Blue Grass Chemical Agent-Destruction Pilot Plant

Resource Conservation and Recovery Act

Research, Development and Demonstration Permit Application

Submitted To:
The Kentucky Department for Environmental Protection,
Division of Waste Management
14 Reilly Road
Frankfort, Kentucky 40601

Submitted By:
Blue Grass Army Depot
2091 Kingston Highway
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BECHTEL PARSONS
BLUE GRASS

This document has been reviewed for OPSEC, and no OPSEC sensitive information was found.

September 2006
Revision 3

Volume II

VOLUME II

Appendices

A Site Topographic Map

B Wind Rose for BGAD

C Process Flow Diagrams (PFDs) and Material Balances for BGCAPP

D Material Safety Data Sheets (MSDSs)

E (Deleted)

F RD&D Permit Pre-Application Meeting Documentation

Appendix A Contents

Site Topographic Map

Figure

A-1 Site Topographic Map A-1

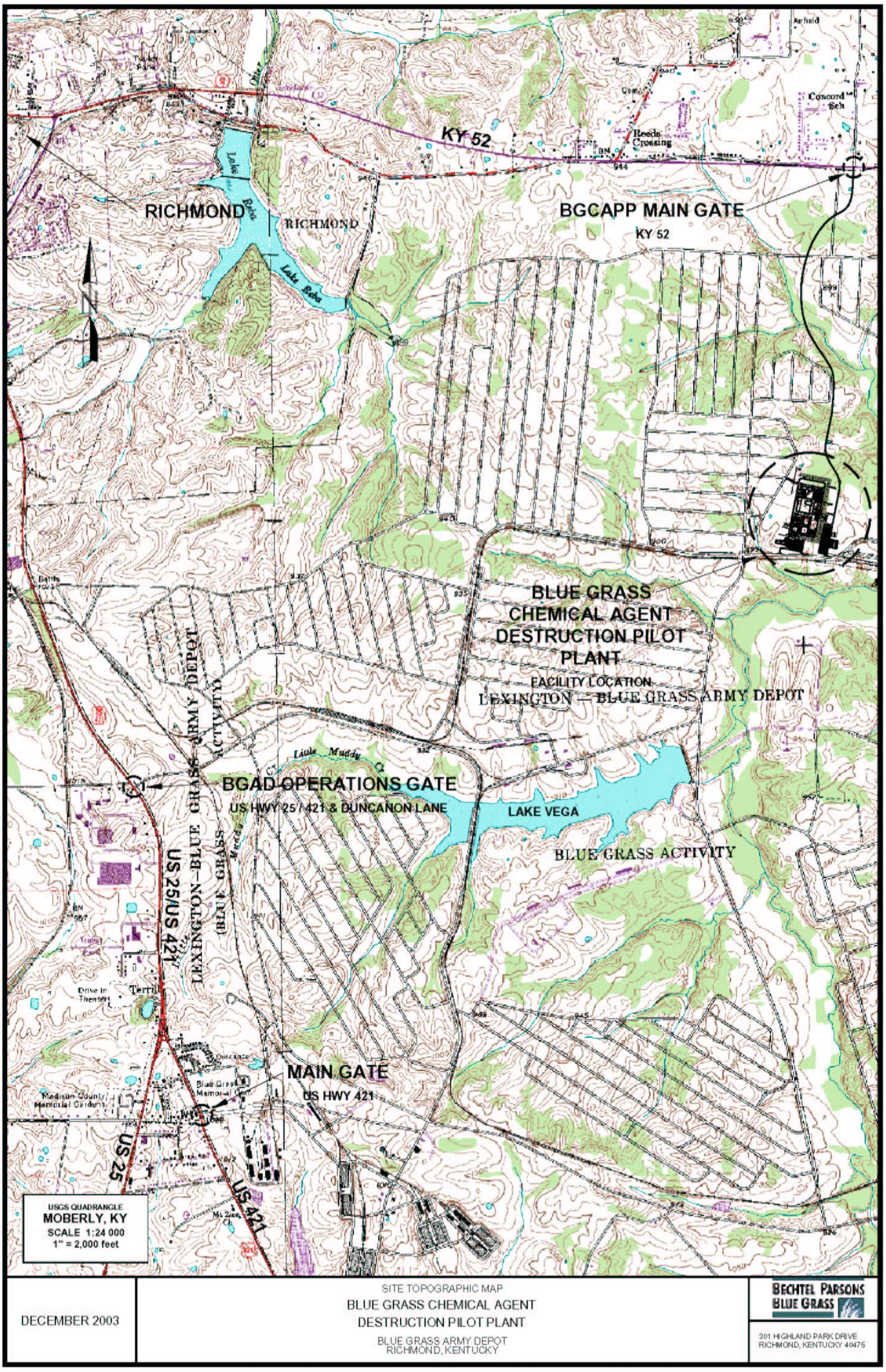
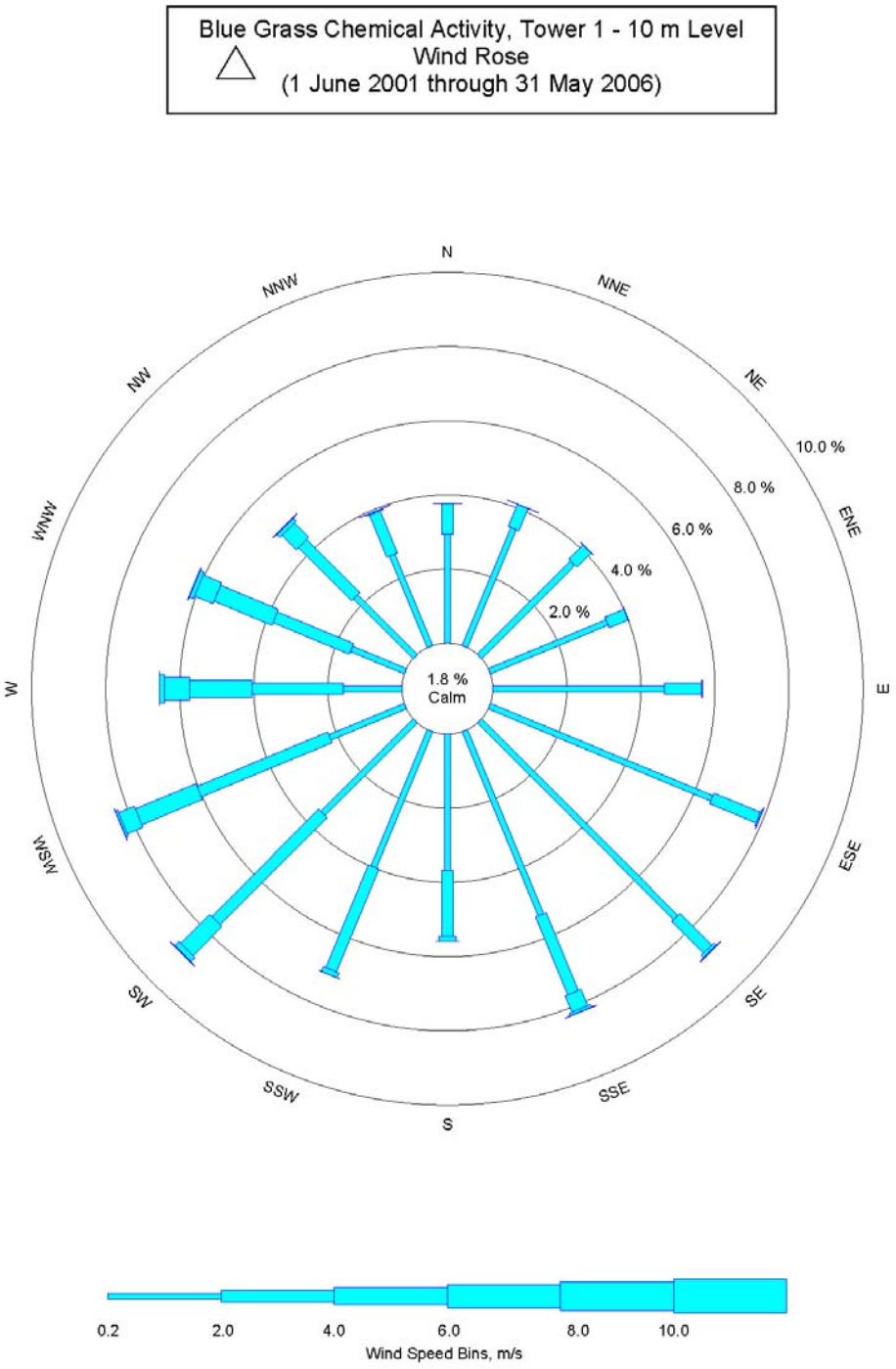


