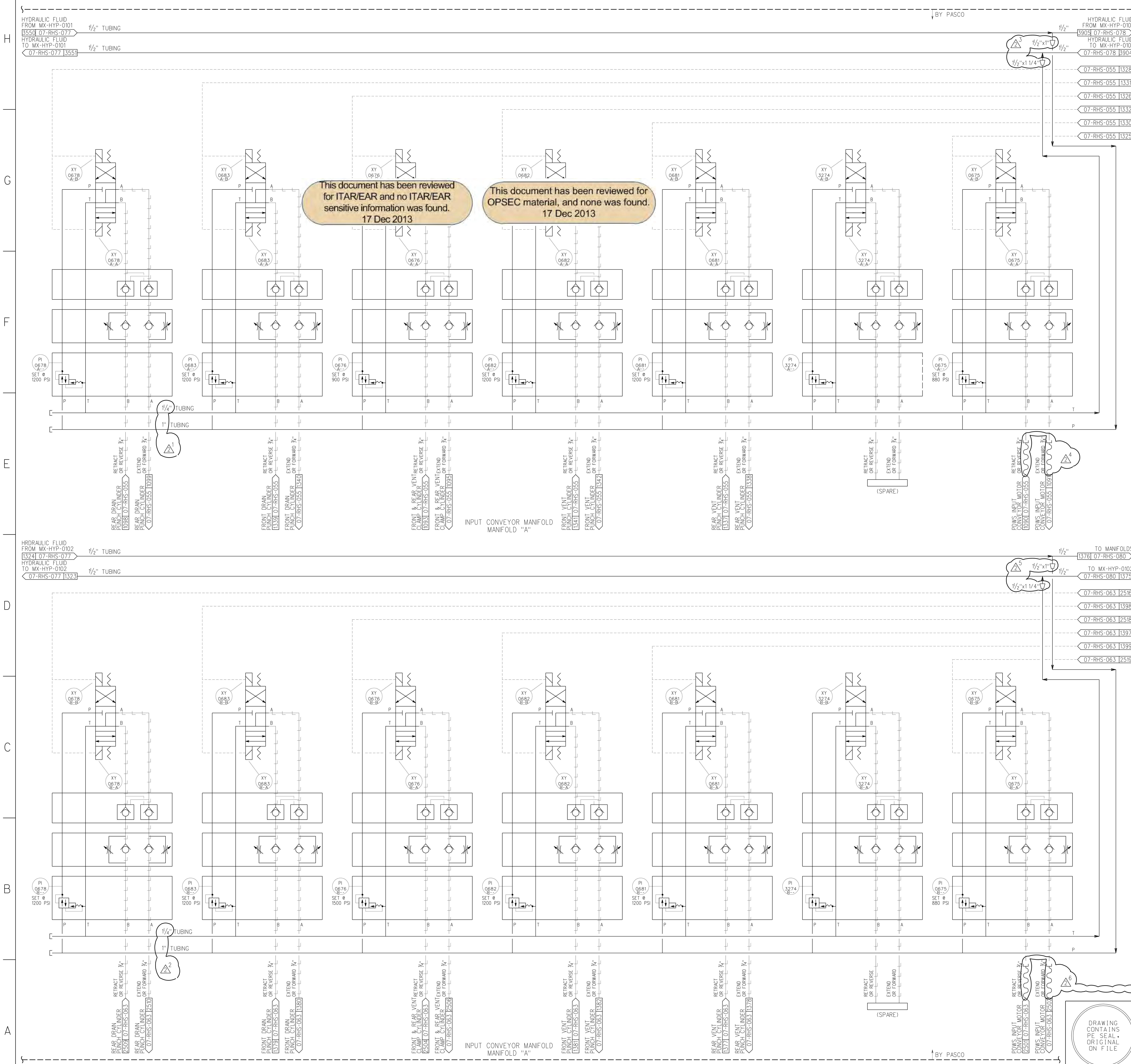

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.
17 Dec 2013

This document has been reviewed for OPSEC material, and none was found.
17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINE ARE COMPLETELY PASCO SCOPE.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. DELETED. 2

REFERENCE DRAWINGS

THIS DRAWING SPLIT FROM 07-M6-RHS-00077

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	09/26/12	IFC, INCORPORATED DCN-323	GM	JDC	SA	KMR	KMR
1	01/07/11	IFC, REDRAWN, INCORPORATED DCN-198	PEB	MDV	SA	BBB	BBB
0	06/25/07	ISSUED FOR CONSTRUCTION (IFC)	JF	JP	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

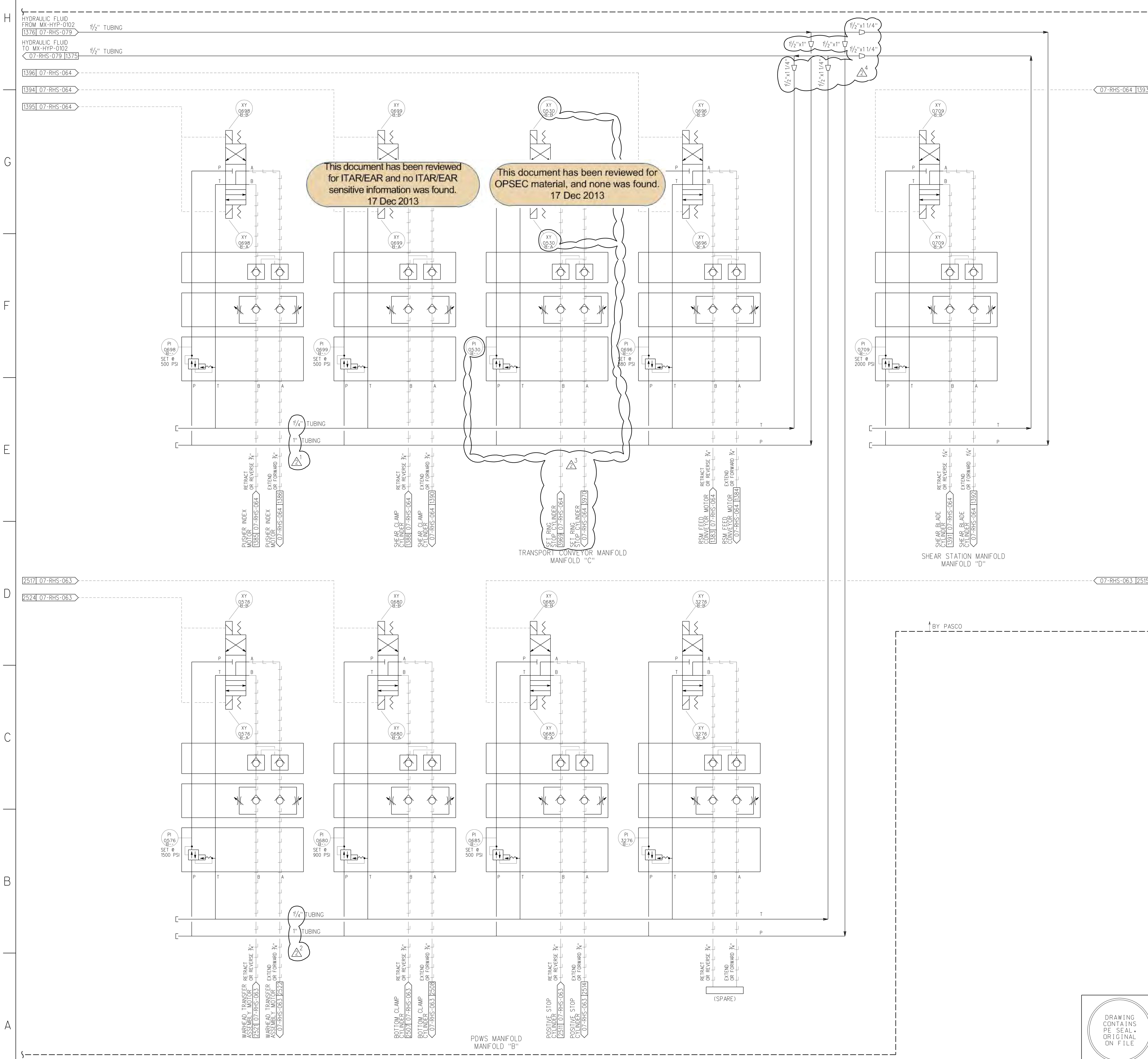
CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING RSM-1 & RSM-2 HYDRAULIC SYS. SHT-1 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00079
SHEET 1 OF 1
REV 2

BGCAPP_DGN.BDR

.../3d/mp/dwgs/pid/07mrhs079.pid 9/26/2012 4:54:51 PM



This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINE ARE COMPLETELY PASCO SCOPE.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. DELETED.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	09/26/12	IFC, INCORPORATED DCN-323, -783	GM	JDC	SA	KMR	KMR
1	01/07/11	IFC, REDRAWN, INCORPORATED DCN-198, -199	PEB	MDV	SA	BBB	BBB
0	06/25/07	ISSUED FOR CONSTRUCTION (IFC)	JF	JP	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

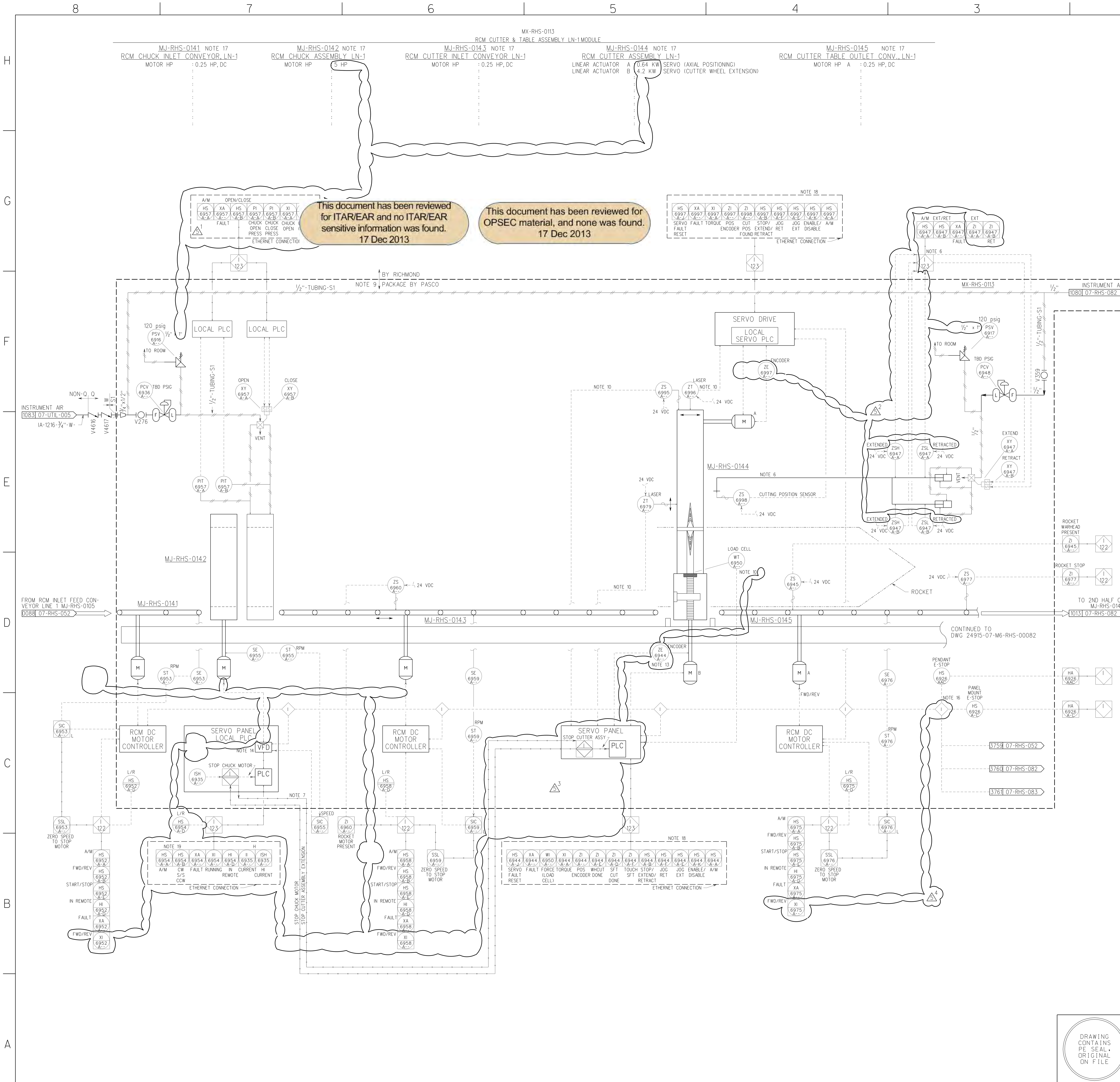
CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING RSM-2 HYDRAULIC SYSTEM SHT-2 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00080 | SHEET 1 OF 1 | REV 2

BGCAPP_DGN.BDR



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
6. THE CUTTING POSITION PROXIMITY SWITCH SHALL BE EXTENDED (AIR TO DOWN) TO TOUCH THE SFT DURING CUTTING POSITION DETECTING PROCESS. OTHERWISE, THE SWITCH SHALL BE RETRACTED (SPRING UP).
7. ON HIGH CHUCK CURRENT STOP CHUCK MOTOR AND CUTTER ASSEMBLY.
8. THE RELATIVE LINEAR POSITION OF CUTTER WHEEL.
9. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE DESIGNED AND FABRICATED BY PASCO.
10. WT-6950A--, ZT-6979A--, AND ZS-6995A-- ARE BACK-UP TO ENCODER ZT-6994A-- FOR POSITIONING.
    ZT-6996A-- IS BACK-UP TO ENCODER
    POSITION ZT-6997A--
    ZS-6995A-- IS USED TO INDICATE THAT THE CUTTER HARD STOP ROLLERS HAVE BEEN RETRACTED.
11. CUTTER ASSEMBLY MOVES AT HIGHER SPEED IN TRANSVERSE DIRECTION.
12. WHEN ROCKET IS TRANSFERRED FROM RCM INPUT CONVEYOR, ROCKET STOP TO BE IN EXTEND POSITION, CHUCK GRIPPER OPENED, CUTTER ASSEMBLY AT BASE POSITION, CUTTER WHEEL AT RETRACTED POSITION AND CHUCK INLET CONVEYOR AND CUTTER INLET CONVEYOR RUNNING.
13. SOFT SWITCH SET POINT:
    TOUCH SFT
    SFT CUT
    WARHEAD CUT
    HOME
14. VFD CONTROLLER SHALL BE PROVIDED WITH SERVO DRIVE PANEL AND PROCURED BY PASCO.
15. DELETED.
16. ONE PANEL MOUNT EMERGENCY STOP PUSH BUTTON AND ONE REMOTE HANDHELD CONTROL WITH UMBILICAL CABLE ARE INSTALLED AT FIELD JUNCTION BOX EJ-FCS-TBF-6214.
17. CONVEYORS MJ-RHS-0141, MJ-RHS-0143, AND MJ-RHS-0145 AND ASSEMBLIES MJ-RHS-0142 AND MJ-RHS-0144 AND ALL ASSOCIATED INSTRUMENTS, MOTORS, AND COMPONENTS ARE "Q".
18. FOR A LIST OF ALL FCS AND SERVO SOFT TAGS REFER TO DOCUMENT 24915-07-JQ-RHS-00001.
19. THESE SIGNALS ARE SENT BACK TO THE FCS OVER AN ETHERNET COMMUNICATION LINK.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	09/26/12	IFC, INCORPORATED DCN-302, -417, -585, -659	GM	JDC	SA	KMR	KMR
4	02/01/11	IFC, INCORP. DCN-163 THRU 166,169,170,214,218,236	PEB	BAC/MDV	SA	BBB	BBB
3	03/26/10	IFC, DELETED "SOFT" NOTE 15	PEB	MDV	SA	BBB	BBB
2	08/11/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
1	06/13/07	IFC, PASCO COMMENT INCORPORATED, TREND 157	IT	JLL	PEB	JB	BBB
0	10/25/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING RCM CUTTER & TABLE ASSEMBLY LN-1 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00081 SHEET 1 OF 1 REV 5

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PLOTTED BY: USER AT SYTIME USING COLOR

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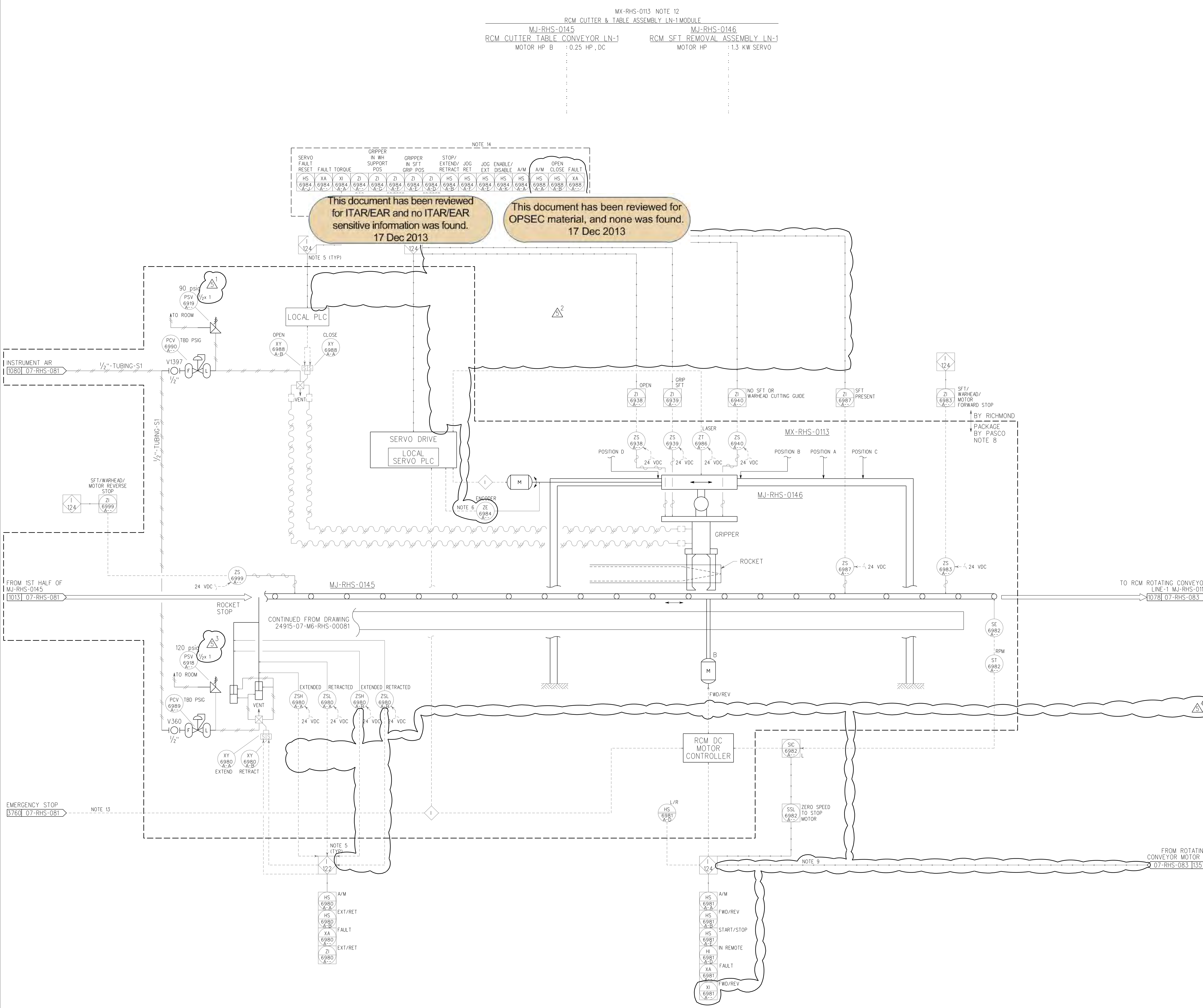

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
6. SFT REMOVAL GRIPPER TRAVEL POSITION:

POSITION	GRIPPER	SWITCH
A: BASE POSITION	OPEN	ZS-6938A--
B: SFT GRIPPING POSITION FOR SFT REMOVAL	CLOSE	ZS-6939A--
C: SFT REMOVED FROM WARHEAD	OPEN	ZS-6938A--
D: NO SFT/WARHEAD CUTTING GUIDE	CLOSE	ZS-6940A--

SFT REMOVAL POSITION AND GRIPPER OPERATION TO BE INTERLOCKED.

7. ON HIGH TORQUE FROM THE SFT REMOVAL ASSEMBLY SERVO MOTOR THE GRIPPER FINGERS WILL BE OPENED AND THE SFT REMOVAL ASSEMBLY WILL BE STOPPED.
8. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE DESIGNED AND FABRICATED BY PASCO.
9. RCM CUTTER TABLE CONVEYOR LN-1 MOTOR "B" SHALL BE INTERLOCKED WITH ROTATING SERVO ENCODER POSITION TO PREVENT ITS MOTOR TO RUN IN FORWARD DIRECTION.
11. DELETED.
12. MJ-RHS-0145 AND MJ-RHS-0146 AND ALL ASSOCIATED INSTRUMENTS, MOTOR AND COMPONENTS ARE "Q".
13. ONE PANEL MOUNT EMERGENCY STOP PUSH BUTTON AND ONE REMOTE HANDHELD CONTROL WITH UMBILICAL CABLE ARE INSTALLED AT FIELD JUNCTION BOX EJ-FCS-TBF-6214.
14. FOR A LIST OF ALL FCS AND SERVO SOFT TAGS REFER TO DOCUMENT 24915-07-JQ-RHS-00001.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	09/26/12	IFC, INCORPORATED DCN-302, -417	GM	JDC	SA	KMR	KMR
4	12/21/10	IFC, INCORPORATED DCN-163, 166 THRU 170, 214, 218	PEB	MDV	SA	BBB	BBB
3	03/26/10	IFC, DELETED "SOFT" NOTE 11	PEB	MDV	SA	BBB	BBB
2	08/11/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
1	06/13/07	IFC, PASCO COMMENTS INCORPORATED, TREND 157	IT	JLL	PEB	JB	BBB
0	10/25/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB

QUALITY ☒ Q ☐ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING RCM SFT REMOVAL ASSEMBLY LN-1 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00082 | SHEET 1 OF 1 | REV 5

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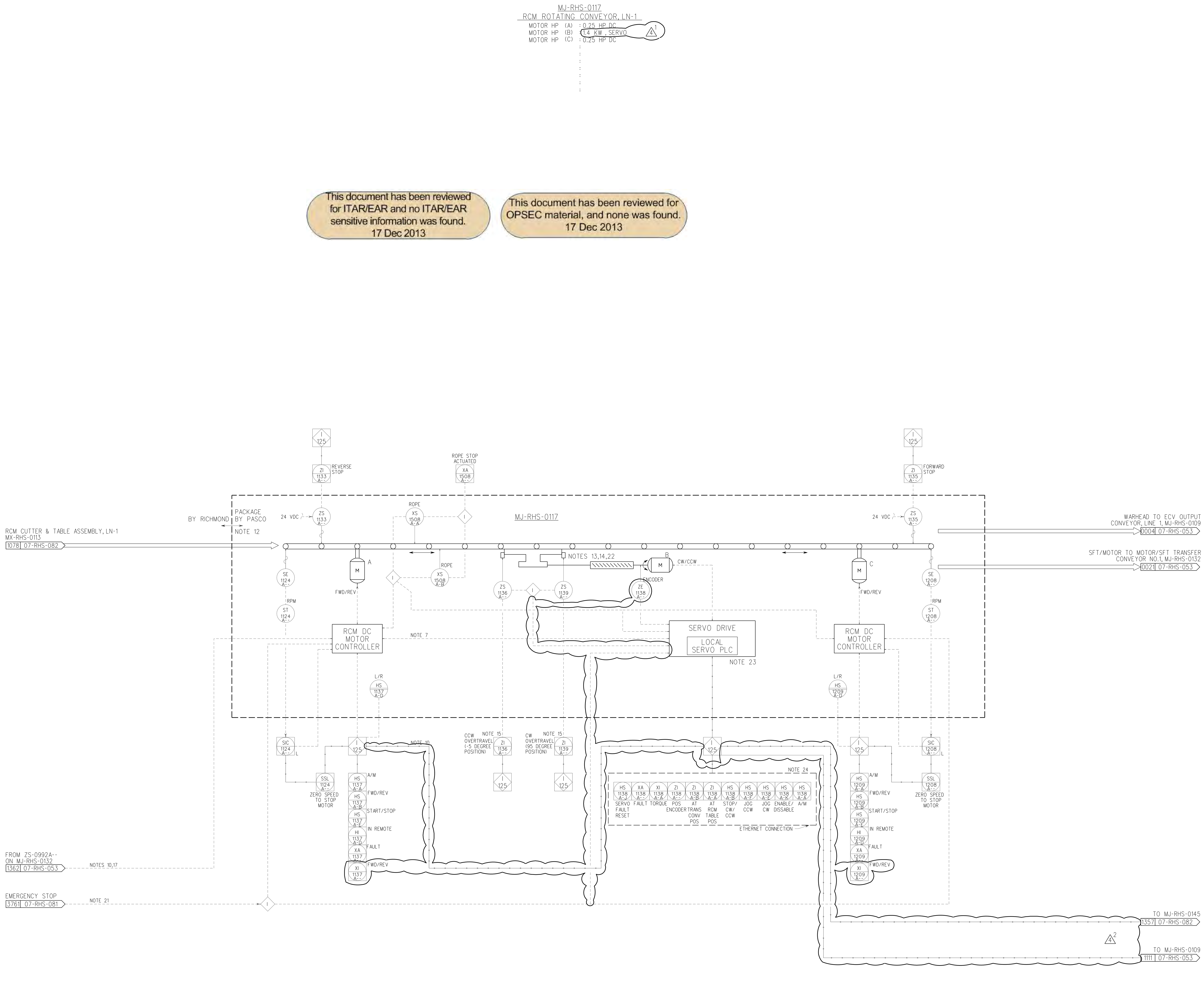

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

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GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. DELETED.
6. DELETED.
7. CONVEYOR MOTOR AND TURNTABLE MOTOR SHALL BE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION.
8. DELETED.
9. A FLOOR MOUNTED HARD STOP SHALL BE PROVIDED ON THE WEST END OF TURNTABLE.
10. ROTATING CONVEYOR MOTOR SHALL BE INTERLOCKED WITH ROTATING SERVO ENCODER POSITION ON RCM ROTATING CONVEYOR (P&ID 24915-07-M6-RHS-00083) AND ZS 0992A-- TO PREVENT IT'S MOTOR FROM RUNNING WHILE RCM ROTATING CONVEYOR LN-1 IS NEITHER AT EAST-WEST NOR NORTH-SOUTH ALIGNMENT.
11. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
12. EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE DESIGNED AND FABRICATED BY PASCO.
13. MECHANICAL STOPPERS FOR -5 AND 95 DEGREE POSITION.
14. RCM ROTATING CONVEYOR SHALL NOT RUN IF ROTATING CONVEYOR IS NOT LOCATED AT 0 OR 90 DEGREE POSITION.
15. ROTATING CONVEYOR OVER TRAVEL PROTECTION.
16. DURING THE ROCKET LEAKER CAMPAIGN, OPERATOR TO LOAD LEAKER ROCKET ON THE LEAKER ROCKET ORIENTATION FEED TABLE TO CONFIRM THE CORRECT ORIENTATION (WARHEAD @ FORWARD POSITION), AND LOADED ON THE ROTATING CONVEYOR. THE LEAKER ROCKET ORIENTATION FEED TABLE WILL BE INSTALLED AT LINE-1 ROTATING CONVEYOR DURING LEAKER OPERATION ONLY.
17. SENSOR ZS-0992A-- IS LOCATED AT CONVEYOR MJ-RHS-0132 TO DETECT ROTATING CONVEYOR AT EAST-WEST ORIENTATION (BY PASADENA).
18. DELETED.
19. DELETED.
20. DELETED.
21. ONE PANEL MOUNT EMERGENCY STOP PUSH BUTTON AND ONE REMOTE HANDHELD CONTROL WITH UMBILICAL CABLE ARE INSTALLED AT FIELD JUNCTION BOX EJ-FCS-TBF-6214.
22. ROCKET CUTTING MACHINE SHALL INCLUDE A GUARD WHICH LOCATES THE SHIPPING AND FIRING TUBE INDEXING RING TO PREVENT OPERATORS FROM MANUALLY LOADING A ROCKET IN THE WRONG ORIENTATION.
23. THE ROTATING CONVEYOR ROLLERS ARE OPERATED BY TWO INDEPENDENT DC MOTORS. THE FRONT PORTION OF THE ROLLERS ARE CONTROLLED BY MOTOR A AND THE BACK ROLLERS ARE CONTROLLED BY MOTOR C. THE ROTATION OF THE CONVEYOR IS CONTROLLED BY SERVO MOTOR B.
24. FOR A LIST OF ALL FCS AND SERVO SOFT TAGS REFER TO DOCUMENT 24915-07-JQ-RHS-00001.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	09/26/12	IFC, INCORPORATED DCN-302, -417	GM	JDC	SA	KMR	KMR
3	12/21/10	IFC, INCORPORATED DCN-163, -166, -167, -170, -214	PEB	MDV	SA	BBB	BBB
2	03/26/10	IFC, HTL-1055, ADDED PASCO COMMENTS FOR E-STOPS	PEB	MDV	SA	BBB	BBB
1	06/13/07	IFC, PASCO COMMENTS INCORPORATED, TREND 157	IT	JLL	PEB	JB	BBB
0	10/25/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING RCM ROTATING CONVEYOR LN-1 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-RHS-00083 | SHEET 1 OF 1 | REV 4

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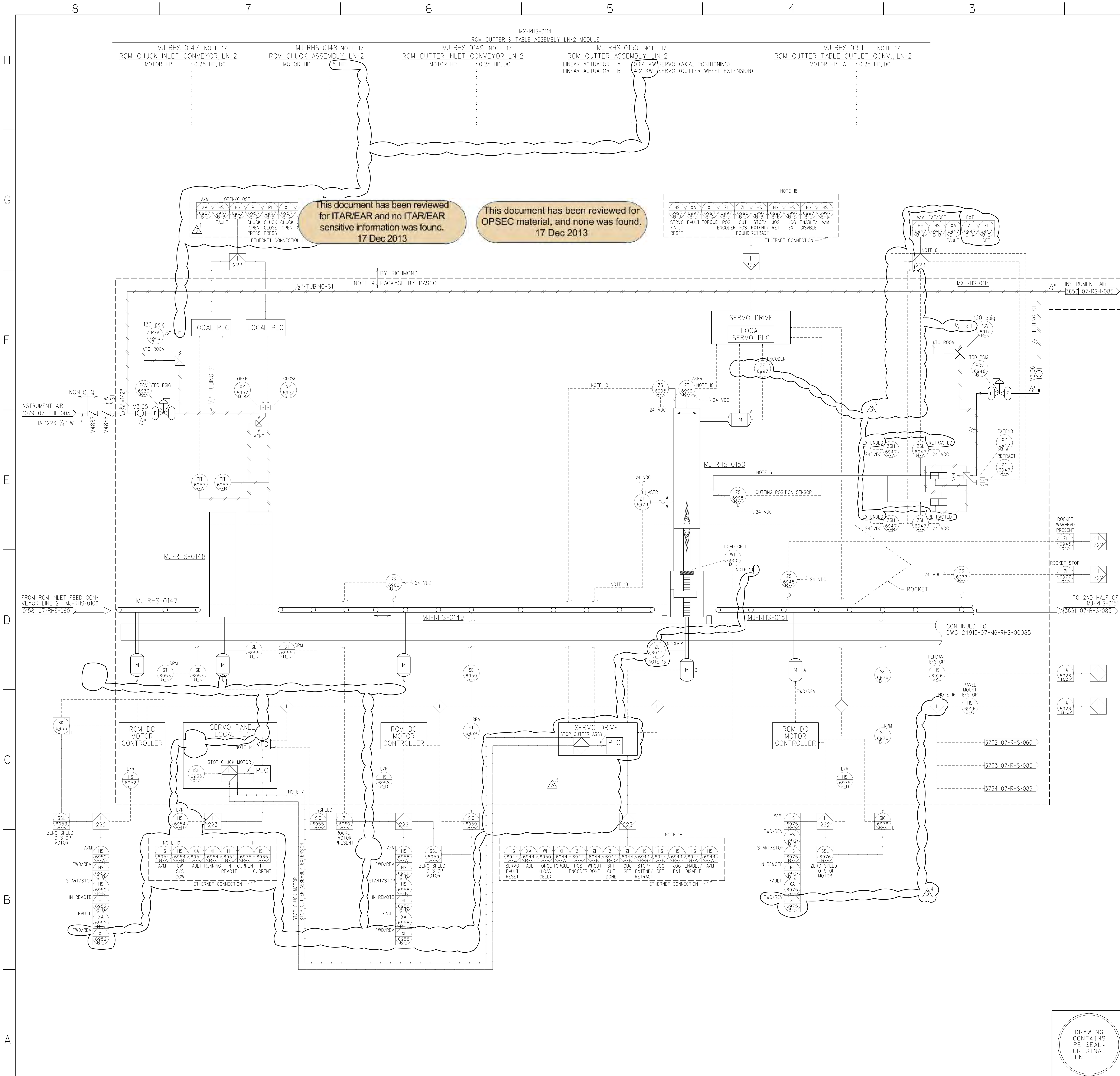

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
6. THE CUTTING POSITION PROXIMITY SWITCH SHALL BE EXTENDED (AIR TO DOWN) TO TOUCH THE SFT DURING CUTTING POSITION DETECTING PROCESS. OTHERWISE, THE SWITCH SHALL BE RETRACTED (SPRING UP).
7. ON HIGH CHUCK CURRENT STOP CHUCK MOTOR AND CUTTER ASSEMBLY.
8. THE RELATIVE LINEAR POSITION OF CUTTER WHEEL.
9. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE DESIGNED AND FABRICATED BY PASCO.
10. WT-6950B--, ZT-6979B--, AND ZS-6995B-- ARE BACK-UP TO ENCODER ZT-6931B-- FOR POSITIONING.
    ZT-6996B-- IS BACK-UP TO ENCODER
    ZT-6933B-- FOR POSITIONING
    ZS-6995B-- IS USED TO INDICATE THAT THE CUTTER HARD STOP ROLLERS HAVE BEEN RETRACTED.
11. CUTTER ASSEMBLY MOVES AT HIGHER SPEED IN TRANSVERSE DIRECTION.
12. WHEN ROCKET IS TRANSFERRED FROM RCM INPUT CONVEYOR, ROCKET STOP TO BE IN EXTEND POSITION, CHUCK GRIPPER OPENED, CUTTER ASSEMBLY AT BASE POSITION, CUTTER WHEEL AT RETRACTED POSITION AND CHUCK INLET CONVEYOR AND CUTTER INLET CONVEYOR RUNNING.
13. SOFT SWITCH SET POINT:
    TOUCH SFT
    SFT CUT
    WARHEAD CUT
    HOME
14. VFD CONTROLLER SHALL BE PROVIDED WITH SERVO DRIVE PANEL AND PROCURED BY PASCO.
15. DELETED.
16. ONE PANEL MOUNT EMERGENCY STOP PUSH BUTTON AND ONE REMOTE HANDHELD CONTROL WITH UMBILICAL CABLE ARE INSTALLED AT FIELD JUNCTION BOX EJ-FCS-TBF-6224.
17. RCM CONVEYORS MJ-RHS-0147, MJ-RHS-0149, MJ-RHS-0151 AND RCM ASSEMBLIES MJ-RHS-0148, MJ-RHS-0150 AND ALL ASSOCIATED INSTRUMENTS, MOTORS AND COMPONENTS ARE "Q".
18. FOR A LIST OF ALL FCS AND SERVO SOFT TAGS REFER TO DOCUMENT 24915-07-JQ-RHS-00001.
19. THESE SIGNALS ARE SENT BACK TO THE FCS OVER AN ETHERNET COMMUNICATION LINK.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	09/26/12	IFC, INCORPORATED DCN-302, -417, -585, -659	GM	JDC	SA	KMR	KMR
2	02/01/11	IFC, INCORP. DCN-163 THRU 166,169,170,214,218,236	PEB	BAC/MDV	SA	BBB	BBB
1	03/26/10	IFC, GC-7629, ADDED PASCO COMMENTS FOR E-STOPS	PEB	MDV	SA	BBB	BBB
0	06/21/07	ISSUED FOR CONSTRUCTION (IFC)	IT	JLL	PEB	JB	BBB

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING RCM CUTTER & TABLE ASSEMBLY LN-2 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00084 | SHEET 1 OF 1 | REV 3

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07MRHS084.pid 09/26/12
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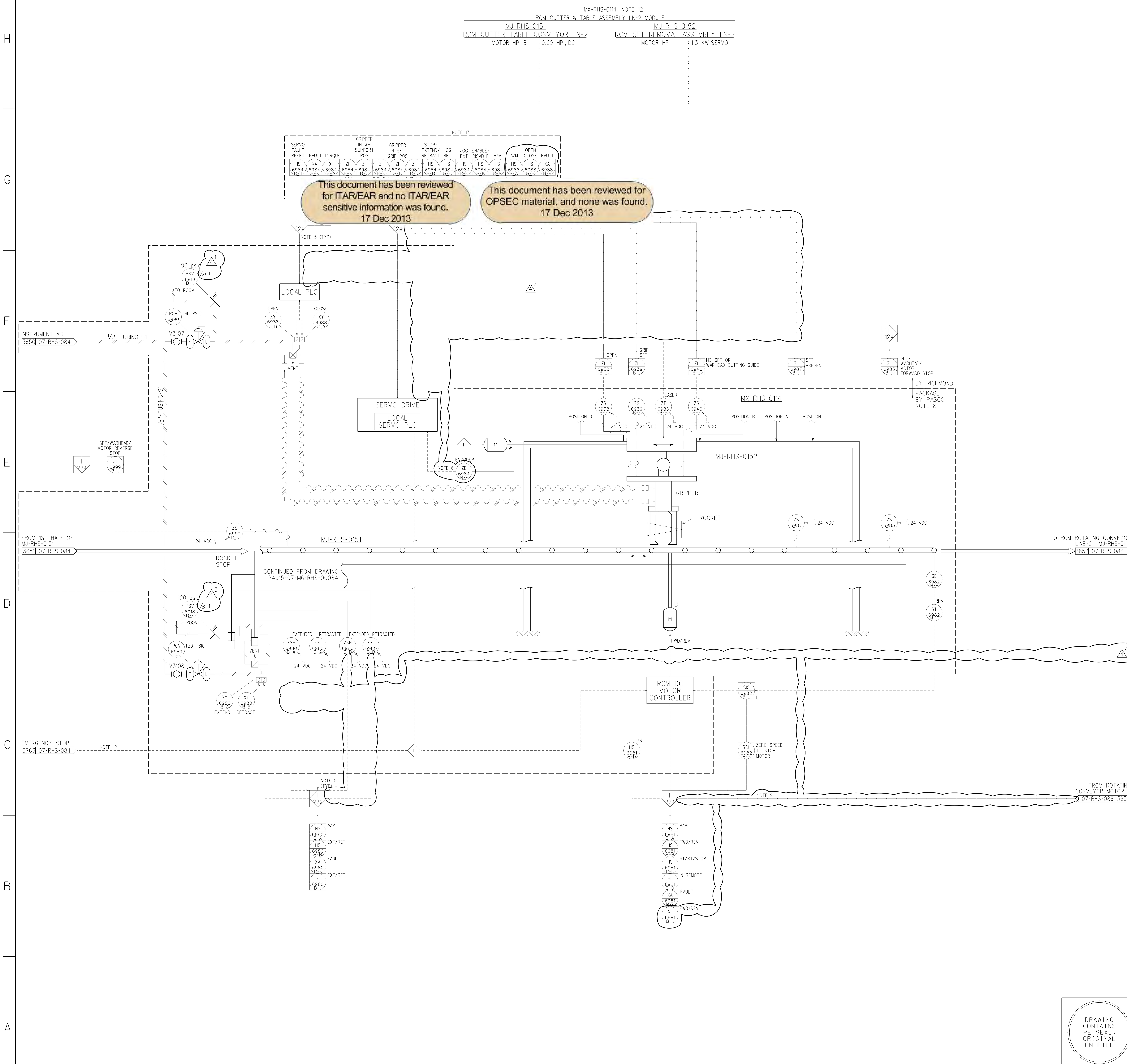

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
6. SFT REMOVAL GRIPPER TRAVEL POSITION:

POSITION	GRIPPER	SWITCH
A: BASE POSITION	OPEN	ZS-6938B--
B: SFT GRIPPING POSITION FOR SFT REMOVAL	CLOSE	ZS-6939B--
C: SFT REMOVED FROM WARHEAD	OPEN	ZS-6938B--
D: NO SFT/WARHEAD CUTTING GUIDE	CLOSE	ZS-6940B--

SFT REMOVAL POSITION AND GRIPPER OPERATION TO BE INTERLOCKED.

7. ON HIGH TORQUE FROM THE SFT REMOVAL ASSEMBLY SERVO MOTOR THE GRIPPER FINGERS WILL BE OPENED AND THE SFT REMOVAL ASSEMBLY WILL BE STOPPED.
8. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE DESIGNED AND FABRICATED BY PASCO.
9. RCM CUTTER TABLE CONVEYOR LN-2 MOTOR "B" SHALL BE INTERLOCKED WITH SERVO ENCODER POSITION TO PREVENT ITS MOTOR TO RUN IN FORWARD DIRECTION.
10. DELETED.
11. MJ-RHS-0151 AND MJ-RHS-0152 AND ALL ASSOCIATED INSTRUMENTS, MOTOR AND COMPONENTS ARE "Q".
12. ONE PANEL MOUNT EMERGENCY STOP PUSH BUTTON AND ONE REMOTE HANDHELD CONTROL WITH UMBILICAL CABLE ARE INSTALLED AT FIELD JUNCTION BOX EJ-FCS-TBF-6224.
13. FOR A LIST OF ALL FCS AND SERVO SOFT TAGS REFER TO DOCUMENT 24915-07-JQ-RHS-00001.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	09/26/12	IFC, INCORPORATED DCN-302, -417	GM	JDC	SA	KMR	KMR
3	12/21/10	IFC, INCORPORATED DCN-163, 166 THRU 170, 214, 218	PEB	MDV	SA	BBB	BBB
2	03/26/10	IFC, DELETED "SOFT" NOTE 10	PEB	MDV	SA	BBB	BBB
1	08/11/09	IFC, GC 7629, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
0	06/21/07	ISSUED FOR CONSTRUCTION (IFC)	IT	JLL	PEB	JB	BBB

QUALITY ☒ Q ☐ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING RCM SFT REMOVAL ASSEMBLY LN-2 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00085 | SHEET 1 OF 1 | REV 4

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07RHS085.pid 09/26/12
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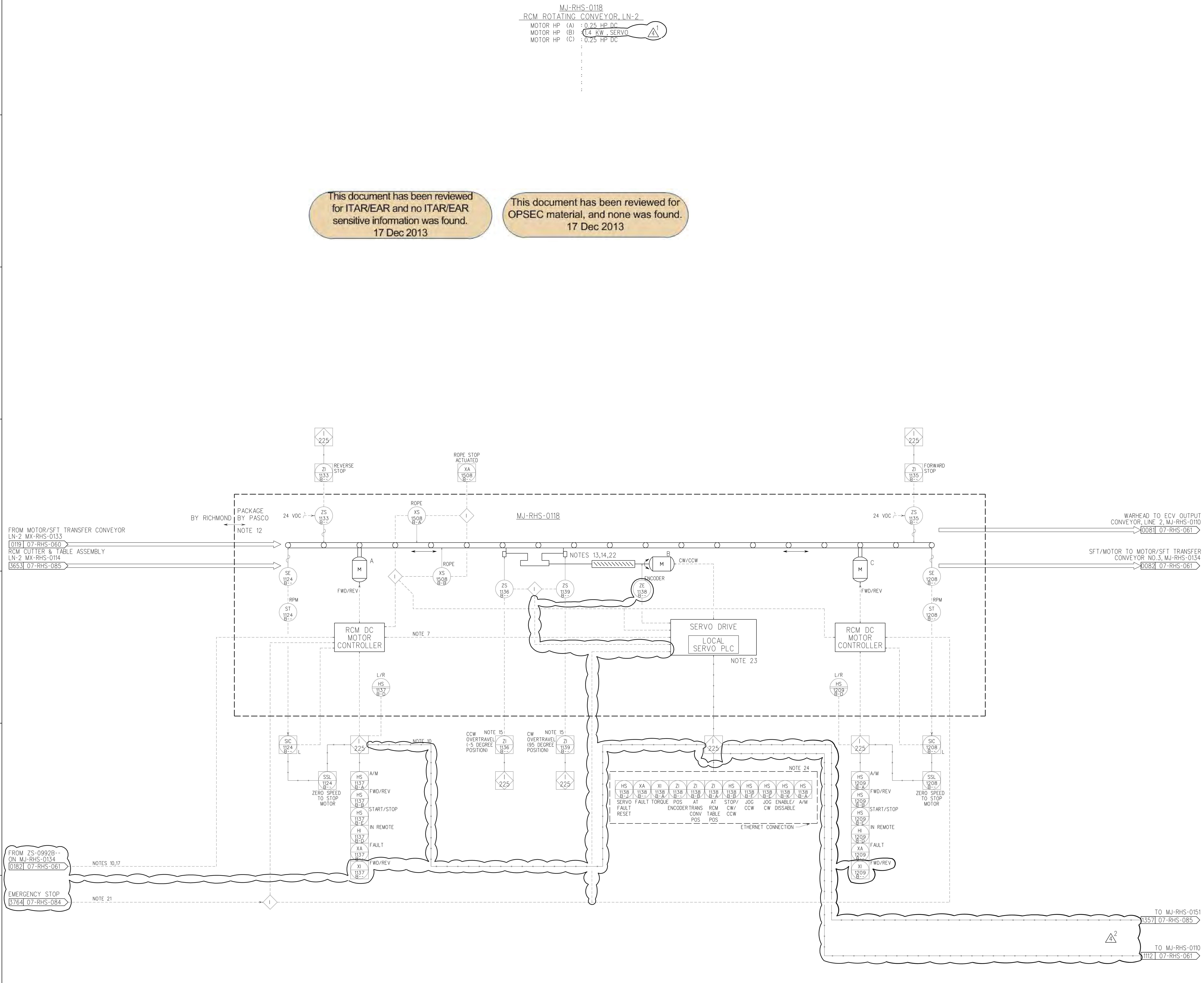
This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. DELETED.
6. DELETED.
7. CONVEYOR MOTOR AND TURNTABLE MOTOR SHALL BE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION.
8. DELETED.
9. A FLOOR MOUNTED HARD STOP SHALL BE PROVIDED ON THE WEST END OF TURNTABLE.
10. ROTATING CONVEYOR MOTOR SHALL BE INTERLOCKED WITH ROTATING SERVO ENCODER POSITION ON RCM ROTATING CONVEYOR (P&ID: 24915-07-M6-RHS-00085) AND ZS-0992B-- TO PREVENT ITS MOTOR FROM RUNNING WHILE RCM ROTATING CONVEYOR LN-2 IS NEITHER AT EAST-WEST NOR NORTH-SOUTH ALIGNMENT.
11. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-RHS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
12. EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE DESIGNED AND FABRICATED BY PASCO.
13. MECHANICAL STOPPERS FOR -5 AND 95 DEGREE POSITION.
14. RCM ROTATING CONVEYOR SHALL NOT RUN IF ROTATING CONVEYOR IS NOT LOCATED AT 0 OR 90 DEGREE POSITION.
15. ROTATING CONVEYOR OVER TRAVEL PROTECTION.
16. DURING THE ROCKET LEAKER CAMPAIGN, OPERATOR TO LOAD LEAKER ROCKET ON THE LEAKER ROCKET ORIENTATION FEED TABLE TO CONFIRM THE CORRECT ORIENTATION (WARHEAD @ FORWARD POSITION), AND LOADED ON THE ROTATING CONVEYOR. THE LEAKER ROCKET ORIENTATION FEED TABLE WILL BE INSTALLED AT LINE-2 ROTATING CONVEYOR DURING LEAKER OPERATION ONLY.
17. SENSOR ZS-0992B-- IS LOCATED AT CONVEYOR MJ-RHS-0140 TO DETECT ROTATING CONVEYOR AT EAST-WEST ORIENTATION (BY PASADENA).
18. DELETED.
19. DELETED.
20. DELETED.
21. ONE PANEL MOUNT EMERGENCY STOP PUSH BUTTON AND ONE REMOTE HANDHELD CONTROL WITH UMBILICAL CABLE ARE INSTALLED AT FIELD JUNCTION BOX EJ-FCS-TBF-6224.
22. ROCKET CUTTING MACHINE SHALL INCLUDE A GUARD WHICH LOCATES THE SHIPPING AND FIRING TUBE INDEXING RING TO PREVENT OPERATORS FROM MANUALLY LOADING A ROCKET IN THE WRONG ORIENTATION.
23. THE ROTATING CONVEYOR ROLLERS ARE OPERATED BY TWO INDEPENDENT DC MOTORS. THE FRONT PORTION OF THE ROLLERS ARE CONTROLLED BY MOTOR A AND THE BACK ROLLERS ARE CONTROLLED BY MOTOR C. THE ROTATION OF THE CONVEYOR IS CONTROLLED BY SERVO MOTOR B.
24. FOR A LIST OF ALL FCS AND SERVO SOFT TAGS REFER TO DOCUMENT 24915-07-JQ-RHS-00001.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	09/26/12	IFC, INCORPORATED DCN-302, -360, -417	GM	JDC	SA	KMR	KMR
3	12/21/10	IFC, INCORPORATED DCN-163, -166, -167, -170, -214	PEB	MDV	SA	BBB	BBB
2	03/26/10	IFC, DELETED "SOFT" NOTE 20	PEB	MDV	SA	BBB	BBB
1	08/11/09	IFC, HTL-1055, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
0	06/21/07	ISSUED FOR CONSTRUCTION (IFC)	IT	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING RCM ROTATING CONVEYOR LN-2 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-RHS-00086 | SHEET 1 OF 1 | REV 4

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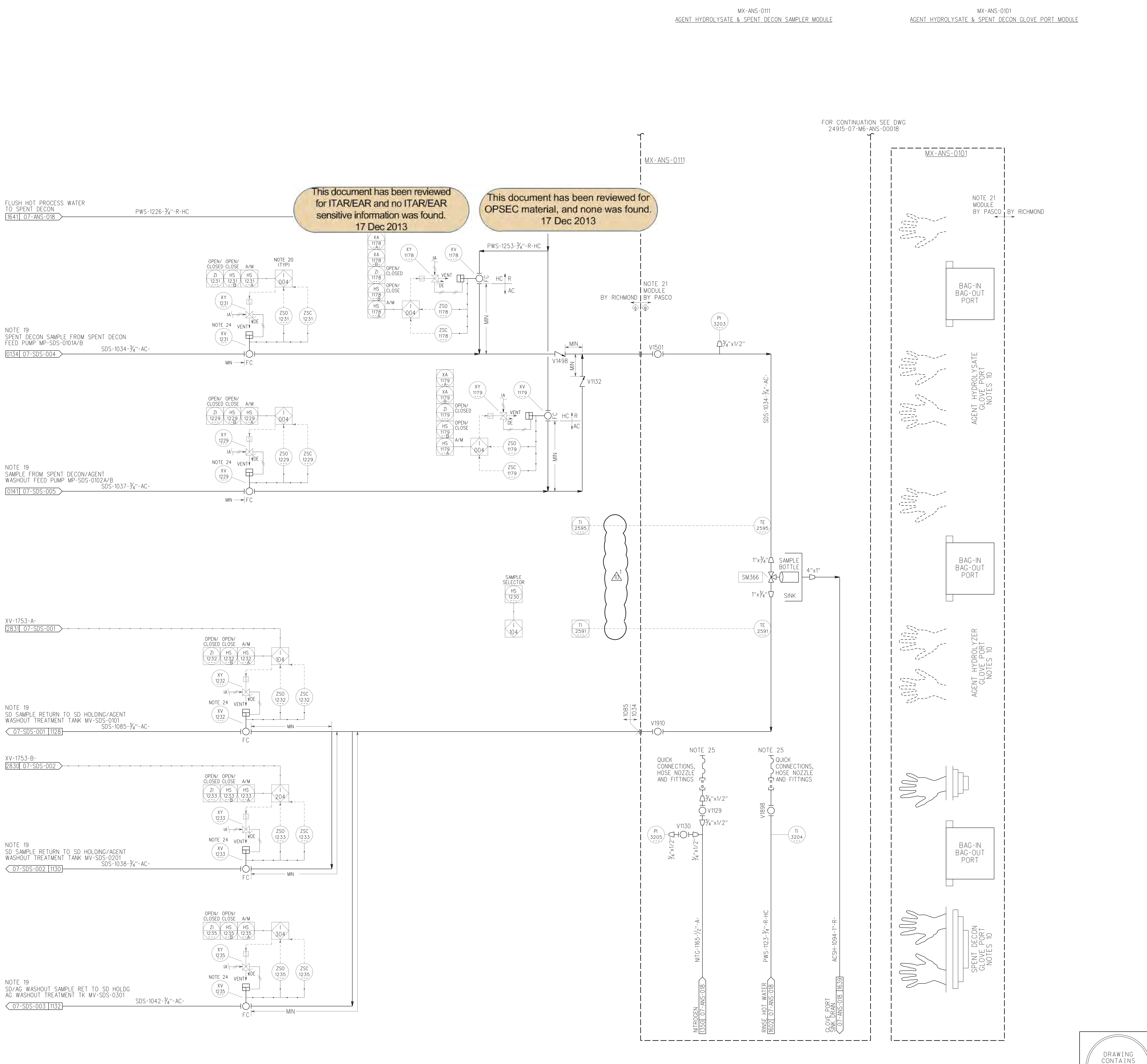

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. DELETED.
6. DELETED.
7. DELETED.
8. DELETED.
9. ONE GLOVE PORT SAMPLER FOR ALL THREE OF THE SPENT DECON HOLDING TANKS.
10. LOCATE GLOVE PORTS NEAR THE BAG-IN BAG-OUT PORT SUCH THAT SAMPLES CAN BE READILY PLACED ONTO THE BAG-IN BAG-OUT PORT.
11. DELETED.
12. DELETED.
13. DELETED.
14. DELETED.
15. DELETED.
16. DELETED.
17. DELETED.
18. DELETED.
19. AGENT SAMPLING IS NOT REQUIRED WHEN AGENT WASHOUT IS STORED IN ANY OF THE TANKS MV-SDS-0101/0201/0301. REMOVABLE SPOOLS ARE INSTALLED ON THE SAMPLING LINES TO PROVIDE POSITIVE ISOLATION FROM THE SAMPLING UNIT WHEN AGENT WASHOUT IS BEING HANDLED AS SHOWN ON P&ID 24915-07-SDS-00004 & 5.
20. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-SDS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
21. LINES, EQUIPMENT AND FIELD INSTRUMENTS INSIDE DASHED LINES ARE PHYSICALLY LOCATED ON MODULE AND ARE DESIGNED, PROCURED AND FABRICATED BY PASCO.
22. DELETED.
23. DELETED.
24. THE FLUSHING OF THE INLET PORTION OF THE SAMPLE LINE REQUIRES THAT THE SOURCE PUMP MP-SDS-0102 A/B AND MP-SDS-0101 A/B BE SHUT OFF DURING THE FLUSHING PERIOD OF 15 MINUTES. FLUSHING OF THE DOWNSTREAM PORTION OF THE LINE CAN BE DONE WITH THE PUMP RUNNING.
25. QUICK CONNECTION, HOSE, NOZZLE, AND FITTINGS TO BE SPECIFIED AND PURCHASED BY OPERATIONS DURING SYSTEMIZATION.

BASED ON BLUE GRASS PFD 24915-07-M5-ANS-00002 REV.8
BASED ON BLUE GRASS MSD 24915-07-NO-ANS-00002 REV.5
REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
10	08/03/12	IFC, INCORPORATED DCN-394	SC	JDC	SA	KMR	KMR
9	04/21/11	IFC, INCORPORATED DCN-365	SA	PEB	SA	BBB	BBB
8	03/17/11	IFC, INCORPORATED DCN-248, -333, HTL-5452	SA	PEB	SA	BBB	BBB
7	06/08/09	IFC, ADDED PIPING AND INSTRUMENT COMMENTS	JLL	PEB	BM	BBB	BBB
6	05/29/07	IFC, ADD PIPING AND PASCO COMMENTS	SF	JLL	PEB	JB	BBB
5	02/07/07	ISSUED FOR DESIGN (IFD), ADD PASCO CHANGES	SF	JLL	PEB	JB	BBB
4	09/27/06	IFD, ADD GOV COMMENT, DESIGN DEVELOPMENT	SF	JLL	PEB	JB	BBB
3	05/03/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	SF	JLL	PEB	JB	BBB

QUALITY ☒ Q ☐ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

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PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING SPENT DECON SAMPLER PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-SDS-00010 | SHEET 1 OF 1 | REV 10

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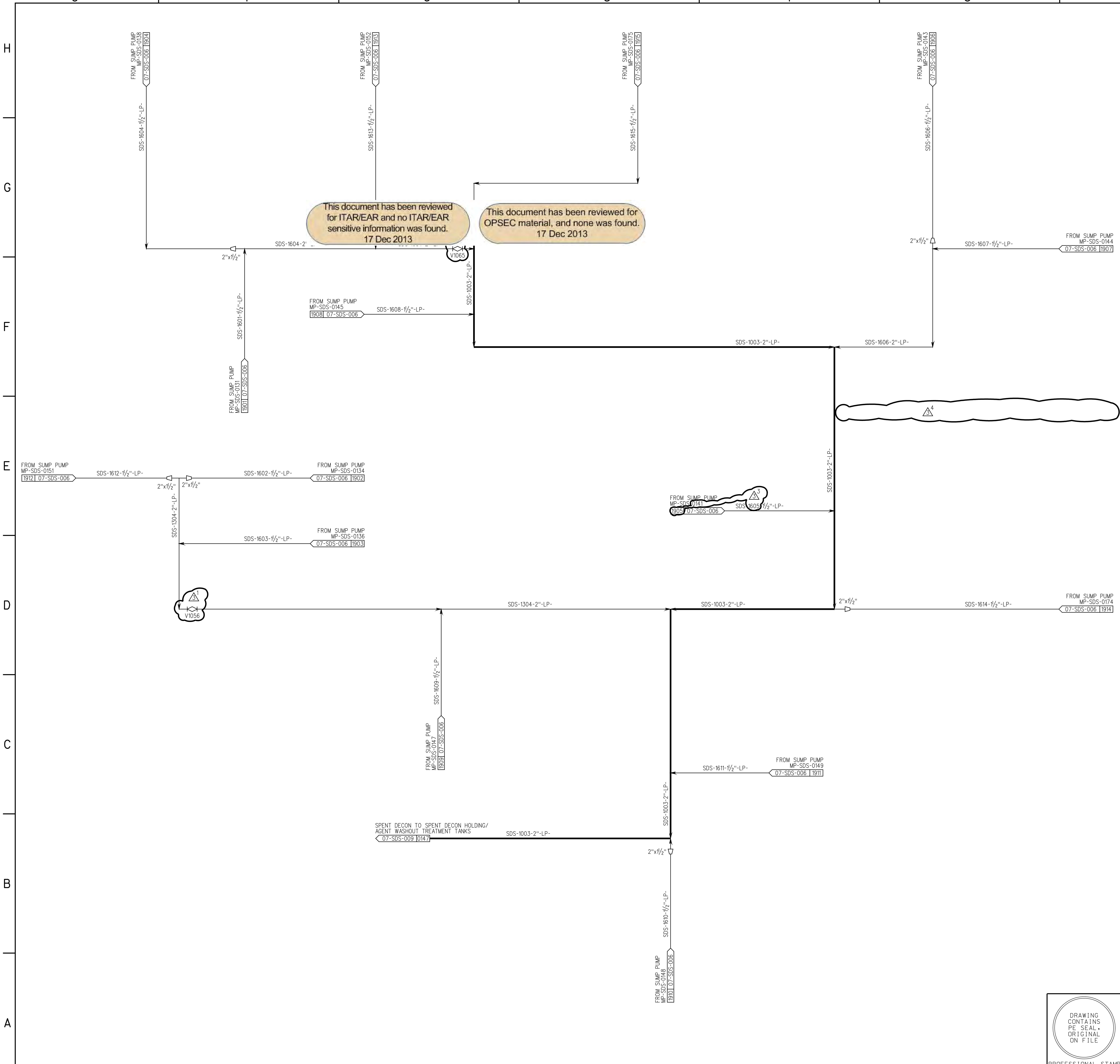

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. PIPING TIE-IN LAYOUT BY PIPING.
5. DELETED.

BASED ON BLUE GRASS MSD 24915-07-ND-SDS-00001 REV.5

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	03/09/07	IFC, SUMP PUMP DELETED, ADDED VALVES	RZ	JLL	PEB	JB	BBB
2	09/28/06	IFD, ADD DESIGN DEVELOPMENT	BE	JLL	PEB	JB	BBB
1	04/26/06	IFD, DESIGN DEVELOPMENT, SHEET REDRAWN	BE	JLL	PEB	JB	BBB
0	04/18/06	ISSUED FOR DESIGN (IFD)	BE	JLL	PEB	JB	BBB

QUALITY ☒ Q ☐ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING CAT-A SUMP PUMPS DISTRIBUTION HDR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-SDS-00011 | SHEET 1 OF 1 | REV 3

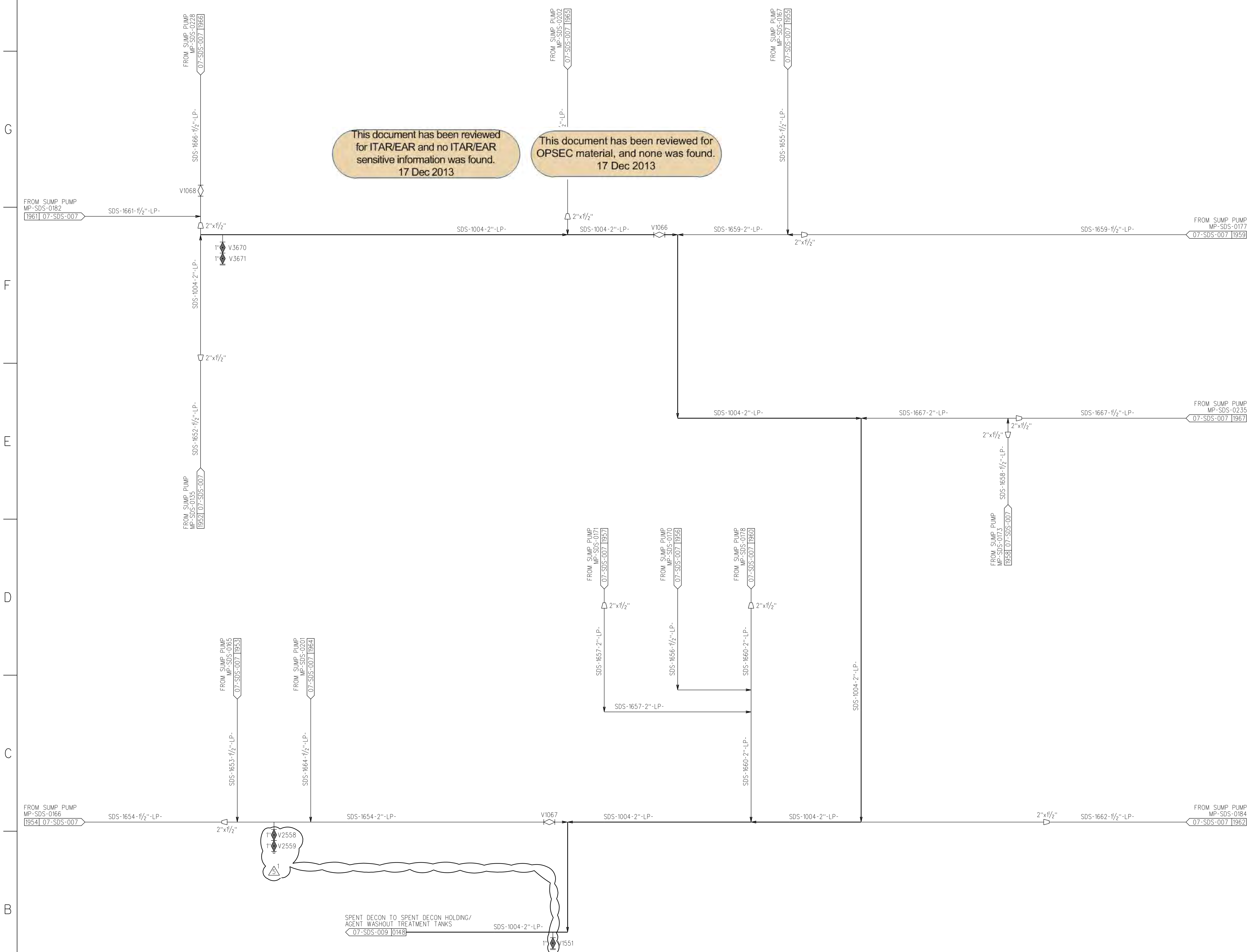
BGCAPP_DGN.BDR

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. PIPING TIE-IN LAYOUT BY PIPING.
5. DELETED.

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



BASED ON BLUE GRASS MSD 24915-07-NO-SDS-00001 REV.6

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	04/12/11	IFC, INCORPORATED DCN-344	SA	PEB	SA	BBB	BBB
4	06/08/09	IFC, ADDED PIPING COMMENTS	JLL	PEB	BM	BBB	BBB
3	03/09/07	ISSUED FOR CONSTRUCTION (IFC), ADDED VALVES	RZ	JLL	PEB	JB	BBB
2	09/28/06	IFD, ADD DESIGN DEVELOPMENT	BE	JLL	PEB	JB	BBB
1	04/26/06	IFD, DESIGN DEVELOPMENT, SHEET REDRAWN	BE	JLL	PEB	JB	BBB
0	04/18/06	ISSUED FOR DESIGN (IFD)	BE	JLL	PEB	JB	BBB

QUALITY ☒ Q ☐ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING CAT-B SUMP PUMPS DISTRIBUTION HDR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-SDS-00012 | SHEET 1 OF 1 | REV 5

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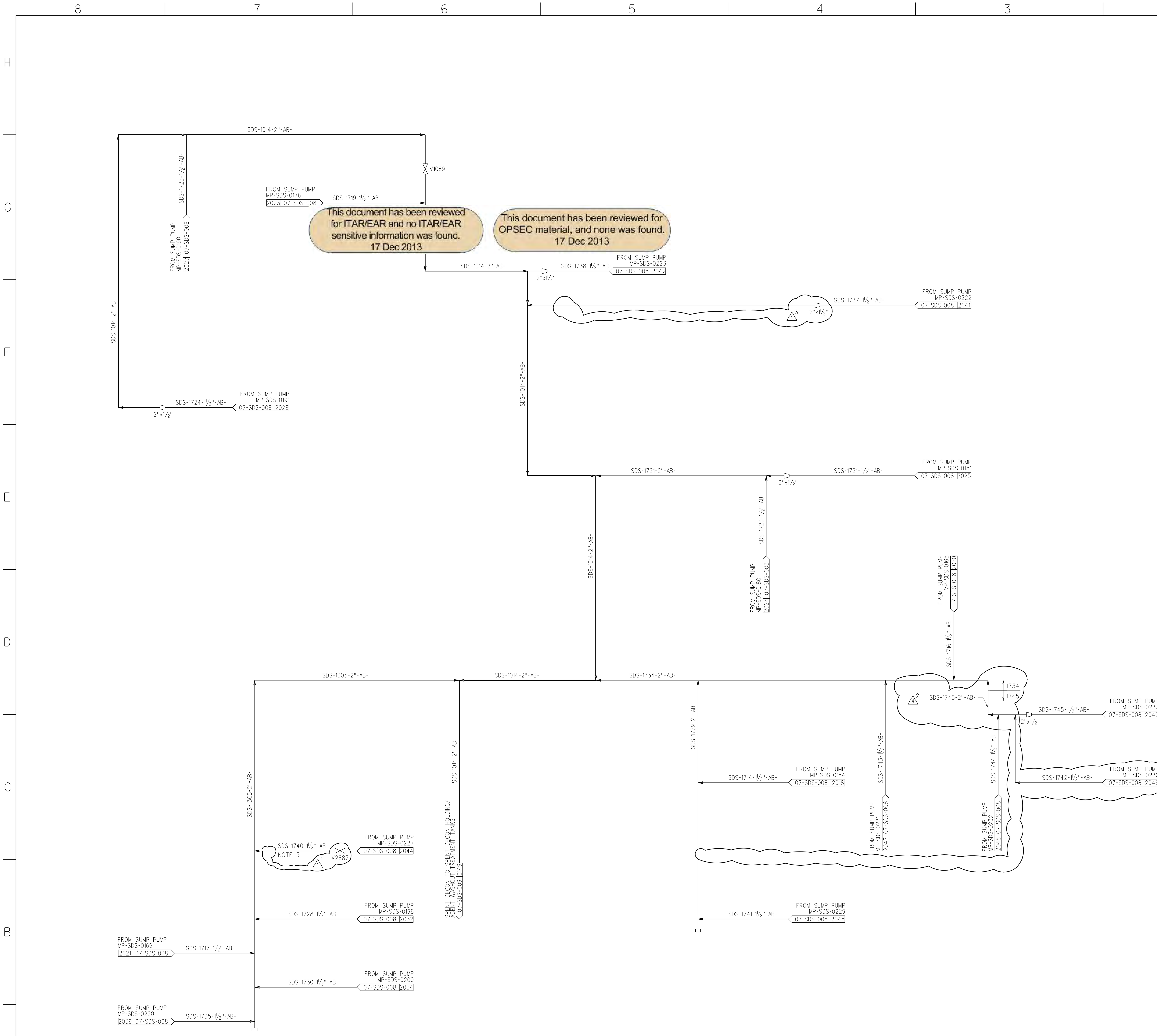

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. PIPING TIE-IN LAYOUT BY PIPING.
5. THE FLOOR SUMP, DB-SDS-0227 AND PUMP, MP-SDS-0227 ARE LOCATED ON THE 2ND FLOOR OF THE EQUIPMENT PLATFORM AT EL. 925 FT.

BASED ON BLUE GRASS MSD 24915-07-N0-SDS-00001 REV. 6

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	06/08/09	IFC, ADDED PIPING COMMENTS	JLL	PEB	BM	BBB	BBB
3	03/09/07	IFC, ADDED VALVE, REVISED LINE NUMBER, LOCATION	RZ	JLL	PEB	JB	BBB
2	09/28/06	IFD, ADD DESIGN DEVELOPMENT	BE	JLL	PEB	JB	BBB
1	04/26/06	IFD, DESIGN DEVELOPMENT, SHEET REDRAWN	BE	JLL	PEB	JB	BBB
0	04/18/06	ISSUED FOR DESIGN (IFD)	BE	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING CAT-C SUMP PUMPS DISTRIBUTION HDR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-SDS-00013 | SHEET 1 OF 1 | REV 4

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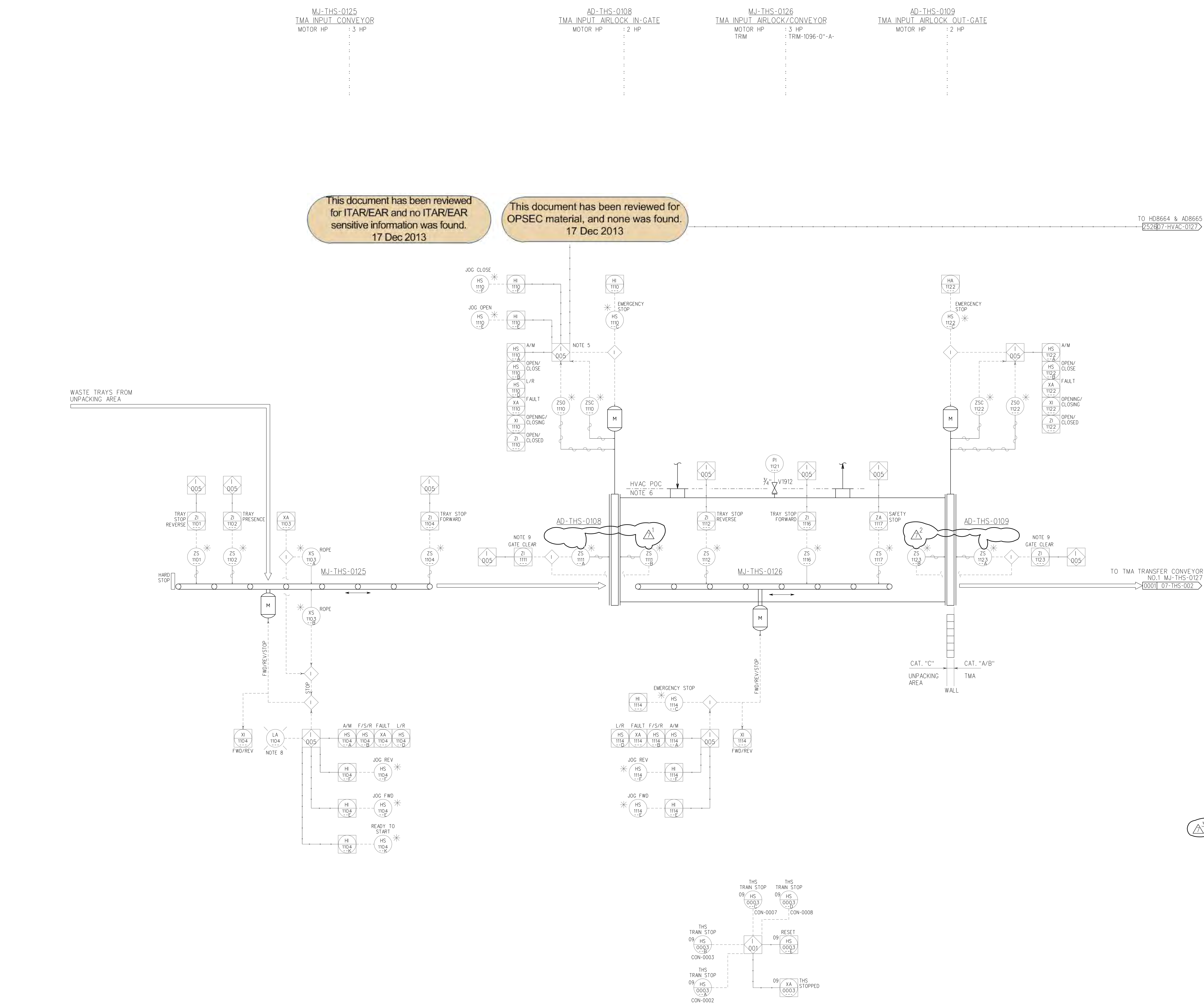


GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. INLET GATE AD-THS-0108 SHALL BE INTERLOCKED WITH OUTLET GATE AD-THS-0109 THROUGH A TIMER TO PREVENT IT FROM OPENING AFTER OUTLET GATE CLOSES UNTIL THE AIRLOCK HAS BEEN PURGED.
6. INSTRUMENTATION AND VALVES SHOWN ON HVAC DRAWING NO. 24915-07-M6-HVAC-00127.
7. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
8. WARNING LIGHT IS INTERLOCKED TO TURN ON 10 SECONDS BEFORE CONVEYOR MOTOR STARTS AND TURN OFF 10 SECONDS AFTER CONVEYOR STARTS.
9. GATE CLEAR SWITCHES SHOWN ON AIRLOCK GATES ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
7	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
6	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
5	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
4	11/15/06	IFD, ADDED GOV. COMMENTS AND INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
3	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
2	10/31/05	IFD, DC-1 INCORPORATED	RZ	JLL	PEB	JB	PGK
1	09/27/05	ISSUED FOR APPROVAL (IFA)	RZ	JLL	PEB	JB	JU
0	01/03/05	ISSUED FOR DESIGN (IFD)	NP	RZ	PEB	JB	JU

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING TMA LOAD & INPUT AIRLOCK/CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-THS-00001
SHEET 1 OF 1
REV 7

BGCAPP_DGN.BDR

07MTHS001.pid 02/23/12
DESIGN FILE: DGNSPEC
PLOTTED BY: USER$ ON DATE$ AT SYTIME USING COLOR

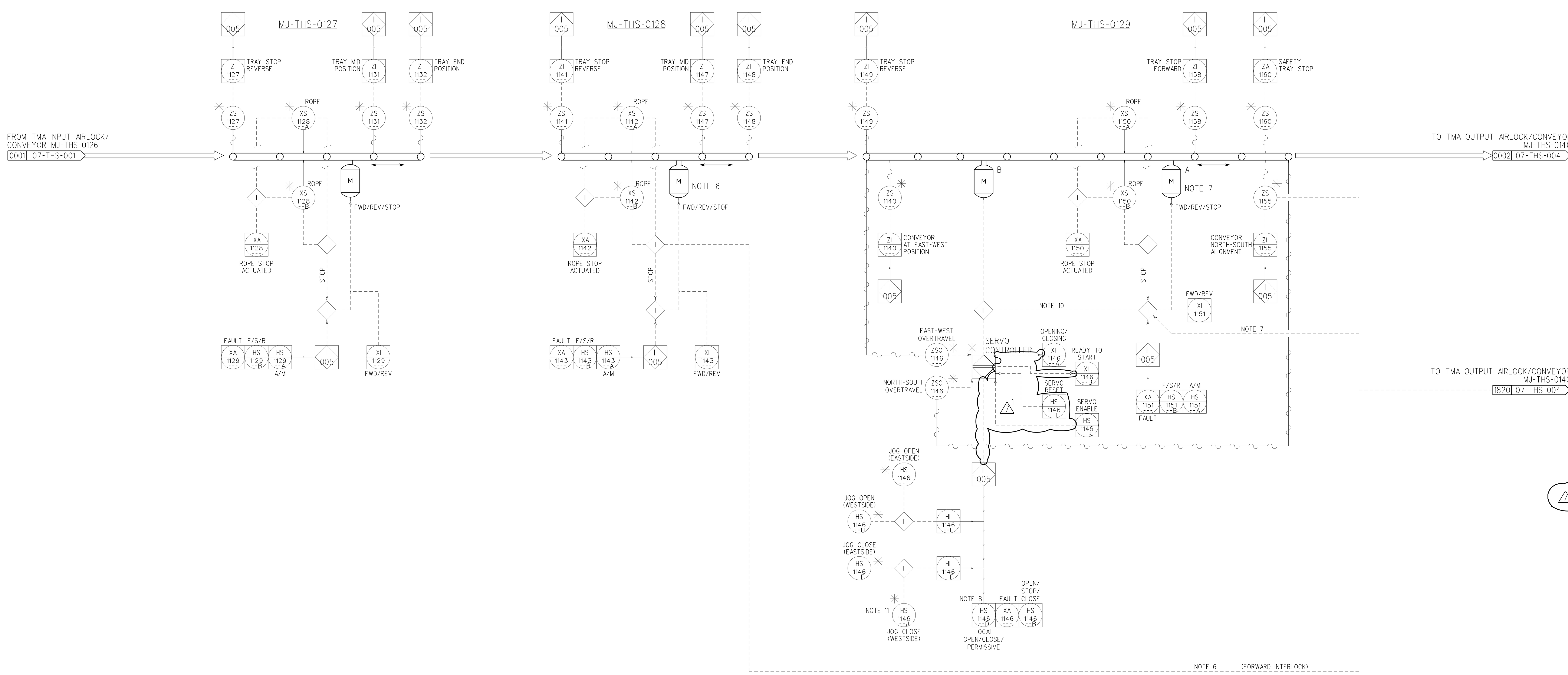
MJ-THS-0127
TMA TRANSFER CONVEYOR NO.1
MOTOR HP : 3 HP

MJ-THS-0128
TMA TRANSFER CONVEYOR NO.2
MOTOR HP : 3 HP

MJ-THS-0129
TMA SWING CONVEYOR
MOTOR HP (A) : 3 HP
MOTOR HP (B) : 0.75 HP (SERVO)

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. DELETED.
5. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
6. CONVEYOR MJ-THS-0128 MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-1155--- SWITCH ON CONVEYOR MJ-THS-0129 TO PREVENT ITS MOTOR RUNNING IN FORWARD DIRECTION WHILE THEY ARE NOT ALIGNED.
7. CONVEYOR MJ-THS-0129 MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-1155--- TO PREVENT ITS MOTOR FROM RUNNING WHILE IT IS NOT IN NORTH-SOUTH ORIENTATION.
8. ONLY LOCAL CONTROL REQUIRED.
9. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
10. SWING CONVEYOR MJ-THS-0129 SWING MOTOR "B" SHALL BE HARDWIRE INTERLOCKED WITH CONVEYOR MOTOR "A" TO PREVENT CONVEYOR ROLLERS TURNING WHILE SWING MOTOR IS OPERATING. ACTUATION OF ROPE WILL STOP THE SWING MOTOR AND CONVEYOR MOTOR.
11. TMA SWING CONVEYOR MJ-THS-0129 LOCAL JOG OPEN AND CLOSE SWITCHES SHALL BE PROVIDED AND SHIPPED LOOSE BY THE CONVEYOR SUPPLIER. EASTSIDE AND WESTSIDE SWITCHES SHALL BE MOUNTED IN SEPARATE CONTROL BOXES.



REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
7	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
6	07/22/09	IFC, GC 7730, VENDOR DATA	PEB	JLL	BM	BBB	BBB
5	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
4	11/15/06	IFD, ADDED GOV. COMMENTS AND INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
3	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
2	10/31/05	IFD, DC-1 INCORPORATED	RZ	JLL	PEB	JB	PGK
1	09/27/05	ISSUED FOR APPROVAL (IFA)	RZ	JLL	PEB	JB	JU
0	01/03/05	ISSUED FOR DESIGN (IFD)	NP	RZ	PEB	JB	JU

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING TMA TRANSFER CONVEYORS PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-THS-00002 | SHEET 1 OF 1 | REV 7

BGCAPP_DGN.BDR

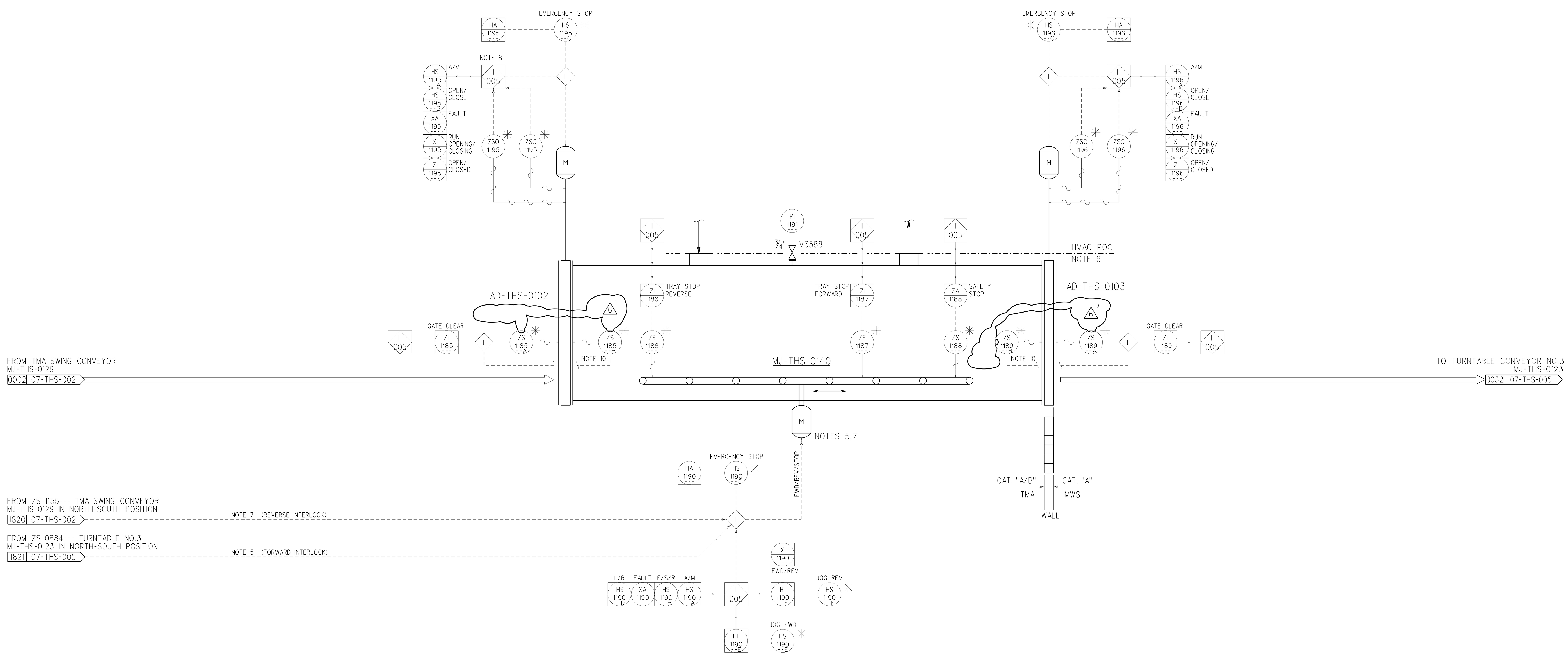
AD-THS-0102
TMA OUTPUT AIRLOCK IN-GATE
MOTOR HP : 2 HP

MJ-THS-0140
TMA OUTPUT AIRLOCK/CONVEYOR
MOTOR HP : 3 HP
TRIM : TRIM-1097-0"-A-

AD-THS-0103
TMA OUTPUT AIRLOCK OUT-GATE
MOTOR HP : 2 HP

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. AIRLOCK CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS 0884--- SWITCH ON TURNTABLE MJ-PHS-0123 TO PREVENT ITS MOTOR RUNNING IN FORWARD DIRECTION IF THE TURNTABLE IS NOT AT NORTH-SOUTH ALIGNMENT.
6. INSTRUMENTATION AND VALVING SHOWN ON HVAC DRAWING NUMBER 24915-07-M6-HVAC-00134.
7. AIRLOCK CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-1155--- SWITCH ON CONVEYOR MJ-THS-0129 TO PREVENT ITS MOTOR RUNNING IN RIVERSE DIRECTION IF SWING CONVEYOR IS NOT IN NORTH-SOUTH ALIGNMENT.
8. INLET GATE AD-THS-0102 SHALL BE INTERLOCKED WITH OUTLET GATE AD-THS-0103 THROUGH A TIMER TO PREVENT IT FROM OPENING AFTER OUTLET GATE CLOSES UNTIL THE AIRLOCK HAS BEEN PURGED.
9. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
10. GATE CLEAR SWITCHES ZS 1185--B AND ZS 1189--B INSIDE AIRLOCK ARE PHYSICALLY LOCATED ON CONVEYOR MJ-THS-0140.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
6	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
5	07/01/10	IFC, INCORPORATED DCR-138	PEB	GM	SA	BBB	BBB
4	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
2	11/15/06	IFD, ADDED GOV. COMMENTS AND INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING TMA OUTPUT AIRLOCK/CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-THS-00004
SHEET 1 OF 1
REV 6

BGCAPP_DGN.BDR

07MTHS004.pid 02/23/12
DESIGN FILE: DGNSPEC$$$
PLOTTED BY: USER$ ON DATE$$$$$$ AT SYTIME USING COLOR$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

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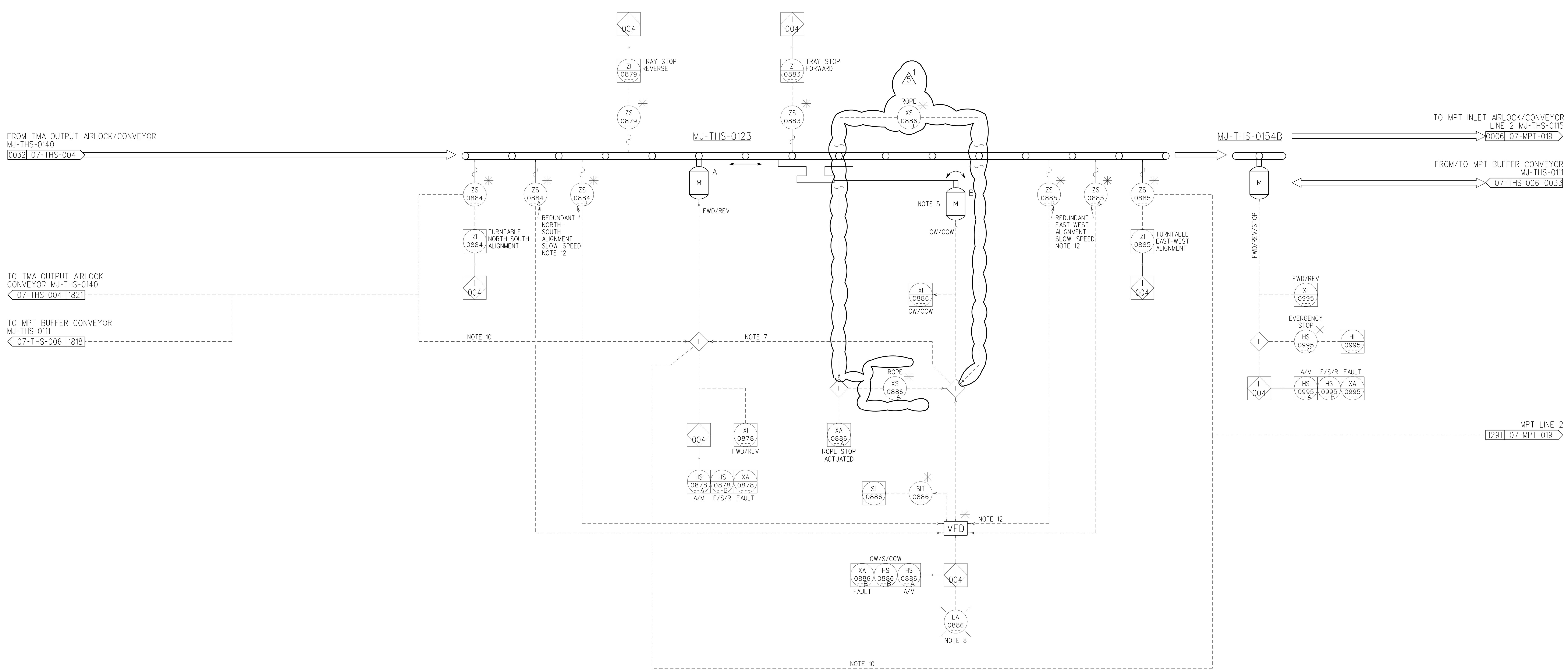
MJ-THS-0123
TURNTABLE CONVEYOR NO. 3
MOTOR HP (A) : 3 HP
MOTOR HP (B) : 0.75 HP

MJ-THS-0154B
MPT INPUT LIVE ROLLER
MOTOR HP : 0.5 HP



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. MOTORS SHALL BE PROVIDED WITH INTEGRAL BRAKE.
6. DELETED.
7. CONVEYOR MOTOR AND TURNTABLE MOTOR SHALL BE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION.
8. WARNING LIGHT IS INTERLOCKED TO TURN ON 10 SECONDS BEFORE TURNTABLE MOTOR STARTS AND TURN OFF WHEN MOTOR STOPS.
9. A FLOOR MOUNTED HARD STOP SHALL BE PROVIDED ON THE WEST END OF TURNTABLE.
10. CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-0884--- AND ZS-0885--- SWITCHES TO PREVENT ITS MOTOR FROM RUNNING WHILE TURNTABLE IS NEITHER AT EAST-WEST NOR NORTH-SOUTH ALIGNMENT.
11. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
12. VENDOR SHALL PROVIDE THE REQUIRED PROGRAMMING TO REDUCE THE VFD SPEED ONCE EITHER OF THE REDUNDANT SLOW SPEED SWITCHES ASSOCIATED WITH THE ALIGNMENT IS ACTIVATED. WHEN THE TABLE IS SLOWING DOWN AND REACHES THE NORTH-SOUTH OR EAST-WEST ALIGNMENT SWITCH, FCS WILL COMMAND THE TABLE TO STOP. VENDOR SHALL ALSO PROVIDE THE SAFETY HARD STOP WITH SPRING TO ELIMINATE DAMAGE IN THE EVENT OF SENSOR FAILURE.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	01/20/12	IFC, INCORPORATED DCN-627	GM	PEB	SA	BBB	BBB
4	07/22/09	IFC, VENDOR DATA, REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, ADDED MJ-RHS-0154B, MOVED GATE CLEAR SWITCH	RZ	JLL	PEB	JB	BBB
2	11/15/06	IFD, ADDED GATE CLEAR SWITCH & INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING TURNTABLE CONVEYOR NO.3 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-THS-00005 SHEET 1 OF 1 REV 5

BGCAPP_DGN.BDR

07MTHS005.pid 01/20/12
DESIGN FILE: DGNSPEC$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
PLOTTED BY: USER$ ON DATE$$$$$$$$ AT SYTIME USING COLOR$$$$$$$$$$$$$$$$$$$$$$$$$$

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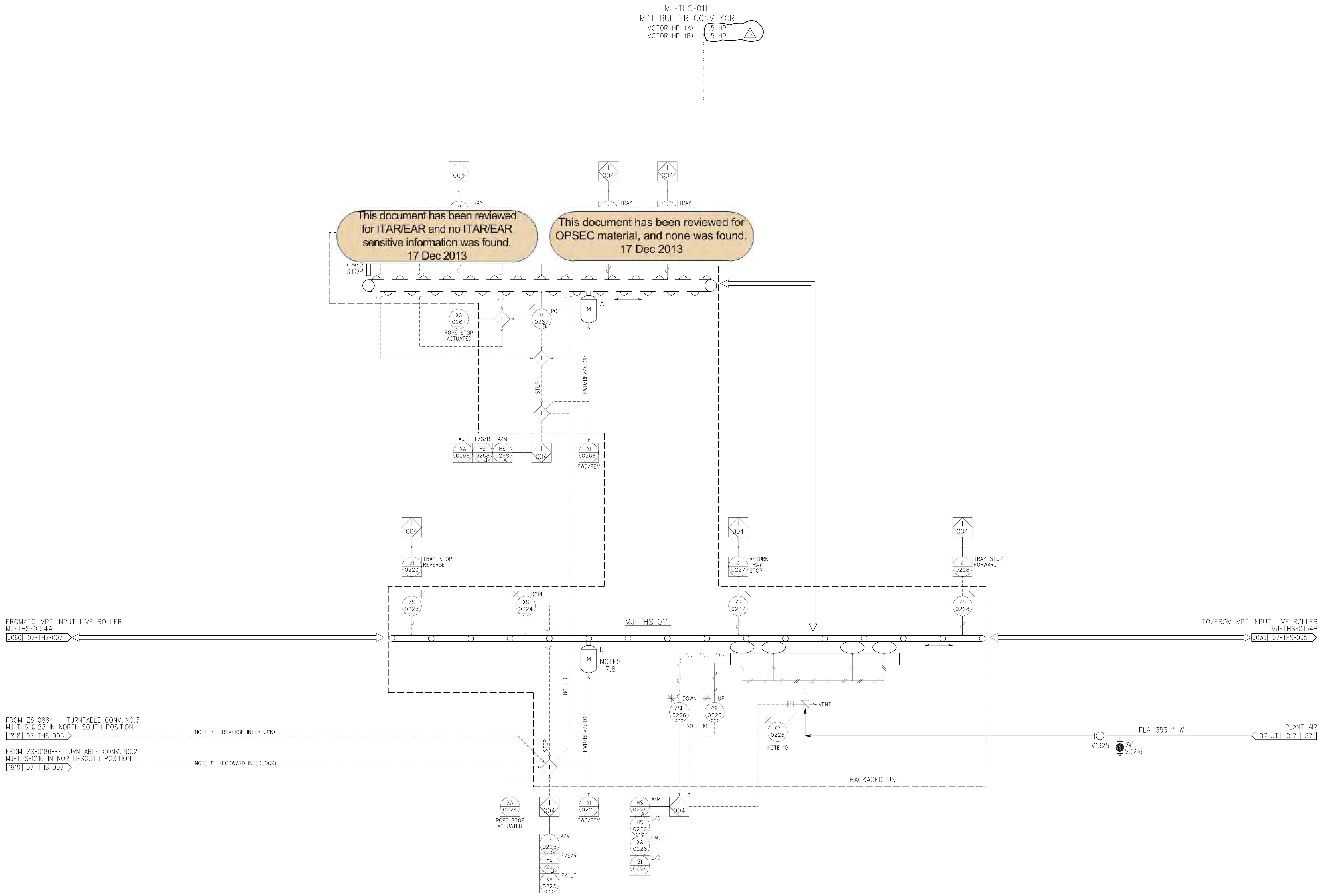

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. MPT BUFFER CONVEYOR HAS A CAPACITY TO CONTAIN 3 TRAYS.
6. CONVEYOR MOTOR AND POP-UP CONVEYOR MOTOR ARE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION AND PULLING ANY OF THE ROPES SHALL STOP BOTH MOTORS FROM RUNNING.
7. CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-0884--- SWITCH ON CONVEYOR MJ-THS-0123 TO PREVENT ITS MOTOR RUNNING IN REVERSE (NORTH) DIRECTION IF TURNTABLE IS NOT AT NORTH-SOUTH ORIENTATION.
8. ROLLER CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-0186--- SWITCH ON CONVEYOR MJ-THS-0110 TO PREVENT ITS MOTOR RUNNING IN FORWARD DIRECTION IF TURNTABLE IS NOT AT NORTH-SOUTH ORIENTATION.
9. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
10. LACK OF POWER TO SWITCHES ZSL-0226--- AND ZSH-0226--- SHALL PREVENT SOLENOID VALVE XY-0226--- FROM OPERATING.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
4	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, CHANGED FLAG DESCRIPTION	RZ	JLL	PEB	JB	BBB
2	11/15/06	IFD, ADDED GOV. COMMENTS & INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING MPT BUFFER CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-THS-00006 | SHEET 1 OF 1 | REV 5

BGCAPP_DGN.BDR

07MTHS006.pid 02/23/12
DESIGN FILE: DGNSPEC$$$$$$$$$
PLOTTED BY: USER$ ON DATE$$$$$$ AT SYTIME USING COLOR$$$$$$$$$$$$$

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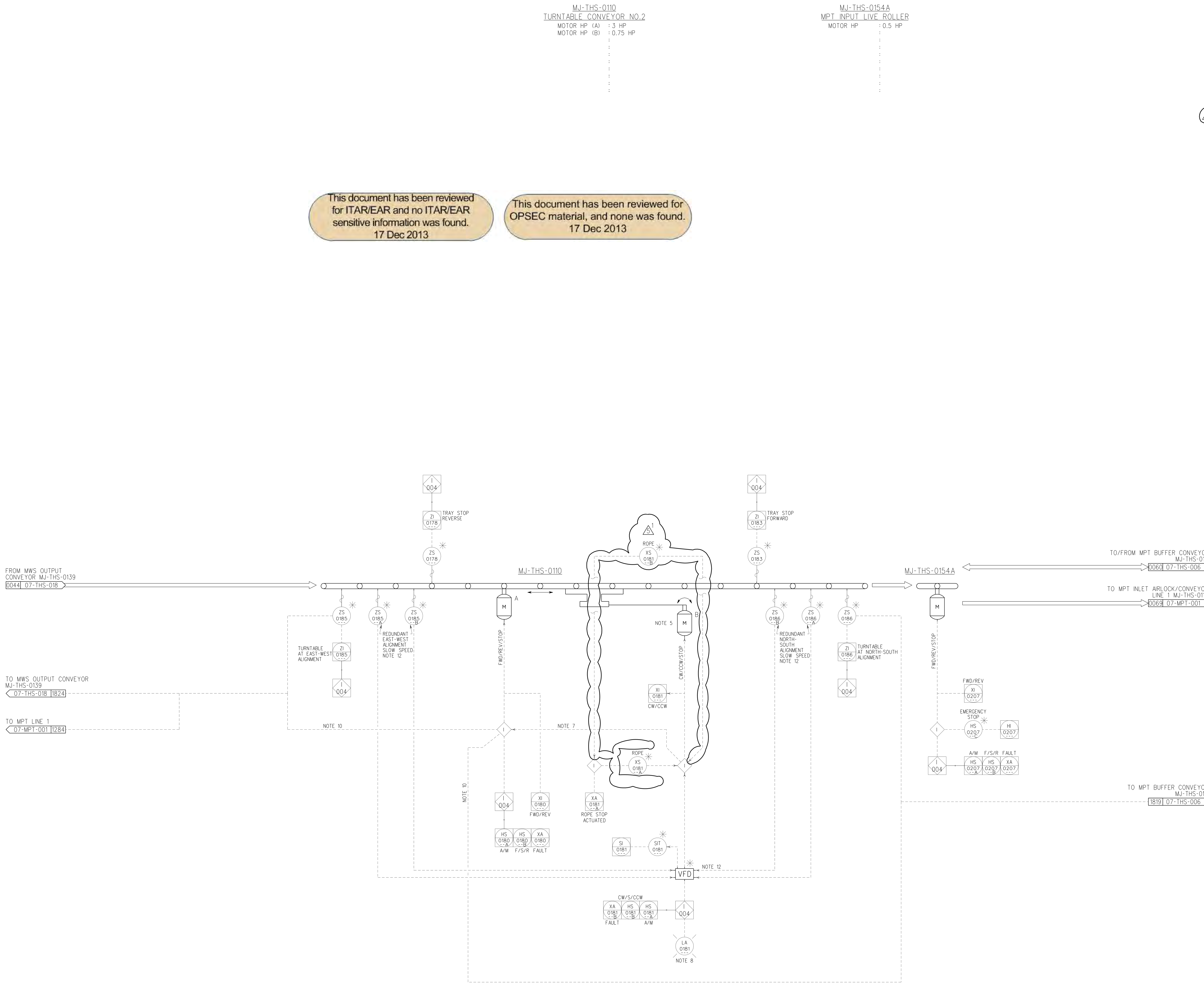

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. MOTORS SHALL BE PROVIDED WITH INTEGRAL BRAKE.
6. DELETED.
7. CONVEYOR MOTOR AND TURNTABLE MOTOR SHALL BE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION.
8. WARNING LIGHT IS INTERLOCKED TO TURN ON 10 SECONDS BEFORE TURNTABLE MOTOR STARTS AND TURN OFF WHEN MOTOR STOPS.
9. A FLOOR MOUNTED HARD STOP SHALL BE PROVIDED ON THE SOUTH END OF TURNTABLE.
10. TURNTABLE CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-0185--- OR ZS-0186--- TO PREVENT ITS MOTOR FROM RUNNING WHILE IT IS NOT ALIGNED.
11. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
12. VENDOR SHALL PROVIDE THE REQUIRED PROGRAMMING TO REDUCE THE VFD SPEED ONCE EITHER OF THE REDUNDANT SLOW SPEED SWITCHES ASSOCIATED WITH THE ALIGNMENT IS ACTIVATED. WHEN THE TABLE IS SLOWING DOWN AND REACHES THE NORTH-SOUTH OR EAST-WEST ALIGNMENT SWITCH, FCS WILL COMMAND THE TABLE TO STOP. VENDOR SHALL ALSO PROVIDE THE SAFETY HARD STOP WITH SPRING TO ELIMINATE DAMAGE IN THE EVENT OF SENSOR FAILURE.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	01/20/12	IFC, INCORPORATED DCN-627	GM	PEB	SA	BBB	BBB
4	07/22/09	IFC, VENDOR DATA, REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, ADDED MJ-RHS-0154A, REVISED NOTE 6	RZ	JLL	PEB	JB	BBB
2	11/15/06	IFD, ADDED GOV. COMMENTS AND INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING TURNTABLE CONVEYOR NO.2 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-THS-00007 SHEET 1 OF 1 REV 5

BGCAPP_DGN.BDR

07MTHS007.pid 01/20/12
DESIGN FILE: DGNSPEC
PLOTTED BY: USER ON DATE AT SYTIME USING COLOR

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MJ-THS-0101
TRAY INPUT CONVEYOR NO.1
MOTOR HP : 3 HP

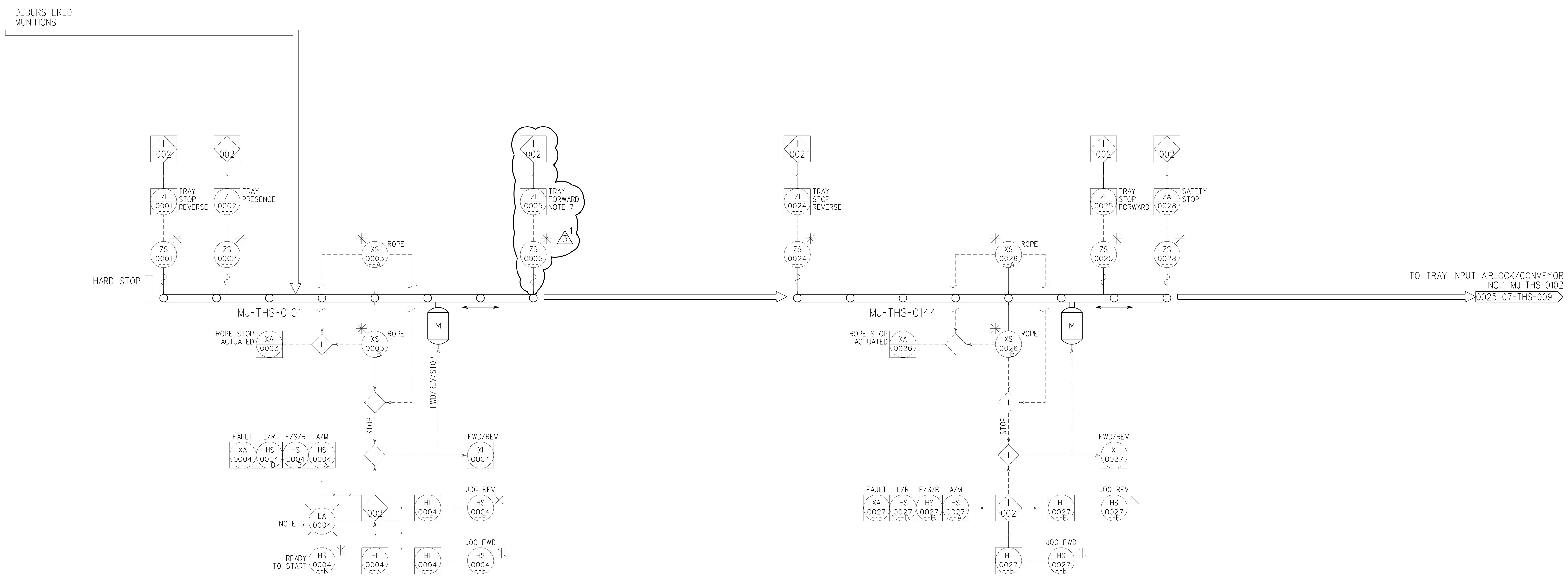
MJ-THS-0144
TRAY INPUT CONVEYOR NO.2
MOTOR HP : 3 HP

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. WARNING LIGHT IS INTERLOCKED TO TURN ON 10 SECONDS BEFORE CONVEYOR MOTOR STARTS AND TURN OFF 10 SECONDS AFTER CONVEYOR STARTS.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. TRAY DOES NOT STOP AT FORWARD SENSOR BUT IS REQUIRED TO INDICATE FORWARD MOVEMENT TO THE FCS.

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.
17 Dec 2013

This document has been reviewed for OPSEC material, and none was found.
17 Dec 2013



REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
2	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
1	11/15/06	IFD, ADDED GOV. COMMENTS AND INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING TRAY INPUT CONVEYORS PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-THS-00008
SHEET 1 OF 1
REV 3

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07MTHS008.pid 07/23/09
DESIGN FILE: DGNSPEC
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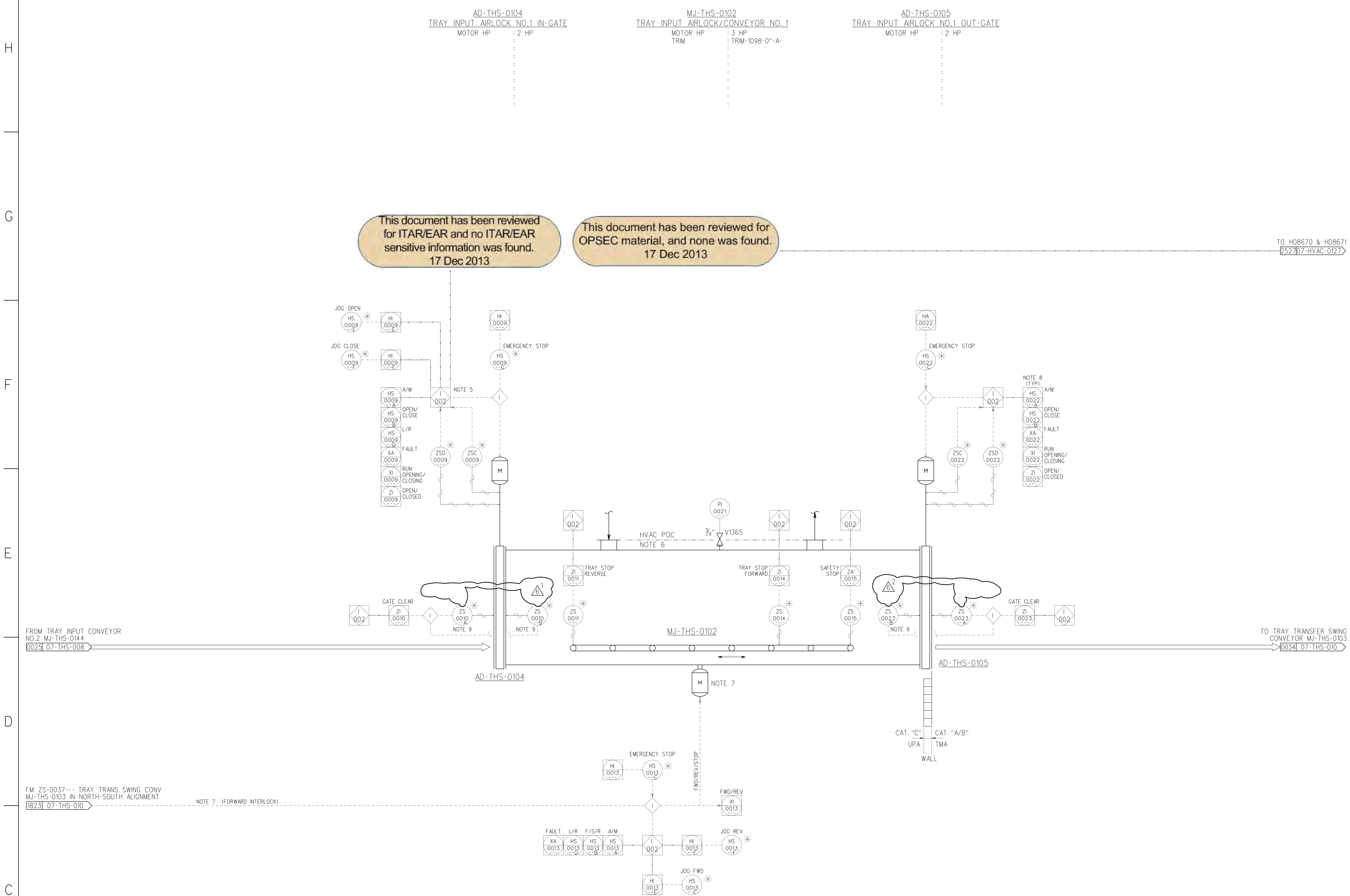
This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. INLET GATE AD-THS-0104 SHALL BE INTERLOCKED WITH OUTLET GATE AD-THS-0105 TO PREVENT IT FROM OPENING AFTER OUTLET GATE CLOSES UNTIL THE AIRLOCK HAS BEEN PURGED. AIRLOCK GATES ARE INTERLOCKED WITH A TIMER.
6. INSTRUMENTATION AND VALVING SHOWN ON HVAC DRAWING NUMBER 24915-07-M6-HVAC-00127.
7. CONVEYOR MOTOR IN FORWARD DIRECTION SHALL BE HARDWIRE INTERLOCKED WITH ZS 0037--- SWITCH ON SWING CONVEYOR MJ-THS-0103 TO PREVENT TRAY TRANSFER WHILE SWING CONVEYOR IS NOT AT NORTH-SOUTH ALIGNMENT.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
9. GATE CLEAR SWITCHES (ZS 0010--A, ZS 0010--B, ZS 0023--B) SHOWN ON AIRLOCK GATES ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
6	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
5	07/01/10	IFC, INCORPORATED DCR-138	PEB	GM	SA	BBB	BBB
4	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
2	11/15/06	ISSUED FOR DESIGN (IFD), ADDED INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING TRAY INPUT AIRLOCK/CONVEYOR NO.1 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-THS-00009
SHEET 1 OF 1
REV 6

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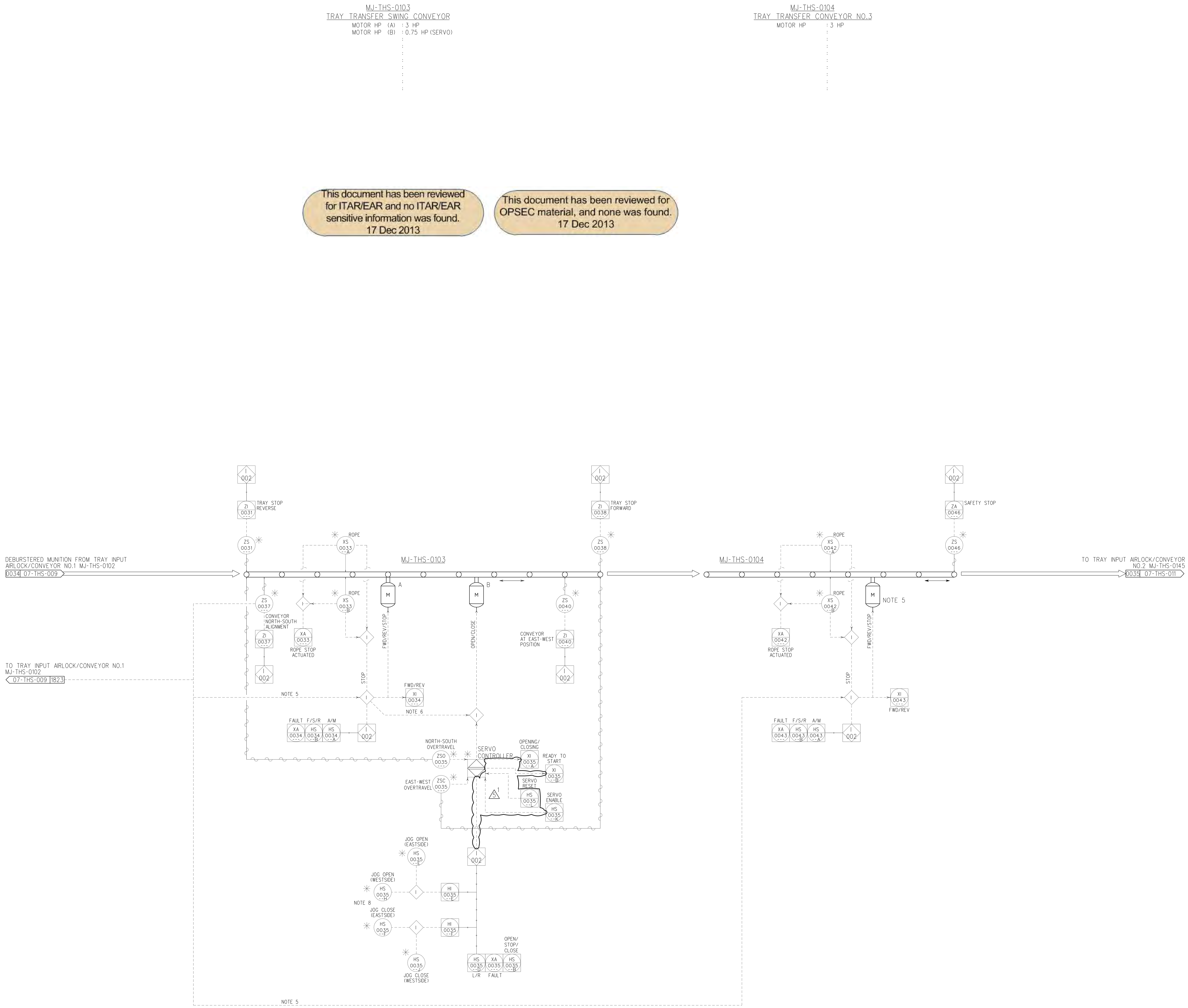

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-0037--- SWITCH ON CONVEYOR MJ-THS-0103 TO PREVENT ITS MOTOR RUNNING EITHER IN FORWARD OR REVERSE DIRECTION WHILE CONVEYOR MJ-THS-0103 IS NOT ALIGNED.
6. SWING CONVEYOR MJ-THS-0103 SWING MOTOR "B" SHALL BE HARDWIRE INTERLOCKED WITH CONVEYOR MOTOR "A" TO PREVENT CONVEYOR ROLLERS TURNING WHILE SWING MOTOR IS OPERATING. ACTUATION OF ROPE SWITCHES WILL STOP THE SWING MOTOR AND CONVEYOR MOTOR.
7. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
8. TRAY TRANSFER SWING CONVEYOR MJ-THS-0103 LOCAL JOG OPEN AND CLOSE SWITCHES SHALL BE PROVIDED AND SHIPPED LOOSE BY THE CONVEYOR SUPPLIER. EASTSIDE AND WESTSIDE SWITCHES SHALL BE MOUNTED IN SEPARATE CONTROL BOXES.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
4	07/22/09	IFC, GC 7730, VENDOR DATA	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
2	11/15/06	ISSUED FOR DESIGN (IFD), ADDED INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING TRAY TRANSFER CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-THS-00010 | SHEET 1 OF 1 | REV 5

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

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07MTHS010.pid 02/23/12
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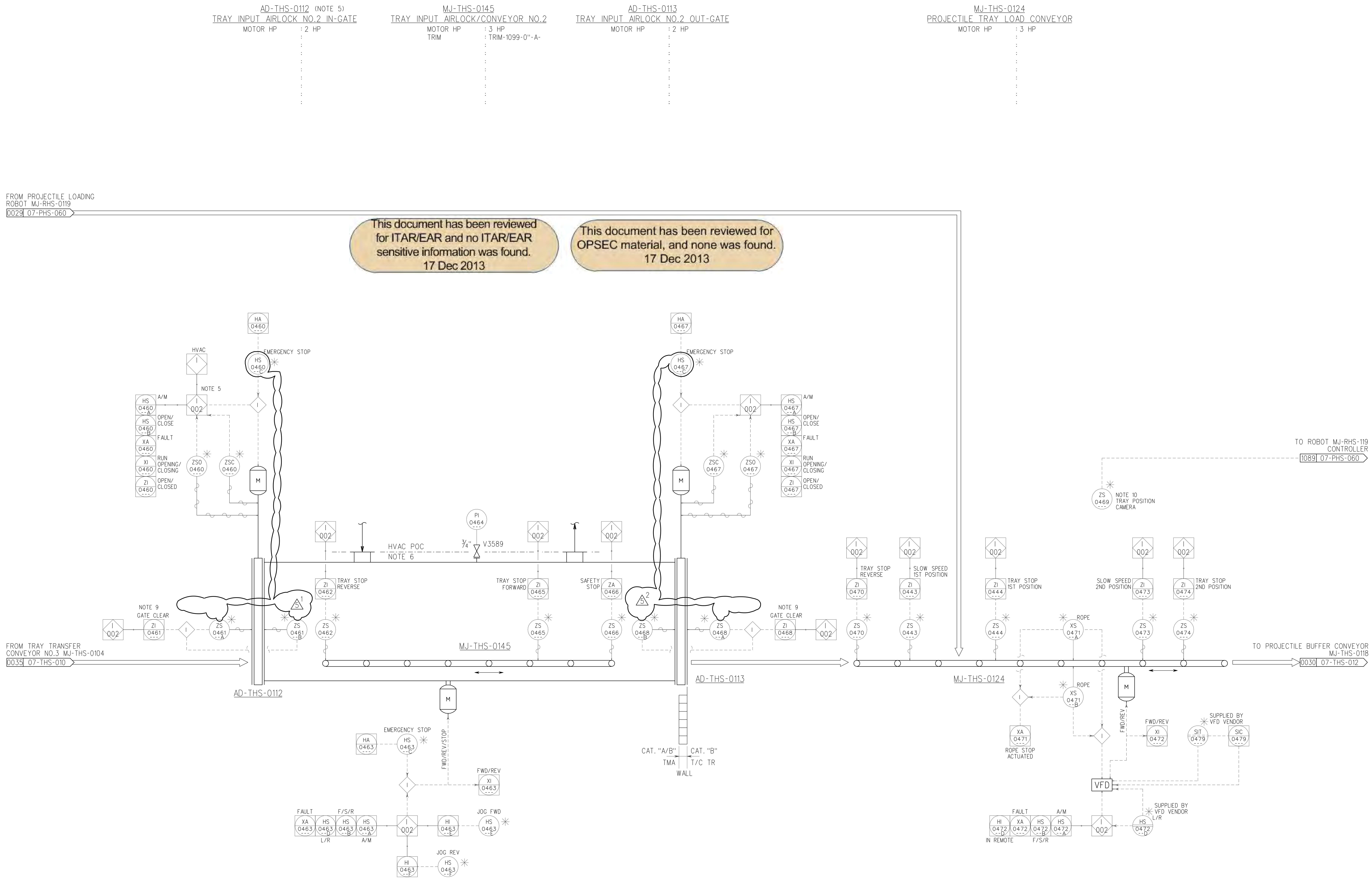
17 Dec 2013

This document has been reviewed for OPSEC material, and none was found.
17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. INLET GATE AD-THS-0112 SHALL BE INTERLOCKED WITH OUTLET GATE AD-THS-0113 TO PREVENT IT FROM OPENING AFTER OUTLET GATE CLOSES UNTIL THE AIRLOCK HAS BEEN PURGED. AIRLOCK GATES ARE INTERLOCKED WITH A TIMER.
6. INSTRUMENTATION AND VALVING SHOWN ON HVAC DRAWING NUMBER 24915-07-M6-HVAC-00134.
7. DELETED.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
9. GATE CLEAR SWITCHES SHOWN ON AIRLOCK GATES ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.
10. VISION CONTROL WILL BE USED FOR TRAY POSITION CONTROL. CAMERA SIGNAL TO BE CONNECTED TO THE ROBOT (MJ-RHS-0119) CONTROLLER AND INTERLOCKED WITH FCS FOR PROJECTILE TRAY LOAD CONVEYOR CONTROL.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
4	07/22/09	IFC, GC 7701 & 7732, REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
2	11/15/06	ISSUED FOR DESIGN (IFD), ADDED INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING TRAY INPUT AIRLOCK/CONVEYOR NO.2 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-THS-00011 | SHEET 1 OF 1 | REV 5

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07MTHS011.pid 02/23/12
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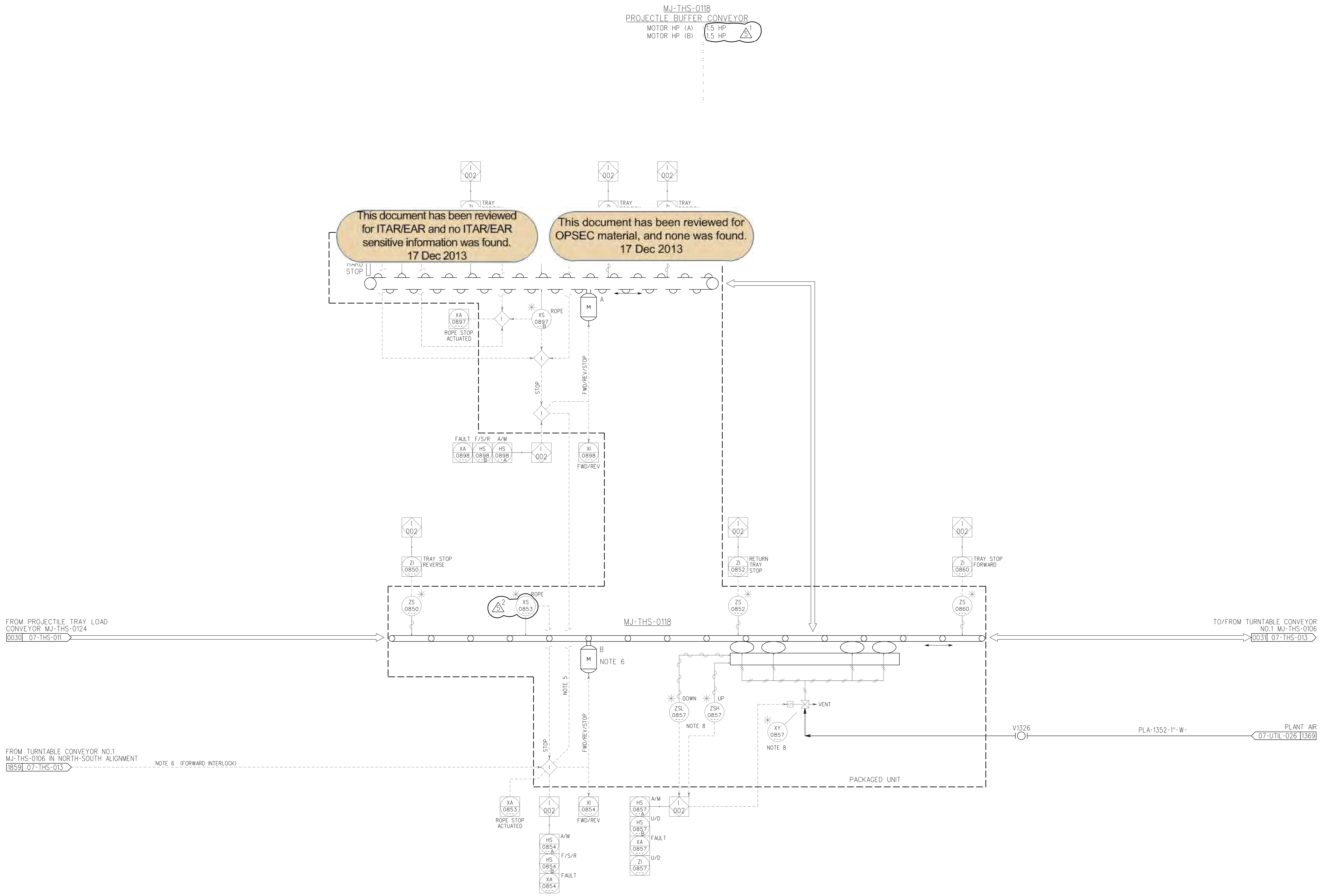

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. CONVEYOR MOTOR AND POP-UP CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION AND PULLING ANY OF THE ROPES SHALL STOP BOTH MOTORS FROM RUNNING.
6. ROLLER CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-1177--- SWITCH ON TURNTABLE MJ-THS-0106 TO PREVENT ITS MOTOR RUNNING IN FORWARD DIRECTION WHILE TURNTABLE IS NOT AT NORTH-SOUTH ORIENTATION.
7. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
8. LACK OF POWER TO SWITCHES ZSL-0857--- AND ZSH-0857--- SHALL PREVENT SOLENOID VALVE XY-0857--- FROM OPERATING.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
4	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	ISSUED FOR CONSTRUCTION (IFC), NO CHANGES	RZ	JLL	PEB	JB	BBB
2	11/15/06	IFD, ADDED GOV. COMMENTS & INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING PROJECTILE BUFFER CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-THS-00012 | SHEET 1 OF 1 | REV 5

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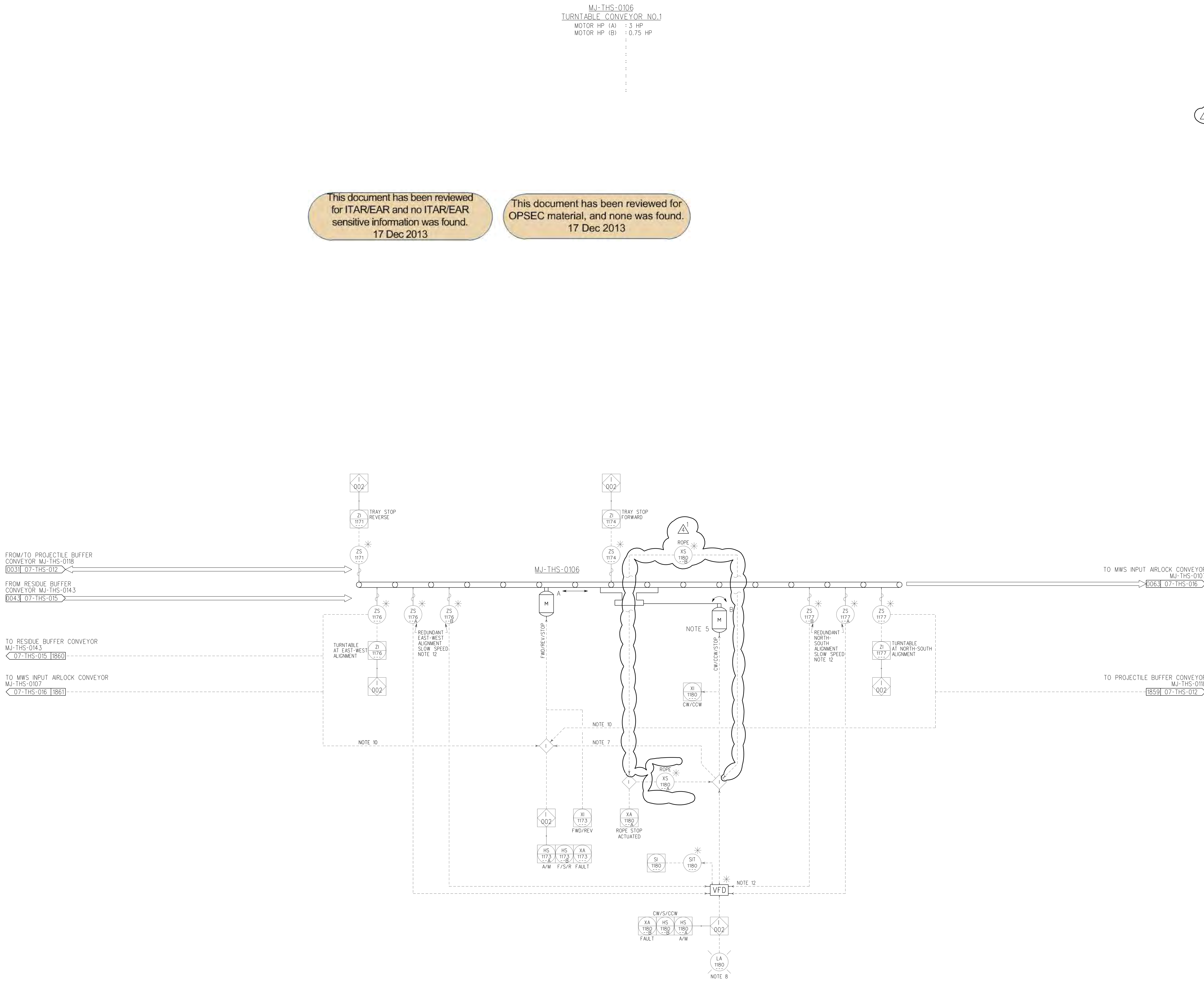
This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIAL HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00002.
5. MOTOR SHALL BE PROVIDED WITH INTEGRAL BRAKE.
6. DELETED.
7. CONVEYOR MOTOR AND TURNTABLE MOTOR SHALL BE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION.
8. WARNING LIGHT IS INTERLOCKED TO TURN ON 10 SECONDS BEFORE TURNTABLE MOTOR STARTS AND TURN OFF WHEN MOTOR STOPS.
9. A FLOOR MOUNTED HARD STOP SHALL BE PROVIDED ON THE SOUTH END OF TURNTABLE.
10. CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-1176--- AND ZS-1177--- SWITCHES TO PREVENT ITS MOTOR FROM RUNNING WHILE TURNTABLE IS NOT ALIGNED IN EITHER EAST-WEST OR NORTH-SOUTH DIRECTIONS.
11. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
12. VENDOR SHALL PROVIDE THE REQUIRED PROGRAMMING TO REDUCE THE VFD SPEED ONCE EITHER OF THE REDUNDANT SLOW SPEED SWITCHES ASSOCIATED WITH THE ALIGNMENT IS ACTIVATED. WHEN THE TABLE IS SLOWING DOWN AND REACHES THE NORTH-SOUTH OR EAST-WEST ALIGNMENT SWITCH, FCS WILL COMMAND THE TABLE TO STOP. VENDOR SHALL ALSO PROVIDE THE SAFETY HARD STOP WITH SPRING TO ELIMINATE DAMAGE IN THE EVENT OF SENSOR FAILURE.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
4	01/20/12	IFC, INCORPORATED DCN-627	GM	PEB	SA	BBB	BBB
3	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
2	02/01/07	IFC, RELOCATED GATE CLEAR SWITCH, REVISED NOTE 6	RZ	JLL	PEB	JB	BBB
1	11/15/06	IFD, ADDED INTERLOCK TAG NO. & GATE CLEAR SWITCH	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING TURNTABLE CONVEYOR NO.1 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-THS-00013 | SHEET 1 OF 1 | REV 4

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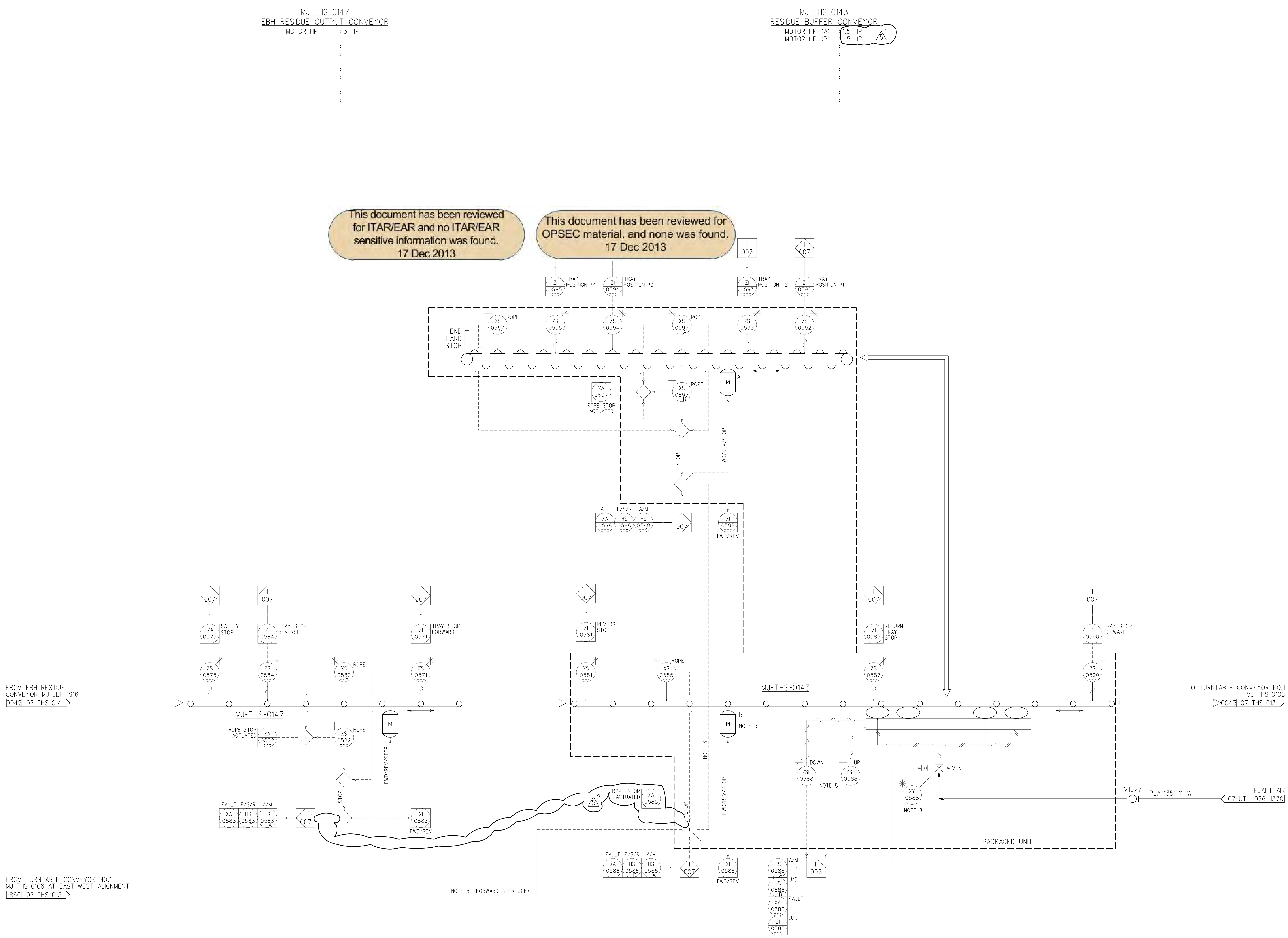

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS-1176--- SWITCH ON CONVEYOR MJ-THS-0106 TO PREVENT ITS MOTOR RUNNING IN FORWARD DIRECTION WHILE TURNTABLE IS NOT AT EAST-WEST ALIGNMENT.
6. CONVEYOR MOTOR AND POP-UP CONVEYOR MOTOR ARE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION AND PULLING ANY OF THE ROPES SHALL STOP BOTH MOTORS FROM RUNNING.
7. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
8. LACK OF POWER TO SWITCHES ZSL-0588--- AND ZSH-0588--- SHALL PREVENT SOLENOID VALVE XY-0588--- FROM OPERATING.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
4	07/22/09	IFC, GC 7702, 7733, TREND 168	PEB	JLL	BM	BBB	BBB
3	02/01/07	ISSUED FOR CONSTRUCTION (IFC), NO CHANGES	RZ	JLL	PEB	JB	BBB
2	11/15/06	IFD, ADDED ROPE SWITCH AND INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING RESIDUE BUFFER CONVEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-THS-00015 | SHEET 1 OF 1 | REV 5

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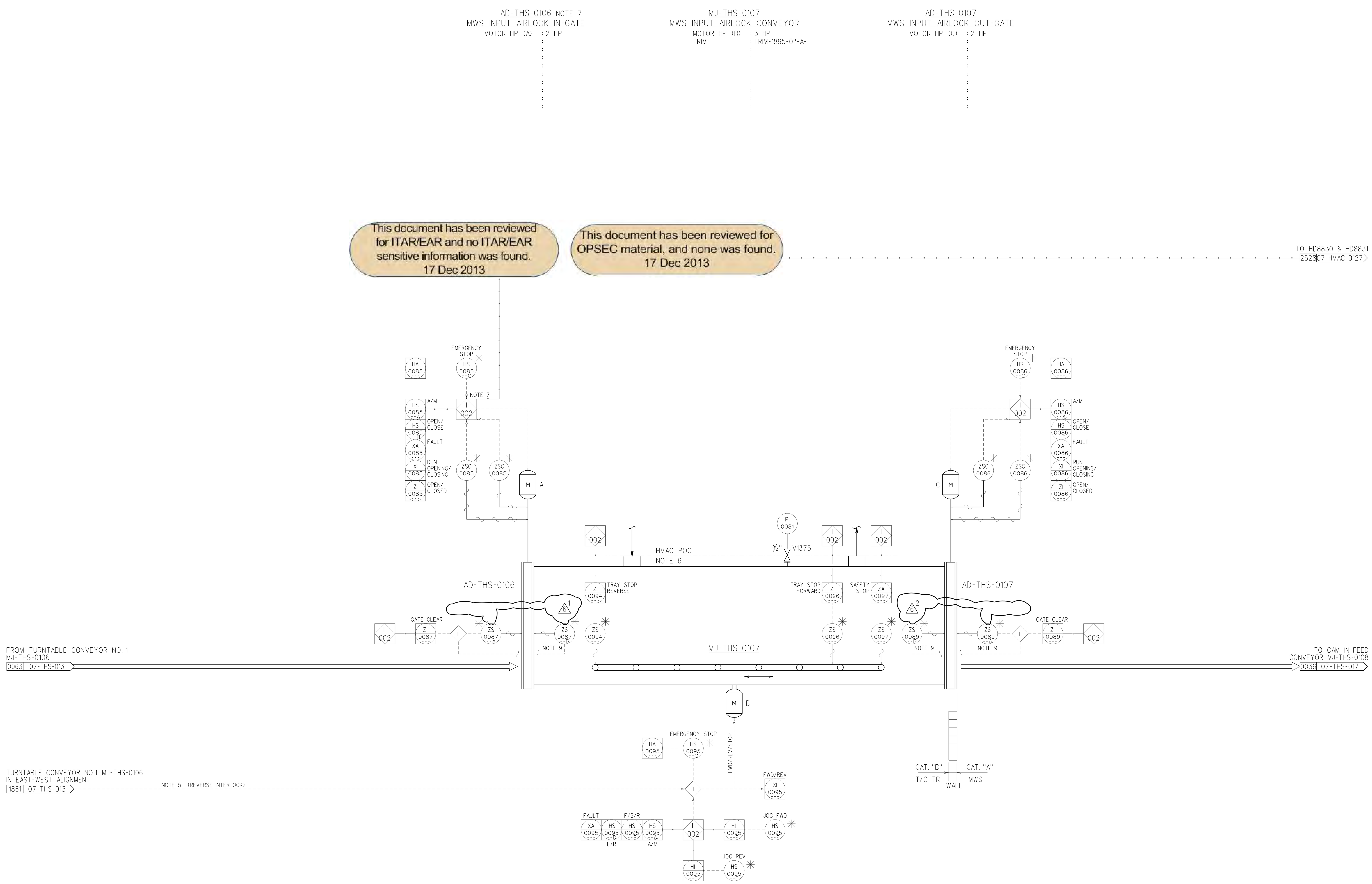

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. AIRLOCK CONVEYOR MOTOR SHALL BE HARDWIRE INTERLOCKED WITH ZS 1176--- SWITCH ON CONVEYOR MJ-THS-0106 TO PREVENT ITS MOTOR RUNNING IN REVERSE DIRECTION WHILE TURNTABLE IS NOT AT EAST-WEST ALIGNMENT.
6. INSTRUMENTATION AND VALVING SHOWN ON HVAC DRAWING NUMBER 20915-07-M6-HVAC-00134.
7. INLET GATE AD-THS-0106 SHALL BE INTERLOCKED WITH OUTLET GATE AD-THS-0107 TO PREVENT IT FROM OPENING AFTER OUTLET GATE CLOSES UNTIL THE AIRLOCK HAS BEEN PURGED. AIRLOCK GATES ARE INTERLOCKED WITH A TIMER.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
9. GATE CLEAR SWITCHES (ZS 0087--B, ZS 0089--A, ZS 0089--B) SHOWN ON AIRLOCK GATES ARE PHYSICALLY LOCATED ON ADJACENT CONVEYORS.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
6	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
5	07/01/10	IFC, INCORPORATED DCR-138	PEB	GM	SA	BBB	BBB
4	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
2	11/15/06	IFD, ADDED INTERLOCK TAG NO. & GATE CLEAR SWITCH	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPEMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING MWS INPUT AIRLOCK/CONVYEYOR PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-THS-00016 | SHEET 1 OF 1 | REV 6

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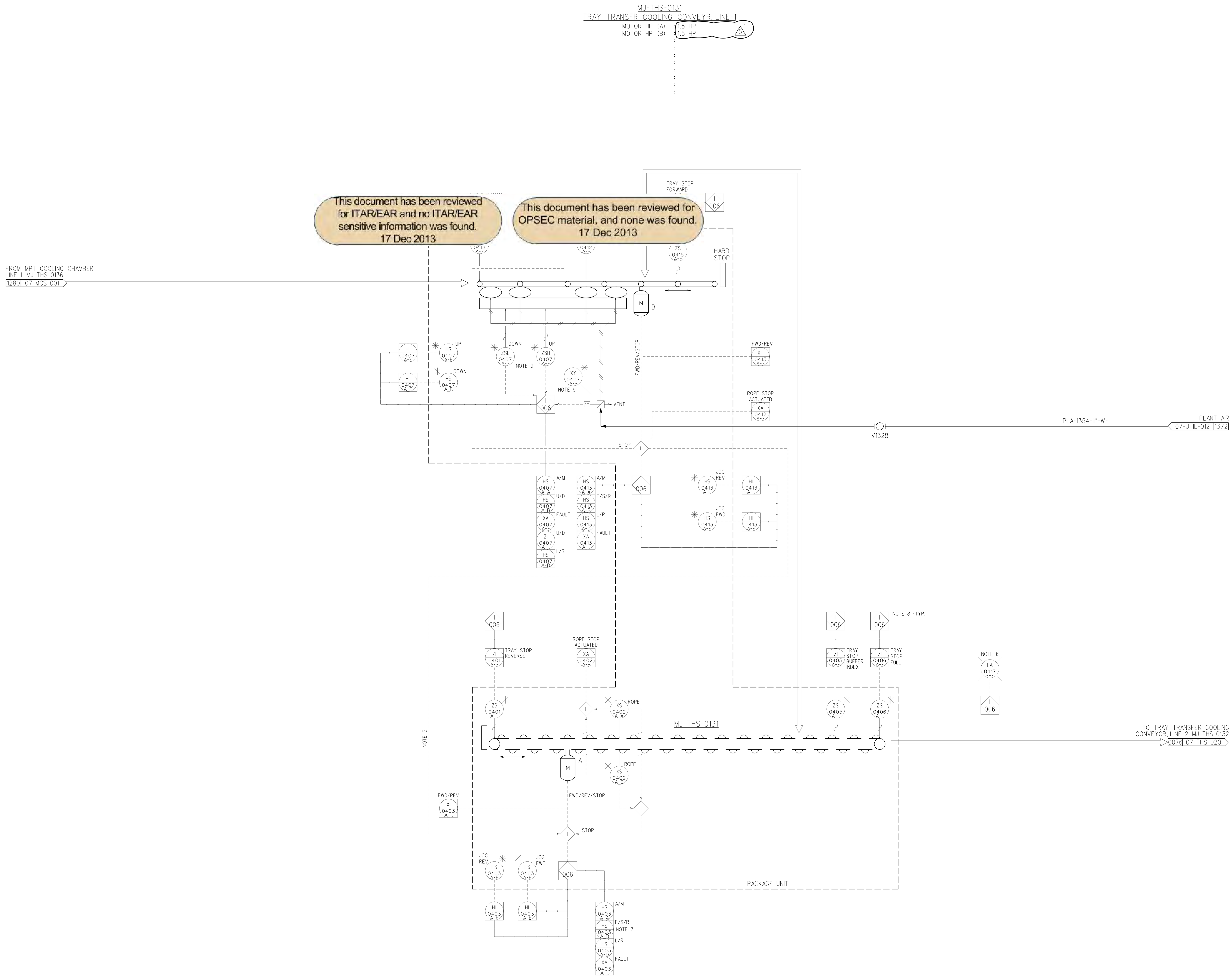
This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. CONVEYOR MOTOR AND POP-UP CONVEYOR MOTOR ARE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION AND PULLING ANY OF THE ROPES SHALL STOP BOTH MOTORS FROM RUNNING.
6. WARNING LIGHT IS INTERLOCKED TO TURN ON 10 SECONDS BEFORE ANY CONVEYOR MOTOR FOR EITHER MJ-THS-0131 OR MJ-THS-0132 STARTS AND TURN OFF WHEN ALL MOTORS ARE STOPPED.
7. SOFTWARE SHALL BE SETUP SUCH THAT AN OPERATOR WOULD BE REQUIRED TO INITIATE TRANSFER OF TRAY TO THE DOWNSTREAM CONVEYORS. IF THE DOWNSTREAM CONVEYORS ARE FULL OR UPON OPERATOR SELECTION/OPTION TRAYS WILL BE BUFFERED ON MJ-THS-0131.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
9. LACK OF POWER TO SWITCHES ZSL-0407A-- AND ZSH-0407A-- SHALL PREVENT SOLENOID VALVE XY-0407A-- FROM OPERATING.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
4	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
2	11/15/06	ISSUED FOR DESIGN (IFD), ADDED INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

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US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING TRAY TRANSFER COOLING CONVEYOR LN 1 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-THS-00019 | SHEET 1 OF 1 | REV 5

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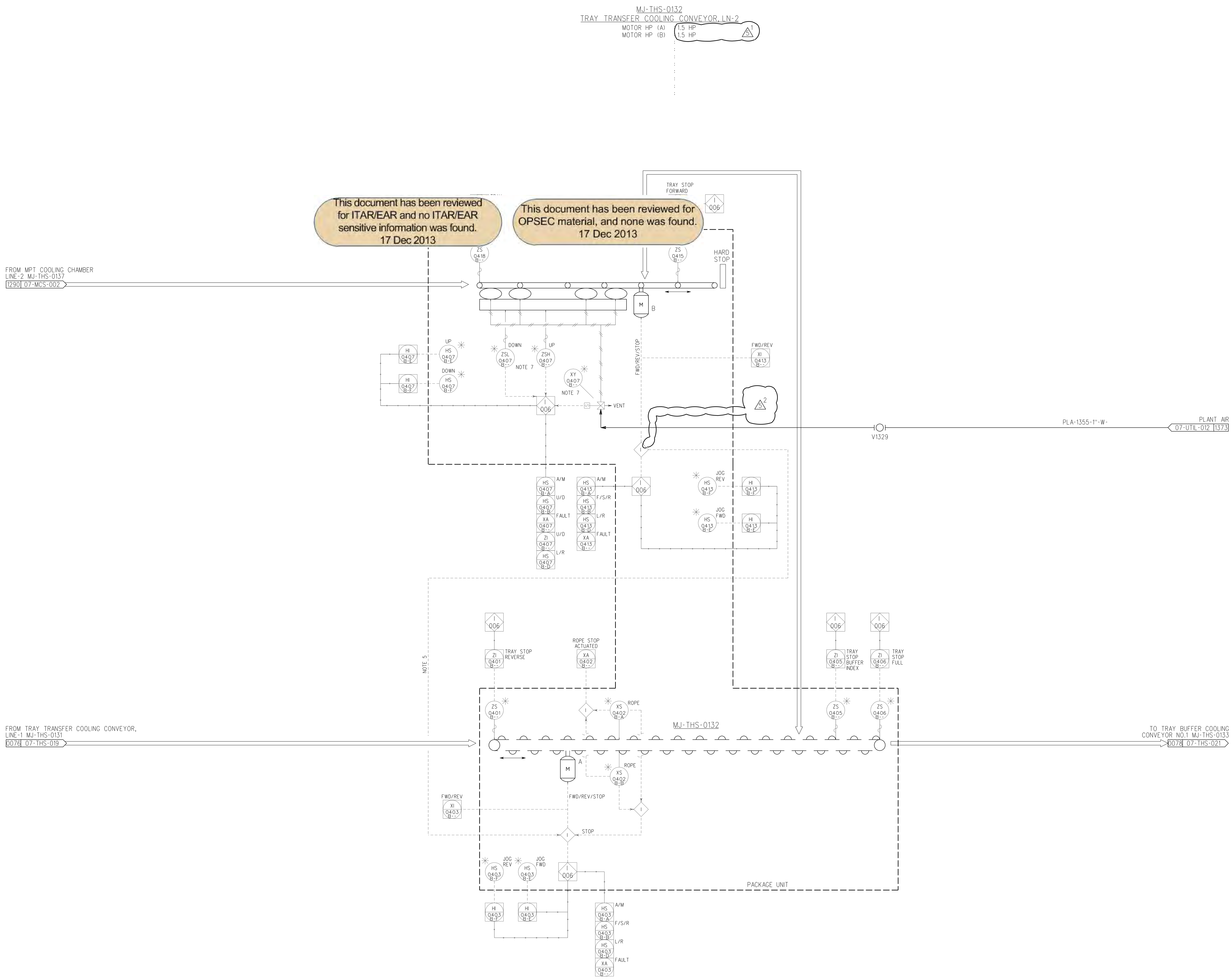

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GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. CONVEYOR MOTOR AND POP-UP CONVEYOR MOTOR ARE HARDWIRE INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION AND PULLING ANY OF THE ROPES SHALL STOP BOTH MOTORS FROM RUNNING.
6. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
7. LACK OF POWER TO SWITCHES ZSL-0407B-- AND ZSH-0407B-- SHALL PREVENT SOLENOID VALVE XY-0407B-- FROM OPERATING.

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
4	07/22/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	PEB	JLL	BM	BBB	BBB
3	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
2	11/15/06	ISSUED FOR DESIGN (IFD), ADDED INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
1	05/05/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

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US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING TRAY TRANSFER COOLING CONVEYOR LN 2 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-THS-00020 | SHEET 1 OF 1 | REV 5

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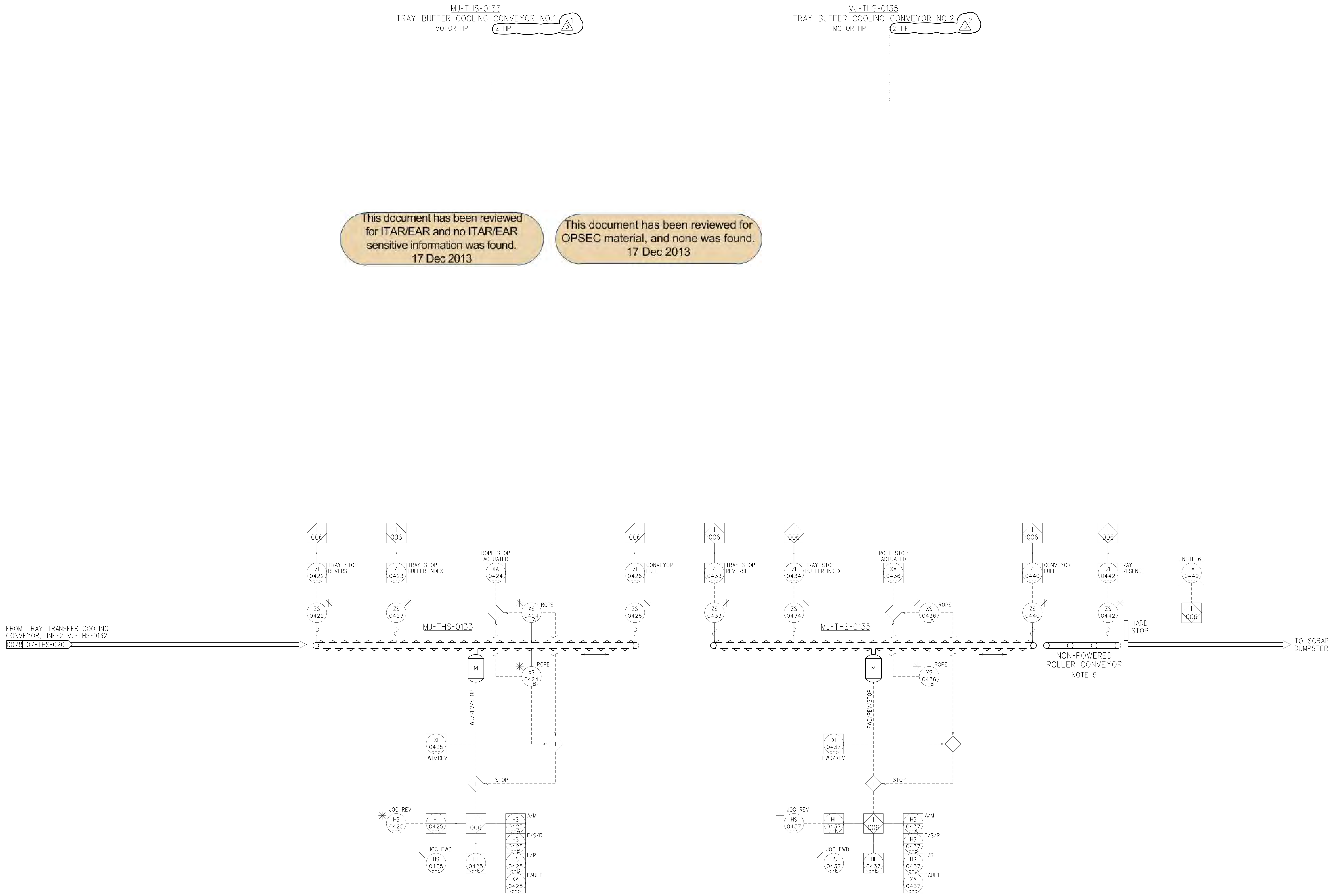

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GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. FOR CONVEYOR LAYOUT/LOCATION SEE MATERIALS HANDLING EQUIPMENT GENERAL ARRANGEMENT DRAWING 24915-07-MJ-00-00002.
5. THIS CONVEYOR IS A CONTINUATION OF MJ-THS-0135. THIS PORTION IS A NON-POWERED ROLLER CONVEYOR.
6. WARNING LIGHT IS INTERLOCKED TO TURN ON 10 SECONDS BEFORE ANY CONVEYOR MOTOR FOR EITHER MJ-THS-0133, MJ-THS-0135 STARTS AND TURN OFF WHEN ALL MOTORS ARE STOPPED.
7. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-THS-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	02/21/12	IFC, INCORPORATED DCN-689	GM	MDV	SA	BBB	BBB
2	02/01/07	IFC, CLARIFY INSTRUMENTS SUPPLIED W/ EQUIPMENT	RZ	JLL	PEB	JB	BBB
1	11/15/06	ISSUED FOR DESIGN (IFD), ADDED INTERLOCK TAG NO.	RZ	JLL	PEB	JB	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	RZ	JLL	PEB	JB	PGK

QUALITY ☐ Q ☒ Non-Q

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BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

MUNITIONS DEMILITARIZATION BUILDING TRAY BUFFER COOLING CONVEYORS PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-07-M6-THS-00021 | SHEET 1 OF 1 | REV 3

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BECHTEL PARSONS BLUE GRASS A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.	Project Number **24915**	Document Number **24915-07-MTD-ACS-00001**	Rev **1**	Date **10/14/2009**	Sheet of **1 9**

Project, Client, Location	Document Title
Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP) Project	**AGENT HOLDING TANK MT-ACS-0105**

☐ In-House Review ☐ Client Approval ☐ Quotation ☑ All Data Sheets Attached

☑ Purchase ☐ Construction ☐ Design ☐ Revised Data Sheets Only Attached

QUALITY: ☑ **Q** ☐ **NON-Q**

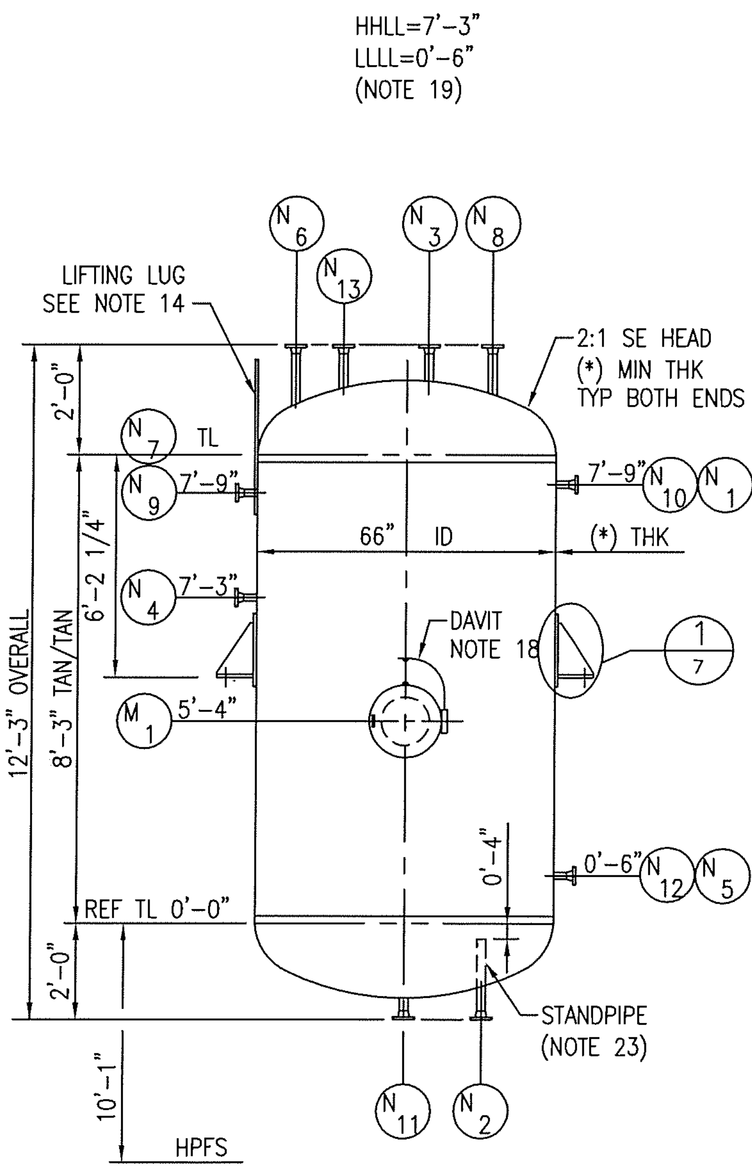
TOXIC CATEGORY ☑ **A** ☐ **B** ☐ **A/B** ________ **OTHER**

REV	DATE	BY	CHK	DL	PROJ ENGR	QA	APPR		REMARKS
0	02/25/09	SC	BM	BM	BBB	JW			Issued for Purchase
1	10/14/09	SC SC	GG SS	SA SA	BBB BBB	JBD JW			Issued for Purchase (added pages 6 & 7 and completely revised page 5 to incorporate seismic data)

This sheet is a record of each issue or revision to the subject specification. Each time the specification is to be changed, only the new or revised sheets must be issued. The exact sheets changed and the nature of the change should be noted in the Remarks column; however, these remarks are not part of the specification. The revised data sheets shall become part of the original specification and shall be compiled within their entirety.

FILE NAME: MTACS0105

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE: BGCAPP AGENT HOLDING TANK MT-ACS-0105	SHEET 2 OF 9	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ACS-00001	REV 1



ONE REQD MT-ACS-0105

SEE SHEET 8 FOR TRUE ORIENTATION

CODE:	ASME SECT VIII DIV 1 (CODE CONSTR. ONLY)			
CODE CERT REQD	NO	CODE STAMP	NO	
NATIONAL BOARD REGISTRATION:	NO			
OPR PRESS (INT)	0.2 PSIG AT		77 °F	
DES PRESS. (INT)	14.9 PSIG AT		125 °F	
DES PRESS. (EXT)	FULL VAC PSIG AT		125 °F	
MIN DESIGN METAL TEMP	(–)1 °F AT		14.9 PSIG	
CRSN ALLOW SHELL =N/A	HEADS =N/A	NOZZ =N/A		
LIQUID LEVEL FOR DESIGN:	FULL	AT SP GR	1.29	
SEISMIC DESIGN:	SEE NOTE 10			
WIND DESIGN:	SEE NOTE 11			
MAWP	(*) PSIG AT	125 °F LIMITED BY (*)		
MAP N&C	(*) PSIG AT AMB TEMP LIMITED BY (*)			
SHOP HYD	(*) PSIG AT	70 °F MIN HORIZ POSN		
FIELD HYD NEW	(*) PSIG AT	70 °F MIN OPR POSN		
FIELD HYD CORR	(*) PSIG AT	70 °F MIN OPR POSN		
PWHT	(PER CODE)	RADIOGRAPHY	(FULL)	
JOINT EFF: SHELL	(PER CODE)	HEADS	(PER CODE)	
ALLOW STRESS	20,000 PSI AT DESIGN TEMP 125°F			
MATERIALS:	SHELL	SA-516-70 (SEE NOTE 20)		
	HEADS	SA-516-70 (SEE NOTE 20)		
	SUPPORTS	CS		
	INTERNALS	N/A	TRAYS	N/A
	BOLTS (INT)	N/A	NUTS	N/A
	BOLTS (EXT)	SA-193-B7	NUTS	SA-194-2H
	FLANGES	SA-105		
	NOZZLE NECKS	SA-106B		
	GASKETS	NOTE 24		
CAPACITY (WORKING)			1000 GAL	
FAB WT	(*) (NOTE 1&15) LB	EMPTY WT	(*) (NOTE 1&15) LB	
TRAY WT	N/A LB	PACKING WT	N/A LB	
OPR WT	(*) (NOTE 1&15) LB	TEST WT	(*) (NOTE 1&15) LB	
PAINTING	SEE NOTE 12			
INSULATION	NONE			
FIREPROOFING	NONE			

ACCESSORIES BY FABRICATOR:	YES	NO
VESSEL DAVIT MARK No.		X
LADDER & PLATFORM CLIPS		X
PIPE SUPPORT AND PIPE GUIDE CLIPS		X
INSULATION SUPPORTS		X
FIREPROOFING SUPPORTS		X
VORTEX BREAKER		X
LIFTING AND GROUNDING LUGS	X	

NOZZLE SCHEDULE

ITEM	No.	SIZE	PROJ	RATING	SERVICE
M1	1	36"	3'-9"	150#	MH W/ BF & DAVIT
N1	1	2"	3'-5"	150#	INLET
N2	1	2"	SEE ELEV	150#	OUTLET
N3	1	8"	SEE ELEV	150#	LEVEL TRANSMITTER
N4	1	2"	3'-5"	150#	LSHH
N5	1	2"	3'-5"	150#	LSLL
N6	1	2"	SEE ELEV	150#	VENT/PURGE
N7	1	2"	3'-5"	150#	SPARE W/ BF
N8	1	2"	SEE ELEV	150#	AIR PURGE/DECON
N9	1	2"	3'-5"	150#	SPARE W/ BF
N10	1	3"	3'-5"	150#	PIT
N11	1	2"	SEE ELEV	150#	DRAIN
N12	1	2"	3'-5"	150#	SAMPLE CONNECTION
N13	1	6"	SEE ELEV	150#	PSV

FLANGE: RFWN FINISH: 125-250 AARH

NOTE #7

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP AGENT HOLDING TANK MT-ACS-0105	SHEET 3 OF 9	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ACS-00001	REV 1

NOTES

1. THE VESSEL SUPPLIER SHALL DESIGN, FURNISH, FABRICATE, INSPECT, TEST AND DELIVER THE VESSEL IN ACCORDANCE WITH THIS DATA SHEET, ATTACHED SPECIFICATIONS AND STANDARDS. VESSEL SHALL BE DESIGNED IN ACCORDANCE WITH SPECIFIED DESIGN REQUIREMENTS, SEE NOTES 10 AND 11.
2. ALL DIMENSIONS ARE FROM REF TANGENT LINE, EXCEPT AS SHOWN.
3. NOZZLES AND MANHOLE SHALL HAVE SAME DESIGNATION AS SHOWN ON THIS DRAWING.
4. BOLT HOLES SHALL STRADDLE THE VERTICAL CENTERLINES OF THE VESSEL FOR NOZZLES ON THE SHELL AND PLANT NORTH-SOUTH, EAST-WEST CENTERLINES FOR NOZZLES ON THE HEADS.
5. ALL ATTACHMENTS WELDED TO VESSEL PRESSURE PARTS SHALL BE SAME MATERIAL AS PRESSURE PART, UNLESS OTHERWISE NOTED.
6. VESSEL SHALL BE THOROUGHLY CLEANED INSIDE AND OUTSIDE, SHALL BE FREE FROM RUST, SCALE, SLAG, WELD SPLATTER AND FOREIGN MATTER PRIOR TO SHOP HYDROTEST, AND SHALL BE THOROUGHLY DRIED AFTER HYDROTEST.
7. PROJECTION OF RADIAL NOZZLES AND MANHOLES ARE FROM VESSEL CENTER LINE TO EXTREME FACE OF FLANGE.
8. ALL VESSEL COMPONENTS SHALL BE FURNISHED IN ACCORDANCE WITH STANDARDS LISTED BELOW.
9. ITEMS WITH (*) ARE VESSEL FABRICATOR RESPONSIBILITY.
10. SEISMIC FORCES SHALL BE PER SPECIFICATION 24915-000-3PS-SV00-00001, SPECIFICATION FOR SEISMIC PROTECTION OF EQUIPMENT. THE VESSEL IS LOCATED INSIDE THE MDB BUILDING (ANS ROOM 123). PER TABLE 1, APPLICABLE CODES AND IMPORTANCE FACTORS, SEISMIC PROTECTION SHALL BE IN ACCORDANCE WITH ICC INTERNATIONAL BUILDING CODE (IBC) 2000, SEISMIC DESIGN FOR BUILDINGS (SEISMIC GROUPS IIIH AND IIIE).
11. THE GENERAL PROJECT SPECIFICATION, 24915-000-3PS-G000-00001, PROVIDES PROJECT DETAILS AND DESIGN CONDITIONS FOR THE SITE. THIS VESSEL IS PART OF THE MUNITIONS DEMILITARIZATION BUILDING (MDB) AND IS INSTALLED INSIDE THE BUILDING (ROOM 123) AND WILL NOT BE SUBJECT TO SITE CONDITIONS SUCH AS WIND, PRECIPITATION, SNOW, ETC. OTHER GENERAL REQUIREMENTS FOR EQUIPMENT, MATERIAL, AND/OR SERVICES REQUIRED AS DEFINED IN THE SPECIFICATION APPLY.
12. ALL EXTERIOR BARE CARBON STEEL SURFACES SHALL BE PAINTED IN ACCORDANCE WITH SPECIFICATION 24915-000-3PS-AFPS-00001, SPECIAL COATINGS – METAL.
13. VESSEL SUPPLIER SHALL SUPPLY GROUNDING LUGS IN ACCORDANCE WITH STANDARD 24915-00-M0-00-00006. GROUNDING LUGS WITH DIMENSIONS SHALL BE CLEARLY CALLED OUT ON SUPPLIER DRAWINGS.
14. VESSEL SUPPLIER SHALL DESIGN AND INSTALL A MINIMUM OF TWO LIFTING LUGS FOR USE DURING LOADING, UNLOADING AND PLACING EQUIPMENT ON ITS FOUNDATION. DESIGN SHALL INCLUDE REQUIRED PIN, SHACKLE SIZE AND MAXIMUM SLOPE OF LIFTING CABLE AND LIFTING LUG PLANE. HOLE IN LIFTING LUG SHALL BE DRILLED OR MACHINED, DO NOT FLAME CUT. LIFTING LUG (AND PAD IF REQUIRED) SHALL BE THE SAME MATERIAL AS THE SHELL. LIFTING LUG SHALL NOT BE REMOVED AFTER INSTALLATION. EQUIPMENT SUPPLIER SHALL PERMANENTLY MARK ON THE LIFTING LUG WITH 1" MINIMUM HIGH LETTERS – "DO NOT REMOVE". SUPPLIER'S DRAWINGS SHALL PROVIDE LIFTING LUG DESIGN AND LOAD AND ANNOTATE EACH LUG WITH ITS LOAD CAPACITY.
15. VESSEL SUPPLIER SHALL PROVIDE FABRICATION, EMPTY, OPERATING, TEST AND INDIVIDUAL WEIGHTS OF HEAD, SHELL AND EQUIPMENT CENTER OF GRAVITY.
16. VESSEL SUPPLIER SHALL IDENTIFY ALL MATERIALS OF CONSTRUCTION (INCLUDING GASKETS) BY WEIGHT OR VOLUME.

REFERENCES

STD NO.	DESCRIPTION
24915-00-M0-00-00001	PRESSURE VESSEL TOLERANCES
24915-00-M0-00-00002	STD BOLT HOLE ORIENT
24915-00-M0-00-00004	VESSEL ABBREVIATIONS & SYMBOLS
24915-00-M0-00-00006	GROUNDING CONN FOR VESSELS & TKS

REFERENCES

SPEC NO.	DESCRIPTION
24915-000-3PS-AFPS-00001	SPECIAL COATINGS – METAL
24915-000-3PS-G000-00001	GENERAL PROJECT REQUIREMENTS
24915-000-3PS-HXYQ-00001	QUALITY ASSURANCE
24915-000-3PS-MV00-00001	PRESSURE VESSELS
24915-000-3PS-NLLG-00001	INTERNAL TANK LINING
24915-000-3PS-SV00-00001	SEISMIC PROTECTION OF EQUIP

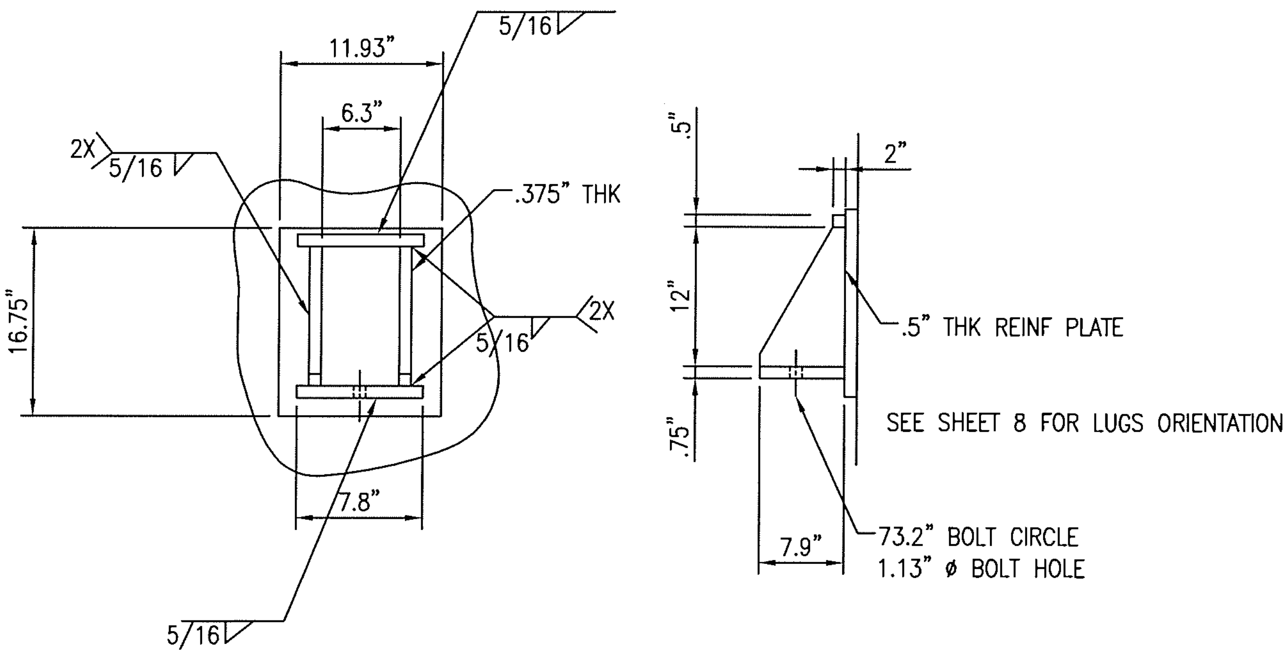
NOTES CONTINUED

17. ALL EXTERNAL BOLTS AND STUDS SHALL BE ASSEMBLED WITH ANTI-SEIZE LUBRICANT. SEE PRESSURE VESSEL SPECIFICATION.
18. VESSEL SUPPLIER SHALL DESIGN AND FABRICATE MANHOLE DAVIT FOR REMOVAL OF MANHOLE COVER.
19. LIQUID LEVELS ARE FROM BOTTOM TANGENT LINE, UNLESS OTHERWISE NOTED.
20. VESSEL FABRICATOR SHALL SPRAY OR LAMINATE LINE VESSEL IN ACCORDANCE WITH SPECIFICATION 24915-000-3PS-NLLG-00001, INTERNAL TANK LINING.
21. VESSEL FABRICATOR SHALL PREPARE ALL INTERNAL CARBON STEEL SURFACES FOR LINING PER NACE RP0178, FABRICATION DETAILS, SURFACE FINISH REQUIREMENTS, AND PROPER DESIGN CONSIDERATIONS FOR TANKS AND VESSELS TO BE LINED FOR IMMERSION SERVICE.
22. NOZZLES SMALLER THAN 2" SHALL BE HASTALLOY (UNS N10276). NOZZLES SMALLER THAN 2" CANNOT BE LINED.
23. STANDPIPE MATERIAL HASTALLOY (UNS N10276), 2" X.S. PIPE.
24. THREE SETS OF SPARE GASKETS FOR NOZZLES WITH BLIND FLANGES SHALL BE SUPPLIED BY VESSEL FABRICATOR. GASKETS SHALL BE FLAT RING, PTFE, 1/8" THK. CL150.
25. ALL BOLTS, NUTS AND WASHERS USED FOR EQUIPMENT IN TOXIC CATEGORIES "A" & "B" SHALL HAVE BOLTS NO SMALLER THAN 1/4". BOLTS ARE SIZED SO THAT PPE WEARERS CAN HANDLE THEM.
26. AGENT HOLDING TANK, MT-ACS-0105, IS REFERENCED ON P&ID 24915-07-M6-ACS-00003.

FILE NAME: MTACS0105D

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP AGENT HOLDING TANK MT-ACS-0105	SHEET 5 OF 9	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ACS-00001	REV 1

N



SEE SHEET 8 FOR LUGS ORIENTATION

THE REINFORCING PAD WILL BE WELDED TO THE VESSEL SHELL ALL AROUND WITH A 3/8" WELD. REFER TO MANUFACTURER DRAWING FOR FULL LUG DETAILS.

DETAIL 1/7 REF SHT 2

(4 REQ'D)

SEISMIC STRESSES IN SDS VESSELS SUPPORTED ON/FROM PLATFORMS

TABLE 1 SHOWS THE SEISMIC STRESSES (S11 AND S22) IN THE TWO ORTHOGONAL DIRECTIONS AT THE LOCATIONS SHOWN IN FIGURE 1 BASED OFF ORIGINAL VESSEL INFORMATION PROVIDED BY THE VENDOR. THESE STRESSES ACT IN BOTH TENSION AND COMPRESSION. THE SEISMIC STRESSES SHOWN IN TABLE 1 WERE COMBINED WITH THE ASME OPERATIONAL STRESSES BY THE VENDOR AND TABLE 3 SHOWS THE NECESSARY DESIGN CHANGE TO THE VESSELS FROM THE VENDOR TO ACCOUNT FOR THE SEISMIC STRESSES. THE BUYER HAS PERFORMED SEISMIC ANALYSIS ON THE UPDATED VESSEL INFORMATION (TABLE 3), AND DETERMINED THERE ARE NO INCREASES TO THE ACCELERATION OF THE CENTER OF GRAVITY OF THE VESSELS. THEREFORE, THE SEISMIC STRESSES IN TABLE 1 ARE A BOUNDING CONDITION PROVIDED THE VESSELS ARE FABRICATED AS DESCRIBED IN TABLE 3 AND LUGS DESIGNED AS SPECIFIED ON PAGE 5.

TABLE 1: S11 AND S22 SEISMIC STRESSES FOR MT-ACS-0105

LOCATION	S11 (KSI)	S22 (KSI)
TOP TANGENT LINE	1.0	1.0
BOTTOM TANGENT LINE	3.5	5.5
AT LUGS	27.0	25.5

Table 2: ACCELERATION OF COG FOR MT-ACS-0105			
Vessel	Acceleration at COG (%g)		
	X	Y	Z
MT-ACS-0105	0.246	0.162	0.252
General Note:			
The 'X' direction is East-West			
The 'Y' direction is North-South			
The 'Z' direction is vertical			

* PLEASE NOTE THAT WHERE THESE ACCELERATIONS WILL PRODUCE LOWER LOADS THAN THOSE DERIVED FROM THE SEISMIC PROTECTION OF EQUIPMENT SPECIFICATION, THE VALUE FROM THE SEISMIC PROTECTION SPEC. IS TO BE USED FOR THE DESIGN OF THE VESSELS' INTERNALS AND ANCHORAGES OF THE VESSELS TO THE STEEL FRAME.

FIGURE 1: LOCATION & ORIENTATION OF STRESSES

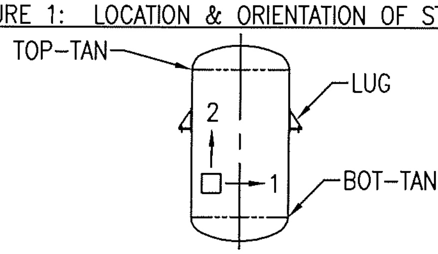
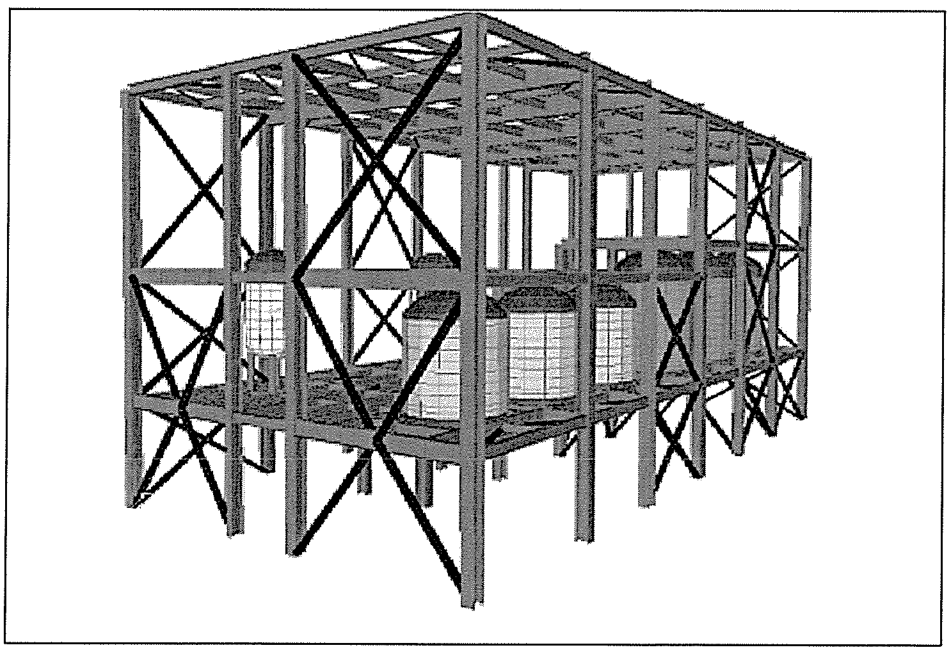


TABLE 3: UPDATED VESSEL INFORMATION FROM VENDOR

VESSEL TAG NO.	CENTER OF GRAVITY (IN) *			OPERATING WEIGHT (LBS)	SHELL THICKNESS (IN)	HEAD THICKNESS (IN)	SKIRT THICKNESS (IN)
	X	Y	Z				
MT-ACS-0105	0.02	-3.48	43.05	21,603	.5	.375	N/A

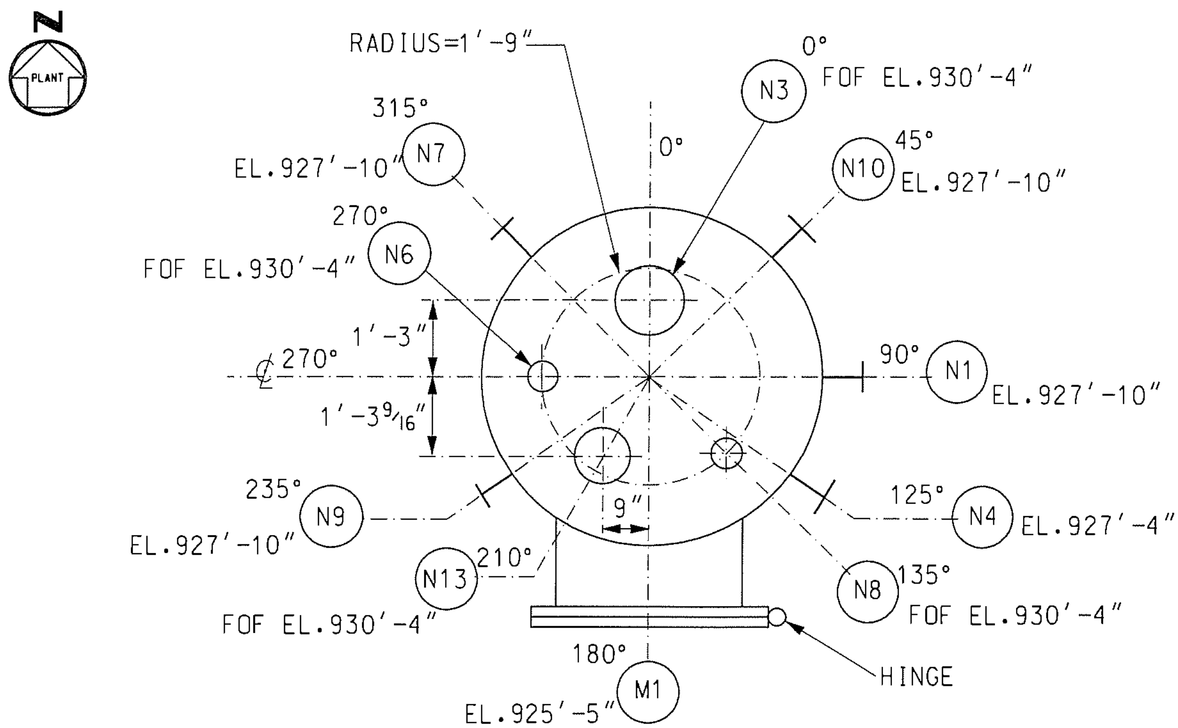
* THE CENTER OF GRAVITY IS BASED ON A STANDARD COORDINATE SYSTEM WITH REFERENCE TO PAGE 7. THE POSITIVE X,Y,Z DIRECTIONS ARE EAST, NORTH, AND UP THE VESSEL (OUT OF THE PAGE), RESPECTIVELY. THE ORIGIN IS AT THE INTERSECTION OF THE VESSEL CENTERLINE AND REFERENCE PLANE (LOWER TANGENT LINE).

FIGURE 2: MODEL SHOWING THE ANS PLATFORM

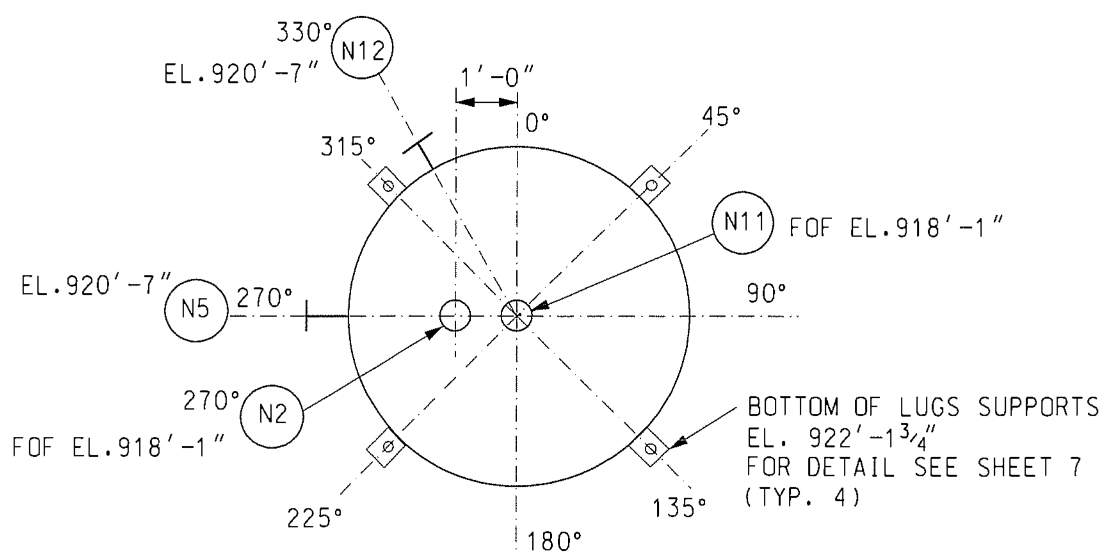


FILE NAME: 07-MT-ACS=0105-s8 r1.dgn

DATA SHEET	TITLE BGCAPP AGENT HOLDING TANK 07-MT-ACS-0105	SHEET 8 OF 9	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ACS-00001	REV 1



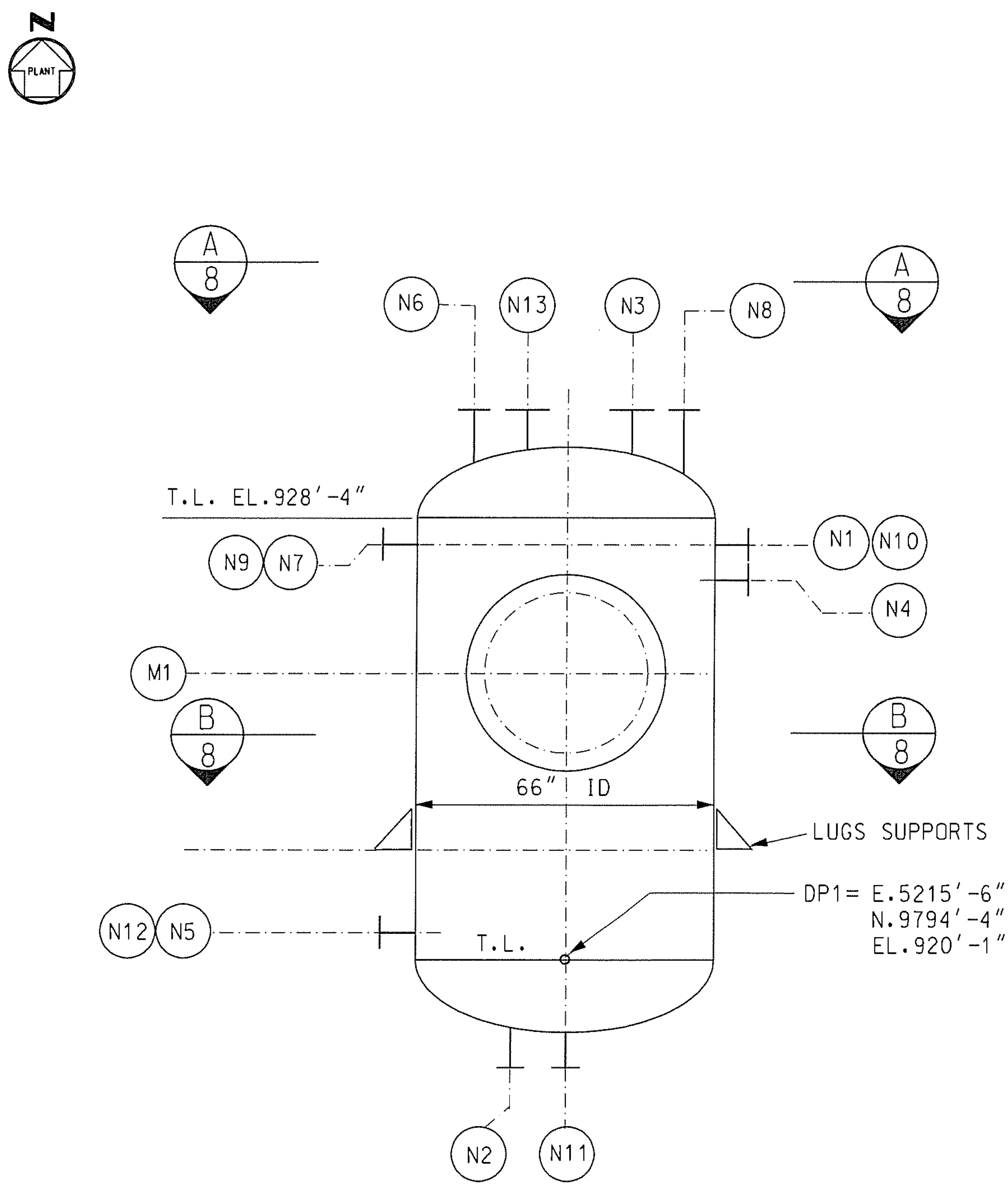
UPPER PLAN A/8 REF. SHEET 9



LOWER PLAN B/8 REF. SHEET 9

FILE NAME: 07-MTA-ACS-0105-s9 r1.dgn

DATA SHEET	TITLE BGCAPP AGENT HOLDING TANK 07-MT-ACS-0105	SHEET 9 OF 9	PROJECT NUMBER 24915	
		DOCUMENT NUMBER 24915-07-MTD-ACS-00001		REV 1



ELEVATION

BECHTEL PARSONS BLUE GRASS A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.	Project Number **24915**	Document Number **24915-07-MTD-ACS-00002**	Rev **1**	Date **10/16/2009**	Sheet of **1 9**

Project, Client, Location	Document Title
Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP) Project	**AGENT SURGE TANK MT-ACS-0106**

☐ In-House Review ☐ Client Approval ☐ Quotation ☑ All Data Sheets Attached

☑ Purchase ☐ Construction ☐ Design ☐ Revised Data Sheets Only Attached

QUALITY: ☑ **Q** ☐ **NON-Q**

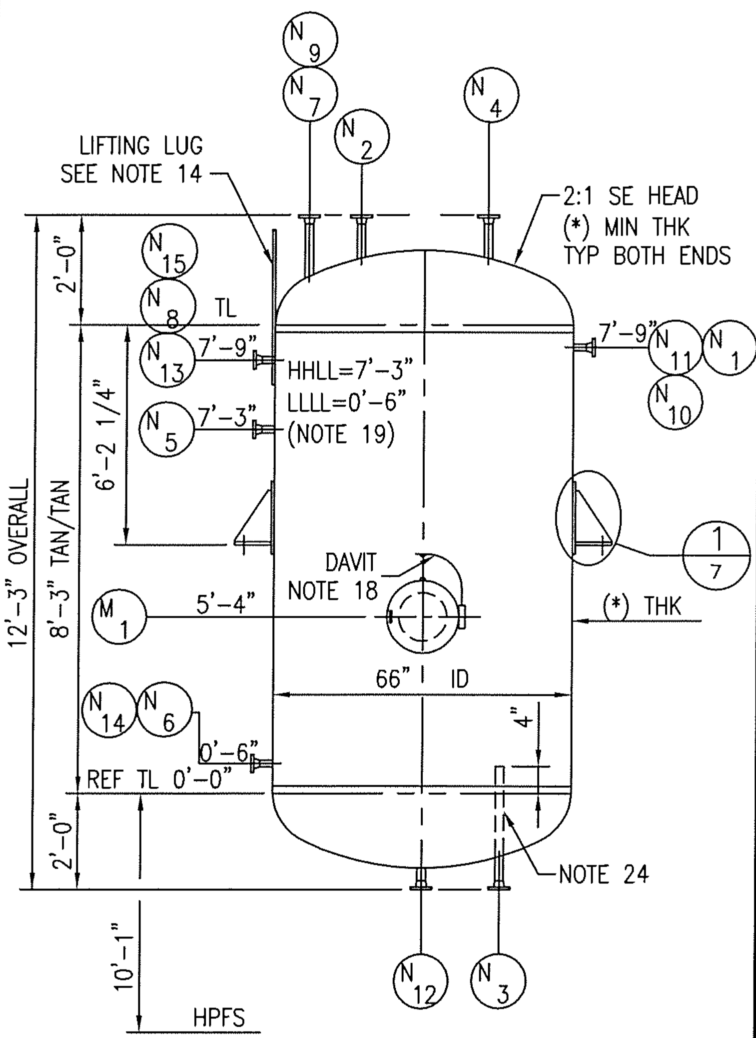
TOXIC CATEGORY ☑ **A** ☐ **B** ☐ **A/B** ________ **OTHER**

REV	DATE	BY	CHK	DL	PROJ ENGR	QA	APPR		REMARKS
0	02/25/09	SC	BM	BM	BBB	JW			Issued for Purchase
1	10/16/09	SC	SS	SA	BBB	JW			Issued for Purchase (added pages 6 & 7 and completely revised page 5 to incorporate seismic data)

This sheet is a record of each issue or revision to the subject specification. Each time the specification is to be changed, only the new or revised sheets must be issued. The exact sheets changed and the nature of the change should be noted in the Remarks column; however, these remarks are not part of the specification. The revised data sheets shall become part of the original specification and shall be compiled within their entirety.

DC- DT-

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP AGENT SURGE TANK MT-ACS-0106	SHEET 2 OF 9	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ACS-00002	REV 1



ONE REQD MT-ACS-0106

SEE SHEETS 8 AND 9 FOR TRUE ORIENTATION

CODE:	ASME SECT VIII DIV 1 (CODE CONSTR. ONLY)
CODE CERT REQD NO	CODE STAMP NO
NATIONAL BOARD REGISTRATION:	NO
OPR PRESS (INT)	0.02 PSIG AT 77 °F
DES PRESS. (INT)	14.9 PSIG AT 125 °F
DES PRESS. (EXT)	FULL VAC PSIG AT 125 °F
MIN DESIGN METAL TEMP	(-)1 °F AT 14.9 PSIG
CRSN ALLOW SHELL =N/A	HEADS =N/A NOZZ =N/A
LIQUID LEVEL FOR DESIGN:	FULL AT SP GR 1.29
SEISMIC DESIGN:	SEE NOTE 10
WIND DESIGN:	SEE NOTE 11
MAWP	(*) PSIG AT 125 °F LIMITED BY (*)
MAP N&C	(*) PSIG AT AMB TEMP LIMITED BY (*)
SHOP HYD	(*) PSIG AT 70 °F MIN HORIZ POSN
FIELD HYD NEW	(*) PSIG AT 70 °F MIN OPR POSN
FIELD HYD CORR	(*) PSIG AT 70 °F MIN OPR POSN
PWHT (PER CODE)	RADIOGRAPHY (FULL)
JOINT EFF: SHELL (PER CODE)	HEADS (PER CODE)
ALLOW STRESS	20,000 PSI AT DESIGN TEMP 125°F

MATERIALS:		
SHELL	SA-516-70 (SEE NOTE 20)	
HEADS	SA-516-70 (SEE NOTE 20)	
SUPPORTS	CS	
INTERNALS	N/A	TRAYS N/A
BOLTS (INT)	N/A	NUTS N/A
BOLTS (EXT)	SA-193-B7	NUTS SA-194-2H
FLANGES	SA-105	
NOZZLE NECKS	SA-106B	
GASKETS	NOTE 23	

CAPACITY (WORKING)	1000 GAL
FAB WT (*) (NOTE 1&15) LB	EMPTY WT (*) (NOTE 1&15) LB
TRAY WT N/A LB	PACKING WT N/A LB
OPR WT (*) (NOTE 1&15) LB	TEST WT (*) (NOTE 1&15) LB
PAINTING	SEE NOTE 12
INSULATION	NONE
FIREPROOFING	NONE

ACCESSORIES BY FABRICATOR:	YES	NO
VESSEL DAVIT MARK No.		X
LADDER & PLATFORM CLIPS		X
PIPE SUPPORT AND PIPE GUIDE CLIPS		X
INSULATION SUPPORTS		X
FIREPROOFING SUPPORTS		X
VORTEX BREAKER		X
LIFTING AND GROUNDING LUGS	X	

NOZZLE SCHEDULE

ITEM	No.	SIZE	PROJ	RATING	SERVICE
M1	1	36"	3'-9"	150#	MH W/ BF & HINGE
N1	1	2"	3'-5"	150#	INLET - DRAINED AGENT
N2	1	6"	SEE ELEV	150#	PSV
N3	1	2"	SEE ELEV	150#	OUTLET
N4	1	8"	SEE ELEV	150#	LEVEL TRANS. (RADAR TYPE)
N5	1	2"	3'-5"	150#	LSHH
N6	1	2"	3'-5"	150#	LSLL
N7	1	2"	SEE ELEV	150#	VENT/PURGE
N8	1	2"	3'-5"	150#	SPARE W/ BF
N9	1	2"	SEE ELEV	150#	AIR PURGE/DECON
N10	1	2"	3'-5"	150#	INLET - AGENT CAT A SUMPS
N11	1	3"	3'-5"	150#	PIT
N12	1	2"	SEE ELEV	150#	DRAIN
N13	1	2"	3'-5"	150#	INLET - AGENT CAT B SUMPS
N14	1	2"	3'-5"	150#	SAMPLE CONNECTION
N15	1	2"	3'-5"	150#	SPARE W/ BF

FLANGE: RFWN FINISH: 125-250 AARH

NOTE #7

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP AGENT SURGE TANK MT-ACS-0106	SHEET 3 OF 9	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ACS-00002	REV 1

NOTES

1. THE VESSEL SUPPLIER SHALL DESIGN, FURNISH, FABRICATE, INSPECT, TEST AND DELIVER THE VESSEL IN ACCORDANCE WITH THIS DATA SHEET, ATTACHED SPECIFICATIONS AND STANDARDS. VESSEL SHALL BE DESIGNED IN ACCORDANCE WITH SPECIFIED DESIGN REQUIREMENTS, SEE NOTES 10 AND 11.
2. ALL DIMENSIONS ARE FROM REF TANGENT LINE, EXCEPT AS SHOWN.
3. NOZZLES AND MANHOLE SHALL HAVE SAME DESIGNATION AS SHOWN ON THIS DRAWING.
4. BOLT HOLES SHALL STRADDLE THE VERTICAL CENTERLINES OF THE VESSEL FOR NOZZLES ON THE SHELL AND PLANT NORTH-SOUTH, EAST-WEST CENTERLINES FOR NOZZLES ON THE HEADS.
5. ALL ATTACHMENTS WELDED TO VESSEL PRESSURE PARTS SHALL BE SAME MATERIAL AS PRESSURE PART, UNLESS OTHERWISE NOTED.
6. VESSEL SHALL BE THOROUGHLY CLEANED INSIDE AND OUTSIDE, SHALL BE FREE FROM RUST, SCALE, SLAG, WELD SPLATTER AND FOREIGN MATTER PRIOR TO SHOP HYDROTEST, AND SHALL BE THOROUGHLY DRIED AFTER HYDROTEST.
7. PROJECTION OF RADIAL NOZZLES AND MANHOLES ARE FROM VESSEL CENTER LINE TO EXTREME FACE OF FLANGE.
8. ALL VESSEL COMPONENTS SHALL BE FURNISHED IN ACCORDANCE WITH STANDARDS LISTED BELOW.
9. ITEMS WITH (*) ARE VESSEL FABRICATOR RESPONSIBILITY.
10. SEISMIC FORCES SHALL BE PER SPECIFICATION 24915-000-3PS-SV00-00001, SPECIFICATION FOR SEISMIC PROTECTION OF EQUIPMENT. THE VESSEL IS LOCATED INSIDE THE MDB BUILDING (ANS ROOM 123). PER TABLE 1, APPLICABLE CODES AND IMPORTANCE FACTORS, SEISMIC PROTECTION SHALL BE IN ACCORDANCE WITH ICC INTERNATIONAL BUILDING CODE (IBC) 2000, SEISMIC DESIGN FOR BUILDINGS (SEISMIC GROUPS IIIH AND IIIE).
11. THE GENERAL PROJECT SPECIFICATION, 24915-000-3PS-G000-00001, PROVIDES PROJECT DETAILS AND DESIGN CONDITIONS FOR THE SITE. THIS VESSEL IS PART OF THE MUNITIONS DEMILITARIZATION BUILDING (MDB) AND IS INSTALLED INSIDE THE BUILDING (ROOM 123) AND WILL NOT BE SUBJECT TO SITE CONDITIONS SUCH AS WIND, PRECIPITATION, SNOW, ETC. OTHER GENERAL REQUIREMENTS FOR EQUIPMENT, MATERIAL, AND/OR SERVICES REQUIRED AS DEFINED IN THE SPECIFICATION APPLY.
12. ALL EXTERIOR BARE CARBON STEEL SURFACES SHALL BE PAINTED IN ACCORDANCE WITH SPECIFICATION 24915-000-3PS-AFPS-00001, SPECIAL COATINGS - METAL.
13. VESSEL SUPPLIER SHALL SUPPLY GROUNDING LUGS IN ACCORDANCE WITH STANDARD 24915-00-M0-00-00006. GROUNDING LUGS WITH DIMENSIONS SHALL BE CLEARLY CALLED OUT ON SUPPLIER DRAWINGS.
14. VESSEL SUPPLIER SHALL DESIGN AND INSTALL A MINIMUM OF TWO LIFTING LUGS FOR USE DURING LOADING, UNLOADING AND PLACING EQUIPMENT ON ITS FOUNDATION. DESIGN SHALL INCLUDE REQUIRED PIN, SHACKLE SIZE AND MAXIMUM SLOPE OF LIFTING CABLE AND LIFTING LUG PLANE. HOLE IN LIFTING LUG SHALL BE DRILLED OR MACHINED, DO NOT FLAME CUT. LIFTING LUG (AND PAD IF REQUIRED) SHALL BE THE SAME MATERIAL AS THE SHELL. LIFTING LUG SHALL NOT BE REMOVED AFTER INSTALLATION. EQUIPMENT SUPPLIER SHALL PERMANENTLY MARK ON THE LIFTING LUG WITH 1" MINIMUM HIGH LETTERS - "DO NOT REMOVE". SUPPLIER'S DRAWINGS SHALL PROVIDE LIFTING LUG DESIGN AND LOAD AND ANNOTATE EACH LUG WITH ITS LOAD CAPACITY.
15. VESSEL SUPPLIER SHALL PROVIDE FABRICATION, EMPTY, OPERATING, TEST AND INDIVIDUAL WEIGHTS OF HEAD, SHELL AND EQUIPMENT CENTER OF GRAVITY.
16. VESSEL SUPPLIER SHALL IDENTIFY ALL MATERIALS OF CONSTRUCTION (INCLUDING GASKETS) BY WEIGHT OR VOLUME.

REFERENCES

STD NO.	DESCRIPTION
24915-00-M0-00-00001	PRESSURE VESSEL TOLERANCES
24915-00-M0-00-00002	STD BOLT HOLE ORIENT
24915-00-M0-00-00004	VESSEL ABBREVIATIONS & SYMBOLS
24915-00-M0-00-00006	GROUNDING CONN FOR VESSELS & TKS

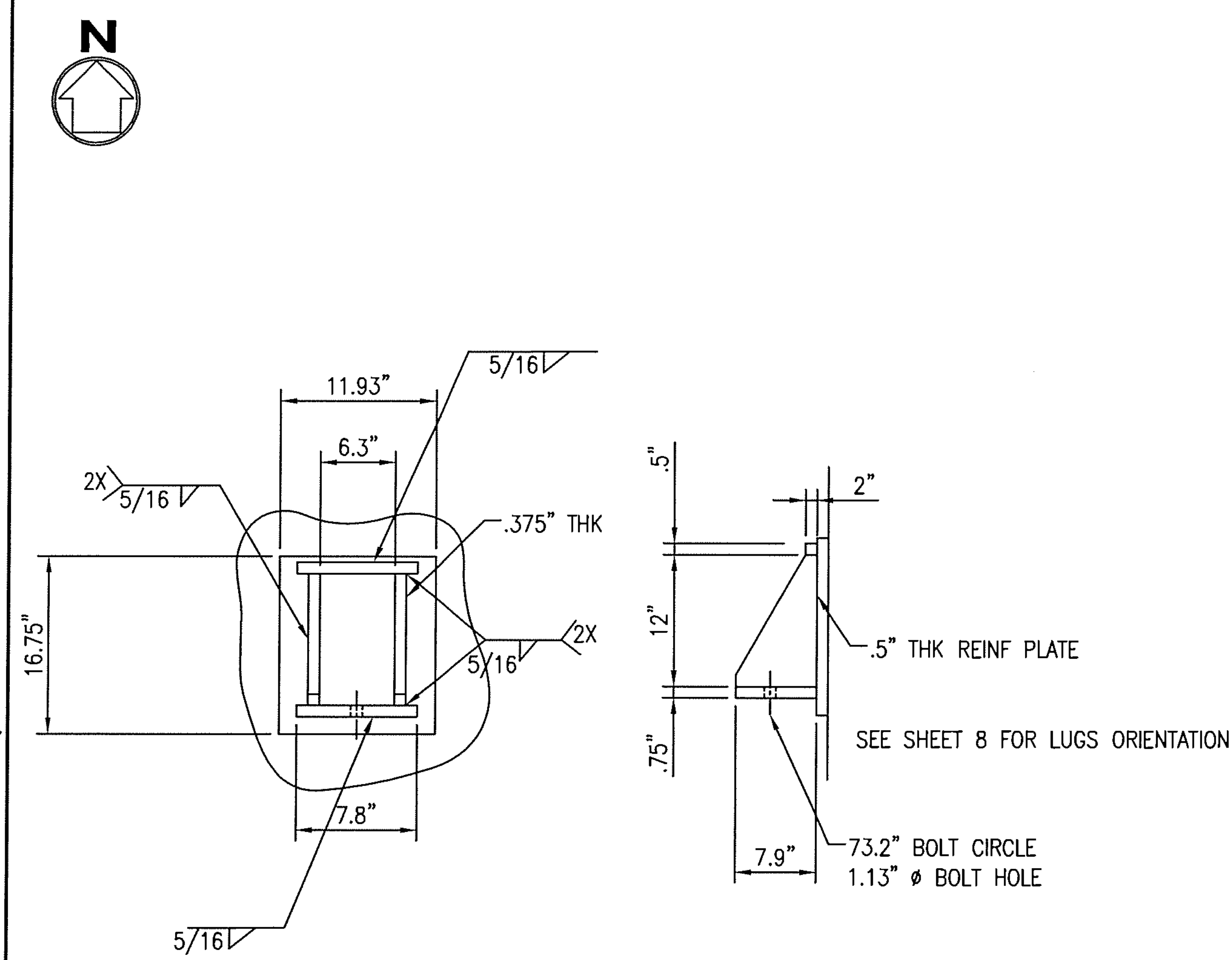
REFERENCES

SPEC NO.	DESCRIPTION
24915-000-3PS-AFPS-00001	SPECIAL COATINGS - METAL
24915-000-3PS-G000-00001	GENERAL PROJECT REQUIREMENTS
24915-000-3PS-HXYQ-00001	QUALITY ASSURANCE
24915-000-3PS-MV00-00001	PRESSURE VESSELS
24915-000-3PS-NLLG-00001	INTERNAL TANK LINING
24915-000-3PS-SV00-00001	SEISMIC PROTECTION OF EQUIP

NOTES CONTINUED

17. ALL EXTERNAL BOLTS AND STUDS SHALL BE ASSEMBLED WITH ANTI-SEIZE LUBRICANT. SEE PRESSURE VESSEL SPECIFICATION.
18. VESSEL SUPPLIER SHALL DESIGN AND FABRICATE MANHOLE DAVIT FOR REMOVAL OF MANHOLE COVER.
19. LIQUID LEVELS ARE FROM BOTTOM TANGENT LINE, UNLESS OTHERWISE NOTED.
20. VESSEL FABRICATOR SHALL SPRAY OR LAMINATE LINE VESSEL IN ACCORDANCE WITH SPECIFICATION 24915-000-3PS-NLLG-00001, INTERNAL TANK LINING.
21. VESSEL FABRICATOR SHALL PREPARE ALL INTERNAL CARBON STEEL SURFACES FOR LINING PER NACE RP0178, FABRICATION DETAILS, SURFACE FINISH REQUIREMENTS, AND PROPER DESIGN CONSIDERATIONS FOR TANKS AND VESSELS TO BE LINED FOR IMMERSION SERVICE.
22. NOZZLES SMALLER THAN 2" SHALL BE HASTALLOY (UNS N10276). NOZZLES SMALLER THAN 2" CANNOT BE LINED. ISOLATION KIT REQUIRED.
23. THREE SETS OF SPARE GASKETS FOR NOZZLES WITH BLIND FLANGES SHALL BE SUPPLIED BY VESSEL FABRICATOR. GASKETS SHALL BE FLAT RING, PTFE, 1/8" THK, CL150.
24. STANDPIPE MATERIAL SHALL BE HASTALLOY (UNS N10276) X.S. PIPE.
25. ALL BOLTS, NUTS AND WASHERS USED FOR EQUIPMENT IN TOXIC CATEGORIES "A" & "B" SHALL HAVE BOLTS NO SMALLER THAN 1/4". BOLTS ARE SIZED SO THAT PPE WEARERS CAN HANDLE THEM.
26. AGENT SURGE TANK, MT-ACS-0106, IS REFERENCED ON P&ID 24915-07-M6-ACS-00002.

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP AGENT HOLDING TANK MT-ACS-0106	SHEET 5 OF 9	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ACS-00002	REV 1



THE REINFORCING PAD WILL BE WELDED TO THE VESSEL SHELL ALL AROUND WITH A 3/8" WELD. REFER TO MANUFACTURER DRAWING FOR FULL LUG DETAILS.

DETAIL 1/7 (4 REQ'D) REF SHT 2

SEISMIC STRESSES IN SDS VESSELS SUPPORTED ON/FROM PLATFORMS

TABLE 1 SHOWS THE SEISMIC STRESSES (S11 AND S22) IN THE TWO ORTHOGONAL DIRECTIONS AT THE LOCATIONS SHOWN IN FIGURE 1 BASED OFF ORIGINAL VESSEL INFORMATION PROVIDED BY THE VENDOR. THESE STRESSES ACT IN BOTH TENSION AND COMPRESSION. THE SEISMIC STRESSES SHOWN IN TABLE 1 WERE COMBINED WITH THE ASME OPERATIONAL STRESSES BY THE VENDOR AND TABLE 3 SHOWS THE NECESSARY DESIGN CHANGE TO THE VESSELS FROM THE VENDOR TO ACCOUNT FOR THE SEISMIC STRESSES. THE BUYER HAS PERFORMED SEISMIC ANALYSIS ON THE UPDATED VESSEL INFORMATION (TABLE 3), AND DETERMINED THERE ARE NO INCREASES TO THE ACCELERATION OF THE CENTER OF GRAVITY OF THE VESSELS. THEREFORE, THE SEISMIC STRESSES IN TABLE 1 ARE A BOUNDING CONDITION PROVIDED THE VESSELS ARE FABRICATED AS DESCRIBED IN TABLE 3 AND LUGS DESIGNED AS SPECIFIED ON PAGE 5.

TABLE 1: S11 AND S22 SEISMIC STRESSES FOR MT-ACS-0106

LOCATION	S11 (KSI)	S22 (KSI)
TOP TANGENT LINE	1.0	1.0
BOTTOM TANGENT LINE	3.5	5.5
AT LUGS	27.0	25.5

Table 2: ACCELERATION OF COG FOR MT-ACS-0106			
	Acceleration at COG (%g)		
Vessel	X	Y	Z
MT-ACS-0106	0.246	0.162	0.252
General Note:			
The 'X' direction is East-West			
The 'Y' direction is North-South			
The 'Z' direction is vertical			

* PLEASE NOTE THAT WHERE THESE ACCELERATIONS WILL PRODUCE LOWER LOADS THAN THOSE DERIVED FROM THE SEISMIC PROTECTION OF EQUIPMENT SPECIFICATION, THE VALUE FROM THE SEISMIC PROTECTION SPEC. IS TO BE USED FOR THE DESIGN OF THE VESSELS' INTERNALS AND ANCHORAGES OF THE VESSELS TO THE STEEL FRAME.

FIGURE 1: LOCATION & ORIENTATION OF STRESSES

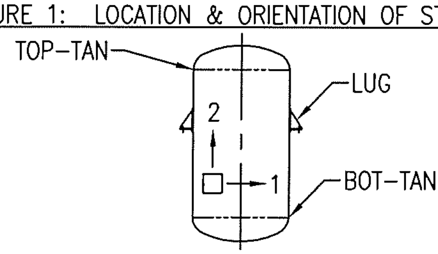
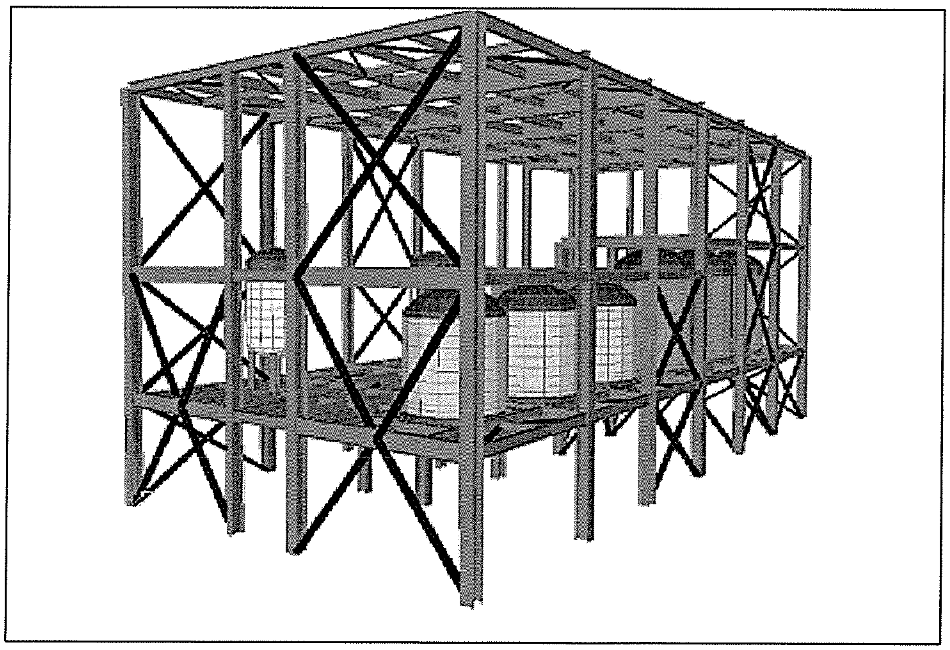


TABLE 3: UPDATED VESSEL INFORMATION FROM VENDOR

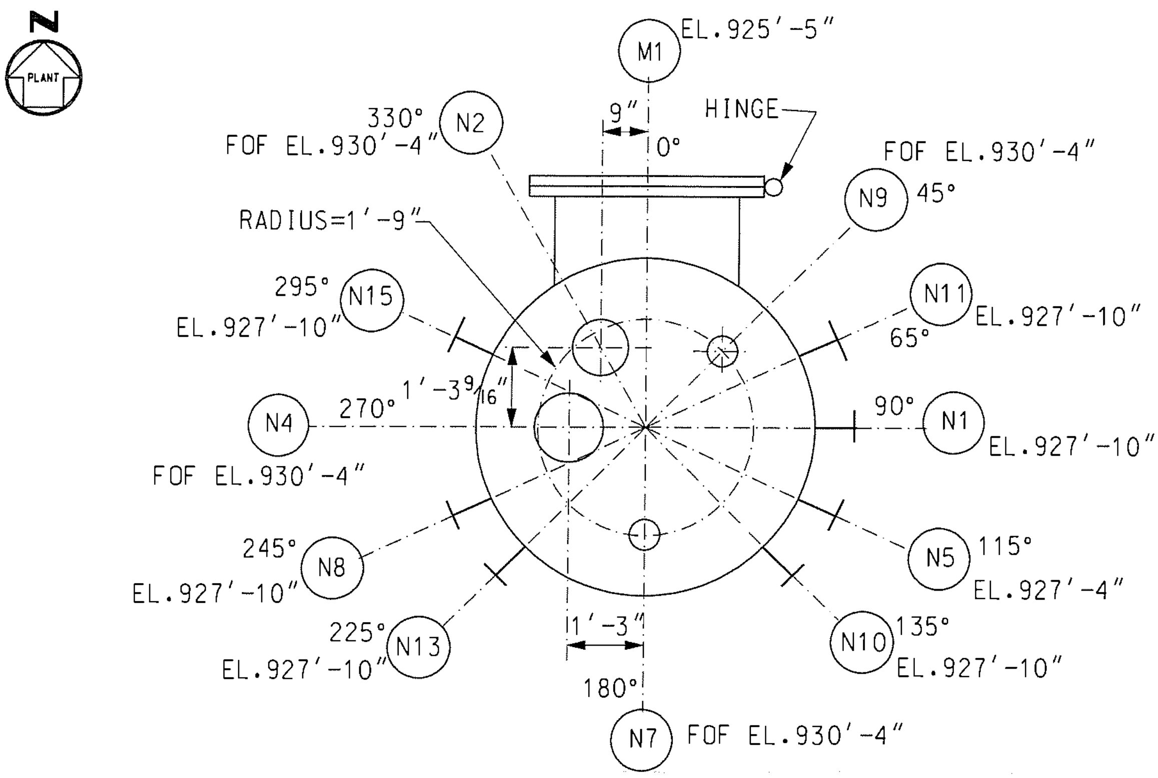
VESSEL TAG NO.	CENTER OF GRAVITY (IN) *			OPERATING WEIGHT (LBS)	SHELL THICKNESS (IN)	HEAD THICKNESS (IN)	SKIRT THICKNESS (IN)
	X	Y	Z				
MT-ACS-0106	.02	-3.48	43.05	21,603	.5	.375	N/A

* THE CENTER OF GRAVITY IS BASED ON A STANDARD COORDINATE SYSTEM WITH REFERENCE TO PAGE 7.
THE POSITIVE X,Y,Z DIRECTIONS ARE EAST, NORTH, AND UP THE VESSEL (OUT OF THE PAGE), RESPECTIVELY.
THE ORIGIN IS AT THE INTERSECTION OF THE VESSEL CENTERLINE AND REFERENCE PLANE (LOWER TANGENT LINE).

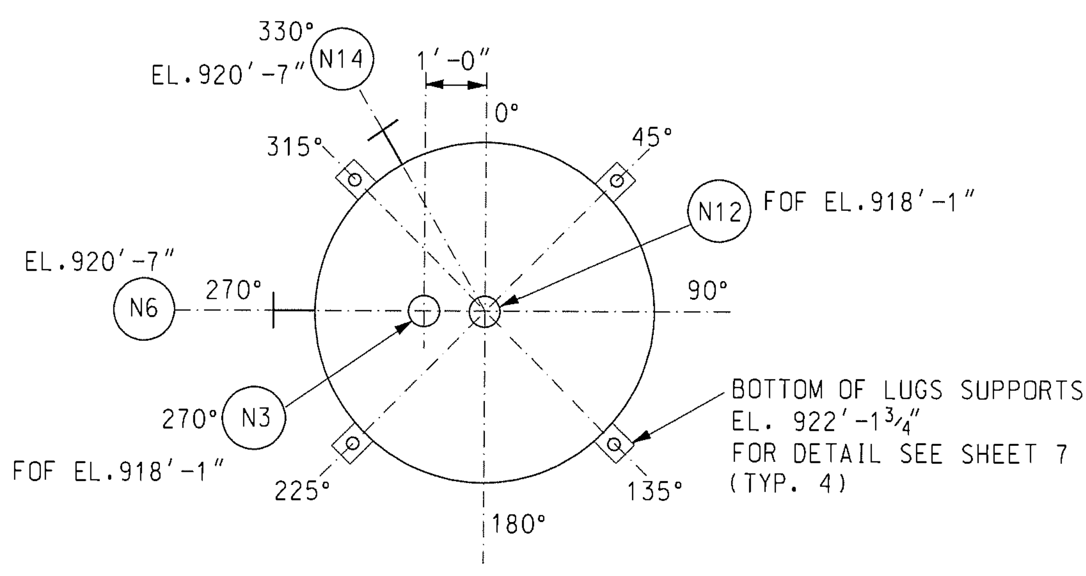
FIGURE 2: MODEL SHOWING THE ANS PLATFORM



DATA SHEET	TITLE BGCAPP AGENT SURGE TANK 07-MT-ACS-0106	SHEET 8 OF 9	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ACS-00002	REV 1

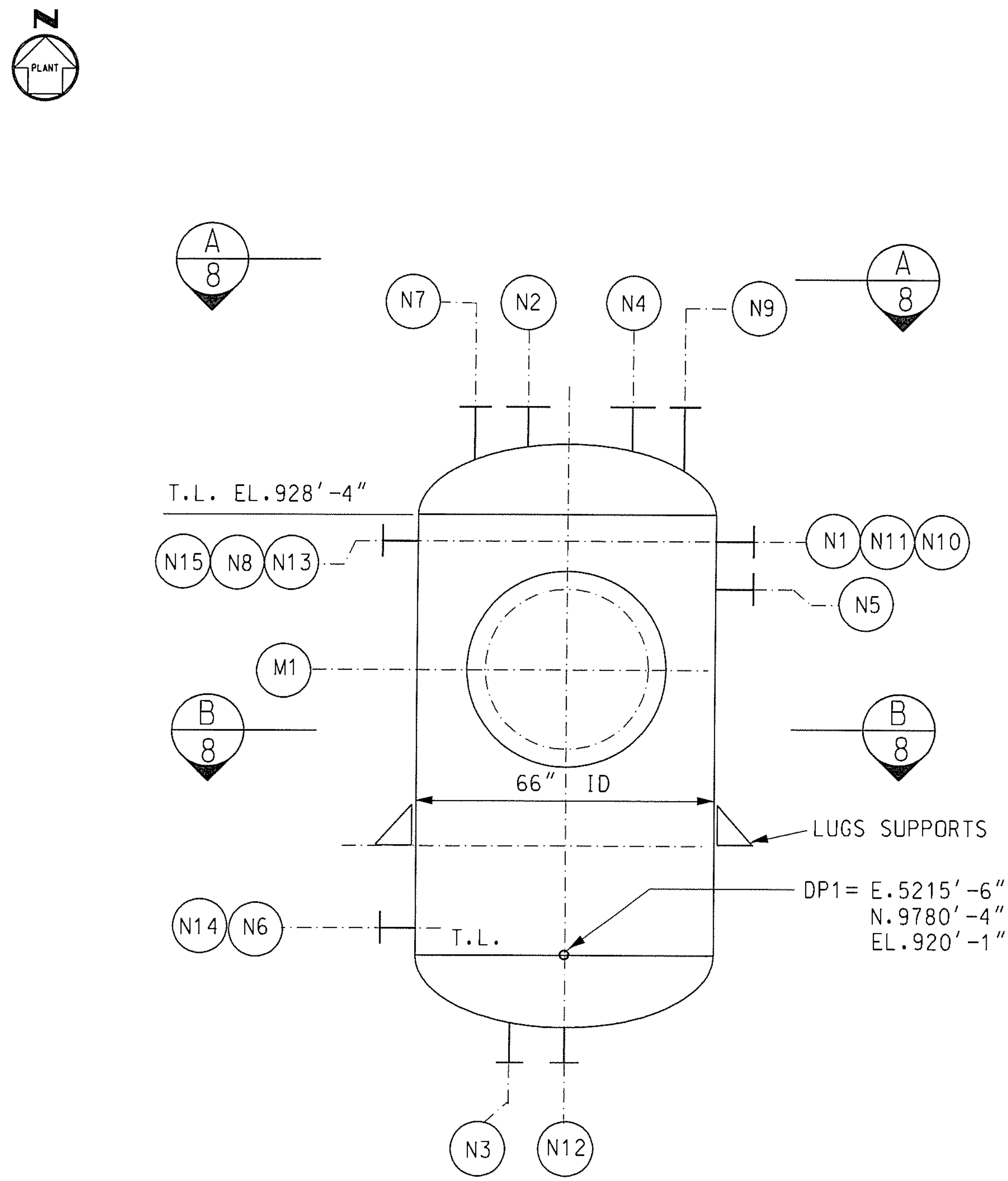


UPPER PLAN (A/8) REF. SHEET 9



LOWER PLAN (B/8) REF. SHEET 9

DATA SHEET	TITLE BGCAPP AGENT SURGE TANK 07-MT-ACS-0106	SHEET 9 OF 9	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ACS-00002	REV 1



ELEVATION

BECHTEL PARSONS BLUE GRASS A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.	Project Number **24915**	Document Number **24915-07-MTD-ANS-00001**	Rev **2**	Date **11/11/2009**	Sheet of **1 10**

Project, Client, Location

Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP) Project

Document Title

AGENT HYDROLYSATE SAMPLING TANKS MT-ANS-0103/0203/0303

☐ In-House Review ☐ Client Approval ☐ Quotation ☑ All Data Sheets Attached

☑ Purchase ☐ Construction ☐ Design ☐ Revised Data Sheets Only Attached

QUALITY: ☑ **Q** ☐ **NON-Q**

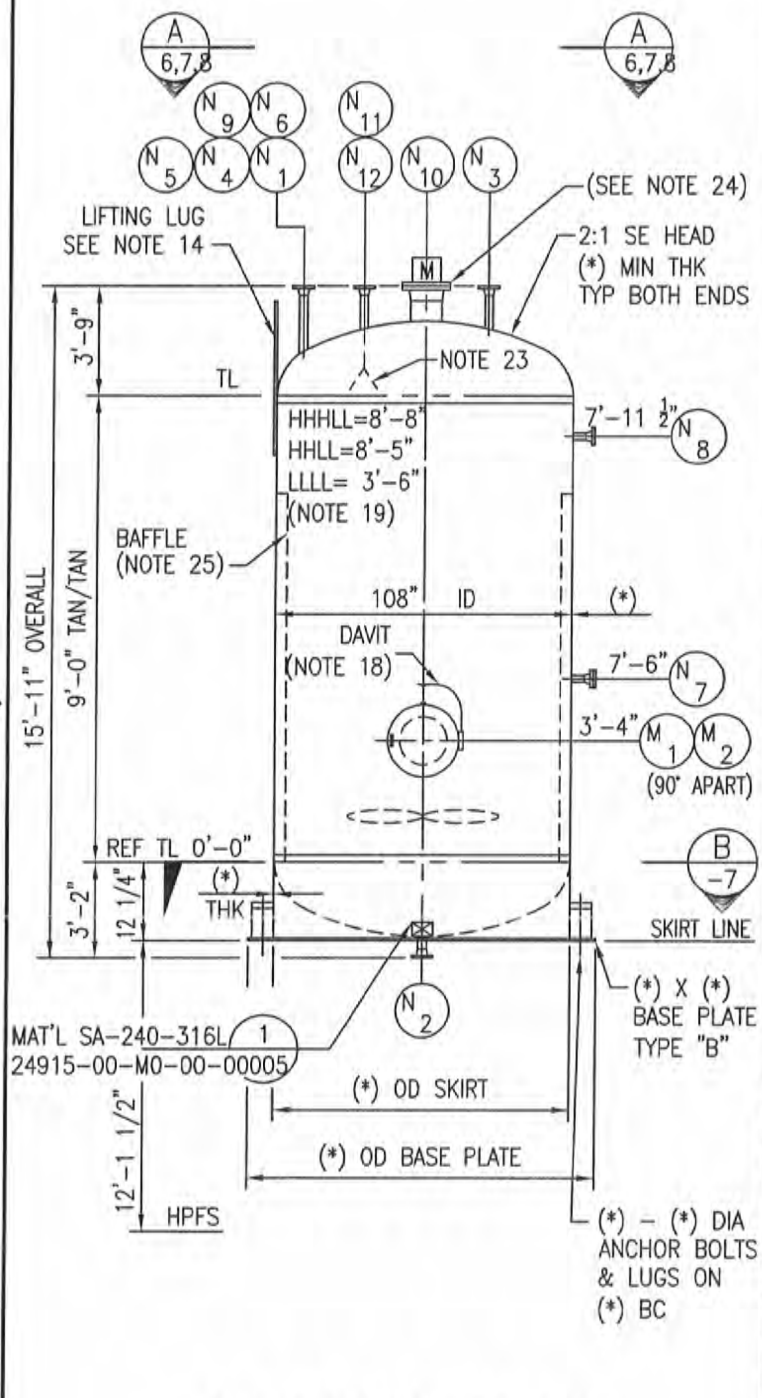
TOXIC CATEGORY ☑ **A** ☐ **B** ☐ **A/B** ______ **OTHER**

REV	DATE	BY	CHK	DL	PROJ ENGR	QA	APPR		REMARKS
0	04/16/09	SC	BM	BM	BBB	JW			Issued for Purchase
1	09/04/09	SC	BM	SA	BBB	JW			Issued for Purchase (included seismic data for vendor's use by adding sheets 5 & 6)
2	11/11/09	MDV MDV	SC SC	SA SA	BBB BBB	JW JBW			Issued for Purchase (revised seismic data for vendor's use and changes shown by clouds)

This sheet is a record of each issue or revision to the subject specification. Each time the specification is to be changed, only the new or revised sheets must be issued. The exact sheets changed and the nature of the change should be noted in the Remarks column; however, these remarks are not part of the specification. The revised data sheets shall become part of the original specification and shall be compiled within their entirety.

FILE NAME: MTANS0103

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP AGENT HYDROLYSATE SAMPLING TANKS MT-ANS-0103/0203/0303	SHEET 2 OF 10	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ANS-00001	REV 2



ONE REQD MT-ANS-0103
ONE REQD MT-ANS-0203
ONE REQD MT-ANS-0303

SEE SHEETS 6, 7, & 8 FOR TRUE ORIENTATION

CODE:	ASME SECT VIII DIV 1 (CODE CONSTR. ONLY)
CODE CERT REQD	NO CODE STAMP NO
NATIONAL BOARD REGISTRATION:	NO
OPR PRESS (INT)	0.20 PSIG AT 100 °F
DES PRESS. (INT)	14.9 PSIG AT 125 °F
DES PRESS. (EXT)	FULL VAC PSIG AT 125 °F
MIN DESIGN METAL TEMP	(-)1 °F AT 14.9 PSIG
CRSN ALLOW SHELL =1/16"	HEADS =1/16" NOZZ =1/16"
LIQUID LEVEL FOR DESIGN:	FULL AT SP GR 1.07
SEISMIC DESIGN:	SEE NOTE 10
WIND DESIGN:	SEE NOTE 11
MAWP	(*) PSIG AT 125 °F LIMITED BY (*)
MAP N&C	(*) PSIG AT AMB TEMP LIMITED BY (*)
SHOP HYD	(*) PSIG AT 70 °F MIN HORIZ POSN
FIELD HYD NEW	(*) PSIG AT 70 °F MIN OPR POSN
FIELD HYD CORR	(*) PSIG AT 70 °F MIN OPR POSN
PWHT (PER CODE)	RADIOGRAPHY (FULL)
JOINT EFF: SHELL (PER CODE)	HEADS (PER CODE)
ALLOW STRESS	16,700 PSI AT DESIGN TEMP 125°F

MATERIALS:		
SHELL	SA-240-316L	
HEADS	SA-240-316L	
SUPPORTS	SA-240-316L	
INTERNALS	SA-240-316L	TRAYS N/A
BOLTS (INT)	N/A	NUTS N/A
BOLTS (EXT)	SA-193-B6	NUTS SA-194-6
FLANGES	SA-182-F316L	
NOZZLE NECKS	SA-312-TP-316L	
GASKETS	NOTE 21	

CAPACITY (WORKING)			3120 GAL
FAB WT	(*) (NOTE 1&15) LB	EMPTY WT	(*) (NOTE 1&15) LB
TRAY WT	N/A LB	PACKING WT	N/A LB
OPR WT	(*) (NOTE 1&15) LB	TEST WT	(*) (NOTE 1&15) LB
PAINTING	SEE NOTE 12		
INSULATION	NONE		
FIREPROOFING	NONE		

ACCESSORIES BY FABRICATOR:	YES	NO
VESSEL DAVIT MARK No.		X
LADDER & PLATFORM CLIPS		X
PIPE SUPPORT AND PIPE GUIDE CLIPS		X
INSULATION SUPPORTS		X
FIREPROOFING SUPPORTS		X
VORTEX BREAKER	X	
LIFTING AND GROUNDING LUGS	X	

NOZZLE SCHEDULE

ITEM	No.	SIZE	PROJ	RATING	SERVICE
M1,M2	2	36"	5'-6"	150#	MH W/ BF & DAVIT
N1	1	3"	SEE ELEV	150#	TANK INLET
N2	1	6"	SEE ELEV	150#	TANK OUTLET
N3	1	8"	SEE ELEV	150#	LEVEL TRANSMITTER
N4	1	2"	SEE ELEV	150#	LSHH
N5	1	2"	SEE ELEV	150#	LSHHH
N6	1	4"	SEE ELEV	150#	VENT
N7	1	3"	5'-2"	150#	RECYCLE LINE
N8	1	2"	5'-2"	150#	SPARE W/ BF
N9	1	2"	SEE ELEV	150#	PURGE INLET
N10	1	14"	SEE ELEV	150#	AGITATOR
N11	1	3"	SEE ELEV	150#	PIT
N12	1	2"	SEE ELEV	150#	DECON SPRAY

FLANGE: RFWN FINISH: 125-250 AARH

NOTE #7

NOTES

1. THE VESSEL SUPPLIER SHALL DESIGN, FURNISH, FABRICATE, INSPECT, TEST AND DELIVER THE VESSEL IN ACCORDANCE WITH THIS DATA SHEET, ATTACHED SPECIFICATIONS AND STANDARDS. VESSEL SHALL BE DESIGNED IN ACCORDANCE WITH SPECIFIED DESIGN REQUIREMENTS, SEE NOTES 10 AND 11.
2. ALL DIMENSIONS ARE FROM REF TANGENT LINE, EXCEPT AS SHOWN.
3. NOZZLES AND MANHOLE SHALL HAVE SAME DESIGNATION AS SHOWN ON THIS DRAWING.
4. BOLT HOLES SHALL STRADDLE THE VERTICAL CENTERLINES OF THE VESSEL FOR NOZZLES ON THE SHELL AND PLANT NORTH-SOUTH, EAST-WEST CENTERLINES FOR NOZZLES ON THE HEADS.
5. ALL ATTACHMENTS WELDED TO VESSEL PRESSURE PARTS SHALL BE SAME MATERIAL AS PRESSURE PART, UNLESS OTHERWISE NOTED.
6. VESSEL SHALL BE THOROUGHLY CLEANED INSIDE AND OUTSIDE, SHALL BE FREE FROM RUST, SCALE, SLAG, WELD SPLATTER AND FOREIGN MATTER PRIOR TO SHOP HYDROTEST, AND SHALL BE THOROUGHLY DRIED AFTER HYDROTEST.
7. PROJECTION OF RADIAL NOZZLES AND MANHOLES ARE FROM VESSEL CENTER LINE TO EXTREME FACE OF FLANGE.
8. ALL VESSEL COMPONENTS SHALL BE FURNISHED IN ACCORDANCE WITH STANDARDS LISTED BELOW.
9. ITEMS WITH (*) ARE VESSEL FABRICATOR RESPONSIBILITY.
10. SEISMIC FORCES SHALL BE PER SPECIFICATION 24915-000-3PS-SV00-00001, SPECIFICATION FOR SEISMIC PROTECTION OF EQUIPMENT. THE VESSEL IS LOCATED INSIDE THE MDB BUILDING (ANS ROOM 123). PER TABLE 1, APPLICABLE CODES AND IMPORTANCE FACTORS, SEISMIC PROTECTION SHALL BE IN ACCORDANCE WITH ICC INTERNATIONAL BUILDING CODE (IBC) 2000, SEISMIC DESIGN FOR BUILDINGS (SEISMIC GROUPS IIIH AND IIIE).
11. THE GENERAL PROJECT SPECIFICATION, 24915-000-3PS-G000-00001, PROVIDES PROJECT DETAILS AND DESIGN CONDITIONS FOR THE SITE. THIS VESSEL IS PART OF THE MUNITIONS DEMILITARIZATION BUILDING (MDB) AND IS INSTALLED INSIDE THE BUILDING (ANS ROOM 123) AND WILL NOT BE SUBJECT TO SITE CONDITIONS SUCH AS WIND, PRECIPITATION, SNOW, ETC. OTHER GENERAL REQUIREMENTS FOR EQUIPMENT, MATERIAL, AND/OR SERVICES REQUIRED AS DEFINED IN THE SPECIFICATION APPLY.
12. ALL EXTERIOR BARE CARBON STEEL SURFACES SHALL BE PAINTED IN ACCORDANCE WITH SPECIFICATION 24915-000-3PS-AFPS-00001, SPECIAL COATINGS - METAL.
13. VESSEL SUPPLIER SHALL SUPPLY GROUNDING LUGS IN ACCORDANCE WITH STANDARD 24915-00-M0-00-00006. GROUNDING LUGS WITH DIMENSIONS SHALL BE CLEARLY CALLED OUT ON SUPPLIER DRAWINGS.
14. VESSEL SUPPLIER SHALL DESIGN AND INSTALL A MINIMUM OF TWO LIFTING LUGS FOR USE DURING LOADING, UNLOADING AND PLACING EQUIPMENT ON ITS FOUNDATION. DESIGN SHALL INCLUDE REQUIRED PIN, SHACKLE SIZE AND MAXIMUM SLOPE OF LIFTING CABLE AND LIFTING LUG PLANE. HOLE IN LIFTING LUG SHALL BE DRILLED OR MACHINED, DO NOT FLAME CUT. LIFTING LUG (AND PAD IF REQUIRED) SHALL BE THE SAME MATERIAL AS THE SHELL. LIFTING LUG SHALL NOT BE REMOVED AFTER INSTALLATION. EQUIPMENT SUPPLIER SHALL PERMANENTLY MARK ON THE LIFTING LUG WITH 1" MINIMUM HIGH LETTERS - "DO NOT REMOVE". SUPPLIER'S DRAWINGS SHALL PROVIDE LIFTING LUG DESIGN AND LOAD AND ANNOTATE EACH LUG WITH ITS LOAD CAPACITY.
15. VESSEL SUPPLIER SHALL PROVIDE FABRICATION, EMPTY, OPERATING, TEST AND INDIVIDUAL WEIGHTS OF HEAD, SHELL AND EQUIPMENT CENTER OF GRAVITY.
16. VESSEL SUPPLIER SHALL IDENTIFY ALL MATERIALS OF CONSTRUCTION (INCLUDING GASKETS) BY WEIGHT OR VOLUME.

	STD NO.	DESCRIPTION		SPEC NO.	DESCRIPTION
REFERENCES	24915-00-M0-00-00001	PRESSURE VESSEL TOLERANCES	REFERENCES	24915-000-3PS-AFPS-00001	SPECIAL COATINGS - METAL
	24915-00-M0-00-00002	STD BOLT HOLE ORIENT		24915-000-3PS-G000-00001	GENERAL PROJECT REQUIREMENTS
	24915-00-M0-00-00004	VESSEL ABBREVIATIONS & SYMBOLS		24915-000-3PS-HXYQ-00001	QUALITY ASSURANCE
	24915-00-M0-00-00005	VORTEX BREAKERS		24915-000-3PS-MMT0-00001	PMI FOR PRESSURE VESSELS & TANKS
	24915-00-M0-00-00006	GROUNDING CONN FOR VESSELS & TKS		24915-000-3PS-MV00-00001	PRESSURE VESSELS
	24915-00-M0-00-00008	SKIRT AND BASE DETAILS		24915-000-3PS-NW00-00002	NICKEL BASE ALLOY WELDING
				24915-000-3PS-SV00-00001	SEISMIC PROTECTION OF EQUIP

NOTES CONTINUED

17. ALL EXTERNAL BOLTS AND STUDS SHALL BE ASSEMBLED WITH ANTI-SEIZE LUBRICANT. SEE PRESSURE VESSEL SPECIFICATION.
18. VESSEL SUPPLIER SHALL DESIGN AND FABRICATE MANHOLE DAVIT FOR REMOVAL OF MANHOLE COVER.
19. LIQUID LEVELS ARE FROM BOTTOM TANGENT LINE, UNLESS OTHERWISE NOTED.
20. AGENT HYDROLYSATE SAMPLING TANKS, MT-ANS-0103/0203/0303, ARE REFERENCED ON P&ID'S 24915-07-M6-ANS-00011, 00012, 00013.
21. THREE SETS OF SPARE GASKETS FOR NOZZLES WITH BLIND FLANGES SHALL BE SUPPLIED BY VESSEL FABRICATOR. GASKETS SHALL BE SP WND, HAST C, FLEX GRAPH FILLER, 1/8" THK, CARBON STEEL CENT RING, CLASS 150.
22. ALL BOLTS, NUTS AND WASHERS USED FOR EQUIPMENT IN TOXIC CATEGORIES "A" & "B" SHALL HAVE BOLTS NO SMALLER THAN 1/4". BOLTS ARE SIZED SO THAT PPE WEARERS CAN HANDLE THEM.
23. WASH SPRAY NOZZLE, N12, SHALL BE SUPPLIED BY VESSEL FABRICATOR. SPRAY NOZZLE BETE MODEL 1"-TW OR EQUAL. MATERIAL SHALL BE 316L.
24. AGITATOR SHALL BE PROVIDED BY VESSEL VENDOR. REFER TO DATA SHEET 24915-07-M5D-ANS-00002, AGENT HYDROLYSATE SAMPLING TANK AGITATORS.
25. FOUR VORTEX REDUCING BAFFLES REQUIRED. BAFFLES SHALL BE 316L MATERIAL. BAFFLES SHALL BE EQUALLY SPACED AT 90°. VESSEL FABRICATOR TO COORDINATE WITH BUYER ON SIZE AND POSITION OF THE INTERNAL BAFFLES. THE BAFFLES SHALL BE 7.5" WIDE, 5/8" THICK AND SHALL EXTEND FROM THE BOTTOM HEAD TANGENT LINE UP TO TOP HEAD TANGENT LINE. BAFFLES SHALL BE INSTALLED WITH 1" CLEARANCE FROM VESSEL WALL.
26. POSITIVE MATERIAL IDENTIFICATION PER SPECIFICATION 24915-000-3PS-MMTO-00001, IS REQUIRED.

SEISMIC STRESSES IN ANS VESSELS SUPPORTED ON/FROM PLATFORMS

TABLE 1 SHOWS THE SEISMIC STRESSES (S11 AND S22) IN THE TWO ORTHOGONAL DIRECTIONS AT THE LOCATIONS SHOWN IN FIGURE 1 BASED OFF ORIGINAL VESSEL INFORMATION PROVIDED BY THE VENDOR. THESE STRESSES ACT IN BOTH TENSION AND COMPRESSION. THE SEISMIC STRESSES SHOWN IN TABLE 1 WERE COMBINED WITH THE ASME OPERATIONAL STRESSES BY THE VENDOR AND TABLE 3 SHOWS THE NECESSARY DESIGN CHANGE TO THE VESSELS FROM THE VENDOR TO ACCOUNT FOR THE SEISMIC STRESSES. THE BUYER HAS PERFORMED SEISMIC ANALYSIS ON THE UPDATED VESSEL INFORMATION (TABLE 3), AND DETERMINED THERE ARE NO INCREASES TO THE ACCELERATION OF THE CENTER OF GRAVITY OF THE VESSELS. THEREFORE, THE SEISMIC STRESSES IN TABLE 1 ARE A BOUNDING CONDITION PROVIDED THE VESSELS ARE FABRICATED AS DESCRIBED IN TABLE 3.

TABLE 1: S11 AND S22 SEISMIC STRESSES FOR MT–ANS–0103/0203/0303

LOCATION	S11 (KSI)	S22 (KSI)
TOP TANGENT LINE	0.5	0.5
BOTTOM TANGENT LINE	4.5	4.5
SKIRT LINE	13.5	24.5

Table 2: ACCELERATION OF COG FOR MT–ANS–0103/0203/0303

LOCATION	ACCELERATION at COG (%g)		
	X	Y	Z
MT–ANS–0103	0.203	0.165	0.253
MT–ANS–0203	0.203	0.165	0.253
MT–ANS–0303	0.203	0.165	0.253

GENERAL NOTE:
The 'X' direction is East–West
The 'Y' direction is North–South
The 'Z' direction is vertical

FIGURE 1: LOCATION & ORIENTATION OF STRESSES

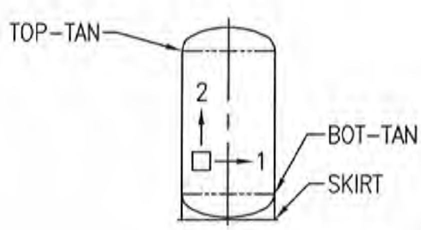
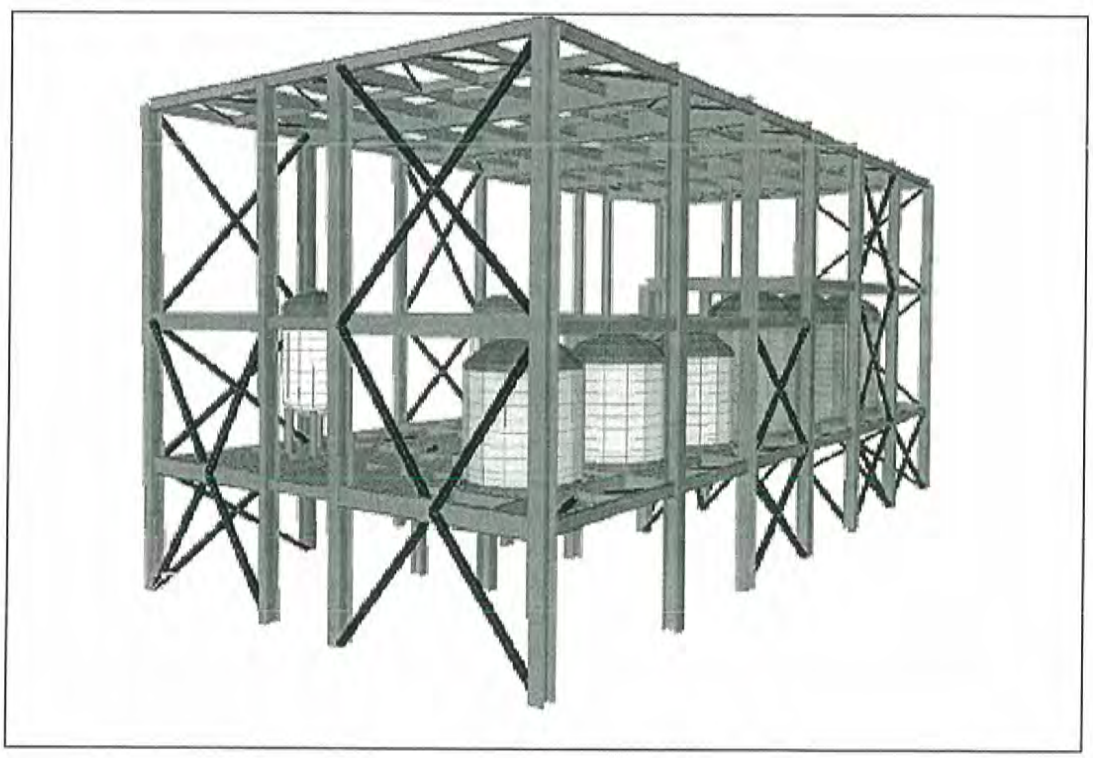


TABLE 3: UPDATED VESSEL INFORMATION FROM VENDOR

VESSEL TAG NO.	CENTER OF GRAVITY (IN) *			OPERATING WEIGHT (LBS)	SHELL THICKNESS (IN)	HEAD THICKNESS (IN)	SKIRT THICKNESS (IN)
	X	Y	Z				
MT-ANS-0103	-1.97	0.02	44.88	56,100	.375	.4375	.75
MT-ANS-0203	-1.97	0.02	44.88	56,100	.375	.4375	.75
MT-ANS-0303	-1.97	0.02	44.88	56,100	.375	.4375	.75

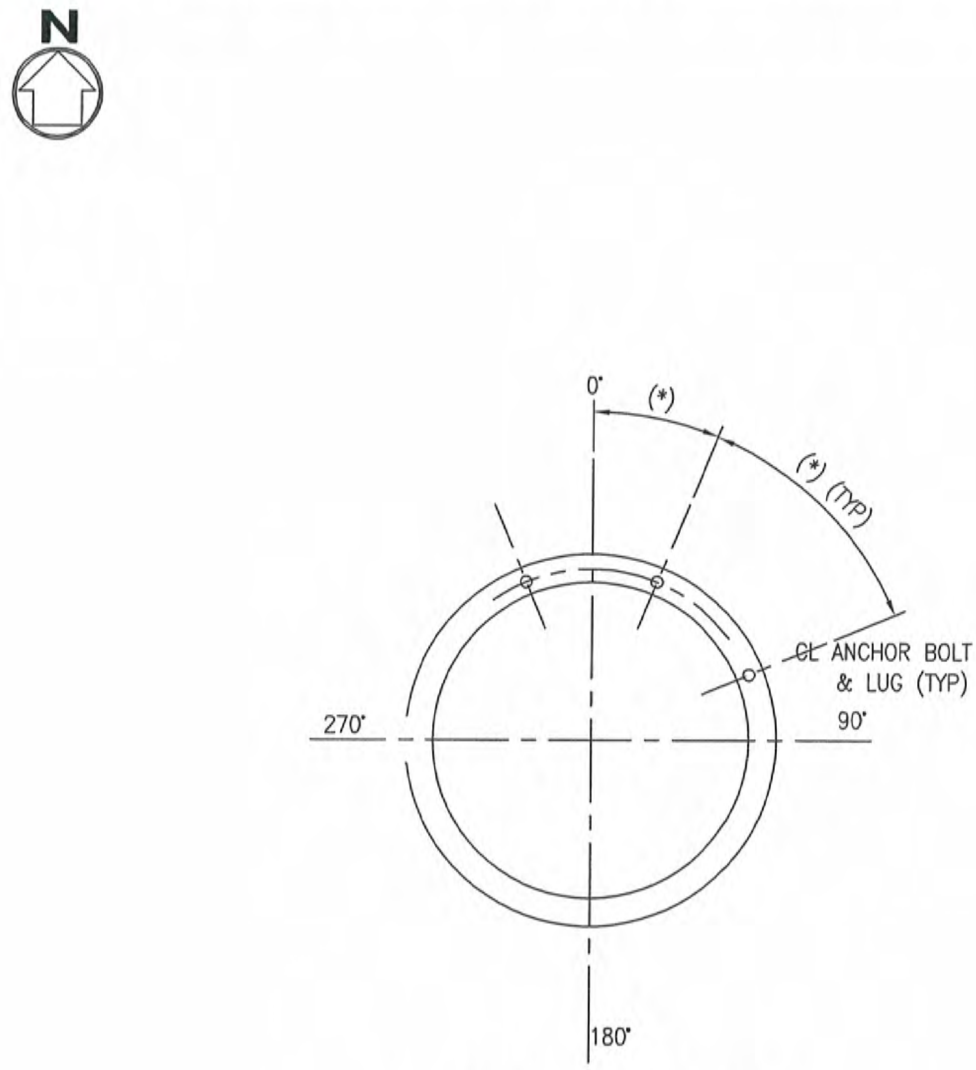
* THE CENTER OF GRAVITY IS BASED ON A STANDARD COORDINATE SYSTEM WITH REFERENCE TO PAGE 7.
THE POSITIVE X,Y,Z DIRECTIONS ARE EAST, NORTH, AND UP THE VESSEL (OUT OF THE PAGE), RESPECTIVELY.
THE ORIGIN IS AT THE INTERSECTION OF THE VESSEL CENTERLINE AND REFERENCE PLANE (LOWER TANGENT LINE).

FIGURE 2: MODEL SHOWING THE ANS PLATFORM



FILE NAME: MTANS0103F

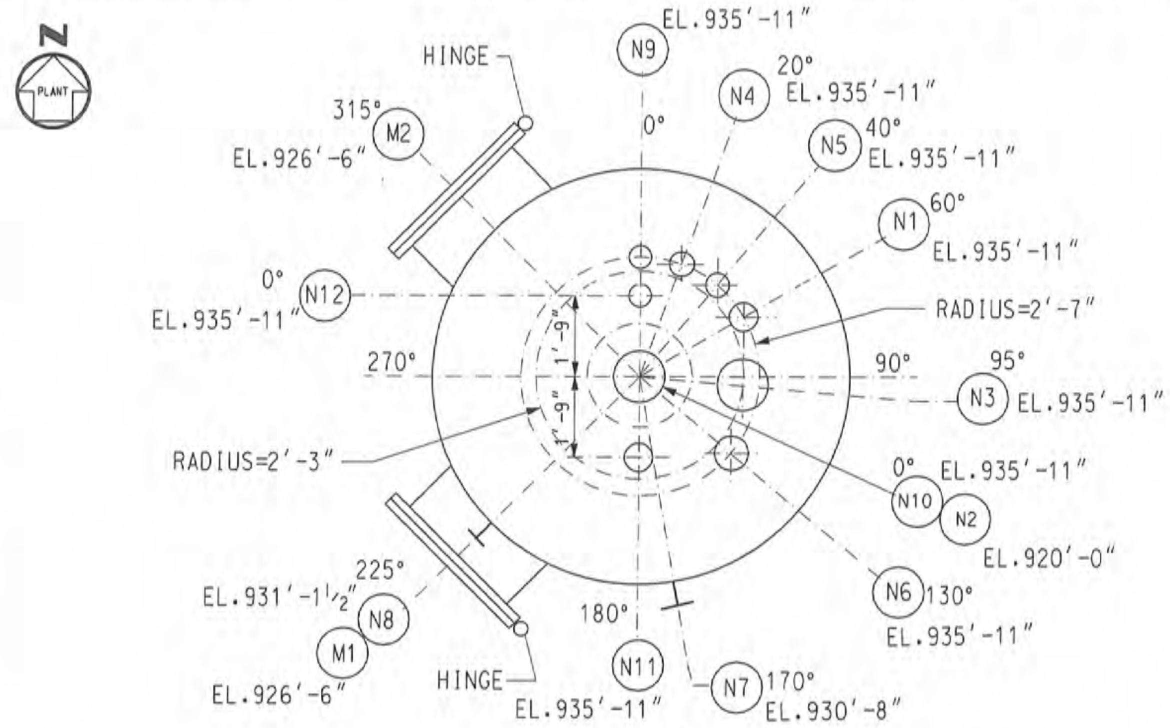
BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP AGENT HYDROLYSATE SAMPLING TANKS MT-ANS-0103/0203/0303	SHEET 7 OF 10	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-07-MTD-ANS-00001	REV 2



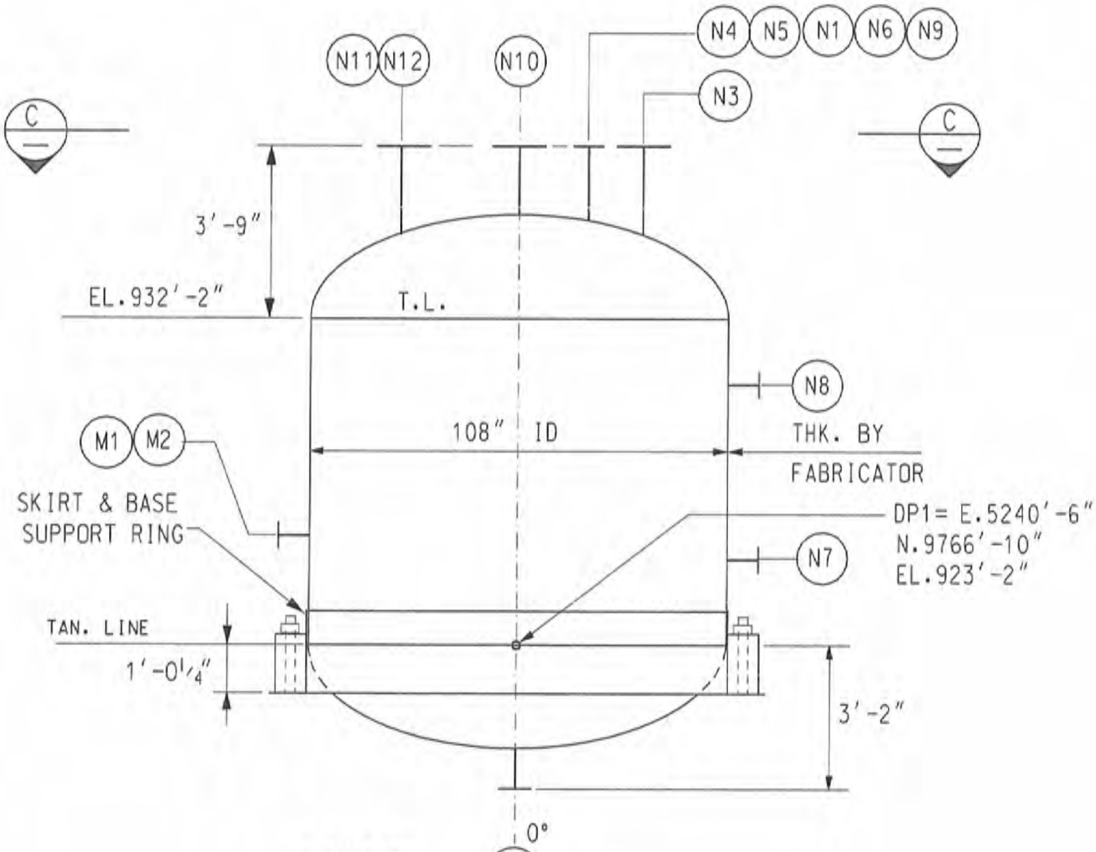
PLAN (B/7) REF SHT 2
ANCHOR BOLT DETAIL

FILE NAME: 07-MT-ANS-0103-s8 r2.dgn

DATA SHEET	TITLE BGCAPP AGENT HYDROLYSATE SAMPLING TANKS 07-MT-ANS-0103	SHEET 8 OF 10	PROJECT NUMBER 24915	DOCUMENT NUMBER 24915-07-MTD-ANS-00001	REV 2

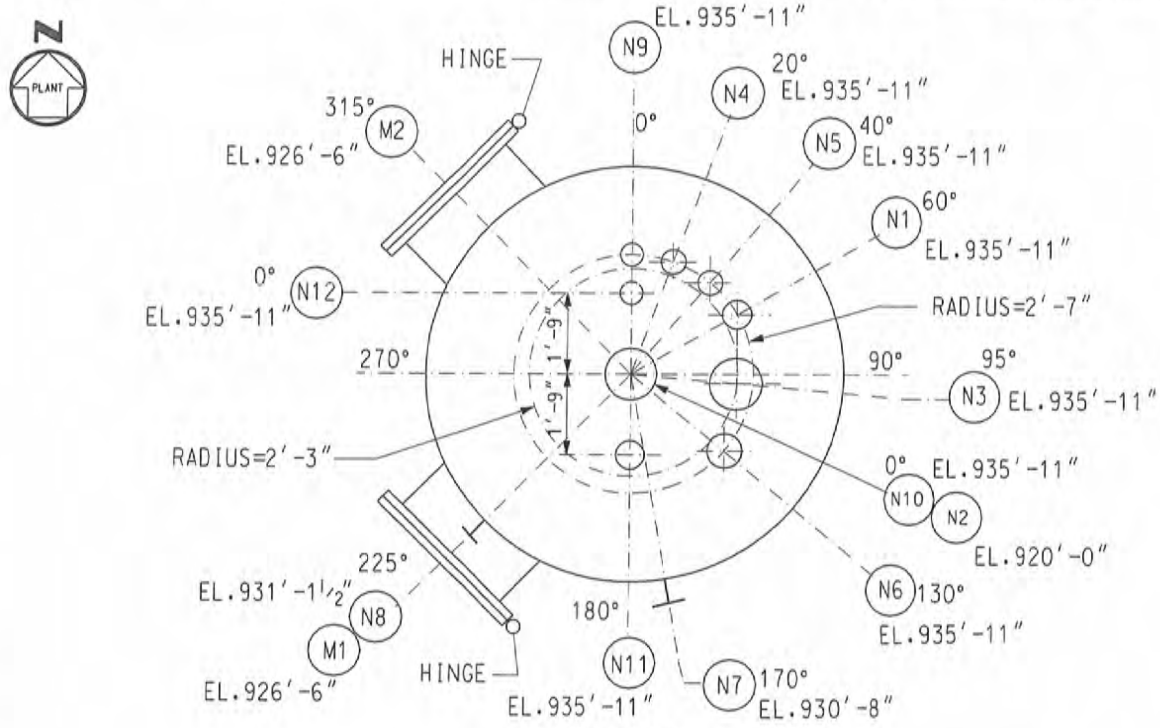


PLAN C-C

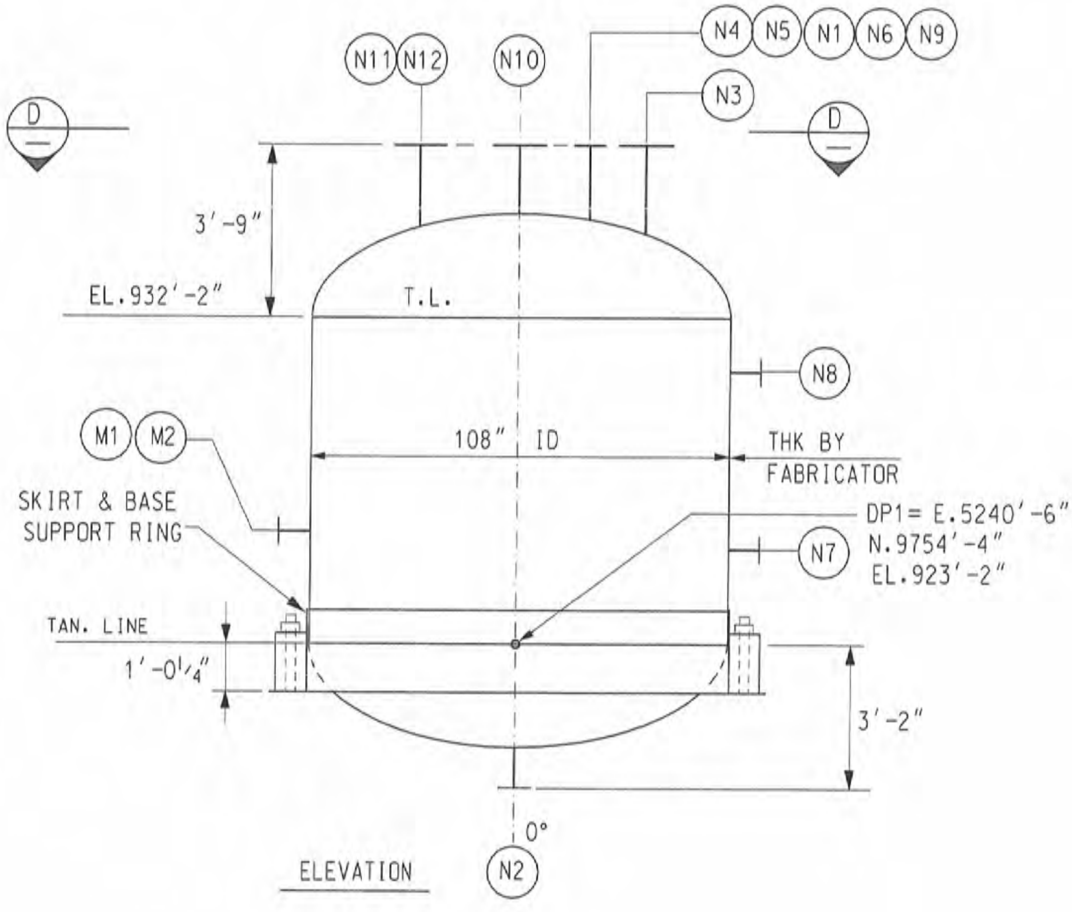


ELEVATION

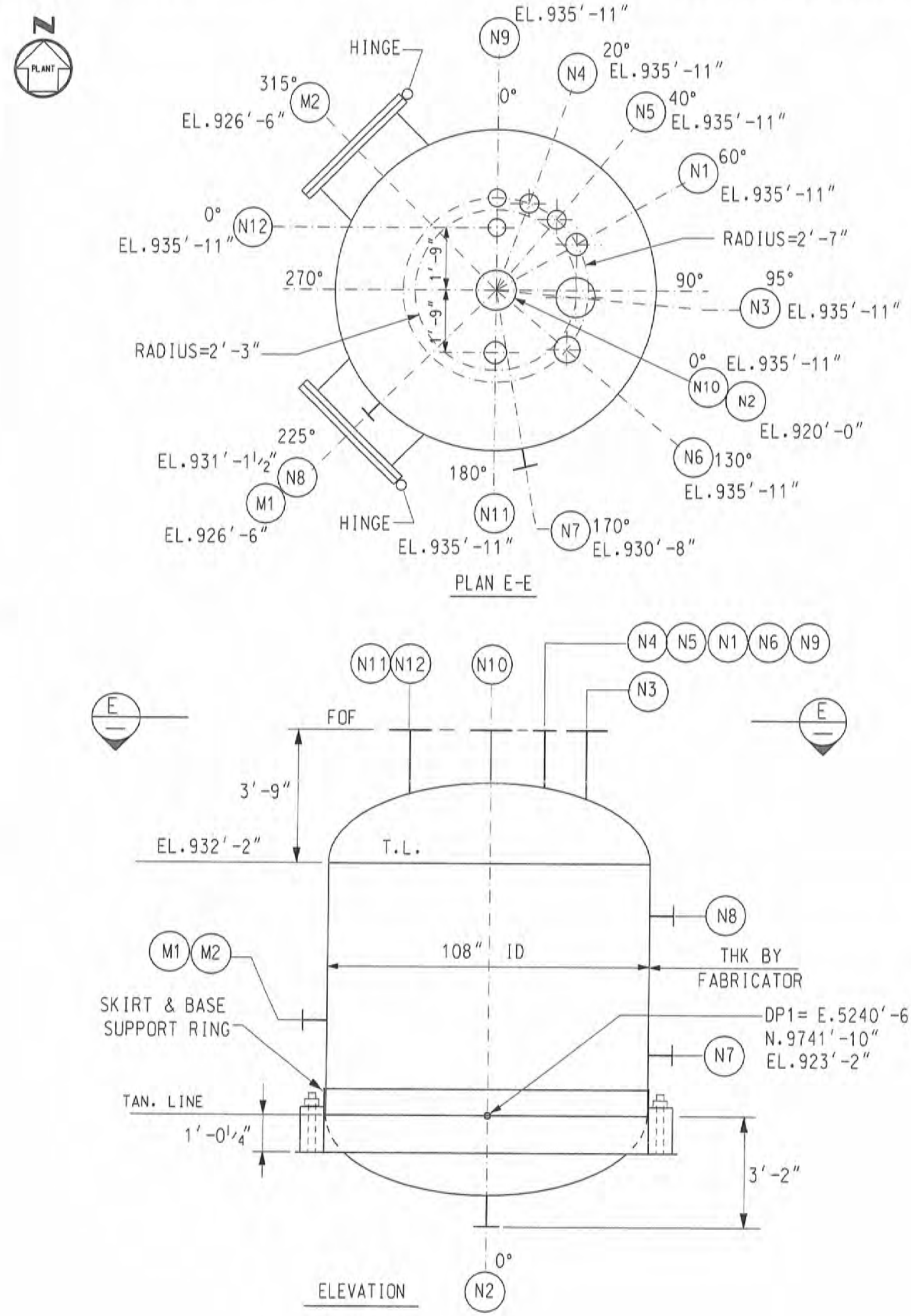
TITLE		
DATA SHEET	BGCAPP AGENT HYDROLYSATE SAMPLING TANKS 07-MT-ANS-0203	DOCUMENT NUMBER 24915-07-MTD-ANS-00001 REV 2



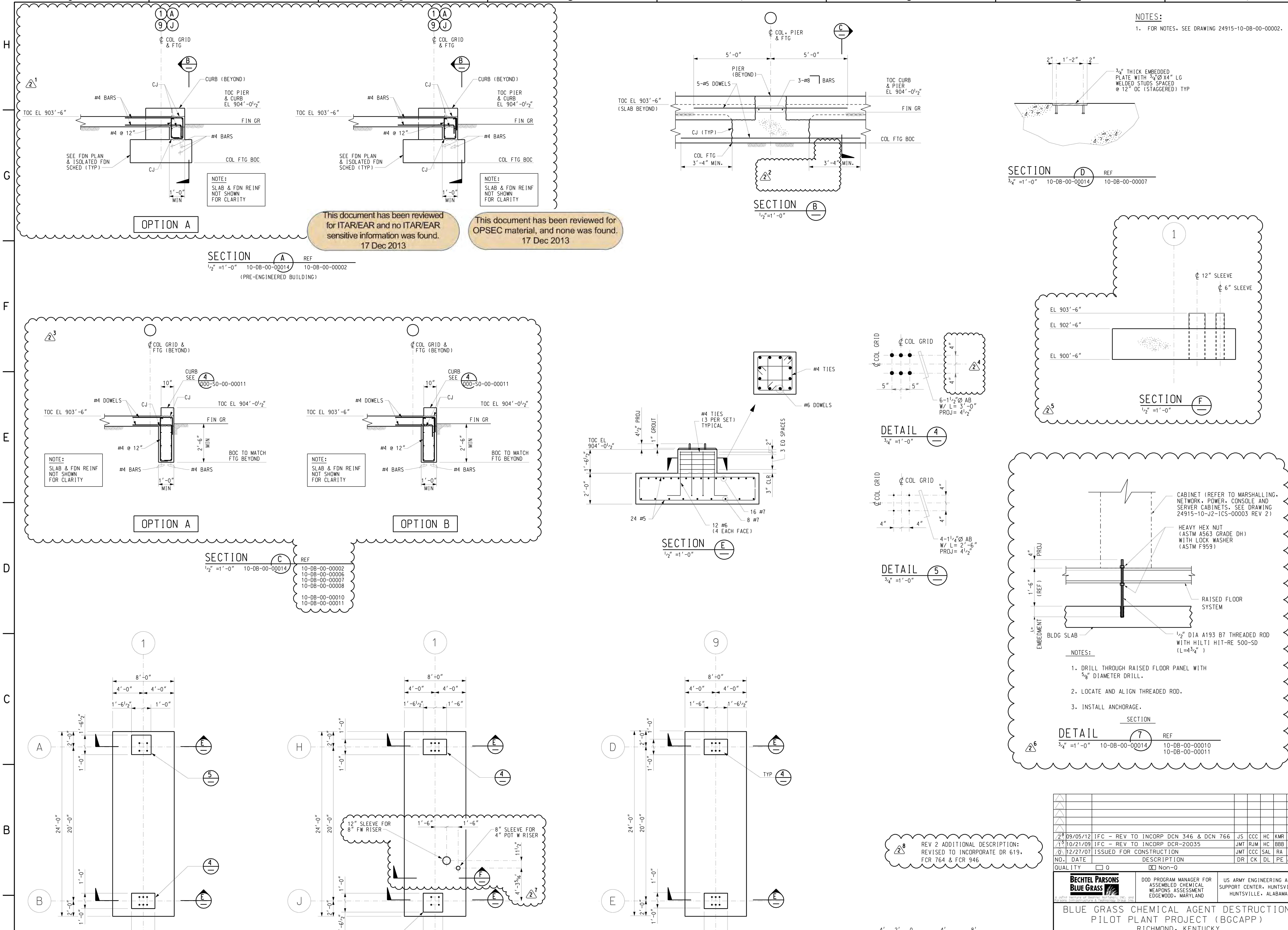
PLAN D-D



ELEVATION



PLANT
N9
EL.935'-11"
HINGE
N4
20°
EL.935'-11"
315°
M2
EL.926'-6"
0°
N5
40°
EL.935'-11"
N1
60°
EL.935'-11"
0°
N12
EL.935'-11"
RADIUS=2'-7"
1'-9"
270°
90°
95°
N3
EL.935'-11"
RADIUS=2'-3"
0°
EL.935'-11"
N10
N2
EL.920'-0"
225°
EL.931'-1½"
N8
M1
EL.926'-6"
180°
N6
130°
EL.935'-11"
HINGE
N11
EL.935'-11"
N7
170°
EL.930'-8"
PLAN E-E
N4 N5 N1 N6 N9
N11 N12
N10
N3
E
FOF
3'-9"
EL.932'-2"
T.L.
N8
M1 M2
108" ID
THK BY FABRICATOR
SKIRT & BASE SUPPORT RING
DP1= E.5240'-6"
N.9741'-10"
EL.923'-2"
N7
TAN. LINE
1'-0¼"
3'-2"
0°
ELEVATION
N2



This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.
17 Dec 2013

This document has been reviewed for OPSEC material, and none was found.
17 Dec 2013

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	09/05/12	IFC - REV TO INCORP DCN 346 & DCN 766	JS	CCC	HC	KMR	KMR
1	10/21/09	IFC - REV TO INCORP DCR-20035	JMT	RJM	HC	BBB	BBB
0	12/27/07	ISSUED FOR CONSTRUCTION	JMT	CCC	SAL	RA	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESS BUILDING PERIMETER FOOTINGS & SLAB SECTIONS & DETAILS

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-DB-00-00014 | SHEET 1 OF 1 | REV 2

10-DB-00-14.CDZ BGCAPP_E3.BDR

DESIGN FILE: \\kyric04fs01\Bg\3d\se_10\10-db-00-14.cdz
PLOTTED BY: c0064630 ON 9/5/2012 AT 4:54:29 PM

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Cover Sheet

Project	Job No.	Calc No.	Sheet
Blue Grass Chemical Agent Destruction Pilot Plant	743341	24915-10-DBC-00-00004	1 of 9

Subject	Group
Gas Bottle Canopy, Support, Equipment and Miscellaneous Foundation Calculations (SPB)	Structural

Calculation Status Designation	Preliminary	Committed Preliminary	Confirmed	Superseded	Voided
	☐	☒	☐	☐	☐

Computer Program/ Type	SCP	Mainframe	PC	Program No.	Version/Release No.
	☐	☐	☒	MathCAD, Mat 3D, Found. 3D	14.0, 5.1, 5.1

Program Validated: ☒ Yes ☐ No Program validation is available in PPCP/InfoWorks

Notes/comments

A structural analysis and design is carried out for the Gas Bottle Canopy, Supports, Equipment and Miscellaneous Foundations for the SCWO Process Building (SPB) [Ref. 4.14]. The design uses BGCAPP Basis of Design and BGCAPP Design Criteria [Ref. 4.1, 4.2]. The design also uses the geotechnical report [Ref. 4.3] recommendations and is carried out in conformance with the ACI 318 [Ref. 4.5] and ASCE 7-98 [Ref. 4.4] codes. The anchor bolt design for the columns was also performed per the requirements of the ACI 318 [Ref. 4.5] code. The calculations were performed using the GTSTRUDL and MathCAD programs and can be seen in this report.
The following are descriptions of the structures:

- Exterior Cable Tray Support Foundations

A structural analysis and design of isolated footings are carried out for the supports for elevated cable trays located in the eastern wall of the SCWO Process Building (SPB) [Ref. 4.14]. The cable tray support structure spans from Column Line B thru Line J. (Appendix B)

- Exterior HVAC Duct Support Foundations

A structural analysis and design of isolated footings are carried out for HVAC duct supports along the eastern part of the SCWO Process Building (SPB) [Ref. 4.14]. Duct extends out from the face of the structure between column Line H thru Line J toward the east and connects to HVAC units 10-MA-HVAC-AHU 1001 and AHU-1002 (Appendix C).

QUALITY LEVEL: ☐ Q ☒ Non-Q

No.	Reason for Revision	Total No. of Sheets	Last Sheet No.	By	Checked	Approved/ Accepted	Date
				MB	RM	HC	
D	ISSUE FOR APPROVAL(IFA)	398	9	MB	RM	HC	1/27/10
C	ISSUE FOR APPROVAL(IFA)	397	9	MB	RM	HC	11/04/09
B	ISSUE FOR APPROVAL(IFA)	397	9	MB	RM	HC	10/06/09
A	ISSUE FOR APPROVAL(IFA)	436	9	RM	BVR	SAL	02/25/08

RECORD OF REVISIONS

- Gas Bottle Canopy # 1 Foundation

A three dimensional structural analysis and design of the combined footing is carried out for the Gas Bottle Canopy # 1 support structure. It is a steel canopy structure located by the side of the exterior, eastern wall of the SCWO Process Building (SPB) between column Line A and Line D [Ref. 4.14]. (Appendix D1).

- Gas Bottle Canopy # 2 Foundation

A three dimensional structural analysis and design of the combined footing is carried out for the Gas Bottle Canopy # 2 support structure. It is a steel canopy structure located by the side of the exterior, western wall of SCWO Process Building (SPB) between column Line A and Line C [Ref. 4.14]. (Appendix D2).

- Miscellaneous Interior Equipment Foundations

Analysis and design of the foundations for the Effluent Caustic Day Tank, RO Skid, RO Multimedia Filters and Hydrolysate Heater Module are carried out. All equipment is located inside the SCWO Process Building (SPB) [Ref. 4.14] (Appendix E).

- SPB Floor Slab on Grade

Analysis and design is carried out for the floor slab on grade in the SCWO Process Building (SPB) (Appendix F).

- Anchor Bolt Design Calculation

Structural calculation is performed for the design of anchor bolt including it’s adequacy for all the equipment inside and outside SCWO Process Building (SPB) (Appendix G).

- Containment and Retention Calculation

Structural calculation is carried out for containment storage area for the net capacity of the largest tank in the area inside SCWO Process Building (SPB) (Appendix H).

Changes from Rev. C to Rev. D are as follows:

1. Revised Appendix H, Containment and Retention Calculations, per environmental requirements.
2. Redesigned Gas Bottle Canopy #2 foundation due to underground interference with main building foundation.

Table of Contents

1. Objective

The objective of the calculation is to perform structural analysis and design for the gas bottle canopies, support equipment and miscellaneous foundations inside and outside the SCWO Processing Building (SPB) of the BGCAPP project per Dwg. # 24915-10-DB-00-00002 (refer to p. A-1 to A-46 for locations).

2. Inputs

2.1 Foundations

The calculation includes analysis and design of foundations for the following structures in the SCWO Processing Building (SPB).

- Exterior Cable Tray Support Foundations

  A structural analysis and design of isolated footings are carried out for the supports for elevated cable trays located along the eastern wall of the SCWO Process Building (SPB). The cable tray support structure span from Column Line B thru Line J [Ref. 4.14].

  (Ref. Appendix B)

- Exterior HVAC Duct Support Foundations

  A structural analysis and design of isolated footings are carried out for the support for HVAC ducts along the eastern part of the SCWO Process Building (SPB). Ducts extend out from the face of the structure between column Line H thru Line J toward the east and connect to HVAC units 10-MA-HVAC-AHU 1001 and AHU-1002 [Ref. 4.14].

  (Ref. Appendix C)

- Gas Bottle Canopy # 1 Foundation

  A three dimensional structural analysis and design of the combined footing is carried out for the Gas Bottle Canopy # 1 support structure. It is a steel canopy structure located by the side of the exterior, eastern wall of the SCWO Process Building (SPB) between column Line A and Line D [Ref. 4.14]. The steel model in Calculation 24915-10-SSC-00-00006 has been updated to remove the dynamic seismic analysis. However, loads have not increased so the previous design is adequate.

  (Ref. Appendix D1)

- Gas Bottle Canopy # 2 Foundation

  A three dimensional structural analysis and design of the combined footing is carried out for the Gas Bottle Canopy # 2 support structure. It is a steel canopy structure located by the side of the exterior, western wall of the SCWO Process Building (SPB) between column Line A and Line C [Ref. 4.14]. The steel model in Calculation 24915-10-SSC-00-00006 has been updated to remove the dynamic seismic analysis. However, loads have not increased so the previous design is adequate.

  (Ref. Appendix D2)

- Miscellaneous Interior Equipment Foundations

  Analysis and design of the foundations are carried out for the Effluent Caustic Day Tank (MV-RO-0101), RO Skid (MK-RO-0101), RO Multi-Media Filters (MK-RO-0101A through MK-RO-0101F) and Hydrolysate Heater Module (MK-SCWO-0042). All equipment is located inside the SCWO Process Building (SPB) [Ref. 4.14].

  (Ref. Appendix E).

- SPB Floor Slab on Grade

  Analysis and design is carried out for the floor slab on grade in the SCWO Process Building (SPB).

  (Ref. Appendix F)

- Anchor Bolt Design Calculation

  Structural calculation is performed for the design of anchor bolts including their adequacy for all the equipment inside and outside the SCWO Process Building (SPB).

  (Ref. Appendix G)

- Containment and Retention Calculation

  Calculations are carried for containment storage areas to confine the net capacity of the largest tank in the area inside the SCWO Process Building (SPB).

  (Ref. Appendix H)

2.2 Construction Materials

- Normal weight concrete with its 28-day concrete strength of at least $f_c' = 4{,}000$ psi and an elastic modulus $E_c = 3{,}600$ ksi [Ref. 4.5, 4.15].

The reinforcing steel is ASTM A706, Grade 60, $f_y = 60$ ksi [Ref. 4.5, 4.15].

2.3 Soil Properties

The soil properties for the project are listed below:

- Soil density is = 125 pcf [Ref. 4.3].
- Coefficient of vertical subgrade reaction of the soil is $k_s = 150$ pci [Ref. 4.1, 4.3].
- Maximum allowable net bearing pressure is 3,000 psf [Ref. 4.1, 4.3].
- Exterior footing should be founded at least 30 inch below final exterior grade for unheated structures, and 24 inch for heated structures [Ref. 4.2].

2.4 Seismic Analysis Data [Ref.4.6]

- The following data is based on Table 12-2 of the design criteria [Ref. 4.2], except as noted.
- Seismic use group: I

- Site classification: D
- Occupancy Importance Factor [Ref. 4.12]: I = 1.5 for Q equipment, 1.0 for non-Q
- Ground Motion A [Ref. 4.6]

  S_{DS} = 2/3 S_{ms} = 0.273 g

  S_{D1} = 2/3 S_{m1} = 0.167 g

2.5 Live Load

Roof live load is 20 psf [Ref. 4.2].

Platform and work area is 100 psf and 2000 lbs concentrated load [Ref. 4.2].

2.6 Wind Load

Per the basis of design [Ref. 4.12], the basic wind speed is 90 mph based on 3-second gust, the importance factor for wind is 1.15, and the site exposure classification is C [Ref. 4.4].

2.7 Snow Load

Per the basis of design (Ref. 4.12), the ground snow load is 15 psf, the importance factor for snow is 1.2, and roof snow load are calculated per ASCE 7-98 code (Ref. 4.4).

2.8 Tank Information

The available tank information is included in Appendix A that is used in the tank foundation analysis and design. Assumptions are made to those tank data not available at the time of design (see Sec. 3 for additional discussion).

3. Assumptions

Equipment information catalog cuts are obtained from the project directory (I:\Blue Grass). They are based on the best knowledge available at the time of the calculations. Final vendor information for equipment loads was not available during the preparation of these calculations. It will be included in the final design and confirmed calculations.

4. References

[4.1] BGCAPP BOD Rev 3, Section 3.3.2.2.3

[4.2] BGCAPP Design Criteria (24915-000-3DR-G01-00001) Rev. 11 Structural, April 2009

[4.3] Geotechnical Report (24915-00-30R-G01-00037 Rev 1)

[4.4] ASCE 7-98: Minimum Design Loads for Buildings and Other Structures, ASCE, 2000

[4.5] ACI 318-02: Building Code Requirements for structural Concrete, ACI, 2002

[4.6] IBC 2000: International Building Code, ICBO, 2000

[4.7] *** Removed from calculation ***

[4.8] *** Removed from calculation ***

[4.9] Munshi, J.A.: Design of Liquid-Containing Concrete Structures for Earthquake Forces, Portland Cement Association, 2002

[4.10] ACI 350.3-01: Seismic Design of Liquid-Containing Concrete Structures, American Concrete Institute, 2001

[4.11] Moss, D.R.: Pressure Vessel Design Manual, Gulf Publishing Company, 1987

[4.12] BGCAPP Engineering Specification for General Project Requirements, Doc. No. 24915-000-3PS-G000-00001 Rev. 6, 11/2/2006

[4.13] AISC Load and Resistance Factor Design 2nd Edition, 1995

[4.14] BGCAPP Drawing No. 24915-10-DB-00-00002, 00005 thru -00011,-00022,-00037,-00038,-00050,-00061 (see p. A1 thru A19)

[4.15] ACI 301 - Specification for Structural Concrete, ACI, 1999

[4.16] Email from Leo Weitzman to Chiman Patel, Sept. 6, 2007

[4.17] Portland Cement Association, “Anchorage to Concrete, Chapter 34”, February,2006

[4.18] BGCAPP Calculation No. 24915-10-SSC-00-00001 thru -00004, 24915-10-DBC-00-00001, 00002, -00004

5. Calculation Body

The foundation design is included in appendices B through H of the calculation. MathCAD worksheets are developed to compute base shears and overturning moments of tanks based on IBC2000 provisions and the related standards and references listed in Sec. 4. Static analysis has been used in this calculation. Foundation3D and Mat3D are used to analyze and design the foundations.

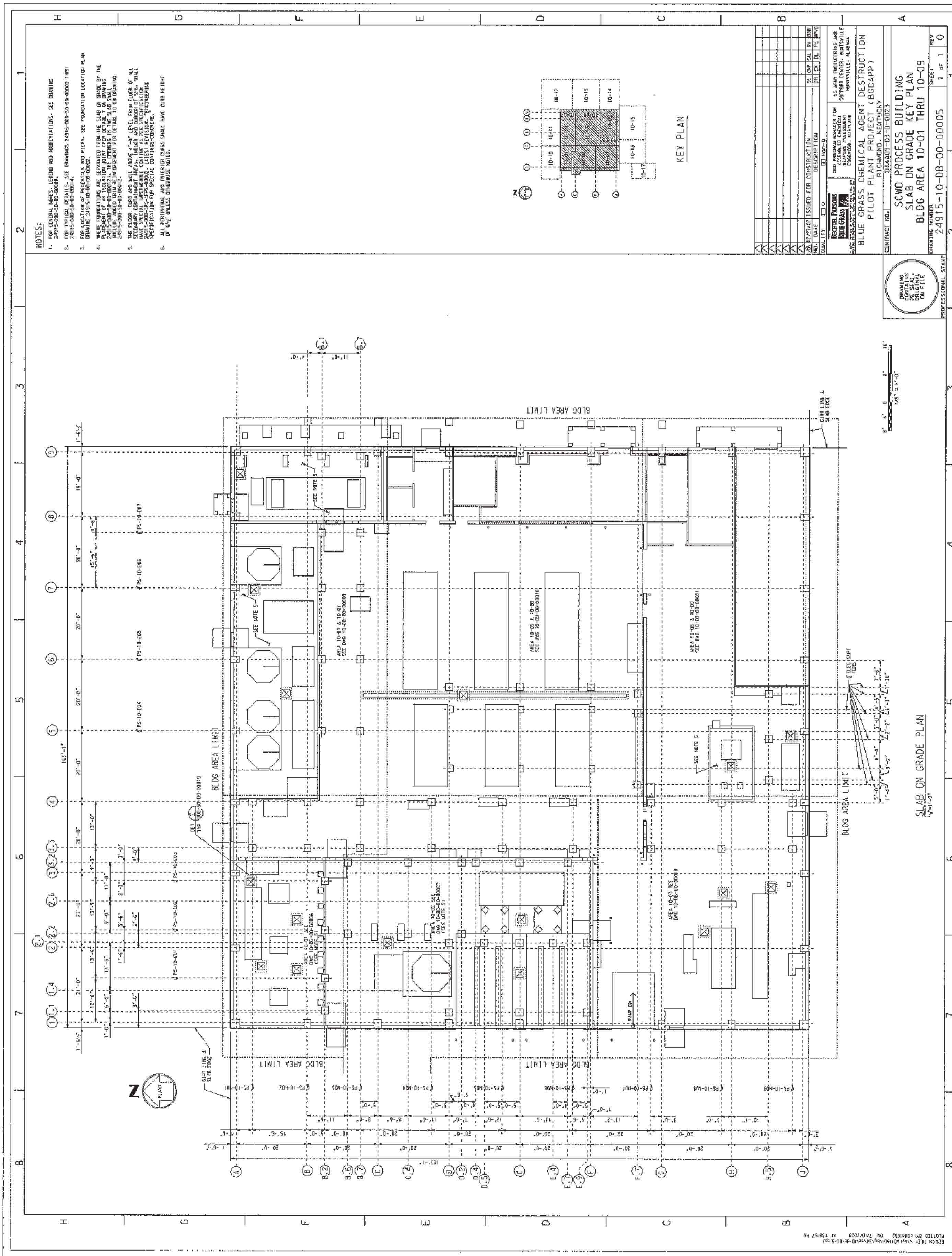
6. Summary

This calculation includes analysis and design of foundations for structures and equipment in and around the SPB. Detailed design can be found in BGCAPP Drawings No. 24915-10-DB-00-00002, 00005 thru -00011, 00022, 00037, 00038, 00050, 00061 showing current revisions of the foundation design details. All loads and bearing pressures are checked according to their design capability to meet AISC/LRFD code requirements [Ref. 4.3, 4.13].

7. Appendices

Appendix A

Design Reference Information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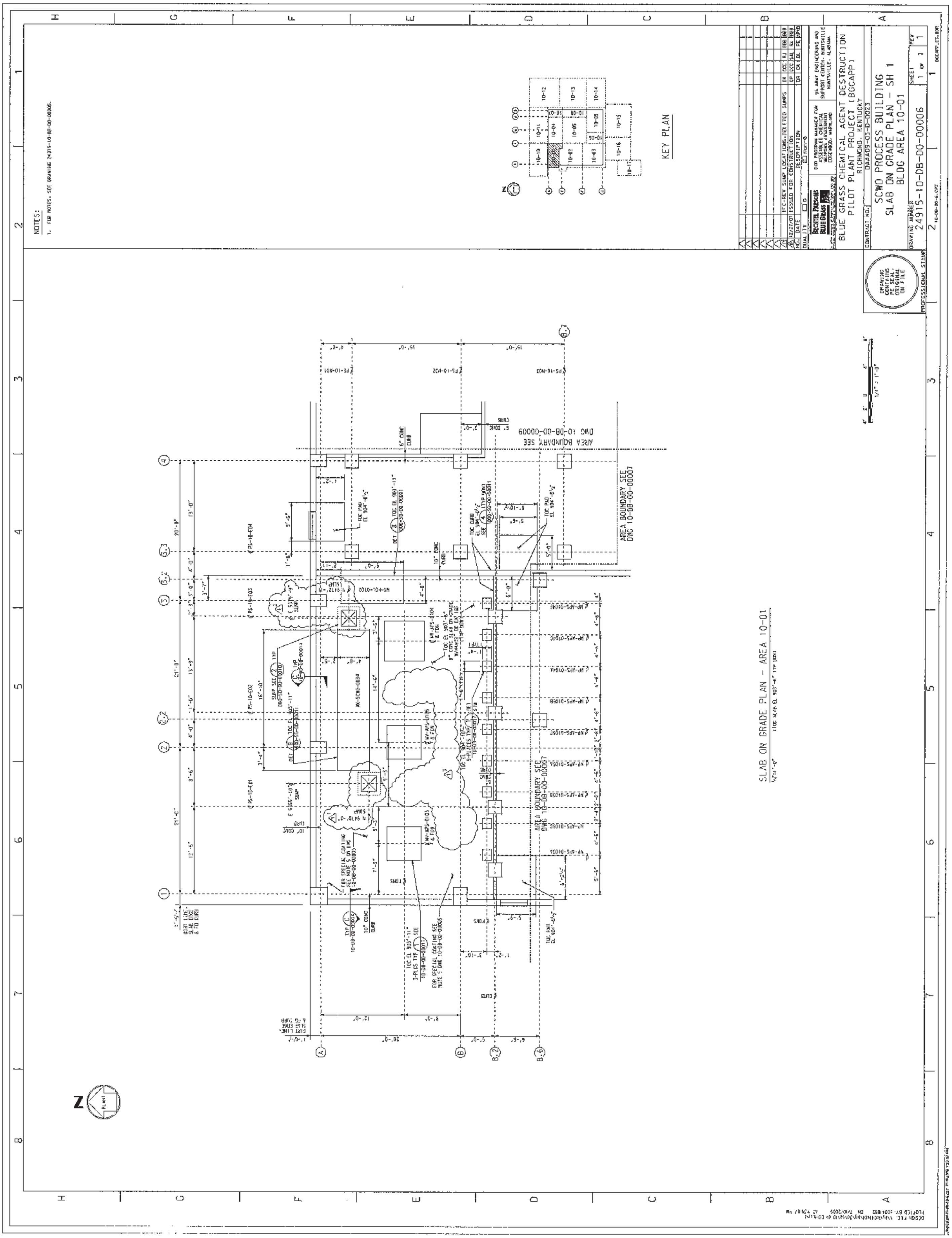
BLDG AREA LIMIT
BLUE GRASS CHEMICAL AGENT DESTRUCTION
PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
CONTRACT NO. DAAA09-03-D-0023
SCWO PROCESS BUILDING
SLAB ON GRADE KEY PLAN
BLDG AREA 10-01 THRU 10-09
DRAWING NUMBER
24915-10-DB-00-00005
SHEET 1 OF 1
REV 0
ISSUED FOR CONSTRUCTION
DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP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RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
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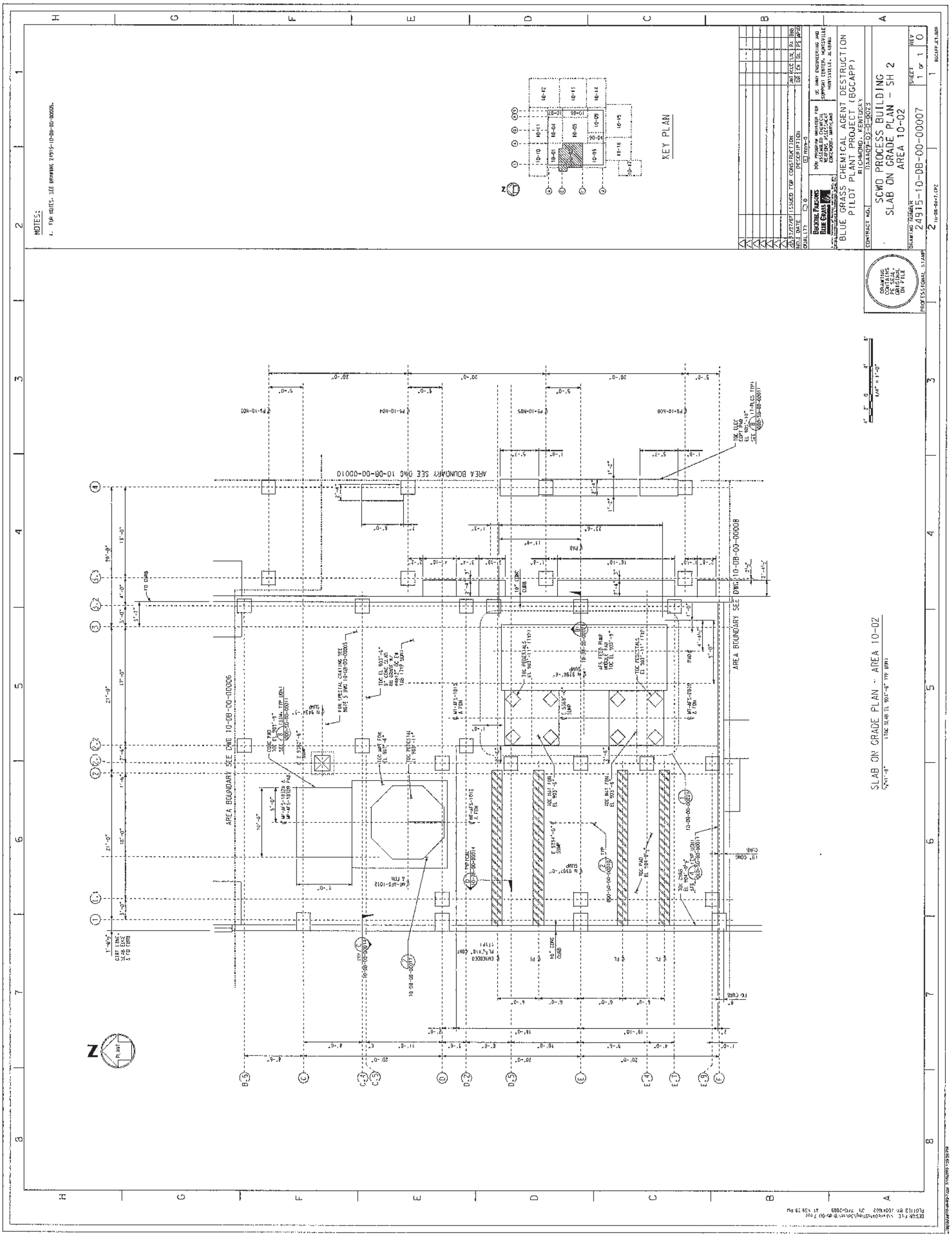
24915-10-DB-00-00006
DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE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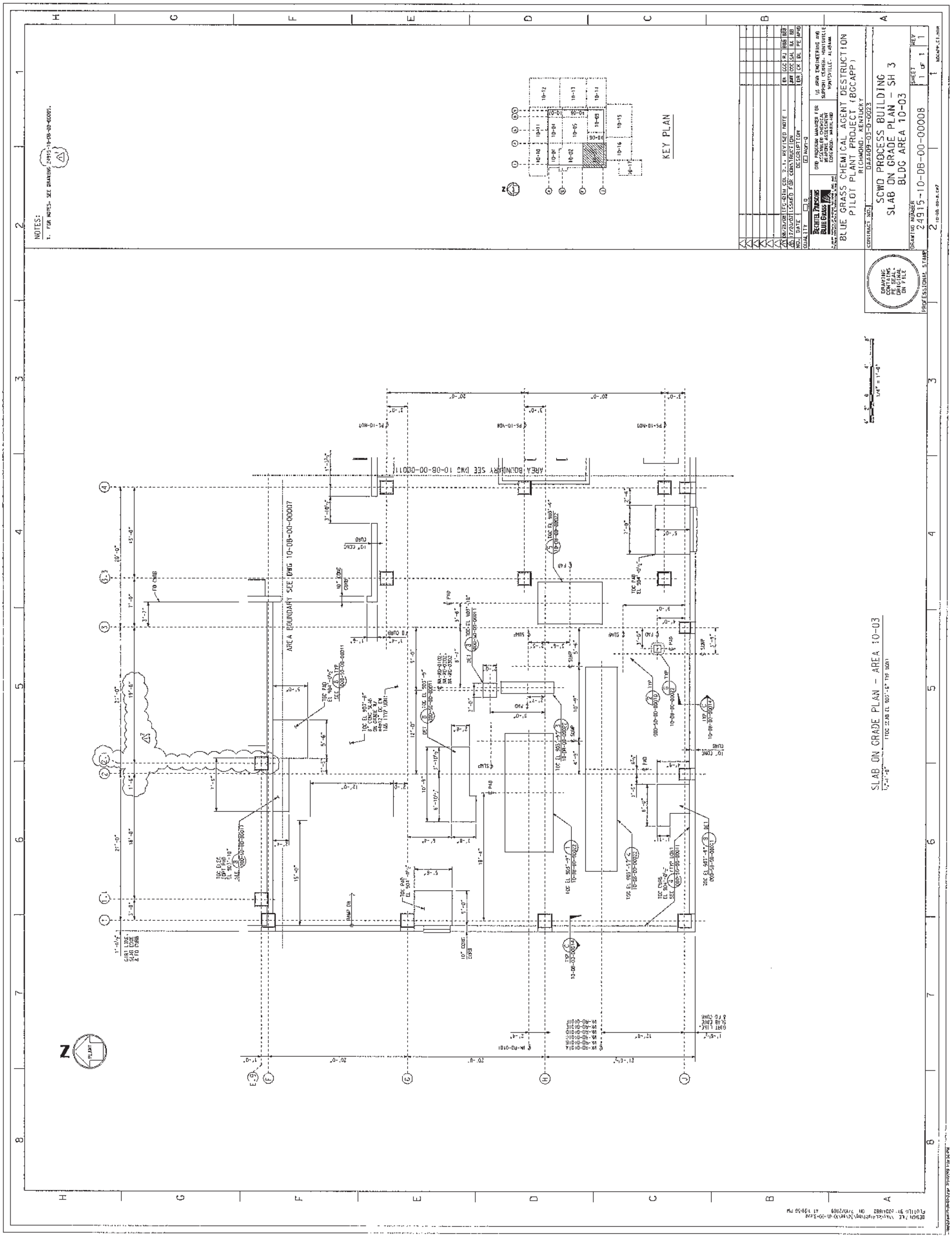
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
SLAB ON GRADE PLAN - SH 2
AREA 10-02
24915-10-DB-00-00007
AREA BOUNDARY SEE DWG 10-DB-00-00010
AREA BOUNDARY SEE DWG 10-DB-00-00006
AREA BOUNDARY SEE DWG 10-DB-00-00008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RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
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24915-10-DB-00-00008
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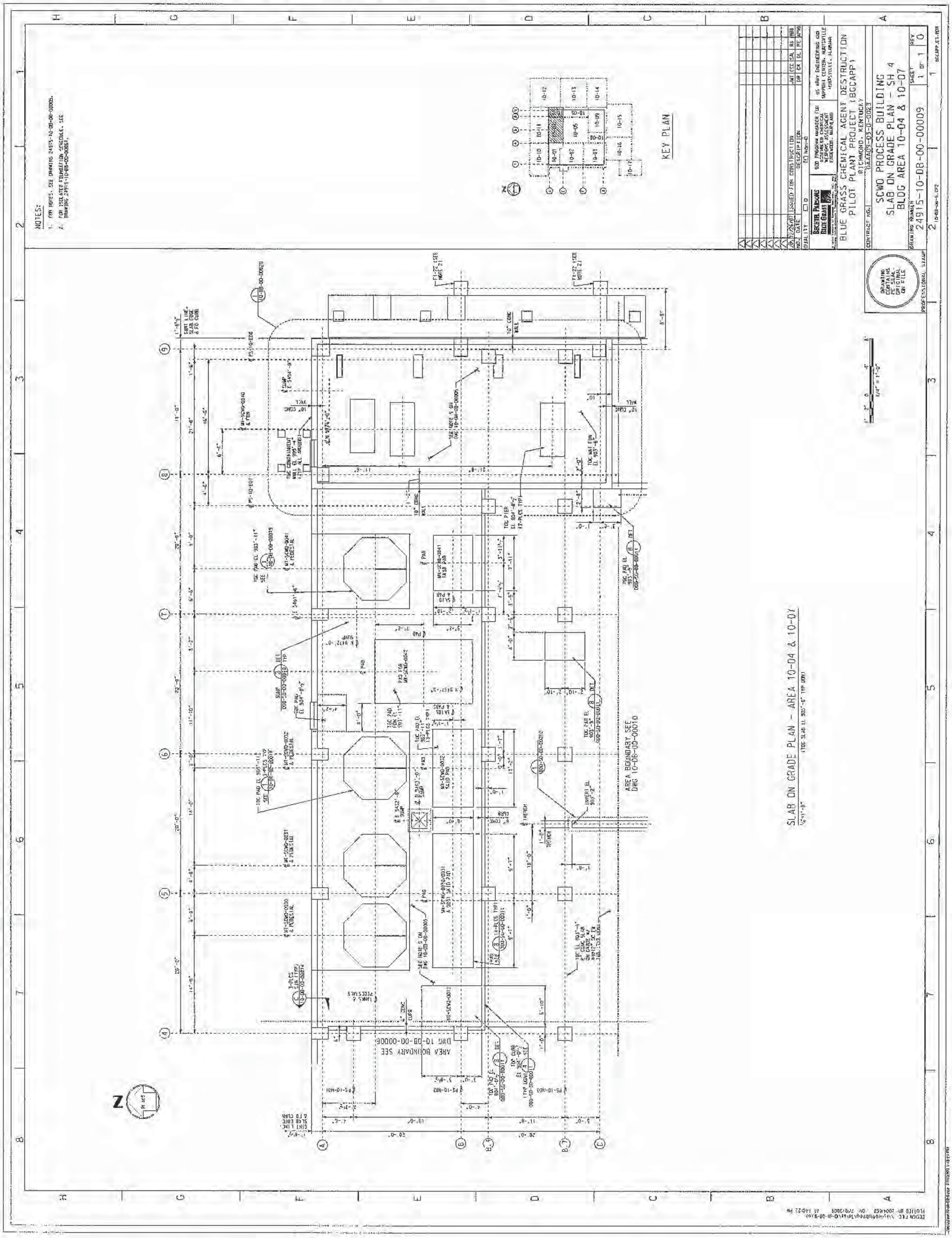
DRAWING CONTAINS PE SEAL. ORIGINAL ON FILE



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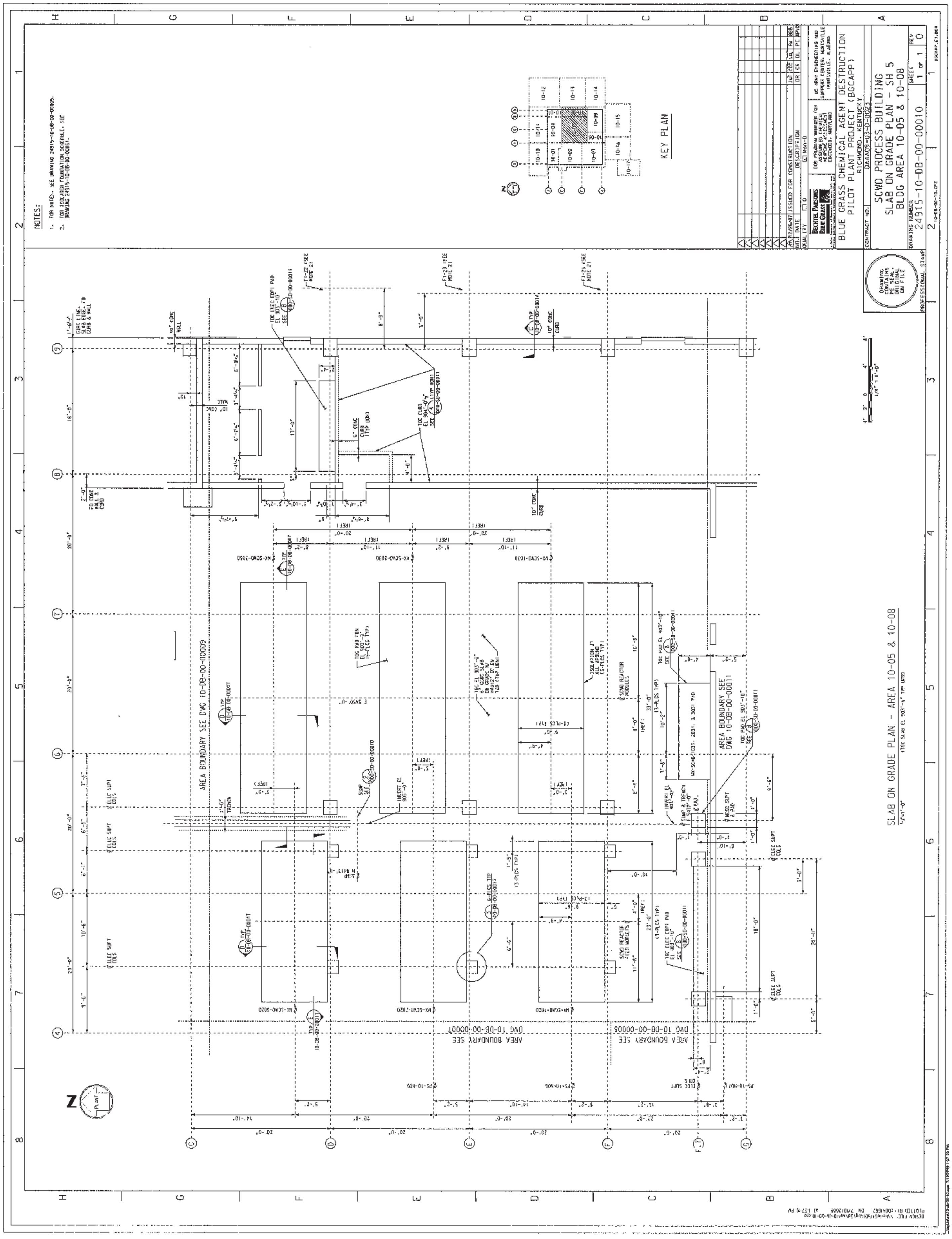
AREA BOUNDARY SEE DWG 10-DB-00-00010
AREA BOUNDARY SEE DWG 10-DB-00-00006
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
SLAB ON GRADE PLAN - SH 4
BLDG AREA 10-04 & 10-07
24915-10-DB-00-00009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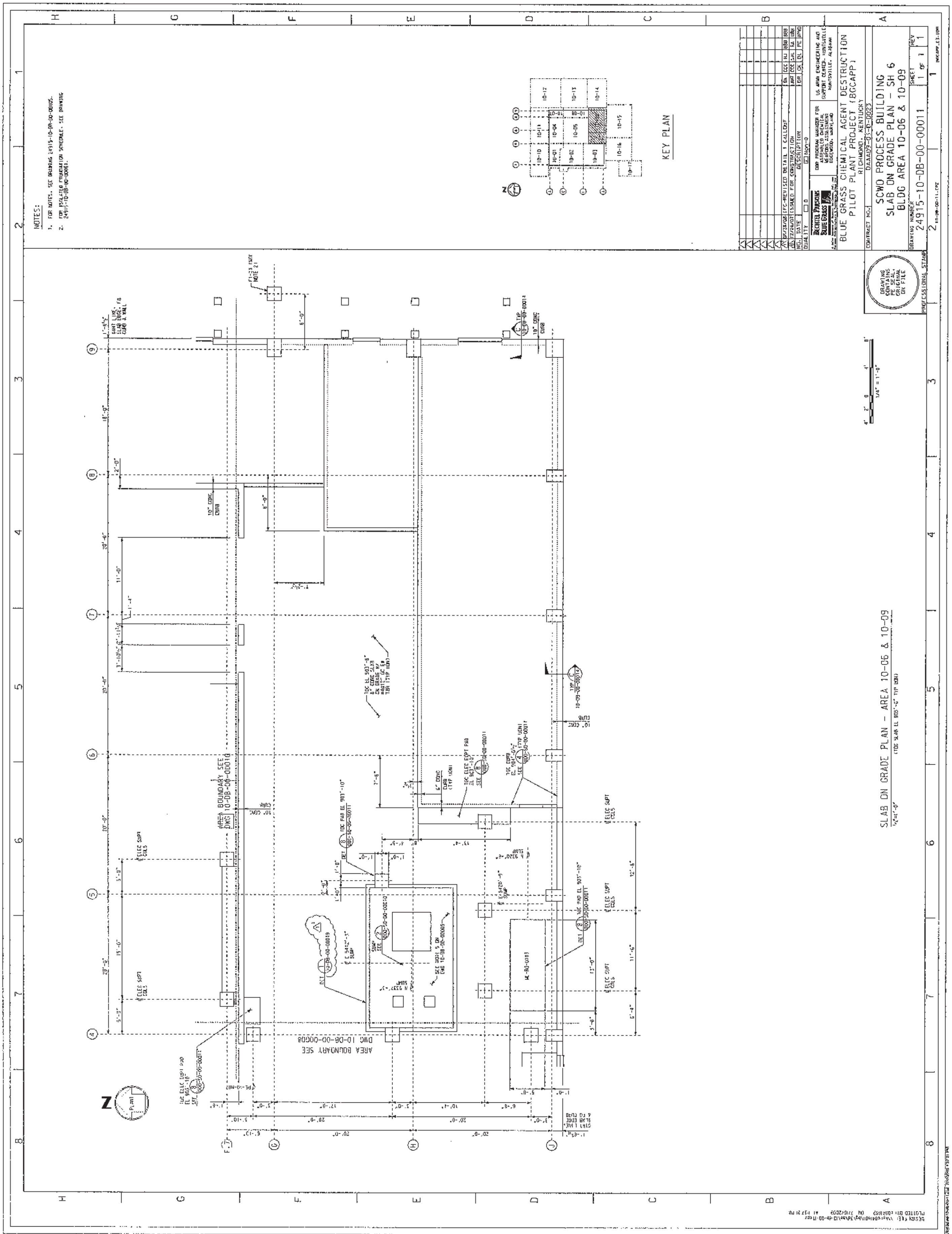
AREA BOUNDARY SEE DWG 10-DB-00-00009
AREA BOUNDARY SEE DWG 10-DB-00-00007
AREA BOUNDARY SEE DWG 10-DB-00-00005
AREA BOUNDARY SEE DWG 10-DB-00-00011
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
SLAB ON GRADE PLAN - SH 5
BLDG AREA 10-05 & 10-08
24915-10-DB-00-00010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RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
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BLDG AREA 10-06 & 10-09
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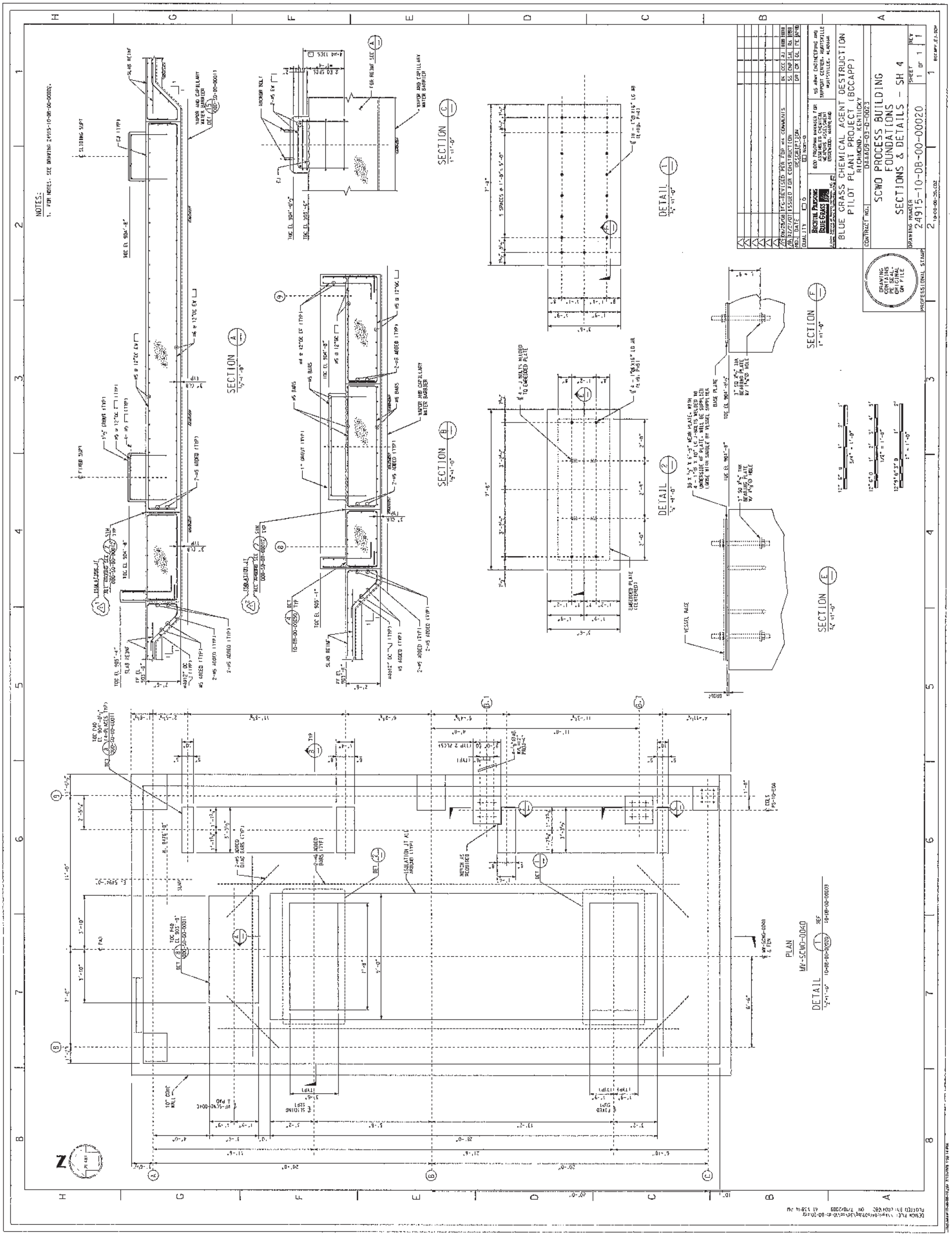
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PILOT PLANT PROJECT (BCCAPP)
RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
FOUNDATIONS
SECTIONS & DETAILS - SH 4
24915-10-DB-00-00020
SECTION A
SECTION B
SECTION C
SECTION E
SECTION F
DETAIL 1
DETAIL 2
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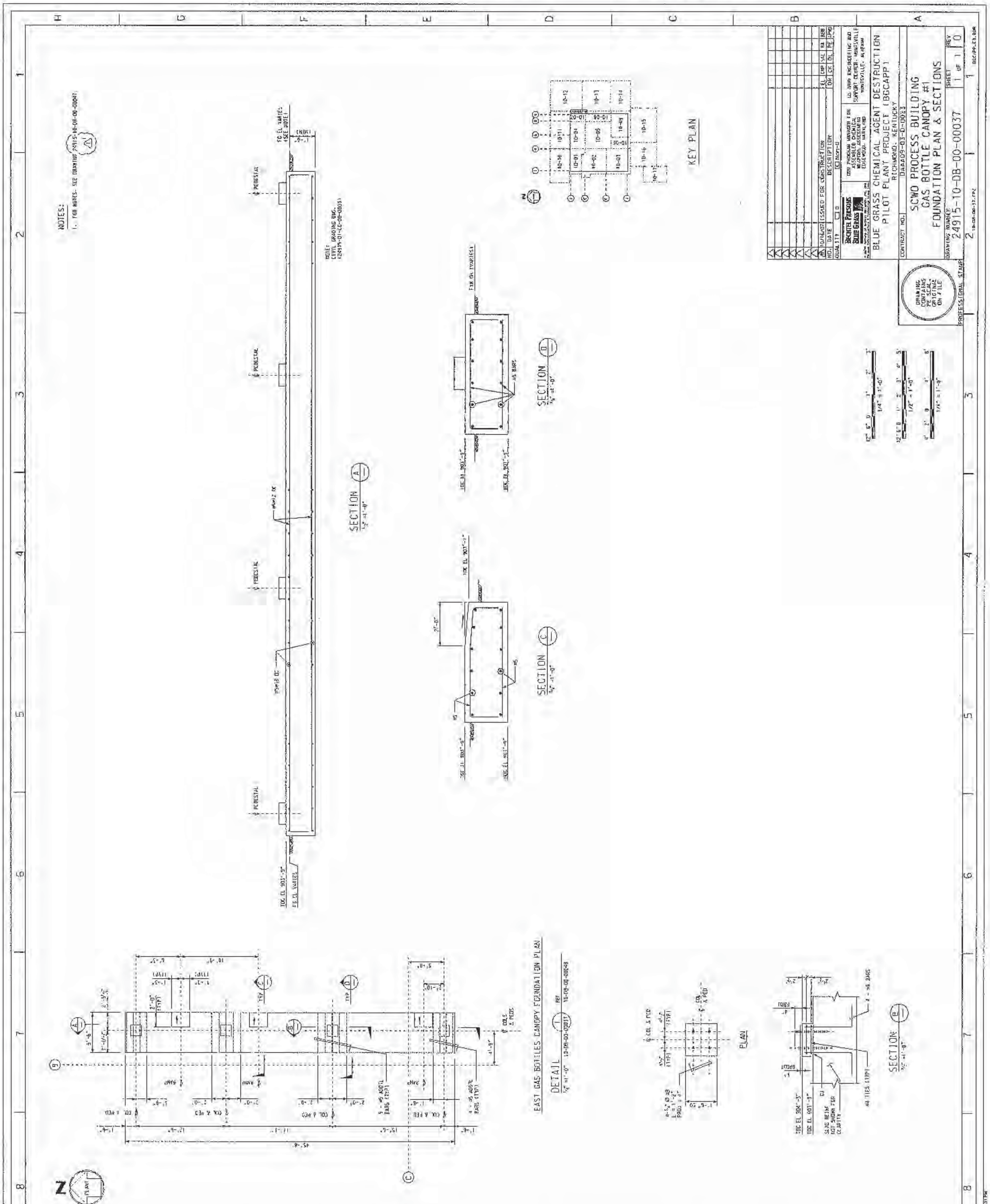
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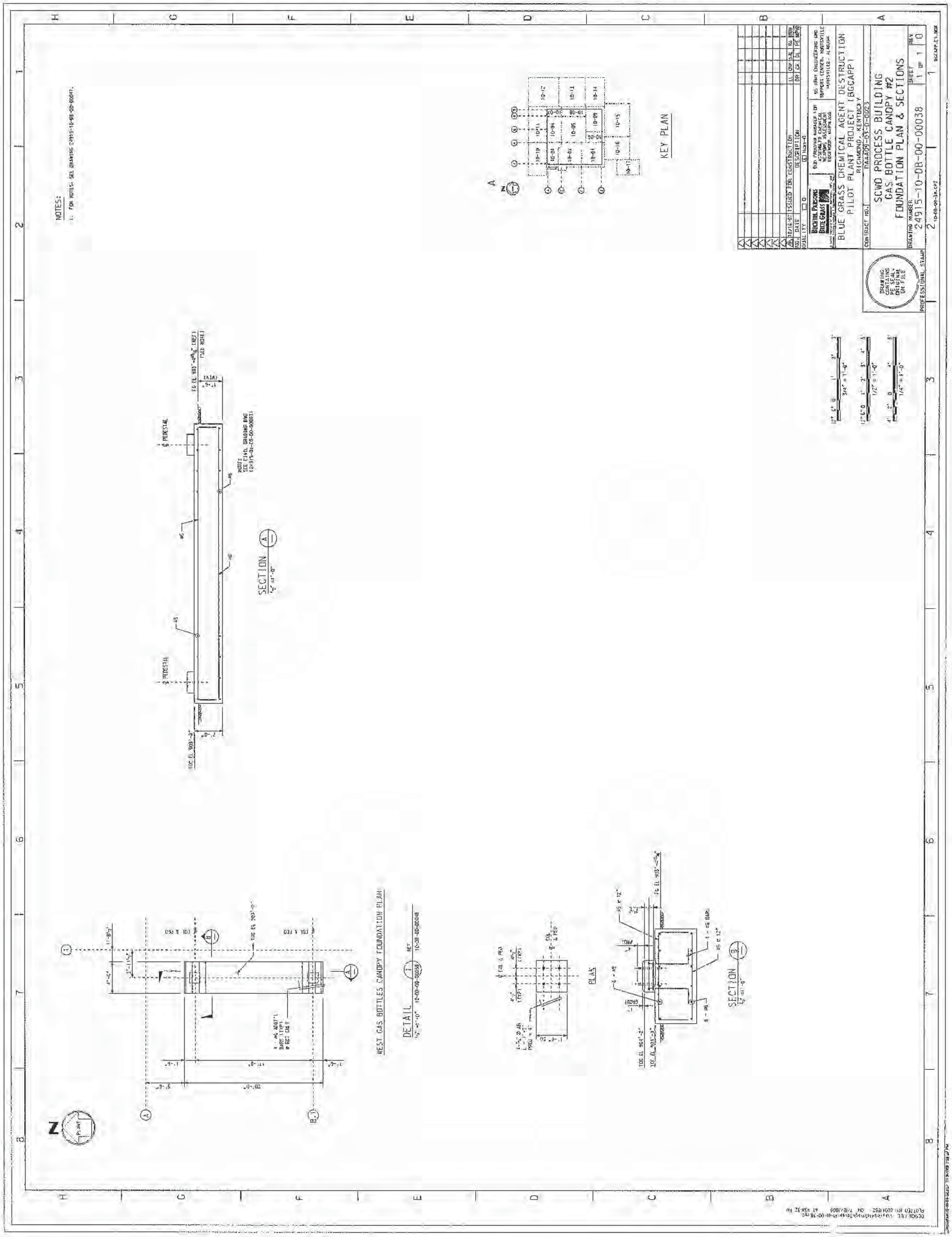
SECTION A
SECTION B
SECTION C
SECTION D
EAST GAS BOTTLES CANOPY FOUNDATION PLAN
DETAIL
PLAN
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
GAS BOTTLE CANOPY #1
FOUNDATION PLAN & SECTIONS
24915-10-DB-00-00037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SECTION B
PLAN
DETAIL 1
WEST GAS BOTTLES CANOPY FOUNDATION PLAN
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
GAS BOTTLE CANOPY #2
FOUNDATION PLAN & SECTIONS
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ISSUED FOR CONSTRUCTION
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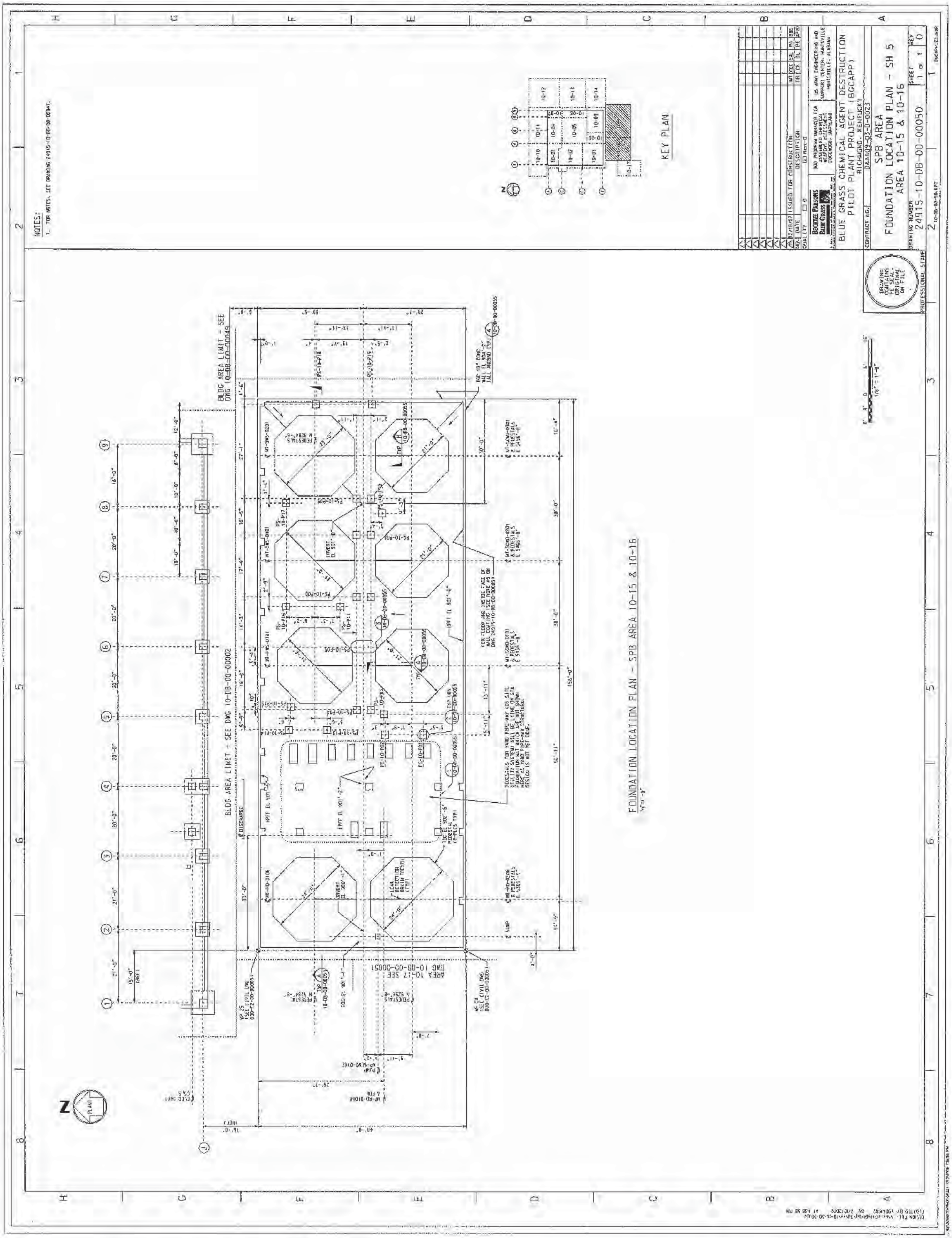
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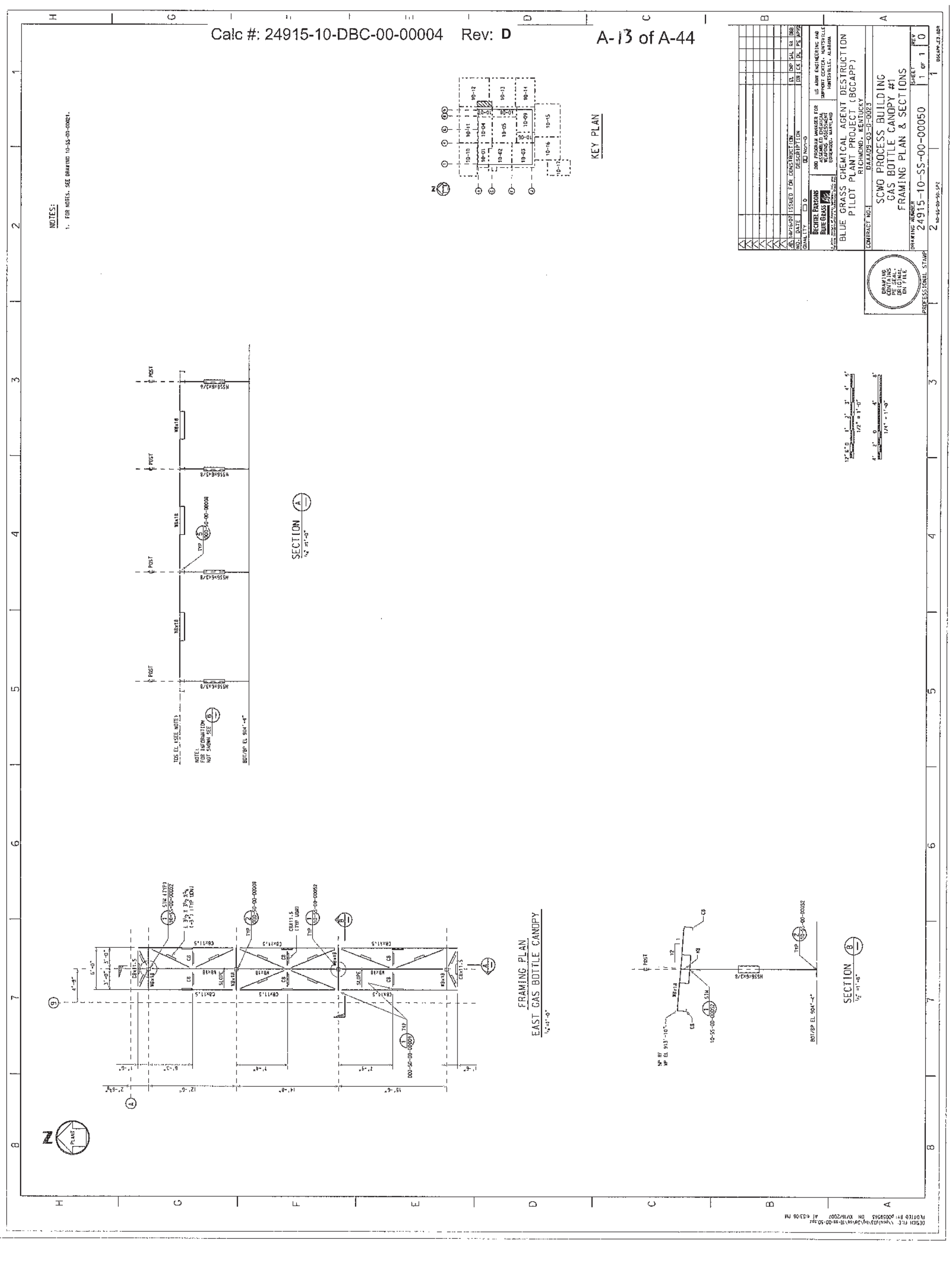
FOUNDATION LOCATION PLAN - SPB AREA 10-15 & 10-16
BLUE GRASS CHEMICAL AGENT DESTRUCTION
PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
SPB AREA
FOUNDATION LOCATION PLAN - SH 5
AREA 10-15 & 10-16
24915-10-DB-00-00050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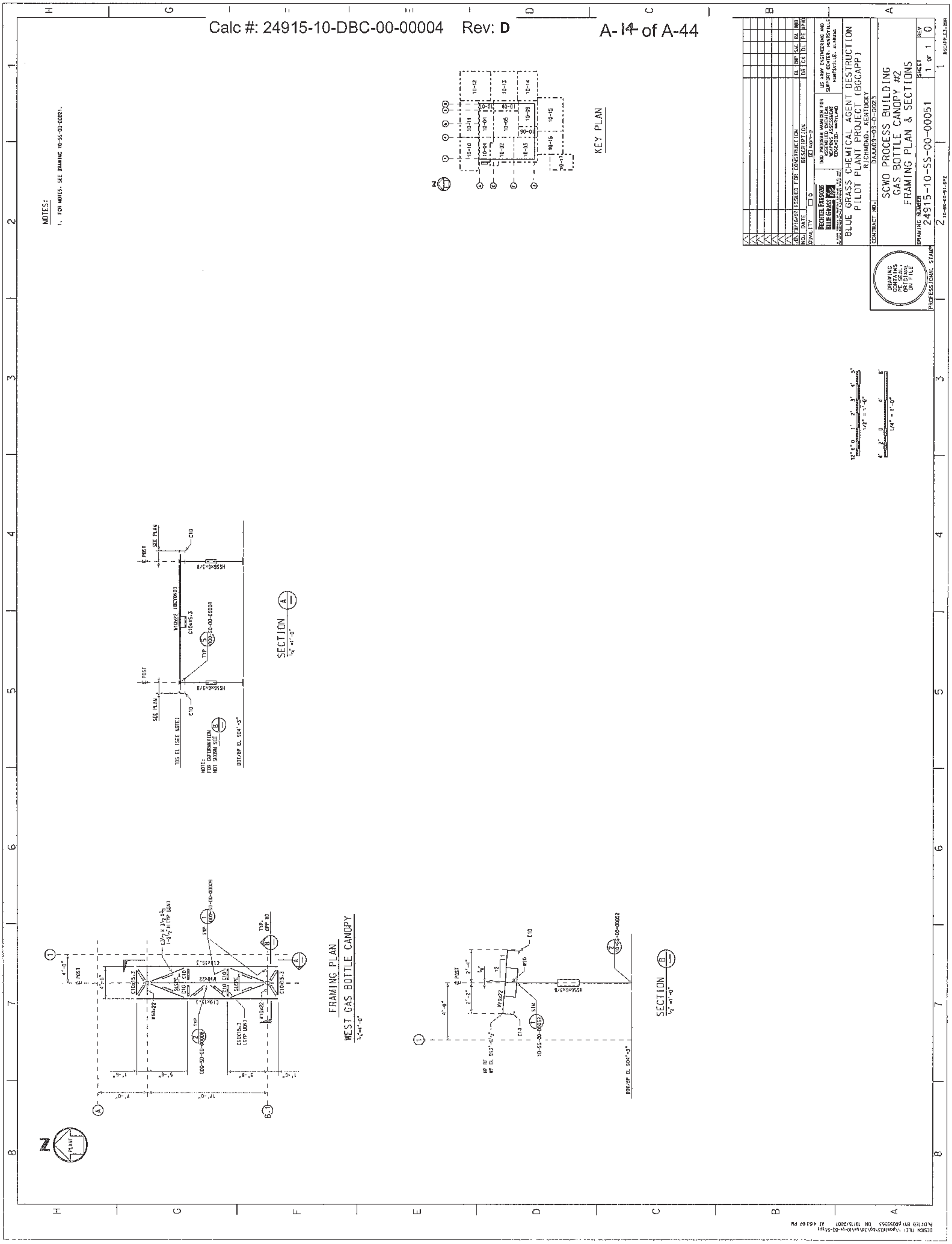
NO. DATE DESCRIPTION
QUALITY Q Non-Q
BECHTEL PARSONS BLUE GRASS
DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND
US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
CONTRACT NO. DAAA09-03-D-0023
SCWO PROCESS BUILDING
GAS BOTTLE CANOPY #1
FRAMING PLAN & SECTIONS
DRAWING NUMBER 24915-10-SS-00-00050
SHEET 1 OF 1
REV 0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SECTION B
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WEST GAS BOTTLE CANOPY
BLUE GRASS CHEMICAL AGENT DESTRUCTION
PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
DAAA09-03-D-0023
SCWO PROCESS BUILDING
GAS BOTTLE CANOPY #2
FRAMING PLAN & SECTIONS
24915-10-SS-00-00051
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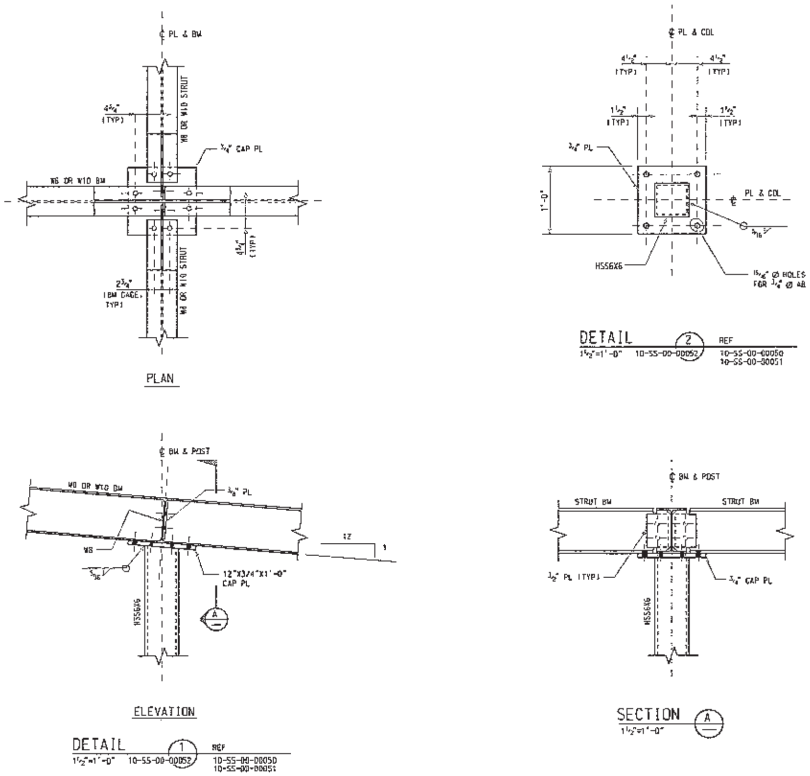

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1. FOR NOTES, SEE DRAWING 10-0B-00-00002.

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QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESS BUILDING
GAS BOTTLE CANOPY
SECTIONS & DETAILS

DRAWING NUMBER 24915-10-SS-00-00052 SHEET 1 OF 1 REV 0

PROFESSIONAL STAMP: DRAWING CONTAINS PE SEAL. ORIGINAL ON FILE

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1" = 1'-0"

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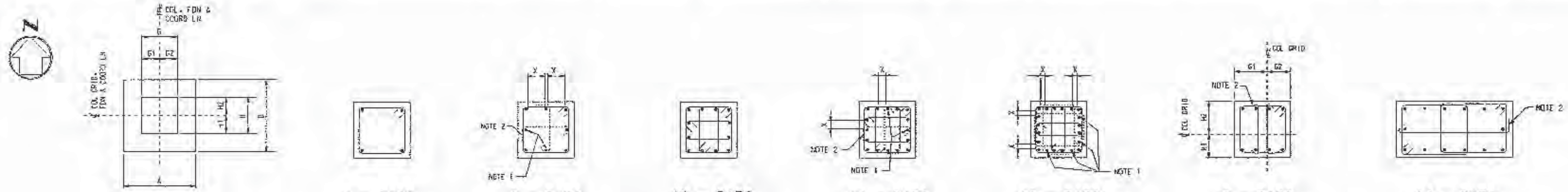


PLAN

4 - BARS
TYPE A

8 - BARS
TYPE B

12 - BARS
TYPE C

16 - BARS
TYPE D

20 - BARS
TYPE E

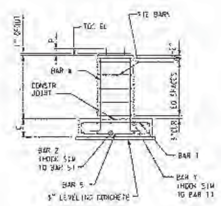
8 - BARS
TYPE F

14 - BARS
TYPE G

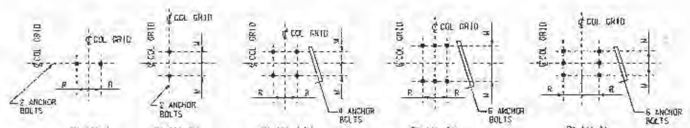
TIE ARRANGEMENT TYPE

TIE REINFORCEMENT NOTES:

1. THESE BARS MUST BE TIED AS SHOWN BY DASHED LINES WHEN X DISTANCE IS OVER 6".
2. ALTERNATE 90° HOOKS IN COLUMNS.
3. DIMENSIONS G1, G2, H1 & H2 ONLY PERTAIN WHERE THE STEEL COLUMN IS ECCENTRIC ON THE PIER.



ELEV



PLAN I PLAN II PLAN III PLAN IV PLAN V

ANCHOR BOLT PLAN

ISOLATED FOUNDATION SCHEDULE

FOUNDATION ID	NO OF FDNS REQ'D	TOP OF CONC EL	DIMENSIONS A	B	C	G1	G2	H1	H2	E	H	J	W	R
F1-20	1	902'-0"	6'-0"	7'-6"	2'-0"					2'-6"	2'-6"	1'-6"		
F1-21	1	902'-0"	5'-0"	5'-0"	2'-0"					2'-0"	2'-0"	1'-6"		
F1-22	1	904'-0"	7'-0"	6'-0"	2'-0"					2'-0"	2'-0"	2'-9"		
F1-23	3	903'-6"	8'-0"	6'-0"	1'-6"					2'-0"	2'-0"	1'-6"		

FOUNDATION ID	ANCHOR BOLTS: ANCHOR BOLT PLAN	TYPE	NO PER PIER	SIZE Ø	L LENGTH	P
F1-20	III		4			
F1-21	III		4			
F1-22	III		4			
F1-23	III		4			

FOUNDATION ID	REINFORCING: BAR S NO	BAR S SIZE	BAR Z NO	BAR Z SIZE	BAR T NO	BAR T SIZE	BAR Y NO	BAR Y SIZE	BAR W NO	BAR W SIZE	TIE BAR TYPE	TIE BAR SIZE	TIE BAR NO REQD	CONC CU YDS	STEEL (LBS)	REMARKS
F1-20	9	#8	8	#6	5	#6	4	#6	8	#6	B	#3	4			
F1-21	7	#6	7	#6	4	#6	4	#6	8	#6	B	#3	4			
F1-22	6	#6	6	#6	6	#6	7	#6	8	#6	B	#3	5			
F1-23	8	#6	9	#6	6	#6	6	#6	9	#6	B	#5	4			

NOTES:
1. FOR NOTES, SEE DRAWINGS 24915-10-DB-00-00002 AND 24915-10-DB-00-00047.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
0	12/20/07	ISSUED FOR CONSTRUCTION	JMT	CCC	SAL	HA	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

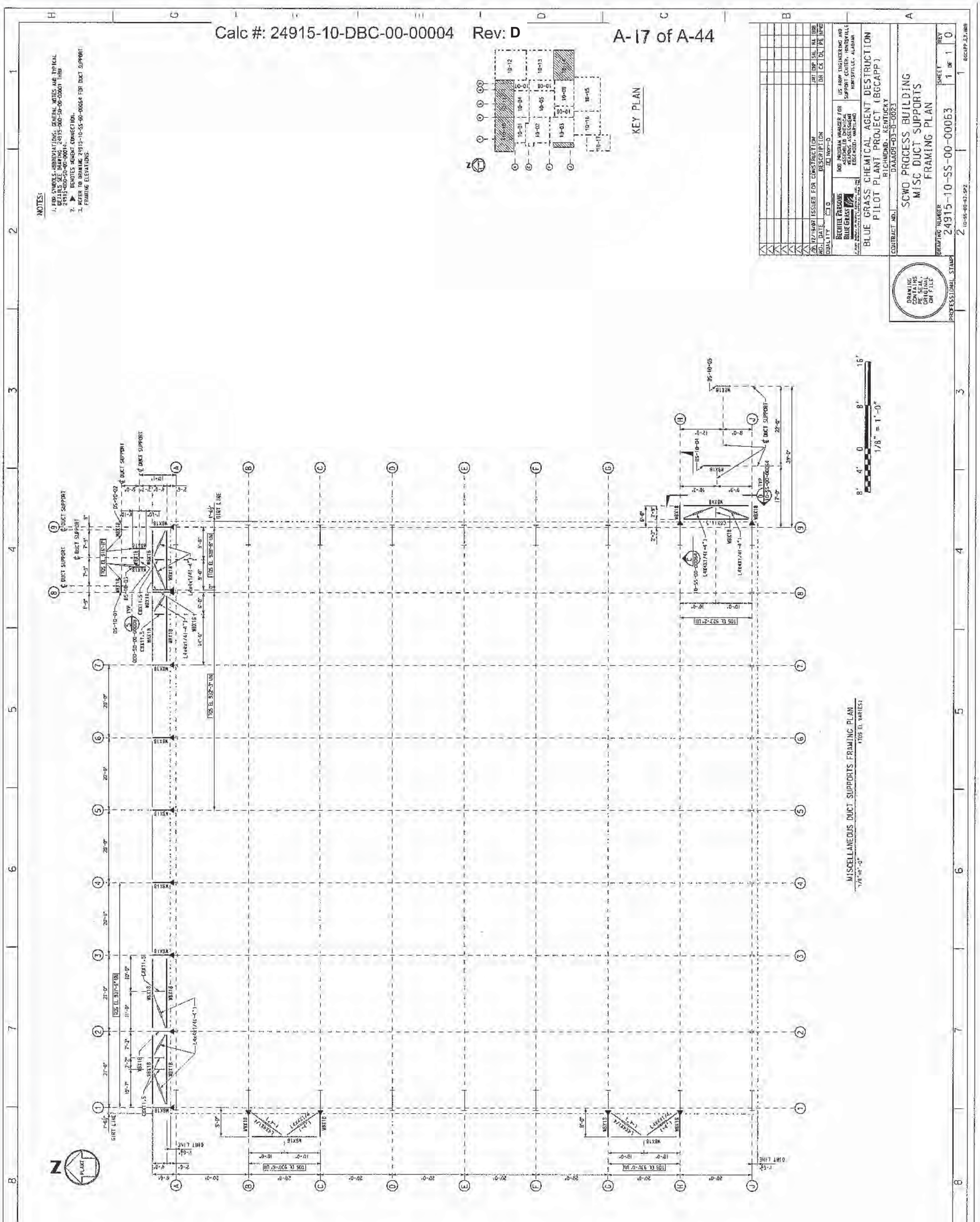
CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL. ORIGINAL ON FILE
PROFESSIONAL STAMP

SCWO PROCESS BUILDING
DUCT/CABLE TRAY SUPPORTS
ISOLATED FOUNDATION SCHEDULE

DRAWING NUMBER 24915-10-DB-00-00061 SHEET 1 OF 1 REV 0

BGCAPP_E3.DGN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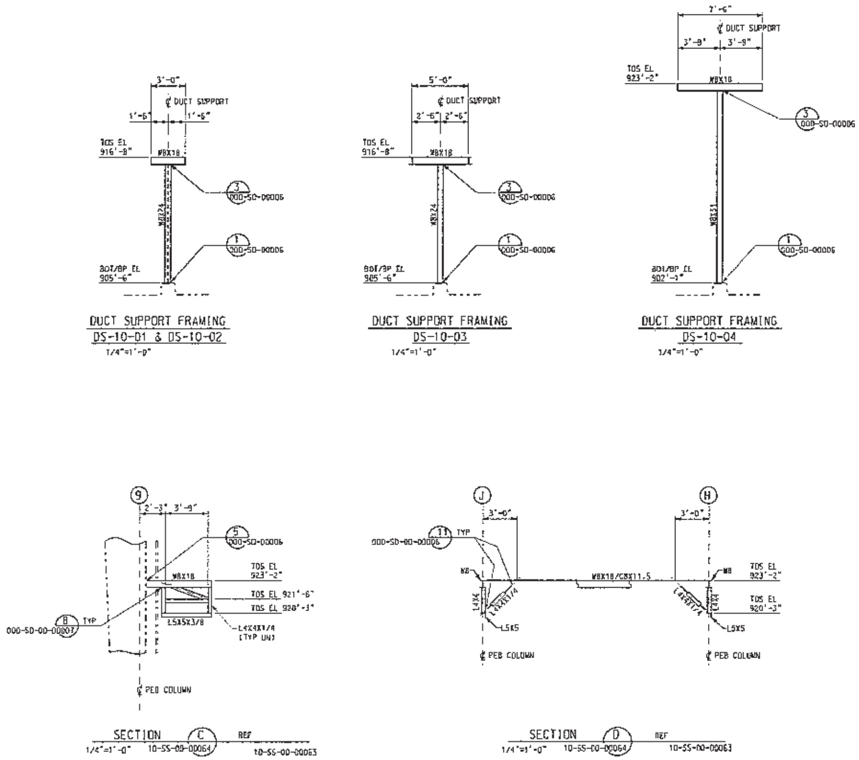
MISCELLANEOUS DUCT SUPPORTS FRAMING PLAN
1/8" = 1'-0"
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
SCWO PROCESS BUILDING
MISC DUCT SUPPORTS
FRAMING PLAN
24915-10-SS-00-00063
PROFESSIONAL STAMP

NOTES:

1. FOR SYMBOLS, ABBREVIATIONS, GENERAL NOTES AND TYPICAL DETAILS SEE DRAWING 24915-000-SD-00-00001 THRU 24915-000-SD-00-00014.



1/4" = 1'-0"

0	12/18/07	ISSUED FOR CONSTRUCTION	JWT	CWP	SAL	RA	BBB
NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS — DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT, EDGEWOOD, MARYLAND — US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE, HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESS BUILDING
MISC DUCT SUPPORTS
SECTIONS & DETAILS

DRAWING CONTAINS PE SEAL. ORIGINAL ON FILE

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-SS-00-00064 SHEET 1 OF 1 REV 0

10-SS-00-64.SDZ BGCAPP_E3.DBR

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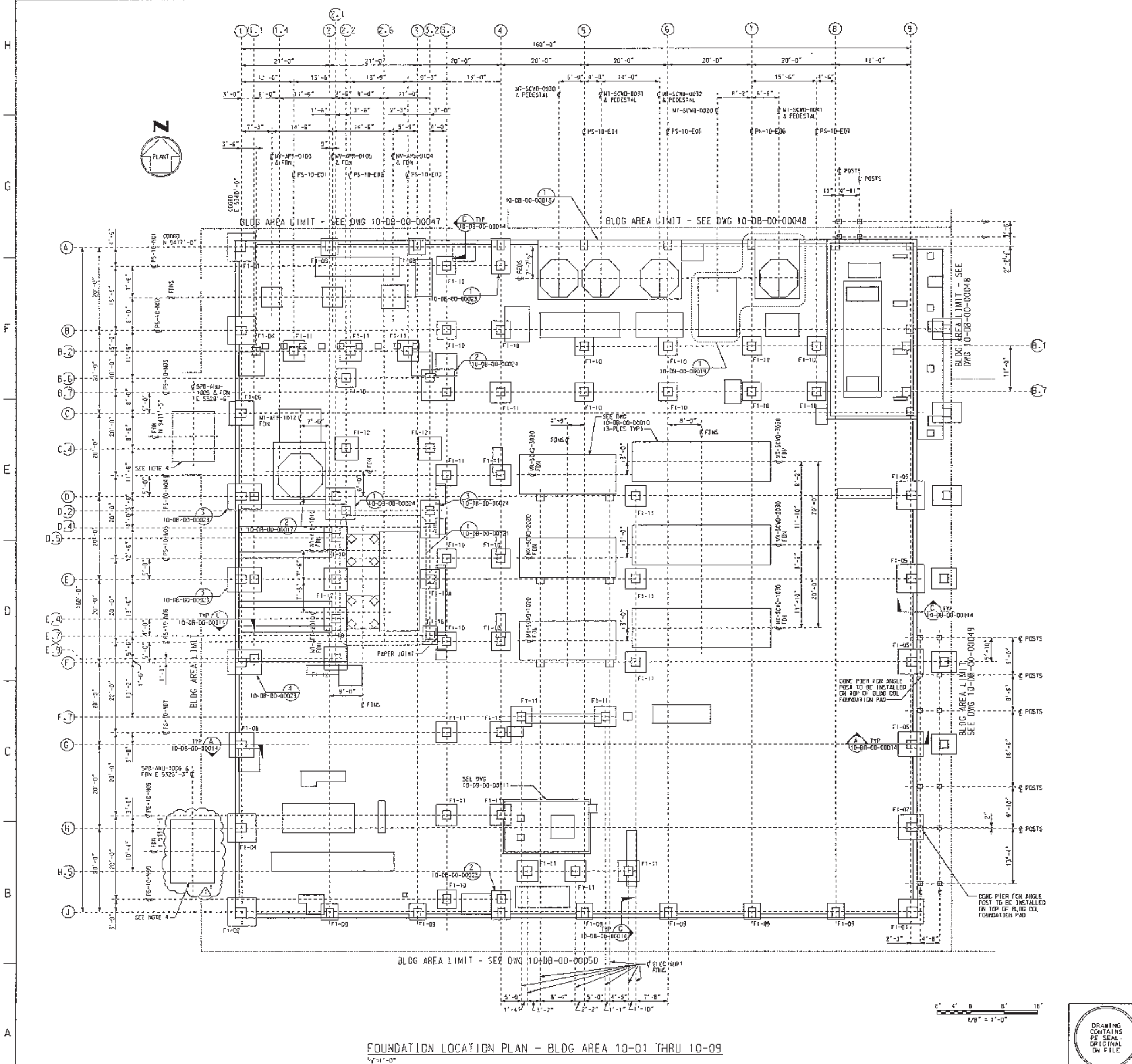
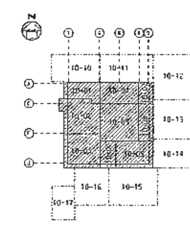


FOUNDATION LOCATION PLAN - BLDG AREA 10-01 THRU 10-09

1/8"=1'-0"

NOTES:

1. FOR GENERAL NOTES, LEGEND AND ABBREVIATIONS, SEE DRAWING 24915-000-S0-00-00001.
2. FOR TYPICAL DETAILS, SEE DRAWINGS 24915-000-S0-00-00002 THRU 24915-000-S0-00-00014.
3. FOR ISOLATED FOUNDATION SCHEDULE, SEE DRAWING 24915-10-DB-00-00013.
4. FOR MISCELLANEOUS EQUIPMENT FOUNDATIONS NOT REFERENCED TO A DETAIL, SEE FOUNDATION SCHEDULE ON DRAWING 24915-10-DB-00-00014.
5. THE PLACEMENT OF A 3 INCH LEAN CONCRETE LEVELING LAYER BENEATH THE BOTTOM SIDE OF FOUNDATIONS IS AT THE DISCRETION OF THE CONTRACTOR.
6. FIELD TO LOCATE EXTERIOR STAIR LANDING ANGLE SUPPORT FOUNDATIONS. REFER TO DETAIL 4, DRAWING 24915-10-DB-00-00024.



KEY PLAN

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
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0	12/27/07	ISSUED FOR CONSTRUCTION	SS	CNP	SAL	RA	BBK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL. ORIGINAL ON FILE

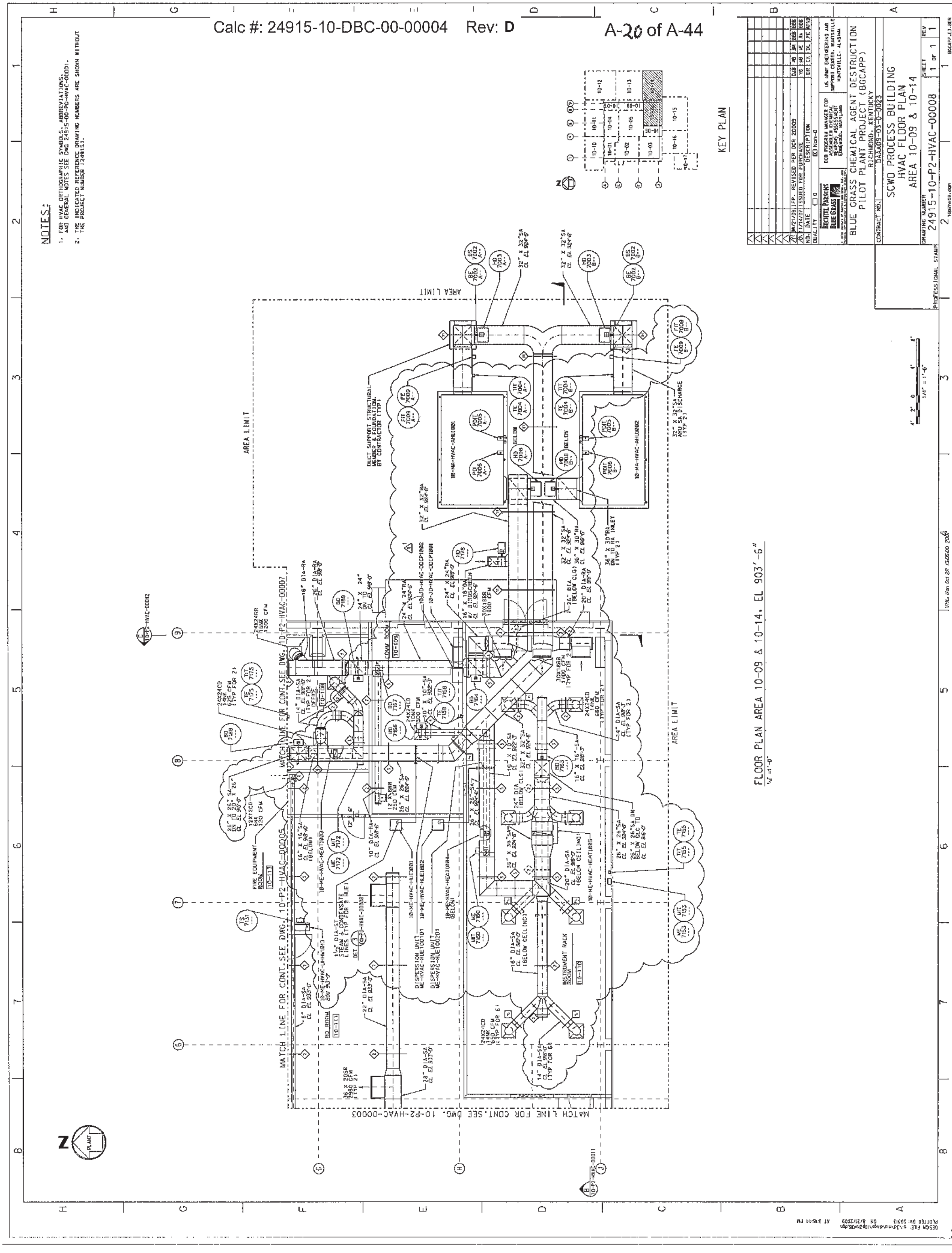
PROFESSIONAL STAMP

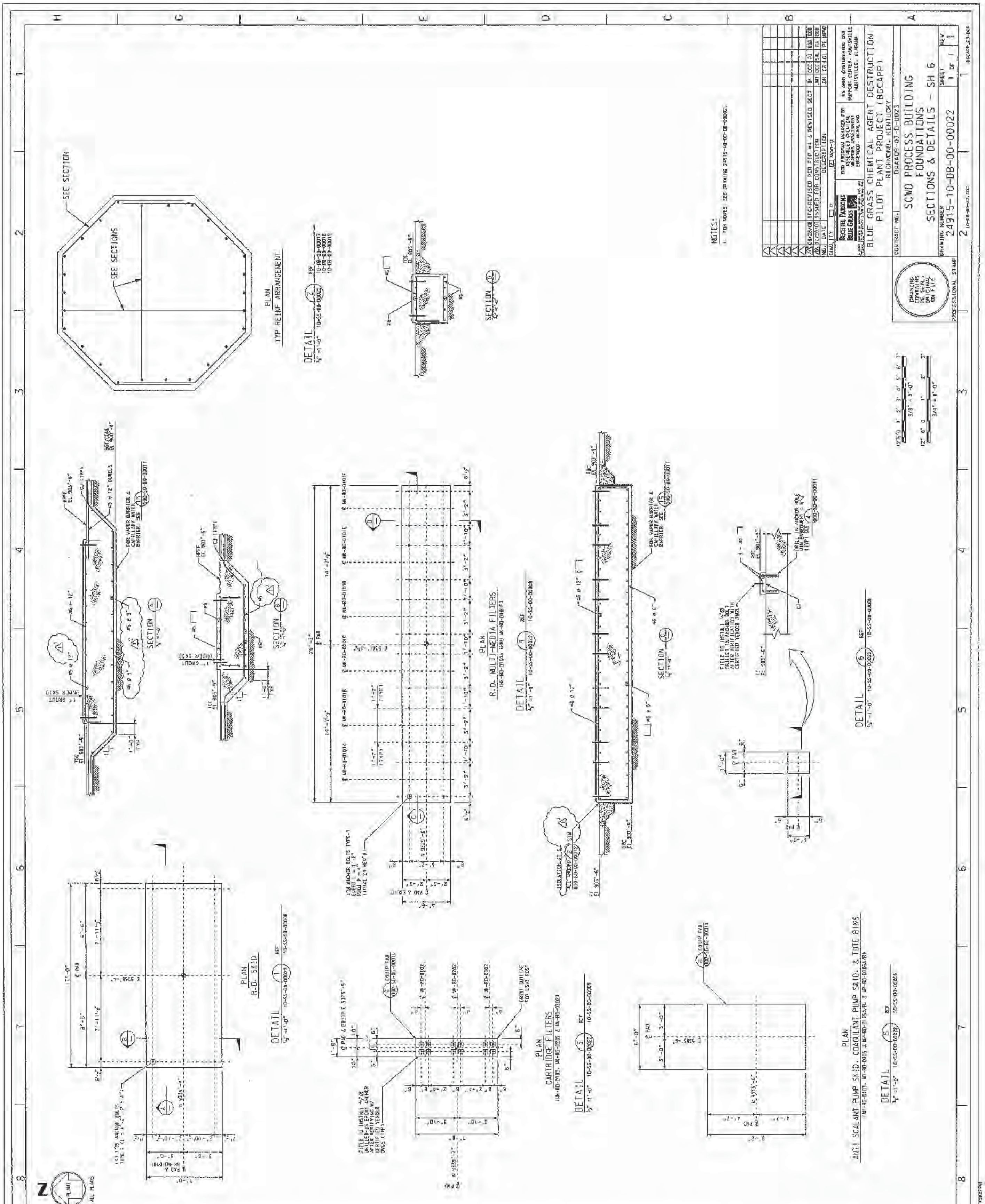
SCWD PROCESS BUILDING
FOUNDATION LOCATION PLAN - SH 1
AREA 10-01 THRU 10-09

DRAWING NUMBER 24915-10-DB-00-00002

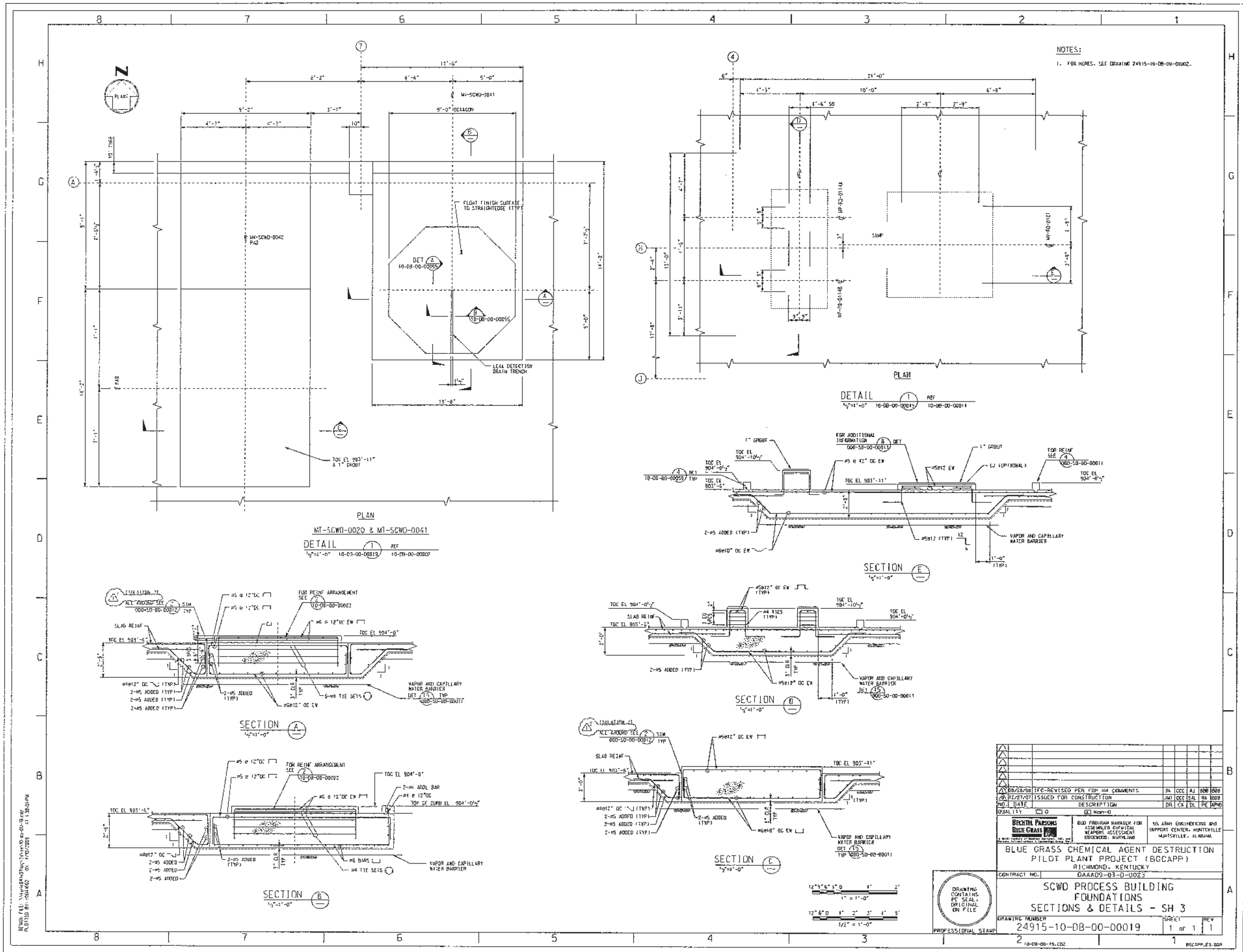
SHEET 1 OF 1

REV 1


NOTES:
1. FOR HVAC ORTHOGRAPHIC SYMBOLS, ABBREVIATIONS, AND GENERAL NOTES SEE DWG 24915-00-P0-HVAC-00001.
2. THE INDICATED REFERENCE DRAWING NUMBERS ARE SHOWN WITHOUT THE PROJECT NUMBER (24915).
KEY PLAN
FLOOR PLAN AREA 10-09 & 10-14. EL 903'-6"
AREA LIMIT
MATCH LINE FOR CONT. SEE DWG. 10-P2-HVAC-00003
MATCH LINE FOR CONT. SEE DWG. 10-P2-HVAC-00005
MATCH LINE FOR CONT. SEE DWG. 10-P2-HVAC-00007
BLUE GRASS CHEMICAL AGENT DESTRUCTION
PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
DAAA09-03-D-0023
SCWO PROCESS BUILDING
HVAC FLOOR PLAN
AREA 10-09 & 10-14
DRAWING NUMBER
24915-10-P2-HVAC-00008
SHEET 1 OF 1
REV 1
BECHTEL PARSONS BLUE GRASS
DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND
US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA
1 08/21/09 IFP. REVISED PER DCR 20009
0 11/14/07 ISSUED FOR PURCHASE
PROFESSIONAL STAMP



BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
SCWO PROCESS BUILDING FOUNDATIONS
SECTIONS & DETAILS - SH 6
24915-10-DB-00-00022
PLAN TYP REINF ARRANGEMENT
PLAN R.O. MULTI-MEDIA FILTERS
PLAN R.O. SKID
PLAN CARTRIDGE FILTERS
PLAN AGENT SCALANT PUMP SKID, COAGULANT PUMP SKID, & TOTE BINS


NOTES:
1. FOR NOTES, SEE DRAWING 24915-10-DB-00-00002.
PLAN
DETAIL 1
MT-SCWO-0020 & MT-SCWO-0041
SECTION A
SECTION B
SECTION C
SECTION D
SECTION E
VAPOR AND CAPILLARY WATER BARRIER
SLAB REINF
LEAK DETECTION DRAIN TRENCH
FLOAT FINISH SURFACE TO STRAIGHTEDGE (TYP)
SUMP
9'-0" OCTAGON
TOC EL 903'-11" & 1" GROUT
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
CONTRACT NO. DAAA09-03-D-0023
SCWO PROCESS BUILDING FOUNDATIONS SECTIONS & DETAILS - SH 3
DRAWING NUMBER 24915-10-DB-00-00019
SHEET 1 OF 1
REV 1
ISSUED FOR CONSTRUCTION
IFC-REVISED PER FOP #4 COMMENTS
DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP
BECHTEL PARSONS BLUE GRASS
US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BECHTEL PARSONS BLUE GRASS	Project Number	Document Number	Rev	Date	Sheet	of
	24915	24915-10-MVD-RO-00001	0	2/24/2009	1	7

Project, Client, Location	Document Title
Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP) Project	SCWO EFFLUENT CAUSTIC DAY TANK MV-RO-0101

☐ In-House Review ☐ Client Approval ☐ Quotation ☑ All Data Sheets Attached

☑ Purchase ☐ Construction ☐ Design ☐ Revised Data Sheets Only Attached

QUALITY: ☐ Q ☑ NON-Q

TOXIC CATEGORY ☐ A ☐ B ☐ A/B N/A OTHER

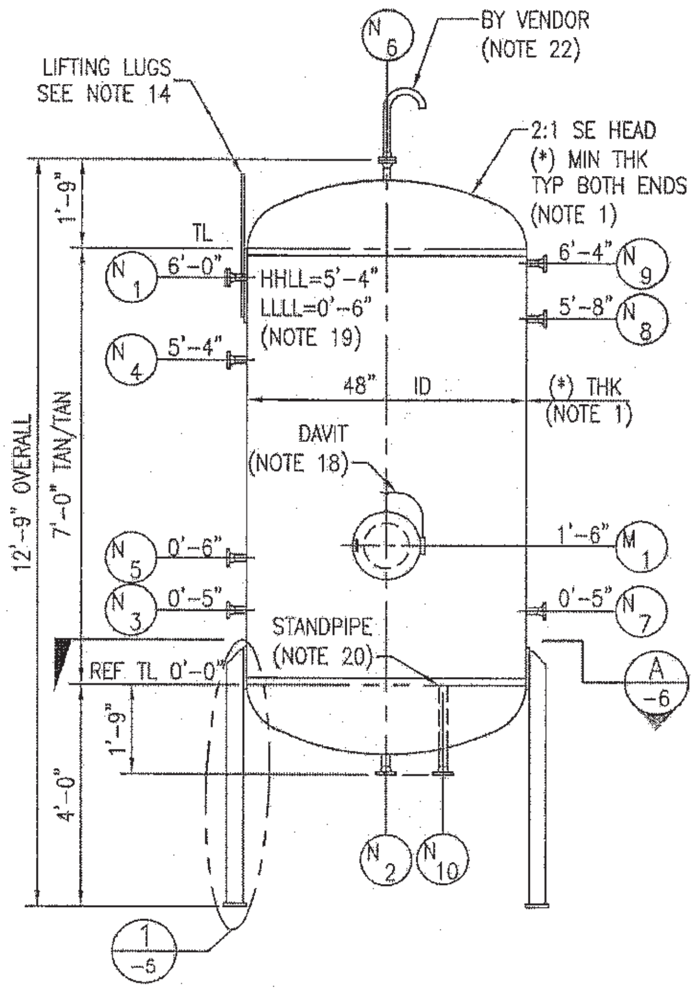
REV	DATE	BY	CHK	DL	PROJ ENGR	QA	APPR		REMARKS
0	02/24/09	SC SC	BM	BM	BBB	JW			Issued for Purchase

This sheet is a record of each issue or revision to the subject specification. Each time the specification is to be changed, only the new or revised sheets must be issued. The exact sheets changed and the nature of the change should be noted in the Remarks column; however, these remarks are not part of the specification. The revised data sheets shall become part of the original specification and shall be compiled within their entirety.

DC- DT-

FILE NAME: MVR00101

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP SCWO EFFLUENT CAUSTIC DAY TANK MV-RO-0101	SHEET 2 OF 7	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-10-MVD-RO-00001	REV 0



ONE REQD MV-RO-0101

SEE SHEET 7 FOR TRUE ORIENTATION

CODE:	ASME SECT VIII DIV 1 (CODE CONSTR. ONLY)
CODE CERT REQD	NO CODE STAMP NO
NATIONAL BOARD REGISTRATION:	NO
OPR PRESS (INT)	ATM PSIG AT 77 °F
DES PRESS. (INT)	14.9 PSIG AT 125 °F
DES PRESS. (EXT)	0 PSIG AT 125 °F
MIN DESIGN METAL TEMP	(-)1 °F AT 14.9 PSIG
CRSN ALLOW SHELL =1/8"	HEADS =1/8" NOZZ =1/8"
LIQUID LEVEL FOR DESIGN:	FULL AT SP GR 1.19
SEISMIC DESIGN:	SEE NOTE 10
WIND DESIGN:	SEE NOTE 11
MAWP	(*) PSIG AT 125 °F LIMITED BY (*)
MAP N&C	(*) PSIG AT AMB TEMP LIMITED BY (*)
SHOP HYD	(*) PSIG AT 70 °F MIN HORIZ POSN
FIELD HYD NEW	(*) PSIG AT 70 °F MIN OPR POSN
FIELD HYD CORR	(*) PSIG AT 70 °F MIN OPR POSN
PWHT	(PER CODE) RADIOGRAPHY (PER CODE)
JOINT EFF: SHELL	(PER CODE) HEADS (PER CODE)
ALLOW STRESS	20,000 PSI AT DESIGN TEMP 125°F

MATERIALS:				
	SHELL	SA-516-70		
	HEADS	SA-516-70		
	SUPPORTS	SA-36		
	INTERNALS	N/A	TRAYS	N/A
	BOLTS (INT)	N/A	NUTS	N/A
	BOLTS (EXT)	SA-193-B7	NUTS	SA-194-2H
	FLANGES	SA-105		
	NOZZLE NECKS	SA-106B		
	GASKETS	NOTE 21		

CAPACITY (WORKING)			350 GAL
FAB WT	(*) (NOTE 1&15) LB	EMPTY WT	(*) (NOTE 1&15) LB
TRAY WT	N/A LB	PACKING WT	N/A LB
OPR WT	(*) (NOTE 1&15) LB	TEST WT	(*) (NOTE 1&15) LB
PAINTING	SEE NOTE 12		
INSULATION	NONE		
FIREPROOFING	NONE		

ACCESSORIES BY FABRICATOR:	YES	NO
VESSEL DAVIT MARK No.		X
LADDER & PLATFORM CLIPS		X
PIPE SUPPORT AND PIPE GUIDE CLIPS		X
INSULATION SUPPORTS		X
FIREPROOFING SUPPORTS		X
VORTEX BREAKER		X
LIFTING AND GROUNDING LUGS	X	

NOZZLE SCHEDULE

ITEM	No.	SIZE	PROJ	RATING	SERVICE
M1	1	24"	3'-0"	150#	MH W/ BF & DAVIT
N1	1	2"	2'-8"	150#	INLET
N2	1	2"	SEE ELEV	150#	DRAIN
N3	1	3"	2'-8"	150#	LEVEL TRANSMITTER
N4	1	2"	2'-8"	150#	LSHH
N5	1	2"	2'-8"	150#	LSLL
N6	1	2"	SEE ELEV	150#	VENT WITH PIPE
N7	1	2"	2'-8"	150#	THERMOWELL
N8	1	3"	2'-8"	150#	SPARE W/ BF
N9	1	2"	2'-8"	150#	OVERFLOW
N10	1	2"	SEE ELEV	150#	OUTLET W/ INT. PIPE

FLANGE: RFWN FINISH: 125-250 AARH

NOTE #7

FILE NAME: MVR00101B

BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP SCWO EFFLUENT CAUSTIC DAY TANK MV-RO-0101	SHEET 3 OF 7	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-10-MVD-RO-00001	REV 0

NOTES

1. THE VESSEL SUPPLIER SHALL DESIGN, FURNISH, FABRICATE, INSPECT, TEST AND DELIVER THE VESSEL IN ACCORDANCE WITH THIS DATA SHEET, ATTACHED SPECIFICATIONS AND STANDARDS. VESSEL SHELL THICKNESS, HEAD THICKNESS, WEIGHTS, AND SUPPORT DESIGN ARE PRELIMINARY. VESSEL SHALL BE DESIGNED IN ACCORDANCE WITH SPECIFIED DESIGN REQUIREMENTS, SEE NOTES 10 AND 11.
2. ALL DIMENSIONS ARE FROM REF TANGENT LINE, EXCEPT AS SHOWN.
3. NOZZLES AND MANHOLE SHALL HAVE SAME DESIGNATION AS SHOWN ON THIS DRAWING.
4. BOLT HOLES SHALL STRADDLE THE VERTICAL CENTERLINES OF THE VESSEL FOR NOZZLES ON THE SHELL AND PLANT NORTH-SOUTH, EAST-WEST CENTERLINES FOR NOZZLES ON THE HEADS.
5. ALL ATTACHMENTS WELDED TO VESSEL PRESSURE PARTS SHALL BE SAME MATERIAL AS PRESSURE PART, UNLESS OTHERWISE NOTED.
6. VESSEL SHALL BE THOROUGHLY CLEANED INSIDE AND OUTSIDE, SHALL BE FREE FROM RUST, SCALE, SLAG, WELD SPLATTER AND FOREIGN MATTER PRIOR TO SHOP HYDROTEST, AND SHALL BE THOROUGHLY DRIED AFTER HYDROTEST.
7. PROJECTION OF RADIAL NOZZLES AND MANHOLES ARE FROM VESSEL CENTER LINE TO EXTREME FACE OF FLANGE.
8. ALL VESSEL COMPONENTS SHALL BE FURNISHED IN ACCORDANCE WITH STANDARDS LISTED BELOW.
9. ITEMS WITH (*) ARE VESSEL FABRICATOR RESPONSIBILITY.
10. SEISMIC FORCES SHALL BE DETERMINED PER SPECIFICATION 24915-000-3PS-SV00-00001, SPECIFICATION FOR SEISMIC PROTECTION OF EQUIPMENT.
11. THE GENERAL PROJECT SPECIFICATION, 24915-000-3PS-G000-00001, PROVIDES PROJECT DETAILS AND DESIGN CONDITIONS FOR THE SITE. THIS VESSEL IS PART OF THE SUPER CRITICAL WATER OXIDATION (SCWO) BUILDING AND IS INSTALLED INSIDE THE BUILDING AND WILL NOT BE SUBJECT TO SITE CONDITIONS SUCH AS WIND, PRECIPITATION, SNOW, ETC. OTHER GENERAL REQUIREMENTS FOR EQUIPMENT, MATERIAL, AND/OR SERVICES REQUIRED AS DEFINED IN THE SPECIFICATION APPLY.
12. ALL EXTERIOR BARE CARBON STEEL SURFACES (LEGS, LUGS, AND MANHOLE DAVIT) SHALL BE PAINTED IN ACCORDANCE WITH SPECIFICATION 24915-000-3PS-NX00-00001, PAINTING, GENERAL.
13. VESSEL SUPPLIER SHALL SUPPLY GROUNDING LUGS IN ACCORDANCE WITH STANDARD 24915-00-M0-00-00006. GROUNDING LUGS WITH DIMENSIONS SHALL BE CLEARLY CALLED OUT ON SUPPLIER DRAWINGS.
14. VESSEL SUPPLIER SHALL DESIGN AND INSTALL A MINIMUM OF TWO LIFTING LUGS FOR USE DURING LOADING, UNLOADING AND PLACING EQUIPMENT ON ITS FOUNDATION. DESIGN SHALL INCLUDE REQUIRED PIN, SHACKLE SIZE AND MAXIMUM SLOPE OF LIFTING CABLE AND LIFTING LUG PLANE. HOLE IN LIFTING LUG SHALL BE DRILLED OR MACHINED, DO NOT FLAME CUT. LIFTING LUG MAY BE CARBON STEEL. PAD, WHICH IS REQUIRED, SHALL BE THE SAME MATERIAL AS THE SHELL. LIFTING LUG SHALL NOT BE REMOVED AFTER INSTALLATION. EQUIPMENT SUPPLIER SHALL PERMANENTLY MARK ON THE LIFTING LUG WITH 1" MINIMUM HIGH LETTERS - "DO NOT REMOVE". SUPPLIER'S DRAWINGS SHALL PROVIDE LIFTING LUG DESIGN AND LOAD AND ANNOTATE EACH LUG WITH ITS LOAD CAPACITY.
15. VESSEL SUPPLIER SHALL PROVIDE FABRICATION, EMPTY, OPERATING, TEST AND INDIVIDUAL WEIGHTS OF HEAD, SHELL AND EQUIPMENT CENTER OF GRAVITY.
16. VESSEL SUPPLIER SHALL IDENTIFY ALL MATERIALS OF CONSTRUCTION (INCLUDING GASKETS) BY WEIGHT OR VOLUME.