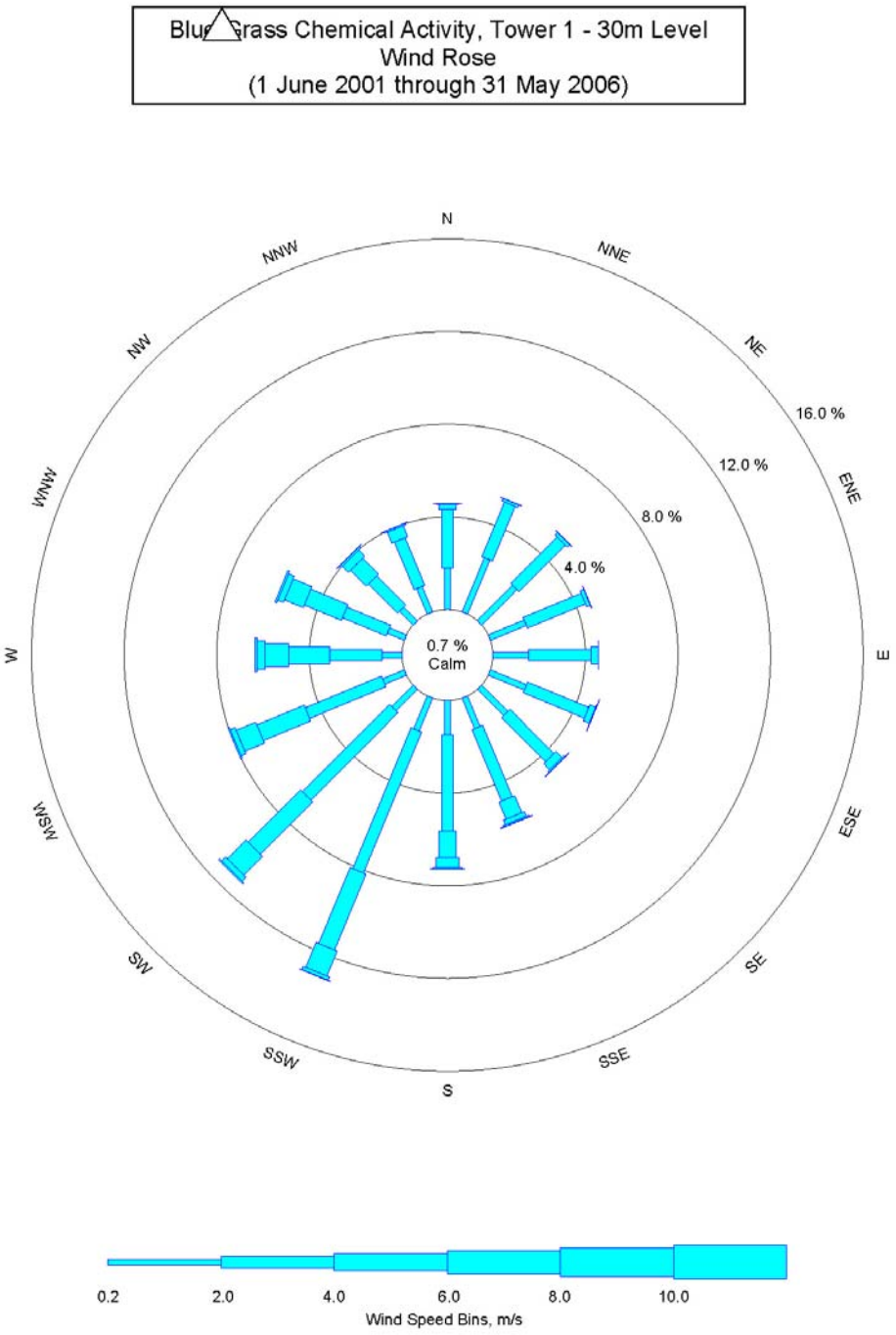
Figure A-1—Site Topographic Map

Appendix B Contents

Five Year Wind Rose for BGAD

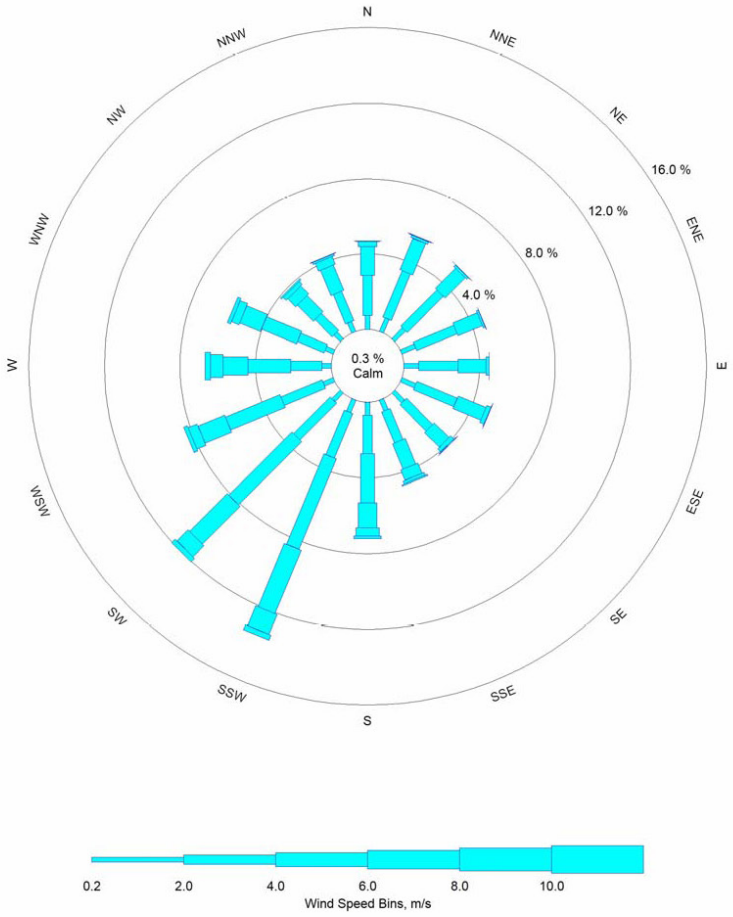

Blue Grass Chemical Activity, Tower 1 - 10 m Level
Wind Rose
(1 June 2001 through 31 May 2006)
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
10.0 %
8.0 %
6.0 %
4.0 %
2.0 %
1.8 %
Calm
0.2
2.0
4.0
6.0
8.0
10.0
Wind Speed Bins, m/s

1


Blue Grass Chemical Activity, Tower 1 - 30m Level
Wind Rose
(1 June 2001 through 31 May 2006)
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
16.0 %
12.0 %
8.0 %
4.0 %
0.7 %
Calm
0.2
2.0
4.0
6.0
8.0
10.0
Wind Speed Bins, m/s

1

Bluegrass Chemical Activity, Tower 1 – 60m Level
Wind Rose
(1 June 2001 through 31 May 2006)



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Appendix C Contents

Process Flow Diagrams and Material Balances for BGCAPP

Bases and Assumptions for Material Balances

Assumptions

The attached GB material balances are based on the peak processing rate for co-processing:

20 M55 Rockets/hour
15 M426 8-in. Projectiles/hour

Bases

Munition Data	M426/8-in. Projectile	M55/115-mm Rocket
Munition Body/Motor Metal 1	Steel	Steel
Munition Metal 1 Wt.	173.2	15.637
Munition Warhead/Fins Metal 2	None	Aluminum
Munition Metal 2 Wt.	0	7.3
Agent Type	**GB**	**GB**
Agent Wt.	14.5	10.75
Burster 1	None	M36
Burster 1 Tube Material (front)	None	Steel
Burster 1 Energetics Material	None	Comp B
Burster 1 Tube Wt.	0	0.1
Burster 1 Energetics Wt.	0	0.64
Burster 2	None	M34
Burster 2 Tube Material (back)	None	Steel
Burster 2 Energetics Material	None	Comp B
Burster 2 Tube Wt.	0	0.25
Burster 2 Energetics Wt.	0	2.5
Fuze Well Cup Material	None	None
Fuze Well Cup Wt.	0	0
Nose Closure Type	Lifting plug	M417 Fuze
Nose Closure Material	Steel	Aluminum
Nose Closure Wt.	1.75	0.6
Nose Closure Energetics	None	12 gm RDX
Propellant	None	M28
Propellant Wt.	0	19.3
Propellant Cellulose Acetate Liner Wt.	0	0.923
Total Munition Weight	189.45	58.00

Bases (cont'd)

Dunnage Estimates	M426/8-in. Projectile	M55/115-mm Rocket
Sub-container	None	S&F Tube
Number in Sub-container	0	1
Sub-container Fiberglass Wt.	0	13.7
Sub-container Aluminum Wt.	0	2.75
Container Designation	Pallet	Pallet
Number of rounds per pallet	6	15
Total Pallet Wt.	51.3	190
Pallet Wood Wt. per round	8.55	12.67
Spent decon	5	lb/round
PPE	0.15	lb/round

Rocket Energetics Composition

Burster			
	Comp B	RDX	60%
		TNT	40%
Propellant			
	M28	Nitrocellulose	60%
		Nitroglycerin	30%
		Triacetin	10%

1

Page	DOCUMENT NUMBER	SHT	DESCRIPTION
1	24915-00-M5-00-00001	1	GENERAL PROCESS BLOCK FLOW DIAGRAM
2	24915-00-M5-00-00002	1	GENERAL LEGEND AND SYMBOLS PFD
3	24915-07-M5-ACS-00001	1	AGENT COLLECTION/TOXIC STORAGE PFD
4	24915-07-M5-ACS-00001	2	AGENT COLLECTION/TOXIC STORAGE M&EB
5	24915-07-M5-ACS-00001	3	AGENT COLLECTION/TOXIC STORAGE M&EB
6	24915-07-M5-ANS-00001	1	AGENT NEUTRALIZATION PFD
7	24915-07-M5-ANS-00001	2	AGENT NEUTRALIZATION M&EB
8	24915-07-M5-ANS-00001	3	AGENT NEUTRALIZATION M&EB
9	24915-07-M5-ANS-00001	4	AGENT NEUTRALIZATION M&EB
	~~24915-07-M5-ANS-00001~~	~~5~~	~~Cancelled- not included~~
10	24915-07-M5-ANS-00001	6	AGENT NEUTRALIZATION M&EB
11	24915-07-M5-EBH-00001	1	ENERGETICS BATCH HYDROLYZER PFD
12	24915-07-M5-EBH-00001	2	ENERGETICS BATCH HYDROLYZER PFD SECONDARY COOLING LOOP Not a Hazardous waste treatment unit
13	24915-07-M5-EBH-00001	3	ENERGETICS BATCH HYDROLYZER M&EB
14	24915-07-M5-EBH-00001	4	ENERGETICS BATCH HYDROLYZER M&EB
15	24915-07-M5-EBH-00001	5	ENERGETICS BATCH HYDROLYZER M&EB
16	24915-07-M5-EBH-00001	6	ENERGETICS BATCH HYDROLYZER M&EB
17	24915-07-M5-EBH-00001	7	ENERGETICS BATCH HYDROLYZER M&EB
18	24915-07-M5-EBH-00001	8	ENERGETICS BATCH HYDROLYZER M&EB
19	24915-07-M5-ENS-00001	1	ENERGETICS NEUTRALIZATION PFD
20	24915-07-M5-ENS-00001	2	ENERGETICS NEUTRALIZATION M&EB
21	24915-07-M5-ENS-00001	3	ENERGETICS NEUTRALIZATION M&EB
22	24915-07-M5-ENS-00001	4	ENERGETICS NEUTRALIZATION M&EB
23	24915-07-M5-MCS-00001	1	METAL PARTS TREATMENT COOLING SYSTEM PFD
24	24915-07-M5-MPT-00001	1	METAL PARTS TREATMENT PFD
25	24915-07-M5-MPT-00001	2	METAL PARTS TREATMENT M&EB
26	24915-07-M5-MPT-00001	3	METAL PARTS TREATMENT M&EB
27	24915-07-M5-MPT-00001	4	METAL PARTS TREATMENT M&EB
28	24915-07-M5-MWS-00001	1	MUNITIONS WASHOUT SYSTEM PFD
29	24915-07-M5-MWS-00001	2	MUNITIONS WASHOUT SYSTEM M&EB
30	24915-07-M5-MWS-00001	3	MUNITIONS WASHOUT SYSTEM M&EB
31	24915-07-M5-OTE-00001	1	OFFGAS TREATMENT EBH/ENR PFD
32	24915-07-M5-OTE-00001	2	OFFGAS TREATMENT EBH/ENR M&EB
33	24915-07-M5-OTE-00001	3	OFFGAS TREATMENT EBH/ENR M&EB
34	24915-07-M5-OTE-00001	4	OFFGAS TREATMENT EBH ENR M&EB
35	24915-07-M5-OTM-00001	1	OFFGAS TREATMENT BATCH MPT PFD
36	24915-07-M5-OTM-00001	2	OFFGAS TREATMENT MPT M&EB
37	24915-07-M5-OTM-00001	3	OFFGAS TREATMENT MPT M&EB
38	24915-07-M5-OTM-00001	4	OFFGAS TREATMENT MPT M&EB
39	24915-07-M5-PHS-00001	1	PROJECTILE DEMILITARIZATION PFD
40	24915-07-M5-PHS-00001	2	PROJECTILE DEMILITARIZATION M&EB
41	24915-07-M5-RHS-00001	1	ROCKET SHEAR MACHINE PFD
42	24915-07-M5-RHS-00001	2	ROCKET SHEAR MACHINE M&EB

Page	DOCUMENT NUMBER	SHT	DESCRIPTION
43	24915-07-M5-SDS-00001	1	SPENT DECONTAMINATION SYSTEM PFD
44	24915-07-M5-SDS-00001	2	SPENT DECONTAMINATION SYSTEM M&EB
45	24915-08-M5-HVAC-00001	1	MDB HVAC FILTERS PFD
46	24915-08-M5-HVAC-00002	1	MDB HVAC FILTERS PFD
47	24915-10-M5-AFS-00001	1	ALUMINUM FILTRATION SYSTEM PFD
48	24915-10-M5-AFS-00001	2	ALUMINUM FILTRATION SYSTEM M&EB
49	24915-10-M5-APS-00001	1	ALUMINUM PRECIPITATION PFD
50	24915-10-M5-APS-00001	2	ALUMINUM PRECIPITATION M&EB
51	24915-10-M5-APS-00001	3	ALUMINUM PRECIPITATION M&EB
52	24915-10-M5-RO-00001	1	Water Recovery - R.O. Unit PFD
53	24915-10-M5-RO-00001	2	Water Recovery - R.O. Unit M&EB
54	24915-10-M5-RO-00002	1	Water Recovery - Tanks PFD
55	24915-10-M5-RO-00002	2	Water Recovery - Tanks M&EB
56	24915-10-M5-SCWO-00001	1	SCWO – PFD
57	24915-10-M5-SCWO-00001	2	SCWO – PFD
58	24915-10-M5-SCWO-00001	3	SCWO - PFD
59	24915-10-M5-SCWO-00001	4	SCWO - M&EB
60	24915-10-M5-SCWO-00001	5	SCWO - M&EB
61	24915-10-M5-SCWO-00001	6	SCWO - M&EB
62	24915-10-M5-SCWO-00001	7	SCWO - M&EB
63	24915-10-M5-SCWO-00001	8	SCWO - M&EB
64	24915-10-M5-SCWO-00001	9	SCWO - M&EB
65	24915-11-M5-HSS-00001	1	AGENT HYDROLYSATE PFD
66	24915-11-M5-HSS-00001	2	AGENT HYDROLYSATE M&EB
67	24915-11-M5-HSS-00002	1	ENERGETICS HYDROLYSATE PFD
68	24915-11-M5-HSS-00002	2	ENERGETICS HYDROLYSATE M&EB

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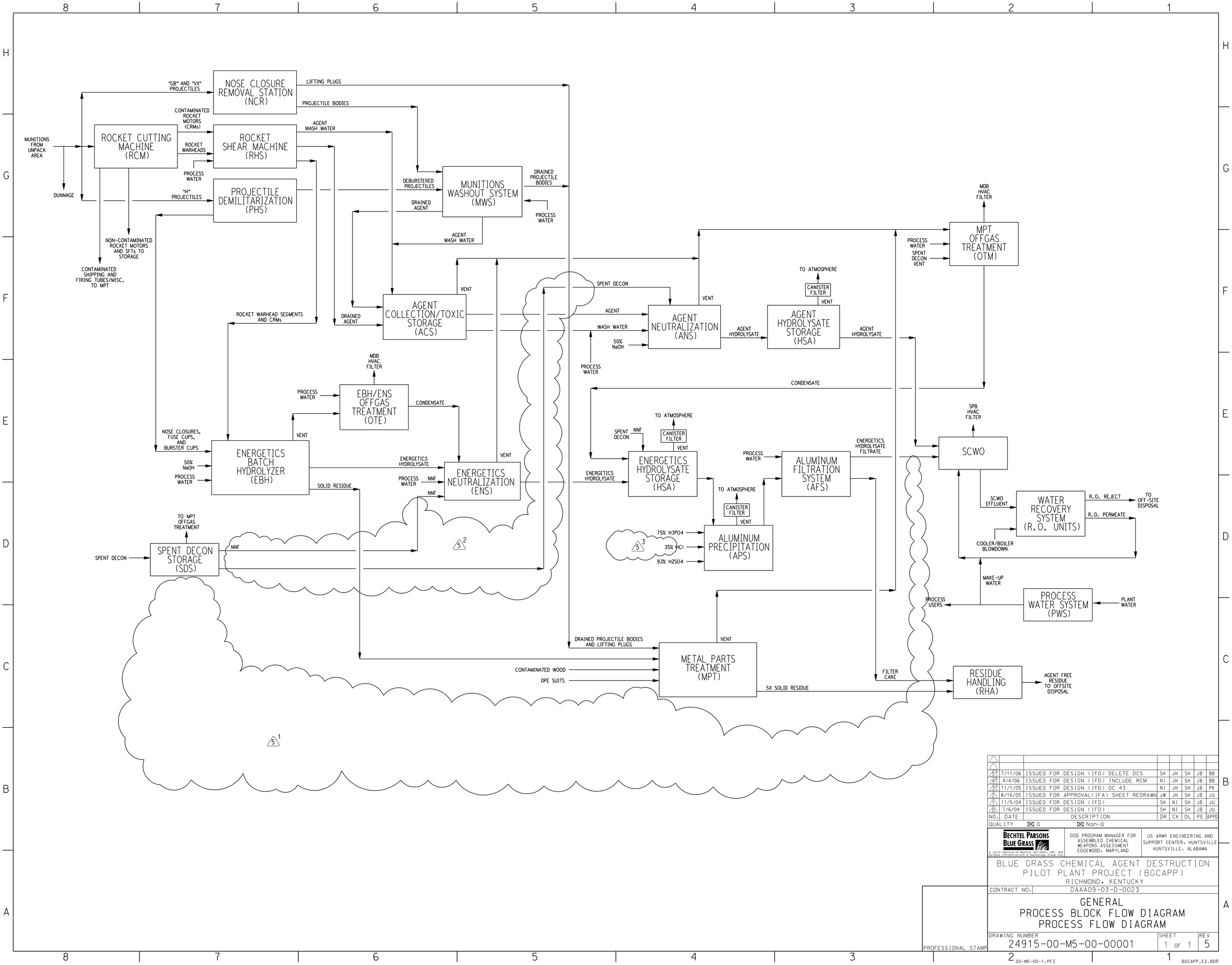