REFERENCES

STD NO.	DESCRIPTION
24915-00-M0-00-00001	PRESSURE VESSEL TOLERANCES
24915-00-M0-00-00002	STD BOLT HOLE ORIENT
24915-00-M0-00-00004	VESSEL ABBREVIATIONS & SYMBOLS
24915-00-M0-00-00006	GROUNDING CONN FOR VESSELS & TKS

REFERENCES

SPEC NO.	DESCRIPTION
24915-000-3PS-G000-00001	GENERAL PROJECT REQUIREMENTS
24915-000-3PS-HXYQ-00001	QUALITY ASSURANCE
24915-000-3PS-MV00-00001	PRESSURE VESSELS
24915-000-3PS-NX00-00001	PAINTING, GENERAL
24915-000-3PS-SV00-00001	SEISMIC PROTECTION OF EQUIP

FILE NAME: MVR00101C

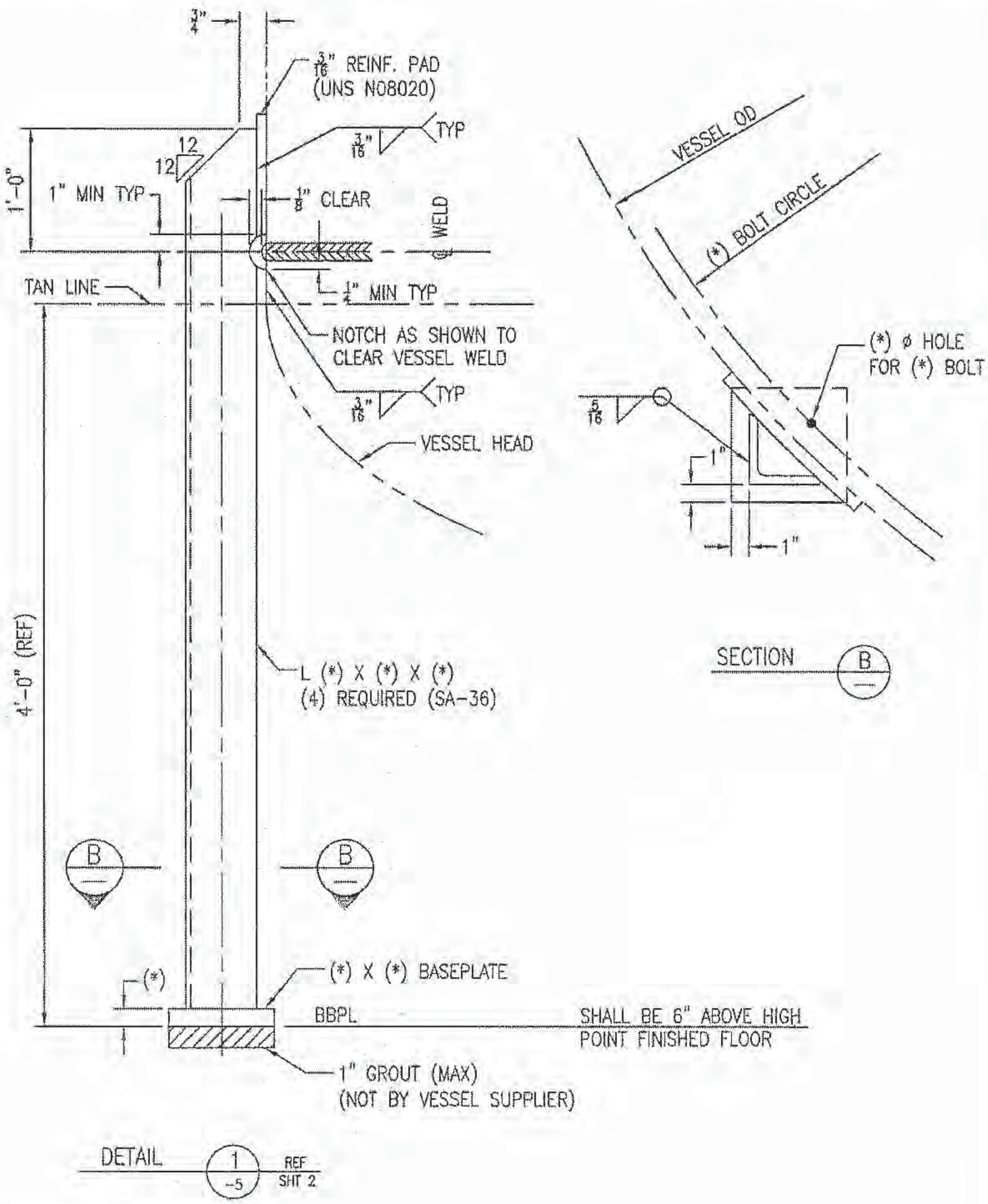
BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP SCWO EFFLUENT CAUSTIC DAY TANK MV-RO-0101	SHEET 4 OF 7	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-10-MVD-RO-00001	REV 0

NOTES CONTINUED

17. ALL EXTERNAL BOLTS AND STUDS SHALL BE ASSEMBLED WITH ANTI-SEIZE LUBRICANT. SEE PRESSURE VESSEL SPECIFICATION.
18. VESSEL SUPPLIER SHALL DESIGN AND FABRICATE MANHOLE DAVIT FOR REMOVAL OF MANHOLE COVER.
19. LIQUID LEVELS ARE FROM BOTTOM TANGENT LINE, UNLESS OTHERWISE NOTED.
20. STANDPIPE MATERIAL SA-106-B, 2" X.S. PIPE. PIPE TO EXTEND TO BOTTOM TANGENT LINE.
21. THREE SETS OF SPARE GASKETS FOR NOZZLES WITH BLIND FLANGES SHALL BE SUPPLIED BY VESSEL FABRICATOR. GASKETS SHALL BE FLAT RING, NON ASB FIBER, 1/8" THK, CL150.
22. VENT PIPE MATERIAL SA-106-B, 2" X.S. PIPE.
23. SCWO EFFLUENT CAUSTIC DAY TANK, MV-RO-0101, IS REFERENCED ON P&ID 24915-10-M6-RO-00021.

FILE NAME: MVR00101D

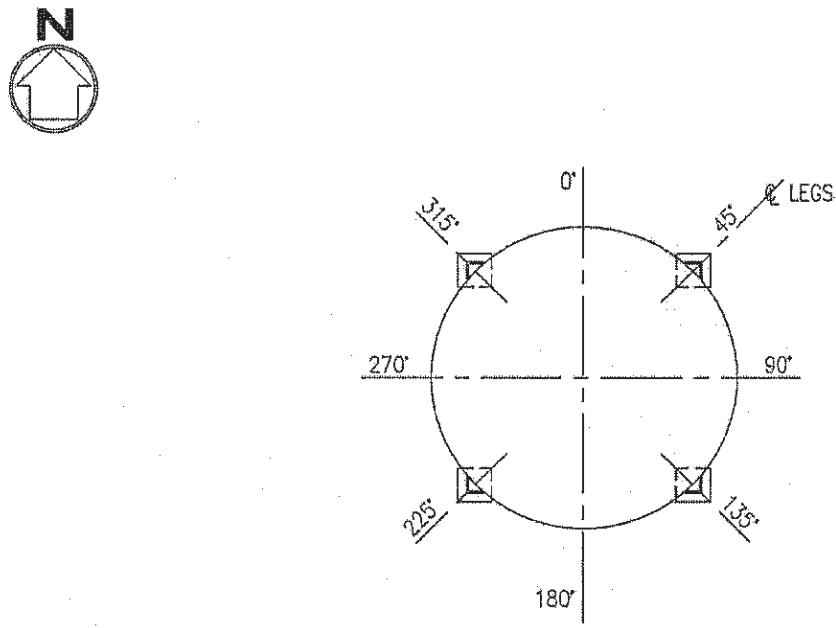
BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP SCWO EFFLUENT CAUSTIC DAY TANK MV-RO-0101	SHEET 5 OF 7	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-10-MVD-RO-00001	REV 0



NOTE – VESSEL SUPPORT
SUPPORT DESIGN IS PRELIMINARY, SEE NOTE 1, SHEET 3

FILE NAME: MVRO0101E

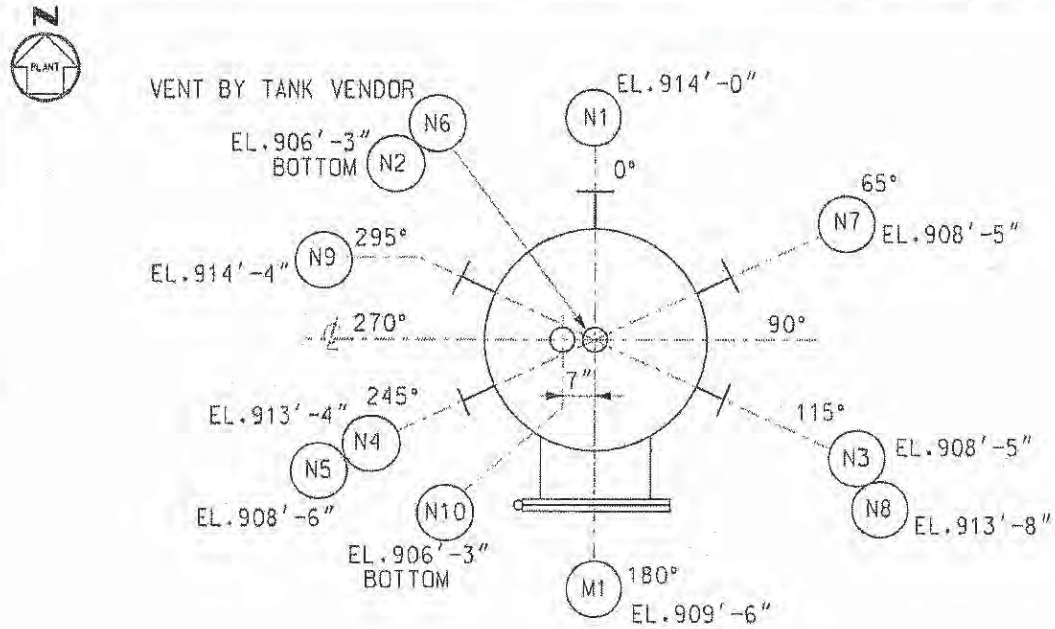
BECHTEL PARSONS BLUE GRASS DATA SHEET	TITLE BGCAPP SCWO EFFLUENT CAUSTIC DAY TANK MV-RO-0101	SHEET 6 OF 7	PROJECT NUMBER 24915
		DOCUMENT NUMBER 24915-10-MVD-RO-00001	REV 0



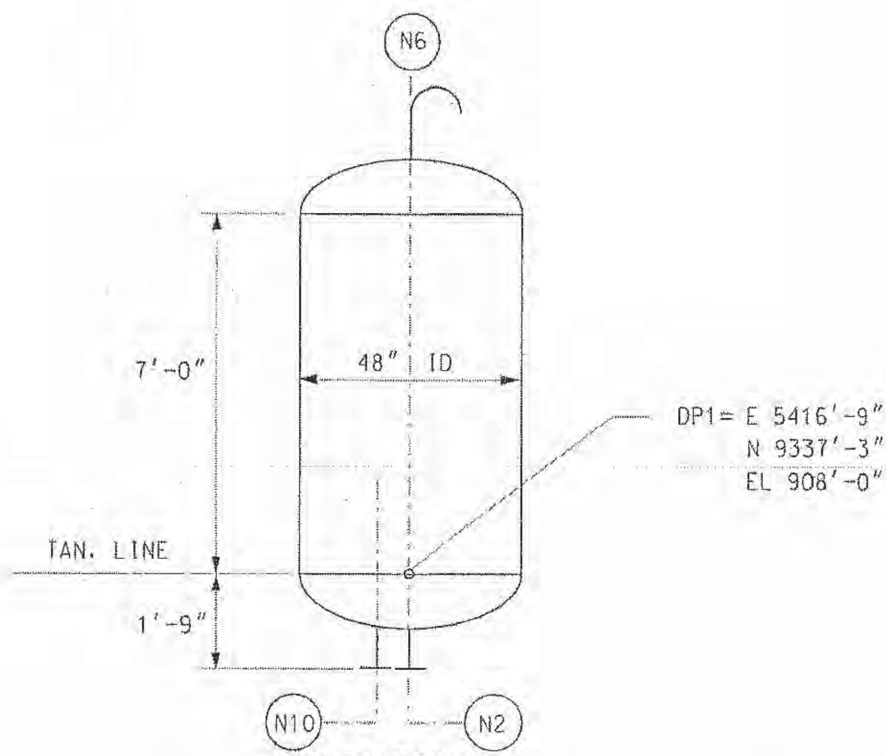
PLAN
TANK SUPPORT ORIENTATION
A
6
REF SHT 2

FILE NAME: 10-MV-RO-0101-s7 r0.dgn

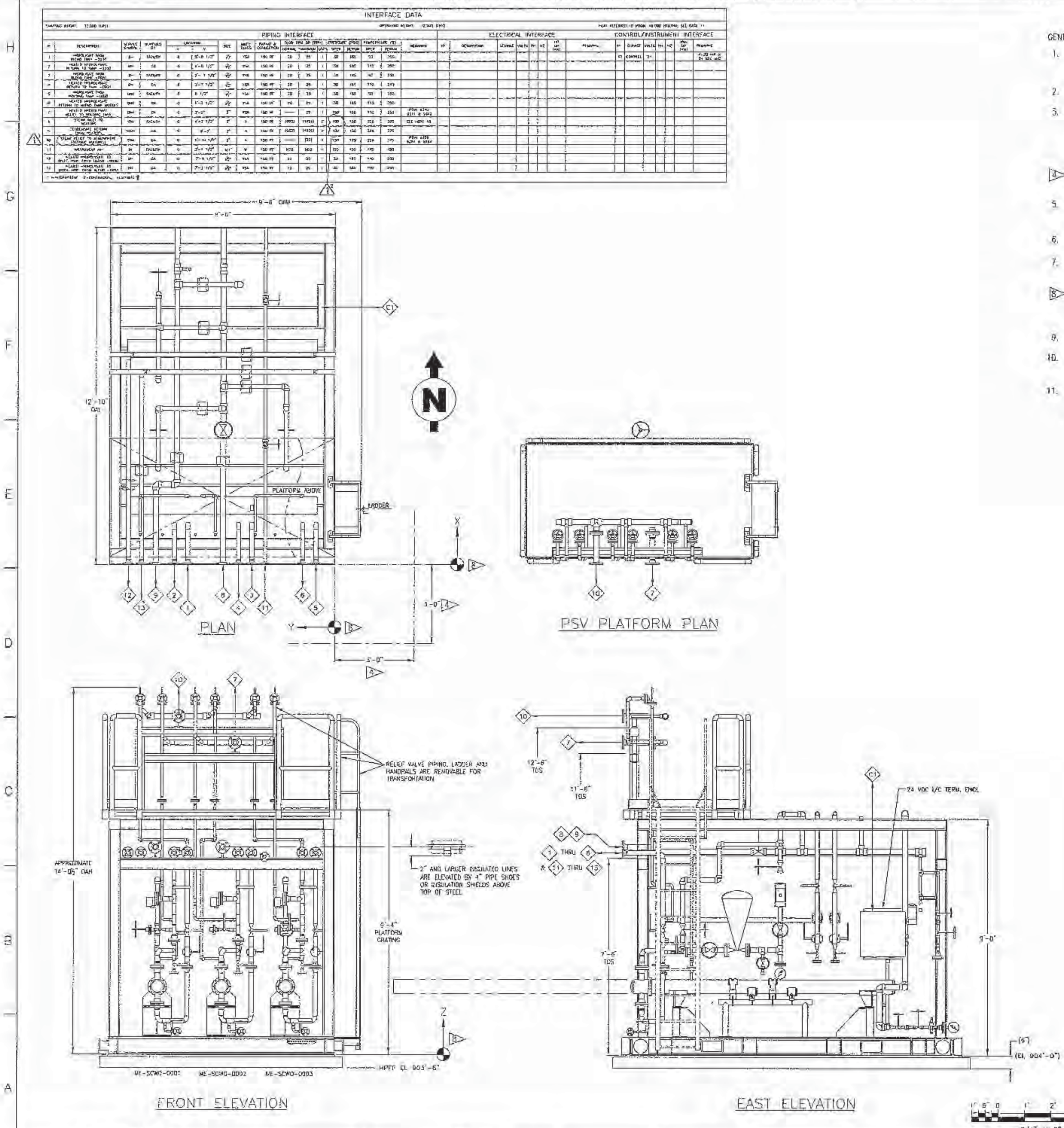
DATA SHEET	TITLE BGCAPP SCWO EFFLUENT CAUSTIC DAY TANK MV-RO-0101	SHEET 7 OF 7	PROJECT NUMBER 24915	
		DOCUMENT NUMBER 24915-VO-10-MVD-RO-00001		REV 0



PLAN



ELEVATION



GENERAL NOTES:

1. PIPING INTERFACE DATA ARE BASED ON BGCAPP DATA FROM THE SCWO LINE SIZING DOCUMENT 24915-10-M6C-SCWO-00002 AND THE SCWO P&IDS 24915-10-M6-SCWO-00013, -00015, -00029 AND 00030.
2. ⟨XX⟩ SYMBOL DESIGNATES INTERFACE POINT (IP) NUMBER (X).
3. "PPH" DENOTES POUNDS PER HOUR.
   "ATM" DENOTES ATMOSPHERE.
   "NEG" DENOTES NEGLIGIBLE FLOW.
   "HPFF" DENOTES HIGH POINT FINISHED FLOOR.
   "EL" DENOTES ELEVATION
4. MINIMUM 36" CLEARANCE REQUIRED AROUND MODULE. ACCESS REQUIRED ON ALL SIDES OF MODULE.
5. MODULE ANCHORING LOCATION AND DETAILS ARE DEPICTED ON SPB HYDROLYSATE BLEND/HOLDING TANK HEATER MODULE ARRANGEMENT DRAWING 24915-10-MO-SCWO-00116.
6. PROCESS AND UTILITY PIPING LOCATION DIMENSION TOLERANCE IS +/-1".
7. DETAILED EQUIPMENT AND PIPING SHOWN ON SPB HYDROLYSATE BLEND/HOLDING TANK HEATER MODULE ARRANGEMENT DRAWINGS 24915-10-MO-SCWO-00115 AND -00116.
8. PIPING INTERFACES ARE LOCATED BY X-Y-Z COORDINATES (RIGHT HAND RULE) FROM NOTED CORNER OF SKID. SEE INTERFACE DATA TABLE FOR X AND Y COORDINATE LOCATIONS. (Z COORDINATES SHOWN ON DRAWING).
9. THE AGENT CONTAMINATION CATEGORY FOR THE SCWO SYSTEM IS N/A.
10. THE THREE HEATERS ARE FED WITH A COMMON STEAM INLET. THE FLOW VALUE PROVIDED IS CUMULATIVE FOR THE THREE.
11. 40,000 BTU/HR IS APPROXIMATE HEAT RELEASED BY TWO (2) HYDROLYSATE HEATERS RUNNING SIMULTANEOUSLY (20,000 BTU'S EACH). IT IS NOT EXPECTED THAT THREE (3) WOULD BE HEATING AT ANY ONE TIME.

CM Aprvd

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
1		IFC (INC. MISC. INTERFACE MOD / CORRECTIONS)	RJY	SY	KWB	DWB	WN
0	5/14/02	(PC) SHEET ENTIRELY REDRAWN	DK	CGI	KWB	DWN	WN

QUALITY ☐ Q ☒ NON-Q

BECHTEL PARSONS BLUE GRASS — DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND — US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

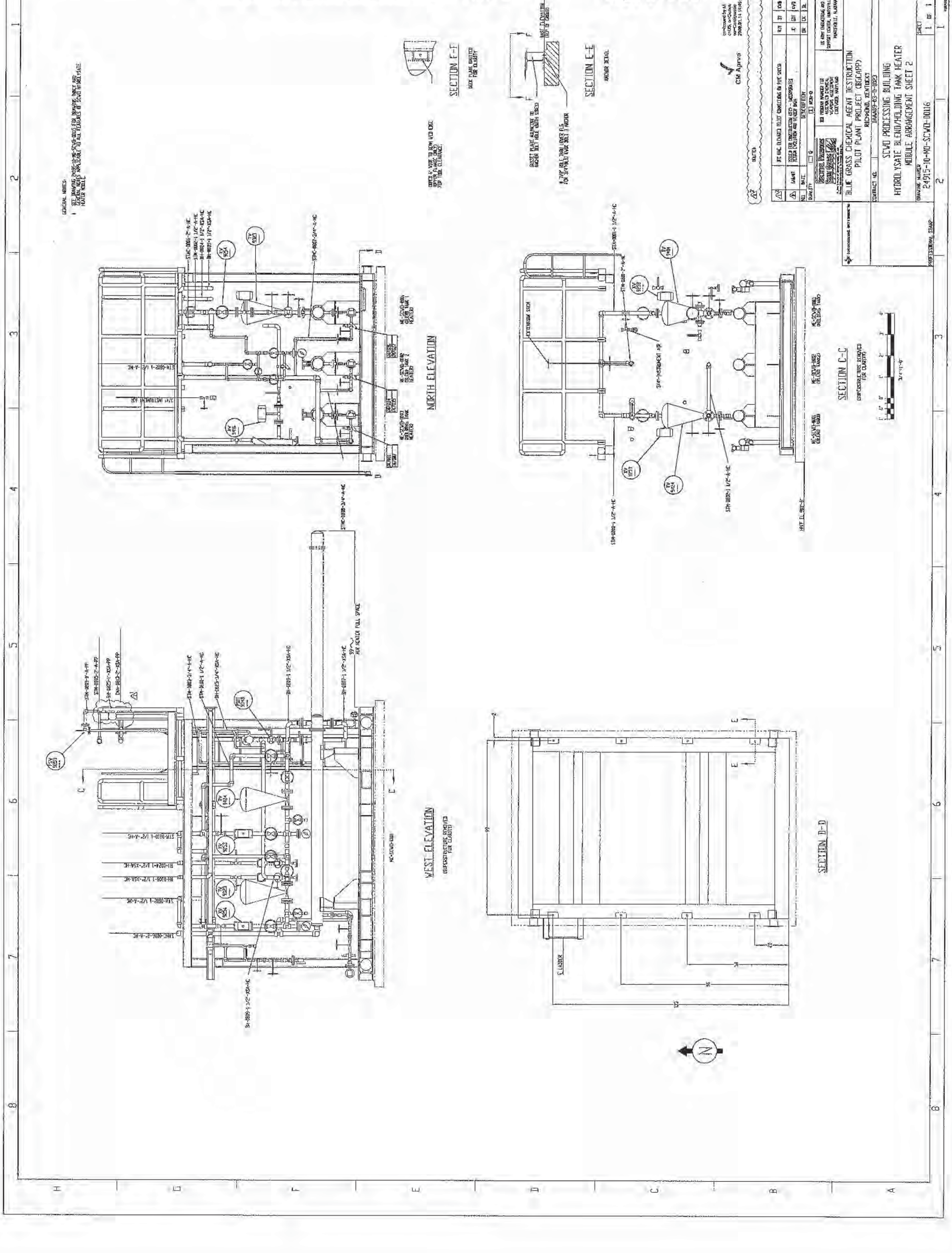
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

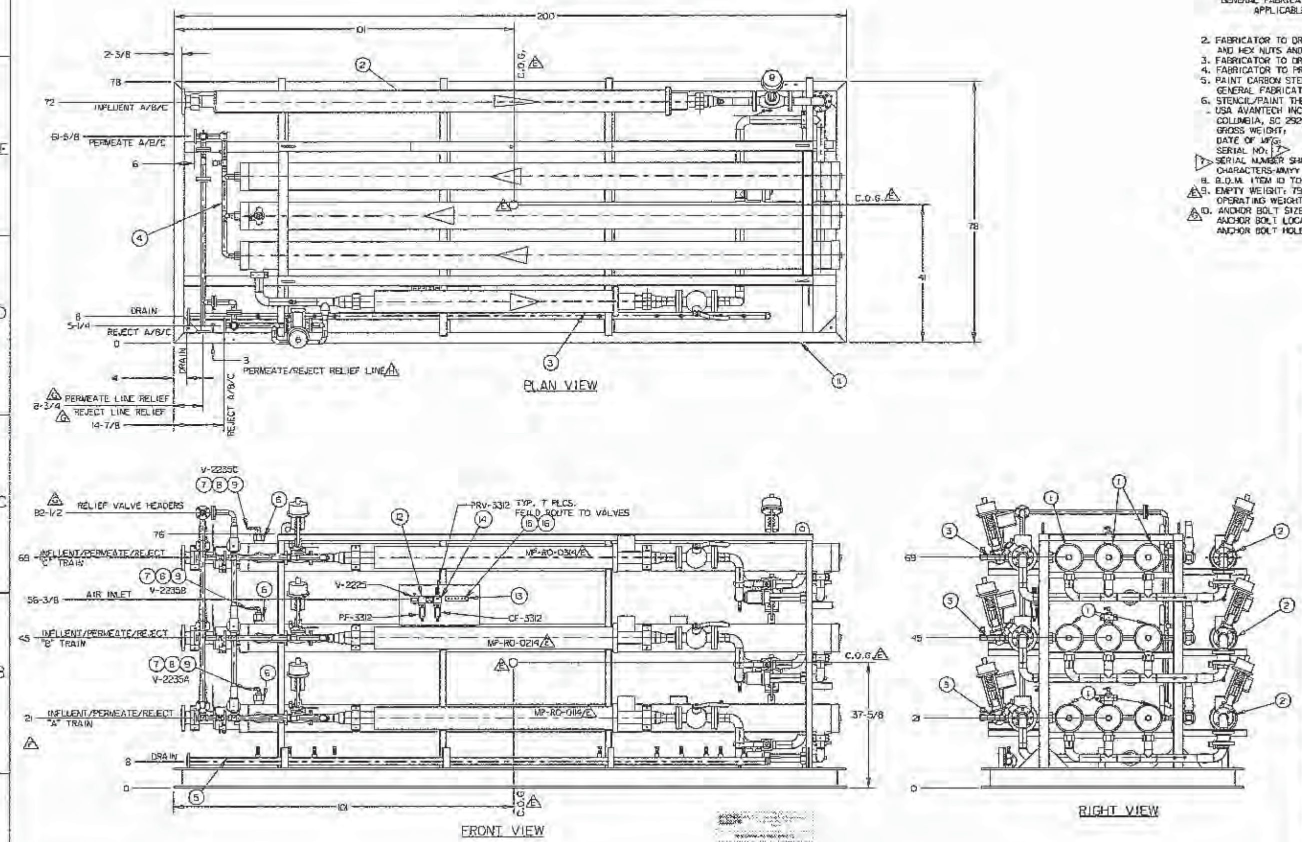
SCWO PROCESSING BUILDING
HYDROLYSATE HEATER MODULE
INTERFACE CONTROL DRAWING

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-B2-SCWO-00012 SHEET 1 OF 1 REV 1


NORTH ELEVATION
WEST ELEVATION
SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
BLUE GRASS CHEMICAL AGENT DESTRUCTION
PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
SCWO PROCESSING BUILDING
HYDROLYSATE BLEND/HOLDING TANK HEATER
MODULE ARRANGEMENT SHEET 2
24915-10-M0-SCWO-00116

no comments



NOTES:

1. MATERIALS, FABRICATION, INSPECTION, TESTING AND DOCUMENTATION TO BE PERFORMED IN ACCORDANCE WITH AVANTECH DOCUMENT NO. 9C500-0702-00 "GENERAL FABRICATION SPECIFICATION" AND APPLICABLE DATA SHEET(S).
   APPLICABLE DRAWINGS: 2F310-0702-D
   2F510-0702-D
   2F610-0702-D
2. FABRICATOR TO DRILL HOLES ON PIPE SUPPORTS FOR U-BOLTS. SUPPLY S.S. U-BOLTS W/ LOCK WASHERS AND HEX NUTS AND MOUNT U-BOLTS
3. FABRICATOR TO DRILL HOLES ON CONTROL PANEL SUPPORTS FOR PANEL MOUNTING
4. FABRICATOR TO PROVIDE ADDITIONAL PIPE SUPPORTS IF/AS NEEDED
5. PAINT CARBON STEEL IN ACCORDANCE WITH GENERAL FABRICATION SPECIFICATION "9C500-0702-00"
6. STENCIL/PAINT THE FOLLOWING INFORMATION AT A CONVENIENT LOCATION
   - USA AVANTECH INCORPORATED
   COLUMBIA, SC 29212
   GROSS WEIGHT:
   DATE OF MFG:
   SERIAL NO: 7
7. SERIAL NUMBER SHALL BE: AVANTECH JOB NUMBER-FIRST FIVE DRAWING NUMBER CHARACTERS-MMYY OF MANUFACTURE-SEQUENTIAL NUMBER. AVANTECH TO PROVIDE.
8. B.O.M. ITEM 10 TO SUPPLIED SEPERATELY AND TO BE INSTALLED ON PLANT PIPING.
9. EMPTY WEIGHT: 7970 LBS
   OPERATING WEIGHT: 11,100 LBS
10. ANCHOR BOLT SIZE AND LOCATION ARE CALLED OUT ON THE ANCHOR BOLT LOCATION DRAWING, 2F301-0702-D
   ANCHOR BOLT HOLE CUTOUTS ARE CALLED ON FRAME WELDMENT DRAWING 2F610-0702-D

ITEM	QTY	DESCRIPTION	SPEC AND/OR PART NO
16	AR	1/4" TUBE x LAR. 0.036" MIN. THK,POLYPROPYLENE	COMMERCIAL
15	7	1/4" TUBE CONNECTOR, MALE NPT, 316 S.S.	SWAGELOK SS-400-1-4
14	1	3/8" HEX NIPPLE, THD, S.S.	COMMERCIAL
13	1	AIR DISTRIBUTION MANIFOLD	MCMASTER 5469K53
12	1	3/8" FNPT, FILTER, COALESCER, REGULATOR, W/ GAUGE SHUT OFF VALVE	NUMATICS M2203VFCXX
11	1	FRAME WELDMENT	SEE DWG. 2F610-0702-D
10	3	1" SWIRL FLOW METER, CPVC, TRU UNION	THRONTON 339060R EQ.
9	3	2" x 1/4" NPT VICTAULIC ADAPTOR, 316 S.S.	VICTAULIC
8	3	1/4" STREET ELBOW, 3000#, 316 S.S.	ASME B16.3
7	3	1/4" PLUG VALVE, MNPT x TUBE CONNECTOR, 316 S.S.	SWAGELOK 4P4T1
6	3	2" VICTAULIC COUPLING, 316 S.S.	VICTAULIC
5	1	DRAIN PIPING	SEE DWG. 2F510-0702-D, SHEET 3
4	3	PERMEATE PIPING	SEE DWG. 2F510-0702-D, SHEET 3
3	3	REJECT PIPING	SEE DWG. 2F510-0702-D, SHEET 2
2	3	INFLUENT PIPING	SEE DWG. 2F510-0702-D, SHEET 1
1	9	8" MEMBRANE HOUSING, W/ 2" PORTS, 4 ELEMENT LONG FILAMENT WOUND EPOXY/GLASS COMPOSITES	CODELINE 80A60 OR EQ.

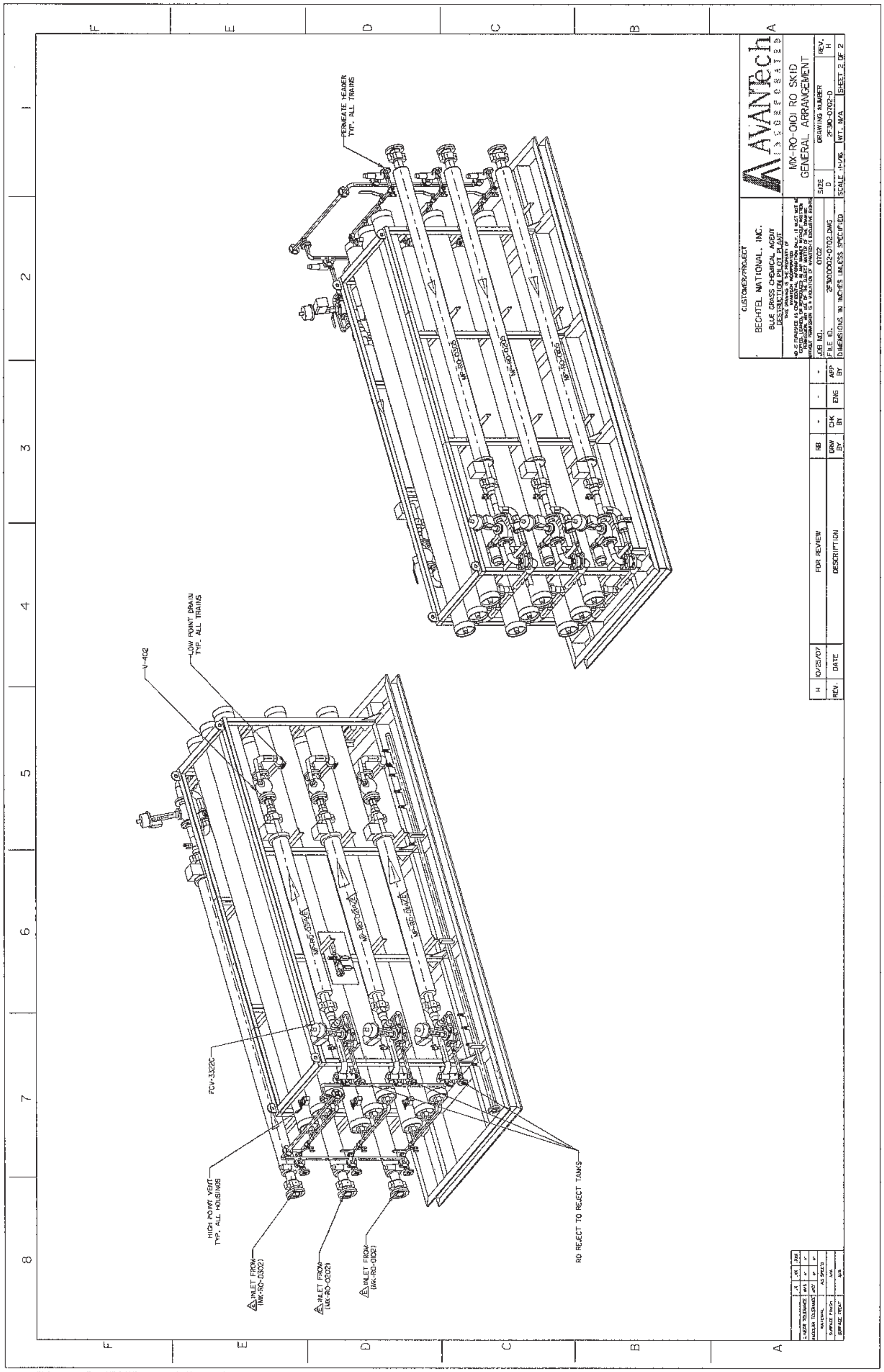
CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT

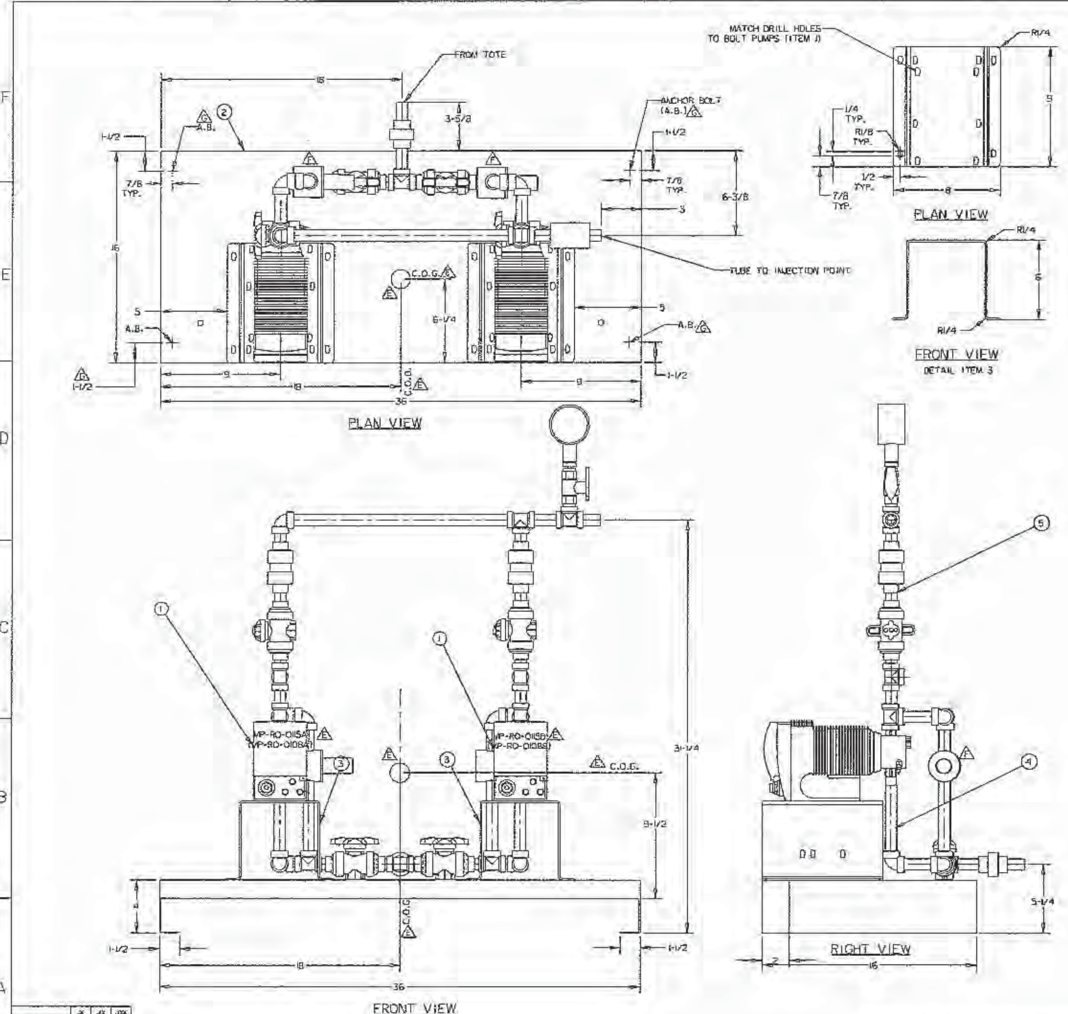
AVANTech INCORPORATED

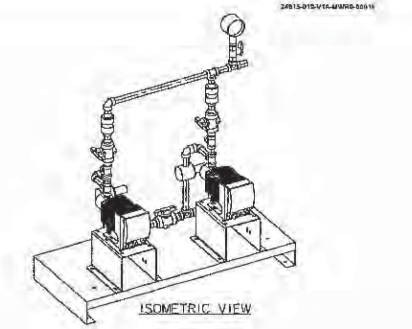
MX-RO-0101 RO SKID
GENERAL ARRANGEMENT

REV.	DATE	DESCRIPTION	DRW BY	CHK BY	ENG	APP BY
H	10/25/07	FOR REVIEW	RB	-	-	-

JOB NO.	0702
FILE ID.	2F310001-0702.DWG
DIMENSIONS IN INCHES UNLESS SPECIFIED	
SIZE	D
DRAWING NUMBER	2F310-0702-D
REV.	H
SCALE	1/16
WT.	N/A
SHEET	1 OF 2


PERMEATE HEADER TYP. ALL TRAINS
LOW POINT DRAIN TYP. ALL TRAINS
V-402
FCV-3222C
HIGH POINT VENT TYP. ALL HOUSINGS
INLET FROM (MX-RO-0302)
INLET FROM (MX-RO-0202)
INLET FROM (MX-RO-0102)
RO REJECT TO REJECT TANKS
CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT
AVANTech INCORPORATED
MX-RO-0101 RO SKID
GENERAL ARRANGEMENT
DRAWING NUMBER
REV.
H
SHEET 2 OF 2
SIZE D
WT. N/A
JOB NO. 0702
DIMENSIONS IN INCHES UNLESS SPECIFIED
H 10/25/07 FOR REVIEW RB
REV. DATE DESCRIPTION DRW BY CHK BY ENG APP BY





NOTE:

1. MATERIALS, FABRICATION, INSPECTION, TESTING AND DOCUMENTATION TO BE PERFORMED IN ACCORDANCE WITH AVANTECH DOCUMENT NO. 9C500-0702-00 "GENERAL FABRICATION SPECIFICATION" AND APPLICABLE DATA SHEET(S).
   APPLICABLE DRAWINGS: 2F312-0702-0
   2F512-0702-0
2. FABRICATOR TO DRILL HOLES ON PIPE SUPPORTS FOR U-BOLTS. SUPPLY S.S. U-BOLTS W/ LOCK WASHERS AND HEX NUTS AND MOUNT U-BOLTS
3. FABRICATOR TO DRILL HOLES ON CONTROL PANEL SUPPORTS FOR PANEL MOUNTING
4. FABRICATOR TO PROVIDE ADDITIONAL PIPE SUPPORTS IF/AS NEEDED
5. PAINT CARBON STEEL IN ACCORDANCE WITH GENERAL FABRICATION SPECIFICATION-9C500-0702-00
6. STENCIL/PAINT THE FOLLOWING INFORMATION AT A CONVENIENT LOCATION
   USA AVANTECH INCORPORATED
   COLUMBIA, SC 29212
   GROSS WEIGHT:
   DATE OF MFG:
   SERIAL NO.: 7
7. SERIAL NUMBER SHALL BE: AVANTECH JOB NUMBER-FIRST FIVE DRAWING NUMBER CHARACTERS-MMYY OF MANUFACTURE-SEQUENTIAL NUMBER. AVANTECH TO PROVIDE.
8. ALL TAG NUMBERS NOT IN BRACKETS ARE FOR COAGULANT SKID AND THOSE IN BRACKETS REFER TO THE ANTI-SCALANT SKID.
9. EMPTY WEIGHT: 50 LBS
   OPERATING WEIGHT: 53 LBS
10. ANCHOR BOLT SIZE AND LOCATION ARE CALLED OUT ON THE ANCHOR BOLT LOCATION DRAWING, 2F301-0702-0

ITEM	QTY	DESCRIPTION	SPEC AND/OR PART NO
5	1	PUMP DISCHARGE HEADER	SEE DWG. 2F512-0702-0
4	1	PUMP SUCTION HEADER	SEE DWG. 2F512-0702-0
3	2	SHEET, 9" x LAR x 14 GAUGE THK., S.S. MAKE AS SHOWN	ASTM A240
2	1	SHEET, 16" x LAR x 14 GAUGE THK, S.S. MAKE AS SHOWN	ASTM A240
1	2	PUMPS	LMI OR EQ.

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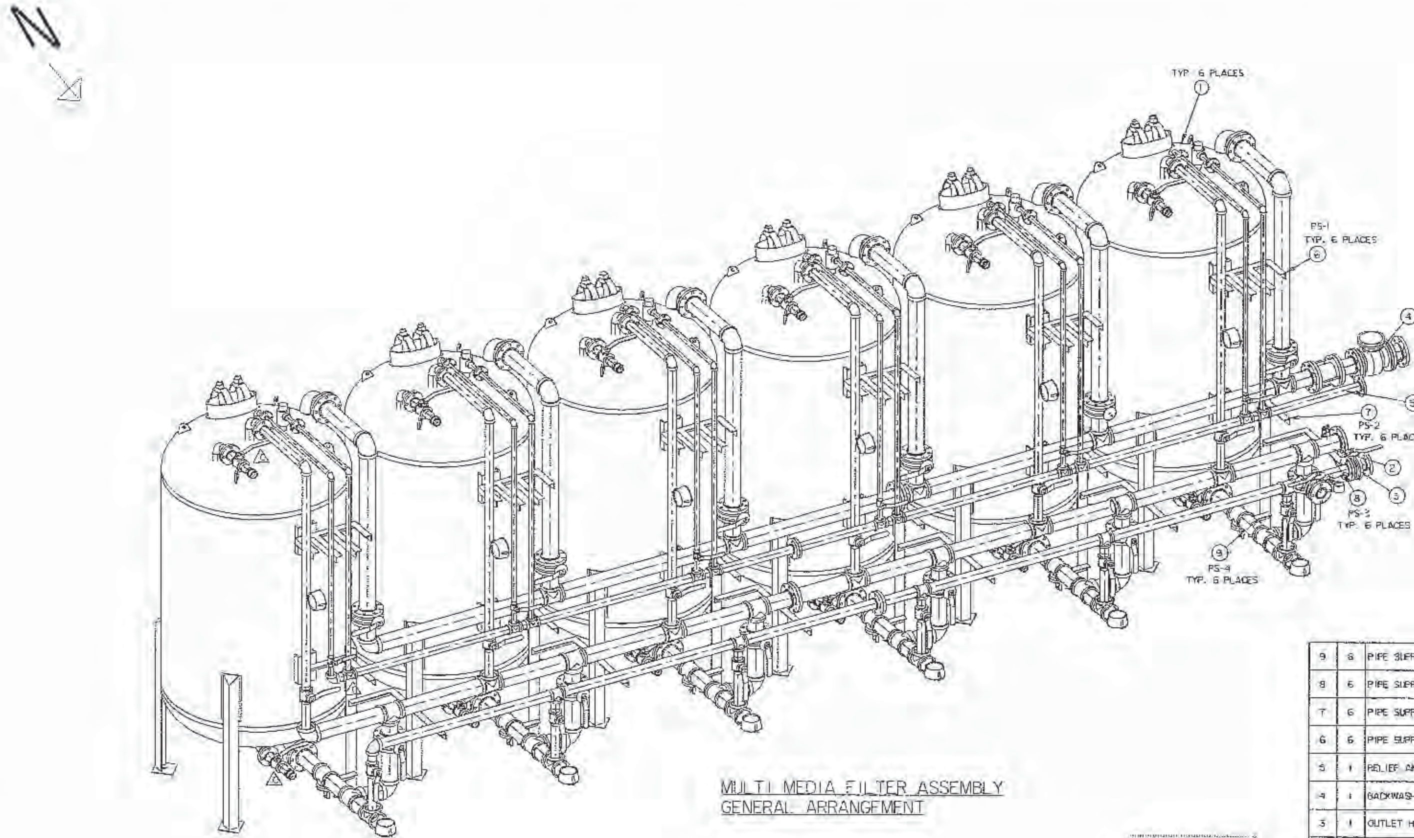
AVANTech INCORPORATED

CHEMICAL ADDITION SKID GENERAL ARRANGEMENT

REV.	DATE	DESCRIPTION	DRW BY	CHK BY	ENG	APP BY
G	09/14/07	FOR REVIEW	RB	-	-	-

JOB NO. 0702	SIZE D	DRAWING NUMBER 2F312-0702-0	REV. G
FILE ID. 2F3120001-0702.DWG			
DIMENSIONS IN INCHES UNLESS SPECIFIED	SCALE 1-1/32	WT. N/A	SHEET 1 OF 1



MULTI MEDIA FILTER ASSEMBLY
GENERAL ARRANGEMENT

ITEM	QTY	DESCRIPTION	SPEC AND/OR PART NO
9	6	PIPE SUPPORT PS-4	SEE PIPE SUPPORTS DWG
8	6	PIPE SUPPORT PS-3	SEE PIPE SUPPORTS DWG
7	6	PIPE SUPPORT PS-2	SEE PIPE SUPPORTS DWG
6	6	PIPE SUPPORT PS-1	SEE PIPE SUPPORTS DWG
5	1	RELIEF AND VENT HEADER	SEE DWG 2F513-0702-D, SHT 4
4	1	BACKWASH OUTLET HEADER	SEE DWG 2F513-0702-D, SHT 3
3	1	OUTLET HEADER	SEE DWG 2F513-0702-D, SHT 2
2	1	INLET HEADER	SEE DWG 2F513-0702-D, SHT 1
1	6	MULTI MEDIA VESSEL, ø54"	SEE DWG 2F400-0702-D

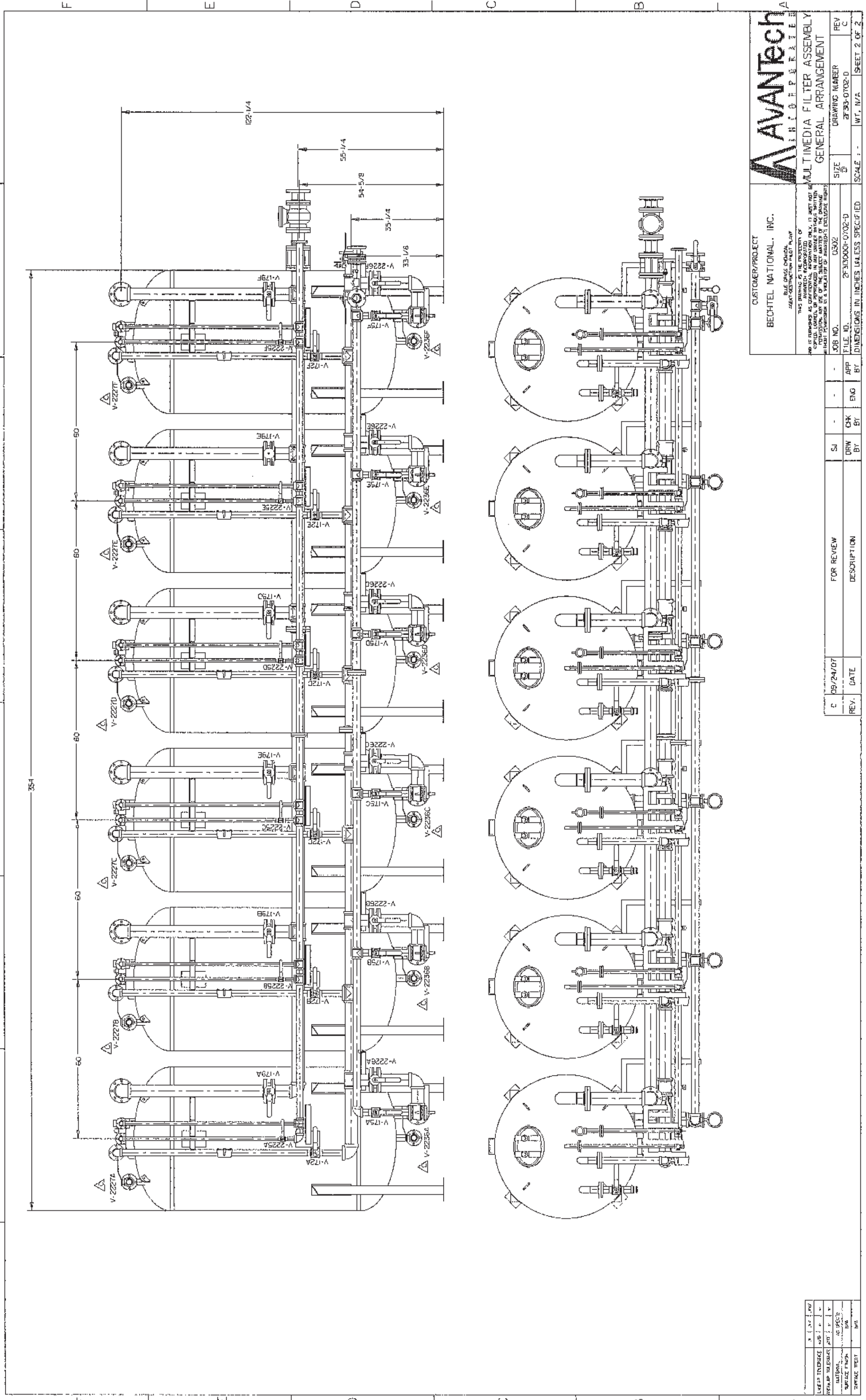
CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.

AVANTech INCORPORATED

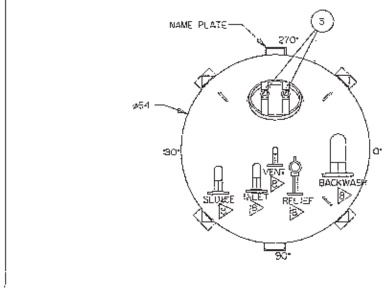
MULTIMEDIA FILTER ASSEMBLY
GENERAL ARRANGEMENT

JOB NO.	0302	SIZE D	DRAWING NUMBER 2F513-0702-D	REV. C
FILE ID.	2F313000I-0702-D	SCALE: -	WT. N/A	SHEET 1 OF 2
DIMENSIONS IN INCHES UNLESS SPECIFIED				

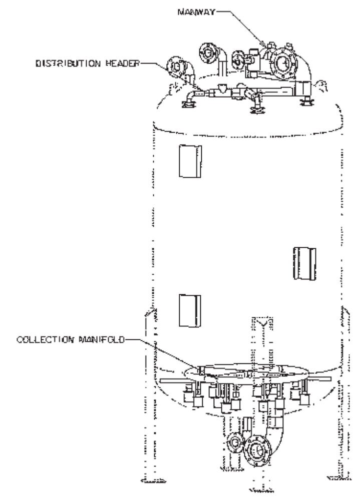
REV.	DATE	DESCRIPTION	DRW BY	CHK BY	ENG	APP BY
C	03/29/07	FOR REVIEW	SJ	-	-	-


AVANTech INCORPORATED
MULTIMEDIA FILTER ASSEMBLY
GENERAL ARRANGEMENT
CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.
FOR REVIEW
09/24/07
DIMENSIONS IN INCHES UNLESS SPECIFIED
SHEET 2 OF 2

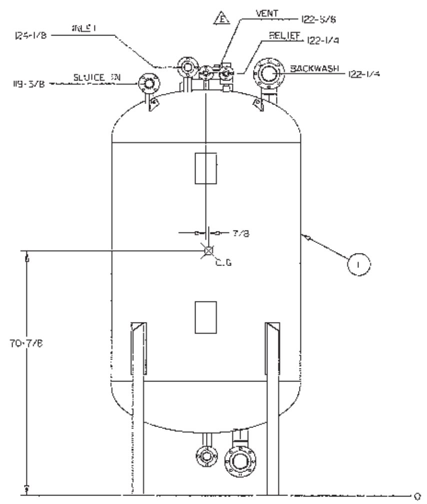
24915-010-V1A-MWR0-00041



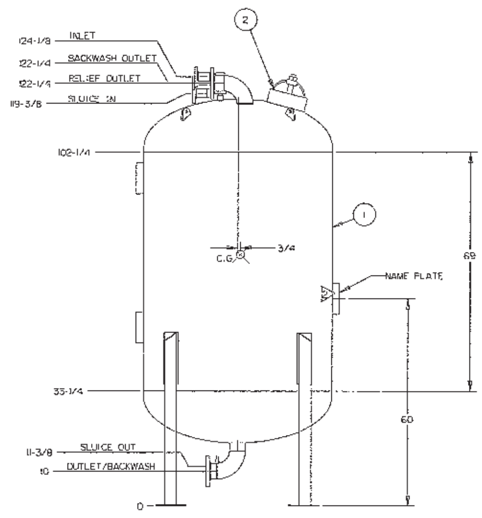
TOP VIEW



ISOMETRIC VIEW
(VESSEL SHOWN TRANSPARENT FOR CLARITY)



FRONT VIEW



RIGHT VIEW

NOTES:

1. MATERIALS, FABRICATION, NDE AND INSPECTIONS SHALL BE IN ACCORDANCE WITH THE ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, DIVISION 1, 2001. CODE STAMP AND DATA REPORT REQ'D.
DESIGN PRESSURE: 150 PSIG
DESIGN TEMPERATURE: 150° F

2 STENCIL 1" TALL LETTERS : USA
AVANTECH INCORPORATED
COLUMBIA, SC 29212
GROSS WEIGHT: 10900 LBS
EMPTY WT: [TO BE WEIGHED BY FABRICATOR]
DATE OF MFG.:
SERIAL NO.: 0702-2F400-MMYY- 01 TO 06

4. DEBURR, BREAK ALL SHARP EDGES, AND REMOVE ALL WELD SPATTER.

5. ALL WELDS ON PIPE SHALL BE FULL PENETRATION, EXCEPT AS NOTED.

6. VESSEL ESTIMATED DESIGN WT. = 2410 LBS.

7. PIPE THREADS SHALL CONFORM TO ANSI B1.20.1. (PIPE THREADS GENERAL PURPOSE), OR ANSI B1.20.3. (DRY SEAL PIPE THREADS).

8 NOZZLES: STENCIL BLACK PAINT, 3/4" TALL LETTERS. "[AS SHOWN]"

9. DIMENSIONS ARE FOR REFERENCE ONLY UNLESS OTHERWISE STATED.

11 GENERAL TOLERANCES APPLY

12. USE ANTI-SIEZE ON ALL S.S. FASTENERS

13. FABRICATION TO BE PERFORMED IN ACCORDANCE WITH AVANTECH'S DOC. #9C500-0300-00 AND #9C400-0300-00

14. CARBON STEEL SURFACES SHALL BE BLASTED USING STEEL SHOT OR EQUIVALENT METHOD TO REMOVE REST, MILL SCALE AND WELD SLAG. WELD SPLATTER AND SURFACE ROUGHNESS SHALL BE REMOVED BY CHIPPING AND GRINDING SMOOTH. PRIMER COAT SHALL BE DUPONT 25P, HIGH SOLIDS EPOXY MASTIC, OR APPROVED EQ. AS A MIN, APPLIED WITH A MIN. DRY FILM THK. OF 5 MILS. THE FINISH COAT SHALL BE DUPONT 50P POLYACRYL ANHYDRIDE ENAMEL, OR APPROVED EQ, AS A MIN., APPLIED WITH A MIN. DFT OF 4 MILS. THE FINISH COAT SHALL MATCH FEDERAL SPEC GRAY COLOR CHIP NO. 16187 OR APPROVED EQ. AS A MIN.

15. FOR ANCHOR LOCATIONS SEE DWG. 2F301-0702-0.

DOCUMENT REVIEW STATUS

ITEM	QTY	DESCRIPTION	SPEC AND/OR PART NO
3	4	BELLVILLE WASHERS, CS	PRECISION SPECIALITIES OR EQ.
2	1	12" x 16" YOKE AND BOLT MANWAY, CS	INTERTECH #479-336-5085 OR EQ.
1	1	54" O. D. PRESSURE VESSEL	SEE SHEET 2

CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.
BLUE GRASS CHEMICAL AGENT-DESTRUCTION PILOT PLANT

AVANTech INCORPORATED

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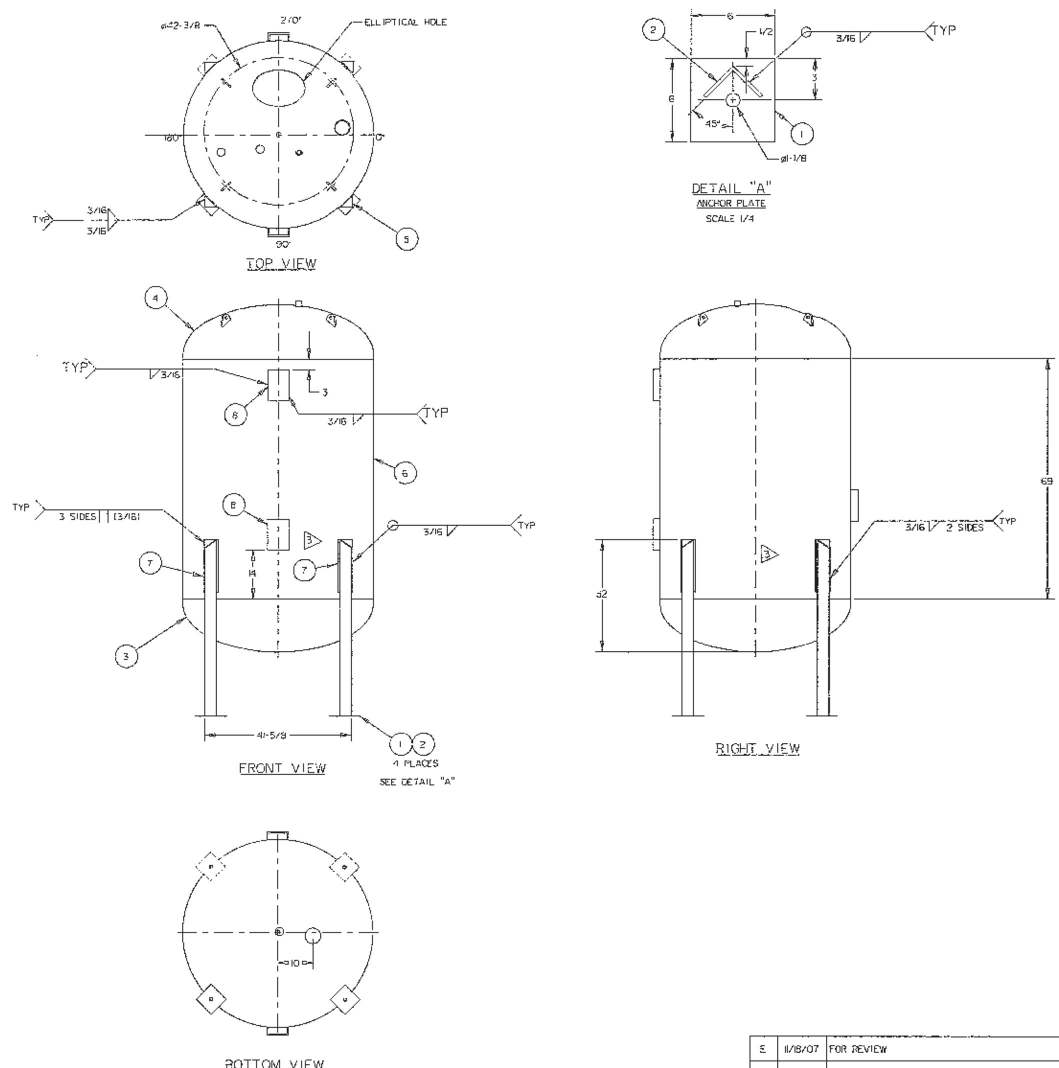
54" INCH DIAMETER MEDIA VESSEL CS ASSEMBLY

REV.	DATE	DESCRIPTION	DRW BY	CHK BY	ENG	APP BY
E	11/18/07	FOR REVIEW	SJ			

JOB NO. 07-02	SIZE D	DRAWING NUMBER 2F400-0702-0		REV. E
FILE ID. 2F400000-0702-D				
DIMENSIONS IN INCHES UNLESS SPECIFIED	SCALE 1:16	WT. N/A	SHEET 1 OF 6	



NOTES:

1 PRESSURE BOUNDARY SHELL AND WELD SIZE NOT SPECIFIED TO BE DETERMINED BY FABRICATOR IN ACCORDANCE WITH THE ASME B & PV CODE, SECTION VIII, DIV. 1, 2004

2 NOZZLES AND MANWAY NOT SHOWN FOR CLARITY

3 TRIM ITEM-2 @ TOP 45° FOR ITEM-5 ATTACHMENT

4 ITEMS- 3, 4 AND SHELL MAY BE FABRICATED FROM MORE THAN ONE PIECE, SEAM WELDED AS REQUIRED.

ITEM	QTY	DESCRIPTION	SPEC AND/OR PART NO
8	2	C-CHANNEL C6 x 13, 9" LG., CS	ASTM A36
7	4	RECTANGULAR PLATE, 15" x 5 3/4" x 1/4" THK, CS	ASTM A36
6	1	PLATE FOR SHELL, AS REQ'D, THK x LAR, ROLLED TO 54" OD, CS	ASTM A516
5	4	TRIANGULAR PLATE, 4 x 4 x 4 5/8 x 1/4" THK, CS	ASTM A36
4	1	TOP HEAD	SEE SHEET 3
3	1	BOTTOM HEAD	SEE SHEET 5
2	4	ANGLE, 3 x 3 x 3/8" THK, 50" LG, CS	ASTM A36
1	4	PLATE, 6 x 6 x 3/8" THK, CS	ASTM A36

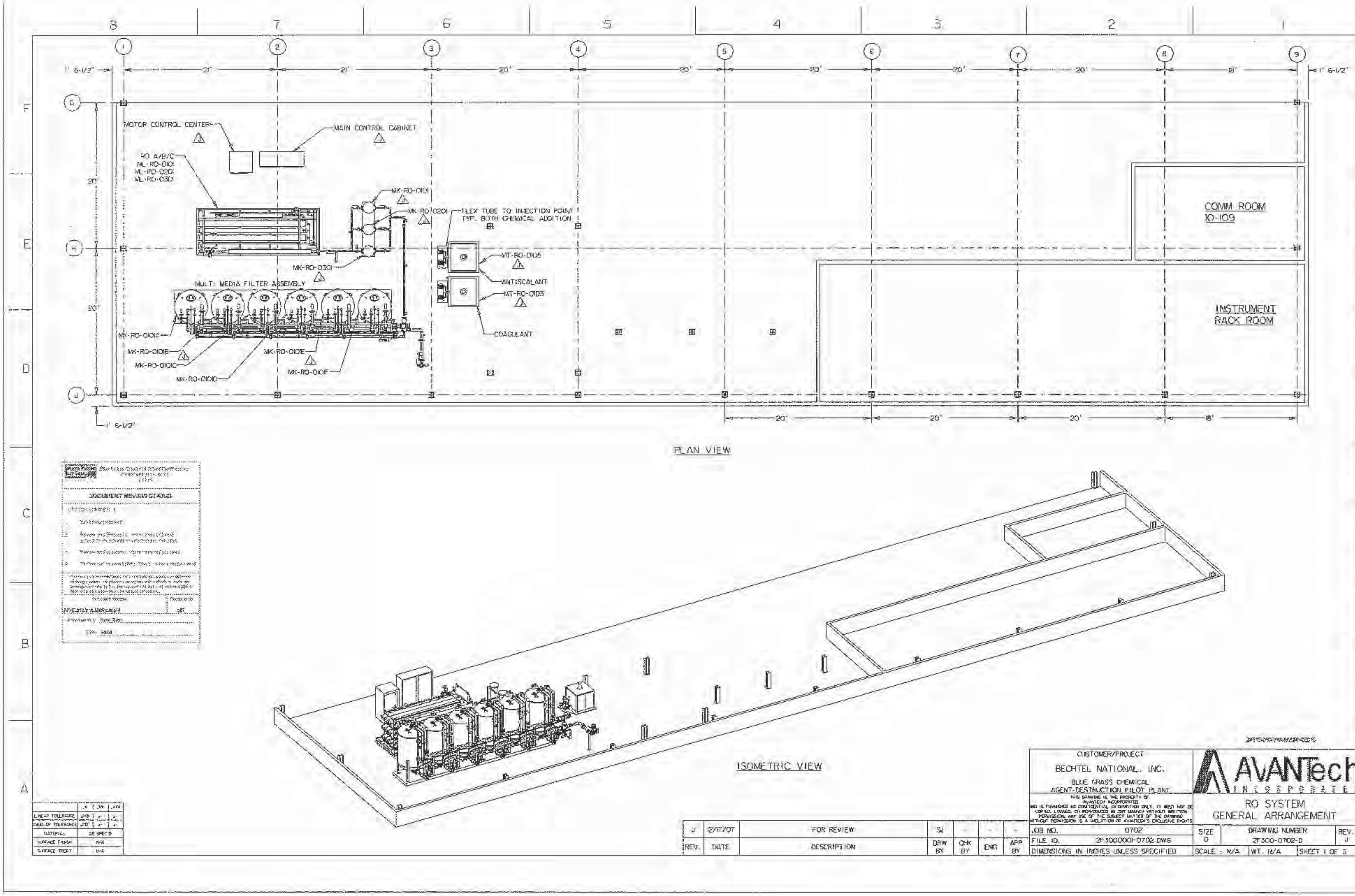
CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.
BLUE GRASS CHEMICAL AGENT-DESTRUCTION PILOT PLANT

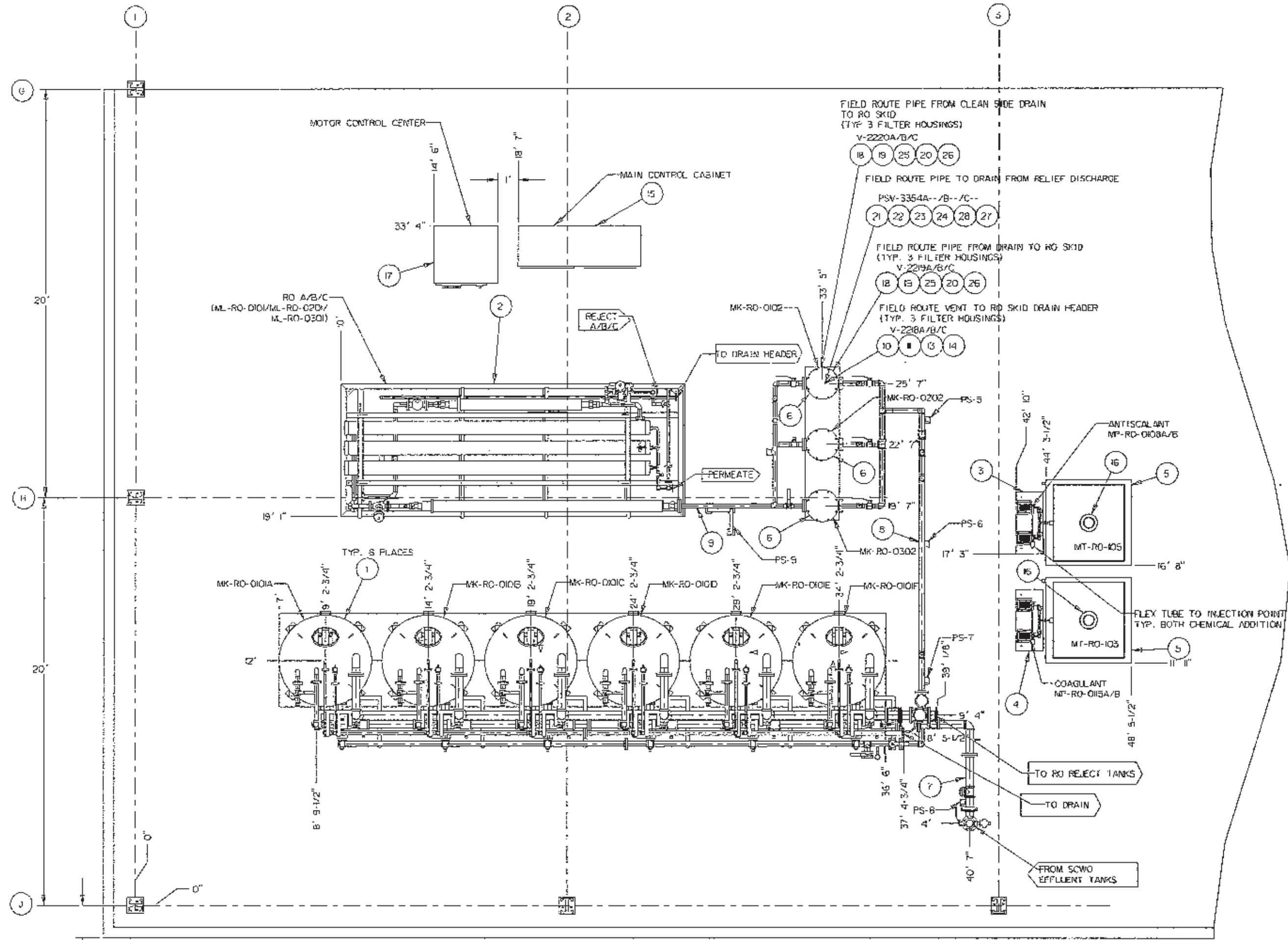
AVANTech INCORPORATED

54" INCH DIAMETER CS MEDIA VESSEL ASSEMBLY

REV.	DATE	DESCRIPTION	DRW BY	CHK BY	ENG	APP BY
E	11/18/07	FOR REVIEW	SJ			

JOB NO. 07-02	SIZE D	DRAWING NUMBER 2F400-0702-D		REV. E
FILE ID. 2F4000002-0702-D				
DIMENSIONS IN INCHES UNLESS SPECIFIED	SCALE 1"=1/16	WT. N/A	SHEET 2 OF 6	


MOTOR CONTROL CENTER
MAIN CONTROL CABINET
RO A/B/C
ML-RO-0101
ML-RO-0201
ML-RO-0301
MK-RO-0101
MK-RO-0201
FLEX TUBE TO INJECTION POINT
TYP. BOTH CHEMICAL ADDITION
MK-RO-0301
MULTI MEDIA FILTER ASSEMBLY
MT-RO-0105
ANTISCALANT
MT-RO-0105
COAGULANT
MK-RO-0101A
MK-RO-0101B
MK-RO-0101C
MK-RO-0101D
MK-RO-0101E
MK-RO-0101F
COMM ROOM
10-109
INSTRUMENT
RACK ROOM
PLAN VIEW
ISOMETRIC VIEW
DOCUMENT REVIEW STATUS
CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.
BLUE GRASS CHEMICAL
AGENT-DESTRUCTION PILOT PLANT
AVANTech INCORPORATED
RO SYSTEM
GENERAL ARRANGEMENT
J 12/17/07 FOR REVIEW SJ
REV. DATE DESCRIPTION DRW BY CHK BY ENG APP BY
JOB NO. 0702
FILE ID. 2F-300000I-0702.DWG
DIMENSIONS IN INCHES UNLESS SPECIFIED
SIZE D
DRAWING NUMBER 2F300-0702-D
REV. J
SCALE : N/A WT. N/A SHEET 1 OF 5



PLAN VIEW

ITEM	QTY	DESCRIPTION	SPEC AND/OR PART NO
28	3	3/4" 90 ELBOW, SOCKET ENDS, SCH 80, PVC	ASTM D2467
27	AR	3/4" PIPE x LAR, SCH 80, PVC	ASTM D1785
26	AR	1" PIPE x LAR, SCH 80, PVC	ASTM D1785
25	6	1" 90 ELBOW, SOCKET ENDS, SCH 80, PVC	ASTM D2467
24	3	3/4" PIPE, TOE, SCH 80, PVC	ASTM D2464
23	3	3/4" x 1" RELIEF VALVE, CS	KUNKLE OR EQ.
22	3	3/4" 90 ELBOW, THD., C.S	ASME B16.3
21	3	3/4" HEX NIPPLE, C.S	ASME B16.3
20	6	1" PIPE x LAR, TOE, SCH 80, PVC	ASTM D2464
19	6	1" BALL VALVE, FNPT, C.S	FLOWTEK OR EQ.
18	6	1" NIPPLE x LAR, SCH 80, PVC	ASTM D2464
17	1	MOTOR CONTROL CENTER	SEE DWG. 2F730-0702-E
16	2	MIXER W/ MOUNTING BRACKET	PULSAFEEDER 42742 OR EQ.
15	1	MAIN CONTROL CABINET	SEE DWG. 2F710-0702-D
14	AR	1/2" TUBE x LAR, POLYPROPYLENE, 0.056" MIN THK	COMMERCIAL
13	3	1/2" TUBE CONNECTOR, MALE NPT, 316 S.S.	SWAGELOK SS-810-1-8 OR EQ.
12	-	-DELETED-	---
11	3	1/2" BALL VALVE, C.S., NPT	FLOWTEK OR EQ.
10	3	1/2" HEX NIPPLE, C.S.	ASME B16.3
9	1	INTERCONNECTING PIPE- RO SKID INLET	SEE DWG. 2F500-0702-D,SHEET 3
8	1	INTERCONNECTING PIPE- CARTRIDGE FILTER INLET	SEE DWG. 2F500-0702-D,SHEET 2
7	1	INTERCONNECTING PIPE- MEDIA FILTER INLET HEADER	SEE DWG. 2F500-0702-D,SHEET 1
6	3	CARTRIDGE FILTER HOUSING, 3" FLANGED CONNECTION, 36-10" ELEMENTS, 5 MICRON	JAMISON JCF-150-3-36
5	2	CHEMICAL ADDITION TOTE, 250 GALLON 45" x 45" x 44" TALL (TO BE SUPPLIED BY BECHTEL)	WATCO TANKS MODEL B-250
4	1	COAGULANT INJECTION SKID	SEE DWG. 2F312-0702-D
3	1	ANTI-SCALANT INJECTION SKID	SEE DWG. 2F312-0702-D
2	1	RO SKID	SEE DWG. 2F310-0702-D
1	6	MULTI-MEDIA FILTER ASSEMBLY, ø54", 29' 6" O.A.L	SEE DWG. 2F513-0702-D

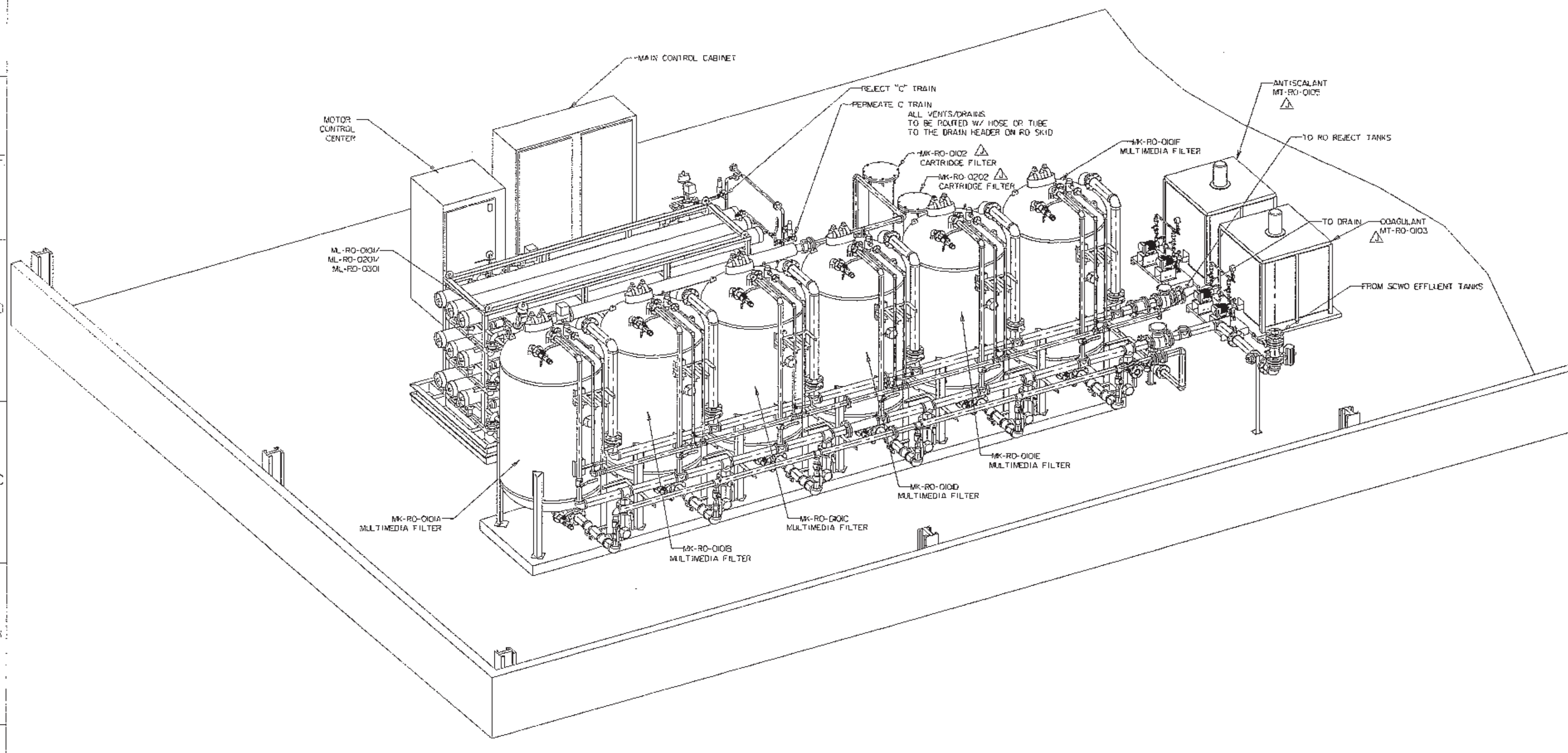
CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.
BLUE GRASS CHEMICAL AGENT-DESTRUCTION PILOT PLANT

AVANTech INCORPORATED

CONCEPTUAL GENERAL ARRANGEMENT

REV.	DATE	DESCRIPTION	DRW BY	CHK BY	ENG	APP BY
J	12/17/07	FOR REVIEW	SJ	-	-	-

JOB NO. 0702	SIZE D	DRAWING NUMBER 2F300-0702-D	REV. J
FILE ID. 2F300002-0702.DWG	SCALE 1/32	WT. N/A	SHEET 2 OF 3
DIMENSIONS IN INCHES UNLESS SPECIFIED			



CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.
BLUE GRASS CHEMICAL AGENT-DESTRUCTION PILOT PLANT

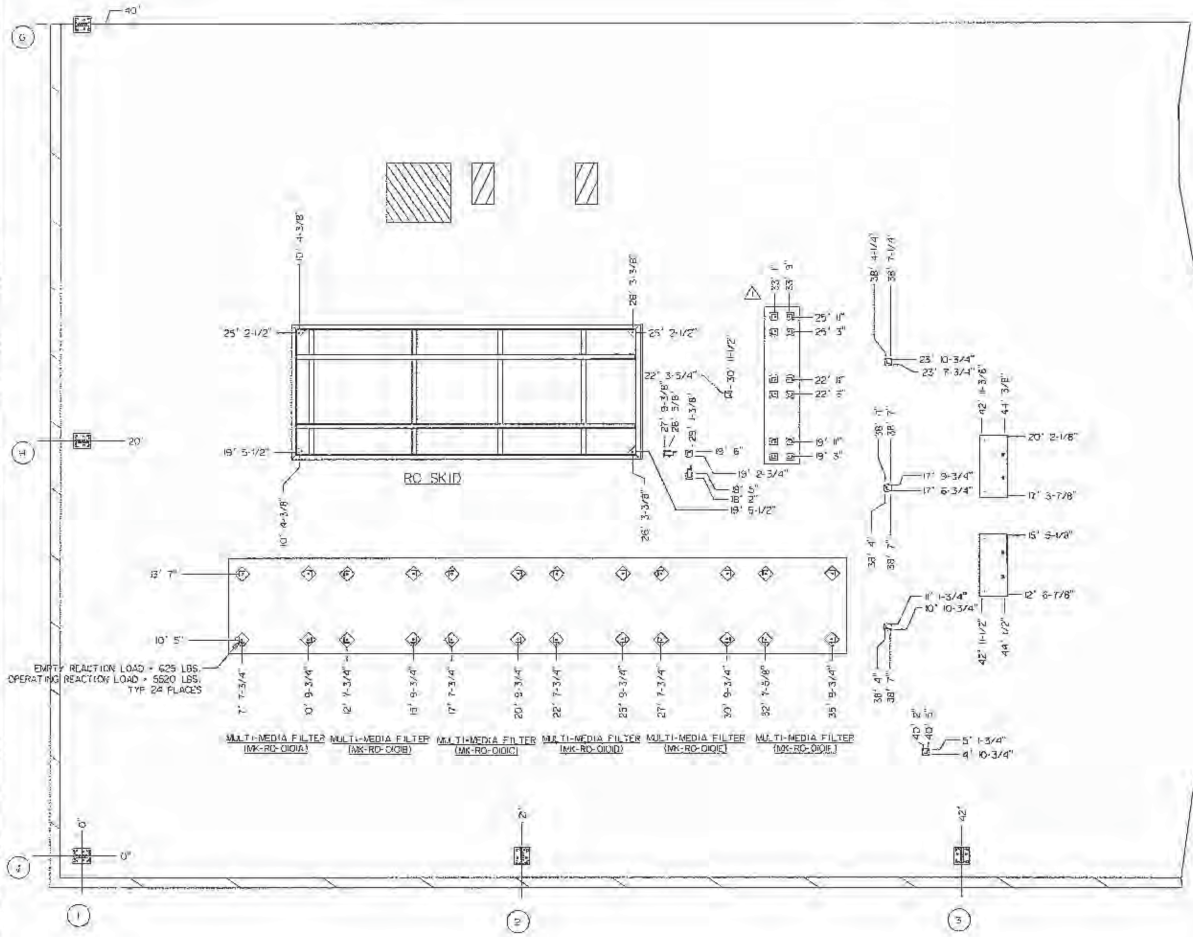
AVANTech INCORPORATED

CONCEPTUAL GENERAL ARRANGEMENT

REV.	DATE	DESCRIPTION	DRW BY	CHK BY	ENG	APP BY
J	12/17/07	FOR REVIEW	SJ	-	-	-

JOB NO.	0702
FILE ID.	2F3000003-0702.DWG
DIMENSIONS IN INCHES UNLESS SPECIFIED	

SIZE	DRAWING NUMBER	REV.
D	2F300-0702-D	J
SCALE 1/32	WT. N/A	SHEET 3 OF 3



ITEM	SKID DESCRIPTION	ANCHOR BOLT SPEC	NO. OF ANCHORS	BOLT SIZE	MIN. EMBEDMENT DEPTH
7	RO SKID	EMBED BOLTS (ASTM F1554, GRADE 36)	4	ø1"	12"
6	CARTRIDGE FILTER C (MK-RO-0302)	POST INSTALLED EPOXY ANCHORS, ITW/RAMSET CERAMIC 6 W/A-307 ANCHOR RODS	4	ø 1/2"	6"
5	CARTRIDGE FILTER B (MK-RO-0202)	POST INSTALLED EPOXY ANCHORS, ITW/RAMSET CERAMIC 6 W/A-307 ANCHOR RODS	4	ø 1/2"	6"
4	CARTRIDGE FILTER A (MK-RO-0102)	POST INSTALLED EPOXY ANCHORS, ITW/RAMSET CERAMIC 6 W/A-307 ANCHOR RODS	4	ø 1/2"	6"
3	ANTISCALANT SKID (MP-RO-0105A/B)	POST INSTALLED EPOXY ANCHORS, ITW/RAMSET CERAMIC 6 W/A-307 ANCHOR RODS	4	ø 3/8"	3-3/8"
2	COAGULANT SKID (MP-RO-0115A/B)	POST INSTALLED EPOXY ANCHORS, ITW/RAMSET CERAMIC 6 W/A-307 ANCHOR RODS	4	ø 3/8"	3-3/8"
1	MULTI-MEDIA FILTERS (MK-RO-0101A TO F)	POST INSTALLED EPOXY ANCHORS, ITW/RAMSET CERAMIC 6 W/A-307 ANCHOR RODS FOR REFERENCE ONLY, QTY MAY VARY	24	ø 1"	12"

REV.	DATE	DESCRIPTION	DRW BY	CHK BY	ENG	APP BY
1	11/8/07	FOR REVIEW	SJ	-	-	-

CUSTOMER/PROJECT
BECHTEL NATIONAL, INC.
BLUE GRASS CHEMICAL AGENT-DESTRUCTION PILOT PLANT

AVANTech INCORPORATED

RO SYSTEM
EQUIPMENT ANCHOR LOCATION

JOB NO. 0702	SIZE D	DRAWING NUMBER 2F30I-0702-D	REV. 1
FILE ID. 2F30I0001-0702-DWG	SCALE 1/32	WT. N/A	SHEET 1 OF 1
DIMENSIONS IN INCHES UNLESS SPECIFIED			

Patel, Chiman

From: Patel, Chiman
Sent: Thursday, September 06, 2007 7:16 AM
To: Aquino, Wilson; Briceno, Cairo
Subject: FW: STA tank volume

Tracking: **Recipient** **Read**
Aquino, Wilson
Briceno, Cairo Read: 9/6/2007 7:53 AM

For STA fdn & dike wall

-----Original Message-----
From: Weitzman, Leo
Sent: Thursday, September 06, 2007 5:17 AM
To: Patel, Chiman; Regan, Kevin
Cc: Phillips, John; Lawrence, Samir; Thakur, Shri; Parson, Gary
Subject: RE: STA tank volume

Thanks for Checking, Chiman.

1. Yes, the contained air volume of the largest tank must be used to size the containment

2. The STA tanks are outside so they need to be sized to contain both rainwater and 100% of the contents of the largest tank. The rainwater containment volume that we are using for this project is 5.75" (the 25-year, 24 hour rainfall event for Madison Co, KY). 110% is only required for agent-containing tanks.

Please feel free to contact Kevin or me if you have any more questions.

Regards,
Leo

Leo Weitzman
Bechtel Parsons Blue Grass
301 Highland Park Drive
Richmond, KY 40475
E-mail: lweitzma@bechtel.com
859-625-1277 Richmond Office
765-430-0809 Cell
859-625-9918 FAX

From: Patel, Chiman
Sent: Wednesday, September 05, 2007 7:41 PM
To: Regan, Kevin; Weitzman, Leo
Cc: Phillips, John; Lawrence, Samir (OWAPF); Thakur, Shri (OWAPF); Parson, Gary
Subject: STA tank volume

Kevin / Leo

STA (storage tanks area) located south of SPB (SCWO Process Bldg.) has 8-tanks. The largest among them is MT-RO-0106/0206 which has 65500 gallon capacity and in size 21'dia & 32' high. Structural has to size peripheral wall height to retain 110% liquid volume of the tank. Should the gallons capacity or air volume be used to size the wall? I asked John Phillips (mechanical process) the same question and his reply were to use air volume but he asked me to check with you. The tank volume is 9631 cu.ft based on 110% of 65500 gallons capacity while it is 12191.9cu.ft based on air volume.

Chiman N. Patel, P.E, S.E.

Structural Engineer

626-440-4148

Appendix B

Exterior Cable Tray Support Foundations

B.1. Objective

The calculation performed in this appendix includes structural analysis and design of isolated footings for supports of elevated cable trays along the exterior of the SCWO Processing Building (SPB).

B.2. Inputs

The cable trays are located along the Eastern wall of the SPB between column lines B and J. See Drawing no. 24915-10-DB-00-00009 to 00011, 24915-10-DB-00-00061for footing locations.

(1) The cable trays have a rectangular cross-section 3'-0" wide and 9" tall.

(2) Six isolated footings are designed individually using the reaction output from GTSTRUDL.

(3) Two worst-case designs were chosen, one worst case was used for footings at B, C, and D and another was used for footings at E, F, and G.

(4) Construction materials are listed in Section 2.1 and load information is listed in Section 2.2.

B.3 Assumptions

Cable tray weight is assumed to be 110plf per request of electrical group.

Seismic loads are not considered in the analysis because they produced lower shear and overturning values than the wind loads.

B.4 Calculation Body

Base reactions from GTSTRUDL steel analysis and design are given here. These loads are the input for the Foundation3D footing design. Designs for the six individual footings are included in this appendix. Note that the designs for the footings at column lines B, C, D are the same (F-23), as are the designs for footings E, F, and G (F-22).

Reaction Values from GTSTRUDL Analysis (units: kip, ft)

	Joint #	Load Case	Z FORCE	X FORCE	Y MOMENT	Y FORCE	X MOMENT
FOUNDATION DESIGN F-23 JOINT 4 IS CONTROLLING CASE	3	'DEADLOAD'	3.005	0.000	9.169	0.001	-0.025
	3	'SNOW'	0.450	0.000	1.674	0.000	0.002
	3	'WLEW'	0.000	0.835	11.598	0.001	-0.019
	3	'WLNS'	0.000	0.000	0.000	-0.302	2.667
	4	'DEADLOAD'	3.184	0.000	9.833	0.000	0.000
	4	'SNOW'	0.900	0.000	3.346	0.000	0.000
	4	'WLEW'	0.000	1.005	14.444	0.000	0.000
	4	'WLNS'	0.000	0.000	0.000	-0.304	2.715
	5	'DEADLOAD'	3.184	0.000	9.839	0.001	-0.025
	5	'SNOW'	0.900	0.000	3.348	0.000	0.002
	5	'WLEW'	0.000	1.005	14.446	0.001	-0.019
	5	'WLNS'	0.000	0.000	0.001	-0.302	2.667
FOUNDATION DESIGN F-22 JOINT 13 IS CONTROLLING CASE	6	'DEADLOAD'	5.342	0.001	21.019	0.003	-0.019
	6	'SNOW'	0.900	0.000	4.245	0.000	-0.003
	6	'WLEW'	0.000	1.357	18.910	-0.001	0.007
	6	'WLNS'	0.000	0.268	4.082	-0.077	0.113
	13	'DEADLOAD'	7.336	-0.002	27.361	0.810	-0.021
	13	'SNOW'	0.810	0.000	3.812	0.057	-0.003
	13	'WLEW'	-0.002	1.922	26.646	-0.001	-0.002
	13	'WLNS'	-1.327	-0.268	-4.077	-0.948	0.072
	14	'DEADLOAD'	3.117	0.001	8.715	-0.816	0.008
	14	'SNOW'	0.136	0.000	0.653	-0.057	0.001
	14	'WLEW'	0.002	1.203	13.064	-0.001	-0.002
	14	'WLNS'	1.327	0.000	-0.006	-1.119	0.059

CIVIL ENGINEERING

FOUNDATION ANALYSIS/DESIGN REPORT

Miscellaneous: Fdn at Grid Line F

PROJECT NO. : 10-DBC-00-00004

PROJECT NAME : SCWO Exterior Cable Tray Support Foundation at Node 4

PROJECT LOCATION : Richmond, KY

CLIENT :

PROJECT TYPE :

REFERENCE DOCUMENTS : ____

____

____

By: ________________ Checked: ________________ Approved: ________________

Date: ________________ Date: ________________ Date: ________________

Parsons

100 West Walnut, Pasadena, CA

Units:

Input Units:	English	Output Units:	English	Code:	ACI 318 - 2002

Concrete Parameters:

Compressive Strength : (psi)	4000	Unit Weight : (pcf)	150
Pier Concrete Cover:		Allowable Concrete Stress increase:	
E-W Direction : (in)	3	Wind	0.00%
N-S Direction : (in)	3	Earthquake	0.00%
Footing Concrete Cover:		Test	0.00%
E-W Direction : (in)	3		
N-S Direction : (in)	3		
Top Steel to Top of footing : (in)	2		
Bot Steel to Bot of footing/ Top of Pile : (in)	3		

Reinforcing Steel Parameters:

Yield Strength : (ksi)	60	Unit Weight of Steel: (pcf)	490
Modulus of Elasticity of Steel: (ksi)	29000	Footing Bar Spacing:	
Pier Bars and Spacing:		Min Rebar spacing: (in)	3
Min Rebar spacing: (in)	3	Max Rebar spacing: (in)	12
Max no. of bars per Pier	800	Max Footing Rebar Size	9
Temperature and Shrinkage Steel Ratio:	0.0018	Min Footing Rebar Size	5

Soil/Pile Parameters:

Foundation Type :	Soil-Supported	Soil Unit Weight : (pcf)	120
Allowable Bearing Pressure : (psf)	3000	Allowable Soil Pressure increase	
Stability Ratios/Safety Factor:		Wind	33.33%
Minimum Stability Ratio for Erection	1.5	Earthquake	33.33%
Minimum Stability Ratio for Operation	1.5	Test	20.00%
Minimum Stability Ratio for Test	1.5	Type of Soil:	Granular
Safety Factor against Lateral Forces	1.5	Passive Pressure Coeff Kp	5
		Soil To Conc. Friction f:	0.5

Pier Parameters:

Shape:	Rectangular
Min. Reinft. Ratio:	0.0018

Footing Parameters:

Min. Footing or Cap Thickness Tf (ft):	1.5
Depth of Footing or Cap below grade Df (ft):	2.5
Min. Soil cover above Footing or Cap Sc (ft):	1
Depth of Water table below grade (ft):	0
Consider Buoyancy:	No

Applied Loads Pier - P1 I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 4.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/14/2007 Checker: B. Rabe Date: 12/14/2007

Load No.	Load case	Axial KIP	Shear E-W KIP	Mom N-S KIP FT	Shear N-S KIP	Mom E-W KIP FT
1	Dead	3.18	0.00	9.83	0.00	0.00
2	Snow	0.90	0.00	3.35	0.00	0.00
3	WLEW	0.00	1.01	14.44	0.00	0.00
4	WLNS	0.00	0.00	0.00	-0.30	2.72

Allowable Strength Load Combinations Pier - P1 I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 4.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/14/2007 Checker: B. Rabe Date: 12/14/2007

Load No.	Load Combination	Axial KIP	Shear E-W KIP	Mom N-S KIP FT	Shear N-S KIP	Mom E-W KIP FT
1	Dead	3.18	0.00	9.83	0.00	0.00
2	Dead + Snow	4.08	0.00	13.18	0.00	0.00
3	Dead + 0.75Snow	3.86	0.00	12.34	0.00	0.00
4	Dead + WLEW	3.18	1.01	24.28	0.00	0.00
5	Dead + WLNS	3.18	0.00	9.83	-0.30	2.72
6	Dead + 0.75Snow + 0.75WLEW	3.86	0.75	23.18	0.00	0.00
7	Dead + 0.75Snow + 0.75WLNS	3.86	0.00	12.34	-0.23	2.04
8	0.6Dead + WLEW	1.91	1.01	20.34	0.00	0.00
9	0.6Dead + WLNS	1.91	0.00	5.90	-0.30	2.72

Ultimate Strength Load Combinations Pier - P1 I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 4.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/14/2007 Checker: B. Rabe Date: 12/14/2007

Load No.	Load Combination	Axial KIP	Shear E-W KIP	Mom N-S KIP FT	Shear N-S KIP	Mom E-W KIP FT
1	1.4Dead	4.46	0.00	13.77	0.00	0.00
2	1.2Dead + 0.5Snow	4.27	0.00	13.47	0.00	0.00
3	1.2Dead + 1.6Snow	5.26	0.00	17.15	0.00	0.00
4	1.2Dead + 1.6Snow + 0.8WLEW	5.26	0.80	28.71	0.00	0.00
5	1.2Dead + 1.6Snow + 0.8WLNS	5.26	0.00	17.15	-0.24	2.17
6	1.2Dead + 0.5Snow + 1.6WLEW	4.27	1.61	36.58	0.00	0.00
7	1.2Dead + 0.5Snow + 1.6WLNS	4.27	0.00	13.47	-0.49	4.34
8	1.2Dead + 0.2Snow	4.00	0.00	12.47	0.00	0.00
9	0.9Dead + 1.6WLEW	2.87	1.61	31.96	0.00	0.00
10	0.9Dead + 1.6WLNS	2.87	0.00	8.85	-0.49	4.34

BECHTEL PARSONS BLUE GRASS	Calculation Sheet	Project:	BGCAPP
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group, Inc.		Job Number:	743341
		Calc. No.	24915-10-DBC-00-00004
Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations		Sheet No.	B-10 / B-34
By: R. Murphy	Date: 12/16/2007	Sheet Rev.	D

BEARING CAPACITY I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETEAPP B CABLE TRAYS\SUPPORT AT JOINT 4.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/14/2007 Checker: B. Rabe Date: 12/14/2007

Load No.	Load Comb	Gross Soil Pres KSF	Allow Soil Pres KSF	S.R. in N/S Dir	S.R. in E/W Dir	Allow Min S.R.	Ecc. in N/S Dir FT	Ecc. in E/W Dir FT	Moment @ N/S axis KIP FT	Moment @ E/W axis KIP FT
1	Dead	0.72	3.30	100.00	4.89	1.50	0.00	0.61	9.83	0.00
2	Dead + Snow	0.84	3.30	100.00	3.85	1.50	0.00	0.78	13.18	0.00
3	Dead + 0.75Snow	0.81	3.30	100.00	4.06	1.50	0.00	0.74	12.34	0.00
4	Dead + WLEW	1.37	4.30	100.00	1.76	1.50	0.00	1.70	27.29	0.00
5	Dead + WLNS	0.77	4.30	18.04	4.89	1.50	0.11	0.61	9.83	1.80
6	Dead + 0.75Snow + 0.75WLEW	1.26	4.30	100.00	1.97	1.50	0.00	1.52	25.44	0.00
7	Dead + 0.75Snow + 0.75WLNS	0.84	4.30	24.94	4.06	1.50	0.08	0.74	12.34	1.35
8	0.6Dead + WLEW	1.87	4.30	100.00	1.89	1.50	0.00	2.43	23.36	0.00
9	0.6Dead + WLNS	0.48	4.30	16.63	7.50	1.50	0.19	0.61	5.90	1.80

PUNCHING SHEAR I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 4.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/14/2007 Checker: B. Rabe Date: 12/14/2007

Pier No.	Load Combination	Max. Load Shear Str KIPS	Applied Punch. Shear Str PSI	Allowed Punch. PSI	Pier Size FT	Pier Shape	Remarks
P1	9. 0.9Dead + 1.6WLEW	3.676	1.727	189.737	2.00 X 2.00	Square	

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group, Inc.

Calculation Sheet

Project: BGCAPP

Job Number: 743341

Calc. No. 24915-10-DBC-00-00004

Sheet No. B-12 / B-34

Sheet Rev. D

Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations

By: R. Murphy   Date: 12/16/2007

MAXIMUM FOOTING SHEAR I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 4.MSC

Proj. No.: 10-DBC-00-00004   Engr: R. Murphy   Date: 12/14/2007   Checker: B. Rabe   Date: 12/14/2007

Load No.	Load Combination	Dist. From Left Edge FT	Max. Shear E-W Dir KIPS	Applied Max. Shear Str PSI	Allowed Max. Shear Str PSI	Remarks
1	1.4Dead	5.167	-2.441	2.421	94.868	
2	1.2Dead + 0.5Snow	5.167	-2.354	2.336	94.868	
3	1.2Dead + 1.6Snow	5.167	-2.932	2.909	94.868	
4	1.2Dead + 1.6Snow + 0.8WLEW	5.167	-4.980	4.940	94.868	
5	1.2Dead + 1.6Snow + 0.8WLNS	5.167	-2.932	2.909	94.868	
6	1.2Dead + 0.5Snow + 1.6WLEW	5.167	-8.322	8.256	94.868	
7	1.2Dead + 0.5Snow + 1.6WLNS	5.167	-2.354	2.336	94.868	
8	1.2Dead + 0.2Snow	5.167	-2.197	2.179	94.868	
9	0.9Dead + 1.6WLEW	5.167	-10.826	10.740	94.868	
10	0.9Dead + 1.6WLNS	5.167	-1.569	1.556	94.868	

MAXIMUM FOOTING SHEAR I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 4.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/14/2007 Checker: B. Rabe Date: 12/14/2007

Load No.	Load Combination	Dist. From Bottom Edge FT	Max. Shear N-S Dir KIPS	Applied Max. Shear Str PSI	Allowed Max. Shear Str PSI	Remarks
1	1.4Dead	0.833	0.794	0.788	94.868	
2	1.2Dead + 0.5Snow	5.167	-0.743	0.737	94.868	
3	1.2Dead + 1.6Snow	5.167	-0.881	0.874	94.868	
4	1.2Dead + 1.6Snow + 0.8WLEW	5.167	-0.881	0.874	94.868	
5	1.2Dead + 1.6Snow + 0.8WLNS	5.167	-1.053	1.045	94.868	
6	1.2Dead + 0.5Snow + 1.6WLEW	5.167	-0.743	0.737	94.868	
7	1.2Dead + 0.5Snow + 1.6WLNS	5.167	-1.088	1.080	94.868	
8	1.2Dead + 0.2Snow	5.167	-0.706	0.700	94.868	
9	0.9Dead + 1.6WLEW	5.167	-0.511	0.506	94.868	
10	0.9Dead + 1.6WLNS	5.167	-0.856	0.849	94.868	

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group, Inc.

Calculation Sheet

Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-10-DBC-00-00004
Sheet No.	B-14 / B-34
Sheet Rev.	D

Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations

By: R. Murphy Date: 12/16/2007

FOOTING REBARS I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 4-F.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/16/2007 Checker: B. Rabe Date: 12/16/2007

Footing Data:

Footing/Pile Cap Size in N/S Direction (ft)	6.00
Footing/Pile Cap Size in E/W Direction (ft)	6.00
Footing/Pile Cap Thickness (ft)	1.50

Top Steel:

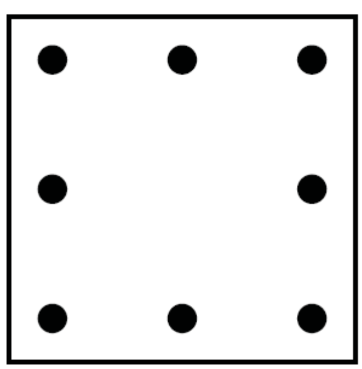
	Tot Bars	Bar Size	Rebar Sp (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Ult Mom (kip ft/ft)	Controlling Load Case
E/W Dir	6	6	12	0.44	0.02	-0.80	6. 1.2Dead + 0.5Snow + 1.6WLEW
N/S Dir	6	6	12	0.44	0.00	0.00	10. 0.9Dead + 1.6WLNS

Bottom Steel:

	Tot Bars	Bar Size	Rebar Sp (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Ult Mom (kip ft/ft)	Controlling Load Case
E/W Dir	6	6	12	0.44	0.39	3.13	9. 0.9Dead + 1.6WLEW
N/S Dir	6	6	12	0.44	0.39	0.42	7. 1.2Dead + 0.5Snow + 1.6WLNS

Pier Data:

Pier Size in N/S Direction (ft)	2.00
Pier Size in E/W Direction (ft)	2.00
Rebar Size:	6
Number of Rebars:	
E/W Direction:	3
N/S Direction:	3
Total No. of bars:	8
Rebar Spacing: (in)	
E/W Direction:	8
N/S Direction:	8
Area Requested: (sq in)	1.04
Area Provided: (sq in)	3.53
Percent Steel Provided:	0.61%
Tie-bars:	
Total No. of Ties:	4
Tie bar size:	3
Major Tie bar spacing: (in)	10



BECHTEL PARSONS BLUE GRASS A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group, Inc.	Calculation Sheet	Project: BGCAPP
		Job Number: 743341
		Calc. No. 24915-10-DBC-00-00004
Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations		Sheet No. B-16 / B-34
By: R. Murphy	Date: 12/16/2007	Sheet Rev. D

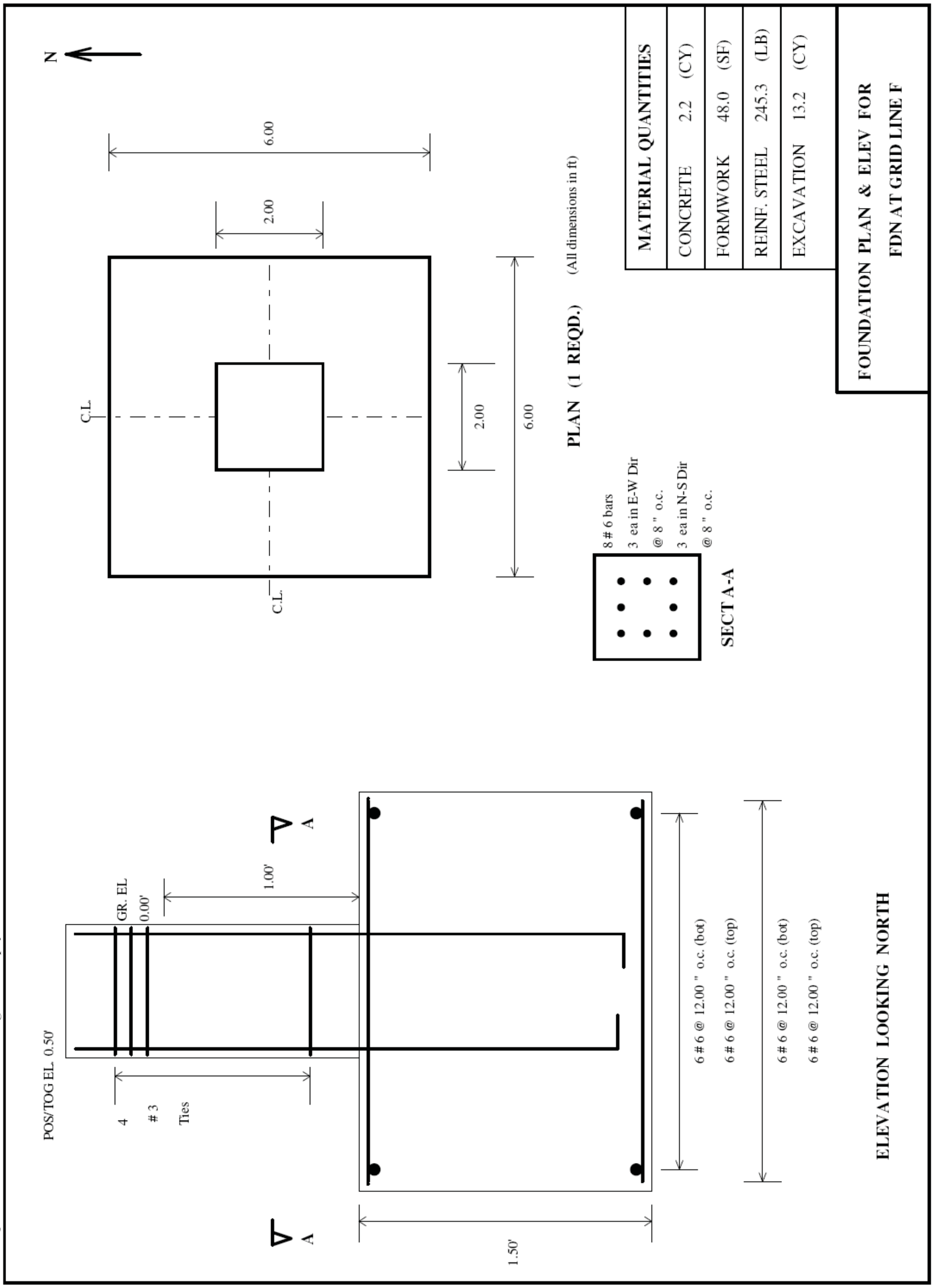
PIER - P1 Ultimate Loads I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 4-F.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/16/2007 Checker: B. Rabe Date: 12/16/2007

Load Case	Load Combination	Axial App Load KIP	Axial All Load KIP	App Mom @ N/S axis KIP FT	All Mom @ N/S axis KIP FT	App Mom @ E/W axis KIP FT	All Mom @ E/W axis KIP FT	Remarks
1	1.4Dead	5.72	86.21	13.77	207.56	0.63	9.49	
2	1.2Dead + 0.5Snow	5.35	80.92	13.47	203.73	0.59	8.90	
3	1.2Dead + 1.6Snow	6.34	73.25	17.15	198.15	0.70	8.06	
4	1.2Dead + 1.6Snow + 0.8WLEW	6.34	36.22	29.91	170.86	0.70	3.98	
5	1.2Dead + 1.6Snow + 0.8WLNS	6.34	72.92	17.15	197.27	1.81	20.79	
6	1.2Dead + 0.5Snow + 1.6WLEW	5.35	22.00	39.00	160.27	0.59	2.42	
7	1.2Dead + 0.5Snow + 1.6WLNS	5.35	78.48	13.47	197.60	3.61	53.02	
8	1.2Dead + 0.2Snow	5.08	83.90	12.47	205.89	0.56	9.23	
9	0.9Dead + 1.6WLEW	3.68	16.73	34.37	156.34	0.40	1.83	
10	0.9Dead + 1.6WLNS	3.68	80.47	8.85	193.58	3.61	79.09	

FOUNDATION MATERIAL QUANTITIES

EQUIPMENT TYPE	**EQUIPMENT NAME/NUMBER**
Miscellaneous	MISC
Concrete Volume: Cubic Yards (CY)	2.22
Formwork Area: Square Feet (SF)	48
Reinforcing Steel Weight: Pounds (LB)	245.29
Excavation Volume: Cubic Yards (CY)	13.22


Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/16/2007 Checker: B. Rabe Date: 12/16/2007
N
6.00
2.00
C.L.
C.L.
2.00
6.00
PLAN (1 REQD.) (All dimensions in ft)
MATERIAL QUANTITIES
CONCRETE 2.2 (CY)
FORMWORK 48.0 (SF)
REINF. STEEL 245.3 (LB)
EXCAVATION 13.2 (CY)
FOUNDATION PLAN & ELEV FOR FDN AT GRID LINE F
8 # 6 bars
3 ea in E-W Dir
@ 8 " o.c.
3 ea in N-S Dir
@ 8 " o.c.
SECT A-A
A
A
GR. EL 0.00'
1.00'
POS/TOG EL 0.50'
4 # 3 Ties
6 # 6 @ 12.00 " o.c. (bot)
6 # 6 @ 12.00 " o.c. (top)
6 # 6 @ 12.00 " o.c. (bot)
6 # 6 @ 12.00 " o.c. (top)
1.50'
ELEVATION LOOKING NORTH

CIVIL ENGINEERING

FOUNDATION ANALYSIS/DESIGN REPORT

Miscellaneous: Fdn at Grid Line C

PROJECT NO. : 10-DBC-00-00004

PROJECT NAME : SCWO Exterior Cable Tray Support Foundation at Node 13

PROJECT LOCATION : Richmond, KY

CLIENT :

PROJECT TYPE :

REFERENCE DOCUMENTS : ____

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By: ________________ Checked: ________________ Approved: ________________

Date: ________________ Date: ________________ Date: ________________

Parsons

100 West Walnut St., Pasadena, CA

Units:

Input Units:	English	Output Units:	English	Code:	ACI 318 - 2002

Concrete Parameters:

Compressive Strength : (psi)	4000	Unit Weight : (pcf)	150
Pier Concrete Cover:		Allowable Concrete Stress increase:	
E-W Direction : (in)	3	Wind	0.00%
N-S Direction : (in)	3	Earthquake	0.00%
Footing Concrete Cover:		Test	0.00%
E-W Direction : (in)	3		
N-S Direction : (in)	3		
Top Steel to Top of footing : (in)	2		
Bot Steel to Bot of footing/ Top of Pile : (in)	3		

Reinforcing Steel Parameters:

Yield Strength : (ksi)	60	Unit Weight of Steel: (pcf)	490
Modulus of Elasticity of Steel: (ksi)	29000	Footing Bar Spacing:	
Pier Bars and Spacing:		Min Rebar spacing: (in)	3
Min Rebar spacing: (in)	3	Max Rebar spacing: (in)	12
Max no. of bars per Pier	800	Max Footing Rebar Size	9
Temperature and Shrinkage Steel Ratio:	0.0018	Min Footing Rebar Size	5

Soil/Pile Parameters:

Foundation Type :	Soil-Supported	Soil Unit Weight : (pcf)	120
Allowable Bearing Pressure : (psf)	3000	Allowable Soil Pressure increase	
Stability Ratios/Safety Factor:		Wind	33.33%
Minimum Stability Ratio for Erection	1.5	Earthquake	33.33%
Minimum Stability Ratio for Operation	1.5	Test	20.00%
Minimum Stability Ratio for Test	1.5	Type of Soil:	Granular
Safety Factor against Lateral Forces	1.5	Passive Pressure Coeff Kp	5
		Soil To Conc. Friction f:	0.5

Pier Parameters:

Shape:	Rectangular
Min. Reinft. Ratio:	0.0018

Footing Parameters:

Min. Footing or Cap Thickness Tf (ft):	2
Depth of Footing or Cap below grade Df (ft):	4.25
Min. Soil cover above Footing or Cap Sc (ft):	2.25
Depth of Water table below grade (ft):	0
Consider Buoyancy:	No

Applied Loads Pier - P1 I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 13.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/13/2007 Checker: B. Rabe Date: 12/13/2007

Load No.	Load case	Axial KIP	Shear E-W KIP	Mom N-S KIP FT	Shear N-S KIP	Mom E-W KIP FT
1	Dead	7.34	0.00	27.36	0.81	-0.02
2	Snow	0.81	0.00	3.81	0.06	0.00
3	WLEW	0.00	1.92	26.65	0.00	0.00
4	WLNS	-1.33	-0.27	-4.08	-0.95	0.07

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group, Inc.

Calculation Sheet

Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-10-DBC-00-00004
Sheet No.	B-23 / B-34
Sheet Rev.	D

Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations

By: R. Murphy Date: 12/16/2007

Allowable Strength Load Combinations Pier - P1 I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 13.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/13/2007 Checker: B. Rabe Date: 12/13/2007

Load No.	Load Combination	Axial KIP	Shear E-W KIP	Mom N-S KIP FT	Shear N-S KIP	Mom E-W KIP FT
1	Dead	7.34	0.00	27.36	0.81	-0.02
2	Dead + Snow	8.15	0.00	31.17	0.87	-0.02
3	Dead + 0.75Snow	7.94	0.00	30.22	0.85	-0.02
4	Dead + WLEW	7.33	1.92	54.01	0.81	-0.02
5	Dead + WLNS	6.01	-0.27	23.28	-0.14	0.05
6	Dead + 0.75Snow + 0.75WLEW	7.94	1.44	50.20	0.85	-0.02
7	Dead + 0.75Snow + 0.75WLNS	6.95	-0.20	27.16	0.14	0.03
8	0.6Dead + WLEW	4.40	1.92	43.06	0.49	-0.01
9	0.6Dead + WLNS	3.07	-0.27	12.34	-0.46	0.06

Ultimate Strength Load Combinations Pier - P1 I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 13.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/13/2007 Checker: B. Rabe Date: 12/13/2007

Load No.	Load Combination	Axial KIP	Shear E-W KIP	Mom N-S KIP FT	Shear N-S KIP	Mom E-W KIP FT
1	1.4Dead	10.27	0.00	38.31	1.13	-0.03
2	1.2Dead + 0.5Snow	9.21	0.00	34.74	1.00	-0.03
3	1.2Dead + 1.6Snow	10.10	0.00	38.93	1.06	-0.03
4	1.2Dead + 1.6Snow + 0.8WLEW	10.10	1.54	60.25	1.06	-0.03
5	1.2Dead + 1.6Snow + 0.8WLNS	9.04	-0.22	35.67	0.30	0.03
6	1.2Dead + 0.5Snow + 1.6WLEW	9.21	3.07	77.37	1.00	-0.03
7	1.2Dead + 0.5Snow + 1.6WLNS	7.09	-0.43	28.22	-0.52	0.09
8	1.2Dead + 0.2Snow	8.97	0.00	33.60	0.98	-0.03
9	0.9Dead + 1.6WLEW	6.60	3.07	67.26	0.73	-0.02
10	0.9Dead + 1.6WLNS	4.48	-0.43	18.10	-0.79	0.10

BEARING CAPACITY I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 13.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/13/2007 Checker: B. Rabe Date: 12/13/2007

Load No.	Load Comb	Gross Soil Pres KSF	Allow Soil Pres KSF	S.R. in N/S Dir	S.R. in E/W Dir	Allow Min S.R.	Ecc. in N/S Dir FT	Ecc. in E/W Dir FT	Moment @ N/S axis KIP FT	Moment @ E/W axis KIP FT
1	Dead	1.41	3.51	24.84	4.07	1.50	0.12	0.86	27.35	3.83
2	Dead + Snow	1.51	3.51	23.79	3.67	1.50	0.13	0.95	31.16	4.09
3	Dead + 0.75Snow	1.49	3.51	24.04	3.76	1.50	0.12	0.93	30.21	4.03
4	Dead + WLEW	2.47	4.51	24.87	1.77	1.50	0.12	1.98	63.13	3.82
5	Dead + WLNS	1.19	4.51	100.00	4.64	1.50	0.02	0.72	22.00	0.60
6	Dead + 0.75Snow + 0.75WLEW	2.20	4.51	24.06	1.99	1.50	0.12	1.76	57.04	4.02
7	Dead + 0.75Snow + 0.75WLNS	1.30	4.51	100.00	4.09	1.50	0.02	0.83	26.20	0.70
8	0.6Dead + WLEW	2.93	4.51	37.65	1.94	1.50	0.12	2.73	52.19	2.29
9	0.6Dead + WLNS	0.70	4.51	37.74	7.93	1.50	0.12	0.62	11.06	2.14

PUNCHING SHEAR I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 13.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/13/2007 Checker: B. Rabe Date: 12/13/2007

Pier No.	Load Combination	Max. Load Shear Str KIPS	Applied Punch. Shear Str PSI	Allowed Punch. PSI	Pier Size FT	Pier Shape	Remarks
P1	9. 0.9Dead + 1.6WLEW	7.756	2.203	189.737	2.00 X 2.00	Square	

MAXIMUM FOOTING SHEAR I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 13.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/13/2007 Checker: B. Rabe Date: 12/13/2007

Load No.	Load Combination	Dist. From Left Edge FT	Max. Shear E-W Dir KIPS	Applied Max. Shear Str PSI	Allowed Max. Shear Str PSI	Remarks
1	1.4Dead	6.167	-4.940	3.430	94.868	
2	1.2Dead + 0.5Snow	6.167	-4.454	3.093	94.868	
3	1.2Dead + 1.6Snow	6.167	-4.937	3.428	94.868	
4	1.2Dead + 1.6Snow + 0.8WLEW	6.167	-8.042	5.585	94.868	
5	1.2Dead + 1.6Snow + 0.8WLNS	6.167	-4.426	3.073	94.868	
6	1.2Dead + 0.5Snow + 1.6WLEW	6.167	-13.534	9.399	94.868	
7	1.2Dead + 0.5Snow + 1.6WLNS	6.167	-3.431	2.383	94.868	
8	1.2Dead + 0.2Snow	6.167	-4.322	3.001	94.868	
9	0.9Dead + 1.6WLEW	6.167	-16.948	11.770	94.868	
10	0.9Dead + 1.6WLNS	6.167	-2.153	1.495	94.868	

MAXIMUM FOOTING SHEAR I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 13.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/13/2007 Checker: B. Rabe Date: 12/13/2007

Load No.	Load Combination	Dist. From Bottom Edge FT	Max. Shear N-S Dir KIPS	Applied Max. Shear Str PSI	Allowed Max. Shear Str PSI	Remarks
1	1.4Dead	5.667	-0.980	0.583	94.868	
2	1.2Dead + 0.5Snow	5.667	-0.870	0.518	94.868	
3	1.2Dead + 1.6Snow	5.667	-0.934	0.556	94.868	
4	1.2Dead + 1.6Snow + 0.8WLEW	5.667	-0.934	0.556	94.868	
5	1.2Dead + 1.6Snow + 0.8WLNS	5.667	-0.690	0.410	94.868	
6	1.2Dead + 0.5Snow + 1.6WLEW	5.667	-0.869	0.517	94.868	
7	1.2Dead + 0.5Snow + 1.6WLNS	0.333	0.628	0.374	94.868	
8	1.2Dead + 0.2Snow	5.667	-0.852	0.507	94.868	
9	0.9Dead + 1.6WLEW	5.667	-0.629	0.375	94.868	
10	0.9Dead + 1.6WLNS	0.333	0.523	0.311	94.868	

FOOTING REBARS I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 13-C.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/16/2007 Checker: B. Rabe Date: 12/16/2007

Footing Data:

Footing/Pile Cap Size in N/S Direction (ft)	6.00
Footing/Pile Cap Size in E/W Direction (ft)	7.00
Footing/Pile Cap Thickness (ft)	2.00

Top Steel:

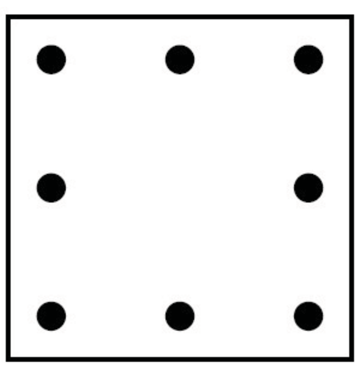
	Tot Bars	Bar Size	Rebar Sp (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Ult Mom (kip ft/ft)	Controlling Load Case
E/W Dir	6	6	12	0.44	0.03	-2.04	6. 1.2Dead + 0.5Snow + 1.6WLEW
N/S Dir	7	6	12	0.44	0.00	0.00	10. 0.9Dead + 1.6WLNS

Bottom Steel:

	Tot Bars	Bar Size	Rebar Sp (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Ult Mom (kip ft/ft)	Controlling Load Case
E/W Dir	8	6	9	0.59	0.52	7.34	9. 0.9Dead + 1.6WLEW
N/S Dir	9	6	9	0.57	0.52	0.80	1. 1.4Dead

Pier Data:

Pier Size in N/S Direction (ft)	2.00
Pier Size in E/W Direction (ft)	2.00
Rebar Size:	6
Number of Rebars:	
E/W Direction:	3
N/S Direction:	3
Total No. of bars:	8
Rebar Spacing: (in)	
E/W Direction:	8
N/S Direction:	8
Area Requested: (sq in)	1.04
Area Provided: (sq in)	3.53
Percent Steel Provided:	0.61%
Tie-bars:	
Total No. of Ties:	5
Tie bar size:	3
Major Tie bar spacing: (in)	11



PIER - P1 Ultimate Loads I:\STRUCT\SCWO 2007\SCWO MISCELLANEOUS\CONCRETE\APP B CABLE TRAYS\SUPPORT AT JOINT 13-C.MSC

Proj. No.: 10-DBC-00-00004 Engr: R. Murphy Date: 12/16/2007 Checker: B. Rabe Date: 12/16/2007

Load Case	Load Combination	Axial App Load KIP	Axial All Load KIP	App Mom @ N/S axis KIP FT	All Mom @ N/S axis KIP FT	App Mom @ E/W axis KIP FT	All Mom @ E/W axis KIP FT	Remarks
1	1.4Dead	12.58	62.35	38.30	189.79	3.09	15.31	
2	1.2Dead + 0.5Snow	11.19	60.77	34.73	188.65	2.72	14.80	
3	1.2Dead + 1.6Snow	12.08	57.90	38.93	186.57	2.89	13.87	
4	1.2Dead + 1.6Snow + 0.8WLEW	12.08	31.30	64.47	167.02	2.89	7.49	
5	1.2Dead + 1.6Snow + 0.8WLNS	11.02	58.95	35.07	187.67	1.21	6.48	
6	1.2Dead + 0.5Snow + 1.6WLEW	11.19	20.76	85.82	159.22	2.72	5.04	
7	1.2Dead + 0.5Snow + 1.6WLNS	9.07	64.20	27.03	191.44	1.33	9.43	
8	1.2Dead + 0.2Snow	10.95	61.69	33.59	189.32	2.68	15.10	
9	0.9Dead + 1.6WLEW	8.08	16.69	75.71	156.21	1.98	4.08	
10	0.9Dead + 1.6WLNS	5.96	68.26	16.92	193.62	2.07	23.69	

FOUNDATION MATERIAL QUANTITIES

EQUIPMENT TYPE	EQUIPMENT NAME/NUMBER
Miscellaneous	MISC
Concrete Volume: Cubic Yards (CY)	3.52
Formwork Area: Square Feet (SF)	74
Reinforcing Steel Weight: Pounds (LB)	339.24
Excavation Volume: Cubic Yards (CY)	36.92

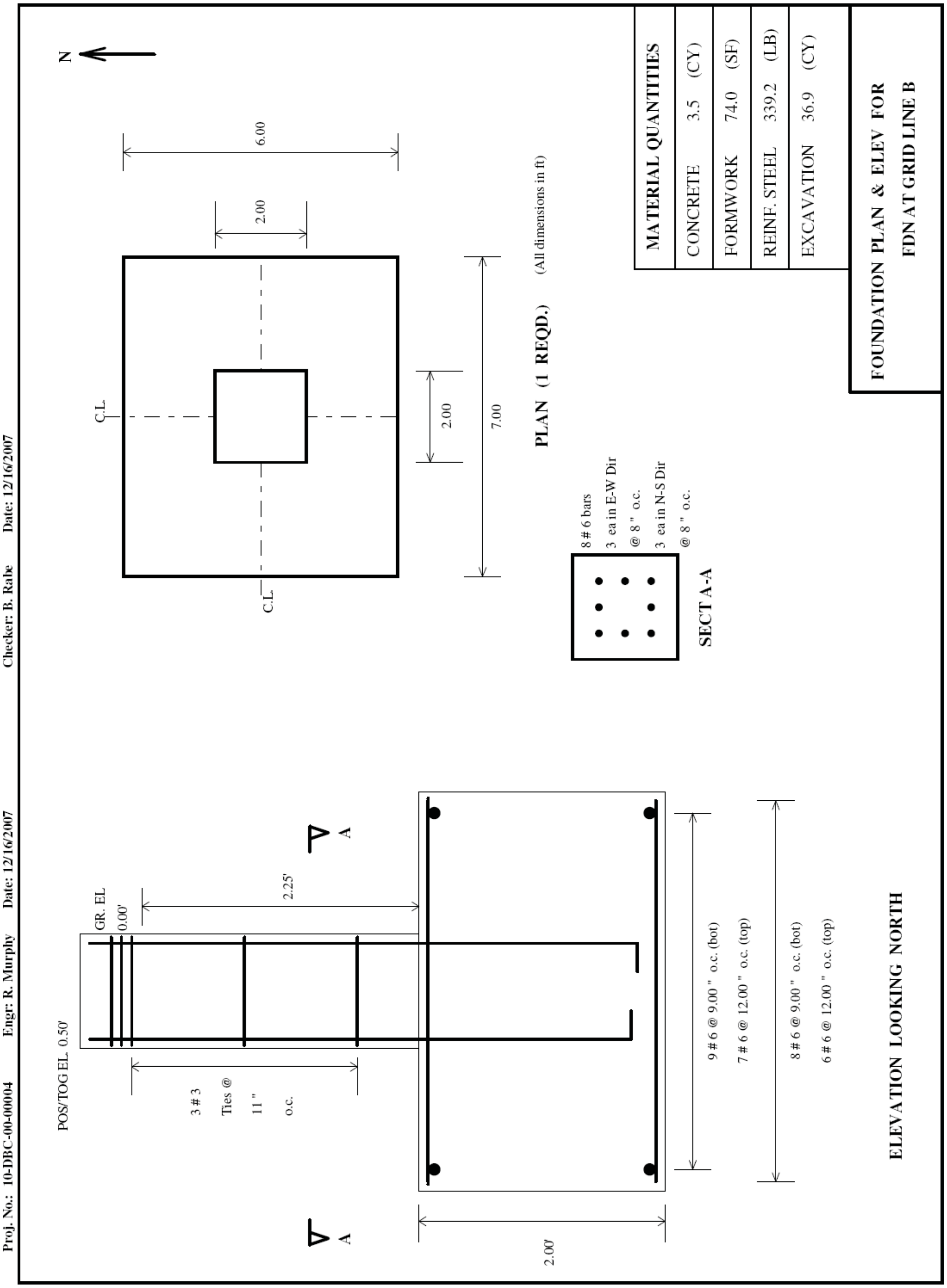
BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-10-DBC-00-00004
Sheet No.	B-33 / B-34
Sheet Rev.	D

Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations

By: R. Murphy Date: 12/16/2007



B.5. Summary

The calculation performed in this appendix includes structural analysis and design of isolated footings for supports of elevated cable trays along the exterior of the SCWO Processing Building (SPB). Wind loads govern the design. No soil uplift is observed under worst-case overturning wind loads, and wind sliding resistance of the foundations is adequate.

Foundations at column lines B, C, and D (F-22) are 2' thick with 2'-3" of soil cover. They measure 7' in the E-W direction and 6' in the N-S direction. Reinforcement is #6 @ 9" o.c. N-S and E-W on bottom, and #6 @ 12" o.c. N-S and E-W on top.

Foundations at column lines E, F, and G (F-23) are 1'-6" thick with 1' of soil cover. They measure 6' in the E-W direction and 6' in the N-S direction. Reinforcement is #6 @ 12" o.c. N-S and E-W on bottom, and #6 @ 12" o.c. N-S and E-W on top.

Appendix C

HVAC Duct Supports Foundations

C.1. Objective

The calculation performed in this appendix includes structural analysis and design of isolated footings for supports of elevated HVAC ducts at the exterior of the SCWO Processing Building (SPB).

C.2. Inputs

The ducts are located along the eastern face of the SPB. Two 32"x32" rectangular ducts extend out from the face of the structure between column lines H and J toward the east before and connect to HVAC units 10-MA-HVAC-AHU1001 and –AHU1002.

See drawing 24915-10-P2-HVAC-00008 for duct locations.

See drawings 24915-10-SS-00-00063 and 00064 for duct support framing layout and details.

Construction materials are listed in Section 2.1 and load information is listed in Section 2.2.

Loads from the steel duct supports are taken from calc. no. 24915-10-SSC-00-00006 Rev. A, Appendix C4.

C.3 Assumptions

Seismic loads are not considered in the analysis because they produced lower shear and overturning values than the wind loads.

C.4 Calculation Body

Base reactions from GTSTRUDL steel analysis and design are given here. These loads are the input for the Foundation3D footing design. Designs for the two individual footings are included in this appendix.

Reaction Values from GTSTRUDL Analysis (units: kip, ft)

Joint	Z FORCE	X FORCE	Y MOMENT	Y FORCE	X MOMENT
10	1.953	0.013	0.096	-0.019	-0.528
	1.168	0.011	0.083	-0.017	-0.450
	-0.066	-0.010	-0.176	-1.208	21.943
	0.009	-0.927	-4.414	-0.182	4.073
15	2.314	-0.038	-0.207	0.001	-0.024
	1.153	-0.033	-0.177	0.001	-0.020
	-0.007	-0.104	-2.190	-2.692	53.474
	-0.033	-1.018	-7.113	-0.015	0.326

Following are the FOUNDATION 3D analyses of the isolated footings at nodes 10 and 15.

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W8x31 Supt - Node 10			Time	8:26:48 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 1.msc				

SUMMARY REPORT FOR W8x31 Supt - Node 10

PROJECT INFORMATION

Project Name:	
Project Number:	
Client:	
Project Location	
Foundation Description	FOUNDATION

DESIGN CODE ACI 318 - 2002 **INPUT UNITS** English **OUTPUT UNITS** English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	6000.00
Unit Weight (pcf)	120.00

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	3
Minimum Soil Cover (ft)	1.00
Grade Elevation (ft)	0.00

REBAR PARAMETERS:

Max Long Bar Size	6
Min Long Bar Size	6
Max Tie Bar Size	4
Min Tie Bar Size	3
Max Ftg Bar Size	9
Min Ftg Bar Size	5
Temp & Shrinkage Steel Ratio	0.0018

BUOYANCY CRITERIA:

Consider Buoyancy:	No
Consider soil for buoyancy:	No
Water table below grade (ft)	0

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version 4.0.0	Date	2/19/2008
Foundation Name	W8x31 Supt - Node 10		Time	8:26:48 AM
Designed By:		Engineer	Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 1.msc			

SUMMARY REPORT FOR W8x31 Supt - Node 10

PIER/BASE PLATE DESIGN INFORMATION

	P1
E-W Dim (ft)	2.00
N-S Dim (ft)	2.00
Height (ft)	1.50
E-W Offset (ft)	0.00
N-S Offset (ft)	0.00
Requested Reinft. Ratio	0.0018
Provided Reinft. Ratio	0.0061
Long Bar Size	6
Bars in E-W Dir	3
Bars in N-S Dir	3
Total Long Bars	8
Tie Bar Size	3
Total No. of Ties	4
Major Tie Spacing (in)	10

FOOTING DESIGN INFORMATION

E-W Dim (ft)	5.00
N-S Dim (ft)	5.00
Thickness (ft)	2.00

MATERIAL QUANTITIES

Concrete Cubic Yards (CY)	2.06
Reinforcing Steel Pounds (LB)	201.69
Formwork Square Feet (SF)	52
Excavation Cubic Yards (CY)	15.44

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
7. 0.9Dead + 1.6Wind EW	4	6	18	0.35	0.01	-0.38	E-W
4. 1.2Dead + 0.5Live + 1.6Wind NS	4	6	18	0.35	0.01	-0.54	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
5. 1.2Dead + 0.5Live + 1.6Wind EW	7	6	9	0.62	0.52	0.7	E-W
6. 0.9Dead + 1.6Wind NS	7	6	9	0.62	0.52	2.86	N-S

BECHTEL PARSONS BLUE GRASS

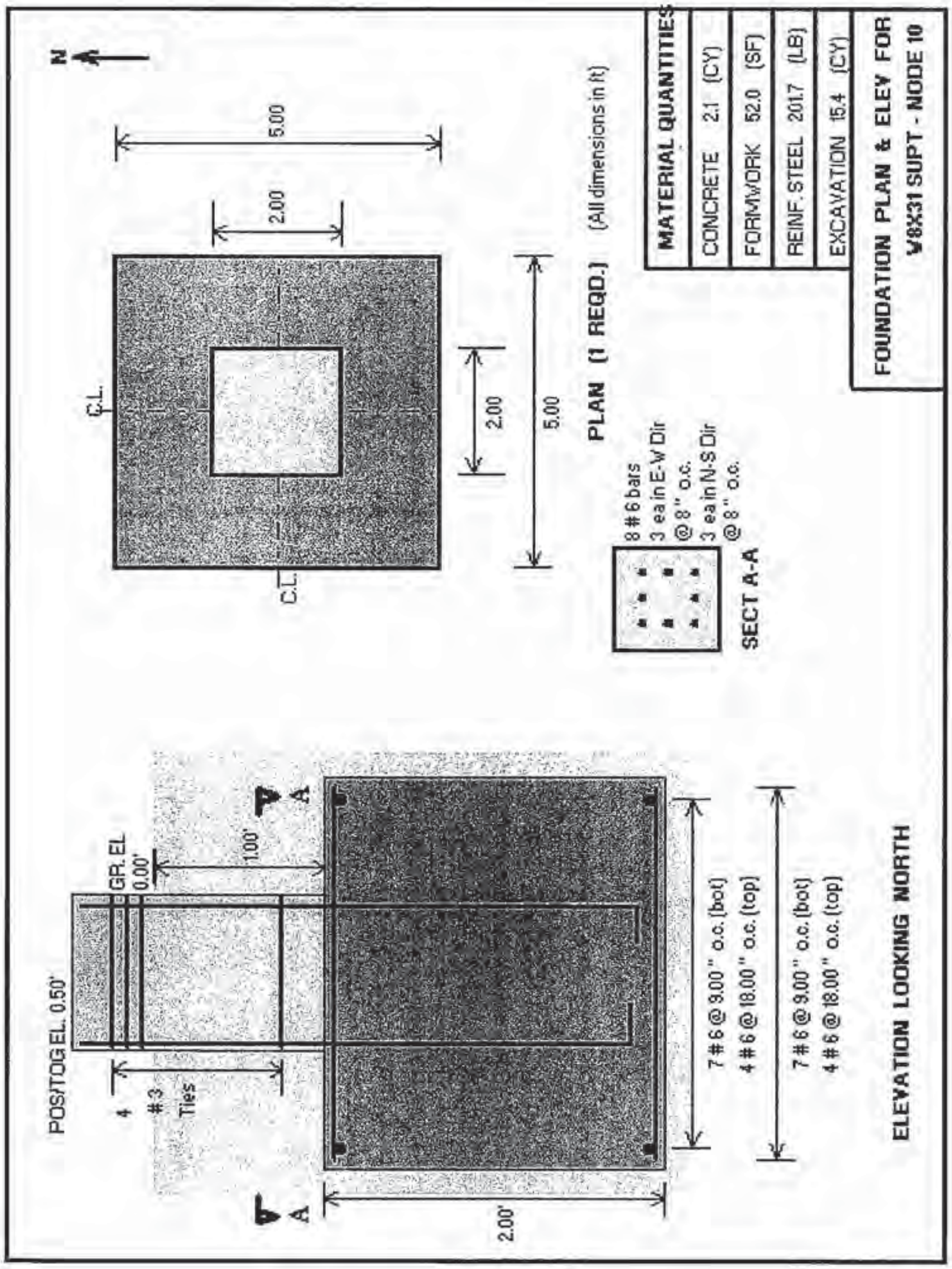
Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No. 24915-10-DBC-00-00004
Sheet No.: C-6 of C-22
Sheet Rev: D

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W8x31 Supt - Node 10			Time	8:26:48 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\pg8 foundation 1.msc				

SUMMARY REPORT FOR W8x31 Supt - Node 10



Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W8x31 Supt - Node 10			Time	8:26:55 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 1.msc				

DETAIL REPORT FOR W8x31 Supt - Node 10

PROJECT INFORMATION

Project Name:	
Project Number:	
Client:	
Project Location	
Foundation Description	FOUNDATION

DESIGN CODE ACI 318 - 2002 **INPUT UNITS** English **OUTPUT UNITS** English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	6000.00
Unit Weight (pcf)	120.00

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	3
Minimum Soil Cover (ft)	1.00
Grade Elevation (ft)	0.00

REBAR PARAMETERS:

Max Long Bar Size	6
Min Long Bar Size	6
Max Tie Bar Size	4
Min Tie Bar Size	3
Max Ftg Bar Size	9
Min Ftg Bar Size	5
Temp & Shrinkage Steel Ratio	0.0018

BUOYANCY CRITERIA:

Consider Buoyancy:	No
Consider soil for buoyancy:	No
Water table below grade (ft)	0

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version 4.0.0	Date 2/19/2008
Foundation Name	W8x31 Supt - Node 10		Time 8:26:55 AM
Designed By:		Engineer	Checker
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 1.msc		

DETAIL REPORT FOR W8x31 Supt - Node 10

APPLIED LOADS

P1

Load Case	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - Dead	1.95	0.01	0.10	-0.02	-0.53
2 - Live	1.17	0.01	0.08	-0.02	-0.45
3 - Wind NS	-0.07	-0.01	-0.18	-1.21	21.94
4 - Wind EW	0.01	-0.93	-4.41	-0.18	4.07

UNFACTORED (ALLOWABLE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - Dead	1.95	0.01	0.10	-0.02	-0.53
2 - Dead + Live	3.12	0.02	0.18	-0.04	-0.98
3 - Dead + Wind NS	1.89	0.00	-0.08	-1.23	21.42
4 - Dead + Wind EW	1.96	-0.91	-4.32	-0.20	3.55
5 - 0.6Dead + Wind NS	1.11	0.00	-0.12	-1.22	21.63
6 - 0.6Dead + Wind EW	1.18	-0.92	-4.36	-0.19	3.76

FACTORED (ULTIMATE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - 1.4Dead	2.73	0.02	0.13	-0.03	-0.74
2 - 1.2Dead + 1.6Live	4.21	0.03	0.25	-0.05	-1.35
3 - 1.2Dead + Live	3.51	0.03	0.20	-0.04	-1.08
4 - 1.2Dead + 0.5Live + 1.6Wind NS	2.82	0.01	-0.12	-1.96	34.25
5 - 1.2Dead + 0.5Live + 1.6Wind EW	2.94	-1.46	-6.91	-0.32	5.66
6 - 0.9Dead + 1.6Wind NS	1.65	0.00	-0.20	-1.95	34.63
7 - 0.9Dead + 1.6Wind EW	1.77	-1.47	-6.98	-0.31	6.04

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W8x31 Supt - Node 10			Time	8:26:55 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\pg8 foundation 1.msc				

DETAIL REPORT FOR W8x31 Supt - Node 10

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.55	6.36	0.05	0.01	0.14	0.59	
2 - Dead + Live	0.63	6.36	0.08	0.02	0.26	1.10	
3 - Dead + Wind NS	1.47	8.36	1.34	0.00	0.07	17.12	
4 - Dead + Wind EW	1.01	8.36	0.22	0.58	7.52	2.84	
5 - 0.6Dead + Wind NS	4.42	8.36	2.27	0.02	0.13	17.36	
6 - 0.6Dead + Wind EW	0.86	8.36	0.40	0.98	7.57	3.08	

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	54.13	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Live	31.80	100.00	1.50	100.00	100.00	1.50	
3 - Dead + Wind NS	1.70	100.00	1.50	15.00	100.00	1.50	
4 - Dead + Wind EW	9.28	4.28	1.50	91.75	20.18	1.50	
5 - 0.6Dead + Wind NS	1.59	100.00	1.50	12.98	100.00	1.50	
6 - 0.6Dead + Wind EW	8.23	3.99	1.50	82.04	17.26	1.50	

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W8x31 Supt - Node 10			Time	8:26:55 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\pg8 foundation 1.msc				

DETAIL REPORT FOR W8x31 Supt - Node 10

FOOTING DESIGN INFORMATION

E-W Dim (ft)	5.00
N-S Dim (ft)	5.00
Thickness (ft)	2.00

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
7. 0.9Dead + 1.6Wind EW	4	6	18	0.35	0.01	-0.38	E-W
4. 1.2Dead + 0.5Live + 1.6Wind NS	4	6	18	0.35	0.01	-0.54	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
5. 1.2Dead + 0.5Live + 1.6Wind EW	7	6	9	0.62	0.52	0.7	E-W
6. 0.9Dead + 1.6Wind NS	7	6	9	0.62	0.52	2.86	N-S

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W8x31 Supt - Node 10			Time	8:26:55 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 1.msc				

DETAIL REPORT FOR W8x31 Supt - Node 10

PUNCHING SHEAR

P1

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
6. 0.9Dead + 1.6Wind NS	2.46	0.70	189.74	

MAXIMUM SHEAR - E-W DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	5.00	0.00	0.00	94.87	
2 - 1.2Dead + 1.6Live	5.00	0.00	0.00	94.87	
3 - 1.2Dead + Live	5.00	0.00	0.00	94.87	
4 - 1.2Dead + 0.5Live + 1.6Wind NS	5.00	0.00	0.00	94.87	
5 - 1.2Dead + 0.5Live + 1.6Wind EW	5.00	0.00	0.00	94.87	
6 - 0.9Dead + 1.6Wind NS	5.00	0.00	0.00	94.87	
7 - 0.9Dead + 1.6Wind EW	5.00	0.00	0.00	94.87	

MAXIMUM SHEAR - N-S DIRECTION

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	5.00	0.00	0.00	94.87	
2 - 1.2Dead + 1.6Live	5.00	0.00	0.00	94.87	
3 - 1.2Dead + Live	5.00	0.00	0.00	94.87	
4 - 1.2Dead + 0.5Live + 1.6Wind NS	5.00	1.13	0.94	94.87	
5 - 1.2Dead + 0.5Live + 1.6Wind EW	5.00	0.00	0.00	94.87	
6 - 0.9Dead + 1.6Wind NS	5.00	8.22	6.85	94.87	
7 - 0.9Dead + 1.6Wind EW	5.00	0.00	0.00	94.87	

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W8x31 Supt - Node 10			Time	8:26:55 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 1.msc				

DETAIL REPORT FOR W8x31 Supt - Node 10

PIER/BASE PLATE DESIGN INFORMATION

	P1
E-W Dim (ft)	2.00
N-S Dim (ft)	2.00
Height (ft)	1.50
E-W Offset (ft)	0.00
N-S Offset (ft)	0.00
Requested Reinft. Ratio	0.0018
Provided Reinft. Ratio	0.0061
Long Bar Size	6
Bars in E-W Dir	3
Bars in N-S Dir	3
Total Long Bars	8
Tie Bar Size	3
Total No. of Ties	4
Major Tie Spacing (in)	10

PIER ULTIMATE LOAD CAPACITIES

P1

Load Comb	Axial Load (kips)	Axial Capa. (kips)	Mom N-S (kip ft)	Mom N-S Capa (kip ft)	Mom E-W (kip ft)	Mom E-W Capa (kip ft)	Rem
1 - 1.4Dead	3.99	1055.63	0.44	113.67	0.78	207.70	
2 - 1.2Dead + 1.6Live	5.29	960.35	0.58	106.17	1.43	258.51	
3 - 1.2Dead + Live	4.59	987.44	0.51	109.89	1.14	244.43	
4 - 1.2Dead + 0.5Live + 1.6Wind NS	3.90	19.78	0.43	2.18	31.30	158.62	
5 - 1.2Dead + 0.5Live + 1.6Wind EW	4.02	81.99	9.10	184.73	5.17	105.17	
6 - 0.9Dead + 1.6Wind NS	2.46	11.87	0.27	1.29	31.71	152.71	
7 - 0.9Dead + 1.6Wind EW	2.58	45.43	9.18	161.59	5.58	98.17	

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W14x43 Supt - Node 1			Time	8:23:22 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 2.msc				

SUMMARY REPORT FOR W14x43 Supt - Node 1

PROJECT INFORMATION

Project Name:
Project Number:
Client:
Project Location
Foundation Description FOUNDATION

DESIGN CODE ACI 318 - 2002 **INPUT UNITS** English **OUTPUT UNITS** English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	6000.00
Unit Weight (pcf)	120.00

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	3
Minimum Soil Cover (ft)	1.00
Grade Elevation (ft)	0.00

REBAR PARAMETERS:

Max Long Bar Size	6
Min Long Bar Size	6
Max Tie Bar Size	4
Min Tie Bar Size	3
Max Ftg Bar Size	9
Min Ftg Bar Size	5
Temp & Shrinkage Steel Ratio	0.0018

BUOYANCY CRITERIA:

Consider Buoyancy:	No
Consider soil for buoyancy:	No
Water table below grade (ft)	0

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W14x43 Supt - Node 1			Time	8:23:22 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 2.msc				

SUMMARY REPORT FOR W14x43 Supt - Node 1

PIER/BASE PLATE DESIGN INFORMATION

	P1
E-W Dim (ft)	2.50
N-S Dim (ft)	2.50
Height (ft)	1.50
E-W Offset (ft)	0.00
N-S Offset (ft)	0.00
Requested Reinft. Ratio	0.0018
Provided Reinft. Ratio	0.0039
Long Bar Size	6
Bars in E-W Dir	3
Bars in N-S Dir	3
Total Long Bars	8
Tie Bar Size	3
Total No. of Ties	4
Major Tie Spacing (in)	10

FOOTING DESIGN INFORMATION

E-W Dim (ft)	6.00
N-S Dim (ft)	7.50
Thickness (ft)	2.00

MATERIAL QUANTITIES

Concrete Cubic Yards (CY)	3.68
Reinforcing Steel Pounds (LB)	297.9
Formwork Square Feet (SF)	69
Excavation Cubic Yards (CY)	20.19

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
0.9Dead + 1.6Wind EW	5	6	18	0.29	0.01	-0.36	E-W
1.2Dead + 0.5Live + 1.6Wind NS	4	6	18	0.29	0.02	-1.51	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
1.2Dead + 0.5Live + 1.6Wind EW	9	6	9	0.53	0.52	0.65	E-W
0.9Dead + 1.6Wind NS	8	6	9	0.59	0.52	6.51	N-S

BECHTEL PARSONS BLUE GRASS

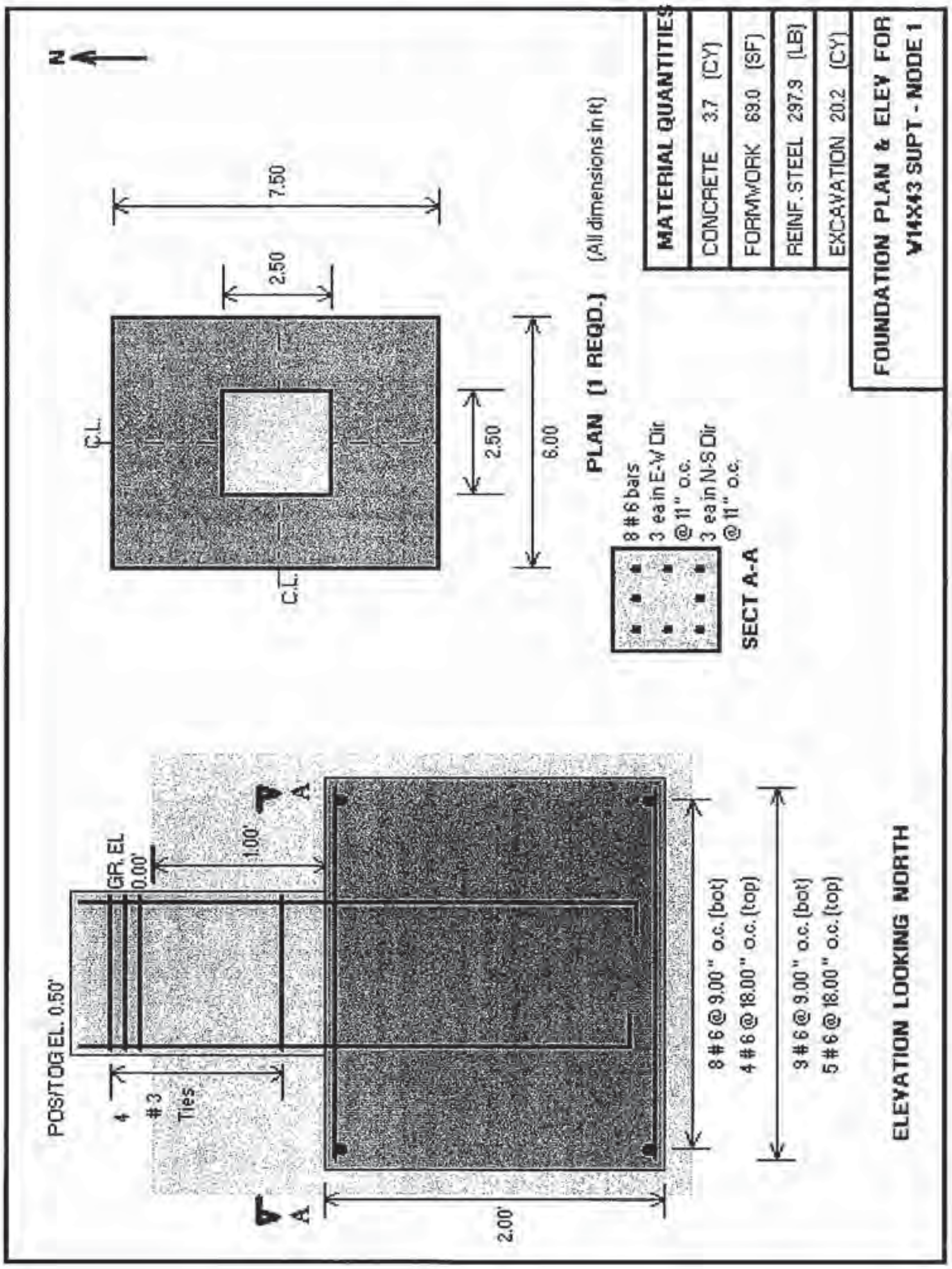
Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No. 24915-10-DBC-00-00004
Sheet No. C-15 of C-22
Sheet Rev: D

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W14x43 Supt - Node 1			Time	8:23:22 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\pg8 foundation 2.msc				

SUMMARY REPORT FOR W14x43 Supt - Node 1



Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W14x43 Supt - Node 1			Time	8:23:29 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\pg8 foundation 2.msc				

DETAIL REPORT FOR W14x43 Supt - Node 1

PROJECT INFORMATION

Project Name:
Project Number:
Client:
Project Location
Foundation Description FOUNDATION

DESIGN CODE ACI 318 - 2002 **INPUT UNITS** English **OUTPUT UNITS** English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	6000.00
Unit Weight (pcf)	120.00

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	3
Minimum Soil Cover (ft)	1.00
Grade Elevation (ft)	0.00

REBAR PARAMETERS:

Max Long Bar Size	6
Min Long Bar Size	6
Max Tie Bar Size	4
Min Tie Bar Size	3
Max Ftg Bar Size	9
Min Ftg Bar Size	5
Temp & Shrinkage Steel Ratio	0.0018

BUOYANCY CRITERIA:

Consider Buoyancy:	No
Consider soil for buoyancy:	No
Water table below grade (ft)	0

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W14x43 Supt - Node 1			Time	8:23:29 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 2.msc				

DETAIL REPORT FOR W14x43 Supt - Node 1

APPLIED LOADS

P1

Load Case	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - Dead	2.31	-0.04	-0.21	0.00	-0.02
2 - Live	1.15	-0.03	-0.18	0.00	-0.02
3 - Wind NS	-0.01	-0.10	-2.19	-2.69	53.47
4 - Wind EW	-0.03	-1.02	-7.11	-0.02	0.33

UNFACTORED (ALLOWABLE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - Dead	2.31	-0.04	-0.21	0.00	-0.02
2 - Dead + Live	3.47	-0.07	-0.38	0.00	-0.04
3 - Dead + Wind NS	2.31	-0.14	-2.40	-2.69	53.45
4 - Dead + Wind EW	2.28	-1.06	-7.32	-0.01	0.30
5 - 0.6Dead + Wind NS	1.38	-0.13	-2.31	-2.69	53.46
6 - 0.6Dead + Wind EW	1.36	-1.04	-7.24	-0.01	0.31

FACTORED (ULTIMATE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear E-W (kips)	Mom N-S (kip ft)	Shear N-S (kips)	Mom E-W (kip ft)
1 - 1.4Dead	3.24	-0.05	-0.29	0.00	-0.03
2 - 1.2Dead + 1.6Live	4.62	-0.10	-0.53	0.00	-0.06
3 - 1.2Dead + Live	3.93	-0.08	-0.43	0.00	-0.05
4 - 1.2Dead + 0.5Live + 1.6Wind NS	3.34	-0.23	-3.84	-4.31	85.52
5 - 1.2Dead + 0.5Live + 1.6Wind EW	3.30	-1.69	-11.72	-0.02	0.48
6 - 0.9Dead + 1.6Wind NS	2.07	-0.20	-3.69	-4.31	85.54
7 - 0.9Dead + 1.6Wind EW	2.03	-1.66	-11.57	-0.02	0.50

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W14x43 Supt - Node 1			Time	8:23:29 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 2.msc				

DETAIL REPORT FOR W14x43 Supt - Node 1

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.49	6.36	0.00	0.02	0.34	0.02	
2 - Dead + Live	0.53	6.36	0.00	0.03	0.63	0.04	
3 - Dead + Wind NS	1.49	8.36	2.01	0.13	2.89	44.03	
4 - Dead + Wind EW	0.73	8.36	0.01	0.50	11.02	0.25	
5 - 0.6Dead + Wind NS	4.12	8.36	3.36	0.21	2.76	44.04	
6 - 0.6Dead + Wind EW	0.54	8.36	0.02	0.83	10.88	0.26	

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	100.00	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Live	100.00	100.00	1.50	100.00	100.00	1.50	
3 - Dead + Wind NS	1.71	22.66	1.50	9.41	100.00	1.50	
4 - Dead + Wind EW	100.00	5.95	1.50	100.00	27.39	1.50	
5 - 0.6Dead + Wind NS	1.64	22.77	1.50	7.79	100.00	1.50	
6 - 0.6Dead + Wind EW	100.00	5.77	1.50	100.00	23.58	1.50	

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version 4.0.0	Date	2/19/2008
Foundation Name	W14x43 Supt - Node 1		Time	8:23:29 AM
Designed By:		Engineer	Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 2.msc			

DETAIL REPORT FOR W14x43 Supt - Node 1

FOOTING DESIGN INFORMATION

E-W Dim (ft)	6.00
N-S Dim (ft)	7.50
Thickness (ft)	2.00

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
0.9Dead + 1.6Wind EW	5	6	18	0.29	0.01	-0.36	E-W
1.2Dead + 0.5Live + 1.6Wind NS	4	6	18	0.29	0.02	-1.51	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
1.2Dead + 0.5Live + 1.6Wind EW	9	6	9	0.53	0.52	0.65	E-W
0.9Dead + 1.6Wind NS	8	6	9	0.59	0.52	6.51	N-S

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version	4.0.0	Date	2/19/2008
Foundation Name	W14x43 Supt - Node 1			Time	8:23:29 AM
Designed By:		Engineer		Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\ pg8 foundation 2.msc				

DETAIL REPORT FOR W14x43 Supt - Node 1

PUNCHING SHEAR

P1

Control Comb	Net Ult Load (kips)	Punch Stress (psi)	All Stress (psi)	Rem
0.9Dead + 1.6Wind NS	3.34	0.83	189.74	

MAXIMUM SHEAR - E-W DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	0.08	0.08	0.04	94.87	
2 - 1.2Dead + 1.6Live	0.08	0.10	0.06	94.87	
3 - 1.2Dead + Live	0.08	0.09	0.05	94.87	
4 - 1.2Dead + 0.5Live + 1.6Wind NS	0.08	0.13	0.07	94.87	
5 - 1.2Dead + 0.5Live + 1.6Wind EW	0.08	0.31	0.17	94.87	
6 - 0.9Dead + 1.6Wind NS	0.08	0.11	0.06	94.87	
7 - 0.9Dead + 1.6Wind EW	0.08	0.28	0.16	94.87	

MAXIMUM SHEAR - N-S DIRECTION

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	0.83	0.58	0.40	94.87	
2 - 1.2Dead + 1.6Live	0.83	0.70	0.49	94.87	
3 - 1.2Dead + Live	6.67	-0.62	0.43	94.87	
4 - 1.2Dead + 0.5Live + 1.6Wind NS	6.67	-9.21	6.40	94.87	
5 - 1.2Dead + 0.5Live + 1.6Wind EW	6.67	-0.59	0.41	94.87	
6 - 0.9Dead + 1.6Wind NS	6.67	-17.86	12.40	94.87	
7 - 0.9Dead + 1.6Wind EW	6.67	-0.40	0.28	94.87	

Subject: Gas Bottle Canopy, Supports, Misc. Fdn's.
By: R. Murphy
Date: 1/22/08

Dimensional Solutions FOUNDATION3D		Version 4.0.0	Date	2/19/2008
Foundation Name	W14x43 Supt - Node 1		Time	8:23:29 AM
Designed By:		Engineer	Checker	
Filename:	C:\Documents and Settings\p0035165\Desktop\SCWO Misc CONCRETE\App C Duct Supports\pg8 foundation 2.msc			

DETAIL REPORT FOR W14x43 Supt - Node 1

PIER/BASE PLATE DESIGN INFORMATION

	P1
E-W Dim (ft)	2.50
N-S Dim (ft)	2.50
Height (ft)	1.50
E-W Offset (ft)	0.00
N-S Offset (ft)	0.00
Requested Reinft. Ratio	0.0018
Provided Reinft. Ratio	0.0039
Long Bar Size	6
Bars in E-W Dir	3
Bars in N-S Dir	3
Total Long Bars	8
Tie Bar Size	3
Total No. of Ties	4
Major Tie Spacing (in)	10

PIER ULTIMATE LOAD CAPACITIES

P1

Load Comb	Axial Load (kips)	Axial Capa. (kips)	Mom N-S (kip ft)	Mom N-S Capa (kip ft)	Mom E-W (kip ft)	Mom E-W Capa (kip ft)	Rem
1 - 1.4Dead	5.21	1695.23	0.65	232.70	0.65	232.70	
2 - 1.2Dead + 1.6Live	6.31	1695.23	0.79	232.70	0.79	232.70	
3 - 1.2Dead + Live	5.62	1695.23	0.70	232.70	0.70	232.70	
4 - 1.2Dead + 0.5Live + 1.6Wind NS	5.03	12.88	4.18	10.72	79.06	202.52	
5 - 1.2Dead + 0.5Live + 1.6Wind EW	4.99	102.88	14.25	293.16	0.62	12.86	
6 - 0.9Dead + 1.6Wind NS	3.34	3.37	3.99	11.03	79.08	220.02	
7 - 0.9Dead + 1.6Wind EW	3.30	3.33	14.06	220.25	0.47	7.24	

C.5. Summary

The calculation performed in this appendix includes structural analysis and design of isolated footings for supports of elevated HVAC ducts along the exterior of the SCWO Processing Building (SPB). Wind loads govern the design. No soil uplift is observed under worst-case overturning wind loads, and wind sliding resistance of the foundations is adequate.

Foundation at node 10 is 2’-0” thick with 1’-0” of soil cover. It measures 5’-0” in the E-W direction and 5’-0” in the N-S direction. Reinforcement on top is 4#6 each way. Reinforcement on bottom is 6#6 each way.

Foundation at node 15 is 2’-0” thick with 1’-0” of soil cover. It measures 6’-0” in the E-W direction and 7’-6” in the N-S direction. Reinforcement on top is #6 @ 18” o.c. each way. Reinforcement on bottom is #6 @ 9” each way.

Appendix D1

Gas Bottle Canopy #1 Foundation

D1.1. Objective

The calculation performed in this appendix includes structural analysis and design of the combined footing for a gas bottle canopy on the exterior of the eastern wall of the SCWO Processing Building (SPB) between column lines A and D.

D1.2. Inputs

Refer to drawing 24915-10-DB-00-0003 for footing dimensions and reinforcement.

Refer to drawing 24915-10-SS-00-00052 for column base plate detail.

(1) Footing loads are taken from SAP2000 base reactions.

(2) Maximum soil bearing pressure is 3000 psf.

(3) A test case is run in MathCad to show the process of checking the base plate and anchor bolts. All load cases are checked in Excel following the same procedure.

D1.3. Assumptions

It is assumed that wind loads and snow loads are applied evenly over the surface of the canopy. No uneven loading is considered, so the reactions applied to the foundation will be equal or equal and opposite for wind and snow load conditions.

D1.4. Calculation Body

Base reactions from SAP2000 steel analysis and design are given here. These loads are the input for the Mat3D footing design. The footing design check in Mat3D is included as well.

Base Plate and Anchor Bolt Design for HSS Section

This worksheet is used to illustrate the procedure to design the base plate and anchor bolts for a moment connected HSS column. Corresponding Excel spreadsheets are used to apply these calculations to a large data set. A test case is calculated using this worksheet to verify the accuracy of the excel spreadsheets. The test case is for the reactions at Joint 14 (see SAP model) resulting from the load combination UDSTL5. Since the moment about the two rotational axes (M1 and M2) are considered separately, only M1 is included in the test case. The test case values are highlighted in the excel spread sheet. To indicate to which spreadsheets the values in this calculation correlate, the following short hand notation is used.

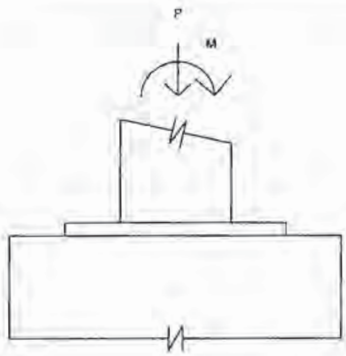
BPJ14 = "BasePlate Joint 14"

JR = "Joint Reactions"

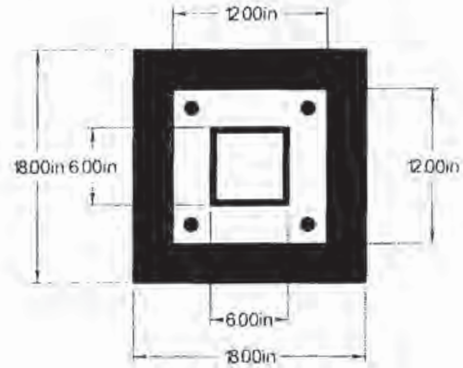
ATJ14 = "Anchor Tension Joint 14"

ASJ = "Anchor Shear Joint"

IC = "Interaction Check"



Elevation



Plan

Force Properties

[JR Column G] $P := 1.5820\text{kip}$

[JR Column H] $M := 76.2240\text{kip}\cdot\text{in}$

[JR Column E] $V_1 := -0.711\text{kip}$

[JR Column F] $V_2 := 0.00273\text{kip}$

[BPJ14 Column E] $e := \dfrac{M}{P}$ $e = 4\text{ ft}$

Geometric Properties (Base Plate)

[BPJ14 Cell E6] $t := .75\text{in}$ plate thickness

$N_{plate} := 12\text{in}$ baseplate edge length

[BPJ14 Cell D6] $c_{plate} := 6\text{in}$ distance to plate's neutral axis

[BPJ14 Cell G6] $d := 6\text{in}$ depth of column

$n := \dfrac{N_{plate}}{2} - \dfrac{0.95\cdot d}{2}$ distance from edge of plate to column face

$n = 0\text{ ft}$

$A_1 := 12\text{in}\cdot 12\text{in}$ note : A1 can't be less than column width times column flange...include that in there

[BPJ14 Cell A6] $A_1 = 1\text{ ft}^2$

[BPJ14 Cell C6] $I := \dfrac{1}{12}\cdot(12\text{in})^4$ $I = 0\text{ ft}^4$

$Z_y := \dfrac{t^2\cdot 1\text{in}}{6}$ $Z_y = 0\text{ gal}$

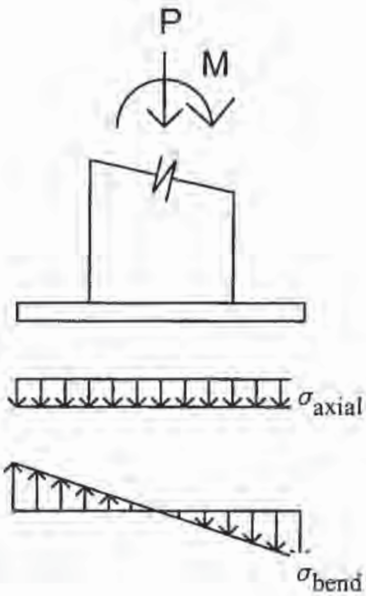
Geometric Properties (Pedesta

$A_2 := 18\text{in}\cdot 18\text{in}$

$A_2 = 2\text{ ft}^2$

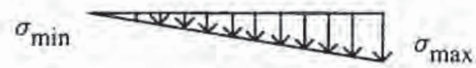
$A := 12\text{in}\cdot 12\text{in}$

Design Forces

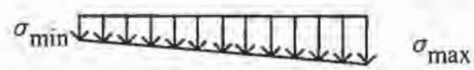


Stress Resultants

if σ axial = σ bending



if σ axial > σ bending



if σ axial < σ bending

Stress Calculations

[BPJ14 Column F] $\sigma_{axial} := \frac{P}{A}$ $\sigma_{axial} = 11\ \text{psi}$

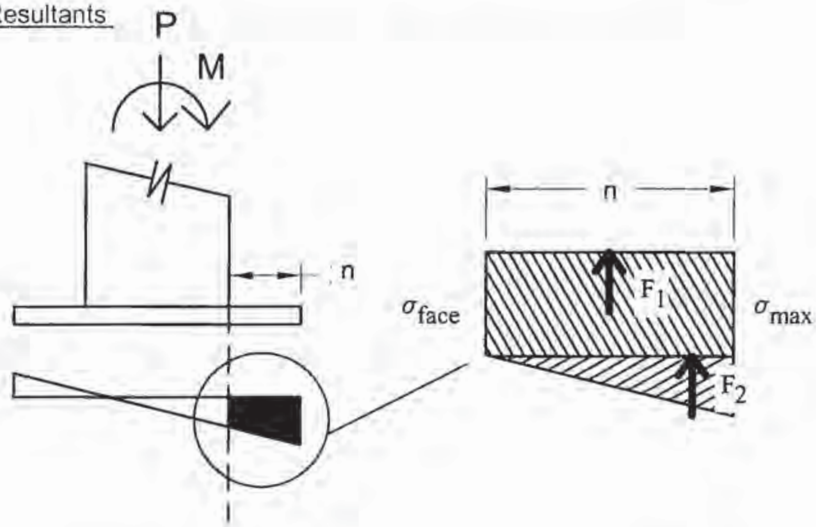
[BPJ14 Column G] $\sigma_{bend} := |M| \cdot \frac{c_{plate}}{I}$ $\sigma_{bend} = 265\ \text{psi}$

Total Stress

[BPJ14 Column I] $\sigma_{max} := \sigma_{axial} + \sigma_{bend}$ $\sigma_{max} = 276\ \text{psi}$

[BPJ14 Column H] $\sigma_{min} := \sigma_{axial} - \sigma_{bend}$ $\sigma_{min} = -254\ \text{psi}$

Calculating Force Resultants



[BPJ14 Column K] $stress\_slope := \frac{\sigma_{max} - \sigma_{min}}{N_{plate}}$ $stress\_slope = 2452435 \frac{lb}{s^2 \cdot ft^2}$

[BPJ14 Column L] $\sigma_{face} := \sigma_{max} + stress\_slope \cdot (9in - 12in)$ $\sigma_{face} = 143\,psi$

Rectangular Stress Block Resultants

[BPJ14 Column M] $F_{rect} := \sigma_{face} \cdot n \cdot 1in$ $F_{rect} = 451\,lbf$

[BPJ14 Column O] $M_{rect} := F_{rect} \cdot \frac{n}{2}$ $M_{rect} = 1906 \frac{ft^2 \cdot lb}{s^2}$

Triangular Stress Block Resultants

[BPJ14 Column N] $F_{tri} := \frac{(\sigma_{max} - \sigma_{face}) \cdot n \cdot 1in}{2}$ $F_{tri} = 208\,lbf$

[BPJ14 Column P] $M_{tri} := F_{tri} \cdot 2 \cdot \frac{n}{3}$ $M_{tri} = 1174 \frac{ft^2 \cdot lb}{s^2}$

Total Moment Per Unit Width

$M_{design} := M_{rect} + M_{tri}$

[BPJ14 Column Q] $\boxed{M_{design} = 3080 \frac{ft^2 \cdot lb}{s^2}}$

Base Plate Design [LRFD-05 J9]

1. Concrete Bearing Stress [LRFD-05 J9

[BPJ14 Cell L6] $f_c := 4\text{ksi}$

[BPJ14 Cell K6] $\varphi_c := .6$

$$A_{ratio} := \text{if}\left[\left(\frac{A_2}{A_1}\right)^{\frac{1}{2}} < 2, \left(\frac{A_2}{A_1}\right)^{\frac{1}{2}}, 2\right]$$

[BPJ14 Cell J6] $A_{ratio} = 2$

$F_p := \varphi_c \cdot 0.85 \cdot f_c \cdot A_{ratio}$ [LRFD-05 EQ J9-2]

[BPJ14 Cell M6] $F_p = 3060\,\text{psi}$

$\text{pedestal\_design} := \text{if}\left(\sigma_{max} < F_p, G_{pedestal}, NG_{pedestal}\right)$

[BPJ14 Column T] $\boxed{\text{pedestal\_design} = \text{"Pedestal design is good"}}$

2. Plate Thickness [LRFD-05 14]

$\varphi_{flex} := .90 \quad F_y := 36\text{ksi}$

[BPJ14 Column R] $t_p := \sqrt{4 \cdot \frac{M_{design} \cdot 1}{\varphi_{flex} \cdot F_y \cdot 1\text{in}}} \quad t_p = 0\,\text{ft}$ [LRFD-05 14-6]

Plate Bending Strength per unit width

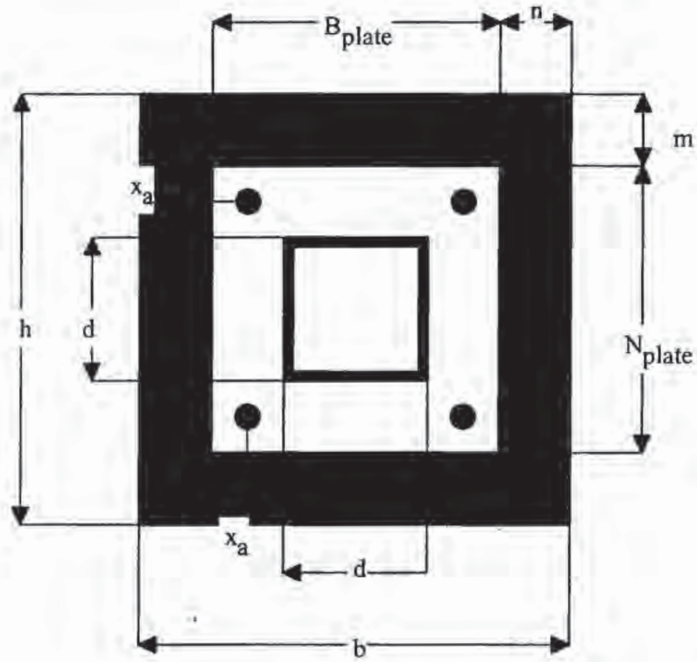
$M_{strength} := \varphi_{flex} \cdot F_y \cdot Z_y \qquad M_{strength} = 3.037 \times 10^3 \cdot \text{in} \cdot \text{lbf}$

Design Check

$\text{base\_plate\_design} := \text{if}\left(t > t_p, G_d, NG\right)$

[BPJ14 Column S] $\boxed{\text{base\_plate\_design} = \text{"Base Plate Design is Good"}}$

Anchor Bolt Design References:
-AISC Steel Design Guide: Base Plate and Anchor Rod Design
-ACI 318-05



[ATJ14 Cell A4] $N_{plate} = 1\ ft$

[ATJ14 Cell C4] $x_a := 1.5in$

$N' := N_{plate} - x_a$

[ATJ14 Cell D4] $N' = 1\ ft$

[ATJ14 Cell B4] $B := N_{plate}$

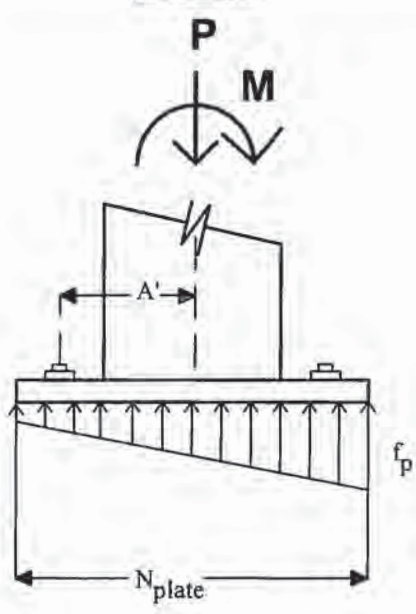
[ATJ14 Cell E4] $A' := 4.5in$

[BPJ14 Column H] $f_p := \sigma_{max}$

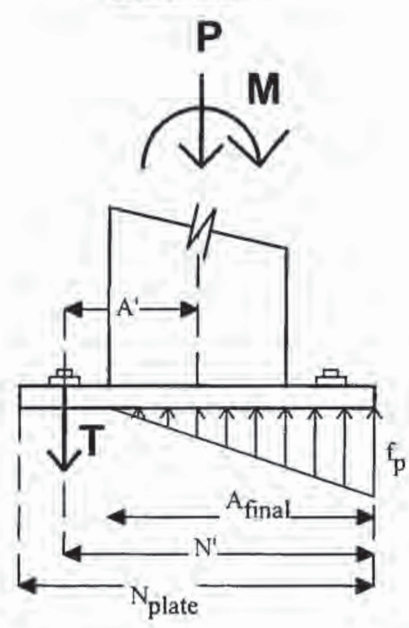
[ATJ14 Column E] $e = 4\ ft$

Tension in Anchor Bolt due to Moment [AISC Design Guide Appendix B]

if e<e_kern



if e>e_kern



Determing effects of eccentricity [AISC B.3]

[ATJ14 Cell F4] $e_{kern} := \frac{N_{plate}}{6}$ $\boxed{e_{kern} = 0\,ft}$ [AISC B.3]

$anchor\_tension := if(e > e_{kern}, BT, NBT)$

anchor_tension = "Anchor bolts in tension"

Determining Tension in Anchor Bolt [AISC B.4.2]

Determining Length of Stress Triangle

[ATJ14 Column H] $f' := f_p \cdot N_{plate} \cdot \frac{N'}{2}$ $\boxed{f' = 17366\,lbf}$

[ATJ14 Column I] $A_{plus} := \frac{f' + \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}}$ $\boxed{A_{plus} = 2\,ft}$

[ATJ14 Column J] $A_{minus} := \frac{f' - \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}}$ $\boxed{A_{minus} = 0\,ft}$

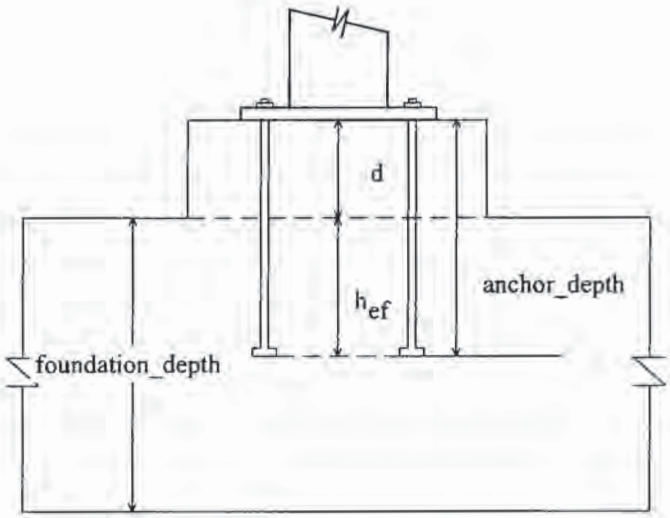
[ATJ14 Column K]
$$A_{final} := \left| \begin{array}{l} \min(A_{plus}, A_{minus}) \text{ if } A_{plus} > 0 \wedge A_{minus} > 0 \\ A_{plus} \text{ if } A_{plus} > 0 \wedge A_{minus} < 0 \\ 0 \text{ if } A_{plus} < 0 \wedge A_{minus} < 0 \end{array} \right.$$
$\boxed{A_{final} = 0\,ft}$

Determining Anchor Tension from Equilibrium

[ATJ14 Column L] $T_{anchors} := \frac{f_p \cdot A_{final} \cdot B}{2} - P$ $\boxed{T_{anchors} = 8187\,lbf}$

[ATJ14 Column M] $T_{one\_anchor} := \frac{T_{anchors}}{2}$ $\boxed{T_{one\_anchor} = 4094\,lbf}$

Pedestal and Foundation Cross Section



$anchor\_depth := 14in$

$d := 6in$

$h_{ef} := anchor\_depth - d$

$h_{ef} = 1\,ft$

To simplify the calculation, the effective embedment depth of the anchor bolt is taken as the length of the bolt that extends beneath the column pedestal. This results in a conservative estimate of the strength of concrete breakout and pryout.

Steel Strength of anchor in tension [ACI 318.05 D.5.1]

$f_{ya} := 36ksi$ $\qquad n_{anch} := 4$

$f_{uta} := \min(1.9 \cdot f_{ya}, 125ksi, 58ksi)$

$f_{uta} = 58000\,psi$

$d_o := 0.75in$

$n_t := \frac{10}{in}$ [LRFD-05 Table 7-18]

$A_{se} := \frac{\pi}{4} \cdot \left(d_o - \frac{0.9743}{n_t}\right)^2$

$A_{se} = 0\,ft^2$ [LRFD-05 Table 7-18]

$N_{sa} := n_{anch} \cdot A_{se} \cdot f_{uta}$ [ACI 318.05 Eq D-3]

[ATJ14 Cell L5] $\boxed{N_{sa} = 77595\,lbf}$ one anchor

Concrete breakout strength-Tension [ACI 318.05 D.5.2]

Concrete breakoutt strength based on a grouping of two anchors, since tension due to moment is the only tension present.