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4	4/4/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	NI	JH	SH	JB	BB
3	11/1/05	ISSUED FOR DESIGN (IFD) DC 43	NI	JH	SH	JB	PK
2	8/16/05	ISSUED FOR APPROVAL(IFA) SHEET REDRAWN	JW	JH	SH	JB	JU
1	11/5/04	ISSUED FOR DESIGN (IFD)	SH	NI	SH	JB	JU
0	7/6/04	ISSUED FOR DESIGN (IFD)	SH	NI	SH	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

GENERAL
PROCESS BLOCK FLOW DIAGRAM
PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-00-M5-00-00001 | SHEET 1 OF 1 | REV 5

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TYPICAL PFD STANDARD INSTRUMENT SYMBOLS

- (pH AIC) pH MONITOR CONTROLLER
- (pH AI) pH MONITOR
- (AGENT AIT) AGENT MONITOR
- (RH AI) RELATIVE HUMIDITY MONITOR
- (O2 AI) OXYGEN MONITOR
- (SOx AI) SOx MONITOR
- (TOC AIC) TOTAL ORGANIC CARBON CONTROLLER
- (TOC AI) TOTAL ORGANIC CARBON MONITOR
- (THC AI) TOTAL HYDROCARBON MONITOR
- (CI) CONDUCTIVITY INDICATOR
- (DC) DENSITY CONTROLLER
- (DI) DENSITY INDICATOR
- (DIC) DENSITY INDICATING CONTROLLER
- (FI) FLOW INDICATOR
- (FC) FLOW CONTROL
- (FFC) FLOW RATIO CONTROLLER
- (FFIC) FLOW RATIO INDICATING CONTROLLER
- (FIC) FLOW INDICATING CONTROLLER
- (1 2 FQI) FLOW INDICATING TOTALIZER
- (FSLL) FLOW SWITCH LOW LOW
- (FQC) FLOW QUANTITY CONTROL
- (LC) LEVEL CONTROL
- (LG) LEVEL GAUGE
- (LIC) LEVEL INDICATING CONTROLLER
- (FQC) FLOW TOTALIZING CONTROLLER
- (LS) LEVEL SWITCH
- (PC) PRESSURE CONTROL
- (PI) PRESSURE INDICATOR
- (PdI) PRESSURE DIFFERENTIAL INDICATOR
- (PIC) PRESSURE INDICATING CONTROLLER
- (QS) FLOW TOTALIZER
- (S) SAMPLE POINT
- (SIC) SPEED INDICATING CONTROLLER
- (TC) TEMPERATURE CONTROL
- (TI) TEMPERATURE INDICATOR
- (TIC) TEMPERATURE INDICATING CONTROLLER
- (TR) TEMPERATURE RECORDER
- (TS) TEMPERATURE SWITCH

EQUIPMENT CODE:

AD - AIRLOCK/BLAST GATE
MA - BLOWER
MC - COMPRESSOR
ME - HEAT EXCHANGER
MF - AGITATOR, RAKE
MJ - CONVEYOR
MK - BULK OXIDIZER, FILTER, SCRUBBER TOWER, VENTURI
ML - CLARIFIER, R.O. UNIT, WATER SOFTENER
MP - PUMP
MT - TANK
MV - REACTOR
(1 3)

ABBREVIATIONS

ACWA - ASSEMBLED CHEMICAL WEAPON ASSESSMENT
ACS - AGENT COLLECTION SYSTEM
ANS - AGENT NEUTRALIZATION SYSTEM
BFW - BOILER FEEDWATER
CAM - CAVITY ACCESS MACHINE
CHWR - CHILLED WATER RETURN
CHWS - CHILLED WATER SUPPLY
COND - CONDENSATE
CWR - COOLING WATER RETURN
CWS - COOLING WATER SUPPLY
DCN - DECONTAMINATION
DPE - DEMILITARIZATION PROTECTIVE ENSEMBLE
EBH - ENERGETICS BATCH REACTOR
ECR - EXPLOSIVE CONTAINMENT ROOM
ECV - ECR VESTIBULE
ENR - ENERGETICS NEUTRALIZATION REACTOR
ENS - ENERGETICS NEUTRALIZATION SYSTEM
MDB - MUNITIONS DEMILITARIZATION BUILDING
MMC - MUNITIONS MONITORING CONTAINER
MPT - METAL PARTS TREATER
NC - NORMALLY CLOSED
NNF - NORMALLY NO FLOW
OTE - OFFGAS TREATMENT EBH/ENR
OTM - OFFGAS TREATMENT MPT
PHS - PROJECTILE HANDLING SYSTEM
RHS - ROCKET HANDLING SYSTEM
SCWO - SUPERCRITICAL WATER OXIDATION
SHT - SECONDARY HEAT TRANSFER SYSTEM
SHTS - SECONDARY HEAT TRANSFER FLUID SUPPLY
SHTR - SECONDARY HEAT TRANSFER FLUID RETURN
STM - STEAM
TMA - TOXIC MAINTENANCE AREA
UPA - UNPACK AREA
(1 4)

DRAWING IDENTIFICATION

24915-000-M5-00-00001
- SEQUENCE NUMBER
- LOCATOR CODE
- DOCUMENT TYPE CODE
- FACILITY CODE
- PROJECT NUMBER

EQUIPMENT IDENTIFICATION

XX-XXXX-XXXX
- SEQUENCE NUMBER
- LOCATOR CODE
- EQUIPMENT TYPE CODE

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24915-00-M5-00-00002	N/A	Legend and Symbols
(1 5) 24915-00-M5-00-00003	N/A	Water Balance
24915-03-M5-FP-00001	SU	Potable/Fire Water Supply
24915-07-M5-ACS-00001	MDB	Agent Collection/Toxic Storage
24915-07-M5-ANS-00001	MDB	Agent Neutralization
24915-07-M5-ANS-00002	MDB	Agent Neutralization Sampling
24915-07-M5-ENS-00001	MDB	Energetics Neutralization
24915-07-M5-ENS-00002	MDB	Energetics Neutralization Sampling
24915-07-M5-MPT-00001	MDB	Metal Parts Treatment
(1 6) 24915-07-M5-MCS-00001	MDB	MPT Cooling System
24915-07-M5-MWS-00001	MDB	Munitions Washout System
24915-07-M5-OTE-00001	MDB	Offgas Treatment EBH/ENR
24915-07-M5-OTM-00001	MDB	Offgas Treatment - MPT
24915-07-M5-PHS-00001	MDB	Projectile Demilitarization
24915-07-M5-RHS-00001	MDB	Rocket Shear Machine
24915-07-M5-SDS-00001	MDB	Spent Decontamination System
24915-07-M5-SHT-00001	MDB	Sec. Heat Trans. Fluid Circ. System - Agent
24915-07-M5-SHT-00002	MDB	Sec. Heat Trans. Fluid Circ. System - Energetic
24915-10-M5-APS-00001	SPB	Aluminum Precipitation
(1 7) 24915-10-M5-RO-00001	SPB	Water Recovery R.O. Unit
24915-10-M5-RO-00002	SPB	Water Recovery Tanks
24915-10-M5-SCWO-00001	SPB	Process Water System
24915-11-M5-HSS-00001	HSA	Agent Hydrolysate
24915-11-M5-HSS-00002	HSA	Energetics Hydrolysate
24915-13-M5-BCS-00001	UB	Bulk Chemical Storage
(1 8) 24915-13-M5-CAS-00001	UB	Compressed Air System
24915-13-M5-CHP-00001	UB	Chilled Water System
24915-13-M5-CWP-00001	UB	Process Cooling Water
24915-13-M5-NIT-00001	UB	Nitrogen Distribution
24915-13-M5-PWS-00002	UB	Plant/Process Water Distribution
24915-13-M5-STM-00001	UB	Steam System