$c_{a1} := 4.5in$ $\qquad s_1 := 9in$

$c_{a2} := 4.5in$ $\qquad s_2 := 9in$

$c_{a11} := 4.5in$ $\qquad f_c = 4000\,psi$

$c_{a22} := 4.5in$

$c_{amin} := \min(c_{a1}, c_{a11}, c_{a2}, c_{a22})$

$n_{anch\_ten} := 2$

Breakout Prism Properties

$h'_{ef} := h_{ef}$

$A_{NCO} := 9 \cdot h'^{\,2}_{ef}$

$A_{NCO} = 4\,ft^2$

$A_{NC} := (1.5 \cdot h'_{ef} + s_1 + 1.5 \cdot h'_{ef}) \cdot (1.5 \cdot h'_{ef} + 1.5 \cdot h'_{ef})$

$A_{NC} = 5\,ft^2$

$A_{NC} := \min(A_{NC}, n_{anch\_ten} \cdot A_{NCO})$

$A_{NC} = 5\,ft^2$

anchor_status := "cast in"

$k_c :=$ if(anchor_status = "cast in" ,24,17)

$k_c = 24$

$$N_b := \begin{cases} 16 \cdot psi^{.5} \cdot in^{\frac{1}{3}} \cdot \sqrt{f_c} \cdot h'^{\,\frac{5}{3}}_{ef} & \text{if } 11in \le h'_{ef} \le 25in \\ k_c \cdot \sqrt{f_c} \cdot h'^{\,1.5}_{ef} \cdot psi^{.5} \cdot in^{.5} & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-7]

[ACI 318-05 EQ D-8]

$N_b = 34346\,lbf$

$e'_N := 4.5in$ Assumption that only one row of anchors on one side of the column center line carry tension load. Eccentricity is therefore distance from this row of anchors to the column center line

$$\psi_{ecN} := \min\left(\frac{1}{1+\frac{2\cdot e'_N}{3\cdot h'_{ef}}}, 1.0\right)$$ [ACI 318-05 EQ D-9]

$\psi_{ecN} = 1$

$$\psi_{edN} := \begin{cases} 1 \text{ if } c_{amin} \geq 1.5\cdot h'_{ef} & \text{[ACI 318-05 EQ D-10]} \\ 0.7 + 0.3\cdot\frac{c_{amin}}{1.5(h'_{ef})} \text{ if } c_{amin} < 1.5\cdot h'_{ef} & \text{[ACI 318-05 EQ D-11]} \end{cases}$$

$\psi_{edN} = 1$

$$\psi_{cN} := \begin{cases} 1.25 \text{ if anchor\_status} = \text{"cast in"} \\ 1.4 \text{ otherwise} \end{cases}$$ [ACI 318-05 EQ D.5.2.6

$\psi_{cN} = 1$

$\psi_{cpN} := 1$ [ACI 318-05 D5.2.7]

$$N_{cbg} := \frac{A_{NC}}{A_{NCO}}\cdot\psi_{ecN}\cdot\psi_{edN}\cdot\psi_{cN}\cdot\psi_{cpN}\cdot N_b$$ [ACI 318-05 EQ D-5]

[ATJ14 Cell M5] $\boxed{N_{cbg} = 34883\,lbf}$ Group of two anchors

Pullout Strength of Anchor in Tension [ACI 318-05 D.5.3]

$A_{brg} := 0.654in^2$ crack_status := "not cracked" hook_status := "not hooked"

$N_p := 8\cdot A_{brg}\cdot f_c$ [ACI 318-02 EQ D-15]

$\psi_{cP} := \text{if}[(\text{crack\_status} = \text{"cracked"}), 1.4, 1.0]$ [ACI 318-05 D.5.3.6]

$N_{pn} := \psi_{cP}\cdot N_p$ [ACI 318-02 EQ D-14]

[ATJ14 Cell N5] $\boxed{N_{pn} = 20928\,lbf}$ One Anchor

Concrete side-face blowout strength-Tension [ACI 318.05 D.5.4]

$c_{a1} = 0\,ft$

$N_{sb} := 160\frac{lbf}{in}\cdot c_{a1}\cdot\sqrt{\frac{A_{brg}}{in^2}}\cdot\sqrt{\frac{f_c}{psi}}$ [ACI 318-05 EQ D-17] $A_{brg} = 0\,ft^2$

[ATJ14 Cell O5] $\boxed{N_{sb} = 36826\,lbf}$ one anchor

Tension Design Check

$\boxed{N_{sa} = 77595\,lbf}$ one anchor $\boxed{N_{pn} = 20928\,lbf}$ one anchor

$\boxed{N_{cbg} = 34883\,lbf}$ two anchors $\boxed{N_{sb} = 36826\,lbf}$ one anchor

$\varphi_{tension} := 0.85$ Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength. Condition A is met [ACI 318-05 D.4.4]

$N_{design} := \varphi_{tension}\cdot\min\left(N_{sa}, \frac{N_{cbg}}{2}, N_{pn}, N_{sb}\right)$ [ACI 318-05 D.4.1.1]

[ATJ14 Cell H4] $\boxed{N_{design} = 14825\,lbf}$

$T_{one\_anchor} = 4094\,lbf$

$tension\_design := if\left(T_{one\_anchor} \le N_{design}, \text{"Good"}, \text{"Not Good"}\right)$ [ACI 318-05 EQ D-1]

[ATJ14 Column M-Q] $\boxed{tension\_design = \text{"Good"}}$

Steel Strength of Anchor in Shear [ACI 318-05 D.6.1]

Anchor Types:

AT1 [ACI 318-05 D.6.1.a]

AT2 [ACI 318-05 D.6.1.b]

AT3 [ACI 318-05 D.6.1.c]

Anchor Type Used:

$AT := \text{"AT1"}$

Grout Pad Factor [ACI 318-05 D.6.1.3]:

$grout\_pad\_used := \text{"yes"}$

$$c_{pad} := \begin{cases} 0.8 & \text{if } grout\_pad\_used = \text{"yes"} \\ 1.0 & \text{otherwise} \end{cases}$$

$c_{pad} = 1$

Shear Strength:

$$V_{sa} := \begin{cases} c_{pad} \cdot n_{anch} \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT1"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT2"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT3"} \end{cases}$$

[ACI 318-05 EQ D-19]
[ACI 318-05 EQ D-20]
[ACI 318-05 EQ D-20]

[ASJ Cell B7] $\boxed{V_{sa} = 62076\ \text{lbf}}$ one anchor

Concrete Breakout Strength-Shear [ACI 318-05 D.6.2]

group_status := "group"

Projected Concrete Failure Area [ACI 318-05 D.6.2.1, RD.6.2.1]

$c_{a1} = 0\,ft$ Assuming that total shear is critical on one anchor row

$h_a := 6\cdot in$ Thicknessof pedestal

$s_1 = 1\,ft$ Anchor Bolt Spacing

$$c := \begin{cases} 1.5\cdot c_{a1} & \text{if } 1.5\cdot c_{a1} < c_{a2} \\ c_{a2} & \end{cases} \qquad c = 0\,ft$$

$$A_{vc} := \begin{cases} \left[2\cdot(c) + s_1\right]\cdot h_a & \text{if } 1.5c_{a1} > h_a \\ 2\cdot\left[(c) + s_1\right]\cdot 1.5\cdot c_{a1} & \text{otherwise} \end{cases}$$

[ACI 318-05 Fig RD.6.2.1(b)]
Failure area for group of anchors

$A_{vc} = 1\,ft^2$

$A_{vco} := 4.5\cdot c_{a1}{}^2$

$A_{vco} = 1\,ft^2$ [ACI 318-05 EQ D-23]

$A_{vc} := \min\left(A_{vc}, n_{anch}\cdot A_{vco}\right)$

$A_{vc} = 1\,ft^2$

Basic Concrete Breakout Strength [ACI 318-05 D.6.2.2]

$l_e := h_{ef}$ anchor load bearing legnth

$$V_b := 7\cdot\left(\frac{l_e}{d_o}\right)^{0.2}\cdot\sqrt{d_o}\cdot\sqrt{f_c}\cdot c_{a1}{}^{1.5}\cdot psi^{.5}$$ [ACI 318-05 EQ D.24]

$V_b = 5876\,lbf$

$e'_v := 0in$ Assumption that shear is distributed equal to all anchors and no shear eccentricity results

$$\psi_{ecV} := \min\left(1, \frac{1}{1 + 2 \cdot \frac{e'_v}{3 \cdot c_{a1}}}\right)$$

$\psi_{ecV} = 1$

$c_{a2} = 0\ ft$

$$\psi_{edV} := \begin{vmatrix} 1.0 \text{ if } c_{a2} \ge 1.5 \cdot c_{a1} \\ 0.7 + 0.3 \cdot \frac{c_{a2}}{1.5 \cdot c_{a1}} \text{ if } c_{a2} < 1.5 \cdot c_{a1} \end{vmatrix}$$

[ACI 318-05 EQ D-27]

[ACI 318-05 EQ D-28]

$\psi_{edV} = 1$

crack_status = "not cracked"

$$\psi_{cV} := \begin{vmatrix} 1.4 \text{ if crack\_status = "not cracked"} \\ 1.0 \text{ if crack\_status = "cracked no reinforce"} \\ 1.2 \text{ if crack\_status = "cracked with reinforce"} \\ 1.4 \text{ if crack\_status = "cracked with reinforce and stirrups"} \end{vmatrix}$$

$\psi_{cV} = 1$

$$V_{cb} := \begin{vmatrix} \frac{A_{vc}}{A_{vco}} \cdot \psi_{edV} \cdot \psi_{cV} \cdot V_b \text{ if group\_status = "single anchor"} \\ 0 \text{ otherwise} \end{vmatrix}$$

[ACI 318-05 EQ D-21]

$$V_{cbg} := \begin{vmatrix} \frac{A_{vc}}{A_{vco}} \cdot \psi_{ecV} \cdot \psi_{edV} \cdot \psi_{cV} \cdot V_b \text{ if group\_status = "group"} \\ 0 \text{ otherwise} \end{vmatrix}$$

[ACI 318-05 EQ D-22]

$V_{cb} = 0\ lbf$

[ASJ Cell C7] $\boxed{V_{cbg} = 8775\ lbf}$ group of 2 anchors

Concrete pryout strength of anchor in shear [ACI 318-05 D.6.3]

$h_{ef} = 1\ \text{ft}$

$k_{cp} := \begin{cases} 1.0 \ \text{if}\ h_{ef} < 2.5\text{in} \\ 2.0 \ \text{if}\ h_{ef} \ge 2.5\text{in} \end{cases}$

$V_{cp} := \begin{cases} k_{cp} \cdot N_{cb} \ \text{if group\_status = "single anchor"} \\ 0 \ \text{otherwise} \end{cases}$ [ACI 318-05 EQ D-29]

$V_{cpg} := \begin{cases} k_{cp} \cdot N_{cbg} \ \text{if group\_status = "group"} \\ 0 \ \text{otherwise} \end{cases}$ [ACI 318-05 EQ D-30]

[ASJ Cell D7] $\boxed{V_{cpg} = 69765\ \text{lbf}}$ group of 2 anchors

Shear Design Check

$\boxed{V_{sa} = 62076\ \text{lbf}}$ one anchor

$\boxed{V_{cbg} = 8775\ \text{lbf}}$ group of 2 anchors

$\boxed{V_{cpg} = 69765\ \text{lbf}}$ group of 2 anchors

[ASJ Cell B3] $\varphi_{shear} := 0.85$ Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength [ACI 318-05 D.4.4]

$V_{design} := \varphi_{shear} \cdot \min(V_{sa} \cdot 4, V_{cbg}, V_{cpg})$ [ACI 318-05 D.4.1.1]

$\boxed{V_{design} = 7459\ \text{lbf}}$

design_shear := if($V_1 \le V_{design} \wedge V_2 \le V_{design}$, "Design is OK", "Design is insufficient")

[ASJ Column E-J] $\boxed{\text{design\_shear = "Design is OK"}}$ [ACI 318-05 EQ D-2]

Interaction of tensile and shear forces [ACI 318-05 D.7]

[IC Column I] $\frac{V_1}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} = 0$

$$ST_{check} := \text{if}\left(\frac{V_1}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} \le 1.2, \text{"Interaction OK"}, \text{"Interactoin Failure"}\right)$$

$$\text{interaction\_check\_V}_1 := \text{if}\left[\left(V_1 > 0.2 \cdot V_{design} \wedge T_{one\_anchor} > N_{design}\right), ST_{check}, \text{"No check needed"}\right]$$

[IC Column I] $\boxed{\text{interaction\_check\_V}_1 = \text{"No check needed"}}$

[IC Column J] $\frac{V_2}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} = 0$

$$ST_{check} := \text{if}\left(\frac{V_2}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} \le 1.2, \text{"Interaction OK"}, \text{"Interactoin Failure"}\right)$$

$$\text{interaction\_check\_V}_2 := \text{if}\left[\left(V_2 > 0.2 \cdot V_{design} \wedge T_{one\_anchor} > N_{design}\right), ST_{check}, \text{"No check needed"}\right]$$

[IC Column J] $\boxed{\text{interaction\_check\_V}_2 = \text{"No check needed"}}$

BECHTEL PARSONS BLUE GRASS

Calculation Sheet

Gas Bottles Misc Support Calculations
By R. Murphy   Date: 12/16/2007

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev D
Sheet No. D1-19 / D1-60

Joint Reactions

Joint Text	OutputCase Text	CaseType Text	StepType Text	F1 Kip	F2 Kip	F3 Kip	M1 Kip-in	M2 Kip-in	M3 Kip-in	
14	UDSTL1	Combination		-1.774E-06	0.0002569	2.066	-1.811	-3.25E-05	-0.018	
14	UDSTL2	Combination		-1.462E-06	0.0002166	3.259	-1.551	9.05E-05	-0.015	
14	UDSTL3	Combination		0.001543	-0.664	1.582	62.471	0.179	0.034	
14	UDSTL4	Combination		-0.001546	0.665	2.89	-65.575	-0.179	-0.064	
14	UDSTL5	Combination		0.002073	-0.711	1.582	78.224	0.241	0.085	<--Test Case (M1, not M2)
14	UDSTL6	Combination		-0.002076	0.712	2.89	-79.328	-0.241	-0.115	
14	UDSTL7	Combination		-0.201	0.0001287	1.659	-1.539	-15.144	-0.01	
14	UDSTL8	Combination		0.201	0.0003094	2.813	-1.565	15.144	-0.02	
14	UDSTL9	Combination		-0.201	0.0001298	2.794	-1.539	-15.144	-0.01	
14	UDSTL10	Combination		0.201	0.0003083	1.678	-1.565	15.144	-0.02	
14	UDSTL11	Combination		0.001543	-0.664	0.674	62.859	0.179	0.037	
14	UDSTL12	Combination		-0.001545	0.665	1.983	-65.187	-0.179	-0.06	
14	UDSTL13	Combination		0.002073	-0.711	0.674	76.612	0.241	0.089	
14	UDSTL14	Combination		-0.002075	0.711	1.983	-78.941	-0.241	-0.112	
14	UDSTL15	Combination		-0.201	0.0000748	0.751	-1.151	-15.144	-0.006601	
14	UDSTL16	Combination		0.201	0.0002555	1.906	-1.177	15.144	-0.016	
14	UDSTL17	Combination		-0.201	7.591E-05	1.886	-1.151	-15.144	-0.006568	
14	UDSTL18	Combination		0.201	0.0002544	0.77	-1.177	15.144	-0.016	
14	UDSTL19	Combination		-0.157	0.001359	2.236	-1.68	-18.171	-0.001199	
14	UDSTL20	Combination		0.157	-0.000921	2.236	-1.424	18.171	-0.029	
14	UDSTL21	Combination		0.0004916	-0.159	2.236	16.916	0.057	0.00092	
14	UDSTL22	Combination		-0.0004946	0.159	2.236	-20.02	-0.057	-0.031	
14	UDSTL23	Combination		-0.157	0.001305	1.328	-1.292	-18.171	0.002593	
14	UDSTL24	Combination		0.157	-0.000975	1.328	-1.036	18.171	-0.025	
14	UDSTL25	Combination		0.0004919	-0.159	1.328	17.304	0.057	0.004712	
14	UDSTL26	Combination		-0.0004942	0.159	1.328	-19.632	-0.057	-0.028	
14	UDSTL27	Combination	Max	0.495	0.006384	2.236	-0.82	57.469	0.021	
14	UDSTL27	Combination	Min	-0.495	-0.005946	2.236	-2.284	-57.469	-0.051	
14	UDSTL28	Combination	Max	0.001568	0.494	2.24	58.491	0.182	0.448	
14	UDSTL28	Combination	Min	-0.001571	-0.493	2.232	-61.595	-0.182	-0.479	
14	UDSTL29	Combination	Max	0.495	0.00633	1.328	-0.432	57.469	0.024	
14	UDSTL29	Combination	Min	-0.495	-0.006	1.328	-1.896	-57.469	-0.047	
14	UDSTL30	Combination	Max	0.001569	0.494	1.333	58.879	0.182	0.452	
14	UDSTL30	Combination	Min	-0.001571	-0.493	1.324	-61.207	-0.182	-0.475	
15	UDSTL1	Combination		3.695E-06	-0.000178	1.807	-1.5	0.000286	-0.018	
15	UDSTL2	Combination		5.745E-06	-0.000171	2.781	-1.286	0.000439	-0.015	
15	UDSTL3	Combination		-0.001444	-0.608	1.392	56.98	-0.168	0.423	
15	UDSTL4	Combination		0.001452	0.607	2.476	-59.552	0.168	-0.453	
15	UDSTL5	Combination		-0.001944	-0.658	1.392	69.661	-0.226	0.534	
15	UDSTL6	Combination		0.001952	0.657	2.476	-72.233	0.227	-0.565	
15	UDSTL7	Combination		-0.201	-0.000504	1.743	-1.249	-15.081	-0.01	
15	UDSTL8	Combination		0.201	0.0001865	2.125	-1.323	15.082	-0.02	
15	UDSTL9	Combination		-0.201	-0.000509	2.125	-1.249	-15.081	-0.01	
15	UDSTL10	Combination		0.201	0.0001918	1.743	-1.323	15.082	-0.02	
15	UDSTL11	Combination		-0.001445	-0.608	0.62	57.302	-0.168	0.426	
15	UDSTL12	Combination		0.00145	0.607	1.704	-59.231	0.168	-0.449	
15	UDSTL13	Combination		-0.001946	-0.658	0.62	69.983	-0.226	0.538	
15	UDSTL14	Combination		0.001951	0.657	1.704	-71.911	0.227	-0.561	
15	UDSTL15	Combination		-0.201	-0.00046	0.971	-0.928	-15.082	-0.006458	
15	UDSTL16	Combination		0.201	0.0002303	1.353	-1.001	15.082	-0.017	
15	UDSTL17	Combination		-0.201	-0.000465	1.353	-0.928	-15.081	-0.006423	
15	UDSTL18	Combination		0.201	0.0002356	0.971	-1.001	15.082	-0.017	
15	UDSTL19	Combination		-0.157	-0.001184	1.934	-1.172	-18.171	-0.001352	
15	UDSTL20	Combination		0.157	0.0008671	1.934	-1.4	18.171	-0.029	
15	UDSTL21	Combination		-0.0004586	-0.147	1.934	15.717	-0.053	0.105	
15	UDSTL22	Combination		0.0004665	0.146	1.934	-18.289	0.054	-0.135	
15	UDSTL23	Combination		-0.157	-0.00114	1.162	-0.851	-18.171	0.002458	
15	UDSTL24	Combination		0.157	0.000911	1.162	-1.078	18.171	-0.025	
15	UDSTL25	Combination		-0.0004602	-0.147	1.162	16.039	-0.054	0.108	
15	UDSTL26	Combination		0.0004649	0.146	1.162	-17.968	0.054	-0.131	
15	UDSTL27	Combination	Max	0.496	0.005898	1.934	-0.573	57.47	0.021	
15	UDSTL27	Combination	Min	-0.495	-0.006215	1.934	-1.999	-57.47	-0.051	
15	UDSTL28	Combination	Max	0.00167	0.405	1.937	47.756	0.194	0.714	
15	UDSTL28	Combination	Min	-0.001662	-0.406	1.931	-50.328	-0.193	-0.745	
15	UDSTL29	Combination	Max	0.496	0.005942	1.162	-0.252	57.47	0.024	

15	UDSTL29	Combination	Min	-0.495	-0.006171	1.162	-1.677	-57.47	-0.047
15	UDSTL30	Combination	Max	0.001668	0.405	1.165	48.077	0.194	0.718
15	UDSTL30	Combination	Min	-0.001663	-0.406	1.159	-50.006	-0.194	-0.741
16	UDSTL1	Combination		-2.416E-05	-0.001073	3.68	-1.657	-0.000768	-0.018
16	UDSTL2	Combination		-4.197E-05	-0.000926	6.083	-1.42	-0.001357	-0.015
16	UDSTL3	Combination		0.0007195	-0.739	2.782	66.475	0.085	0.17
16	UDSTL4	Combination		-0.0007742	0.737	5.357	-69.315	-0.087	-0.2
16	UDSTL5	Combination		0.0009646	-0.685	2.782	76.518	0.114	0.238
16	UDSTL6	Combination		-0.001019	0.683	5.357	-79.359	-0.115	-0.269
16	UDSTL7	Combination		-0.201	-0.000924	3.178	-1.423	-15.118	-0.011
16	UDSTL8	Combination		0.201	-0.00092	4.961	-1.418	15.116	-0.02
16	UDSTL9	Combination		-0.201	-0.00093	4.847	-1.422	-15.118	-0.01
16	UDSTL10	Combination		0.201	-0.000914	3.292	-1.418	15.117	-0.02
16	UDSTL11	Combination		0.0007314	-0.739	1.078	66.83	0.085	0.173
16	UDSTL12	Combination		-0.0007624	0.738	3.653	-68.96	-0.086	-0.196
16	UDSTL13	Combination		0.0009764	-0.685	1.078	76.873	0.114	0.242
16	UDSTL14	Combination		-0.001007	0.683	3.654	-79.004	-0.115	-0.265
16	UDSTL15	Combination		-0.201	-0.000692	1.474	-1.068	-15.118	-0.006699
16	UDSTL16	Combination		0.201	-0.000688	3.257	-1.063	15.117	-0.016
16	UDSTL17	Combination		-0.201	-0.000698	3.144	-1.068	-15.118	-0.006666
16	UDSTL18	Combination		0.201	-0.000682	1.588	-1.063	15.117	-0.016
16	UDSTL19	Combination		-0.157	-0.001567	4.07	-1.35	-18.199	-0.001292
16	UDSTL20	Combination		0.157	-0.000276	4.07	-1.491	18.197	-0.029
16	UDSTL21	Combination		0.0002067	-0.164	4.07	17.546	0.026	0.035
16	UDSTL22	Combination		-0.0002614	0.163	4.07	-20.387	-0.028	-0.066
16	UDSTL23	Combination		-0.157	-0.001335	2.366	-0.995	-18.199	0.002535
16	UDSTL24	Combination		0.157	-4.42E-05	2.366	-1.136	18.198	-0.026
16	UDSTL25	Combination		0.0002185	-0.164	2.366	17.901	0.027	0.039
16	UDSTL26	Combination		-0.0002496	0.163	2.366	-20.032	-0.028	-0.062
16	UDSTL27	Combination	Max	0.496	0.0006472	4.07	-1.243	57.555	0.021
16	UDSTL27	Combination	Min	-0.496	-0.002491	4.07	-1.598	-57.557	-0.052
16	UDSTL28	Combination	Max	0.0006711	0.454	4.075	56.478	0.08	0.536
16	UDSTL28	Combination	Min	-0.0007258	-0.456	4.065	-59.318	-0.082	-0.567
16	UDSTL29	Combination	Max	0.496	0.0008792	2.366	-0.888	57.555	0.025
16	UDSTL29	Combination	Min	-0.496	-0.002259	2.366	-1.243	-57.556	-0.048
16	UDSTL30	Combination	Max	0.0006829	0.454	2.371	56.833	0.081	0.54
16	UDSTL30	Combination	Min	-0.000714	-0.455	2.361	-58.963	-0.082	-0.563
17	UDSTL1	Combination		0.00002224	0.0009945	3.422	-1.632	0.001053	-0.018
17	UDSTL2	Combination		0.00003769	0.0008803	5.605	-1.4	0.001717	-0.015
17	UDSTL3	Combination		-0.0008187	-0.706	2.593	63.723	-0.096	0.339
17	UDSTL4	Combination		0.0008685	0.708	4.943	-66.521	0.099	-0.369
17	UDSTL5	Combination		-0.001093	-0.664	2.593	73.731	-0.13	0.438
17	UDSTL6	Combination		0.001143	0.666	4.943	-76.529	0.132	-0.469
17	UDSTL7	Combination		-0.201	0.001299	3.297	-1.446	-15.096	-0.01
17	UDSTL8	Combination		0.201	0.0004237	4.238	-1.352	15.098	-0.02
17	UDSTL9	Combination		-0.201	0.001309	4.22	-1.447	-15.095	-0.01
17	UDSTL10	Combination		0.201	0.0004135	3.316	-1.351	15.098	-0.02
17	UDSTL11	Combination		-0.0008293	-0.707	1.025	64.073	-0.097	0.342
17	UDSTL12	Combination		0.0008579	0.708	3.375	-66.171	0.098	-0.366
17	UDSTL13	Combination		-0.001104	-0.664	1.025	74.081	-0.13	0.442
17	UDSTL14	Combination		0.001132	0.665	3.375	-76.179	0.131	-0.465
17	UDSTL15	Combination		-0.201	0.001077	1.729	-1.096	-15.096	-0.006592
17	UDSTL16	Combination		0.201	0.0002019	2.67	-1.002	15.098	-0.017
17	UDSTL17	Combination		-0.201	0.001087	2.651	-1.097	-15.096	-0.006558
17	UDSTL18	Combination		0.201	0.0001917	1.748	-1.001	15.097	-0.017
17	UDSTL19	Combination		-0.157	0.001393	3.768	-1.455	-18.195	-0.001364
17	UDSTL20	Combination		0.157	0.0003295	3.768	-1.343	18.197	-0.029
17	UDSTL21	Combination		-0.0002396	-0.157	3.768	16.914	-0.03	0.082
17	UDSTL22	Combination		0.0002894	0.159	3.768	-19.712	0.032	-0.113
17	UDSTL23	Combination		-0.157	0.001171	2.2	-1.105	-18.195	0.002469
17	UDSTL24	Combination		0.157	0.0001077	2.2	-0.993	18.197	-0.026
17	UDSTL25	Combination		-0.0002502	-0.157	2.2	17.264	-0.03	0.086
17	UDSTL26	Combination		0.0002788	0.159	2.2	-19.362	0.032	-0.109
17	UDSTL27	Combination	Max	0.496	0.002161	3.768	-1.242	57.551	0.021
17	UDSTL27	Combination	Min	-0.496	-0.000439	3.768	-1.556	-57.548	-0.052
17	UDSTL28	Combination	Max	0.001039	0.426	3.772	52.395	0.121	0.659
17	UDSTL28	Combination	Min	-0.0009896	-0.424	3.764	-55.193	-0.118	-0.69
17	UDSTL29	Combination	Max	0.496	0.00194	2.2	-0.891	57.55	0.025

17	UDSTL29	Combination	Min	-0.496	-0.000661	2.2	-1.206	-57.549	-0.048
17	UDSTL30	Combination	Max	0.001029	0.425	2.203	52.745	0.12	0.663
17	UDSTL30	Combination	Min	-0.001	-0.424	2.196	-54.843	-0.119	-0.686

Base Plate Design

HSS 6X6X.375
12"x12" Plate

A (in^2)		I (in)	c (in)	t (in)	n(in)	d (in)	Fy (ksi)	A2 (in^2)	Aratio	Φ_c	Fc (ksi)	Fp (ksi)
144		1728	6	0.75	3.15	12	36	324	1.5	0.6	4	3.06

Joint	OutputCase	F3	M1	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	d. check plate	d. check ped bearing
Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
14	UDSTL1	2.0660	-1.8110	-0.8766	0.0143	0.0063	0.0206	0.0081	0.3905	0.0010	0.0173	0.0546	0.0052	0.0860	0.0109	0.0969	0.109385	Design Good	Design Good
14	UDSTL2	3.2590	-1.5510	-0.4759	0.0226	0.0054	0.0280	0.0172	0.6156	0.0009	0.0252	0.0793	0.0045	0.1250	0.0094	0.1343	0.128776	Design Good	Design Good
14	UDSTL3	1.5820	62.4710	39.4886	0.0110	0.2169	0.2279	-0.2059	-0.9036	0.0362	0.1140	0.3592	0.1794	0.5657	0.3767	0.9423	0.341083	Design Good	Design Good
14	UDSTL4	2.8900	-65.5750	-22.6903	0.0201	0.2277	0.2478	-0.2076	-0.8380	0.0379	0.1282	0.4039	0.1883	0.6361	0.3954	1.0315	0.356858	Design Good	Design Good
14	UDSTL5	1.5820	76.2240	48.1820	0.0110	0.2647	0.2757	-0.2537	-0.9203	0.0441	0.1367	0.4306	0.2188	0.6782	0.4596	1.1378	0.374781	Design Good	Design Good
14	UDSTL6	2.8900	-79.3280	-27.4491	0.0201	0.2754	0.2955	-0.2554	-0.8642	0.0459	0.1509	0.4754	0.2278	0.7487	0.4783	1.2270	0.389202	Design Good	Design Good
14	UDSTL7	1.6590	-1.5390	-0.9277	0.0115	0.0053	0.0169	0.0062	0.3663	0.0009	0.0141	0.0443	0.0044	0.0698	0.0093	0.0790	0.098776	Design Good	Design Good
14	UDSTL8	2.8130	-1.5650	-0.5563	0.0195	0.0054	0.0250	0.0141	0.5647	0.0009	0.0221	0.0697	0.0045	0.1097	0.0094	0.1192	0.121288	Design Good	Design Good
14	UDSTL9	2.7940	-1.5390	-0.5508	0.0194	0.0053	0.0247	0.0141	0.5681	0.0009	0.0219	0.0691	0.0044	0.1089	0.0093	0.1181	0.120766	Design Good	Design Good
14	UDSTL10	1.6780	-1.5650	-0.9327	0.0117	0.0054	0.0171	0.0062	0.3640	0.0009	0.0142	0.0448	0.0045	0.0706	0.0094	0.0801	0.099414	Design Good	Design Good
14	UDSTL11	0.6740	62.8590	93.2626	0.0047	0.2183	0.2229	-0.2136	-0.9580	0.0364	0.1084	0.3413	0.1805	0.5376	0.3790	0.9166	0.336388	Design Good	Design Good
14	UDSTL12	1.9830	-65.1870	-32.8729	0.0138	0.2263	0.2401	-0.2126	-0.8853	0.0377	0.1213	0.3820	0.1872	0.6017	0.3930	0.9948	0.350441	Design Good	Design Good
14	UDSTL13	0.6740	76.6120	113.6677	0.0047	0.2660	0.2707	-0.2613	-0.9654	0.0443	0.1310	0.4128	0.2200	0.6501	0.4619	1.1120	0.370523	Design Good	Design Good
14	UDSTL14	1.9830	-78.9410	-39.8089	0.0138	0.2741	0.2879	-0.2603	-0.9043	0.0457	0.1440	0.4535	0.2266	0.7143	0.4760	1.1902	0.383329	Design Good	Design Good
14	UDSTL15	0.7510	-1.1510	-1.5326	0.0052	0.0040	0.0092	0.0012	0.1323	0.0007	0.0071	0.0224	0.0033	0.0353	0.0069	0.0422	0.072207	Design Good	Design Good
14	UDSTL16	1.9060	-1.1770	-0.6175	0.0132	0.0041	0.0173	0.0091	0.5282	0.0007	0.0152	0.0478	0.0034	0.0753	0.0071	0.0824	0.100857	Design Good	Design Good
14	UDSTL17	1.8860	-1.1510	-0.6103	0.0131	0.0040	0.0171	0.0091	0.5324	0.0007	0.0150	0.0472	0.0033	0.0744	0.0069	0.0813	0.100208	Design Good	Design Good
14	UDSTL18	0.7700	-1.1770	-1.5286	0.0053	0.0041	0.0094	0.0013	0.1336	0.0007	0.0073	0.0230	0.0034	0.0362	0.0071	0.0433	0.073077	Design Good	Design Good
14	UDSTL19	2.2360	-1.6800	-0.7513	0.0155	0.0058	0.0214	0.0097	0.4538	0.0010	0.0183	0.0576	0.0048	0.0908	0.0101	0.1009	0.111617	Design Good	Design Good
14	UDSTL20	2.2360	-1.4240	-0.6369	0.0155	0.0049	0.0205	0.0106	0.5170	0.0008	0.0179	0.0563	0.0041	0.0887	0.0086	0.0973	0.109587	Design Good	Design Good
14	UDSTL21	2.2360	16.9160	7.5653	0.0155	0.0587	0.0743	-0.0432	-0.5818	0.0098	0.0434	0.1368	0.0486	0.2155	0.1020	0.3174	0.197967	Design Good	Design Good
14	UDSTL22	2.2360	-20.0200	-8.9535	0.0155	0.0695	0.0850	-0.0540	-0.6348	0.0116	0.0485	0.1529	0.0575	0.2409	0.1207	0.3616	0.211275	Design Good	Design Good
14	UDSTL23	1.3280	-1.2920	-0.9729	0.0092	0.0045	0.0137	0.0047	0.3455	0.0007	0.0114	0.0358	0.0037	0.0563	0.0078	0.0641	0.088969	Design Good	Design Good
14	UDSTL24	1.3280	-1.0360	-0.7801	0.0092	0.0036	0.0128	0.0056	0.4388	0.0006	0.0109	0.0344	0.0030	0.0542	0.0062	0.0605	0.086408	Design Good	Design Good
14	UDSTL25	1.3280	17.3040	13.0301	0.0092	0.0601	0.0693	-0.0509	-0.7339	0.0100	0.0378	0.1189	0.0497	0.1873	0.1043	0.2917	0.189762	Design Good	Design Good
14	UDSTL26	1.3280	-19.6320	-14.7831	0.0092	0.0682	0.0774	-0.0589	-0.7617	0.0114	0.0416	0.1310	0.0564	0.2064	0.1184	0.3248	0.200235	Design Good	Design Good
14	UDSTL27	2.2360	-0.8200	-0.3667	0.0155	0.0028	0.0184	0.0127	0.6901	0.0005	0.0169	0.0532	0.0024	0.0837	0.0049	0.0887	0.10464	Design Good	Design Good
14	UDSTL27	2.2360	-2.2840	-1.0215	0.0155	0.0079	0.0235	0.0076	0.3239	0.0013	0.0193	0.0608	0.0066	0.0957	0.0138	0.1095	0.116268	Design Good	Design Good
14	UDSTL28	2.2400	58.4910	26.1121	0.0156	0.2031	0.2186	-0.1875	-0.8577	0.0338	0.1120	0.3529	0.1679	0.5558	0.3527	0.9084	0.334893	Design Good	Design Good
14	UDSTL28	2.2320	-61.5950	-27.5963	0.0155	0.2139	0.2294	-0.1984	-0.8648	0.0356	0.1171	0.3688	0.1768	0.5809	0.3714	0.9523	0.342879	Design Good	Design Good
14	UDSTL29	1.3280	-0.4320	-0.3253	0.0092	0.0015	0.0107	0.0077	0.7202	0.0003	0.0099	0.0313	0.0012	0.0493	0.0026	0.0519	0.080041	Design Good	Design Good
14	UDSTL29	1.3280	-1.8960	-1.4277	0.0092	0.0066	0.0158	0.0026	0.1670	0.0011	0.0123	0.0389	0.0054	0.0613	0.0114	0.0727	0.094738	Design Good	Design Good
14	UDSTL30	1.3330	58.8790	44.1703	0.0093	0.2044	0.2137	-0.1952	-0.9134	0.0341	0.1064	0.3351	0.1690	0.5277	0.3550	0.8827	0.330116	Design Good	Design Good
14	UDSTL30	1.3240	-61.2070	-46.2289	0.0092	0.2125	0.2217	-0.2033	-0.9171	0.0354	0.1101	0.3470	0.1757	0.5464	0.3690	0.9155	0.336189	Design Good	Design Good

Joint	OutputCase	F3	M2	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	d. check plate	d. check ped bearing
Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
14	UDSTL1	2.0660	0.0000	0.0000	0.0143	0.0000	0.0143	0.0143	1.0000	0.0000	0.0143	0.0452	0.0000	0.0712	0.0000	0.0712	0.093743	Design Good	Design Good
14	UDSTL2	3.2590	0.0001	0.0000	0.0226	0.0000	0.0226	0.0226	1.0000	0.0000	0.0226	0.0713	0.0000	0.1123	0.0000	0.1123	0.117738	Design Good	Design Good
14	UDSTL3	1.5820	0.1790	0.1131	0.0110	0.0006	0.0116	0.0104	0.8929	0.0001	0.0113	0.0355	0.0005	0.0560	0.0011	0.0570	0.083923	Design Good	Design Good
14	UDSTL4	2.8900	-0.1790	-0.0619	0.0201	0.0006	0.0207	0.0194	0.9399	0.0001	0.0204	0.0641	0.0005	0.1010	0.0011	0.1021	0.112279	Design Good	Design Good
14	UDSTL5	1.5820	0.2410	0.1523	0.0110	0.0008	0.0118	0.0101	0.8584	0.0001	0.0114	0.0359	0.0007	0.0565	0.0015	0.0579	0.084569	Design Good	Design Good
14	UDSTL6	2.8900	-0.2410	-0.0834	0.0201	0.0008	0.0209	0.0192	0.9199	0.0001	0.0205	0.0645	0.0007	0.1015	0.0015	0.1030	0.112763	Design Good	Design Good
14	UDSTL7	1.6590	-15.1440	-9.1284	0.0115	0.0526	0.0641	-0.0411	-0.6406	0.0088	0.0365	0.1150	0.0435	0.1811	0.0913	0.2724	0.183378	Design Good	Design Good
14	UDSTL8	2.8130	15.1440	5.3836	0.0195	0.0526	0.0721	-0.0330	-0.4583	0.0088	0.0445	0.1402	0.0435	0.2208	0.0913	0.3121	0.196306	Design Good	Design Good
14	UDSTL9	2.7940	-15.1440	-5.4202	0.0194	0.0526	0.0720	-0.0332	-0.4609	0.0088	0.0444	0.1398	0.0435	0.2202	0.0913	0.3115	0.1961	Design Good	Design Good
14	UDSTL10	1.6780	15.1440	9.0250	0.0117	0.0526	0.0642	-0.0409	-0.6372	0.0088	0.0366	0.1154	0.0435	0.1817	0.0913	0.2730	0.183598	Design Good	Design Good
14	UDSTL11	0.6740	0.1790	0.2656	0.0047	0.0006	0.0053	0.0041	0.7656	0.0001	0.0050	0.0157	0.0005	0.0247	0.0011	0.0258	0.0564	Design Good	Design Good
14	UDSTL12	1.9830	-0.1790	-0.0903	0.0138	0.0006	0.0144	0.0131	0.9136	0.0001	0.0141	0.0443	0.0005	0.0698	0.0011	0.0709	0.093534	Design Good	Design Good
14	UDSTL13	0.6740	0.2410	0.3576	0.0047	0.0008	0.0055	0.0038	0.6967	0.0001	0.0051	0.0160	0.0007	0.0252	0.0015	0.0268	0.057356	Design Good	Design Good
14	UDSTL14	1.9830	-0.2410	-0.1215	0.0138	0.0008	0.0146	0.0129	0.8854	0.0001	0.0142	0.0446	0.0007	0.0703	0.0015	0.0717	0.094114	Design Good	Design Good
14	UDSTL15	0.7510	-15.1440	-20.1651	0.0052	0.0526	0.0578	-0.0474	-0.8195	0.0088	0.0302	0.0951	0.0435	0.1498	0.0913	0.2411	0.172526	Design Good	Design Good
14	UDSTL16	1.9060	15.1440	7.9454	0.0132	0.0526	0.0658	-0.0393	-0.5978	0.0088	0.0382	0.1204	0.0435	0.1896	0.0913	0.2609	0.186221	Design Good	Design Good
14	UDSTL17	1.8860	-15.1440	-8.0297	0.0131	0.0526	0.0657	-0.0395	-0.6012	0.0088	0.0381	0.1199	0.0435	0.1889	0.0913	0.2802	0.185992	Design Good	Design Good
14	UDSTL18	0.7700	15.1440	19.6675	0.0053	0.0526	0.0579	-0.0472	-0.8154	0.0088	0.0303	0.0955	0.0435	0.1504	0.0913	0.2418	0.17276	Design Good	Design Good
14	UDSTL19	2.2360	-18.1710	-8.1266	0.0155	0.0631	0.0786	-0.0476	-0.6050	0.0105	0.0455	0.1433	0.0522	0.2257	0.1096	0.3353	0.203452	Design Good	Design Good
14	UDSTL20	2.2360	18.1710	8.1266	0.0155	0.0631	0.0786	-0.0476	-0.6050	0.0105	0.0455	0.1433	0.0522	0.2257	0.1096	0.3353	0.203452	Design Good	Design Good
14	UDSTL21	2.2360	0.0570	0.0255	0.0155	0.0002	0.0157	0.0153	0.9748	0.0000	0.0156	0.0492	0.0002	0.0775	0.0003	0.0778	0.098035	Design Good	Design Good
14	UDSTL22	2.2360	-0.0570	-0.0255	0.0155	0.0002	0.0157	0.0153	0.9748	0.0000	0.0156	0.0492	0.0002	0.0775	0.0003	0.0778	0.098035	Design Good	Design Good
14	UDSTL23	1.3280	-18.1710	-13.6830	0.0092	0.0631	0.0723	-0.0539	-0.7449	0.0105	0.0392	0.1235	0.0522	0.1944	0.1096	0.3040	0.193728	Design Good	Design Good
14	UDSTL24	1.3280	18.1710	13.6830	0.0092	0.0631	0.0723	-0.0539	-0.7449	0.0105	0.0392	0.1235	0.0522	0.1944	0.1096	0.3040	0.193728	Design Good	Design Good
14	UDSTL25	1.3280	0.0570	0.0429	0.0092	0.0002	0.0094	0.0090	0.9580	0.0000	0.0093	0.0293	0.0002	0.0462	0.0003	0.0466	0.07582	Design Good	Design Good
14	UDSTL26	1.3280	-0.0570	-0.0429	0.0092	0.0002	0.0094	0.0090	0.9580	0.0000	0.0093	0.0293	0.0002	0.0462	0.0003	0.0466	0.07582	Design Good	Design Good
14	UDSTL27	2.2360	57.4690	25.7017	0.0155	0.1995	0.2151	-0.1840	-0.8556	0.0333	0.1103	0.3475	0.1650	0.5473	0.3465	0.8938	0.33218	Design Good	Design Good
14	UDSTL27	2.2360	-57.4690	-25.7017	0.0155	0.1995	0.2151	-0.1840	-0.8556	0.0333	0.1103	0.3475	0.1650	0.5473	0.3465	0.8938	0.33218	Design Good	Design Good
14	UDSTL28	2.2400	0.1820	0.0813	0.0156	0.0006	0.0162	0.0149	0.9219	0.0001	0.0159	0.0499	0.0005	0.0787	0.0011	0.0798	0.099233	Design Good	Design Good
14	UDSTL28	2.2320	-0.1820	-0.0815	0.0155	0.0006	0.0161	0.0149	0.9217	0.0001	0.0158	0.0498	0.0005	0.0784	0.0011	0.0795	0.099061	Design Good	Design Good
14	UDSTL29	1.3280	57.4690	43.2748	0.0092	0.1995	0.2088	-0.1903	-0.9117	0.0333	0.1040	0.3276	0.1650	0.5160	0.3465	0.8625	0.326315	Design Good	Design Good
14	UDSTL29	1.3280	-57.4690	-43.2748	0.0092	0.1995	0.2088	-0.1903	-0.9117	0.0333	0.1040	0.3276	0.1650	0.5160	0.3465	0.8625	0.326315	Design Good	Design Good
14	UDSTL30	1.3330	0.1820	0.1365	0.0093	0.0006	0.0099	0.0086	0.8722	0.0001	0.0096	0.0301	0.0005	0.0474	0.0011	0.0485	0.07739	Design Good	Design Good
14	UDSTL30	1.3240	-0.1820	-0.1375	0.0092	0.0006	0.0098	0.0086	0.8714	0.0001	0.0095	0.0299	0.0005	0.0471	0.0011	0.0482	0.077142	Design Good	Design Good

Base Plate Design

HSS 6X6X.375
12"x12" Plate

A (in^2)		I (in)	c (in)	t (in)	n(in)	d (in)	Fy (ksi)	A2 (in^2)	Aratio	Φ_c	Fc (ksi)	Fp (ksi)
144		1728	6	0.75	3.15	12	36	324	1.5	0.6	4	3.06

Joint	OutputCase	F3	M1	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	d. check plate	d. check ped bearing
Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
15	UDSTL1	1.8070	-1.5000	-0.8301	0.0125	0.0052	0.0178	0.0073	0.4134	0.0009	0.0150	0.0473	0.0043	0.0745	0.0090	0.0836	0.101577	Design Good	Design Good
15	UDSTL2	2.7810	-1.2860	-0.4624	0.0193	0.0045	0.0238	0.0148	0.6244	0.0007	0.0214	0.0675	0.0037	0.1063	0.0078	0.1141	0.118681	Design Good	Design Good
15	UDSTL3	1.3920	56.9800	40.9339	0.0097	0.1978	0.2075	-0.1882	-0.9068	0.0330	0.1036	0.3265	0.1636	0.5142	0.3435	0.8578	0.325416	Design Good	Design Good
15	UDSTL4	2.4760	-59.5520	-24.0517	0.0172	0.2068	0.2240	-0.1896	-0.8465	0.0345	0.1154	0.3636	0.1710	0.5726	0.3591	0.9317	0.339145	Design Good	Design Good
15	UDSTL5	1.3920	69.6610	50.0438	0.0097	0.2419	0.2515	-0.2322	-0.9231	0.0403	0.1246	0.3924	0.2000	0.6180	0.4200	1.0380	0.357974	Design Good	Design Good
15	UDSTL6	2.4760	-72.2330	-29.1733	0.0172	0.2508	0.2680	-0.2336	-0.8717	0.0418	0.1363	0.4294	0.2074	0.6764	0.4355	1.1119	0.370498	Design Good	Design Good
15	UDSTL7	1.7430	-1.2490	-0.7166	0.0121	0.0043	0.0164	0.0078	0.4724	0.0007	0.0142	0.0446	0.0036	0.0703	0.0075	0.0778	0.098006	Design Good	Design Good
15	UDSTL8	2.1250	-1.3230	-0.6226	0.0148	0.0046	0.0194	0.0102	0.5252	0.0008	0.0169	0.0534	0.0038	0.0840	0.0080	0.0920	0.106583	Design Good	Design Good
15	UDSTL9	2.1250	-1.2490	-0.5878	0.0148	0.0043	0.0191	0.0104	0.5457	0.0007	0.0168	0.0530	0.0036	0.0834	0.0075	0.0910	0.105972	Design Good	Design Good
15	UDSTL10	1.7430	-1.3230	-0.7590	0.0121	0.0046	0.0167	0.0075	0.4498	0.0008	0.0143	0.0450	0.0038	0.0709	0.0080	0.0789	0.098667	Design Good	Design Good
15	UDSTL11	0.6200	57.3020	92.4226	0.0043	0.1990	0.2033	-0.1947	-0.9576	0.0332	0.0988	0.3113	0.1645	0.4902	0.3455	0.8357	0.321211	Design Good	Design Good
15	UDSTL12	1.7040	-59.2310	-34.7600	0.0118	0.2057	0.2175	-0.1938	-0.8912	0.0343	0.1095	0.3450	0.1701	0.5434	0.3571	0.9005	0.333425	Design Good	Design Good
15	UDSTL13	0.6200	69.9830	112.8758	0.0043	0.2430	0.2473	-0.2387	-0.9652	0.0405	0.1197	0.3771	0.2009	0.5940	0.4219	1.0160	0.354156	Design Good	Design Good
15	UDSTL14	1.7040	-71.9110	-42.2013	0.0118	0.2497	0.2615	-0.2379	-0.9095	0.0416	0.1304	0.4109	0.2065	0.6471	0.4336	1.0807	0.365267	Design Good	Design Good
15	UDSTL15	0.9710	-0.9280	-0.9557	0.0067	0.0032	0.0100	0.0035	0.3533	0.0005	0.0083	0.0261	0.0027	0.0410	0.0056	0.0466	0.075884	Design Good	Design Good
15	UDSTL16	1.3530	-1.0010	-0.7398	0.0094	0.0035	0.0129	0.0059	0.4599	0.0006	0.0110	0.0348	0.0029	0.0548	0.0060	0.0608	0.086668	Design Good	Design Good
15	UDSTL17	1.3530	-0.9280	-0.6859	0.0094	0.0032	0.0126	0.0062	0.4893	0.0005	0.0109	0.0344	0.0027	0.0542	0.0056	0.0598	0.085925	Design Good	Design Good
15	UDSTL18	0.9710	-1.0010	-1.0309	0.0067	0.0035	0.0102	0.0033	0.3197	0.0006	0.0084	0.0264	0.0029	0.0416	0.0060	0.0477	0.076723	Design Good	Design Good
15	UDSTL19	1.9340	-1.1720	-0.6060	0.0134	0.0041	0.0175	0.0094	0.5349	0.0007	0.0154	0.0484	0.0034	0.0762	0.0071	0.0833	0.101403	Design Good	Design Good
15	UDSTL20	1.9340	-1.4000	-0.7239	0.0134	0.0049	0.0183	0.0086	0.4685	0.0008	0.0157	0.0496	0.0040	0.0781	0.0084	0.0865	0.103357	Design Good	Design Good
15	UDSTL21	1.9340	15.7170	8.1267	0.0134	0.0546	0.0680	-0.0411	-0.6050	0.0091	0.0394	0.1240	0.0451	0.1952	0.0948	0.2900	0.189216	Design Good	Design Good
15	UDSTL22	1.9340	-18.2890	-9.4566	0.0134	0.0635	0.0769	-0.0501	-0.6509	0.0106	0.0436	0.1373	0.0525	0.2163	0.1103	0.3266	0.200787	Design Good	Design Good
15	UDSTL23	1.1620	-0.8510	-0.7324	0.0081	0.0030	0.0110	0.0051	0.4639	0.0005	0.0095	0.0298	0.0024	0.0470	0.0051	0.0521	0.080223	Design Good	Design Good
15	UDSTL24	1.1620	-1.0780	-0.9277	0.0081	0.0037	0.0118	0.0043	0.3663	0.0006	0.0098	0.0310	0.0031	0.0489	0.0065	0.0554	0.082668	Design Good	Design Good
15	UDSTL25	1.1620	16.0390	13.8029	0.0081	0.0557	0.0638	-0.0476	-0.7469	0.0093	0.0345	0.1087	0.0460	0.1713	0.0967	0.2680	0.18189	Design Good	Design Good
15	UDSTL26	1.1620	-17.9680	-15.4630	0.0081	0.0624	0.0705	-0.0543	-0.7709	0.0104	0.0377	0.1188	0.0516	0.1871	0.1083	0.2954	0.190967	Design Good	Design Good
15	UDSTL27	1.9340	-0.5730	-0.2963	0.0134	0.0020	0.0154	0.0114	0.7420	0.0003	0.0144	0.0453	0.0016	0.0713	0.0035	0.0748	0.096081	Design Good	Design Good
15	UDSTL27	1.9340	-1.9990	-1.0336	0.0134	0.0069	0.0204	0.0065	0.3186	0.0012	0.0167	0.0527	0.0057	0.0830	0.0121	0.0950	0.108322	Design Good	Design Good
15	UDSTL28	1.9370	47.7560	24.6546	0.0135	0.1658	0.1793	-0.1524	-0.8499	0.0276	0.0922	0.2905	0.1371	0.4575	0.2879	0.7454	0.303364	Design Good	Design Good
15	UDSTL28	1.9310	-50.3280	-26.0632	0.0134	0.1748	0.1882	-0.1613	-0.8575	0.0291	0.0964	0.3037	0.1445	0.4783	0.3034	0.7818	0.310672	Design Good	Design Good
15	UDSTL29	1.1620	-0.2520	-0.2169	0.0081	0.0009	0.0089	0.0072	0.8043	0.0001	0.0085	0.0267	0.0007	0.0421	0.0015	0.0436	0.07338	Design Good	Design Good
15	UDSTL29	1.1620	-1.6770	-1.4432	0.0081	0.0058	0.0139	0.0022	0.1617	0.0010	0.0108	0.0341	0.0048	0.0538	0.0101	0.0639	0.088797	Design Good	Design Good
15	UDSTL30	1.1650	48.0770	41.2678	0.0081	0.1669	0.1750	-0.1588	-0.9076	0.0278	0.0874	0.2753	0.1380	0.4335	0.2899	0.7234	0.298846	Design Good	Design Good
15	UDSTL30	1.1590	-50.0060	-43.1458	0.0080	0.1736	0.1817	-0.1656	-0.9114	0.0289	0.0905	0.2851	0.1436	0.4491	0.3015	0.7506	0.304414	Design Good	Design Good

BECHTEL PARSONS BLUE GRASS

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev. D
Sheet No. D1-25 / D1-60

Joint	OutputCase	F3	M2	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	d. check plate	d. check ped bearing
Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
15	UDSTL1	1.8070	0.0003	0.0002	0.0125	0.0000	0.0125	0.0125	0.9998	0.0000	0.0125	0.0395	0.0000	0.0623	0.0000	0.0623	0.087673	Design Good	Design Good
15	UDSTL2	2.7810	0.0004	0.0002	0.0193	0.0000	0.0193	0.0193	0.9998	0.0000	0.0193	0.0608	0.0000	0.0958	0.0000	0.0958	0.108764	Design Good	Design Good
15	UDSTL3	1.3920	-0.1680	-0.1207	0.0097	0.0006	0.0103	0.0091	0.8862	0.0001	0.0099	0.0313	0.0005	0.0493	0.0010	0.0503	0.078839	Design Good	Design Good
15	UDSTL4	2.4760	0.1680	0.0679	0.0172	0.0006	0.0178	0.0166	0.9344	0.0001	0.0175	0.0550	0.0005	0.0867	0.0010	0.0877	0.10405	Design Good	Design Good
15	UDSTL5	1.3920	-0.2260	-0.1624	0.0097	0.0008	0.0105	0.0089	0.8498	0.0001	0.0100	0.0316	0.0006	0.0496	0.0014	0.0512	0.079482	Design Good	Design Good
15	UDSTL6	2.4760	0.2270	0.0917	0.0172	0.0008	0.0180	0.0164	0.9123	0.0001	0.0176	0.0553	0.0007	0.0872	0.0014	0.0885	0.104546	Design Good	Design Good
15	UDSTL7	1.7430	-15.0810	-8.6523	0.0121	0.0524	0.0645	-0.0403	-0.6245	0.0087	0.0370	0.1165	0.0433	0.1835	0.0909	0.2744	0.18405	Design Good	Design Good
15	UDSTL8	2.1250	15.0820	7.0974	0.0148	0.0524	0.0671	-0.0376	-0.5603	0.0087	0.0396	0.1248	0.0433	0.1966	0.0909	0.2876	0.188417	Design Good	Design Good
15	UDSTL9	2.1250	-15.0810	-7.0969	0.0148	0.0524	0.0671	-0.0376	-0.5603	0.0087	0.0396	0.1248	0.0433	0.1966	0.0909	0.2875	0.188412	Design Good	Design Good
15	UDSTL10	1.7430	15.0820	8.6529	0.0121	0.0524	0.0645	-0.0403	-0.6245	0.0087	0.0370	0.1165	0.0433	0.1835	0.0909	0.2744	0.184054	Design Good	Design Good
15	UDSTL11	0.6200	-0.1680	-0.2710	0.0043	0.0006	0.0049	0.0037	0.7614	0.0001	0.0046	0.0144	0.0005	0.0227	0.0010	0.0237	0.054147	Design Good	Design Good
15	UDSTL12	1.7040	0.1680	0.0986	0.0118	0.0006	0.0124	0.0113	0.9060	0.0001	0.0121	0.0381	0.0005	0.0601	0.0010	0.0611	0.086849	Design Good	Design Good
15	UDSTL13	0.6200	-0.2260	-0.3645	0.0043	0.0008	0.0051	0.0035	0.6917	0.0001	0.0047	0.0147	0.0006	0.0232	0.0014	0.0246	0.055079	Design Good	Design Good
15	UDSTL14	1.7040	0.2270	0.1332	0.0118	0.0008	0.0126	0.0110	0.8751	0.0001	0.0122	0.0385	0.0007	0.0606	0.0014	0.0619	0.087443	Design Good	Design Good
15	UDSTL15	0.9710	-15.0820	-15.5324	0.0067	0.0524	0.0591	-0.0456	-0.7719	0.0087	0.0316	0.0996	0.0433	0.1569	0.0909	0.2478	0.174907	Design Good	Design Good
15	UDSTL16	1.3530	15.0820	11.1471	0.0094	0.0524	0.0618	-0.0430	-0.6957	0.0087	0.0343	0.1080	0.0433	0.1700	0.0909	0.2610	0.179491	Design Good	Design Good
15	UDSTL17	1.3530	-15.0810	-11.1463	0.0094	0.0524	0.0618	-0.0430	-0.6957	0.0087	0.0343	0.1079	0.0433	0.1700	0.0909	0.2609	0.179487	Design Good	Design Good
15	UDSTL18	0.9710	15.0820	15.5324	0.0067	0.0524	0.0591	-0.0456	-0.7719	0.0087	0.0316	0.0996	0.0433	0.1569	0.0909	0.2478	0.174907	Design Good	Design Good
15	UDSTL19	1.9340	-18.1710	-9.3956	0.0134	0.0631	0.0765	-0.0497	-0.6490	0.0105	0.0434	0.1367	0.0522	0.2153	0.1096	0.3249	0.200271	Design Good	Design Good
15	UDSTL20	1.9340	18.1710	9.3956	0.0134	0.0631	0.0765	-0.0497	-0.6490	0.0105	0.0434	0.1367	0.0522	0.2153	0.1096	0.3249	0.200271	Design Good	Design Good
15	UDSTL21	1.9340	-0.0530	-0.0274	0.0134	0.0002	0.0136	0.0132	0.9730	0.0000	0.0135	0.0426	0.0002	0.0671	0.0003	0.0674	0.09121	Design Good	Design Good
15	UDSTL22	1.9340	0.0540	0.0279	0.0134	0.0002	0.0136	0.0132	0.9725	0.0000	0.0135	0.0426	0.0002	0.0671	0.0003	0.0674	0.091219	Design Good	Design Good
15	UDSTL23	1.1620	-18.1710	-15.6377	0.0081	0.0631	0.0712	-0.0550	-0.7732	0.0105	0.0380	0.1198	0.0522	0.1887	0.1096	0.2983	0.191897	Design Good	Design Good
15	UDSTL24	1.1620	18.1710	15.6377	0.0081	0.0631	0.0712	-0.0550	-0.7732	0.0105	0.0380	0.1198	0.0522	0.1887	0.1096	0.2983	0.191897	Design Good	Design Good
15	UDSTL25	1.1620	-0.0540	-0.0465	0.0081	0.0002	0.0083	0.0079	0.9546	0.0000	0.0082	0.0257	0.0002	0.0405	0.0003	0.0408	0.070974	Design Good	Design Good
15	UDSTL26	1.1620	0.0540	0.0465	0.0081	0.0002	0.0083	0.0079	0.9546	0.0000	0.0082	0.0257	0.0002	0.0405	0.0003	0.0408	0.070974	Design Good	Design Good
15	UDSTL27	1.9340	57.4700	29.7156	0.0134	0.1995	0.2130	-0.1861	-0.8739	0.0333	0.1082	0.3409	0.1650	0.5369	0.3465	0.8834	0.330243	Design Good	Design Good
15	UDSTL27	1.9340	-57.4700	-29.7156	0.0134	0.1995	0.2130	-0.1861	-0.8739	0.0333	0.1082	0.3409	0.1650	0.5369	0.3465	0.8834	0.330243	Design Good	Design Good
15	UDSTL28	1.9370	0.1940	0.1002	0.0135	0.0007	0.0141	0.0128	0.9046	0.0001	0.0138	0.0434	0.0006	0.0683	0.0012	0.0695	0.092625	Design Good	Design Good
15	UDSTL28	1.9310	-0.1930	-0.0999	0.0134	0.0007	0.0141	0.0127	0.9048	0.0001	0.0137	0.0432	0.0006	0.0681	0.0012	0.0693	0.092477	Design Good	Design Good
15	UDSTL29	1.1620	57.4700	49.4578	0.0081	0.1995	0.2076	-0.1915	-0.9223	0.0333	0.1029	0.3240	0.1650	0.5103	0.3465	0.8568	0.325234	Design Good	Design Good
15	UDSTL29	1.1620	-57.4700	-49.4578	0.0081	0.1995	0.2076	-0.1915	-0.9223	0.0333	0.1029	0.3240	0.1650	0.5103	0.3465	0.8568	0.325234	Design Good	Design Good
15	UDSTL30	1.1650	0.1940	0.1665	0.0081	0.0007	0.0088	0.0074	0.8463	0.0001	0.0084	0.0265	0.0006	0.0417	0.0012	0.0429	0.072771	Design Good	Design Good
15	UDSTL30	1.1590	-0.1940	-0.1674	0.0080	0.0007	0.0087	0.0074	0.8455	0.0001	0.0084	0.0264	0.0006	0.0415	0.0012	0.0427	0.072596	Design Good	Design Good

Base Plate Design

HSS 6X6X.375 12"x12" Plate												
A (in^2)		I (in)	c (in)	t (in)	n(in)	d (in)	Fy (ksi)	A2 (in^2)	Aratio	Φc	Fc (ksi)	Fp (ksi)
144		1728	6	0.75	3.15	12	36	324	1.5	0.6	4	3.06

Joint	OutputCase	F3	M1	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	d. check plate	d. check ped bearing
Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
16	UDSTL1	3.6800	-1.6570	-0.4503	0.0256	0.0058	0.0313	0.0198	0.6325	0.0010	0.0283	0.0891	0.0048	0.1403	0.0100	0.1503	0.136235382	Design Good	Design Good
16	UDSTL2	6.0830	-1.4200	-0.2334	0.0422	0.0049	0.0472	0.0373	0.7910	0.0008	0.0446	0.1404	0.0041	0.2212	0.0086	0.2298	0.168420138	Design Good	Design Good
16	UDSTL3	2.7820	66.4750	23.8947	0.0193	0.2308	0.2501	-0.2115	-0.8455	0.0385	0.1290	0.4062	0.1909	0.6398	0.4008	1.0406	0.358423431	Design Good	Design Good
16	UDSTL4	5.3570	-69.3150	-12.9391	0.0372	0.2407	0.2779	-0.2035	-0.7322	0.0401	0.1515	0.4773	0.1990	0.7517	0.4179	1.1697	0.380003933	Design Good	Design Good
16	UDSTL5	2.7820	76.5180	27.5047	0.0193	0.2657	0.2850	-0.2464	-0.8644	0.0443	0.1455	0.4584	0.2197	0.7220	0.4613	1.1833	0.382215089	Design Good	Design Good
16	UDSTL6	5.3570	-79.3590	-14.8141	0.0372	0.2756	0.3128	-0.2384	-0.7621	0.0459	0.1681	0.5295	0.2278	0.8339	0.4785	1.3124	0.402524239	Design Good	Design Good
16	UDSTL7	3.1780	-1.4230	-0.4478	0.0221	0.0049	0.0270	0.0171	0.6341	0.0008	0.0244	0.0769	0.0041	0.1211	0.0086	0.1297	0.1265475	Design Good	Design Good
16	UDSTL8	4.9610	-1.4180	-0.2858	0.0345	0.0049	0.0394	0.0295	0.7499	0.0008	0.0368	0.1159	0.0041	0.1825	0.0085	0.1911	0.153588535	Design Good	Design Good
16	UDSTL9	4.8470	-1.4220	-0.2934	0.0337	0.0049	0.0386	0.0287	0.7442	0.0008	0.0360	0.1134	0.0041	0.1786	0.0086	0.1872	0.152024867	Design Good	Design Good
16	UDSTL10	3.2920	-1.4180	-0.4307	0.0229	0.0049	0.0278	0.0179	0.6456	0.0008	0.0252	0.0794	0.0041	0.1250	0.0085	0.1336	0.128414924	Design Good	Design Good
16	UDSTL11	1.0780	66.8300	61.9944	0.0075	0.2320	0.2395	-0.2246	-0.9375	0.0387	0.1177	0.3708	0.1919	0.5840	0.4029	0.9869	0.349059174	Design Good	Design Good
16	UDSTL12	3.6530	-68.9600	-18.8776	0.0254	0.2394	0.2648	-0.2141	-0.8084	0.0399	0.1391	0.4382	0.1980	0.6901	0.4158	1.1059	0.369502645	Design Good	Design Good
16	UDSTL13	1.0780	76.8730	71.3108	0.0075	0.2669	0.2744	-0.2594	-0.9454	0.0445	0.1343	0.4230	0.2207	0.6662	0.4635	1.1297	0.373447889	Design Good	Design Good
16	UDSTL14	3.6540	-79.0040	-21.6212	0.0254	0.2743	0.2997	-0.2489	-0.8307	0.0457	0.1557	0.4904	0.2268	0.7724	0.4763	1.2487	0.392631165	Design Good	Design Good
16	UDSTL15	1.4740	-1.0680	-0.7246	0.0102	0.0037	0.0139	0.0065	0.4681	0.0006	0.0120	0.0378	0.0031	0.0595	0.0064	0.0660	0.090241261	Design Good	Design Good
16	UDSTL16	3.2570	-1.0630	-0.3264	0.0226	0.0037	0.0263	0.0189	0.7194	0.0006	0.0244	0.0768	0.0031	0.1209	0.0064	0.1273	0.125374054	Design Good	Design Good
16	UDSTL17	3.1440	-1.0680	-0.3397	0.0218	0.0037	0.0255	0.0181	0.7096	0.0006	0.0236	0.0743	0.0031	0.1171	0.0064	0.1235	0.123477868	Design Good	Design Good
16	UDSTL18	1.5880	-1.0630	-0.6694	0.0110	0.0037	0.0147	0.0073	0.4985	0.0006	0.0128	0.0403	0.0031	0.0634	0.0064	0.0698	0.092841846	Design Good	Design Good
16	UDSTL19	4.0700	-1.3500	-0.3317	0.0283	0.0047	0.0330	0.0236	0.7155	0.0008	0.0305	0.0960	0.0039	0.1513	0.0081	0.1594	0.140286437	Design Good	Design Good
16	UDSTL20	4.0700	-1.4910	-0.3663	0.0283	0.0052	0.0334	0.0231	0.6904	0.0009	0.0307	0.0968	0.0043	0.1524	0.0090	0.1614	0.141165424	Design Good	Design Good
16	UDSTL21	4.0700	17.5460	4.3111	0.0283	0.0609	0.0892	-0.0327	-0.3662	0.0102	0.0572	0.1802	0.0504	0.2838	0.1058	0.3896	0.219310497	Design Good	Design Good
16	UDSTL22	4.0700	-20.3870	-5.0091	0.0283	0.0708	0.0991	-0.0425	-0.4293	0.0118	0.0619	0.1949	0.0585	0.3070	0.1229	0.4300	0.23039486	Design Good	Design Good
16	UDSTL23	2.3660	-0.9950	-0.4205	0.0164	0.0035	0.0199	0.0130	0.6525	0.0006	0.0181	0.0569	0.0029	0.0897	0.0060	0.0957	0.108671522	Design Good	Design Good
16	UDSTL24	2.3660	-1.1360	-0.4801	0.0164	0.0039	0.0204	0.0125	0.6128	0.0007	0.0183	0.0577	0.0033	0.0908	0.0068	0.0977	0.109803881	Design Good	Design Good
16	UDSTL25	2.3660	17.9010	7.5659	0.0164	0.0622	0.0786	-0.0457	-0.5818	0.0104	0.0460	0.1448	0.0514	0.2280	0.1079	0.3359	0.203646864	Design Good	Design Good
16	UDSTL26	2.3660	-20.0320	-8.4666	0.0164	0.0696	0.0860	-0.0531	-0.6178	0.0116	0.0495	0.1558	0.0575	0.2454	0.1208	0.3662	0.212628801	Design Good	Design Good
16	UDSTL27	4.0700	-1.2430	-0.3054	0.0283	0.0043	0.0326	0.0239	0.7351	0.0007	0.0303	0.0955	0.0036	0.1504	0.0075	0.1579	0.139615711	Design Good	Design Good
16	UDSTL27	4.0700	-1.5980	-0.3926	0.0283	0.0055	0.0338	0.0227	0.6718	0.0009	0.0309	0.0973	0.0046	0.1533	0.0096	0.1629	0.141828821	Design Good	Design Good
16	UDSTL28	4.0750	56.4780	13.8596	0.0283	0.1961	0.2244	-0.1678	-0.7478	0.0327	0.1214	0.3826	0.1622	0.6025	0.3405	0.9431	0.341213696	Design Good	Design Good
16	UDSTL28	4.0650	-59.3180	-14.5924	0.0282	0.2060	0.2342	-0.1777	-0.7589	0.0343	0.1261	0.3971	0.1703	0.6254	0.3576	0.9831	0.348377947	Design Good	Design Good
16	UDSTL29	2.3660	-0.8880	-0.3753	0.0164	0.0031	0.0195	0.0133	0.6840	0.0005	0.0179	0.0564	0.0025	0.0888	0.0054	0.0941	0.107804277	Design Good	Design Good
16	UDSTL29	2.3660	-1.2430	-0.5254	0.0164	0.0043	0.0207	0.0121	0.5839	0.0007	0.0185	0.0582	0.0036	0.0917	0.0075	0.0992	0.110655456	Design Good	Design Good
16	UDSTL30	2.3710	56.8330	23.9701	0.0165	0.1973	0.2138	-0.1809	-0.8460	0.0329	0.1102	0.3471	0.1632	0.5467	0.3427	0.8894	0.331363452	Design Good	Design Good
16	UDSTL30	2.3610	-58.9630	-24.9737	0.0164	0.2047	0.2211	-0.1883	-0.8517	0.0341	0.1136	0.3580	0.1693	0.5638	0.3555	0.9193	0.336892282	Design Good	Design Good

BECHTEL PARSONS BLUE GRASS

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev D
Sheet No D1-27 / D1-60

Joint	OutputCase	F3	M2	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	d. check plate	d. check ped bearing
Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
16	UDSTL1	3.6800	-0.0008	-0.0002	0.0256	0.0000	0.0256	0.0256	0.9998	0.0000	0.0256	0.0805	0.0000	0.1268	0.0000	0.1268	0.125116449	Design Good	Design Good
16	UDSTL2	6.0830	-0.0014	-0.0002	0.0422	0.0000	0.0422	0.0422	0.9998	0.0000	0.0422	0.1331	0.0000	0.2096	0.0000	0.2096	0.160860972	Design Good	Design Good
16	UDSTL3	2.7820	0.0850	0.0306	0.0193	0.0003	0.0196	0.0190	0.9699	0.0000	0.0195	0.0613	0.0002	0.0965	0.0005	0.0971	0.109463679	Design Good	Design Good
16	UDSTL4	5.3570	-0.0870	-0.0162	0.0372	0.0003	0.0375	0.0369	0.9839	0.0001	0.0373	0.1176	0.0002	0.1853	0.0005	0.1858	0.151454604	Design Good	Design Good
16	UDSTL5	2.7820	0.1140	0.0410	0.0193	0.0004	0.0197	0.0189	0.9598	0.0001	0.0195	0.0614	0.0003	0.0968	0.0007	0.0975	0.109695849	Design Good	Design Good
16	UDSTL6	5.3570	-0.1150	-0.0215	0.0372	0.0004	0.0376	0.0368	0.9788	0.0001	0.0374	0.1178	0.0003	0.1855	0.0007	0.1862	0.151616704	Design Good	Design Good
16	UDSTL7	3.1780	-15.1180	-4.7571	0.0221	0.0525	0.0746	-0.0304	-0.4080	0.0087	0.0470	0.1481	0.0434	0.2332	0.0912	0.3243	0.200107301	Design Good	Design Good
16	UDSTL8	4.9610	15.1160	3.0470	0.0345	0.0525	0.0869	-0.0180	-0.2074	0.0087	0.0594	0.1871	0.0434	0.2946	0.0911	0.3857	0.218227779	Design Good	Design Good
16	UDSTL9	4.8470	-15.1180	-3.1190	0.0337	0.0525	0.0862	-0.0188	-0.2186	0.0087	0.0586	0.1846	0.0434	0.2907	0.0912	0.3819	0.217122032	Design Good	Design Good
16	UDSTL10	3.2920	15.1170	4.5920	0.0229	0.0525	0.0754	-0.0296	-0.3932	0.0087	0.0478	0.1506	0.0434	0.2371	0.0911	0.3283	0.201310887	Design Good	Design Good
16	UDSTL11	1.0780	0.0850	0.0788	0.0075	0.0003	0.0078	0.0072	0.9241	0.0000	0.0076	0.0240	0.0002	0.0378	0.0005	0.0383	0.068806834	Design Good	Design Good
16	UDSTL12	3.6530	-0.0860	-0.0235	0.0254	0.0003	0.0257	0.0251	0.9767	0.0000	0.0255	0.0804	0.0002	0.1266	0.0005	0.1271	0.125255044	Design Good	Design Good
16	UDSTL13	1.0780	0.1140	0.1058	0.0075	0.0004	0.0079	0.0071	0.8996	0.0001	0.0077	0.0242	0.0003	0.0381	0.0007	0.0388	0.069175592	Design Good	Design Good
16	UDSTL14	3.6540	-0.1150	-0.0315	0.0254	0.0004	0.0258	0.0250	0.9690	0.0001	0.0256	0.0805	0.0003	0.1268	0.0007	0.1275	0.125474944	Design Good	Design Good
16	UDSTL15	1.4740	-15.1180	-10.2564	0.0102	0.0525	0.0627	-0.0423	-0.6736	0.0087	0.0352	0.1108	0.0434	0.1745	0.0912	0.2656	0.18109394	Design Good	Design Good
16	UDSTL16	3.2570	15.1170	4.6414	0.0226	0.0525	0.0751	-0.0299	-0.3977	0.0087	0.0476	0.1498	0.0434	0.2359	0.0911	0.3271	0.200940791	Design Good	Design Good
16	UDSTL17	3.1440	-15.1180	-4.8085	0.0218	0.0525	0.0743	-0.0307	-0.4125	0.0087	0.0468	0.1473	0.0434	0.2320	0.0912	0.3232	0.199745623	Design Good	Design Good
16	UDSTL18	1.5880	15.1170	9.5195	0.0110	0.0525	0.0635	-0.0415	-0.6528	0.0087	0.0360	0.1133	0.0434	0.1784	0.0911	0.2696	0.182423015	Design Good	Design Good
16	UDSTL19	4.0700	-18.1990	-4.4715	0.0283	0.0632	0.0915	-0.0349	-0.3819	0.0105	0.0583	0.1836	0.0523	0.2891	0.1097	0.3989	0.221907233	Design Good	Design Good
16	UDSTL20	4.0700	18.1970	4.4710	0.0283	0.0632	0.0914	-0.0349	-0.3819	0.0105	0.0583	0.1836	0.0522	0.2891	0.1097	0.3988	0.221899326	Design Good	Design Good
16	UDSTL21	4.0700	0.0260	0.0064	0.0283	0.0001	0.0284	0.0282	0.9936	0.0000	0.0283	0.0892	0.0001	0.1404	0.0002	0.1406	0.131746918	Design Good	Design Good
16	UDSTL22	4.0700	-0.0280	-0.0069	0.0283	0.0001	0.0284	0.0282	0.9931	0.0000	0.0283	0.0892	0.0001	0.1405	0.0002	0.1406	0.131760235	Design Good	Design Good
16	UDSTL23	2.3660	-18.1990	-7.6919	0.0164	0.0632	0.0796	-0.0468	-0.5873	0.0105	0.0464	0.1463	0.0523	0.2304	0.1097	0.3402	0.204926581	Design Good	Design Good
16	UDSTL24	2.3660	18.1980	7.6915	0.0164	0.0632	0.0796	-0.0468	-0.5873	0.0105	0.0464	0.1463	0.0522	0.2304	0.1097	0.3401	0.2049223	Design Good	Design Good
16	UDSTL25	2.3660	0.0270	0.0114	0.0164	0.0001	0.0165	0.0163	0.9887	0.0000	0.0165	0.0519	0.0001	0.0817	0.0002	0.0819	0.100553908	Design Good	Design Good
16	UDSTL26	2.3660	-0.0280	-0.0118	0.0164	0.0001	0.0165	0.0163	0.9882	0.0000	0.0165	0.0519	0.0001	0.0817	0.0002	0.0819	0.100562632	Design Good	Design Good
16	UDSTL27	4.0700	57.5550	14.1413	0.0283	0.1998	0.2281	-0.1716	-0.7522	0.0333	0.1232	0.3880	0.1652	0.6112	0.3470	0.9582	0.343940659	Design Good	Design Good
16	UDSTL27	4.0700	-57.5570	-14.1418	0.0283	0.1999	0.2281	-0.1716	-0.7522	0.0333	0.1232	0.3881	0.1653	0.6112	0.3470	0.9582	0.34394576	Design Good	Design Good
16	UDSTL28	4.0750	0.0800	0.0196	0.0283	0.0003	0.0286	0.0280	0.9806	0.0000	0.0284	0.0896	0.0002	0.1411	0.0005	0.1415	0.132186474	Design Good	Design Good
16	UDSTL28	4.0650	-0.0820	-0.0202	0.0282	0.0003	0.0285	0.0279	0.9800	0.0000	0.0284	0.0893	0.0002	0.1407	0.0005	0.1412	0.132038776	Design Good	Design Good
16	UDSTL29	2.3660	57.5550	24.3259	0.0164	0.1998	0.2163	-0.1834	-0.8481	0.0333	0.1114	0.3508	0.1652	0.5525	0.3470	0.8995	0.333237543	Design Good	Design Good
16	UDSTL29	2.3660	-57.5560	-24.3263	0.0164	0.1998	0.2163	-0.1834	-0.8481	0.0333	0.1114	0.3508	0.1652	0.5525	0.3470	0.8995	0.333240176	Design Good	Design Good
16	UDSTL30	2.3710	0.0810	0.0342	0.0165	0.0003	0.0167	0.0162	0.9664	0.0000	0.0166	0.0523	0.0002	0.0824	0.0005	0.0828	0.101129134	Design Good	Design Good
16	UDSTL30	2.3610	-0.0820	-0.0347	0.0164	0.0003	0.0167	0.0161	0.9659	0.0000	0.0165	0.0521	0.0002	0.0820	0.0005	0.0825	0.100927309	Design Good	Design Good

Base Plate Design

HSS 6X6X.375
12"x12" Plate

A (in^2)		I (in)	c (in)	t (in)	n(in)	d (in)	Fy (ksi)	A2 (in^2)	Aratio	Φc	Fc (ksi)	Fp (ksi)
144		1728	6	0.75	3.15	12	36	324	1.5	0.6	4	3.06

Joint	OutputCase	F3	M1	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	d. check plate	d. check ped bearing
Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
17	UDSTL1	3.4220	-1.6320	-0.4769	0.0238	0.0057	0.0294	0.0181	0.6149	0.0009	0.0265	0.0833	0.0047	0.1313	0.0098	0.1411	0.13198	Design Good	Design Good
17	UDSTL2	5.6050	-1.4000	-0.2498	0.0389	0.0049	0.0438	0.0341	0.7780	0.0008	0.0412	0.1299	0.0040	0.2046	0.0084	0.2130	0.162164	Design Good	Design Good
17	UDSTL3	2.5930	63.7230	24.5750	0.0180	0.2213	0.2393	-0.2033	-0.8495	0.0369	0.1231	0.3878	0.1830	0.6108	0.3842	0.9950	0.350478	Design Good	Design Good
17	UDSTL4	4.9430	-66.5210	-13.4576	0.0343	0.2310	0.2653	-0.1966	-0.7412	0.0385	0.1440	0.4537	0.1910	0.7146	0.4011	1.1157	0.371133	Design Good	Design Good
17	UDSTL5	2.5930	73.7310	28.4346	0.0180	0.2560	0.2740	-0.2380	-0.8686	0.0427	0.1396	0.4398	0.2117	0.6926	0.4445	1.1372	0.374693	Design Good	Design Good
17	UDSTL6	4.9430	-76.5290	-15.4823	0.0343	0.2657	0.3001	-0.2314	-0.7712	0.0443	0.1605	0.5057	0.2197	0.7965	0.4614	1.2579	0.39408	Design Good	Design Good
17	UDSTL7	3.2970	-1.4460	-0.4386	0.0229	0.0050	0.0279	0.0179	0.6403	0.0008	0.0253	0.0796	0.0042	0.1254	0.0087	0.1341	0.128689	Design Good	Design Good
17	UDSTL8	4.2380	-1.3520	-0.3190	0.0294	0.0047	0.0341	0.0247	0.7249	0.0008	0.0317	0.0997	0.0039	0.1571	0.0082	0.1652	0.142823	Design Good	Design Good
17	UDSTL9	4.2200	-1.4470	-0.3429	0.0293	0.0050	0.0343	0.0243	0.7073	0.0008	0.0317	0.0998	0.0042	0.1572	0.0087	0.1660	0.143138	Design Good	Design Good
17	UDSTL10	3.3160	-1.3510	-0.4074	0.0230	0.0047	0.0277	0.0183	0.6615	0.0008	0.0253	0.0796	0.0039	0.1253	0.0081	0.1334	0.128355	Design Good	Design Good
17	UDSTL11	1.0250	64.0730	62.5102	0.0071	0.2225	0.2296	-0.2154	-0.9380	0.0371	0.1128	0.3553	0.1840	0.5596	0.3863	0.9459	0.34173	Design Good	Design Good
17	UDSTL12	3.3750	-66.1710	-19.6062	0.0234	0.2298	0.2532	-0.2063	-0.8149	0.0383	0.1326	0.4176	0.1900	0.6577	0.3990	1.0567	0.361187	Design Good	Design Good
17	UDSTL13	1.0250	74.0810	72.2741	0.0071	0.2572	0.2643	-0.2501	-0.9461	0.0429	0.1293	0.4073	0.2127	0.6415	0.4467	1.0881	0.366523	Design Good	Design Good
17	UDSTL14	3.3750	-76.1790	-22.5716	0.0234	0.2645	0.2879	-0.2411	-0.8372	0.0441	0.1491	0.4696	0.2187	0.7396	0.4593	1.1989	0.384728	Design Good	Design Good
17	UDSTL15	1.7290	-1.0960	-0.6339	0.0120	0.0038	0.0158	0.0082	0.5187	0.0006	0.0138	0.0435	0.0031	0.0685	0.0066	0.0751	0.096318	Design Good	Design Good
17	UDSTL16	2.6700	-1.0020	-0.3753	0.0185	0.0035	0.0220	0.0151	0.6840	0.0006	0.0202	0.0636	0.0029	0.1002	0.0060	0.1062	0.11452	Design Good	Design Good
17	UDSTL17	2.6510	-1.0970	-0.4138	0.0184	0.0038	0.0222	0.0146	0.6571	0.0006	0.0202	0.0637	0.0031	0.1003	0.0066	0.1069	0.114894	Design Good	Design Good
17	UDSTL18	1.7480	-1.0010	-0.5727	0.0121	0.0035	0.0156	0.0087	0.5548	0.0006	0.0138	0.0434	0.0029	0.0684	0.0060	0.0745	0.095872	Design Good	Design Good
17	UDSTL19	3.7680	-1.4550	-0.3861	0.0262	0.0051	0.0312	0.0211	0.6763	0.0008	0.0286	0.0900	0.0042	0.1417	0.0088	0.1505	0.136308	Design Good	Design Good
17	UDSTL20	3.7680	-1.3430	-0.3564	0.0262	0.0047	0.0308	0.0215	0.6975	0.0008	0.0284	0.0894	0.0039	0.1408	0.0081	0.1489	0.135586	Design Good	Design Good
17	UDSTL21	3.7680	16.9140	4.4889	0.0262	0.0587	0.0849	-0.0326	-0.3836	0.0098	0.0541	0.1703	0.0486	0.2682	0.1020	0.3702	0.213784	Design Good	Design Good
17	UDSTL22	3.7680	-19.7120	-5.2314	0.0262	0.0684	0.0946	-0.0423	-0.4469	0.0114	0.0587	0.1848	0.0566	0.2911	0.1188	0.4100	0.224973	Design Good	Design Good
17	UDSTL23	2.2000	-1.1050	-0.5023	0.0153	0.0038	0.0191	0.0114	0.5985	0.0006	0.0171	0.0539	0.0032	0.0848	0.0067	0.0915	0.106285	Design Good	Design Good
17	UDSTL24	2.2000	-0.9930	-0.4514	0.0153	0.0034	0.0187	0.0118	0.6317	0.0006	0.0169	0.0533	0.0029	0.0839	0.0060	0.0899	0.105356	Design Good	Design Good
17	UDSTL25	2.2000	17.2640	7.8473	0.0153	0.0599	0.0752	-0.0447	-0.5938	0.0100	0.0438	0.1378	0.0496	0.2171	0.1041	0.3212	0.199119	Design Good	Design Good
17	UDSTL26	2.2000	-19.3620	-8.8009	0.0153	0.0672	0.0825	-0.0520	-0.6297	0.0112	0.0472	0.1487	0.0556	0.2342	0.1167	0.3510	0.208157	Design Good	Design Good
17	UDSTL27	3.7680	-1.2420	-0.3296	0.0262	0.0043	0.0305	0.0219	0.7170	0.0007	0.0282	0.0889	0.0036	0.1400	0.0075	0.1475	0.134931	Design Good	Design Good
17	UDSTL27	3.7680	-1.5560	-0.4130	0.0262	0.0054	0.0316	0.0208	0.6577	0.0009	0.0287	0.0905	0.0045	0.1426	0.0094	0.1519	0.136957	Design Good	Design Good
17	UDSTL28	3.7720	52.3950	13.8905	0.0262	0.1819	0.2081	-0.1557	-0.7483	0.0303	0.1126	0.3547	0.1504	0.5587	0.3159	0.8746	0.328594	Design Good	Design Good
17	UDSTL28	3.7640	-55.1930	-14.6634	0.0261	0.1916	0.2178	-0.1655	-0.7600	0.0319	0.1172	0.3691	0.1585	0.5813	0.3328	0.9141	0.335931	Design Good	Design Good
17	UDSTL29	2.2000	-0.8910	-0.4050	0.0153	0.0031	0.0184	0.0122	0.6632	0.0005	0.0167	0.0528	0.0026	0.0831	0.0054	0.0885	0.104503	Design Good	Design Good
17	UDSTL29	2.2000	-1.2060	-0.5482	0.0153	0.0042	0.0195	0.0111	0.5697	0.0007	0.0173	0.0544	0.0035	0.0857	0.0073	0.0929	0.107115	Design Good	Design Good
17	UDSTL30	2.2030	52.7450	23.9424	0.0153	0.1831	0.1984	-0.1676	-0.8458	0.0305	0.1023	0.3222	0.1514	0.5075	0.3180	0.8255	0.319241	Design Good	Design Good
17	UDSTL30	2.1960	-54.8430	-24.9740	0.0153	0.1904	0.2057	-0.1752	-0.8517	0.0317	0.1057	0.3330	0.1575	0.5244	0.3307	0.8551	0.324909	Design Good	Design Good

Joint	OutputCase	F3	M2	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	d. check plate	d. check ped bearing
Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
17	UDSTL1	3.4220	0.0011	0.0003	0.0238	0.0000	0.0238	0.0238	0.9997	0.0000	0.0238	0.0749	0.0000	0.1179	0.0000	0.1179	0.120653	Design Good	Design Good
17	UDSTL2	5.6050	0.0017	0.0003	0.0389	0.0000	0.0389	0.0389	0.9997	0.0000	0.0389	0.1226	0.0000	0.1931	0.0000	0.1931	0.154414	Design Good	Design Good
17	UDSTL3	2.5930	-0.0960	-0.0370	0.0180	0.0003	0.0183	0.0177	0.9637	0.0001	0.0182	0.0572	0.0003	0.0901	0.0006	0.0907	0.105819	Design Good	Design Good
17	UDSTL4	4.9430	0.0990	0.0200	0.0343	0.0003	0.0347	0.0340	0.9802	0.0001	0.0345	0.1086	0.0003	0.1711	0.0006	0.1717	0.145597	Design Good	Design Good
17	UDSTL5	2.5930	-0.1300	-0.0501	0.0180	0.0005	0.0185	0.0176	0.9511	0.0001	0.0182	0.0574	0.0004	0.0904	0.0008	0.0912	0.106101	Design Good	Design Good
17	UDSTL6	4.9430	0.1320	0.0267	0.0343	0.0005	0.0348	0.0339	0.9736	0.0001	0.0345	0.1088	0.0004	0.1714	0.0008	0.1722	0.145796	Design Good	Design Good
17	UDSTL7	3.2970	-15.0960	-4.5787	0.0229	0.0524	0.0753	-0.0295	-0.3920	0.0087	0.0478	0.1506	0.0433	0.2371	0.0910	0.3281	0.201272	Design Good	Design Good
17	UDSTL8	4.2380	15.0980	3.5625	0.0294	0.0524	0.0819	-0.0230	-0.2809	0.0087	0.0543	0.1711	0.0433	0.2696	0.0910	0.3606	0.210989	Design Good	Design Good
17	UDSTL9	4.2200	-15.0950	-3.5770	0.0293	0.0524	0.0817	-0.0231	-0.2828	0.0087	0.0542	0.1707	0.0433	0.2689	0.0910	0.3599	0.210795	Design Good	Design Good
17	UDSTL10	3.3160	15.0980	4.5531	0.0230	0.0524	0.0755	-0.0294	-0.3896	0.0087	0.0479	0.1510	0.0433	0.2378	0.0910	0.3288	0.201482	Design Good	Design Good
17	UDSTL11	1.0250	-0.0970	-0.0946	0.0071	0.0003	0.0075	0.0068	0.9096	0.0001	0.0073	0.0229	0.0003	0.0361	0.0006	0.0367	0.067305	Design Good	Design Good
17	UDSTL12	3.3750	0.0980	0.0290	0.0234	0.0003	0.0238	0.0231	0.9714	0.0001	0.0236	0.0743	0.0003	0.1171	0.0006	0.1177	0.12053	Design Good	Design Good
17	UDSTL13	1.0250	-0.1300	-0.1268	0.0071	0.0005	0.0076	0.0067	0.8807	0.0001	0.0073	0.0231	0.0004	0.0364	0.0008	0.0372	0.067734	Design Good	Design Good
17	UDSTL14	3.3750	0.1310	0.0388	0.0234	0.0005	0.0239	0.0230	0.9619	0.0001	0.0237	0.0745	0.0004	0.1174	0.0008	0.1181	0.12077	Design Good	Design Good
17	UDSTL15	1.7290	-15.0960	-8.7311	0.0120	0.0524	0.0644	-0.0404	-0.6273	0.0087	0.0369	0.1163	0.0433	0.1831	0.0910	0.2741	0.183959	Design Good	Design Good
17	UDSTL16	2.6700	15.0980	5.6547	0.0185	0.0524	0.0710	-0.0339	-0.4774	0.0087	0.0434	0.1368	0.0433	0.2155	0.0910	0.3066	0.194543	Design Good	Design Good
17	UDSTL17	2.6510	-15.0960	-5.6945	0.0184	0.0524	0.0708	-0.0340	-0.4801	0.0087	0.0433	0.1364	0.0433	0.2149	0.0910	0.3059	0.194326	Design Good	Design Good
17	UDSTL18	1.7480	15.0970	8.6367	0.0121	0.0524	0.0646	-0.0403	-0.6239	0.0087	0.0370	0.1167	0.0433	0.1838	0.0910	0.2748	0.184184	Design Good	Design Good
17	UDSTL19	3.7680	-18.1950	-4.8288	0.0262	0.0632	0.0893	-0.0370	-0.4142	0.0105	0.0562	0.1770	0.0522	0.2787	0.1097	0.3884	0.218978	Design Good	Design Good
17	UDSTL20	3.7680	18.1970	4.8294	0.0262	0.0632	0.0894	-0.0370	-0.4143	0.0105	0.0562	0.1770	0.0522	0.2787	0.1097	0.3884	0.218986	Design Good	Design Good
17	UDSTL21	3.7680	-0.0300	-0.0080	0.0262	0.0001	0.0263	0.0261	0.9921	0.0000	0.0262	0.0826	0.0001	0.1301	0.0002	0.1302	0.126806	Design Good	Design Good
17	UDSTL22	3.7680	0.0320	0.0085	0.0262	0.0001	0.0263	0.0261	0.9915	0.0000	0.0262	0.0826	0.0001	0.1301	0.0002	0.1303	0.12682	Design Good	Design Good
17	UDSTL23	2.2000	-18.1950	-8.2705	0.0153	0.0632	0.0785	-0.0479	-0.6105	0.0105	0.0453	0.1427	0.0522	0.2247	0.1097	0.3344	0.203179	Design Good	Design Good
17	UDSTL24	2.2000	18.1970	8.2714	0.0153	0.0632	0.0785	-0.0479	-0.6106	0.0105	0.0453	0.1427	0.0522	0.2247	0.1097	0.3344	0.203188	Design Good	Design Good
17	UDSTL25	2.2000	-0.0300	-0.0136	0.0153	0.0001	0.0154	0.0152	0.9865	0.0000	0.0153	0.0483	0.0001	0.0760	0.0002	0.0762	0.097007	Design Good	Design Good
17	UDSTL26	2.2000	0.0320	0.0145	0.0153	0.0001	0.0154	0.0152	0.9856	0.0000	0.0153	0.0483	0.0001	0.0761	0.0002	0.0763	0.097025	Design Good	Design Good
17	UDSTL27	3.7680	57.5510	15.2736	0.0262	0.1998	0.2260	-0.1737	-0.7684	0.0333	0.1211	0.3814	0.1652	0.6007	0.3470	0.9477	0.342058	Design Good	Design Good
17	UDSTL27	3.7680	-57.5480	-15.2728	0.0262	0.1998	0.2260	-0.1737	-0.7684	0.0333	0.1211	0.3814	0.1652	0.6007	0.3470	0.9477	0.34205	Design Good	Design Good
17	UDSTL28	3.7720	0.1210	0.0321	0.0262	0.0004	0.0266	0.0258	0.9684	0.0001	0.0264	0.0831	0.0003	0.1309	0.0007	0.1317	0.127501	Design Good	Design Good
17	UDSTL28	3.7640	-0.1180	-0.0313	0.0261	0.0004	0.0265	0.0257	0.9691	0.0001	0.0263	0.0830	0.0003	0.1306	0.0007	0.1314	0.127346	Design Good	Design Good
17	UDSTL29	2.2000	57.5500	26.1591	0.0153	0.1998	0.2151	-0.1845	-0.8579	0.0333	0.1102	0.3471	0.1652	0.5467	0.3470	0.8937	0.332163	Design Good	Design Good
17	UDSTL29	2.2000	-57.5490	-26.1586	0.0153	0.1998	0.2151	-0.1845	-0.8579	0.0333	0.1102	0.3471	0.1652	0.5467	0.3470	0.8937	0.332161	Design Good	Design Good
17	UDSTL30	2.2030	0.1200	0.0545	0.0153	0.0004	0.0157	0.0149	0.9470	0.0001	0.0155	0.0488	0.0003	0.0769	0.0007	0.0776	0.097882	Design Good	Design Good
17	UDSTL30	2.1960	-0.1190	-0.0542	0.0153	0.0004	0.0157	0.0148	0.9472	0.0001	0.0154	0.0487	0.0003	0.0766	0.0007	0.0774	0.097721	Design Good	Design Good

Anchor Bolt: Tension Design

N.plate (in)	B.plate (in)	x.a (in)	N.prime (in)	A.prime (in)	e.kern	φ	N.design
12	12	1.5	10.5	4.5	2	0.85	14.82528

<---one anchor

	Nsa (kip)	Ncbg (kip)	Npn (kip)	Nsb (kip)
	one anchor	two anchors	one anchor	one anchor
	77.6	34.883	20.93	36.83
ΦN	65.96	29.65055	17.7905	31.3055

<--reduced by phi factor

Joint	OutputCase	F3	M1	e	fp	anchor_tension	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor	Nsa check	Ncbg check	Nsb check	Npn check
Text	Text	Kip	Kip-in	in							Kips	Kips				
14	UDSTL1	2.0660	-1.8110	-0.8766	0.0206	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL2	3.2590	-1.5510	-0.4759	0.0280	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL3	1.5820	62.4710	39.4886	0.2279	Anchor bolts in tension	14.3577	25.5165	5.9835	5.9835	6.5997	3.2999	Design OK	Design OK	Design OK	Design OK
14	UDSTL4	2.8900	-65.5750	-22.6903	0.2478	Anchor bolts in tension	15.6089	34.5690	-3.0690	3.0690	1.6722	0.8361	Design OK	Design OK	Design OK	Design OK
14	UDSTL5	1.5820	76.2240	48.1820	0.2757	Anchor bolts in tension	17.3661	25.5932	5.9068	5.9068	8.1874	4.0937	Design OK	Design OK	Design OK	Design OK
14	UDSTL6	2.8900	-79.3280	-27.4491	0.2955	Anchor bolts in tension	18.6174	34.7310	-3.2310	3.2310	2.8389	1.4194	Design OK	Design OK	Design OK	Design OK
14	UDSTL7	1.6590	-1.5390	-0.9277	0.0169	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL8	2.8130	-1.5650	-0.5563	0.0250	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL9	2.7940	-1.5390	-0.5508	0.0247	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL10	1.6780	-1.5650	-0.9327	0.0171	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL11	0.6740	62.8590	93.2626	0.2229	Anchor bolts in tension	14.0453	25.7642	5.7358	5.7358	6.9985	3.4993	Design OK	Design OK	Design OK	Design OK
14	UDSTL12	1.9830	-65.1870	-32.8729	0.2401	Anchor bolts in tension	15.1272	34.8608	-3.3608	3.3608	2.8588	1.4294	Design OK	Design OK	Design OK	Design OK
14	UDSTL13	0.6740	76.6120	113.6677	0.2707	Anchor bolts in tension	17.0538	25.7974	5.7026	5.7026	8.5880	4.2940	Design OK	Design OK	Design OK	Design OK
14	UDSTL14	1.9830	-78.9410	-39.8089	0.2879	Anchor bolts in tension	18.1359	34.9769	-3.4769	3.4769	4.0225	2.0112	Design OK	Design OK	Design OK	Design OK
14	UDSTL15	0.7510	-1.1510	-1.5326	0.0092	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL16	1.9060	-1.1770	-0.6175	0.0173	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL17	1.8860	-1.1510	-0.6103	0.0171	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL18	0.7700	-1.1770	-1.5286	0.0094	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL19	2.2360	-1.6800	-0.7513	0.0214	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL20	2.2360	-1.4240	-0.6369	0.0205	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL21	2.2360	16.9160	7.5653	0.0743	Anchor bolts in tension	4.6786	23.9002	7.5998	7.5998	1.1503	0.5752	Design OK	Design OK	Design OK	Design OK
14	UDSTL22	2.2360	-20.0200	-8.9535	0.0850	Anchor bolts in tension	5.3576	33.2603	-1.7603	1.7603	-1.3378	-0.6689	Design OK	Design OK	Design OK	Design OK
14	UDSTL23	1.3280	-1.2920	-0.9729	0.0137	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL24	1.3280	-1.0360	-0.7801	0.0128	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL25	1.3280	17.3040	13.0301	0.0693	Anchor bolts in tension	4.3663	24.7005	6.7995	6.7995	1.4995	0.7497	Design OK	Design OK	Design OK	Design OK
14	UDSTL26	1.3280	-19.6320	-14.7831	0.0774	Anchor bolts in tension	4.8755	34.0883	-2.5883	2.5883	-0.1262	-0.0631	Design OK	Design OK	Design OK	Design OK
14	UDSTL27	2.2360	-0.8200	-0.3667	0.0184	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL27	2.2360	-2.2840	-1.0215	0.0235	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL28	2.2400	58.4910	26.1121	0.2186	Anchor bolts in tension	13.7749	25.3028	6.1972	6.1972	5.8900	2.9450	Design OK	Design OK	Design OK	Design OK
14	UDSTL28	2.2320	-61.5950	-27.5963	0.2294	Anchor bolts in tension	14.4504	34.7352	-3.2352	3.2352	2.2203	1.1102	Design OK	Design OK	Design OK	Design OK
14	UDSTL29	1.3280	-0.4320	-0.3253	0.0107	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL29	1.3280	-1.8960	-1.4277	0.0158	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL30	1.3330	58.8790	44.1703	0.2137	Anchor bolts in tension	13.4630	25.5615	5.9385	5.9385	6.2813	3.1406	Design OK	Design OK	Design OK	Design OK
14	UDSTL30	1.3240	-61.2070	-46.2289	0.2217	Anchor bolts in tension	13.9683	35.0543	-3.5543	3.5543	3.4043	1.7021	Design OK	Design OK	Design OK	Design OK

Calculation Sheet

Joint	OutputCase	F3	M2	e	fp	anchor_tension	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor	Nsa check	Ncbg check	Nsb check	Npn check
Text	Text	Kip	Kip-in	in							Kips	Kips				
14	UDSTL1	2.0660	0.0000	0.0000	0.0143	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL2	3.2590	0.0001	0.0000	0.0226	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL3	1.5820	0.1790	0.1131	0.0116	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL4	2.8900	-0.1790	-0.0619	0.0207	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL5	1.5820	0.2410	0.1523	0.0118	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL6	2.8900	-0.2410	-0.0834	0.0209	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL7	1.6590	-15.1440	-9.1284	0.0641	Anchor bolts in tension	4.0386	33.2986	-1.7986	1.7986	-0.9672	-0.4836	Design OK	Design OK	Design OK	Design OK
14	UDSTL8	2.8130	15.1440	5.3836	0.0721	Anchor bolts in tension	4.5434	23.1868	8.3132	8.3132	0.7842	0.3921	Design OK	Design OK	Design OK	Design OK
14	UDSTL9	2.7940	-15.1440	-5.4202	0.0720	Anchor bolts in tension	4.5351	32.0571	-0.5571	0.5571	-2.5534	-1.2767	Design OK	Design OK	Design OK	Design OK
14	UDSTL10	1.6780	15.1440	9.0250	0.0642	Anchor bolts in tension	4.0469	24.2004	7.2996	7.2996	1.1354	0.5677	Design OK	Design OK	Design OK	Design OK
14	UDSTL11	0.6740	0.1790	0.2656	0.0053	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL12	1.9830	-0.1790	-0.0903	0.0144	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL13	0.6740	0.2410	0.3576	0.0055	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL14	1.9830	-0.2410	-0.1215	0.0146	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL15	0.7510	-15.1440	-20.1651	0.0578	Anchor bolts in tension	3.6413	34.4538	-2.9538	2.9538	0.2734	0.1367	Design OK	Design OK	Design OK	Design OK
14	UDSTL16	1.9060	15.1440	7.9454	0.0658	Anchor bolts in tension	4.1466	23.9880	7.5120	7.5120	1.0606	0.5303	Design OK	Design OK	Design OK	Design OK
14	UDSTL17	1.8860	-15.1440	-8.0297	0.0657	Anchor bolts in tension	4.1379	33.0341	-1.5341	1.5341	-1.2814	-0.6407	Design OK	Design OK	Design OK	Design OK
14	UDSTL18	0.7700	15.1440	19.6675	0.0579	Anchor bolts in tension	3.6496	25.1014	6.3986	6.3986	1.4541	0.7270	Design OK	Design OK	Design OK	Design OK
14	UDSTL19	2.2360	-18.1710	-8.1266	0.0786	Anchor bolts in tension	4.9532	33.0599	-1.5599	1.5599	-1.5002	-0.7501	Design OK	Design OK	Design OK	Design OK
14	UDSTL20	2.2360	18.1710	8.1266	0.0786	Anchor bolts in tension	4.9532	24.0272	7.4728	7.4728	1.2891	0.6446	Design OK	Design OK	Design OK	Design OK
14	UDSTL21	2.2360	0.0570	0.0255	0.0157	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL22	2.2360	-0.0570	-0.0255	0.0157	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL23	1.3280	-18.1710	-13.6830	0.0723	Anchor bolts in tension	4.5559	33.9813	-2.4813	2.4813	-0.2514	-0.1257	Design OK	Design OK	Design OK	Design OK
14	UDSTL24	1.3280	18.1710	13.6830	0.0723	Anchor bolts in tension	4.5559	24.7560	6.7440	6.7440	1.5982	0.7991	Design OK	Design OK	Design OK	Design OK
14	UDSTL25	1.3280	0.0570	0.0429	0.0094	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL26	1.3280	-0.0570	-0.0429	0.0094	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL27	2.2360	57.4690	25.7017	0.2151	Anchor bolts in tension	13.5496	25.2929	6.2071	6.2071	5.7739	2.8869	Design OK	Design OK	Design OK	Design OK
14	UDSTL27	2.2360	-57.4690	-25.7017	0.2151	Anchor bolts in tension	13.5496	34.6781	-3.1781	3.1781	1.8652	0.9326	Design OK	Design OK	Design OK	Design OK
14	UDSTL28	2.2400	0.1820	0.0813	0.0162	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL28	2.2320	-0.1820	-0.0815	0.0161	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL29	1.3280	57.4690	43.2748	0.2088	Anchor bolts in tension	13.1523	25.5536	5.9464	5.9464	6.1205	3.0602	Design OK	Design OK	Design OK	Design OK
14	UDSTL29	1.3280	-57.4690	-43.2748	0.2088	Anchor bolts in tension	13.1523	35.0214	-3.5214	3.5214	3.0830	1.5415	Design OK	Design OK	Design OK	Design OK
14	UDSTL30	1.3330	0.1820	0.1365	0.0099	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	UDSTL30	1.3240	-0.1820	-0.1375	0.0098	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

BECHTEL PARSONS BLUE GRASS

Gas Bottles Misc Support Calculations
By R. Murphy   Date: 12/16/2007

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev. D
Sheet No. D1-32 / D1-60

Anchor Bolt: Tension Design

N.plate (in)	B.plate (in)	x.a (in)	N.prime (in)	A.prime (in)	e.kern	Φ	N.design	
12	12	1.5	10.5	4.5	2	0.85	14.82528	<---one anchor

	Nsa (kip)	Ncbg (kip)	Npn (kip)	Nsb (kip)	
	one anchor	two anchors	one anchor	one anchor	
	77.6	34.883	20.928	36.83	
ΦN	65.96	29.65055	17.7888	31.3055	<--reduced by phi factor

Joint	OutputCase	F3	M1	e	fp	anchor_tension	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor	Nsa check	Ncbg check	Nsb check	Npn check
Text	Text	Kip	Kip-in	in							Kips	Kips				
15	UDSTL1	1.6070	-1.5000	-0.8301	0.0178	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL2	2.7810	-1.2860	-0.4624	0.0238	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL3	1.3920	56.9800	40.9339	0.2075	Anchor bolts in tension	13.0734	25.5315	5.9685	5.9685	6.0393	3.0196	Design OK	Design OK	Design OK	Design OK
15	UDSTL4	2.4760	-59.5520	-24.0517	0.2240	Anchor bolts in tension	14.1103	34.6215	-3.1215	3.1215	1.7188	0.8594	Design OK	Design OK	Design OK	Design OK
15	UDSTL5	1.3920	69.6610	50.0438	0.2515	Anchor bolts in tension	15.8473	25.6062	5.8938	5.8938	7.5033	3.7516	Design OK	Design OK	Design OK	Design OK
15	UDSTL6	2.4760	-72.2330	-29.1733	0.2680	Anchor bolts in tension	16.8842	34.7773	-3.2773	3.2773	2.7939	1.3970	Design OK	Design OK	Design OK	Design OK
15	UDSTL7	1.7430	-1.2490	-0.7166	0.0164	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL8	2.1250	-1.3230	-0.6226	0.0194	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL9	2.1250	-1.2490	-0.5878	0.0191	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL10	1.7430	-1.3230	-0.7590	0.0167	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL11	0.6200	57.3020	92.4226	0.2033	Anchor bolts in tension	12.8061	25.7625	5.7375	5.7375	6.3776	3.1888	Design OK	Design OK	Design OK	Design OK
15	UDSTL12	1.7040	-59.2310	-34.7600	0.2175	Anchor bolts in tension	13.7023	34.8968	-3.3968	3.3968	2.7288	1.3644	Design OK	Design OK	Design OK	Design OK
15	UDSTL13	0.6200	69.9830	112.8758	0.2473	Anchor bolts in tension	15.5800	25.7963	5.7037	5.7037	7.8432	3.9216	Design OK	Design OK	Design OK	Design OK
15	UDSTL14	1.7040	-71.9110	-42.2013	0.2615	Anchor bolts in tension	16.4760	35.0084	-3.5084	3.5084	3.8012	1.9006	Design OK	Design OK	Design OK	Design OK
15	UDSTL15	0.9710	-0.9280	-0.9557	0.0100	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL16	1.3530	-1.0010	-0.7398	0.0129	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL17	1.3530	-0.9280	-0.6859	0.0126	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL18	0.9710	-1.0010	-1.0309	0.0102	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL19	1.9340	-1.1720	-0.6060	0.0175	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL20	1.9340	-1.4000	-0.7239	0.0183	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL21	1.9340	15.7170	8.1267	0.0680	Anchor bolts in tension	4.2842	24.0272	7.4728	7.4728	1.1150	0.5575	Design OK	Design OK	Design OK	Design OK
15	UDSTL22	1.9340	-18.2890	-9.4566	0.0769	Anchor bolts in tension	4.8468	33.3671	-1.8671	1.8671	-1.0721	-0.5361	Design OK	Design OK	Design OK	Design OK
15	UDSTL23	1.1620	-0.8510	-0.7324	0.0110	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL24	1.1620	-1.0780	-0.9277	0.0118	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL25	1.1620	16.0390	13.8029	0.0638	Anchor bolts in tension	4.0169	24.7656	6.7344	6.7344	1.4143	0.7072	Design OK	Design OK	Design OK	Design OK
15	UDSTL26	1.1620	-17.9680	-15.4630	0.0705	Anchor bolts in tension	4.4389	34.1474	-2.6474	2.6474	-0.0428	-0.0214	Design OK	Design OK	Design OK	Design OK
15	UDSTL27	1.9340	-0.5730	-0.2963	0.0154	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL27	1.9340	-1.9990	-1.0336	0.0204	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL28	1.9370	47.7560	24.6546	0.1793	Anchor bolts in tension	11.2941	25.2661	6.2339	6.2339	4.7683	2.3842	Design OK	Design OK	Design OK	Design OK
15	UDSTL28	1.9310	-50.3280	-26.0632	0.1882	Anchor bolts in tension	11.8541	34.6896	-3.1896	3.1896	1.6699	0.8350	Design OK	Design OK	Design OK	Design OK
15	UDSTL29	1.1620	-0.2520	-0.2169	0.0089	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL29	1.1620	-1.6770	-1.4432	0.0139	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL30	1.1650	48.0770	41.2678	0.1750	Anchor bolts in tension	11.0265	25.5348	5.9652	5.9652	5.0993	2.5497	Design OK	Design OK	Design OK	Design OK
15	UDSTL30	1.1590	-50.0060	-43.1458	0.1817	Anchor bolts in tension	11.4459	35.0199	-3.5199	3.5199	2.6780	1.3390	Design OK	Design OK	Design OK	Design OK

BECHTEL PARSONS BLUE GRASS

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev. D
Sheet No. D1-33 / D1-60

Joint	OutputCase	F3	M2	e	fp	anchor_tension	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor	Nsa check	Ncbg check	Nsb check	Npn check
Text	Text	Kip	Kip-in	in							Kips	Kips				
15	UDSTL1	1.8070	0.0003	0.0002	0.0125	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL2	2.7810	0.0004	0.0002	0.0193	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL3	1.3920	-0.1680	-0.1207	0.0103	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL4	2.4760	0.1680	0.0679	0.0178	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL5	1.3920	-0.2260	-0.1624	0.0105	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL6	2.4760	0.2270	0.0917	0.0180	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL7	1.7430	-15.0810	-8.6523	0.0645	Anchor bolts in tension	4.0615	33.1912	-1.6912	1.6912	-1.0888	-0.5444	Design OK	Design OK	Design OK	Design OK
15	UDSTL8	2.1250	15.0820	7.0974	0.0671	Anchor bolts in tension	4.2289	23.7806	7.7194	7.7194	0.9840	0.4920	Design OK	Design OK	Design OK	Design OK
15	UDSTL9	2.1250	-15.0810	-7.0969	0.0671	Anchor bolts in tension	4.2287	32.7550	-1.2550	1.2550	-1.6196	-0.8098	Design OK	Design OK	Design OK	Design OK
15	UDSTL10	1.7430	15.0820	8.6529	0.0645	Anchor bolts in tension	4.0618	24.1327	7.3673	7.3673	1.1069	0.5535	Design OK	Design OK	Design OK	Design OK
15	UDSTL11	0.6200	-0.1680	-0.2710	0.0049	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL12	1.7040	0.1680	0.0986	0.0124	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL13	0.6200	-0.2260	-0.3645	0.0051	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL14	1.7040	0.2270	0.1332	0.0126	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL15	0.9710	-15.0820	-15.5324	0.0591	Anchor bolts in tension	3.7240	34.1531	-2.6531	2.6531	-0.0300	-0.0150	Design OK	Design OK	Design OK	Design OK
15	UDSTL16	1.3530	15.0820	11.1471	0.0618	Anchor bolts in tension	3.8911	24.5067	6.9933	6.9933	1.2386	0.6193	Design OK	Design OK	Design OK	Design OK
15	UDSTL17	1.3530	-15.0810	-11.1463	0.0618	Anchor bolts in tension	3.8909	33.6627	-2.1627	2.1627	-0.5516	-0.2758	Design OK	Design OK	Design OK	Design OK
15	UDSTL18	0.9710	15.0820	15.5324	0.0591	Anchor bolts in tension	3.7240	24.8894	6.6106	6.6106	1.3735	0.6868	Design OK	Design OK	Design OK	Design OK
15	UDSTL19	1.9340	-18.1710	-9.3956	0.0765	Anchor bolts in tension	4.8210	33.3547	-1.8547	1.8547	-1.0824	-0.5412	Design OK	Design OK	Design OK	Design OK
15	UDSTL20	1.9340	18.1710	9.3956	0.0765	Anchor bolts in tension	4.8210	24.2630	7.2370	7.2370	1.3888	0.6944	Design OK	Design OK	Design OK	Design OK
15	UDSTL21	1.9340	-0.0530	-0.0274	0.0136	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL22	1.9340	0.0540	0.0279	0.0136	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL23	1.1620	-18.1710	-15.6377	0.0712	Anchor bolts in tension	4.4833	34.1618	-2.6618	2.6618	-0.0255	-0.0127	Design OK	Design OK	Design OK	Design OK
15	UDSTL24	1.1620	18.1710	15.6377	0.0712	Anchor bolts in tension	4.4833	24.8961	6.6039	6.6039	1.6577	0.8289	Design OK	Design OK	Design OK	Design OK
15	UDSTL25	1.1620	-0.0540	-0.0465	0.0083	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL26	1.1620	0.0540	0.0465	0.0083	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL27	1.9340	57.4700	29.7156	0.2130	Anchor bolts in tension	13.4177	25.3787	6.1213	6.1213	5.8883	2.9441	Design OK	Design OK	Design OK	Design OK
15	UDSTL27	1.9340	-57.4700	-29.7156	0.2130	Anchor bolts in tension	13.4177	34.7908	-3.2908	3.2908	2.2712	1.1356	Design OK	Design OK	Design OK	Design OK
15	UDSTL28	1.9370	0.1940	0.1002	0.0141	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL28	1.9310	-0.1930	-0.0999	0.0141	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL29	1.1620	57.4700	49.4578	0.2076	Anchor bolts in tension	13.0799	25.6022	5.8978	5.8978	6.1849	3.0924	Design OK	Design OK	Design OK	Design OK
15	UDSTL29	1.1620	-57.4700	-49.4578	0.2076	Anchor bolts in tension	13.0799	35.0858	-3.5858	3.5858	3.3049	1.6524	Design OK	Design OK	Design OK	Design OK
15	UDSTL30	1.1650	0.1940	0.1665	0.0088	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
15	UDSTL30	1.1590	-0.1940	-0.1674	0.0087	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Anchor Bolt: Tension Design

N.plate (in)	B.plate (in)	x.a (in)	N.prime (in)	A.prime (in)	e.kern	Φ	N.design	
12	12	1.5	10.5	4.5	2	0.75	13.08113	<---one anchor

	Nsa (kip)	Ncbg (kip)	Npn (kip)	Nsb (kip)	
	one anchor	two anchors	one anchor	one anchor	
	77.6	34.883	20.93	36.83	
ΦN	58.2	26.16225	15.6975	27.6225	<--reduced by phi factor

Joint	OutputCase	F3	M1	e	fp	anchor_tension	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor	Nsa check	Ncbg check	Nsb check	Npn check
Text	Text	Kip	Kip-in	in							Kips	Kips				
16	UDSTL1	3.6800	-1.6570	-0.4503	0.0313	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL2	6.0830	-1.4200	-0.2334	0.0472	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL3	2.7820	66.4750	23.8947	0.2501	Anchor bolts in tension	15.7585	25.2453	6.2547	6.2547	6.6052	3.3026	Design OK	Design OK	Design OK	Design OK
16	UDSTL4	5.3570	-69.3150	-12.9391	0.2779	Anchor bolts in tension	17.5063	33.8996	-2.3996	2.3996	-1.3562	-0.6781	Design OK	Design OK	Design OK	Design OK
16	UDSTL5	2.7820	76.5180	27.5047	0.2850	Anchor bolts in tension	17.9554	25.3344	6.1656	6.1656	7.7614	3.8807	Design OK	Design OK	Design OK	Design OK
16	UDSTL6	5.3570	-79.3590	-14.8141	0.3128	Anchor bolts in tension	19.7035	34.0911	-2.5911	2.5911	-0.4948	-0.2474	Design OK	Design OK	Design OK	Design OK
16	UDSTL7	3.1780	-1.4230	-0.4478	0.0270	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL8	4.9610	-1.4180	-0.2858	0.0394	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL9	4.8470	-1.4220	-0.2934	0.0386	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL10	3.2920	-1.4180	-0.4307	0.0278	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL11	1.0780	66.8300	61.9944	0.2395	Anchor bolts in tension	15.0907	25.6715	5.8285	5.8285	7.2987	3.6494	Design OK	Design OK	Design OK	Design OK
16	UDSTL12	3.6530	-68.9600	-18.8776	0.2648	Anchor bolts in tension	16.6832	34.3841	-2.8841	2.8841	0.9295	0.4647	Design OK	Design OK	Design OK	Design OK
16	UDSTL13	1.0780	76.8730	71.3108	0.2744	Anchor bolts in tension	17.2876	25.7075	5.7925	5.7925	8.4590	4.2295	Design OK	Design OK	Design OK	Design OK
16	UDSTL14	3.6540	-79.0040	-21.6212	0.2997	Anchor bolts in tension	18.8808	34.5233	-3.0233	3.0233	1.7824	0.8912	Design OK	Design OK	Design OK	Design OK
16	UDSTL15	1.4740	-1.0680	-0.7246	0.0139	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL16	3.2570	-1.0630	-0.3264	0.0263	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL17	3.1440	-1.0680	-0.3397	0.0255	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL18	1.5880	-1.0630	-0.6694	0.0147	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL19	4.0700	-1.3500	-0.3317	0.0330	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL20	4.0700	-1.4910	-0.3663	0.0334	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL21	4.0700	17.5460	4.3111	0.0892	Anchor bolts in tension	5.6188	22.6071	8.8929	8.8929	0.6888	0.3444	Design OK	Design OK	Design OK	Design OK
16	UDSTL22	4.0700	-20.3870	-5.0091	0.0991	Anchor bolts in tension	6.2403	31.8286	-0.3286	0.3286	-3.8747	-1.9374	Design OK	Design OK	Design OK	Design OK
16	UDSTL23	2.3660	-0.9950	-0.4205	0.0199	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL24	2.3660	-1.1360	-0.4801	0.0204	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL25	2.3660	17.9010	7.5659	0.0786	Anchor bolts in tension	4.9510	23.9004	7.5996	7.5996	1.2174	0.6087	Design OK	Design OK	Design OK	Design OK
16	UDSTL26	2.3660	-20.0320	-8.4666	0.0860	Anchor bolts in tension	5.4171	33.1464	-1.6464	1.6464	-1.5166	-0.7583	Design OK	Design OK	Design OK	Design OK
16	UDSTL27	4.0700	-1.2430	-0.3054	0.0326	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL27	4.0700	-1.5980	-0.3926	0.0338	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL28	4.0750	56.4780	13.8596	0.2244	Anchor bolts in tension	14.1374	24.7702	6.7298	6.7298	4.9862	2.4931	Design OK	Design OK	Design OK	Design OK
16	UDSTL28	4.0650	-59.3180	-14.5924	0.2342	Anchor bolts in tension	14.7543	34.0708	-2.5708	2.5708	-0.4526	-0.2263	Design OK	Design OK	Design OK	Design OK
16	UDSTL29	2.3660	-0.8880	-0.3753	0.0195	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL29	2.3660	-1.2430	-0.5254	0.0207	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL30	2.3710	56.8330	23.9701	0.2138	Anchor bolts in tension	13.4695	25.2474	6.2526	6.2526	5.6499	2.8250	Design OK	Design OK	Design OK	Design OK
16	UDSTL30	2.3610	-58.9630	-24.9737	0.2211	Anchor bolts in tension	13.9311	34.6540	-3.1540	3.1540	1.8237	0.9118	Design OK	Design OK	Design OK	Design OK

Joint	OutputCase	F3	M2	e	fp	anchor_tension	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor	Nsa check	Ncbg check	Nsb check	Npn check
Text	Text	Kip	Kip-in	in							Kips	Kips				
16	UDSTL1	3.6800	-0.0008	-0.0002	0.0256	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL2	6.0830	-0.0014	-0.0002	0.0422	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL3	2.7820	0.0850	0.0306	0.0196	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL4	5.3570	-0.0870	-0.0162	0.0375	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL5	2.7820	0.1140	0.0410	0.0197	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL6	5.3570	-0.1150	-0.0215	0.0376	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL7	3.1780	-15.1180	-4.7571	0.0746	Anchor bolts in tension	4.6974	31.6730	-0.1730	0.1730	-3.1006	-1.5503	Design OK	Design OK	Design OK	Design OK
16	UDSTL8	4.9610	15.1160	3.0470	0.0869	Anchor bolts in tension	5.4771	21.4712	10.0288	10.0288	0.2703	0.1351	Design OK	Design OK	Design OK	Design OK
16	UDSTL9	4.8470	-15.1180	-3.1190	0.0862	Anchor bolts in tension	5.4276	30.2143	1.2857	1.2857	-4.1824	-2.0912	Design OK	Design OK	Design OK	Design OK
16	UDSTL10	3.2920	15.1170	4.5920	0.0754	Anchor bolts in tension	4.7471	22.7822	8.7178	8.7178	0.6494	0.3247	Design OK	Design OK	Design OK	Design OK
16	UDSTL11	1.0780	0.0850	0.0788	0.0078	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL12	3.6530	-0.0860	-0.0235	0.0257	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL13	1.0780	0.1140	0.1058	0.0079	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL14	3.6540	-0.1150	-0.0315	0.0258	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL15	1.4740	-15.1180	-10.2564	0.0627	Anchor bolts in tension	3.9519	33.5178	-2.0178	2.0178	-0.7146	-0.3573	Design OK	Design OK	Design OK	Design OK
16	UDSTL16	3.2570	15.1170	4.6414	0.0751	Anchor bolts in tension	4.7318	22.8109	8.6891	8.6891	0.6587	0.3293	Design OK	Design OK	Design OK	Design OK
16	UDSTL17	3.1440	-15.1180	-4.8085	0.0743	Anchor bolts in tension	4.6826	31.7058	-0.2058	0.2058	-3.0522	-1.5261	Design OK	Design OK	Design OK	Design OK
16	UDSTL18	1.5880	15.1170	9.5195	0.0635	Anchor bolts in tension	4.0016	24.2829	7.2171	7.2171	1.1624	0.5812	Design OK	Design OK	Design OK	Design OK
16	UDSTL19	4.0700	-18.1990	-4.4715	0.0915	Anchor bolts in tension	5.7617	31.4799	0.0201	0.0201	-4.0589	-2.0295	Design OK	Design OK	Design OK	Design OK
16	UDSTL20	4.0700	18.1970	4.4710	0.0914	Anchor bolts in tension	5.7612	22.7091	8.7909	8.7909	0.7534	0.3767	Design OK	Design OK	Design OK	Design OK
16	UDSTL21	4.0700	0.0260	0.0064	0.0284	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL22	4.0700	-0.0280	-0.0069	0.0284	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL23	2.3660	-18.1990	-7.6919	0.0796	Anchor bolts in tension	5.0162	32.9397	-1.4397	1.4397	-1.6782	-0.8391	Design OK	Design OK	Design OK	Design OK
16	UDSTL24	2.3660	18.1980	7.6915	0.0796	Anchor bolts in tension	5.0159	23.9302	7.5698	7.5698	1.2501	0.6251	Design OK	Design OK	Design OK	Design OK
16	UDSTL25	2.3660	0.0270	0.0114	0.0165	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL26	2.3660	-0.0280	-0.0118	0.0165	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL27	4.0700	57.5550	14.1413	0.2281	Anchor bolts in tension	14.3708	24.7921	6.7079	6.7079	5.1107	2.5554	Design OK	Design OK	Design OK	Design OK
16	UDSTL27	4.0700	-57.5570	-14.1418	0.2281	Anchor bolts in tension	14.3712	34.0278	-2.5278	2.5278	-0.6103	-0.3051	Design OK	Design OK	Design OK	Design OK
16	UDSTL28	4.0750	0.0800	0.0196	0.0286	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL28	4.0650	-0.0820	-0.0202	0.0285	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL29	2.3660	57.5550	24.3259	0.2163	Anchor bolts in tension	13.6253	25.2572	6.2428	6.2428	5.7349	2.8674	Design OK	Design OK	Design OK	Design OK
16	UDSTL29	2.3660	-57.5560	-24.3263	0.2163	Anchor bolts in tension	13.6255	34.6314	-3.1314	3.1314	1.6976	0.8488	Design OK	Design OK	Design OK	Design OK
16	UDSTL30	2.3710	0.0810	0.0342	0.0167	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
16	UDSTL30	2.3610	-0.0820	-0.0347	0.0167	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Anchor Bolt: Tension Design

N.plate (in)	B.plate (in)	x.a (in)	N.prime (in)	A.prime (in)	e.kern	Φ	N.design	
12	12	1.5	10.5	4.5	2	0.75	13.08113	<---one anchor

	Nsa (kip)	Ncbg (kip)	Npn (kip)	Nsb (kip)	
	one anchor	two anchors	one anchor	one anchor	
	77.6	34.883	20.93	36.83	
ΦN	58.2	26.16225	15.6975	27.6225	<--reduced by phi factor

Joint	OutputCase	F3	M1	e	fp	anchor_tension	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor	Nsa check	Ncbg check	Nsb check	Npn check
Text	Text	Kip	Kip-in	in							Kips	Kips				
17	UDSTL1	3.4220	-1.6320	-0.4769	0.0294	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL2	5.6050	-1.4000	-0.2498	0.0438	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL3	2.5930	63.7230	24.5750	0.2393	Anchor bolts in tension	15.0738	25.2640	6.2360	6.2360	6.3594	3.1797	Design OK	Design OK	Design OK	Design OK
17	UDSTL4	4.9430	-66.5210	-13.4576	0.2653	Anchor bolts in tension	16.7140	33.9574	-2.4574	2.4574	-1.0313	-0.5156	Design OK	Design OK	Design OK	Design OK
17	UDSTL5	2.5930	73.7310	28.4346	0.2740	Anchor bolts in tension	17.2631	25.3538	6.1462	6.1462	7.5119	3.7560	Design OK	Design OK	Design OK	Design OK
17	UDSTL6	4.9430	-76.5290	-15.4823	0.3001	Anchor bolts in tension	18.9033	34.1490	-2.6490	2.6490	-0.1740	-0.0870	Design OK	Design OK	Design OK	Design OK
17	UDSTL7	3.2970	-1.4460	-0.4386	0.0279	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL8	4.2380	-1.3520	-0.3190	0.0341	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL9	4.2200	-1.4470	-0.3429	0.0343	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL10	3.3160	-1.3510	-0.4074	0.0277	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL11	1.0250	64.0730	62.5102	0.2296	Anchor bolts in tension	14.4644	25.6738	5.8262	5.8262	7.0009	3.5005	Design OK	Design OK	Design OK	Design OK
17	UDSTL12	3.3750	-66.1710	-19.6062	0.2532	Anchor bolts in tension	15.9515	34.4246	-2.9246	2.9246	1.0681	0.5340	Design OK	Design OK	Design OK	Design OK
17	UDSTL13	1.0250	74.0810	72.2741	0.2643	Anchor bolts in tension	16.6537	25.7107	5.7893	5.7893	8.1572	4.0786	Design OK	Design OK	Design OK	Design OK
17	UDSTL14	3.3750	-76.1790	-22.5716	0.2879	Anchor bolts in tension	18.1407	34.5641	-3.0641	3.0641	1.9188	0.9594	Design OK	Design OK	Design OK	Design OK
17	UDSTL15	1.7290	-1.0960	-0.6339	0.0158	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL16	2.6700	-1.0020	-0.3753	0.0220	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL17	2.6510	-1.0970	-0.4138	0.0222	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL18	1.7480	-1.0010	-0.5727	0.0156	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL19	3.7680	-1.4550	-0.3861	0.0312	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL20	3.7680	-1.3430	-0.3564	0.0308	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL21	3.7680	16.9140	4.4889	0.0849	Anchor bolts in tension	5.3484	22.7201	8.7799	8.7799	0.7042	0.3521	Design OK	Design OK	Design OK	Design OK
17	UDSTL22	3.7680	-19.7120	-5.2314	0.0946	Anchor bolts in tension	5.9605	31.9558	-0.4558	0.4558	-3.5093	-1.7546	Design OK	Design OK	Design OK	Design OK
17	UDSTL23	2.2000	-1.1050	-0.5023	0.0191	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL24	2.2000	-0.9930	-0.4514	0.0187	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL25	2.2000	17.2640	7.8473	0.0752	Anchor bolts in tension	4.7390	23.9661	7.5339	7.5339	1.2003	0.6002	Design OK	Design OK	Design OK	Design OK
17	UDSTL26	2.2000	-19.3620	-8.8009	0.0825	Anchor bolts in tension	5.1979	33.2258	-1.7258	1.7258	-1.3457	-0.6728	Design OK	Design OK	Design OK	Design OK
17	UDSTL27	3.7680	-1.2420	-0.3296	0.0305	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL27	3.7680	-1.5560	-0.4130	0.0316	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL28	3.7720	52.3950	13.8905	0.2081	Anchor bolts in tension	13.1117	24.7726	6.7274	6.7274	4.6287	2.3143	Design OK	Design OK	Design OK	Design OK
17	UDSTL28	3.7640	-55.1930	-14.6634	0.2178	Anchor bolts in tension	13.7202	34.0773	-2.5773	2.5773	-0.3962	-0.1981	Design OK	Design OK	Design OK	Design OK
17	UDSTL29	2.2000	-0.8910	-0.4050	0.0184	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL29	2.2000	-1.2060	-0.5482	0.0195	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL30	2.2030	52.7450	23.9424	0.1984	Anchor bolts in tension	12.5018	25.2466	6.2534	6.2534	5.2426	2.6213	Design OK	Design OK	Design OK	Design OK
17	UDSTL30	2.1960	-54.8430	-24.9740	0.2057	Anchor bolts in tension	12.9577	34.6540	-3.1540	3.1540	1.6963	0.8481	Design OK	Design OK	Design OK	Design OK

Joint	OutputCase	F3	M2	e	fp	anchor_tension	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor	Nsa check	Ncbg check	Nsb check	Npn check
Text	Text	Kip	Kip-in	in							Kips	Kips				
17	UDSTL1	3.4220	0.0011	0.0003	0.0238	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL2	5.6050	0.0017	0.0003	0.0389	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL3	2.5930	-0.0960	-0.0370	0.0183	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL4	4.9430	0.0990	0.0200	0.0347	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL5	2.5930	-0.1300	-0.0501	0.0185	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL6	4.9430	0.1320	0.0267	0.0348	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL7	3.2970	-15.0960	-4.5787	0.0753	Anchor bolts in tension	4.7447	31.5546	-0.0546	0.0546	-3.2723	-1.6362	Design OK	Design OK	Design OK	Design OK
17	UDSTL8	4.2360	15.0980	3.5625	0.0819	Anchor bolts in tension	5.1568	22.0225	9.4775	9.4775	0.4167	0.2083	Design OK	Design OK	Design OK	Design OK
17	UDSTL9	4.2200	-15.0950	-3.5770	0.0817	Anchor bolts in tension	5.1483	30.7243	0.7757	0.7757	-3.8397	-1.9198	Design OK	Design OK	Design OK	Design OK
17	UDSTL10	3.3160	15.0980	4.5531	0.0755	Anchor bolts in tension	4.7534	22.7590	8.7410	8.7410	0.6411	0.3206	Design OK	Design OK	Design OK	Design OK
17	UDSTL11	1.0250	-0.0970	-0.0946	0.0075	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL12	3.3750	0.0980	0.0290	0.0238	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL13	1.0250	-0.1300	-0.1268	0.0076	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL14	3.3750	0.1310	0.0388	0.0239	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL15	1.7290	-15.0960	-8.7311	0.0644	Anchor bolts in tension	4.0587	33.2096	-1.7096	1.7096	-1.0682	-0.5341	Design OK	Design OK	Design OK	Design OK
17	UDSTL16	2.6700	15.0980	5.6547	0.0710	Anchor bolts in tension	4.4708	23.3020	8.1980	8.1980	0.8206	0.4103	Design OK	Design OK	Design OK	Design OK
17	UDSTL17	2.6510	-15.0960	-5.6945	0.0708	Anchor bolts in tension	4.4621	32.1943	-0.6943	0.6943	-2.3559	-1.1780	Design OK	Design OK	Design OK	Design OK
17	UDSTL18	1.7480	15.0970	8.6367	0.0646	Anchor bolts in tension	4.0672	24.1296	7.3704	7.3704	1.1070	0.5535	Design OK	Design OK	Design OK	Design OK
17	UDSTL19	3.7680	-18.1950	-4.8288	0.0893	Anchor bolts in tension	5.6287	31.7186	-0.2186	0.2186	-3.6508	-1.8254	Design OK	Design OK	Design OK	Design OK
17	UDSTL20	3.7680	18.1970	4.8294	0.0894	Anchor bolts in tension	5.6291	22.9158	8.5842	8.5842	0.8340	0.4170	Design OK	Design OK	Design OK	Design OK
17	UDSTL21	3.7680	-0.0300	-0.0080	0.0263	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL22	3.7680	0.0320	0.0085	0.0263	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL23	2.2000	-18.1950	-8.2705	0.0785	Anchor bolts in tension	4.9427	33.0973	-1.5973	1.5973	-1.4481	-0.7241	Design OK	Design OK	Design OK	Design OK
17	UDSTL24	2.2000	18.1970	8.2714	0.0785	Anchor bolts in tension	4.9431	24.0574	7.4426	7.4426	1.3037	0.6519	Design OK	Design OK	Design OK	Design OK
17	UDSTL25	2.2000	-0.0300	-0.0136	0.0154	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL26	2.2000	0.0320	0.0145	0.0154	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL27	3.7680	57.5510	15.2736	0.2260	Anchor bolts in tension	14.2378	24.8726	6.6274	6.6274	5.2186	2.6093	Design OK	Design OK	Design OK	Design OK
17	UDSTL27	3.7680	-57.5480	-15.2728	0.2260	Anchor bolts in tension	14.2371	34.1313	-2.6313	2.6313	-0.2001	-0.1001	Design OK	Design OK	Design OK	Design OK
17	UDSTL28	3.7720	0.1210	0.0321	0.0266	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL28	3.7640	-0.1180	-0.0313	0.0265	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL29	2.2000	57.5500	26.1591	0.2151	Anchor bolts in tension	13.5516	25.3040	6.1960	6.1960	5.7968	2.8984	Design OK	Design OK	Design OK	Design OK
17	UDSTL29	2.2000	-57.5490	-26.1586	0.2151	Anchor bolts in tension	13.5513	34.6926	-3.1926	3.1926	1.9204	0.9602	Design OK	Design OK	Design OK	Design OK
17	UDSTL30	2.2030	0.1200	0.0545	0.0157	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
17	UDSTL30	2.1960	-0.1190	-0.0542	0.0157	Anchor bolts not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

BECHTEL PARSONS BLUE GRASS

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev D
Sheet No. D1-38 / D1-60

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

Anchor Shear Design

Φ	0.85

	Vsa (kip)	Vcbg (kip)	Vcpg (kip)
	one anchor	four anchor	four anchor
	62.08	8.775	69.765
ΦV	52.768	7.45875	59.30025

				F1=V1			F2=V2		
Joint	OutputCase	F1	F2	Vsa check	Vcbg check	Vcpg check	Vsa check	Vcbg check	Vcpg check
Text	Text	Kip	Kip						
14	UDSTL1	-0.000001774	0.0002569	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL2	-0.000001462	0.0002166	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL3	0.001543	-0.664	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL4	-0.001546	0.665	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL5	0.002073	-0.711	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL6	-0.002076	0.712	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL7	-0.201	0.0001287	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL8	0.201	0.0003094	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL9	-0.201	0.0001298	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL10	0.201	0.0003083	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL11	0.001543	-0.664	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL12	-0.001545	0.665	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL13	0.002073	-0.711	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL14	-0.002075	0.711	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL15	-0.201	0.0000748	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL16	0.201	0.0002555	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL17	-0.201	0.00007591	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL18	0.201	0.0002544	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL19	-0.157	0.001359	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL20	0.157	-0.0009206	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL21	0.0004916	-0.159	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL22	-0.0004946	0.159	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL23	-0.157	0.001305	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL24	0.157	-0.0009745	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL25	0.0004919	-0.159	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL26	-0.0004942	0.159	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL27	0.495	0.006384	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL27	-0.495	-0.005946	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL28	0.001568	0.494	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL28	-0.001571	-0.493	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL29	0.495	0.00633	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL29	-0.495	-0.006	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL30	0.001569	0.494	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	UDSTL30	-0.001571	-0.493	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient

BECHTEL PARSONS BLUE GRASS

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev D
Sheet No. D1-39 / D1-60

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

				F1=V1			F2=V2		
Joint	OutputCase	F1	F2	Vsa check	Vcbg check	Vcpg check	Vsa check	Vcbg check	Vcpg check
Text	Text	Kip	Kip						
15	UDSTL1	0.000003695	-0.0001784	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL2	0.000005745	-0.0001708	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL3	-0.001444	-0.608	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL4	0.001452	0.607	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL5	-0.001944	-0.658	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL6	0.001952	0.657	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL7	-0.201	-0.0005035	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL8	0.201	0.0001865	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL9	-0.201	-0.0005088	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL10	0.201	0.0001918	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL11	-0.001445	-0.608	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL12	0.00145	0.607	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL13	-0.001946	-0.658	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL14	0.001951	0.657	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL15	-0.201	-0.0004597	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL16	0.201	0.0002303	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL17	-0.201	-0.000465	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL18	0.201	0.0002356	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL19	-0.157	-0.001184	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL20	0.157	0.0008671	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL21	-0.0004586	-0.147	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL22	0.0004665	0.146	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL23	-0.157	-0.00114	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL24	0.157	0.000911	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL25	-0.0004602	-0.147	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL26	0.0004649	0.146	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL27	0.496	0.005898	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL27	-0.495	-0.006215	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL28	0.00167	0.405	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL28	-0.001662	-0.406	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL29	0.496	0.005942	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL29	-0.495	-0.006171	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL30	0.001668	0.405	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	UDSTL30	-0.001663	-0.406	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient

				F1=V1			F2=V2		
Joint	OutputCase	F1	F2	Vsa check	Vcbg check	Vcpg check	Vsa check	Vcbg check	Vcpg check
Text	Text	Kip	Kip						
16	UDSTL1	-0.00002416	-0.001073	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL2	-0.00004197	-0.0009261	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL3	0.0007195	-0.739	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL4	-0.0007742	0.737	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL5	0.0009646	-0.685	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL6	-0.001019	0.683	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL7	-0.201	-0.0009237	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL8	0.201	-0.0009196	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL9	-0.201	-0.0009298	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL10	0.201	-0.0009136	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL11	0.0007314	-0.739	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL12	-0.0007624	0.738	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL13	0.0009764	-0.685	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL14	-0.001007	0.683	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL15	-0.201	-0.0006918	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL16	0.201	-0.0006877	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL17	-0.201	-0.0006978	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL18	0.201	-0.0006817	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL19	-0.157	-0.001567	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL20	0.157	-0.0002761	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL21	0.0002067	-0.164	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL22	-0.0002614	0.163	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL23	-0.157	-0.001335	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL24	0.157	-0.00004415	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL25	0.0002185	-0.164	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL26	-0.0002496	0.163	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL27	0.496	0.0006472	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL27	-0.496	-0.002491	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL28	0.0006711	0.454	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL28	-0.0007258	-0.456	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL29	0.496	0.0008792	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL29	-0.496	-0.002259	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL30	0.0006829	0.454	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	UDSTL30	-0.000714	-0.455	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient

				F1=V1			F2=V2		
Joint	OutputCase	F1	F2	Vsa check	Vcbg check	Vcpg check	Vsa check	Vcbg check	Vcpg check
Text	Text	Kip	Kip						
17	UDSTL1	0.00002224	0.0009945	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL2	0.00003769	0.0008803	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL3	-0.0008187	-0.706	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL4	0.0008685	0.708	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL5	-0.001093	-0.664	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL6	0.001143	0.666	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL7	-0.201	0.001299	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL8	0.201	0.0004237	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL9	-0.201	0.001309	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL10	0.201	0.0004135	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL11	-0.0008293	-0.707	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL12	0.0008579	0.708	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL13	-0.001104	-0.664	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL14	0.001132	0.665	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL15	-0.201	0.001077	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL16	0.201	0.0002019	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL17	-0.201	0.001087	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL18	0.201	0.0001917	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL19	-0.157	0.001393	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL20	0.157	0.0003295	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL21	-0.0002396	-0.157	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL22	0.0002894	0.159	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL23	-0.157	0.001171	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL24	0.157	0.0001077	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL25	-0.0002502	-0.157	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL26	0.0002788	0.159	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL27	0.496	0.002161	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL27	-0.496	-0.0004392	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL28	0.001039	0.426	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL28	-0.0009896	-0.424	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL29	0.496	0.00194	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL29	-0.496	-0.000661	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL30	0.001029	0.425	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	UDSTL30	-0.001	-0.424	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

Anchor Interaction Check

	Nsa (kip)	Ncbg (kip)	Npn (kip)	Nsb (kip)
	one anchor	two anchors	one anchor	one anchor
	77.6	9.859	20.928	36.826
ΦN	65.96	29.65055	17.7905	31.3055

	Vsa (kip)	Vcbg (kip)	Vcpg (kip)
	one anchor	four anchor	four anchor
	62.08	8.775	19.718
ΦV	52.768	7.45875	59.30025

one anchor--->	N.design	14.825275
four anchor--->	V.design	7.45875

Joint	OutputCase	T_one_anchor	F1=V1	F2=V2	T/N.design	V1/V.design	V2/V.design	Interaction Check (V1)	Interaction Check (V2)
Text	Text	Kips	Kip	Kip					
14	UDSTL1	XXXX	-0.000001774	0.0002569	0.000	0.000	0.000	Check not needed	Check not needed
14	UDSTL2	XXXX	-0.000001462	0.0002166	0.000	0.000	0.000	Check not needed	Check not needed
14	UDSTL3	3.299874983	0.001543	-0.664	0.223	0.000	-0.089	0.223	0.134
14	UDSTL4	0.836093269	-0.001546	0.665	0.056	0.000	0.089	Check not needed	Check not needed
14	UDSTL5	4.093676073	0.002073	-0.711	0.276	0.000	-0.095	0.276	0.181
14	UDSTL6	1.419428336	-0.002076	0.712	0.096	0.000	0.095	Check not needed	Check not needed
14	UDSTL7	XXXX	-0.201	0.0001287	0.000	-0.027	0.000	Check not needed	Check not needed
14	UDSTL8	XXXX	0.201	0.0003094	0.000	0.027	0.000	Check not needed	Check not needed
14	UDSTL9	XXXX	-0.201	0.0001298	0.000	-0.027	0.000	Check not needed	Check not needed
14	UDSTL10	XXXX	0.201	0.0003083	0.000	0.027	0.000	Check not needed	Check not needed
14	UDSTL11	3.499258824	0.001543	-0.664	0.236	0.000	-0.089	0.236	0.147
14	UDSTL12	1.429422092	-0.001545	0.665	0.096	0.000	0.089	Check not needed	Check not needed
14	UDSTL13	4.293990946	0.002073	-0.711	0.290	0.000	-0.095	0.290	0.194
14	UDSTL14	2.011229067	-0.002075	0.711	0.136	0.000	0.095	Check not needed	Check not needed
14	UDSTL15	XXXX	-0.201	0.0000748	0.000	-0.027	0.000	Check not needed	Check not needed
14	UDSTL16	XXXX	0.201	0.0002555	0.000	0.027	0.000	Check not needed	Check not needed
14	UDSTL17	XXXX	-0.201	7.591E-05	0.000	-0.027	0.000	Check not needed	Check not needed
14	UDSTL18	XXXX	0.201	0.0002544	0.000	0.027	0.000	Check not needed	Check not needed
14	UDSTL19	XXXX	-0.157	0.001359	0.000	-0.021	0.000	Check not needed	Check not needed
14	UDSTL20	XXXX	0.157	-0.000921	0.000	0.021	0.000	Check not needed	Check not needed
14	UDSTL21	0.575162782	0.0004916	-0.159	0.039	0.000	-0.021	Check not needed	Check not needed
14	UDSTL22	-0.668905906	-0.0004946	0.159	-0.045	0.000	0.021	Check not needed	Check not needed
14	UDSTL23	XXXX	-0.157	0.001305	0.000	-0.021	0.000	Check not needed	Check not needed
14	UDSTL24	XXXX	0.157	-0.000975	0.000	0.021	0.000	Check not needed	Check not needed
14	UDSTL25	0.749739295	0.0004919	-0.159	0.051	0.000	-0.021	Check not needed	Check not needed
14	UDSTL26	-0.063089517	-0.0004942	0.159	-0.004	0.000	0.021	Check not needed	Check not needed
14	UDSTL27	XXXX	0.495	0.006384	0.000	0.066	0.001	Check not needed	Check not needed
14	UDSTL27	XXXX	-0.495	-0.005946	0.000	-0.066	-0.001	Check not needed	Check not needed
14	UDSTL28	2.945019233	0.001568	0.494	0.199	0.000	0.066	Check not needed	Check not needed
14	UDSTL28	1.110172608	-0.001571	-0.493	0.075	0.000	-0.066	Check not needed	Check not needed
14	UDSTL29	XXXX	0.495	0.00633	0.000	0.066	0.001	Check not needed	Check not needed
14	UDSTL29	XXXX	-0.495	-0.006	0.000	-0.066	-0.001	Check not needed	Check not needed
14	UDSTL30	3.140643526	0.001569	0.494	0.212	0.000	0.066	0.212	0.278
14	UDSTL30	1.702148173	-0.001571	-0.493	0.115	0.000	-0.066	Check not needed	Check not needed

BECHTEL PARSONS BLUE GRASS

Calculation Sheet

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev. D
Sheet No. D1-43 / D1-60

Joint	OutputCase	T_one_anchor	F1=V1	F2=V2	T/N.design	V1/V.design	V2/V.design	Interaction Check (V1)	Interaction Check (V2)
Text	Text	Kips	Kip	Kip					
15	UDSTL1	XXXX	0.000003695	-0.000178	0.000	0.000	0.000	Check not needed	Check not needed
15	UDSTL2	XXXX	0.000005745	-0.000171	0.000	0.000	0.000	Check not needed	Check not needed
15	UDSTL3	3.019647039	-0.001444	-0.608	0.204	0.000	-0.082	0.203	0.122
15	UDSTL4	0.859395444	0.001452	0.607	0.058	0.000	0.081	Check not needed	Check not needed
15	UDSTL5	3.751648245	-0.001944	-0.658	0.253	0.000	-0.088	0.253	0.165
15	UDSTL6	1.396954273	0.001952	0.657	0.094	0.000	0.088	Check not needed	Check not needed
15	UDSTL7	XXXX	-0.201	-0.000504	0.000	-0.027	0.000	Check not needed	Check not needed
15	UDSTL8	XXXX	0.201	0.0001865	0.000	0.027	0.000	Check not needed	Check not needed
15	UDSTL9	XXXX	-0.201	-0.000509	0.000	-0.027	0.000	Check not needed	Check not needed
15	UDSTL10	XXXX	0.201	0.0001918	0.000	0.027	0.000	Check not needed	Check not needed
15	UDSTL11	3.188808464	-0.001445	-0.608	0.215	0.000	-0.082	0.215	0.134
15	UDSTL12	1.364377883	0.00145	0.607	0.092	0.000	0.081	Check not needed	Check not needed
15	UDSTL13	3.921590843	-0.001946	-0.658	0.265	0.000	-0.088	0.264	0.176
15	UDSTL14	1.900609419	0.001951	0.657	0.128	0.000	0.088	Check not needed	Check not needed
15	UDSTL15	XXXX	-0.201	-0.00046	0.000	-0.027	0.000	Check not needed	Check not needed
15	UDSTL16	XXXX	0.201	0.0002303	0.000	0.027	0.000	Check not needed	Check not needed
15	UDSTL17	XXXX	-0.201	-0.000465	0.000	-0.027	0.000	Check not needed	Check not needed
15	UDSTL18	XXXX	0.201	0.0002356	0.000	0.027	0.000	Check not needed	Check not needed
15	UDSTL19	XXXX	-0.157	-0.001184	0.000	-0.021	0.000	Check not needed	Check not needed
15	UDSTL20	XXXX	0.157	0.0008671	0.000	0.021	0.000	Check not needed	Check not needed
15	UDSTL21	0.557519123	-0.0004586	-0.147	0.038	0.000	-0.020	Check not needed	Check not needed
15	UDSTL22	-0.536066689	0.0004665	0.146	-0.036	0.000	0.020	Check not needed	Check not needed
15	UDSTL23	XXXX	-0.157	-0.00114	0.000	-0.021	0.000	Check not needed	Check not needed
15	UDSTL24	XXXX	0.157	0.000911	0.000	0.021	0.000	Check not needed	Check not needed
15	UDSTL25	0.707155271	-0.0004602	-0.147	0.048	0.000	-0.020	Check not needed	Check not needed
15	UDSTL26	-0.021410884	0.0004649	0.146	-0.001	0.000	0.020	Check not needed	Check not needed
15	UDSTL27	XXXX	0.496	0.005898	0.000	0.066	0.001	Check not needed	Check not needed
15	UDSTL27	XXXX	-0.495	-0.006215	0.000	-0.066	-0.001	Check not needed	Check not needed
15	UDSTL28	2.384162571	0.00167	0.405	0.161	0.000	0.054	Check not needed	Check not needed
15	UDSTL28	0.834973769	-0.001662	-0.406	0.056	0.000	-0.054	Check not needed	Check not needed
15	UDSTL29	XXXX	0.496	0.005942	0.000	0.066	0.001	Check not needed	Check not needed
15	UDSTL29	XXXX	-0.495	-0.006171	0.000	-0.066	-0.001	Check not needed	Check not needed
15	UDSTL30	2.549667217	0.001668	0.405	0.172	0.000	0.054	Check not needed	Check not needed
15	UDSTL30	1.339001148	-0.001663	-0.406	0.090	0.000	-0.054	Check not needed	Check not needed

BECHTEL PARSONS BLUE GRASS

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev. D
Sheet No. D1-44 / D1-60

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

Joint	OutputCase	T_one_anchor	F1=V1	F2=V2	T/N.design	V1/V.design	V2/V.design	Interaction Check (V1)	Interaction Check (V2)
Text	Text	Kips	Kip	Kip					
16	UDSTL1	XXXX	-0.00002416	-0.001073	0.000	0.000	0.000	Check not needed	Check not needed
16	UDSTL2	XXXX	-0.00004197	-0.000926	0.000	0.000	0.000	Check not needed	Check not needed
16	UDSTL3	3.3025933	0.0007195	-0.739	0.223	0.000	-0.099	0.223	0.124
16	UDSTL4	-0.67810083	-0.0007742	0.737	-0.046	0.000	0.099	Check not needed	Check not needed
16	UDSTL5	3.880702196	0.0009646	-0.685	0.262	0.000	-0.092	0.262	0.170
16	UDSTL6	-0.247401482	-0.001019	0.683	-0.017	0.000	0.092	Check not needed	Check not needed
16	UDSTL7	XXXX	-0.201	-0.000924	0.000	-0.027	0.000	Check not needed	Check not needed
16	UDSTL8	XXXX	0.201	-0.00092	0.000	0.027	0.000	Check not needed	Check not needed
16	UDSTL9	XXXX	-0.201	-0.00093	0.000	-0.027	0.000	Check not needed	Check not needed
16	UDSTL10	XXXX	0.201	-0.000914	0.000	0.027	0.000	Check not needed	Check not needed
16	UDSTL11	3.649353657	0.0007314	-0.739	0.246	0.000	-0.099	0.246	0.147
16	UDSTL12	0.464740446	-0.0007624	0.738	0.031	0.000	0.099	Check not needed	Check not needed
16	UDSTL13	4.229490835	0.0009764	-0.685	0.285	0.000	-0.092	0.285	0.193
16	UDSTL14	0.891206974	-0.001007	0.683	0.060	0.000	0.092	Check not needed	Check not needed
16	UDSTL15	XXXX	-0.201	-0.000692	0.000	-0.027	0.000	Check not needed	Check not needed
16	UDSTL16	XXXX	0.201	-0.000688	0.000	0.027	0.000	Check not needed	Check not needed
16	UDSTL17	XXXX	-0.201	-0.000698	0.000	-0.027	0.000	Check not needed	Check not needed
16	UDSTL18	XXXX	0.201	-0.000682	0.000	0.027	0.000	Check not needed	Check not needed
16	UDSTL19	XXXX	-0.157	-0.001567	0.000	-0.021	0.000	Check not needed	Check not needed
16	UDSTL20	XXXX	0.157	-0.000276	0.000	0.021	0.000	Check not needed	Check not needed
16	UDSTL21	0.344407872	0.0002067	-0.164	0.023	0.000	-0.022	Check not needed	Check not needed
16	UDSTL22	-1.937351998	-0.0002614	0.163	-0.131	0.000	0.022	Check not needed	Check not needed
16	UDSTL23	XXXX	-0.157	-0.001335	0.000	-0.021	0.000	Check not needed	Check not needed
16	UDSTL24	XXXX	0.157	-4.42E-05	0.000	0.021	0.000	Check not needed	Check not needed
16	UDSTL25	0.60868579	0.0002185	-0.164	0.041	0.000	-0.022	Check not needed	Check not needed
16	UDSTL26	-0.758293441	-0.0002496	0.163	-0.051	0.000	0.022	Check not needed	Check not needed
16	UDSTL27	XXXX	0.496	0.0006472	0.000	0.066	0.000	Check not needed	Check not needed
16	UDSTL27	XXXX	-0.496	-0.002491	0.000	-0.066	0.000	Check not needed	Check not needed
16	UDSTL28	2.493081613	0.0006711	0.454	0.168	0.000	0.061	Check not needed	Check not needed
16	UDSTL28	-0.22631162	-0.0007258	-0.456	-0.015	0.000	-0.061	Check not needed	Check not needed
16	UDSTL29	XXXX	0.496	0.0008792	0.000	0.066	0.000	Check not needed	Check not needed
16	UDSTL29	XXXX	-0.496	-0.002259	0.000	-0.066	0.000	Check not needed	Check not needed
16	UDSTL30	2.824964354	0.0006829	0.454	0.191	0.000	0.061	Check not needed	Check not needed
16	UDSTL30	0.911832832	-0.000714	-0.455	0.062	0.000	-0.061	Check not needed	Check not needed

Joint	OutputCase	T_one_anchor	F1=V1	F2=V2	T/N.design	V1/V.design	V2/V.design	Interaction Check (V1)	Interaction Check (V2)
Text	Text	Kips	Kip	Kip					
17	UDSTL1	XXXX	0.00002224	0.0009945	0.000	0.000	0.000	Check not needed	Check not needed
17	UDSTL2	XXXX	0.00003769	0.0008803	0.000	0.000	0.000	Check not needed	Check not needed
17	UDSTL3	3.179723502	-0.0008187	-0.706	0.214	0.000	-0.095	0.214	0.120
17	UDSTL4	-0.515630946	0.0008685	0.708	-0.035	0.000	0.095	Check not needed	Check not needed
17	UDSTL5	3.75595819	-0.001093	-0.664	0.253	0.000	-0.089	0.253	0.164
17	UDSTL6	-0.0870001	0.001143	0.666	-0.006	0.000	0.089	Check not needed	Check not needed
17	UDSTL7	XXXX	-0.201	0.001299	0.000	-0.027	0.000	Check not needed	Check not needed
17	UDSTL8	XXXX	0.201	0.0004237	0.000	0.027	0.000	Check not needed	Check not needed
17	UDSTL9	XXXX	-0.201	0.001309	0.000	-0.027	0.000	Check not needed	Check not needed
17	UDSTL10	XXXX	0.201	0.0004135	0.000	0.027	0.000	Check not needed	Check not needed
17	UDSTL11	3.500470916	-0.0008293	-0.707	0.236	0.000	-0.095	0.236	0.141
17	UDSTL12	0.534027421	0.0008579	0.708	0.036	0.000	0.095	Check not needed	Check not needed
17	UDSTL13	4.078593949	-0.001104	-0.664	0.275	0.000	-0.089	0.275	0.186
17	UDSTL14	0.959387904	0.001132	0.665	0.065	0.000	0.089	Check not needed	Check not needed
17	UDSTL15	XXXX	-0.201	0.001077	0.000	-0.027	0.000	Check not needed	Check not needed
17	UDSTL16	XXXX	0.201	0.0002019	0.000	0.027	0.000	Check not needed	Check not needed
17	UDSTL17	XXXX	-0.201	0.001087	0.000	-0.027	0.000	Check not needed	Check not needed
17	UDSTL18	XXXX	0.201	0.0001917	0.000	0.027	0.000	Check not needed	Check not needed
17	UDSTL19	XXXX	-0.157	0.001393	0.000	-0.021	0.000	Check not needed	Check not needed
17	UDSTL20	XXXX	0.157	0.0003295	0.000	0.021	0.000	Check not needed	Check not needed
17	UDSTL21	0.352122534	-0.0002396	-0.157	0.024	0.000	-0.021	Check not needed	Check not needed
17	UDSTL22	-1.754633742	0.0002894	0.159	-0.118	0.000	0.021	Check not needed	Check not needed
17	UDSTL23	XXXX	-0.157	0.001171	0.000	-0.021	0.000	Check not needed	Check not needed
17	UDSTL24	XXXX	0.157	0.0001077	0.000	0.021	0.000	Check not needed	Check not needed
17	UDSTL25	0.600152089	-0.0002502	-0.157	0.040	0.000	-0.021	Check not needed	Check not needed
17	UDSTL26	-0.672831788	0.0002788	0.159	-0.045	0.000	0.021	Check not needed	Check not needed
17	UDSTL27	XXXX	0.496	0.002161	0.000	0.066	0.000	Check not needed	Check not needed
17	UDSTL27	XXXX	-0.496	-0.000439	0.000	-0.066	0.000	Check not needed	Check not needed
17	UDSTL28	2.314344879	0.001039	0.426	0.156	0.000	0.057	Check not needed	Check not needed
17	UDSTL28	-0.198109855	-0.0009896	-0.424	-0.013	0.000	-0.057	Check not needed	Check not needed
17	UDSTL29	XXXX	0.496	0.00194	0.000	0.066	0.000	Check not needed	Check not needed
17	UDSTL29	XXXX	-0.496	-0.000661	0.000	-0.066	0.000	Check not needed	Check not needed
17	UDSTL30	2.621287127	0.001029	0.425	0.177	0.000	0.057	Check not needed	Check not needed
17	UDSTL30	0.848137104	-0.001	-0.424	0.057	0.000	-0.057	Check not needed	Check not needed

Dimensional Solutions Mat3D		Version	4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp				Time	11:28:49 AM
Designed By:	Parsons	Engineer		Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d					

DETAIL REPORT

PROJECT INFORMATION

Project Name:	
Project Number:	
Client:	
Project Location	
Foundation Description	SHED_TEMP

DESIGN CODE	ACI 318 - 2005	INPUT UNITS	English	OUTPUT UNITS	English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	3000.00
Unit Weight (pcf)	120.00

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	1.50
Minimum Soil Cover (ft)	0.00

PILE PARAMETERS:

Diameter (in)	0
Type	

REBAR PARAMETERS:

Max Long Bar Size	6
Min Long Bar Size	6
Max Tie Bar Size	4
Min Tie Bar Size	4
Max Ftg Bar Size	5
Min Ftg Bar Size	5
Temp & Shrinkage Steel Ratio	0.0000

![BECHTEL PARSONS BLUE GRASS]

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev. D
Sheet No. D1-46a / D1-60

Subject: Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

TABLE: Joint Reactions

Joint	OutputCase	CaseType	StepType	F1	F2	F3	M1	M2	M3
Text	Text	Text	Text	Kip	Kip	Kip	Kip-in	Kip-in	Kip-in
14	Wind_Envelope	Combination	Max	0.001596	-6.865E-05	0.429	59.828	0.185	0.077
14	Wind_Envelope	Combination	Min	-0.155	-0.547	-0.503	0.01	-11.649	0.003719
14	EQuake_Envelope	Combination	Max	0.0004931	0.00114	-5.845E-07	18.468	0.057	0.016
14	EQuake_Envelope	Combination	Min	-0.157	-0.159	-1.711E-05	-0.128	-18.171	0.014
14	Roof_Live_Snow	Combination		0.0004266	-0.038	3.655	11.049	0.05	0.041
14	DEAD_SELF_WEIGHT	Combination		-1.267E-06	0.0001835	1.476	-1.293	-2.323E-05	-0.013
15	Wind_Envelope	Combination	Max	-0.001114	-0.0002654	0.147	54.575	-0.129	0.423
15	Wind_Envelope	Combination	Min	-0.154	-0.506	-0.417	0.028	-11.601	0.003878
15	EQuake_Envelope	Combination	Max	-0.0004626	-0.001026	0.00003258	17.003	-0.054	0.12
15	EQuake_Envelope	Combination	Min	-0.157	-0.147	-2.436E-06	0.114	-18.171	0.014
15	Roof_Live_Snow	Combination		-0.0003973	-0.04	3.025	10.195	-0.047	0.089
15	DEAD_SELF_WEIGHT	Combination		2.639E-06	-0.0001274	1.291	-1.072	0.0002046	-0.013
16	Wind_Envelope	Combination	Max	0.000763	-1.577E-06	0.598	59.953	0.088	0.195
16	Wind_Envelope	Combination	Min	-0.155	-0.568	-0.99	-0.001927	-11.629	0.003725
16	EQuake_Envelope	Combination	Max	0.000234	-0.0006456	5.304E-07	18.966	0.027	0.051
16	EQuake_Envelope	Combination	Min	-0.157	-0.164	-2.063E-05	0.07	-18.198	0.014
16	Roof_Live_Snow	Combination		0.0001489	0.044	7.192	8.073	0.022	0.055
16	DEAD_SELF_WEIGHT	Combination		-1.726E-05	-0.0007664	2.629	-1.184	-0.0005488	-0.013
17	Wind_Envelope	Combination	Max	-0.0006489	0.0003443	0.348	57.792	-0.075	0.349
17	Wind_Envelope	Combination	Min	-0.155	-0.544	-0.904	-0.037	-11.613	0.003826
17	EQuake_Envelope	Combination	Max	-0.0002645	0.0005316	5.165E-06	18.313	-0.031	0.098
17	EQuake_Envelope	Combination	Min	-0.157	-0.158	2.491E-06	-0.056	-18.196	0.014
17	Roof_Live_Snow	Combination		-0.0001782	0.034	6.57	8.029	-0.025	0.08
17	DEAD_SELF_WEIGHT	Combination		0.00001589	0.0007103	2.444	-1.165	0.0007525	-0.013

Dimensional Solutions Mat3D		Version 4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp			Time	11:26:49 AM
Designed By:	Parsons	Engineer	Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d				

DETAIL REPORT

APPLIED LOADS

P2

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.63	0.00	0.00	0.00	0.10
2 - Live	6.40	0.00	0.00	0.04	0.64
3 - Wind	0.30	0.17	1.06	0.34	2.99
4 - Earthquake	0.16	0.16	1.51	0.00	1.58

P3

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.44	0.00	0.00	0.00	0.10
2 - Live	5.84	0.00	0.00	0.03	0.64
3 - Wind	0.27	0.17	1.07	0.33	2.90
4 - Earthquake	0.00	0.16	1.52	0.16	1.53

P1

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.48	0.00	0.00	0.00	0.10
2 - Live	3.25	0.00	0.00	0.04	0.87
3 - Wind	0.15	0.17	1.06	0.16	3.14
4 - Earthquake	0.00	0.16	1.51	0.33	1.54

P4

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.29	0.00	0.00	0.00	0.09
2 - Live	2.69	0.00	0.00	0.04	0.81
3 - Wind	0.13	0.17	1.07	0.32	2.90
4 - Earthquake	0.00	0.16	1.51	0.15	1.42

Dimensional Solutions Mat3D		Version 4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp			Time	11:26:49 AM
Designed By:	Parsons	Engineer	Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d				

DETAIL REPORT

UNFACTORED (ALLOWABLE) LOAD COMBINATIONS

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.63	0.00	0.00	0.00	0.10
2 - Dead + Live	9.03	0.00	0.00	0.04	0.74
3 - Dead + Live + Wind	9.33	0.17	1.06	0.38	3.73
4 - Dead + Wind	2.93	0.17	1.06	0.34	3.09
5 - Dead + Live + Earthquake	9.19	0.16	1.51	0.04	2.32
6 - Dead + Earthquake	2.79	0.16	1.51	0.00	1.68

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.44	0.00	0.00	0.00	0.10
2 - Dead + Live	8.28	0.00	0.00	0.03	0.74
3 - Dead + Live + Wind	8.55	0.17	1.07	0.36	3.64
4 - Dead + Wind	2.71	0.17	1.07	0.33	3.00
5 - Dead + Live + Earthquake	8.28	0.16	1.52	0.19	2.27
6 - Dead + Earthquake	2.44	0.16	1.52	0.16	1.63

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.48	0.00	0.00	0.00	0.10
2 - Dead + Live	4.73	0.00	0.00	0.04	0.97
3 - Dead + Live + Wind	4.88	0.17	1.06	0.20	4.11
4 - Dead + Wind	1.63	0.17	1.06	0.16	3.24
5 - Dead + Live + Earthquake	4.73	0.16	1.51	0.37	2.51
6 - Dead + Earthquake	1.48	0.16	1.51	0.33	1.64

Dimensional Solutions Mat3D		Version	4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp				Time	11:26:49 AM
Designed By:	Parsons	Engineer		Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d					

DETAIL REPORT

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.29	0.00	0.00	0.00	0.09
2 - Dead + Live	3.98	0.00	0.00	0.04	0.90
3 - Dead + Live + Wind	4.11	0.17	1.07	0.36	3.80
4 - Dead + Wind	1.42	0.17	1.07	0.32	2.99
5 - Dead + Live + Earthquake	3.98	0.16	1.51	0.19	2.32
6 - Dead + Earthquake	1.29	0.16	1.51	0.15	1.51

Dimensional Solutions Mat3D		Version	4.0.0	Date	1/22/2008
Foundation Name	Shed_Temp			Time	11:26:49 AM
Designed By:	Parsons	Engineer	Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d				

DETAIL REPORT

FACTORED (ULTIMATE) LOAD COMBINATIONS

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	3.68	0.00	0.00	0.00	0.14
2 - 1.2Dead + 1.6Live	13.40	0.00	0.00	0.06	1.14
3 - 1.2Dead + Live	9.56	0.00	0.00	0.04	0.76
4 - 1.2Dead + 0.8Wind	3.40	0.14	0.85	0.27	2.51
5 - 1.2Dead + Live + 1.6Wind	10.04	0.27	1.70	0.58	5.54
6 - 0.9Dead + 1.6Wind	2.85	0.27	1.70	0.54	4.87
7 - 1.2Dead + Live + Earthquake	9.72	0.16	1.51	0.04	2.34
8 - 0.9Dead + Earthquake	2.53	0.16	1.51	0.00	1.67

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	3.42	0.00	0.00	0.00	0.14
2 - 1.2Dead + 1.6Live	12.27	0.00	0.00	0.05	1.14
3 - 1.2Dead + Live	8.77	0.00	0.00	0.03	0.76
4 - 1.2Dead + 0.8Wind	3.14	0.14	0.86	0.26	2.44
5 - 1.2Dead + Live + 1.6Wind	9.20	0.27	1.71	0.56	5.40
6 - 0.9Dead + 1.6Wind	2.63	0.27	1.71	0.53	4.73
7 - 1.2Dead + Live + Earthquake	8.77	0.16	1.52	0.19	2.29
8 - 0.9Dead + Earthquake	2.20	0.16	1.52	0.16	1.62

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	2.07	0.00	0.00	0.00	0.14
2 - 1.2Dead + 1.6Live	6.98	0.00	0.00	0.06	1.51
3 - 1.2Dead + Live	5.03	0.00	0.00	0.04	0.99
4 - 1.2Dead + 0.8Wind	1.90	0.14	0.85	0.13	2.63
5 - 1.2Dead + Live + 1.6Wind	5.27	0.27	1.70	0.30	6.01
6 - 0.9Dead + 1.6Wind	1.57	0.27	1.70	0.26	5.11
7 - 1.2Dead + Live + Earthquake	5.03	0.16	1.51	0.37	2.53
8 - 0.9Dead + Earthquake	1.33	0.16	1.51	0.33	1.63

Calculation Sheet

BECHTEL PARSONS BLUE GRASS

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev. D
Sheet No. D1-51 / D1-60

Dimensional Solutions Mat3D		Version	4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp				Time	11:28:49 AM
Designed By:	Parsons	Engineer		Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d					

DETAIL REPORT

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	1.81	0.00	0.00	0.00	0.13
2 - 1.2Dead + 1.6Live	5.85	0.00	0.00	0.06	1.40
3 - 1.2Dead + Live	4.24	0.00	0.00	0.04	0.92
4 - 1.2Dead + 0.8Wind	1.65	0.14	0.86	0.26	2.43
5 - 1.2Dead + Live + 1.6Wind	4.45	0.27	1.71	0.55	5.56
6 - 0.9Dead + 1.6Wind	1.37	0.27	1.71	0.51	4.72
7 - 1.2Dead + Live + Earthquake	4.24	0.16	1.51	0.19	2.34
8 - 0.9Dead + Earthquake	1.16	0.16	1.51	0.15	1.50

BECHTEL PARSONS BLUE GRASS

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc No: 24915-10-DBC-00-00004
Rev. D
Sheet No. D1-52 / D1-60

Gas Bottles Misc Support Calculations
By R. Murphy Date: 12/16/2007

Dimensional Solutions Mat3D		Version 4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp			Time	11:26:49 AM
Designed By:	Parsons	Engineer	Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d				

DETAIL REPORT

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.34	3.18	0.03	0.02	1.66	2.63	
2 - Dead + Live	0.42	3.18	0.05	0.02	1.65	5.75	
3 - Dead + Live + Wind	0.44	3.18	0.08	0.07	7.71	8.75	
4 - Dead + Wind	0.39	3.18	0.13	0.09	7.73	11.87	
5 - Dead + Live + Earthquake	0.41	3.18	0.02	0.08	8.31	1.86	
6 - Dead + Earthquake	0.36	3.18	0.06	0.09	8.33	4.98	

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	100.00	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Live	83.84	100.00	1.50	100.00	100.00	1.50	
3 - Dead + Live + Wind	17.00	100.00	1.50	83.89	88.69	1.50	
4 - Dead + Wind	16.89	100.00	1.50	86.93	75.32	1.50	
5 - Dead + Live + Earthquake	27.45	100.00	1.50	100.00	93.69	1.50	
6 - Dead + Earthquake	31.57	100.00	1.50	100.00	79.49	1.50	

Dimensional Solutions Mat3D		Version	4.0.0	Date	1/22/2008
Foundation Name	Shed_Temp			Time	11:28:49 AM
Designed By:	Parsons	Engineer	Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d				

DETAIL REPORT

FOOTING DESIGN INFORMATION

X Dim (ft)	46.33
Z Dim (ft)	5.71
Thickness (ft)	2.00

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
2. 1.2Dead + 1.6Live	6	5	12	0.32	0.05	-3.46	E-W
6. 0.9Dead + 1.6Wind	46	5	12	0.3	0	-0.05	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
2. 1.2Dead + 1.6Live	6	5	12	0.32	0.02	1.08	E-W
5. 1.2Dead + Live + 1.6Wind	46	5	12	0.3	0.01	0.49	N-S

Dimensional Solutions Mat3D		Version 4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp			Time	11:26:49 AM
Designed By:	Parsons	Engineer	Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d				

DETAIL REPORT

PUNCHING SHEAR

P2

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
2. 1.2Dead + 1.6Live	8.50	2.80	189.74	

P3

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
2. 1.2Dead + 1.6Live	7.37	2.43	189.74	

P1

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
2. 1.2Dead + 1.6Live	4.70	2.10	189.74	

P4

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
2. 1.2Dead + 1.6Live	1.08	0.48	189.74	

Dimensional Solutions Mat3D		Version	4.0.0	Date	1/22/2008
Foundation Name	Shed_Temp			Time	11:26:49 AM
Designed By:	Parsons	Engineer	Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d				

DETAIL REPORT

MAXIMUM SHEAR - X DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	14.58	1.38	1.01	94.87	
2 - 1.2Dead + 1.6Live	14.58	5.14	3.75	94.87	
3 - 1.2Dead + Live	14.58	3.66	2.67	94.87	
4 - 1.2Dead + 0.8Wind	19.42	-1.35	0.98	94.87	
5 - 1.2Dead + Live + 1.6Wind	19.42	-3.61	2.63	94.87	
6 - 0.9Dead + 1.6Wind	19.42	-1.29	0.94	94.87	
7 - 1.2Dead + Live + Earthquake	14.58	3.52	2.57	94.87	
8 - 0.9Dead + Earthquake	19.42	-1.14	0.83	94.87	

MAXIMUM SHEAR - Z DIRECTION

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	4.92	-1.19	0.11	94.87	
2 - 1.2Dead + 1.6Live	4.92	-4.44	0.40	94.87	
3 - 1.2Dead + Live	4.92	-3.16	0.28	94.87	
4 - 1.2Dead + 0.8Wind	4.92	-2.58	0.23	94.87	
5 - 1.2Dead + Live + 1.6Wind	4.92	-6.26	0.56	94.87	
6 - 0.9Dead + 1.6Wind	4.92	-3.87	0.35	94.87	
7 - 1.2Dead + Live + Earthquake	4.92	-4.14	0.37	94.87	
8 - 0.9Dead + Earthquake	4.92	-1.75	0.16	94.87	

Dimensional Solutions Mat3D		Version	4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp				Time	11:26:49 AM
Designed By:	Parsons	Engineer		Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d					

DETAIL REPORT

PIER/BASE PLATE DESIGN INFORMATION

	P2	P3	P1	P4
X Dim (ft)	1.50	1.50	1.50	1.50
Z Dim (ft)	1.50	1.50	1.50	1.50
Height (ft)	0.50	0.50	0.50	0.50
X Offset (ft)	17.00	32.00	1.50	44.83
Z Offset (ft)	2.50	2.50	2.50	2.50
Requested Reinft. Ratio	0.0018	0.0018	0.0018	0.0018
Provided Reinft. Ratio	0.0055	0.0055	0.0055	0.0055
Long Bar Size	6	6	6	6
Bars in X Dir	2	2	2	2
Bars in Z Dir	2	2	2	2
Total Long Bars	4	4	4	4
Tie Bar Size	3	4	4	4
Total No. of Ties	6	4	3	3
Major Tie Spacing (in)	0	0	1	1

Dimensional Solutions Mat3D		Version	4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp				Time	11:26:49 AM
Designed By:	Parsons	Engineer		Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d					

DETAIL REPORT

PIER ULTIMATE LOAD CAPACITIES

P2

Load Comb	Axial Load (kips)	Axial Capa. (kips)	Mom X (kip ft)	Mom X Capa (kip ft)	Mom Z (kip ft)	Mom Z Capa (kip ft)	Rem
1 - 1.4Dead	3.92	624.85	0.37	59.37	0.37	59.37	
2 - 1.2Dead + 1.6Live	13.60	624.85	1.29	59.37	1.29	59.37	
3 - 1.2Dead + Live	9.76	624.85	0.93	59.37	0.93	59.37	
4 - 1.2Dead + 0.8Wind	3.60	153.05	2.65	111.13	0.92	38.51	
5 - 1.2Dead + Live + 1.6Wind	10.24	227.84	5.84	129.60	1.83	40.74	
6 - 0.9Dead + 1.6Wind	3.00	43.57	5.15	74.75	1.83	26.62	
7 - 1.2Dead + Live + Earthquake	9.92	456.88	2.36	108.02	1.59	72.94	
8 - 0.9Dead + Earthquake	2.68	124.79	1.67	76.11	1.59	72.51	

P3

Load Comb	Axial Load (kips)	Axial Capa. (kips)	Mom X (kip ft)	Mom X Capa (kip ft)	Mom Z (kip ft)	Mom Z Capa (kip ft)	Rem
1 - 1.4Dead	3.65	624.85	0.35	59.37	0.35	59.37	
2 - 1.2Dead + 1.6Live	12.47	624.85	1.19	59.37	1.19	59.37	
3 - 1.2Dead + Live	8.97	624.85	0.85	59.37	0.85	59.37	
4 - 1.2Dead + 0.8Wind	3.35	141.16	2.57	106.64	0.92	39.01	
5 - 1.2Dead + Live + 1.6Wind	9.40	207.87	5.68	125.06	1.85	40.77	
6 - 0.9Dead + 1.6Wind	2.78	40.72	4.99	73.15	1.85	27.07	
7 - 1.2Dead + Live + Earthquake	8.97	423.08	2.39	111.55	1.60	75.01	
8 - 0.9Dead + Earthquake	2.35	99.22	1.70	70.52	1.60	66.43	

P1

Load Comb	Axial Load (kips)	Axial Capa. (kips)	Mom X (kip ft)	Mom X Capa (kip ft)	Mom Z (kip ft)	Mom Z Capa (kip ft)	Rem
1 - 1.4Dead	2.31	624.85	0.22	59.37	0.22	59.37	
2 - 1.2Dead + 1.6Live	7.18	538.29	1.54	108.28	0.68	42.33	
3 - 1.2Dead + Live	5.23	537.60	1.01	103.53	0.50	51.46	
4 - 1.2Dead + 0.8Wind	2.10	68.28	2.70	86.82	0.92	29.75	
5 - 1.2Dead + Live + 1.6Wind	5.47	85.53	6.16	95.72	1.83	28.66	
6 - 0.9Dead + 1.6Wind	1.72	20.96	5.24	63.74	1.83	22.28	
7 - 1.2Dead + Live + Earthquake	5.23	217.71	2.72	112.05	1.59	65.63	
8 - 0.9Dead + Earthquake	1.48	57.74	1.80	69.63	1.59	61.77	

Dimensional Solutions Mat3D		Version	4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp				Time	11:26:49 AM
Designed By:	Parsons	Engineer		Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d					

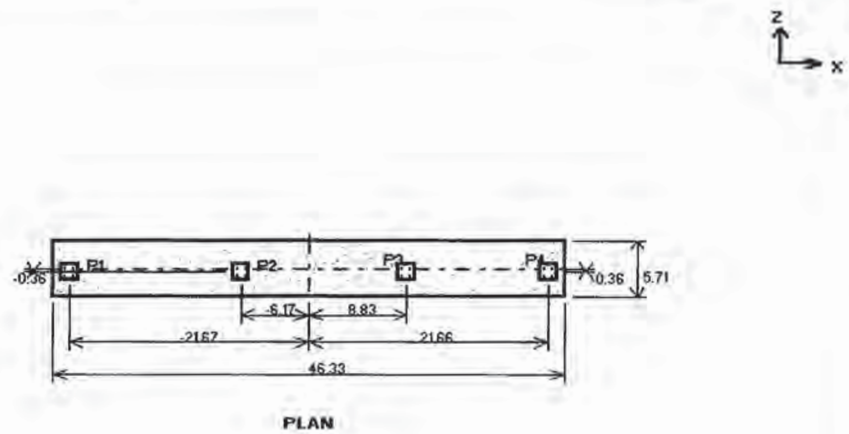
DETAIL REPORT

P4

Load Comb	Axial Load (kips)	Axial Capa. (kips)	Mom X (kip ft)	Mom X Capa (kip ft)	Mom Z (kip ft)	Mom Z Capa (kip ft)	Rem
1 - 1.4Dead	2.04	624.85	0.19	59.37	0.19	59.37	
2 - 1.2Dead + 1.6Live	6.05	497.88	1.44	117.46	0.58	47.22	
3 - 1.2Dead + Live	4.44	521.25	0.94	109.66	0.42	49.64	
4 - 1.2Dead + 0.8Wind	1.85	59.85	2.56	82.49	0.92	29.82	
5 - 1.2Dead + Live + 1.6Wind	4.65	71.41	5.83	88.73	1.85	28.36	
6 - 0.9Dead + 1.6Wind	1.52	19.11	4.98	62.55	1.85	23.23	
7 - 1.2Dead + Live + Earthquake	4.44	189.29	2.43	103.06	1.59	67.64	
8 - 0.9Dead + Earthquake	1.31	54.73	1.58	65.49	1.59	65.86	

Dimensional Solutions Mat3D		Version 4.0.0		Date	1/22/2008
Foundation Name	Shed_Temp			Time	11:26:49 AM
Designed By:	Parsons	Engineer	Jeremy Tillman	Checker	N/A
Filename:	I:\Struct\SCWO 2007\SCWO Miscellaneous\STEEL\App D Gas Bottle Canopies\Gas Bottle Canopy #1\ SAP Model\shed_temp.$2k.m3d				

DETAIL REPORT



FOUNDATION PLAN FOR Shed_Temp

D1.5. Summary

The calculation performed in this appendix includes structural analysis and design of a combined footing gas bottle canopy #1. No soil uplift is observed under worst-case overturning loads, and wind and seismic sliding resistance of the foundations is adequate.

The footing is 2'-0" thick with top of slab 6" above finished grade. Reinforcement is as follows:

#5 @ 12" o.c. E-W top.

#5 @12" o.c.. N-S top.

#5 @ 12" o.c. E-W bottom.

#5 @ 12" o.c.. N-S bottom.

(4) additional horizontal #6 bars E-W at bottom under each pier.

Piers 1, 2, 3 & 4 are 1'-6" square and are 6" tall. Top of pier is 1'-0" above finished grade. Reinforcement is (4) #6 longitudinal bars with (4) #3 ties.

Appendix D2

Gas Bottle Canopy #2 Foundation

D2.1. Objective

The calculation performed in this appendix includes structural analysis and design of the combined footing for a gas bottle canopy on the exterior of the western wall of the SCWO Processing Building (SPB) between column lines A and B.

D2.2. Inputs

Refer to drawing 24915-10-DB-00-00038 for footing dimensions and reinforcement.

Refer to drawing 24915-10-SS-00-00052 for column base plate detail.

(1) Footing loads are taken from GTSTRUDL base reactions.

(2) Maximum soil bearing pressure is 3000 psf.

(3) A test case is run in MathCad to show the process of checking the base plate and anchor bolts. All load cases are checked in Excel following the same procedure.

D2.3. Assumptions

It is assumed that wind loads and snow loads are applied evenly over the surface of the canopy. No uneven loading is considered, so the reactions applied to the foundation will be equal or equal and opposite for wind and snow load conditions.

D2.4. Calculation Body

Base reactions from GTSTRUDL steel analysis and design are given here. These loads are the input for the Mat3D footing design. The footing design check in Mat3D is included as well.

Reaction Values from GTSTRUDL Analysis (units: kip, ft)

JOINT #	LOAD	Y FORCE	X FORCE	Z MOMENT	Z FORCE	X MOMENT
9	Dead	1.874	-0.001	-0.062	0.173	0.484
9	Snow	1.842	-0.002	0.091	0.267	0.740
9	WLEW1	0.488	-0.774	6.447	0.043	0.127
9	WLEW2	0.486	-0.774	6.058	0.048	0.139
9	WLEW3	0.745	-0.752	6.167	0.069	0.200
9	WLEW4	0.772	-0.750	5.531	0.079	0.227
9	WLNS	-0.214	-0.071	0.614	0.133	0.545
9	EQX	0.012	0.342	3.068	0.003	0.009
9	EQY	0.183	0.004	0.032	0.409	1.930

JOINT #	LOAD	Y FORCE	X FORCE	Z MOMENT	Z FORCE	X MOMENT
10	Dead	1.932	0.001	-0.007	-0.173	-0.494
10	Snow	2.005	0.002	0.220	-0.267	-0.764
10	WLEW1	0.488	-0.774	6.447	-0.043	-0.127
10	WLEW2	0.486	-0.774	6.058	-0.048	-0.139
10	WLEW3	0.745	-0.752	6.167	-0.069	-0.200
10	WLEW4	0.772	-0.750	5.531	-0.079	-0.227
10	WLNS	-0.335	-0.075	0.636	0.213	0.769
10	EQX	0.010	0.358	3.201	0.003	0.009
10	EQY	0.183	0.004	0.032	0.409	1.930

D2.4.1 Base Plate and Anchor Bolt Design

Following is the MathCad calculation checking the base plate and anchor bolts for the HSS posts.

Base Plate and Anchor Bolt Design for HSS Section

This worksheet is used to illustrate the procedure to design the base plate and anchor bolts for a moment connected HSS column. Corresponding Excel spreadsheets are used to apply these calculations to a large data set. A test case is calculated using this worksheet to verify the accuracy of the excel spreadsheets. The test case is for the reactions at Joint 9 (see GTSTRUDL model) resulting from the load combination 'COMBO_4A'. Since the moment about the two rotational axes (MX and MZ) are considered separately, only MX is included in the test case. The test case values are highlighted in the excel spread sheet. To indicate to which spreadsheets the values in this calculation correlate, the following short hand notation is used.

BPJ9 = "BasePlate Joint 9"

JR = "Joint Reactions"

ATJ9 = "Anchor Tension Joint 9"

ASJ = "Anchor Shear Joint"

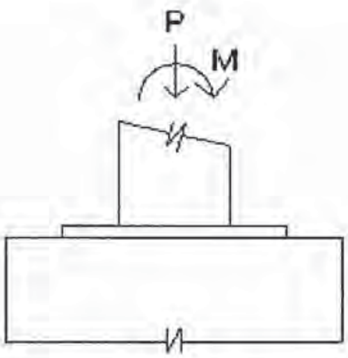
IC = "Interaction Check"

BECHTEL PARSONS BLUE GRASS

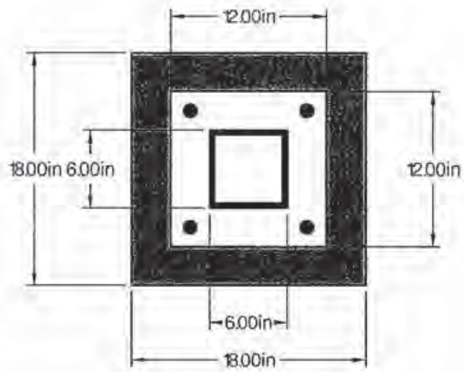
Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No.: 24915- 10-DBC-00-00004
Sheet No.: D2-5 / D2-51
Sheet Rev.: D

Subject: Gas Bottle Canopy, supports, equip, & misc. fdn.
By: R. Murphy
Date: 1/20/2008



Elevation



Plan

Force Properties (See Section D2.4.2)

[JR Column E] $P := 3.0127\text{kip}$ [JR Column D] $V_1 := 0.5767\text{kip}$

[JR Column I] $M := 52.2029\text{kip}\cdot\text{in}$ [JR Column F] $V_2 := 0.2445\text{kip}$

[BPJ9 Column E] $e := \frac{M}{P}$ $e = 17.33\cdot\text{in}$

Geometric Properties (Base Plate)

[BPJ9 Cell E6] $t := .75\text{in}$ plate thickness

$N_{plate} := 12\text{in}$ baseplate edge length

[BPJ9 Cell D6] $c_{plate} := 6\text{in}$ distance to plate's neutral axis

[BPJ9 Cell G6] $d := 6\text{in}$ depth of column

$n := \frac{N_{plate}}{2} - \frac{0.95\cdot d}{2}$ distance from edge of plate to column face

$n = 3.15\cdot\text{in}$

$A_1 := 12\text{in}\cdot 12\text{in}$

[BPJ9 Cell A6] $A_1 = 144\cdot\text{in}^2$

[BPJ9 Cell C6] $I := \frac{1}{12}\cdot(12\text{in})^4$ $I = 1728\cdot\text{in}^4$ $Z_y := \frac{t^2\cdot 1\text{in}}{6}$ $Z_y = 0.094\cdot\text{in}^3$

Geometric Properties (Pedestal)

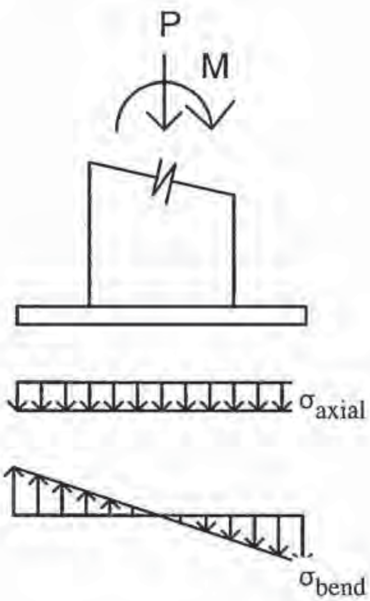
$A_2 := 18\text{in}\cdot 18\text{in}$

$A_2 = 324\cdot\text{in}^2$

$A := 12\text{in}\cdot 12\text{in}$

$A = 144\,\text{in}^2$

Design Forces



Stress Resultants

if σ_axial = σ_bending

if σ_axial > σ_bending

if σ_axial < σ_bending

Stress Calculations

[BPJ9 Column F] $\sigma_{axial} := \frac{P}{A}$ $\sigma_{axial} = 0.0209 \cdot ksi$

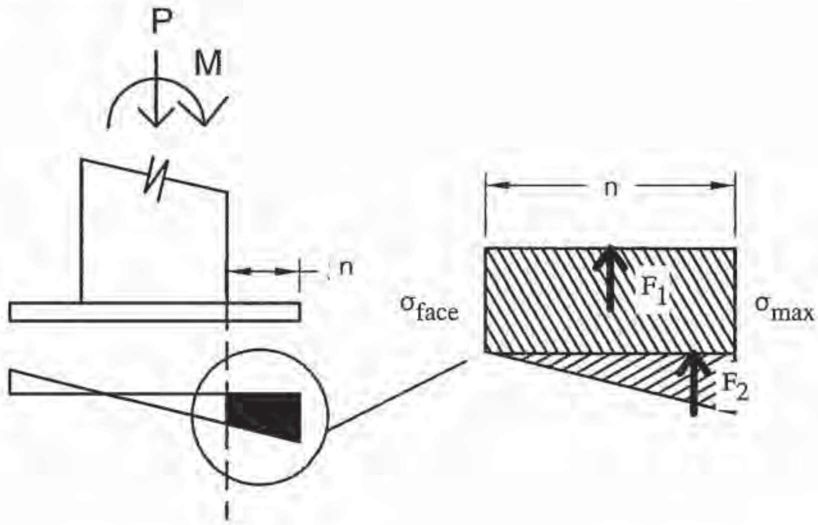
[BPJ9 Column G] $\sigma_{bend} := |M| \cdot \frac{c_{plate}}{I}$ $\sigma_{bend} = 0.1813 \cdot ksi$

Total Stress

[BPJ9 Column H] $\sigma_{max} := \sigma_{axial} + \sigma_{bend}$ $\sigma_{max} = 0.2022 \cdot ksi$

[BPJ9 Column I] $\sigma_{min} := \sigma_{axial} - \sigma_{bend}$ $\sigma_{min} = -0.1603 \cdot ksi$

Calculating Force Resultants



[BPJ9 Column K] $\text{stress\_slope} := \dfrac{\sigma_{max} - \sigma_{min}}{N_{plate}}$ $\text{stress\_slope} = 0.0302 \cdot \dfrac{kip}{in^3}$

[BPJ9 Column L] $\sigma_{face} := \sigma_{max} - \text{stress\_slope} \cdot (n)$ $\sigma_{face} = 0.107 \cdot ksi$

Rectangular Stress Block Resultants $n = 3.15\,in$

[BPJ9 Column M] $F_{rect} := \sigma_{face} \cdot n \cdot 1in$ $F_{rect} = 0.3371 \cdot kip$

[BPJ9 Column O] $M_{rect} := F_{rect} \cdot \dfrac{n}{2}$ $M_{rect} = 0.531 \cdot kip \cdot in$

Triangular Stress Block Resultants

[BPJ9 Column N] $F_{tri} := \dfrac{(\sigma_{max} - \sigma_{face}) \cdot n \cdot 1in}{2}$ $F_{tri} = 0.1499 \cdot kip$

[BPJ9 Column P] $M_{tri} := F_{tri} \cdot 2 \cdot \dfrac{n}{3}$ $M_{tri} = 0.3147 \cdot kip \cdot in$

Total Moment Per Unit Width

$M_{design} := M_{rect} + M_{tri}$

[BPJ9 Column Q] $\boxed{M_{design} = 0.8457 \cdot kip \cdot in}$

Base Plate Design [AISC-LRFD 2nd ED J9]

1. Concrete Bearing Stress [AISC LRFD-2nd ED J9]

[BPJ9 Cell L6] $f_c := 4\text{ksi}$

[BPJ9 Cell K6] $\Phi_c := .6$

$$A_{ratio} := \text{if}\left[\left(\frac{A_2}{A_1}\right)^{\frac{1}{2}} < 2, \left(\frac{A_2}{A_1}\right)^{\frac{1}{2}}, 2\right]$$

[BPJ9 Cell J6] $A_{ratio} = 1.5$

$F_p := \Phi_c \cdot 0.85 \cdot f_c \cdot A_{ratio}$ [AISC LRFD-2nd ED EQ J9-2]

[BPJ9 Cell M6] $F_p = 3.06 \cdot \text{ksi}$

$\text{pedestal\_design} := \text{if}\left(\sigma_{max} < F_p, G_{pedestal}, NG_{pedestal}\right)$

[BPJ9 Column T] pedestal_design = "Pedestal design is good"

2. Plate Thickness [AISC LRFD-2nd ED]

$\Phi_{flex} := .90 \quad F_y := 36\text{ksi}$

[BPJ9 Column R] $t_p := \sqrt{4 \cdot \frac{M_{design} \cdot 1}{\Phi_{flex} \cdot F_y \cdot 1\text{in}}} \quad t_p = 0.3231 \cdot \text{in}$ [AISC LRFD-2nd ED 14-6]

Plate Bending Strength per unit width

$M_{strength} := \Phi_{flex} \cdot F_y \cdot Z_y \qquad M_{strength} = 3.037 \cdot \text{kip} \cdot \text{in}$

Design Check

$\text{base\_plate\_design} := \text{if}\left(t > t_p, G_d, NG\right)$

[BPJ9 Column S] base_plate_design = "Base Plate Design is Good"

BECHTEL PARSONS BLUE GRASS

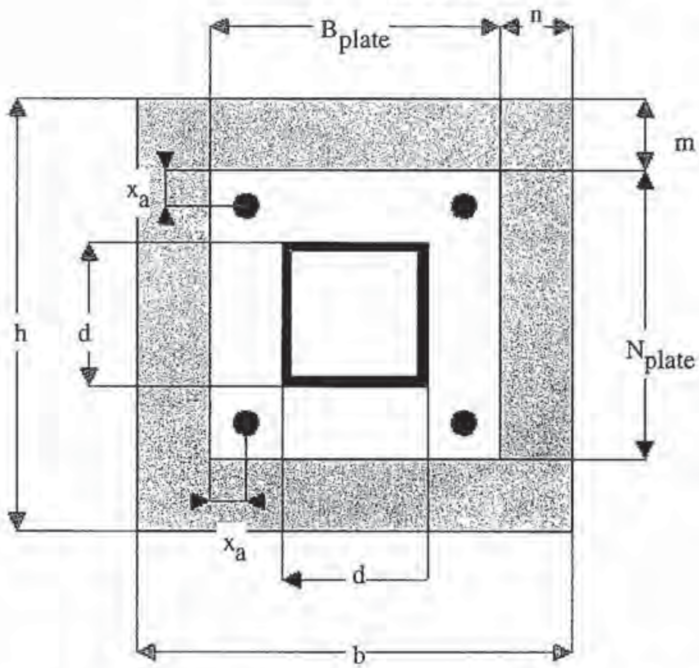
Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No.: 24915- 10-DBC-00-00004
Sheet No.: D2-9 / D2-51
Sheet Rev.: D

Subject: Gas Bottle Canopy, supports, equip, & misc. fdn.
By: R. Murphy
Date: 1/20/2008

Anchor Bolt Design

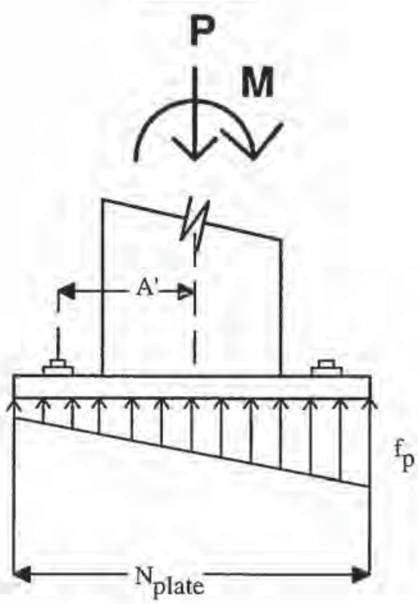
References:
-AISC LRFD 2nd ed. Steel Design Guide: Base Plate and Anchor Rod Design
-ACI 318-02



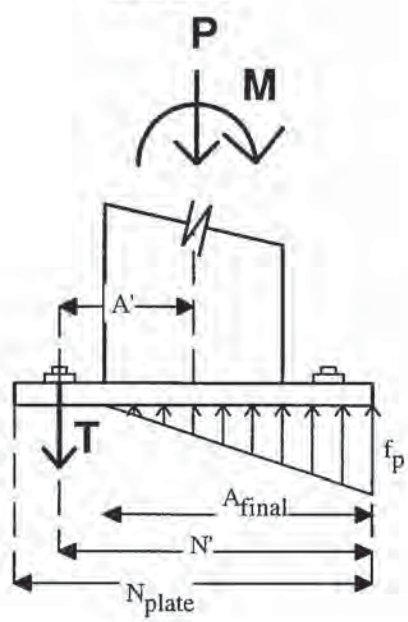
[ATJ9 Cell A4]	$N_{plate} = 12 \cdot in$
[ATJ9 Cell C4]	$x_a := 1.5in$
	$N' := N_{plate} - x_a$
[ATJ9 Cell D4]	$N' = 10 \cdot in$
[ATJ9 Cell B4]	$B := N_{plate}$
[ATJ9 Cell E4]	$A' := 4.5in$
[BPJ9 Column H]	$f_p := \sigma_{max}$
[ATJ9 Column E]	$e = 17 \cdot in$

Tension in Anchor Bolt due to Moment [AISC Design Guide Appendix B]

if e<e_kern



if e>e_kern



Determining effects of eccentricity [AISC LRFD B.3]

[ATJ9 Cell F4] $e_{kern} := \frac{N_{plate}}{6}$ $\boxed{e_{kern} = 2 \cdot in}$ [AISC B.3]

$anchor\_tension := if(e > e_{kern}, BT, NBT)$

$anchor\_tension =$ "Anchor bolts in tension"

Determining Tension in Anchor Bolt [AISC B.4.2]

$P = 3013\,lbf$

$f_p = 0 \cdot ksi$

$B = 1\,ft$

Determining Length of Stress Triangle

[ATJ9 Column H] $f' := f_p \cdot N_{plate} \cdot \frac{N'}{2}$ $\boxed{f' = 12.7374 \cdot kip}$

[ATJ9 Column I] $A_{plus} := \frac{f' + \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}}$ $\boxed{A_{plus} = 24.993 \cdot in}$

[ATJ9 Column J] $A_{minus} := \frac{f' - \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}}$ $\boxed{A_{minus} = 6.507 \cdot in}$

[ATJ9 Column K]

$$A_{final} := \left| \begin{array}{l} \min(A_{plus}, A_{minus}) \text{ if } A_{plus} > 0 \wedge A_{minus} > 0 \\ A_{plus} \text{ if } A_{plus} > 0 \wedge A_{minus} < 0 \\ 0 \text{ if } A_{plus} < 0 \wedge A_{minus} < 0 \end{array} \right.$$

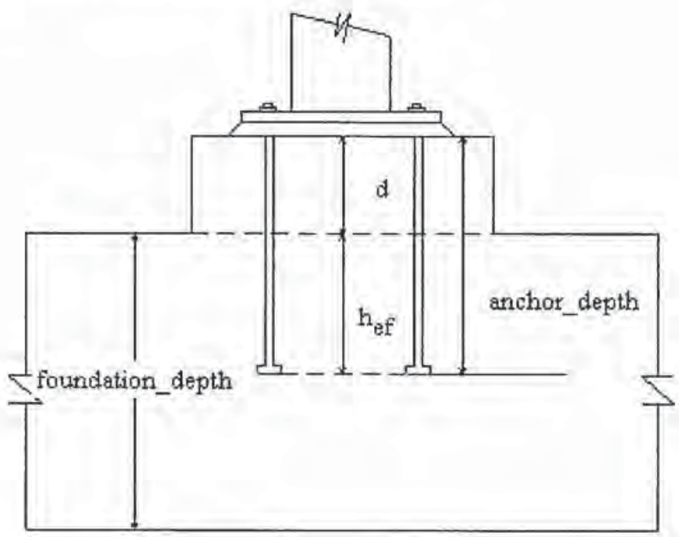
$\boxed{A_{final} = 6.507 \cdot in}$

Determining Anchor Tension from Equilibrium

[ATJ9 Column L] $T_{anchors} := \frac{f_p \cdot A_{final} \cdot B}{2} - P$ $\boxed{T_{anchors} = 4.8807 \cdot kip}$

[ATJ9 Column M] $T_{one\_anchor} := \frac{T_{anchors}}{2}$ $\boxed{T_{one\_anchor} = 2.4403 \cdot kip}$

Pedestal and Foundation Cross Section



$\text{anchor\_depth} := 14\text{in}$

$d := 6\text{in}$

$h_{ef} := \text{anchor\_depth} - d$

$h_{ef} = 8 \cdot \text{in}$

To simplify the calculation, the effective embedment depth of the anchor bolt is taken as the length of the bolt that extends beneath the column pedestal. This results in a conservative estimate of the strength of concrete breakout and pryout.