- VALVE (NORMALLY OPEN)
- VALVE (NORMALLY CLOSED)
- BUTTERFLY VALVE
- CHECK VALVE
- PRESSURE RELIEF VALVE
- 3-WAY VALVE
- CONTROL VALVE
- HAND CONTROL VALVE
- SLIDE GATE VALVE
- PRESSURE REGULATOR (SELF-CONTAINED)
- PRESSURE REGULATOR (EXTERNAL TAP)
- CONTROL STATION
- STREAM NUMBER
- PROCESS LINE
- EXISTING LINES AND EQUIPMENT
- PNEUMATIC INSTRUMENT SIGNAL
- ELECTRIC INSTRUMENT SIGNAL
- HYDRAULIC SIGNAL
- ELECTROMAGNETIC INSTR. SIGNAL
- COMPUTER SIGNAL
- SLOPE OR "GRAVITY FLOW"
- VORTEX BREAKER
- HOSE CONNECTION
- TRACED LINE (ET=ELECTRIC, ST=STEAM)
- STEAM JACKETED LINE
- FLEXIBLE HOSE
- (DWG. NO.) LINE TERMINATION ARROW (USED TO REFERENCE MAIN PROCESS LINES)
- ARROW FOR GENERAL USE WITHIN DRAWING
- LINE BREAK
- LINE TERMINATOR TO OFF SITE

- FLAME ARRESTOR
- ORIFICE PLATE
- EJECTOR OR EDUCTOR
- FILTER-AIR INTAKE
- PUMP, GENERAL
- MOTOR DRIVEN RECIPROCATING PUMP
- GEAR PUMP OR ROTARY COMPRESSOR/BLOWER
- PUMP (SUBMERGED)
- BLOWER OR FAN
- AIR OPERATED DIAPHRAGM PUMP
- PROGRESSING CAVITY PUMP
- CARBON FILTER
- PISTON OR METERING PUMP

- SHELL & TUBE EXCHANGER (INDICATING TUBE-SIDE)
- STEAM HEATER
- WATER COOLER OR CONDENSER
- ELECTRIC HEATER
- AIR COOLER
- ELECTRIC HEATER
- SAMPLE COOLER OR SAMPLE CONNECTION
- ROTARY FEEDER
- ROTARY PUMP
- CLARIFIER

- IN-LINE MIXER
- BELT CONVEYOR
- PRESSURE VESSEL (HORIZONTAL OR VERTICAL)
- TANK
- TANK AGITATOR WITH MOTOR
- HOPPER
- FILTER PRESS
- ROLL OFF BIN OR DUMP TRUCK
- PRESSURE FILTER

- SHELL JACKETED VESSEL
- FLAT TOP TANK
- AIR COMPRESSOR
- MULTI-MEDIA FILTER
- ELECTRIC HEATER
- ROBOT
- R.O. UNIT
- FILLING FUNNEL OR DRAIN
- CYCLONE
- VENTURI
- DRUM
- COOLING CONVEYOR
- HIGH PRESSURE PUMP
- CONSERVATION VENT
- AIRLOCK GATE

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
1	4-24-06	ISSUED FOR DESIGN (IFD)	GL	NI	SH	JB	BB
0	6-11-04	ISSUED FOR DESIGN (IFD)	GL	PC	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

GENERAL LEGEND AND SYMBOLS PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-00-M5-00-00002 | SHEET 1 OF 1 | REV 1

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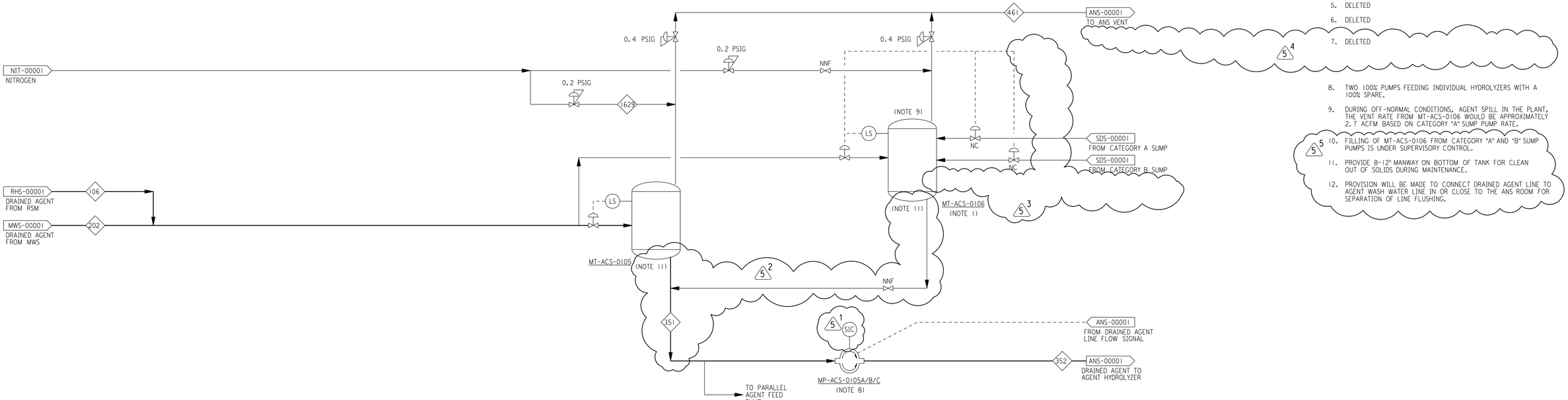
MT-ACS-0105
AGENT HOLDING TANK
WORKING CAPACITY: 1000 GAL

MP-ACS-0105A/B/C
AGENT FEED PUMP
AND SPARE
CAPACITY: 4.4 GPM

MT-ACS-0106
AGENT SURGE TANK
WORKING CAPACITY: 1000 GAL

NOTES:

1. FOR AGENT OVERFLOW OR SPILL FROM AGENT HOLDING TANK OR SUMPS. TANK IS NORMALLY EMPTY. TRANSFER TO AGENT SURGE TANKS IS UNDER SUPERVISORY CONTROL.
2. DELETED
3. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
4. DELETED
5. DELETED
6. DELETED
7. DELETED
8. TWO 100% PUMPS FEEDING INDIVIDUAL HYDROLYZERS WITH A 100% SPARE.
9. DURING OFF-NORMAL CONDITIONS, AGENT SPILL IN THE PLANT, THE VENT RATE FROM MT-ACS-0106 WOULD BE APPROXIMATELY 2.7 ACFM BASED ON CATEGORY "A" SUMP PUMP RATE.
10. FILLING OF MT-ACS-0106 FROM CATEGORY "A" AND "B" SUMP PUMPS IS UNDER SUPERVISORY CONTROL.
11. PROVIDE 8-12" MANWAY ON BOTTOM OF TANK FOR CLEAN OUT OF SOLIDS DURING MAINTENANCE.
12. PROVISION WILL BE MADE TO CONNECT DRAINED AGENT LINE TO AGENT WASH WATER LINE IN OR CLOSE TO THE ANS ROOM FOR SEPARATION OF LINE FLUSHING.



NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	NI	SH	JB	BB
4	11/10/05	(IFD) LL FROM NEWPORT AND GOV. COM.	JW	JH	SH	JB	JU
3	6/15/05	ISSUED FOR DESIGN (IFD)	JW	JH	SH	JB	JU
2	5/11/05	ISSUED FOR APPROVAL (IFA)	JW	JH	SH	JB	JU
1	10/11/04	ISSUED FOR DESIGN (IFD)	EV	PC	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	EV	PC	SH	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 COLLECTION/TOXIC STORAGE PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-ACS-00001
SHEET 1 OF 3
REV 5

PROFESSIONAL STAMP

07-M5-ACS-1-1.PFZ
BGCAPP_E2.BDR

DESIGN FILE: s:\2d\pr\07-m5-acs-1-1.pfz
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MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-ACS-00001

AGENT COLLECTION SYSTEM - CASE AGENT GB CO-PROCESSING
0 WT% AGENT HEEL TO MPT

PEAK CASE

STREAM NUMBER	106	202	351	352	461	1629
DESCRIPTION	DRAINED AGENT FROM ROCKET SHEAR MACHINES	DRAINED AGENT FROM MUNITION WASH SYSTEM	DRAINED AGENT TO AGENT HYDROLYZERS	DRAINED AGENT TO ONE AGENT HYDROLYZER	ACS VENT	NITROGEN TO THE ACS
TEMPERATURE, °F	77	77	77	77	77	77
PRESSURE, PSIA	55.23	28.23	174.23	174.23	14.00	14.43
INSTANTANEOUS FLOW, GPM/ (ACFM)	2.5	5.1	8.0	4.0	(1.02)	(1.07)
DENSITY, LB/FT3	67.97	67.97	67.97	67.97	0.069	0.070
VISCOSITY, cP	1.4	1.4	1.4	1.4	0.018	0.018
MOLECULAR WEIGHT					28.47	28.01
COMPONENT FLOWS, LB/HR						
GB	172.0	174.0	346.0	173.0	7.0E-03	
VX						
H						
WATER						
NITROGEN					3.5E-01	3.5E-01
OXYGEN						
HYDROGEN						
CARBON DIOXIDE						
ETHANE						
VOCs						
TOTAL PEAK, LB/HR (Note 1)	172.0	174.0	346.0	173.0	3.5E-01	3.5E-01
AVG THROUGHPUT, LB/HR	80.0	87.0	167.0	83.5	1.7E-01	1.7E-01
NOTES				4		