Steel Strength of anchor in tension [ACI 318.05 D.5.1]

$f_{ya} := 36\text{ksi}$ $\quad n_{anch} := 4$

$f_{uta} := \min(1.9 \cdot f_{ya}, 125\text{ksi}, 58\text{ksi})$

$f_{uta} = 58000\,\text{psi}$

$d_o := 0.75\text{in}$

$n_t := \frac{10}{\text{in}}$ [AISC LRFD-05 Table 7-18]

$A_{se} := \frac{\pi}{4} \cdot \left(d_o - \frac{0.9743}{n_t}\right)^2$

$A_{se} = 0.3345 \cdot \text{in}^2$ Net tensile area

$N_{sa} := n_{anch} \cdot A_{se} \cdot f_{uta}$ [ACI 318.05 Eq D-3]

[ATJ9 Cell L5] $\boxed{N_{sa} = 77.595 \cdot \text{kip}}$ one anchor

Concrete breakout strength-Tension [ACI 318.05 D.5.2]

Concrete breakoutt strength based on a grouping of two anchors, since tension due to moment is the only tension present.

$c_{a1} := 4.5in$ $\quad s_1 := 9in$

$c_{a2} := 4.5in$ $\quad s_2 := 9in$

$c_{a11} := 4.5in$ $\quad f_c = 4000psi$

$c_{a22} := 4.5in$

$c_{amin} := \min(c_{a1}, c_{a11}, c_{a2}, c_{a22})$

$n_{anch\_ten} := 2$

Breakout Prism Properties

$h'_{ef} := h_{ef}$

$A_{NCO} := 9 \cdot h'_{ef}{}^2$

$A_{NCO} = 576 \cdot in^2$

$A_{NC} := (1.5 \cdot h'_{ef} + s_1 + 1.5 \cdot h'_{ef}) \cdot (1.5 \cdot h'_{ef} + 1.5 \cdot h'_{ef})$

$A_{NC} = 792 \cdot in^2$

$A_{NC} := \min(A_{NC}, n_{anch\_ten} \cdot A_{NCO})$

$A_{NC} = 792 \cdot in^2$

anchor_status := "cast in"

$k_c :=$ if(anchor_status = "cast in", 24, 17)

$k_c = 24$

$$N_b := \begin{cases} 16 \cdot psi^{.5} \cdot in^{\frac{1}{3}} \cdot \sqrt{f_c} \cdot h'_{ef}{}^{\frac{5}{3}} & \text{if } 11in \le h'_{ef} \le 25in \\ k_c \cdot \sqrt{f_c} \cdot h'_{ef}{}^{1.5} \cdot psi^{.5} \cdot in^{.5} & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-7]

[ACI 318-05 EQ D-8]

$N_b = 34346\,lbf$

$e'_N := 4.5in$ Assumption that only one row of anchors on one side of the column center line carry tension load. Eccentricity is therefore distance from this row of anchors to the column center line

$$\Psi_{ecN} := \min\left(\frac{1}{1+\frac{2\cdot e'_N}{3\cdot h'_{ef}}}, 1.0\right)$$ [ACI 318-05 EQ D-9]

$\Psi_{ecN} = 1$

$$\Psi_{edN} := \begin{vmatrix} 1 \text{ if } c_{amin} \ge 1.5\cdot h'_{ef} \\ 0.7 + 0.3\cdot\frac{c_{amin}}{1.5(h'_{ef})} \text{ if } c_{amin} < 1.5\cdot h'_{ef} \end{vmatrix}$$ [ACI 318-05 EQ D-10] [ACI 318-05 EQ D-11]

$\Psi_{edN} = 1$

$$\Psi_{cN} := \begin{vmatrix} 1.25 \text{ if anchor\_status = "cast in"} \\ 1.4 \text{ otherwise} \end{vmatrix}$$ [ACI 318-05 EQ D.5.2.6

$\Psi_{cN} = 1$

$\Psi_{cpN} := 1$ [ACI 318-05 D5.2.7]

$$N_{cbg} := \frac{A_{NC}}{A_{NCO}}\cdot\Psi_{ecN}\cdot\Psi_{edN}\cdot\Psi_{cN}\cdot\Psi_{cpN}\cdot N_b$$ [ACI 318-05 EQ D-5]

[ATJ9 Cell M5] $\boxed{N_{cbg} = 34.883\cdot kip}$ Group of two anchors

Pullout Strength of Anchor in Tension [ACI 318-05 D.5.3]

$A_{brg} := 0.654in^2$ crack_status := "not cracked" hook_status := "not hooked"

$N_p := 8\cdot A_{brg}\cdot f_c$ [ACI 318-02 EQ D-15]

$\Psi_{cP} := \text{if}[(\text{crack\_status = "cracked"}), 1.4, 1.0]$ [ACI 318-05 D.5.3.6]

$N_{pn} := \Psi_{cP}\cdot N_p$ [ACI 318-02 EQ D-14]

[ATJ9 Cell N5] $\boxed{N_{pn} = 20.928\cdot kip}$ One Anchor

Concrete side-face blowout strength-Tension [ACI 318.05 D.5.4]

$c_{a1} = 0\,\text{ft}$

$$N_{sb} := 160\frac{\text{lbf}}{\text{in}} \cdot c_{a1} \cdot \sqrt{\frac{A_{brg}}{\text{in}^2}} \cdot \sqrt{\frac{f_c}{\text{psi}}}$$ [ACI 318-05 EQ D-17] $A_{brg} = 1 \cdot \text{in}^2$

[ATJ9 Cell O5] $\boxed{N_{sb} = 36.826 \cdot \text{kip}}$ one anchor

Tension Design Check

$\boxed{N_{sa} = 77595\,\text{lbf}}$ one anchor $\boxed{N_{pn} = 20928\,\text{lbf}}$ one anchor

$\boxed{N_{cbg} = 34883\,\text{lbf}}$ two anchors $\boxed{N_{sb} = 36826\,\text{lbf}}$ one anchor

$\Phi_{tension} := 0.85$ Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength. Condition A is met [ACI 318-05 D.4.4]

$$N_{design} := \Phi_{tension} \cdot \min\left(N_{sa}, \frac{N_{cbg}}{2}, N_{pn}, N_{sb}\right)$$ [ACI 318-05 D.4.1.1]

[ATJ9 Cell H4] $\boxed{N_{design} = 14.825 \cdot \text{kip}}$

$T_{one\_anchor} = 2440\,\text{lbf}$

$\text{tension\_design} := \text{if}\left(T_{one\_anchor} \le N_{design}, \text{"Good"}, \text{"Not Good"}\right)$ [ACI 318-05 EQ D-1]

[ATJ9 Column M-Q] $\boxed{\text{tension\_design} = \text{"Good"}}$

Steel Strength of Anchor in Shear [ACI 318-05 D.6.1]

Anchor Types:

AT1 [ACI 318-05 D.6.1.a]

AT2 [ACI 318-05 D.6.1.b]

AT3 [ACI 318-05 D.6.1.c]

Anchor Type Used:

$AT := \text{"AT1"}$

Grout Pad Factor [ACI 318-05 D.6.1.3]:

$grout\_pad\_used := \text{"yes"}$

$$c_{pad} := \begin{cases} 0.8 & \text{if } grout\_pad\_used = \text{"yes"} \\ 1.0 & \text{otherwise} \end{cases}$$

$c_{pad} = 1$

Shear Strength:

$$V_{sa} := \begin{cases} c_{pad} \cdot n_{anch} \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT1"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT2"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT3"} \end{cases}$$

[ACI 318-05 EQ D-19]
[ACI 318-05 EQ D-20]
[ACI 318-05 EQ D-20]

[ASJ Cell B7] $\boxed{V_{sa} = 62.076 \cdot kip}$ one anchor

Concrete Breakout Strength-Shear [ACI 318-05 D.6.2]

group_status := "group"

Projected Concrete Failure Area [ACI 318-05 D.6.2.1, RD.6.2.1]

$c_{a1} = 5 \cdot in$ Assuming that total shear is critical on one anchor row

$h_a := 6.in$ Thicknessof pedestal

$s_1 = 9 \cdot in$ Anchor Bolt Spacing

$$c := \begin{cases} 1.5 \cdot c_{a1} & \text{if } 1.5 \cdot c_{a1} < c_{a2} \\ c_{a2} & \end{cases} \qquad c = 5 \cdot in$$

$$A_{vc} := \begin{cases} \left[2 \cdot (c) + s_1\right] \cdot h_a & \text{if } 1.5 c_{a1} > h_a \\ 2 \cdot \left[(c) + s_1\right] \cdot 1.5 \cdot c_{a1} & \text{otherwise} \end{cases}$$

[ACI 318-05 Fig RD.6.2.1(b)]
Failure area for group of anchors

$A_{vc} = 108 \cdot in^2$

$A_{vco} := 4.5 \cdot c_{a1}{}^2$

$A_{vco} = 91 \cdot in^2$ [ACI 318-05 EQ D-23]

$A_{vc} := \min\left(A_{vc}, n_{anch} \cdot A_{vco}\right)$

$A_{vc} = 108 \cdot in^2$

Basic Concrete Breakout Strength [ACI 318-05 D.6.2.2]

$l_e := h_{ef}$ anchor load bearing legnth

$$V_b := 7 \cdot \left(\frac{l_e}{d_o}\right)^{0.2} \cdot \sqrt{d_o} \cdot \sqrt{f_c} \cdot c_{a1}{}^{1.5} \cdot psi^{.5}$$ [ACI 318-05 EQ D.24]

$V_b = 5876 \, lbf$

$e'_v := 0in$ Assumption that shear is distributed equal to all anchors and no shear eccentricity results

$$\Psi_{ecV} := \min\left(1, \frac{1}{1 + 2\cdot\frac{e'_v}{3\cdot c_{a1}}}\right)$$

$\Psi_{ecV} = 1$

$c_{a2} = 5\cdot in$

$$\Psi_{edV} := \begin{cases} 1.0 \text{ if } c_{a2} \ge 1.5\cdot c_{a1} & \text{[ACI 318-05 EQ D-27]} \\ 0.7 + 0.3\cdot\frac{c_{a2}}{1.5\cdot c_{a1}} \text{ if } c_{a2} < 1.5\cdot c_{a1} & \text{[ACI 318-05 EQ D-28]} \end{cases}$$

$\Psi_{edV} = 1$

crack_status = "not cracked"

$$\Psi_{cV} := \begin{cases} 1.4 \text{ if crack\_status = "not cracked"} \\ 1.0 \text{ if crack\_status = "cracked no reinforce"} \\ 1.2 \text{ if crack\_status = "cracked with reinforce"} \\ 1.4 \text{ if crack\_status = "cracked with reinforce and stirrups"} \end{cases}$$

$\Psi_{cV} = 1$

$$V_{cb} := \begin{cases} \frac{A_{vc}}{A_{vco}}\cdot\Psi_{edV}\cdot\Psi_{cV}\cdot V_b \text{ if group\_status = "single anchor"} \\ 0 \text{ otherwise} \end{cases}$$ [ACI 318-05 EQ D-21]

$$V_{cbg} := \begin{cases} \frac{A_{vc}}{A_{vco}}\cdot\Psi_{ecV}\cdot\Psi_{edV}\cdot\Psi_{cV}\cdot V_b \text{ if group\_status = "group"} \\ 0 \text{ otherwise} \end{cases}$$ [ACI 318-05 EQ D-22]

$V_{cb} = 0\,lbf$

[ASJ Cell C7] $\boxed{V_{cbg} = 9\cdot kip}$ group of 2 anchors

Concrete pryout strength of anchor in shear [ACI 318-05 D.6.3]

$h_{ef} = 8 \cdot in$

$k_{cp} := \begin{cases} 1.0 & \text{if } h_{ef} < 2.5in \\ 2.0 & \text{if } h_{ef} \geq 2.5in \end{cases}$

$V_{cp} := \begin{cases} k_{cp} \cdot N_{cb} & \text{if group\_status = "single anchor"} \\ 0 & \text{otherwise} \end{cases}$ [ACI 318-05 EQ D-29]

$V_{cpg} := \begin{cases} k_{cp} \cdot N_{cbg} & \text{if group\_status = "group"} \\ 0 & \text{otherwise} \end{cases}$ [ACI 318-05 EQ D-30]

[ASJ Cell D7] $\boxed{V_{cpg} = 69.765 \cdot kip}$ group of 2 anchors

Shear Design Check

$\boxed{V_{sa} = 62076\,lbf}$ one anchor

$\boxed{V_{cbg} = 8775\,lbf}$ group of 2 anchors

$\boxed{V_{cpg} = 69765\,lbf}$ group of 2 anchors

[ASJ Cell B3] $\Phi_{shear} := 0.85$ Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength [ACI 318-05 D.4.4]

$V_{design} := \Phi_{shear} \cdot \min(V_{sa} \cdot 4, V_{cbg}, V_{cpg})$ [ACI 318-05 D.4.1.1]

$\boxed{V_{design} = 7.459 \cdot kip}$

design_shear := if($V_1 \leq V_{design} \wedge V_2 \leq V_{design}$, "Design is OK" , "Design is insufficient")

[ASJ Column E-J] $\boxed{\text{design\_shear = "Design is OK"}}$ [ACI 318-05 EQ D-2]

Interaction of tensile and shear forces [ACI 318-05 D.7]

[IC Column I] $\frac{V_1}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} = 0.242$

$$ST_{check} := \text{if}\left(\frac{V_1}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} \le 1.2, \text{"Interaction OK"}, \text{"Interactoin Failure"}\right)$$

$$interaction\_check\_V_1 := \text{if}\left[\left(V_1 > 0.2 \cdot V_{design} \wedge T_{one\_anchor} > N_{design}\right), ST_{check}, \text{"No check needed"}\right]$$

[IC Column I] $\boxed{interaction\_check\_V_1 = \text{"No check needed"}}$

[IC Column J] $\frac{V_2}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} = 0.197$

$$ST_{check} := \text{if}\left(\frac{V_2}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} \le 1.2, \text{"Interaction OK"}, \text{"Interactoin Failure"}\right)$$

$$interaction\_check\_V_2 := \text{if}\left[\left(V_2 > 0.2 \cdot V_{design} \wedge T_{one\_anchor} > N_{design}\right), ST_{check}, \text{"No check needed"}\right]$$

[IC Column J] $\boxed{interaction\_check\_V_2 = \text{"No check needed"}}$

BECHTEL PARSONS BLUE GRASS A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.	Calculation Sheet	Project:	BGCAPP
		Job Number:	743341
		Calc. No.	24915-10-DBC-00-00004
Subject:	Gas Bottles Canopy, Supports, Equip, & Misc Foundations	Sheet No.	D2-20 / D2-51
By: R. Murphy	Date: 12/16/2007	Sheet Rev.	D

Table "Joint Reactions"

	A	B	C	D	E	F	G	H	I	J
1	TABLE: Joint Reactions									
2	Joint	OutputCase	CaseType	X FORCE	Y FORCE	Z FORCE	X MOMENT	Y MOMENT	Z MOMENT	
3	Text	Text	Text	Kip	Kip	Kip	Kip-in	Kip-in	Kip-in	
4	9	'COMBO_1'	Combination	0.0000	2.0869	0.1503	5.1053	0.1310	-0.5820	
5	9	'COMBO_2A	Combination	0.0000	1.7887	0.1289	4.3759	0.1123	-0.4988	
6	9	'COMBO_2B	Combination	0.0000	3.3699	0.3070	10.4146	0.2652	1.1212	
7	9	'COMBO_3A	Combination	0.0332	2.1480	0.0350	-0.1982	0.1666	-3.8963	
8	9	'COMBO_3B	Combination	-0.2883	2.4007	0.1867	6.3906	0.1160	25.8521	
9	9	'COMBO_3C	Combination	-0.3903	1.1767	0.0713	2.3692	0.0001	36.3326	
10	9	'COMBO_3D	Combination	-0.3063	2.1847	0.1663	5.6810	0.0956	27.7016	
11	9	'COMBO_3E	Combination	-0.3723	1.3927	0.0916	3.0789	0.0206	34.4831	
12	9	'COMBO_3F	Combination	0.0332	7.2078	0.6051	19.1256	0.6558	1.2876	
13	9	'COMBO_3G	Combination	-0.2884	7.4605	0.7568	25.7145	0.6052	31.0360	
14	9	'COMBO_3H	Combination	-0.3903	1.1767	0.0713	2.3692	0.0001	36.3326	
15	9	'COMBO_3I	Combination	-0.3063	2.1847	0.1663	5.6810	0.0956	27.7016	
16	9	'COMBO_3J	Combination	-0.3723	1.3927	0.0916	3.0789	0.0206	34.4831	
17	9	'COMBO_3K	Combination	0.0000	6.8485	0.6990	23.6998	0.6015	4.6852	
18	9	'COMBO_3L	Combination	0.0000	6.8485	0.6990	23.6998	0.6015	4.6852	
19	9	'COMBO_3M	Combination	0.0000	1.7887	0.1289	4.3759	0.1123	-0.4988	
20	9	'COMBO_3N	Combination	0.0000	1.7887	0.1289	4.3759	0.1123	-0.4988	
21	9	'COMBO_4A	Combination	-0.5767	3.0127	0.2445	8.4053	0.1197	52.2029	<---Test
22	9	'COMBO_4B	Combination	-0.7807	0.5647	0.0136	0.3625	-0.1121	73.1639	
23	9	'COMBO_4C	Combination	-0.6127	2.5807	0.2037	6.9860	0.0788	55.9019	
24	9	'COMBO_4D	Combination	-0.7447	0.9967	0.0544	1.7818	-0.0712	69.4649	
25	9	'COMBO_4E	Combination	0.0663	2.5074	-0.0589	-4.7724	0.2209	-7.2940	
26	9	'COMBO_4F	Combination	-0.5767	4.5939	0.4226	14.4440	0.2726	53.8229	
27	9	'COMBO_4G	Combination	-0.7807	2.1459	0.1918	6.4012	0.0407	74.7839	
28	9	'COMBO_4H	Combination	-0.6127	4.1619	0.3819	13.0247	0.2317	57.5219	
29	9	'COMBO_4I	Combination	-0.7447	2.5779	0.2325	7.8205	0.0816	71.0849	
30	9	'COMBO_4J	Combination	0.0663	4.0885	0.1192	1.2663	0.3737	-5.6740	
31	9	'COMBO_6A	Combination	-0.5767	2.5656	0.2122	7.3113	0.0916	52.3276	
32	9	'COMBO_6B	Combination	-0.7807	0.1176	-0.0186	-0.7315	-0.1402	73.2886	
33	9	'COMBO_6C	Combination	-0.6127	2.1336	0.1715	5.8920	0.0507	56.0266	
34	9	'COMBO_6D	Combination	-0.7447	0.5496	0.0222	0.6878	-0.0993	69.5896	
35	9	'COMBO_6E	Combination	0.0663	2.0602	-0.0911	-5.8664	0.1928	-7.1693	
36	9	'COMBO_5A	Combination	0.2730	2.6473	0.5307	25.3616	0.3453	29.4265	
37	9	'COMBO_5B	Combination	0.2665	2.3577	-0.1168	-11.3164	0.1042	28.7370	
38	9	'COMBO_5C	Combination	-0.2665	2.6218	0.5269	25.2348	0.2514	-28.4769	
39	9	'COMBO_5D	Combination	-0.2730	2.3322	-0.1206	-11.4433	0.0103	-29.1664	
40	9	'COMBO_7A	Combination	0.2730	1.5676	0.4272	21.8522	0.2561	28.9032	
41	9	'COMBO_7B	Combination	0.2665	1.2781	-0.2203	-14.8259	0.0149	28.2138	
42	9	'COMBO_7C	Combination	-0.2665	1.5422	0.4235	21.7253	0.1621	-29.0002	
43	9	'COMBO_7D	Combination	-0.2730	1.2526	-0.2241	-14.9528	-0.0790	-29.6897	

Table "Joint Reactions" (Cont.)

	A	B	C	D	E	F	G	H	I	J
1	TABLE: Joint Reactions									
2	Joint	OutputCase	CaseType	X FORCE	Y FORCE	Z FORCE	X MOMENT	Y MOMENT	Z MOMENT	
3	Text	Text	Text	Kip	Kip	Kip	Kip-in	Kip-in	Kip-in	
44	10	'COMBO_1'	Combination	0.0000	2.0869	-0.1503	-5.1053	-0.1310	-0.5820	
45	10	'COMBO_2A	Combination	0.0000	1.7887	-0.1289	-4.3759	-0.1123	-0.4988	
46	10	'COMBO_2B	Combination	0.0000	3.3699	-0.3070	-10.4146	-0.2652	1.1212	
47	10	'COMBO_3A	Combination	0.0328	2.2214	-0.2977	-11.5653	-0.1330	-3.8828	
48	10	'COMBO_3B	Combination	-0.2884	2.4007	-0.1867	-6.3906	-0.1160	25.8520	
49	10	'COMBO_3C	Combination	-0.3904	1.1767	-0.0713	-2.3692	-0.0001	36.3325	
50	10	'COMBO_3D	Combination	-0.3064	2.1847	-0.1663	-5.6810	-0.0955	27.7015	
51	10	'COMBO_3E	Combination	-0.3724	1.3927	-0.0916	-3.0789	-0.0205	34.4830	
52	10	'COMBO_3F	Combination	0.0328	7.2812	-0.8678	-30.8892	-0.6222	1.3013	
53	10	'COMBO_3G	Combination	-0.2884	7.4605	-0.7568	-25.7145	-0.6052	31.0360	
54	10	'COMBO_3H	Combination	-0.3904	1.1767	-0.0713	-2.3692	-0.0001	36.3325	
55	10	'COMBO_3I	Combination	-0.3064	2.1847	-0.1663	-5.6810	-0.0955	27.7015	
56	10	'COMBO_3J	Combination	-0.3724	1.3927	-0.0916	-3.0789	-0.0205	34.4830	
57	10	'COMBO_3K	Combination	0.0000	6.8485	-0.6990	-23.6998	-0.6015	4.6852	
58	10	'COMBO_3L	Combination	0.0000	6.8485	-0.6990	-23.6998	-0.6015	4.6852	
59	10	'COMBO_3M	Combination	0.0000	1.7887	-0.1289	-4.3759	-0.1123	-0.4989	
60	10	'COMBO_3N	Combination	0.0000	1.7887	-0.1289	-4.3759	-0.1123	-0.4989	
61	10	'COMBO_4A	Combination	-0.5767	3.0127	-0.2445	-8.4053	-0.1197	52.2029	
62	10	'COMBO_4B	Combination	-0.7807	0.5647	-0.0136	-0.3625	0.1122	73.1639	
63	10	'COMBO_4C	Combination	-0.6127	2.5807	-0.2037	-6.9860	-0.0788	55.9019	
64	10	'COMBO_4D	Combination	-0.7447	0.9967	-0.0544	-1.7818	0.0712	69.4649	
65	10	'COMBO_4E	Combination	0.0657	2.6541	-0.4665	-18.7547	-0.1536	-7.2667	
66	10	'COMBO_4F	Combination	-0.5767	4.5939	-0.4226	-14.4440	-0.2726	53.8229	
67	10	'COMBO_4G	Combination	-0.7807	2.1459	-0.1918	-6.4012	-0.0407	74.7839	
68	10	'COMBO_4H	Combination	-0.6127	4.1619	-0.3819	-13.0247	-0.2317	57.5219	
69	10	'COMBO_4I	Combination	-0.7447	2.5779	-0.2325	-7.8205	-0.0816	71.0849	
70	10	'COMBO_4J	Combination	0.0657	4.2353	-0.6446	-24.7934	-0.3065	-5.6467	
71	10	'COMBO_6A	Combination	-0.5767	2.5656	-0.2122	-7.3113	-0.0916	52.3276	
72	10	'COMBO_6B	Combination	-0.7807	0.1176	0.0186	0.7315	0.1402	73.2886	
73	10	'COMBO_6C	Combination	-0.6127	2.1336	-0.1715	-5.8920	-0.0507	56.0266	
74	10	'COMBO_6D	Combination	-0.7447	0.5496	-0.0222	-0.6878	0.0993	69.5896	
75	10	'COMBO_6E	Combination	0.0657	2.2069	-0.4342	-17.6607	-0.1255	-7.1420	
76	10	'COMBO_5A	Combination	0.2730	2.6473	0.1206	11.4433	-0.0103	29.4265	
77	10	'COMBO_5B	Combination	0.2665	2.3577	-0.5269	-25.2348	-0.2514	28.7370	
78	10	'COMBO_5C	Combination	-0.2665	2.6218	0.1168	11.3164	-0.1042	-28.4769	
79	10	'COMBO_5D	Combination	-0.2730	2.3322	-0.5307	-25.3616	-0.3453	-29.1664	
80	10	'COMBO_7A	Combination	0.2730	1.5676	0.2241	14.9528	0.0790	28.9032	
81	10	'COMBO_7B	Combination	0.2665	1.2781	-0.4235	-21.7253	-0.1621	28.2138	
82	10	'COMBO_7C	Combination	-0.2665	1.5422	0.2203	14.8259	-0.0149	-29.0002	
83	10	'COMBO_7D	Combination	-0.2730	1.2526	-0.4272	-21.8522	-0.2561	-29.6897	

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Subject:	Gas Bottles Canopy, Supports, Equip, & Misc Foundations	Project:	BGCAPP
By:	R. Murphy	Job Number:	743341
Date:	12/16/2007	Calc. No.	24915-10-DBC-00-00004
		Sheet No.	D2-22 / D2-51
		Sheet Rev.	D

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
3	HSS 6X6X.375																			
4	12"x12" Plate																			
5	A (in^2)		I (in)	c (in)	t (in)	n(in)	d (in)	Fy (ksi)	A2 (in^2)	Aratio	Φ_c	Fc (ksi)	Fp (ksi)							
6	144		1728	6	0.75	3.15	12	36	324	1.5	0.6	4	3.06							
7																				
8																				
9																				
10	Joint	OutputCase	Fy	Mz	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	design check plate	design check ped bearing
11	Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
12	9	'COMBO_1'	2.0869	-0.5820	-0.2789	0.0145	0.0020	0.0165	0.0125	0.7553	0.0003	0.0155	0.0487	0.0017	0.0787	0.0035	0.0802	0.099	Design Good	Design Good
13	9	'COMBO_2A	1.7887	-0.4988	-0.2789	0.0124	0.0017	0.0142	0.0107	0.7553	0.0003	0.0132	0.0417	0.0014	0.0657	0.0030	0.0687	0.092	Design Good	Design Good
14	9	'COMBO_2B	3.3699	1.1212	0.3327	0.0234	0.0039	0.0273	0.0195	0.7147	0.0006	0.0253	0.0795	0.0032	0.1253	0.0068	0.1320	0.128	Design Good	Design Good
15	9	'COMBO_3A	2.1480	-3.8963	-1.8139	0.0149	0.0135	0.0284	0.0014	0.0488	0.0023	0.0213	0.0672	0.0112	0.1059	0.0235	0.1294	0.126	Design Good	Design Good
16	9	'COMBO_3B	2.4007	25.8521	10.7684	0.0167	0.0898	0.1064	-0.0731	-0.6867	0.0150	0.0593	0.1868	0.0742	0.2943	0.1559	0.4501	0.236	Design Good	Design Good
17	9	'COMBO_3C	1.1767	36.3326	30.8756	0.0082	0.1262	0.1343	-0.1180	-0.8783	0.0210	0.0681	0.2145	0.1043	0.3378	0.2191	0.5569	0.262	Design Good	Design Good
18	9	'COMBO_3D	2.1847	27.7016	12.6796	0.0152	0.0962	0.1114	-0.0810	-0.7275	0.0160	0.0609	0.1917	0.0795	0.3019	0.1670	0.4690	0.241	Design Good	Design Good
19	9	'COMBO_3E	1.3927	34.4831	24.7592	0.0097	0.1197	0.1294	-0.1101	-0.8505	0.0200	0.0865	0.2096	0.0990	0.3301	0.2079	0.5381	0.258	Design Good	Design Good
20	9	'COMBO_3F	7.2078	1.2876	0.1786	0.0501	0.0045	0.0545	0.0456	0.8360	0.0007	0.0522	0.1644	0.0037	0.2589	0.0078	0.2666	0.181	Design Good	Design Good
21	9	'COMBO_3G	7.4605	31.0360	4.1601	0.0518	0.1078	0.1596	-0.0560	-0.3507	0.0180	0.1030	0.3244	0.0891	0.5110	0.1871	0.6981	0.294	Design Good	Design Good
22	9	'COMBO_3H	1.1767	36.3326	30.8756	0.0082	0.1262	0.1343	-0.1180	-0.8783	0.0210	0.0681	0.2145	0.1043	0.3378	0.2191	0.5569	0.262	Design Good	Design Good
23	9	'COMBO_3I	2.1847	27.7016	12.6796	0.0152	0.0962	0.1114	-0.0810	-0.7275	0.0160	0.0609	0.1917	0.0795	0.3019	0.1670	0.4690	0.241	Design Good	Design Good
24	9	'COMBO_3J	1.3927	34.4831	24.7592	0.0097	0.1197	0.1294	-0.1101	-0.8505	0.0200	0.0665	0.2096	0.0990	0.3301	0.2079	0.5381	0.258	Design Good	Design Good
25	9	'COMBO_3K	6.8485	4.6852	0.6841	0.0476	0.0163	0.0638	0.0313	0.4902	0.0027	0.0553	0.1742	0.0135	0.2743	0.0282	0.3025	0.193	Design Good	Design Good
26	9	'COMBO_3L	6.8485	4.6852	0.6841	0.0476	0.0163	0.0638	0.0313	0.4902	0.0027	0.0553	0.1742	0.0135	0.2743	0.0282	0.3025	0.193	Design Good	Design Good
27	9	'COMBO_3M	1.7887	-0.4988	-0.2788	0.0124	0.0017	0.0142	0.0107	0.7553	0.0003	0.0132	0.0417	0.0014	0.0657	0.0030	0.0687	0.092	Design Good	Design Good
28	9	'COMBO_3N	1.7887	-0.4988	-0.2788	0.0124	0.0017	0.0142	0.0107	0.7553	0.0003	0.0132	0.0417	0.0014	0.0657	0.0030	0.0687	0.092	Design Good	Design Good
29	9	'COMBO_4A	3.0127	52.2029	17.3274	0.0209	0.1813	0.2022	-0.1603	-0.7930	0.0302	0.1070	0.3371	0.1499	0.5310	0.3147	0.8457	0.323	Design Good	Design Good
30	9	'COMBO_4B	0.5647	73.1639	129.5541	0.0039	0.2540	0.2580	-0.2501	-0.9696	0.0423	0.1246	0.3925	0.2101	0.6181	0.4411	1.0593	0.362	Design Good	Design Good
31	9	'COMBO_4C	2.5807	55.9019	21.6612	0.0179	0.1941	0.2120	-0.1762	-0.8309	0.0324	0.1101	0.3469	0.1605	0.5463	0.3370	0.8834	0.330	Design Good	Design Good
32	9	'COMBO_4D	0.9967	69.4649	69.6924	0.0069	0.2412	0.2481	-0.2343	-0.9442	0.0402	0.1215	0.3827	0.1994	0.6027	0.4188	1.0216	0.355	Design Good	Design Good
33	9	'COMBO_4E	2.5074	-7.2940	-2.9090	0.0174	0.0253	0.0427	-0.0079	-0.1852	0.0042	0.0294	0.0927	0.0209	0.1461	0.0440	0.1900	0.153	Design Good	Design Good
34	9	'COMBO_4F	4.5939	53.8229	11.7162	0.0319	0.1869	0.2188	-0.1550	-0.7084	0.0311	0.1207	0.3801	0.1545	0.5987	0.3245	0.9232	0.338	Design Good	Design Good
35	9	'COMBO_4G	2.1459	74.7839	34.8497	0.0149	0.2597	0.2746	-0.2448	-0.8915	0.0433	0.1382	0.4355	0.2147	0.6859	0.4509	1.1368	0.375	Design Good	Design Good
36	9	'COMBO_4H	4.1619	57.5219	13.8211	0.0289	0.1997	0.2286	-0.1708	-0.7472	0.0333	0.1238	0.3899	0.1652	0.6141	0.3468	0.9609	0.344	Design Good	Design Good
37	9	'COMBO_4I	2.5779	71.0849	27.5747	0.0179	0.2468	0.2647	-0.2289	-0.8647	0.0411	0.1351	0.4257	0.2041	0.6705	0.4286	1.0991	0.368	Design Good	Design Good
38	9	'COMBO_4J	4.0885	-5.6740	-1.3878	0.0284	0.0197	0.0481	0.0087	0.1807	0.0033	0.0378	0.1189	0.0163	0.1873	0.0342	0.2215	0.165	Design Good	Design Good
39	9	'COMBO_6A	2.5656	52.3276	20.3962	0.0178	0.1817	0.1995	-0.1639	-0.8214	0.0303	0.1041	0.3280	0.1502	0.5166	0.3155	0.8321	0.321	Design Good	Design Good
40	9	'COMBO_6B	0.1176	73.2886	623.4596	0.0008	0.2545	0.2553	-0.2537	-0.9938	0.0424	0.1217	0.3833	0.2104	0.6037	0.4419	1.0456	0.359	Design Good	Design Good
41	9	'COMBO_6C	2.1336	56.0266	26.2598	0.0148	0.1945	0.2094	-0.1797	-0.8585	0.0324	0.1072	0.3377	0.1609	0.5320	0.3378	0.8698	0.328	Design Good	Design Good
42	9	'COMBO_6D	0.5496	69.5896	126.6298	0.0038	0.2416	0.2454	-0.2378	-0.9689	0.0403	0.1186	0.3736	0.1998	0.5884	0.4196	1.0079	0.353	Design Good	Design Good
43	9	'COMBO_6E	2.0602	-7.1693	-3.4799	0.0143	0.0249	0.0392	-0.0106	-0.2701	0.0041	0.0261	0.0823	0.0206	0.1296	0.0432	0.1729	0.146	Design Good	Design Good
44	9	'COMBO_5A	2.6473	29.4265	11.1157	0.0184	0.1022	0.1206	-0.0838	-0.6950	0.0170	0.0669	0.2108	0.0845	0.3320	0.1774	0.5094	0.251	Design Good	Design Good
45	9	'COMBO_5B	2.3577	28.7370	12.1885	0.0164	0.0998	0.1162	-0.0834	-0.7181	0.0166	0.0638	0.2009	0.0825	0.3164	0.1733	0.4896	0.246	Design Good	Design Good
46	9	'COMBO_5C	2.6218	-28.4769	-10.8615	0.0182	0.0989	0.1171	-0.0807	-0.6890	0.0165	0.0652	0.2053	0.0818	0.3233	0.1717	0.4950	0.247	Design Good	Design Good
47	9	'COMBO_5D	2.3322	-29.1664	-12.5057	0.0162	0.1013	0.1175	-0.0851	-0.7242	0.0169	0.0643	0.2025	0.0837	0.3190	0.1759	0.4949	0.247	Design Good	Design Good
48	9	'COMBO_7A	1.5676	28.9032	18.4374	0.0109	0.1004	0.1112	-0.0895	-0.8043	0.0167	0.0586	0.1845	0.0830	0.2905	0.1743	0.4648	0.240	Design Good	Design Good
49	9	'COMBO_7B	1.2781	28.2138	22.0754	0.0089	0.0980	0.1068	-0.0891	-0.8339	0.0163	0.0554	0.1745	0.0810	0.2749	0.1701	0.4450	0.234	Design Good	Design Good
50	9	'COMBO_7C	1.5422	-29.0002	-18.8047	0.0107	0.1007	0.1114	-0.0900	-0.8077	0.0168	0.0585	0.1844	0.0833	0.2904	0.1749	0.4653	0.240	Design Good	Design Good
51	9	'COMBO_7D	1.2526	-29.6897	-23.7025	0.0087	0.1031	0.1118	-0.0944	-0.8444	0.0172	0.0577	0.1816	0.0852	0.2861	0.1790	0.4651	0.240	Design Good	Design Good

"BasePlate Joint 9"

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No. 24915-10-DBC-00-00004
Sheet No. D2-23 / D2-51
Sheet Rev. D

Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations

By: R. Murphy Date: 12/16/2007

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
61	Joint	OutputCase	Fy	Mx	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	design check plate	design check ped bearing
62	Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
63	9	'COMBO_1'	2.0869	5.1053	2.4464	0.0145	0.0177	0.0322	-0.0032	-0.1004	0.0030	0.0229	0.0722	0.0147	0.1137	0.0308	0.1445	0.1335	Design Good	Design Good
64	9	'COMBO_2A	1.7887	4.3759	2.4464	0.0124	0.0152	0.0276	-0.0028	-0.1004	0.0025	0.0196	0.0619	0.0126	0.0974	0.0264	0.1238	0.1236	Design Good	Design Good
65	9	'COMBO_2B	3.3699	10.4146	3.0905	0.0234	0.0362	0.0596	-0.0128	-0.2142	0.0060	0.0406	0.1278	0.0299	0.2013	0.0628	0.2641	0.1806	Design Good	Design Good
66	9	'COMBO_3A	2.1480	-0.1982	-0.0923	0.0149	0.0007	0.0156	0.0142	0.9118	0.0001	0.0152	0.0480	0.0006	0.0756	0.0012	0.0768	0.0974	Design Good	Design Good
67	9	'COMBO_3B	2.4007	6.3906	2.6619	0.0167	0.0222	0.0389	-0.0055	-0.1420	0.0037	0.0272	0.0857	0.0183	0.1350	0.0385	0.1735	0.1464	Design Good	Design Good
68	9	'COMBO_3C	1.1767	2.3692	2.0134	0.0082	0.0082	0.0164	-0.0001	-0.0033	0.0014	0.0121	0.0380	0.0068	0.0599	0.0143	0.0742	0.0957	Design Good	Design Good
69	9	'COMBO_3D	2.1847	5.6810	2.6003	0.0152	0.0197	0.0349	-0.0046	-0.1305	0.0033	0.0245	0.0773	0.0163	0.1218	0.0343	0.1560	0.1388	Design Good	Design Good
70	9	'COMBO_3E	1.3927	3.0789	2.2107	0.0097	0.0107	0.0204	-0.0010	-0.0500	0.0018	0.0147	0.0465	0.0088	0.0732	0.0186	0.0917	0.1064	Design Good	Design Good
71	9	'COMBO_3F	7.2078	19.1256	2.6535	0.0501	0.0664	0.1165	-0.0164	-0.1404	0.0111	0.0816	0.2570	0.0549	0.4048	0.1153	0.5201	0.2534	Design Good	Design Good
72	9	'COMBO_3G	7.4605	25.7145	3.4468	0.0518	0.0893	0.1411	-0.0375	-0.2656	0.0149	0.0942	0.2968	0.0738	0.4674	0.1550	0.6225	0.2772	Design Good	Design Good
73	9	'COMBO_3H	1.1767	2.3692	2.0134	0.0082	0.0082	0.0164	-0.0001	-0.0033	0.0014	0.0121	0.0380	0.0068	0.0599	0.0143	0.0742	0.0957	Design Good	Design Good
74	9	'COMBO_3I	2.1847	5.6810	2.6003	0.0152	0.0197	0.0349	-0.0046	-0.1305	0.0033	0.0245	0.0773	0.0163	0.1218	0.0343	0.1560	0.1388	Design Good	Design Good
75	9	'COMBO_3J	1.3927	3.0789	2.2107	0.0097	0.0107	0.0204	-0.0010	-0.0500	0.0018	0.0147	0.0465	0.0088	0.0732	0.0186	0.0917	0.1064	Design Good	Design Good
76	9	'COMBO_3K	6.8485	23.6998	3.4606	0.0476	0.0823	0.1298	-0.0347	-0.2675	0.0137	0.0866	0.2729	0.0680	0.4299	0.1429	0.5728	0.2659	Design Good	Design Good
77	9	'COMBO_3L	6.8485	23.6998	3.4606	0.0476	0.0823	0.1298	-0.0347	-0.2675	0.0137	0.0866	0.2729	0.0680	0.4299	0.1429	0.5728	0.2659	Design Good	Design Good
78	9	'COMBO_3M	1.7887	4.3759	2.4464	0.0124	0.0152	0.0276	-0.0028	-0.1004	0.0025	0.0196	0.0619	0.0126	0.0974	0.0264	0.1238	0.1236	Design Good	Design Good
79	9	'COMBO_3N	1.7887	4.3759	2.4464	0.0124	0.0152	0.0276	-0.0028	-0.1004	0.0025	0.0196	0.0619	0.0126	0.0974	0.0264	0.1238	0.1236	Design Good	Design Good
80	9	'COMBO_4A	3.0127	8.4053	2.7899	0.0209	0.0292	0.0501	-0.0083	-0.1649	0.0049	0.0348	0.1096	0.0241	0.1726	0.0507	0.2233	0.166	Design Good	Design Good
81	9	'COMBO_4B	0.5647	0.3625	0.6418	0.0039	0.0013	0.0052	0.0027	0.5141	0.0002	0.0045	0.0142	0.0010	0.0224	0.0022	0.0246	0.0551	Design Good	Design Good
82	9	'COMBO_4C	2.5807	6.9860	2.7070	0.0179	0.0243	0.0422	-0.0063	-0.1502	0.0040	0.0294	0.0927	0.0201	0.1461	0.0421	0.1882	0.1524	Design Good	Design Good
83	9	'COMBO_4D	0.9967	1.7818	1.7876	0.0069	0.0062	0.0131	0.0007	0.0561	0.0010	0.0099	0.0311	0.0051	0.0489	0.0107	0.0597	0.0858	Design Good	Design Good
84	9	'COMBO_4E	2.5074	-4.7724	-1.9034	0.0174	0.0166	0.0340	0.0008	0.0248	0.0028	0.0253	0.0796	0.0137	0.1254	0.0288	0.1542	0.138	Design Good	Design Good
85	9	'COMBO_4F	4.5939	14.4440	3.1442	0.0319	0.0502	0.0821	-0.0183	-0.2224	0.0084	0.0557	0.1755	0.0415	0.2765	0.0871	0.3636	0.2119	Design Good	Design Good
86	9	'COMBO_4G	2.1459	6.4012	2.9830	0.0149	0.0222	0.0371	-0.0073	-0.1973	0.0037	0.0255	0.0802	0.0184	0.1263	0.0386	0.1649	0.1427	Design Good	Design Good
87	9	'COMBO_4H	4.1619	13.0247	3.1295	0.0289	0.0452	0.0741	-0.0163	-0.2202	0.0075	0.0504	0.1587	0.0374	0.2500	0.0785	0.3285	0.2014	Design Good	Design Good
88	9	'COMBO_4I	2.5779	7.8205	3.0337	0.0179	0.0272	0.0451	-0.0093	-0.2054	0.0045	0.0308	0.0970	0.0225	0.1528	0.0472	0.2000	0.1571	Design Good	Design Good
89	9	'COMBO_4J	4.0885	1.2663	0.3097	0.0284	0.0044	0.0328	0.0240	0.7318	0.0007	0.0305	0.0960	0.0036	0.1512	0.0076	0.1589	0.14	Design Good	Design Good
90	9	'COMBO_6A	2.5656	7.3113	2.8498	0.0178	0.0254	0.0432	-0.0076	-0.1752	0.0042	0.0299	0.0941	0.0210	0.1482	0.0441	0.1923	0.1541	Design Good	Design Good
91	9	'COMBO_6B	0.1176	-0.7315	-6.2229	0.0008	0.0025	0.0034	-0.0017	-0.5136	0.0004	0.0020	0.0064	0.0021	0.0100	0.0044	0.0144	0.0422	Design Good	Design Good
92	9	'COMBO_6C	2.1336	5.8920	2.7616	0.0148	0.0205	0.0353	-0.0056	-0.1599	0.0034	0.0245	0.0773	0.0169	0.1217	0.0355	0.1572	0.1393	Design Good	Design Good
93	9	'COMBO_6D	0.5496	0.6878	1.2516	0.0038	0.0024	0.0062	0.0014	0.2302	0.0004	0.0050	0.0156	0.0020	0.0246	0.0041	0.0287	0.0595	Design Good	Design Good
94	9	'COMBO_6E	2.0602	-5.8664	-2.8475	0.0143	0.0204	0.0347	-0.0061	-0.1748	0.0034	0.0240	0.0755	0.0168	0.1190	0.0354	0.1544	0.138	Design Good	Design Good
95	9	'COMBO_5A	2.6473	25.3616	9.5802	0.0184	0.0881	0.1064	-0.0697	-0.6546	0.0147	0.0602	0.1897	0.0728	0.2987	0.1529	0.4516	0.2361	Design Good	Design Good
96	9	'COMBO_5B	2.3577	-11.3164	-4.7998	0.0164	0.0393	0.0557	-0.0229	-0.4117	0.0065	0.0350	0.1104	0.0325	0.1738	0.0682	0.2421	0.1729	Design Good	Design Good
97	9	'COMBO_5C	2.6218	25.2348	9.6249	0.0182	0.0876	0.1058	-0.0694	-0.6559	0.0146	0.0598	0.1885	0.0725	0.2968	0.1521	0.4490	0.2354	Design Good	Design Good
98	9	'COMBO_5D	2.3322	-11.4433	-4.9066	0.0162	0.0397	0.0559	-0.0235	-0.4208	0.0066	0.0351	0.1105	0.0329	0.1740	0.0690	0.2430	0.1732	Design Good	Design Good
99	9	'COMBO_7A	1.5676	21.8522	13.9395	0.0109	0.0759	0.0868	-0.0650	-0.7491	0.0126	0.0469	0.1478	0.0627	0.2328	0.1318	0.3846	0.2122	Design Good	Design Good
100	9	'COMBO_7B	1.2781	-14.8259	-11.6003	0.0089	0.0515	0.0604	-0.0426	-0.7059	0.0086	0.0333	0.1050	0.0426	0.1653	0.0894	0.2547	0.1773	Design Good	Design Good
101	9	'COMBO_7C	1.5422	21.7253	14.0874	0.0107	0.0754	0.0861	-0.0647	-0.7514	0.0126	0.0465	0.1466	0.0624	0.2309	0.1310	0.3619	0.2114	Design Good	Design Good
102	9	'COMBO_7D	1.2526	-14.9528	-11.9374	0.0087	0.0519	0.0606	-0.0432	-0.7130	0.0087	0.0334	0.1051	0.0429	0.1655	0.0902	0.2557	0.1777	Design Good	Design Good

"BasePlate Joint 9"

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
3	HSS 6X6X.375																			
4	12"x12" Plate																			
5	A (in^2)		I (in)	c (in)	t (in)	n(in)	d (in)	Fy (ksi)	A2 (in^2)	Aratio	Φc	Fc (ksi)	Fp (ksi)							
6	144		1728	6	0.75	3.15	12	36	324	1.5	0.6	4	3.06							
7																				
8																				
9																				
10	Joint	OutputCase	Fy	Mz	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	design check plate	design check ped bearing
11	Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
12	10	'COMBO_1'	2.0869	-0.5820	-0.2789	0.0145	0.0020	0.0165	0.0125	0.7553	0.0003	0.0155	0.0487	0.0017	0.0767	0.0035	0.0802	0.099486	Design Good	Design Good
13	10	'COMBO_2A	1.7887	-0.4988	-0.2789	0.0124	0.0017	0.0142	0.0107	0.7553	0.0003	0.0132	0.0417	0.0014	0.0657	0.0030	0.0687	0.092106	Design Good	Design Good
14	10	'COMBO_2B	3.3699	1.1212	0.3327	0.0234	0.0039	0.0273	0.0195	0.7147	0.0006	0.0253	0.0795	0.0032	0.1253	0.0068	0.1320	0.127675	Design Good	Design Good
15	10	'COMBO_3A	2.2214	-3.8828	-1.7479	0.0154	0.0135	0.0289	0.0019	0.0673	0.0022	0.0218	0.0688	0.0111	0.1083	0.0234	0.1317	0.12752	Design Good	Design Good
16	10	'COMBO_3B	2.4007	25.8520	10.7684	0.0167	0.0898	0.1064	-0.0731	-0.6867	0.0150	0.0593	0.1868	0.0742	0.2943	0.1559	0.4501	0.235734	Design Good	Design Good
17	10	'COMBO_3C	1.1767	36.3325	30.8756	0.0082	0.1262	0.1343	-0.1180	-0.8783	0.0210	0.0681	0.2145	0.1043	0.3378	0.2191	0.5569	0.262207	Design Good	Design Good
18	10	'COMBO_3D	2.1847	27.7015	12.6796	0.0152	0.0962	0.1114	-0.0810	-0.7275	0.0160	0.0609	0.1917	0.0795	0.3019	0.1670	0.4690	0.240617	Design Good	Design Good
19	10	'COMBO_3E	1.3927	34.4830	24.7591	0.0097	0.1197	0.1294	-0.1101	-0.8505	0.0200	0.0665	0.2096	0.0990	0.3301	0.2079	0.5381	0.257733	Design Good	Design Good
20	10	'COMBO_3F	7.2812	1.3013	0.1787	0.0506	0.0045	0.0551	0.0460	0.8359	0.0008	0.0527	0.1660	0.0037	0.2615	0.0078	0.2694	0.182355	Design Good	Design Good
21	10	'COMBO_3G	7.4605	31.0360	4.1601	0.0518	0.1078	0.1596	-0.0560	-0.3507	0.0180	0.1030	0.3244	0.0891	0.5110	0.1871	0.6981	0.293577	Design Good	Design Good
22	10	'COMBO_3H	1.1767	36.3325	30.8756	0.0082	0.1262	0.1343	-0.1180	-0.8783	0.0210	0.0681	0.2145	0.1043	0.3378	0.2191	0.5569	0.262207	Design Good	Design Good
23	10	'COMBO_3I	2.1847	27.7015	12.6796	0.0152	0.0962	0.1114	-0.0810	-0.7275	0.0160	0.0609	0.1917	0.0795	0.3019	0.1670	0.4690	0.240617	Design Good	Design Good
24	10	'COMBO_3J	1.3927	34.4830	24.7591	0.0097	0.1197	0.1294	-0.1101	-0.8505	0.0200	0.0665	0.2096	0.0990	0.3301	0.2079	0.5381	0.257733	Design Good	Design Good
25	10	'COMBO_3K	6.8485	4.6852	0.6841	0.0476	0.0163	0.0638	0.0313	0.4902	0.0027	0.0553	0.1742	0.0135	0.2743	0.0282	0.3025	0.193262	Design Good	Design Good
26	10	'COMBO_3L	6.8485	4.6852	0.6841	0.0476	0.0163	0.0638	0.0313	0.4902	0.0027	0.0553	0.1742	0.0135	0.2743	0.0282	0.3025	0.193262	Design Good	Design Good
27	10	'COMBO_3M	1.7887	-0.4989	-0.2789	0.0124	0.0017	0.0142	0.0107	0.7552	0.0003	0.0132	0.0417	0.0014	0.0657	0.0030	0.0687	0.092107	Design Good	Design Good
28	10	'COMBO_3N	1.7887	-0.4989	-0.2789	0.0124	0.0017	0.0142	0.0107	0.7552	0.0003	0.0132	0.0417	0.0014	0.0657	0.0030	0.0687	0.092107	Design Good	Design Good
29	10	'COMBO_4A	3.0127	52.2029	17.3274	0.0209	0.1813	0.2022	-0.1603	-0.7930	0.0302	0.1070	0.3371	0.1499	0.5310	0.3147	0.8457	0.323122	Design Good	Design Good
30	10	'COMBO_4B	0.5647	73.1639	129.5540	0.0039	0.2540	0.2580	-0.2501	-0.9696	0.0423	0.1246	0.3925	0.2101	0.6181	0.4411	1.0593	0.361625	Design Good	Design Good
31	10	'COMBO_4C	2.5907	55.9019	21.6612	0.0179	0.1941	0.2120	-0.1762	-0.8309	0.0324	0.1101	0.3469	0.1605	0.5463	0.3370	0.8834	0.330243	Design Good	Design Good
32	10	'COMBO_4D	0.9967	69.4649	69.6923	0.0069	0.2412	0.2481	-0.2343	-0.9442	0.0402	0.1215	0.3827	0.1994	0.6027	0.4188	1.0216	0.355133	Design Good	Design Good
33	10	'COMBO_4E	2.6541	-7.2687	-2.7379	0.0184	0.0252	0.0437	-0.0068	-0.1557	0.0042	0.0304	0.0958	0.0209	0.1509	0.0438	0.1947	0.155045	Design Good	Design Good
34	10	'COMBO_4F	4.5939	53.8229	11.7162	0.0319	0.1869	0.2188	-0.1550	-0.7084	0.0311	0.1207	0.3801	0.1545	0.5987	0.3245	0.9232	0.337602	Design Good	Design Good
35	10	'COMBO_4G	2.1459	74.7839	34.8497	0.0149	0.2597	0.2746	-0.2448	-0.8915	0.0433	0.1382	0.4355	0.2147	0.6859	0.4509	1.1368	0.37462	Design Good	Design Good
36	10	'COMBO_4H	4.1619	57.5219	13.8211	0.0289	0.1997	0.2286	-0.1708	-0.7472	0.0333	0.1238	0.3999	0.1652	0.6141	0.3468	0.9609	0.344424	Design Good	Design Good
37	10	'COMBO_4I	2.5779	71.0849	27.5747	0.0179	0.2468	0.2647	-0.2289	-0.8647	0.0411	0.1351	0.4257	0.2041	0.6705	0.4286	1.0991	0.368358	Design Good	Design Good
38	10	'COMBO_4J	4.2353	-5.6467	-1.3332	0.0294	0.0196	0.0490	0.0098	0.2000	0.0033	0.0387	0.1220	0.0162	0.1921	0.0340	0.2262	0.167099	Design Good	Design Good
39	10	'COMBO_6A	2.5656	52.3276	20.3962	0.0178	0.1817	0.1995	-0.1639	-0.8214	0.0303	0.1041	0.3280	0.1502	0.5166	0.3155	0.8321	0.320506	Design Good	Design Good
40	10	'COMBO_6B	0.1176	73.2886	623.4596	0.0008	0.2545	0.2553	-0.2537	-0.9936	0.0424	0.1217	0.3833	0.2104	0.6037	0.4419	1.0456	0.35929	Design Good	Design Good
41	10	'COMBO_6C	2.1336	56.0266	26.2598	0.0148	0.1945	0.2094	-0.1797	-0.8585	0.0324	0.1072	0.3377	0.1609	0.5320	0.3378	0.8698	0.327684	Design Good	Design Good
42	10	'COMBO_6D	0.5496	69.5896	126.6298	0.0038	0.2416	0.2454	-0.2378	-0.9689	0.0403	0.1186	0.3736	0.1998	0.5884	0.4196	1.0079	0.352756	Design Good	Design Good
43	10	'COMBO_6E	2.2069	-7.1420	-3.2361	0.0153	0.0248	0.0401	-0.0095	-0.2361	0.0041	0.0271	0.0854	0.0205	0.1345	0.0431	0.1775	0.148048	Design Good	Design Good
44	10	'COMBO_5A	2.6473	29.4265	11.1157	0.0184	0.1022	0.1206	-0.0838	-0.6950	0.0170	0.0669	0.2108	0.0845	0.3320	0.1774	0.5094	0.25078	Design Good	Design Good
45	10	'COMBO_5B	2.3577	28.7370	12.1885	0.0164	0.0998	0.1162	-0.0834	-0.7181	0.0166	0.0638	0.2009	0.0825	0.3164	0.1733	0.4896	0.245864	Design Good	Design Good
46	10	'COMBO_5C	2.6218	-28.4769	-10.8615	0.0182	0.0989	0.1171	-0.0807	-0.6890	0.0165	0.0652	0.2053	0.0818	0.3233	0.1717	0.4950	0.247217	Design Good	Design Good
47	10	'COMBO_5D	2.3322	-29.1664	-12.5057	0.0162	0.1013	0.1175	-0.0851	-0.7242	0.0169	0.0643	0.2025	0.0837	0.3190	0.1759	0.4949	0.247172	Design Good	Design Good
48	10	'COMBO_7A	1.5676	28.9032	18.4374	0.0109	0.1004	0.1112	-0.0895	-0.8043	0.0167	0.0586	0.1845	0.0830	0.2905	0.1743	0.4648	0.239542	Design Good	Design Good
49	10	'COMBO_7B	1.2781	28.2138	22.0754	0.0089	0.0980	0.1068	-0.0891	-0.8339	0.0163	0.0554	0.1745	0.0810	0.2749	0.1701	0.4450	0.23439	Design Good	Design Good
50	10	'COMBO_7C	1.5422	-29.0002	-18.8047	0.0107	0.1007	0.1114	-0.0900	-0.8077	0.0168	0.0585	0.1844	0.0833	0.2904	0.1749	0.4653	0.239671	Design Good	Design Good
51	10	'COMBO_7D	1.2526	-29.8897	-23.7025	0.0087	0.1031	0.1118	-0.0944	-0.8444	0.0172	0.0577	0.1816	0.0852	0.2861	0.1790	0.4651	0.239625	Design Good	Design Good

"BasePlate Joint 10"

BECHTEL PARSONS BLUE GRASS	**Calculation Sheet**	Project:	BGCAPP
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.		Job Number:	743341
		Calc. No.	24915-10-DBC-00-00004
Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations		Sheet No.	D2-25 / D2-51
By: R. Murphy	Date: 12/16/2007	Sheet Rev.	D

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
58	Joint	OutputCase	Fy	Mx	e	σ_axial	σ_bend	σ_max	σ_min	ratio	stress_slope	σ_face	F_rect	F_tri	M_rect	M_tri	M_design	tp	design check plate	design check ped bearing
59	Text	Text	Kip	Kip-in	in	ksi	ksi	ksi	ksi			ksi	Kip	Kip	Kip-in	Kip-in	Kip-in	in		
60	10	'COMBO_1'	2.0869	-5.1053	-2.4464	0.0145	0.0177	0.0322	-0.0032	-0.1004	0.0030	0.0229	0.0722	0.0147	0.1137	0.0308	0.1445	0.133543	Design Good	Design Good
61	10	'COMBO_2A	1.7887	-4.3759	-2.4464	0.0124	0.0152	0.0276	-0.0028	-0.1004	0.0025	0.0196	0.0619	0.0126	0.0974	0.0264	0.1238	0.123637	Design Good	Design Good
62	10	'COMBO_2B	3.3699	-10.4146	-3.0905	0.0234	0.0362	0.0596	-0.0128	-0.2142	0.0060	0.0406	0.1278	0.0299	0.2013	0.0628	0.2641	0.180574	Design Good	Design Good
63	10	'COMBO_3A	2.2214	-11.5653	-5.2062	0.0154	0.0402	0.0556	-0.0247	-0.4449	0.0067	0.0345	0.1087	0.0332	0.1712	0.0697	0.2409	0.172455	Design Good	Design Good
64	10	'COMBO_3B	2.4007	-6.3906	-2.6619	0.0167	0.0222	0.0389	-0.0055	-0.1420	0.0037	0.0272	0.0857	0.0183	0.1350	0.0385	0.1735	0.14637	Design Good	Design Good
65	10	'COMBO_3C	1.1767	-2.3692	-2.0134	0.0082	0.0082	0.0164	-0.0001	-0.0033	0.0014	0.0121	0.0380	0.0068	0.0599	0.0143	0.0742	0.095719	Design Good	Design Good
66	10	'COMBO_3D	2.1847	-5.6810	-2.6003	0.0152	0.0197	0.0349	-0.0046	-0.1305	0.0033	0.0245	0.0773	0.0163	0.1218	0.0343	0.1560	0.138781	Design Good	Design Good
67	10	'COMBO_3E	1.3927	-3.0789	-2.2107	0.0097	0.0107	0.0204	-0.0010	-0.0500	0.0018	0.0147	0.0465	0.0088	0.0732	0.0186	0.0917	0.106424	Design Good	Design Good
68	10	'COMBO_3F	7.2812	-30.8892	-4.2423	0.0506	0.1073	0.1578	-0.0567	-0.3592	0.0179	0.1015	0.3198	0.0887	0.5036	0.1862	0.6899	0.291834	Design Good	Design Good
69	10	'COMBO_3G	7.4605	-25.7145	-3.4468	0.0518	0.0893	0.1411	-0.0375	-0.2656	0.0149	0.0942	0.2968	0.0738	0.4674	0.1550	0.6225	0.277219	Design Good	Design Good
70	10	'COMBO_3H	1.1767	-2.3692	-2.0134	0.0082	0.0082	0.0164	-0.0001	-0.0033	0.0014	0.0121	0.0380	0.0063	0.0599	0.0143	0.0742	0.095719	Design Good	Design Good
71	10	'COMBO_3I	2.1847	-5.6810	-2.6003	0.0152	0.0197	0.0349	-0.0046	-0.1305	0.0033	0.0245	0.0773	0.0163	0.1218	0.0343	0.1560	0.138781	Design Good	Design Good
72	10	'COMBO_3J	1.3927	-3.0789	-2.2107	0.0097	0.0107	0.0204	-0.0010	-0.0500	0.0018	0.0147	0.0465	0.0088	0.0732	0.0186	0.0917	0.106424	Design Good	Design Good
73	10	'COMBO_3K	6.8485	-23.6998	-3.4606	0.0476	0.0823	0.1298	-0.0347	-0.2675	0.0137	0.0866	0.2729	0.0680	0.4299	0.1429	0.5728	0.265918	Design Good	Design Good
74	10	'COMBO_3L	6.8485	-23.6998	-3.4606	0.0476	0.0823	0.1298	-0.0347	-0.2675	0.0137	0.0866	0.2729	0.0680	0.4299	0.1429	0.5728	0.265918	Design Good	Design Good
75	10	'COMBO_3M	1.7887	-4.3759	-2.4464	0.0124	0.0152	0.0276	-0.0028	-0.1004	0.0025	0.0196	0.0619	0.0126	0.0974	0.0264	0.1238	0.123637	Design Good	Design Good
76	10	'COMBO_3N	1.7887	-4.3759	-2.4464	0.0124	0.0152	0.0276	-0.0028	-0.1004	0.0025	0.0196	0.0619	0.0126	0.0974	0.0264	0.1238	0.123637	Design Good	Design Good
77	10	'COMBO_4A	3.0127	-8.4053	-2.7899	0.0209	0.0292	0.0501	-0.0083	-0.1649	0.0049	0.0348	0.1096	0.0241	0.1726	0.0507	0.2233	0.166019	Design Good	Design Good
78	10	'COMBO_4B	0.5647	-0.3625	-0.6418	0.0039	0.0013	0.0052	0.0027	0.5141	0.0002	0.0045	0.0142	0.0010	0.0224	0.0022	0.0246	0.055119	Design Good	Design Good
79	10	'COMBO_4C	2.5807	-6.9860	-2.7070	0.0179	0.0243	0.0422	-0.0063	-0.1502	0.0040	0.0294	0.0927	0.0201	0.1461	0.0421	0.1882	0.152428	Design Good	Design Good
80	10	'COMBO_4D	0.9967	-1.7818	-1.7876	0.0069	0.0062	0.0131	0.0007	0.0561	0.0010	0.0099	0.0311	0.0051	0.0489	0.0107	0.0597	0.085825	Design Good	Design Good
81	10	'COMBO_4E	2.6541	-18.7547	-7.0662	0.0184	0.0651	0.0836	-0.0467	-0.5568	0.0109	0.0494	0.1555	0.0538	0.2449	0.1131	0.3580	0.210227	Design Good	Design Good
82	10	'COMBO_4F	4.5939	-14.4440	-3.1442	0.0319	0.0502	0.0821	-0.0183	-0.2224	0.0084	0.0557	0.1755	0.0415	0.2765	0.0971	0.3636	0.211856	Design Good	Design Good
83	10	'COMBO_4G	2.1459	-6.4012	-2.9830	0.0149	0.0222	0.0371	-0.0073	-0.1973	0.0037	0.0255	0.0802	0.0184	0.1263	0.0386	0.1649	0.142684	Design Good	Design Good
84	10	'COMBO_4H	4.1619	-13.0247	-3.1295	0.0289	0.0452	0.0741	-0.0163	-0.2202	0.0075	0.0504	0.1587	0.0374	0.2500	0.0785	0.3285	0.201383	Design Good	Design Good
85	10	'COMBO_4I	2.5779	-7.8205	-3.0337	0.0179	0.0272	0.0451	-0.0093	-0.2054	0.0045	0.0308	0.0970	0.0225	0.1528	0.0472	0.2000	0.15712	Design Good	Design Good
86	10	'COMBO_4J	4.2353	-24.7934	-5.8540	0.0294	0.0861	0.1155	-0.0567	-0.4907	0.0143	0.0703	0.2215	0.0712	0.3488	0.1495	0.4983	0.248024	Design Good	Design Good
87	10	'COMBO_6A	2.5656	-7.3113	-2.8498	0.0178	0.0254	0.0432	-0.0076	-0.1752	0.0042	0.0299	0.0941	0.0210	0.1482	0.0441	0.1923	0.15408	Design Good	Design Good
88	10	'COMBO_6B	0.1176	0.7315	6.2229	0.0008	0.0025	0.0034	-0.0017	-0.5136	0.0004	0.0020	0.0064	0.0021	0.0100	0.0044	0.0144	0.042231	Design Good	Design Good
89	10	'COMBO_6C	2.1336	-5.8920	-2.7616	0.0148	0.0205	0.0353	-0.0056	-0.1599	0.0034	0.0245	0.0773	0.0169	0.1217	0.0355	0.1572	0.13933	Design Good	Design Good
90	10	'COMBO_6D	0.5496	-0.6878	-1.2516	0.0038	0.0024	0.0062	0.0014	0.2302	0.0004	0.0050	0.0156	0.0020	0.0246	0.0041	0.0287	0.059534	Design Good	Design Good
91	10	'COMBO_6E	2.2069	-17.6607	-8.0024	0.0153	0.0613	0.0766	-0.0460	-0.6001	0.0102	0.0445	0.1400	0.0507	0.2205	0.1065	0.3270	0.200932	Design Good	Design Good
92	10	'COMBO_5A	2.6473	11.4433	4.3227	0.0184	0.0397	0.0581	-0.0213	-0.3674	0.0066	0.0373	0.1174	0.0329	0.1848	0.0690	0.2538	0.177026	Design Good	Design Good
93	10	'COMBO_5B	2.3577	-25.2348	-10.7031	0.0164	0.0876	0.1040	-0.0712	-0.6851	0.0146	0.0580	0.1827	0.0725	0.2377	0.1521	0.4399	0.233033	Design Good	Design Good
94	10	'COMBO_5C	2.6218	11.3164	4.3162	0.0182	0.0393	0.0575	-0.0211	-0.3667	0.0065	0.0369	0.1161	0.0325	0.1829	0.0682	0.2512	0.176089	Design Good	Design Good
95	10	'COMBO_5D	2.3322	-25.3616	-10.8743	0.0162	0.0881	0.1043	-0.0719	-0.6893	0.0147	0.0580	0.1828	0.0728	0.2879	0.1529	0.4408	0.233278	Design Good	Design Good
96	10	'COMBO_7A	1.5676	14.9528	9.5384	0.0109	0.0519	0.0628	-0.0410	-0.6533	0.0087	0.0355	0.1120	0.0429	0.1764	0.0902	0.2665	0.181393	Design Good	Design Good
97	10	'COMBO_7B	1.2781	-21.7253	-16.9986	0.0089	0.0754	0.0843	-0.0666	-0.7895	0.0125	0.0447	0.1408	0.0624	0.2218	0.1310	0.3528	0.208697	Design Good	Design Good
98	10	'COMBO_7C	1.5422	14.3259	9.6136	0.0107	0.0515	0.0622	-0.0408	-0.6556	0.0086	0.0352	0.1108	0.0426	0.1744	0.0894	0.2638	0.180478	Design Good	Design Good
99	10	'COMBO_7D	1.2526	-21.8522	-17.4455	0.0087	0.0759	0.0846	-0.0672	-0.7843	0.0126	0.0447	0.1409	0.0627	0.2220	0.1318	0.3537	0.208971	Design Good	Design Good

"BasePlate Joint 10"

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No. 24915-10-DBC-00-00004
Sheet No. D2-26 / D2-51
Sheet Rev. D

Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations

By: R. Murphy Date: 12/16/2007

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
3	N.plate (in)	B.plate (in)	x.a (in)	N.prime (in)	A.prime (in)	e.kern	φ	N.design				Nsa (kip)	Ncbg (kip)	Npn (kip)	Nsb (kip)		
4	12	12	1.5	10.5	4.5	2	0.85	14.82528	<---one anchor			one anchor	two anchors	one anchor	one anchor		
5												77.6	34.883	20.93	36.83		
6											ΦN	65.96	29.65055	17.7905	31.3055	<--reduced by phi factor	
7																	
8	Joint	OutputCase	Fy	Mz	e	fp	anchor_tensio	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor				
9	Text	Text	Kip	Kip-in	in		n					Kips	Kips	Nsa check	Ncbg check	Nsb check	Npn check
10	9	'COMBO_1'	2.0869	-0.5820	-0.2789	0.0165	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
11	9	'COMBO_2A	1.7887	-0.4988	-0.2789	0.0142	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
12	9	'COMBO_2B	3.3699	1.1212	0.3327	0.0273	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
13	9	'COMBO_3A	2.1480	-3.8963	-1.8139	0.0284	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	9	'COMBO_3B	2.4007	25.8521	10.7684	0.1064	in tension	6.7055	24.4602	7.0398	7.0398	2.0950	1.0475	Design OK	Design OK	Design OK	Design OK
15	9	'COMBO_3C	1.1767	36.3326	30.8756	0.1343	in tension	8.4626	25.3995	6.1005	6.1005	3.7400	1.8700	Design OK	Design OK	Design OK	Design OK
16	9	'COMBO_3D	2.1847	27.7016	12.6796	0.1114	in tension	7.0155	24.6684	6.8316	6.8316	2.3797	1.1899	Design OK	Design OK	Design OK	Design OK
17	9	'COMBO_3E	1.3927	34.4831	24.7592	0.1294	in tension	8.1525	25.2689	6.2311	6.2311	3.4453	1.7226	Design OK	Design OK	Design OK	Design OK
18	9	'COMBO_3F	7.2078	1.2876	0.1786	0.0545	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
19	9	'COMBO_3G	7.4605	31.0360	4.1601	0.1596	in tension	10.0531	22.5044	8.9956	8.9956	1.1523	0.5761	Design OK	Design OK	Design OK	Design OK
20	9	'COMBO_3H	1.1767	36.3326	30.8756	0.1343	in tension	8.4626	25.3995	6.1005	6.1005	3.7400	1.8700	Design OK	Design OK	Design OK	Design OK
21	9	'COMBO_3I	2.1847	27.7016	12.6796	0.1114	in tension	7.0155	24.6684	6.8316	6.8316	2.3797	1.1899	Design OK	Design OK	Design OK	Design OK
22	9	'COMBO_3J	1.3927	34.4831	24.7592	0.1294	in tension	8.1525	25.2689	6.2311	6.2311	3.4453	1.7226	Design OK	Design OK	Design OK	Design OK
23	9	'COMBO_3K	6.8485	4.6852	0.6841	0.0638	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
24	9	'COMBO_3L	6.8485	4.6852	0.6841	0.0638	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
25	9	'COMBO_3M	1.7887	-0.4988	-0.2788	0.0142	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
26	9	'COMBO_3N	1.7887	-0.4988	-0.2788	0.0142	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
27	9	'COMBO_4A	3.0127	52.2029	17.3274	0.2022	in tension	12.7375	24.9932	6.5068	6.5068	4.8806	2.4403	Design OK	Design OK	Design OK	Design OK
28	9	'COMBO_4B	0.5647	73.1639	129.5541	0.2580	in tension	16.2517	25.8161	5.6839	5.6839	8.2327	4.1164	Design OK	Design OK	Design OK	Design OK
29	9	'COMBO_4C	2.5807	55.9019	21.6612	0.2120	in tension	13.3576	25.1759	6.3241	6.3241	5.4645	2.7322	Design OK	Design OK	Design OK	Design OK
30	9	'COMBO_4D	0.9967	69.4649	69.6924	0.2481	in tension	15.6315	25.7019	5.7981	5.7981	7.6349	3.8175	Design OK	Design OK	Design OK	Design OK
31	9	'COMBO_4E	2.5074	-7.2940	-2.9090	0.0427	in tension	2.6925	29.9413	1.5587	1.5587	-2.1077	-1.0538	Design OK	Design OK	Design OK	Design OK
32	9	'COMBO_4F	4.5939	53.8229	11.7162	0.2188	in tension	13.7836	24.5713	6.9287	6.9287	4.5015	2.2508	Design OK	Design OK	Design OK	Design OK
33	9	'COMBO_4G	2.1459	74.7839	34.8497	0.2746	in tension	17.2978	25.4605	6.0395	6.0395	7.8037	3.9018	Design OK	Design OK	Design OK	Design OK
34	9	'COMBO_4H	4.1619	57.5219	13.8211	0.2286	in tension	14.4037	24.7671	6.7329	6.7329	5.0742	2.5371	Design OK	Design OK	Design OK	Design OK
35	9	'COMBO_4I	2.5779	71.0849	27.5747	0.2647	in tension	16.6777	25.3359	6.1641	6.1641	7.2128	3.6064	Design OK	Design OK	Design OK	Design OK
36	9	'COMBO_4J	4.0885	-5.6740	-1.3878	0.0481	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
37	9	'COMBO_6A	2.5656	52.3276	20.3962	0.1995	in tension	12.5691	25.1302	6.3698	6.3698	5.0594	2.5297	Design OK	Design OK	Design OK	Design OK
38	9	'COMBO_6B	0.1176	73.2886	623.4596	0.2553	in tension	16.0833	25.9229	5.5771	5.5771	8.4252	4.2126	Design OK	Design OK	Design OK	Design OK
39	9	'COMBO_6C	2.1336	56.0266	26.2598	0.2094	in tension	13.1892	25.3063	6.1937	6.1937	5.6464	2.8232	Design OK	Design OK	Design OK	Design OK
40	9	'COMBO_6D	0.5496	69.5896	126.6298	0.2454	in tension	15.4632	25.8130	5.6870	5.6870	7.8256	3.9128	Design OK	Design OK	Design OK	Design OK
41	9	'COMBO_6E	2.0602	-7.1693	-3.4799	0.0392	in tension	2.4696	30.6247	0.8753	0.8753	-1.8543	-0.9272	Design OK	Design OK	Design OK	Design OK
42	9	'COMBO_5A	2.6473	29.4265	11.1157	0.1206	in tension	7.5952	24.5030	6.9970	6.9970	2.4140	1.2070	Design OK	Design OK	Design OK	Design OK
43	9	'COMBO_5B	2.3577	28.7370	12.1885	0.1162	in tension	7.3177	24.6207	6.8793	6.8793	2.4366	1.2183	Design OK	Design OK	Design OK	Design OK
44	9	'COMBO_5C	2.6218	-28.4769	-10.8615	0.1171	in tension	7.3764	33.6186	-2.1186	2.1186	-1.1335	-0.5667	Design OK	Design OK	Design OK	Design OK
45	9	'COMBO_5D	2.3322	-29.1664	-12.5057	0.1175	in tension	7.4005	33.8480	-2.3480	2.3480	-0.6774	-0.3387	Design OK	Design OK	Design OK	Design OK
46	9	'COMBO_7A	1.5676	28.9032	18.4374	0.1112	in tension	7.0084	25.0477	6.4523	6.4523	2.7390	1.3695	Design OK	Design OK	Design OK	Design OK
47	9	'COMBO_7B	1.2781	28.2138	22.0754	0.1068	in tension	6.7309	25.1898	6.3102	6.3102	2.7670	1.3835	Design OK	Design OK	Design OK	Design OK
48	9	'COMBO_7C	1.5422	-29.0002	-18.8047	0.1114	in tension	7.0185	34.3799	-2.8799	2.8799	0.3828	0.1914	Design OK	Design OK	Design OK	Design OK
49	9	'COMBO_7D	1.2526	-29.6897	-23.7025	0.1118	in tension	7.0426	34.6086	-3.1086	3.1086	0.8324	0.4162	Design OK	Design OK	Design OK	Design OK

"Anchors Tension Jt. 9"

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No. 24915-10-DBC-00-00004
Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations
Sheet No. D2-27 / D2-51
By: R. Murphy Date: 12/16/2007
Sheet Rev. D

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
62	Joint	OutputCase	Fy	Mx	e	fp	anchor_tensio	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor				
63	Text	Text	Kip	Kip-in	in		n					Kips	Kips	Nsa check	Ncbg check	Nsb check	Npn check
64	9	'COMBO_1'	2.0869	5.1053	2.4464	0.0322	in tension	2.0298	20.5560	10.9440	10.9440	0.0287	0.0144	Design OK	Design OK	Design OK	Design OK
65	9	'COMBO_2A	1.7887	4.3759	2.4464	0.0276	in tension	1.7398	20.5560	10.9440	10.9440	0.0246	0.0123	Design OK	Design OK	Design OK	Design OK
66	9	'COMBO_2B	3.3699	10.4146	3.0905	0.0596	in tension	3.7525	21.5243	9.9757	9.9757	0.1953	0.0976	Design OK	Design OK	Design OK	Design OK
67	9	'COMBO_3A	2.1480	-0.1982	-0.0923	0.0156	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
68	9	'COMBO_3B	2.4007	6.3906	2.6619	0.0389	in tension	2.4483	20.9309	10.5691	10.5691	0.0637	0.0319	Design OK	Design OK	Design OK	Design OK
69	9	'COMBO_3C	1.1767	2.3692	2.0134	0.0164	in tension	1.0331	19.5397	11.9603	11.9603	0.0000	0.0000	Design OK	Design OK	Design OK	Design OK
70	9	'COMBO_3D	2.1847	5.6810	2.6003	0.0349	in tension	2.1985	20.8300	10.6700	10.6700	0.0494	0.0247	Design OK	Design OK	Design OK	Design OK
71	9	'COMBO_3E	1.3927	3.0789	2.2107	0.0204	in tension	1.2828	20.0587	11.4413	11.4413	0.0051	0.0025	Design OK	Design OK	Design OK	Design OK
72	9	'COMBO_3F	7.2078	19.1256	2.6535	0.1165	in tension	7.3371	20.9173	10.5827	10.5827	0.1872	0.0936	Design OK	Design OK	Design OK	Design OK
73	9	'COMBO_3G	7.4605	25.7145	3.4468	0.1411	in tension	8.8890	21.9118	9.5882	9.5882	0.6566	0.3283	Design OK	Design OK	Design OK	Design OK
74	9	'COMBO_3H	1.1767	2.3692	2.0134	0.0164	in tension	1.0331	19.5397	11.9603	11.9603	0.0000	0.0000	Design OK	Design OK	Design OK	Design OK
75	9	'COMBO_3I	2.1847	5.6810	2.6003	0.0349	in tension	2.1985	20.8300	10.6700	10.6700	0.0494	0.0247	Design OK	Design OK	Design OK	Design OK
76	9	'COMBO_3J	1.3927	3.0789	2.2107	0.0204	in tension	1.2828	20.0587	11.4413	11.4413	0.0051	0.0025	Design OK	Design OK	Design OK	Design OK
77	9	'COMBO_3K	6.8485	23.6998	3.4606	0.1298	in tension	8.1805	21.9254	9.5746	9.5746	0.6111	0.3055	Design OK	Design OK	Design OK	Design OK
78	9	'COMBO_3L	6.8485	23.6998	3.4606	0.1298	in tension	8.1805	21.9254	9.5746	9.5746	0.6111	0.3055	Design OK	Design OK	Design OK	Design OK
79	9	'COMBO_3M	1.7887	4.3759	2.4464	0.0276	in tension	1.7398	20.5560	10.9440	10.9440	0.0246	0.0123	Design OK	Design OK	Design OK	Design OK
80	9	'COMBO_3N	1.7887	4.3759	2.4464	0.0276	in tension	1.7398	20.5560	10.9440	10.9440	0.0246	0.0123	Design OK	Design OK	Design OK	Design OK
81	9	'COMBO_4A	3.0127	8.4053	2.7899	0.0501	in tension	3.1567	21.1263	10.3737	10.3737	0.1060	0.0530	Design OK	Design OK	Design OK	Design OK
82	9	'COMBO_4B	0.5647	0.3625	0.6418	0.0052	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
83	9	'COMBO_4C	2.5807	6.9860	2.7070	0.0422	in tension	2.6573	21.0017	10.4983	10.4983	0.0761	0.0380	Design OK	Design OK	Design OK	Design OK
84	9	'COMBO_4D	0.9967	1.7818	1.7876	0.0131	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
85	9	'COMBO_4E	2.5074	-4.7724	-1.9034	0.0340	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
86	9	'COMBO_4F	4.5939	14.4440	3.1442	0.0821	in tension	5.1695	21.5878	9.9122	9.9122	0.2861	0.1431	Design OK	Design OK	Design OK	Design OK
87	9	'COMBO_4G	2.1459	6.4012	2.9830	0.0371	in tension	2.3391	21.3906	10.1094	10.1094	0.1062	0.0531	Design OK	Design OK	Design OK	Design OK
88	9	'COMBO_4H	4.1619	13.0247	3.1295	0.0741	in tension	4.6700	21.5707	9.9293	9.9293	0.2543	0.1271	Design OK	Design OK	Design OK	Design OK
89	9	'COMBO_4I	2.5779	7.8205	3.0337	0.0451	in tension	2.8386	21.4547	10.0453	10.0453	0.1377	0.0689	Design OK	Design OK	Design OK	Design OK
90	9	'COMBO_4J	4.0885	1.2663	0.3097	0.0328	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
91	9	'COMBO_6A	2.5656	7.3113	2.8498	0.0432	in tension	2.7218	21.2119	10.2881	10.2881	0.1013	0.0506	Design OK	Design OK	Design OK	Design OK
92	9	'COMBO_6B	0.1176	-0.7315	-6.2229	0.0034	in tension	0.2114	32.4304	-0.9304	0.9304	-0.0988	-0.0494	Design OK	Design OK	Design OK	Design OK
93	9	'COMBO_6C	2.1336	5.8920	2.7616	0.0353	in tension	2.2223	21.0846	10.4154	10.4154	0.0709	0.0354	Design OK	Design OK	Design OK	Design OK
94	9	'COMBO_6D	0.5496	0.6878	1.2516	0.0062	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
95	9	'COMBO_6E	2.0602	-5.8664	-2.8475	0.0347	in tension	2.1846	29.8558	1.6442	1.6442	-1.7181	-0.8590	Design OK	Design OK	Design OK	Design OK
96	9	'COMBO_5A	2.6473	25.3616	9.5802	0.1064	in tension	6.7060	24.2925	7.2075	7.2075	1.9559	0.9780	Design OK	Design OK	Design OK	Design OK
97	9	'COMBO_5B	2.3577	-11.3164	-4.7998	0.0557	in tension	3.5070	31.7002	-0.2002	0.2002	-2.2908	-1.1454	Design OK	Design OK	Design OK	Design OK
98	9	'COMBO_5C	2.6218	25.2348	9.6249	0.1058	in tension	6.6672	24.2995	7.2005	7.2005	1.9502	0.9751	Design OK	Design OK	Design OK	Design OK
99	9	'COMBO_5D	2.3322	-11.4433	-4.9066	0.0559	in tension	3.5236	31.7668	-0.2668	0.2668	-2.2427	-1.1214	Design OK	Design OK	Design OK	Design OK
100	9	'COMBO_7A	1.5676	21.8522	13.9395	0.0868	in tension	5.4660	24.7765	6.7235	6.7235	1.9324	0.9662	Design OK	Design OK	Design OK	Design OK
101	9	'COMBO_7B	1.2781	-14.8259	-11.6003	0.0604	in tension	3.8023	33.7289	-2.2289	2.2289	-0.4709	-0.2355	Design OK	Design OK	Design OK	Design OK
102	9	'COMBO_7C	1.5422	21.7253	14.0874	0.0861	in tension	5.4271	24.7880	6.7120	6.7120	1.9271	0.9635	Design OK	Design OK	Design OK	Design OK
103	9	'COMBO_7D	1.2526	-14.9528	-11.9374	0.0606	in tension	3.8189	33.7751	-2.2751	2.2751	-0.4251	-0.2126	Design OK	Design OK	Design OK	Design OK

"Anchors Tension Jt. 9"

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project: BGCAPP

Job Number: 743341

Calc. No. 24915-10-DBC-00-00004

Sheet No. D2-28 / D2-51

Sheet Rev. D

Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations

By: R. Murphy

Date: 12/16/2007

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
3	N.plate (in)	B.plate (in)	x.a (in)	N.prime (in	A.prime (in)	e.kern	φ	N.design				Nsa (kip)	Ncbg (kip)	Npn (kip)	Nsb (kip)		
4	12	12	1.5	10.5	4.5	2	0.85	14.82528	<---one anchor			one anchor	two anchors	one anchor	one anchor		
5												77.6	34.883	20.928	36.83		
6											ΦN	65.98	29.65055	17.7888	31.3055	<--reduced by phi factor	
7																	
8	Joint	OutputCase	Fy	Mz	e	fp		f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor				
9	Text	Text	Kip	Kip-in	in		anchor_tension					Kips	Kips	Nsa check	Ncbg check	Nsb check	Npn check
10	10	'COMBO_1'	2.0869	-0.5820	-0.2789	0.0165	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
11	10	'COMBO_2A	1.7887	-0.4988	-0.2789	0.0142	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
12	10	'COMBO_2B	3.3699	1.1212	0.3327	0.0273	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
13	10	'COMBO_3A	2.2214	-3.8828	-1.7479	0.0289	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
14	10	'COMBO_3B	2.4007	25.8520	10.7684	0.1064	in tension	6.7055	24.4602	7.0398	7.0398	2.0950	1.0475	Design OK	Design OK	Design OK	Design OK
15	10	'COMBO_3C	1.1767	36.3325	30.8756	0.1343	in tension	8.4626	25.3995	6.1005	6.1005	3.7400	1.8700	Design OK	Design OK	Design OK	Design OK
16	10	'COMBO_3D	2.1847	27.7015	12.6796	0.1114	in tension	7.0155	24.6684	6.8316	6.8316	2.3797	1.1899	Design OK	Design OK	Design OK	Design OK
17	10	'COMBO_3E	1.3927	34.4830	24.7591	0.1294	in tension	8.1525	25.2689	6.2311	6.2311	3.4453	1.7226	Design OK	Design OK	Design OK	Design OK
18	10	'COMBO_3F	7.2812	1.3013	0.1787	0.0551	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
19	10	'COMBO_3G	7.4605	31.0360	4.1601	0.1596	in tension	10.0531	22.5044	8.9956	8.9956	1.1523	0.5761	Design OK	Design OK	Design OK	Design OK
20	10	'COMBO_3H	1.1767	36.3325	30.8756	0.1343	in tension	8.4626	25.3995	6.1005	6.1005	3.7400	1.8700	Design OK	Design OK	Design OK	Design OK
21	10	'COMBO_3I	2.1847	27.7015	12.6796	0.1114	in tension	7.0155	24.6684	6.8316	6.8316	2.3797	1.1899	Design OK	Design OK	Design OK	Design OK
22	10	'COMBO_3J	1.3927	34.4830	24.7591	0.1294	in tension	8.1525	25.2689	6.2311	6.2311	3.4453	1.7226	Design OK	Design OK	Design OK	Design OK
23	10	'COMBO_3K	6.8485	4.6852	0.6841	0.0638	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
24	10	'COMBO_3L	6.8485	4.6852	0.6841	0.0638	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
25	10	'COMBO_3M	1.7887	-0.4989	-0.2789	0.0142	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
26	10	'COMBO_3N	1.7887	-0.4989	-0.2789	0.0142	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
27	10	'COMBO_4A	3.0127	52.2029	17.3274	0.2022	in tension	12.7375	24.9932	6.5068	6.5068	4.8806	2.4403	Design OK	Design OK	Design OK	Design OK
28	10	'COMBO_4B	0.5647	73.1639	129.5540	0.2580	in tension	16.2517	25.8161	5.6839	5.6839	8.2327	4.1164	Design OK	Design OK	Design OK	Design OK
29	10	'COMBO_4C	2.5807	55.9019	21.6612	0.2120	in tension	13.3576	25.1759	6.3241	6.3241	5.4645	2.7322	Design OK	Design OK	Design OK	Design OK
30	10	'COMBO_4D	0.9967	69.4649	69.6923	0.2481	in tension	15.6315	25.7019	5.7981	5.7981	7.6349	3.8175	Design OK	Design OK	Design OK	Design OK
31	10	'COMBO_4E	2.6541	-7.2667	-2.7379	0.0437	in tension	2.7508	29.6965	1.8035	1.8035	-2.1817	-1.0908	Design OK	Design OK	Design OK	Design OK
32	10	'COMBO_4F	4.5939	53.8229	11.7162	0.2188	in tension	13.7836	24.5713	6.9287	6.9287	4.5015	2.2508	Design OK	Design OK	Design OK	Design OK
33	10	'COMBO_4G	2.1459	74.7839	34.8497	0.2746	in tension	17.2978	25.4605	6.0395	6.0395	7.8037	3.9018	Design OK	Design OK	Design OK	Design OK
34	10	'COMBO_4H	4.1619	57.5219	13.8211	0.2286	in tension	14.4037	24.7671	6.7329	6.7329	5.0742	2.5371	Design OK	Design OK	Design OK	Design OK
35	10	'COMBO_4I	2.5779	71.0849	27.5747	0.2647	in tension	16.6777	25.3359	6.1641	6.1641	7.2128	3.6064	Design OK	Design OK	Design OK	Design OK
36	10	'COMBO_4J	4.2353	-5.6467	-1.3332	0.0490	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
37	10	'COMBO_6A	2.5656	52.3276	20.3962	0.1995	in tension	12.5691	25.1302	6.3698	6.3698	5.0594	2.5297	Design OK	Design OK	Design OK	Design OK
38	10	'COMBO_6B	0.1176	73.2888	623.4596	0.2553	in tension	16.0833	25.9229	5.5771	5.5771	8.4252	4.2126	Design OK	Design OK	Design OK	Design OK
39	10	'COMBO_6C	2.1336	56.0266	26.2598	0.2094	in tension	13.1892	25.3063	6.1937	6.1937	5.6464	2.8232	Design OK	Design OK	Design OK	Design OK
40	10	'COMBO_6D	0.5496	69.5896	126.6298	0.2454	in tension	15.4632	25.8130	5.6870	5.6870	7.8256	3.9128	Design OK	Design OK	Design OK	Design OK
41	10	'COMBO_6E	2.2069	-7.1420	-3.2361	0.0401	in tension	2.5278	30.3550	1.1450	1.1450	-1.9313	-0.9656	Design OK	Design OK	Design OK	Design OK
42	10	'COMBO_5A	2.6473	29.4265	11.1157	0.1206	in tension	7.5952	24.5030	6.9970	6.9970	2.4140	1.2070	Design OK	Design OK	Design OK	Design OK
43	10	'COMBO_5B	2.3577	28.7370	12.1885	0.1162	in tension	7.3177	24.6207	6.8793	6.8793	2.4366	1.2183	Design OK	Design OK	Design OK	Design OK
44	10	'COMBO_5C	2.6218	-28.4769	-10.8615	0.1171	in tension	7.3764	33.6186	-2.1186	2.1186	-1.1335	-0.5667	Design OK	Design OK	Design OK	Design OK
45	10	'COMBO_5D	2.3322	-29.1664	-12.5057	0.1175	in tension	7.4005	33.8480	-2.3480	2.3480	-0.6774	-0.3387	Design OK	Design OK	Design OK	Design OK
46	10	'COMBO_7A	1.5676	28.9032	18.4374	0.1112	in tension	7.0084	25.0477	6.4523	6.4523	2.7390	1.3695	Design OK	Design OK	Design OK	Design OK
47	10	'COMBO_7B	1.2781	28.2138	22.0754	0.1068	in tension	6.7309	25.1898	6.3102	6.3102	2.7670	1.3835	Design OK	Design OK	Design OK	Design OK
48	10	'COMBO_7C	1.5422	-29.0002	-18.8047	0.1114	in tension	7.0185	34.3799	-2.8799	2.8799	0.3828	0.1914	Design OK	Design OK	Design OK	Design OK
49	10	'COMBO_7D	1.2526	-29.6897	-23.7025	0.1118	in tension	7.0426	34.6086	-3.1086	3.1086	0.8324	0.4162	Design OK	Design OK	Design OK	Design OK

"Anchors Tension Joint 10"

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
62	Joint	OutputCase	Fy	Mx	e	fp	anchor_tension	f.prime	A.plus	A.minus	A.final	T_anchors	T_one_anchor				
63	Text	Text	Kip	Kip-in	in							Kips	Kips	Nsa check	Ncbg check	Nsb check	Npn check
64	10	'COMBO_1'	2.0869	-5.1053	-2.4464	0.0322	in tension	2.0298	29.2242	2.2758	2.2758	-1.6469	-0.8235	Design OK	Design OK	Design OK	Design OK
65	10	'COMBO_2A	1.7887	-4.3759	-2.4464	0.0276	in tension	1.7398	29.2242	2.2758	2.2758	-1.4116	-0.7058	Design OK	Design OK	Design OK	Design OK
66	10	'COMBO_2B	3.3699	-10.4146	-3.0905	0.0596	in tension	3.7525	30.1788	1.3212	1.3212	-2.8977	-1.4489	Design OK	Design OK	Design OK	Design OK
67	10	'COMBO_3A	2.2214	-11.5653	-5.2062	0.0556	in tension	3.5018	31.9418	-0.4418	0.4418	-2.0741	-1.0370	Design OK	Design OK	Design OK	Design OK
68	10	'COMBO_3B	2.4007	-6.3906	-2.6619	0.0399	in tension	2.4483	29.5807	1.9193	1.9193	-1.9532	-0.9766	Design OK	Design OK	Design OK	Design OK
69	10	'COMBO_3C	1.1767	-2.3692	-2.0134	0.0164	in tension	1.0331	28.3532	3.1468	3.1468	-0.8671	-0.4336	Design OK	Design OK	Design OK	Design OK
70	10	'COMBO_3D	2.1847	-5.6810	-2.6003	0.0349	in tension	2.1985	29.4831	2.0169	2.0169	-1.7624	-0.8812	Design OK	Design OK	Design OK	Design OK
71	10	'COMBO_3E	1.3927	-3.0789	-2.2107	0.0204	in tension	1.2828	28.7796	2.7204	2.7204	-1.0604	-0.5302	Design OK	Design OK	Design OK	Design OK
72	10	'COMBO_3F	7.2812	-30.8892	-4.2423	0.1578	in tension	9.9425	31.3102	0.1898	0.1898	-7.1014	-3.5507	Design OK	Design OK	Design OK	Design OK
73	10	'COMBO_3G	7.4605	-25.7145	-3.4468	0.1411	in tension	8.8890	30.5897	0.9103	0.9103	-6.6899	-3.3449	Design OK	Design OK	Design OK	Design OK
74	10	'COMBO_3H	1.1767	-2.3692	-2.0134	0.0164	in tension	1.0331	28.3532	3.1468	3.1468	-0.8671	-0.4336	Design OK	Design OK	Design OK	Design OK
75	10	'COMBO_3I	2.1847	-5.6810	-2.6003	0.0349	in tension	2.1985	29.4831	2.0169	2.0169	-1.7624	-0.8812	Design OK	Design OK	Design OK	Design OK
76	10	'COMBO_3J	1.3927	-3.0789	-2.2107	0.0204	in tension	1.2828	28.7796	2.7204	2.7204	-1.0604	-0.5302	Design OK	Design OK	Design OK	Design OK
77	10	'COMBO_3K	6.8485	-23.6998	-3.4606	0.1298	in tension	8.1805	30.6044	0.8956	0.8956	-6.1507	-3.0753	Design OK	Design OK	Design OK	Design OK
78	10	'COMBO_3L	6.8485	-23.6998	-3.4606	0.1298	in tension	8.1805	30.6044	0.8956	0.8956	-6.1507	-3.0753	Design OK	Design OK	Design OK	Design OK
79	10	'COMBO_3M	1.7887	-4.3759	-2.4464	0.0276	in tension	1.7398	29.2242	2.2758	2.2758	-1.4116	-0.7058	Design OK	Design OK	Design OK	Design OK
80	10	'COMBO_3N	1.7887	-4.3759	-2.4464	0.0276	in tension	1.7398	29.2242	2.2758	2.2758	-1.4116	-0.7058	Design OK	Design OK	Design OK	Design OK
81	10	'COMBO_4A	3.0127	-8.4053	-2.7899	0.0501	in tension	3.1567	29.7733	1.7267	1.7267	-2.4936	-1.2468	Design OK	Design OK	Design OK	Design OK
82	10	'COMBO_4B	0.5647	-0.3625	-0.6418	0.0052	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
83	10	'COMBO_4C	2.5807	-6.9860	-2.7070	0.0422	in tension	2.6573	29.6499	1.8501	1.8501	-2.1125	-1.0563	Design OK	Design OK	Design OK	Design OK
84	10	'COMBO_4D	0.9967	-1.7818	-1.7876	0.0131	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
85	10	'COMBO_4E	2.6541	-18.7547	-7.0662	0.0836	in tension	5.2638	32.7448	-1.2448	1.2448	-2.0301	-1.0151	Design OK	Design OK	Design OK	Design OK
86	10	'COMBO_4F	4.5939	-14.4440	-3.1442	0.0821	in tension	5.1695	30.2451	1.2549	1.2549	-3.9761	-1.9880	Design OK	Design OK	Design OK	Design OK
87	10	'COMBO_4G	2.1459	-6.4012	-2.9830	0.0371	in tension	2.3391	30.0407	1.4593	1.4593	-1.8208	-0.9104	Design OK	Design OK	Design OK	Design OK
88	10	'COMBO_4H	4.1619	-13.0247	-3.1295	0.0741	in tension	4.6700	30.2272	1.2728	1.2728	-3.5958	-1.7979	Design OK	Design OK	Design OK	Design OK
89	10	'COMBO_4I	2.5779	-7.8205	-3.0337	0.0451	in tension	2.8386	30.1067	1.3933	1.3933	-2.2012	-1.1006	Design OK	Design OK	Design OK	Design OK
90	10	'COMBO_4J	4.2353	-24.7934	-5.8540	0.1155	in tension	7.2765	32.2693	-0.7693	0.7693	-3.7022	-1.8511	Design OK	Design OK	Design OK	Design OK
91	10	'COMBO_6A	2.5656	-7.3113	-2.8498	0.0432	in tension	2.7218	29.8590	1.6410	1.6410	-2.1402	-1.0701	Design OK	Design OK	Design OK	Design OK
92	10	'COMBO_6B	0.1176	0.7315	6.2229	0.0034	in tension	0.2114	23.5142	7.9858	7.9858	0.0433	0.0216	Design OK	Design OK	Design OK	Design OK
93	10	'COMBO_6C	2.1336	-5.8920	-2.7616	0.0353	in tension	2.2223	29.7318	1.7682	1.7682	-1.7593	-0.8797	Design OK	Design OK	Design OK	Design OK
94	10	'COMBO_6D	0.5496	-0.6878	-1.2516	0.0062	not in tension	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
95	10	'COMBO_6E	2.2069	-17.6607	-8.0024	0.0766	in tension	4.8288	33.0267	-1.5267	1.5267	-1.5048	-0.7524	Design OK	Design OK	Design OK	Design OK
96	10	'COMBO_5A	2.6473	11.4433	4.3227	0.0581	in tension	3.6614	22.6147	8.8853	8.8853	0.4511	0.2255	Design OK	Design OK	Design OK	Design OK
97	10	'COMBO_5B	2.3577	-25.2348	-10.7031	0.1040	in tension	6.5516	33.5932	-2.0932	2.0932	-1.0516	-0.5258	Design OK	Design OK	Design OK	Design OK
98	10	'COMBO_5C	2.6218	11.3164	4.3162	0.0575	in tension	3.6225	22.6105	8.8895	8.8895	0.4451	0.2225	Design OK	Design OK	Design OK	Design OK
99	10	'COMBO_5D	2.3322	-25.3616	-10.8743	0.1043	in tension	6.5682	33.6206	-2.1206	2.1206	-1.0057	-0.5028	Design OK	Design OK	Design OK	Design OK
100	10	'COMBO_7A	1.5676	14.9528	9.5384	0.0628	in tension	3.9568	24.2859	7.2141	7.2141	1.1509	0.5754	Design OK	Design OK	Design OK	Design OK
101	10	'COMBO_7B	1.2781	-21.7253	-16.9986	0.0843	in tension	5.3116	34.2647	-2.7647	2.7647	0.1205	0.0603	Design OK	Design OK	Design OK	Design OK
102	10	'COMBO_7C	1.5422	14.8259	9.6136	0.0622	in tension	3.9179	24.2978	7.2022	7.2022	1.1452	0.5726	Design OK	Design OK	Design OK	Design OK
103	10	'COMBO_7D	1.2526	-21.8522	-17.4455	0.0846	in tension	5.3282	34.2953	-2.7953	2.7953	0.1659	0.0829	Design OK	Design OK	Design OK	Design OK

"Anchors Tension Joint 10"

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Subject:	Gas Bottles Canopy, Supports, Equip, & Misc Foundations	Project:	BGCAPP
		Job Number:	743341
		Calc. No.	24915-10-DBC-00-00004
By:	R. Murphy	Sheet No.	D2-30 / D2-51
Date:	12/16/2007	Sheet Rev.	D

"Anchors Shear Joint"

	A	B	C	D	E	F	G	H	I	J
5		Vsa (kip)	Vcbg (kip)	Vcpg (kip)		Φ	0.85			
6		one anchor	four anchor	four anchor						
7		62.08	8.775	69.765						
8	ΦV	52.768	7.45875	59.30025						
9										
10					Fx=Vx			Fz=Vz		
11	Joint	OutputCase	Fx	Fz	Vsa check	Vcbg check	Vcpg check	Vsa check	Vcbg check	Vcpg check
12	Text	Text	Kip	Kip						
13	9	'COMBO_1'	2.50376E-09	0.1503422	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	9	'COMBO_2A	3.93235E-08	0.1288647	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	9	'COMBO_2B	4.45626E-10	0.3070338	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	9	'COMBO_3A	0.03316494	0.03497258	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	9	'COMBO_3B	-0.2883499	0.1866611	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
18	9	'COMBO_3C	-0.3903499	0.07125147	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
19	9	'COMBO_3D	-0.3063499	0.1662947	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
20	9	'COMBO_3E	-0.3723499	0.09161788	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
21	9	'COMBO_3F	0.03316481	0.6051137	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
22	9	'COMBO_3G	-0.28835	0.7568022	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
23	9	'COMBO_3H	-0.3903499	0.07125147	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
24	9	'COMBO_3I	-0.3063499	0.1662947	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
25	9	'COMBO_3J	-0.3723499	0.09161788	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
26	9	'COMBO_3K	-1.94225E-10	0.6990058	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
27	9	'COMBO_3L	-1.94225E-10	0.6990058	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
28	9	'COMBO_3M	1.27851E-07	0.1288647	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
29	9	'COMBO_3N	1.27851E-07	0.1288647	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
30	9	'COMBO_4A	-0.5767	0.2444575	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
31	9	'COMBO_4B	-0.7807	0.0136382	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
32	9	'COMBO_4C	-0.6127	0.2037247	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
33	9	'COMBO_4D	-0.7447	0.05437102	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
34	9	'COMBO_4E	0.06632966	-0.05891958	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
35	9	'COMBO_4F	-0.5767	0.4226266	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
36	9	'COMBO_4G	-0.7807	0.1918073	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
37	9	'COMBO_4H	-0.6127	0.3818938	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
38	9	'COMBO_4I	-0.7447	0.2325401	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
39	9	'COMBO_4J	0.06632962	0.1192495	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
40	9	'COMBO_6A	-0.5767	0.2122413	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
41	9	'COMBO_6B	-0.7807	-0.01857799	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
42	9	'COMBO_6C	-0.6127	0.1715085	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
43	9	'COMBO_6D	-0.7447	0.02215483	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
44	9	'COMBO_6E	0.06632962	-0.09113577	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
45	9	'COMBO_5A	0.2729927	0.5307288	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
46	9	'COMBO_5B	0.2665012	-0.1168047	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
47	9	'COMBO_5C	-0.2665012	0.5269491	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
48	9	'COMBO_5D	-0.2729927	-0.1205844	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
49	9	'COMBO_7A	0.2729927	0.4272449	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
50	9	'COMBO_7B	0.2665012	-0.2202885	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
51	9	'COMBO_7C	-0.2665012	0.4234652	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
52	9	'COMBO_7D	-0.2729927	-0.2240682	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-10-DBC-00-00004
Sheet No.	D2-31 / D2-51
Sheet Rev.	D

Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations

By: R. Murphy Date: 12/16/2007

"Anchors Shear Joint"

	A	B	C	D	E	F	G	H	I	J
5		Vsa (kip)	Vcbg (kip)	Vcpg (kip)		ϕ	0.85			
6		one anchor	four anchor	four anchor						
7		62.08	8.775	69.765						
8	ϕV	52.768	7.45875	59.30025						
9										
10					Fx=Vx			Fz=Vz		
11	Joint	OutputCase	Fx	Fz	Vsa check	Vcbg check	Vcpg check	Vsa check	Vcbg check	Vcpg check
12	Text	Text	Kip	Kip						
13	9	'COMBO_1'	2.50376E-09	0.1503422	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
14	9	'COMBO_2A	3.93235E-08	0.1288647	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
15	9	'COMBO_2B	4.45626E-10	0.3070338	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
16	9	'COMBO_3A	0.03316494	0.03497258	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
17	9	'COMBO_3B	-0.2983499	0.1866611	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
18	9	'COMBO_3C	-0.3903499	0.07125147	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
19	9	'COMBO_3D	-0.3063499	0.1662947	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
20	9	'COMBO_3E	-0.3723499	0.09161788	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
21	9	'COMBO_3F	0.03316481	0.6051137	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
22	9	'COMBO_3G	-0.29835	0.7568022	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
23	9	'COMBO_3H	-0.3903499	0.07125147	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
24	9	'COMBO_3I	-0.3063499	0.1662947	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
25	9	'COMBO_3J	-0.3723499	0.09161788	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
26	9	'COMBO_3K	-1.94225E-10	0.6990058	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
27	9	'COMBO_3L	-1.94225E-10	0.6990058	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
28	9	'COMBO_3M	1.27851E-07	0.1288647	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
29	9	'COMBO_3N	1.27851E-07	0.1288647	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
30	9	'COMBO_4A	-0.5767	0.2444575	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
31	9	'COMBO_4B	-0.7807	0.0136382	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
32	9	'COMBO_4C	-0.6127	0.2037247	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
33	9	'COMBO_4D	-0.7447	0.05437102	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
34	9	'COMBO_4E	0.06632966	-0.05891958	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
35	9	'COMBO_4F	-0.5767	0.4226266	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
36	9	'COMBO_4G	-0.7807	0.1918073	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
37	9	'COMBO_4H	-0.6127	0.3818938	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
38	9	'COMBO_4I	-0.7447	0.2325401	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
39	9	'COMBO_4J	0.06632962	0.1192495	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
40	9	'COMBO_6A	-0.5767	0.2122413	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
41	9	'COMBO_6B	-0.7807	-0.01857799	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
42	9	'COMBO_6C	-0.6127	0.1715085	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
43	9	'COMBO_6D	-0.7447	0.02215483	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
44	9	'COMBO_6E	0.06632962	-0.09113577	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
45	9	'COMBO_5A	0.2729927	0.5307288	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
46	9	'COMBO_5B	0.2665012	-0.1168047	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
47	9	'COMBO_5C	-0.2665012	0.5269491	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
48	9	'COMBO_5D	-0.2729927	-0.1205844	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
49	9	'COMBO_7A	0.2729927	0.4272449	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
50	9	'COMBO_7B	0.2665012	-0.2202885	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
51	9	'COMBO_7C	-0.2665012	0.4234652	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient
52	9	'COMBO_7D	-0.2729927	-0.2240682	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient	Design Sufficient

"Interaction Check"

	A	B	C	D	E	F	G	H	I	J
3		Nsa (kip)	Ncbg (kip)	Npn (kip)	Nsb (kip)			Vsa (kip)	Vcbg (kip)	Vcpg (kip)
4		one anchor	two anchors	one anchor	one anchor			one anchor	four anchor	four anchor
5		77.6	9.859	20.928	36.826			62.08	8.775	19.718
6	ΦN	65.96	29.65055	17.7905	31.3055		ΦV	52.768	7.45875	59.30025
7										
8		one anchor--->	N.design	14.825275						
9		four anchor--->	V.design	7.45875						
10										
11	Joint	OutputCase	T_one_anchor	Fx=Vx	Fz=Vz	T/N.design	Vx/V.design	Vz/V.design	Interaction Check	Interaction Check
12	Text	Text	Kips	Kip	Kip				(Vx)	(Vz)
13	9	'COMBO_1'	XXXX	0.0000	0.1503	0.0000	0.0000	0.0202	Check not needed	Check not needed
14	9	'COMBO_2A	XXXX	0.0000	0.1289	0.0000	0.0000	0.0173	Check not needed	Check not needed
15	9	'COMBO_2B	XXXX	0.0000	0.3070	0.0000	0.0000	0.0412	Check not needed	Check not needed
16	9	'COMBO_3A	XXXX	0.0332	0.0350	0.0000	0.0044	0.0047	Check not needed	Check not needed
17	9	'COMBO_3B	1.0475	-0.2883	0.1867	0.0707	-0.0387	0.0250	Check not needed	Check not needed
18	9	'COMBO_3C	1.8700	-0.3903	0.0713	0.1261	-0.0523	0.0096	Check not needed	Check not needed
19	9	'COMBO_3D	1.1899	-0.3063	0.1663	0.0803	-0.0411	0.0223	Check not needed	Check not needed
20	9	'COMBO_3E	1.7226	-0.3723	0.0916	0.1162	-0.0499	0.0123	Check not needed	Check not needed
21	9	'COMBO_3F	XXXX	0.0332	0.6051	0.0000	0.0044	0.0811	Check not needed	Check not needed
22	9	'COMBO_3G	0.5761	-0.2884	0.7568	0.0389	-0.0387	0.1015	Check not needed	Check not needed
23	9	'COMBO_3H	1.8700	-0.3903	0.0713	0.1261	-0.0523	0.0096	Check not needed	Check not needed
24	9	'COMBO_3I	1.1899	-0.3063	0.1663	0.0803	-0.0411	0.0223	Check not needed	Check not needed
25	9	'COMBO_3J	1.7226	-0.3723	0.0916	0.1162	-0.0499	0.0123	Check not needed	Check not needed
26	9	'COMBO_3K	XXXX	0.0000	0.6990	0.0000	0.0000	0.0937	Check not needed	Check not needed
27	9	'COMBO_3L	XXXX	0.0000	0.6990	0.0000	0.0000	0.0937	Check not needed	Check not needed
28	9	'COMBO_3M	XXXX	0.0000	0.1289	0.0000	0.0000	0.0173	Check not needed	Check not needed
29	9	'COMBO_3N	XXXX	0.0000	0.1289	0.0000	0.0000	0.0173	Check not needed	Check not needed
30	9	'COMBO_4A	2.4403	-0.5767	0.2445	0.1646	-0.0773	0.0328	Check not needed	Check not needed
31	9	'COMBO_4B	4.1164	-0.7807	0.0136	0.2777	-0.1047	0.0018	0.173	0.279
32	9	'COMBO_4C	2.7322	-0.6127	0.2037	0.1843	-0.0821	0.0273	Check not needed	Check not needed
33	9	'COMBO_4D	3.8175	-0.7447	0.0544	0.2575	-0.0998	0.0073	0.158	0.265
34	9	'COMBO_4E	-1.0538	0.0663	-0.0589	-0.0711	0.0089	-0.0079	Check not needed	Check not needed
35	9	'COMBO_4F	2.2508	-0.5767	0.4226	0.1518	-0.0773	0.0567	Check not needed	Check not needed
36	9	'COMBO_4G	3.9018	-0.7807	0.1918	0.2632	-0.1047	0.0257	0.159	0.289
37	9	'COMBO_4H	2.5371	-0.6127	0.3819	0.1711	-0.0821	0.0512	Check not needed	Check not needed
38	9	'COMBO_4I	3.6064	-0.7447	0.2325	0.2433	-0.0998	0.0312	0.143	0.274
39	9	'COMBO_4J	XXXX	0.0663	0.1192	0.0000	0.0089	0.0160	Check not needed	Check not needed
40	9	'COMBO_6A	2.5297	-0.5767	0.2122	0.1706	-0.0773	0.0285	Check not needed	Check not needed
41	9	'COMBO_6B	4.2126	-0.7807	-0.0186	0.2842	-0.1047	-0.0025	0.179	0.282
42	9	'COMBO_6C	2.8232	-0.6127	0.1715	0.1904	-0.0821	0.0230	Check not needed	Check not needed
43	9	'COMBO_6D	3.9128	-0.7447	0.0222	0.2639	-0.0998	0.0030	0.164	0.267
44	9	'COMBO_6E	-0.9272	0.0663	-0.0911	-0.0625	0.0089	-0.0122	Check not needed	Check not needed
45	9	'COMBO_5A	1.2070	0.2730	0.5307	0.0814	0.0366	0.0712	Check not needed	Check not needed
46	9	'COMBO_5B	1.2183	0.2665	-0.1168	0.0822	0.0357	-0.0157	Check not needed	Check not needed
47	9	'COMBO_5C	-0.5667	-0.2665	0.5269	-0.0382	-0.0357	0.0706	Check not needed	Check not needed
48	9	'COMBO_5D	-0.3387	-0.2730	-0.1206	-0.0228	-0.0366	-0.0162	Check not needed	Check not needed
49	9	'COMBO_7A	1.3695	0.2730	0.4272	0.0924	0.0366	0.0573	Check not needed	Check not needed
50	9	'COMBO_7B	1.3835	0.2665	-0.2203	0.0933	0.0357	-0.0295	Check not needed	Check not needed
51	9	'COMBO_7C	0.1914	-0.2665	0.4235	0.0129	-0.0357	0.0568	Check not needed	Check not needed
52	9	'COMBO_7D	0.4162	-0.2730	-0.2241	0.0281	-0.0366	-0.0300	Check not needed	Check not needed

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations

By: R. Murphy Date: 12/16/2007

Project: BGCAPP

Job Number: 743341

Calc. No. 24915-10-DBC-00-00004

Sheet No. D2-33 / D2-51

Sheet Rev. D

"Interaction Check"

	A	B	C	D	E	F	G	H	I	J
66	Joint	OutputCase	T_one_anchor	Fx=Vx	Fz=Vz	T/N.design	Vx/V.design	Vz/V.design	Interaction Check (Vx)	Interaction Check (Vz)
67	Text	Text	Kips	Kip	Kip					
68	10	'COMBO_1'	-0.8235	0.0000	-0.1503	-0.0555	0.0000	-0.020	Check not needed	Check not needed
69	10	'COMBO_2A	-0.7058	0.0000	-0.1289	-0.0476	0.0000	-0.017	Check not needed	Check not needed
70	10	'COMBO_2B	-1.4489	0.0000	-0.3070	-0.0977	0.0000	-0.041	Check not needed	Check not needed
71	10	'COMBO_3A	-1.0370	0.0328	-0.2977	-0.0700	0.0044	-0.040	Check not needed	Check not needed
72	10	'COMBO_3B	-0.9766	-0.2884	-0.1867	-0.0659	-0.0387	-0.025	Check not needed	Check not needed
73	10	'COMBO_3C	-0.4336	-0.3904	-0.0713	-0.0292	-0.0523	-0.010	Check not needed	Check not needed
74	10	'COMBO_3D	-0.8812	-0.3064	-0.1663	-0.0594	-0.0411	-0.022	Check not needed	Check not needed
75	10	'COMBO_3E	-0.5302	-0.3724	-0.0916	-0.0358	-0.0499	-0.012	Check not needed	Check not needed
76	10	'COMBO_3F	-3.5507	0.0328	-0.8678	-0.2395	0.0044	-0.116	Check not needed	Check not needed
77	10	'COMBO_3G	-3.3449	-0.2884	-0.7569	-0.2256	-0.0387	-0.101	Check not needed	Check not needed
78	10	'COMBO_3H	-0.4336	-0.3904	-0.0713	-0.0292	-0.0523	-0.010	Check not needed	Check not needed
79	10	'COMBO_3I	-0.8812	-0.3064	-0.1663	-0.0594	-0.0411	-0.022	Check not needed	Check not needed
80	10	'COMBO_3J	-0.5302	-0.3724	-0.0916	-0.0358	-0.0499	-0.012	Check not needed	Check not needed
81	10	'COMBO_3K	-3.0753	0.0000	-0.6990	-0.2074	0.0000	-0.094	Check not needed	Check not needed
82	10	'COMBO_3L	-3.0753	0.0000	-0.6990	-0.2074	0.0000	-0.094	Check not needed	Check not needed
83	10	'COMBO_3M	-0.7058	0.0000	-0.1289	-0.0476	0.0000	-0.017	Check not needed	Check not needed
84	10	'COMBO_3N	-0.7058	0.0000	-0.1289	-0.0476	0.0000	-0.017	Check not needed	Check not needed
85	10	'COMBO_4A	-1.2468	-0.5767	-0.2445	-0.0841	-0.0773	-0.033	Check not needed	Check not needed
86	10	'COMBO_4B	XXXX	-0.7807	-0.0136	0.0000	-0.1047	-0.002	Check not needed	Check not needed
87	10	'COMBO_4C	-1.0563	-0.6127	-0.2037	-0.0712	-0.0821	-0.027	Check not needed	Check not needed
88	10	'COMBO_4D	XXXX	-0.7447	-0.0544	0.0000	-0.0998	-0.007	Check not needed	Check not needed
89	10	'COMBO_4E	-1.0151	0.0657	-0.4665	-0.0685	0.0088	-0.063	Check not needed	Check not needed
90	10	'COMBO_4F	-1.9880	-0.5767	-0.4226	-0.1341	-0.0773	-0.057	Check not needed	Check not needed
91	10	'COMBO_4G	-0.9104	-0.7807	-0.1918	-0.0614	-0.1047	-0.026	Check not needed	Check not needed
92	10	'COMBO_4H	-1.7979	-0.6127	-0.3819	-0.1213	-0.0821	-0.051	Check not needed	Check not needed
93	10	'COMBO_4I	-1.1006	-0.7447	-0.2325	-0.0742	-0.0998	-0.031	Check not needed	Check not needed
94	10	'COMBO_4J	-1.8511	0.0657	-0.6446	-0.1249	0.0088	-0.086	Check not needed	Check not needed
95	10	'COMBO_6A	-1.0701	-0.5767	-0.2122	-0.0722	-0.0773	-0.028	Check not needed	Check not needed
96	10	'COMBO_6B	0.0216	-0.7807	0.0186	0.0015	-0.1047	0.002	Check not needed	Check not needed
97	10	'COMBO_6C	-0.8797	-0.6127	-0.1715	-0.0593	-0.0821	-0.023	Check not needed	Check not needed
98	10	'COMBO_6D	XXXX	-0.7447	-0.0222	0.0000	-0.0998	-0.003	Check not needed	Check not needed
99	10	'COMBO_6E	-0.7524	0.0657	-0.4342	-0.0508	0.0088	-0.058	Check not needed	Check not needed
100	10	'COMBO_5A	0.2255	0.2730	0.1206	0.0152	0.0366	0.016	Check not needed	Check not needed
101	10	'COMBO_5B	-0.5258	0.2665	-0.5269	-0.0355	0.0357	-0.071	Check not needed	Check not needed
102	10	'COMBO_5C	0.2225	-0.2665	0.1168	0.0150	-0.0357	0.016	Check not needed	Check not needed
103	10	'COMBO_5D	-0.5028	-0.2730	-0.5307	-0.0339	-0.0366	-0.071	Check not needed	Check not needed
104	10	'COMBO_7A	0.5754	0.2730	0.2241	0.0388	0.0366	0.030	Check not needed	Check not needed
105	10	'COMBO_7B	0.0603	0.2665	-0.4235	0.0041	0.0357	-0.057	Check not needed	Check not needed
106	10	'COMBO_7C	0.5726	-0.2665	0.2203	0.0386	-0.0357	0.030	Check not needed	Check not needed
107	10	'COMBO_7D	0.0829	-0.2730	-0.4272	0.0056	-0.0366	-0.057	Check not needed	Check not needed

Dimensional Solutions Mat3D		**Version**	**5.1.0**		**Date**	**1/25/2010**
Foundation Name	**Gas bottle canopies, Supports, Equip. & Misc Fdns**				**Time**	**10:21:49 AM**
Designed By:	**PARSONS**	**Engineer**		M. Bratt	**Checker**	
Filename:	**C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**					

D2.4.2 Combined Footing Design

DETAIL REPORT

PROJECT INFORMATION

Project Name:	Gas Bottle Canopy #2
Project Number:	10-DBC-00-00004
Client:	
Project Location	Richmond, KY
Foundation Description	GAS BOTTLE CANOPIES, SUPPORTS, EQUIP. & MISC FDNS

DESIGN CODE ACI 318 - 1999 **INPUT UNITS** English **OUTPUT UNITS** English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

PILE PARAMETERS:

Diameter (in)	0
Type	Drilled Shaft

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

REBAR PARAMETERS:

Max Long Bar Size	6
Min Long Bar Size	4
Max Tie Bar Size	6
Min Tie Bar Size	3
Max Ftg Bar Size	9
Min Ftg Bar Size	4
Temp & Shrinkage Steel Ratio	0.0018

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	3000.00
Unit Weight (pcf)	125.50

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	0.70
Minimum Soil Cover (ft)	0.00

Dimensional Solutions Mat3D		Version	5.1.0	Date	1/25/2010
Foundation Name	Gas bottle canopies, Supports, Equip. & Misc Fdns			Time	10:21:49 AM
Designed By:	PARSONS	Engineer	M. Bratt	Checker	
Filename:	C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d				

APPLIED LOADS

1

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.87	0.00	-0.06	0.17	0.48
2 - Snow	1.84	0.00	0.09	0.27	0.74
3 - WLEW1	0.49	-0.77	6.45	0.04	0.13
4 - WLEW2	0.49	-0.77	6.06	0.05	0.14
5 - WLEW3	0.75	-0.75	6.17	0.07	0.20
6 - WLEW4	0.77	-0.75	5.53	0.08	0.23
7 - WLNS	-0.21	-0.07	0.61	0.13	0.55
8 - EQX	0.01	0.34	3.07	0.00	0.01
9 - EQY	0.18	0.00	0.03	0.41	1.93

P2

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.93	0.00	-0.01	-0.17	-0.49
2 - Snow	2.01	0.00	0.22	-0.27	-0.76
3 - WLEW1	0.49	-0.77	6.45	-0.04	-0.13
4 - WLEW2	0.49	-0.77	6.06	-0.05	-0.14
5 - WLEW3	0.75	-0.75	6.17	-0.07	-0.20
6 - WLEW4	0.77	-0.75	5.53	-0.08	-0.23
7 - WLNS	-0.34	-0.08	0.64	0.21	0.77
8 - EQX	0.01	0.36	3.20	0.00	0.01
9 - EQY	0.18	0.00	0.03	0.41	1.93

Dimensional Solutions Mat3D		**Version**	**5.1.0**	**Date**	**1/25/2010**
Foundation Name	**Gas bottle canopies, Supports, Equip. & Misc Fdns**			**Time**	**10:21:49 AM**
Designed By:	**PARSONS**	**Engineer**	M. Bratt	**Checker**	
Filename:	**C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**				

UNFACTORED (ALLOWABLE) LOAD COMBINATIONS

1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.87	0.00	-0.06	0.17	0.48
2 - Dead + Snow	3.72	0.00	0.03	0.44	1.22
3 - Dead + 0.75Snow	3.26	0.00	0.01	0.37	1.04
4 - Dead + WLEW1	2.36	-0.78	6.39	0.22	0.61
5 - Dead + WLEW2	2.36	-0.78	6.00	0.22	0.62
6 - Dead + WLEW3	2.62	-0.75	6.11	0.24	0.68
7 - Dead + WLEW4	2.65	-0.75	5.47	0.25	0.71
8 - Dead + WLNS	1.66	-0.07	0.55	0.31	1.03
9 - Dead + 0.7EQX	1.88	0.24	2.09	0.18	0.49
10 - Dead + 0.7EQY	2.00	0.00	-0.04	0.46	1.84
11 - Dead + 0.75Snow + 0.75WLEW1	3.62	-0.58	4.84	0.41	1.13
12 - Dead + 0.75Snow + 0.75WLEW2	3.62	-0.58	4.55	0.41	1.14
13 - Dead + 0.75Snow + 0.75WLEW3	3.81	-0.57	4.63	0.43	1.19
14 - Dead + 0.75Snow + 0.75WLEW4	3.83	-0.57	4.15	0.43	1.21
15 - Dead + 0.75Snow + 0.75WLNS	3.10	-0.06	0.47	0.47	1.45
16 - Dead + 0.75Snow + 0.525EQX	3.26	0.18	1.62	0.37	1.04
17 - Dead + 0.75Snow + 0.525EQY	3.35	0.00	0.02	0.59	2.05
18 - 0.6Dead + WLEW1	1.61	-0.77	6.41	0.15	0.42
19 - 0.6Dead + WLEW2	1.61	-0.77	6.02	0.15	0.43
20 - 0.6Dead + WLEW3	1.87	-0.75	6.13	0.17	0.49
21 - 0.6Dead + WLEW4	1.90	-0.75	5.49	0.18	0.52
22 - 0.6Dead + WLNS	0.91	-0.07	0.58	0.24	0.84
23 - 0.6Dead + 0.7EQX	1.13	0.24	2.11	0.11	0.30
24 - 0.6Dead + 0.7EQY	1.25	0.00	-0.01	0.39	1.64

Dimensional Solutions Mat3D		Version	5.1.0		Date	1/25/2010
Foundation Name	Gas bottle canopies, Supports, Equip. & Misc Fdns				Time	10:21:49 AM
Designed By:	PARSONS	Engineer		M. Bratt	Checker	
Filename:	C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d					

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.93	0.00	-0.01	-0.17	-0.49
2 - Dead + Snow	3.94	0.00	0.21	-0.44	-1.26
3 - Dead + 0.75Snow	3.44	0.00	0.16	-0.37	-1.07
4 - Dead + WLEW1	2.42	-0.77	6.44	-0.22	-0.62
5 - Dead + WLEW2	2.42	-0.77	6.05	-0.22	-0.63
6 - Dead + WLEW3	2.68	-0.75	6.16	-0.24	-0.69
7 - Dead + WLEW4	2.70	-0.75	5.52	-0.25	-0.72
8 - Dead + WLNS	1.60	-0.07	0.63	0.04	0.28
9 - Dead + 0.7EQX	1.94	0.25	2.23	-0.17	-0.49
10 - Dead + 0.7EQY	2.06	0.00	0.02	0.11	0.86
11 - Dead + 0.75Snow + 0.75WLEW1	3.80	-0.58	4.99	-0.41	-1.16
12 - Dead + 0.75Snow + 0.75WLEW2	3.80	-0.58	4.70	-0.41	-1.17
13 - Dead + 0.75Snow + 0.75WLEW3	3.99	-0.56	4.78	-0.43	-1.22
14 - Dead + 0.75Snow + 0.75WLEW4	4.01	-0.56	4.31	-0.43	-1.24
15 - Dead + 0.75Snow + 0.75WLNS	3.18	-0.05	0.64	-0.21	-0.49
16 - Dead + 0.75Snow + 0.525EQX	3.44	0.19	1.84	-0.37	-1.06
17 - Dead + 0.75Snow + 0.525EQY	3.53	0.00	0.17	-0.16	-0.05
18 - 0.6Dead + WLEW1	1.65	-0.77	6.44	-0.15	-0.42
19 - 0.6Dead + WLEW2	1.65	-0.77	6.05	-0.15	-0.44
20 - 0.6Dead + WLEW3	1.90	-0.75	6.16	-0.17	-0.50
21 - 0.6Dead + WLEW4	1.93	-0.75	5.53	-0.18	-0.52
22 - 0.6Dead + WLNS	0.82	-0.07	0.63	0.11	0.47
23 - 0.6Dead + 0.7EQX	1.17	0.25	2.24	-0.10	-0.29
24 - 0.6Dead + 0.7EQY	1.29	0.00	0.02	0.18	1.05

Dimensional Solutions Mat3D		**Version**	**5.1.0**	**Date**	**1/25/2010**
Foundation Name	**Gas bottle canopies, Supports, Equip. & Misc Fdns**			**Time**	**10:21:49 AM**
Designed By:	**PARSONS**	**Engineer**	M. Bratt	**Checker**	
Filename:	**C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**				

FACTORED (ULTIMATE) LOAD COMBINATIONS

1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	2.62	0.00	-0.09	0.24	0.68
2 - 1.2Dead + 0.5Snow	3.17	0.00	-0.03	0.34	0.95
3 - 1.2Dead + 1.6Snow + 0.8WLEW1	5.59	-0.62	5.23	0.67	1.87
4 - 1.2Dead + 1.6Snow + 0.8WLEW2	5.58	-0.62	4.92	0.67	1.88
5 - 1.2Dead + 1.6Snow + 0.8WLEW3	5.79	-0.61	5.00	0.69	1.92
6 - 1.2Dead + 1.6Snow + 0.8WLEW4	5.81	-0.60	4.50	0.70	1.95
7 - 1.2Dead + 1.6Snow + 0.8WLNS	5.02	-0.06	0.56	0.74	2.20
8 - 1.2Dead + 0.5Snow + 1.6WLEW1	3.95	-1.24	10.29	0.41	1.15
9 - 1.2Dead + 0.5Snow + 1.6WLEW2	3.95	-1.24	9.66	0.42	1.17
10 - 1.2Dead + 0.5Snow + 1.6WLEW3	4.36	-1.21	9.84	0.45	1.27
11 - 1.2Dead + 0.5Snow + 1.6WLEW4	4.41	-1.20	8.82	0.47	1.31
12 - 1.2Dead + 0.5Snow + 1.6WLNS	2.83	-0.12	0.95	0.55	1.82
13 - 1.2Dead + 0.2Snow + EQX	2.63	0.34	3.01	0.26	0.74
14 - 1.2Dead + 0.2Snow + EQY	2.80	0.00	-0.02	0.67	2.66
15 - 0.9Dead + 1.6WLEW1	2.47	-1.24	10.26	0.22	0.64
16 - 0.9Dead + 1.6WLEW2	2.46	-1.24	9.64	0.23	0.66
17 - 0.9Dead + 1.6WLEW3	2.88	-1.20	9.81	0.27	0.76
18 - 0.9Dead + 1.6WLEW4	2.92	-1.20	8.79	0.28	0.80
19 - 0.9Dead + 1.6WLNS	1.34	-0.11	0.93	0.37	1.31
20 - 0.9Dead + EQX	1.70	0.34	3.01	0.16	0.44
21 - 0.9Dead + EQY	1.87	0.00	-0.02	0.56	2.37

Dimensional Solutions Mat3D		**Version**	**5.1.0**	**Date**	**1/25/2010**
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Designed By:	**PARSONS**	**Engineer**	M. Bratt	**Checker**	
Filename:	**C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**				

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	2.70	0.00	-0.01	-0.24	-0.69
2 - 1.2Dead + 0.5Snow	3.32	0.00	0.10	-0.34	-0.97
3 - 1.2Dead + 1.6Snow + 0.8WLEW1	5.92	-0.61	5.50	-0.67	-1.92
4 - 1.2Dead + 1.6Snow + 0.8WLEW2	5.92	-0.61	5.19	-0.67	-1.93
5 - 1.2Dead + 1.6Snow + 0.8WLEW3	6.12	-0.60	5.28	-0.69	-1.98
6 - 1.2Dead + 1.6Snow + 0.8WLEW4	6.14	-0.60	4.77	-0.70	-2.00
7 - 1.2Dead + 1.6Snow + 0.8WLNS	5.26	-0.06	0.85	-0.46	-1.20
8 - 1.2Dead + 0.5Snow + 1.6WLEW1	4.10	-1.24	10.42	-0.41	-1.18
9 - 1.2Dead + 0.5Snow + 1.6WLEW2	4.10	-1.24	9.79	-0.42	-1.20
10 - 1.2Dead + 0.5Snow + 1.6WLEW3	4.51	-1.20	9.97	-0.45	-1.29
11 - 1.2Dead + 0.5Snow + 1.6WLEW4	4.56	-1.20	8.95	-0.47	-1.34
12 - 1.2Dead + 0.5Snow + 1.6WLNS	2.78	-0.12	1.12	0.00	0.26
13 - 1.2Dead + 0.2Snow + EQX	2.73	0.36	3.24	-0.26	-0.74
14 - 1.2Dead + 0.2Snow + EQY	2.90	0.01	0.07	0.15	1.18
15 - 0.9Dead + 1.6WLEW1	2.52	-1.24	10.31	-0.22	-0.65
16 - 0.9Dead + 1.6WLEW2	2.52	-1.24	9.69	-0.23	-0.67
17 - 0.9Dead + 1.6WLEW3	2.93	-1.20	9.86	-0.27	-0.76
18 - 0.9Dead + 1.6WLEW4	2.97	-1.20	8.84	-0.28	-0.81
19 - 0.9Dead + 1.6WLNS	1.20	-0.12	1.01	0.19	0.79
20 - 0.9Dead + EQX	1.75	0.36	3.19	-0.15	-0.44
21 - 0.9Dead + EQY	1.92	0.00	0.03	0.25	1.49

Dimensional Solutions Mat3D		**Version**	**5.1.0**	**Date**	**1/25/2010**
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Designed By:	**PARSONS**	**Engineer**	M. Bratt	**Checker**	
Filename:	**C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**				

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.23	3.09	0.02	0.00	0.07	0.48	
2 - Dead + Snow	0.28	3.09	0.08	0.01	0.24	1.84	
3 - Dead + 0.75Snow	0.26	3.09	0.06	0.00	0.16	1.50	
4 - Dead + WLEW1	0.39	4.09	0.02	0.48	10.19	0.48	
5 - Dead + WLEW2	0.38	4.09	0.02	0.44	9.42	0.48	
6 - Dead + WLEW3	0.39	4.09	0.02	0.44	9.71	0.48	
7 - Dead + WLEW4	0.37	4.09	0.02	0.39	8.44	0.48	
8 - Dead + WLNS	0.24	4.09	0.07	0.05	0.93	1.36	
9 - Dead + 0.7EQX	0.30	4.09	0.02	0.25	5.15	0.49	
10 - Dead + 0.7EQY	0.24	4.09	0.20	0.00	0.01	4.16	
11 - Dead + 0.75Snow + 0.75WLEW1	0.39	4.09	0.06	0.33	7.86	1.50	
12 - Dead + 0.75Snow + 0.75WLEW2	0.38	4.09	0.06	0.30	7.28	1.50	
13 - Dead + 0.75Snow + 0.75WLEW3	0.39	4.09	0.06	0.31	7.50	1.50	
14 - Dead + 0.75Snow + 0.75WLEW4	0.37	4.09	0.06	0.27	6.55	1.50	
15 - Dead + 0.75Snow + 0.75WLNS	0.27	4.09	0.09	0.04	0.92	2.16	
16 - Dead + 0.75Snow + 0.525EQX	0.32	4.09	0.06	0.18	4.08	1.51	
17 - Dead + 0.75Snow + 0.525EQY	0.27	4.09	0.18	0.00	0.20	4.26	
18 - 0.6Dead + WLEW1	0.30	4.09	0.02	0.78	10.22	0.29	
19 - 0.6Dead + WLEW2	0.29	4.09	0.02	0.72	9.44	0.29	
20 - 0.6Dead + WLEW3	0.30	4.09	0.02	0.71	9.74	0.29	
21 - 0.6Dead + WLEW4	0.28	4.09	0.02	0.62	8.47	0.29	
22 - 0.6Dead + WLNS	0.15	4.09	0.10	0.08	0.96	1.16	
23 - 0.6Dead + 0.7EQX	0.21	4.09	0.02	0.42	5.18	0.30	
24 - 0.6Dead + 0.7EQY	0.15	4.09	0.32	0.00	0.01	3.97	

Dimensional Solutions Mat3D		**Version**	**5.1.0**	**Date**	**1/25/2010**
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Designed By:	**PARSONS**	**Engineer**	M. Bratt	**Checker**	
Filename:	**C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**				

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	100.00	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Snow	100.00	100.00	1.50	100.00	100.00	1.50	
3 - Dead + 0.75Snow	100.00	100.00	1.50	100.00	100.00	1.50	
4 - Dead + WLEW1	100.00	3.95	1.50	100.00	12.72	1.50	
5 - Dead + WLEW2	100.00	4.20	1.50	100.00	12.72	1.50	
6 - Dead + WLEW3	100.00	4.21	1.50	100.00	13.27	1.50	
7 - Dead + WLEW4	100.00	4.71	1.50	100.00	13.32	1.50	
8 - Dead + WLNS	100.00	37.92	1.50	34.48	100.00	1.50	
9 - Dead + 0.7EQX	100.00	8.89	1.50	100.00	39.22	1.50	
10 - Dead + 0.7EQY	56.07	100.00	1.50	21.54	100.00	1.50	
11 - Dead + 0.75Snow + 0.75WLEW1	100.00	5.68	1.50	100.00	18.10	1.50	
12 - Dead + 0.75Snow + 0.75WLEW2	100.00	6.04	1.50	100.00	18.10	1.50	
13 - Dead + 0.75Snow + 0.75WLEW3	100.00	6.02	1.50	100.00	18.80	1.50	
14 - Dead + 0.75Snow + 0.75WLEW4	100.00	6.71	1.50	100.00	18.87	1.50	
15 - Dead + 0.75Snow + 0.75WLNS	100.00	46.77	1.50	51.80	100.00	1.50	
16 - Dead + 0.75Snow + 0.525EQX	100.00	12.82	1.50	100.00	56.21	1.50	
17 - Dead + 0.75Snow + 0.525EQY	76.35	100.00	1.50	32.00	100.00	1.50	
18 - 0.6Dead + WLEW1	100.00	3.67	1.50	100.00	10.09	1.50	
19 - 0.6Dead + WLEW2	100.00	3.91	1.50	100.00	10.09	1.50	
20 - 0.6Dead + WLEW3	100.00	3.93	1.50	100.00	10.56	1.50	
21 - 0.6Dead + WLEW4	100.00	4.39	1.50	100.00	10.61	1.50	
22 - 0.6Dead + WLNS	96.75	34.22	1.50	22.72	100.00	1.50	
23 - 0.6Dead + 0.7EQX	100.00	8.18	1.50	100.00	30.91	1.50	
24 - 0.6Dead + 0.7EQY	51.91	100.00	1.50	14.43	100.00	1.50	

Dimensional Solutions Mat3D		Version	5.1.0		Date	1/25/2010
Foundation Name	Gas bottle canopies, Supports, Equip. & Misc Fdns				Time	10:21:49 AM
Designed By:	PARSONS	Engineer		M. Bratt	Checker	
Filename:	C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d					

FOOTING DESIGN INFORMATION

X Dim (ft)	4.50
Z Dim (ft)	20.00
Thickness (ft)	1.20

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
15. 0.9Dead + 1.6WLEW1	20	5	12	0.31	0	-0.14	E-W
6. 1.2Dead + 1.6Snow + 0.8WLEW4	5	5	12	0.34	0.11	-4.11	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
10. 1.2Dead + 0.5Snow + 1.6WLEW3	20	5	12	0.31	0.31	0.32	E-W
21. 0.9Dead + EQY	5	5	12	0.34	0.31	0.47	N-S

PUNCHING SHEAR

1

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
6. 1.2Dead + 1.6Snow + 0.8WLEW4	5.31	4.74	215.04	

Dimensional Solutions Mat3D		Version	5.1.0		Date	1/25/2010
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P2

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
6. 1.2Dead + 1.6Snow + 0.8WLEW4	5.60	5.00	215.04	

MAXIMUM SHEAR - X DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	0.67	0.86	0.36	107.52	
2 - 1.2Dead + 0.5Snow	0.67	1.02	0.43	107.52	
3 - 1.2Dead + 1.6Snow + 0.8WLEW1	3.83	-3.22	1.34	107.52	
4 - 1.2Dead + 1.6Snow + 0.8WLEW2	3.83	-3.11	1.30	107.52	
5 - 1.2Dead + 1.6Snow + 0.8WLEW3	3.83	-3.21	1.34	107.52	
6 - 1.2Dead + 1.6Snow + 0.8WLEW4	3.83	-3.05	1.27	107.52	
7 - 1.2Dead + 1.6Snow + 0.8WLNS	3.83	-1.79	0.75	107.52	
8 - 1.2Dead + 0.5Snow + 1.6WLEW1	3.83	-4.03	1.68	107.52	
9 - 1.2Dead + 0.5Snow + 1.6WLEW2	3.83	-3.82	1.59	107.52	
10 - 1.2Dead + 0.5Snow + 1.6WLEW3	3.83	-4.02	1.68	107.52	
11 - 1.2Dead + 0.5Snow + 1.6WLEW4	3.83	-3.69	1.54	107.52	
12 - 1.2Dead + 0.5Snow + 1.6WLNS	3.83	-1.17	0.49	107.52	
13 - 1.2Dead + 0.2Snow + EQX	3.83	-2.11	0.88	107.52	
14 - 1.2Dead + 0.2Snow + EQY	0.67	0.91	0.38	107.52	
15 - 0.9Dead + 1.6WLEW1	3.83	-3.55	1.48	107.52	
16 - 0.9Dead + 1.6WLEW2	3.83	-3.33	1.39	107.52	
17 - 0.9Dead + 1.6WLEW3	3.83	-3.53	1.47	107.52	
18 - 0.9Dead + 1.6WLEW4	3.83	-3.20	1.33	107.52	
19 - 0.9Dead + 1.6WLNS	3.83	-0.68	0.28	107.52	
20 - 0.9Dead + EQX	3.83	-1.80	0.75	107.52	
21 - 0.9Dead + EQY	0.67	0.61	0.25	107.52	

Dimensional Solutions Mat3D		Version 5.1.0		Date	1/25/2010
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MAXIMUM SHEAR - Z DIRECTION

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	16.92	2.02	3.74	107.52	
2 - 1.2Dead + 0.5Snow	16.92	2.41	4.47	107.52	
3 - 1.2Dead + 1.6Snow + 0.8WLEW1	16.92	4.18	7.73	107.52	
4 - 1.2Dead + 1.6Snow + 0.8WLEW2	16.92	4.17	7.73	107.52	
5 - 1.2Dead + 1.6Snow + 0.8WLEW3	16.92	4.32	8.00	107.52	
6 - 1.2Dead + 1.6Snow + 0.8WLEW4	16.92	4.33	8.02	107.52	
7 - 1.2Dead + 1.6Snow + 0.8WLNS	3.08	-3.72	6.88	107.52	
8 - 1.2Dead + 0.5Snow + 1.6WLEW1	16.92	2.95	5.47	107.52	
9 - 1.2Dead + 0.5Snow + 1.6WLEW2	16.92	2.95	5.46	107.52	
10 - 1.2Dead + 0.5Snow + 1.6WLEW3	16.92	3.24	5.99	107.52	
11 - 1.2Dead + 0.5Snow + 1.6WLEW4	16.92	3.27	6.05	107.52	
12 - 1.2Dead + 0.5Snow + 1.6WLNS	3.08	-2.21	4.09	107.52	
13 - 1.2Dead + 0.2Snow + EQX	16.92	2.01	3.72	107.52	
14 - 1.2Dead + 0.2Snow + EQY	3.08	-2.30	4.26	107.52	
15 - 0.9Dead + 1.6WLEW1	16.92	1.84	3.41	107.52	
16 - 0.9Dead + 1.6WLEW2	16.92	1.84	3.40	107.52	
17 - 0.9Dead + 1.6WLEW3	16.92	2.12	3.93	107.52	
18 - 0.9Dead + 1.6WLEW4	16.92	2.15	3.99	107.52	
19 - 0.9Dead + 1.6WLNS	3.08	-1.13	2.09	107.52	
20 - 0.9Dead + EQX	16.92	1.31	2.42	107.52	
21 - 0.9Dead + EQY	3.08	-1.61	2.99	107.52	

BECHTEL PARSONS
BLUE GRASS

Project: BGCAPP
Job Number: 24915
Calc. No.: 10-DBC-00-00004
Sheet No.: D2-45 of D2-51
Sheet Rev.: D

Subject: Gas Bottle Canopy, Supports, Equip Misc Foundations
By: M. Bratt Date: 1/25/2010

Dimensional Solutions Mat3D		**Version**	**5.1.0**		**Date**	**1/25/2010**
Foundation Name	**Gas bottle canopies, Supports, Equip. & Misc Fdns**				**Time**	**10:21:49 AM**
Designed By:	**PARSONS**	**Engineer**		M. Bratt	**Checker**	
Filename:	**C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**					

PIER/BASE PLATE DESIGN INFORMATION

	1	**P2**
X Dim (ft)	1.50	1.50
Z Dim (ft)	1.50	1.50
Height (ft)	0.50	0.50
X Offset (ft)	2.25	2.25
Z Offset (ft)	1.50	18.50
Requested Reinft. Ratio	0.0018	0.0018
Provided Reinft. Ratio	0.0055	0.0055
Long Bar Size	6	6
Bars in X Dir	2	2
Bars in Z Dir	2	2
Total Long Bars	4	4
Tie Bar Size	3	3
Total No. of Ties	2	2
Major Tie Spacing (in)	2	2

Dimensional Solutions Mat3D		Version	5.1.0	Date	1/25/2010
Foundation Name	Gas bottle canopies, Supports, Equip. & Misc Fdns			Time	10:21:49 AM
Designed By:	PARSONS	Engineer	M. Bratt	Checker	
Filename:	C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d				

PIER ULTIMATE LOAD CAPACITIES

1

Load Comb	Axial Load (kips)	Axial Capa. (kips)	Mom X (kip ft)	Mom X Capa (kip ft)	Mom Z (kip ft)	Mom Z Capa (kip ft)	Rem
1 - 1.4Dead	2.86	497.23	0.80	137.80	0.27	47.13	
2 - 1.2Dead + 0.5Snow	3.37	446.11	1.12	146.71	0.32	42.29	
3 - 1.2Dead + 1.6Snow + 0.8WLEW1	5.79	118.37	2.20	45.00	4.92	100.29	
4 - 1.2Dead + 1.6Snow + 0.8WLEW2	5.79	132.36	2.21	50.32	4.61	104.04	
5 - 1.2Dead + 1.6Snow + 0.8WLEW3	5.99	134.86	2.27	50.79	4.70	104.70	
6 - 1.2Dead + 1.6Snow + 0.8WLEW4	6.02	153.60	2.30	58.39	4.19	106.11	
7 - 1.2Dead + 1.6Snow + 0.8WLNS	5.23	322.12	2.57	154.68	0.53	32.43	
8 - 1.2Dead + 0.5Snow + 1.6WLEW1	4.15	31.40	1.36	10.28	9.67	73.10	
9 - 1.2Dead + 0.5Snow + 1.6WLEW2	4.15	34.13	1.38	11.37	9.04	74.38	
10 - 1.2Dead + 0.5Snow + 1.6WLEW3	4.56	37.58	1.50	12.32	9.24	76.06	
11 - 1.2Dead + 0.5Snow + 1.6WLEW4	4.61	44.44	1.55	14.93	8.22	79.28	
12 - 1.2Dead + 0.5Snow + 1.6WLNS	3.03	171.26	2.10	117.26	0.90	50.17	
13 - 1.2Dead + 0.2Snow + EQX	2.83	90.12	0.87	27.70	3.18	100.48	
14 - 1.2Dead + 0.2Snow + EQY	3.00	101.64	2.99	100.93	0.29	9.65	
15 - 0.9Dead + 1.6WLEW1	2.62	18.16	0.75	5.21	9.64	66.83	
16 - 0.9Dead + 1.6WLEW2	2.62	19.58	0.77	5.80	9.02	67.50	
17 - 0.9Dead + 1.6WLEW3	3.03	22.71	0.89	6.66	9.21	69.02	
18 - 0.9Dead + 1.6WLEW4	3.07	26.58	0.94	8.13	8.19	70.85	
19 - 0.9Dead + 1.6WLNS	1.50	95.60	1.49	94.64	0.87	55.43	
20 - 0.9Dead + EQX	1.85	46.98	0.52	13.30	3.18	80.81	
21 - 0.9Dead + EQY	2.02	72.76	2.65	94.55	0.19	6.92	

BECHTEL PARSONS BLUE GRASS

Project: BGCAPP
Job Number: 24915
Calc. No.: 10-DBC-00-00004

Sheet Rev.: D

Subject: Gas Bottle Canopy, Supports, Equip Misc Foundations
By: M. Bratt Date: 1/25/2010

Dimensional Solutions Mat3D		**Version**	**5.1.0**	**Date**	**1/25/2010**
Foundation Name	**Gas bottle canopies, Supports, Equip. & Misc Fdns**			**Time**	**10:21:49 AM**
Designed By:	**PARSONS**	**Engineer**	M. Bratt	**Checker**	
Filename:	**C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**				

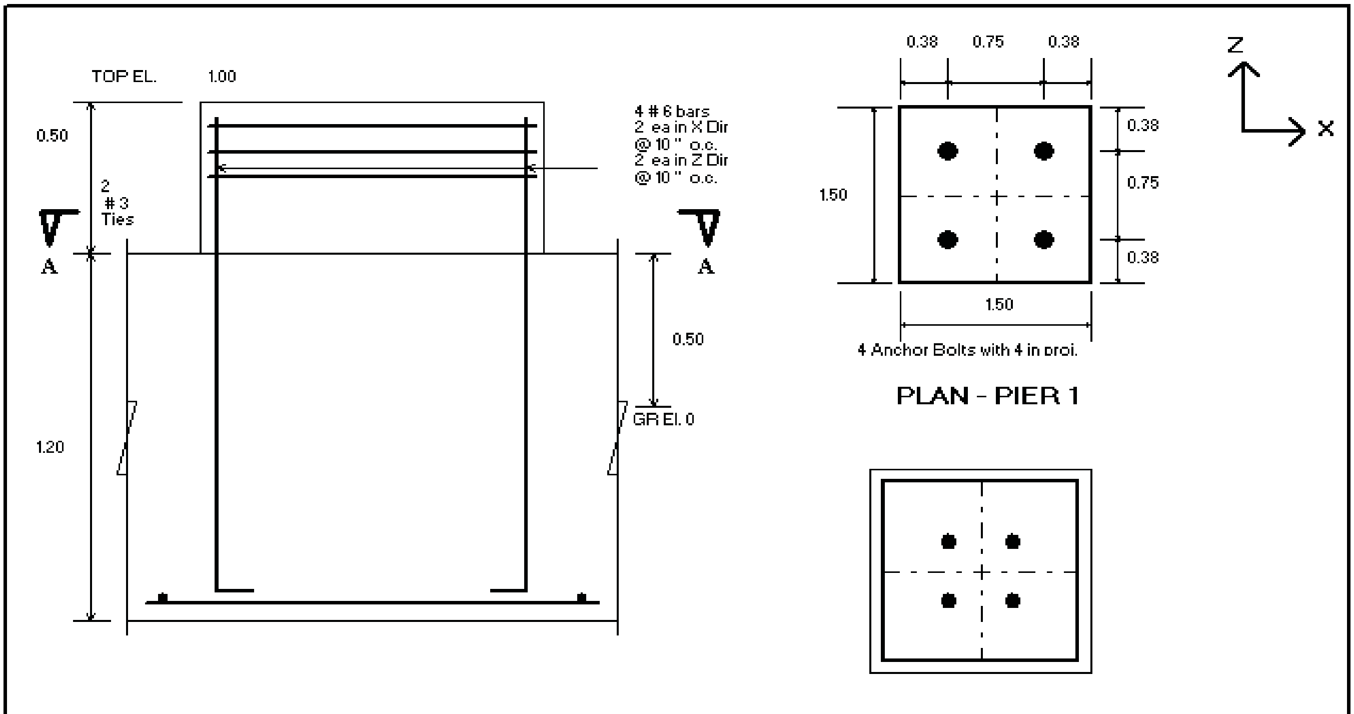
P2

Load Comb	Axial Load (kips)	Axial Capa. (kips)	Mom X (kip ft)	Mom X Capa (kip ft)	Mom Z (kip ft)	Mom Z Capa (kip ft)	Rem
1 - 1.4Dead	2.94	464.26	0.81	127.33	0.28	44.01	
2 - 1.2Dead + 0.5Snow	3.52	420.46	1.15	135.23	0.33	39.86	
3 - 1.2Dead + 1.6Snow + 0.8WLEW1	6.12	111.04	2.25	40.85	5.19	93.98	
4 - 1.2Dead + 1.6Snow + 0.8WLEW2	6.12	124.23	2.26	45.72	4.88	97.60	
5 - 1.2Dead + 1.6Snow + 0.8WLEW3	6.32	126.20	2.32	46.05	4.98	98.27	
6 - 1.2Dead + 1.6Snow + 0.8WLEW4	6.35	142.79	2.35	52.59	4.47	99.70	
7 - 1.2Dead + 1.6Snow + 0.8WLNS	5.46	445.01	1.43	115.70	0.82	66.48	
8 - 1.2Dead + 0.5Snow + 1.6WLEW1	4.30	31.30	1.38	10.06	9.80	71.26	
9 - 1.2Dead + 0.5Snow + 1.6WLEW2	4.30	33.99	1.41	11.11	9.18	72.53	
10 - 1.2Dead + 0.5Snow + 1.6WLEW3	4.72	37.31	1.52	12.03	9.37	74.14	
11 - 1.2Dead + 0.5Snow + 1.6WLEW4	4.76	44.04	1.57	14.55	8.35	77.31	
12 - 1.2Dead + 0.5Snow + 1.6WLNS	2.99	395.88	0.28	37.46	1.06	138.86	
13 - 1.2Dead + 0.2Snow + EQX	2.93	82.82	0.87	24.49	3.42	95.57	
14 - 1.2Dead + 0.2Snow + EQY	3.10	357.39	1.26	142.61	0.29	33.79	
15 - 0.9Dead + 1.6WLEW1	2.67	17.89	0.76	5.09	9.69	64.89	
16 - 0.9Dead + 1.6WLEW2	2.67	19.29	0.78	5.66	9.07	65.55	
17 - 0.9Dead + 1.6WLEW3	3.08	22.31	0.90	6.50	9.26	67.02	
18 - 0.9Dead + 1.6WLEW4	3.13	26.09	0.95	7.92	8.24	68.81	
19 - 0.9Dead + 1.6WLNS	1.35	105.93	0.88	67.61	0.95	73.18	
20 - 0.9Dead + EQX	1.90	43.62	0.51	11.75	3.37	77.45	
21 - 0.9Dead + EQY	2.07	151.52	1.61	117.66	0.20	14.40	

Project: BGCAPP
Job Number: 24915
Calc. No.: 10-DBC-00-00004
Sheet No.: D2-48 of D2-51
Sheet Rev.: D

Subject: Gas Bottle Canopy, Supports, Equip Misc Foundations
By: M. Bratt Date: 1/25/2010

Dimensional Solutions Mat3D		**Version**	**5.1.0**		**Date**	**1/25/2010**
Foundation Name	**Gas bottle canopies, Supports, Equip. & Misc Fdns**				**Time**	**10:21:49 AM**
Designed By:	**PARSONS**	**Engineer**		M. Bratt	**Checker**	
	C:\Documents and Settings\p0045388\My Documents\SCWO					
Filename:	**...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**					

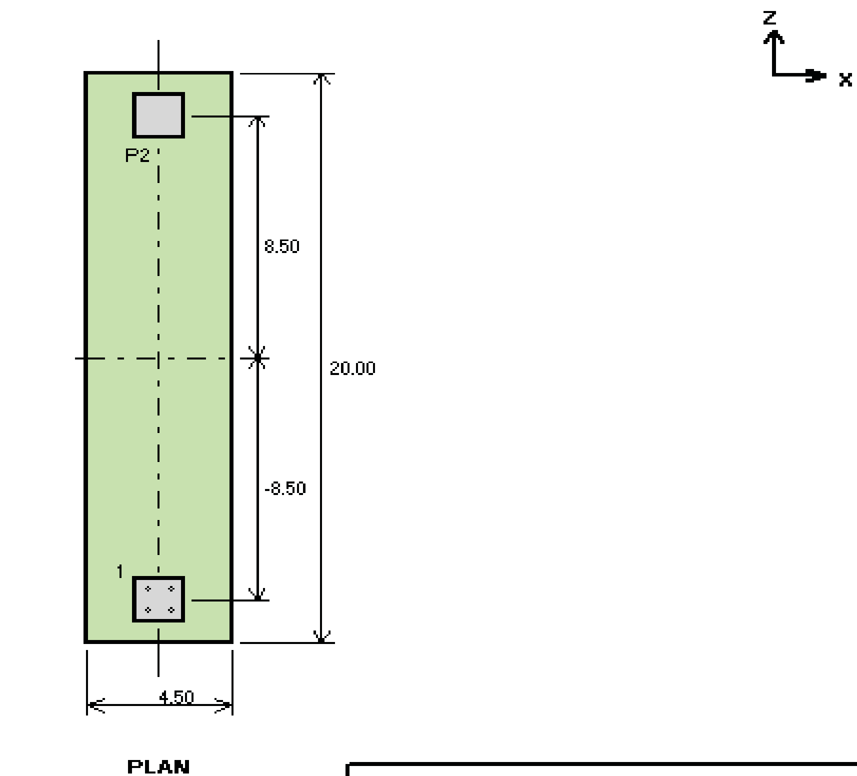


ELEVATION LOOKING Z

PLAN - PIER 1

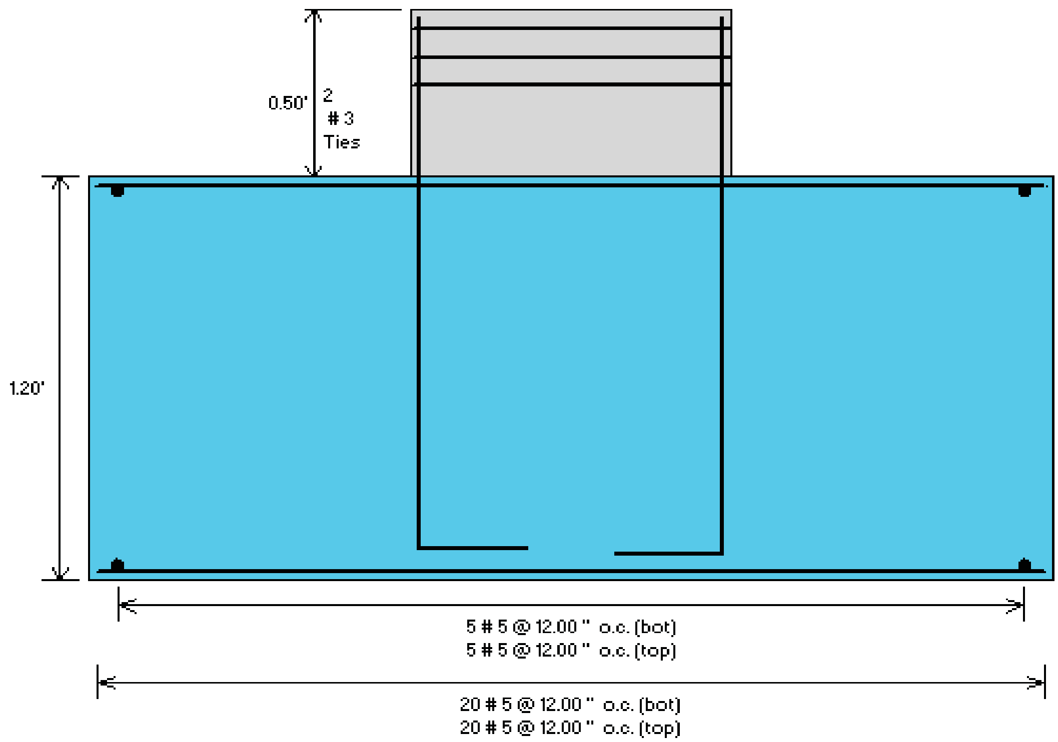
SECTION A - A

Dimensional Solutions Mat3D		**Version**	**5.1.0**			**Date**	**1/25/2010**
Foundation Name	**Gas bottle canopies, Supports, Equip. & Misc Fdns**					**Time**	**10:21:49 AM**
Designed By:	**PARSONS**	**Engineer**		M. Bratt		**Checker**	
Filename:	**C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d**						



FOUNDATION PLAN FOR Gas bottle canopi

Dimensional Solutions Mat3D		Version	5.1.0	Date	1/25/2010
Foundation Name	Gas bottle canopies, Supports, Equip. & Misc Fdns			Time	10:21:49 AM
Designed By:	PARSONS	Engineer	M. Bratt	Checker	
Filename:	C:\Documents and Settings\p0045388\My Documents\SCWO\ ...\App D.2 Gas Bottle Canopy 2\FOUNDATION.m3d				



ELEVATION ALONG X: P2

D2.5. Summary

The calculation performed in this appendix includes structural analysis and design of a combined footing gas bottle canopy #2. No soil uplift is observed under worst-case overturning loads, and wind and seismic sliding resistance of the foundations is adequate.

The footing is 2'-0" thick with top of slab 6" above finished grade. Reinforcement is as follows:
#5@ 12 o.c. E-W top.
(6) #5 eq. spc. N-S top.
#6 @ 12" o.c. E-W bottom.
(6) #6 eq. spc. N-S bottom.
(4) additional horizontal #6 bars E-W at bottom under each pier.

Piers 1 & 2 are 1'-6" square and are 6" tall. Top of pier is 1'-0" above finished grade. Reinforcement is (4) #6 longitudinal bars with (4) #3 ties.

Appendix E

Miscellaneous Interior Equipment Foundations

E.1. Objective

The calculation performed in this appendix includes structural analysis and design of foundations for the Effluent Caustic Day Tank (MV-RO-0101), R.O. Skid (MK-RO-0101), R.O. Multimedia Filters (MK-RO-0101A through MK-RO-0101F), and Hydrolysate Heater Module (MX-SCWO-0042). All equipment is contained within the SCWO Processing Building (SPB).

E.2. Inputs

The Effluent Caustic Day Tank is located between column lines H.5, G, 4, and 5.

The R.O. Multimedia Filters and R.O. Skid are located between column lines J, G, 1, and 3.

The Hydrolysate Heater Module is located between column lines 6, 7, A and B.

See Drawing no. 24915-10-AE-00-00001 for equipment arrangement.

(1) The Effluent Caustic Day Tank is circular and welded steel measuring 12’-9” tall (overall) and 4’-0” in diameter. It is supported on steel unbraced legs. The estimated operating weight of the tank is 10350 lb. See sheets A-1 through A-8 for dimensions and technical data.

(2) The R.O Skid is 6’-10.5” tall, with a footprint of 16’-8” x 6’-6”. The operating weight of the equipment is 12,100 lb. See sheets A-9 through A-10 for dimensions and technical data.

(3) The R.O. Multimedia Filters are circular welded steel each measuring 10’-2.25” tall and 54” outside diameter. There are a total of six filters supported on steel unbraced legs. The estimated operating weight of each filter is 22080 lb. See sheets A-10 through A-12 for dimensions and technical data.

(4) The Hydrolysate Heater Module is 9’-0” tall (not including platform) and has a footprint of 9’-2” x 13’-6”. The operating weight of the equipment is 12,500 lb. See drawing 24915-10-B2-SCWO-00012 for weight and dimensions.

E.3 Assumptions

Dry and operating weights of the Effluent Caustic Day Tank are estimated based on the physical characteristics of the tank itself and its fluid capacity.

All equipment is inside the SPB, so wind and snow loads are ignored.

Assumed tank contents weight and sloshing calculations are based on the properties of water.

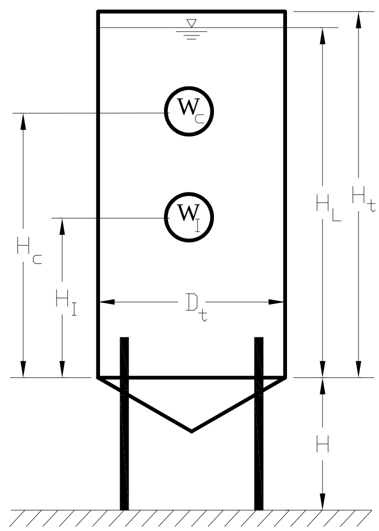
E.4 Calculation Body

Base shear and overturning moment of each piece of equipment are computed in the following MathCAD templates. These loads are then entered into Mat3D and the foundations are checked for sliding and soil uplift.

Tank Seismic Load Calculation - Effluent Caustic Day Tank

Tank Information

The tank is circular, elevated, supported on unbraced legs, and welded steel.



Operational weight: $W_t := 10350 \cdot lbf$

Tank empty weight: $W_W := 2200 \cdot lbf \cdot 1.15$ $\quad W_W = 2530\,lbf$

(Includes 15% increase for misc attachments)

Diameter: $D_t := 48 \cdot in$

Tank wall thickness: $t := \frac{3}{8} \cdot in$

Tank height: $H_t := 7 \cdot ft$

Height of liquid: $H_L := H_t - 0.5 \cdot ft$ $\quad H_L = 6.5\,ft$

Leg height: $H := 4 \cdot ft$ $\quad A := 2.86 in^2$

Leg angle size: L4x4x3/8 (Assume) $\quad r_z := 0.779 in$

Number of legs: $N := 4$

Moment of inertia of a leg about x-axis: $I_x := 4.32 \cdot in^4$

Moment of inertia of a leg about z-axis: $I_z := r_z^{\,2} \cdot A$ (= r_z^2 x A) i.e. $I_z = 1.736 \cdot in^4$

Moment of inertia of a leg about w-axis: $I_w := 2 \cdot I_x - I_z$ i.e. $I_w = 6.904 \cdot in^4$

Bolt circle diameter: $D_{bolt} := 4ft$

Base plate area: $A_{bp} := (6 \cdot in)^2$

Liquid Content Density Estimation and Platform Weight

Weight of liquid: $W_L := W_t - W_W$ i.e. $W_L = 7.82 \cdot kip$

Tank content density: $\gamma_{liquid} := \dfrac{W_L}{\frac{\pi}{4} \cdot D_t^{\,2} \cdot H_L}$ i.e. $\gamma_{liquid} = 95.738 \cdot pcf$

Tank Seismic Load Calculation - Effluent Caustic Day Tank

Check if the Tank is a Rigid Structure

Density of steel: $\rho_s := 490 \cdot pcf$ Steel elastic modulus: $E_s := 29000 \cdot ksi$

Lateral deflection under N-S EQ load: $y_x := \dfrac{2 \cdot W_t \cdot H^3}{3 \cdot N \cdot E_s \cdot I_x}$ i.e. $y_x = 1.523 \cdot in$

Lateral deflection under NW EQ load: $y_2 := \dfrac{2 \cdot W_t \cdot H^3}{3 \cdot \frac{N}{2} \cdot E_s \cdot \left(I_z + I_w\right)}$ i.e. $y_2 = 1.523 \cdot in$

The fundamental period of the tank with its content is computed by using Ref. 4.11 Fig. 3-9 formula:

N-S EQ: $T_x := 2 \cdot \pi \cdot \sqrt{\dfrac{y_x}{g}}$ $T_x = 0.395\,s$ > 0.06, the tank is not rigid and Sec. 1622.2.6 of IBC2000 is not used.

NW EQ: $T_2 := 2 \cdot \pi \cdot \sqrt{\dfrac{y_2}{g}}$ $T_2 = 0.395\,s$ > 0.06, the tank is not rigid and Sec. 1622.2.6 of IBC2000 is not used.

Water Weights and Their C.G. Heights (Circular Tank)

Height of liquid: $H_L = 6.5\,ft$

Tank diameter: $D_t = 4\,ft$

$D/HL := \dfrac{D_t}{H_L}$ $D/HL = 0.615$

Impulsive weight of liquid: $W_I := \dfrac{\tanh(0.866 \cdot D/HL)}{0.866 \cdot D/HL} \cdot W_L$ (ACI350.3-01 Eq. 9-15) $W_I = 7155.12\,lbf$

C.G. height of W_I: $H_I := H_L \cdot \begin{cases} 0.5 - 0.09375 \cdot D/HL & \text{if } D/HL < 1.333 \\ 0.375 & \text{otherwise} \end{cases}$ (ACI350.3-01 Eq. 9-17) (ACI350.3-01 Eq. 9-18)

i.e. $H_I = 2.875\,ft$

Convective weight of liquid: $W_C := 0.230 \cdot D/HL \cdot \tanh\left(\dfrac{3.68}{D/HL}\right) \cdot W_L$ (ACI350.3-01 Eq. 9-16)

i.e. $W_C = 1106.817\,lbf$

C.G. Height of W_C: $H_C := \left(1 - \dfrac{\cosh\left(\dfrac{3.68}{D/HL}\right) - 1}{\dfrac{3.68}{D/HL} \cdot \sinh\left(\dfrac{3.68}{D/HL}\right)}\right) \cdot H_L$ (ACI350.3-01 Eq. 9-19)

i.e. $H_C = 5.419\,ft$

Tank Seismic Load Calculation - Effluent Caustic Day Tank

Sloshing Periods

Coefficient λ (Fig. 9.9 of ACI350.3-01):

$$\lambda := \sqrt{3.68 \cdot 32.2 \cdot \tanh\left(\frac{3.68}{D/HL}\right)} \qquad \text{i.e.} \quad \lambda = 10.886$$

$$\frac{2\pi}{\lambda} = 0.577$$

Period for convective component:

$$T_c := \frac{2\pi}{\lambda} \cdot \sqrt{\frac{D_t}{ft}} \qquad \text{(ACI350.3-01 Eq. 9-30)} \quad \text{i.e.} \quad T_c = 1.154$$

Check Code Sloshing Requirement (IBC2000 Sec. 1622.4.3.1)

N-S EQ:

$$\frac{T_c \cdot sec}{T_x} = 292.556 \cdot \%$$

$$\text{if}\left(70\% \le \frac{T_c \cdot sec}{T_x} \le 150\%, \text{"INCLUDE Sloshing"}, \text{"Ignore sloshing"}\right) = \text{"Ignore sloshing"}$$

NW EQ:

$$\frac{T_c \cdot sec}{T_2} = 292.556 \cdot \%$$

$$\text{if}\left(70\% \le \frac{T_c \cdot sec}{T_2} \le 150\%, \text{"INCLUDE Sloshing"}, \text{"Ignore sloshing"}\right) = \text{"Ignore sloshing"}$$

Seismic Base Shear and Overturning Moment

Design spectral response acceleration parameters (Sec. 1615.1.3 of IBC2000)

At short period: $S_{DS} := 0.273$ (per BGCAPP Design Criteria and IBC2000)

At long period: $S_{D1} := 0.167$

Seismic Importance Factor: $I_E := 1.5$ (APS, Level = 2, Ref. 4.13)

The tank is elevated, supported by unbraced legs, and welded steel. Table 1622.2.5(1) of IBC2000 specifies the seismic coefficients as follows.

$R := 3 \qquad \Omega_o := 2 \qquad C_d := 2.5$

Component amplification factor (Table 1621.3 of IBC2000): $a_p := 2.50$

Height in structure at point of attachement of component: $z := 0$

Tank Seismic Load Calculation - Effluent Caustic Day Tank

Impulsive seismic force: $F_{P1} := \dfrac{0.4 \cdot a_p \cdot S_{DS}}{\dfrac{R}{I_E}} \cdot \left(1 + 2 \cdot \dfrac{z}{H}\right)$ i.e. $F_{P1} = 0.137$

$F_{Pmax} := 1.6 \cdot S_{DS} \cdot I_E$ i.e. $F_{Pmax} = 0.655$

$F_{Pmin} := 0.3 \cdot S_{DS} \cdot I_E$ i.e. $F_{Pmin} = 0.123$

$F_P := \max\left(\min\left(F_{P1}, F_{Pmax}\right), F_{Pmin}\right)$ i.e. $F_P = 0.137$

Combined seismic coeff.: $C_s := F_P$ i.e. $C_s = 0.137$

Lateral base shear force: $V := C_s \cdot \left(W_W + W_L\right)$ (IBC2000 Eq. 16-34) i.e. $V = 1412.775\,\text{lbf}$

Vertical component of EQ: $0.2 \cdot S_{DS} = 0.055$

$$OTM := C_s \cdot \left[W_W \cdot \frac{H_t + H}{2} + W_L \cdot \left(\frac{H_t}{2} + H\right)\right]$$

i.e. $OTM = 9.905 \cdot ft \cdot kip$

Mat Foundation Design Load Calculation - Effluent Caustic Day Tank

Gravity Loads Applied on Concrete Pad

Tank self-weight: $W_W = 2.53 \cdot kip$

Tank content weight: $W_L = 7.82 \cdot kip$

Pad thickness: $t_{pad} := 5 \cdot in$

Vertical load applied on concrete pad due to self-weight: $P_{DLpad} := \frac{W_W}{4} + \frac{t_{pad} \cdot 5.5ft \cdot 5.5ft \cdot 150 \cdot pcf}{4}$ i.e. $P_{DLpad} = 1105.156 \cdot lbf$

Vertical load applied on concrete pad due to tank liquid content with LL deducted:

$P_{LLpad} := \frac{W_L}{4}$ i.e. $P_{LLpad} = 1955\, lbf$

Overturning Moments Applied on Concrete Pad

Lateral base shear force: $V = 1.413 \cdot kip$

Overturning moment at the mat top surface: $OTM = 9.905 \cdot ft \cdot kip$

Mat foundation thickness: $t_{mat} := 2 \cdot ft + 0 \cdot in$

Overturning moment at the mat bottom: $OTM2 := OTM + V \cdot (t_{mat} + t_{pad})$ i.e. $OTM2 = 13 \cdot ft \cdot kip$

For N-S direction EQ load, assume that the seismic overturning moment of a tank is applied on two base plates using an upward uniform pressure value and on the remaining two using a downward valu

Overturning moment arm: $a_x := \frac{D_{bolt}}{\sqrt{2}}$ i.e. $a_x = 2.828\, ft$

Pad force from OTM2: $P_{xEQpad} := \frac{OTM2}{a_x \cdot 2}$ i.e. $P_{xEQpad} = 2354.547\, lbf$

Lateral Shear: $V_{pl} := \frac{V}{4}$ $V_{pl} = 0.353 \cdot kip$

For NW direction EQ load (diagonal), assume that the seismic overturning moment of a tank is applie one base plate using an upward uniform pressure value and on the opposite one using a downward va

Overturning moment arm: $a_2 := D_{bolt}$ i.e. $a_2 = 4\, ft$

Pad force from OTM2: $P_{2EQpad} := \frac{OTM2}{a_2}$ i.e. $P_{2EQpad} = 3329.832\, lbf$

Lateral Shear in x & y dir: $V_{pl} := \frac{V}{4} \cdot \cos(45)$ $V_{pl} = 0.186 \cdot kip$

Dimensional Solutions Mat3D		Version	5.1.0		Date	10/7/2009
Foundation Name	Effluent Caustic Day Tank				Time	7:37:08 AM
Designed By:	PARSONS	Engineer		R. Murphy	Checker	B. Rabe
	C:\Documents and Settings\p0045388\My Documents\SCWO\					
Filename:	10-DBC-00-00004 Gas Bottle & Misc Concrete\...\01 Effluent Caustic Day Tank\CAUSTIC DAY TANK.m3d					

DETAIL REPORT

PROJECT INFORMATION

Project Name:	
Project Number:	24915-10-DBC-00-00004
Client:	
Project Location	
Foundation Description	EFFLUENT CAUSTIC DAY TANK

DESIGN CODE	ACI 318 - 1999	**INPUT UNITS**	English	**OUTPUT UNITS**	English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

PILE PARAMETERS:

Diameter (in)		0
Type	Drilled Shaft	

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

REBAR PARAMETERS:

Max Long Bar Size	9
Min Long Bar Size	4
Max Tie Bar Size	8
Min Tie Bar Size	3
Max Ftg Bar Size	9
Min Ftg Bar Size	4
Temp & Shrinkage Steel Ratio	0.0018

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	3000.00
Unit Weight (pcf)	120.00

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	2.00
Minimum Soil Cover (ft)	0.00

APPLIED LOADS

P1

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.11	0.00	0.00	0.00	0.00
2 - Live	1.96	0.00	0.00	0.00	0.00
3 - EQNS	-2.40	0.00	0.00	0.35	0.00
4 - EQEW	-2.40	0.35	0.00	0.00	0.00
5 - EQNE	-3.40	0.19	0.00	0.19	0.00

P2

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.11	0.00	0.00	0.00	0.00
2 - Live	1.96	0.00	0.00	0.00	0.00
3 - EQNS	2.40	0.00	0.00	0.35	0.00
4 - EQEW	-2.40	0.35	0.00	0.00	0.00
5 - EQNE	0.00	0.19	0.00	0.19	0.00

P3

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.11	0.00	0.00	0.00	0.00
2 - Live	1.96	0.00	0.00	0.00	0.00
3 - EQNS	-2.40	0.00	0.00	0.35	0.00
4 - EQEW	2.40	0.35	0.00	0.00	0.00
5 - EQNE	0.00	0.19	0.00	0.19	0.00

P4

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.11	0.00	0.00	0.00	0.00
2 - Live	1.96	0.00	0.00	0.00	0.00
3 - EQNS	2.40	0.00	0.00	0.35	0.00
4 - EQEW	2.40	0.35	0.00	0.00	0.00
5 - EQNE	3.40	0.19	0.00	0.19	0.00

UNFACTORED (ALLOWABLE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.11	0.00	0.00	0.00	0.00
2 - Dead + Live	3.07	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	-0.57	0.00	0.00	0.25	0.00
4 - Dead + 0.7EQEW	-0.57	0.25	0.00	0.00	0.00
5 - Dead + 0.7EQNE	-1.27	0.13	0.00	0.13	0.00

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.11	0.00	0.00	0.00	0.00
2 - Dead + Live	3.07	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	2.79	0.00	0.00	0.25	0.00
4 - Dead + 0.7EQEW	-0.57	0.25	0.00	0.00	0.00
5 - Dead + 0.7EQNE	1.11	0.13	0.00	0.13	0.00

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.11	0.00	0.00	0.00	0.00
2 - Dead + Live	3.07	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	-0.57	0.00	0.00	0.25	0.00
4 - Dead + 0.7EQEW	2.79	0.25	0.00	0.00	0.00
5 - Dead + 0.7EQNE	1.11	0.13	0.00	0.13	0.00

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	1.11	0.00	0.00	0.00	0.00
2 - Dead + Live	3.07	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	2.79	0.00	0.00	0.25	0.00
4 - Dead + 0.7EQEW	2.79	0.25	0.00	0.00	0.00
5 - Dead + 0.7EQNE	3.49	0.13	0.00	0.13	0.00

FACTORED (ULTIMATE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	1.55	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.47	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.29	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	-1.07	0.00	0.00	0.35	0.00
5 - 1.2Dead + EQEW	-1.07	0.35	0.00	0.00	0.00
6 - 1.2Dead + EQNE	-2.07	0.19	0.00	0.19	0.00

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	1.55	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.47	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.29	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	3.73	0.00	0.00	0.35	0.00
5 - 1.2Dead + EQEW	-1.07	0.35	0.00	0.00	0.00
6 - 1.2Dead + EQNE	1.33	0.19	0.00	0.19	0.00

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	1.55	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.47	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.29	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	-1.07	0.00	0.00	0.35	0.00
5 - 1.2Dead + EQEW	3.73	0.35	0.00	0.00	0.00
6 - 1.2Dead + EQNE	1.33	0.19	0.00	0.19	0.00

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	1.55	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.47	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.29	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	3.73	0.00	0.00	0.35	0.00
5 - 1.2Dead + EQEW	3.73	0.35	0.00	0.00	0.00
6 - 1.2Dead + EQNE	4.73	0.19	0.00	0.19	0.00

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.38	3.24	0.00	0.00	0.00	0.00	
2 - Dead + Live	0.52	3.24	0.00	0.00	0.00	0.00	
3 - Dead + 0.7EQNS	0.63	4.24	0.82	0.00	0.00	17.48	
4 - Dead + 0.7EQEW	0.63	4.24	0.00	0.82	17.48	0.00	
5 - Dead + 0.7EQNE	0.72	4.24	0.56	0.56	11.99	11.99	

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	100.00	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Live	100.00	100.00	1.50	100.00	100.00	1.50	
3 - Dead + 0.7EQNS	7.82	100.00	1.50	20.09	100.00	1.50	
4 - Dead + 0.7EQEW	100.00	7.82	1.50	100.00	20.09	1.50	
5 - Dead + 0.7EQNE	8.66	8.66	1.50	37.01	37.01	1.50	

FOOTING DESIGN INFORMATION

X Dim (ft)	7.50
Z Dim (ft)	7.50
Thickness (ft)	2.00

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
2. 1.2Dead + 1.6Live	8	5	12	0.33	0.01	-0.45	E-W
2. 1.2Dead + 1.6Live	8	5	12	0.33	0.01	-0.45	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
5. 1.2Dead + EQEW	15	5	6	0.61	0.52	0.32	E-W
4. 1.2Dead + EQNS	15	5	6	0.61	0.52	0.32	N-S

PUNCHING SHEAR

P1

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
2. 1.2Dead + 1.6Live	2.99	1.44	215.04	

P2

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
4. 1.2Dead + EQNS	3.30	1.59	215.04	

P3

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
5. 1.2Dead + EQEW	3.30	1.59	215.04	

P4

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
6. 1.2Dead + EQNE	3.61	1.74	215.04	

MAXIMUM SHEAR - X DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	4.08	0.28	0.16	107.52	
2 - 1.2Dead + 1.6Live	4.08	0.80	0.44	107.52	
3 - 1.2Dead + Live	4.08	0.59	0.33	107.52	
4 - 1.2Dead + EQNS	4.08	0.24	0.13	107.52	
5 - 1.2Dead + EQEW	3.42	-0.39	0.22	107.52	
6 - 1.2Dead + EQNE	4.08	0.24	0.14	107.52	

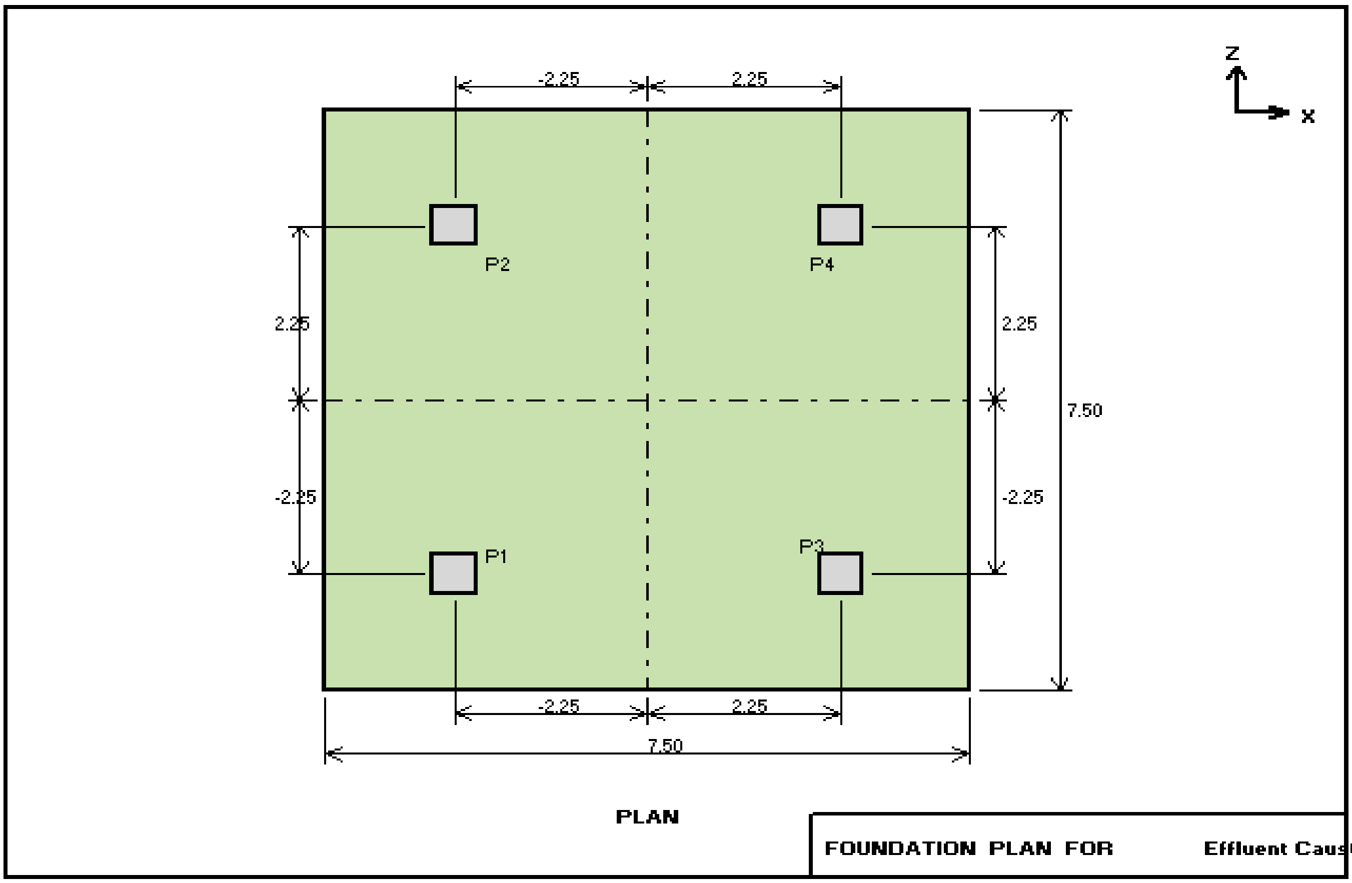
MAXIMUM SHEAR - Z DIRECTION

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	4.08	0.28	0.16	107.52	
2 - 1.2Dead + 1.6Live	4.08	0.80	0.44	107.52	
3 - 1.2Dead + Live	4.08	0.59	0.33	107.52	
4 - 1.2Dead + EQNS	3.42	-0.39	0.22	107.52	
5 - 1.2Dead + EQEW	4.08	0.24	0.13	107.52	
6 - 1.2Dead + EQNE	4.08	0.24	0.14	107.52	

PIER/BASE PLATE DESIGN INFORMATION

	P1	P2	P3	P4
X Dim (ft)	0.50	0.50	0.50	0.50
Z Dim (ft)	0.50	0.50	0.50	0.50

Height (ft)	0.33	0.42	0.42	0.42
X Offset (ft)	1.50	1.50	6.00	6.00
Z Offset (ft)	1.50	6.00	1.50	6.00
Requested Reinft. Ratio	0.0018	0.0018	0.0018	0.0018
Provided Reinft. Ratio	0.0000	0.0000	0.0000	0.0000
Long Bar Size	0	0	0	0
Bars in X Dir	0	0	0	0
Bars in Z Dir	0	0	0	0
Total Long Bars	0	0	0	0
Tie Bar Size	3	3	3	3
Total No. of Ties	1	1	1	1
Major Tie Spacing (in)	-1	1	1	1



Seismic Load Calculation - R.O. Skid

Operational weight: $W_t := 12210\text{lbf}$

Empty weight: $W_W := 8767\text{lbf}$

Contents Weight: $W_L := W_t - W_W$ $\quad W_L = 3443\,\text{lbf}$

COG Height: $H_t := 38\text{in}$

Distance between Anchor Bolts: $D_{bolt} := 69\cdot\text{in}$

Seismic Base Shear and Overturning Moment

Design spectral response acceleration parameters (Sec. 1615.1.3 of IBC2003)

At short period: $S_{DS} := 0.273$ (per BGCAPP Design Criteria and IBC2000)

At long period: $S_{D1} := 0.167$

Seismic Importance Factor: $I_E := 1.0$ (APS, Level = 2, Ref. 4.13)

Response Modification factor (Table 12-6 BGCAPP Design Criteria): 'General Mechanical - Other' $R := 1$

Component amplification factor (Table 12-6 BGCAPP Design Criteria): $a_p := 2.50$

Height in structure at point of attachement of component: $z := 0$

Impulsive seismic force:

$$F_{P1} := \frac{0.4\cdot a_p\cdot S_{DS}}{\dfrac{R}{I_E}}\cdot\left(1 + 2\cdot\frac{z}{H}\right) \qquad F_{P1} = 0$$

$$F_{Pmax} := 1.6\cdot S_{DS}\cdot I_E \qquad F_{Pmax} = 0$$

$$F_{Pmin} := 0.3\cdot S_{DS}\cdot I_E \qquad F_{Pmin} = 0$$

$$F_P := \max\left(\min\left(F_{P1}, F_{Pmax}\right), F_{Pmin}\right) \qquad F_P = 0$$

Combined seismic coeff.: $C_s := F_P$ $\quad C_s = 0.273$

Lateral base shear force: $V := C_s\cdot\left(W_t\right)$ (IBC2000 Eq. 16-34) $\quad V = 3333\,\text{lbf}$

Vertical component of EQ: $0.2\cdot S_{DS} = 0.055$

Overturning Moment: $OTM := C_s\cdot\left(W_t\cdot H_t\right)$ $\quad OTM = 11\cdot\text{ft}\cdot\text{kip}$

Seismic Load Calculation - R.O. Skid

Gravity Loads Applied on Concrete Pad

Unit self-weight: $W_W = 9 \cdot kip$

Unit content weight: $W_L = 3 \cdot kip$

Pad thickness: $t_{pad} := 1 \cdot in$

Vertical load applied on concrete pad due to self-weight:

$$P_{DLpad} := \frac{W_W}{4} \qquad P_{DLpad} = 2.192 \cdot kip$$

Vertical load applied on concrete pad from internal contents:

$$P_{LLpad} := \frac{W_L}{4} \qquad P_{LLpad} = 0.861 \cdot kip$$

Overturning Moments Applied on Concrete Pad

Lateral base shear force: $V = 3 \cdot kip$

Overturning moment per tank: $OTM = 11 \cdot ft \cdot kip$

Mat foundation thickness: $t_{mat} := 3 \cdot ft + 4 \cdot in$

For N-S direction EQ load, assume that the seismic overturning moment of the unit is applied on two anchor points using an upward force and on the remaining two using a downward force.

Overturning moment arm: $a_1 := D_{bolt}$ $\qquad a_1 = 6\,ft$

Pad force from OTM: $P_{xEQpad} := \frac{OTM}{a_1 \cdot 2}$ $\qquad P_{xEQpad} = 0.918 \cdot kip$

Lateral Shear: $V_{pl} := \frac{V}{4}$ $\qquad V_{pl} = 0.833 \cdot kip$

For NE direction EQ load, assume that the seismic overturning moment of the unit is applied on one anchor point using an upward force and on the opposite one using a downward force.

Overturning moment arm: $a_2 := D_{bolt} \cdot \sqrt{2}$ $\qquad a_1 = 6\,ft$

Pad force from OTM: $P_{2EQpad} := \frac{OTM}{a_2}$ $\qquad P_{2EQpad} = 1.298 \cdot kip$

Lateral Shear in x & y dir: $V_{pl} := \frac{V}{4} \cdot \cos(45)$ $\qquad V_{pl} = 0.438 \cdot kip$

Subject: Gas Bottle Canopy Misc Support Calculations
By: M. Bratt   Date: 10/5/2009

Project: BGCAPP
Job Number: 743341
Calc. No.: 24915-10-DBC-00-00004
Sheet No.: E-20 of E-80
Sheet Rev.: D

Dimensional Solutions Mat3D		**Version**	**5.1.0**		**Date**	**10/7/2009**
Foundation Name	**R.O. Skid Foundation**				**Time**	**7:16:03 AM**
Designed By:	**PARSONS**	**Engineer**		R. Murphy	**Checker**	B. Rabe
	C:\Documents and Settings\p0045388\My Documents\SCWO					
Filename:	**10-DBC-00-00004 Gas Bottle & Misc Concrete\...\02 03 RO Skid\RO SKID FOUNDATION.m3d**					

DETAIL REPORT

PROJECT INFORMATION

Project Name:	
Project Number:	10-DBC-00-00004
Client:	
Project Location	
Foundation Description	R.O. SKID FOUNDATION

DESIGN CODE ACI 318 - 2002 **INPUT UNITS** English **OUTPUT UNITS** English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	3000.00
Unit Weight (pcf)	120.00

PILE PARAMETERS:

Diameter (in)	0
Type	Drilled Shaft

REBAR PARAMETERS:

Max Long Bar Size	9
Min Long Bar Size	4
Max Tie Bar Size	8
Min Tie Bar Size	3
Max Ftg Bar Size	9
Min Ftg Bar Size	4
Temp & Shrinkage Steel Ratio	0.0018

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	2.00
Minimum Soil Cover (ft)	0.00

APPLIED LOADS

P1

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.19	0.00	0.00	0.00	0.00
2 - Live	0.86	0.00	0.00	0.00	0.00
3 - EQNS	-1.00	0.00	0.00	0.83	0.00
4 - EQEW	-1.00	0.83	0.00	0.00	0.00
5 - EQNE	-1.30	0.44	0.00	0.44	0.00

P2

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.19	0.00	0.00	0.00	0.00
2 - Live	0.86	0.00	0.00	0.00	0.00
3 - EQNS	1.00	0.00	0.00	0.83	0.00
4 - EQEW	-1.00	0.83	0.00	0.00	0.00
5 - EQNE	0.00	0.44	0.00	0.44	0.00

P3

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.19	0.00	0.00	0.00	0.00
2 - Live	0.86	0.00	0.00	0.00	0.00
3 - EQNS	-1.00	0.00	0.00	0.83	0.00
4 - EQEW	1.00	0.83	0.00	0.00	0.00
5 - EQNE	0.00	0.44	0.00	0.44	0.00

P4

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.19	0.00	0.00	0.00	0.00
2 - Live	0.86	0.00	0.00	0.00	0.00
3 - EQNS	1.00	0.00	0.00	0.83	0.00
4 - EQEW	1.00	0.83	0.00	0.00	0.00
5 - EQNE	1.30	0.44	0.00	0.44	0.00

UNFACTORED (ALLOWABLE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.19	0.00	0.00	0.00	0.00
2 - Dead + Live	3.05	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	1.49	0.00	0.00	0.58	0.00
4 - Dead + 0.7EQEW	1.49	0.58	0.00	0.00	0.00
5 - Dead + 0.7EQNE	1.28	0.31	0.00	0.31	0.00

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.19	0.00	0.00	0.00	0.00
2 - Dead + Live	3.05	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	2.89	0.00	0.00	0.58	0.00
4 - Dead + 0.7EQEW	1.49	0.58	0.00	0.00	0.00
5 - Dead + 0.7EQNE	2.19	0.31	0.00	0.31	0.00

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.19	0.00	0.00	0.00	0.00
2 - Dead + Live	3.05	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	1.49	0.00	0.00	0.58	0.00
4 - Dead + 0.7EQEW	2.89	0.58	0.00	0.00	0.00
5 - Dead + 0.7EQNE	2.19	0.31	0.00	0.31	0.00

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	2.19	0.00	0.00	0.00	0.00
2 - Dead + Live	3.05	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	2.89	0.00	0.00	0.58	0.00
4 - Dead + 0.7EQEW	2.89	0.58	0.00	0.00	0.00
5 - Dead + 0.7EQNE	3.10	0.31	0.00	0.31	0.00

FACTORED (ULTIMATE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	3.07	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.01	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.49	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	1.63	0.00	0.00	0.83	0.00
5 - 1.2Dead + EQEW	1.63	0.83	0.00	0.00	0.00
6 - 1.2Dead + EQNE	1.33	0.44	0.00	0.44	0.00

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	3.07	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.01	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.49	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	3.63	0.00	0.00	0.83	0.00
5 - 1.2Dead + EQEW	1.63	0.83	0.00	0.00	0.00
6 - 1.2Dead + EQNE	2.63	0.44	0.00	0.44	0.00

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	3.07	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.01	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.49	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	1.63	0.00	0.00	0.83	0.00
5 - 1.2Dead + EQEW	3.63	0.83	0.00	0.00	0.00
6 - 1.2Dead + EQNE	2.63	0.44	0.00	0.44	0.00

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	3.07	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.01	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.49	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	3.63	0.00	0.00	0.83	0.00
5 - 1.2Dead + EQEW	3.63	0.83	0.00	0.00	0.00
6 - 1.2Dead + EQNE	3.93	0.44	0.00	0.44	0.00

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.41	3.24	0.00	0.00	0.00	0.00	
2 - Dead + Live	0.44	3.24	0.00	0.00	0.00	0.00	
3 - Dead + 0.7EQNS	0.51	4.24	0.28	0.00	0.00	13.49	
4 - Dead + 0.7EQEW	0.49	4.24	0.00	0.56	27.35	0.00	
5 - Dead + 0.7EQNE	0.52	4.24	0.17	0.35	17.12	8.12	

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	100.00	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Live	100.00	100.00	1.50	100.00	100.00	1.50	
3 - Dead + 0.7EQNS	30.10	100.00	1.50	21.64	100.00	1.50	
4 - Dead + 0.7EQEW	100.00	72.67	1.50	100.00	15.10	1.50	
5 - Dead + 0.7EQNE	57.76	100.00	1.50	40.82	28.49	1.50	

FOOTING DESIGN INFORMATION

X Dim (ft)	17.00
Z Dim (ft)	7.00
Thickness (ft)	2.25

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
2. 1.2Dead + 1.6Live	7	5	12	0.31	0.05	-4.1	E-W
2. 1.2Dead + 1.6Live	17	5	12	0.31	0.01	-0.53	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
5. 1.2Dead + EQEW	14	5	6	0.61	0.58	0.49	E-W
4. 1.2Dead + EQNS	34	5	6	0.61	0.58	0.19	N-S

PUNCHING SHEAR

P1

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
2. 1.2Dead + 1.6Live	3.61	3.78	189.74	

P2

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
2. 1.2Dead + 1.6Live	3.61	3.78	189.74	

P3

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
2. 1.2Dead + 1.6Live	3.61	3.78	189.74	

P4

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
2. 1.2Dead + 1.6Live	3.61	3.78	189.74	

MAXIMUM SHEAR - X DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	2.71	-4.18	2.16	94.87	
2 - 1.2Dead + 1.6Live	14.29	5.46	2.83	94.87	
3 - 1.2Dead + Live	2.71	-4.76	2.46	94.87	
4 - 1.2Dead + EQNS	2.71	-3.58	1.86	94.87	
5 - 1.2Dead + EQEW	14.29	3.74	1.93	94.87	
6 - 1.2Dead + EQNE	14.29	3.73	1.93	94.87	

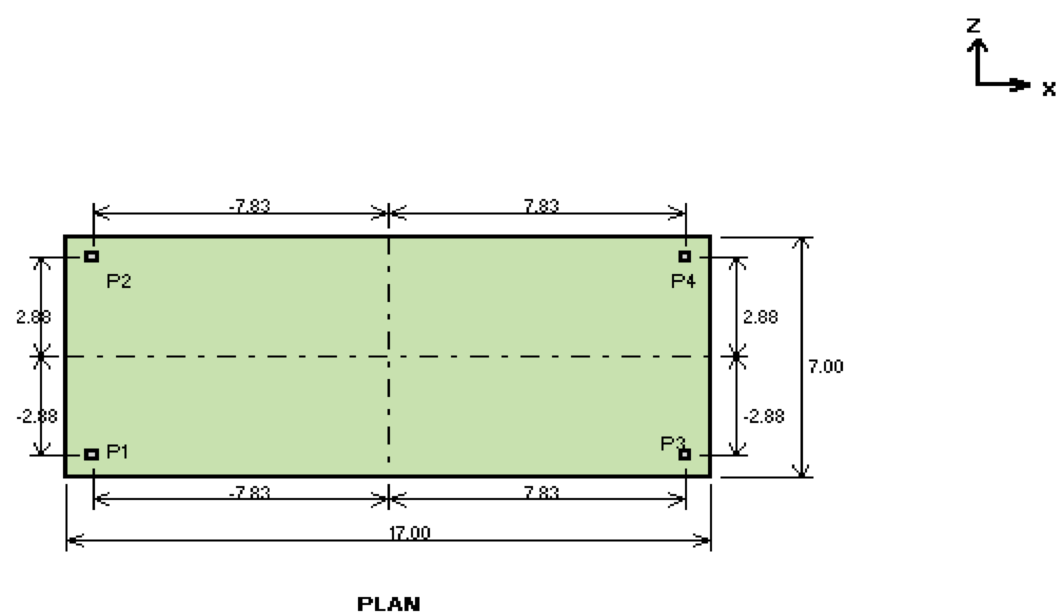
MAXIMUM SHEAR - Z DIRECTION

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	4.34	1.47	0.31	94.87	
2 - 1.2Dead + 1.6Live	4.34	1.92	0.41	94.87	
3 - 1.2Dead + Live	2.66	-1.67	0.36	94.87	
4 - 1.2Dead + EQNS	2.66	-3.15	0.67	94.87	
5 - 1.2Dead + EQEW	2.66	-1.26	0.27	94.87	
6 - 1.2Dead + EQNE	2.66	-2.30	0.49	94.87	

PIER/BASE PLATE DESIGN INFORMATION

	P1	P2	P3	P4
X Dim (ft)	0.25	0.25	0.25	0.25
Z Dim (ft)	0.25	0.25	0.25	0.25

Height (ft)	0.08	0.08	0.08	0.08
X Offset (ft)	0.67	0.67	16.33	16.33
Z Offset (ft)	0.62	6.38	0.62	6.38
Requested Reinft. Ratio	0.0018	0.0018	0.0018	0.0018
Provided Reinft. Ratio	0.0000	0.0000	0.0000	0.0000
Long Bar Size	0	0	0	0
Bars in X Dir	0	0	0	0
Bars in Z Dir	0	0	0	0
Total Long Bars	0	0	0	0
Tie Bar Size	3	3	3	3
Total No. of Ties	2	2	2	2
Major Tie Spacing (in)	-4	-4	-4	-4

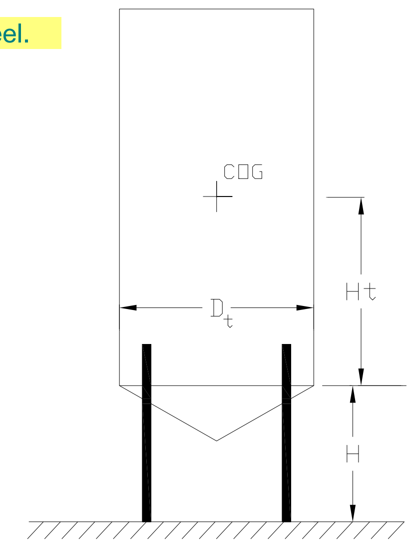


FOUNDATION PLAN FOR R.O. Skid Founda

Tank Seismic Load Calculation - Multimedia Filter SCWO

Tank Information

The tank is circular, elevated, supported on unbraced legs, and welded steel.



Operational weight: $W_t := 11880\text{lbf}$

Tank empty weight: $W_W := 2651\text{lbf}$

Tank Content Weight: $W_L := W_t - W_W$ $\quad W_L = 9229\,\text{lbf}$

Leg height: $H := 50\text{in}$

Tank COG: $H_t := 71\text{in}$

Leg angle size: L3x3x3/8

Number of legs: $N := 4$

Moment of inertia of a leg about x-axis: $I_x := 1.75\text{in}^4$

Moment of inertia of a leg about z-axis: $I_z := 0.581^2 \cdot 2.11\text{in}^4$ (= r_z^2 x A) $\quad I_z = 1 \cdot \text{in}^4$

Moment of inertia of a leg about w-axis: $I_w := 2 \cdot I_x - I_z$ $\quad I_w = 3 \cdot \text{in}^4$

Distance between Anchor Bolts: $D_{bolt} := 38 \cdot \text{in}$

Base plate area: $A_{bp} := (6 \cdot \text{in})^2$ $\quad A_{bp} = 0 \cdot \text{ft}^2$

Check if the Tank is a Rigid Structure

Density of steel: $\rho_s := 490 \cdot \text{pcf}$

Steel elastic modulus: $E_s := 29000 \cdot \text{ksi}$

Lateral deflection under N-S EQ load: $y_x := \dfrac{2 \cdot W_t \cdot H^3}{3 \cdot N \cdot E_s \cdot I_x}$ $\quad y_x = 5 \cdot \text{in}$

Lateral deflection under NW EQ load: $y_2 := \dfrac{2 \cdot W_t \cdot H^3}{3 \cdot \frac{N}{2} \cdot E_s \cdot (I_z + I_w)}$ $\quad y_2 = 5 \cdot \text{in}$

The fundamental period of the tank with its content is computed by using Ref. 4.11 Fig. 3-9 formula:

N-S EQ: $T_x := 2 \cdot \pi \cdot \sqrt{\dfrac{y_x}{g}}$ $\quad T_x = 0.706\,\text{s}$ $\quad$ > 0.06, the tank is not rigid and Sec. 1622.2.6 of IBC2000 is not used.

NW EQ: $T_2 := 2 \cdot \pi \cdot \sqrt{\dfrac{y_2}{g}}$ $\quad T_2 = 0.706\,\text{s}$ $\quad$ > 0.06, the tank is not rigid and Sec. 1622.2.6 of IBC2000 is not used.

Tank Seismic Load Calculation - Multimedia Filter SCWO

Seismic Base Shear and Overturning Moment

Design spectral response acceleration parameters (Sec. 1615.1.3 of IBC2003)

At short period: $S_{DS} := 0.273$ (per BGCAPP Design Criteria and IBC2000)

At long period: $S_{D1} := 0.167$

Seismic Importance Factor: $I_E := 1.0$ (APS, Level = 2, Ref. 4.13)

The tank is elevated, supported by unbraced legs, and welded steel. Table 1622.2.5(1) of IBC2000 specifies the seismic coefficients as follows.

$R := 3$ $C_d := 2.5$ $\Omega_o := 2$

Component amplification factor (Table 1621.3 of IBC2000):

$a_p := 2.50$

Height in structure at point of attachement of component:

$z := 0$ $z = 0$

Impulsive seismic force: $F_{P1} := \dfrac{0.4 \cdot a_p \cdot S_{DS}}{\dfrac{R}{I_E}} \cdot \left(1 + 2 \cdot \dfrac{z}{H}\right)$ $F_{P1} = 0$

$F_{Pmax} := 1.6 \cdot S_{DS} \cdot I_E$ $F_{Pmax} = 0$

$F_{Pmin} := 0.3 \cdot S_{DS} \cdot I_E$ $F_{Pmin} = 0$

$F_P := \max\left(\min\left(F_{P1}, F_{Pmax}\right), F_{Pmin}\right)$ $F_P = 0$

Combined seismic coeff.: $C_s := F_P$ $C_s = 0.091$

Lateral base shear force: $V := C_s \cdot \left(W_t\right)$ (IBC2000 Eq. 16-34) $V = 1081\,\text{lbf}$

Vertical component of EQ: $0.2 \cdot S_{DS} = 0.055$

$OTM := C_s \cdot \left(W_t \cdot \dfrac{H_t + H}{2}\right)$ $OTM = 5 \cdot ft \cdot kip$

Live Loads Applied Outside Concrete Pad

$LL := 200 \cdot psf$ (refer to Sec. D2.3)

Tank Seismic Load Calculation - Multimedia Filter SCWO

Gravity Loads Applied on Concrete Pad

Tank self-weight: $W_W = 3 \cdot kip$

Tank content weight: $W_L = 9 \cdot kip$

Pad thickness: $t_{pad} := 1 \cdot in$

Vertical load applied on concrete pad due to self-weight:

$$P_{DLpad} := \frac{W_W}{4} + t_{pad} \cdot A_{bp} \cdot 150 \cdot pcf \qquad P_{DLpad} = 0.666 \cdot kip$$

Vertical load applied on concrete pad due to tank liquid content with LL deducted:

$$P_{LLpad} := \frac{W_L}{4} - LL \cdot A_{bp} \qquad P_{LLpad} = 2.257 \cdot kip$$

Overturning Moments Applied on Concrete Pad

Lateral base shear force: $V = 1 \cdot kip$

Overturning moment per tank: $OTM = 5 \cdot ft \cdot kip$

Mat foundation thickness: $t_{mat} := 3 \cdot ft + 4 \cdot in$

For N-S direction EQ load, assume that the seismic overturning moment of a tank is applied on two base plates using an upward uniform pressure value and on the remaining two using a downward value.

Overturning moment arm: $a_1 := D_{bolt}$ $\qquad a_1 = 3\,ft$

Pad force from OTM: $P_{xEQpad} := \frac{OTM}{a_1 \cdot 2}$ $\qquad P_{xEQpad} = 0.861 \cdot kip$

Lateral Shear: $V_{pl} := \frac{V}{4}$ $\qquad V_{pl} = 0.270 \cdot kip$

For NE direction EQ load, assume that the seismic overturning moment of a tank is applied on one base plate using an upward uniform pressure value and on the opposite one using a downward value.

Overturning moment arm: $a_2 := D_{bolt} \cdot \sqrt{2}$ $\qquad a_1 = 3\,ft$

Pad force from OTM: $P_{2EQpad} := \frac{OTM}{a_2}$ $\qquad P_{2EQpad} = 1.217 \cdot kip$

Lateral Shear in x & y dir: $V_{pl} := \frac{V}{4} \cdot \cos(45)$ $\qquad V_{pl} = 0.142 \cdot kip$

Dimensional Solutions Mat3D		**Version**	**5.1.0**		**Date**	**10/7/2009**
Foundation Name	**Multimedia Filter**				**Time**	**11:01:53 AM**
Designed By:	**PARSONS**	**Engineer**		R. Murphy	**Checker**	B. Rabe
	C:\Documents and Settings\p0045388\My Documents\SCWO					
Filename:	**10-DBC-00-00004 Gas Bottle & Misc Concrete\...\App E\Foundation For Filters.m3d**					

DETAIL REPORT

PROJECT INFORMATION

Project Name:	
Project Number:	10-DBC-00-00004
Client:	
Project Location	
Foundation Description	MULTIMEDIA FILTER

DESIGN CODE	ACI 318 - 1999	**INPUT UNITS**	English	**OUTPUT UNITS**	English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

PILE PARAMETERS:

Diameter (in)	0
Type	Drilled Shaft

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

REBAR PARAMETERS:

Max Long Bar Size	9
Min Long Bar Size	4
Max Tie Bar Size	8
Min Tie Bar Size	3
Max Ftg Bar Size	9
Min Ftg Bar Size	4
Temp & Shrinkage Steel Ratio	0.0018

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	3000.00
Unit Weight (pcf)	120.00

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	2.50
Minimum Soil Cover (ft)	0.00

APPLIED LOADS

P1

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	-1.22	0.14	0.00	0.14	0.00

P2

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P3

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P4

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	1.22	0.14	0.00	0.14	0.00

P5

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	-1.22	0.14	0.00	0.14	0.00

P6

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P7

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P8

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	1.22	0.14	0.00	0.14	0.00

P9

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	-1.22	0.14	0.00	0.14	0.00

P10

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P11

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P12

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	1.22	0.14	0.00	0.14	0.00

P13

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	-1.22	0.14	0.00	0.14	0.00

P14

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P15

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P16

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	1.22	0.14	0.00	0.14	0.00

P17

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	-1.22	0.14	0.00	0.14	0.00

P18

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P19

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P20

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	1.22	0.14	0.00	0.14	0.00

P21

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	-1.22	0.14	0.00	0.14	0.00

P22

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	-0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P23

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	-0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	0.00	0.14	0.00	0.14	0.00

P24

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Live	2.26	0.00	0.00	0.00	0.00
3 - Earthquake NS	0.86	0.00	0.00	0.27	0.00
4 - Earthquake EW	0.86	0.27	0.00	0.00	0.00
5 - Earthquake NE	1.22	0.14	0.00	0.14	0.00

UNFACTORED (ALLOWABLE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	-0.19	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	-0.45	0.10	0.00	0.10	0.00

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00

8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	1.52	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	1.25	0.10	0.00	0.10	0.00

P5

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	-0.19	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	-0.45	0.10	0.00	0.10	0.00

P6

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00

7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P7

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P8

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	1.52	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	1.25	0.10	0.00	0.10	0.00

P9

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	-0.19	0.10	0.00	0.10	0.00

6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	-0.45	0.10	0.00	0.10	0.00

P10

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P11

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P12

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00

5 - Dead + 0.7Earthquake NE	1.52	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	1.25	0.10	0.00	0.10	0.00

P13

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	-0.19	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	-0.45	0.10	0.00	0.10	0.00

P14

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P15

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00

4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P16

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	1.52	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	1.25	0.10	0.00	0.10	0.00

P17

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	-0.19	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	-0.45	0.10	0.00	0.10	0.00

P18

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00

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3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P19

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P20

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	1.52	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	1.25	0.10	0.00	0.10	0.00

P21

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00

2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	-0.19	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	-0.45	0.10	0.00	0.10	0.00

P22

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	0.06	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	-0.20	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P23

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	0.06	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	0.67	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	-0.20	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	0.40	0.10	0.00	0.10	0.00

P24

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	0.67	0.00	0.00	0.00	0.00
2 - Dead + Live	2.92	0.00	0.00	0.00	0.00
3 - Dead + 0.7Earthquake NS	1.27	0.00	0.00	0.19	0.00
4 - Dead + 0.7Earthquake EW	1.27	0.19	0.00	0.00	0.00
5 - Dead + 0.7Earthquake NE	1.52	0.10	0.00	0.10	0.00
6 - 0.6Dead + 0.7Earthquake NS	1.00	0.00	0.00	0.19	0.00
7 - 0.6Dead + 0.7Earthquake EW	1.00	0.19	0.00	0.00	0.00
8 - 0.6Dead + 0.7Earthquake NE	1.25	0.10	0.00	0.10	0.00

FACTORED (ULTIMATE) LOAD COMBINATIONS

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	-0.42	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	-0.62	0.14	0.00	0.14	0.00

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00

7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	2.02	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	1.82	0.14	0.00	0.14	0.00

P5

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00

3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	-0.42	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	-0.62	0.14	0.00	0.14	0.00

P6

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P7

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P8

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	2.02	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	1.82	0.14	0.00	0.14	0.00

P9

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	-0.42	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	-0.62	0.14	0.00	0.14	0.00

P10

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00

8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P11

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P12

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	2.02	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	1.82	0.14	0.00	0.14	0.00

P13

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00

4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	-0.42	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	-0.62	0.14	0.00	0.14	0.00

P14

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P15

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P16

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	2.02	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	1.82	0.14	0.00	0.14	0.00

P17

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	-0.42	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	-0.62	0.14	0.00	0.14	0.00

P18

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00

8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P19

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P20

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	2.02	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	1.82	0.14	0.00	0.14	0.00

P21

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00

4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	-0.42	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	-0.62	0.14	0.00	0.14	0.00

P22

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	-0.06	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	-0.26	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P23

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	-0.06	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	0.80	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	-0.26	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	0.60	0.14	0.00	0.14	0.00

P24

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	0.93	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	4.41	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.06	0.00	0.00	0.00	0.00
4 - 1.2Dead + Earthquake NS	1.66	0.00	0.00	0.27	0.00
5 - 1.2Dead + Earthquake EW	1.66	0.27	0.00	0.00	0.00
6 - 1.2Dead + Earthquake NE	2.02	0.14	0.00	0.14	0.00
7 - 0.9Dead + Earthquake NS	1.46	0.00	0.00	0.27	0.00
8 - 0.9Dead + Earthquake EW	1.46	0.27	0.00	0.00	0.00
9 - 0.9Dead + Earthquake NE	1.82	0.14	0.00	0.14	0.00

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.62	3.30	0.01	0.00	0.00	1.03	
2 - Dead + Live	1.07	3.30	0.03	0.00	0.01	4.48	
3 - Dead + 0.7Earthquake NS	0.99	4.30	0.47	0.00	0.00	37.59	
4 - Dead + 0.7Earthquake EW	0.68	4.30	0.01	0.48	38.35	1.13	
5 - Dead + 0.7Earthquake NE	0.88	4.30	0.29	0.30	24.32	23.41	
6 - 0.6Dead + 0.7Earthquake NS	0.75	4.30	0.79	0.00	0.00	38.00	
7 - 0.6Dead + 0.7Earthquake EW	0.43	4.30	0.01	0.80	38.35	0.72	
8 - 0.6Dead + 0.7Earthquake NE	0.65	4.30	0.49	0.50	24.31	23.82	

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	100.00	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Live	100.00	100.00	1.50	100.00	100.00	1.50	
3 - Dead + 0.7Earthquake NS	10.28	100.00	1.50	29.28	100.00	1.50	
4 - Dead + 0.7Earthquake EW	100.00	74.65	1.50	100.00	11.99	1.50	
5 - Dead + 0.7Earthquake NE	13.61	44.90	1.50	55.68	22.80	1.50	
6 - 0.6Dead + 0.7Earthquake NS	6.14	100.00	1.50	25.74	100.00	1.50	
7 - 0.6Dead + 0.7Earthquake EW	30.70	19.98	1.50	100.00	8.45	1.50	

8 - 0.6Dead + 0.7Earthquake NE	8.62	21.28	1.50	48.95	16.07	1.50

FOOTING DESIGN INFORMATION

X Dim (ft)	29.25
Z Dim (ft)	4.50
Thickness (ft)	3.25

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
2. 1.2Dead + 1.6Live	3	6	12	0.29	0.02	-2.8	E-W
2. 1.2Dead + 1.6Live	15	6	12	0.23	0.01	-0.87	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
8. 0.9Dead + Earthquake EW	7	6	6	**0.69**	**0.84**	1.3	E-W
7. 0.9Dead + Earthquake NS	44	6	6	**0.66**	**0.84**	0.25	N-S

* additional capacity gained from top layer steel.

PUNCHING SHEAR

P1

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	0.53	0.27	215.04	

P2

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
4. 1.2Dead + Earthquake NS	0.87	0.44	215.04	

P3

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
8. 0.9Dead + Earthquake EW	1.08	0.31	215.04	

P4

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
9. 0.9Dead + Earthquake NE	1.25	0.36	215.04	

P5

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	0.93	0.27	215.04	

P6

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	0.56	0.16	215.04	

P7

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
9. 0.9Dead + Earthquake NE	1.08	0.33	215.04	

P8

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
9. 0.9Dead + Earthquake NE	1.09	0.32	215.04	

P9

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	1.01	0.30	215.04	

P10

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	0.56	0.16	215.04	

P11

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
9. 0.9Dead + Earthquake NE	1.08	0.33	215.04	

P12

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
9. 0.9Dead + Earthquake NE	0.94	0.27	215.04	

P13

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	1.01	0.30	215.04	

P14

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	0.56	0.16	215.04	

P15

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
9. 0.9Dead + Earthquake NE	1.08	0.33	215.04	

P16

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
9. 0.9Dead + Earthquake NE	0.79	0.23	215.04	

P17

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	1.01	0.30	215.04	

P18

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	0.56	0.16	215.04	

P19

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
9. 0.9Dead + Earthquake NE	1.08	0.33	215.04	

P20

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
9. 0.9Dead + Earthquake NE	0.63	0.18	215.04	

P21

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	1.01	0.30	215.04	

P22

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
7. 0.9Dead + Earthquake NS	0.56	0.16	215.04	

P23

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
6. 1.2Dead + Earthquake NE	0.93	0.49	215.04	

P24

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
6. 1.2Dead + Earthquake NE	0.95	0.49	215.04	

MAXIMUM SHEAR - X DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	2.37	-1.93	1.02	107.52	
2 - 1.2Dead + 1.6Live	2.37	-9.07	4.80	107.52	
3 - 1.2Dead + Live	2.37	-6.29	3.33	107.52	
4 - 1.2Dead + Earthquake NS	26.88	1.65	0.88	107.52	
5 - 1.2Dead + Earthquake EW	12.37	-4.23	2.24	107.52	
6 - 1.2Dead + Earthquake NE	12.37	-3.23	1.71	107.52	
7 - 0.9Dead + Earthquake NS	2.37	-1.24	0.66	107.52	

8 - 0.9Dead + Earthquake EW	12.37	-3.86	2.04	107.52
9 - 0.9Dead + Earthquake NE	12.37	-2.86	1.51	107.52

MAXIMUM SHEAR - Z DIRECTION

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	3.71	10.40	0.85	107.52	
2 - 1.2Dead + 1.6Live	3.71	48.88	3.98	107.52	
3 - 1.2Dead + Live	3.71	33.89	2.76	107.52	
4 - 1.2Dead + Earthquake NS	3.88	8.71	0.71	107.52	
5 - 1.2Dead + Earthquake EW	0.00	-8.12	0.66	107.52	
6 - 1.2Dead + Earthquake NE	3.88	8.91	0.73	107.52	
7 - 0.9Dead + Earthquake NS	3.88	6.92	0.56	107.52	
8 - 0.9Dead + Earthquake EW	0.00	-6.30	0.51	107.52	
9 - 0.9Dead + Earthquake NE	3.88	7.12	0.58	107.52	

PIER/BASE PLATE DESIGN INFORMATION

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**
X Dim (ft)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Z Dim (ft)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Height (ft)	0.15	0.15	0.15	0.15	0.15	0.15	0.15
X Offset (ft)	0.54	0.54	3.71	3.71	5.54	5.54	8.71
Z Offset (ft)	0.71	3.79	0.71	3.79	0.71	3.79	0.54
Requested Reinft. Ratio	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018
Provided Reinft. Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Long Bar Size	0	0	0	0	0	0	0
Bars in X Dir	0	0	0	0	0	0	0
Bars in Z Dir	0	0	0	0	0	0	0
Total Long Bars	0	0	0	0	0	0	0
Tie Bar Size	3	3	3	3	3	3	3
Total No. of Ties	0	0	0	0	0	0	0
Major Tie Spacing (in)	-3	-3	-3	-3	-3	-3	-3

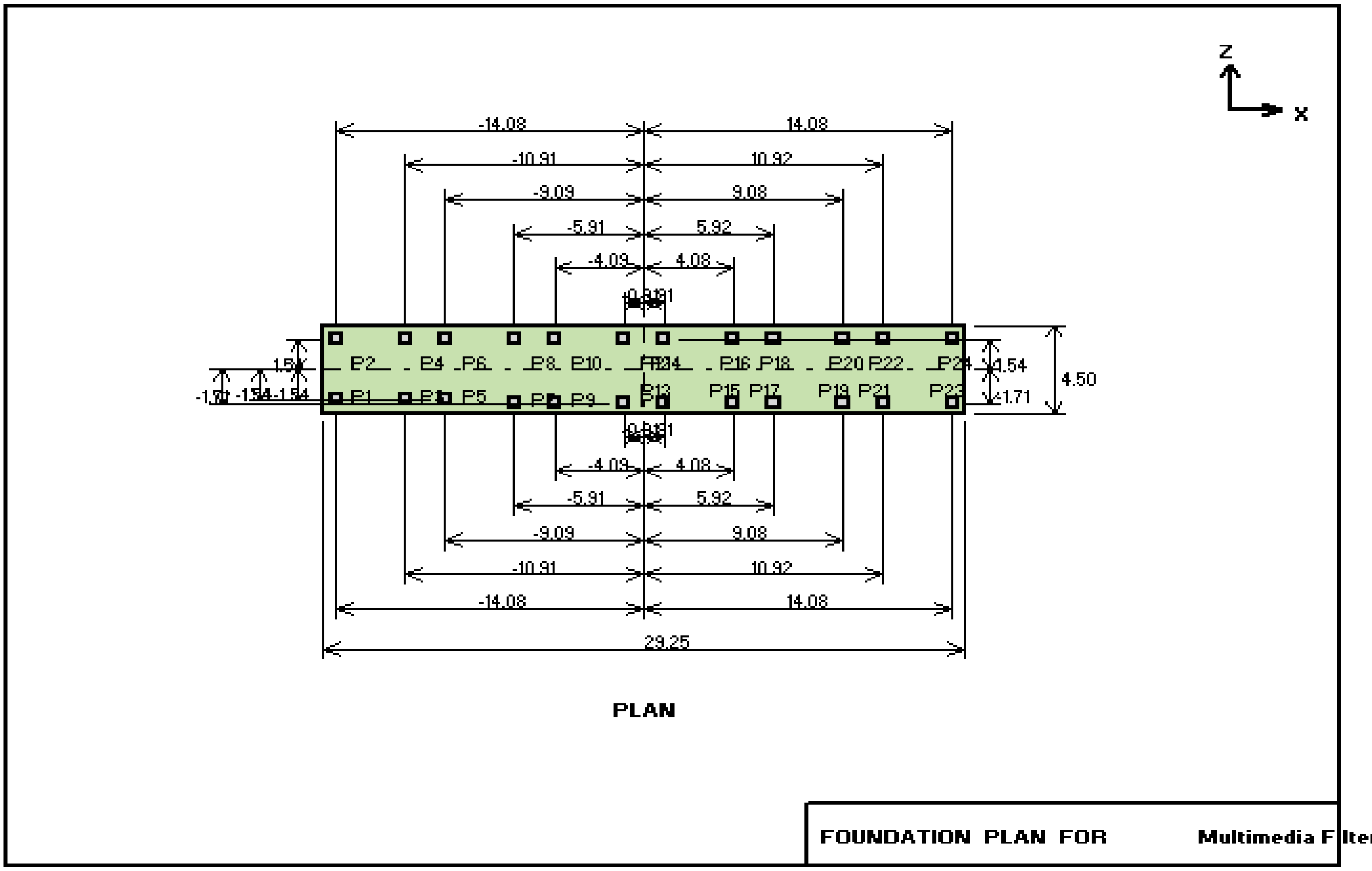
	P8	**P9**	**P10**	**P11**	**P12**	**P13**	**P14**
X Dim (ft)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Z Dim (ft)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Height (ft)	0.15	0.15	0.15	0.15	0.15	0.15	0.15
X Offset (ft)	8.71	10.54	10.54	13.71	13.71	15.54	15.54
Z Offset (ft)	3.79	0.54	3.79	0.54	3.79	0.54	3.79

Requested Reinft. Ratio	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018
Provided Reinft. Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Long Bar Size	0	0	0	0	0	0	0
Bars in X Dir	0	0	0	0	0	0	0
Bars in Z Dir	0	0	0	0	0	0	0
Total Long Bars	0	0	0	0	0	0	0
Tie Bar Size	3	3	3	3	3	3	3
Total No. of Ties	0	0	0	0	0	0	0
Major Tie Spacing (in)	-3	-3	-3	-3	-3	-3	-3

	P15	**P16**	**P17**	**P18**	**P19**	**P20**	**P21**
X Dim (ft)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Z Dim (ft)	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Height (ft)	0.15	0.15	0.15	0.15	0.15	0.15	0.15
X Offset (ft)	18.71	18.71	20.54	20.54	23.71	23.71	25.54
Z Offset (ft)	0.54	3.79	0.54	3.79	0.54	3.79	0.54
Requested Reinft. Ratio	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018
Provided Reinft. Ratio	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Long Bar Size	0	0	0	0	0	0	0
Bars in X Dir	0	0	0	0	0	0	0
Bars in Z Dir	0	0	0	0	0	0	0
Total Long Bars	0	0	0	0	0	0	0
Tie Bar Size	3	3	3	3	3	3	3
Total No. of Ties	0	0	0	0	0	0	0
Major Tie Spacing (in)	-3	-3	-3	-3	-3	-3	-3

	P22	**P23**	**P24**
X Dim (ft)	0.50	0.50	0.50
Z Dim (ft)	0.50	0.50	0.50
Height (ft)	0.15	0.15	0.15
X Offset (ft)	25.54	28.71	28.71
Z Offset (ft)	3.79	0.54	3.79
Requested Reinft. Ratio	0.0018	0.0018	0.0018
Provided Reinft. Ratio	0.0000	0.0000	0.0000
Long Bar Size	0	0	0
Bars in X Dir	0	0	0
Bars in Z Dir	0	0	0
Total Long Bars	0	0	0
Tie Bar Size	3	3	3
Total No. of Ties	0	0	0
Major Tie Spacing (in)	-3	-3	-3

Subject: Gas Bottle Canopy Misc Support Calculations
By: M. Bratt Date: 10/5/2009



Seismic Load Calculation - Hydrolysate Heater Module

Operational weight: $W_t := 12500\,lbf$

Empty weight: $W_W := 12000\,lbf$

Contents Weight: $W_L := W_t - W_W$ $W_L = 500\,lbf$

COG Height: $H_t := 66.5\,in$

Distance between Anchor Bolts: $D_{bolt} := 99\,in$

Seismic Base Shear and Overturning Moment

Design spectral response acceleration parameters (Sec. 1615.1.3 of IBC2003)

At short period: $S_{DS} := 0.273$ (per BGCAPP Design Criteria and IBC2000)

At long period: $S_{D1} := 0.167$

Seismic Importance Factor: $I_E := 1.0$ (APS, Level = 2, Ref. 4.13)

Response Modification factor (Table 12-6 BGCAPP Design Criteria): 'General Mechanical - Other' $R := 1$

Component amplification factor (Table 12-6 BGCAPP Design Criteria): $a_p := 2.50$

Height in structure at point of attachement of component: $z := 0$

Impulsive seismic force: $F_{P1} := \dfrac{0.4 \cdot a_p \cdot S_{DS}}{\frac{R}{I_E}} \cdot \left(1 + 2 \cdot \frac{z}{H}\right)$ $F_{P1} = 0$

$F_{Pmax} := 1.6 \cdot S_{DS} \cdot I_E$ $F_{Pmax} = 0$

$F_{Pmin} := 0.3 \cdot S_{DS} \cdot I_E$ $F_{Pmin} = 0$

$F_P := \max\left(\min\left(F_{P1}, F_{Pmax}\right), F_{Pmin}\right)$ $F_P = 0$

Combined seismic coeff.: $C_s := F_P$ $C_s = 0.273$

Lateral base shear force: $V := C_s \cdot \left(W_t\right)$ (IBC2000 Eq. 16-34) $V = 3413\,lbf$

Vertical component of EQ: $0.2 \cdot S_{DS} = 0.055$

Overturning Moment: $OTM := C_s \cdot \left(W_t \cdot H_t\right)$ $OTM = 19 \cdot ft \cdot kip$

Seismic Load Calculation - Hydrolysate Heater Module

Gravity Loads Applied on Concrete Pad

Unit self-weight: $W_W = 12 \cdot kip$

Unit content weight: $W_L = 0.5 \cdot kip$

Pad thickness: $t_{pad} := 1 \cdot in$

Vertical load applied on concrete pad due to self-weight:

$$P_{DLpad} := \frac{W_W}{4} \qquad P_{DLpad} = 3.000 \cdot kip$$

Vertical load applied on concrete pad from internal contents:

$$P_{LLpad} := \frac{W_L}{4} \qquad P_{LLpad} = 0.125 \cdot kip$$

Overturning Moments Applied on Concrete Pad

Lateral base shear force: $V = 3.41 \cdot kip$

Overturning moment per tank: $OTM = 19 \cdot ft \cdot kip$

Mat foundation thickness: $t_{mat} := 2ft$

For N-S direction EQ load, assume that the seismic overturning moment of the unit is applied on two anchor points using an upward force and on the remaining two using a downward force.

Overturning moment arm: $a_1 := D_{bolt}$ $\qquad a_1 = 8\,ft$

Pad force from OTM: $P_{xEQpad} := \frac{OTM}{a_1 \cdot 2}$ $\qquad P_{xEQpad} = 1.146 \cdot kip$

Lateral Shear: $V_{pl} := \frac{V}{4}$ $\qquad V_{pl} = 0.853 \cdot kip$

For NE direction EQ load, assume that the seismic overturning moment of the unit is applied on one anchor point using an upward force and on the opposite one using a downward force.

Overturning moment arm: $a_2 := D_{bolt} \cdot \sqrt{2}$ $\qquad a_1 = 8\,ft$

Pad force from OTM: $P_{2EQpad} := \frac{OTM}{a_2}$ $\qquad P_{2EQpad} = 1.621 \cdot kip$

Lateral Shear in x & y dir: $V_{pl} := \frac{V}{4} \cdot \cos(45)$ $\qquad V_{pl} = 0.448 \cdot kip$

Dimensional Solutions Mat3D		**Version**	**5.1.0**		**Date**	**10/7/2009**
Foundation Name	**Hydrolysate Heater Module Foundation**				**Time**	**7:48:11 AM**
Designed By:	**PARSONS**	**Engineer**		R. Murphy	**Checker**	
	C:\Documents and Settings\p0045388\My Documents\SCWO					
Filename:	**10-DBC-00-00004 Gas Bottle & Misc Concrete\...\04 Hydrolysate Heater Module\RO SKID FOUNDATION.m3d**					

DETAIL REPORT

PROJECT INFORMATION

Project Name:	Gas Bottles canopy, Supports, eqiup. & misc. fdns Calculations
Project Number:	24915-10-DBC-00-00004
Client:	
Project Location	
Foundation Description	HYDROLYSATE HEATER MODULE FOUNDATION

DESIGN CODE	ACI 318 - 1999	**INPUT UNITS**	English	**OUTPUT UNITS**	English

CONCRETE PARAMETERS:

Compressive Strength (psi)	4000.00
Unit Weight (pcf)	150.00

REINFORCING STEEL PARAMETERS:

Yield Strength (ksi)	60.00
Unit Weight (pcf)	490.00
Modulus of Elasticity (ksi)	29000.00

SOIL PARAMETERS:

Allowable Net Bearing Capacity (psf)	3000.00
Unit Weight (pcf)	120.00

MINIMUM FOUNDATION CRITERIA:

Depth of Footing Below Grade (ft)	2.00
Minimum Soil Cover (ft)	0.00

PILE PARAMETERS:

Diameter (in)	0
Type	Drilled Shaft

REBAR PARAMETERS:

Max Long Bar Size	9
Min Long Bar Size	4
Max Tie Bar Size	8
Min Tie Bar Size	3
Max Ftg Bar Size	9
Min Ftg Bar Size	4
Temp & Shrinkage Steel Ratio	0.0018

APPLIED LOADS

P2

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	3.00	0.00	0.00	0.00	0.00
2 - Live	0.13	0.00	0.00	0.00	0.00
3 - EQNS	1.20	0.00	0.00	0.85	0.00
4 - EQEW	-1.20	0.85	0.00	0.00	0.00
5 - EQNE	0.00	0.45	0.00	0.45	0.00

P3

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	3.00	0.00	0.00	0.00	0.00
2 - Live	0.13	0.00	0.00	0.00	0.00
3 - EQNS	-1.20	0.00	0.00	0.85	0.00
4 - EQEW	1.20	0.85	0.00	0.00	0.00
5 - EQNE	0.00	0.45	0.00	0.45	0.00

P4

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	3.00	0.00	0.00	0.00	0.00
2 - Live	0.13	0.00	0.00	0.00	0.00
3 - EQNS	1.20	0.00	0.00	0.85	0.00
4 - EQEW	1.20	0.85	0.00	0.00	0.00
5 - EQNE	1.65	0.45	0.00	0.45	0.00

P1

Load Case	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	3.00	0.00	0.00	0.00	0.00
2 - Live	0.13	0.00	0.00	0.00	0.00
3 - EQNS	-1.20	0.00	0.00	0.85	0.00
4 - EQEW	-1.20	0.85	0.00	0.00	0.00
5 - EQNE	-1.65	0.45	0.00	0.45	0.00

UNFACTORED (ALLOWABLE) LOAD COMBINATIONS

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	3.00	0.00	0.00	0.00	0.00
2 - Dead + Live	3.13	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	3.84	0.00	0.00	0.60	0.00
4 - Dead + 0.7EQEW	2.16	0.60	0.00	0.00	0.00
5 - Dead + 0.7EQNE	3.00	0.31	0.00	0.31	0.00

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	3.00	0.00	0.00	0.00	0.00
2 - Dead + Live	3.13	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	2.16	0.00	0.00	0.60	0.00
4 - Dead + 0.7EQEW	3.84	0.60	0.00	0.00	0.00
5 - Dead + 0.7EQNE	3.00	0.31	0.00	0.31	0.00

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	3.00	0.00	0.00	0.00	0.00
2 - Dead + Live	3.13	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	3.84	0.00	0.00	0.60	0.00
4 - Dead + 0.7EQEW	3.84	0.60	0.00	0.00	0.00
5 - Dead + 0.7EQNE	4.16	0.31	0.00	0.31	0.00

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - Dead	3.00	0.00	0.00	0.00	0.00
2 - Dead + Live	3.13	0.00	0.00	0.00	0.00
3 - Dead + 0.7EQNS	2.16	0.00	0.00	0.60	0.00
4 - Dead + 0.7EQEW	2.16	0.60	0.00	0.00	0.00
5 - Dead + 0.7EQNE	1.85	0.31	0.00	0.31	0.00

FACTORED (ULTIMATE) LOAD COMBINATIONS

P2

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	4.20	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	3.80	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.73	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	4.80	0.00	0.00	0.85	0.00
5 - 1.2Dead + EQEW	2.40	0.85	0.00	0.00	0.00
6 - 1.2Dead + EQNE	3.60	0.45	0.00	0.45	0.00

Project: BGCAPP
Job Number: 743341
Calc. No.: 24915-10-DBC-00-00004
Sheet No.: E-75 of E-80
Sheet Rev.: D

Subject: Gas Bottle Canopy Misc Support Calculations
By: M. Bratt Date: 10/5/2009

P3

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	4.20	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	3.80	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.73	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	2.40	0.00	0.00	0.85	0.00
5 - 1.2Dead + EQEW	4.80	0.85	0.00	0.00	0.00
6 - 1.2Dead + EQNE	3.60	0.45	0.00	0.45	0.00

P4

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	4.20	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	3.80	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.73	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	4.80	0.00	0.00	0.85	0.00
5 - 1.2Dead + EQEW	4.80	0.85	0.00	0.00	0.00
6 - 1.2Dead + EQNE	5.25	0.45	0.00	0.45	0.00

P1

Load Comb	Axial (kips)	Shear X (kips)	Mom Z (kip ft)	Shear Z (kips)	Mom X (kip ft)
1 - 1.4Dead	4.20	0.00	0.00	0.00	0.00
2 - 1.2Dead + 1.6Live	3.80	0.00	0.00	0.00	0.00
3 - 1.2Dead + Live	3.73	0.00	0.00	0.00	0.00
4 - 1.2Dead + EQNS	2.40	0.00	0.00	0.85	0.00
5 - 1.2Dead + EQEW	2.40	0.85	0.00	0.00	0.00
6 - 1.2Dead + EQNE	1.95	0.45	0.00	0.45	0.00

BEARING CAPACITY - LINEAR SOIL PRESSURE METHOD

Load Comb	Max Pressure (ksf)	All Pressure (ksf)	Ecc N/S Dir (ft)	Ecc E/W Dir (ft)	Moment N/S axis (kip-ft)	Moment E/W axis (kip-ft)	Rem
1 - Dead	0.40	3.24	0.00	0.00	0.06	0.00	
2 - Dead + Live	0.40	3.24	0.00	0.00	0.06	0.00	
3 - Dead + 0.7EQNS	0.50	4.24	0.40	0.00	0.06	19.65	
4 - Dead + 0.7EQEW	0.49	4.24	0.00	0.51	25.47	0.00	
5 - Dead + 0.7EQNE	0.52	4.24	0.26	0.34	16.62	12.64	

STABILITY RATIO / SLIDING SAFETY FACTOR

Load Comb	S.R. N/S Dir	S.R. E/W Dir	All S.R.	Sliding FS - N/S	Sliding FS - E/W	All FS	Remarks
1 - Dead	100.00	100.00	1.50	100.00	100.00	1.50	
2 - Dead + Live	100.00	100.00	1.50	100.00	100.00	1.50	
3 - Dead + 0.7EQNS	41.13	100.00	1.50	16.99	100.00	1.50	
4 - Dead + 0.7EQEW	100.00	56.97	1.50	100.00	15.14	1.50	
5 - Dead + 0.7EQNE	79.90	100.00	1.50	32.35	28.84	1.50	

FOOTING DESIGN INFORMATION

X Dim (ft)	13.17
Z Dim (ft)	9.50
Thickness (ft)	2.00

Top Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
1. 1.4Dead	5	5	12	0.16	0.03	-2.4	E-W
1. 1.4Dead	7	5	12	0.16	0.02	-1.2	N-S

Bottom Steel

Governing Combination	No of Bars	Bar Size	Bar Spac (in)	Area Prov (sq in/ft)	Area Req (sq in/ft)	Moment (kip ft/ft)	Direction
5. 1.2Dead + EQEW	19	5	6	0.61	0.52	0.34	E-W
4. 1.2Dead + EQNS	26	5	6	0.61	0.52	0.24	N-S

PUNCHING SHEAR

P2

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
4. 1.2Dead + EQNS	4.54	6.32	215.04	

P3

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
5. 1.2Dead + EQEW	4.54	6.30	215.04	

P4

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
6. 1.2Dead + EQNE	4.82	6.68	215.04	

BECHTEL PARSONS BLUE GRASS

Subject: Gas Bottle Canopy Misc Support Calculations
By: M. Bratt   Date: 10/5/2009

P1

Control Comb	Net Ult Load (kips)	Punch. Stress (psi)	All Stress (psi)	Rem
1. 1.4Dead	3.90	5.43	215.04	

MAXIMUM SHEAR - X DIRECTION

Load Comb	Left Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	2.37	-5.38	2.36	107.52	
2 - 1.2Dead + 1.6Live	2.37	-4.87	2.13	107.52	
3 - 1.2Dead + Live	2.37	-4.77	2.09	107.52	
4 - 1.2Dead + EQNS	2.37	-4.61	2.02	107.52	
5 - 1.2Dead + EQEW	2.37	-4.66	2.04	107.52	
6 - 1.2Dead + EQNE	10.79	4.65	2.04	107.52	

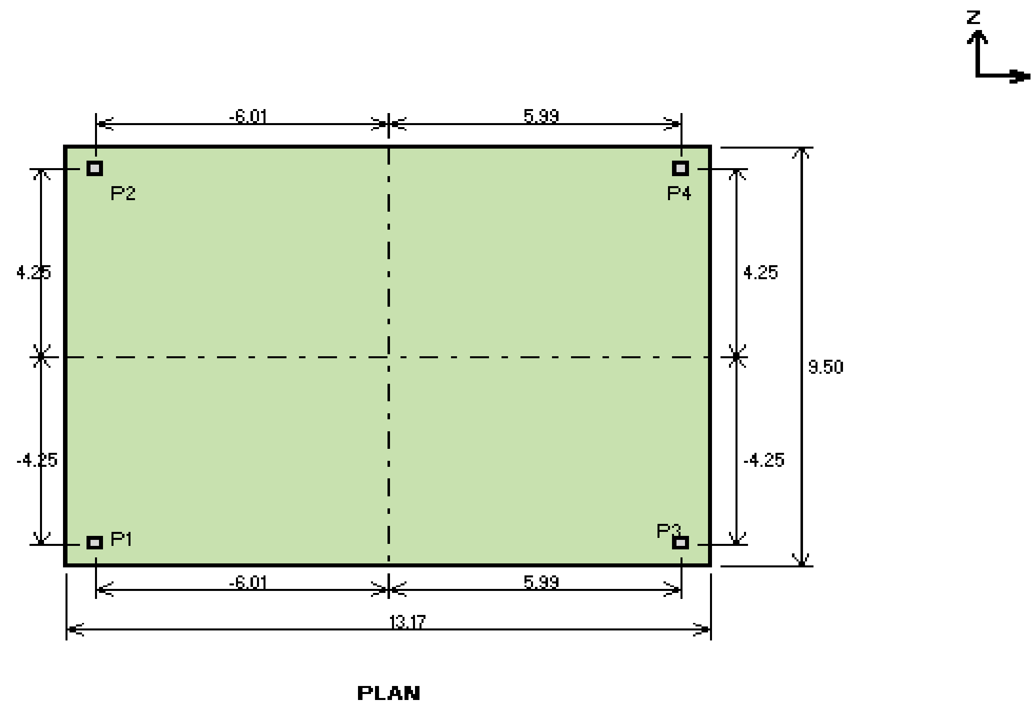
MAXIMUM SHEAR - Z DIRECTION

Load Comb	Bottom Dist (ft)	Max Shear (kips)	Shear Stress (psi)	All Stress (psi)	Rem
1 - 1.4Dead	2.29	-4.35	1.38	107.52	
2 - 1.2Dead + 1.6Live	7.21	3.94	1.25	107.52	
3 - 1.2Dead + Live	7.21	3.86	1.22	107.52	
4 - 1.2Dead + EQNS	2.29	-4.58	1.45	107.52	
5 - 1.2Dead + EQEW	2.29	-3.73	1.18	107.52	
6 - 1.2Dead + EQNE	2.29	-4.17	1.32	107.52	

PIER/BASE PLATE DESIGN INFORMATION

	P2	**P3**	**P4**	**P1**
X Dim (ft)	0.25	0.25	0.25	0.25
Z Dim (ft)	0.25	0.25	0.25	0.25

Height (ft)	0.25	0.25	0.25	0.25
X Offset (ft)	0.58	12.58	12.58	0.58
Z Offset (ft)	9.00	0.50	9.00	0.50
Requested Reinft. Ratio	0.0018	0.0018	0.0018	0.0018
Provided Reinft. Ratio	0.0000	0.0000	0.0000	0.0000
Long Bar Size	0	0	0	0
Bars in X Dir	0	0	0	0
Bars in Z Dir	0	0	0	0
Total Long Bars	0	0	0	0
Tie Bar Size	3	3	3	3
Total No. of Ties	0	0	0	0
Major Tie Spacing (in)	-1	-1	-1	-1



FOUNDATION PLAN FOR Hydrolysate Heat

E.5 Summary

The calculation performed in this appendix includes structural analysis and design of foundations for the Effluent Caustic Day Tank (MV-RO-0101), R.O. Skid (MK-RO-0101), R.O. Multimedia Filters (MK-RO-0101A through MK-RO-0101F), and Hydrolysate Heater Module (MX-SCWO-0042). No soil uplift is observed under worst-case overturning loads, and sliding resistance of the foundations is adequate. A summary of the foundation designs is as follows:

Effluent Caustic Day Tank

Mat Thickness: 2’-3”

Top Reinforcement: #5 bars @ 12” o.c. both ways

Bottom Reinforcement: #5 bars @ 6” o.c. both ways

R.O. Skid

Mat Thickness: 2’-3”

Top Reinforcement: #5 bars @ 12” o.c. both ways

Bottom Reinforcement: #5 bars @ 6” o.c. both ways

R.O. Multimedia Filters

Mat Thickness: 3’-3”

Top Reinforcement: #6 bars @ 12” o.c. both ways

Bottom Reinforcement: #6 bars @ 6” o.c. both ways

Hydrolysate Heater Module

Mat Thickness: 2’-0”

Top Reinforcement: #5 bars @ 12” o.c. both ways

Bottom Reinforcement: #5 bars @ 6” o.c. both ways

Appendix F

SPB Floor Slab on Grade

F.1. Objective

The calculation performed in this appendix includes an analysis of the SCWO Processing Building (SPB) floor slab on grade.

F.2. Inputs

The slab is 8" thick and is reinforced with #4 bars @ 12" o.c. each way top and bottom.

F.3 Assumptions

A soft soil pocket 4'-6" square is assumed under a portion of the slab and a concentrated load is placed at the center of the pocket. It is assumed that the slab is supported at points 6" outside the perimeter of the soft soil pocket.

F.4 Calculation Body

Maximum allowable concentrated and distributed loads are calculated for the slab in the following MathCAD sheets. The first sheet calculates the maximum allowable loads when there is no soft soil pocket under the slab. The second sheet calculates what the maximum allowable loads are when there is a soft soil pocket under the slab with dimensions equal to 10% of the distance between construction joints.

BECHTEL PARSONS BLUE GRASS A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.	Calculation Sheet	Project:	BGCAPP
		Job Number:	743341
		Calc. No.	24915-10-DBC-00-00004
Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations		Sheet No.	F-3 / F-5
By: R. Murphy	Date: 12/16/2007	Sheet Rev.	D

SPB Slab on Grade Calculations

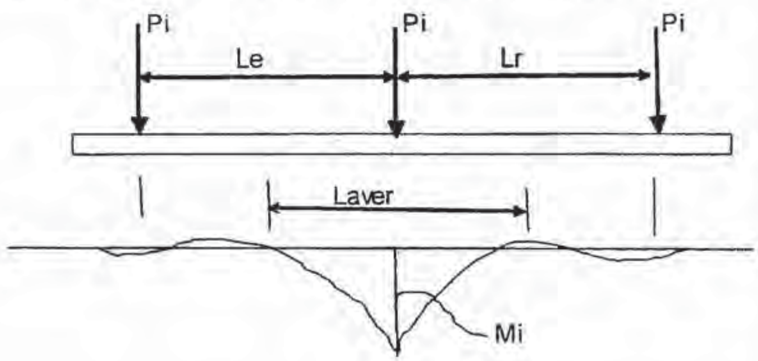
Slab on grade is 8" thick and reinforced with # 4 @ 12 each way T & B $\quad t := 8in \quad d := t - 3.75in \quad b := 6ft$

(K= 150lb/in^3 or 1800 psi for 12" wide strip of slab; 7200psi for b = 48')

Mod of subgrade $\quad K := 150\frac{lb}{in^3}\cdot b$

$K = 10800.00\,psi$

$E := 3000ksi \quad d = 4.25\,in \qquad L = L_{aver}$



$L := 6ft \qquad P_i := 20k$

$I := \frac{b\cdot d^3}{12} \qquad I = 460.59\,in^4$

Considering one way strip of slab width, b

(For one way action; For two way action it is 2Pi = 58k)

$\lambda := \sqrt[4]{\frac{K}{4\cdot E\cdot I}} \qquad \lambda = 0.45\frac{1}{ft}$

$L_{max} := \frac{3.5}{\lambda} \quad L_{min} := \frac{1.75}{\lambda} \qquad L_{max} = 7.80\,ft \quad L_{min} = 3.90\,ft$

$M_i := \frac{P_i}{4\cdot\lambda}\cdot(0.24\cdot\lambda\cdot L + 0.16)$ Ref:-Reinf. Conc Design Bldg. By Paul Rogers

7.80 ft > L=6 ft < 3.90ft
So, assumed span L is O.Kay

$M_i = 8.98\,k\cdot ft$ (For 1' wide strip moment= Mi/b) $\qquad f_c := 4000psi$

$\frac{M_i}{b}\cdot 1ft = 1.50\,k\cdot ft \qquad f_s := 24ksi \qquad j := .875$

For two way action , soil press fsoil

$A_s := \frac{\frac{M_i}{b}\cdot 1ft}{f_s\cdot j\cdot d} \qquad A_s = 0.20\,in^2$

$f_{soil} := \frac{2\cdot P_i}{b\cdot L} \qquad f_{soil} = 1111.11\,psf$

Provided reinf., # 4 @12 = 0.20 sq. in

So, 8 "slab w/# 4@12 ea.way T & B is good for Uniform Distributed Load of 1111 psf or concentrated load P_i = 20 kips

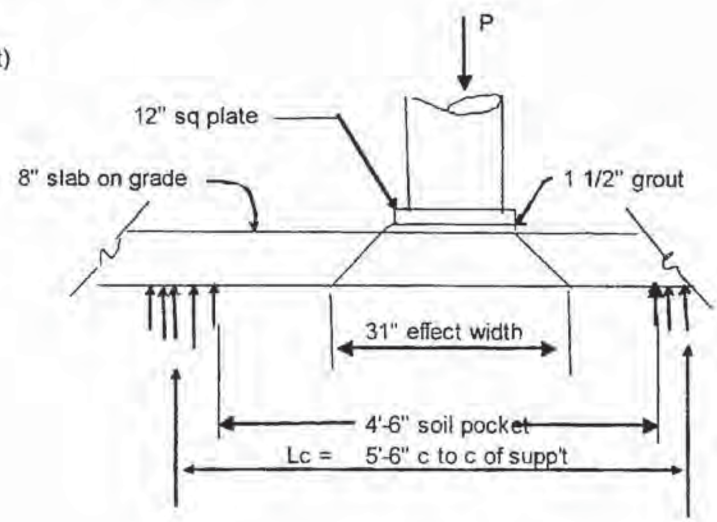
BECHTEL PARSONS BLUE GRASS A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.	Calculation Sheet	Project:	BGCAPP
		Job Number:	743341
		Calc. No.	24915-10-DBC-00-00004
Subject: Gas Bottles Canopy, Supports, Equip, & Misc Foundations		Sheet No.	F-4 / F-5
By: R. Murphy	Date: 12/16/2007	Sheet Rev.	D

SOFT SOIL POCKET UNDER SLAB ON GR.

As per job standard drawing 24195-000-S0-00-00012, maximum spacing of construction joint is 45 feet. Consider (10% of 45') 4'-6" square soft soil pocket under the slab and a concentrated load P on 12" square plate on the center of the pocket

fc' = 4000 psi
fs = 24000 psi
$fs := 24000psi$

$P := 16k \qquad Lc := 5.5ft$ (Support length @ soil pocket)



Reaction per foot length of periphery, p

$$p := \frac{P}{4 \cdot Lc} \qquad p = 727.27\,plf$$

M is moment for 1'-0" length of periphery

$$M := p \cdot \frac{Lc - 12in}{2} \cdot 1ft$$

$$M = 1.64\,k \cdot ft \qquad j := .875 \qquad d := 4.75in$$

$$As := \frac{M}{fs \cdot j \cdot d}$$

$$As = 0.20\,in^2$$

Cosidering 1' wide strip of soil on periphery, soil pressure fsoil

$$fsoil := \frac{p}{1ft} \qquad fsoil = 727.27\,psf$$

Also, $$f_{soil} := \frac{P}{(4.5ft)^2}$$

$$f_{soil} = 790.12\,psf$$

Soil pressure if no weak soil pocket

$$f_{soilnopocket} := \frac{P}{(31in)^2}$$

$f_{soilnopocket} = 2397.50\,psf$ <3000psf So O.K

So,8"slab w/# 4@12 ea.way T & B is good for Uniform Distributed Load of 727 psf or concentrated load P_i = 16 kips

F.5 Summary

The calculation performed in this appendix includes an analysis of the SCWO Processing Building (SPB) floor slab on grade. Calculations were performed to find the maximum allowable uniform and concentrated loads on the slab.

For typical slab on grade with no soft soil pockets, allowable uniform distributed load is 1111psf. Allowable concentrated load is 20 kips.

For slab on grade with a soft soil pocket with a width of 10% of the distance between construction joints, allowable uniform distributed load is 727 psf. Allowable concentrated load is 16 kips.

Appendix G

Base Plate and Anchor Bolt Calculations

Baseplate and Anchor Bolt Design - W8x31 - Multiple Conditions

This calculation contains designs for anchor bolts at the following locations:

All design will be based off of the standard base plate detail for a W8x31 column (Detail 1, 24915-000-SO-00006)

W8x31 column supports for HVAC ducts (Calculation no. 24915-10-SSC-00-00006, App C4).

W8x31 column supports for Exterior Cable Trays (Calculation no. 24915-10-SSC-00-00006, App B).

Column Reactions

Following are the controlling node outputs from the duct supports and exterior cable trays.
Units are kips, kip-ft.

Structure	Joint	Load Case	Fx	Fy	Axial	Mx	My
Duct Supports	10 (From App C4)	DL	0.013	0.019	1.953	0.528	0.096
		SNOW	0.011	0.017	1.168	0.45	0.083
		WLEW	0.01	1.208	-0.066	21.943	0.176
		WLNS	0.927	0.182	0.009	4.073	4.414
Cable Trays	13	DL	0	0.81	7.336	0	27.36
		SNOW	0	0	0.9	0	3.813
		WLEW	1.922	0	0	0	26.65
		WLNS	0.267	0.949	-1.33	0	-4.077

Duct support analysis follows with cable tray analysis following on page G-18.

W8x31 - Check Duct Support Loads

Applicable Load Combinations:

1.4D
1.2D + 1.6S + 0.8W
1.2D + 1.6W + 0.5S
0.9D + 1.6W* *Worst case loading

Loads

$P := 0.9\cdot 1.953\text{kip} - 1.6\cdot 0.066\text{kip}$ $\boxed{P = 1.652\cdot \text{kip}}$

$V := 0.9\cdot 0.019\text{kip} + 1.6\cdot 1.208\text{kip}$ $\boxed{V = 1.95\cdot \text{kip}}$

$M := 0.9\cdot 0.528\text{kip}\cdot\text{ft} + 1.6\cdot 21.943\text{kip}\cdot\text{ft}$ $\boxed{M = 35.58\cdot \text{kip}\cdot\text{ft}}$

Eccentricity: $e := \frac{M}{P}$ $e = 258.46\cdot\text{in}$

Check Duct Supports

Base Plate Properties

Plate Thickness: $t := 1.0in$

Plate Dimensions: $N_{plate} := 16in$

Dist. to plate Neutral Axis: $c_{plate} := 0.5 \cdot N_{plate}$ $\quad c_{plate} = 8 \cdot in$

Column Depth: $d := 8in$

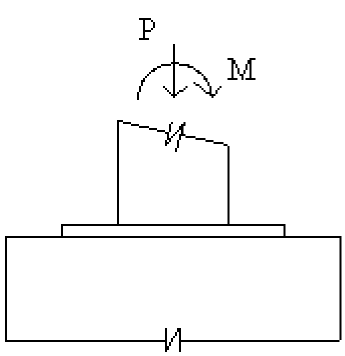
Dist. column edge to plate edge: $n := \frac{N_{plate}}{2} - \frac{0.95 \cdot d}{2}$ $\quad n = 4.2 \cdot in$

Section Properties:: $A := N_{plate}^{\;2}$ $\quad A = 256 \cdot in^2$ $\quad Z_y := \frac{t^2 \cdot 1in}{6}$ $\quad Z_y = 0.167 \cdot in^3$

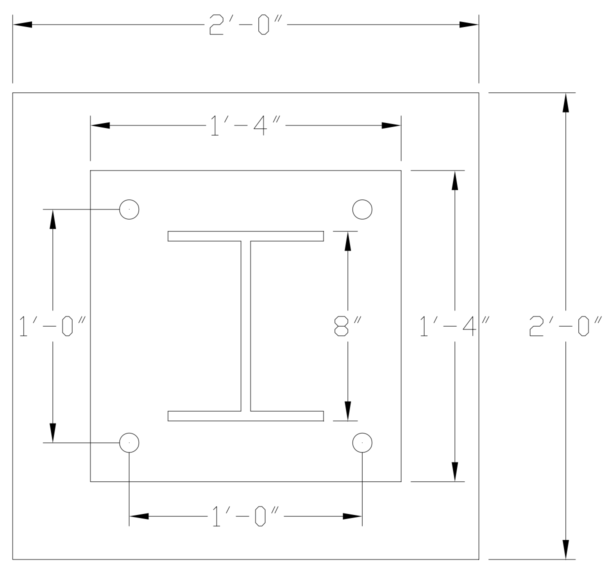
$I := \frac{1}{12} \cdot \left(N_{plate}\right)^4$ $\quad I = 5461 \cdot in^4$

Pedestal Properties

$A_2 := 2ft \cdot 2ft$ $\quad A_2 = 576 \cdot in^2$

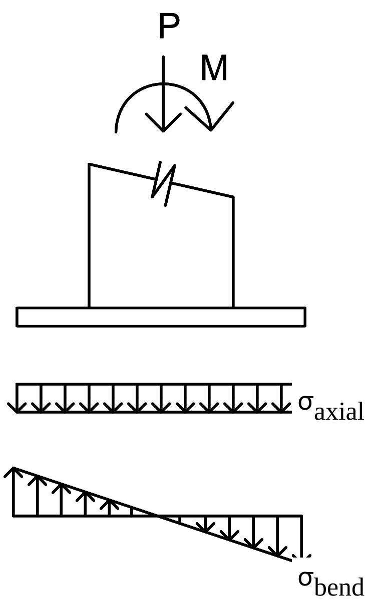


Elevation



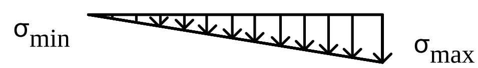
Plan

Design Forces

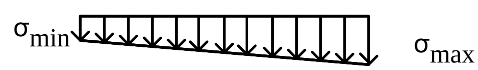


Stress Resultants

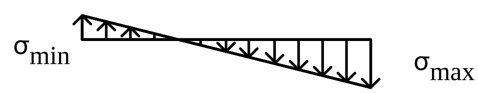
if σ_axial = σ_bending



if σ_axial > σ_bending



if σ_axial < σ_bending



Stress Calculations

$$\sigma_{axial} := \frac{P}{A} \qquad \sigma_{axial} = 6.4535 \times 10^{-3} \cdot ksi$$

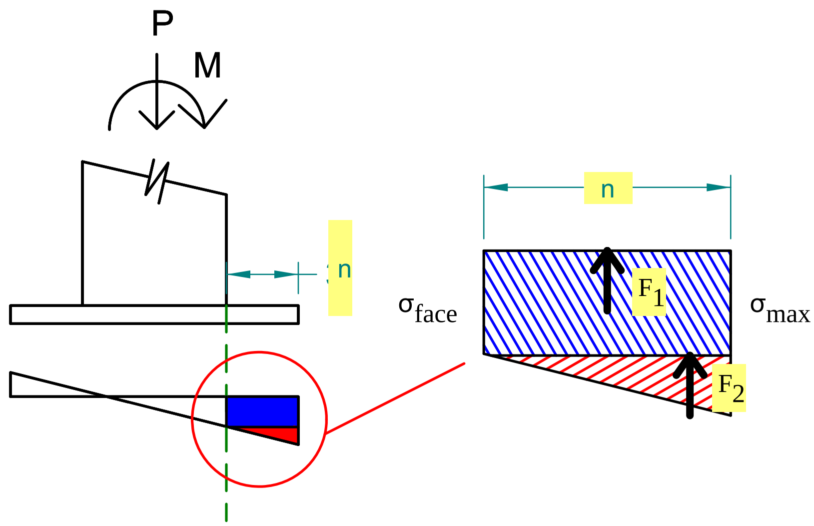
$$\sigma_{bend} := |M| \cdot \frac{c_{plate}}{I} \qquad \sigma_{bend} = 0.6255 \cdot ksi$$

Total Stress

$$\sigma_{max} := \sigma_{axial} + \sigma_{bend} \qquad \sigma_{max} = 0.632 \cdot ksi$$

$$\sigma_{min} := \sigma_{axial} - \sigma_{bend} \qquad \sigma_{min} = -0.619 \cdot ksi$$

Calculating Force Resultants



$$stress\_slope := \frac{\sigma_{max} - \sigma_{min}}{N_{plate}} \qquad stress\_slope = 0.0782 \cdot \frac{kip}{in^3}$$

$$\sigma_{face} := \sigma_{max} - stress\_slope \cdot (n) \qquad \sigma_{face} = 0.3036 \cdot ksi$$

Rectangular Stress Block Resultants

$$F_{rect} := \sigma_{face} \cdot n \cdot 1in \qquad F_{rect} = 1.275 \cdot kip$$

$$M_{rect} := F_{rect} \cdot \frac{n}{2} \qquad M_{rect} = 2.6775 \cdot kip \cdot in$$

Triangular Stress Block Resultants

$$F_{tri} := \frac{(\sigma_{max} - \sigma_{face}) \cdot n \cdot 1in}{2} \qquad F_{tri} = 0.6896 \cdot kip$$

$$M_{tri} := F_{tri} \cdot 2 \cdot \frac{n}{3} \qquad M_{tri} = 1.9309 \cdot kip \cdot in$$

Total Moment Per Unit Width

$$M_{design} := M_{rect} + M_{tri}$$

$$\boxed{M_{design} = 4.6084 \cdot kip \cdot in}$$

Base Plate Design [AISC-LRFD 2nd ED J9]

1. Concrete Bearing Stress [AISC LRFD-2nd ED J9]

$f_c := 4ksi$

$\Phi_c := .6$

$$A_{ratio} := \text{if}\left[\left(\frac{A_2}{A}\right)^{\frac{1}{2}} < 2, \left(\frac{A_2}{A}\right)^{\frac{1}{2}}, 2\right]$$

$A_{ratio} = 1.5$

$F_p := \Phi_c \cdot 0.85 \cdot f_c \cdot A_{ratio}$ [AISC LRFD-2nd ED J9]

$F_p = 3.06 \cdot ksi$

$\text{pedestal\_design} := \text{if}\left(\sigma_{max} < F_p, G_{pedestal}, NG_{pedestal}\right)$

pedestal_design = "Pedestal design is good"

2. Plate Thickness [AISC LRFD-2nd ED]

$\Phi_{flex} := .90 \quad F_y := 36ksi$

$t_p := \sqrt{4 \cdot \frac{M_{design} \cdot 1}{\Phi_{flex} \cdot F_y \cdot 1in}}$ $\quad t_p = 0.7543 \cdot in$ [AISC LRFD-2nd ED 14-6]

Plate Bending Strength per unit width

$M_{strength} := \Phi_{flex} \cdot F_y \cdot Z_y \qquad M_{strength} = 5.4 \cdot kip \cdot in$

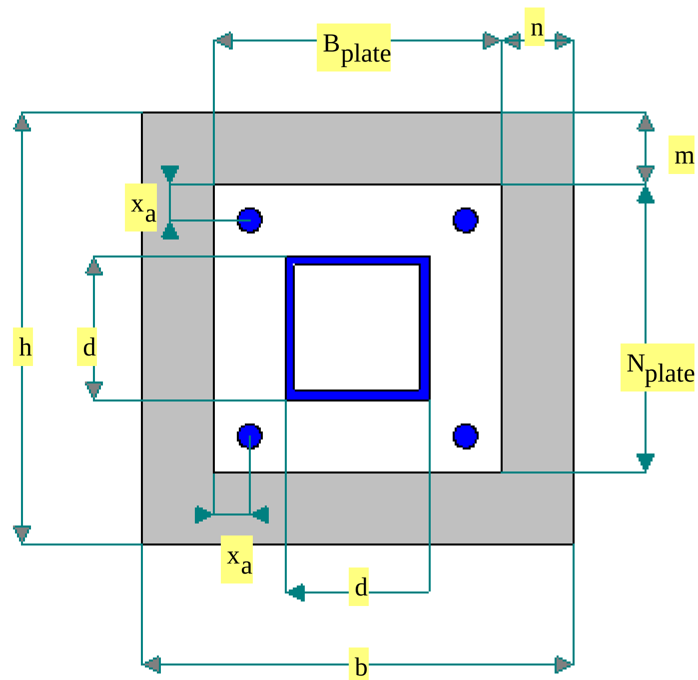
Design Check

$\text{base\_plate\_design} := \text{if}\left(t > t_p, G_d, NG\right)$

base_plate_design = "Base Plate Design is Good"

Anchor Bolt Design

References:
-AISC LRFD 2nd ed. Steel Design Guide:Base Plate and Anchor Rod Design
-ACI 318-02



$N_{plate} = 16 \cdot in$

$x_a := 2in$

$N' := N_{plate} - x_a$

$N' = 14 \cdot in$

$B := N_{plate}$

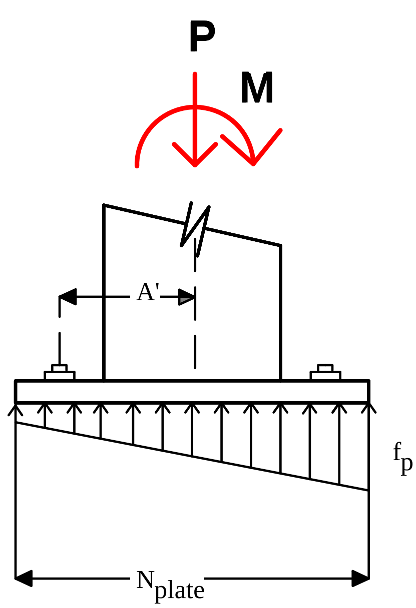
$B = 16 \cdot in$

$f_p := \sigma_{max}$

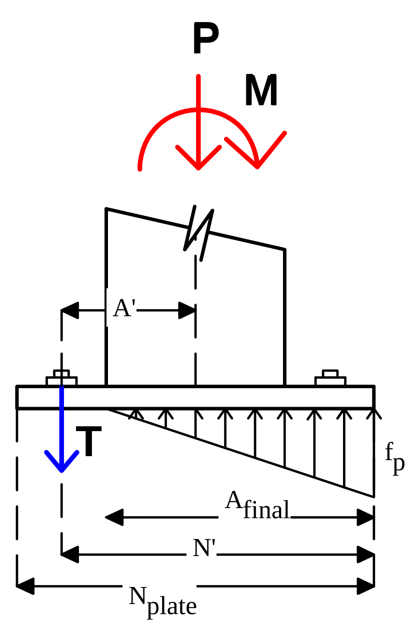
$e = 258.464 \cdot in$

Tension in Anchor Bolt due to Moment [AISC Design Guide Appendix B]

if e<e_kern



if e>e_kern



Determining effects of eccentricity [AISC LRFD B.3]

$$e_{kern} := \frac{N_{plate}}{6} \qquad \boxed{e_{kern} = 2.67 \cdot in} \qquad \text{[AISC B.3]}$$

$$anchor\_tension := if\left(e > e_{kern}, BT, NBT\right)$$

$$anchor\_tension = \text{"Anchor bolts in tension"}$$

Determining Tension in Anchor Bolt [AISC B.4.2]

$$P = 1652\, lbf$$

$$f_p = 1 \cdot ksi$$

$$B = 1\, ft$$

Determining Length of Stress Triangle

$$f' := f_p \cdot N_{plate} \cdot \frac{N'}{2} \qquad \boxed{f' = 70.7788 \cdot kip}$$

$$A_{plus} := \frac{f' + \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}} \qquad \boxed{A_{plus} = 34.535 \cdot in}$$

$$A_{minus} := \frac{f' - \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}} \qquad \boxed{A_{minus} = 7.465 \cdot in}$$

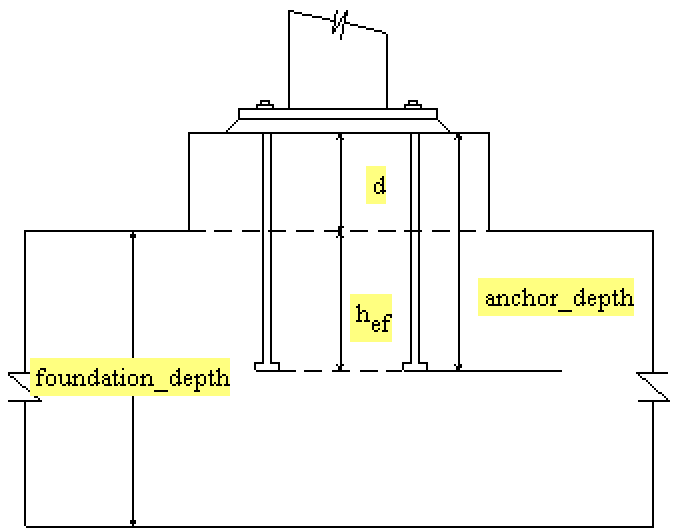
$$A_{final} := \left| \begin{array}{l} \min\left(A_{plus}, A_{minus}\right) \ \text{ if } A_{plus} > 0 \wedge A_{minus} > 0 \\ A_{plus} \ \text{ if } A_{plus} > 0 \wedge A_{minus} < 0 \\ 0 \ \text{ if } A_{plus} < 0 \wedge A_{minus} < 0 \end{array} \right. \qquad \boxed{A_{final} = 7.465 \cdot in}$$

Determining Anchor Tension from Equilibrium

$$T_{anchors} := \frac{f_p \cdot A_{final} \cdot B}{2} - P \qquad \boxed{T_{anchors} = 36.087 \cdot kip}$$

$$T_{one\_anchor} := \frac{T_{anchors}}{2} \qquad \boxed{T_{one\_anchor} = 18.0435 \cdot kip}$$

Pedestal and Foundation Cross Section



$d := \text{VARIES}$

$h_{ef} := 10\text{in}$ (minimum)

To simplify the calculation, the effective embedment depth of the anchor bolt is taken as the length of the bolt that extends beneath the column pedestal. This results in a conservative estimate of the strength of concrete breakout and pryout.

Steel Strength of anchor in tension [ACI 318.05 D.5.1]

NOTE: ACI 318-05 Appendix D was adopted in lieu of ACI 318-02 in order to include the updated ductility requirements.

$f_{ya} := 36\text{ksi}$ $n_{anch} := 4$

$f_{uta} := \min(1.9 \cdot f_{ya}, 125\text{ksi}, 58\text{ksi})$

$f_{uta} = 58000\,\text{psi}$

Anchor Bolt Diameter: $d_o := 0.875\text{in}$

Net tensile area $A_{se} := 0.462\text{in}^2$ [Ref. 4.17]

$N_{sa} := n_{anch} \cdot A_{se} \cdot f_{uta}$ [ACI 318.05 Eq D-3]

$\boxed{N_{sa} = 107.184 \cdot \text{kip}}$ one anchor

Concrete breakout strength-Tension [ACI 318.05 D.5.2]

Concrete breakout strength based on a grouping of two anchors, since tension due to moment is the only tension present.

$c_{a1} := 15in$ $\quad s_1 := 12in$

$c_{a2} := 15in$ $\quad s_2 := 12in$

$c_{a11} := 15in$ $\quad f_c = 4000\,psi$

$c_{a22} := 15in$

Bolts are not located near any edges of concrete. Use 15" because it is 1.5*hef

$c_{amin} := \min(c_{a1}, c_{a11}, c_{a2}, c_{a22})$

$n_{anch\_ten} := 2$

Breakout Prism Properties

$h'_{ef} := h_{ef}$

$A_{NCO} := 9 \cdot h'^{\,2}_{ef}$

$A_{NCO} = 900 \cdot in^2$

$A_{NC} := (1.5 \cdot h'_{ef} + s_1 + 1.5 \cdot h'_{ef}) \cdot (1.5 \cdot h'_{ef} + s_2 + 1.5 \cdot h'_{ef})$

$A_{NC} = 1764 \cdot in^2$

$A_{NC} := \min(A_{NC}, n_{anch\_ten} \cdot A_{NCO})$

$A_{NC} = 1764 \cdot in^2$

anchor_status := "cast in"

$k_c :=$ if (anchor_status = "cast in", 24, 17)

$k_c = 24$

$$N_b := \begin{cases} 16 \cdot psi^{.5} \cdot in^{\frac{1}{3}} \cdot \sqrt{f_c} \cdot h'^{\,\frac{5}{3}}_{ef} & \text{if } 11in \le h'_{ef} \le 25in \\ k_c \cdot \sqrt{f_c} \cdot h'^{\,1.5}_{ef} \cdot psi^{.5} \cdot in^{.5} & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-7]

[ACI 318-05 EQ D-8]

$N_b = 48000\,lbf$

$e'_N := 6in$

Assumption that only one row of anchors on one side of the column center line carry tension load. Eccentricity is therefore distance from this row of anchors to the column center line

$$\Psi_{ecN} := \min\left(\frac{1}{1 + \frac{2 \cdot e'_N}{3 \cdot h'_{ef}}}, 1.0\right)$$

[ACI 318-05 EQ D-9]

$\Psi_{ecN} = 1$

$$\Psi_{edN} := \begin{cases} 1 & \text{if } c_{amin} \geq 1.5 \cdot h'_{ef} \\ 0.7 + 0.3 \cdot \frac{c_{amin}}{1.5(h'_{ef})} & \text{if } c_{amin} < 1.5 \cdot h'_{ef} \end{cases}$$

[ACI 318-05 EQ D-10]

[ACI 318-05 EQ D-11]

$\Psi_{edN} = 1$

$$\Psi_{cN} := \begin{cases} 1.25 & \text{if anchor\_status = "cast in"} \\ 1.4 & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D.5.2.6

$\Psi_{cN} = 1$

$\Psi_{cpN} := 1$ [ACI 318-05 D5.2.7]

$$N_{cbg} := \frac{A_{NC}}{A_{NCO}} \cdot \Psi_{ecN} \cdot \Psi_{edN} \cdot \Psi_{cN} \cdot \Psi_{cpN} \cdot N_b$$

[ACI 318-05 EQ D-5]

$\boxed{N_{cbg} = 84 \cdot kip}$ Group of two anchors

Pullout Strength of Anchor in Tension [ACI 318-05 D.5.3]

$A_{brg} := 0.891in^2$ crack_status := "not cracked" hook_status := "not hooked"

$N_p := 8 \cdot A_{brg} \cdot f_c$ [ACI 318-02 EQ D-15]

$\Psi_{cP} :=$ if[(crack_status = "cracked"), 1.4, 1.0] [ACI 318-05 D.5.3.6]

$N_{pn} := \Psi_{cP} \cdot N_p$ [ACI 318-02 EQ D-14]

$\boxed{N_{pn} = 28.512 \cdot kip}$ One Anchor

Concrete side-face blowout strength-Tension [ACI 318.05 D.5.4]

$c_{a1} = 15 \cdot in$

$N_{sb} := 160 \frac{lbf}{in} \cdot c_{a1} \cdot \sqrt{\frac{A_{brg}}{in^2}} \cdot \sqrt{\frac{f_c}{psi}}$ [ACI 318-05 EQ D-17] $A_{brg} = 0.891 \cdot in^2$

$\boxed{N_{sb} = 143.278 \cdot kip}$ one anchor

Tension Design Check

$\boxed{N_{sa} = 107184\, lbf}$ one anchor $\boxed{N_{pn} = 28512\, lbf}$ one anchor

$\boxed{N_{cbg} = 84000\, lbf}$ two anchors $\boxed{N_{sb} = 143278\, lbf}$ one anchor

$\Phi_{tension} := 0.85$ Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength. Condition A is met [ACI 318-05 D.4.4]

$N_{design} := \Phi_{tension} \cdot \min\left(N_{sa}, \frac{N_{cbg}}{2}, N_{pn}, N_{sb}\right)$ [ACI 318-05 D.4.1.1]

$\boxed{N_{design} = 24.235 \cdot kip}$

$T_{one\_anchor} = 18.043 \cdot kip$

$tension\_design := if\left(T_{one\_anchor} \le N_{design}, \text{"Good"}, \text{"Not Good"}\right)$ [ACI 318-05 EQ D-1]

$\boxed{tension\_design = \text{"Good"}}$

Steel Strength of Anchor in Shear [ACI 318-05 D.6.1]

Anchor Types:

AT1 [ACI 318-05 D.6.1.a]

AT2 [ACI 318-05 D.6.1.b]

AT3 [ACI 318-05 D.6.1.c]

Anchor Type Used:

AT := "AT1"

Grout Pad Factor [ACI 318-05 D.6.1.3]:

grout_pad_used := "yes"

$$c_{pad} := \begin{cases} 0.8 & \text{if grout\_pad\_used} = \text{"yes"} \\ 1.0 & \text{otherwise} \end{cases}$$

$c_{pad} = 1$

Shear Strength:

$$V_{sa} := \begin{cases} c_{pad} \cdot n_{anch} \cdot A_{se} \cdot f_{uta} & \text{if AT} = \text{"AT1"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if AT} = \text{"AT2"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if AT} = \text{"AT3"} \end{cases}$$

[ACI 318-05 EQ D-19]
[ACI 318-05 EQ D-20]
[ACI 318-05 EQ D-20]

$\boxed{V_{sa} = 85.747 \cdot kip}$ one anchor

Concrete Breakout Strength-Shear [ACI 318-05 D.6.2]

group_status := "group"

Projected Concrete Failure Area [ACI 318-05 D.6.2.1, RD.6.2.1]

$c_{a1} = 1\ \text{ft}$ Assuming that total shear is critical on one anchor row

$h_a := 6.\text{in}$ Thicknessof pedestal

$s_1 = 1\ \text{ft}$ Anchor Bolt Spacing

$$c := \begin{cases} 1.5 \cdot c_{a1} & \text{if } 1.5 \cdot c_{a1} < c_{a2} \\ c_{a2} & \end{cases}$$

$c = 1\ \text{ft}$

$$A_{vc} := \begin{cases} \left[2 \cdot (c) + s_1\right] \cdot h_a & \text{if } 1.5c_{a1} > h_a \\ 2 \cdot \left[(c) + s_1\right] \cdot 1.5 \cdot c_{a1} & \text{otherwise} \end{cases}$$

[ACI 318-05 Fig RD.6.2.1(b)]
Failure area for group of anchors

$A_{vc} = 2\ \text{ft}^2$

$A_{vco} := 4.5 \cdot {c_{a1}}^2$

$A_{vco} = 7\ \text{ft}^2$ [ACI 318-05 EQ D-23]

$A_{vc} := \min\left(A_{vc}, n_{anch} \cdot A_{vco}\right)$

$A_{vc} = 2\ \text{ft}^2$

Basic Concrete Breakout Strength [ACI 318-05 D.6.2.2]

$l_e := h_{ef}$ anchor load bearing legnth

$$V_b := 7 \cdot \left(\frac{l_e}{d_o}\right)^{0.2} \cdot \sqrt{d_o} \cdot \sqrt{f_c} \cdot {c_{a1}}^{1.5} \cdot \text{psi}^{.5}$$ [ACI 318-05 EQ D.24]

$V_b = 39162\ \text{lbf}$

$e'_v := 0in$ Assumption that shear is distributed equal to all anchors and no shear eccentricity results

$$\Psi_{ecV} := \min\left(1, \frac{1}{1 + 2\cdot\frac{e'_v}{3\cdot c_{a1}}}\right)$$

$\Psi_{ecV} = 1$

$c_{a2} = 1\ ft$

$$\Psi_{edV} := \begin{cases} 1.0 & \text{if } c_{a2} \geq 1.5\cdot c_{a1} \\ 0.7 + 0.3\cdot\frac{c_{a2}}{1.5\cdot c_{a1}} & \text{if } c_{a2} < 1.5\cdot c_{a1} \end{cases}$$

[ACI 318-05 EQ D-27]

[ACI 318-05 EQ D-28]

$\Psi_{edV} = 1$

crack_status = "not cracked"

$$\Psi_{cV} := \begin{cases} 1.4 & \text{if crack\_status} = \text{"not cracked"} \\ 1.0 & \text{if crack\_status} = \text{"cracked no reinforce"} \\ 1.2 & \text{if crack\_status} = \text{"cracked with reinforce"} \\ 1.4 & \text{if crack\_status} = \text{"cracked with reinforce and stirrups"} \end{cases}$$

$\Psi_{cV} = 1$

$$V_{cb} := \begin{cases} \frac{A_{vc}}{A_{vco}}\cdot\Psi_{edV}\cdot\Psi_{cV}\cdot V_b & \text{if group\_status} = \text{"single anchor"} \\ 0 & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-21]

$$V_{cbg} := \begin{cases} \frac{A_{vc}}{A_{vco}}\cdot\Psi_{ecV}\cdot\Psi_{edV}\cdot\Psi_{cV}\cdot V_b & \text{if group\_status} = \text{"group"} \\ 0 & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-22]

$V_{cb} = 0\ lbf$

$\boxed{V_{cbg} = 12\cdot kip}$ group of 2 anchors

Concrete pryout strength of anchor in shear [ACI 318-05 D.6.3]

$h_{ef} = 1\ \text{ft}$

$$k_{cp} := \begin{cases} 1.0 & \text{if } h_{ef} < 2.5\text{in} \\ 2.0 & \text{if } h_{ef} \geq 2.5\text{in} \end{cases}$$

$$V_{cp} := \begin{cases} k_{cp} \cdot N_{cb} & \text{if group\_status} = \text{"single anchor"} \\ 0 & \text{otherwise} \end{cases}$$ [ACI 318-05 EQ D-29]

$$V_{cpg} := \begin{cases} k_{cp} \cdot N_{cbg} & \text{if group\_status} = \text{"group"} \\ 0 & \text{otherwise} \end{cases}$$ [ACI 318-05 EQ D-30]

$V_{cpg} = 168 \cdot \text{kip}$ — group of 2 anchors

Shear Design Check

$V_{sa} = 85747\ \text{lbf}$ — one anchor

$V_{cbg} = 12281\ \text{lbf}$ — group of 2 anchors

$V_{cpg} = 168000\ \text{lbf}$ — group of 2 anchors

$\Phi_{shear} := 0.85$ — Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength [ACI 318-05 D.4.4]

$V_{design} := \Phi_{shear} \cdot \min(V_{sa} \cdot 4, V_{cbg}, V_{cpg})$ [ACI 318-05 D.4.1.1]

$V_{design} = 10.439 \cdot \text{kip}$

design_shear := if(V ≤ V_{design}, "Design is OK" , "Design is insufficient")

design_shear = "Design is OK" [ACI 318-05 EQ D-2]

Interaction of tensile and shear forces [ACI 318-05 D.7]

$$\frac{V}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} = 0.931$$

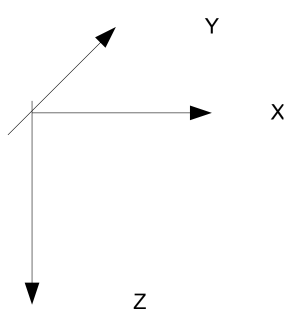
$$ST_{check} := \text{if}\left(\frac{V}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} \le 1.2, \text{"Interaction OK"}, \text{"Interactoin Failure"}\right)$$

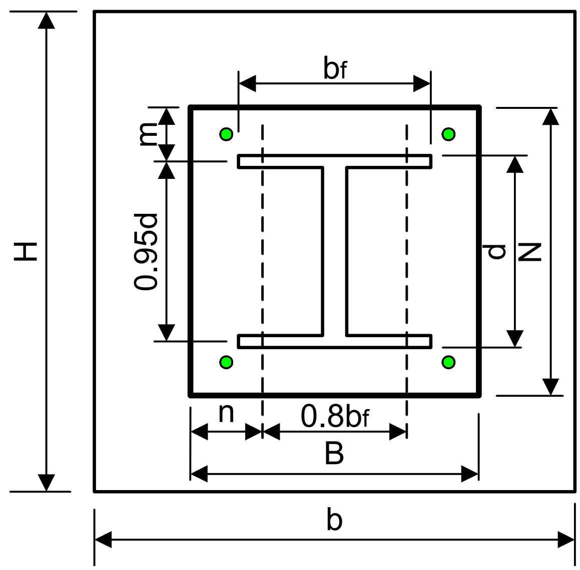
$$interaction\_check\_V := \text{if}\left[\left(V > 0.2 \cdot V_{design} \wedge T_{one\_anchor} > N_{design}\right), ST_{check}, \text{"No check needed"}\right]$$

$interaction\_check\_V = \text{"No check needed"}$

Anchor Bolt and Base Plate Design

Load Sign Convention





$b_f := 8.0\text{in}$

$d := 8.0\text{in}$ (ref 4.13)

W8x31 beam size

Plate dimension in direction of column major axis $N := 16\text{in}$

Plate dimension in direction of column minor axis $B := 16\text{in}$

Per structural typical detail 2 on dwg 000-SO-00-00006

Base Plate thickness $t_{PL} := 1.0\text{in}$

Base plate strength $F_y := 50\text{ksi}$

$$m := \frac{N - 0.95 \cdot d}{2} \qquad m = 4.2 \cdot \text{in}$$

$$n := \frac{N - 0.8 \cdot b_f}{2} \qquad n = 4.8 \cdot \text{in}$$

Footing Dimensions

Pier Height: $h_p := 6.5\text{in}$

Footing Pad Thickness: $t_p := 2.0\text{ft}$

Pier Cross-sectional dimensions: $h := 24\text{in}$ $b := 24\text{in}$

Anchor Bolt Design

Length of anchor Bolt embedded in concrete: $L_{bolt} := 15in$

$s_1 := 12in$ $s_2 := 12in$ Spacing between anchor bolts

Is the anchor bolt failure plane truncated by pier dimensions?

$$breakout_{cone.} := if\left[L_{bolt} > h_p + \left(\frac{if(b < h, b, h) - if(b < h, s_2, s_1)}{2}\right)\cdot\left(\frac{1}{1.5}\right), \text{"by embedment depth"}, \text{"by pier dimensions"}\right]$$

$$breakout_{cone.} = \text{"by embedment depth"}$$

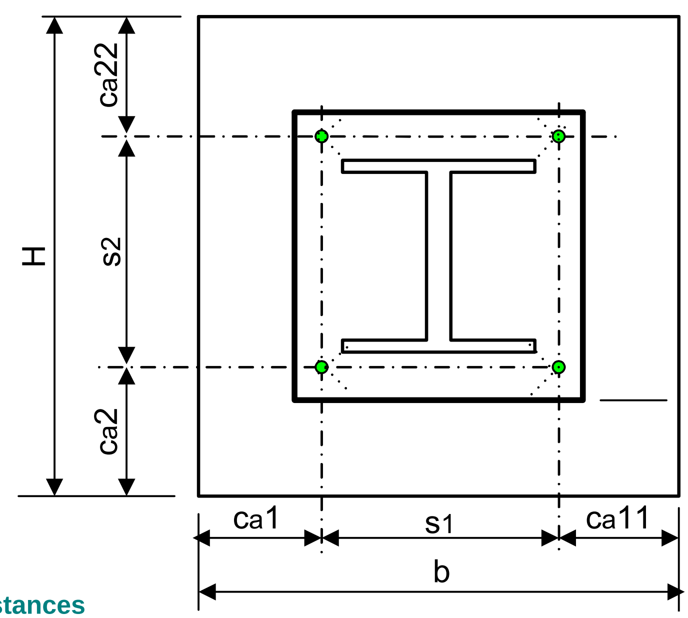
The second term in the check shown here is used to determine if, even though the anchor is embedded in the pad, whether the failure plane would extend back up into the area of the pier.

$c_{a1} := \frac{b - s_1}{2}$ $c_{a1} = 6\cdot in$

$c_{a11} := \frac{b - s_1}{2}$ $c_{a11} = 6\cdot in$

$c_{a2} := \frac{h - s_2}{2}$ $c_{a2} = 6\cdot in$

$c_{a22} := \frac{h - s_2}{2}$ $c_{a22} = 6\cdot in$



Pier Edge Distances

To determine the effective depth of the anchor bolts:

Per ACI 318 section D.5.2.3, if the anchors are located less than 1.5hef from three of more edges,

$$h'_{ef} := \max\left(\frac{\max(c_{a1}, c_{a11}, c_{a2}, c_{a22})}{1.5}, \frac{1}{3}\cdot\max(s_1, s_2)\right) \qquad h'_{ef} = 4\cdot in$$

$$h_{ef} := \begin{cases} h'_{ef} & \text{if } h_p \geq L_{bolt} \\ L_{bolt} - h_p & \text{otherwise} \end{cases}$$

$$h_{ef} = 8.5\cdot in$$

Adjust breakout cone dimensions if failure plane is not truncated by pier dimensions.
If pier truncates breakout cone, edge distances will stay the same.

$$c_{a1} := \text{if}\left[h_p \geq h_{ef}, \left(\frac{b - s_1}{2}\right), 1.5\cdot h_{ef}\right] \qquad c_{a1} = 12.75\cdot in$$

$$c_{a11} := \text{if}\left[h_p \geq h_{ef}, \left(\frac{b - s_1}{2}\right), 1.5\cdot h_{ef}\right] \qquad c_{a11} = 12.75\cdot in$$

$$c_{a2} := \text{if}\left[h_p \geq h_{ef}, \left(\frac{h - s_2}{2}\right), 1.5\cdot h_{ef}\right] \qquad c_{a2} = 12.75\cdot in$$

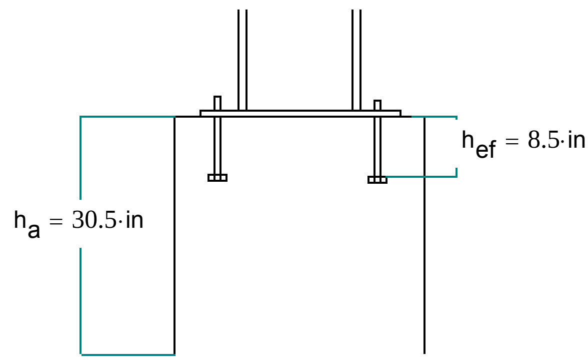
$$c_{a22} := \text{if}\left[h_p \geq h_{ef}, \left(\frac{h - s_2}{2}\right), 1.5\cdot h_{ef}\right] \qquad c_{a22} = 12.75\cdot in$$

Total depth of footing: $h_a := h_p + t_p$ $h_a = 30.5 \cdot in$

Concrete strength: $f'_c := 4000psi$

Number of anchors used:

$no := 4$ Type ASTM F1554 Bolt Grade 36
Per 24915-000-S0-00-00005 Rev 0



Anchor Bolt Properties:

Bolt diameter $d_b := \left(\frac{7}{8}\right) in$

Effective Area: $A_{se} = (0.462) \cdot in^2$ [Ref 4.5 Table 34-2]

Yield Strength: $f_{ya} := 36000psi$

Ultimate Strength: $f_{uta} := 58000psi$

$f_{uta} := \min(f_{uta}, 1.9 \cdot f_{ya}, 125000psi)$ [Ref 4.5, Sec D.5.1]

$f_{uta} = 58 \cdot ksi$

Steel Strength of anchor group in tension

$N_{sa} := no \cdot A_{se} \cdot f_{uta}$

$\boxed{N_{sa} = (107.2) \cdot kip}$

Concrete breakout strength of anchor group in tension

$A_{Nco} := 9 \cdot h_{ef}^{2}$ (D-6)

$A_{Nco} = 650.25 \cdot in^{2}$

Per ACI 318 section D.5.2.1A_{Nc} must be less than n*A_{Nco}

$$A_{Nc} := \left(\min\left(1.5 \cdot h_{ef}, c_{a1}\right) + s_1 + \min\left(1.5h_{ef}, c_{a11}\right)\right) \cdot \left(\min\left(1.5 \cdot h_{ef}, c_{a2}\right) + s_2 + \min\left(1.5h_{ef}, c_{a22}\right)\right)$$

$A_{Nc} = 1406.25 \cdot in^{2}$

$Check_{Anc} := if\left(A_{Nc} < no \cdot A_{Nco}, \text{"OK"}, \text{"NOT OK"}\right)$

$Check_{Anc} = \text{"OK"}$

$$N_b := \begin{cases} 16 \cdot \sqrt{\dfrac{f'_c}{psi}} \cdot \dfrac{h_{ef}^{\frac{5}{3}}}{in^{\frac{5}{3}}} \cdot lbf & \text{if } 25in \ge h_{ef} \ge 11in \\ 24 \cdot \sqrt{\dfrac{f'_c}{psi}} \cdot \dfrac{h_{ef}^{1.5}}{in^{1.5}} \cdot lbf & \text{otherwise} \end{cases}$$ (D-7)

$N_b = 37.62 \cdot kip$

eccentricity of tension force on a group of bolts

$e_{N'} := 0$

For concentric braced frames only.
Otherwise input a value of e_N

$$\Psi_{ec\_N} := \begin{cases} \dfrac{1}{1 + \dfrac{2 \cdot e_{N'}}{3 \cdot h_{ef}}} & \text{if } \dfrac{1}{1 + \dfrac{2 \cdot e_{N'}}{3 \cdot h_{ef}}} < 1.0 \\ 1.0 & \text{otherwise} \end{cases}$$ (D-9)

$\Psi_{ec\_N} = 1$

$$\Psi_{ed\_N} := \begin{cases} 1 & \text{if } \min(c_{a1}, c_{a11}, c_{a2}, c_{a22}) > 1.5 \cdot h_{ef} \\ 0.7 + 0.3 \cdot \dfrac{\min(c_{a1}, c_{a11}, c_{a2}, c_{a22})}{1.5 h_{ef}} & \text{otherwise} \end{cases}$$

(D-10)

(D-11)

$\Psi_{ed\_N} = 1$

Per ACI 318 section D.5.2.6 ψc_N =

1.25 for cast in anchors
1.4 for post installed anchors, where the value of kc is 17

$\Psi_{c\_N} := 1.25$

$\Psi_{c\_N} = 1.25$

$$N_{cbg} := \frac{A_{Nc}}{A_{Nco}} \cdot \Psi_{ec\_N} \cdot \Psi_{ed\_N} \cdot \Psi_{c\_N} \cdot N_b$$

$\boxed{N_{cbg} = 101.7 \cdot kip}$

Pullout strength of anchor in tension

$A_{brg} = (0.891) \cdot in^2$ [Ref 4.17 Table 34-2]

$N_p := 8 \cdot A_{brg} \cdot f'_c$ (D-15) $N_p = (28.51) \cdot kip$

$\Psi_{c\_P} := 1.0$ Use 1.0 if cracked (D.5.3.6)
1.4 if uncracked

$N_{pn} := no \cdot \Psi_{c\_P} \cdot N_p$

$\boxed{N_{pn} = (114) \cdot kip}$

Concrete side face blowout strength of headed anchor in tension

$$N_{sb} := \begin{cases} \left(160 \cdot \min(c_{a1}, c_{a11}, c_{a2}, c_{a22}) \cdot \sqrt{\dfrac{A_{brg}}{in^2}} \cdot \sqrt{\dfrac{f'_c}{psi}}\right) \cdot psi \cdot in & \text{if } \min(c_{a1}, c_{a11}, c_{a2}, c_{a22}) < 0.4 h_{ef} \\ \text{"tension does not control"} & \text{otherwise} \end{cases}$$

(D-15)

If $\min(c_{a1}, c_{a11}, c_{a2}, c_{a22})$ > 0.4hef, then the blowout strength of the headed anchor in tension does not control.

$$N_{sbg} := \begin{cases} \left(1 + \dfrac{\min(s_1, s_2)}{6 \cdot \min(c_{a1}, c_{a11}, c_{a2}, c_{a22})}\right) \cdot N_{sb} & \text{if } N_{sb} \neq \text{"tension does not control"} \\ \text{"tension does not control"} & \text{otherwise} \end{cases}$$

$\boxed{N_{sbg} = \text{"tension does not control"}}$

Steel strength of anchor group in shear

$V_{sa} := 0.6no \cdot A_{se} \cdot f_{uta}$

$\boxed{V_{sa} = (64.3) \cdot kip}$

Concrete breakout strength of anchor in shear

Per ACI 318 section D.6.2.4, since the anchors are located less than 1.5c $_{a1}$ from three of more edges

$$c_1 := \min\left(c_{a1}, \max\left(\frac{\max(c_{a2}, c_{a22})}{1.5}, \frac{1}{3} \cdot \max(s_1, s_2), \frac{h_a}{1.5}\right)\right)$$

$c_1 = 12.75 \cdot in$

$A_{Vco} := 4.5 \cdot \min(c_1)^2$ (D-22)

$A_{Vco} = 731.53 \cdot in^2$

Per ACI 318 section D.6.2.1, V_{Nc} must be less than n*V_{Nco}

$$A_{Vc} := (\min(1.5 \cdot c_1, c_{a1}) + s_1 + \min(1.5c_1, c_{a11})) \cdot (\min(1.5c_1, h_a))$$

$$A_{Vc} := \begin{cases} no \cdot A_{Vco} & \text{if } A_{Vc} > no \cdot A_{Vco} \\ A_{Vc} & \text{otherwise} \end{cases}$$

$A_{Vc} = 717.19 \cdot in^2$

$l_e := \min(8 \cdot d_b, h_{ef}, 25in)$

$l_e = 7 \cdot in$

$$V_b := 7\left(\frac{l_e}{d_b}\right)^{0.2} \cdot \sqrt{d_b} \cdot \sqrt{\frac{f'_c}{psi}} \cdot \min(c_1)^{1.5} \cdot psi$$ (D-23)

$V_b = 28.58 \cdot kip$

eccentricity of shear force on a group of bolts

$e_{V'} := 0$ For concentric braced frames only.
Otherwise input value of e_V

$$\Psi_{ec\_V} := \begin{cases} \dfrac{1}{1+\dfrac{2\cdot e_{V'}}{3\cdot \min(c_1)}} & \text{if } \dfrac{1}{1+\dfrac{2\cdot e_{V'}}{3\cdot \min(c_1)}} < 1.0 \\ 1.0 & \text{otherwise} \end{cases}$$ (D-25)

$\Psi_{ec\_V} = 1$

$$\Psi_{ed\_V} := \begin{cases} 1 & \text{if } \min(c_{a2}, c_{a22}) > 1.5\cdot\min(c_1) \\ 0.7 + 0.3\cdot\dfrac{\min(c_{a2}, c_{a22})}{1.5\min(c_1)} & \text{otherwise} \end{cases}$$

$\Psi_{ed\_V} = 0.9$

Per ACI318 section D.6.2.7 ψ_{c_V} =
1.0 for anchors in cracked concrete with no edge reinforcement.
1.2 for anchors with No. 4 or greater bars between the anchor and the edge.
1.4 for anchors with No. 4 or greater bars between the anchor and the edge, and with stirrups enclosing the supplemental steel.

$\Psi_{c\_V} := 1.2$

$\Psi_{c\_V} = 1.2$

$$V_{cbg} := \frac{A_{Vc}}{A_{Vco}}\cdot\Psi_{ec\_V}\cdot\Psi_{ed\_V}\cdot\Psi_{c\_V}\cdot V_b$$

$\boxed{V_{cbg} = 30.3\cdot kip}$

Concrete pryout strength of anchor in shear

$$k_{cp} := \begin{cases} 1.0 & \text{if } h_{ef} < 2.5in \\ 2.0 & \text{if } h_{ef} > 2.5in \end{cases}$$

$k_{cp} = 2$

$V_{cpg} := k_{cp}\cdot N_{cbg}$

$\boxed{V_{cpg} = 203.4\cdot kip}$

Limit States of Anchors Under Shear and Tension Loading

Tensile Limit States Summary

Steel Strength of Anchor Group: $N_{sa} = (107.18)\cdot kip$

Concrete Breakout Strength of Group: $N_{cbg} = 101.69\cdot kip$

Concrete Side-face Blowout Strength of Group: $N_{sbg} =$ "tension does not control"

Pullout Strength of Anchor Group: $N_{pn} = (114.05)\cdot kip$

Design Tensile Allowable:

$$N_n := \begin{cases} \min(N_{sa}, N_{cbg}, N_{sbg}, N_{pn}) & \text{if } N_{sb} \neq \text{"tension does not control"} \\ \min(N_{sa}, N_{cbg}, N_{pn}) & \text{otherwise} \end{cases}$$

$$\boxed{N_n = 101.69\cdot kip}$$

Shear Limit States Summary

Steel Strength of Anchor Group: $V_{sa} = (64.31)\cdot kip$

Concrete Breakout Strength of Group: $V_{cbg} = 30.26\cdot kip$

Concrete Pryout Strength of Group: $V_{cpg} = 203.37\cdot kip$

Design Shear Allowable: $V_n := \min(V_{sa}, V_{cbg}, V_{cpg})$

$$\boxed{V_n = 30.26\cdot kip}$$

Loads from Calc. 24915-10-SSC-00-00006 [Ref. 4.18]

Service Axial Loads

Dead Load	$N_D := 7.34\text{kip}$
Live Load	$N_L := 0\text{kip}$
Roof Live Load	$N_{Lr} := 0\text{kip}$
Snow Load	$N_S := 0.81\text{kip}$
Wind Load	$N_W := 1.333\text{kip}$
Seismic Load	$N_E := 0\text{kip}$

Service Shear Loads

Dead Load	$V_D := 0.81\text{kip}$
Live Load	$V_L := 0\text{kip}$
Roof Live Load	$V_{Lr} := 0\text{kip}$
Snow Load	$V_S := 0\text{kip}$
Wind Load	$V_W := 1.93\text{kip}$
Seismic Load	$V_E := 0\text{kip}$

Service Moments

$M_D := 27.37\text{kip}\cdot\text{ft}$

$M_W := 26.65\text{kip}\cdot\text{ft}$

$M_E := \max(M_D, M_W)$

ASCE 7 Load Combinations [Ref 4.4]

$P_1 := 1.4 \cdot N_D$

$P_2 := 1.2N_D + 1.6 \cdot N_L + 0.5N_{Lr}$

$P_3 := 1.2N_D + 1.6 \cdot N_L + 0.5N_S$

$P_4 := 1.2N_D + 1.6N_{Lr} + 0.5N_L$

$P_5 := 1.2N_D + 1.6N_{Lr} + 0.8N_W$

$P_6 := 1.2N_D + 1.6N_{Lr} - 0.8N_W$

$P_7 := 1.2N_D + 1.6N_S + 0.5N_L$

$P_8 := 1.2N_D + 1.6N_S + 0.8N_W$

$P_9 := 1.2N_D + 1.6N_S - 0.8N_W$

$P_{10} := 1.2N_D + 1.6 \cdot N_W + 0.5N_L + 0.5N_S$

$P_{11} := 1.2N_D - 1.6 \cdot N_W + 0.5N_L + 0.5N_S$

$P_{12} := 1.2N_D + 1.6 \cdot N_W + 0.5N_L + 0.5N_{Lr}$

$P_{13} := 1.2N_D - 1.6 \cdot N_W + 0.5N_L + 0.5N_{Lr}$

$P_{14} := 1.2N_D + 1.0N_E + 0.5N_L + 0.2N_S$

$P_{15} := 1.2N_D - 1.0N_E + 0.5N_L + 0.2N_S$

$P_{16} := 0.9N_D + 1.6N_W$

$P_{17} := 0.9N_D - 1.6N_W$

$P_{18} := 0.9N_D + 1.0N_E$

$P_{19} := 0.9N_D - 1.0N_E$

$$P = \begin{pmatrix} 10.28 \\ 8.81 \\ 9.21 \\ 8.81 \\ 9.87 \\ 7.74 \\ 10.1 \\ 11.17 \\ 9.04 \\ 11.35 \\ 7.08 \\ 10.94 \\ 6.68 \\ 8.97 \\ 8.97 \\ 8.74 \\ 4.47 \\ 6.61 \\ 6.61 \end{pmatrix} \cdot \text{kip}$$

$P_{max} := \max(P)$ $\quad P_{max} = 11.35 \cdot \text{kip}$

$P_{min} := \min(P)$ $\quad P_{min} = 4.47 \cdot \text{kip}$

$$N_{ua} := \begin{cases} P_{min} & \text{if } P_{min} \le 0 \\ 0 & \text{otherwise} \end{cases}$$

$N_{ua} = 0 \cdot \text{kip}$

ASCE 7 Load Combinations [Ref 4.4]

$V_1 := 1.4 \cdot V_D$

$V_2 := 1.2V_D + 1.6 \cdot V_L + 0.5V_{Lr}$

$V_3 := 1.2V_D + 1.6 \cdot V_L + 0.5V_S$

$V_4 := 1.2V_D + 1.6V_{Lr} + 0.5V_L$

$V_5 := 1.2V_D + 1.6V_{Lr} + 0.8V_W$

$V_6 := 1.2V_D + 1.6V_{Lr} - 0.8V_W$

$V_7 := 1.2V_D + 1.6V_S + 0.5V_L$

$V_8 := 1.2V_D + 1.6V_S + 0.8V_W$

$V_9 := 1.2V_D + 1.6V_S - 0.8V_W$

$V_{10} := 1.2V_D + 1.6 \cdot V_W + 0.5V_L + 0.5V_S$

$V_{11} := 1.2V_D - 1.6 \cdot V_W + 0.5V_L + 0.5V_S$

$V_{12} := 1.2V_D + 1.6 \cdot V_W + 0.5V_L + 0.5V_{Lr}$

$V_{13} := 1.2V_D - 1.6 \cdot V_W + 0.5V_L + 0.5V_{Lr}$

$V_{14} := 1.2V_D + 1.0V_E + 0.5V_L + 0.2V_S$

$V_{15} := 1.2V_D - 1.0V_E + 0.5V_L + 0.2V_S$

$V_{16} := 0.9V_D + 1.6V_W$

$V_{17} := 0.9V_D - 1.6V_W$

$V_{18} := 0.9V_D + 1.0V_E$

$V_{19} := 0.9V_D - 1.0V_E$

$V_i := \mathrm{if}\left[V_i < 0\mathrm{kip}, (-V)_i, V_i\right]$ convert negative values into positive

$V_{max} := \max(V)$ $V_{max} = 4.06 \cdot \mathrm{kip}$

$$V = \begin{pmatrix} 1.13 \\ 0.97 \\ 0.97 \\ 0.97 \\ 2.52 \\ 0.57 \\ 0.97 \\ 2.52 \\ 0.57 \\ 4.06 \\ 2.12 \\ 4.06 \\ 2.12 \\ 0.97 \\ 0.97 \\ 3.82 \\ 2.36 \\ 0.73 \\ 0.73 \end{pmatrix} \cdot \mathrm{kip}$$

$$P_{seism} := \begin{pmatrix} P_{14} \\ P_{15} \\ P_{18} \\ P_{19} \end{pmatrix} \qquad P_{seism} = \begin{pmatrix} 8970 \\ 8970 \\ 6606 \\ 6606 \end{pmatrix} \mathrm{lb}$$

$$\mathrm{condition} := \left| \begin{array}{ll} \text{"tension"} & \text{if } M_E \neq 0\mathrm{kip} \\ \text{"compression"} & \text{otherwise} \end{array} \right.$$

$\mathrm{condition} = \text{"tension"}$

Base plate under condition = "tension"

Moments at the center line of column

$$e := \frac{M_E}{P_{seism}}$$

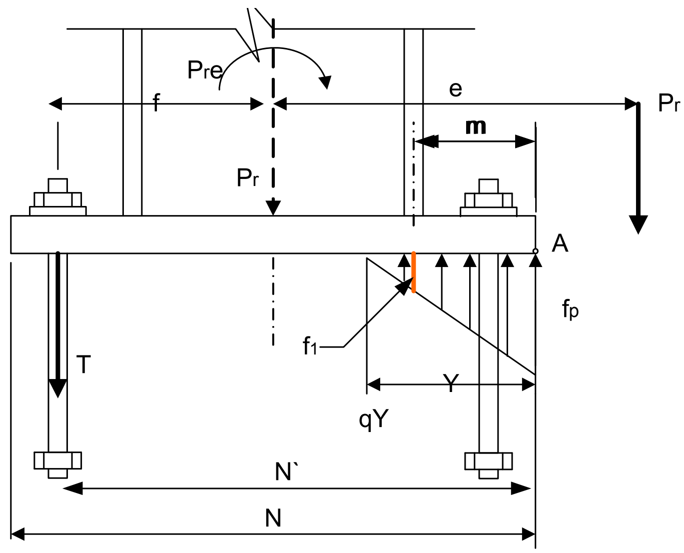
$$e^T = (36.62 \quad 36.62 \quad 49.72 \quad 49.72)\cdot in$$

$$e_{min} := \min(e) \qquad e_{min} = 36.62\cdot in$$

Ref 4.19, pg.56

$$\mathrm{check}\left(\frac{N}{6} < e_{min} < \frac{N}{2}\right) = \text{"Not Ok!"}$$

Use following large eccentricities procedure



Tension in bolt due to tension load

$$T_1 := \frac{N_{ua}}{2} \qquad T_1 = 0\,lb$$

Tension in bolt due to moment

$$T_2 := \frac{M_E}{2\cdot s_2} \qquad T_2 = 13.69\cdot kip$$

$$T := T_1 + T_2$$

$$T = 13.69\cdot kip$$

Moment in the plate 1" strip

$$M_u := \frac{T\cdot(s_2 - d)}{2\cdot(s_2 - d)}$$

$$t_{min} := \sqrt{\frac{4\cdot|M_u|}{0.9\cdot F_y}} \qquad t_{min} = 0.78\cdot in$$

$$\mathrm{check}(t_{PL} > t_{min}) = \text{"Ok!"}$$

Column with Compressive Load and Shear Load

Enter the values from the load case with the largest shear value
and the lowest axial compression

$\mu := 0.55$ Coefficient of friction between concrete and steel [Ref 4.19 Sec 3.5.1]

Check friction-only case to see if only minimum anchorage is necessary.

$\text{Friction} := (0.75 \cdot \mu \cdot P) > V$

$\text{Friction}_i := \text{if}\left[\left(0.75 \cdot \mu \cdot P_i\right) > V_i, \text{"OK"}, \text{"Check Failed"}\right]$

$$\text{Friction}_i = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"Check Failed"} \\ \text{"Check Failed"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

Check if anchor bolts are adequate for transfer shear

$\text{AnchorBolt} := 0.75 \dfrac{V_n}{2} > V$

$\text{AnchorBolt}_i := \text{if}\left(0.75 \dfrac{V_n}{2} > V_i, \text{"OK"}, \text{"anchor bolts are not adequate for transfer"}\right)$

$$\text{AnchorBolt}_i = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

strength reduction factors,

$\varphi_V := 0.65$ $\varphi_N := 0.75$

ASTM F1554 anchors are considered to be ductile
Therefore Condition A load factors are used

OSHA check on Anchor Bolts [Ref 4.19 Sec 3.0]

$P_{worker} := 300\text{lbf}$ at $e := 18\text{in} + \frac{d}{2}$

$M_{OSHA} := P_{worker} \cdot e$

$M_{OSHA} = 0.55 \cdot \text{ft} \cdot \text{kip}$

$$N_{OSHA} := \frac{M_{OSHA}}{\min(s_1, s_2)}$$

$N_{OSHA} = 0.55 \cdot \text{kip}$

$$\left| \frac{N_{OSHA}}{\varphi_N \cdot N_n} \right| = 0.01$$

$$\text{test} := \begin{cases} \text{"OK"} & \text{if } \left| \frac{N_{OSHA}}{\varphi_N \cdot N_n} \right| \le 1.0 \\ \text{"NO GOOD"} & \text{otherwise} \end{cases}$$

$\boxed{\text{test} = \text{"OK"}}$

Column with Tensile Load and Shear Load (D-7)

$\boxed{N_n = 101.69 \cdot kip}$ $\boxed{V_n = 30.26 \cdot kip}$ $V_{max} = 4.06 \cdot kip$

$N_{ua} := \max(T, N_{ua})$ $N_{ua} = 13.69 \cdot kip$ Tension load

Individual Shear and Tension Checks

Tension interaction ratio check

$$\frac{N_{ua}}{\varphi_N \cdot \frac{N_n}{2}} = 0.36$$

since moment is present, consider only 2 bolts will resist tension

$$Tension_{chk} := if\left[\left(\frac{N_{ua}}{\varphi_N \cdot \frac{N_n}{2}}\right) < 1.0, "OK", "failure"\right]$$

$Tension_{chk} = "OK"$

Shear interaction ratio check

$$\frac{V}{\varphi_V \cdot \frac{V_n}{2}} = \begin{pmatrix} 0.12 \\ 0.1 \\ 0.1 \\ 0.1 \\ 0.26 \\ 0.06 \\ 0.1 \\ 0.26 \\ 0.06 \\ 0.41 \\ 0.22 \\ 0.41 \\ 0.22 \\ 0.1 \\ 0.1 \\ 0.39 \\ 0.24 \\ 0.07 \\ 0.07 \end{pmatrix}$$

$$Shear_{check_i} := \text{if}\left[\left(\frac{V_i}{\varphi_V \cdot \frac{V_n}{2}}\right) < 1.0, \text{"OK"}, \text{"anchor bolts are not adequate for transfer"}\right]$$

$$Shear_{check_i} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

Combined Shear and Tension Check

$$\left(\frac{N_{ua}}{\varphi_N \cdot \frac{N_n}{2}} + \frac{V}{\varphi_V \cdot \frac{V_n}{2}}\right)^T = (0.47\ \ 0.46\ \ 0.46\ \ 0.46\ \ 0.61\ \ 0.42\ \ 0.46\ \ 0.61\ \ 0.42\ \ 0.77\ \ 0.57\ \ 0.77\ \ 0.57\ \ 0.46\ \ 0.46\ \ 0.75\ \ 0.6\ \ 0.43\ \ ($$

$$Test_i := \text{if}\left[\left(\frac{N_{ua}}{\varphi_N \cdot \frac{N_n}{2}} + \frac{V_i}{\varphi_V \cdot \frac{V_n}{2}}\right) < 1.2, \text{"OK"}, \text{"anchor bolt failure"}\right]$$

$$Test_i = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

Find minimum embedment

$g := c_{a1} - 1.5in - \frac{d_b}{2} - 0.5in$

$g = 10.31 \cdot in$

$Le := L_{bolt} - \frac{g}{1.5} - 1.5in$

$Le = 6.62 \cdot in$

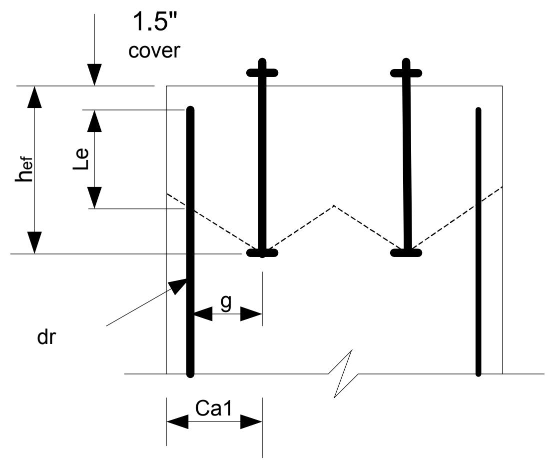
$Le := \text{if}\left(h_{ef} > Le, Le, h_{ef}\right)$

$Le = 6.62 \cdot in$

use size 7 rebar

$d_r := 0.875in$ $\quad$ $no_{bars} := 8$

$A_s = (0.6) \cdot in^2$



Development Length in Tension $\quad F_{y\_rebar} := 60ksi$

Location factor : $\alpha := 1.0$ (bottom reinforcement)

Coating factor : $\beta := 1.0$ (no-epoxy coating)

Normal weight concrete factor : $\lambda := 1.0$ (normal weight concrete)

$d_b = 0.875 \cdot in$ Bar diameter: [Ref 4.5, Section 12.2.2]

$$L_{db} := \begin{cases} \left[\dfrac{3 \cdot \left(\dfrac{F_{y\_rebar}}{psi} \cdot \alpha \cdot \beta \cdot \lambda\right)}{40 \cdot \left(\sqrt{\dfrac{f'_c}{psi}} \cdot 2.5\right)}\right] \cdot d_r & \text{if } d_r \geq 0.875in \\ \left(\dfrac{F_{y\_rebar} \cdot \alpha \cdot \beta \cdot \lambda}{25 \cdot \sqrt{f'_c \cdot psi}}\right) \cdot d_r & \text{otherwise} \end{cases}$$

[for # 7 and larger bars]

[for # 6 and smaller bars]

$L_{db} = 24.9 \cdot in$

Find Le needed to transfer uplift $\quad$ Use Class B splice factor=1.3

$$LE := \frac{1.3 \cdot L_{db} \cdot N_{ua}}{no_{bars} \cdot A_s \cdot 0.9 \cdot F_{y\_rebar}}$$

$LE = (1.71) \cdot in$

Tensile capacity of fully developed rebars:

$$N_{h\_max} := 0.9\left[\left(no_{bars}\right)\cdot\left(A_s\right)\cdot F_{y\_rebar}\right]$$

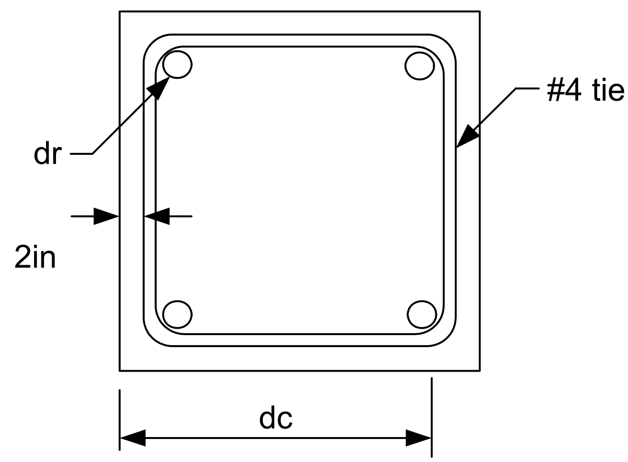
$$N_{h\_max} = (259.2)\cdot kip$$

Tensile capacity in the potential failure plan

$$N_h := \text{if}\left[Le > L_{bolt}, N_{h\_max}, \left(\frac{Le}{L_{db}}\right)\cdot N_{h\_max}\right]$$

$$\boxed{N_h = (68.96)\cdot kip}$$

Shear Capacity of Concrete Pedestal



$$N_{ua} = 13.69\cdot kip$$

Distance from tension steel
to the extreme compression fiber

$$d_c := h - 2in - \frac{d_r}{2} - 0.5in$$

$$A_g := b\cdot h$$

$$\varphi V_c := 0.75\cdot 2\cdot\left[\left(1 + \frac{N_{ua}}{500\cdot b\cdot h}\cdot\frac{in^2}{lbf}\right)\cdot\sqrt{\frac{f'_c}{psi}}\cdot psi\cdot b\cdot d_c\right]$$

$$\varphi V_c = 50.23\cdot kip$$

$$\varphi V_s := 0.75\cdot\frac{2.0\cdot 0.2in^2\cdot F_{y\_rebar}\cdot d_c}{6.0in}$$

$$\varphi V_s = 63.19\cdot kip$$

$$\varphi V_c + \varphi V_s = 113.42\cdot kip$$

Replace V_{cbg} with $\varphi V_c + \varphi V_s$ in shear limit states summary.

Using #4 ties spaced at 6" on center

Connection Ductility Summary

Anchor bolt or Shear Lug strength $\max(V_{sa}) = 64 \cdot kip$ which is less than $\min(\varphi V_c + \varphi V_s, V_{cpg}) = 113 \cdot kip$

Therefore the failure will be in shear lug or bolts not concrete and there will be a ductile mode of failure.

Tensile strength of anchor bolts $N_{sa} = (107) \cdot kip$ $\min(N_h + N_{cbg}, N_{pn}) = 114 \cdot kip$

Note: N_{sbg} not included

Anchors under combined shear and tension loading

Tensile Limit States Summary

Steel Strength of Anchor Group: $N_{sa} = (107.18) \cdot kip$

Concrete Breakout Strength of Group: (steel + concrete) $N_h + N_{cbg} = (170.64) \cdot kip$

Concrete Side-face Blowout Strength of Group: $N_{sbg} = \text{"tension does not control"} \cdot kip$

Pullout Strength of Anchor Group: $N_{pn} = (114.05) \cdot kip$

Design Tensile Allowable: $N_n := \min(N_{sa}, N_h + N_{cbg}, N_{pn})$ $\boxed{N_n = 107 \cdot kip}$

Shear Limit States Summary

Steel Strength of Anchor Group: $V_{sa} = (64.31) \cdot kip$

Concrete Breakout Strength of Group: $\varphi V_c + \varphi V_s = 113.42 \cdot kip$

Concrete Pryout Strength of Group: $V_{cpg} = 203.37 \cdot kip$

Design Shear Allowable: $V_n := \min(V_{sa}, \varphi V_c + \varphi V_s, V_{cpg})$ $\boxed{V_n = 64 \cdot kip}$

Combined Shear and Tension Check

$$\left(\frac{N_{ua}}{\varphi_N \cdot \frac{N_n}{2}} + \frac{V}{\varphi_V \cdot \frac{V_n}{2}}\right)^T = (0.39\ \ 0.39\ \ 0.39\ \ 0.39\ \ 0.46\ \ 0.37\ \ 0.39\ \ 0.46\ \ 0.37\ \ 0.53\ \ 0.44\ \ 0.53\ \ 0.44\ \ 0.39\ \ 0.39\ \ 0.52\ \ 0.45\ \ 0.38$$

$$interaction_{ratio_i} := \text{if}\left[\left(\frac{N_{ua}}{\varphi_N \cdot \frac{N_n}{2}} + \frac{V_i}{\varphi_V \cdot \frac{V_n}{2}}\right) < 1.2, \text{"OK"}, \text{"anchor bolt failure"}\right]$$

$$interaction_{ratio_i} = \begin{pmatrix} \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \\ \text{"OK"} \end{pmatrix}$$

All load combinations pass code check. Design is adequate.

Design Summary

Anchor Bolts

Number of anchor bolts: $no = 4$

Bolt Diameter: $d_b = \frac{7}{8} \cdot in$

Bolt Embed Depth: $L_{bolt} = 15 \cdot in$

Spacing of anchor bolts: $s_1 = 12 \cdot in$ $s_2 = 12 \cdot in$

Max interaction ratio

$$IR := \max\left(\frac{N_{ua}}{\varphi_N \cdot \frac{N_n}{2}} + \frac{V}{\varphi_V \cdot \frac{V_n}{2}}\right)$$

$IR = 0.53$

Baseplate Thickness: $t_{PL} = 1 \cdot in$ $t_{min} = 0.78 \cdot in$

DCR for AB's

$$\frac{N_{ua}}{\varphi_N \cdot \frac{N_n}{2}} = 0.34$$

$$\left(\frac{V}{\varphi_V \cdot \frac{V_n}{2}}\right)^T = (0.05\ \ 0.05\ \ 0.05\ \ 0.05\ \ 0.12\ \ 0.03\ \ 0.05\ \ 0.12\ \ 0.03\ \ 0.19\ \ 0.1\ \ 0.19\ \ 0.1\ \ 0.05\ \ 0.05\ \ 0.18\ \ 0.11\ \ 0.03\ \ 0.03)$$

Baseplate and Anchor Bolt Design - W8x24 - Duct Support

This calculation contains designs for anchor bolts at the following locations:

All design will be based off of the standard base plate detail for a W8x24 column (Detail 1, 24915-000-SO-00006)

W8x24 column supports for HVAC ducts (Calculation no. 24915-10-SSC-00-00006, App C3).

Column Reactions

Following are the controlling node outputs from the duct supports and Filter structure. Units are kips, kip-ft.

Structure	Joint	Load Case	Fx	Fy	Axial	Mx	My
Duct Supports	46 (From App C3)	DL	0	0	0.542	0.369	0.054
		WLEW	0.07	0.647	0.018	6.935	0.894
		WLNS	0.751	0.042	0.036	0.646	8.508

Duct supports are checked for worst case overturning.
Filter structure is checked for worst case bearing.

W8x24 - Check Duct Support Loads

Applicable Load Combinations:

1.4D
1.2D + 1.6S + 0.8W
1.2D + 1.6W + 0.5S
0.9D + 1.6W* *Worst case loading

Loads

$P := 0.9 \cdot 0.542\text{kip} - 1.6 \cdot 0.036\text{kip}$ $\boxed{P = 0.43 \cdot \text{kip}}$

$V := 0.9 \cdot 0\text{kip} + 1.6 \cdot 0.751\text{kip}$ $\boxed{V = 1.202 \cdot \text{kip}}$

$M := 0.9 \cdot 0.054\text{kip} \cdot \text{ft} + 1.6 \cdot 8.508\text{kip} \cdot \text{ft}$ $\boxed{M = 13.66 \cdot \text{kip} \cdot \text{ft}}$

Eccentricity: $e := \frac{M}{P}$ $e = 381.07 \cdot \text{in}$

Check Duct Supports

Base Plate Properties

Plate Thickness: $t := 1.0in$

Plate Dimensions: $N_{plate} := 16in$

Dist. to plate Neutral Axis: $c_{plate} := 0.5 \cdot N_{plate}$ $\quad c_{plate} = 8 \cdot in$

Column Depth: $d := 7.875in$

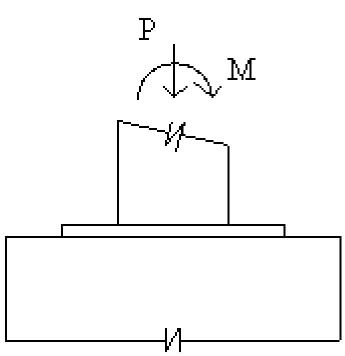
Dist. column edge to plate edge: $n := \frac{N_{plate}}{2} - \frac{0.95 \cdot d}{2}$ $\quad n = 4.26 \cdot in$

Section Properties:: $A := N_{plate}^2$ $\quad A = 256 \cdot in^2$ $\quad Z_y := \frac{t^2 \cdot 1in}{6}$ $\quad Z_y = 0.167 \cdot in^3$

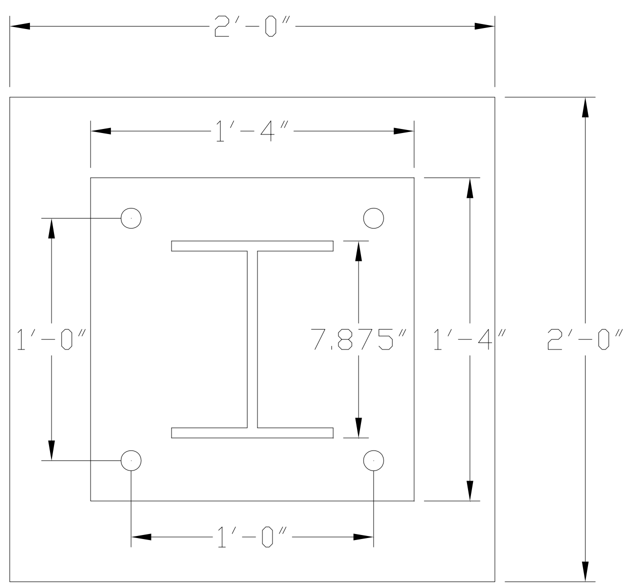
$I := \frac{1}{12} \cdot (N_{plate})^4$ $\quad I = 5461 \cdot in^4$

Pedestal Properties

$A_2 := 2ft \cdot 2ft$ $\quad A_2 = 576 \cdot in^2$



Elevation



Plan

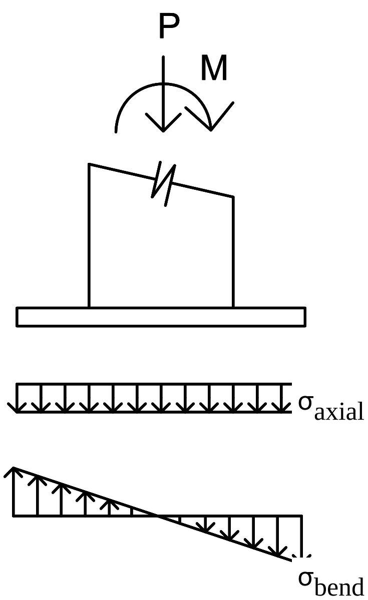
BECHTEL PARSONS BLUE GRASS

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No.: 24915- 10-DBC-00-00004
Sheet No.: G-42 / G-83
Sheet Rev.: D

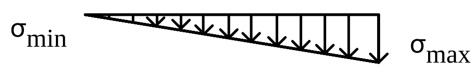
Subject: Gas Bottle Canopy, Supports, Equip, & Misc. Foundations
By: R. Murphy
Date: 2/25/2008

Design Forces

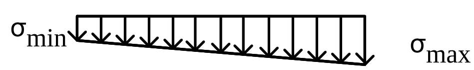


Stress Resultants

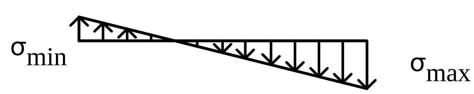
if σ_axial = σ_bending



if σ_axial > σ_bending



if σ_axial < σ_bending



Stress Calculations

$\sigma_{axial} := \dfrac{P}{A}$ $\qquad \sigma_{axial} = 1.6805 \times 10^{-3} \cdot ksi$

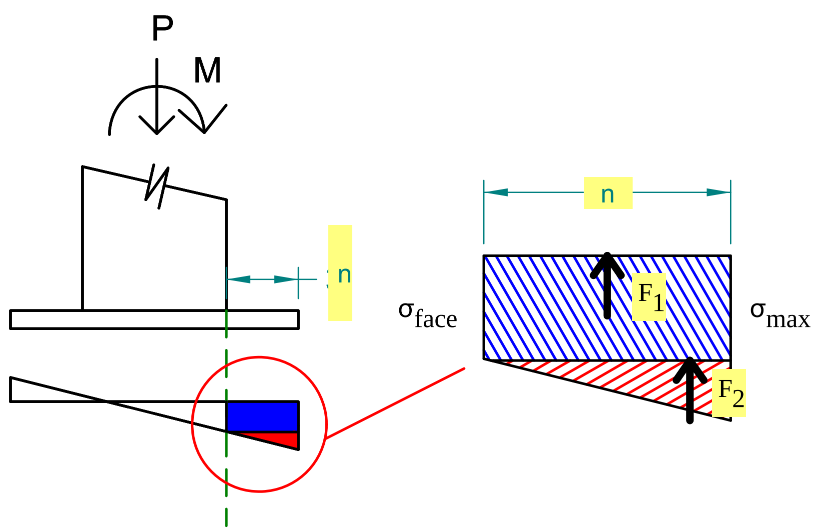
$\sigma_{bend} := |M| \cdot \dfrac{c_{plate}}{I}$ $\qquad \sigma_{bend} = 0.2401 \cdot ksi$

Total Stress

$\sigma_{max} := \sigma_{axial} + \sigma_{bend}$ $\qquad \sigma_{max} = 0.2418 \cdot ksi$

$\sigma_{min} := \sigma_{axial} - \sigma_{bend}$ $\qquad \sigma_{min} = -0.2385 \cdot ksi$

Calculating Force Resultants



$$stress\_slope := \frac{\sigma_{max} - \sigma_{min}}{N_{plate}} \qquad stress\_slope = 0.03 \cdot \frac{kip}{in^3}$$

$$\sigma_{face} := \sigma_{max} - stress\_slope \cdot (n) \qquad \sigma_{face} = 0.114 \cdot ksi$$

Rectangular Stress Block Resultants

$$F_{rect} := \sigma_{face} \cdot n \cdot 1in \qquad F_{rect} = 0.4854 \cdot kip$$

$$M_{rect} := F_{rect} \cdot \frac{n}{2} \qquad M_{rect} = 1.0338 \cdot kip \cdot in$$

Triangular Stress Block Resultants

$$F_{tri} := \frac{(\sigma_{max} - \sigma_{face}) \cdot n \cdot 1in}{2} \qquad F_{tri} = 0.2723 \cdot kip$$

$$M_{tri} := F_{tri} \cdot 2 \cdot \frac{n}{3} \qquad M_{tri} = 0.7732 \cdot kip \cdot in$$

Total Moment Per Unit Width

$$M_{design} := M_{rect} + M_{tri}$$

$$\boxed{M_{design} = 1.807 \cdot kip \cdot in}$$

Base Plate Design [AISC-LRFD 2nd ED J9]

1. Concrete Bearing Stress [AISC LRFD-2nd ED J9]

$f_c := 4\text{ksi}$

$\Phi_c := .6$

$$A_{ratio} := \text{if}\left[\left(\frac{A_2}{A}\right)^{\frac{1}{2}} < 2, \left(\frac{A_2}{A}\right)^{\frac{1}{2}}, 2\right]$$

$A_{ratio} = 1.5$

$F_p := \Phi_c \cdot 0.85 \cdot f_c \cdot A_{ratio}$ [AISC LRFD-2nd ED J9]

$F_p = 3.06 \cdot \text{ksi}$

$\text{pedestal\_design} := \text{if}\left(\sigma_{max} < F_p, G_{pedestal}, NG_{pedestal}\right)$

pedestal_design = "Pedestal design is good"

2. Plate Thickness [AISC LRFD-2nd ED]

$\Phi_{flex} := .90 \quad F_y := 36\text{ksi}$

$$t_p := \sqrt{4 \cdot \frac{M_{design} \cdot 1}{\Phi_{flex} \cdot F_y \cdot 1\text{in}}} \qquad t_p = 0.4723 \cdot \text{in}$$ [AISC LRFD-2nd ED 14-6]

Plate Bending Strength per unit width

$M_{strength} := \Phi_{flex} \cdot F_y \cdot Z_y \qquad M_{strength} = 5.4 \cdot \text{kip} \cdot \text{in}$

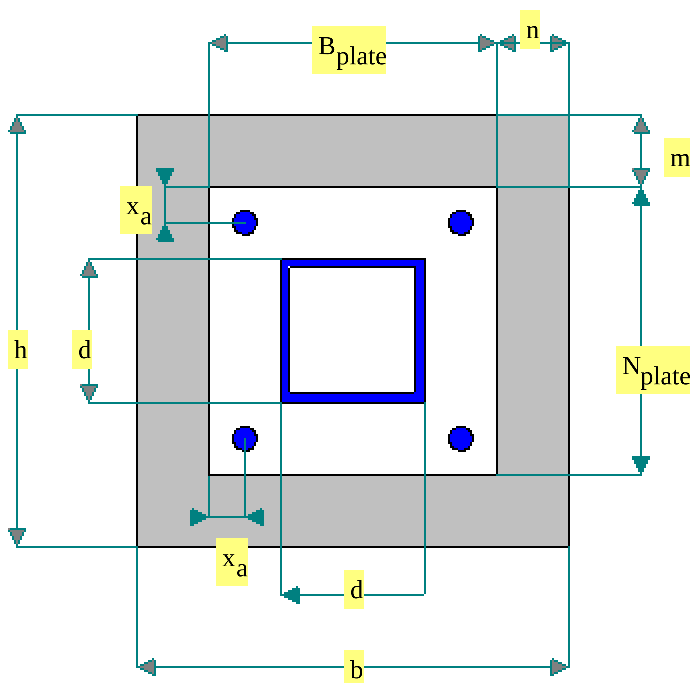
Design Check

$\text{base\_plate\_design} := \text{if}\left(t > t_p, G_d, NG\right)$

base_plate_design = "Base Plate Design is Good"

Anchor Bolt Design

References:
-AISC LRFD 2nd ed. Steel Design Guide:Base Plate and Anchor Rod Design
-ACI 318-02



$N_{plate} = 16 \cdot in$

$x_a := 2in$

$N' := N_{plate} - x_a$

$N' = 14 \cdot in$

$B := N_{plate}$

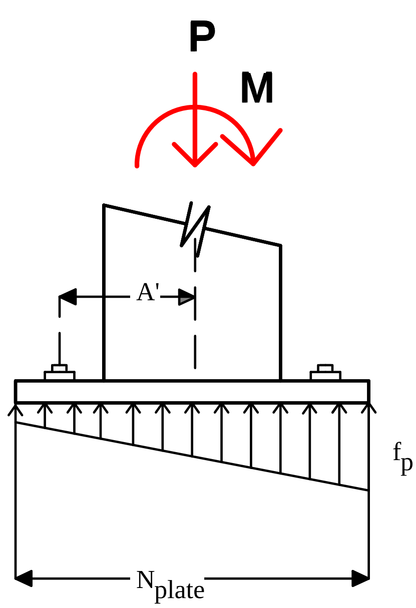
$B = 16 \cdot in$

$f_p := \sigma_{max}$

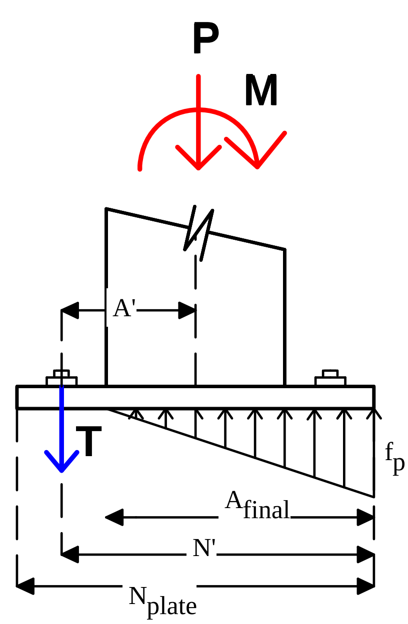
$e = 381.071 \cdot in$

Tension in Anchor Bolt due to Moment [AISC Design Guide Appendix B]

if e<e_kern



if e>e_kern



Determining effects of eccentricity [AISC LRFD B.3]

$$e_{kern} := \frac{N_{plate}}{6} \qquad \boxed{e_{kern} = 2.67 \cdot in}$$ [AISC B.3]

$$\text{anchor\_tension} := \text{if}\left(e > e_{kern}, BT, NBT\right)$$

$$\text{anchor\_tension} = \text{"Anchor bolts in tension"}$$

Determining Tension in Anchor Bolt [AISC B.4.2]

$P = 430\,lbf$

$f_p = 0 \cdot ksi$

$B = 1\,ft$

Determining Length of Stress Triangle

$$f' := f_p \cdot N_{plate} \cdot \frac{N'}{2} \qquad \boxed{f' = 27.0841 \cdot kip}$$

$$A_{plus} := \frac{f' + \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}} \qquad \boxed{A_{plus} = 34.556 \cdot in}$$

$$A_{minus} := \frac{f' - \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}} \qquad \boxed{A_{minus} = 7.444 \cdot in}$$

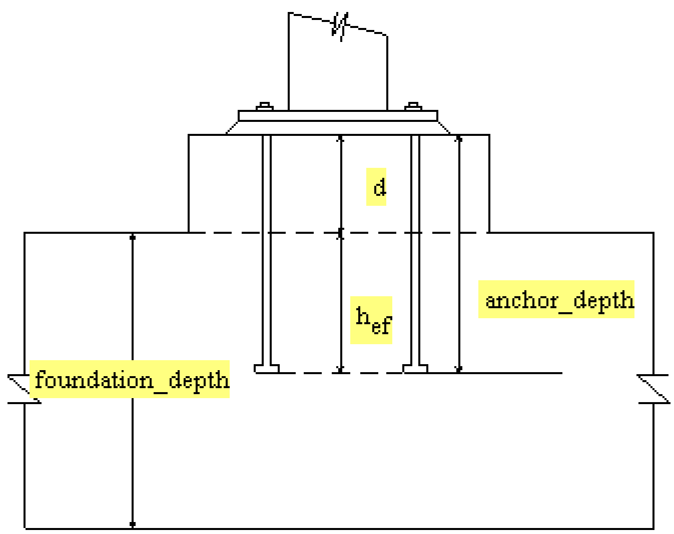
$$A_{final} := \left| \begin{array}{l} \min\left(A_{plus}, A_{minus}\right) \ \text{ if } \ A_{plus} > 0 \wedge A_{minus} > 0 \\ A_{plus} \ \text{ if } \ A_{plus} > 0 \wedge A_{minus} < 0 \\ 0 \ \text{ if } \ A_{plus} < 0 \wedge A_{minus} < 0 \end{array} \right. \qquad \boxed{A_{final} = 7.444 \cdot in}$$

Determining Anchor Tension from Equilibrium

$$T_{anchors} := \frac{f_p \cdot A_{final} \cdot B}{2} - P \qquad \boxed{T_{anchors} = 13.97 \cdot kip}$$

$$T_{one\_anchor} := \frac{T_{anchors}}{2} \qquad \boxed{T_{one\_anchor} = 6.985 \cdot kip}$$

Pedestal and Foundation Cross Section



d := VARIES

$h_{ef} := 10\text{in}$ (minimum)

To simplify the calculation, the effective embedment depth of the anchor bolt is taken as the length of the bolt that extends beneath the column pedestal. This results in a conservative estimate of the strength of concrete breakout and pryout.

Steel Strength of anchor in tension [ACI 318.05 D.5.1]

NOTE: ACI 318-05 Appendix D was adopted in lieu of ACI 318-02 in order to include the updated ductility requirements.

$f_{ya} := 36\text{ksi}$ $n_{anch} := 4$

$f_{uta} := \min(1.9 \cdot f_{ya}, 125\text{ksi}, 58\text{ksi})$

$f_{uta} = 58000\,\text{psi}$

Anchor Bolt Diameter: $d_o := 0.75\text{in}$

Net tensile area $A_{se} := 0.334\text{in}^2$ [Ref. 4.17]

$N_{sa} := n_{anch} \cdot A_{se} \cdot f_{uta}$ [ACI 318.05 Eq D-3]

$\boxed{N_{sa} = 77.488 \cdot \text{kip}}$ one anchor

Concrete breakout strength-Tension [ACI 318.05 D.5.2]

Concrete breakout strength based on a grouping of two anchors, since tension due to moment is the only tension present.

$c_{a1} := 15in$ $s_1 := 12in$

$c_{a2} := 15in$ $s_2 := 12in$

$c_{a11} := 15in$ $f_c = 4000\,psi$

$c_{a22} := 15in$

Bolts are not located near any edges of concrete.
Use 15" because it is 1.5*hef

$c_{amin} := \min(c_{a1}, c_{a11}, c_{a2}, c_{a22})$

$n_{anch\_ten} := 2$

Breakout Prism Properties

$h'_{ef} := h_{ef}$

$A_{NCO} := 9 \cdot h'^{\,2}_{ef}$

$A_{NCO} = 900 \cdot in^2$

$A_{NC} := (1.5 \cdot h'_{ef} + s_1 + 1.5 \cdot h'_{ef}) \cdot (1.5 \cdot h'_{ef} + s_2 + 1.5 \cdot h'_{ef})$

$A_{NC} = 1764 \cdot in^2$

$A_{NC} := \min(A_{NC}, n_{anch\_ten} \cdot A_{NCO})$

$A_{NC} = 1764 \cdot in^2$

anchor_status := "cast in"

$k_c :=$ if (anchor_status = "cast in" , 24, 17)

$k_c = 24$

$$N_b := \begin{cases} 16 \cdot psi^{.5} \cdot in^{\frac{1}{3}} \cdot \sqrt{f_c} \cdot h'^{\,\frac{5}{3}}_{ef} & \text{if } 11in \le h'_{ef} \le 25in \\ k_c \cdot \sqrt{f_c} \cdot h'^{\,1.5}_{ef} \cdot psi^{.5} \cdot in^{.5} & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-7]

[ACI 318-05 EQ D-8]

$N_b = 48000\,lbf$

$e'_N := 6in$

Assumption that only one row of anchors on one side of the column center line carry tension load. Eccentricity is therefore distance from this row of anchors to the column center line

$$\Psi_{ecN} := \min\left(\frac{1}{1+\frac{2\cdot e'_N}{3\cdot h'_{ef}}}, 1.0\right)$$ [ACI 318-05 EQ D-9]

$\Psi_{ecN} = 1$

$$\Psi_{edN} := \begin{cases} 1 \text{ if } c_{amin} \geq 1.5\cdot h'_{ef} \\ 0.7+0.3\cdot\dfrac{c_{amin}}{1.5(h'_{ef})} \text{ if } c_{amin} < 1.5\cdot h'_{ef} \end{cases}$$

[ACI 318-05 EQ D-10]
[ACI 318-05 EQ D-11]

$\Psi_{edN} = 1$

$$\Psi_{cN} := \begin{cases} 1.25 \text{ if anchor\_status = "cast in"} \\ 1.4 \text{ otherwise} \end{cases}$$ [ACI 318-05 EQ D.5.2.6

$\Psi_{cN} = 1$

$\Psi_{cpN} := 1$ [ACI 318-05 D5.2.7]

$$N_{cbg} := \frac{A_{NC}}{A_{NCO}}\cdot\Psi_{ecN}\cdot\Psi_{edN}\cdot\Psi_{cN}\cdot\Psi_{cpN}\cdot N_b$$ [ACI 318-05 EQ D-5]

$N_{cbg} = 84\cdot kip$ Group of two anchors

Pullout Strength of Anchor in Tension [ACI 318-05 D.5.3]

$A_{brg} := 0.654in^2$ crack_status := "not cracked" hook_status := "not hooked"

$N_p := 8\cdot A_{brg}\cdot f_c$ [ACI 318-02 EQ D-15]

$\Psi_{cP} :=$ if [(crack_status = "cracked"), 1.4, 1.0] [ACI 318-05 D.5.3.6]

$N_{pn} := \Psi_{cP}\cdot N_p$ [ACI 318-02 EQ D-14]

$N_{pn} = 20.928\cdot kip$ One Anchor

Concrete side-face blowout strength-Tension [ACI 318.05 D.5.4]

$c_{a1} = 15 \cdot in$

$N_{sb} := 160 \frac{lbf}{in} \cdot c_{a1} \cdot \sqrt{\frac{A_{brg}}{in^2}} \cdot \sqrt{\frac{f_c}{psi}}$ [ACI 318-05 EQ D-17] $A_{brg} = 0.654 \cdot in^2$

$N_{sb} = 122.752 \cdot kip$ one anchor

Tension Design Check

$N_{sa} = 77488\ lbf$ one anchor $N_{pn} = 20928\ lbf$ one anchor

$N_{cbg} = 84000\ lbf$ two anchors $N_{sb} = 122752\ lbf$ one anchor

$\Phi_{tension} := 0.85$ Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength. Condition A is met [ACI 318-05 D.4.4]

$N_{design} := \Phi_{tension} \cdot \min\left(N_{sa}, \frac{N_{cbg}}{2}, N_{pn}, N_{sb}\right)$ [ACI 318-05 D.4.1.1]

$N_{design} = 17.789 \cdot kip$

$T_{one\_anchor} = 6.985 \cdot kip$

$tension\_design := if\left(T_{one\_anchor} \le N_{design}, \text{"Good"}, \text{"Not Good"}\right)$ [ACI 318-05 EQ D-1]

$tension\_design = \text{"Good"}$

Steel Strength of Anchor in Shear [ACI 318-05 D.6.1]

Anchor Types:

AT1 [ACI 318-05 D.6.1.a]

AT2 [ACI 318-05 D.6.1.b]

AT3 [ACI 318-05 D.6.1.c]

Anchor Type Used:

$AT := \text{"AT1"}$

Grout Pad Factor [ACI 318-05 D.6.1.3]:

$\text{grout\_pad\_used} := \text{"yes"}$

$$c_{pad} := \begin{cases} 0.8 & \text{if grout\_pad\_used} = \text{"yes"} \\ 1.0 & \text{otherwise} \end{cases}$$

$c_{pad} = 1$

Shear Strength:

$$V_{sa} := \begin{cases} c_{pad} \cdot n_{anch} \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT1"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT2"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT3"} \end{cases}$$

[ACI 318-05 EQ D-19]
[ACI 318-05 EQ D-20]
[ACI 318-05 EQ D-20]

$\boxed{V_{sa} = 61.99 \cdot kip}$ one anchor

Concrete Breakout Strength-Shear [ACI 318-05 D.6.2]

group_status := "group"

Projected Concrete Failure Area [ACI 318-05 D.6.2.1, RD.6.2.1]

$c_{a1} = 1\ \text{ft}$ Assuming that total shear is critical on one anchor row

$h_a := 6.\text{in}$ Thicknessof pedestal

$s_1 = 1\ \text{ft}$ Anchor Bolt Spacing

$$c := \begin{cases} 1.5\cdot c_{a1} & \text{if } 1.5\cdot c_{a1} < c_{a2} \\ c_{a2} & \end{cases} \qquad c = 1\ \text{ft}$$

$$A_{vc} := \begin{cases} \left[2\cdot(c) + s_1\right]\cdot h_a & \text{if } 1.5c_{a1} > h_a \\ 2\cdot\left[(c) + s_1\right]\cdot 1.5\cdot c_{a1} & \text{otherwise} \end{cases}$$

[ACI 318-05 Fig RD.6.2.1(b)]
Failure area for group of anchors

$A_{vc} = 2\ \text{ft}^2$

$A_{vco} := 4.5\cdot {c_{a1}}^2$

$A_{vco} = 7\ \text{ft}^2$ [ACI 318-05 EQ D-23]

$A_{vc} := \min\left(A_{vc}, n_{anch}\cdot A_{vco}\right)$

$A_{vc} = 2\ \text{ft}^2$

Basic Concrete Breakout Strength [ACI 318-05 D.6.2.2]

$l_e := h_{ef}$ anchor load bearing legngth

$$V_b := 7\cdot\left(\frac{l_e}{d_o}\right)^{0.2}\cdot\sqrt{d_o}\cdot\sqrt{f_c}\cdot {c_{a1}}^{1.5}\cdot \text{psi}^{.5}$$ [ACI 318-05 EQ D.24]

$V_b = 37392\ \text{lbf}$

$e'_v := 0\text{in}$ Assumption that shear is distributed equal to all anchors and no shear eccentricity results

$$\Psi_{ecV} := \min\left(1, \frac{1}{1 + 2\cdot\frac{e'_v}{3\cdot c_{a1}}}\right)$$

$\Psi_{ecV} = 1$

$c_{a2} = 1\,\text{ft}$

$$\Psi_{edV} := \begin{cases} 1.0 & \text{if } c_{a2} \geq 1.5\cdot c_{a1} \\ 0.7 + 0.3\cdot\frac{c_{a2}}{1.5\cdot c_{a1}} & \text{if } c_{a2} < 1.5\cdot c_{a1} \end{cases}$$

[ACI 318-05 EQ D-27]

[ACI 318-05 EQ D-28]

$\Psi_{edV} = 1$

crack_status = "not cracked"

$$\Psi_{cV} := \begin{cases} 1.4 & \text{if crack\_status} = \text{"not cracked"} \\ 1.0 & \text{if crack\_status} = \text{"cracked no reinforce"} \\ 1.2 & \text{if crack\_status} = \text{"cracked with reinforce"} \\ 1.4 & \text{if crack\_status} = \text{"cracked with reinforce and stirrups"} \end{cases}$$

$\Psi_{cV} = 1$

$$V_{cb} := \begin{cases} \frac{A_{vc}}{A_{vco}}\cdot\Psi_{edV}\cdot\Psi_{cV}\cdot V_b & \text{if group\_status} = \text{"single anchor"} \\ 0 & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-21]

$$V_{cbg} := \begin{cases} \frac{A_{vc}}{A_{vco}}\cdot\Psi_{ecV}\cdot\Psi_{edV}\cdot\Psi_{cV}\cdot V_b & \text{if group\_status} = \text{"group"} \\ 0 & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-22]

$V_{cb} = 0\,\text{lbf}$

$\boxed{V_{cbg} = 12\cdot\text{kip}}$ group of 2 anchors

Concrete pryout strength of anchor in shear [ACI 318-05 D.6.3]

$h_{ef} = 1\ \text{ft}$

$$k_{cp} := \begin{cases} 1.0 & \text{if } h_{ef} < 2.5\text{in} \\ 2.0 & \text{if } h_{ef} \geq 2.5\text{in} \end{cases}$$

$$V_{cp} := \begin{cases} k_{cp} \cdot N_{cb} & \text{if group\_status} = \text{"single anchor"} \\ 0 & \text{otherwise} \end{cases}$$ [ACI 318-05 EQ D-29]

$$V_{cpg} := \begin{cases} k_{cp} \cdot N_{cbg} & \text{if group\_status} = \text{"group"} \\ 0 & \text{otherwise} \end{cases}$$ [ACI 318-05 EQ D-30]

$V_{cpg} = 168 \cdot \text{kip}$ group of 2 anchors

Shear Design Check

$V_{sa} = 61990\ \text{lbf}$ one anchor

$V_{cbg} = 11726\ \text{lbf}$ group of 2 anchors

$V_{cpg} = 168000\ \text{lbf}$ group of 2 anchors

$\Phi_{shear} := 0.85$ Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength [ACI 318-05 D.4.4]

$V_{design} := \Phi_{shear} \cdot \min(V_{sa} \cdot 4, V_{cbg}, V_{cpg})$ [ACI 318-05 D.4.1.1]

$V_{design} = 9.967 \cdot \text{kip}$

design_shear := if($V \leq V_{design}$, "Design is OK" , "Design is insufficient")

design_shear = "Design is OK" [ACI 318-05 EQ D-2]

Interaction of tensile and shear forces [ACI 318-05 D.7]

$$\frac{V}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} = 0.513$$

$$ST_{check} := \text{if}\left(\frac{V}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} \le 1.2, \text{"Interaction OK"}, \text{"Interactoin Failure"}\right)$$

$$interaction\_check\_V := \text{if}\left[\left(V > 0.2 \cdot V_{design} \wedge T_{one\_anchor} > N_{design}\right), ST_{check}, \text{"No check needed"}\right]$$

$$interaction\_check\_V = \text{"No check needed"}$$

Baseplate and Anchor Bolt Design - W14x43

This calculation contains designs for anchor bolts at the following locations:

All design will be based off of the standard base plate detail for a W14x43 column (Detail 1, 24915-000-SO-00006)

W14x43 column support for HVAC ducts (Calculation no. 24915-10-SSC-00-00006, App C4).

Column Reactions

Following is the controlling node output from the duct support in App. C4.
Units are kips, kip-ft.

Structure	Joint	Load Case	Fx	Fy	Axial	Mx	My
Duct Support	15 (From App C4)	DL	0.038	0.001	2.314	0.024	0.207
		SNOW	0.033	0.001	1.153	0.02	0.177
		WLEW	0.104	2.692	0.007	53.474	2.19
		WLNS	1.018	0.015	0.033	0.326	7.113

By inspection, the worst case loading is wind overturning.

Applicable Load Combinations:

1.4D
1.2D + 1.6S + 0.8W
1.2D + 1.6W + 0.5S
0.9D + 1.6W* *Worst case loading

Loads

$P := 0.9 \cdot 2.314\text{kip} - 1.6 \cdot 0.007\text{kip}$ $\boxed{P = 2.071 \cdot \text{kip}}$

$V := 0.9 \cdot 0.038\text{kip} + 1.6 \cdot 2.692\text{kip}$ $\boxed{V = 4.341 \cdot \text{kip}}$

$M := 0.9 \cdot 0.024\text{kip} \cdot \text{ft} + 1.6 \cdot 53.474\text{kip} \cdot \text{ft}$ $\boxed{M = 85.58 \cdot \text{kip} \cdot \text{ft}}$

Eccentricity: $e := \frac{M}{P}$ $e = 495.78 \cdot \text{in}$

Base Plate Properties

Plate Thickness: $t := 1.5in$

Plate Dimensions: $N_{plate} := 26in$

Dist. to plate Neutral Axis: $c_{plate} := 0.5 \cdot N_{plate}$ $\quad c_{plate} = 13 \cdot in$

Column Depth: $d := 13.625in$

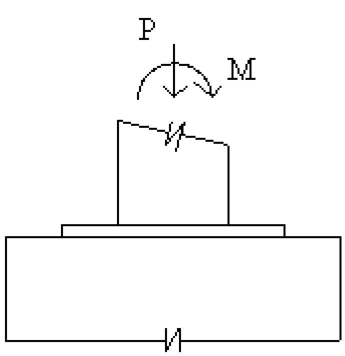
Dist. column edge to plate edge: $n := \frac{N_{plate}}{2} - \frac{0.95 \cdot d}{2}$ $\quad n = 6.53 \cdot in$

Section Properties:: $A := N_{plate}^{\ 2}$ $\quad A = 676 \cdot in^2$ $\quad Z_y := \frac{t^2 \cdot 1in}{6}$ $\quad Z_y = 0.375 \cdot in^3$

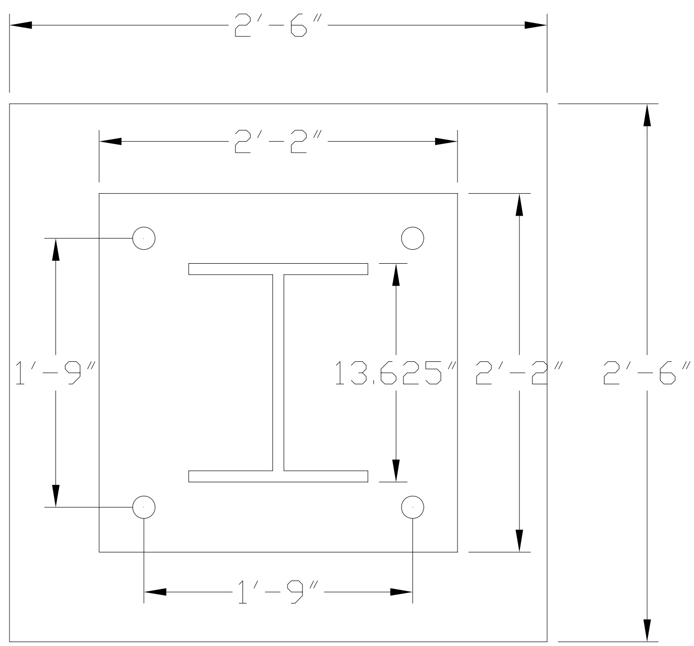
$I := \frac{1}{12} \cdot \left(N_{plate}\right)^4$ $\quad I = 38081 \cdot in^4$

Pedestal Properties

$A_2 := 2.5ft \cdot 2.5ft$ $\quad A_2 = 900 \cdot in^2$

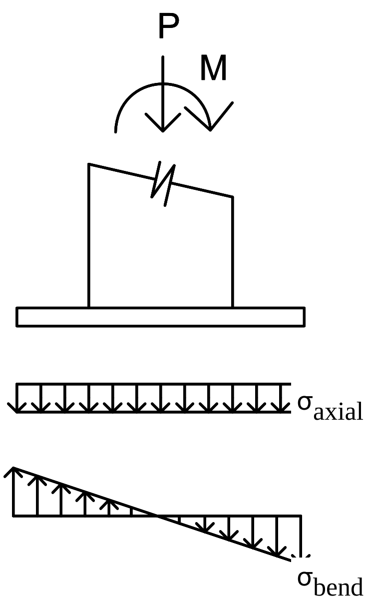


Elevation



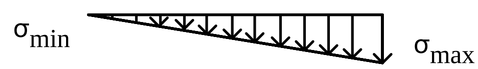
Plan

Design Forces

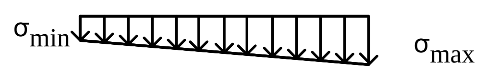


Stress Resultants

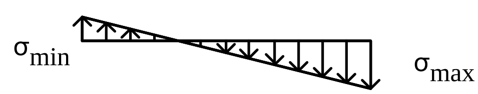
if σ_axial = σ_bending



if σ_axial > σ_bending



if σ_axial < σ_bending



Stress Calculations

$\sigma_{axial} := \frac{P}{A}$ $\qquad$ $\sigma_{axial} = 3.0642 \times 10^{-3} \cdot \text{ksi}$

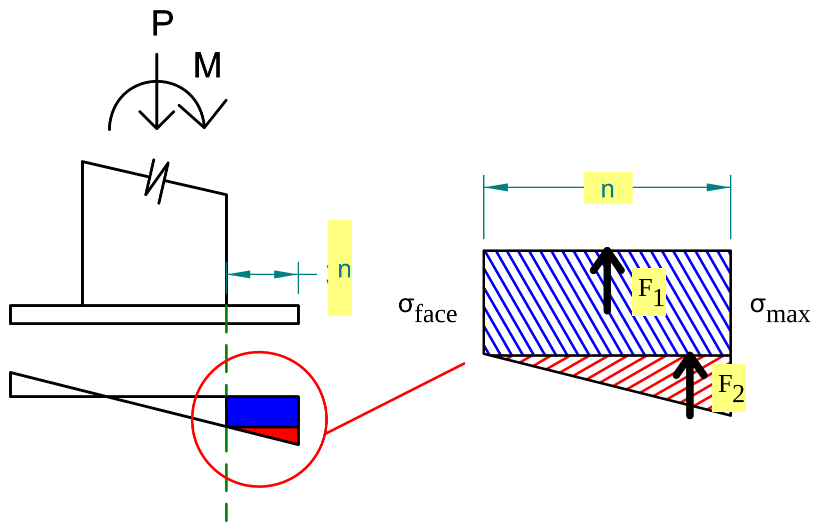
$\sigma_{bend} := |M| \cdot \frac{c_{plate}}{I}$ $\qquad$ $\sigma_{bend} = 0.3506 \cdot \text{ksi}$

Total Stress

$\sigma_{max} := \sigma_{axial} + \sigma_{bend}$ $\qquad$ $\sigma_{max} = 0.3536 \cdot \text{ksi}$

$\sigma_{min} := \sigma_{axial} - \sigma_{bend}$ $\qquad$ $\sigma_{min} = -0.3475 \cdot \text{ksi}$

Calculating Force Resultants



$$stress\_slope := \frac{\sigma_{max} - \sigma_{min}}{N_{plate}} \qquad stress\_slope = 0.027 \cdot \frac{kip}{in^3}$$

$$\sigma_{face} := \sigma_{max} - stress\_slope \cdot (n) \qquad \sigma_{face} = 0.1776 \cdot ksi$$

Rectangular Stress Block Resultants

$$F_{rect} := \sigma_{face} \cdot n \cdot 1in \qquad F_{rect} = 1.1594 \cdot kip$$

$$M_{rect} := F_{rect} \cdot \frac{n}{2} \qquad M_{rect} = 3.7842 \cdot kip \cdot in$$

Triangular Stress Block Resultants

$$F_{tri} := \frac{(\sigma_{max} - \sigma_{face}) \cdot n \cdot 1in}{2} \qquad F_{tri} = 0.5746 \cdot kip$$

$$M_{tri} := F_{tri} \cdot 2 \cdot \frac{n}{3} \qquad M_{tri} = 2.5008 \cdot kip \cdot in$$

Total Moment Per Unit Width

$$M_{design} := M_{rect} + M_{tri}$$

$$\boxed{M_{design} = 6.2851 \cdot kip \cdot in}$$

Base Plate Design [AISC-LRFD 2nd ED J9]

1. Concrete Bearing Stress [AISC LRFD-2nd ED J9]

$f_c := 4\text{ksi}$

$\Phi_c := .6$

$$A_{ratio} := \text{if}\left[\left(\frac{A_2}{A}\right)^{\frac{1}{2}} < 2, \left(\frac{A_2}{A}\right)^{\frac{1}{2}}, 2\right]$$

$A_{ratio} = 1.2$

$F_p := \Phi_c \cdot 0.85 \cdot f_c \cdot A_{ratio}$ [AISC LRFD-2nd ED J9]

$F_p = 2.35 \cdot \text{ksi}$

$\text{pedestal\_design} := \text{if}\left(\sigma_{max} < F_p, G_{pedestal}, NG_{pedestal}\right)$

pedestal_design = "Pedestal design is good"

2. Plate Thickness [AISC LRFD-2nd ED]

$\Phi_{flex} := .90 \quad F_y := 36\text{ksi}$

$$t_p := \sqrt{4 \cdot \frac{M_{design} \cdot 1}{\Phi_{flex} \cdot F_y \cdot 1\text{in}}} \qquad t_p = 0.8809 \cdot \text{in}$$ [AISC LRFD-2nd ED 14-6]

Plate Bending Strength per unit width

$M_{strength} := \Phi_{flex} \cdot F_y \cdot Z_y \qquad M_{strength} = 12.15 \cdot \text{kip} \cdot \text{in}$

Design Check

$\text{base\_plate\_design} := \text{if}\left(t > t_p, G_d, NG\right)$

base_plate_design = "Base Plate Design is Good"

BECHTEL PARSONS BLUE GRASS

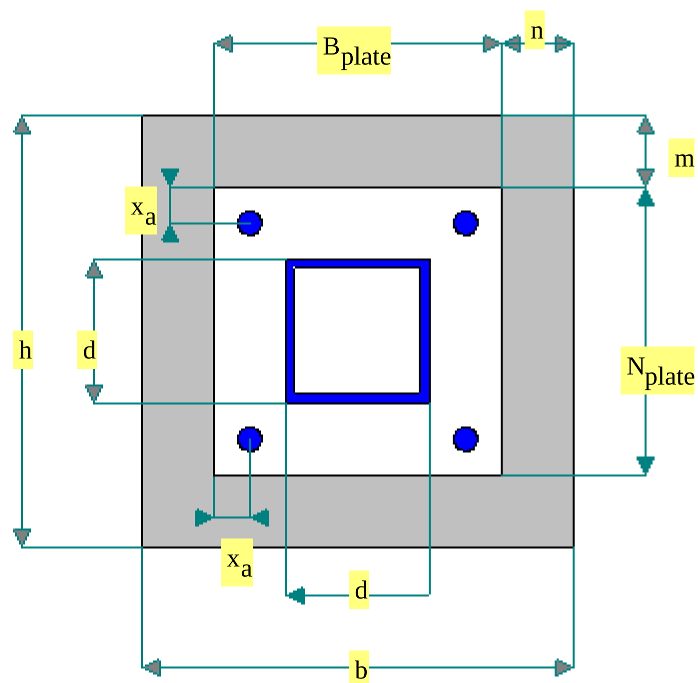
Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No.: 24915-10-DBC-00-00004
Sheet No.: G-61 / G-83
Sheet Rev.: D

Subject: Gas Bottle Canopy, Supports, Equip, & Misc. Foundations
By: M. Bratt
Date: 10/5/2009

Anchor Bolt Design

References:
-AISC LRFD 2nd ed. Steel Design Guide:Base Plate and Anchor Rod Design
-ACI 318-02



$N_{plate} = 26 \cdot in$

$x_a := 2in$

$N' := N_{plate} - x_a$

$N' = 24 \cdot in$

$B := N_{plate}$

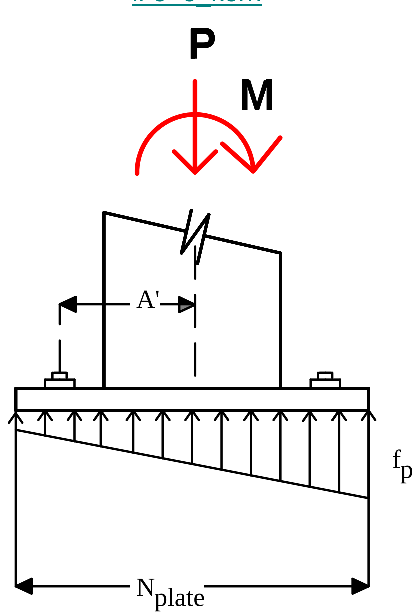
$B = 26 \cdot in$

$f_p := \sigma_{max}$

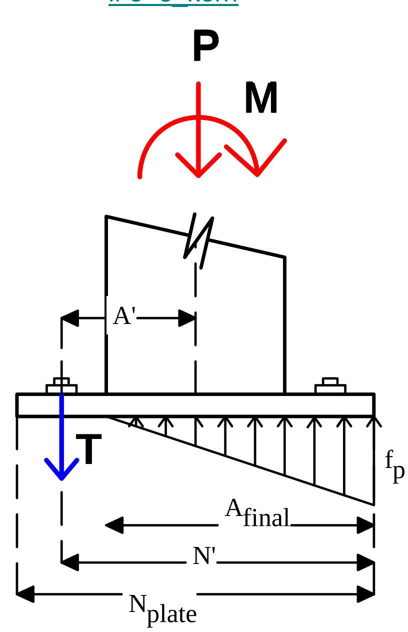
$e = 495.781 \cdot in$

Tension in Anchor Bolt due to Moment [AISC Design Guide Appendix B]

if e<e_kern



if e>e_kern



Determining effects of eccentricity [AISC LRFD B.3]

$$e_{kern} := \frac{N_{plate}}{6} \qquad e_{kern} = 4.33 \cdot in$$

[AISC B.3]

$$anchor\_tension := if\left(e > e_{kern}, BT, NBT\right)$$

anchor_tension = "Anchor bolts in tension"

Determining Tension in Anchor Bolt [AISC B.4.2]

$$P = 2071\,lbf$$

$$f_p = 0 \cdot ksi$$

$$B = 2\,ft$$

Determining Length of Stress Triangle

$$f' := f_p \cdot N_{plate} \cdot \frac{N'}{2} \qquad f' = 110.3364 \cdot kip$$

$$A_{plus} := \frac{f' + \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}} \qquad A_{plus} = 60.895 \cdot in$$

$$A_{minus} := \frac{f' - \sqrt{f'^2 - 4 \cdot \left(f_p \cdot \frac{B}{6}\right) \cdot (P \cdot A' + M)}}{f_p \cdot \frac{B}{3}} \qquad A_{minus} = 11.105 \cdot in$$

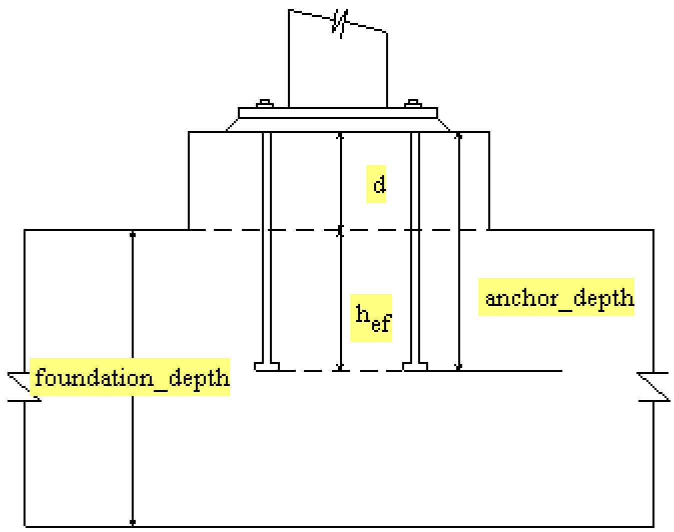
$$A_{final} := \begin{cases} \min\left(A_{plus}, A_{minus}\right) & \text{if } A_{plus} > 0 \wedge A_{minus} > 0 \\ A_{plus} & \text{if } A_{plus} > 0 \wedge A_{minus} < 0 \\ 0 & \text{if } A_{plus} < 0 \wedge A_{minus} < 0 \end{cases} \qquad A_{final} = 11.105 \cdot in$$

Determining Anchor Tension from Equilibrium

$$T_{anchors} := \frac{f_p \cdot A_{final} \cdot B}{2} - P \qquad T_{anchors} = 48.9809 \cdot kip$$

$$T_{one\_anchor} := \frac{T_{anchors}}{2} \qquad T_{one\_anchor} = 24.4905 \cdot kip$$

Pedestal and Foundation Cross Section



$d :=$ VARIES

$h_{ef} := 10in$ (minimum)

To simplify the calculation, the effective embedment depth of the anchor bolt is taken as the length of the bolt that extends beneath the column pedestal. This results in a conservative estimate of the strength of concrete breakout and pryout.

Steel Strength of anchor in tension [ACI 318.05 D.5.1]

NOTE: ACI 318-05 Appendix D was adopted in lieu of ACI 318-02 in order to include the updated ductility requirements.

$f_{ya} := 36ksi$ $\quad n_{anch} := 6$

$f_{uta} := \min(1.9 \cdot f_{ya}, 125ksi, 58ksi)$

$f_{uta} = 58000\,psi$

Anchor Bolt Diameter: $d_o := 1.375in$

Net tensile area $A_{se} := 1.160in^2$ [Ref. 4.17]

$N_{sa} := n_{anch} \cdot A_{se} \cdot f_{uta}$ [ACI 318.05 Eq D-3]

$\boxed{N_{sa} = 403.68 \cdot kip}$ one anchor

Concrete breakout strength-Tension [ACI 318.05 D.5.2]

Concrete breakout strength based on a grouping of two anchors, since tension due to moment is the only tension present.

$c_{a1} := 15in$ $\quad s_1 := 21in$

$c_{a2} := 15in$ $\quad s_2 := 21in$

$c_{a11} := 15in$ $\quad f_c = 4000\,psi$

$c_{a22} := 15in$

$c_{amin} := \min(c_{a1}, c_{a11}, c_{a2}, c_{a22})$

$n_{anch\_ten} := 2$

Breakout Prism Properties

$h'_{ef} := h_{ef}$

$A_{NCO} := 9 \cdot h'^{2}_{ef}$

$A_{NCO} = \blacksquare \cdot in^2$

$A_{NC} := (1.5 \cdot h'_{ef} + s_1 + 1.5 \cdot h'_{ef}) \cdot (1.5 \cdot h'_{ef} + s_2 + 1.5 \cdot h'_{ef})$

$A_{NC} = 2601 \cdot in^2$

$A_{NC} := \min(A_{NC}, n_{anch\_ten} \cdot A_{NCO})$

$A_{NC} = 1800 \cdot in^2$

anchor_status := "cast in"

$k_c :=$ if (anchor_status = "cast in" , 24, 17)

$k_c = 24$

$$N_b := \begin{cases} 16 \cdot psi^{.5} \cdot in^{\frac{1}{3}} \cdot \sqrt{f_c} \cdot h'^{\frac{5}{3}}_{ef} & \text{if } 11in \le h'_{ef} \le 25in \quad \text{[ACI 318-05 EQ D-7]} \\ k_c \cdot \sqrt{f_c} \cdot h'^{1.5}_{ef} \cdot psi^{.5} \cdot in^{.5} & \text{otherwise} \quad \text{[ACI 318-05 EQ D-8]} \end{cases}$$

$N_b = 48000\,lbf$

$e'_N := 10.5in$

Assumption that only one row of anchors on one side of the column center line carry tension load. Eccentricity is therefore distance from this row of anchors to the column center line

$$\Psi_{ecN} := \min\left(\frac{1}{1 + \frac{2 \cdot e'_N}{3 \cdot h'_{ef}}}, 1.0\right)$$ [ACI 318-05 EQ D-9]

$\Psi_{ecN} = 1$

$$\Psi_{edN} := \begin{cases} 1 & \text{if } c_{amin} \geq 1.5 \cdot h'_{ef} \\ 0.7 + 0.3 \cdot \frac{c_{amin}}{1.5(h'_{ef})} & \text{if } c_{amin} < 1.5 \cdot h'_{ef} \end{cases}$$

[ACI 318-05 EQ D-10]
[ACI 318-05 EQ D-11]

$\Psi_{edN} = 1$

$$\Psi_{cN} := \begin{cases} 1.25 & \text{if anchor\_status} = \text{"cast in"} \\ 1.4 & \text{otherwise} \end{cases}$$ [ACI 318-05 EQ D.5.2.6

$\Psi_{cN} = 1$

$\Psi_{cpN} := 1$ [ACI 318-05 D5.2.7]

$$N_{cbg} := \frac{A_{NC}}{A_{NCO}} \cdot \Psi_{ecN} \cdot \Psi_{edN} \cdot \Psi_{cN} \cdot \Psi_{cpN} \cdot N_b$$ [ACI 318-05 EQ D-5]

$\boxed{N_{cbg} = 70.588 \cdot kip}$ Group of two anchors

Pullout Strength of Anchor in Tension [ACI 318-05 D.5.3]

$A_{brg} := 2.199in^2$ crack_status := "not cracked" hook_status := "not hooked"

$N_p := 8 \cdot A_{brg} \cdot f_c$ [ACI 318-02 EQ D-15]

$\Psi_{cP} := \text{if}[(\text{crack\_status} = \text{"cracked"}), 1.4, 1.0]$ [ACI 318-05 D.5.3.6]

$N_{pn} := \Psi_{cP} \cdot N_p$ [ACI 318-02 EQ D-14]

$\boxed{N_{pn} = 70.368 \cdot kip}$ One Anchor

Concrete side-face blowout strength-Tension [ACI 318.05 D.5.4]

$c_{a1} = 15 \cdot in$

$N_{sb} := 160 \frac{lbf}{in} \cdot c_{a1} \cdot \sqrt{\frac{A_{brg}}{in^2}} \cdot \sqrt{\frac{f_c}{psi}}$ [ACI 318-05 EQ D-17] $A_{brg} = 2.199 \cdot in^2$

$N_{sb} = 225.089 \cdot kip$ one anchor

Tension Design Check

$N_{sa} = 403680\ lbf$ one anchor $N_{pn} = 70368\ lbf$ one anchor

$N_{cbg} = 70588\ lbf$ two anchors $N_{sb} = 225089\ lbf$ one anchor

$\Phi_{tension} := 0.85$ Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength. Condition A is met [ACI 318-05 D.4.4]

$N_{design} := \Phi_{tension} \cdot \min\left(N_{sa}, \frac{N_{cbg}}{2}, N_{pn}, N_{sb}\right)$ [ACI 318-05 D.4.1.1]

$N_{design} = 30 \cdot kip$

$T_{one\_anchor} = 24490\ lbf$

$tension\_design := if\left(T_{one\_anchor} \le N_{design}, "Good", "Not Good"\right)$ [ACI 318-05 EQ D-1]

$tension\_design = "Good"$

Steel Strength of Anchor in Shear [ACI 318-05 D.6.1]

Anchor Types:

AT1 [ACI 318-05 D.6.1.a]

AT2 [ACI 318-05 D.6.1.b]

AT3 [ACI 318-05 D.6.1.c]

Anchor Type Used:

AT := "AT1"

Grout Pad Factor [ACI 318-05 D.6.1.3]:

grout_pad_used := "yes"

$$c_{pad} := \begin{cases} 0.8 & \text{if grout\_pad\_used} = \text{"yes"} \\ 1.0 & \text{otherwise} \end{cases}$$

$c_{pad} = 1$

Shear Strength:

$$V_{sa} := \begin{cases} c_{pad} \cdot n_{anch} \cdot A_{se} \cdot f_{uta} & \text{if AT} = \text{"AT1"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if AT} = \text{"AT2"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if AT} = \text{"AT3"} \end{cases}$$

[ACI 318-05 EQ D-19]
[ACI 318-05 EQ D-20]
[ACI 318-05 EQ D-20]

$V_{sa} = 322.944 \cdot kip$ one anchor

Concrete Breakout Strength-Shear [ACI 318-05 D.6.2]

group_status := "group"

Projected Concrete Failure Area [ACI 318-05 D.6.2.1, RD.6.2.1]

$c_{a1} = 15 \cdot in$ Assuming that total shear is critical on one anchor row

$h_a := 6.in$ Thicknessof pedestal

$s_1 = 2\ ft$ Anchor Bolt Spacing

$$c := \begin{cases} 1.5 \cdot c_{a1} & \text{if } 1.5 \cdot c_{a1} < c_{a2} \\ c_{a2} & \end{cases} \qquad c = 1\ ft$$

$$A_{vc} := \begin{cases} \left[2 \cdot (c) + s_1\right] \cdot h_a & \text{if } 1.5c_{a1} > h_a \\ 2 \cdot \left[(c) + s_1\right] \cdot 1.5 \cdot c_{a1} & \text{otherwise} \end{cases}$$

[ACI 318-05 Fig RD.6.2.1(b)]
Failure area for group of anchors

$$A_{vc} = 2\ ft^2$$

$$A_{vco} := 4.5 \cdot c_{a1}^{\ 2}$$

$$A_{vco} = 7\ ft^2$$ [ACI 318-05 EQ D-23]

$$A_{vc} := \min\left(A_{vc}, n_{anch} \cdot A_{vco}\right)$$

$$A_{vc} = 2\ ft^2$$

Basic Concrete Breakout Strength [ACI 318-05 D.6.2.2]

$l_e := h_{ef}$ anchor load bearing legnth

$$V_b := 7 \cdot \left(\frac{l_e}{d_o}\right)^{0.2} \cdot \sqrt{d_o} \cdot \sqrt{f_c} \cdot c_{a1}^{\ 1.5} \cdot psi^{.5}$$ [ACI 318-05 EQ D.24]

$$V_b = 44849\ lbf$$

$e'_v := 0\text{in}$ Assumption that shear is distributed equal to all anchors and no shear eccentricity results

$$\Psi_{ecV} := \min\left(1, \frac{1}{1 + 2\cdot\frac{e'_v}{3\cdot c_{a1}}}\right)$$

$\Psi_{ecV} = 1$

$c_{a2} = 1\text{ ft}$

$$\Psi_{edV} := \begin{cases} 1.0 & \text{if } c_{a2} \geq 1.5\cdot c_{a1} \\ 0.7 + 0.3\cdot\dfrac{c_{a2}}{1.5\cdot c_{a1}} & \text{if } c_{a2} < 1.5\cdot c_{a1} \end{cases}$$

[ACI 318-05 EQ D-27]

[ACI 318-05 EQ D-28]

$\Psi_{edV} = 1$

crack_status = "not cracked"

$$\Psi_{cV} := \begin{cases} 1.4 & \text{if crack\_status} = \text{"not cracked"} \\ 1.0 & \text{if crack\_status} = \text{"cracked no reinforce"} \\ 1.2 & \text{if crack\_status} = \text{"cracked with reinforce"} \\ 1.4 & \text{if crack\_status} = \text{"cracked with reinforce and stirrups"} \end{cases}$$

$\Psi_{cV} = 1$

$$V_{cb} := \begin{cases} \dfrac{A_{vc}}{A_{vco}}\cdot\Psi_{edV}\cdot\Psi_{cV}\cdot V_b & \text{if group\_status} = \text{"single anchor"} \\ 0 & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-21]

$$V_{cbg} := \begin{cases} \dfrac{A_{vc}}{A_{vco}}\cdot\Psi_{ecV}\cdot\Psi_{edV}\cdot\Psi_{cV}\cdot V_b & \text{if group\_status} = \text{"group"} \\ 0 & \text{otherwise} \end{cases}$$

[ACI 318-05 EQ D-22]

$V_{cb} = 0\text{ lbf}$

$\boxed{V_{cbg} = 17\cdot\text{kip}}$ group of 2 anchors

Concrete pryout strength of anchor in shear [ACI 318-05 D.6.3]

$h_{ef} = 1\ \text{ft}$

$$k_{cp} := \begin{cases} 1.0 & \text{if } h_{ef} < 2.5\text{in} \\ 2.0 & \text{if } h_{ef} \geq 2.5\text{in} \end{cases}$$

$$V_{cp} := \begin{cases} k_{cp} \cdot N_{cb} & \text{if group\_status} = \text{"single anchor"} \\ 0 & \text{otherwise} \end{cases}$$ [ACI 318-05 EQ D-29]

$$V_{cpg} := \begin{cases} k_{cp} \cdot N_{cbg} & \text{if group\_status} = \text{"group"} \\ 0 & \text{otherwise} \end{cases}$$ [ACI 318-05 EQ D-30]

$V_{cpg} = 141.176 \cdot \text{kip}$ group of 2 anchors

Shear Design Check

$V_{sa} = 322944\ \text{lbf}$ one anchor

$V_{cbg} = 17079\ \text{lbf}$ group of 2 anchors

$V_{cpg} = 141176\ \text{lbf}$ group of 2 anchors

$\Phi_{shear} := 0.85$ Anchor governed by concrete breakout, side-face blowout, pullout, or pryout strength [ACI 318-05 D.4.4]

$V_{design} := \Phi_{shear} \cdot \min(V_{sa} \cdot 4, V_{cbg}, V_{cpg})$ [ACI 318-05 D.4.1.1]

$V_{design} = 14.517 \cdot \text{kip}$

design_shear := if$\left(V \leq V_{design}, \text{"Design is OK"}, \text{"Design is insufficient"}\right)$

design_shear = "Design is OK" [ACI 318-05 EQ D-2]

Interaction of tensile and shear forces [ACI 318-05 D.7]

$$\frac{V}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} = 1.115$$

$$ST_{check} := \text{if}\left(\frac{V}{V_{design}} + \frac{T_{one\_anchor}}{N_{design}} \le 1.2, \text{"Interaction OK"}, \text{"Interactoin Failure"}\right)$$

$$interaction\_check\_V := \text{if}\left[\left(V > 0.2 \cdot V_{design} \wedge T_{one\_anchor} > N_{design}\right), ST_{check}, \text{"No check needed"}\right]$$

$interaction\_check\_V = \text{"No check needed"}$

Anchor Bolt Design - Equipment

Worst case Equipment Loads:

Multimedia Filter Tension: $T := 3.651\text{kip}$

Hydrolysate Heater Module Shear: $V := 0.853 \cdot \text{kip}$

(See App. E)

Steel Strength of anchor in tension [ACI 318.05 D.5.1]

NOTE: ACI 318-05 Appendix D was adopted in lieu of ACI 318-02 in order to include the updated ductility requirements.