AGENT COLLECTION SYSTEM - CASE AGENT GB ROCKETS
0 WT% AGENT HEEL TO MPT

PEAK CASE

STREAM NUMBER	106	202	351	352	461	1629
DESCRIPTION	DRAINED AGENT FROM ROCKET SHEAR MACHINES	DRAINED AGENT FROM MUNITION WASH SYSTEM	DRAINED AGENT TO AGENT HYDROLYZERS	DRAINED AGENT TO ONE AGENT HYDROLYZER	ACS VENT	NITROGEN TO THE ACS
TEMPERATURE, °F	77		77	77	77	77
PRESSURE, PSIA	55.23		174.23	174.23	14.00	14.43
INSTANTANEOUS FLOW, GPM/ (ACFM)	2.5		8.0	4.0	(0.33)	(1.07)
DENSITY, LB/FT3	67.97		67.97	67.97	0.069	0.070
VISCOSITY, cP	1.4		1.4	1.4	0.018	0.018
MOLECULAR WEIGHT					28.47	28.01
COMPONENT FLOWS, LB/HR						
GB	172.0		172.0	86.0	3.5E-03	
VX						
H						
WATER						
NITROGEN					1.7E-01	1.7E-01
OXYGEN						
HYDROGEN						
CARBON DIOXIDE						
ETHANE						
VOCs						
TOTAL PEAK, LB/HR (Note 1)	172.0	0.00	172.0	86.0	1.8E-01	1.7E-01
AVG THROUGHPUT, LB/HR	80.0		80.0	40.0	8.1E-02	8.1E-02
NOTES				4		

NOTES:

1. AVERAGED FOR 24 HOURS.
2. DELETED
3. DELETED
4. COMPOSITION BREAKDOWN OF INDIVIDUAL COMPONENTS IS SHOWN ON DRAWING 24915-07-M5-ANS-00001 SHEETS 2 AND 3.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	6/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	NI	SH	JB	BB
5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	NI	SH	JB	BB
4	11/10/05	(IFD) LL FROM NEWPORT AND GOV. COM.	JW	JH	SH	JB	JU
3	6/15/05	ISSUED FOR DESIGN (IFD)	JW	JH	SH	JB	JU
2	5/11/05	ISSUED FOR APPROVAL (IFA)	JW	JH	SH	JB	JU
1	10/11/04	ISSUED FOR DESIGN (IFD)	EV	PC	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	EV	PC	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 AGENT COLLECTION/TOXIC STORAGE PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-ACS-00001 | SHEET 2 OF 3 | REV 6

PROFESSIONAL STAMP

DESIGN FILE: s:\2dwr\07-m5-acs-1-2.pfz
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BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-ACS-00001

AGENT COLLECTION SYSTEM - CASE AGENT VX CO-PROCESSING
0 WT% AGENT HEEL TO MPT

PEAK CASE

STREAM NUMBER	106	202	351	352	461	1629
DESCRIPTION	DRAINED AGENT FROM ROCKET SHEAR MACHINES	DRAINED AGENT FROM MUNITION WASH SYSTEM	DRAINED AGENT TO AGENT HYDROLYZERS	DRAINED AGENT TO ONE AGENT HYDROLYZER	ACS VENT	NITROGEN TO THE ACS
TEMPERATURE, °F	77	77	77	77	77	77
PRESSURE, PSIA	55.23	28.23	174.23	174.23	14.00	14.43
INSTANTANEOUS FLOW, GPM/ (ACFM)	2.5	2.7	8.6	4.3	(0.70)	(1.15)
DENSITY, LB/FT3	62.95	62.95	62.95	62.95	0.068	0.070
VISCOSITY, cP	10.0	10.0	10.0	10.0	0.018	0.018
MOLECULAR WEIGHT	-	-	-	-	28.01	28.01
COMPONENT FLOWS, LB/HR						
GB						
VX	232.70	113.47	346.17	173.09	3.2E-06	
H						
WATER						
NITROGEN					3.7E-01	3.7E-01
OXYGEN						
HYDROGEN						
CARBON DIOXIDE						
ETHANE						
VOCs						
TOTAL PEAK, LB/HR (Note 1)	232.70	113.47	346.17	173.09	3.7E-01	3.7E-01
AVG THROUGHPUT, LB/HR	106.66	46.08	152.74	76.37	1.7E-01	1.7E-01
NOTES				5		

7 1

AGENT COLLECTION SYSTEM - CASE AGENT H PROJECTILES
0 WT% AGENT HEEL TO MPT

STREAM NUMBER	106	202	351	352	461	1629
DESCRIPTION	DRAINED AGENT FROM ROCKET SHEAR MACHINES	DRAINED AGENT FROM MUNITION WASH SYSTEM	DRAINED AGENT TO AGENT HYDROLYZERS	DRAINED AGENT TO ONE AGENT HYDROLYZER	ACS VENT	NITROGEN TO THE ACS
TEMPERATURE, °F		77	77	77	77	77
PRESSURE, PSIA		28.23	174.23	174.23	14.00	14.43
INSTANTANEOUS FLOW, GPM/ (ACFM)		1.9	8.8	4.4	(0.25)	(1.18)
DENSITY, LB/FT3		80.20	80.20	80.20	0.068	0.070
VISCOSITY, cP		5.8	5.8	5.8	0.018	0.018
MOLECULAR WEIGHT		-	-	-	28.03	28.01
COMPONENT FLOWS, LB/HR						
GB						
VX						
H		88.22	88.22	44.11	5.2E-05	
WATER						
NITROGEN					7.5E-02	7.5E-02
OXYGEN						
HYDROGEN						
CARBON DIOXIDE						
ETHANE						
VOCs						
TOTAL PEAK, LB/HR (Note 1)	0.0	88.22	88.22	44.11	7.5E-02	7.5E-02
AVG THROUGHPUT, LB/HR		33.59	33.59	16.80	2.9E-02	2.9E-02
NOTES				5		

NOTES:

1. AVERAGED FOR 24 HOURS
2. DELETED
3. DELETED
4. DELETED
5. COMPOSITION BREAKDOWN OF INDIVIDUAL COMPONENTS IS SHOWN ON DRAWING 24915-07-M5-ANS-00001 SHEET 4 FOR VX CASE AND SHEET 6 FOR H CASE.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7	6/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	NI	SH	JB	BB
6	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	NI	SH	JB	BB
5	12/5/05	(IFD) LL FROM NEWPORT AND GOV. COM.	JW	JH	SH	JB	JU
4	11/10/05	(IFD) LL FROM NEWPORT AND GOV. COM.	JW	JH	SH	JB	JU
3	6/15/05	ISSUED FOR DESIGN (IFD)	JW	JH	SH	JB	JU
2	5/11/05	ISSUED FOR APPROVAL (IFA)	JW	JH	SH	JB	JU
1	10/11/04	ISSUED FOR DESIGN (IFD)	EV	PC	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	EV	PC	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 AGENT COLLECTION/TOXIC STORAGE PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-ACS-00001 | SHEET 3 OF 3 | REV 7

PROFESSIONAL STAMP

DESIGN FILE: s:\2d\pr\07-m5-acs-1-3.pfz
PLOTTED BY: 51439 ON 6/21/2006 AT 3:12:26 PM

07-M5-ACS-1-3.PFZ

BGCAPP_E2.BDR

MP-ANS-0101A/B
MP-ANS-0201A/B
AGENT HYDROLYZER RECIRCULATION PUMPS AND SPARES
CAPACITY: 312 GPM EA.
(NOTES 1, 4)

ME-ANS-0101/0201
AGENT HYDROLYZER HEAT EXCHANGERS
DUTY: 1.21 MMBTU/HR EA.
(NOTES 1, 16)

MF-ANS-0101/0201
AGENT HYDROLYZER AGITATORS
TBD HP
(NOTES 1, 4)

MV-ANS-0101/0201
AGENT HYDROLYZERS
6'-0" ID X 9'-0" H
WORKING CAPACITY: 1560 GAL
(NOTE 1)

MF-ANS-0103/0203/0303
AGENT HYDROLYSATE SAMPLING TANK AGITATOR
HP TBD

MT-ANS-0103/0203/0303
AGENT HYDROLYSATE SAMPLING TANK
WORKING VOLUME: 3,120 GAL
(NOTE 10)