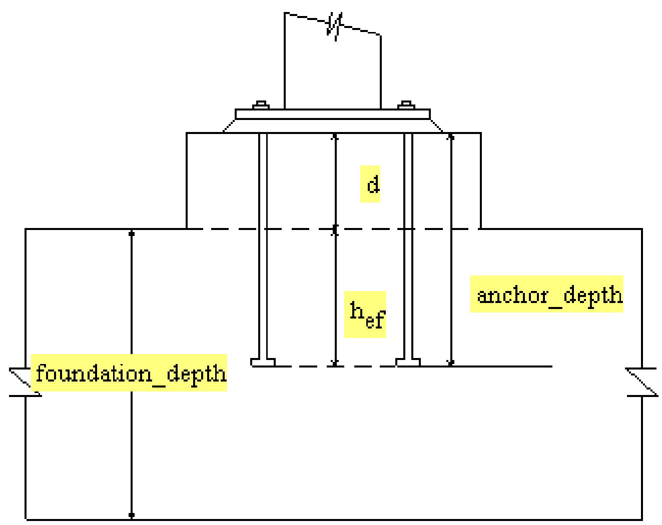
$f_{ya} := 36\text{ksi}$ $\quad n_{anch} := 4$

$f_{uta} := \min(1.9 \cdot f_{ya}, 125\text{ksi}, 58\text{ksi})$

$f_{uta} = 58000\text{ psi}$

Minimum bolt diameter: $d_o := 0.5\text{in}$

Minimum embedment into slab $h_{ef} := 6\text{in}$



$A_{se} := 0.142\text{in}^2$ [Ref. 4.17]

$N_{sa} := n_{anch} \cdot A_{se} \cdot f_{uta}$ [ACI 318.05 Eq D-3]

$\boxed{N_{sa} = 32.944 \cdot \text{kip}}$ one anchor

Steel Strength of Anchor in Shear [ACI 318-05 D.6.1]

Anchor Types:

AT1 [ACI 318-05 D.6.1.a]

AT2 [ACI 318-05 D.6.1.b]

AT3 [ACI 318-05 D.6.1.c]

Anchor Type Used:

$AT := \text{"AT1"}$

Grout Pad Factor [ACI 318-05 D.6.1.3]:

$grout\_pad\_used := \text{"yes"}$

$$c_{pad} := \begin{cases} 0.8 & \text{if } grout\_pad\_used = \text{"yes"} \\ 1.0 & \text{otherwise} \end{cases}$$

$c_{pad} = 1$

Shear Strength:

$$V_{sa} := \begin{cases} c_{pad} \cdot n_{anch} \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT1"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT2"} \\ c_{pad} \cdot n_{anch} \cdot 0.6 \cdot A_{se} \cdot f_{uta} & \text{if } AT = \text{"AT3"} \end{cases}$$

[ACI 318-05 EQ D-19]
[ACI 318-05 EQ D-20]
[ACI 318-05 EQ D-20]

$\boxed{V_{sa} = 26.355 \cdot kip}$ one anchor

Concrete breakout strength-Tension [ACI 318.05 D.5.2]

Breakout Prism Properties

$A_{NCO} := 9 \cdot h'_{ef}{}^{2}$

$A_{NCO} = 900 \cdot in^{2}$

$A_{NC} := \dfrac{\left(n_{anch\_ten} \cdot A_{NCO}\right)}{3}$ (Assume severe edge constraints for conservatism. Side blowout is not an issue because the concrete is confined)

$A_{NC} = 600 \cdot in^{2}$

anchor_status := "cast in"

$k_c :=$ if (anchor_status = "cast in", 24, 17)

$k_c = 24$

$$N_b := \begin{cases} 16 \cdot psi^{.5} \cdot in^{\frac{1}{3}} \cdot \sqrt{f_c} \cdot h'_{ef}{}^{\frac{5}{3}} & \text{if } 11in \le h'_{ef} \le 25in \quad \text{[ACI 318-05 EQ D-7]} \\ k_c \cdot \sqrt{f_c} \cdot h'_{ef}{}^{1.5} \cdot psi^{.5} \cdot in^{.5} & \text{otherwise} \quad \text{[ACI 318-05 EQ D-8]} \end{cases}$$

$N_b = 48000\, lbf$

$e'_N := 0in$

Assumption that only one row of anchors on one side of the column center line carry tension load. Eccentricity is therefore distance from this row of anchors to the column center line

$$\Psi_{ecN} := \min\left(\frac{1}{1+\frac{2\cdot e'_N}{3\cdot h'_{ef}}}, 1.0\right)$$ [ACI 318-05 EQ D-9]

$\Psi_{ecN} = 1$

$$\Psi_{edN} := \begin{cases} 1 \text{ if } c_{amin} \ge 1.5\cdot h'_{ef} & \text{[ACI 318-05 EQ D-10]} \\ 0.7 + 0.3\cdot\frac{c_{amin}}{1.5(h'_{ef})} \text{ if } c_{amin} < 1.5\cdot h'_{ef} & \text{[ACI 318-05 EQ D-11]} \end{cases}$$

$\Psi_{edN} = 1$

$$\Psi_{cN} := \begin{cases} 1.25 \text{ if anchor\_status = "cast in"} \\ 1.4 \text{ otherwise} \end{cases}$$ [ACI 318-05 EQ D.5.2.6

$\Psi_{cN} = 1$

$\Psi_{cpN} := 1$ [ACI 318-05 D5.2.7]

$$N_{cbg} := \frac{A_{NC}}{A_{NCO}}\cdot\Psi_{ecN}\cdot\Psi_{edN}\cdot\Psi_{cN}\cdot\Psi_{cpN}\cdot N_b$$ [ACI 318-05 EQ D-5]

$N_{cbg} = 40\cdot kip$ Group of two anchors

Pullout Strength of Anchor in Tension [ACI 318-05 D.5.3]

$A_{brg} := 0.291in^2$ crack_status := "not cracked" hook_status := "not hooked"

$N_p := 8\cdot A_{brg}\cdot f_c$ [ACI 318-02 EQ D-15]

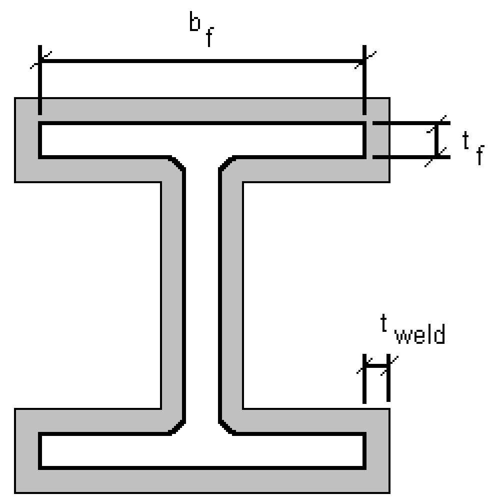
$\Psi_{cP} :=$ if [(crack_status = "cracked"), 1.4, 1.0] [ACI 318-05 D.5.3.6]

$N_{pn} := \Psi_{cP}\cdot N_p$ [ACI 318-02 EQ D-14]

$N_{pn} = 9.312\cdot kip$ One Anchor

Therefore using one minimum 1/2" diameter anchor bolt with minimum 6" embedment is OK.

Base Plate Weld Design - Duct Support W8x31



Weld reduction factor: $\varphi_{vw} := 0.75$

Weld tensile strength: $F_{exx} := 70ksi$ for E70 electrodes

Weld thickness: $t_{weld} := \frac{5}{16}in$

Flange Thickness: $t_f := 0.435in$

Web Thickness: $t_w := 0.285in$

Flange Width: $b_f := 8.0in$ [Ref. 4.13]

Beam Depth: $d := 8.0in$

Axial Tension Load: $P := 1.652kip$ Shear Load: $V := 1.95kip$

Service Moment: $M := 35.58kip \cdot ft$

Length of the weld: $l_{weld} := 2 \cdot (2b_f + d) - 2(t_w + 2 \cdot t_f)$ $l_{weld} = 45.69 \cdot in$

Axial Stress: $\sigma_p := \frac{P}{l_{weld}}$ $\sigma_p = 0.04 \cdot \frac{kip}{in}$

Shear Stress: $\sigma_v := \frac{V}{l_{weld}}$ $\sigma_v = 0.04 \cdot \frac{kip}{in}$

Moment Stress:

$$Iz_{weld} := \frac{3 \cdot d^2 \cdot b_f + \left(d - 2t_f\right)^2 \left[3\left(b_f - t_w\right) + \left(d - 2t_f\right)\right]}{6} \qquad Iz_{weld} = 512.51 \cdot in^3$$

$$Sz_{weld} := \frac{2 \cdot Iz_{weld}}{d} \qquad Sz_{weld} = 128.13 \cdot in^2$$

Resultant Stress:

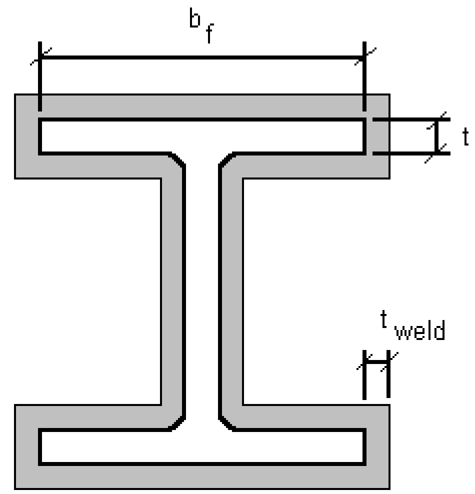
$$\sigma_u := \sqrt{\left(\sigma_p + \frac{M}{Sz_{weld}}\right)^2 + \sigma_v^{\,2}} \qquad \sigma_u = 3.37 \cdot \frac{kip}{in}$$

Weld Capacity:

$$R_{n1} := \varphi_{vw} \cdot \frac{\sqrt{2}}{2} \cdot 0.6F_{exx} \cdot t_{weld} \qquad R_{n1} = 6.96 \cdot \frac{kip}{in}$$

$$Check_{weld} := \text{if}\left(\sigma_u < R_{n1}, \text{"OK"}, \text{"NO GOOD"}\right) \qquad \boxed{Check_{weld} = \text{"OK"}}$$

Base Plate Weld Design - Cable Tray W8x31



Weld reduction factor: $\varphi_{vw} := 0.75$

Weld tensile strength: $F_{exx} := 70\text{ksi}$ for E70 electrodes

Weld thickness: $t_{weld} := \frac{5}{16}\text{in}$

Flange Thickness: $t_f := 0.435\text{in}$

Web Thickness: $t_w := 0.285\text{in}$

Flange Width: $b_f := 8.0\text{in}$ [Ref. 4.13]

Beam Depth: $d := 8.0\text{in}$

Axial Tension Load: $P := 11.35\text{kip}$ Shear Load: $V := 4.06\text{kip}$

Service Moment: $M := 67.27\text{kip}\cdot\text{ft}$

Length of the weld: $l_{weld} := 2\cdot(2b_f + d) - 2(t_w + 2\cdot t_f)$ $l_{weld} = 45.69\cdot\text{in}$

Axial Stress: $\sigma_p := \frac{P}{l_{weld}}$ $\sigma_p = 0.25\cdot\frac{\text{kip}}{\text{in}}$

Shear Stress: $\sigma_v := \frac{V}{l_{weld}}$ $\sigma_v = 0.09\cdot\frac{\text{kip}}{\text{in}}$

Moment Stress:

$$Iz_{weld} := \frac{3 \cdot d^2 \cdot b_f + (d - 2t_f)^2 [3(b_f - t_w) + (d - 2t_f)]}{6} \qquad Iz_{weld} = 512.51 \cdot in^3$$

$$Sz_{weld} := \frac{2 \cdot Iz_{weld}}{d} \qquad Sz_{weld} = 128.13 \cdot in^2$$

Resultant Stress:

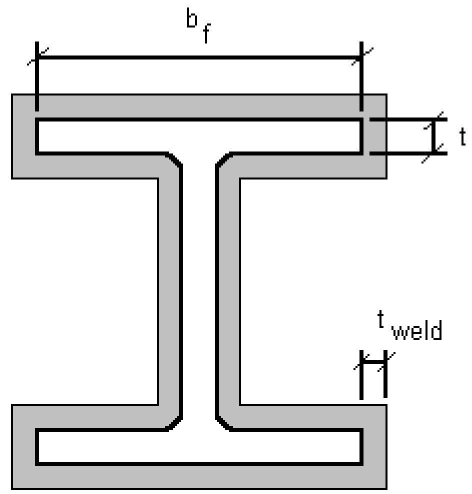
$$\sigma_u := \sqrt{\left(\sigma_p + \frac{M}{Sz_{weld}}\right)^2 + \sigma_v^2} \qquad \sigma_u = 6.55 \cdot \frac{kip}{in}$$

Weld Capacity:

$$R_{n1} := \varphi_{vw} \cdot \frac{\sqrt{2}}{2} \cdot 0.6F_{exx} \cdot t_{weld} \qquad R_{n1} = 6.96 \cdot \frac{kip}{in}$$

$$Check_{weld} := if(\sigma_u < R_{n1}, \text{"OK"}, \text{"NO GOOD"}) \qquad \boxed{Check_{weld} = \text{"OK"}}$$

Base Plate Weld Design - Duct Support W8x24



Weld reduction factor: $\varphi_{vw} := 0.75$

Weld tensile strength: $F_{exx} := 70\text{ksi}$ for E70 electrodes

Weld thickness: $t_{weld} := \frac{5}{16}\text{in}$

Flange Thickness: $t_f := 0.40\text{in}$

Web Thickness: $t_w := 0.245\text{in}$

Flange Width: $b_f := 6.5\text{in}$ [Ref. 4.13]

Beam Depth: $d := 8.0\text{in}$

Axial Tension Load: $P := 0.43\text{kip}$ Shear Load: $V := 1.202\text{kip}$

Applied Moment: $M := 13.66\text{kip}\cdot\text{ft}$

Length of the weld: $l_{weld} := 2\cdot(2b_f + d) - 2(t_w + 2\cdot t_f)$ $l_{weld} = 39.91\cdot\text{in}$

Axial Stress: $\sigma_p := \frac{P}{l_{weld}}$ $\sigma_p = 0.01\cdot\frac{\text{kip}}{\text{in}}$

Shear Stress: $\sigma_v := \frac{V}{l_{weld}}$ $\sigma_v = 0.03\cdot\frac{\text{kip}}{\text{in}}$

Moment Stress:

$$Iz_{weld} := \frac{3 \cdot d^2 \cdot b_f + \left(d - 2t_f\right)^2 \left[3\left(b_f - t_w\right) + \left(d - 2t_f\right)\right]}{6} \qquad Iz_{weld} = 432.34 \cdot in^3$$

$$Sz_{weld} := \frac{2 \cdot Iz_{weld}}{d} \qquad Sz_{weld} = 108.08 \cdot in^2$$

Resultant Stress:

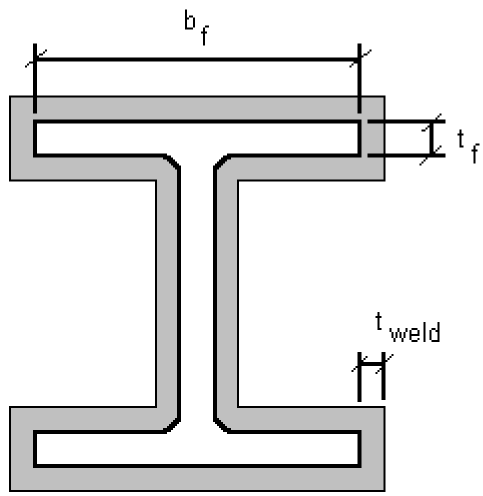
$$\sigma_u := \sqrt{\left(\sigma_p + \frac{M}{Sz_{weld}}\right)^2 + \sigma_v^{\,2}} \qquad \sigma_u = 1.53 \cdot \frac{kip}{in}$$

Weld Capacity:

$$R_{n1} := \varphi_{vw} \cdot \frac{\sqrt{2}}{2} \cdot 0.6F_{exx} \cdot t_{weld} \qquad R_{n1} = 6.96 \cdot \frac{kip}{in}$$

$$Check_{weld} := \text{if}\left(\sigma_u < R_{n1}, \text{"OK"}, \text{"NO GOOD"}\right) \qquad \boxed{Check_{weld} = \text{"OK"}}$$

Base Plate Weld Design - Duct Support W14x43



Weld reduction factor: $\varphi_{vw} := 0.75$

Weld tensile strength: $F_{exx} := 70\text{ksi}$ for E70 electrodes

Weld thickness: $t_{weld} := \frac{7}{16}\text{in}$

Flange Thickness: $t_f := 0.530\text{in}$

Web Thickness: $t_w := 0.305\text{in}$

[Ref. 4.13]

Flange Width: $b_f := 8.0\text{in}$

Beam Depth: $d := 13.7\text{in}$

Axial Tension Load: $P := 2.071\text{kip}$ Shear Load: $V := 4.341\text{kip}$

Applied Moment: $M := 85.58\text{kip}\cdot\text{ft}$

Length of the weld: $l_{weld} := 2\cdot\left(2b_f + d\right) - 2\left(t_w + 2\cdot t_f\right)$ $l_{weld} = 56.67\cdot\text{in}$

Axial Stress: $\sigma_p := \frac{P}{l_{weld}}$ $\sigma_p = 0.04\cdot\frac{\text{kip}}{\text{in}}$

Shear Stress: $\sigma_v := \frac{V}{l_{weld}}$ $\sigma_v = 0.08\cdot\frac{\text{kip}}{\text{in}}$

Moment Stress:

$$Iz_{weld} := \frac{3 \cdot d^2 \cdot b_f + (d - 2t_f)^2 \left[3(b_f - t_w) + (d - 2t_f)\right]}{6} \qquad Iz_{weld} = 1702.05 \cdot in^3$$

$$Sz_{weld} := \frac{2 \cdot Iz_{weld}}{d} \qquad Sz_{weld} = 248.48 \cdot in^2$$

Resultant Stress:

$$\sigma_u := \sqrt{\left(\sigma_p + \frac{M}{Sz_{weld}}\right)^2 + \sigma_v^2} \qquad \sigma_u = 4.17 \cdot \frac{kip}{in}$$

Weld Capacity:

$$R_{n1} := \varphi_{vw} \cdot \frac{\sqrt{2}}{2} \cdot 0.6F_{exx} \cdot t_{weld} \qquad R_{n1} = 9.74 \cdot \frac{kip}{in}$$

$$Check_{weld} := if(\sigma_u < R_{n1}, \text{"OK"}, \text{"NO GOOD"}) \qquad \boxed{Check_{weld} = \text{"OK"}}$$

Appendix H

Containment and Retention Calculations

1/25/2010

SCWO Retention Capacity Summary

Morgan Bratt

No	Area ID	Area Boundary	(Net) Area Sq. Ft.	Area Volume Capacity		Largest Vessel/Tank in Area		Air Volume of Largest Vessel/Tank in Area		Remarks
				Cu. Ft.	Gallons	Capacity Cu. Ft.	Capacity Gallons	Capacity Cu. Ft.	Capacity Gallons	
1	(Dwg 10-DB-06) Acid Tank	Between Ln A to B.2 and Ln 1 thru 3.2	1,017.50	573.94	4,293	113	845	125	935	Inside SPB
2	(Dwg 10-DB-07) AFS Filtrate and Feed Tank	Between Ln B.2 to F and Ln 1 thru 3.2	2,030.15	1,133.83	8,480	554	4,144	640	4,787	Inside SPB
3	(Dwg 10-DB-09) Hydrolysate Blend and Holding Tank	Between Ln A to B.1 and Ln 4 thru 8	1,643.80	913.18	6,830	650	4,862	860	6,432	Inside SPB
4	(Dwg 10-DB-09) Emergency Relief Tank	Between Ln A to C and Ln 8 thru 9	738.50	1,337.23	10,002	1,388	10,381	N/A	N/A	* Inside SPB
5	(Dwg 10-DB-50) STA Tanks	South of Ln J and Ln 1 thru 9	6,483.48	21,504.40	160,841	8,757	65,497	** 15,406	** 115,230	Outside SPB

* The containment volume requirement does not apply to this area. The Emergency relief tank, which is the only vessel in this containment area is not a liquid storage tank. It is used only to capture vapors and liquids that would be released in case of the emergency opening of the pressure relief in the SCWO reactors. Per General Atomics calculations, the liquid resulting from such a relief opening is less than 10% of the tank volume. The balance is gas.

** The Air Volume of Largest Vessel/Tank in Area includes the 25 year, 24 hour rainfall event.
Tank air volume = 11,372 cu. ft. Rainwater volume = 4,034 cu. ft. (see pg. H-7)

Note: Sump capacity shown on following pages is calculated based on Detail 2/24915-000-S0-00-00010.
(L x W x H) = 2'-3" x 2'-3" x 2'-3" = 11.4 ft^3

Area **10-01** **Dwg 10-DB-06**

			L	B			
Room size	L x B =		46.500	26.500	,=	1,232.250	sq.ft
				Gross area =		1,232.250	sq.ft
		No of pads	w	b			
Pad size	w1 x b1 =	1.000	5.700	5.800	,=	33.060	
	w2 x b2 =	2.000	4.900	4.900	,=	48.020	
	w3 x b3 =	1.000	4.700	20.200	,=	94.940	
Col	w4 x b4 =	9.000	2.000	1.400	,=	25.200	
	w5 x b5 =	1.000	1.500	9.000	,=	13.500	
Pump pad	w6 x b6 =				,=	0.000	
				Total pad area =		214.720	sq.ft

Net area, **Anet**= Gross area - Total pad area
, = 1,017.530 sq.ft

Curb height @ door = 6.500 in
diff in floor elevation = HP EL - LP EL
,= 0.000 in

Accum wtr ht. Hwtr = (Curb ht. @ door + Diff in floor elevation/2)/12
Hwtr = 0.542

Sump vol, Vsump = 11.391 cu.ft   No.of Sumps,n= 2.000
Trench vol, Vtrench = Trench lngth x aver depth x width in ft
Trench lngth, = 0.000 ft   Width,= 1.000 ft
aver depth in ft = 0.000 ft
Vtrench = 0.000

I **Room Containm't Cap., Vcap =** Anet x Hwtr + n x Vsump + Vtrench
Vcap = 573.943 cu.ft

II **Zone Room Containm'nt Cap**
Accum zone wtr ht. =Hzwtr = (6.5+Diff in floor elevation/2)/12
Hzwtr = 0.542
Vzcap = Anet x Hzwtr +n x Vsump +Vtrench
Vzcap = 573.943 cu.ft

Area **10-02** **Dwg 10-DB-07**

			L	B			
Room size	L x B =		75.000	46.500	,=	3,487.500	sq.ft
				Gross area =		3,487.500	sq.ft
		No of pads	w	b			
Pad size	w1 x b1 =	1.000	10.000	7.500	,=	75.000	
	w2 x b2 =	1.000	13.000	12.500	,=	162.500	
	w3 x b3 =	1.000	25.500	16.000	,=	408.000	
	w4 x b4 =	1.000	25.500	17.900	,=	456.450	
	w5 x b5 =	1.000	23.500	9.000	,=	211.500	
	w6 x b6 =	2.000	6.200	5.800	,=	71.920	
Col	w7 x b7 =	15.000	2.000	1.000		30.000	
	w8 x b8 =	6.000	2.000	2.000		24.000	
	w9 x b9 =	8.000	1.500	1.500		18.000	

Total pad area = 1,457.370 sq.ft

Net area, **Anet**= Gross area - Total pad area
, = 2,030.130 sq.ft

Curb height @ door = 6.500 in
diff in floor elevation = HP EL - LP EL
,= 0.000 in

Accum wtr ht. Hwtr = (Curb ht. @ door + Diff in floor elevation/2)/12
Hwtr = 0.542

Sump vol, Vsump = 11.391 cu.ft   No.of Sumps,n= 3.000
Trench vol, Vtrench = Trench lngth x aver depth x width in ft
Trench lngth, = 0.000 ft   Width,= 1.000 ft
aver depth in ft = 0.000 ft
Vtrench = 0.000

I **Room Containm't Cap., Vcap =** Anet x Hwtr + n x Vsump + Vtrench
Vcap = 1,133.826 cu.ft

II **Zone Room Containm'nt Cap**
Accum zone wtr ht. =Hzwtr = (6.5+Diff in floor elevation/2)/12
Hzwtr = 0.542
Vzcap = Anet x Hzwtr +n x Vsump +Vtrench
Vzcap = 1,133.826 cu.ft

BECHTEL PARSONS BLUE GRASS

Subject: Gas Bottles Canopy, Supports, Equip, Misc Foundations
By: M. Bratt
Date: 1/25/2010

Project: BGCAPP
Job Number: 743341
Calc. No.: 24915-10-DBC-00-00004
Sheet No.: H-5 of H-8
Sheet Rev.: D

Area **10-04** **Dwg 10-DB-09** **Line 4-8**

			L	B		
Room size	L x B =		77.000	24.000	,=	1,848.000 sq.ft
	L1 x B1 =		77.000	11.000		847.000
				Gross area =		2,695.000 sq.ft
		No of pads	w	b		
Pad size	w1 x b1 =	1.000	33.300	13.000	,=	432.900
	w2 x b2 =	1.000	8.800	5.900	,=	51.920
	w3 x b3 =	1.000	19.500	6.000	,=	117.000
	w4 x b4 =	1.000	11.200	6.000	,=	67.200
	w5 x b5 =	1.000	5.200	4.200	,=	21.840
	w6 x b6 =	1.000	14.200	9.200	,=	130.640
	w7 x b7 =	1.000	14.200	10.800		153.360
	w8 x b8 =	1.000	9.500	6.000		57.000
	w9 x b9 =	0.000	0.000	0.000		0.000
	w10 x b10 =	1.000	1.833	4.000		7.332
Col	w11 x b11 =	3.000	2.000	2.000		12.000
	w12 x b12 =	0.000	0.000	0.000		0.000

Total pad area = 1,051.192 sq.ft

Net area, **Anet**= Gross area - Total pad area
, = 1,643.808 sq.ft

Curb height @ door = 6.500 in
diff in floor elevation = HP EL - LP EL
,= 0.000 in

Accum wtr ht. Hwtr = (Curb ht. @ door + Diff in floor elevation/2)/12
Hwtr = 0.542

Sump vol, Vsump = 11.391 cu.ft No.of Sumps,n= 2.000
Trench vol, Vtrench = Trench lngth x aver depth x width in ft
Trench lngth, = 0.000 ft Width,= 1.000 ft
aver depth in ft = 0.600 ft
Vtrench = 0.000

I **Room Containm't Cap., Vcap =** Anet x Hwtr + n x Vsump + Vtrench
Vcap = 913.177 cu.ft

II **Zone Room Containm'nt Cap**
Accum zone wtr ht. =Hzwtr = (6.5+Diff in floor elevation/2)/12
Hzwtr = 0.542
Vzcap = Anet x Hzwtr +n x Vsump +Vtrench
Vzcap = 913.177 cu.ft

Area **10-07** **Dwg 10-DB-09 & 20** **Line 8-9**

			L	B			
Room size	L x B =		41.500	19.900	,=	825.850	sq.ft
				Gross area =		825.850	sq.ft
		No of pads	w	b			
Pad size	w1 x b1 =	2.000	7.700	3.500	,=	53.900	
	w2 x b2 =	2.000	3.500	1.400	,=	9.800	
	w3 x b3 =	2.000	1.500	0.900	,=	2.700	
Col	w4 x b4 =	2.000	2.000	2.000	,=	8.000	
	w5 x b5 =	4.000	2.000	1.600	,=	12.800	
				Total pad area =		87.200	sq.ft
				Net area, **Anet**=		Gross area - Total pad area	
				, =		738.650	sq.ft

Wall height all around = 20.000 in
diff in floor elevation = HP EL - LP EL
,= 0.000 in

Accum wtr ht. Hwtr = (Curb ht. @ door + Diff in floor elevation/2)/12
Hwtr = 1.667

Sump vol, Vsump = 11.391 cu.ft   No.of Sumps,n= 1.000
Trench vol, Vtrench = Trench lngth x aver depth x width in ft
Trench lngth, = 0.000 ft   Width,= 0.000 ft
aver depth in ft = 0.000 ft
Vtrench = 0.000

l **Room Containm't Cap., Vcap =** Anet x Hwtr + n x Vsump + Vtrench
Vcap = 1,242.474 cu.ft

Additional Volume

87.2 x (1.667 - 0.58) = 87.2 x 1.087 = 94.757 cu.ft.

Σ Vcu.ft = 1245.29 + 94.87 = 1,337.231 cu.ft.

Bechtel Parsons Blue Grass

Subject: Gas Bottles Canopy, Supports, Equip, Misc Foundations
By: M. Bratt
Date: 1/25/2010

Project: BGCAPP
Job Number: 743341
Calc. No.: 24915-10-DBC-00-00004

Sheet Rev.: D

Area **10-15 & 10-16** **Dwg 10-DB-50** **Line 1-9**

Wall height =	32.000	in		
diff in floor elevation =	HP EL - LP EL			
,=	4.000	in		
Accum wtr ht. Hwtr =	(Wall ht. + Diff in floor elevation / 2)			
Hwtr =	34.000	in	2.833	ft
Madison County 25-yr, 24 hour rain event, Hrain =	5.300	in	0.442	ft

	L	B	Ht		
Room size L x B =	156.400	58.400	2.833	=	25,878.987 cu. ft
Rain Water Volume =	156.400	58.400	0.442	=	4,034.077 cu. ft
		Gross volume =			25,878.987 cu. ft

		No of pads	w	b	ht		Volume	Area
Pump pad size	w1 x b1 =	2.000	5.500	2.333	2.167	=	55.620	25.667
	w2 x b2 =	2.000	4.583	2.000	2.167	=	39.728	18.333
	w3 x b3 =	4.000	4.000	2.000	2.167	=	69.344	32.000
	w4 x b4 =	2.000	4.583	2.000	2.167	=	39.728	18.333
	w5 x b5 =	1.000	1.333	1.333	2.167	=	3.852	1.778
Col	w7 x b7 =	20.000	2.000	2.000	0.500	=	40.000	80.000
	w8 x b8 =	17.000	2.667	2.667	2.392	=	289.239	120.919
		No of tanks	diameter	ht				
Tank immersion	w9 x ht9 =	2.000	21.000	1.667		=	1,154.766	692.721
	w10 x ht10 =	2.000	20.000	1.667		=	1,047.407	628.319
	w11 x ht11 =	1.000	18.500	1.667		=	448.094	268.803
	w12 x ht12 =	3.000	18.000	1.667		=	1,272.599	763.407

Tank pad volume, Vtank = 477.170 sq. ft x 1'-0" 8 pads 3,817.360 cu. ft
(Calc. 24915-10-DBC-00-00002, Ref. 4-18)
(see pg. H-8)

Total pad volume = 4,460.378 cu. ft
Total pad area = 2,650.279 sq. ft

Net volume, **Vnet** = Gross volume - Total pad volume
, = 21,418.609 cu. ft
Net area, **Anet** = L x B - Total pad area
, = 6,483.481 sq. ft

Sump vol, Vsump =	11.391	cu. ft	No. of Sumps, n=	1.000	
Trench vol, Vtrench =	Trench length x aver depth x width in ft				
Trench length, =	124.000	ft	Width,=	1.000	ft
aver depth in ft =	0.600	ft			
Vtrench =	74.400	cu. ft			
Largest Tank Air Volume =	11,372.000	cu. ft			

I Room Containment Cap., Vcap = Vnet + n x Vsump + Vtrench
Vcap = 21,504.400 cu. ft

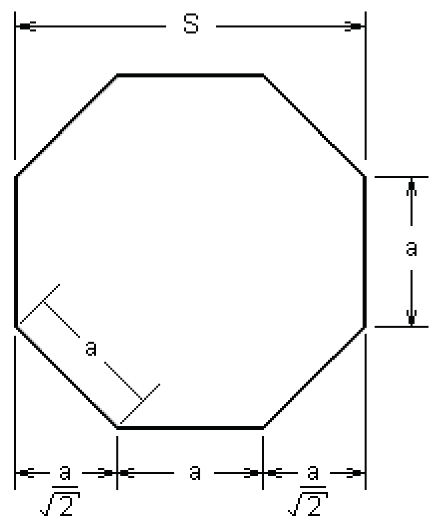
II Room Required Containment, Vreq = Rain Water Volume + Largest Tank Air Volume
Vreq = 15,406.077 cu. ft

Exerpt from Calc. 24915-10-DBC-00-00002 pg. B9 [Ref 4.18]

Live Loads Applied Outside Concrete Pad $LL := 250 \bullet psf$ [Ref. 4.2]

Dead Loads Applied on Concrete Pad

Area of a regular octagon:



Width of Pad: $S := 24 \bullet ft$

Side edge length: $a := \dfrac{S}{1+\sqrt{2}}$ $a = 9.94\,ft$

Octogon tank pad area: $A_{pad} := S^2 - a^2$ $A_{pad} = 477.17\,ft^2$

Tank self-weight: $W_S = 36.37 \bullet kip$

Tank content weight: $W_L = 685.84 \bullet kip$

Pad thickness:~ $t_{pad} := 12 \bullet in$

Density of Concrete: $\rho_c := 150pcf$

Pressure applied on concrete Mat due to Deadweight of empty Tank + Pad + Platform:

$$p_{DLpad} := \frac{W_S + W_R}{\pi \bullet \left(\frac{D_t}{2}\right)^2} + t_{pad} \bullet \rho_c = 263.25 \bullet psf$$

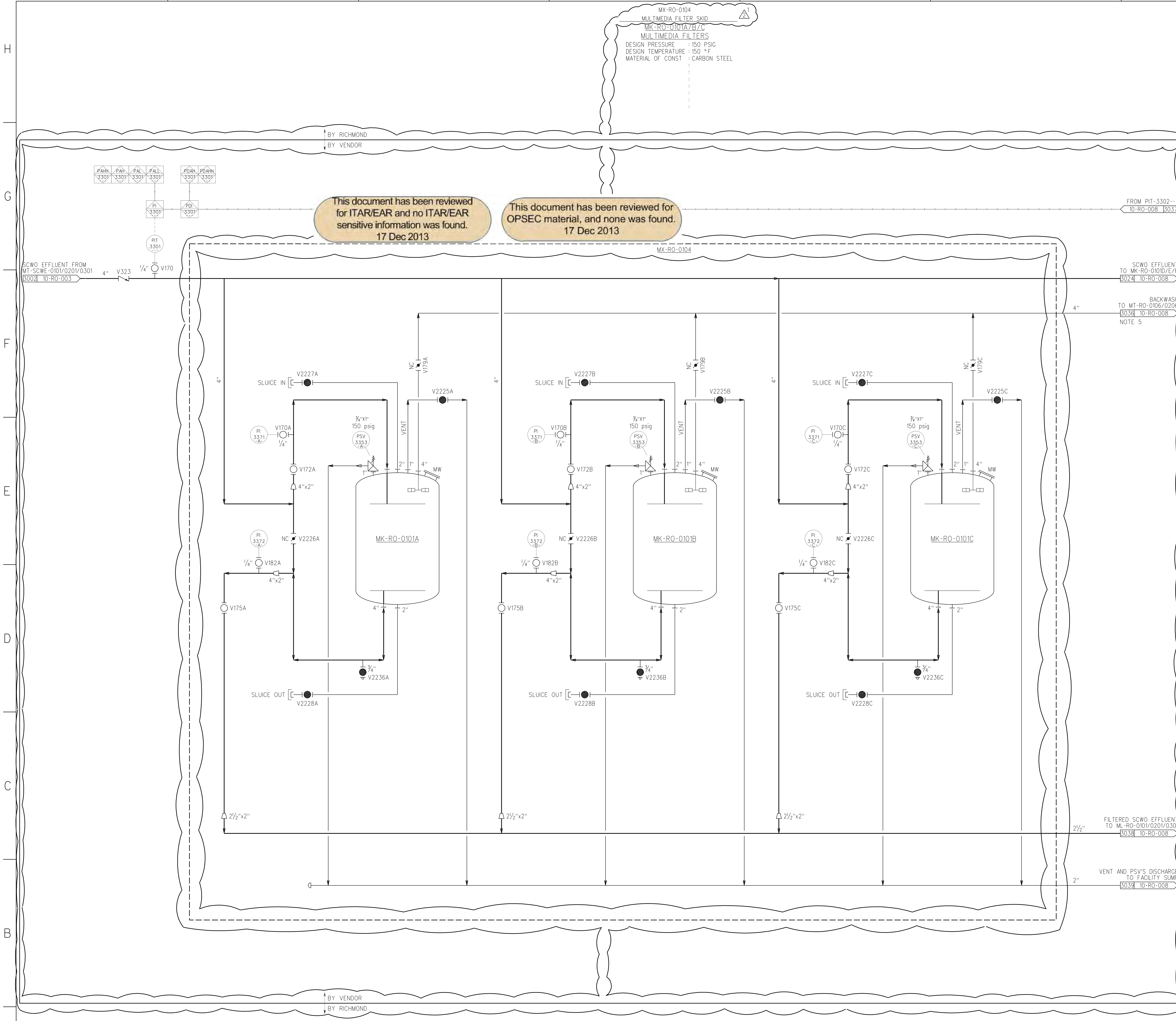
+ 28 psf Say 300 psf

(28 psf added to incorporate Snow/Ice loads, see Sheet B11) <--SAFE input

Pressure applied on concrete pad due to tank liquid content with LL on Slab, (250 psf) deducted + LL on Platform, (100 psf) added:

$$p_{LLpad} := \frac{W_L}{\pi \bullet \left(\frac{D_t}{2}\right)^2} - LL = 1730.15 \bullet psf$$

Say 1750 psf <--SAFE input



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "10" UNLESS OTHERWISE NOTED.
4. ALL WATER RECOVERY SYSTEMS INCLUDING CHEMICAL INJECTION SKIDS, MULTIMEDIA FILTERS: MK-RO-0101A/B/C/D/E/F, PREFILTERS: MK-RO-0102/0202/0302 AND RO UNITS: ML-RO-0101/0201/0301 TO SHARE ONE COMMON CONTAINMENT AREA.
5. MULTIMEDIA FILTERS BACKWASH WILL OCCUR FOR AT LEAST 10 MINUTES/CYCLE.
6. DASHED LINES DEFINE MODULE BOUNDARY. ALL DESIGN, PROCUREMENT AND FABRICATION INSIDE SOLID LINES IS VENDOR SCOPE.

BASED ON BLUE GRASS PFD 24915-10-M5-RO-00001 REV.6
BASED ON BLUE GRASS MSD 24915-10-NO-RO-00001 REV.2

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	07/26/11	IFC, INCORPORATED DCN-464	JAW	PEB	SA	BBB	BBB
1	08/21/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
0	08/15/07	ISSUED FOR CONSTRUCTION (IFC), TREND #00193	YWC	JP	PEB	RSA	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

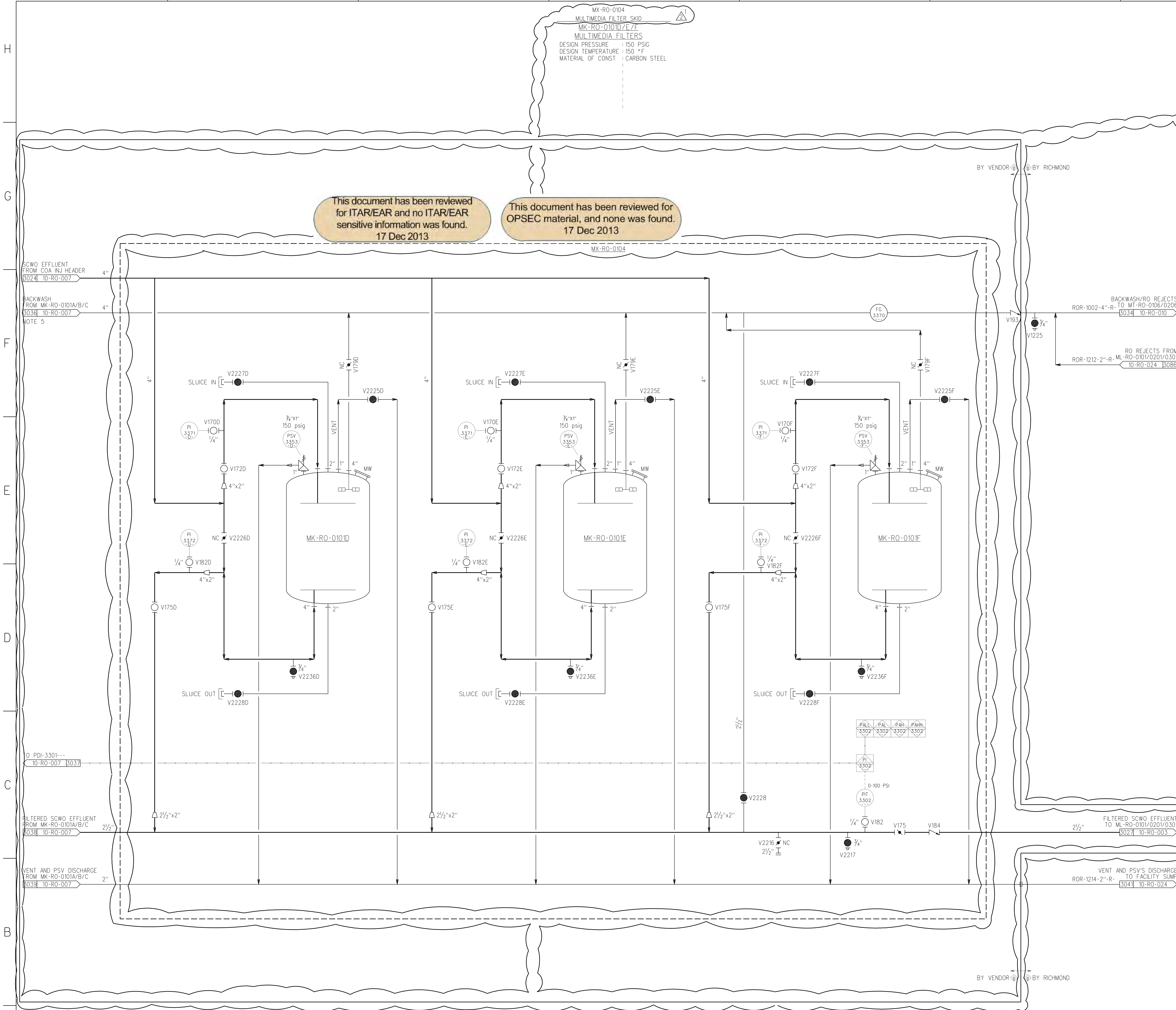
CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

SCWO PROCESSING BUILDING MULTIMEDIA FILTERS PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-RO-00007 | SHEET 1 OF 1 | REV 2

BGCAPP_DGN.BDR



GENERAL NOTES:

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3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "10" UNLESS OTHERWISE NOTED.
4. ALL WATER RECOVERY SYSTEMS INCLUDING CHEMICAL INJECTION SKIDS, MULTIMEDIA FILTERS: MK-RO-0101A/B/C/D/E/F, PREFILTERS: MK-RO-0102/0202/0302 AND RO UNITS: ML-RO-0101/0201/0301 TO SHARE ONE COMMON CONTAINMENT AREA.
5. MULTIMEDIA FILTERS BACKWASH WILL OCCUR FOR AT LEAST 10 MINUTES/CYCLE.
6. DASHED LINES DEFINE MODULE BOUNDARY. ALL DESIGN, PROCUREMENT AND FABRICATION INSIDE SOLID LINES IS VENDOR SCOPE.

BASED ON BLUE GRASS PFD 24915-10-M5-RO-00001 REV.6
BASED ON BLUE GRASS MSD 24915-10-NO-RO-00001 REV.2
REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	07/26/11	IFC, INCORPORATED DCN-464	JAW	PEB	SA	BBB	BBB
1	08/21/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
0	08/15/07	ISSUED FOR CONSTRUCTION (IFC), TREND #00193	YWC	JP	PEB	RSA	BBB

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

SCWO PROCESSING BUILDING MULTIMEDIA FILTERS PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-RO-00008 | SHEET 1 OF 1 | REV 2

BGCAPP_DGN.BDR

10MRO008.pid 07/26/11
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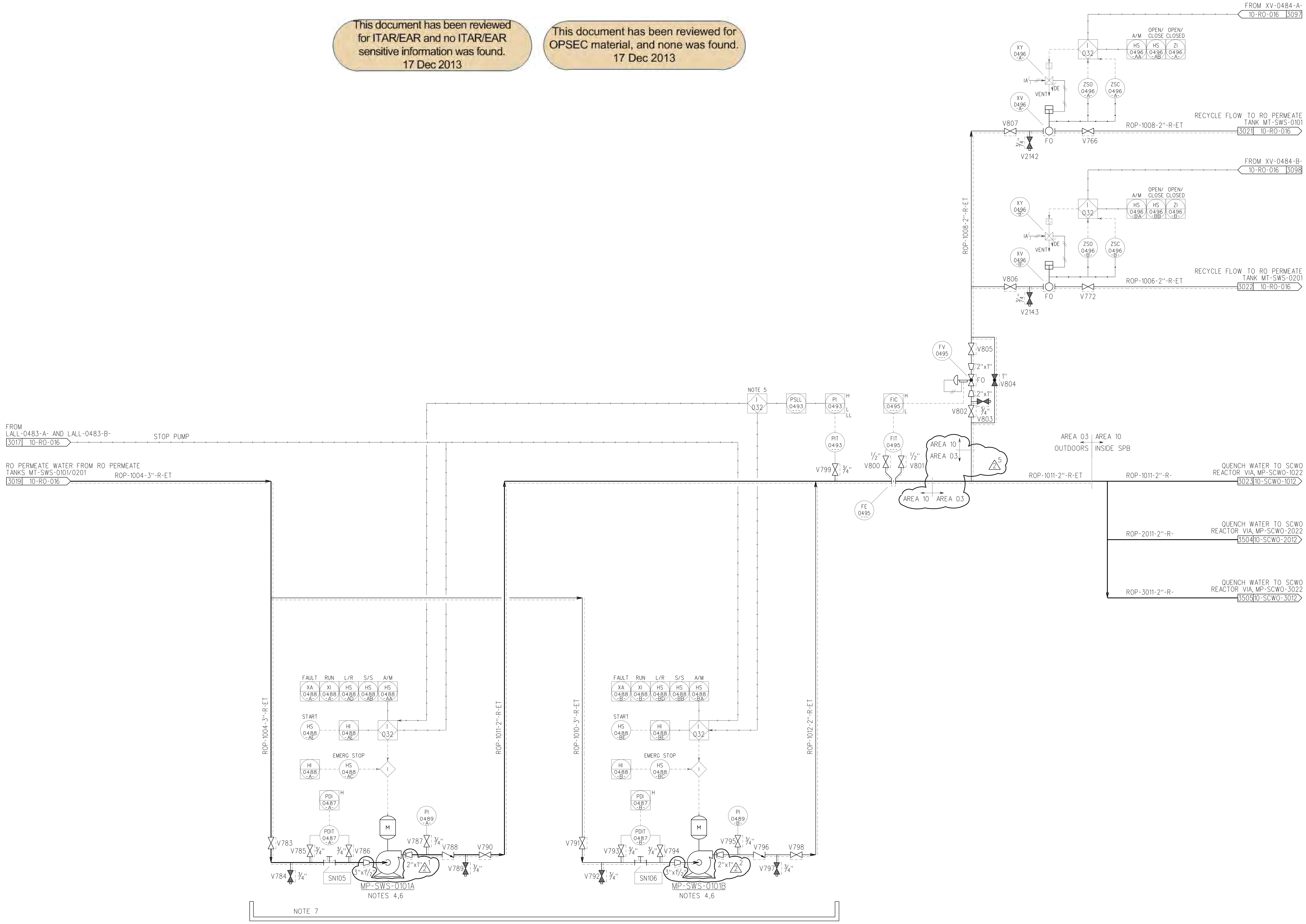
PLOTTED BY: USER$ ON DATE$$$$ AT SYTIME USING COLOR$$$$



MP-SWS-0101A/B
RO PERMEATE PUMP AND SPARE

RATED FLOW	: 72.5 GPM
RATED DELTA P	: 63.8 PSI
MOTOR HP	: 7.5 HP
MATERIAL OF CONST	: API A-8 (316 SS)
TRIM	: TRIM-1111-0"-R-ET

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "10" UNLESS OTHERWISE NOTED.
4. MOTOR FAILURE OF RUNNING PUMP TO AUTOMATICALLY START STANDBY PUMP AND ALARM.
5. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW NORMAL FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE DOES NOT RETURN TO NORMAL WITHIN 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP. IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" WILL AUTOMACTICALLY START WITHOUT WAITING FOR THE PRESSURE TO FALL BELOW NORMAL. BOTH PUMPS TO BE SHUTDOWN IF LALL-0483-A- AND -B- ARE ACTIVATED.
6. PUMPS TO BE LOCATED OUTDOORS. PUMPS, ASSOCIATED PIPING AND INSTRUMENTS TO BE ELECTRIC HEAT TRACED TO 40°F AND INSULATED FOR FREEZE PROTECTION.
7. SCWO EFFLUENT TANKS MT-SCWO-0101/0201/0301, PROCESS WATER TANK MT-PWS-0101, RO PERMEATE TANKS MT-SWS-0101/0201 AND THEIR ASSOCIATED PUMPS ARE LOCATED INSIDE THE SAME CURBED CONTAINMENT AREA.
8. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "10-RO-".

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-10-M5-RO-00002 REV.7
BASED ON BLUE GRASS MSD 24915-10-NO-RO-00002 REV.2

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
2	08/21/09	IFC, INCORPORATED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
1	08/15/07	ISSUED FOR CONSTRUCTION (IFC), TREND #00193	YWC	JP	PEB	RSA	BBB
0	10/31/05	ISSUED FOR DESIGN (IFD)	BE	JLL	PEB	JH	PGK

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING RO PERMEATE PUMPS PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-RO-00017 | SHEET 1 OF 1 | REV 2

BGCAPP_DGN.BDR

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DESIGN FILE: DGNSPEC$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
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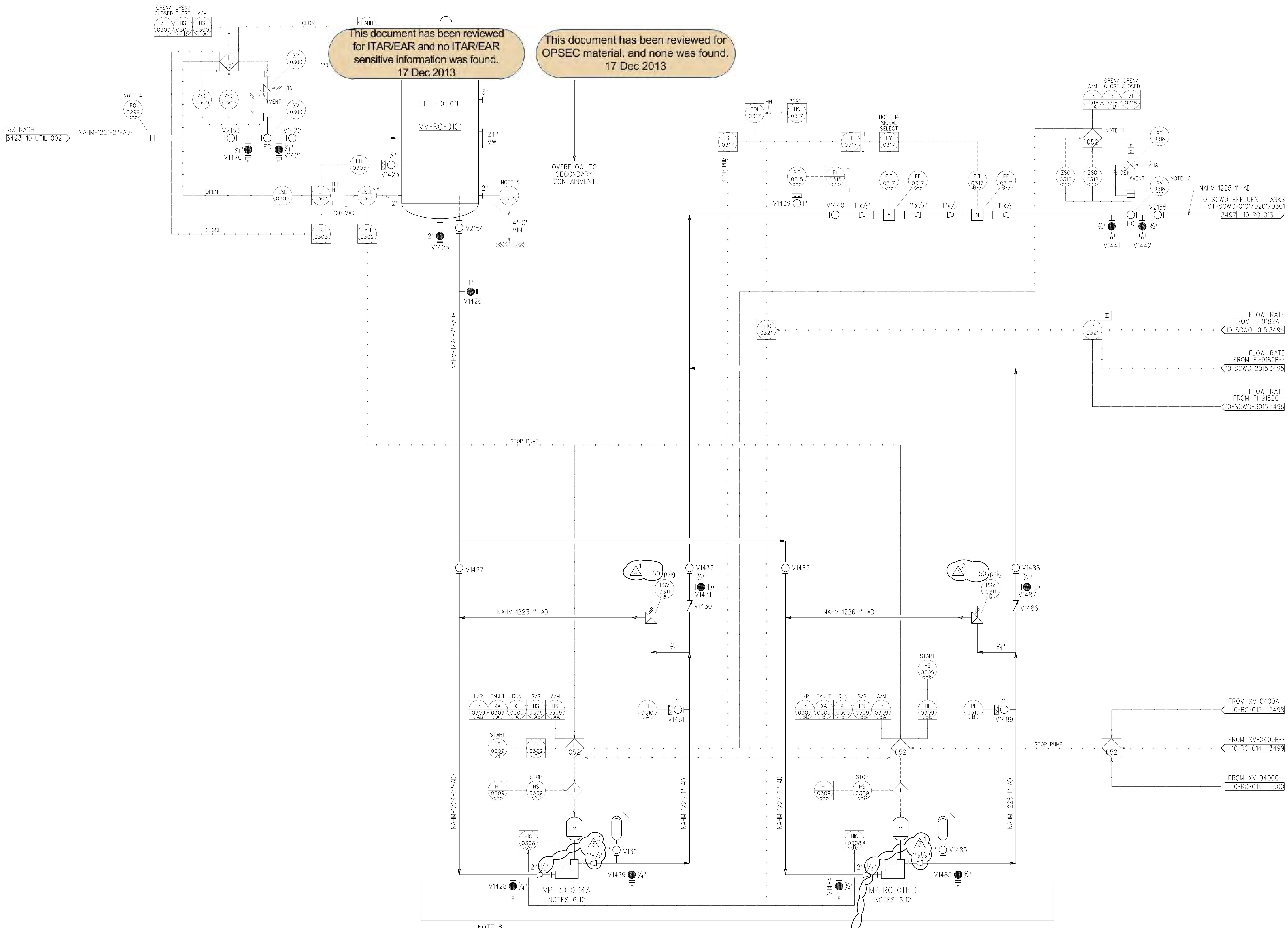
MV-RO-0101
SCWO EFFLUENT CAUSTIC DAY TANK

WORKING VOLUME	:	350 GAL
I.D.	:	4.0 FT
T-T	:	7.0 FT
DESIGN PRESSURE	:	14.9 PSIG
DESIGN TEMPERATURE	:	125 °F
MATERIAL OF CONST	:	CS
TRIM	:	TRIM-1161-0"-AD-



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "10" UNLESS OTHERWISE NOTED.
4. RESTRICTION ORIFICE TO MAINTAIN BACK PRESSURE FROM THE 18% CAUSTIC TRANSFERING SYSTEM.
5. THERMOWELL CONNECTION BELOW LLLL.
6. METERING PUMP SHALL BE EQUIPPED WITH CALIBRATION TUBE BY VENDOR.
7. DELETED.
8. TANK AND PUMPS ARE LOCATED INSIDE THE SCWO EFFLUENT CAUSTIC DAY TANK CONTAINMENT AREA INSIDE THE SPB.
9. DELETED.
10. LEAK-PROOF POSITIVE SHUT-OFF VALVE IS OPENED ONLY BEFORE THE START OF THE CAUSTIC INJECTION PUMP.
11. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "10-RO-".
12. METERING PUMPS WILL HAVE THE CAPABILITY TO BE CONTROLLED FROM THE CONTROL ROOM.
13. DELETED.
14. FIT0317A-- IS SELECTED BY DEFAULT. IF FIT0317A-- FAILS THEN FIT0317B-- IS SELECTED.

MP-RO-0114A/B
CAUSTIC INJECTION PUMP AND SPARE

RATED FLOW	:	0.23 GPM
RATED DELTA P	:	26.9 PSI
MOTOR HP	:	1 HP
MATERIAL OF CONST	:	316 SS
TRIM	:	TRIM-2007-0"-AD-

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-10-M5-RO-00002 REV.7
BASED ON BLUE GRASS MSD 24915-10-NO-RO-00002 REV.2

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	03/22/12	IFC, INCORPORATED DCN-552 AND -711	JAW	JDC	SA	BBB	BBB
2	08/21/09	IFC, HTL-937, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
1	08/13/07	ISSUED FOR CONSTRUCTION (IFC), GA CONTROL INPUT	YWC	JLL	PEB	RSA	BBB
0	05/02/07	ISSUED FOR DESIGN (IFD)	YWC	JLL	PEB	RSA	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

SCWO PROCESSING BUILDING
SCWO EFFLUENT CAUSTIC DAY TK & PUMP
PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-RO-00021 | SHEET 1 OF 1 | REV 3

BGCAPP_DGN.BDR

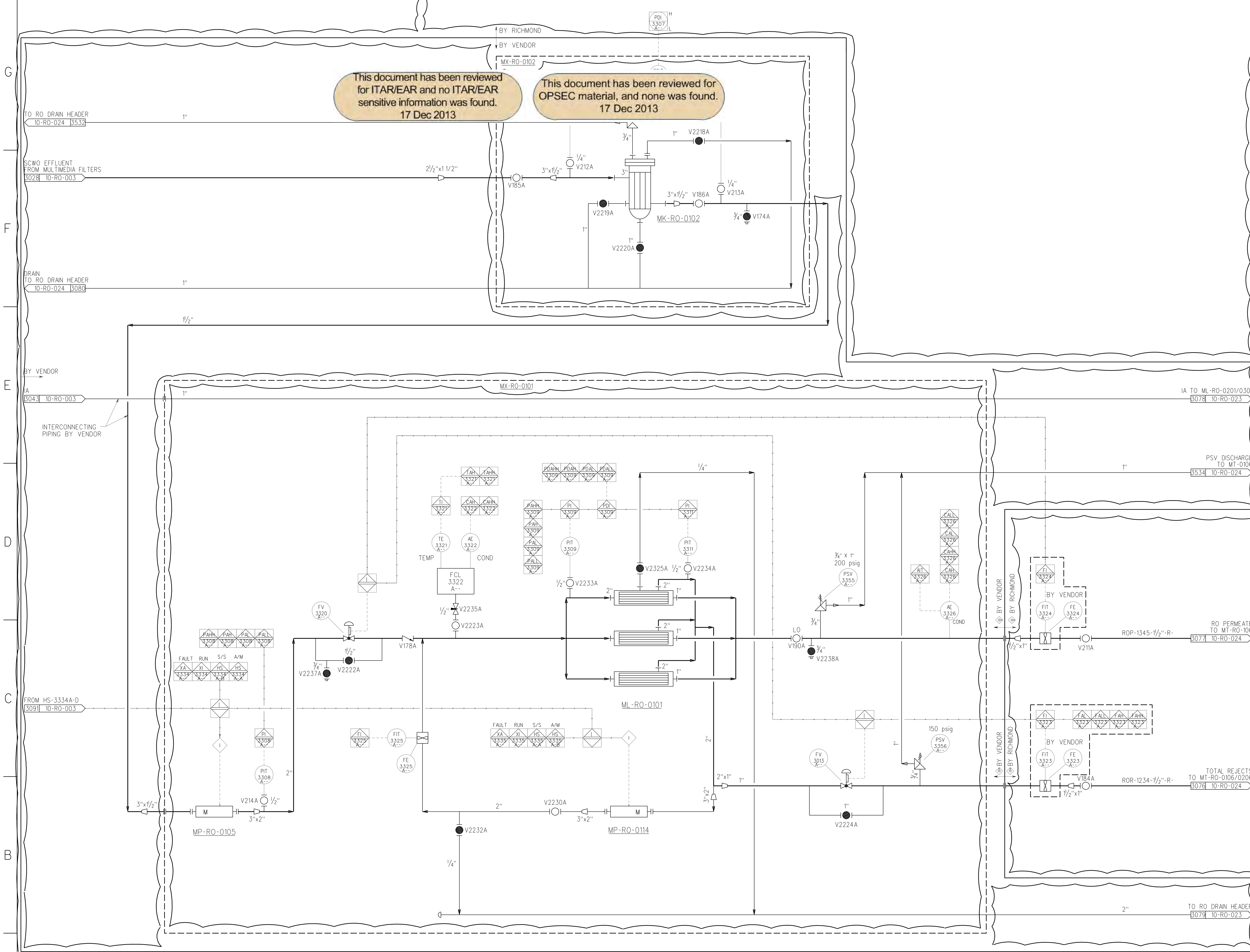
MX-RO-0102 CANISTER FILTER SKID	
MK-RO-0102 CANISTER FILTER AND SPARE	
DESIGN PRESSURE	: 150 PSIG
DESIGN TEMPERATURE	: 110 °F
MEAN DIAMETER CAPTURE	: 5 MICRONS ABSOLUTE
MATERIAL OF CONST	: COATED CARBON STEEL

MX-RO-0101
REVERSE OSMOSIS (R.O.) UNITS PACKAGE

ML-RO-0101 REVERSE OSMOSIS UNIT AND SPARE	
DESIGN PRESSURE	: 3600 PSIG
DESIGN TEMPERATURE	: 120 °F
MATERIAL OF CONST (SHELL)	: EPOXY/GLASS COMPOSITE
MATERIAL OF CONST	: 316 SS HEADS

MP-RO-0105 RO HIGH PRESSURE PUMP AND SPARE	
RATED FLOW	: 45 GPM
RATED DELTA P	: 670 PSI
MOTOR HP	: 35 HP
MATERIAL OF CONST	: 316 SS

MP-RO-0114 RO RECYCLE PUMP AND SPARE	
RATED FLOW	: 80 GPM
RATED DELTA P	: 50 PSI
MOTOR HP	: 4 HP
MATERIAL OF CONST	: 316 SS



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "10" UNLESS OTHERWISE NOTED.
4. VENDOR TO PROVIDE THREE RO HIGH PRESSURE PUMPS, THREE RO RECYCLE PUMPS, AND THREE SETS OF RO UNITS IN ONE SKID, SIX MULTIMEDIA FILTERS AND THREE CANISTER FILTERS INCLUDING ASSOCIATED VALVES, INSTRUMENTS, PIPING, SUPPORTS, AND CONTROL SYSTEMS INTEGRATED WITH OVERALL REVERSE OSMOSIS (RO) UNITS.
5. ALL WATER RECOVERY SYSTEMS INCLUDING CHEMICAL INJECTION SKIDS, MULTIMEDIA FILTERS: MK-RO-0101A/B/C/D/E/F, PREFILTERS: MK-RO-0102/0202/0302, AND RO UNITS: ML-RO-0101/0201/0301 TO SHARE ONE COMMON CONTAINMENT AREA.
6. VENDOR TO PROVIDE LOW-POINT DRAIN VALVES.
7. DELETED.
8. DELETED.
9. DASHED LINES DEFINE MODULE BOUNDARY. ALL DESIGN, PROCUREMENT AND FABRICATION INSIDE SOLID LINES IS VENDOR SCOPE.

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-10-M5-RO-00001 REV.6
BASED ON BLUE GRASS MSD 24915-10-NO-RO-00001 REV.2

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	07/26/11	IFC, INCORPORATED DCN-464	JAW	PEB	SA	BBB	BBB
2	05/20/10	IFC, ADDED PIPING COMMENTS	PEB	MDV	SA	BBB	BBB
1	08/21/09	IFC, GC 8483, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
0	08/15/07	ISSUED FOR CONSTRUCTION (IFC), TREND #00193	YWC	JP	PEB	RSA	BBB

QUALITY ☐ Q ☒ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

SCWO PROCESSING BUILDING CANISTER FILTER & RO UNIT 0101 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-RO-00022 | SHEET 1 OF 1 | REV 3

BGCAPP_DGN.BDR

MX-RO-0102
CANISTER FILTER SKID

MK-RO-0202
CANISTER FILTER AND SPARE

DESIGN PRESSURE	: 150 PSIG
DESIGN TEMPERATURE	: 110 °F
MEAN DIAMETER CAPTURE	: 5 MICRONS ABSOLUTE
MATERIAL OF CONST	: COATED CARBON STEEL

MX-RO-0101
REVERSE OSMOSIS (R.O.) UNITS PACKAGE

ML-RO-0201
REVERSE OSMOSIS UNIT AND SPARE

DESIGN PRESSURE	: 3600 PSIG
DESIGN TEMPERATURE	: 120 °F
MATERIAL OF CONST (SHELL)	: EPOXY/GLASS COMPOSITE
MATERIAL OF CONST	: 316 SS HEADS

MP-RO-0205
RO HIGH PRESSURE PUMP AND SPARE

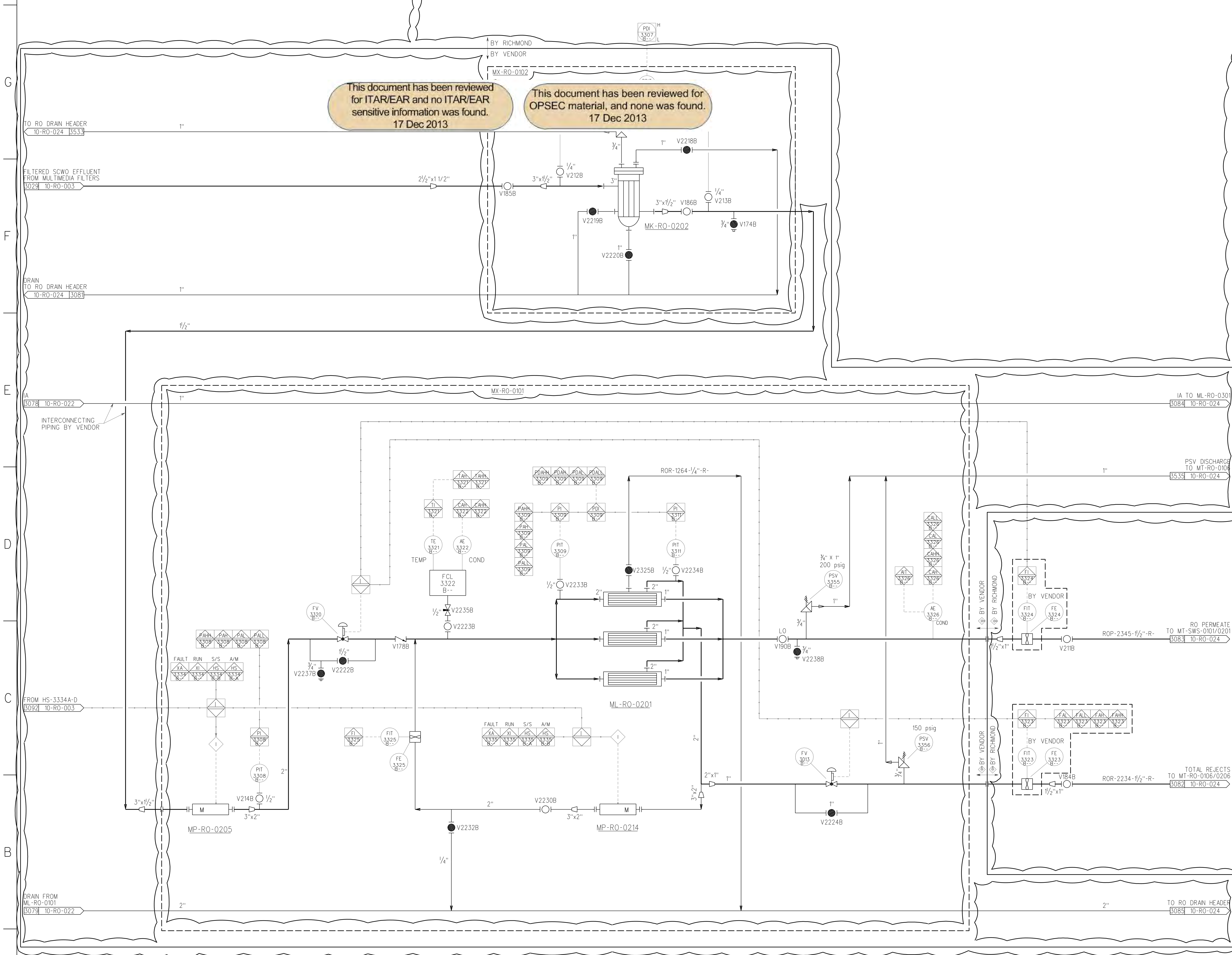
RATED FLOW	: 45 GPM
RATED DELTA P	: 670 PSI
MOTOR HP	: 35 HP
MATERIAL OF CONST	: 316 SS

MP-RO-0214
RO RECYCLE PUMP AND SPARE

RATED FLOW	: 80 GPM
RATED DELTA P	: 50 PSI
MOTOR HP	: 4 HP
MATERIAL OF CONST	: 316 SS

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "10" UNLESS OTHERWISE NOTED.
4. VENDOR TO PROVIDE THREE RO HIGH PRESSURE PUMPS, THREE RO RECYCLE PUMPS, AND THREE SETS OF RO UNITS IN ONE SKID, SIX MULTIMEDIA FILTERS AND THREE CANISTER FILTERS INCLUDING ASSOCIATED VALVES, INSTRUMENTS, PIPING, SUPPORTS, AND CONTROL SYSTEMS INTEGRATED WITH OVERALL REVERSE OSMOSIS (RO) UNITS.
5. ALL WATER RECOVERY SYSTEMS INCLUDING CHEMICAL INJECTION SKIDS, MULTIMEDIA FILTERS: MK-RO-0101A/B/C/D/E/F, PREFILTERS: MK-RO-0102/0202/0302, AND RO UNITS: ML-RO-0101/0201/0301 TO SHARE ONE COMMON CONTAINMENT AREA.
6. VENDOR TO PROVIDE LOW-POINT DRAIN VALVES.
7. DELETED.
8. DELETED.
9. DASHED LINES DEFINE MODULE BOUNDARY. ALL DESIGN, PROCUREMENT AND FABRICATION INSIDE SOLID LINES IS VENDOR SCOPE.



This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.
17 Dec 2013

This document has been reviewed for OPSEC material, and none was found.
17 Dec 2013

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-10-M5-RO-00001 REV.6
BASED ON BLUE GRASS MSD 24915-10-NO-RO-00001 REV.2

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	07/26/11	IFC, INCORPORATED DCN-464	JAW	PEB	SA	BBB	BBB
2	05/20/10	IFC, ADDED PIPING COMMENTS	PEB	MDV	SA	BBB	BBB
1	08/21/09	IFC, GC 8483, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
0	08/15/07	ISSUED FOR CONSTRUCTION (IFC), TREND #00193	YWC	JP	PEB	RSA	BBB

QUALITY ☐ Q ☒ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING CANISTER FILTER & RO UNIT 0201 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
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DRAWING NUMBER 24915-10-M6-RO-00023 | SHEET 1 OF 1 | REV 3

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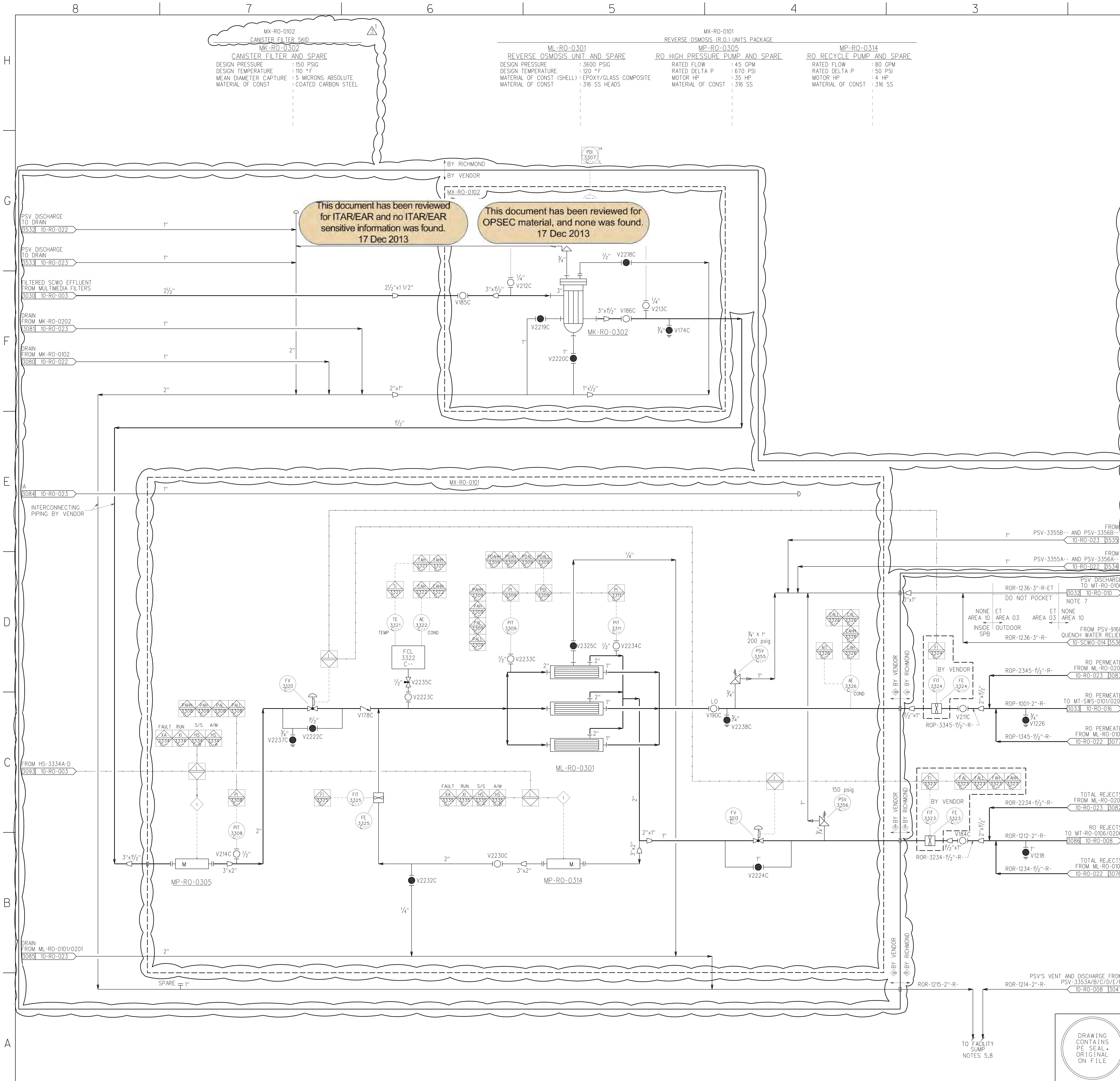

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
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5. ALL WATER RECOVERY SYSTEMS INCLUDING CHEMICAL INJECTION SKIDS, MULTIMEDIA FILTERS: MK-RO-0101A/B/C/D/E/F, PREFILTERS: MK-RO-0102/0202/0302, AND RO UNITS: ML-RO-0101/0201/0301 TO SHARE ONE COMMON CONTAINMENT AREA.
6. VENDOR TO PROVIDE LOW-POINT DRAIN VALVES.
7. RELIEF VALVE DISCHARGE FROM PSV'S ON REVERSE OSMOSIS UNITS ML-RO-0101, 0201 AND 0301 IS TO BE PIPED TO RO REJECT TANK MT-RO-0106. (OR MT-RO-0206 WHEN MT-RO-0106 IS DOWN FOR MAINTENANCE).
8. TO BE HARD PIPED TO FACILITY SUMP.
9. DELETED.
10. DELETED.
11. DASHED LINES DEFINE MODULE BOUNDARY. ALL DESIGN, PROCUREMENT AND FABRICATION INSIDE SOLID LINES IS VENDOR SCOPE.

BASED ON BLUE GRASS PFD 24915-10-M5-RO-00001 REV.6
BASED ON BLUE GRASS MSD 24915-10-NO-RO-00001 REV.2

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3 [1]	07/26/11	IFC, INCORPORATED DCN-464	JAW	PEB	SA	BBB	BBB
2 [4]	05/20/10	IFC, ADDED VENDOR DATA	PEB	MDV	SA	BBB	BBB
1 [13]	08/21/09	IFC, GC 8483, ADDED REVISED DESIGN REQUIREMENTS	JLL	PEB	BM	BBB	BBB
0	08/15/07	ISSUED FOR CONSTRUCTION (IFC), TREND #00193	YWC	JP	PEB	RSA	BBB

QUALITY ☐ Q ☒ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

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PROFESSIONAL STAMP

SCWO PROCESSING BUILDING CANISTER FILTER & RO UNIT 0301 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-RO-00024 | SHEET 1 OF 1 | REV 3

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MX-SCWO-0012
SCWO SOLIDS FEED ADDITIVE MODULE

MH-SCWO-0001 — FEED ADDITIVE WEIGH HOPPER
- WORKING VOLUME : 7 CU FT
- DIAMETER : 36 IN
- HEIGHT : 34 IN
- MATERIAL OF CONST : 316/316L

MH-SCWO-0002 — FEED ADDITIVE SCREW CONVEYOR NO.1
- MOTOR HP : 3 HP
- LENGTH : 25 FT
- RATED FLOW : 900 LB/HR
- MATERIAL OF CONST : 316/316L

MH-SCWO-0003 — FEED ADDITIVE SCREW CONVEYOR NO.2
- MOTOR HP : 3 HP
- LENGTH : 20 FT
- RATED FLOW : 900 LB/HR
- MATERIAL OF CONST : 316/316L

MH-SCWO-0004 — BULK BAG UNLOADER
- CAPACITY : 2000 LBS BAG
- LENGTH (BASE DIMENSION) : 60 IN
- WIDTH (BASE DIMENSION) : 60 IN
- HEIGHT : 199 IN
- MATERIAL OF CONST : MANUF. STD

MH-SCWO-0005 — AUTOMATED BULK BAG ADAPTER DISPENSER
- CAPACITY : 5.5 CU FT
- LENGTH : 30 IN
- WIDTH : 30 IN
- HEIGHT : 42 IN
- MATERIAL OF CONST : 316/316L

MD-SCWO-0001 — SLIDE GATE VALVE
- RATED FLOW : 900 LB/HR
- DIAMETER : 6 IN
- MATERIAL OF CONST : 316/316L

MD-SCWO-0002 — SLIDE GATE VALVE
- RATED FLOW : 900 LB/HR
- DIAMETER : 6 IN
- MATERIAL OF CONST : 316/316L

MD-SCWO-0003 — FEED ADDITIVE DIVERTER VALVE
- RATED FLOW : 900 LB/HR
- DIAMETER : 6 IN ROUND
- MATERIAL OF CONST : 316/316L

MD-SCWO-0004 — AIRLOCK ROTARY VALVE
- RATED FLOW : 900 LB/HR
- MOTOR HP : 0.5 HP
- MATERIAL OF CONST : 316/316L

MD-SCWO-0006 — SLIDE GATE VALVE
- RATED FLOW : 900 LB/HR
- DIAMETER : 6 IN
- MATERIAL OF CONST : 316/316L

MV-SCWO-0007 — BIN VENT DUST COLLECTOR
- MOTOR HP : 0.5 HP
- CAPACITY : 400 CFM

MF-SCWO-0012 — FLOOR HOPPER AGITATOR
- MOTOR HP : 0.5 HP
- MATERIAL OF CONST : 316

MF-SCWO-0013 — FLOOR HOPPER VIBRATOR
- PNEUMATIC
- MATERIAL OF CONST : MANUF. STD

MF-SCWO-0014 — WEIGH HOPPER AGITATOR
- MOTOR HP : 0.25 HP
- MATERIAL OF CONST : 316

MH-SCWO-0012 — BULK BAG HOIST/TROLLEY
- MOTOR HP : 2.5/0.5 HP
- MATERIAL OF CONST : MANUF STD
- CAPACITY : 2000 LB

MF-SCWO-0016 — TRANSITION DISCH ADAPTER VIBRATOR
- PNEUMATIC
- MATERIAL OF CONST : MANUF. STD

MF-SCWO-0015 — WEIGH HOPPER VIBRATOR
- PNEUMATIC
- MATERIAL OF CONST : MANUF. STD

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

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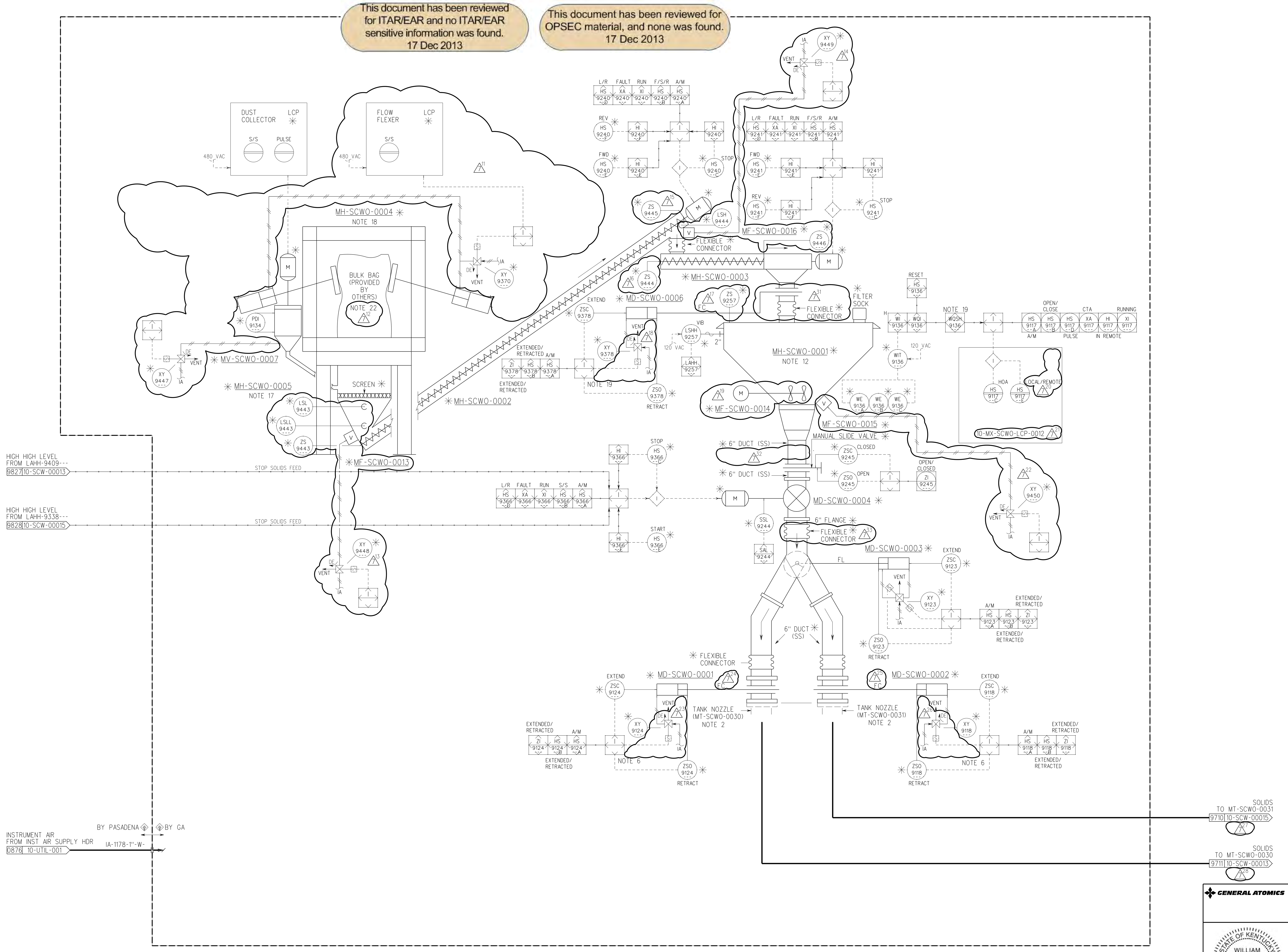

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. HARD CONNECTION DUCT TO TOP OF ASSOCIATED BLEND TANK.
6. PROGRAM AN INTERLOCK BETWEEN MD-SCWO-0001 AND MD-SCWO-0002 TO ENSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
7. * DENOTES VENDOR SUPPLIED.
11. ELECTRICAL AREA CLASSIFICATION: UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)
12. ALL CONNECTIONS TO WEIGH HOPPER (INCLUDING INSTRUMENT AIR LINE TO WEIGH HOPPER BIN DISCHARGER) TO BE FLEXIBLE. WEIGH HOPPER TO BE OF CYLINDRICAL DESIGN WITH THREE LEGGED SUPPORT STRUCTURE.
16. VENDOR RESPONSIBLE FOR DUST CONTROL SYSTEM.
17. MH-SCWO-0005 TO INCLUDE VENDOR SUPPLIED DE-LUMPING SCREEN, TO BE USED FOR SALT TRANSPORT ONLY (NOT REQUIRED FOR SULFUR TRANSPORT).
18. MH-SCWO-0004 TO INCLUDE SMALL CRANE FOR LIFTING BAG ONTO FRAME.
19. PROGRAM AN INTERLOCK TO OPEN MD-SCWO-0006 WHEN CONVEYOR MH-SCWO-0002 AND MH-SCWO-0003 ARE RUNNING, AND TO CLOSE MD-SWCO-0006 WHEN WQSH-9136 SIGNALS A HIGH OR COMPLETED WEIGHT LOAD AS WELL AS STOP CONVEYORS MH-SCWO-0002 AND MH-SCWO-0003.
22. SULFUR SUPERSACKS SHALL BE GROUNDED.
23. PROGRAM AN INTERLOCK TO ENSURE THAT ROTARY VALVE MD-SCWO-0004 CANNOT OPERATE UNLESS EITHER SLIDE GATE VALVE MD-SCWO-0001 OR -0002 IS OPEN.
24. CONVEYORS MH-SCWO-0002 AND MH-SCWO-0003 UTILIZE A ROUND WIRE SPIRAL CONFIGURATION FOR CONVEYING SOLID SULFUR DURING GB CAMPAIGN. SPIRAL MUST BE CHANGED TO A FLAT WIRE CONFIGURATION FOR CONVEYING SALT DURING VX AND H CAMPAIGNS.
25. FLOOR HOPPER AGITATOR MF-SCWO-0012, FLOOR HOPPER VIBRATOR MF-SCWO-0013, AND TRANSITION DISCHARGE ADAPTER VIBRATOR MF-SCWO-0016 ARE PROGRAMMED TO OPERATE DURING SALT TRANSPORT ONLY. THEY ARE NOT USED FOR SULFUR TRANSPORT.
26. NOTES 3, 4, 5, 8, 9, 10, 13, 14, 15, 20 AND 21 ARE DELETED.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

cn=Issued By Norbil Espiritu, o=General Atomics, ou=Configuration Management, email=Norbil.Espiritu@ga.com, c=US
2012.03.05 08:42:04 -08'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7		IFC (INCORPORATES DCN-442)	NL	WR	KWD	KWD	VN
6	05/24/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
5	05/24/10	IFC (UPDATED TO INCLUDE SULFUR FEED ADDITIVE)	NL	SY	KWD	DNW	VN
4	01/15/09	IFC (SHEET REDRAWN - INCORP. VENDOR DATA & GOV'T CMT. #7807)	NL	JL	KWD	DNW	VN
3	06/06/07	IFC (DELETED LSL-9257 AND MD-SCWO-0005)	NL	MD	KWD	DNW	VN
2	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

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US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING SOLID FEED ADDITIVES PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY — WILLIAM RICKMAN — 25486 — LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-SCWO-00021 | SHEET 1 OF 1 | REV 7

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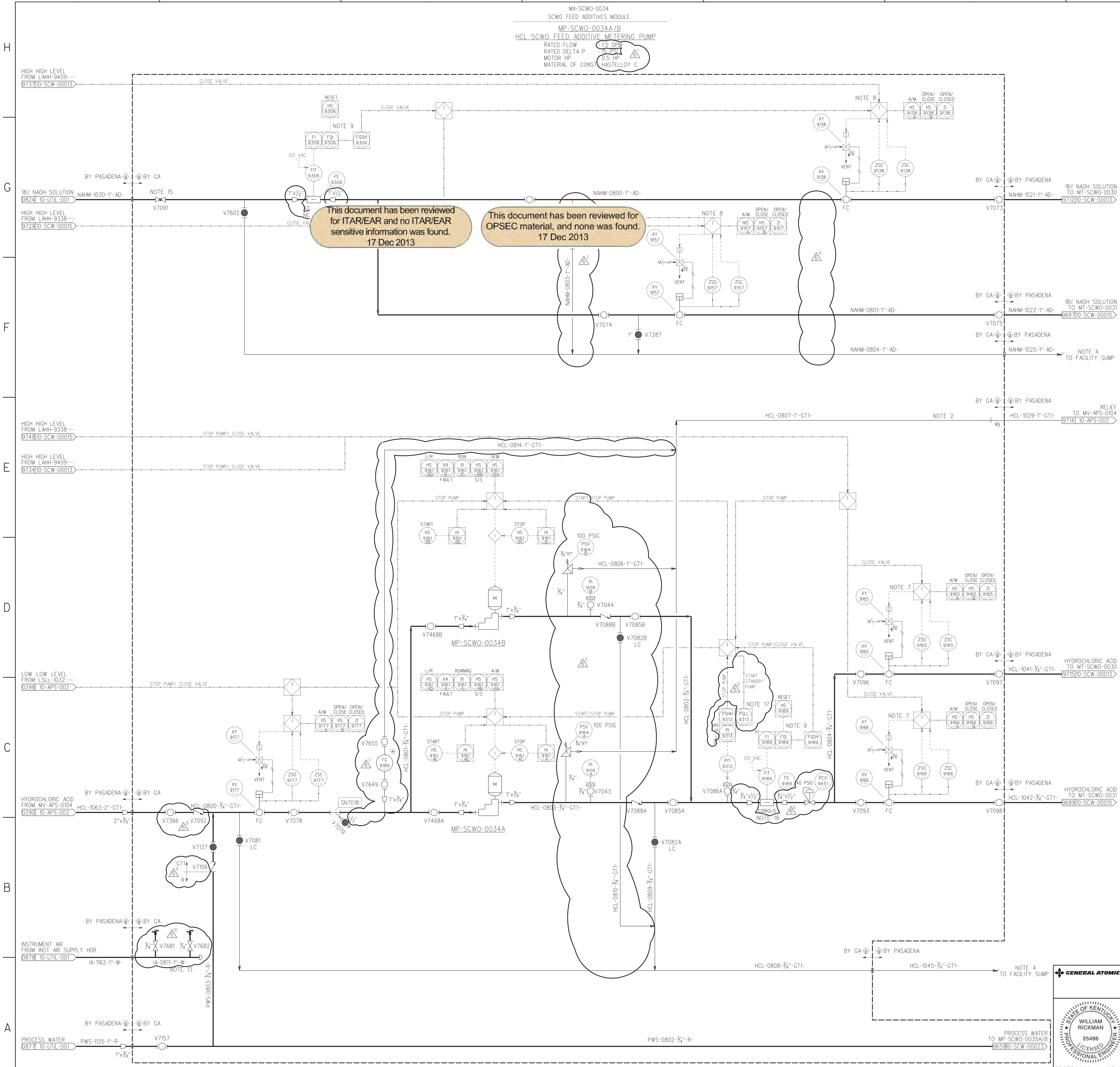

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

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GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. NO POCKETS. NO RESTRICTIONS IN LINE.
4. TO BE HARD PIPED TO FACILITY SUMP.
7. PROGRAM AN INTERLOCK BETWEEN VALVES XV-9165--- AND XV-9166--- TO ENSURE THAT NO MORE THAN ONE VALVE IS OPEN AT ANY TIME.
8. PROGRAM AN INTERLOCK BETWEEN VALVES XV-9138---, XV-9157--- AND XV-9435--- TO ENSURE THAT NO MORE THAN ONE VALVE IS OPEN AT ANY TIME.
9. FQI-9189--- AND FQI-9306 TO BE PROGRAMMED TO AUTOMATICALLY RESET TO ZERO UPON INITIALIZING "ADDITIVE FEED".
10. DENOTES DESIGN RESPONSIBILITY LABEL.
11. DESIGN SHALL INCLUDE WELDED PIPE (JOINTS) TO MAXIMUM EXTENT PRACTICAL, FLANGE SHIELDS AROUND FLANGED FITTINGS, AND DRIP-PROOF TRAYS BELOW FITTINGS AND OTHER POTENTIAL LEAK SOURCES. DESIGN TO INCLUDE SECONDARY CONTAINMENT TO CAPTURE FLANGE AND VALVE LEAKS.
13. COMMON INSTRUMENT AIR HEADER SERVICES COMPONENTS ON THIS PID AS WELL AS COMPONENTS ON PID 24915-10-M6-SCWO-00023.
15. OPERATIONS TO THROTTLE GLOBE VALVE V7091 TO OBTAIN THE REQUIRED FLOW TO MT-SCWO-0030 OR MT-SCWO-0031. FIT-9306 IS TO BE READABLE BY THE OPERATOR WHEN THROTTLING V7091, MANUAL VALVE LOCATED IN NAHM-1030-1"-AD TO BE USED TO ISOLATE MODULE FOR MAINTENANCE PURPOSES.
17. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 10 SECONDS, THE "LEAD" PUMP WILL STOP. IF THE "STANDBY" PUMP DOES NOT REACH THE NORMAL SET POINT WITHIN ANOTHER 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP. IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR PRESSURE TO FALL BELOW NORMAL.
18. VERIFY THE STRAIGHT RUN BETWEEN REDUCERS CONFORMS TO FLOW METER MANUFACTURER'S REQUIREMENTS.
19. NOTES 3, 5, 6, 12, 14 AND 16 ARE DELETED.

RCM Apvd

DN: cn=Issued by: Joe Murek, o=General Atomics, ou=Configuration Management, email=joe.murek@ga.com, c=US
Date: 2012.01.23 14:15:43 -08'00'

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INCORPORATES DCN-379)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/16/09	IFC (INC DESIGNATION OF "LC" VALVES AND ALARM DELETION)	NL	JL	KWD	DNW	VN
3	06/06/07	IFC (ADDED HOLD 1, REDUCERS AT PUMPS)	NL	MD	KWD	DNW	VN
2	03/15/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

SCWO PROCESSING BUILDING HCL AND NAOH FEED ADDITIVES PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-00022 | SHEET 1 OF 1 | REV 6

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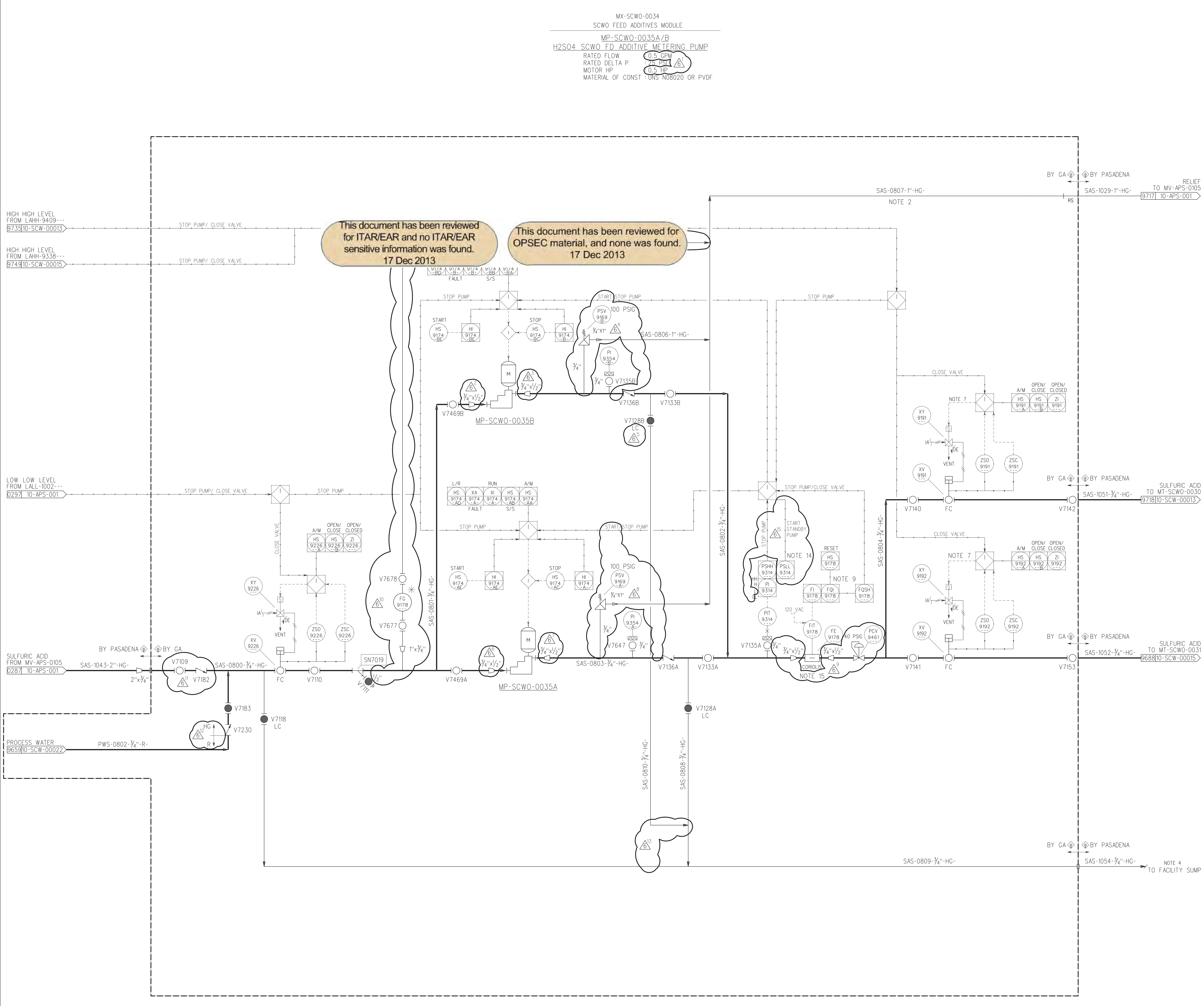

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. DO NOT POCKET. NO RESTRICTIONS INLINE.
4. TO BE HARD PIPED TO FACILITY SUMP.
7. PROGRAM AN INTERLOCK FOR VALVES XV-9191---AND XV-9192--- TO ENSURE THAT NOT MORE THAN ONE VALVE IS OPEN AT ANY TIME.
8. DESIGN SHALL INCLUDE WELDED PIPE (JOINTS) TO MAXIMUM EXTENT PRACTICAL, FLANGE SHIELDS AROUND FLANGED FITTINGS, AND DRIP-PROOF TRAYS BELOW FITTINGS AND OTHER POTENTIAL LEAK SOURCES. DESIGN TO INCLUDE SECONDARY CONTAINMENT TO CAPTURE FLANGE AND VALVE LEAKS.
9. FQI-9178--- TO BE PROGRAMMED TO AUTOMATICALLY RESET TO ZERO UPON INITIALIZING "ADDITIVE FEED".
10. DENOTES DESIGN RESPONSIBILITY LABEL.
14. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 10 SECONDS, THE "LEAD" PUMP WILL STOP. IF THE "STANDBY" PUMP DOES NOT REACH THE NORMAL SET POINT WITHIN ANOTHER 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP. IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR PRESSURE TO FALL BELOW NORMAL.
15. VERIFY THE STRAIGHT RUN BETWEEN REDUCERS CONFORMS TO FLOW METER MANUFACTURER'S REQUIREMENTS.
16. NOTES 3, 5, 6, 11, 12 AND 13 ARE DELETED.

cn=ISSUED by Jordan Finkelstein, o=Records and Configuration Mgmt, ou=General Atomics, email=jordan.finkelstein@ga.com, c=US
2012.01.23 15:31:47 -08'00'

RCM Apvd

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INCORPORATES DCN-379)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/16/09	IFC (INCORPORATES DESIGNATION OF "LC" VALVES)	NL	JL	KWD	DNW	VN
3	06/06/07	IFC (ADDED HOLD 1, REDUCERS AT PUMPS)	NL	MD	KWD	DNW	VN
2	03/15/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING H2SO4 FEED ADDITIVES PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-SCWO-00023 | SHEET 1 OF 1 | REV 6

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MX-SCWO-0021
SCWO FLUSH WATER HEATER MODULE

MS-SCWO-0020
FLUSH WATER HEATER

DUTY	: 80 KW (RATING)
DESIGN PRESSURE	: 150 PSIG
DESIGN TEMPERATURE	: 160 °F
MATERIAL OF CONST	: MFR. STD.
TRIM	: TRIM-0817-0"-R-HC

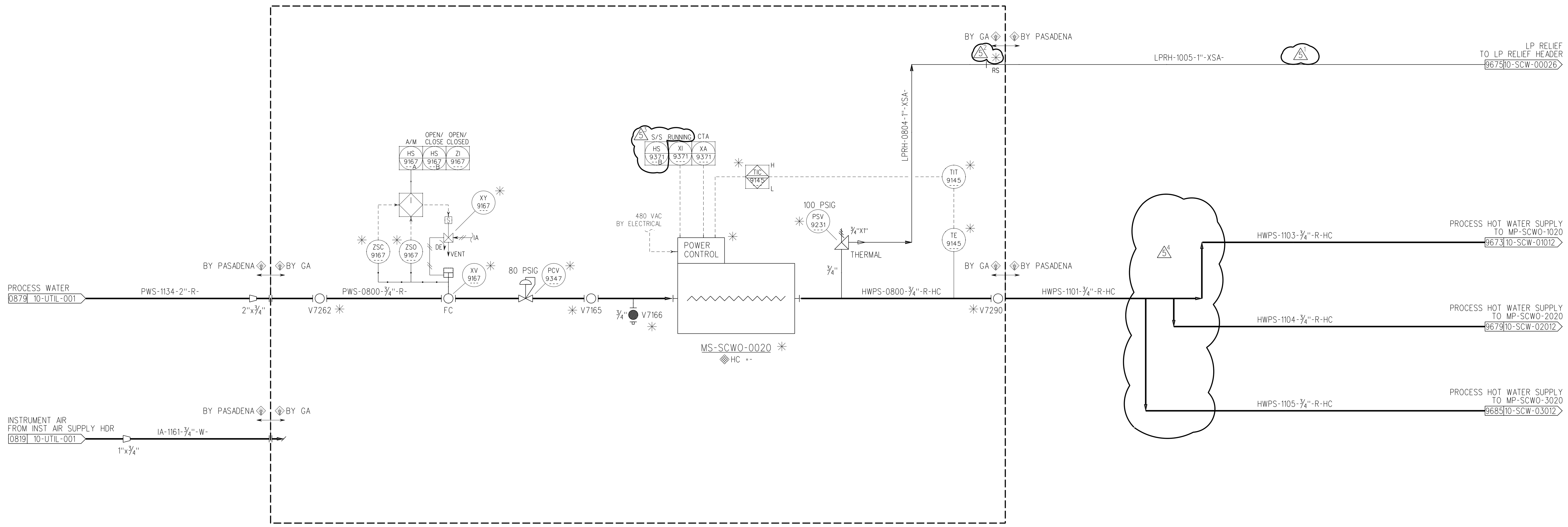
ASME CODE STAMPED VESSEL

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
4. FLUSH WATER HEATER SIZED TO SUPPORT TWO OPERATING SCWO TRAINS.
5. ✳ DENOTES VENDOR SUPPLIED.
7. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
8. ELECTRICAL AREA CLASSIFICATION:
   UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)
10. NOTES 2, 3, 6 AND 9 ARE DELETED.
    HOLD 1 HAS BEEN RESOLVED.

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



BASED ON BLUE GRASS PFD 24915-10M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

cn=Issued By Norbil Espiritu, o=General Atomics, ou=Configuration Management, email=Norbil.Espiritu@ga.com, c=US
2012.01.23 15:05:10 -08'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5		IFC (INC DCN-380)	NL	WR	KWD	KWD	VN
4	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
3	06/06/07	IFC (REMOVED HOLD 1)	JEM	MD	KWD	DNW	VN
2	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

SCWO PROCESSING BUILDING FLUSH WATER HEATER PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-00024 | SHEET 1 OF 1 | REV 5

BGCAPP_DGN.BDR

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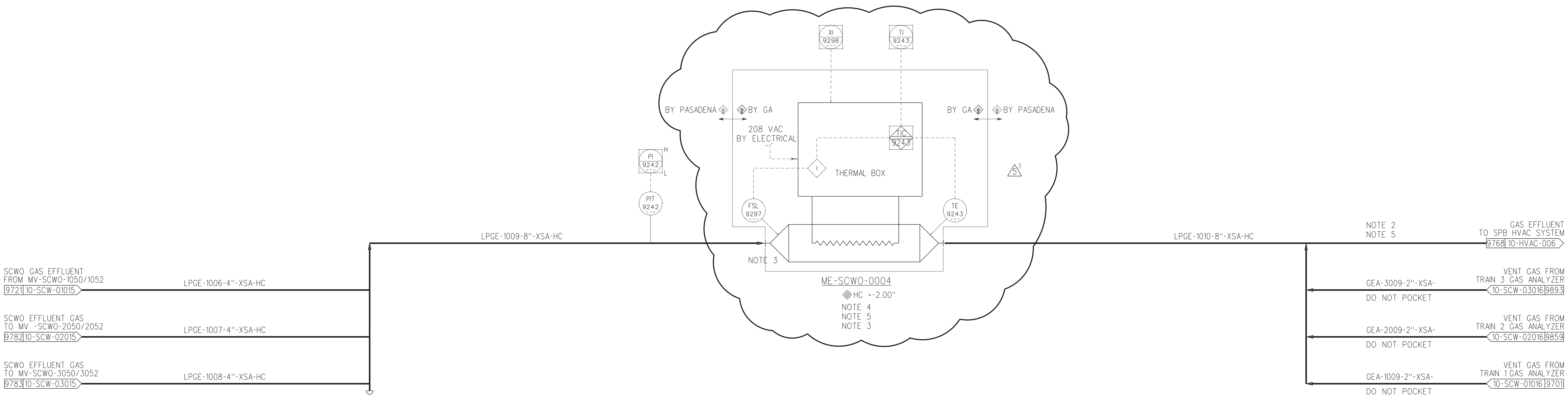
ME-SCWO-0004
GAS EFFLUENT DUCT HEATER
DUTY : 20 KW
DESIGN PRESSURE : 30 IN WC
DESIGN TEMPERATURE : 190 °F
MATERIAL OF CONST. : 316/316L WETTED PARTS

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. VENT LINE FINAL POINT OF CONNECTION TO SPB HVAC SYSTEM NOT TO BE HARD PIPED.
3. DUCT HEATER DIMENSIONS DEPENDENT UPON FINAL VENDOR SELECTION.
4. GA TO SUPPLY DUCT HEATER, WITH INSTRUMENTATION, AND PIT-9242---. PASADENA TO INSTALL THESE ITEMS AS WELL AS SUPPLY AND INSTALL INSULATION SUPPORTS AND ASSOCIATED PIPING.
5. HEATER VENDOR RECOMMENDS MECHANICALLY STRENGTHENING CONNECTING PIPING (e.g. ANGLE IRONS, CHAINS, ETC.) AND INSULATING PIPING IN IMMEDIATE AREA OF HEATER TO PREVENT EXCESSIVE HEAT LOSS.
6. HEATER TO BE INSTALLED IN ELECTRICALLY UNCLASSIFIED AREA.
11. NOTES 7, 8, 9 AND 10 ARE DELETED. HOLD 1 HAS BEEN RESOLVED.



BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

DN: cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
Date: 2012.10.02 09:44:22 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5		IFC (INCORPORATES DCN-679)	NL	WR	KWD	KWD	DJ
4	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	DJ
3	06/06/07	IFC (REMOVED HOLD 1, GAS ANALYZERS CONN'D TO LPGE-1010 LINE)	JEM	MD	KWD	NW	DJ
2	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	NW	DJ
1	08/07/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	NW	DJ
0	10/21/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	NW	DJ

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING GAS EFFLUENT DUCT HEATER PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-00027 | SHEET 1 OF 1 | REV 5

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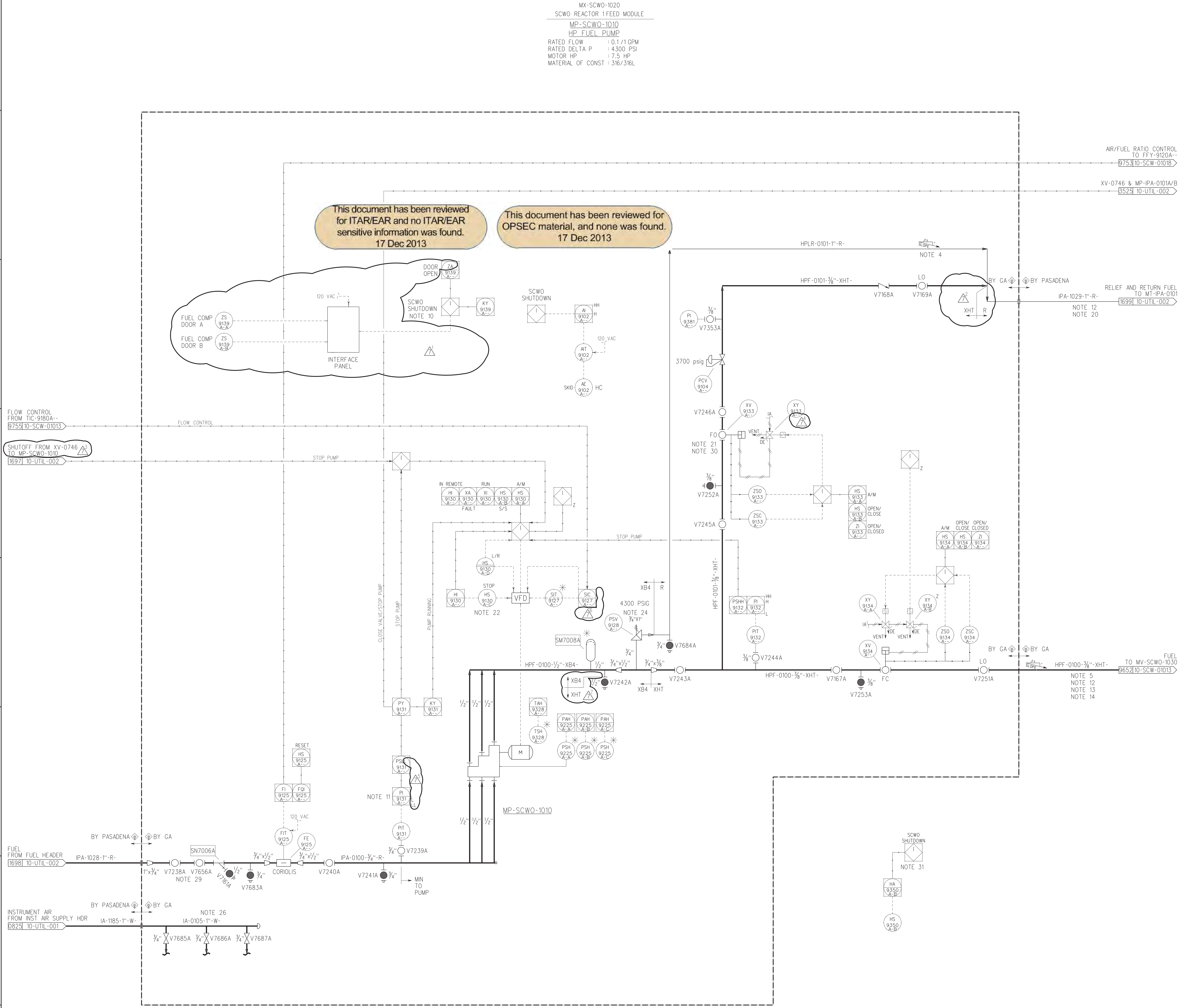

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
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   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. ELECTRICAL AREA CLASSIFICATION: CLASS 1, DIVISION 2, GROUP D.
4. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS FUEL TANK, AND WITH NO POCKETS.
5. INTERCONNECTING (FUEL: IPA) PIPING BY GA. HPF-0100-3/8"-XHT SHALL BE DOUBLE CONTAINED WITHIN A 3/4" PIPE (MIN) XSA SHALL BE THIS PIPE'S DESIGNATION.
10. SYSTEM SHUTDOWN UPON OPENING OF CLASSIFIED COMPARTMENT DOOR (AFTER SPECIFIED TIME DELAY).
11. SHUTDOWN HP FUEL PUMP UPON LOW LOW PRESSURE ALARM WHEN PUMP IS RUNNING. IN ADDITION, FIRE ALARM CONTROL SYSTEM PER P.M. ACWA.
12. FUEL PIPING IS ALL WELDED TO MAXIMUM PRACTICAL EXTENT.
13. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.
14. PROVIDE PROTECTION AROUND HIGH PRESSURE FUEL VALVES, FLANGES, AND FITTINGS TO PREVENT POTENTIAL IGNITION AT EXPOSED SURFACE. PROVIDE CONTAINMENT AROUND EXPOSED HIGH PRESSURE FUEL PIPING.
15. DEDICATED SKID VENTILATION (ELECTRICAL CLASSIFICATION AREA CLASS 1, DIVISION 2, GROUP D) IS REQUIRED TO PREVENT CROSS-VENTILATION OF POTENTIAL HAZARDOUS FUEL (IPA) VAPORS INTO UNCLASSIFIED AREAS.
17. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN AN UNCLASSIFIED (NON-HAZARD) AREA.
19. DENOTES DESIGN RESPONSIBILITY LABEL.
20. NO VALVES, RESTRICTIONS AND NO POCKETS ARE TO BE ALLOWED IN THIS LINE.
21. THE FOLLOWING VALVE(S) ARE NORMALLY CLOSED:
   XV-9133A--
22. VFD TO BE PROVIDED BY PASADENA.
23. ✳ DENOTES VENDOR SUPPLIED.
24. PSV-9128A-- RELIEF VALVE INCREASED IN SIZE (FROM RELIEF VALVE SIZING DOCUMENT) DUE TO REQUIREMENT FOR PIPING INSTALLATION.
26. COMMON INSTRUMENT AIR HEADER SERVICES SCWO REACTOR 1 FEED MODULE COMPONENTS ON THIS PID AND SCWO PID 24915-10-M6-SCWO-01012.
29. DOUBLE MANUAL BLOCK VALVE ON INLET TO FEED SKID PER PRELIMINARY HAZARD ANALYSIS FOR SCWO FIRE & ELECTRICAL AREA CLASSIFICATION.
30. XV-9133A-- SHALL BE PROGRAMMED SO THAT IT CANNOT OPEN WHILE IPA FUEL IS FEEDING THE SCWO REACTOR THROUGH XV-9389A--. IN ADDITION, AS A PERMISSIVE FUNCTION THE IPA FUEL FLOW TO THE SCWO REACTOR THROUGH XV-9389A-- CANNOT START IF XV-9133A-- IS OPEN.
31. FPS SHUTDOWN SWITCH TO BE LOCATED AT GRADE, NEAR WEST END OF SCWO FEED SKID.
32. NOTES 3, 6, 7, 8, 9, 16, 18, 25, 27 AND 28 ARE DELETED.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Configuration / Data Management, email=Judy.dishon@ga.com, c=US
2013.06.18 09:31:26 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
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6	01-23-12	IFC (INCORPORATES DCN-381)	NL	WR	KWD	KWD	VN
5	11-16-10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01-15-09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
3	06-04-07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN
2	03-16-07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08-08-06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10-21-05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

SCWO PROCESSING BUILDING TRAIN 1 REACTOR FUEL FEED PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-01011 | SHEET 1 OF 1 | REV 7

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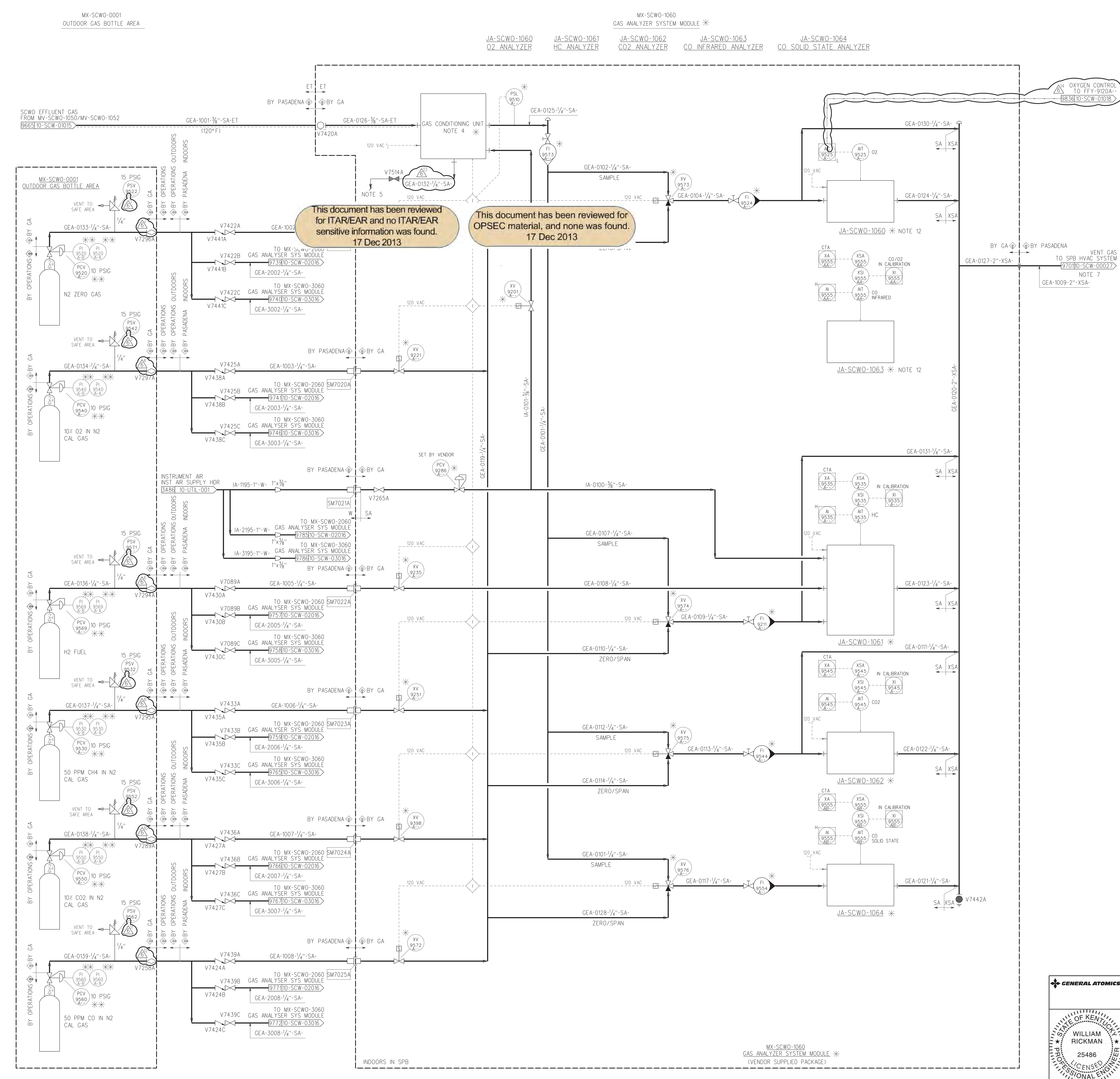

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
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   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
4. GAS CONDITIONING UNIT TO CONSIST OF CONDENSER, PERISTALTIC PUMPS, GAS FILTER, BACK PRESSURE REGULATOR AND 1-GALLON CONDENSATE RESERVOIR.
5. TO BE PERIODICALLY MANUALLY DRAINED BY OPERATIONS.
6. DENOTES DESIGN RESPONSIBILITY LABEL.
7. VENT LINE FINAL POINT OF CONNECTION TO SPB HVAC SYSTEM NOT TO BE HARD PIPED.
8. ✳ DENOTES VENDOR SUPPLIED - BY GAS ANALYZER SUPPLIER.
   ✳✳ DENOTES VENDOR SUPPLIED - BY GAS CYLINDER SUPPLIER.
10. FIELD WIRING TO GAS ANALYZER JUNCTION BOX BY PASADENA.
12. JA-SCWO-1060 IS INTEGRAL WITH JA-SCWO-1063.
15. NOTES 2, 3, 9, 11, 13 AND 14 ARE DELETED.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2012.01.23 13:46:03 -08'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INC DCN-382)	NL	SY	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	SY	KWD	KWD	VN
4	01/15/09	IFC (INCORPORATES GOV'T AND BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
3	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	NL	MD	KWD	DNW	VN
2	03/16/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING TRAIN 1 GAS ANALYZER SYSTEM PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-01016 | SHEET 1 OF 1 | REV 6

BGCAPP_DGN.BDR

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MX-SCWO-1020
SCWO REACTOR 1 FEED MODULE

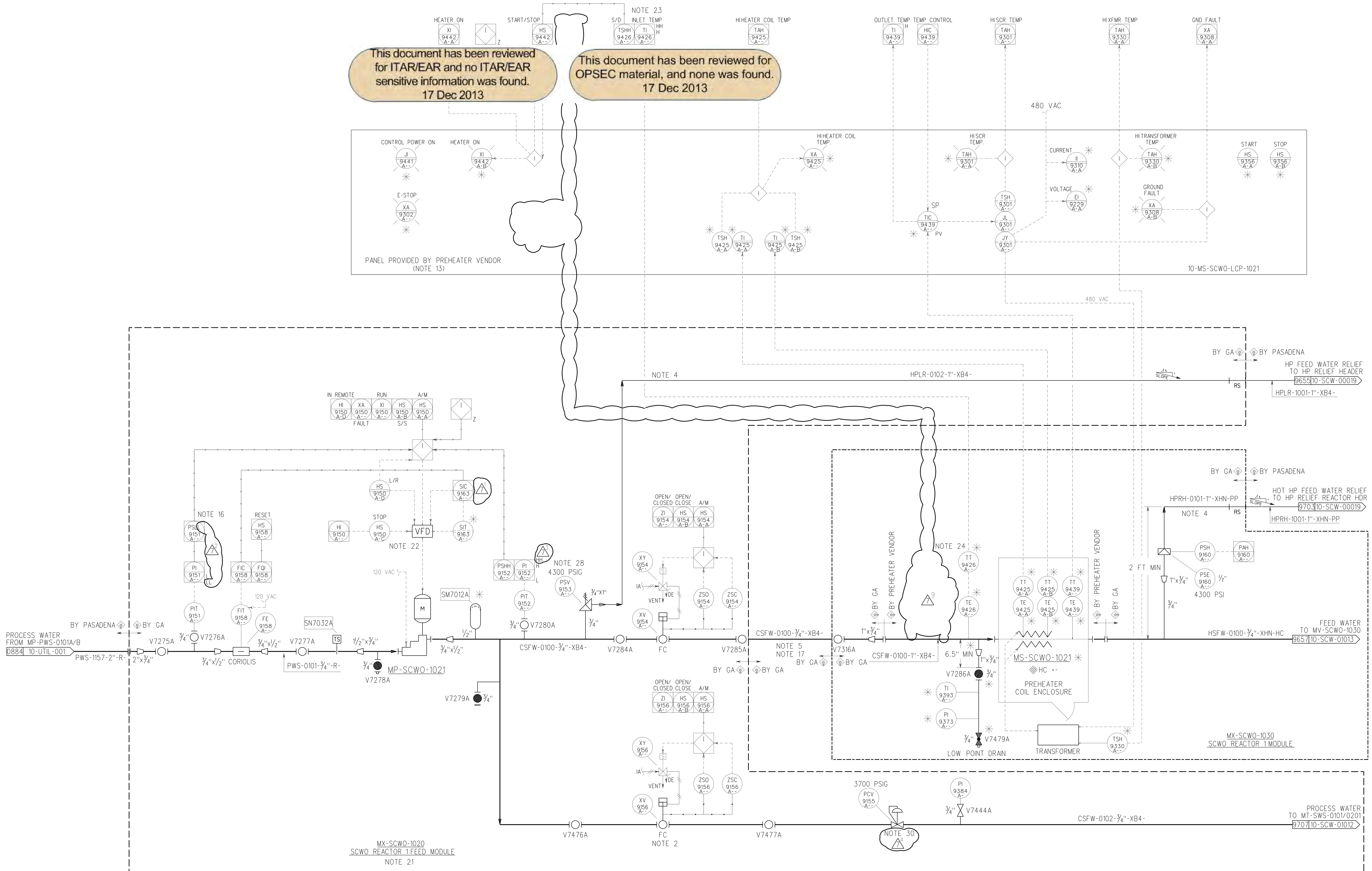
MP-SCWO-1021
FEED WATER PUMP
RATED FLOW : 0.2/1.2 GPM
RATED DELTA P : 4300 PSI
MOTOR HP : 10 HP
MATERIAL OF CONST : 316/316L

MX-SCWO-1030
SCWO REACTOR 1 MODULE

MS-SCWO-1021
FEED WATER PREHEATER
DUTY : 370 KW (RATING)
DESIGN PRESSURE : 4300 PSIG
DESIGN TEMPERATURE : 1225 °F
MATERIAL OF CONST : UNS N08811 (HEATER COIL)
TRIM : TRIM-0805-0"-XHN-HC
ASME CODE STAMPED VESSEL

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
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   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015

2. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV-9156A--

4. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, AND WITH NO POCKETS.

5. INTERCONNECTING PIPING BY GA.

12. ✳ DENOTES VENDOR SUPPLIED.

13. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN UNCLASSIFIED (NON-HAZARD) AREA.

14. ADDITIONAL INSTRUMENT AIR, INSTRUMENTATION OR PIPING WILL BE ADDED AS REQUIRED AFTER EQUIPMENT IS SPECIFIED BY VENDOR.

16. SHUT-OFF FEED WATER PUMP UPON LOW LOW ALARM WHEN PUMP IS RUNNING.

17. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.

18. DENOTES DESIGN RESPONSIBILITY LABEL.

21. ELECTRICAL CLASSIFICATION AREA:
    UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)

22. VFD'S TO BE PROVIDED BY PASADENA.

23. UPON HIGH-HIGH FEED WATER TEMPERATURE ALARM, THE PRE-HEATER AND SCWO SYSTEM SHALL SHUT DOWN.

24. VENDOR SHALL PROVIDE A ROSEMOUNT SMART "RAIL MOUNT" (M/N 644R) TEMPERATURE TRANSMITTER. VENDOR SHALL PROVIDE THREE-WIRE 100 OHM RTD'S.

26. PASADENA TO PROVIDE POWER CABLE TO THE PREHEATER CONTROLLER. ALSO, PASADENA TO PROVIDE POWER CABLE FROM PREHEATER CONTROLLER TO THE PREHEATER UNIT ON THE MODULE AS WELL AS INSTRUMENT AND CONTROL WIRING AND CONDUIT.

28. ORIENT RELIEF VALVE VERTICALLY TO PRECLUDE PARTICULATE BUILD-UP.

30. PCV-9155A SETPOINT IS FOR PUMP CALIBRATION ONLY. SETPOINT TO BE ADJUSTED DOWN FOR OPERATION TO ALLOW PUMP RE-START AT NO LOAD.

31. NOTES 3, 6, 7, 8, 9, 10, 11, 15, 19, 20, 21, 25, 27 AND 29 ARE DELETED.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.06.27 08:00:13 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7		IFC (INCORPORATES DCN-1040 & -1128)	NL	WR	KWD	KWD	VN
6	01/25/12	IFC (INCORPORATES DCN-381)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/15/09	IFC (CHANGE INDICATED VALVES TO BALL VALVES AND ADD NOTES)	NL	JL	KWD	DNW	VN
3	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN
2	03/16/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING TRAIN 1 FEED WATER AND PREHEATER PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-01017 | SHEET 1 OF 1 | REV 7

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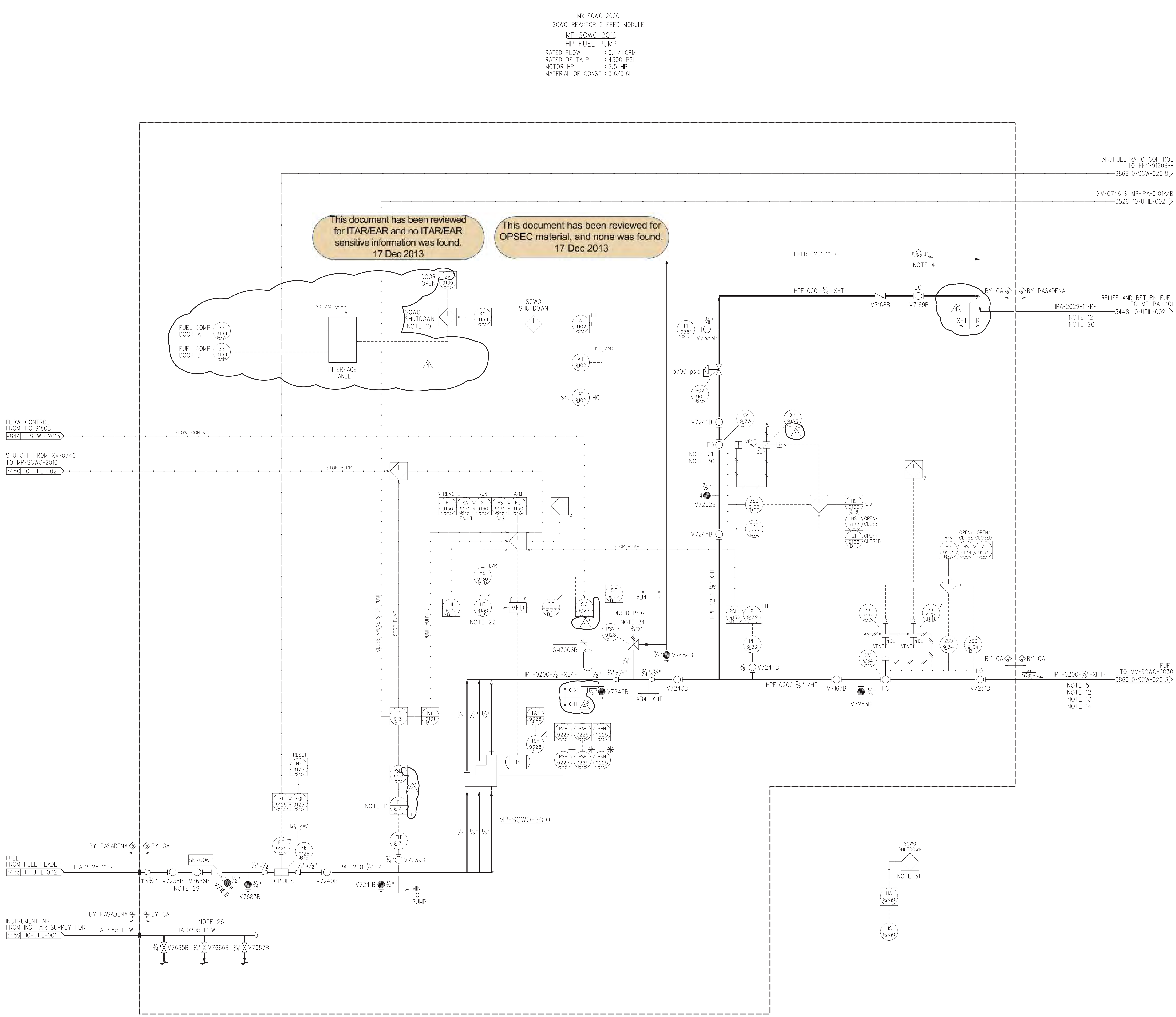

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015

2. ELECTRICAL AREA CLASSIFICATION: CLASS 1, DIVISION 2, GROUP D.

4. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS FUEL TANK, AND WITH NO POCKETS.

5. INTERCONNECTING (FUEL: IPA) PIPING BY GA. HPF-0200-3/8"-XHT SHALL BE DOUBLE CONTAINED WITHIN A 3/4" PIPE (MIN) XSA SHALL BE THIS PIPE'S DESIGNATION.

10. SYSTEM SHUTDOWN UPON OPENING OF CLASSIFIED COMPARTMENT DOOR (AFTER SPECIFIED TIME DELAY).

11. SHUTDOWN HP FUEL PUMP UPON LOW LOW PRESSURE ALARM WHEN PUMP IS RUNNING. IN ADDITION, FIRE ALARM CONTROL SYSTEM PER P.M. ACWA.

12. FUEL PIPING IS ALL WELDED TO MAXIMUM PRACTICAL EXTENT.

13. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.

14. PROVIDE PROTECTION AROUND HIGH PRESSURE FUEL VALVES, FLANGES, AND FITTINGS TO PREVENT POTENTIAL IGNITION AT EXPOSED SURFACE. PROVIDE CONTAINMENT AROUND EXPOSED HIGH PRESSURE FUEL PIPING.

15. DEDICATED SKID VENTILATION (ELECTRICAL CLASSIFICATION AREA CLASS 1, DIVISION 2, GROUP D) IS REQUIRED TO PREVENT CROSS-VENTILATION OF POTENTIAL HAZARDOUS FUEL (IPA) VAPORS INTO UNCLASSIFIED AREAS.

17. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN AN UNCLASSIFIED (NON-HAZARD) AREA.

19. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.

20. NO VALVES, RESTRICTIONS AND NO POCKETS ARE TO BE ALLOWED IN THIS LINE.

21. THE FOLLOWING VALVE(S) ARE NORMALLY CLOSED:
    XV-9133B--

22. VFD TO BE PROVIDED BY PASADENA.

23. ✳ DENOTES VENDOR SUPPLIED.

24. PSV-9128B-- RELIEF VALVE INCREASED IN SIZE (FROM RELIEF VALVE SIZING DOCUMENT) DUE TO REQUIREMENT FOR PIPING INSTALLATION.

26. COMMON INSTRUMENT AIR HEADER SERVICES SCWO REACTOR 2 FEED MODULE COMPONENTS ON THIS PID AND SCWO PID 24915-10-M6-SCWO-02012.

29. DOUBLE MANUAL BLOCK VALVE ON INLET TO FEED SKID PER PRELIMINARY HAZARD ANALYSIS FOR SCWO FIRE & ELECTRICAL AREA CLASSIFICATION.

30. XV-9133B-- SHALL BE PROGRAMMED SO THAT IT CANNOT OPEN WHILE IPA FUEL IS FEEDING THE SCWO REACTOR THROUGH XV-9389B--. IN ADDITION, AS A PERMISSIVE FUNCTION THE IPA FUEL FLOW TO THE SCWO REACTOR THROUGH XV-9389B-- CANNOT START IF XV-9133B-- IS OPEN.

31. FPS SHUTDOWN SWITCH TO BE LOCATED AT GRADE, NEAR WEST END OF SCWO FEED SKID.

32. NOTES 3, 6, 7, 8, 9, 16, 18, 25, 27 AND 28 ARE DELETED.

DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01011

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Configuration / Data Management, email=Judy.dishon@ga.com, c=US 2013.06.18 11:16:44 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4		IFC (INCORPORATES DCN-1040)	NL	WR	KWD	KWD	VN
3	09/06/12	IFC (INCORPORATES DCN-741)	NL	WR	KWD	KWD	VN
2	11/16/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATE TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

SCWO PROCESSING BUILDING TRAIN 2 REACTOR FUEL FEED PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-02011 | SHEET 1 OF 1 | REV 4

BGCAPP_DGN.BDR

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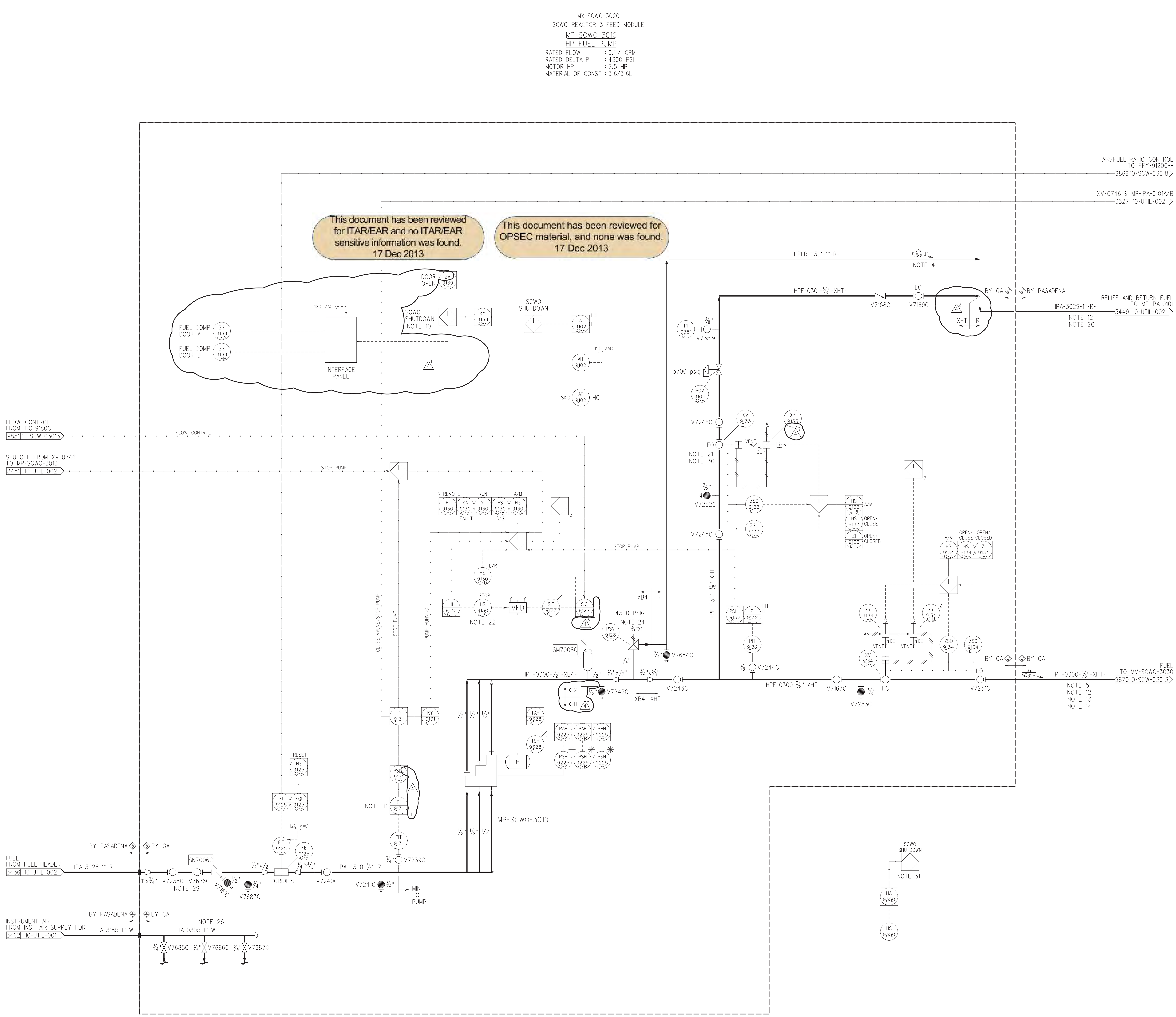

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. ELECTRICAL AREA CLASSIFICATION: CLASS 1, DIVISION 2, GROUP D.
4. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS FUEL TANK, AND WITH NO POCKETS.
5. INTERCONNECTING (FUEL: IPA) PIPING BY GA. HPF-0300-3/8"-XHT SHALL BE DOUBLE CONTAINED WITHIN A 3/4" PIPE (MIN) XSA SHALL BE THIS PIPE'S DESIGNATION.
10. SYSTEM SHUTDOWN UPON OPENING OF CLASSIFIED COMPARTMENT DOOR (AFTER SPECIFIED TIME DELAY).
11. SHUTDOWN HP FUEL PUMP UPON LOW LOW PRESSURE ALARM WHEN PUMP IS RUNNING. IN ADDITION, FIRE ALARM CONTROL SYSTEM PER P.M. ACWA.
12. FUEL PIPING IS ALL WELDED TO MAXIMUM PRACTICAL EXTENT.
13. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.
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15. DEDICATED SKID VENTILATION (ELECTRICAL CLASSIFICATION AREA CLASS 1, DIVISION 2, GROUP D) IS REQUIRED TO PREVENT CROSS-VENTILATION OF POTENTIAL HAZARDOUS FUEL (IPA) VAPORS INTO UNCLASSIFIED AREAS.
17. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN AN UNCLASSIFIED (NON-HAZARD) AREA.
19. DENOTES DESIGN RESPONSIBILITY LABEL.
20. NO VALVES, RESTRICTIONS AND NO POCKETS ARE TO BE ALLOWED IN THIS LINE.
21. THE FOLLOWING VALVE(S) ARE NORMALLY CLOSED:
   XV-9133C--
22. VFD TO BE PROVIDED BY PASADENA.
23. ✳ DENOTES VENDOR SUPPLIED.
24. PSV-9128C-- RELIEF VALVE INCREASED IN SIZE (FROM RELIEF VALVE SIZING DOCUMENT) DUE TO REQUIREMENT FOR PIPING INSTALLATION.
26. COMMON INSTRUMENT AIR HEADER SERVICES SCWO REACTOR 3 FEED MODULE COMPONENTS ON THIS PID AND SCWO PID 24915-10-M6-SCWO-03012.
29. DOUBLE MANUAL BLOCK VALVE ON INLET TO FEED SKID PER PRELIMINARY HAZARD ANALYSIS FOR SCWO FIRE & ELECTRICAL AREA CLASSIFICATION.
30. XV-9133C-- SHALL BE PROGRAMMED SO THAT IT CANNOT OPEN WHILE IPA FUEL IS FEEDING THE SCWO REACTOR THROUGH XV-9389C--. IN ADDITION, AS A PERMISSIVE FUNCTION THE IPA FUEL FLOW TO THE SCWO REACTOR THROUGH XV-9389C-- CANNOT START IF XV-9133C-- IS OPEN.
31. FPS SHUTDOWN SWITCH TO BE LOCATED AT GRADE, NEAR WEST END OF SCWO FEED SKID.
32. NOTES 3, 6, 7, 8, 9, 16, 18, 25, 27 AND 28 ARE DELETED.

DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01011

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.06.18 13:21:52 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4		IFC (INCORPORATES DCN-1040)	NL	WR	KWD	KWD	VN
3	09/06/12	IFC (INCORPORATES DCN-741)	NL	WR	KWD	KWD	VN
2	11/16/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING TRAIN 3 REACTOR FUEL FEED PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

DRAWING NUMBER 24915-10-M6-SCWO-03011

SHEET 1 OF 1

REV 4

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BECHTEL PARSONS BLUE GRASS

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Calculation Cover Sheet

Project	Job No.	Calc No.	Sheet
Blue Grass Chemical Agent Destruction Pilot Plant	743341	24915-11-DBC-00-00002	1 of 3

Subject	Group
HSA Mat Foundation Containment Capacity Evaluation	Structural

Calculation Status Designation	Preliminary	Committed Preliminary	Confirmed	Superseded	Voided
	☐	☒	☐	☐	☐

Computer Program/ Type	SCP	Mainframe	PC	Program No.	Version/Release No.
	☐	☐	☒	MATHCAD	Version 15

Program Validated: ☒ Yes ☐ No Program validation is available in PPCP/InfoWorks

Notes/comments

The HSA Area Tanks and Pipe Rack Foundation is a slab-on-grade supporting (5) Storage Tanks, a Steel Rack for the Pipes and Cable-trays and Pumps serving the HSA facility. The reinforced concrete foundation is 2' – 6" thick slab with 10" thick reinforced wall around the perimeter. The wall serves as containment in case of accidental spillage of the contents of the largest tank.

The 2' 6" thick Slab has a sloped top and bottom. The sloped top surface drains the spilled effluent into a trench located along the South-side. The top elevation of the wall is at the same elevation all-around the perimeter of the mat Foundation.

The Accidental spillage is considered as the contents of the largest Tank's air-volume, plus the occurrence of maximum expected rainfall.

This calculation concludes that the containment capacity is adequate.

Reason for revision A to B: Incorporate comment by Environmental group. See Sheet B5

Reason For revision B to C: Incorporate Environmental comments and incorporate DCN-260, DCN-324 and DCN-438. Revised Appendix A and added Extracts of DCN-260, -324 and -438 to Attachment C.

QUALITY LEVEL: ☐ Q ☒ Non-Q

No.	Reason for Revision	Total No. of Sheets	Last Sheet No.	By	Checked	Approved/ Accepted	Date
				AFR	MB	HC	
C	Issued for Approval (IFA)	28	3	AFR	MB	HC	7/9/12
B	Issued for Approval (IFA)	21	3	AFR	MB	HC	9-22-10
A	Issued for Approval (IFA)	20	3	AFR	MB	HC	4-19-2010

RECORD OF REVISIONS

Table of Contents **Page**

1. **Objective**

This calculation performs evaluation that the HSA Mat containment volume capacity is adequate to contain the accidental spillage of the largest Tank's contents.

2. **Input**

2.1 HSA foundation drawings, 24915-11-DB-00-00001 thru -00011 and DCNS # 24915-00-30E-G01-00260, -00324 and -00438. See Attachment C.

2.2 E-mail from Process, Volume capacity of the largest Tank. See Attachment B, sheet B2.

2.3 E-mail for rainfall considerations. See Attachment B, sheet B3.

3. **Assumptions**

The Tank information is based on preliminary Tank data sheets and requires confirmation.

4. **References**

4.1 Tank data sheets, 24915-11-MTD-HSS-00001 thru -00003 (project folders)

4.2 Pump data sheets, 24915-000- V2A-MPCA-00019, -00023, -00024 and -00025
24915-000-V1A-MPP0-00017

4.3 DCN 24915-24915-00-30E-G01-00260, -00324 and -00438

5. **Calculation Body**

See Appendix A

6. **Summary of Results**

Volume available = 83131 cu. Ft > Containment capacity required = 83122 cu. Ft.

7. **Appendices/Attachments**

Appendix A, Tank Foundation Volumetric Containment Capacity

Attachment B, Input Information

Attachment C, HSA Area Foundation design drawings and Extracts from associated Design Change Notices.

APPENDIX A

Tank Foundation Volumetric Containment Capacity

Body of Calculation

Mat with Wall height from 4' at north-end to 5' - 4" at south-end, average height $h_{avg} := 4ft + 8in = 4.67\,ft$

Mat net north-south dimension, 258' - 4" minus (2), 10" walls $L_{ns} := 256ft + 8in = 256.67\,ft$

Mat net east-west dimension, 90' minus (2), 10" walls $W_{ew} := 88ft + 4in = 88.33\,ft$

use Free-board $h_{fb} := 1 \cdot ft$ conservative

Case 1 available volume with free-board $V_{avail} := \left[\left(h_{avg} - h_{fb}\right) \cdot L_{ns} \cdot W_{ew}\right] = 83131 \cdot ft^3$

Tank contents spill volume as the largest Tank air-vol [Ref. 4.1]

Tank No	Diameter (ft)	Tank Ht (ft)	Air-Vol (ft^3)	
MT-HSS-0704	37	42.33	45520	
MT-HSS-0604	37	42.33	45520	
MT-HSS-0105	38.5	42.33	49285	<--largest
MT-HSS-0104	24	35	15836	
MT-HSS-0205	38.5	42.33	49285	

$$V_{spill} := 49285 \cdot ft^3$$

Tank-pad vol based on Diameter of Tank ~ Diameter of pad x submerged height ~ average height of wall.

Tank No	Diameter (ft)	Submerge avg Ht (ft)	Vol (ft^3)	
MT-HSS-0704	37	4.67	5022	
MT-HSS-0604	37	4.67	5022	
MT-HSS-0105	38.5	4.67	5437	
MT-HSS-0104	24	4.67	2113	
MT-HSS-0205	38.5	4.67	5437	
		total	23031	ft^3

$$V_{tkpad} := 23031 \cdot ft^3$$

Pump Pads, with top of Pad elevation ~ 911' - 1" conservatively for all pump-pads, the height varies from 1' -7" to 2' - 11" gives 2' - 2" average, use ~ 2.25' conservatively to derive Volume as follows, [Ref. 4.3]

Pump No	Pump Description	Pad Size (in)	Total Area (ft^2)	Average Height (ft)	Volume (ft^3)	
MP-HSS-0604A/B	Energetics Hydrolysate	27x52	19.5	2.67	52.07	
MP-HSS-0704A/B	Energetics Hydrolysate	27x52	19.5	2.67	52.07	
MP-HSS-0605A/B	Energetics Hydrolysate Recirc	30x60	25	2.67	66.75	
MP-HSS-0705A/B	Energetics Hydrolysate Recirc	30x60	25	2.67	66.75	
MP-HSS-0108A/B	Aqueous Hydrolysate	30x60	25	2.67	66.75	
MP-HSS-0208A/B	Aqueous Hydrolysate	24x46	15.3	2.67	40.94	
MP-HSS-0107A/B	Aqueous Hydrolysate	24x46	15.3	2.67	40.94	
MP-HSS-0104A/B	Organic Hydrolysate	24x48	16	2.67	42.72	
MP-HSS-0105A/B	Organic Hydrolysate	24x48	16	2.67	42.72	
MP-HSS-0205A/B	Organic Hydrolysate	24x48	16	2.67	42.72	
MP-HSS-0101	Agent Hydrolysate TK Area Sump	21x19	2.8	2.67	7.40	
				sub-total	522	ft^3

C

$$V_{pumpp} := 522 \cdot ft^3$$

Pipe and Cable-tray Rack Piers, with top of concrete elevation of ~ 910' - 6", the height varies from 6" to 1' - 10" gives Volume as follows, [Ref. 2.4]

(26) Rack Piers x 2' - 6" square Pier x average height 1' - 2" =

$$V_{rackp} := 26 \cdot 2.5ft \cdot 2.5ft \cdot 1.167ft = 190\, ft \cdot ft^2$$

(5) Stair-case stoops x 4' - 0" x 1' - 7" with average height 1' - 6" =

C

(10) Stair-case pedestals x 18" x 18" with average height 1' - 6" =

$$V_{stairp} := (5 \cdot 4ft \cdot 1.583ft \cdot 1.5ft) + (10 \cdot 1.5ft \cdot 1.5ft \cdot 1.5ft) = 81 \cdot ft^3$$

Volume due to 5.3 in of Rainfall $V_{rain} := 5.3in \cdot L_{ns} \cdot W_{ew} = 10014 \cdot ft^3$ [See Attachment B]

Total Volume required $V_{reqd} := V_{tkpad} + V_{rain} + V_{pumpp} + V_{rackp} + V_{stairp} + V_{spill} = 83122 \cdot ft^3$

Therefore $V_{avail} = 83131 \cdot ft^3$ > $V_{reqd} = 83122 \cdot ft^3$ <--O.K

C

Note that conservatism in using 100% of Air Volume of the Tank, 1 ft of free-board and conservative height of the pump-pads is included in the above results.
Also the conincidence of maximum Rainfall-event, of 5.3in and Spill-event is incorporated.

ATTACHMENT B :

Input Information

From: Bartok, Philip
Sent: Tuesday, October 20, 2009 10:18 AM
To: Rahim, Abdulaziz
Cc: Cruz, Chona
Subject: RE: HSA Client Comments

Thank you. I will answer the comment that we will change the volume of the dike to 125% of the largest tank plus rainfall.

Phil

From: Rahim, Abdulaziz
Sent: Tuesday, October 20, 2009 9:54 AM
To: Bartok, Philip
Cc: Cruz, Chona
Subject: HSA Client Comments

Phil Bartok,

Comment #s 9837 and 9838 are specifically addressed to Process documents and needs your reply. However, the containment calculation will be done in the next revision of Calc. 24915-11-DBC-00-00001, HSA Tank Foundation design. The containment capacity will be based on 125% of the largest Tank in the HSA farm with rainfall allowance.
FYI,
Thanks,
Azee Rahiim

Superceded by e-mail (see Sheet B4)

Azee Rahim
859-625-6251

From: Cruz, Chona
Sent: Thursday, September 10, 2009 4:55 PM
To: Rahim, Abdulaziz
Subject: FW: Structural HSA Area Calcs - Issued for Approval - IFA 091009

see comments on calculation from environmental

From: Regan, Kevin
Sent: Thursday, September 10, 2009 4:49 PM
To: Cruz, Chona; Costales, Henry; Moore, Caryn
Subject: FW: Structural HSA Area Calcs - Issued for Approval - IFA 091009

Please see comments below. Thanks.

Regards,

Kevin Regan
Environmental Manager
(859) 625-5417

From: Weitzman, Leo
Sent: Thursday, September 10, 2009 4:23 PM
To: 'Kevin Regan (kregan@bechtel.com)'
Subject: FW: Structural HSA Area Calcs - Issued for Approval - IFA 091009

These documents address the structural requirements of the HSA pads and foundations but we were unable to find the calculatin demosntit is also necessary to verify the adequacy of the containment volume of the HSA areas. Please add these calculations to one or the other of these two documents.

When performing these calculations, please take into account the following requirements. The HSA is outdoors and not under roof. Per 40 CFR §296.193(e), the containment volume for hazardous waste tanks that are outdoors, must be adequate to fully contain the total "contained air" volume of the largest tank plus 5.3 inches, which is the 25-year, 24-hour rainfall event for Madison County, KY.

Leo Weitzman, PhD
Permitting Manager
Bechtel Parsons Blue Grass
830 Eastern Bypass, Suite 106
Richmond, KY 40475
E-mail: lweitzma@bechtel.com
859-625-1277 Richmond Office
859-361-6362 Cell
859-625-9918 FAX

From: Talbert, Susan (OWAPF)

1/27/2010

From: Bartok, Philip
Sent: Friday, March 19, 2010 7:28 AM
To: Rahim, Abdulaziz
Cc: Costales, Henry; Ahrens, Ron
Subject: RE: HSA Tank Spill Volume

I approached Ron Ahrens about the problem. I asked if we could change our response to Gov. Comment 9837 to Concur. Will revise note 10 on P&ID 11-M6-HSS-00001, as well as on P&IDs HSS-00004, -00007, -00010, and -00012, to change to 100% of largest tank and rainfall, plus 1'-0" freeboard. This is over 130% without the freeboard.

He will get back to me early next week with an answer.

Phil

From: Rahim, Abdulaziz
Sent: Thursday, March 18, 2010 6:10 PM
To: Bartok, Philip
Cc: Costales, Henry
Subject: HSA Tank Spill Volume

Phil Bartok,

Please provide your finalized input for the HSA tank spill volume.

Thanks
Azee Rahim
859-779-7612

From: Weitzman, Leo
Sent: Monday, August 30, 2010 10:28 AM
To: Costales, Henry
Cc: Regan, Kevin; Danley, Gary N; Rowden, Scott (Parsons)
Subject: FW: HAS TAR
Importance: High

Henry,
Please could you please let me know whether Charlie Sturdivant of Franklin Engineering is correct or not? If he is, please have the referenced document corrected. This is a potentially serious matter that is very likely to impact our hazardous waste permit.

Leo Weitzman, PhD
Permitting Manager
Bechtel Parsons Blue Grass
830 Eastern Bypass, Suite 106
Richmond, KY 40475
E-mail: lweitzma@bechtel.com
859-625-1277 Richmond Office
859-361-6362 Cell
859-625-9918 FAX

From: Charlie Sturdivant [mailto:csturdivant@franklinengineering.com]
Sent: Monday, August 30, 2010 10:16 AM
To: Weitzman, Leo
Subject: HAS TAR

Leo:
During the review for the HSA TAR we found a minor discrepancy in a containment capacity. In Calc. No. 24915-11-DBC-00-00002, Rev. A, Appendix A, page A2, the east-west inside dimension of the containment area is incorrectly calculated. The calculation is given as follows:

Mat net east-west dimension, 90' minus (2), 10" walls =>> W_{ew} : = 88ft + 8in The correct result of subtracting 20" from 90' is 88ft + 4in.

This error propagates through several of the calculations used to determine both the Available Volume and the Required Volume but the containment is adequate anyway.

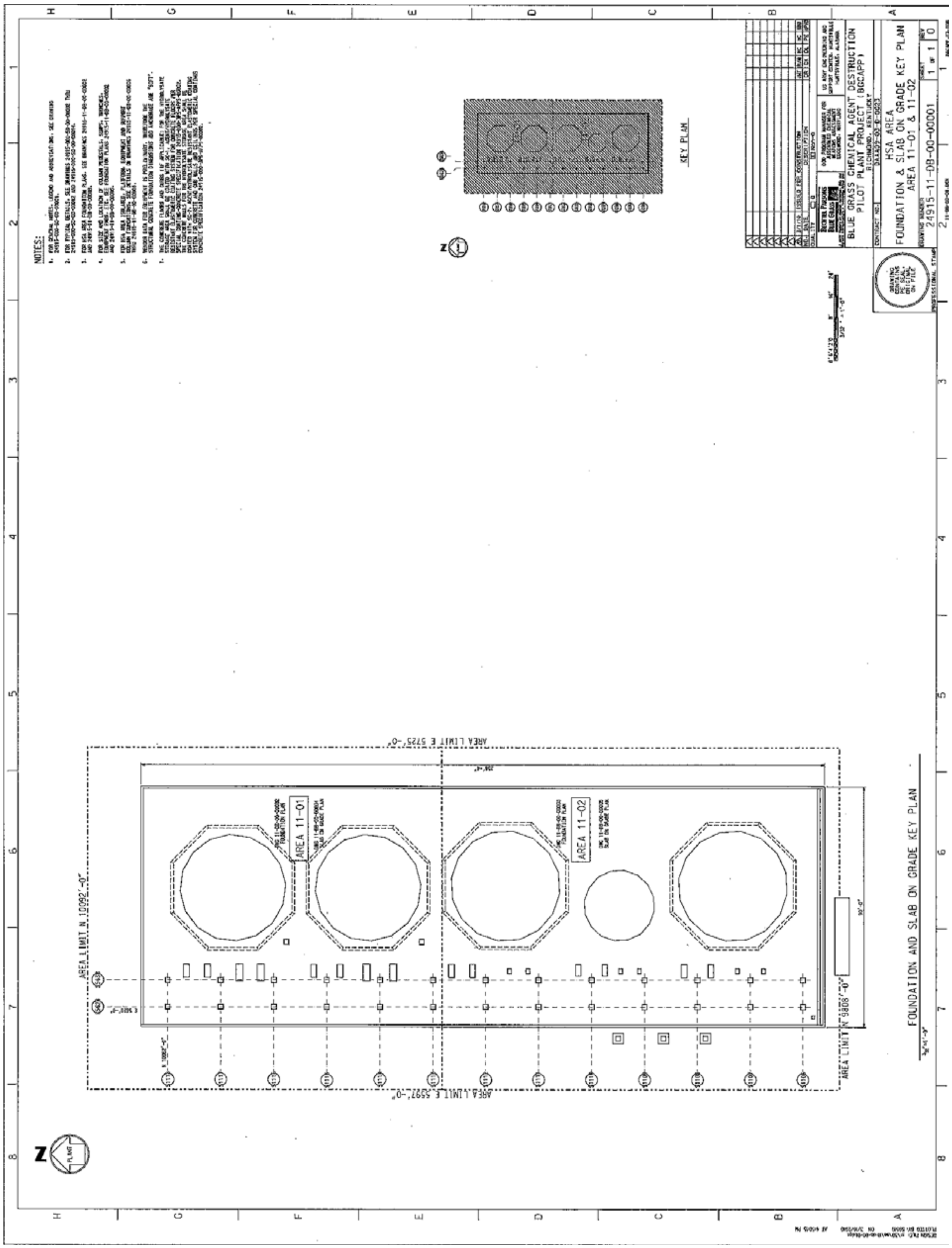
2

Also, the calculations for volume use an average depth for the containment area of 4.67 ft. This depth is calculated by taking the average of the depths from each end of the containment area shown on drawing number24915-11-DB-00-00008, Rev. 0, found in appendix C, sheet C9, of the same calculation sheet. This depth is based on the difference between the elevation of the top of the containment wall versus the elevations inside the area on each end. The drawing shown on sheet C9 has a hand written notation to revise this elevation from 913' up to 914'. The calculations use the hand written value of 914'. If this mark-up does not get picked up and the structure gets built as drawn then the containment volume would not meet the design criteria.

Charlie

ATTACHMENT C :

HSA Area Foundations Design Drawings



FOUNDATION AND SLAB ON GRADE KEY PLAN
AREA 11-01
AREA 11-02
KEY PLAN
NOTES:
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
HSA AREA
FOUNDATION & SLAB ON GRADE KEY PLAN AREA 11-01 & 11-02
24915-11-DB-00-00001

BECHTEL PARSONS BLUE GRASS

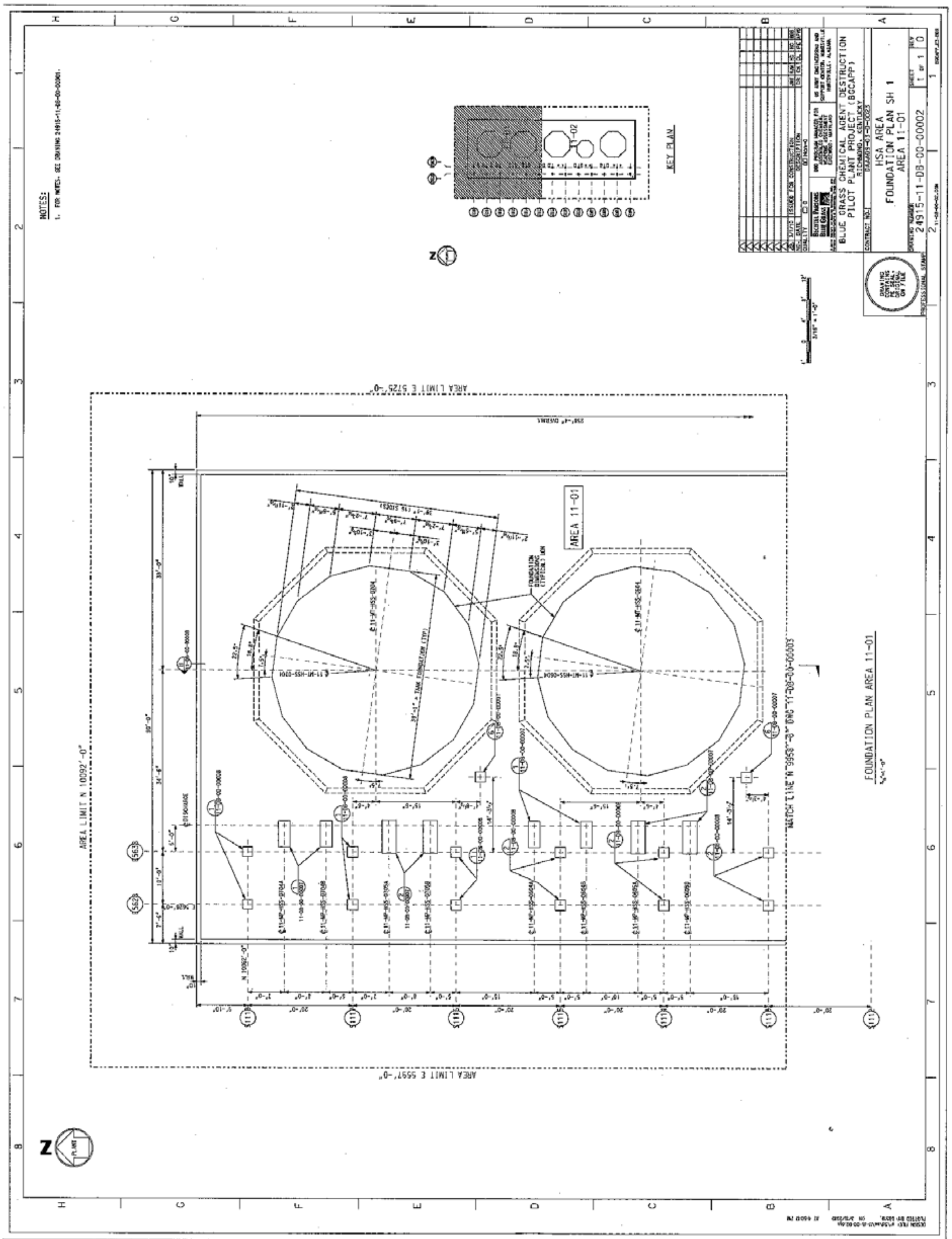
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-11-DBC-00-00002
Sheet No.	C3 of C16
Sheet Rev.	C

Subject: HSA Mat Foundation Containment Capacity Evaluation

By: AFR Date: 7/03/2012



BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project: BGCAPP

Job Number: 743341

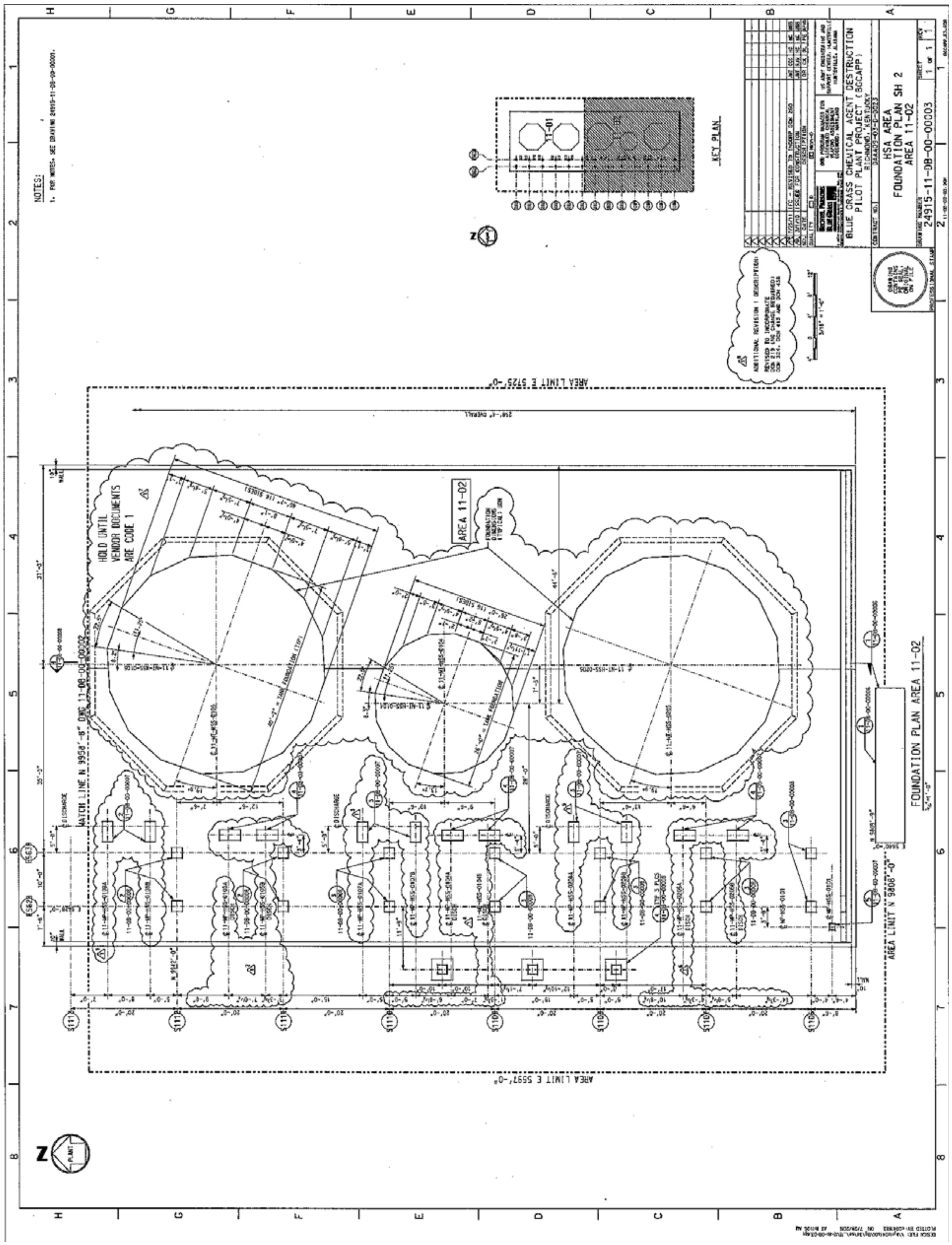
Calc. No. 24915-11-DBC-00-00002

Sheet No. C4 of C16

Sheet Rev. C

Subject: HSA Mat Foundation Containment Capacity Evaluation

By: AFR Date: 7/03/2012



7/9/2012

BECHTEL PARSONS BLUE GRASS

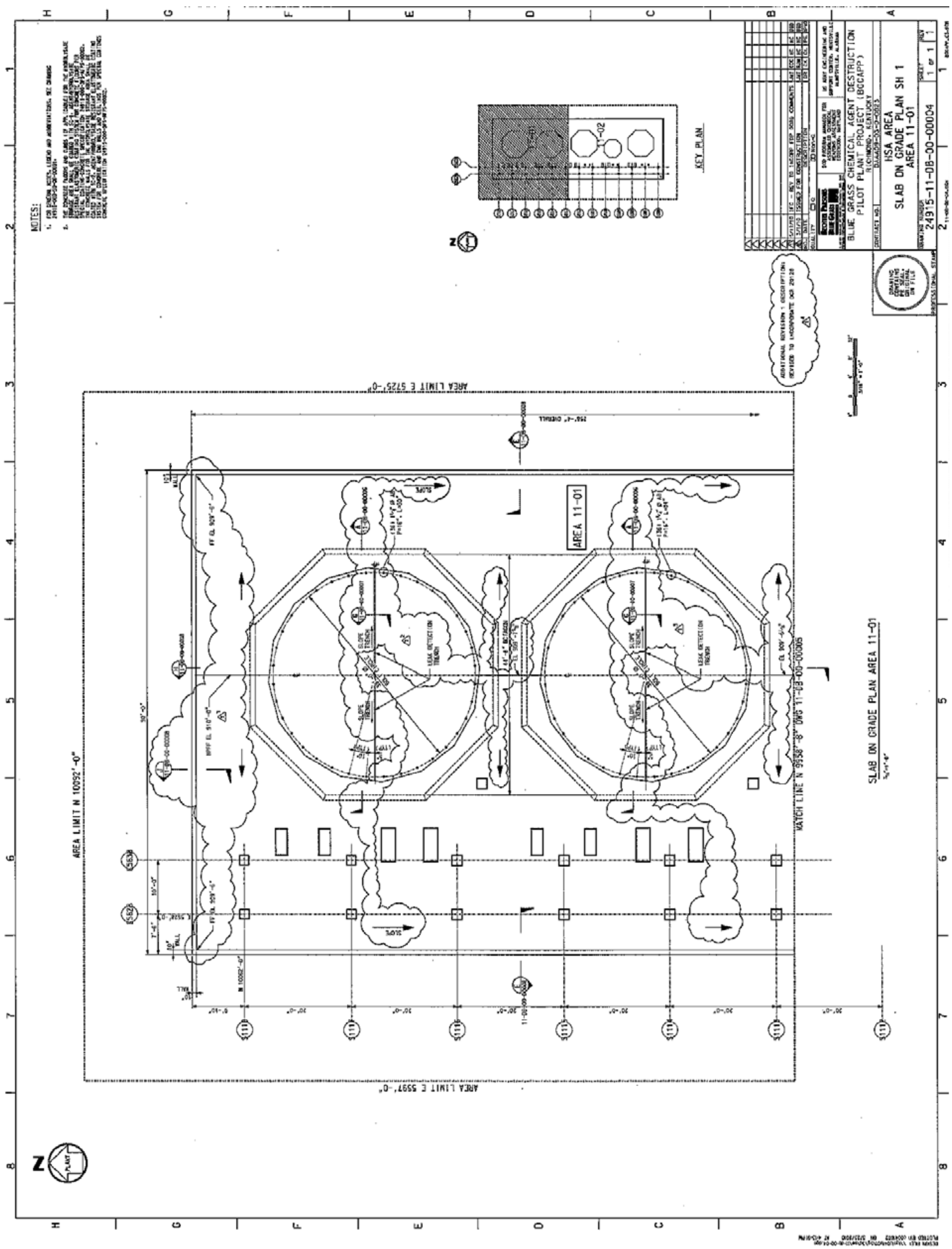
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-11-DBC-00-00002
Sheet No.	C5 of C16
Sheet Rev.	C

Subject: HSA Mat Foundation Containment Capacity Evaluation

By: AFR Date: 7/03/2012



BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project: BGCAPP

Job Number: 743341

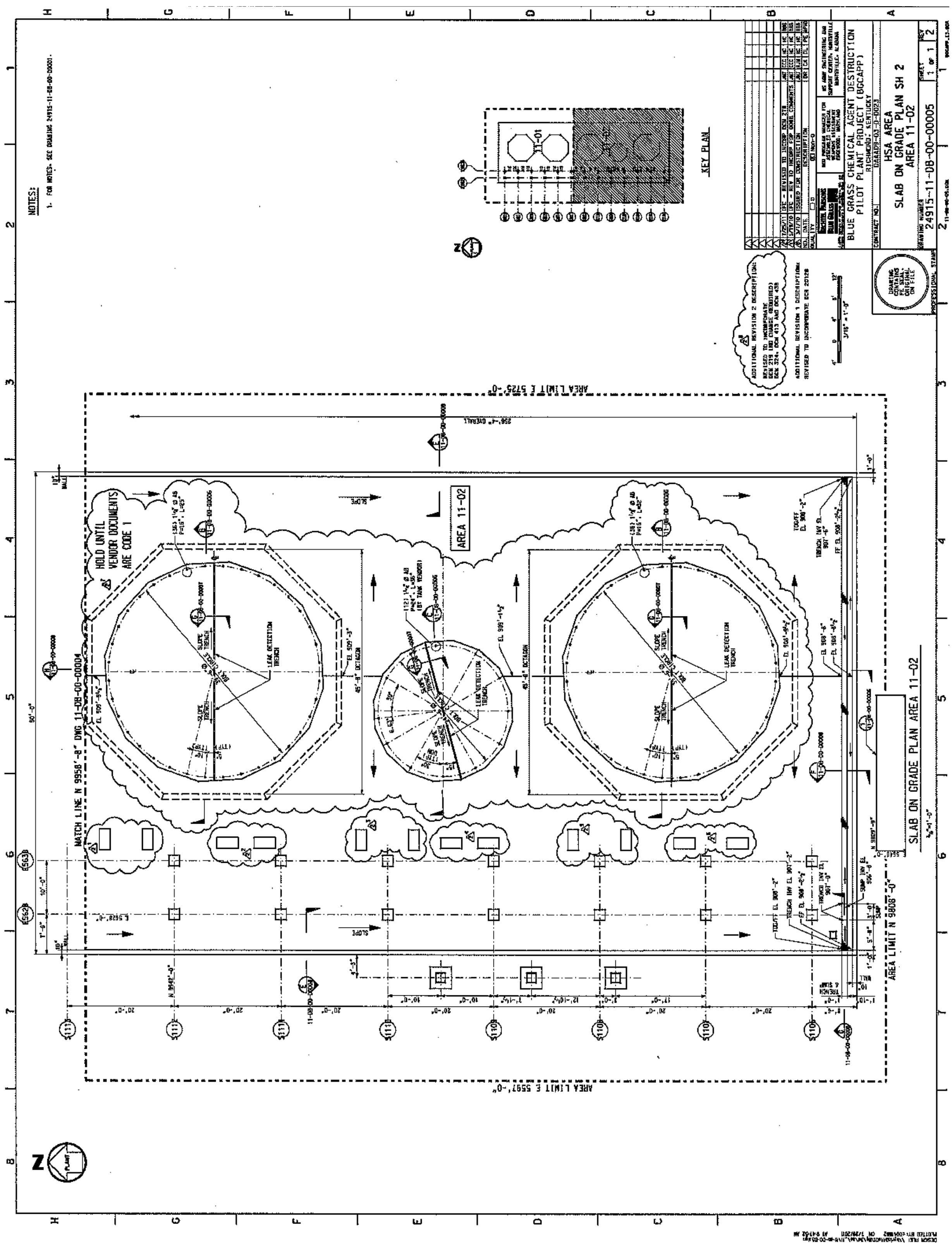
Calc. No. 24915-11-DBC-00-00002

Sheet No. C6 of C16

Sheet Rev. C

Subject: HSA Mat Foundation Containment Capacity Evaluation

By: AFR Date: 7/03/2012



7/9/2012

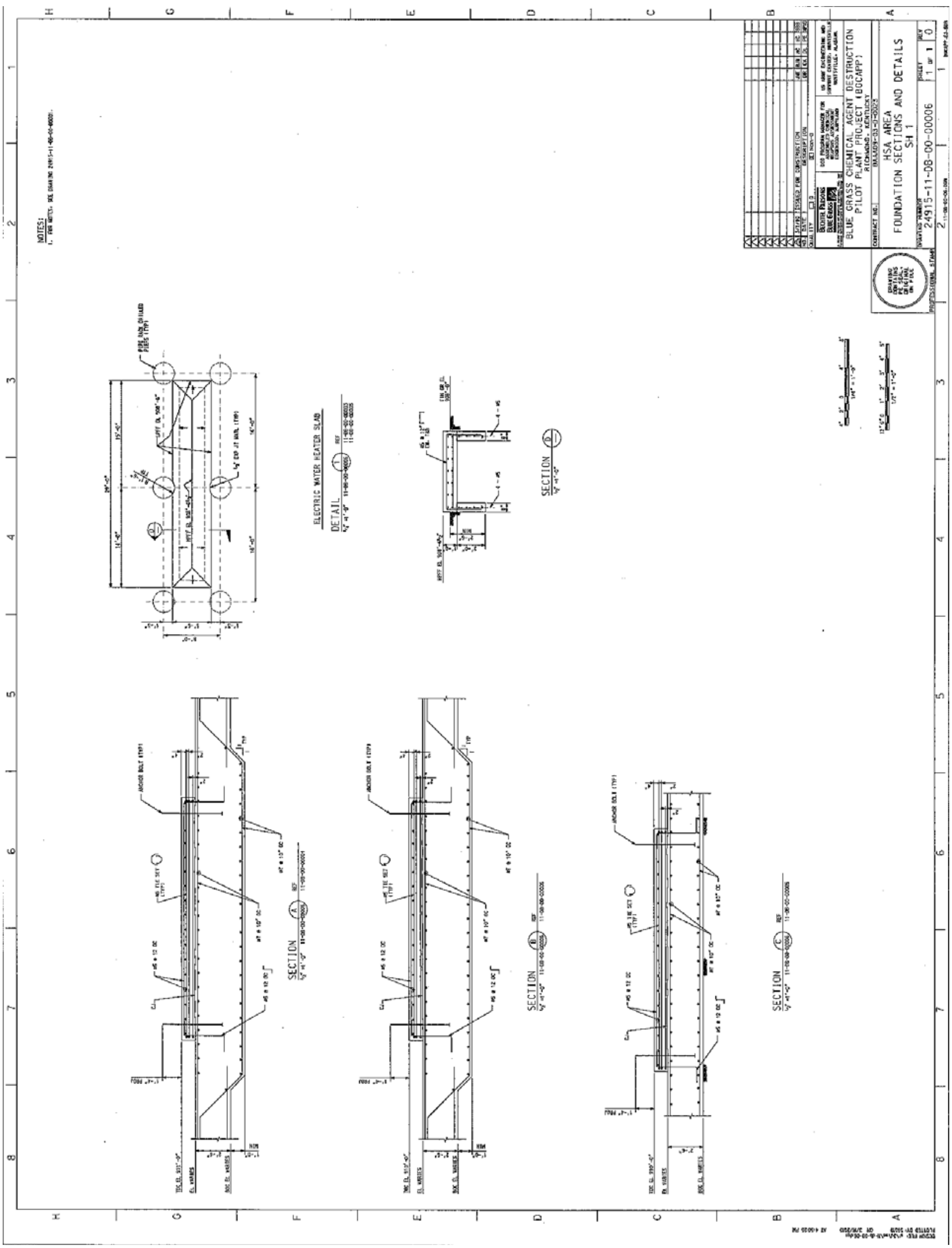
BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

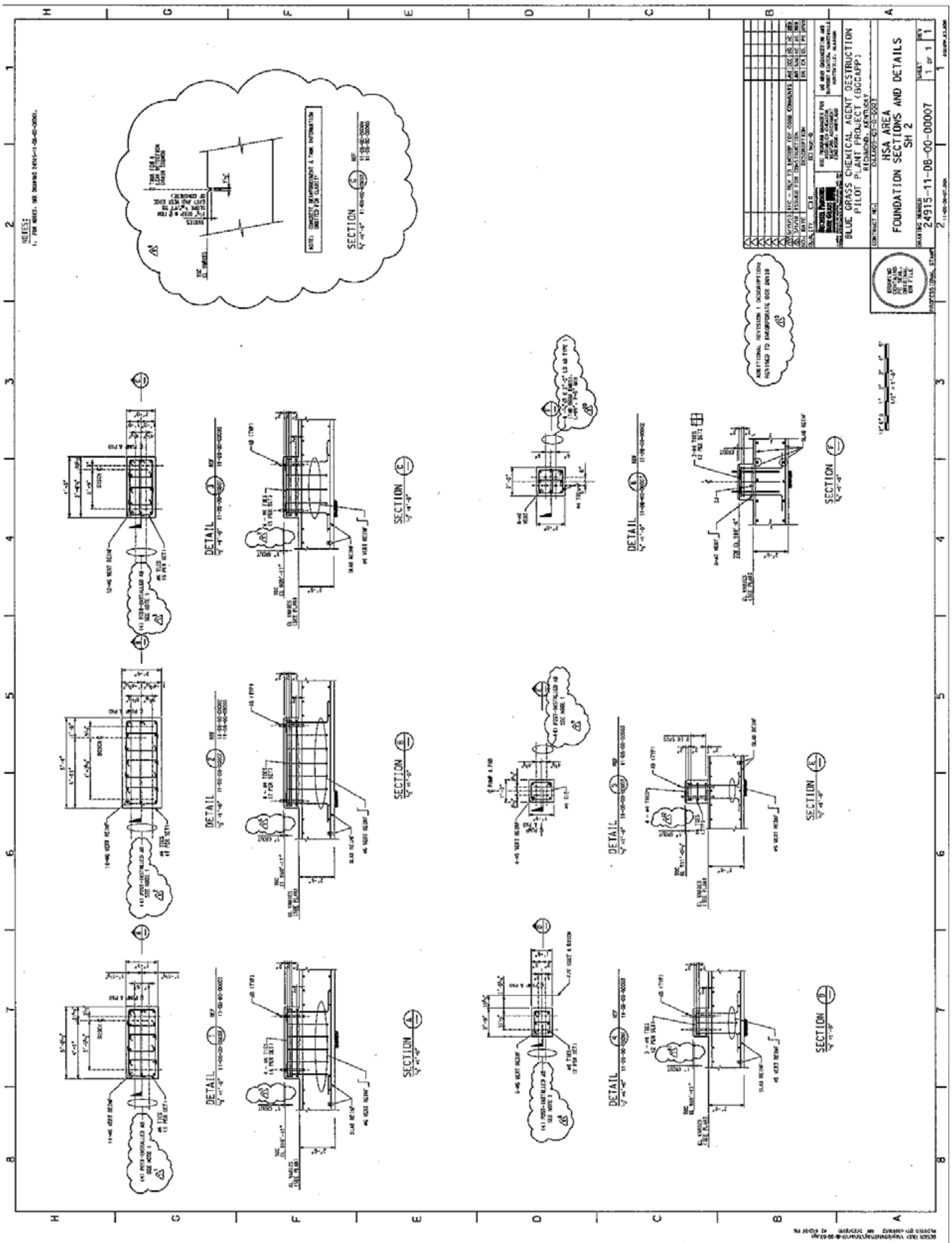
Calculation Sheet

Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-11-DBC-00-00002
Sheet No.	C7 of C16
Sheet Rev.	C

Subject: HSA Mat Foundation Containment Capacity Evaluation

By: AFR   Date: 7/03/2012





BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY
HSA AREA
FOUNDATION SECTIONS AND DETAILS
SH 2
24915-11-DB-00-00007

BECHTEL PARSONS BLUE GRASS

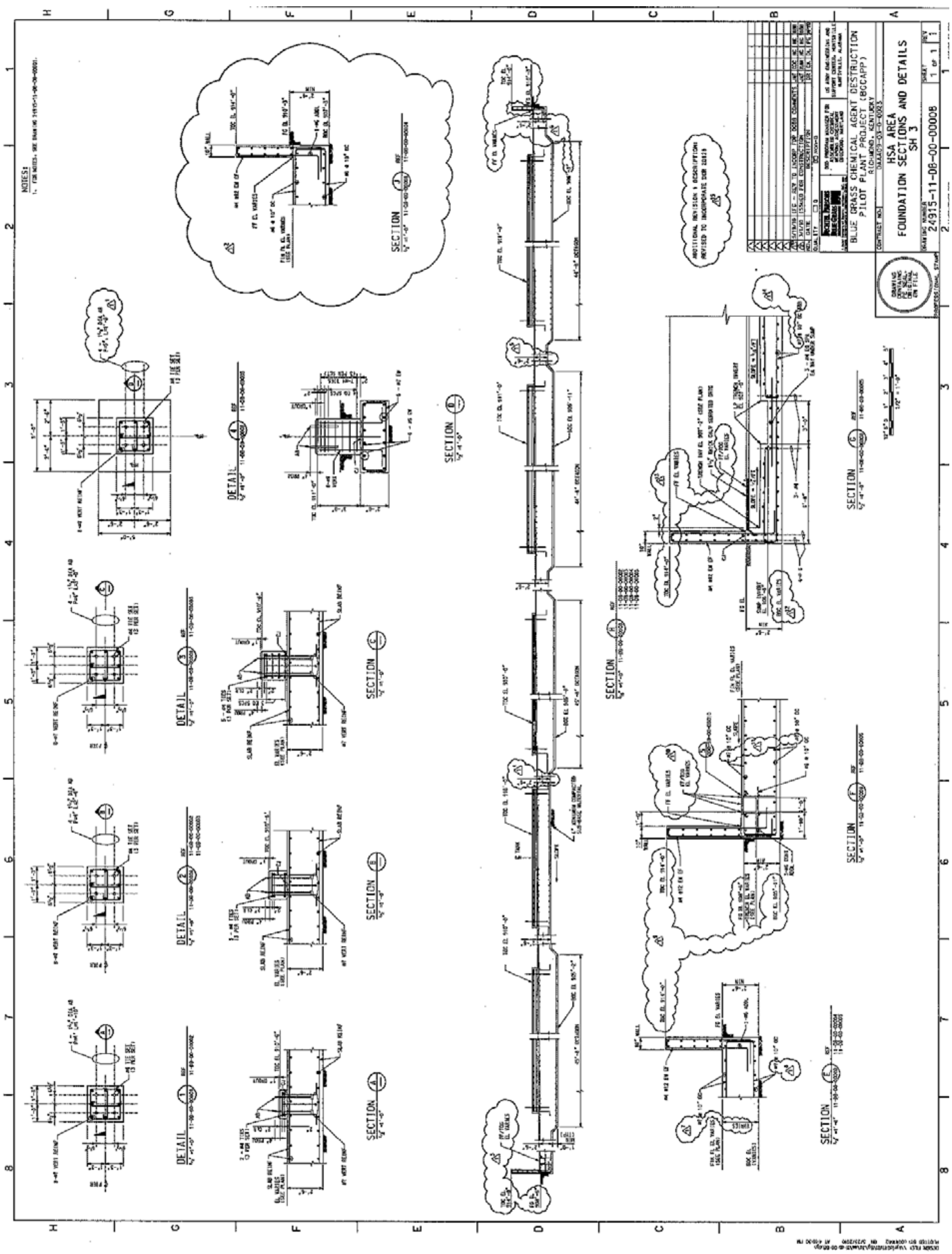
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

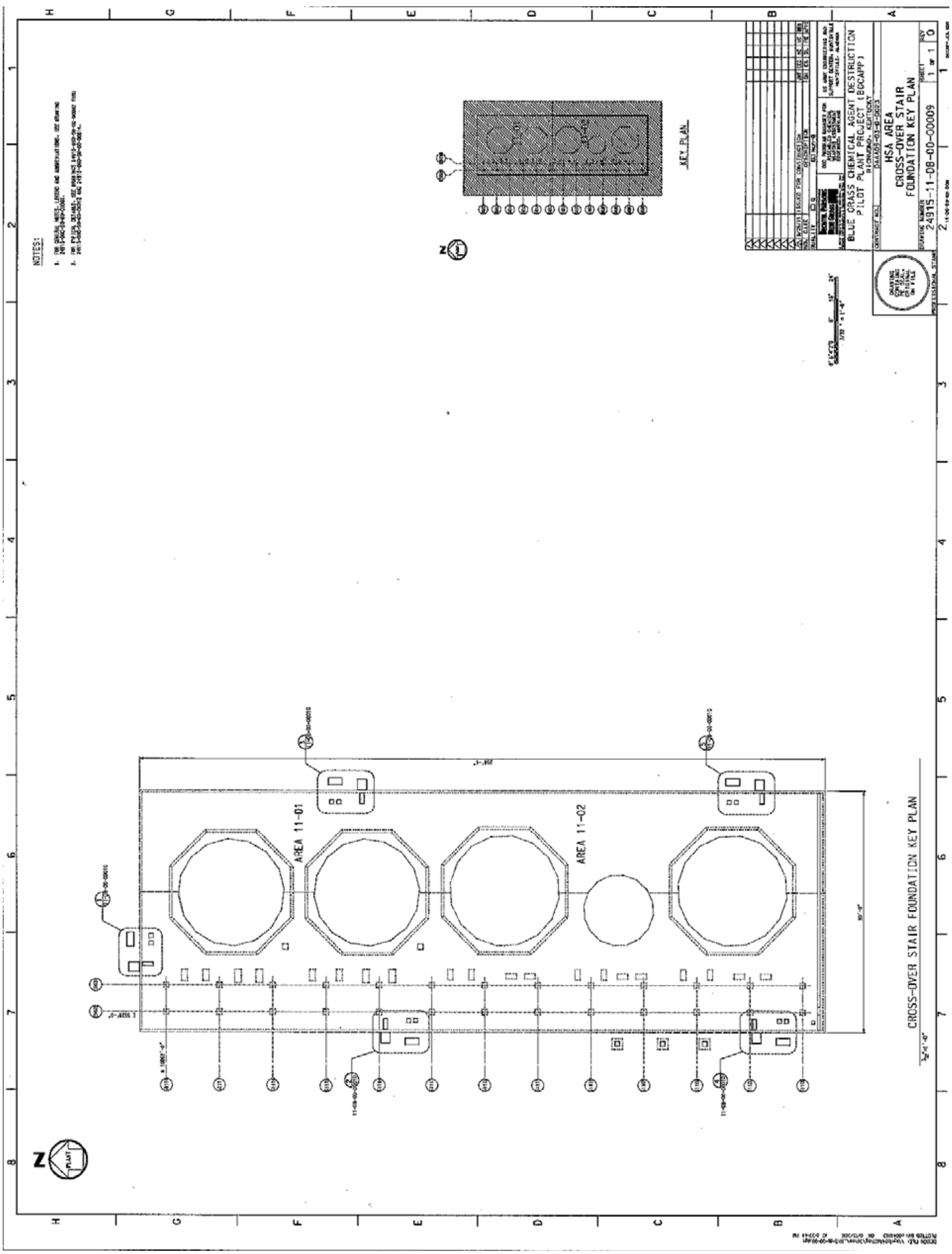
Calculation Sheet

Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-11-DBC-00-00002
Sheet No.	C9 of C16
Sheet Rev.	C

Subject: HSA Mat Foundation Containment Capacity Evaluation

By: AFR   Date: 7/03/2012





KEY PLAN
AREA 11-01
AREA 11-02
CROSS-OVER STAIR FOUNDATION KEY PLAN
NOTES:
BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
HSA AREA
CROSS-OVER STAIR
FOUNDATION KEY PLAN
24915-11-DB-00-00009

BECHTEL PARSONS BLUE GRASS

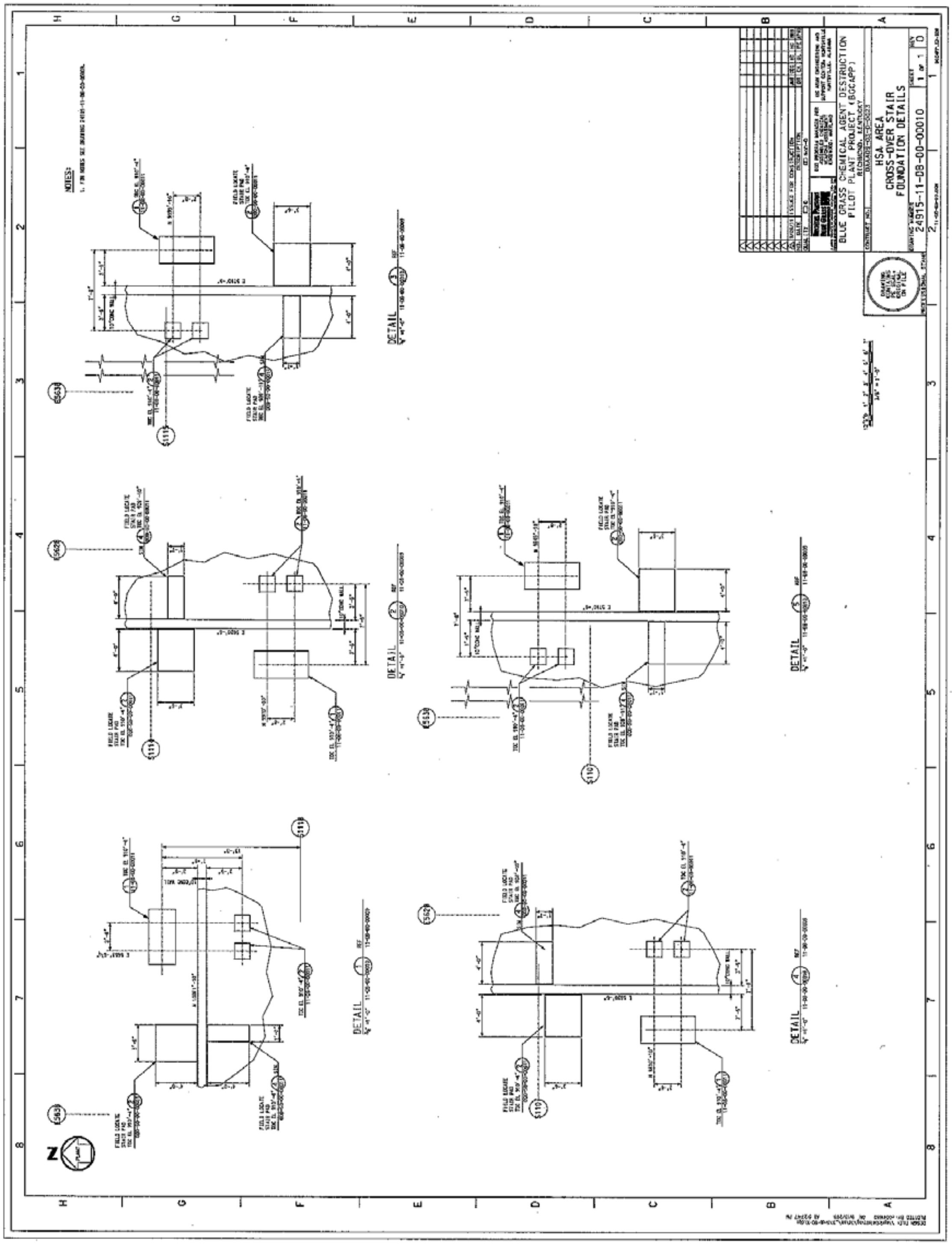
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

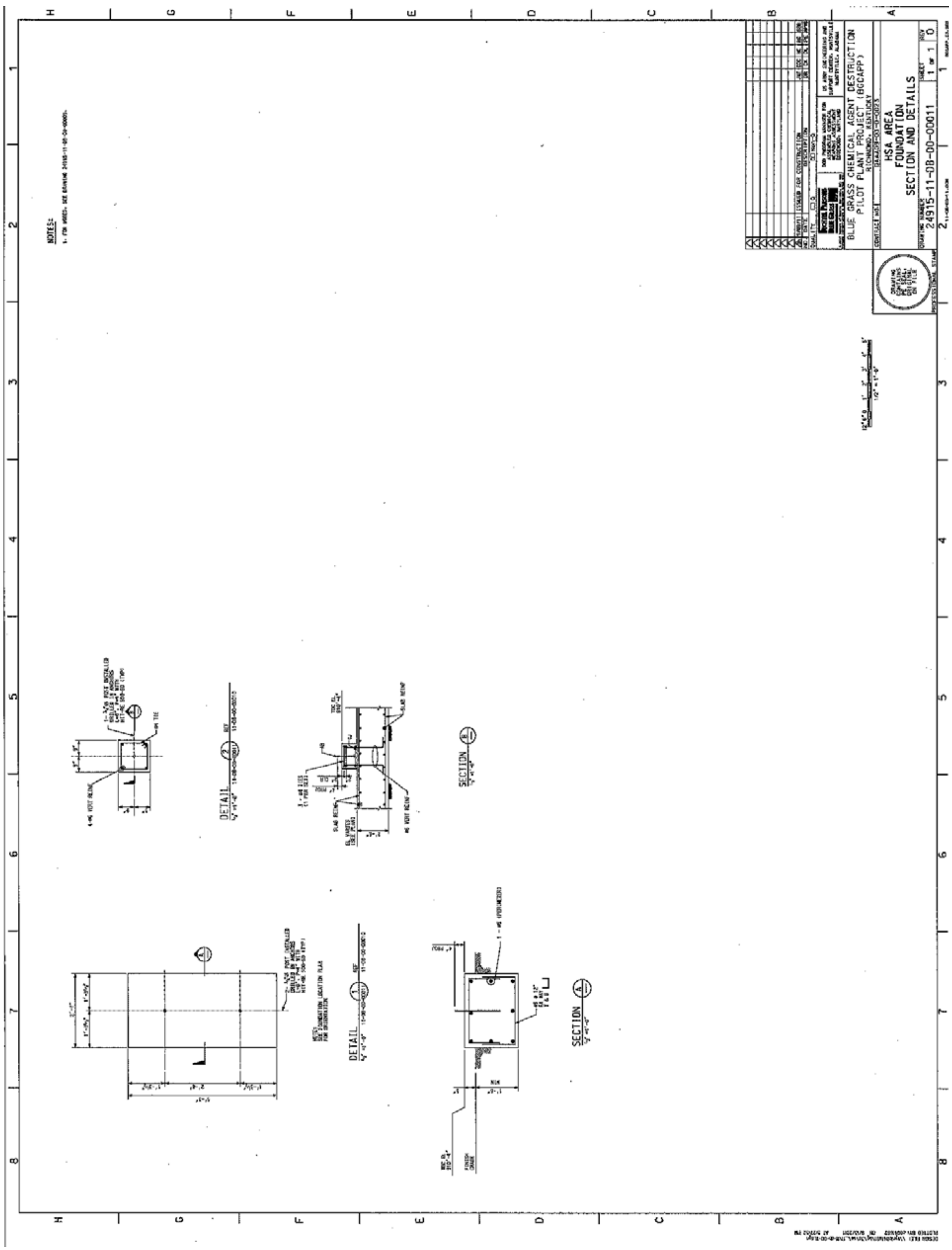
Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-11-DBC-00-00002
Sheet No.	C11 of C16
Sheet Rev.	C

Subject: HSA Mat Foundation Containment Capacity Evaluation

By: AFR   Date: 7/03/2012



BECHTEL PARSONS BLUE GRASS A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.	**Calculation Sheet**	Project:	BGCAPP
		Job Number:	743341
		Calc. No.	24915-11-DBC-00-00002
Subject: HSA Mat Foundation Containment Capacity Evaluation		Sheet No.	C12 of C16
By: AFR	Date: 7/03/2012	Sheet Rev.	C



DCN-260 (Extract)

Description of change:

Tag Number	Vendor Submittal	CHANGE TO: Vendor Dwg. Pad Size (LxW, ftxft) L (in)	W (in)	Structural Calculations	CURRENT: Structural Dwg. Pad Size (LxW, ftxft) L (in)	W (in)
10-MP-APS-0103A	24915-000-V1A-MPP0-00018	36	12	24915-10-DB-00-00006	18	16
10-MP-APS-0103B		36	12		18	16
10-MP-APS-0103C		36	12		18	16
10-MP-APS-0104A	24915-000-V1A-MPP0-00016	56	36		18	16
10-MP-APS-0104B		56	36		18	16
10-MP-APS-0104C		56	36		18	16
10-MP-APS-0105A	24915-000-V1A-MPP0-00019	36	12		18	16
10-MP-APS-0105B		36	12		18	16
10-MP-APS-0105C		36	12		18	16
10-MP-RO-0114A	24915-000-V1A-MPP0-00020	28	12	24915-10-DB-00-00019	18	18
10-MP-RO-0114B		28	12		18	18
11-MP-HSS-0104A	24915-000-V1A-MPP0-00017	36	12	24915-11-DB-00-00003/7	24	18
11-MP-HSS-0104B		36	12		24	18
11-MP-HSS-0105A		36	12		24	18
11-MP-HSS-0105B		36	12		24	18
11-MP-HSS-0205A		36	12		24	18
11-MP-HSS-0205B		36	12		24	18

Pump Pads will be modified to accommodate the baseplate dimensional changes in table above from vendor submittals.

DCN 228 shall be superseded based on these new vendor dimensions for SPB and HSS pumps.

Concrete foundation modification sketch is attached to show how construction will proceed in modifying the existing concrete foundation based on new vendor information as described above.

The vendor submittals (see table above for list) are Code Status 1 (i.e. as shown in Appendix A).

Originator:	Checked By:	Discipline Lead:	FDM / REM:	Date: 11/22/10
☐ Mechan'l/Process:	☒ Plant Design:	☐ Electrical:	☐ Operations:	
☒ Civil/Struct/Arch:	☐ Control Sys:	☐ Environ:	☐ Safety:	
☐	☐	☐	☐ Gov't/COE:	

CCB Approval Required: Yes ☐ No ☒

BCR Reference Number: Disposition Requested By (date):

☐ CCB Approved
☐ CCB Approved with Comments
☐ CCB Disapproved CCB: Date:

C

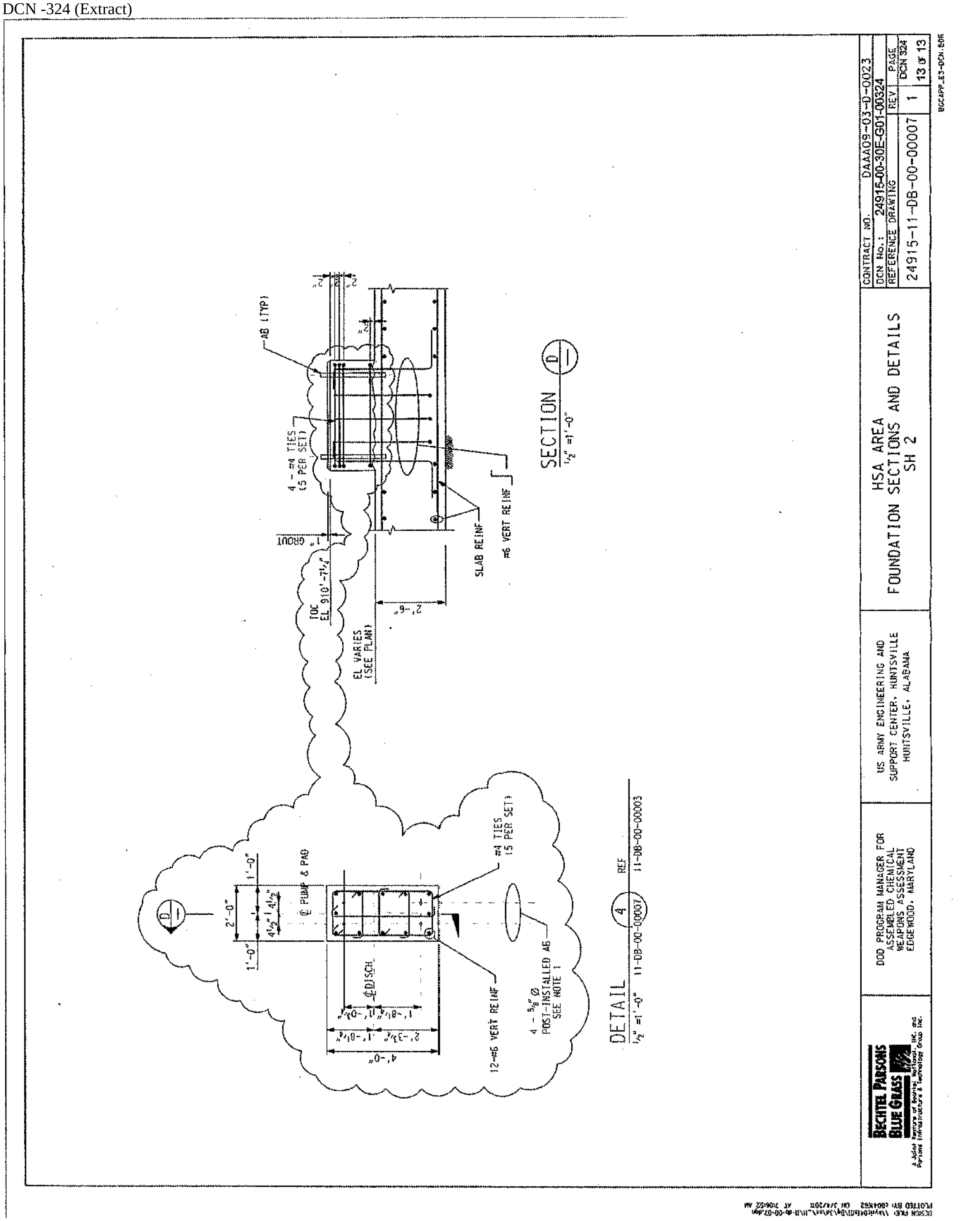
BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project: BGCAPP
Job Number: 743341
Calc. No. 24915-11-DBC-00-00002
Sheet No. C14 of C16
Sheet Rev. C

Subject: HSA Mat Foundation Containment Capacity Evaluation
By: AFR   Date: 7/03/2012

DCN -324 (Extract)



C

BECHTEL PARSONS BLUE GRASS

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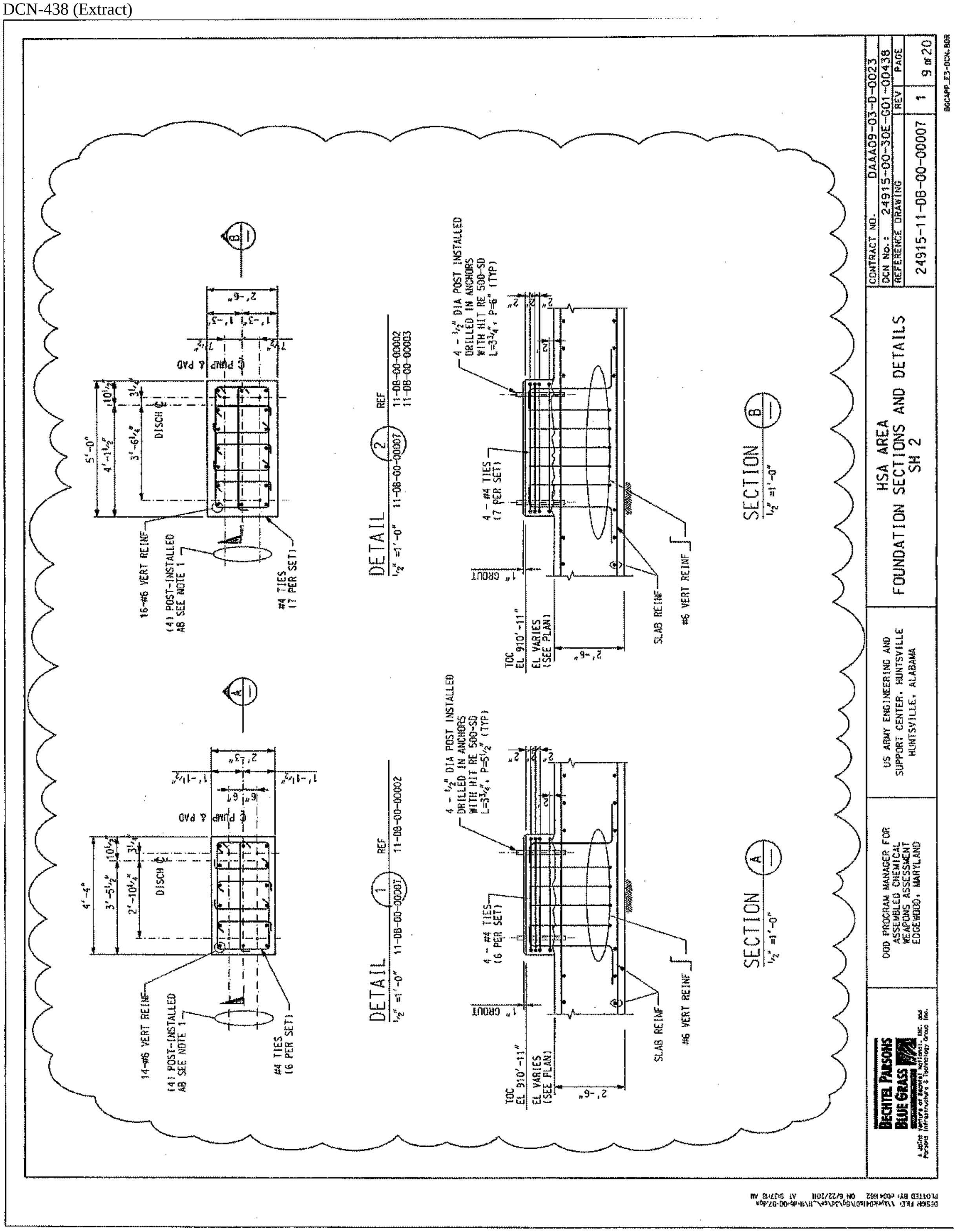
Calculation Sheet

Project:	BGCAPP
Job Number:	743341
Calc. No.	24915-11-DBC-00-00002
Sheet No.	C15 of C16
Sheet Rev.	C

Subject: HSA Mat Foundation Containment Capacity Evaluation

By: AFR Date: 7/03/2012

DCN-438 (Extract)



C

7/9/2012

BECHTEL PARSONS BLUE GRASS

A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

Calculation Sheet

Project: BGCAPP

Job Number: 743341

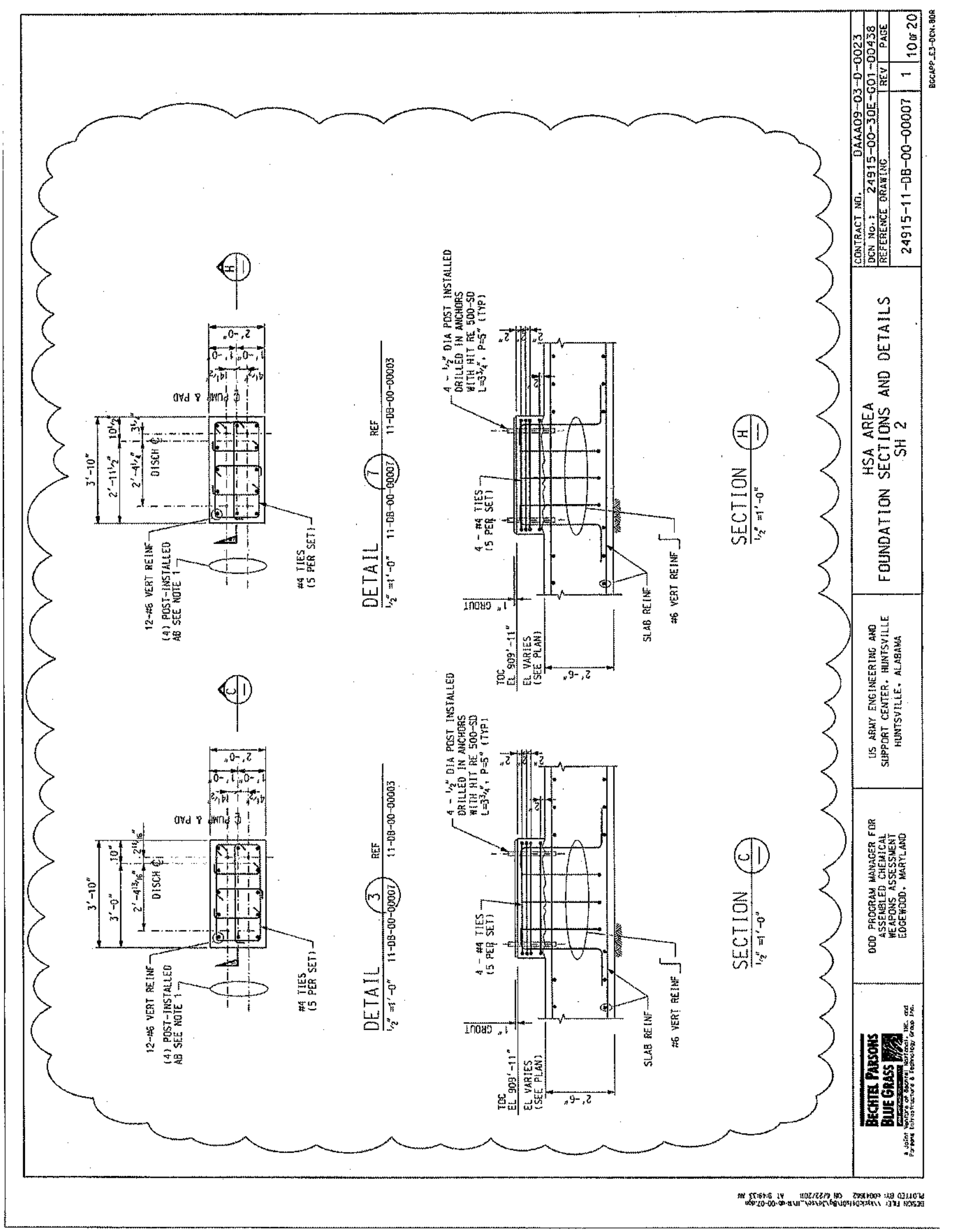
Calc. No. 24915-11-DBC-00-00002

Sheet No. C16 of C16

Sheet Rev. C

Subject: HSA Mat Foundation Containment Capacity Evaluation

By: AFR Date: 7/03/2012

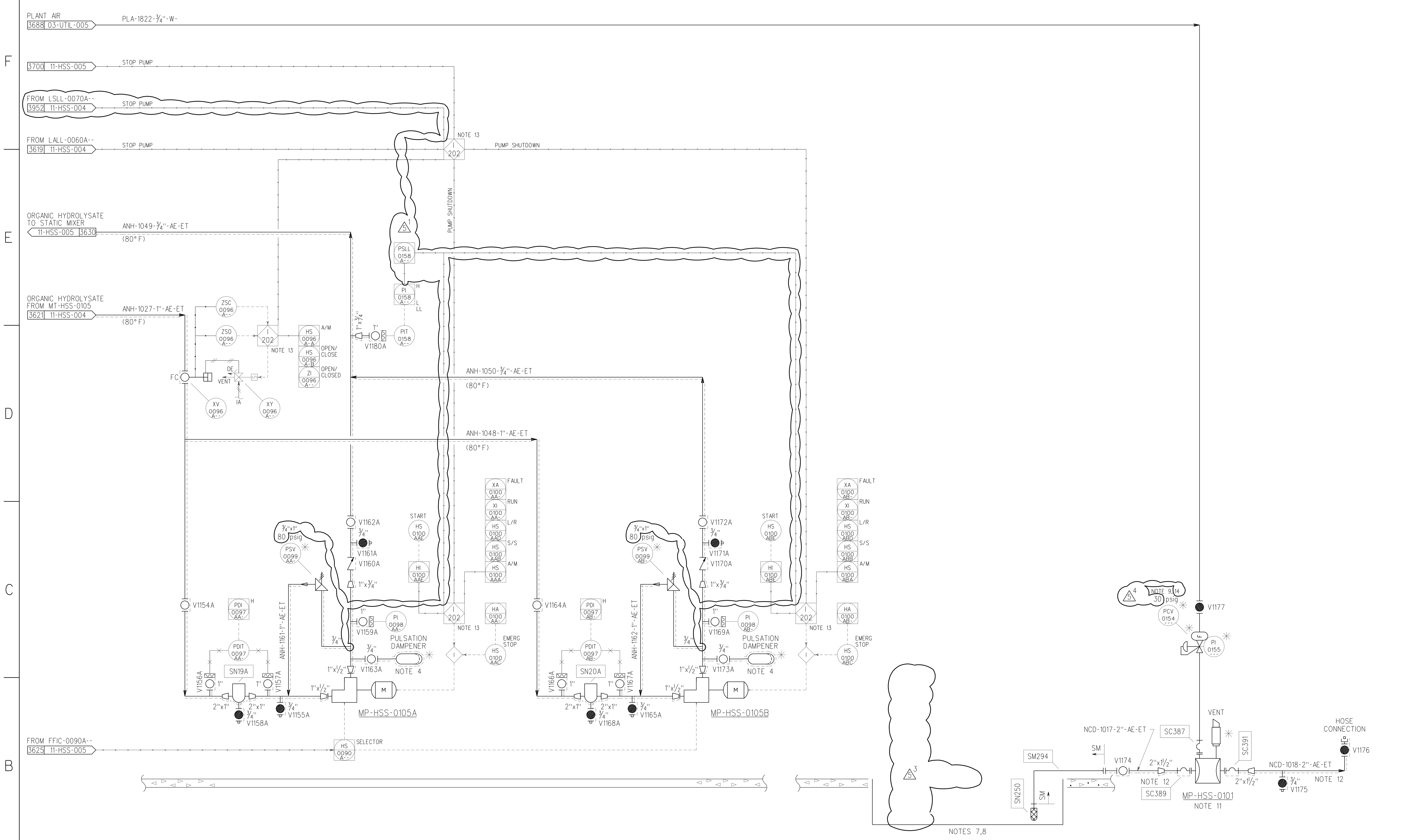


C

7/9/2012

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "11" UNLESS OTHERWISE NOTED.
4. LOCATE VENDOR FURNISHED PULSATION DAMPENER MINIMUM DISTANCE FROM PUMP DISCHARGE NOZZLE.
5. DELETED.
6. THE ORGANIC AND AQUEOUS AGENT HYDROLYSATE PUMPS (ONE OPERATING AND ONE SPARE EACH) SHALL BE DESIGNED TO PROVIDE THE FOLLOWING:
   A) DELETED
   B) STOP PUMPS IF INLET TO BLEND TANK IS SHUT OFF
   C) DELETED
   D) THE ORGANIC HYDROLYSATE PUMP FLOWRATE IS SET PROPORTIONAL TO THE AQUEOUS HYDROLYSATE BLEND TANK DELIVERY AT 1% TO 5% RATIO.
7. SUMP IS A SINGLE WALL SUMP.
8. COVER SUMP WITH SCREEN TO MINIMIZE SOLID ACCUMULATION.
9. ✳ FURNISHED BY PUMP MANUFACTURER.
10. DELETED.
11. SUMP PUMPOUT IS MANUAL START ONLY. SUMP CONTENTS TO BE SAMPLED PRIOR TO PUMPOUT.
12. PROVIDE ELECTRIC TRACING TO MAINTAIN A MINIMUM TEMPERATURE OF 40°F AND INSULATION FOR FREEZE PROTECTION OF THE HORIZONTAL PORTION OF THE SUCTION PIPING, AND ALL THE DISCHARGE PIPING.
13. FCS INTERLOCK NUMBERS ARE PREFIXED WITH "11-HSS-".
14. PCV SET POINT BASED ON VENDOR INFORMATION. FINAL PCV SET POINT TO BE DETERMINED IN FIELD.
15. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN "1" SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. IF PRESSURE DOES NOT RETURN TO NORMAL WITHIN "5" SECONDS, BOTH THE "LEAD" AND STANDBY PUMPS WILL STOP. ONCE THE STANDBY PUMP HAS STARTED AND PRESSURE RETURNS TO NORMAL WITHIN "10" SECONDS, THE "LEAD" PUMP WILL STOP. IF THE "LEAD" PUMP BECOMES DEENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR THE PRESSURE TO FALL BELOW NORMAL.



MP-HSS-0105A
ORGANIC HYDROLYSATE PUMP
RATED FLOW : 1.2 GPM
RATED DELTA P : 62.5 PSI
MOTOR HP : 1.0 HP
MATERIAL OF CONST : 316 SS

MP-HSS-0105B
ORGANIC HYDROLYSATE PUMP (SPARE)
RATED FLOW : 1.2 GPM
RATED DELTA P : 62.5 PSI
MOTOR HP : 1.0 HP
MATERIAL OF CONST : 316 SS

MP-HSS-0101
AGT HYDROLYSATE TANK AREA SUMP PUMP
RATED FLOW : 22 GPM
RATED DELTA P : 24.2 PSI
MATERIAL OF CONST : PVDF

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-11-M5-HSS-00001 REV.5
BASED ON BLUE GRASS MSD 24915-11-NO-HSS-00001 REV.2

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
5	05/23/12	IFC, INCORPORATED DCN-530, -673, -735, -745, -790	JDC	SC	SA	KMR	KMR
4	04/29/11	IFC, REVISED PUMP NOZZLES & MATERIAL PER VENDOR	BM	PEB	SA	BBB	BBB
3	12/15/09	IFC, GC 9838	JLL	PEB	SA	BBB	BBB
2	02/16/09	IFC,REVISD PMP DIFF HEAD, SPECIALTY NO,ADD REDUCER	JLL	PEB	BM	BBB	BBB
1	12/20/07	IFC, CORRECTED INSTRUMENTATION, ADDED I-NO'S	CGD	JLL	PEB	JB	BBB
0	11/26/07	ISSUED FOR DESIGN (IFD)	CGD	JLL	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

HYDROLYSATE STORAGE AREA ORG HYDRO PUMPS & SUMP PUMP TR-1 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-11-M6-HSS-00006 | SHEET 1 OF 1 | REV 5

BGCAPP_DGN.BDR

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found. 17 Dec 2013

This document has been reviewed for OPSEC material, and none was found. 17 Dec 2013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
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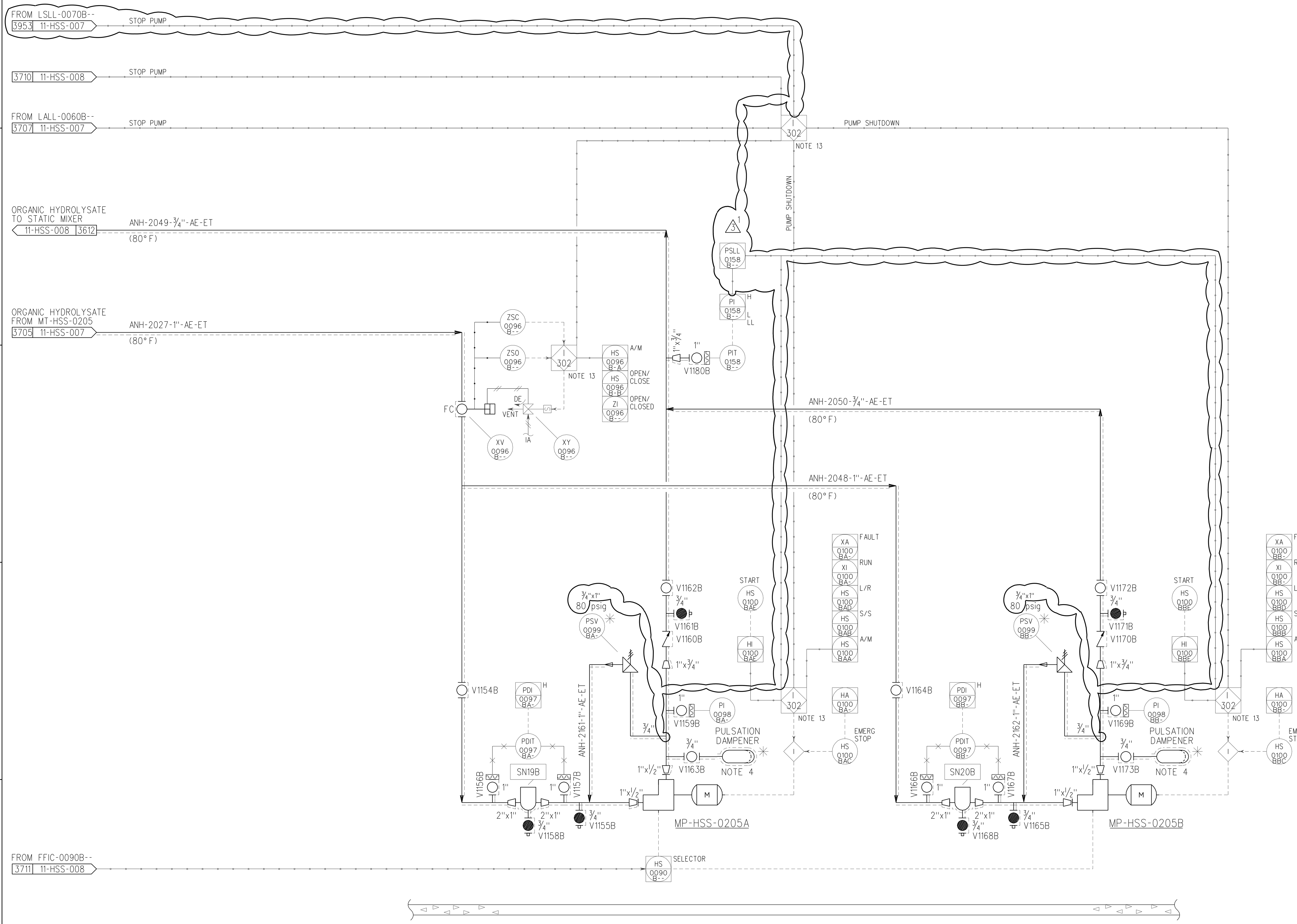
4. LOCATE VENDOR FURNISHED PULSATION DAMPENER MINIMUM DISTANCE FROM PUMP DISCHARGE NOZZLE.
5. DELETED.
6. THE ORGANIC AND AQUEOUS AGENT HYDROLYSATE PUMPS (ONE OPERATING AND ONE SPARE EACH) SHALL BE DESIGNED TO PROVIDE THE FOLLOWING:
   A) DELETED
   B) STOP PUMPS IF INLET TO BLEND TANK IS SHUT OFF
   C) DELETED
   D) THE ORGANIC HYDROLYSATE PUMP FLOWRATE IS SET PROPORTIONAL TO THE AQUEOUS HYDROLYSATE BLEND TANK DELIVERY AT 1% TO 5% RATIO.
7. DELETED.
8. DELETED.
9. ✳ FURNISHED BY PUMP MANUFACTURER.
10. DELETED.
11. DELETED.
12. DELETED.
13. FCS INTERLOCK NUMBERS ARE PREFIXED WITH "11-HSS-".
14. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN "1" SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. IF PRESSURE DOES NOT RETURN TO NORMAL WITHIN "5" SECONDS, BOTH THE "LEAD" AND STANDBY PUMPS WILL STOP. ONCE THE STANDBY PUMP HAS STARTED AND PRESSURE RETURNS TO NORMAL WITHIN "10" SECONDS, THE "LEAD" PUMP WILL STOP. IF THE "LEAD" PUMP BECOMES DEENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR THE PRESSURE TO FALL BELOW NORMAL.



MP-HSS-0205A
ORGANIC HYDROLYSATE PUMP
RATED FLOW : 1.2 GPM
RATED DELTA P : 62.5 PSI
MOTOR HP : 1.0 HP
MATERIAL OF CONST : 316 SS

MP-HSS-0205B
ORGANIC HYDROLYSATE PUMP (SPARE)
RATED FLOW : 1.2 GPM
RATED DELTA P : 62.5 PSI
MOTOR HP : 1.0 HP
MATERIAL OF CONST : 316 SS

REFERENCE DRAWINGS
BASED ON BLUE GRASS PFD 24915-11-M5-HSS-00001 REV.5
BASED ON BLUE GRASS MSD 24915-11-N0-HSS-00001 REV.2

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
3	05/23/12	IFC, INCORPORATED DCN-673, -745, -790	JDC	SC	SA	KMR	KMR
2	04/29/11	IFC, REVISED PUMP NOZZLES & MATERIAL PER VENDOR	BM	PEB	SA	BBB	BBB
1	02/16/09	IFC, ADD REDUCER	JLL	PEB	BM	BBB	BBB
0	12/28/07	ISSUED FOR CONSTRUCTION (IFC)	CGD	JP	PEB	JB	BBB

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

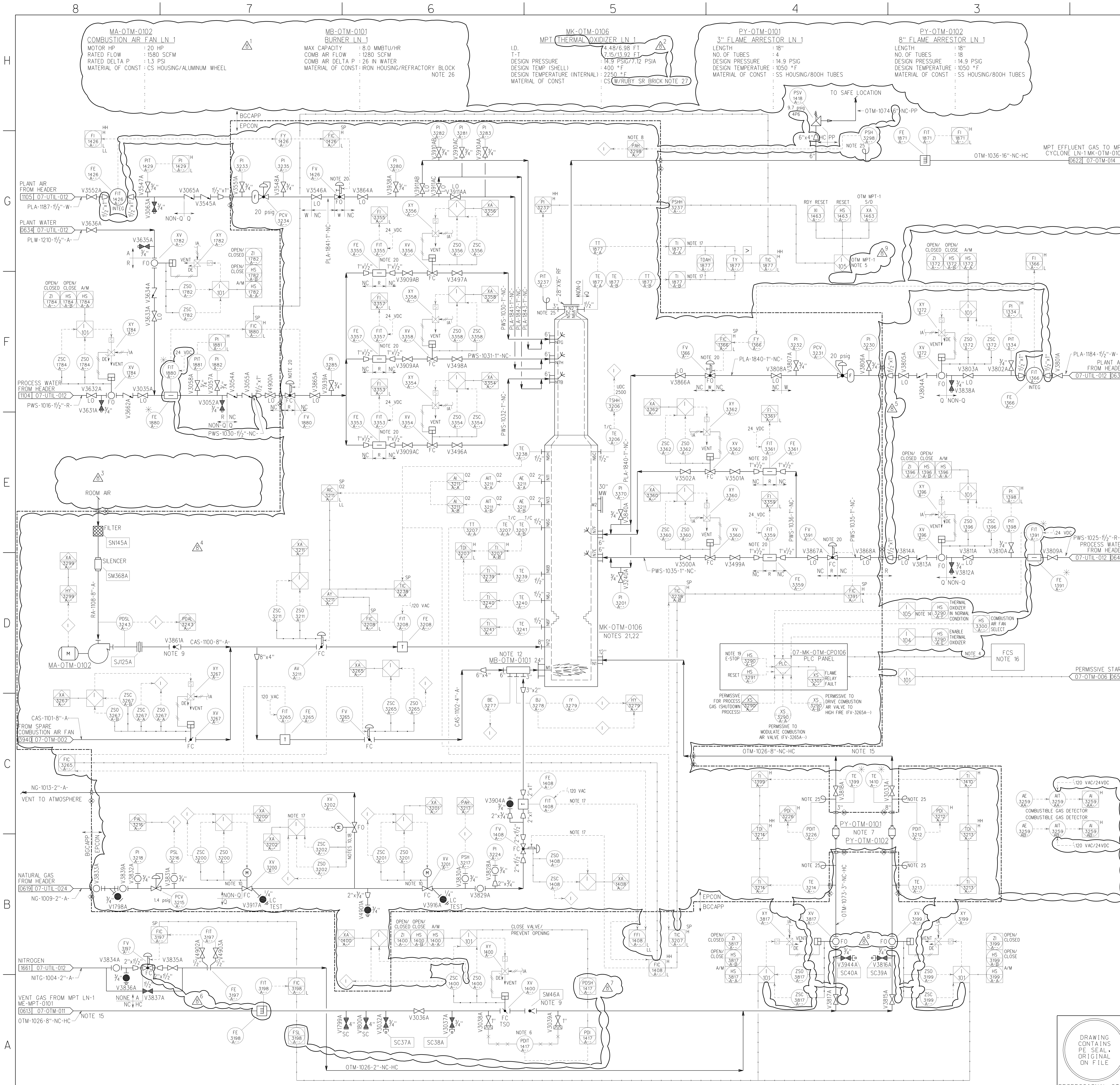
CONTRACT NO. DAAA09-03-D-0023

HYDROLYSATE STORAGE AREA ORGANIC HYDROLYSATE PUMPS TRAIN 2 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-11-M6-HSS-00009 | SHEET 1 OF 1 | REV 3

BGCAPP_DGN.BDR



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M6-00-00010 THRU 00015.
2. DRAWING NUMBERS IN OFF-PAGE CONNECTORS ARE TRUNCATED BY SUPPRESSING PROJECT NUMBER "24915" AND DOCUMENTS TYPE "M6". TWO LEADING ZEROS IN SEQUENCE NUMBER ARE NOT SHOWN.
3. ALL EQUIPMENT NUMBERS, INSTRUMENT TAG NUMBERS AND VALVE NUMBERS ARE PREFIXED "07" UNLESS OTHERWISE NOTED.
4. A HEARTBEAT IS MONITORED BETWEEN THE PLC AND FCS ON THE ETHERNET NETWORK. IF THE HEARTBEAT FAILS, THE PRIMARY PLC FAILS, OR ANY PORTION OF THE NETWORK BETWEEN THE PRIMARY PLC AND FCS FAILS, THE SECONDARY PLC WILL ASSUME CONTROL OF THE PROCESS.
5. MPT-1 IS SHUTDOWN ON HIGH-HIGH OUTLET PRESSURE FROM MPT TOX UNIT (MK-OTM-0106).
6. LOW SIDE OF PDIT IS DOWNSTREAM OF BLOCK VALVE XV-1400A--. PDIT INDICATES IF DOWNSTREAM PRESSURE IS EQUAL TO OR GREATER THAN UPSTREAM PRESSURE. VALVE CLOSES IF THIS OCCURS.
7. ALL REQUIRED FLAME ARRESTORS ARE TO BE PROVIDED BY TOX VENDOR.
8. BURNER CANNOT BE LIT UNLESS AN MPT BLOWER IS RUNNING AS SIGNIFIED BY PAH-3298A-- NOT IN ALARM CONDITION.
9. CHECK VALVES ARE LOW CRACKING PRESSURE WAFER CHECK TYPE.
10. XV-3202A-- CANNOT BE OPENED UNLESS XV-3201A-- AND XV-3200A-- ARE CLOSED.
11. UNLESS OTHERWISE NOTED, FCS INTERLOCK NUMBERS ARE PREFIXED WITH "07-OTM-" AND FPS (OR Z) INTERLOCKS ARE PREFIXED WITH "07-FPS-".
12. BURNER MANAGEMENT SYSTEM (BMS) CONTROLS ARE PART OF VENDOR SUPPLIED PACKAGE.
13. HARD-WIRED INTERLOCK FOR BMS IS DEPICTED AS I
14. HIGH-HIGH OVERHEAD TEMPERATURE OF SCRUBBER INITIATES ABNORMAL SHUTDOWN OF TOX VIA REMOVAL OF HY-3290A-F SIGNAL FROM FCS.
15. PROVIDE BREAKOUT FLANGES AT ELBOWS FOR POTENTIAL CLEAN OUT OF HEADER.
16. FCS COMMUNICATION LINK WILL BE PROVIDED TO DISPLAY ALL VENDOR COMMUNICATIONS, PROCESS VARIABLES AND ALARMS IN THE FCS.
17. FCS I/O SIGNALS ARE HARDWIRED TO FIELD INSTRUMENTS VIA THE PLC PANEL.
18. ALARM IS ACTIVATED IF VALVE XV-3202A-- IS NOT CLOSED.
19. E-STOP HS-3290A-C WILL CLOSE NATURAL GAS BLOCKING VALVES XV-3200A-- AND XV-3201A--, AND OPEN NATURAL GAS VENT VALVE XV-3202A--.
20. FLOW METERS FE-3353A--, FE-3355A--, FE-3357A--, FE-3359A--, AND FE-3361A-- ARE SUPPLIED IN PIPING MATERIAL CLASS R INSTEAD OF NC AS JUSTIFIED IN CALCULATION 24915-307-VIA-MBT0-00191. CONTROL VALVES FV-1366A-- AND FV-1426A-- ARE SUPPLIED IN PIPING MATERIAL CLASS W INSTEAD OF NC, AND FV-1391A-- AND FV-1880A-- ARE SUPPLIED IN PIPING MATERIAL CLASS R INSTEAD OF NC BASED ON THE RESULTS OF THIS SAME CALCULATION.
21. NOZZLES N3, N4, N5A, N5B, N7A, N7C, N7D, AND N8 ARE NOT DEPICTED SINCE THEY ARE BRICKED OVER.
22. USE OF EXPANDED METAL TO PROTECT PERSONNEL FROM TOX SURFACES GREATER THAN 140°F WAS WAIVED IN ACCORDANCE WITH SDDR 24915-307-YDA-MBT0-10018.
23. REV. 8, INCORPORATED DCN-279, -504, -722, 784, AND -831; SDDR 24915-307-YDA-MBT0-10006 AND 24915-307-YDA-MBT0-10007; AND HTL-1273, -6490, -6528, -6531, -6548, AND -6573.
24. FOR ADDITIONAL DETAILS ON MATERIALS OF CONSTRUCTION FOR THE INDIVIDUAL COMPONENTS, SEE 24915-11-00316.
25. TRANSMITTER OR SWITCH TO BE LOCATED REMOTELY TO ENABLE ADEQUATE HEAT DISSIPATION.
26. FOR DETAILS OF MATERIALS OF CONSTRUCTION FOR BURNER MB-OTM-0101, SEE SUBMITTAL 24915-307-VIA-MBT0-00188.
27. FOR DETAILS OF MATERIALS OF CONSTRUCTION FOR TOX MK-OTM-0106, SEE SUBMITTAL 24915-307-VIA-MBT0-00226.

BASED ON BLUE GRASS PFD 24915-07-M5-OTM-00001 REV.7
BASED ON BLUE GRASS MSD 24915-07-N0-OTM-00001 REV.6
BASED ON VENDOR SUBMITTAL 24915-307-VIA-MBT0-00001

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APVD
8 [9]	05/17/12	IFC, SEE NOTE 23	BDT	JAW	SA	KMR	KMR
7 [7]	01/15/09	IFC,ADD HTL 1270-1277,1279,1280,1339,1340 VEN DATA	JLL	PEB	BM	BBB	BBB
6	07/03/07	IFC, REDRAWN TO INCORP VENDOR DATA, TREND #139	JSM	JLL	PEB	JB	BBB
5 [21]	11/29/06	ISSUED FOR DESIGN (IFD), ADD MODEL REVIEW COMMENT	JSM	JLL	PEB	JB	BBB
4 [16]	09/19/06	IFD, ADD GOV COMMENTS, HAZOP, DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
3 [23]	05/03/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
2 [26]	02/22/06	ISSUED FOR DESIGN (IFD), ADD DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	BBB
1 [17]	01/13/06	IFA, ADD GC 3610,3611,3612, DESIGN DEVELOPMENT	JSM	JLL	PEB	JB	PGK

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

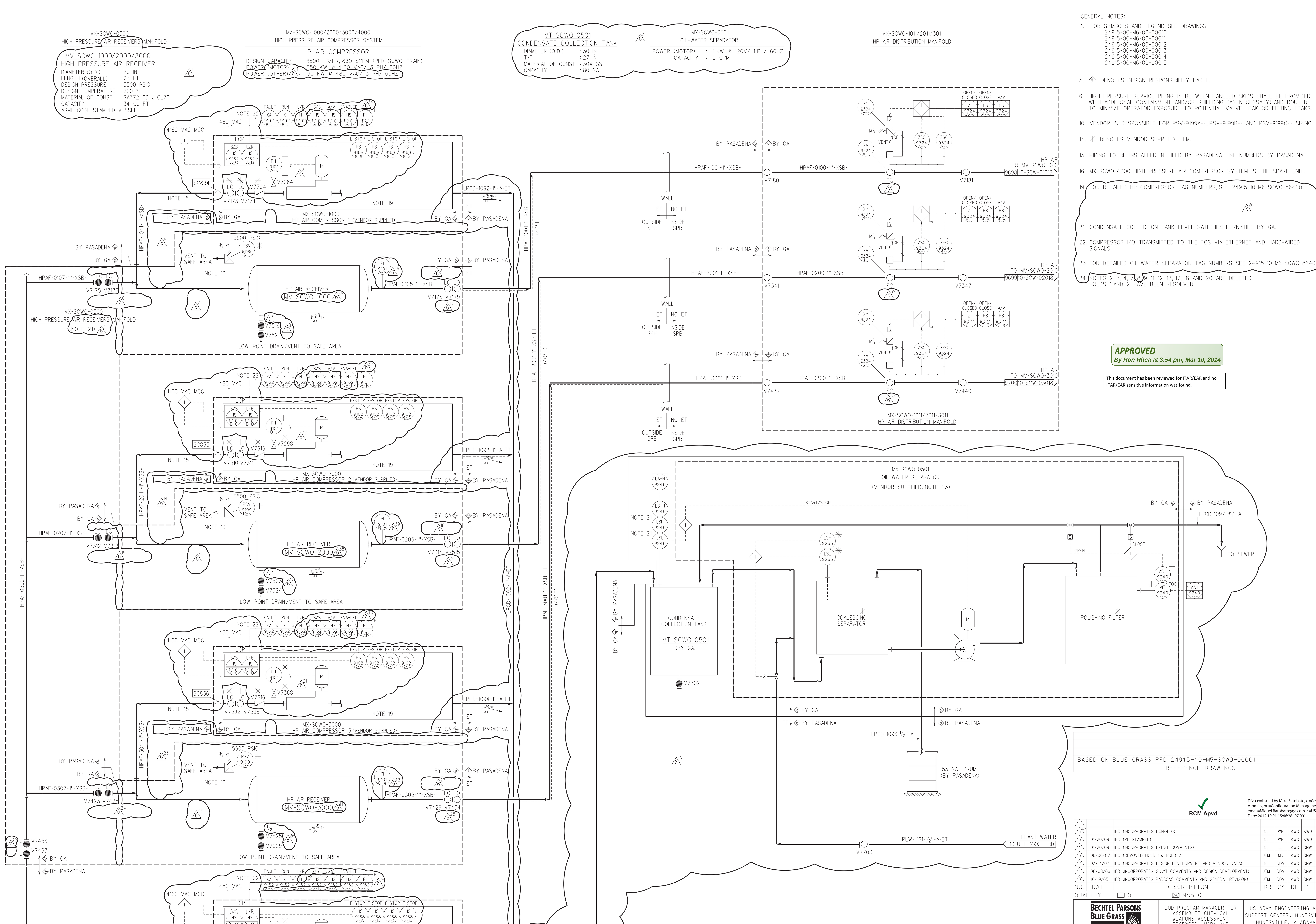
MUNITIONS DEMILITARIZATION BUILDING MPT THERMAL OXIDIZER UNIT - LN 1 PIPING & INSTRUMENT DIAGRAM

DRAWING CONTAINS PE SEAL, ORIGINAL ON FILE
PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M6-OTM-00001 | SHEET 1 OF 1 | REV 8

BGCAPP_DGN.BDR

.../3d/mp/dwgs/pid/07motm001.pid 5/21/2012 9:50:41 AM



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015

5. DENOTES DESIGN RESPONSIBILITY LABEL.

6. HIGH PRESSURE SERVICE PIPING IN BETWEEN PANELED SKIDS SHALL BE PROVIDED WITH ADDITIONAL CONTAINMENT AND/OR SHIELDING (AS NECESSARY) AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE LEAK OR FITTING LEAKS.

10. VENDOR IS RESPONSIBLE FOR PSV-9199A--, PSV-9199B-- AND PSV-9199C-- SIZING.

14. ✳ DENOTES VENDOR SUPPLIED ITEM.

15. PIPING TO BE INSTALLED IN FIELD BY PASADENA. LINE NUMBERS BY PASADENA.

16. MX-SCWO-4000 HIGH PRESSURE AIR COMPRESSOR SYSTEM IS THE SPARE UNIT.

19. FOR DETAILED HP COMPRESSOR TAG NUMBERS, SEE 24915-10-M6-SCWO-86400.

21. CONDENSATE COLLECTION TANK LEVEL SWITCHES FURNISHED BY GA.

22. COMPRESSOR I/O TRANSMITTED TO THE FCS VIA ETHERNET AND HARD-WIRED SIGNALS.

23. FOR DETAILED OIL-WATER SEPARATOR TAG NUMBERS, SEE 24915-10-M6-SCWO-86401.

24. NOTES 2, 3, 4, 7, 8, 9, 11, 12, 13, 17, 18 AND 20 ARE DELETED. HOLDS 1 AND 2 HAVE BEEN RESOLVED.

APPROVED
By Ron Rhea at 3:54 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001
REFERENCE DRAWINGS

RCM Apvd

DN: cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
Date: 2012.10.01 15:46:28 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INCORPORATES DCN-440)	NL	WR	KWD	KWD	VN
5	01/20/09	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/20/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
3	06/06/07	IFC (REMOVED HOLD 1 & HOLD 2)	JEM	MD	KWD	DNW	VN
2	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING HP AIR DISTRIBUTION PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

DRAWING NUMBER 24915-10-M6-SCWO-00016 | SHEET 1 OF 1 | REV 6

BGCAPP_DGN.BDR

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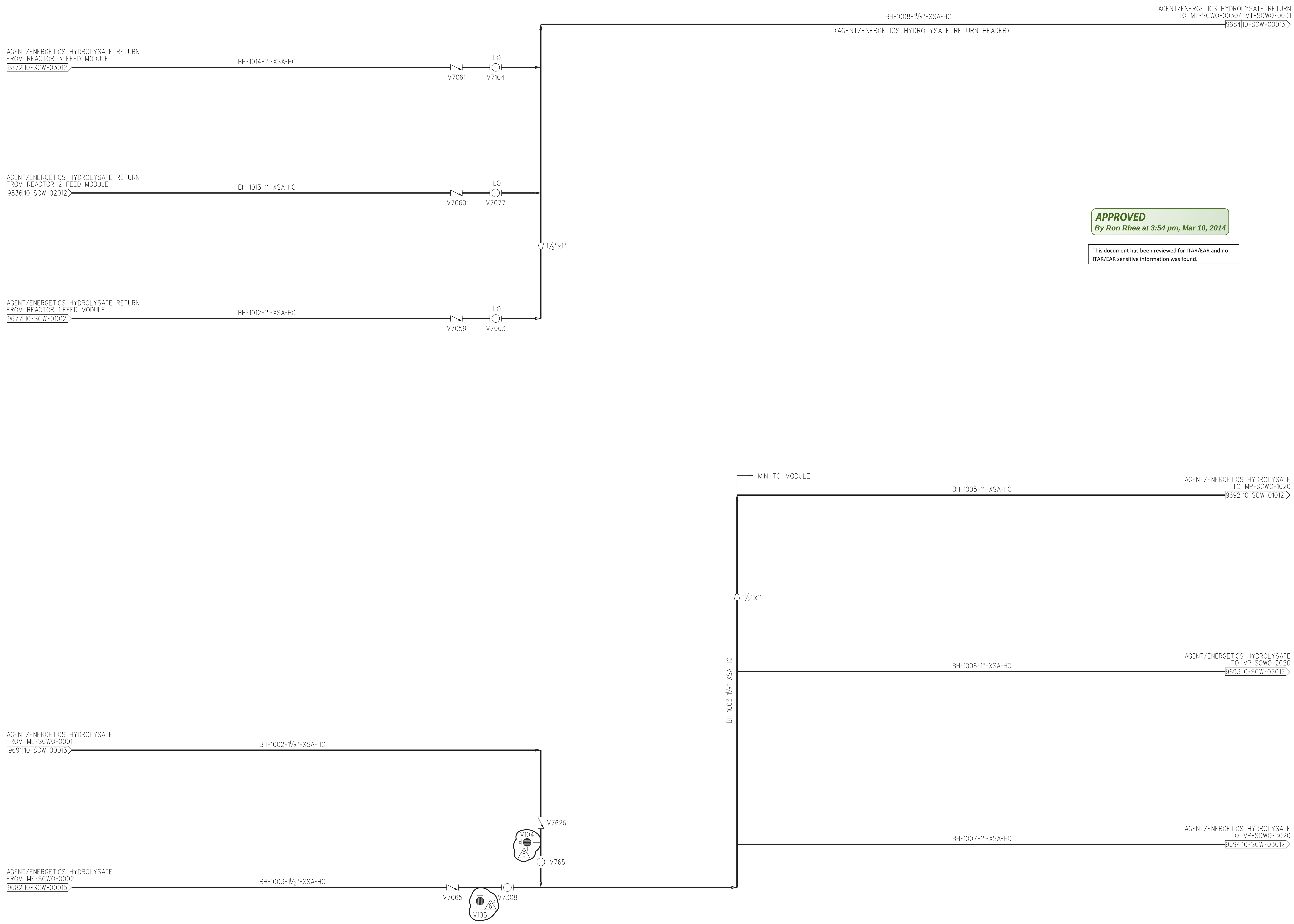
GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS:
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. FINAL ROUTING OF HEADERS TO CONFORM TO EQUIPMENT LAYOUT.
3. DELETED.
4. DELETED.
5. DESIGN SHALL INCLUDE WELDED PIPE (JOINTS) TO MAXIMUM EXTENT PRACTICAL, FLANGE SHIELDS AROUND FLANGED FITTINGS, AND DRIP-PROOF TRAYS BELOW FITTINGS AND OTHER POTENTIAL LEAK SOURCES. DESIGN TO INCLUDE SECONDARY CONTAINMENT TO CAPTURE FLANGE AND VALVE LEAKS.
6. ELECTRICAL AREA CLASSIFICATION: UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)
7. DELETED.
8. ALL PIPING/VALVES ON THIS DRAWING ARE BY PASADENA. 6



APPROVED
By Ron Rhea at 3:54 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001
REFERENCE DRAWINGS

RCM Apvd

DN: cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
Date: 2012.10.02 07:53:53 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INCORPORATES DCN-679)	NL	WR	KWD	KWD	VN
5	11/16/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	10/09/07	IFC (REVISED LINE NUMBER & PIPING ARRANGEMENT)	NL	MD	KWD	DNW	VN
3	06/06/07	IFC (REMOVED HOLD 1, REVISED LINE SIZE)	JEM	MD	KWD	DNW	VN
2	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/07/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING AGENT/ENRGTCS HYDROLYSATE DIST HDR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-00018 SHEET 1 OF 1 REV 6

BGCAPP_DGN.BDR

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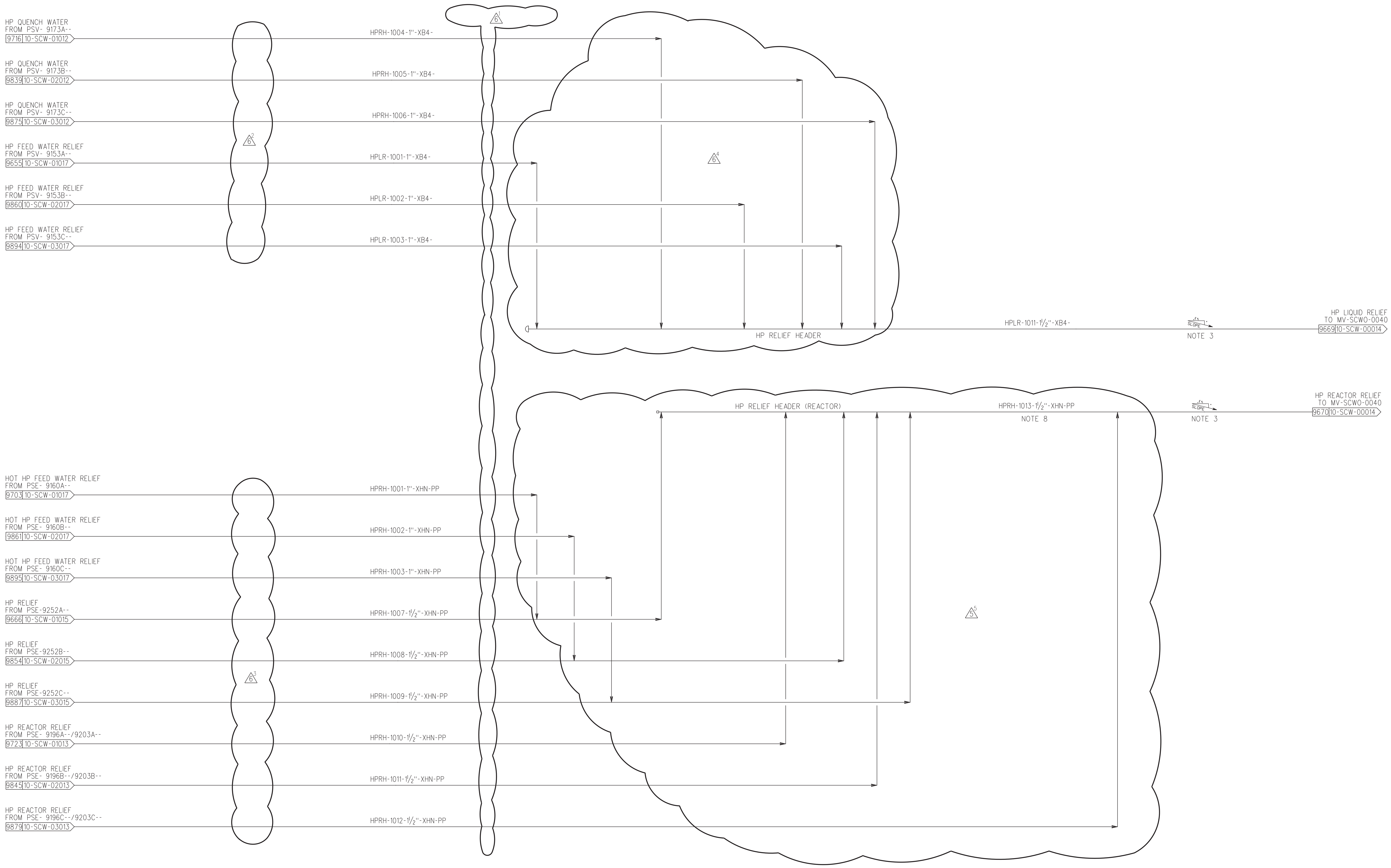

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS:
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. FINAL ROUTING OF HEADERS TO CONFORM TO EQUIPMENT LAYOUT.
3. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, WITH NO POCKETS.
6. TO ACCOMMODATE "SUPERIMPOSED" RELIEF HEADER BACKPRESSURE DURING A RELIEVING EVENT ON EXISTING RUPTURE DISK OR REACTOR BLOWDOWN, THE RELIEF AND BLOWDOWN PIPING HEADER TO BE DESIGNED AND SIZED TO AVOID EXCESSIVE BACKPRESSURE.
8. ROUTE HP RELIEF HEADER (REACTOR) FOR MINIMUM PIPE RUN TO MV-SCWO-0040.
11. ALL PIPING ON THIS DRAWING IS BY PASADENA. 6
12. NOTES 4, 5, 7, 9 AND 10 ARE DELETED.
    HOLD 1 HAS BEEN RESOLVED.

APPROVED
By Ron Rhea at 3:55 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

DN: cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
Date: 2012.10.02 08:10:13 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INCORPORATES DCN-679)	NL	JL	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	JL	KWD	KWD	VN
4	01/16/09	IFC (INCORPORATES REVISED INTERFACE LOCATION)	NL	JL	KWD	DNW	VN
3	06/06/07	IFC (REMOVED HOLD 1, REVISED LINE SIZE)	JEM	MD	KWD	DNW	VN
2	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/07/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING PRESSURE RELIEF HEADERS PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER	SHEET	REV
24915-10-M6-SCWO-00019	1 OF 1	6

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MX-SCWO-0010
CONDENSATE COLLECTION POT MODULE

MV-SCWO-0010
HP CONDENSATE COLLECTION POT

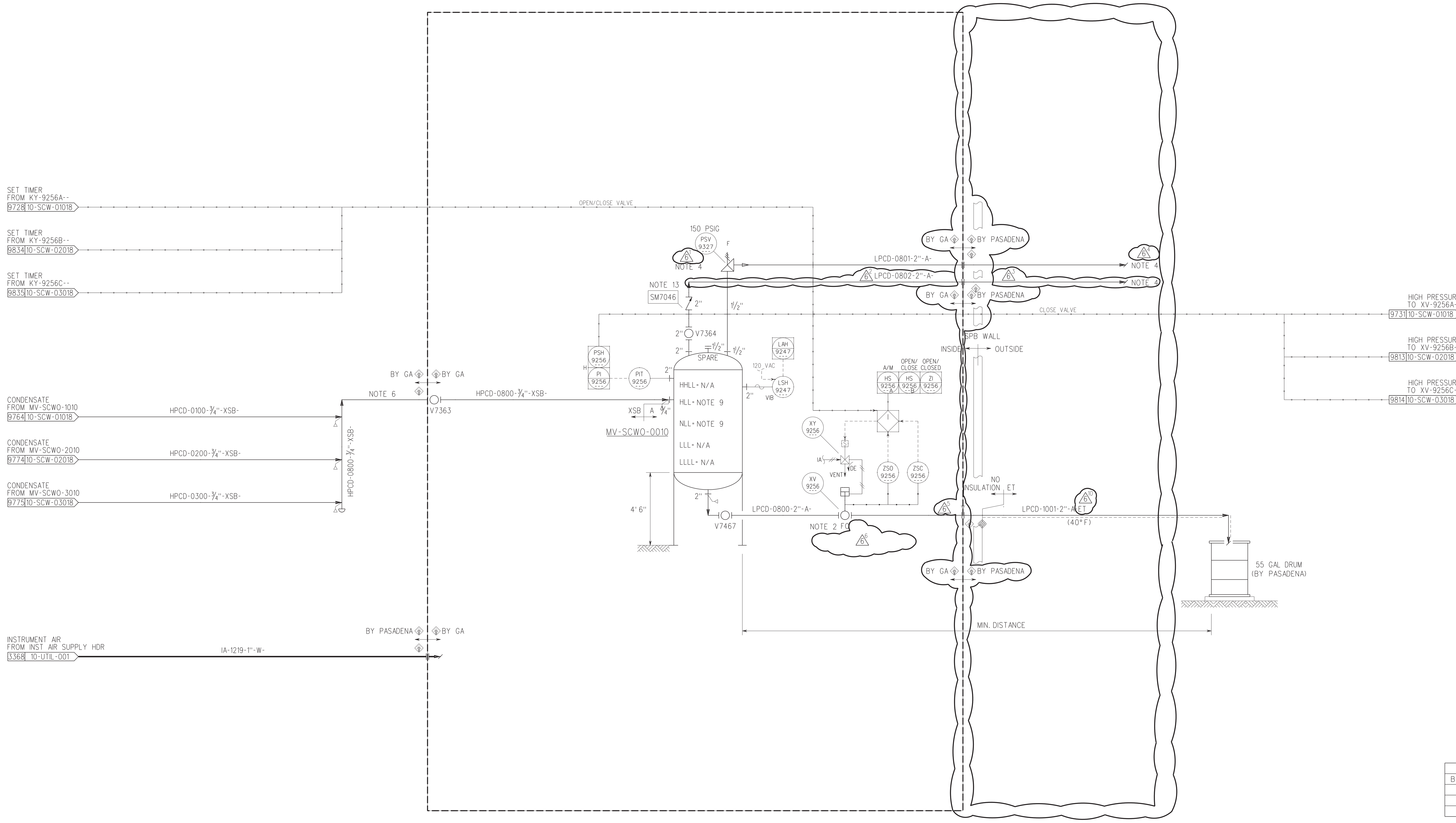
CAPACITY (WORKING) : 20 GAL
DIAMETER (O.D.) : 20 IN
T-T : 30 IN
DESIGN PRESSURE : 150 PSIG
DESIGN TEMPERATURE : 125 °F
MATERIAL OF CONST : CARBON STEEL
TRIM : TRIM-0818-0"-A-
ASME CODE STAMPED VESSEL

APPROVED
By Ron Rhea at 3:55 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS.
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. STAGGER AND DELAY TIMERS ON THE CONDENSATE DRAIN SYSTEM SO THAT XV-9256--- IS NOT OPEN WHEN XV-9256A--, XV-9256B--, XV9256C-- (SEE PIDS 24915-10-M6-SCWO-01018, -02018 & -03018) ARE OPEN AND THAT MV-SCWO-0010 IS EMPTIED IN ACCORDANCE WITH EACH SCWO TRAIN WHICH DRAINS AT DIFFERENT TIMES.
4. VENT OUTDOORS, THROUGH THE SPB WALL. 6 7
6. INTERCONNECTING PIPING BY GA.
8. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
9. HLL IS 50% OF VESSEL HEIGHT, NLL IS 25% OF VESSEL HEIGHT. LIQUID LEVEL IS MEASURED FROM POT'S BOTTOM TANGENT LINE.
12. COMMON INSTRUMENT AIR HEADER, AS SHOWN ON PID 24915-10-M6-SCWO-01018, SERVICES COMPONENTS ON THIS DRAWING.
13. THE CHECK VALVE (SM7046) IS TO BE DESIGNED TO OPEN UPON AN OVER PRESSURIZATION EVENT IF PIT-9256 FAILS TO RESPOND IN TIME TO CLOSE THE RESPECTIVE VALVE (XV-9256A--, XV-9256B-- OR XV-9256C--) OR WHEN VAPOR ENTERS THE VESSEL WHEN LIQUID CONDENSATE DRAINS. THIS IS LIKELY BECAUSE THE CONDENSATE DRAIN CONTROLS ARE BASED UPON SEASONAL PRE-DETERMINED STAGGERED TIME SET POINTS AND NOT ON ACTUAL LIQUID MEASUREMENT. 6 8
16. CONDENSATE COLLECTION POT MODULE MX-SCWO-0010 IS MOUNTED WITHIN AIR DISTRIBUTION MANIFOLD MX-SCWO-1011, P&ID 24915-10-M6-SCWO-01018. 6 9
17. NOTES 3, 5, 7, 10, 11, 14 AND 15 ARE DELETED.
    HOLDS 1 AND 2 HAVE BEEN RESOLVED.



BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

DN: cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
Date: 2012.10.02 08:27:57 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INCORPORATES DCN-440)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/15/09	IFC (INCORPORATES BPBGT COMMENTS AND REMOVAL OF HOLD)	NL	JL	KWD	DNW	VN
3	06/06/07	IFC (REMOVED HOLD 1, ADDED HOLD 2, LINE SIZE CHANGE)	JEM	MD	KWD	DNW	VN
2	03/16/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING CONDENSATE COLLECTION POT PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-00025
SHEET 1 OF 1
REV 6

BGCAPP_DGN.BDR

10MSCWO025.pid 09/04/12

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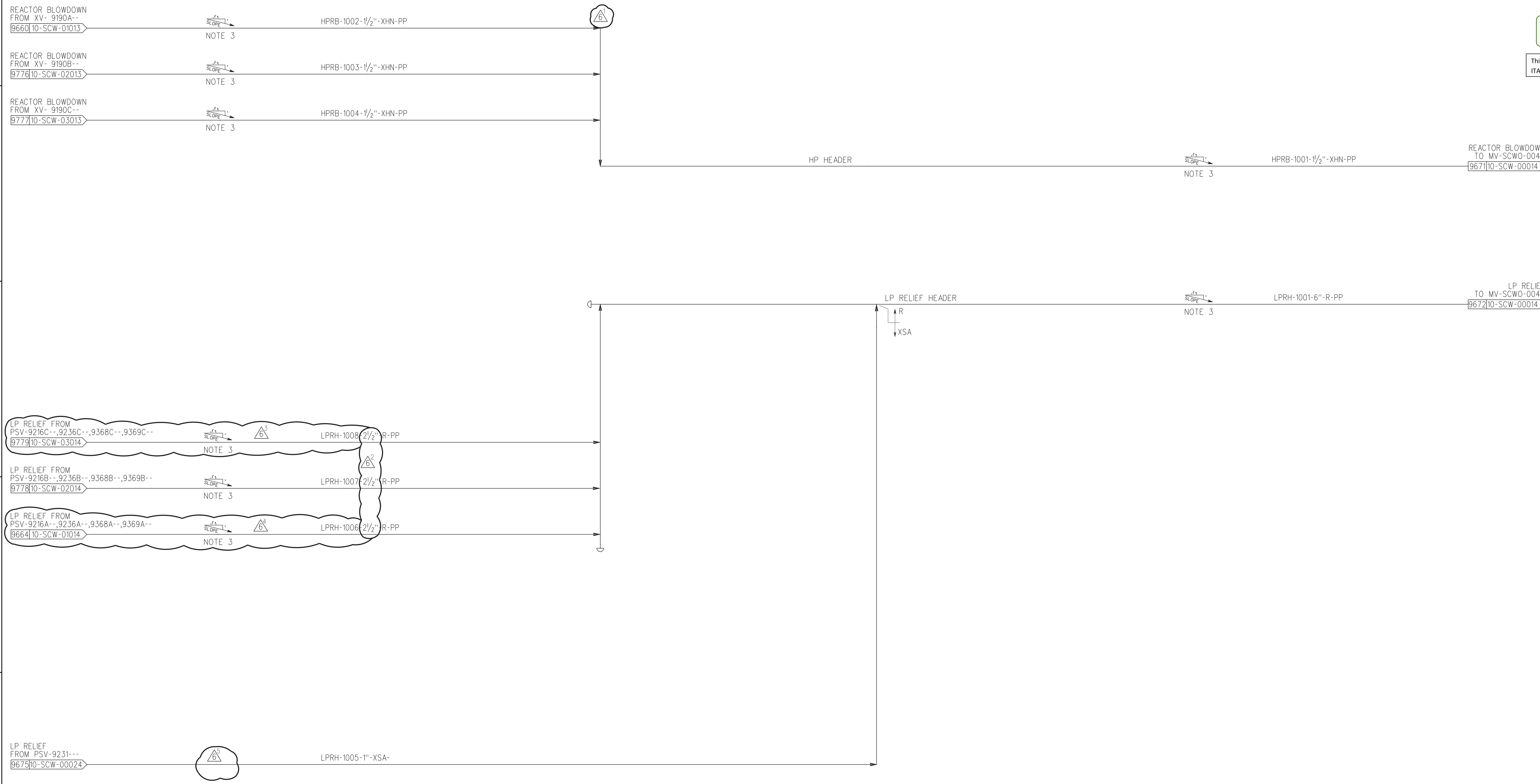
GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS:
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. FINAL ROUTING OF HEADERS TO CONFORM TO EQUIPMENT LAYOUT.
3. HP REACTOR BLOWDOWN PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, WITH NO POCKETS.
6. TO ACCOMMODATE "SUPERIMPOSED" RELIEF HEADER BACKPRESSURE DURING A RELIEVING EVENT, THE RELIEF PIPING HEADER WILL BE DESIGNED TO AVOID EXCESSIVE BACKPRESSURE.
10. ALL PIPING ON THIS DRAWING IS BY PASADENA.
11. NOTES 4, 5, 7, 8 AND 9 ARE DELETED. HOLD 1 HAS BEEN RESOLVED.

APPROVED
By Ron Rhea at 3:56 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.



BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

DN: cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
Date: 2012.10.02 09:07:45 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		IFC (INCORPORATES DCN-679)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (RELIEF PIPING REMOVED PER DCN240 & PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
3	06/06/07	IFC (REVISED MANIFOLD ARRANGEMENT, CHANGED PIPE CLASS)	NL	MD	KWD	DNW	VN
2	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING REACTOR BLOWDOWN & PRESS RELIEF HDR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-00026 SHEET 1 OF 1 REV 6

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MX-SCWO-0042
HYDROLYSATE BLEND/BATCH TANKS HEATER MODULE

ME-SCWO-0003
BATCH HYDROLYSATE HOLDING TANK HTR

DUTY	: 720,000 BTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG/FV
DESIGN TEMP (SHELL)	: 375 °F
DESIGN PRESS (TUBE)	: 150 PSIG
DESIGN TEMP (TUBE)	: 200 °F
MATERIAL OF CONST (SHELL)	: CARBON STEEL
MATERIAL OF CONST (TUBE)	: 316/316L SS
TRIM (SHELL)	: TRIM-0820-0"-A-HC
TRIM (TUBE)	: TRIM-0821-0"-XSA-HC

ASME CODE STAMP HEAT EXCHANGER

GENERAL NOTES:

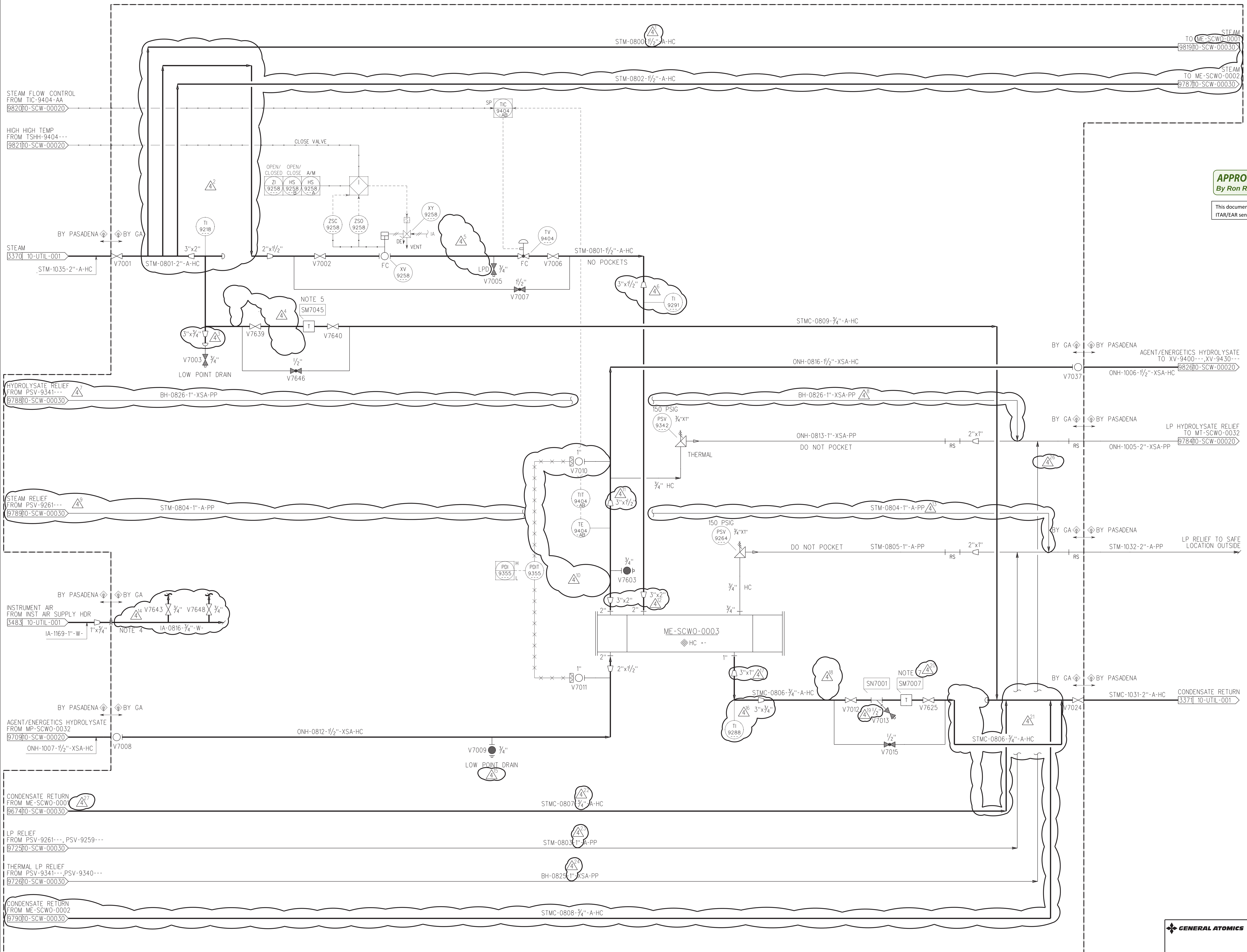
1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015

4. COMMON INSTRUMENT AIR HEADER SERVICES COMPONENTS ON THIS PID AS WELL AS COMPONENTS ON PID 24915-10-M6-SCWO-00030.

5. STEAM TRAP YARWAY 721 OR EQUAL WITH INTEGRAL Y-STRAINER AND BLOWOFF VALVE.

7. FLOAT AND THERMOSTATIC STEAM TRAP.

8. NOTES 2, 3 AND 6 ARE DELETED.



APPROVED
By Ron Rhea at 3:56 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Records / Configuration Management, email=Judy.Dishon@ga.com, c=US
2012.08.15 13:46:56 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4		IFC (INCORPORATES DCN-439)	NL	JL	KWD	DNW	VN
3	11/15/10	IFC (PE STAMPED)	NL	JL	KWD	DNW	VN
2	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
1	06/06/07	IFC (REVISED CONTROL VALVE BYPASS)	NL	MD	KWD	DNW	VN
0	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)

RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING HYDROL BATCH TANK HEATER PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-SCWO-00029 | SHEET 1 OF 1 | REV 4

BGCAPP_DGN.BDR

10MSCWO029.pid 02/06/12

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MX-SCWO-0042
HYDROLYSATE BLEND/BATCH TANKS HEATERS MODULE

ME-SCWO-0001
HYDROLYSATE BLEND TANK 1 HTR

DUTY	: 720,000 BTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG/FV
DESIGN TEMP (SHELL)	: 375 °F
DESIGN PRESS (TUBE)	: 150 PSIG
DESIGN TEMP (TUBE)	: 200 °F
MATERIAL OF CONST (SHELL)	: CARBON STEEL
MATERIAL OF CONST (TUBE)	: 316/316L SS
TRIM (SHELL)	: TRIM-0822-0"-A-HC
TRIM (TUBE)	: TRIM-0823-0"-XSA-HC

ASME CODE STAMP HEAT EXCHANGER

ME-SCWO-0002
HYDROLYSATE BLEND TANK 2 HTR

DUTY	: 720,000 BTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG/FV
DESIGN TEMP (SHELL)	: 375 °F
DESIGN PRESS (TUBE)	: 150 PSIG
DESIGN TEMP (TUBE)	: 200 °F
MATERIAL OF CONST (SHELL)	: CARBON STEEL
MATERIAL OF CONST (TUBE)	: 316/316L SS
TRIM (SHELL)	: TRIM-0824-0"-A-HC
TRIM (TUBE)	: TRIM-0825-0"-XSA-HC

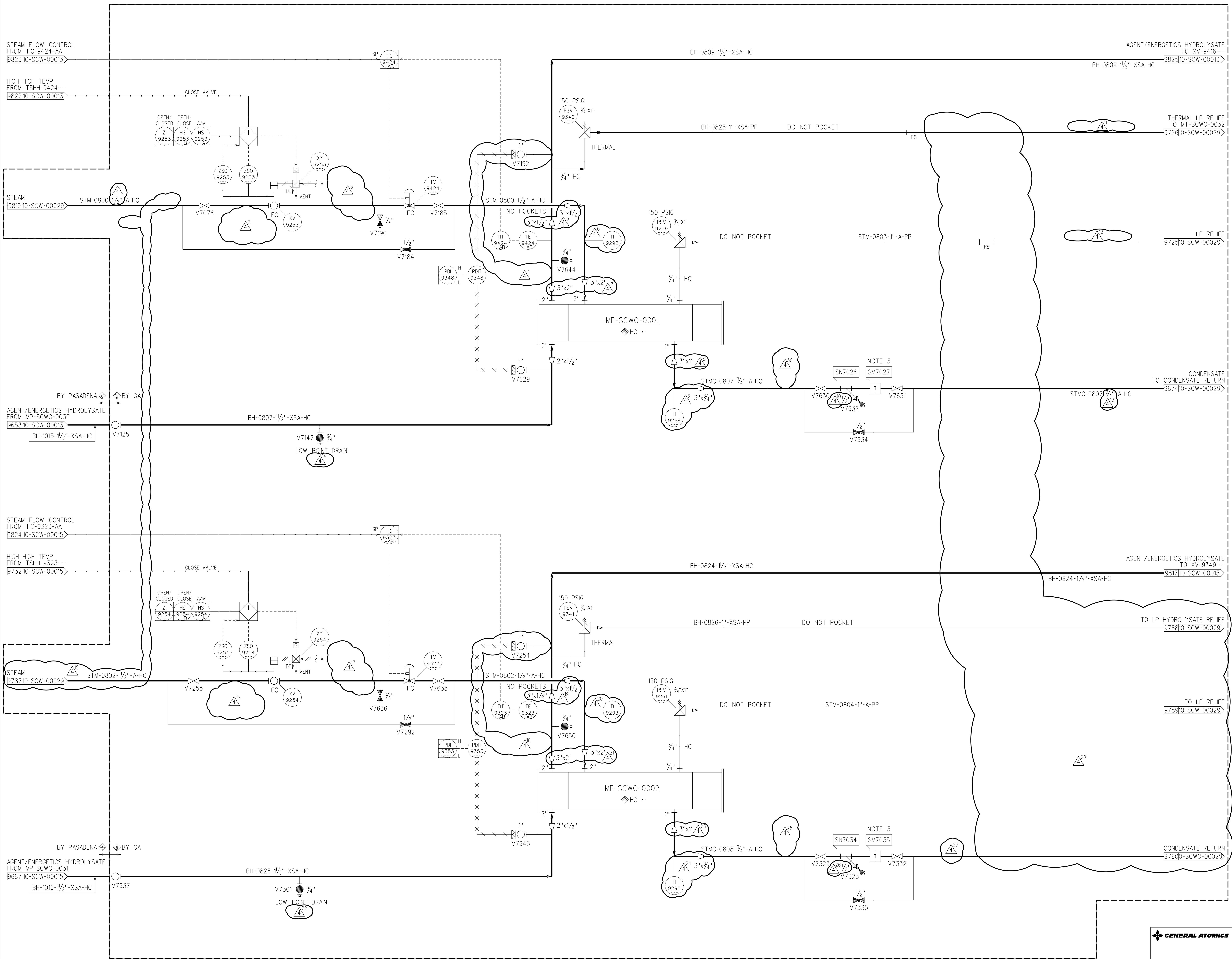
ASME CODE STAMP HEAT EXCHANGER

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
3. FLOAT AND THERMOSTATIC STEAM TRAP
5. NOTES 2 AND 4 ARE DELETED.

APPROVED
By Ron Rhea at 3:57 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.



BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4		IFC (INCORPORATES DCN-439)	NL	JL	KWD	DNW	VN
3	11/15/10	IFC (PE STAMPED)	NL	JL	KWD	DNW	VN
2	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
1	06/01/07	IFC (REVISED CONTROL VALVE BYPASS)	NL	MD	KWD	DNW	VN
0	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

SCWO PROCESSING BUILDING HYDROL BLEND TANK HEATERS 1 AND 2 PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-00030 | SHEET 1 OF 1 | REV 4

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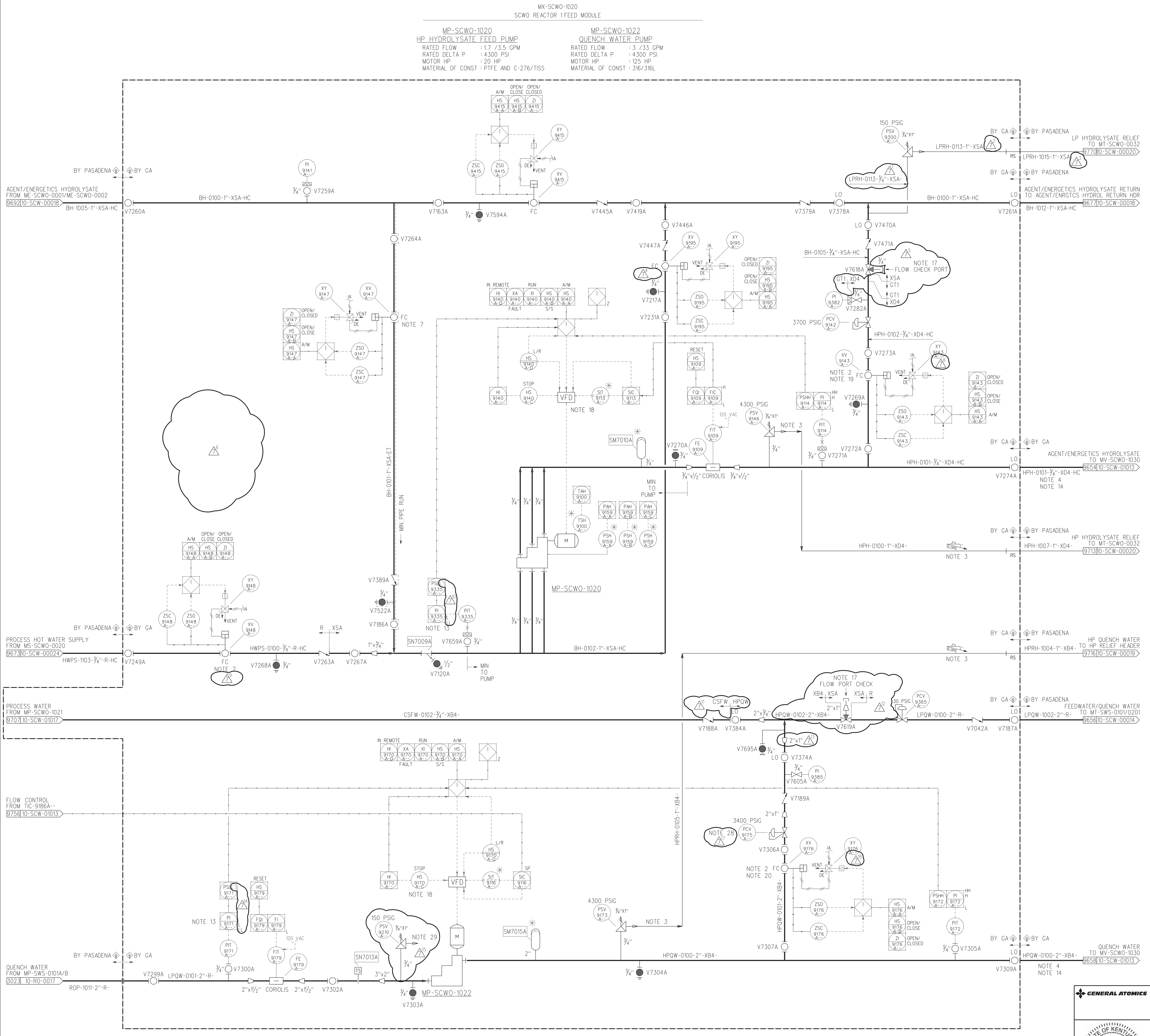

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV-9143A--
   XV-9176A--
3. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK OR BLEND TANK, AND WITH NO POCKETS.
4. INTERCONNECTING PIPING BY GA.
5. ELECTRICAL AREA CLASSIFICATION: UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)
7. PROGRAM AN INTERLOCK FOR XV-9148A-- TO ENSURE THAT IT CANNOT BE OPENED WHILE XV-9147A-- IS OPEN.
13. SHUT-OFF HP PUMP (HYDROLYSATE OR QUENCH WATER) UPON LOW LOW ALARM WHEN PUMP IS RUNNING.
14. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.
15. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
17. FLOW CHECK VALVE TO BE OPERATED AT LOW PRESSURE (i.e. PRESSURES ~ 30 PSIG OR LESS)
18. VFD TO BE PROVIDED BY PASADENA.
19. PROGRAM AN INTERLOCK BETWEEN XV-9143A-- AND XV-9222A-- (SEE SCWO PID - 01013) TO ENSURE BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
20. PROGRAM AN INTERLOCK BETWEEN XV-9176A-- AND XV-9198A-- (SEE SCWO PID - 01013) TO ENSURE BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
22. ✳ DENOTES SUPPLIED BY VENDOR.
28. PCV-9175A-- SETPOINT IS FOR PUMP CALIBRATION ONLY. SETPOINT TO BE ADJUSTED DOWN FOR OPERATION TO ALLOW PUMP RE-START AT NO LOAD.
29. RELIEVE INTO QUENCH PUMP DRIP PAN.
30. NOTES 6, 8, 9, 10, 11, 12, 16, 21, 23, 24, 25, 26 AND 27 ARE DELETED.

APPROVED
By Ron Rhea at 3:58 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Configuration / Data Management, email=Judy.dishon@ga.com, c=US
2013.06.18 09:56:21 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7		IFC (INCORPORATES DCN-1040)	NL	WR	KWD	KWD	VN
6	01/24/12	IFC (INCORPORATES DCN-381)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
3	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN
2	03/16/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/07/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

SCWO PROCESSING BUILDING TRAIN 1 QUENCH WATER AND HYDROL FEED PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-01012 | SHEET 1 OF 1 | REV 7

BGCAPP_DGN.BDR

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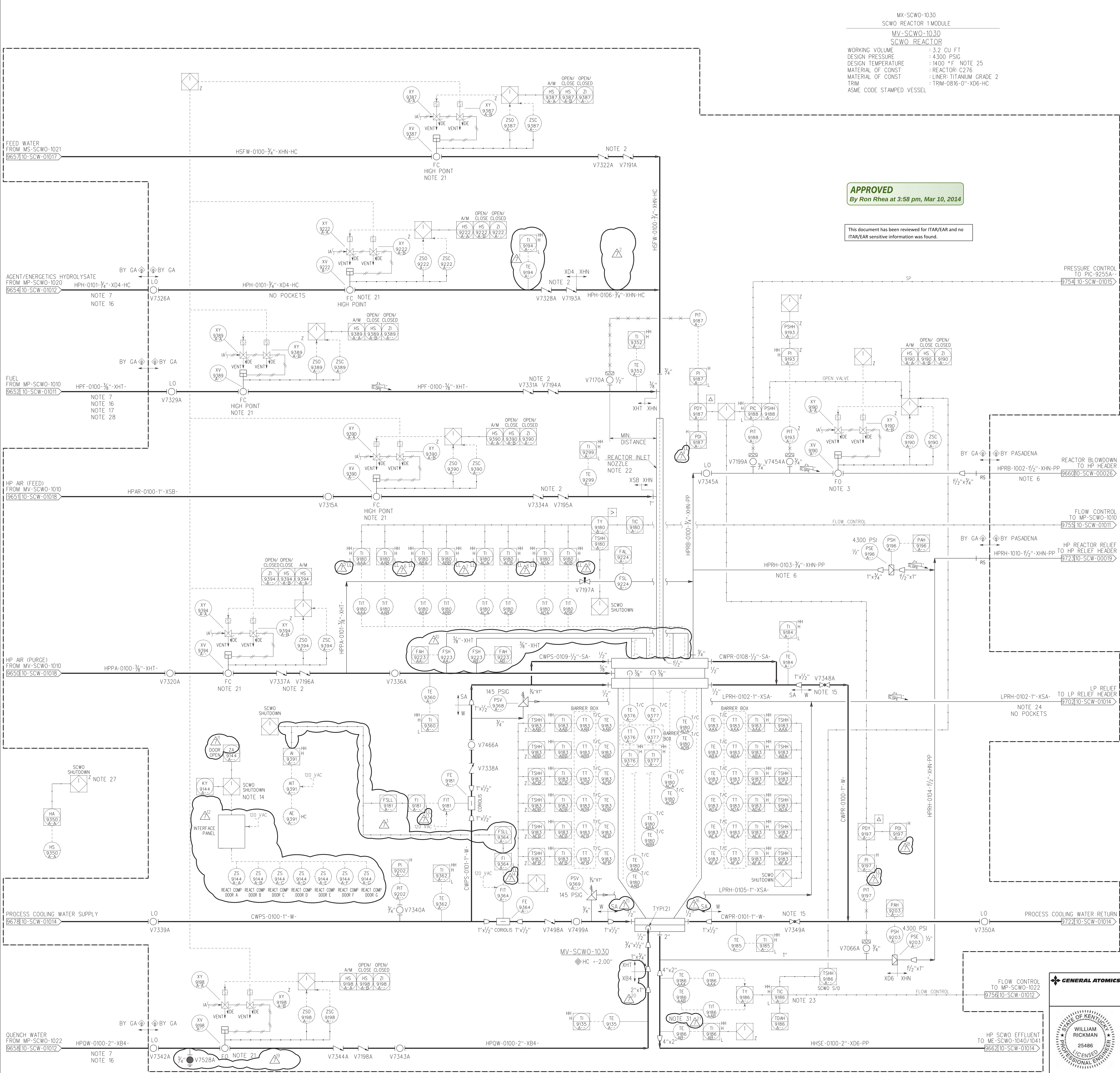

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015

2. FIRST CHECK VALVE PROVIDED WITH SOFT SEAT. SECOND CHECK VALVE PROVIDED WITH HARD SEAT, EXCEPT FOR HOT SERVICES WHERE ONLY HARD SEATS ARE PROVIDED.

3. THE FOLLOWING VALVE(S) ARE NORMALLY CLOSED:
   XV-9190A--

6. HP RELIEF AND REACTOR BLOWDOWN PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, AND WITH NO POCKETS.

7. INTERCONNECTING PIPING BY GA. IPA AND HYDROLYSATE PIPING IS ALL WELDED TO MAXIMUM EXTENT POSSIBLE. HPF-0100-3/8"-XHT SHALL BE DOUBLE CONTAINED WITHIN A 3/4" PIPE (MIN) XSA SHALL BE THIS PIPE'S DESIGNATION.

11. ELECTRICAL AREA CLASSIFICATION: CLASS 1, DIVISION 2, GROUP D.

13. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN AN UNCLASSIFIED (NON-HAZARD) AREA.

14. SYSTEM SHUTDOWN UPON OPENING OF CLASSIFIED COMPARTMENT DOOR (AFTER SPECIFIED TIME DELAY).

15. GLOBE VALVE IS TO BE LOCATED ADJACENT TO THE CORIOLIS FLOW METER.

16. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.

17. PROVIDE PROTECTION AROUND HIGH PRESSURE FUEL VALVES, FLANGES, AND FITTINGS TO PREVENT POTENTIAL IGNITION AT EXPOSED SURFACE. PROVIDE CONTAINMENT AROUND EXPOSED HIGH PRESSURE FUEL PIPING ANG TUBING.

18. DEDICATED VENTILATION OF ELECTRICAL CLASSIFICATION AREA (I.E. CLASS 1, DIVISION 2, GROUP D) IS REQUIRED TO PREVENT CROSS-VENTILATION OF POTENTIAL HAZARDOUS FUEL (IPA) VAPORS INTO UNCLASSIFIED AREAS.

19. DENOTES DESIGN RESPONSIBILITY LABEL.

21. THE FOLLOWING VALVES ARE TO BE SPECIFIED AS FAST CLOSING (<= 1.0 SEC, VENDOR TO VERIFY):
   XV-9387A--
   XV-9222A--
   XV-9389A--
   XV-9390A--
   XV-9394A--
   XV-9198A--

22. REACTOR FEED NOZZLE TO BE REMOVED (I.E. AFTER SYSTEM DEPRESSURIZATION, LOCK-OUT, TAG-OUT, ETC.) FOR VALVE MAINTENANCE WITH TEMPORARY BLIND FLANGES ADDED AS REQUIRED FOR SAFETY PURPOSES FOR XV-9387A--, XV-9222A--, XV-9389A-- AND XV-9390A--.

23. XV-9190A-- TO OPEN UPON TSHH-9186A-- HIGH HIGH ALARM.

24. FINAL ROUTING OF HEADER TO CONFORM TO EQUIPMENT LAYOUT.

25. REACTOR COMPONENTS SHALL BE DESIGNED FOR PROCESS TEMPERATURES OF 1200°F (OPERATING), 1250°F (MAX. OPERATING), AND 1400°F (DESIGN).

27. FPS TRAIN SHUTDOWN SWITCH LOCATED IN SPB LOCAL CONTROL ROOM.

28. FUEL PIPING IS ALL WELDED TO MAXIMUM PRACTICAL EXTENT.

31. TE-9186AAA, AAB, AND AB- ARE LOCATED OUTSIDE OF THE ELECTRICALLY CLASSIFIED AREA. 7 22

32. NOTES 4, 5, 8, 9, 10, 12, 20, 26, 29 AND 30 ARE DELETED.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Configuration / Data Management, email=Judy.dishon@ga.com, c=US
2013.06.18 10:38:24 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
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6	01/24/12	IFC (INCORPORATES DCN-382)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/15/09	IFC (INCORPORATES GOV'T AND BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
3	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	NL	MD	KWD	DNW	VN
2	03/16/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/07/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING TRAIN 1 REACTOR PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-SCWO-01013 | SHEET 1 OF 1 | REV 7

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MX-SCWO-1030
SCWO REACTOR 1 MODULE

ME-SCWO-1040 EFFLUENT HEAT EXCHANGER 1		ME-SCWO-1041 EFFLUENT HEAT EXCHANGER 2	
DUTY	: 1,710,000 BTU/HR	DUTY	: 1,710,000 BTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG	DESIGN PRESS (SHELL)	: 150 PSIG
DESIGN TEMP (SHELL)	: 185 °F	DESIGN TEMP (SHELL)	: 185 °F
DESIGN PRESS (TUBE)	: 4300 PSIG	DESIGN PRESS (TUBE)	: 4300 PSIG
DESIGN TEMP (TUBE)	: 750 °F	DESIGN TEMP (TUBE)	: 750 °F
MATERIAL OF CONST (SHELL)	: CARBON STEEL	MATERIAL OF CONST (SHELL)	: CARBON STEEL
MATERIAL OF CONST (TUBE)	: C276	MATERIAL OF CONST (TUBE)	: C276
TRIM (SHELL)	: TRIM-0808-0"-W-	TRIM (SHELL)	: TRIM-0810-0"-W-
TRIM (TUBE)	: TRIM-0809-0"-XD6-PP	TRIM (TUBE)	: TRIM-0811-0"-XD6-PP
ASME CODE STAMPED VESSEL		ASME CODE STAMPED VESSEL	

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015

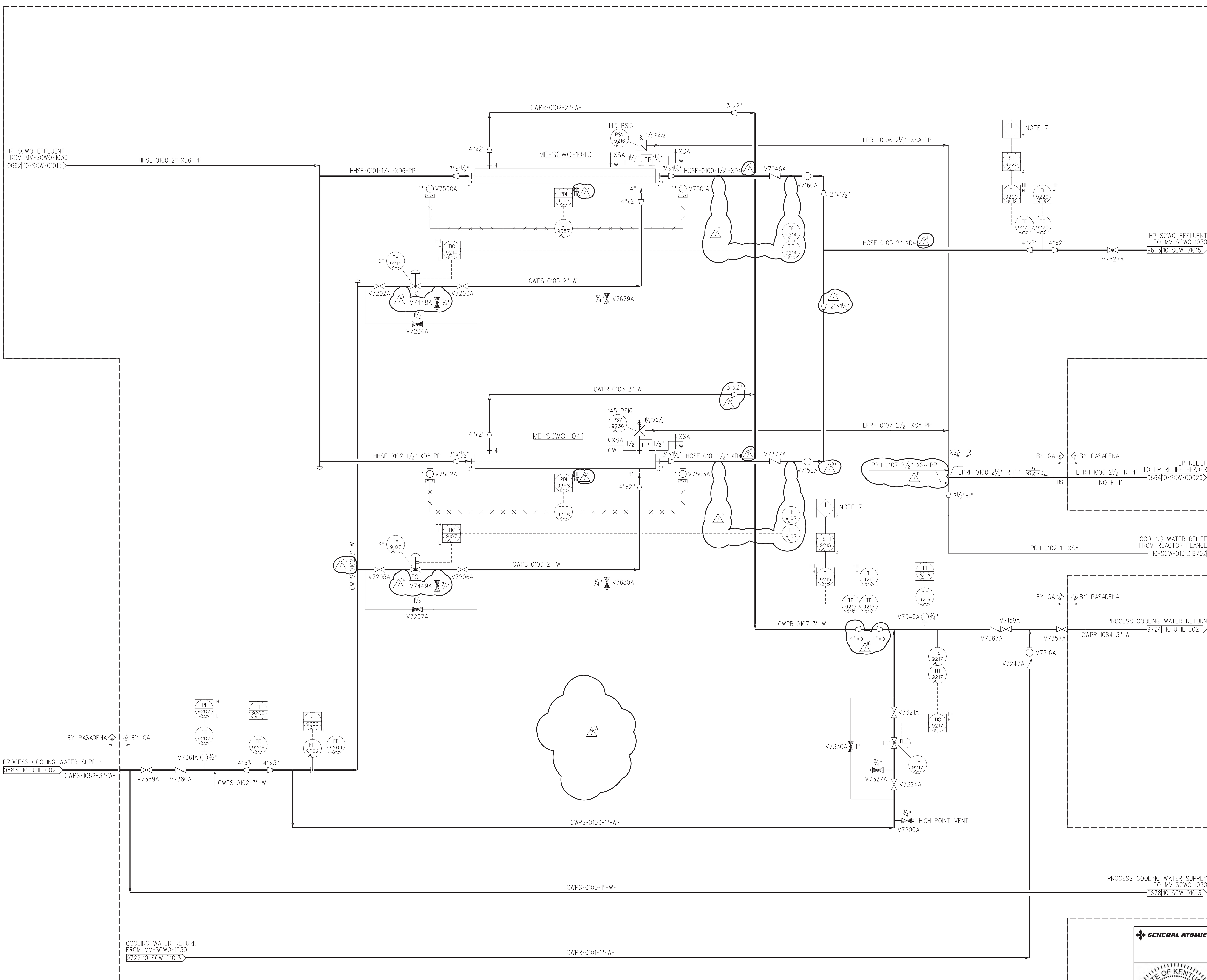
6. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN UNCLASSIFIED (NON-HAZARD) AREA.

7. SCWO REACTOR TO SHUT DOWN ON HIGH-HIGH COOLING WATER DISCHARGE TEMPERATURE OR HIGH-HIGH EFFLUENT TEMPERATURE.

9. DENOTES DESIGN RESPONSIBILITY LABEL.

11. FINAL ROUTING OF RELIEF HEADER TO CONFORM TO EQUIPMENT LAYOUT.

16. NOTES 2, 3, 4, 5, 8, 10, 12, 13, 14 AND 15 ARE DELETED.



APPROVED
By Ron Rhea at 3:59 pm, Mar 10, 2014

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.06.18 09:55:25 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7		IFC (INC DCN-1040)	NL	WR	KWD	KWD	VN
6	01/23/12	IFC (INC DCN-382)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/20/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
3	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	NL	MD	KWD	DNW	VN
2	03/16/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	DDV	KWD	DNW	VN
0	10/19/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING TRAIN 1 EFFLUENT COOLING PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-01014 | SHEET 1 OF 1 | REV 7

BGCAPP_DGN.BDR

10MSCW01014.pid 03/15/13

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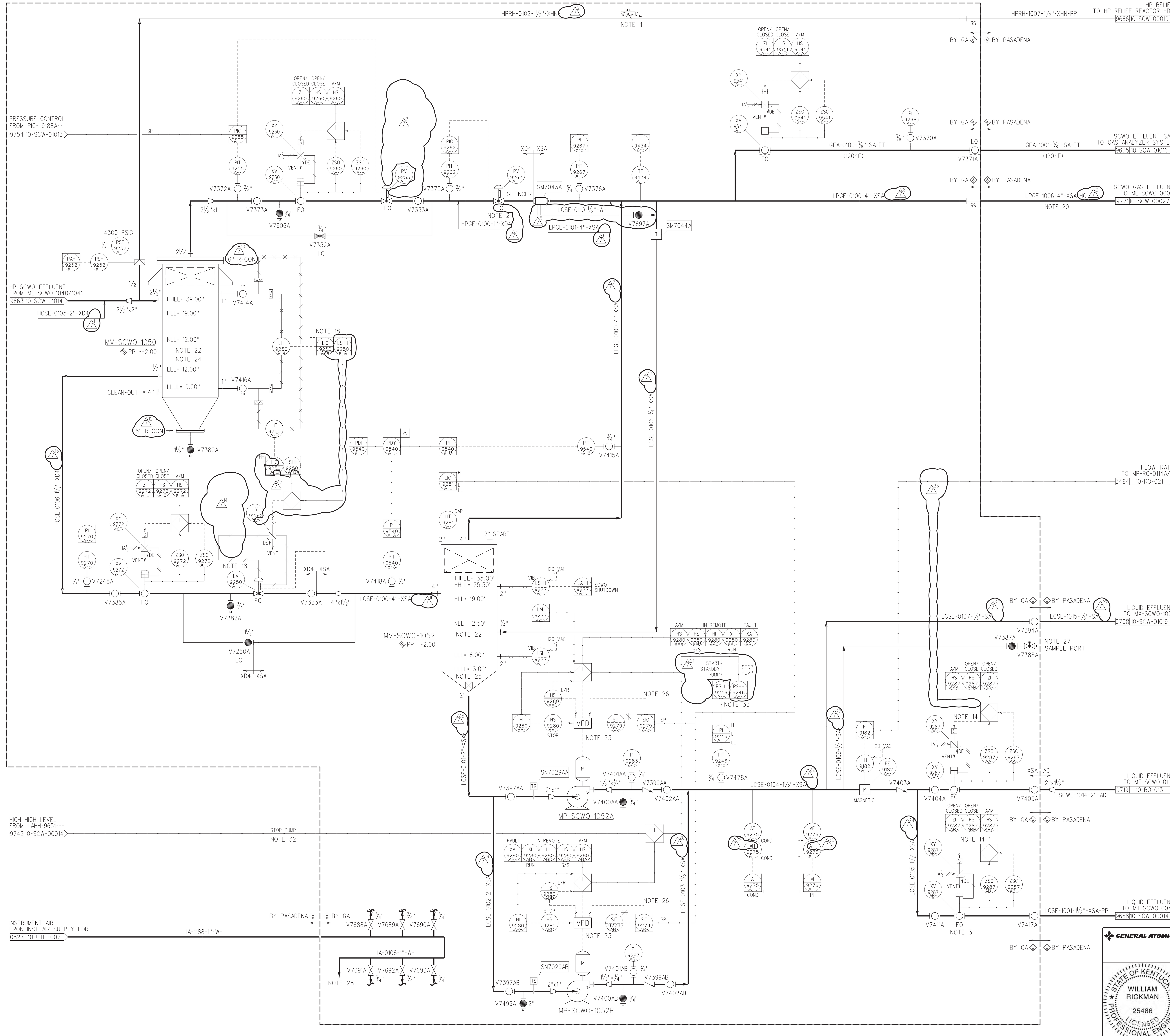
MX-SCWO-1030
SCWO REACTOR 1 MODULE

MV-SCWO-1050 HP GAS/LIQUID SEPARATOR		MV-SCWO-1052 LP GAS/LIQUID SEPARATOR		MP-SCWO-1052A/B LIQUID EFFLUENT PUMP	
I.D.	: 11.2 IN	I.D.	: 29.5 IN	RATED FLOW	: 5/40 GPM
T-T	: 82 IN	T-T	: 79 IN	RATED DELTA P	: 30 PSI
DESIGN PRESSURE	: 4300 PSIG/FV	DESIGN PRESSURE	: 5 PSIG	MOTOR HP	: 3 HP
DESIGN TEMPERATURE	: 190 °F	DESIGN TEMPERATURE	: 190 °F	MATERIAL OF CONST	: 316/316L
MATERIAL OF CONST	: C276	MATERIAL OF CONST	: 316L		
TRIM	: TRIM-0806-0"-XD4-PP	TRIM	: TRIM-0807-0"-XSA-PP		
ASME CODE STAMPED VESSEL					



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. PV-9262A-- HAS A CONTINUOUS SET POINT OF ~1000 PSIG TO REDUCE THE PRESSURE DROP OVER PV-9255A-- TO AVOID CAVITATION AND ASSOCIATED WEAR.
3. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV- 9287AB-
4. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, AND WITH NO POCKET.
9. ✳ DENOTES SUPPLIED BY VENDOR.
14. PROGRAM AN INTERLOCK BETWEEN XV-9287AA- AND XV-9287AB- TO ENSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
15. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
18. HP GAS/LIQUID SEPARATOR OUTLET VALVE LV-9250A-- TO CONTROL FLOW AT A PRE-SET VALUE (VALVE PERCENT OPEN) WHICH IS TO BE DETERMINED PRIOR TO SYSTEM START-UP. AUTOMATIC LEVEL CONTROL IS AVAILABLE AS AN OPTION.
20. DO NOT POCKET.
22. LIQUID LEVEL SET POINTS ARE MEASURED FROM VESSEL'S BOTTOM TANGENT LINE. SET POINTS SHOWN ARE FOR THE PLANNED OPERATING MODE WHERE THE HPGLS RUNS WITH NO DEFINED LIQUID LEVEL, I.E., ALL LIQUID AND SOME GAS EXIT THE BOTTOM OF THE VESSEL. FCS PROGRAMMED SET POINTS ARE PER TABLE 6 (CORRESPONDING TO THE BACK UP CASE WHERE A DEFINED, CONTROLLED LIQUID LEVEL IS DESIRED) OF 10-M6C-SCWO-00003, HPGLS CALCULATION SIZING, AND REFERENCED RELATIVE TO DP SENSOR MOUNTING LOCATION. 7 28
23. VFD TO BE PROVIDED BY PASADENA.
24. 2 1/2 INCH NOZZLE SIZE IS SPECIFIED TO MAINTAIN HP GLS GAS VELOCITY WITHIN THE SPECIFIED LIMITS. NOZZLE TO BE PROVIDED BY EQUIPMENT VENDOR AS PART OF MANUFACTURER'S STANDARD REQUIREMENT.
25. VORTEX BREAKER TO BE PROVIDED.
26. THE VFD SPEED CONTROLLER SHALL BE PRE-SET WITH A MINIMUM FLOW CONTROL SETPOINT (BASED UPON FINAL PUMP VENDOR SELECTION REQUIREMENT) TO AVOID PUMP DAMAGE DURING A MINIMUM FLOW CONDITION.
27. SAMPLE VALVES TO BE LOCATED AT EDGE OF SKID TO BE ACCESSIBLE BY OPERATOR DURING NORMAL OPERATIONS WITHOUT ENTERING SKID.
28. COMMON INSTRUMENT AIR HEADER SERVICES MODULE MX-SCWO-1030 SHOWN ON THIS PID AS WELL AS COMPONENTS SHOWN ON PIDS 24915-10-M6-SCWO-01013, -01014 AND -01017.
30. CONTROL SYSTEM TO ENSURE NO AUTOSTART OF SECOND LIQUID EFFLUENT PUMP IF DOWNSTREAM VALVES XV-9287AA- AND XV-9287AB- ARE BOTH CLOSED.
32. PUMP SHALL STOP UPON OFF-SPEC TANK HIGH-HIGH LEVEL FROM LAHH-9651--- ONLY IF VALVE XV-9287AB- IS OPEN.
33. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 10 SECONDS, THE "LEAD" PUMP WILL STOP.
    IF THE "STANDBY" PUMP DOES NOT REACH THE NORMAL SET POINT WITHIN ANOTHER 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP.
    IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR PRESSURE TO FALL BELOW NORMAL.
34. NOTES 5, 6, 7, 8, 10, 11, 12, 13, 16, 17, 19, 21, 29 AND 31 ARE DELETED.

APPROVED
By Ron Rhea at 3:59 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.06.18 10:42:01 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7 30		IFC (INC DCN-1040)	NL	WR	KWD	KWD	VN
6	01/25/12	IFC (INC DCN-382)	NL	WR	KWD	KWD	VN
5	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
4	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
3	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN
2	03/15/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	KWD	KWD	DNW	VN
1	08/08/06	IFD (INCORPORATES GOV'T COMMENTS AND DESIGN DEVELOPMENT)	JEM	KWD	KWD	DNW	VN
0	10/21/05	IFD (INCORPORATES PARSONS COMMENTS AND GENERAL REVISION)	JEM	KWD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

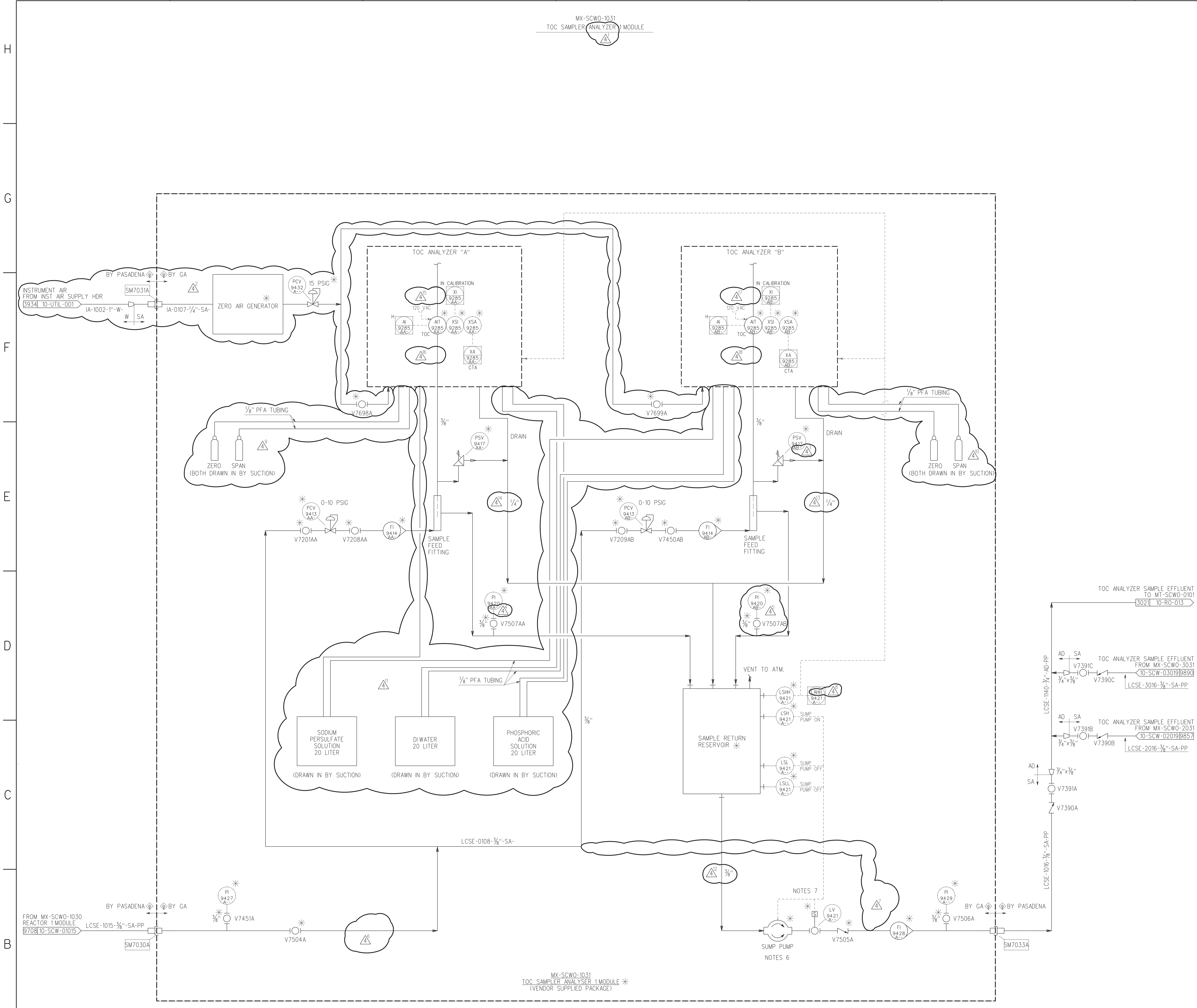
STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING TRAIN 1 GAS/LIQUID SEPARATION PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-01015 | SHEET 1 OF 1 | REV 7

BGCAPP_DGN.BDR

10MSCWO1015.pid 03/15/13



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. CONTROL PANELS AND TOC SAMPLE ANALYZERS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN UNCLASSIFIED (NON-HAZARD) AREA.
3. TOC ANALYZER SAMPLE PUMP(S) SHALL BE SIZED WITH HEAD GREATER THAN LIQUID EFFLUENT PUMP.
4. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
5. ✳ DENOTES SUPPLIED BY VENDOR.
6. SUMP PUMP TURNS ON UPON HIGH RESERVOIR LIQUID LEVEL. SUMP PUMP TURNS OFF UPON LOW AND LOW LOW RESERVOIR LIQUID LEVEL.
7. VALVE LV-9421A-- OPENS WHEN SUMP PUMP TURNS ON AND CLOSES WHEN SUMP PUMP TURNS OFF.
9. NOTE 8 IS DELETED.

APPROVED
By Ron Rhea at 4:00 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

DN: cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
Date: 2012.10.02 10:00:56 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
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1	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN
0	03/14/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	NL	DDV	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING TRAIN 1 TOC SAMPLE ANALYZER PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-01019 | SHEET 1 OF 1 | REV 4

BGCAPP_DGN.BDR

10MSCW01019.pid 07/27/12

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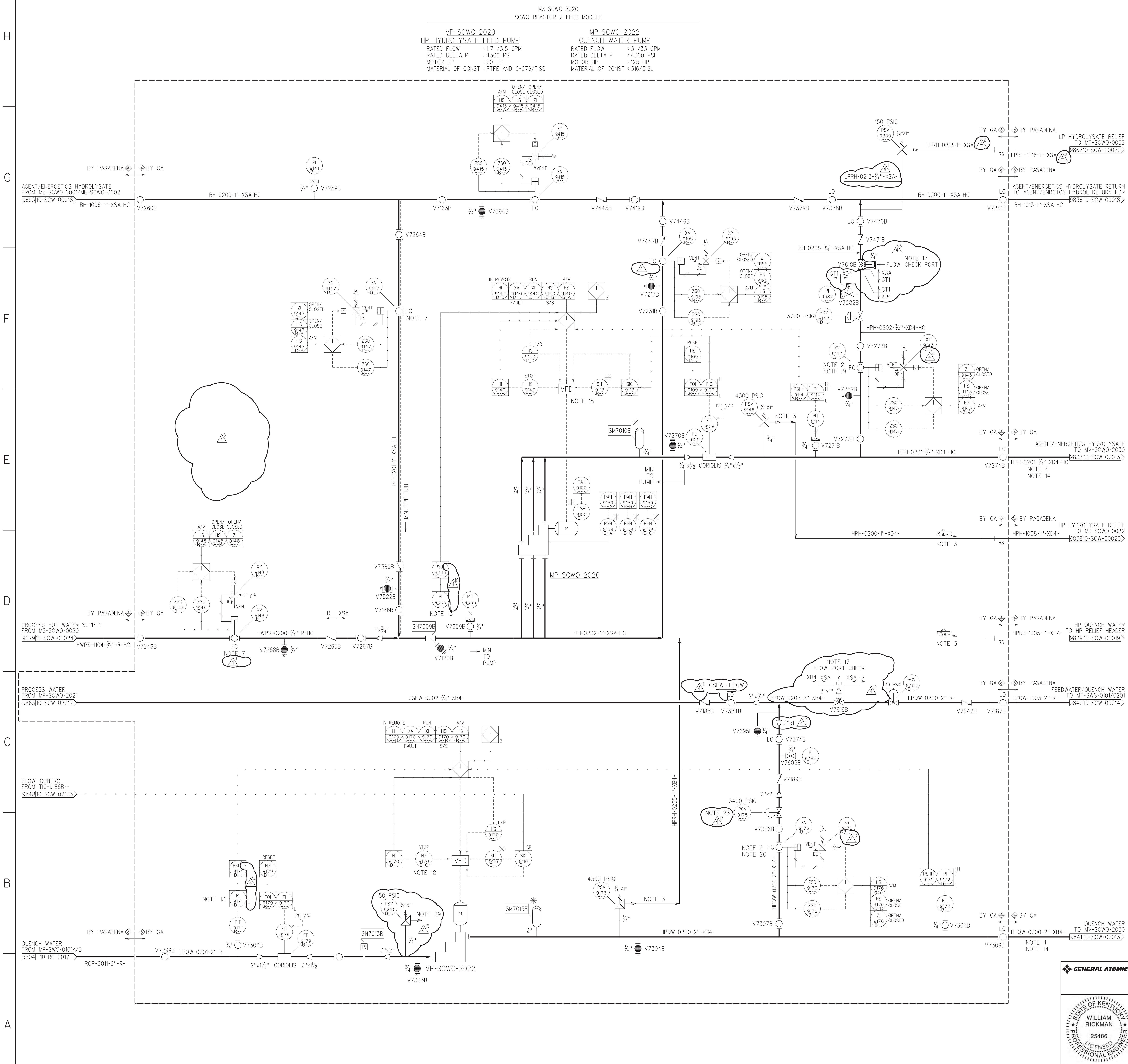

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
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   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV-9143B--
   XV-9176B--
3. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK OR BLEND TANK, AND WITH NO POCKETS.
4. INTERCONNECTING PIPING BY GA.
5. ELECTRICAL AREA CLASSIFICATION: UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)
7. PROGRAM AN INTERLOCK FOR XV-9148B-- TO ENSURE THAT IT CANNOT BE OPENED WHILE XV-9147B-- IS OPEN.
13. SHUT-OFF HP PUMP (HYDROLYSATE OR QUENCH WATER) UPON LOW LOW ALARM WHEN PUMP IS RUNNING.
14. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.
15. DENOTES DESIGN RESPONSIBILITY LABEL.
17. FLOW CHECK VALVE TO BE OPERATED AT LOW PRESSURE (i.e. PRESSURES ~ 30 PSIG OR LESS)
18. VFD TO BE PROVIDED BY PASADENA.
19. PROGRAM AN INTERLOCK BETWEEN XV-9143B-- AND XV-9222B-- (SEE SCWO PID - 02013) TO ENSURE BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
20. PROGRAM AN INTERLOCK BETWEEN XV-9176B-- AND XV-9198B-- (SEE SCWO PID - 02013) TO ENSURE BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
22. ✳ DENOTES SUPPLIED BY VENDOR.
28. PCV-9175B-- SETPOINT IS FOR PUMP CALIBRATION ONLY. SETPOINT TO BE ADJUSTED DOWN FOR OPERATION TO ALLOW PUMP RE-START AT NO LOAD.
29. RELIEVE INTO QUENCH PUMP DRIP PAN. 4
30. NOTES 6, 8, 9, 10, 11, 12, 16, 21, 23, 24, 25, 26 AND 27 ARE DELETED.

APPROVED
By Ron Rhea at 4:00 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

THIS DRAWING, WHILE EVENTUALLY REQUIRING A STATE OF KENTUCKY PROFESSIONAL ENGINEER (PE) SEAL, IS ISSUED WITHOUT THAT SEAL AT THIS TIME PENDING CONFIRMATION OF VENDOR DATA. WHEN VENDOR DATA ARE CONFIRMED (~2012), THE DRAWING WILL BE REISSUED WITH A KENTUCKY PE SEAL.

DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01012

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001
REFERENCE DRAWINGS

CDM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Configuration / Data Management, email=Judy.dishon@ga.com, c=US
2013.06.18 11:29:09 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
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3	09/06/12	IFC (INCORPORATES DCN-741)	NL	WR	KWD	KWD	VN
2	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/15/19	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING TRAIN 2 QUENCH WATER AND HYDROL FEED PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M6-SCWO-02012 SHEET 1 OF 1 REV 4

BGCAPP_DGN.BDR

10MSCW02012.pid 03/15/13

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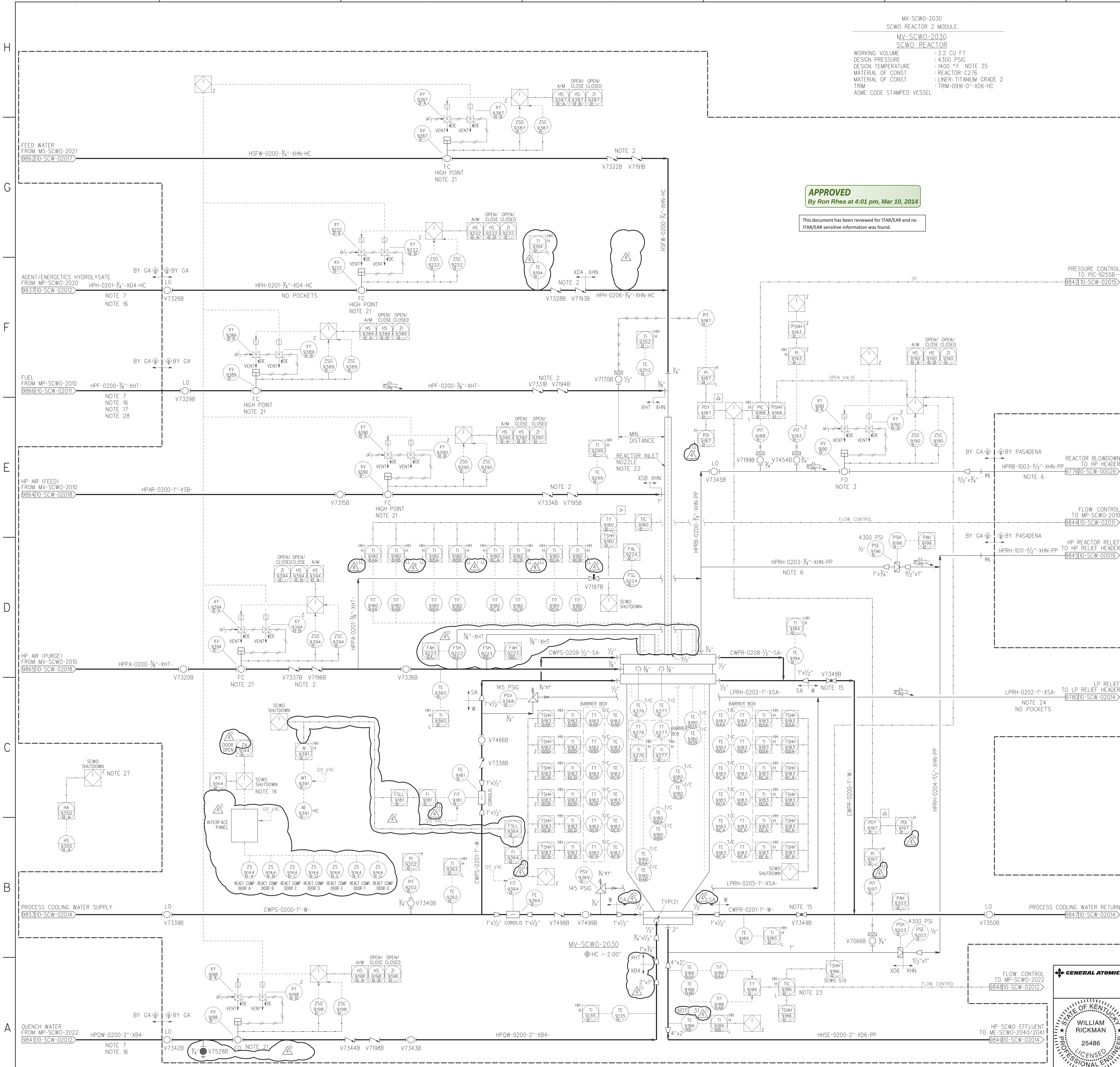

MX-SCWO-2030
SCWO REACTOR 2 MODULE

MV-SCWO-2030
SCWO REACTOR

WORKING VOLUME	: 3.2 CU FT
DESIGN PRESSURE	: 4300 PSIG
DESIGN TEMPERATURE	: 1400 °F NOTE 25
MATERIAL OF CONST	: REACTOR: C276
MATERIAL OF CONST	: LINER: TITANIUM GRADE 2
TRIM	: TRIM-0916-0"-XD6-HC
ASME CODE STAMPED VESSEL	

APPROVED
By Ron Rhea at 4:01 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. FIRST CHECK VALVE PROVIDED WITH SOFT SEAT. SECOND CHECK VALVE PROVIDED WITH HARD SEAT, EXCEPT FOR HOT SERVICES WHERE ONLY HARD SEATS ARE PROVIDED.
3. THE FOLLOWING VALVE(S) ARE NORMALLY CLOSED:
   XV-9190B--
6. HP RELIEF AND REACTOR BLOWDOWN PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, AND WITH NO POCKETS.
7. INTERCONNECTING PIPING BY GA. IPA AND HYDROLYSATE PIPING IS ALL WELDED TO MAXIMUM EXTENT POSSIBLE. HPF-0200-3/8"-XHT SHALL BE DOUBLE CONTAINED WITHIN A 3/4" PIPE (MIN) XSA SHALL BE THIS PIPE'S DESIGNATION.
11. ELECTRICAL AREA CLASSIFICATION:
   CLASS 1, DIVISION 2, GROUP D.
13. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN AN UNCLASSIFIED (NON-HAZARD) AREA.
14. SYSTEM SHUTDOWN UPON OPENING OF CLASSIFIED COMPARTMENT DOOR (AFTER SPECIFIED TIME DELAY).
15. GLOBE VALVE IS TO BE LOCATED ADJACENT TO THE CORIOLIS FLOW METER.
16. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.
17. PROVIDE PROTECTION AROUND HIGH PRESSURE FUEL VALVES, FLANGES, AND FITTINGS TO PREVENT POTENTIAL IGNITION AT EXPOSED SURFACE. PROVIDE CONTAINMENT AROUND EXPOSED HIGH PRESSURE FUEL PIPING AND TUBING.
18. DEDICATED VENTILATION OF ELECTRICAL CLASSIFICATION AREA (I.E. CLASS 1, DIVISION 2, GROUP D) IS REQUIRED TO PREVENT CROSS-VENTILATION OF POTENTIAL HAZARDOUS FUEL (IPA) VAPORS INTO UNCLASSIFIED AREAS.
19. DENOTES DESIGN RESPONSIBILITY LABEL.
21. THE FOLLOWING VALVES ARE TO BE SPECIFIED AS FAST CLOSING (<= 1.0 SEC, VENDOR TO VERIFY):
   XV-9387B--
   XV-9222B--
   XV-9389B--
   XV-9390B--
   XV-9394B--
   XV-9198B--
22. REACTOR FEED NOZZLE TO BE REMOVED (I.E. AFTER SYSTEM DEPRESSURIZATION, LOCK-OUT, TAG-OUT, ETC.) FOR VALVE MAINTENANCE WITH TEMPORARY BLIND FLANGES ADDED AS REQUIRED FOR SAFETY PURPOSES FOR XV-9387B--, XV-9222B--, XV-9389B-- AND XV-9390B--.
23. XV-9190B-- TO OPEN UPON TSHH-9186B-- HIGH HIGH ALARM.
24. FINAL ROUTING OF HEADER TO CONFORM TO EQUIPMENT LAYOUT.
25. REACTOR COMPONENTS SHALL BE DESIGNED FOR PROCESS TEMPERATURES OF 1200°F (OPERATING), 1250°F (MAX. OPERATING), AND 1400°F (DESIGN).
27. FPS TRAIN SHUTDOWN SWITCH LOCATED IN SPB LOCAL CONTROL ROOM.
28. FUEL PIPING IS ALL WELDED TO MAXIMUM PRACTICAL EXTENT.
31. TE-9186BAA, BAB, AND BB- ARE LOCATED OUTSIDE OF THE ELECTRICALLY CLASSIFIED AREA.
32. NOTES 4, 5, 8, 9, 10, 12, 20, 26, 29 AND 30 ARE DELETED.

THIS DRAWING EXPAND FROM PID 24915-10-M6-SCWO-01013

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001
REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.06.18 11:51:07 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
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3	10/01/12	IFC (INCORPORATES DCN-741)	NL	WR	KWD	KWD	VN
2	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/15/09	IFC (INCORPORATES GOV'T AND BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY — WILLIAM RICKMAN — 25486 — LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING TRAIN 2 REACTOR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-02013 SHEET 1 OF 1 REV 4

BGCAPP_DGN.BDR

10MSCWO2013.pid 03/15/13

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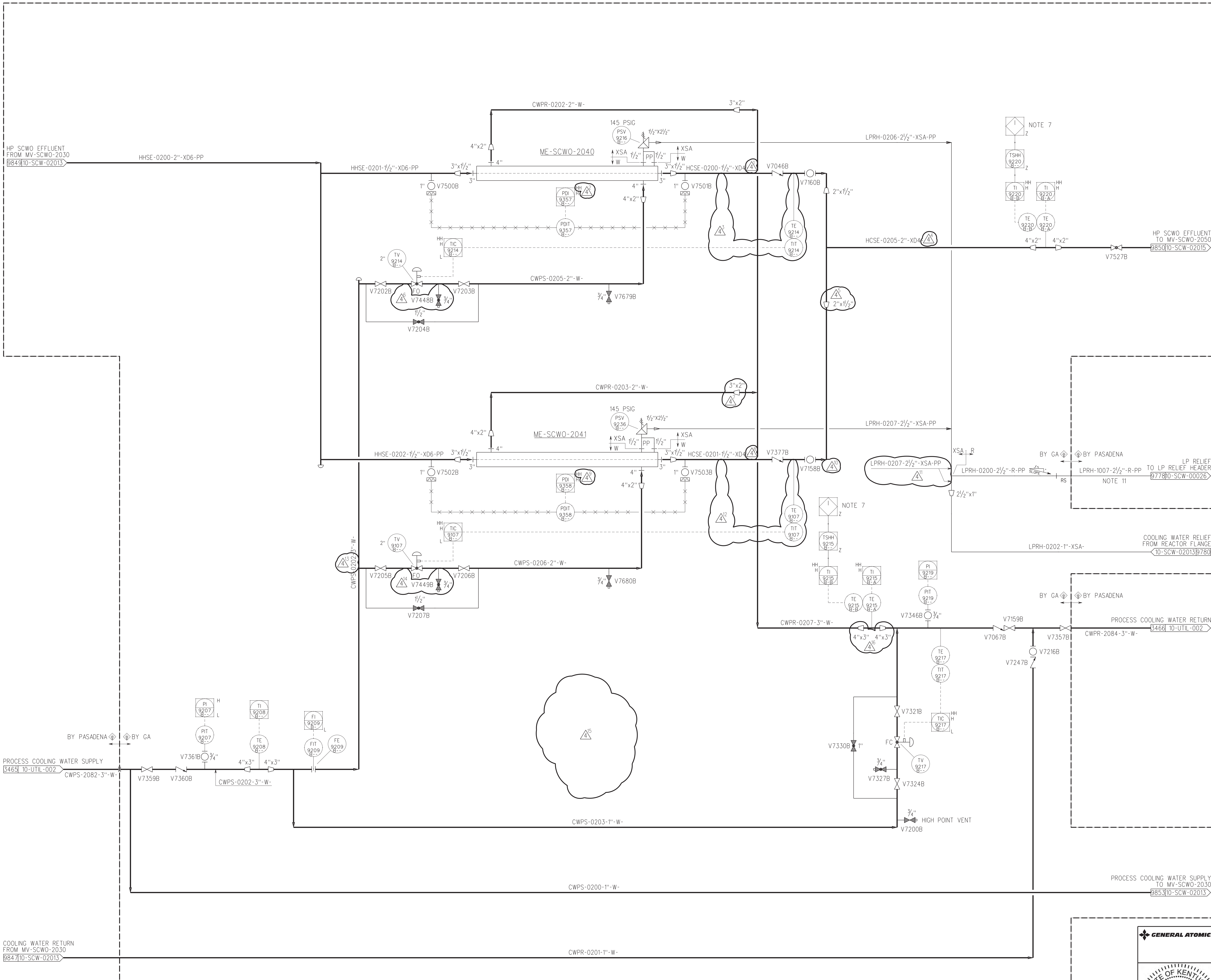
MX-SCWO-2030
SCWO REACTOR 2 MODULE

ME-SCWO-2040 EFFLUENT HEAT EXCHANGER 1		ME-SCWO-2041 EFFLUENT HEAT EXCHANGER 2	
DUTY	: 1,710,000 BTU/HR	DUTY	: 1,710,000 BTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG	DESIGN PRESS (SHELL)	: 150 PSIG
DESIGN TEMP (SHELL)	: 185 °F	DESIGN TEMP (SHELL)	: 185 °F
DESIGN PRESS (TUBE)	: 4300 PSIG	DESIGN PRESS (TUBE)	: 4300 PSIG
DESIGN TEMP (TUBE)	: 750 °F	DESIGN TEMP (TUBE)	: 750 °F
MATERIAL OF CONST (SHELL)	: CARBON STEEL	MATERIAL OF CONST (SHELL)	: CARBON STEEL
MATERIAL OF CONST (TUBE)	: C276	MATERIAL OF CONST (TUBE)	: C276
TRIM (SHELL)	: TRIM-0908-0"-W-	TRIM (SHELL)	: TRIM-0910-0"-W-
TRIM (TUBE)	: TRIM-0917-0"-XD6-PP	TRIM (TUBE)	: TRIM-0911-0"-XD6-PP
ASME CODE STAMPED VESSEL		ASME CODE STAMPED VESSEL	

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
6. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN UNCLASSIFIED (NON-HAZARD) AREA.
7. SCWO REACTOR TO SHUT DOWN ON HIGH-HIGH COOLING WATER DISCHARGE TEMPERATURE OR HIGH-HIGH EFFLUENT TEMPERATURE.
9. DENOTES DESIGN RESPONSIBILITY LABEL.
11. FINAL ROUTING OF RELIEF HEADER TO CONFORM TO EQUIPMENT LAYOUT.
16. NOTES 2, 3, 4, 5, 8, 10, 12, 13, 14 AND 15 ARE DELETED.



APPROVED
By Ron Rhea at 4:01 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01014

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.06.18 10:10:54 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
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3	10/01/12	IFC (INCORPORATES DCN-741)	NL	WR	KWD	KWD	VN
2	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/20/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING TRAIN 2 EFFLUENT COOLING PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-02014 | SHEET 1 OF 1 | REV 4

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10MSCWO2014.pid 03/15/13

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MX-SCWO-2030
SCWO REACTOR 2 MODULE

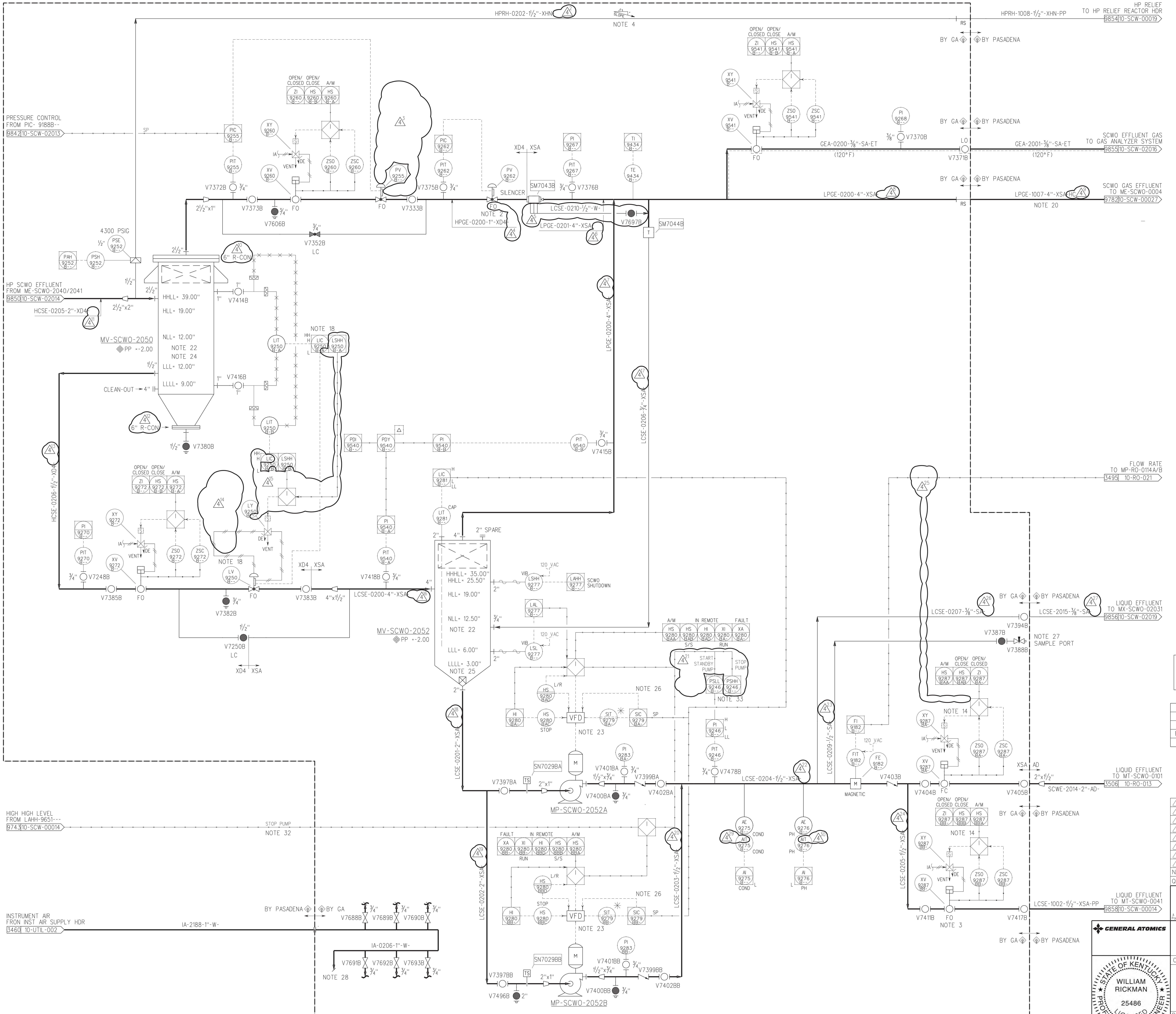
MV-SCWO-2050 HP GAS/LIQUID SEPARATOR	
I.D.	: 11.2 IN
T-T	: 82 IN
DESIGN PRESSURE	: 4300 PSIG/FV
DESIGN TEMPERATURE	: 190 °F
MATERIAL OF CONST	: C276
TRIM	: TRIM-0914-0"-XD4-PP
ASME CODE STAMPED VESSEL	

MV-SCWO-2052 LP GAS/LIQUID SEPARATOR	
I.D.	: 29.5 IN
T-T	: 79 IN
DESIGN PRESSURE	: 5 PSIG
DESIGN TEMPERATURE	: 190 °F
MATERIAL OF CONST	: 316L
TRIM	: TRIM-0915-0"-XSA-PP

MP-SCWO-2052A/B LIQUID EFFLUENT PUMP	
RATED FLOW	: 5/40 GPM
RATED DELTA P	: 30 PSI
MOTOR HP	: 1 HP
MATERIAL OF CONST	: 316/316L

APPROVED
By Ron Rhea at 4:02 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. PV-9262B-- HAS A CONTINUOUS SET POINT OF ~1000 PSIG TO REDUCE THE PRESSURE DROP OVER PV-9255B-- TO AVOID CAVITATION AND ASSOCIATED WEAR.
3. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV-9287BB-
4. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, AND WITH NO POCKET.
9. ✳ DENOTES SUPPLIED BY VENDOR.
14. PROGRAM AN INTERLOCK BETWEEN XV-9287BA- AND XV-9287BB- TO INSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
15. DENOTES DESIGN RESPONSIBILITY LABEL.
18. HP GAS/LIQUID SEPARATOR OUTLET VALVE LV-9250B-- TO CONTROL FLOW AT A PRE-SET VALUE (VALVE PERCENT OPEN) WHICH IS TO BE DETERMINED PRIOR TO SYSTEM START-UP. AUTOMATIC LEVEL CONTROL IS AVAILABLE AS AN OPTION.
20. DO NOT POCKET.
22. LIQUID LEVEL SET POINTS ARE MEASURED FROM VESSEL'S BOTTOM TANGENT LINE. SET POINTS SHOWN ARE FOR THE PLANNED OPERATING MODE WHERE THE HPGLS RUNS WITH NO DEFINED LIQUID LEVEL, I.E., ALL LIQUID AND SOME GAS EXIT THE BOTTOM OF THE VESSEL. FCS PROGRAMMED SET POINTS ARE PER TABLE 6 (CORRESPONDING TO THE BACK UP CASE WHERE A DEFINED, CONTROLLED LIQUID LEVEL IS DESIRED) OF 10-M6C-SCWO-00003, HPGLS CALCULATION SIZING, AND REFERENCED RELATIVE TO DP SENSOR MOUNTING LOCATION. 4 28
23. VFD TO BE PROVIDED BY PASADENA.
24. 2 1/2 INCH NOZZLE SIZE IS SPECIFIED TO MAINTAIN HP GLS GAS VELOCITY WITHIN THE SPECIFIED LIMITS. NOZZLE TO BE PROVIDED BY EQUIPMENT VENDOR AS PART OF MANUFACTURER'S STANDARD REQUIREMENT.
25. VORTEX BREAKER TO BE PROVIDED.
26. THE VFD SPEED CONTROLLER SHALL BE PRE-SET WITH A MINIMUM FLOW CONTROL SETPOINT (BASED UPON FINAL PUMP VENDOR SELECTION REQUIREMENT) TO AVOID PUMP DAMAGE DURING A MINIMUM FLOW CONDITION.
27. SAMPLE VALVES TO BE LOCATED AT EDGE OF SKID TO BE ACCESSIBLE BY OPERATOR DURING NORMAL OPERATIONS WITHOUT ENTERING SKID.
28. COMMON INSTRUMENT AIR HEADER SERVICES MODULE MX-SCWO-2030 SHOWN ON THIS PID AS WELL AS COMPONENTS SHOWN ON PIDS 24915-10-M6-SCWO-02013, -02014 AND -02017.
30. CONTROL SYSTEM TO ENSURE NO AUTOSTART OF SECOND LIQUID EFFLUENT PUMP IF DOWNSTREAM VALVES XV-9287BA- AND XV-9287BB- ARE BOTH CLOSED.
32. PUMP SHALL STOP UPON OFF-SPEC TANK HIGH-HIGH LEVEL FROM LAHH-9651--- ONLY IF VALVE XV-9287BB- IS OPEN.
33. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 10 SECONDS, THE "LEAD" PUMP WILL STOP.
    IF THE "STANDBY" PUMP DOES NOT REACH THE NORMAL SET POINT WITHIN ANOTHER 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP.
    IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR PRESSURE TO FALL BELOW NORMAL.
34. NOTES 5, 6, 7, 8, 10, 11, 12, 13, 16, 17, 19, 21, 29 AND 31 ARE DELETED.

DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01015

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.06.18 11:05:50 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4 (30)		IFC (INC DCN-1040)	NL	WR	KWD	KWD	VN
3	10/01/12	IFC (INC DCN-741)	NL	WR	KWD	KWD	VN
2	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING TRAIN 2 GAS/LIQUID SEPARATION PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-02015 | SHEET 1 OF 1 | REV 4

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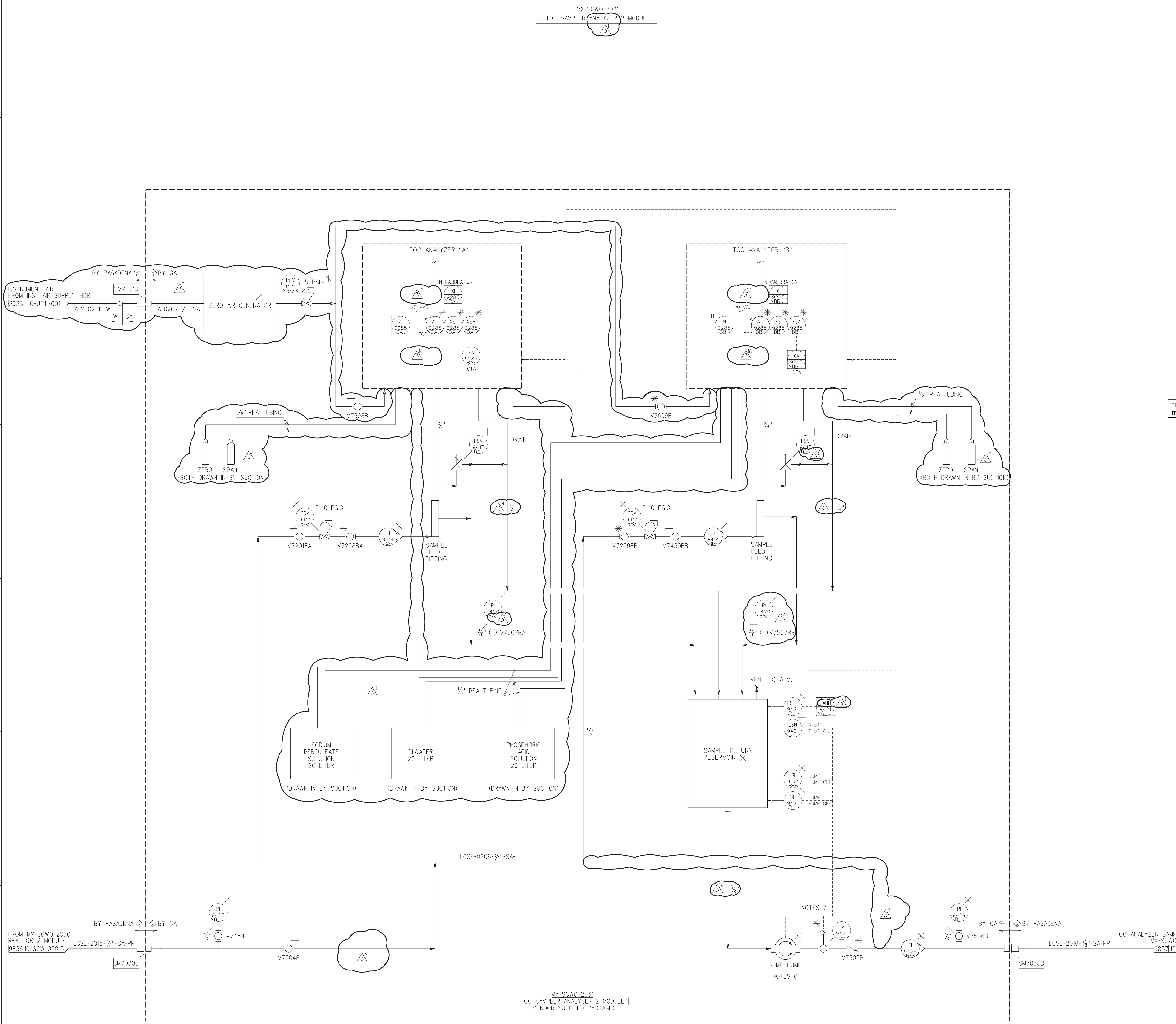

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. CONTROL PANELS AND TOC SAMPLE ANALYZERS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN UNCLASSIFIED (NON-HAZARD) AREA.
3. TOC ANALYZER SAMPLE PUMP(S) SHALL BE SIZED WITH HEAD GREATER THAN LIQUID EFFLUENT PUMP.
4. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
5. ✳ DENOTES SUPPLIED BY VENDOR.
6. SUMP PUMP TURNS ON UPON HIGH RESERVOIR LIQUID LEVEL. SUMP PUMP TURNS OFF UPON LOW AND LOW LOW RESERVOIR LIQUID LEVEL.
7. VALVE LV-9421B-- OPENS WHEN SUMP PUMP TURNS ON AND CLOSES WHEN SUMP PUMP TURNS OFF.
9. NOTE 8 IS DELETED.

APPROVED
By Ron Rhea at 4:03 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01019

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=ISSUED by Judy Dishon, o=General Atomics, ou=Configuration / Data Management, email=Judy.dishon@ga.com, c=US
2012.10.01 15:47:45 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
3		IFC (INCORPORATES DCN-441)	NL	WR	KWD	KWD	VN
2	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL STAMP

SCWO PROCESSING BUILDING
TRAIN 2 TOC SAMPLE ANALYZER
PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-02019 | SHEET 1 OF 1 | REV 3

BGCAPP_DGN.BDR

10MSCWO2019.pid 07/27/12

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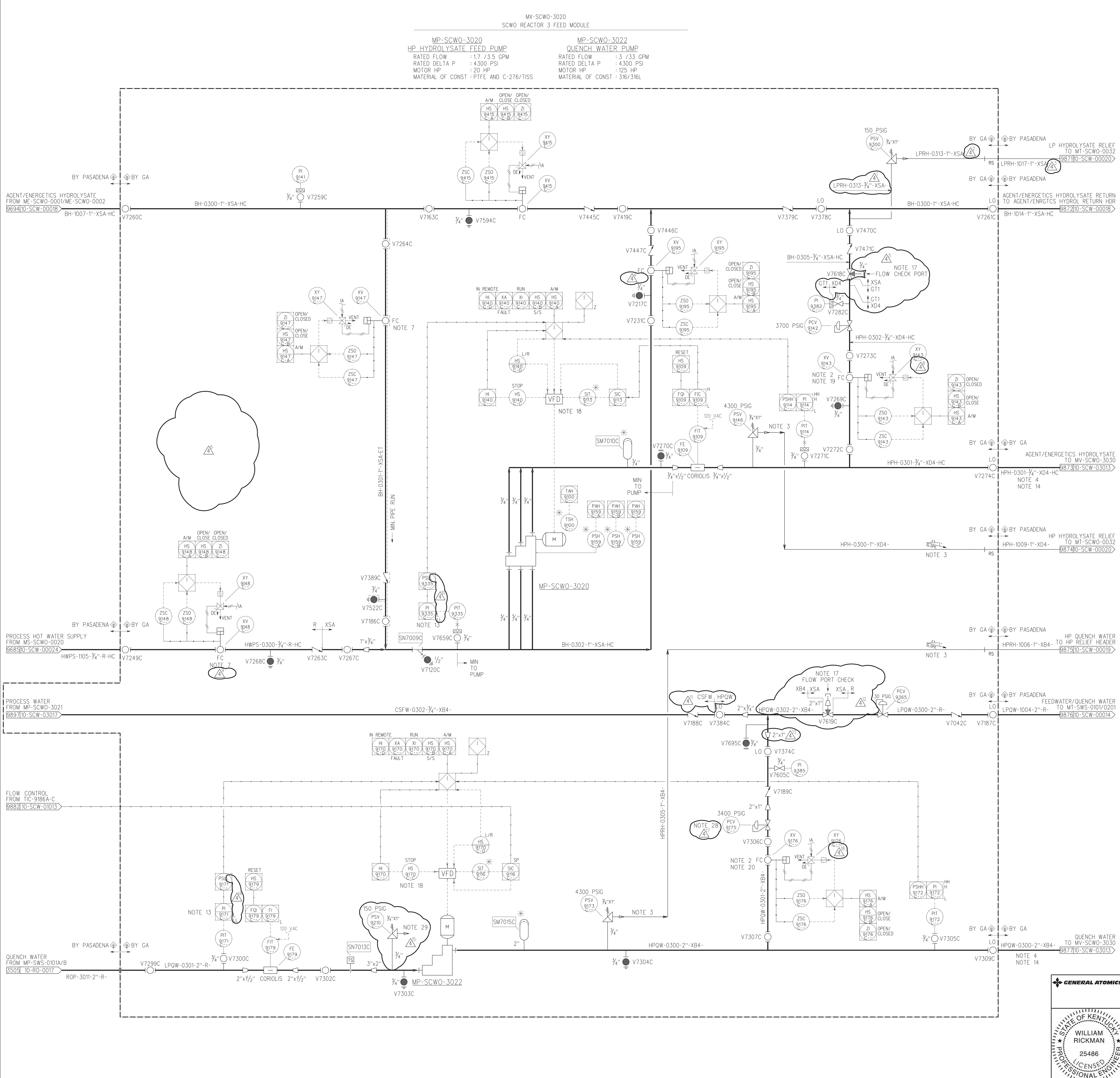

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV-9143C--
   XV-9176C--
3. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK OR BLEND TANK, AND WITH NO POCKETS.
4. INTERCONNECTING PIPING BY GA.
5. ELECTRICAL AREA CLASSIFICATION: UNCLASSIFIED (PER DIRECTION FROM GOVERNMENT 5/4/06 CORRESPONDENCE)
7. PROGRAM AN INTERLOCK FOR XV-9148C-- TO ENSURE THAT IT CANNOT BE OPENED WHILE XV-9147C-- IS OPEN.
13. SHUT-OFF HP PUMP (HYDROLYSATE OR QUENCH WATER) UPON LOW LOW ALARM WHEN PUMP IS RUNNING.
14. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.
15. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
17. FLOW CHECK VALVE TO BE OPERATED AT LOW PRESSURE (i.e. PRESSURES ~ 30 PSIG OR LESS)
18. VFD TO BE PROVIDED BY PASADENA.
19. PROGRAM AN INTERLOCK BETWEEN XV-9143C-- AND XV-9222C-- (SEE SCWO PID - 03013) TO ENSURE BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
20. PROGRAM AN INTERLOCK BETWEEN XV-9176C-- AND XV-9198C-- (SEE SCWO PID - 03013) TO ENSURE BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
22. ✳ DENOTES SUPPLIED BY VENDOR.
28. PCV-9175C-- SETPOINT IS FOR PUMP CALIBRATION ONLY. SETPOINT TO BE ADJUSTED DOWN FOR OPERATION TO ALLOW PUMP RE-START AT NO LOAD.
29. RELIEVE INTO QUENCH PUMP DRIP PAN.
30. NOTES 6, 8, 9, 10, 11, 12, 16, 21, 23, 24, 25, 26 AND 27 ARE DELETED.

APPROVED
By Ron Rhea at 4:03 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01012

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US 2013.06.18 13:11:00 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4		IFC (INCORPORATES DCN-1040)	NL	WR	KWD	KWD	VN
3	09/06/12	IFC (INCORPORATES DCN-741)	NL	WR	KWD	KWD	VN
2	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING TRAIN 3 QUENCH WATER AND HYDROL FEED PIPING & INSTRUMENT DIAGRAM

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

DRAWING NUMBER 24915-10-M6-SCWO-03012 | SHEET 1 OF 1 | REV 4

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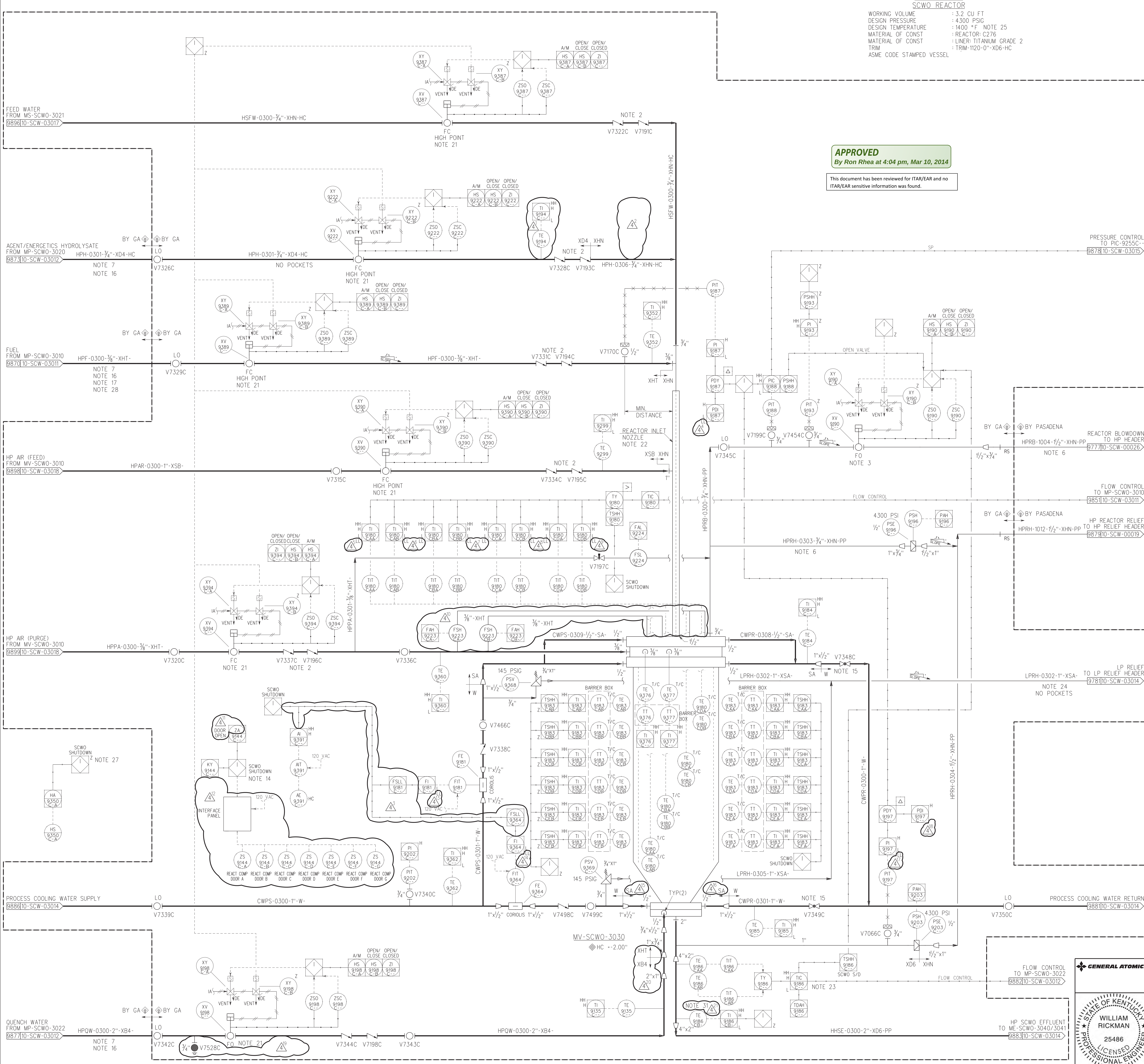
MX-SCWO-3030
SCWO REACTOR 3 MODULE

MV-SCWO-3030
SCWO REACTOR

WORKING VOLUME	: 3.2 CU FT
DESIGN PRESSURE	: 4300 PSIG
DESIGN TEMPERATURE	: 1400 °F NOTE 25
MATERIAL OF CONST	: REACTOR: C276
MATERIAL OF CONST	: LINER: TITANIUM GRADE 2
TRIM	: TRIM-1120-0"-XD6-HC
ASME CODE STAMPED VESSEL	

APPROVED
By Ron Rhea at 4:04 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.



DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01013

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
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   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. FIRST CHECK VALVE PROVIDED WITH SOFT SEAT. SECOND CHECK VALVE PROVIDED WITH HARD SEAT, EXCEPT FOR HOT SERVICES WHERE ONLY HARD SEATS ARE PROVIDED.
3. THE FOLLOWING VALVE(S) ARE NORMALLY CLOSED:
   XV-9190C--
6. HP RELIEF AND REACTOR BLOWDOWN PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, AND WITH NO POCKETS.
7. INTERCONNECTING PIPING BY GA. IPA AND HYDROLYSATE PIPING IS ALL WELDED TO MAXIMUM EXTENT POSSIBLE. HPF-0300-3/8"-XHT SHALL BE DOUBLE CONTAINED WITHIN A 3/4" PIPE (MIN) XSA SHALL BE THIS PIPE'S DESIGNATION.
11. ELECTRICAL AREA CLASSIFICATION: CLASS 1, DIVISION 2, GROUP D.
13. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN AN UNCLASSIFIED (NON-HAZARD) AREA.
14. SYSTEM SHUTDOWN UPON OPENING OF CLASSIFIED COMPARTMENT DOOR (AFTER SPECIFIED TIME DELAY).
15. GLOBE VALVE IS TO BE LOCATED ADJACENT TO THE CORIOLIS FLOW METER.
16. HIGH PRESSURE SERVICE PIPING IN BETWEEN SKIDS SHALL BE PROVIDED WITH ADDITIONAL SHIELDING AND ROUTED TO MINIMIZE OPERATOR EXPOSURE TO POTENTIAL VALVE OR FITTING LEAKS. USE WELDED CONSTRUCTION TO MAXIMUM PRACTICAL EXTENT IN THE HIGH PRESSURE PIPING ON AND IN BETWEEN THE SCWO SKIDS. ADDITIONAL SHIELDING TO BE ADDED WHEN PIPING IS INSTALLED AT BGCAPP.
17. PROVIDE PROTECTION AROUND HIGH PRESSURE FUEL VALVES, FLANGES, AND FITTINGS TO PREVENT POTENTIAL IGNITION AT EXPOSED SURFACE. PROVIDE CONTAINMENT AROUND EXPOSED HIGH PRESSURE FUEL PIPING ANG TUBING.
18. DEDICATED VENTILATION OF ELECTRICAL CLASSIFICATION AREA (I.E. CLASS 1, DIVISION 2, GROUP D) IS REQUIRED TO PREVENT CROSS-VENTILATION OF POTENTIAL HAZARDOUS FUEL (IPA) VAPORS INTO UNCLASSIFIED AREAS.
19. DENOTES DESIGN RESPONSIBILITY LABEL.
21. THE FOLLOWING VALVES ARE TO BE SPECIFIED AS FAST CLOSING (<= 1.0 SEC, VENDOR TO VERIFY):
   XV-9387C--
   XV-9222C--
   XV-9389C--
   XV-9390C--
   XV-9394C--
   XV-9198C--
22. REACTOR FEED NOZZLE TO BE REMOVED (I.E. AFTER SYSTEM DEPRESSURIZATION, LOCK-OUT, TAG-OUT, ETC.) FOR VALVE MAINTENANCE WITH TEMPORARY BLIND FLANGES ADDED AS REQUIRED FOR SAFETY PURPOSES FOR XV-9387C--, XV-9222C--, XV-9389C-- AND XV-9390C--.
23. XV-9190C-- TO OPEN UPON TSHH-9186C-- HIGH HIGH ALARM.
24. FINAL ROUTING OF HEADER TO CONFORM TO EQUIPMENT LAYOUT.
25. REACTOR COMPONENTS SHALL BE DESIGNED FOR PROCESS TEMPERATURES OF 1200°F (OPERATING), 1250°F (MAX. OPERATING), AND 1400°F (DESIGN).
27. FPS TRAIN SHUTDOWN SWITCH LOCATED IN SPB LOCAL CONTROL ROOM.
28. FUEL PIPING IS ALL WELDED TO MAXIMUM PRACTICAL EXTENT.
31. TE-9186CAA, CAB, AND CB- ARE LOCATED OUTSIDE OF THE ELECTRICALLY CLASSIFIED AREA. 4 22
32. NOTES 4, 5, 8, 9, 10, 12, 20, 26, 29 AND 30 ARE DELETED.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001	
REFERENCE DRAWINGS	

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.06.18 09:35:32 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4 (22)		IFC (INCORPORATES DCN-1040)	NL	WR	KWD	KWD	VN
3	10/02/12	IFC (INCORPORATES DCN-741)	NL	WR	KWD	KWD	VN
2	11/15/10	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/15/09	IFC (INCORPORATES GOV'T AND BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

STATE OF KENTUCKY WILLIAM RICKMAN 25486 LICENSED PROFESSIONAL ENGINEER

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING TRAIN 3 REACTOR PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER	SHEET	REV
24915-10-M6-SCWO-03013	1 OF 1	4

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MX-SCWO-3030
SCWO-REACTOR 3 MODULE

ME-SCWO-3040
EFFLUENT HEAT EXCHANGER 1

DUTY	: 1,710,000 BTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG
DESIGN TEMP (SHELL)	: 185 °F
DESIGN PRESS (TUBE)	: 4300 PSIG
DESIGN TEMP (TUBE)	: 750 °F
MATERIAL OF CONST (SHELL)	: CARBON STEEL
MATERIAL OF CONST (TUBE)	: C276
TRIM (SHELL)	: TRIM-1008-0"-W-
TRIM (TUBE)	: TRIM-1095-0"-XD6-PP
ASME CODE STAMPED VESSEL	

ME-SCWO-3041
EFFLUENT HEAT EXCHANGER 2

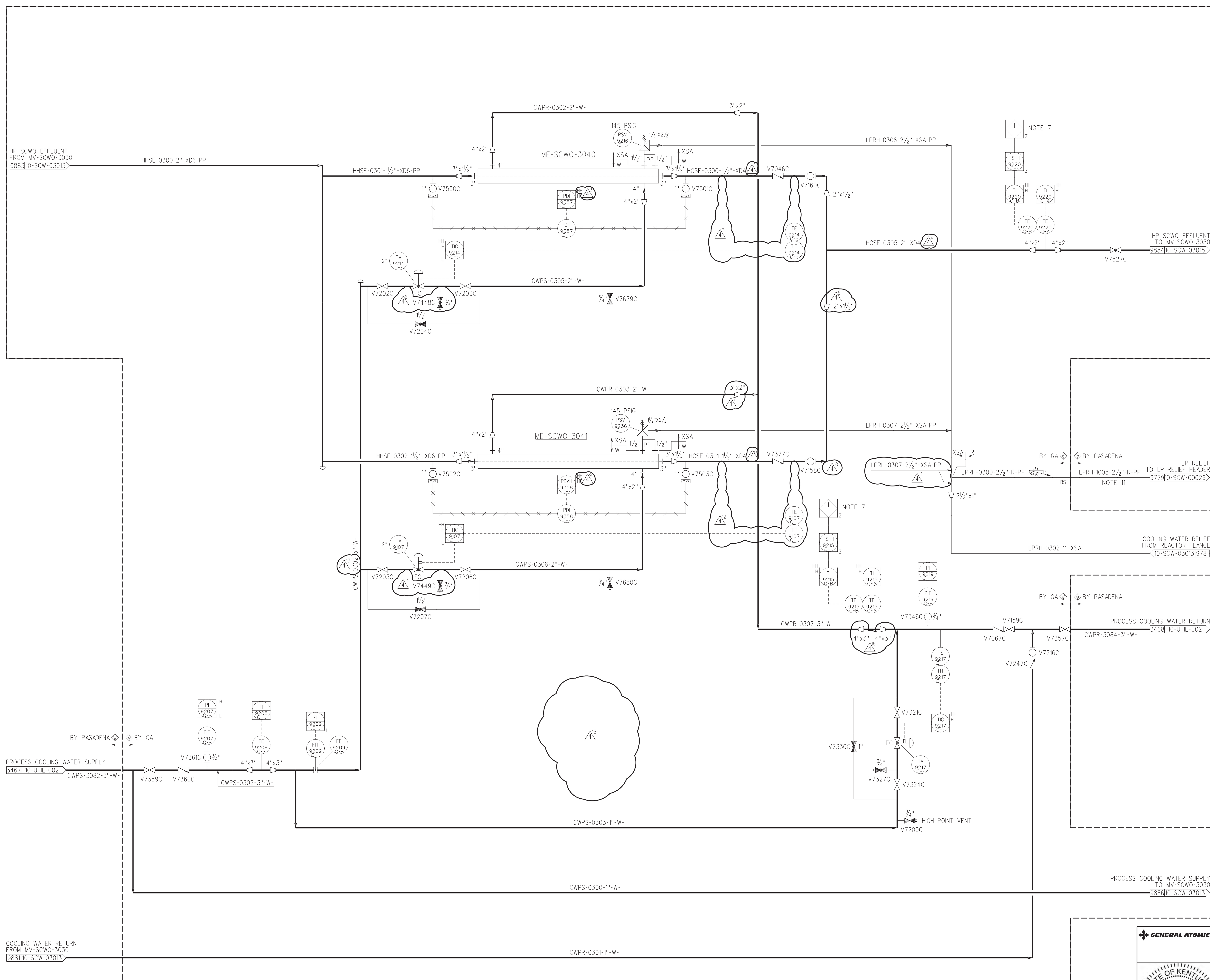
DUTY	: 1,710,000 BTU/HR
DESIGN PRESS (SHELL)	: 150 PSIG
DESIGN TEMP (SHELL)	: 185 °F
DESIGN PRESS (TUBE)	: 4300 PSIG
DESIGN TEMP (TUBE)	: 750 °F
MATERIAL OF CONST (SHELL)	: CARBON STEEL
MATERIAL OF CONST (TUBE)	: C276
TRIM (SHELL)	: TRIM-1112-0"-W-
TRIM (TUBE)	: TRIM-1011-0"-XD6-PP
ASME CODE STAMPED VESSEL	

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
6. CONTROL PANELS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN UNCLASSIFIED (NON-HAZARD) AREA.
7. SCWO REACTOR TO SHUT DOWN ON HIGH-HIGH COOLING WATER DISCHARGE TEMPERATURE OR HIGH-HIGH EFFLUENT TEMPERATURE.
9. DENOTES DESIGN RESPONSIBILITY LABEL.
11. FINAL ROUTING OF RELIEF HEADER TO CONFORM TO EQUIPMENT LAYOUT.
16. NOTES 2, 3, 4, 5, 8, 10, 12, 13, 14 AND 15 ARE DELETED.

APPROVED
By Ron Rhea at 4:04 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.



DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01014

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

CDM Apvd

cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
2013.06.18 10:25:15 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4		IFC (INCORPORATES DCN-1040)	NL	WR	KWD	KWD	VN
3	10/02/12	IFC (INCORPORATES DCN-741)	NL	WR	KWD	KWD	VN
2	06/01/07	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/20/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, INC. and Parsons Infrastructure & Technology Group Inc.

DOD PROGRAM MANAGER FOR ASSEMBLED CHEMICAL WEAPONS ASSESSMENT EDGEWOOD, MARYLAND

US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

STATE OF KENTUCKY
WILLIAM RICKMAN
25486
LICENSED PROFESSIONAL ENGINEER

SCWO PROCESSING BUILDING TRAIN 3 EFFLUENT COOLING PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-03014 | SHEET 1 OF 1 | REV 4

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MX-SCWO-3030
SCWO REACTOR 3 MODULE

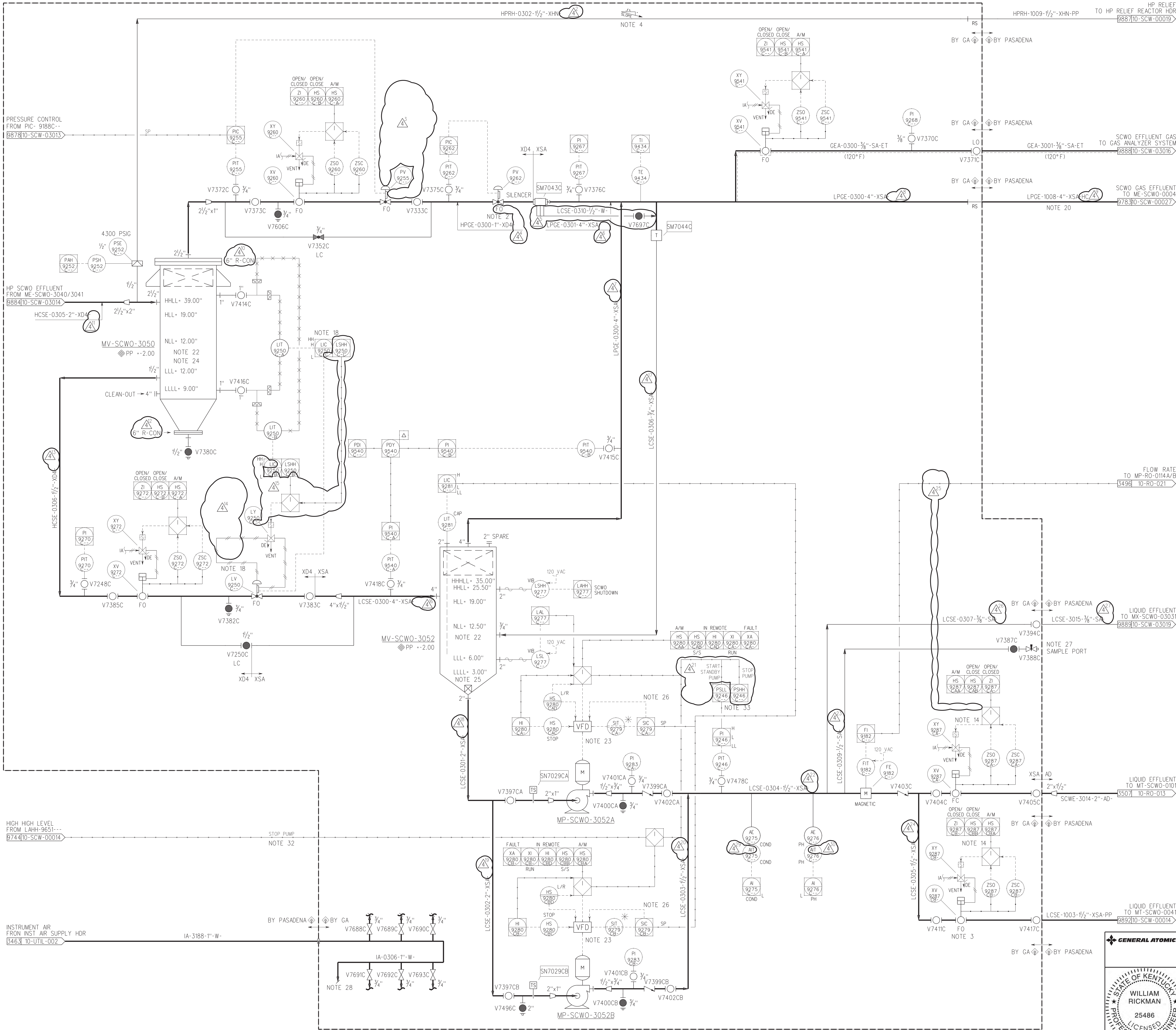
MV-SCWO-3050 HP GAS/LIQUID SEPARATOR	
I.D.	: 11.2 IN
T-T	: 82 IN
DESIGN PRESSURE	: 4300 PSIG/FV
DESIGN TEMPERATURE	: 190 °F
MATERIAL OF CONST	: C276
TRIM	: TRIM-1093-0"-XD4-PP
ASME CODE STAMPED VESSEL	

MV-SCWO-3052 LP GAS/LIQUID SEPARATOR	
I.D.	: 29.5 IN
T-T	: 79 IN
DESIGN PRESSURE	: 5 PSIG
DESIGN TEMPERATURE	: 190 °F
MATERIAL OF CONST	: 316L
TRIM	: TRIM-1094-0"-XSA-PP

MP-SCWO-3052A/B LIQUID EFFLUENT PUMP	
RATED FLOW	: 5/40 GPM
RATED DELTA P	: 30 PSI
MOTOR HP	: 3 HP
MATERIAL OF CONST	: 316/316L

APPROVED
By Ron Rhea at 4:05 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.



GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. PV-9262C-- HAS A CONTINUOUS SET POINT OF ~1000 PSIG TO REDUCE THE PRESSURE DROP OVER PV-9255C-- TO AVOID CAVITATION AND ASSOCIATED WEAR.
3. THE FOLLOWING VALVES ARE NORMALLY CLOSED:
   XV- 9287CB-
4. HP RELIEF PIPING TO BE ADEQUATELY ANCHORED, SLOPED TOWARDS EMERGENCY RELIEF TANK, AND WITH NO POCKET.
9. ✳ DENOTES SUPPLIED BY VENDOR.
14. PROGRAM AN INTERLOCK BETWEEN XV-9287CA- AND XV-9287CB- TO INSURE THAT BOTH VALVES ARE NOT OPEN AT THE SAME TIME.
15. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
18. HP GAS/LIQUID SEPARATOR OUTLET VALVE LV-9250C-- TO CONTROL FLOW AT A PRE-SET VALUE (VALVE PERCENT OPEN) WHICH IS TO BE DETERMINED PRIOR TO SYSTEM START-UP. AUTOMATIC LEVEL CONTROL IS AVAILABLE AS AN OPTION.
20. DO NOT POCKET.
22. LIQUID LEVEL SET POINTS ARE MEASURED FROM VESSEL'S BOTTOM TANGENT LINE. SET POINTS SHOWN ARE FOR THE PLANNED OPERATING MODE WHERE THE HPGLS RUNS WITH NO DEFINED LIQUID LEVEL, I.E., ALL LIQUID AND SOME GAS EXIT THE BOTTOM OF THE VESSEL. FCS PROGRAMMED SET POINTS ARE PER TABLE 6 (CORRESPONDING TO THE BACK UP CASE WHERE A DEFINED, CONTROLLED LIQUID LEVEL IS DESIRED) OF 10-M6C-SCWO-00003, HPGLS CALCULATION SIZING, AND REFERENCED RELATIVE TO DP SENSOR MOUNTING LOCATION. 4 28
23. VFD TO BE PROVIDED BY PASADENA.
24. 2 1/2 INCH NOZZLE SIZE IS SPECIFIED TO MAINTAIN HP GLS GAS VELOCITY WITHIN THE SPECIFIED LIMITS. NOZZLE TO BE PROVIDED BY EQUIPMENT VENDOR AS PART OF MANUFACTURER'S STANDARD REQUIREMENT.
25. VORTEX BREAKER TO BE PROVIDED.
26. THE VFD SPEED CONTROLLER SHALL BE PRE-SET WITH A MINIMUM FLOW CONTROL SETPOINT (BASED UPON FINAL PUMP VENDOR SELECTION REQUIREMENT) TO AVOID PUMP DAMAGE DURING A MINIMUM FLOW CONDITION.
27. SAMPLE VALVES TO BE LOCATED AT EDGE OF SKID TO BE ACCESSIBLE BY OPERATOR DURING NORMAL OPERATIONS WITHOUT ENTERING SKID.
28. COMMON INSTRUMENT AIR HEADER SERVICES MODULE MX-SCWO-3030 SHOWN ON THIS PID AS WELL AS COMPONENTS SHOWN ON PIDS 24915-10-M6-SCWO-03013, -03014 AND -03017.
30. CONTROL SYSTEM TO ENSURE NO AUTOSTART OF SECOND LIQUID EFFLUENT PUMP IF DOWNSTREAM VALVES XV-9287CA- AND XV-9287CB- ARE BOTH CLOSED.
32. PUMP SHALL STOP UPON OFF-SPEC TANK HIGH-HIGH LEVEL FROM LAHH-9651--- ONLY IF VALVE XV-9287CB- IS OPEN.
33. IF THE PUMP DISCHARGE PRESSURE FALLS BELOW LOW LOW PRESSURE FOR MORE THAN 1 SECOND WHILE THE "LEAD" PUMP IS RUNNING, THE "STANDBY" PUMP WILL AUTOMATICALLY START. ONCE THE "STANDBY" PUMP HAS STARTED AND IF PRESSURE RETURNS TO NORMAL WITHIN 10 SECONDS, THE "LEAD" PUMP WILL STOP. IF THE "STANDBY" PUMP DOES NOT REACH THE NORMAL SET POINT WITHIN ANOTHER 5 SECONDS, BOTH THE "LEAD" AND "STANDBY" PUMPS WILL STOP. IF THE "LEAD" PUMP BECOMES DE-ENERGIZED, THE "STANDBY" PUMP WILL AUTOMATICALLY START, WITHOUT WAITING FOR PRESSURE TO FALL BELOW NORMAL.
34. NOTES 5, 6, 7, 8, 10, 11, 12, 13, 16, 17, 19, 21, 29 AND 31 ARE DELETED.

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001
REFERENCE DRAWINGS

CDM Apvd

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2013.06.18 11:31:27 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4		IFC (INC DCN-1040)	NL	WR	KWD	KWD	VN
3	10/02/12	IFC (INC DCN-741)	NL	WR	KWD	KWD	VN
2	01/15/09	IFC (PE STAMPED)	NL	WR	KWD	KWD	VN
1	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES TRAIN 2 & TRAIN 3 DRAWINGS)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

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CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING TRAIN 3 GAS/LIQUID SEPARATION PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-03015 | SHEET 1 OF 1 | REV 4

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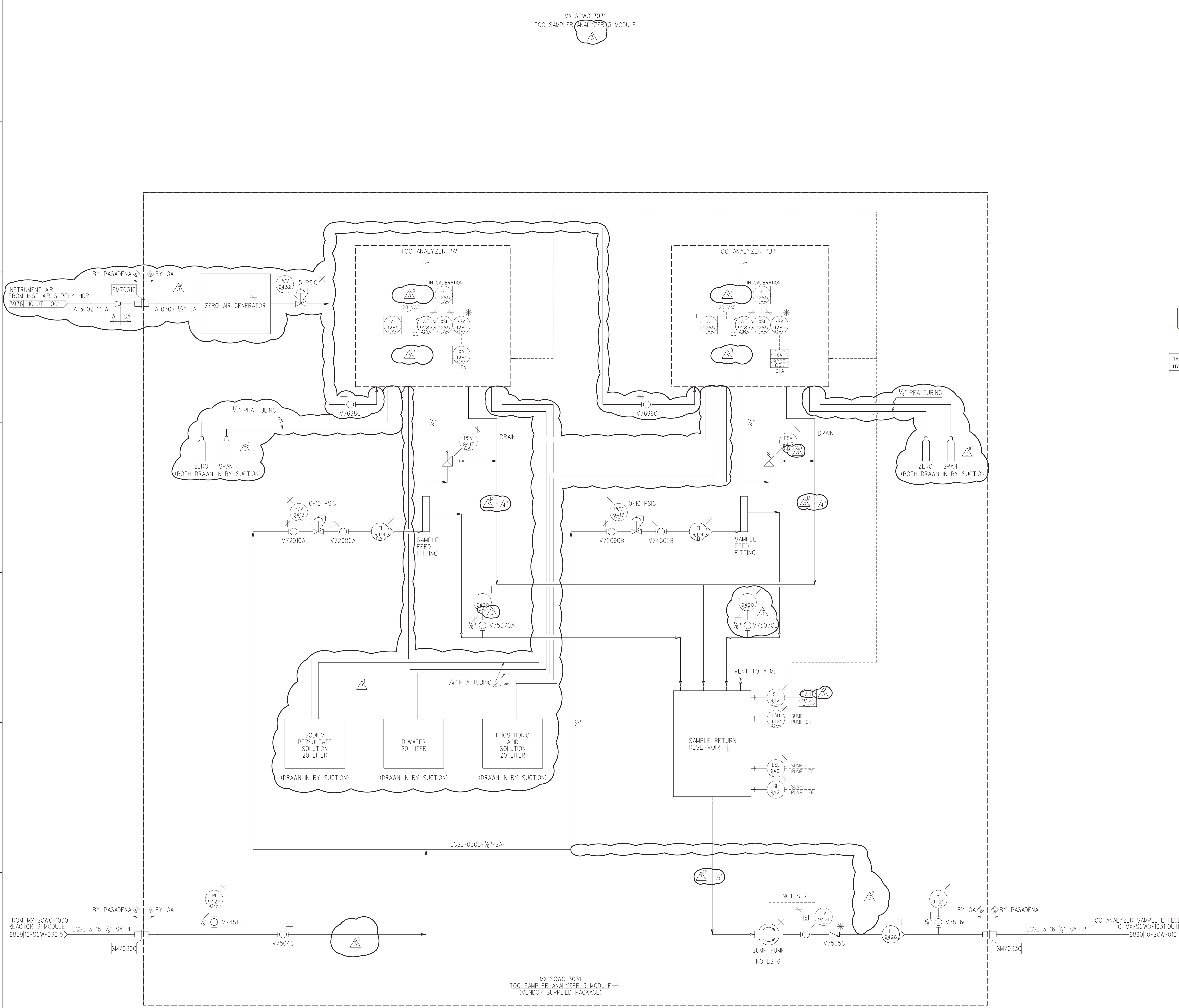

GENERAL NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS
   24915-00-M6-00-00010
   24915-00-M6-00-00011
   24915-00-M6-00-00012
   24915-00-M6-00-00013
   24915-00-M6-00-00014
   24915-00-M6-00-00015
2. CONTROL PANELS AND TOC SAMPLE ANALYZERS ARE TO BE LOCATED OFF-BOARD FROM THE MODULE IN UNCLASSIFIED (NON-HAZARD) AREA.
3. TOC ANALYZER SAMPLE PUMP(S) SHALL BE SIZED WITH HEAD GREATER THAN LIQUID EFFLUENT PUMP.
4. ◈ DENOTES DESIGN RESPONSIBILITY LABEL.
5. ✳ DENOTES SUPPLIED BY VENDOR.
6. SUMP PUMP TURNS ON UPON HIGH RESERVOIR LIQUID LEVEL. SUMP PUMP TURNS OFF UPON LOW AND LOW LOW RESERVOIR LIQUID LEVEL.
7. VALVE LV-9421C-- OPENS WHEN SUMP PUMP TURNS ON AND CLOSES WHEN SUMP PUMP TURNS OFF.
9. NOTE 8 IS DELETED.

APPROVED
By Ron Rhea at 4:06 pm, Mar 10, 2014

This document has been reviewed for ITAR/EAR and no ITAR/EAR sensitive information was found.

DRAWING EXPANDED FROM PID 24915-10-M6-SCWO-01019

BASED ON BLUE GRASS PFD 24915-10-M5-SCWO-00001

REFERENCE DRAWINGS

RCM Apvd

DN: cn=Issued by Mike Batobato, o=General Atomics, ou=Configuration Management, email=Miguel.Batobato@ga.com, c=US
Date: 2012.10.02 14:36:15 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
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1	01/15/09	IFC (INCORPORATES BPBGT COMMENTS)	NL	JL	KWD	DNW	VN
0	06/01/07	IFC (INCORPORATES DESIGN DEVELOPMENT AND VENDOR DATA)	JEM	MD	KWD	DNW	VN

QUALITY ☐ Q ☒ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING TRAIN 3 TOC SAMPLE ANALYZER PIPING & INSTRUMENT DIAGRAM

DRAWING NUMBER 24915-10-M6-SCWO-03019 | SHEET 1 OF 1 | REV 3

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