MP-ANS-0103/0203/0303/0403
AGENT HYDROLYSATE PUMP & SPARE
CAPACITY: 156 GPM EA.
(NOTE 11)

SDS-00001
VENT FROM MV-SDS-0201/0301
(NOTE 31)

ACS-00001
AGENT HOLDING TANK VENT

BCS-00001
50% WT NaOH

PWS-00002
PROCESS WATER

NIT-00001
NITROGEN

SDS-00001
FROM MV-SDS-0201/0301
(NOTES 7, 31)

SDS-00001
FROM MV-SDS-0101/0201
(NOTE 18)

ACS-00001
TO AGENT FEED PUMP

ACS-00001
DRAINED AGENT FROM AGENT HOLDING TANK

TO PARALLEL HYDROLYZER (NOTE 1)

FROM PARALLEL HYDROLYZER (NOTE 1)

NNF (NOTE 24)

(NOTE 14)

3 PSIG

MF-ANS-0101

(NOTE 19)

(NOTE 29)

IN-LINE MIXER (NOTE 9)

SHTS

SHTR

MV-ANS-0101
(NOTES 13, 32)

SAMPLING SYSTEM
(NOTES 12, 13)

ME-ANS-0101

MP-ANS-0101A/B
(NOTE 4)

(NOTE 2)

NC
(NOTE 15)

NIT-00001
NITROGEN

TO PARALLEL SAMPLING TANKS

MF-ANS-0103

(NOTE 21)

MT-ANS-0103

(NOTE 12)

SAMPLING SYSTEM

MP-ANS-0103

FROM COMMON HYDROLYSATE SAMPLING TANK (NOTE 10)

NNF

TO COMMON HYDROLYSATE SAMPLING TANK (NOTE 10)

FROM PARALLEL AGENT HYDROLYSATE SAMPLING TANK

0.5 PSIG

FROM COMMON HYDROLYSATE SAMPLING TANK (NOTE 10)

(NOTES 15, 25)

TO/FROM PARALLEL HYDROLYZER
(NOTES 1, 5)

NNF

SDS-00001
TO SPENT DECON HOLDING TANKS
(NOTE 28)

ENS-00001
VENT FROM ENS

MPT-00001
TO MPT
(DURING NORMAL OPERATIONS)

NNF
TO HVAC
(DURING START-UP)

MPT-00001
TO MPT
(DURING NORMAL OPERATIONS)

NNF
TO HVAC
(DURING START-UP)

NNF
SDS-00001
VENT FROM MV-SDS-0101/0201

HSS-00001
TO/FROM HSA AGENT HYDROLYSATE STORAGE TANKS
(NOTE 25)

INTERMITTENT SERVICE
SDS-00001
CLEARED SPENT DECON

NOTES:

1. THERE ARE A TOTAL OF TWO AGENT HYDROLYZERS AND ANCILLARY EQUIPMENT.
2. DO NOT POCKET.
3. DELETED
4. VARIABLE SPEED MOTOR.
5. PROVIDE TRANSFER LINE FROM ONE AGENT HYDROLYZER TO THE OTHER.
6. DELETED
7. THIS STREAM TRANSFERS AGENT WASH WATER OR SPENT DECON. SPENT DECON SUPPLY, IF CONTAMINATED WITH AGENT, CAN BE USED TO REPLACE WASH WATER OR PROCESSED INDEPENDENTLY.
8. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
9. STATIC MIXERS TO BE LOCATED AS CLOSE AS POSSIBLE TO THE REACTORS. THERE ARE TWO PARALLEL STATIC MIXERS, ONE IS USED AS A SPARE.
10. COMMON HYDROLYSATE SAMPLING TANK (MT-ANS-0303) IS CONNECTED TO BOTH HYDROLYZERS.
11. THREE OPERATING PUMPS AND ONE COMMON SPARE (MP-ANS-0403).
12. SAMPLING SYSTEM IS LOCATED IN THE GLOVE BOX. LOCAL SAMPLE CONNECTION IS ALSO PROVIDED TO BE USED AS AND IF REQUIRED.
13. VX HYDROLYSATE WILL BE SAMPLED IN THE HYDROLYZERS.
14. VENT LINE IS HEAT TRACED AT 150 °F.
15. THIS LINE IS ALSO USED TO TRANSFER ACCEPTABLE VX HYDROLYSATE TO STORAGE TANK DIRECTLY FROM AGENT HYDROLYZERS
16. H PEAK IS THE CONTROLLING CASE FOR SIZING THE HEAT EXCHANGERS.
17. RECIPE FOR AGENT NEUTRALIZATION:
    VX- 16.6% AGENT 65.96% WATER 17.44% 50%WT NaOH
    GB- 7.5% AGENT 81.33% WATER 11.17% 50%WT NaOH
    H - 8.6% AGENT 91.4% WATER
18. WASH WATER WILL BE USED TO FLUSH AGENT LINES AFTER AGENT INJECTION FOR VX CAMPAIGN. FOR GB AND H CAMPAIGNS, SPENT DECON WILL BE USED.
19. VALVE INCLUDES RAMP DOWN DURING DEPRESSURIZATION OF HYDROLYZER. VALVE IS ALSO USED FOR SWEEPING OF HYDROLYZER.
20. DELETED
21. NITROGEN IS USED INTERMITTENTLY FOR BLANKETING EACH AGENT HYDROLYSATE SAMPLING TANK.
22. DELETED
23. DELETED
24. PROCESS WATER IS USED TO FLUSH HYDROLYSATE SAMPLING TANK AND AGENT HYDROLYSATE PUMP AFTER A FAILED BATCH IS TRANSFERRED TO THE AGENT HYDROLYZER FOR REPROCESSSING. LINE SHOULD BE SIZED FOR 51 GPM.
25. RETURN LINE IS PROVIDED IN ORDER TO FACILITATE TRANSFER OF HYDROLYSATE BATCH TO SPENT DECON TANKS DUE TO CONTAMINATION FROM UNFORSEEN REASONS.
26. DELETED
27. DELETED
28. LINE TO SPENT DECON HOLDING TANK WILL BE SIZED FOR APPROXIMATELY THE SAME FLOWRATE AS STREAM 451.
29. MINIMIZE CONNECTIONS IN RECIRCULATION LINE AND THE HYDROLYZER.
30. MINIMUM DEAD LEG AND AGENT HIDEOUT TO BE APPLIED TO REACTOR RECIRCULATION AND PUMPOUT SYSTEM.
31. MV-SDS-0201 IS A SPARE FOR MV-SDS-0301.
32. JACKET WILL BE IN THE FORM OF HALF PIPE.
33. EQUIPMENT SIZING DATA FOR DESIGN SHOWN ON THIS SHEET IS BASED ON REV. 4, SHEETS 2 AND 6 OF 6 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.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	4/19/06	ISSUED FOR DESIGN (IFD) ADD NOTE 33	JW	JH	SH	JB	BB
5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	JH	SH	JB	BB
4	11/10/05	(IFD) LL FROM NEWPORT	JW	JH	SH	JB	PK
3	6/15/05	ISSUED FOR DESIGN (IFD)	JW	JH	SH	JB	JU
2	5/6/05	ISSUED FOR APPROVAL (IFA)	JW	JH	SH	JB	JU
1	10/13/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	JB	JU

QUALITY ☒ Q ☐ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING AGENT NEUTRALIZATION PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-ANS-00001
SHEET 1 OF 6
REV 6

PROFESSIONAL STAMP

DESIGN FILE: s:\24\pr\07-m5-ans-1-1.pfz
PLOTTED BY: 51439 AT 8:08:12 AM ON 4/21/2006

07-M5-ANS-1-1.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-ANS-00001
AGENT NEUTRALIZATION SYSTEM - CASE AGENT GB COPROCESSING (RECIPE: 7.5% GB, 11.17% CAUSTIC (50% NaOH), 81.33% H2O)

STREAM NUMBER		254	352	354	403	404	405	410	432	433	434	451	452	453	461	462	552	1619
LINE DESCRIPTION		SPENT DECON FOR FLUSHING AGENT LINES	DRAINED AGENT TO ONE AGENT HYDROLYZER	AGENT WASH WATER TO AGENT HYDROLYZERS	50% WT NaOH TO AGENT HYDROLYZERS	NITROGEN TO AGENT HYDROLYZERS	PROCESS WATER TO AGENT HYDROLYZERS	AGENT HYDROLYZER RECIRCULATION	AGENT HYDROLYZER VENT	AGENT HYDROLYSATE FROM ONE AGENT HYDROLYZER	FLOW TO THE HEAT EXCHANGER	TOTAL AGENT HYDROLYSATE TRANSFER	ANS VENT #1 TO MPT	ANS VENT #2 TO MPT	VENT FROM AGENT HOLDING TANK	VENT FROM SAMPLING TANKS	ENR OFFGAS TO ANS	SDS OFFGAS TO ANS
TEMPERATURE	°F	77	77	96	80	77	77	100	160	100	100	100	99	157	77	100	240	99
PRESSURE	PSIA	34.23	174.23	34.23	34.23	94.23	34.23	24.23	17.23	51.23	180.00	51.23	14.00	14.00	14.00	14.00	40.00	14.00
INSTANTANEOUS FLOW - VOLUME	GPM (ACFM)	20.0	4.0	26.6	23.3	(7.3)	29.5	312	(34.2)	156	14.3	156	(42.6)	(44.1)	(1.02)	(41.7)	(34.5)	(2.0)
DENSITY	LB/FT3	62.25	67.97	62.24	94.86	0.459	62.25	63.25	0.066	63.25	63.25	63.25	0.066	0.054	0.069	0.065	0.124	0.066
VISCOSITY	cP	0.89	1.40	0.95	50	0.018	0.89	0.72	0.018	0.72	0.72	0.72	0.018	0.018	0.018	0.018	0.019	0.018
MOLECULAR WEIGHT (GAS)			(6) 1			28.01			25.36				28.04	25.49	28.47	28.01	23.22	28.01
Liquid Solution (including suspended solids and dissolved gases)																		
AGENT (GB)	LB/HR		138.82	69.41									7.0E-03		7.0E-03			
HF	LB/HR		3.8E-01	1.9E-01														
Nitrogen	LB/HR							120.64		2.20	5.51	4.39						
Tributylamine (TBA)	LB/HR		4.64	2.32				318.66		5.80	14.56	11.60						
Diisopropyl methylphosphonate (DIMP)	LB/HR		19.41	9.70														
Isopropyl Fluoride	LB/HR		5.1E-02	2.6E-02				3.48		6.3E-02	1.6E-01	1.3E-01						
1,3-Diisopropylurea (DIPU)	LB/HR		3.04	1.52				208.43		3.80	9.52	7.59						
"GB"-Pyro-Na (Na-salt of isopropyl methylphosphonic acid)	LB/HR							12,074		219.84	551.77	439.68						
MPA-Na2 (Na-salt of methylphosphonic acid)	LB/HR																	
IPA (Isopropyl alcohol)	LB/HR		8.2E-01	4.1E-01				499.45		9.09	22.82	18.19						
Sodium fluoride	LB/HR							2,911.7		53.01	133.06	106.03						
Sodium chloride	LB/HR																	
Other organics	LB/HR		4.79	2.39				328.59		5.98	15.02	11.97						
NaOH	LB/HR				322.20			3,057.7		55.67	139.73	111.35						
Water	LB/HR	109.09		1897.8	322.20		2683.2	138,689		2525.1	6337.7	5050.3						
Chloroform	LB/HR		1.2E-01	6.0E-02				8.18		1.5E-01	3.7E-01	3.0E-01						
Isopropyl methylphosphonic acid (IMPA)	LB/HR		9.3E-01	4.6E-01				63.78		1.16	2.91	2.32						
Vapor																		
1,3-Diisopropylurea (DIPU)	LB/HR								5.4E-05					1.1E-04				
Tributylamine (TBA)	LB/HR								1.2E-04					2.4E-04				
Isopropyl Fluoride	LB/HR								8.7E-04					1.7E-03				
Diisopropyl methylphosphonate (DIMP)	LB/HR																	
Water	LB/HR								3.71					7.42			84.19	
Nitrogen	LB/HR					35.96			15.78				6.30	33.81	3.5E-01	5.95	163.59	2.24
IPA (Isopropyl alcohol)	LB/HR								2.6E-02					5.3E-02				
Chloroform	LB/HR								9.3E-04					1.9E-03				
Isopropyl methylphosphonic acid (IMPA)	LB/HR																	
Other organics	LB/HR								4.8E-05					9.5E-05				
N2O	LB/HR																3.0E-02	
NH3	LB/HR																10.02	
O2	LB/HR																1.9E-03	
H2	LB/HR																1.5E-06	
TOTAL PEAK FLOW (Notes 2, 8)	LB/HR	109.09	173.00	1984.3	644.40	35.96	2683.2	158284	19.52	2881.9	7233.2	5763.8	6.31	41.28	3.6E-01	5.95	257.83	2.24
NOTES				12		4		1	3		1		5	5		6		

NOTES:

1. THIS STREAM SHOWS ONLY THE INSTANTANEOUS COMPONENT FLOWS DURING COOLING.
2. THE PEAK CASE IS BASED ON MAXIMUM AGENT DRAIN RATE OF 10,380 LB/DAY.
3. INSTANTANEOUS RATE OF VENT IS BASED ON TEN PURGES OF HYDROLYZER HEADSPACE AT 3 PSIG OVER 30 MINUTES TO MITIGATE HYDROLYSATE FLASH POINT.
4. NITROGEN SUPPLY INSTANTANEOUS RATE BASED ON REACTOR EMPTYING RATE. NITROGEN SUPPLY PEAK RATE BASED ON REACTOR EMPTYING AND SWEEPING RATE.
5. PEAK RATE OF STREAM 452 INCLUDES ANS SAMPLING TANK AND AGENT HOLDING TANK OFFGAS. PEAK RATE OF STREAM 453 INCLUDES BOTH THE AGENT HYDROLYZERS AND SDS OFFGAS FROM STREAM 1619.
6. THE SAMPLING TANK VENTS ARE ASSUMED TO CONSIST OF NITROGEN ONLY.
7. TOTAL NUMBER OF BATCHES IS APPROXIMATELY BASED ON 1,560 GAL/BATCH.
8. AVERAGED FOR 24 HOURS.
9. BATCH STEPS FOR NEUTRALIZATION:

(6) 2

STEP	MIN.	PHASE ACTION
1	50	Charge reactor with process water
2	10	Feed caustic and agent wash water to reactor with vent opened. (note 12)
3	25	Agitate, recirculate, sweep with N2 (15 min) at 3psig, close the vent, and continue to heat up to 160°F.
4	35	Charge reactor with agent wash water with vent closed.
5	21.7	Feed agent to recirc. loop
6	3	Flush agent lines (time approximate)
7	50	Recirc. & maintain at 160°F, sweep & purge with nitrogen during the last 30 min. before cooling
8	50	Cool down to 100°F.
9	10	Pump out to agent hydrolysate sampling tank
TOTAL MIN/BATCH	254.7	

10. DELETED
11. DELETED
12. AGENT WASH WATER WILL BE ADDED DURING STEP 2 FOR LIQUID IN HYDROLYZER TO REACH LOW LIQUID LEVEL (APPROXIMATELY 6 MINUTES).

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	6/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	JH	SH	JB	BB
5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	JH	SH	JB	BB
4	11/10/05	(IFD) LL FROM NEWPORT	JW	JH	SH	JB	PK
3	6/15/05	ISSUED FOR DESIGN (IFD)	JW	JH	SH	JB	JU
2	5/6/05	ISSUED FOR APPROVAL (IFA)	JW	JH	SH	JB	JU
1	10/26/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	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 NEUTRALIZATION PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-ANS-00001 | SHEET 2 OF 6 | REV 6

PROFESSIONAL STAMP

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BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-ANS-00001
AGENT NEUTRALIZATION SYSTEM - CASE AGENT GB ROCKETS (RECIPE: 7.5% GB, 11.17% CAUSTIC (50% NaOH), 81.33% H2O)

STREAM NUMBER		254	352	354	403	404	405	410	432	433	434	451	452	453	461	462	552	1619
LINE DESCRIPTION		SPENT DECON FOR FLUSHING AGENT LINES	DRAINED AGENT TO ONE AGENT HYDROLYZER	AGENT WASH WATER TO AGENT HYDROLYZERS	50% WT NaOH TO AGENT HYDROLYZERS	NITROGEN TO AGENT HYDROLYZERS	PROCESS WATER TO AGENT HYDROLYZERS	AGENT HYDROLYZER RECIRCULATION	AGENT HYDROLYZER VENT	AGENT HYDROLYSATE FROM ONE AGENT HYDROLYZER	FLOW TO THE HEAT EXCHANGER	TOTAL AGENT HYDROLYSATE TRANSFER	ANS VENT #1 TO MPT	ANS VENT #2 TO MPT	VENT FROM AGENT HOLDING TANK	VENT FROM SAMPLING TANKS	ENR OFFGAS TO ANS	SDS OFFGAS TO ANS
TEMPERATURE	°F	77	77	77	80	77	77	100	160	100	100	100	99	154	77	100	240	99
PRESSURE	PSIA	34.23	174.23	34.23	34.23	94.23	34.23	24.23	17.23	51.23	180.00	51.23	14.00	14.00	14.00	14.00	40.00	14.00
INSTANTANEOUS FLOW - VOLUME	GPM (ACFM)	20.0	4.0	24.9	23.3	(7.3)	33.8	312	(32.4)	156	14.3	156	(41.9)	(41.5)	(0.33)	(41.7)	(34.5)	(2.0)
DENSITY	LB/FT3	62.25	61.98	62.53	94.86	0.459	62.25	63.25	0.066	63.25	63.25	63.25	0.066	0.054	0.069	0.065	0.065	0.066
VISCOSITY	cP	0.89	1.40	0.96	50	0.018	0.89	0.72	0.018	0.72	0.72	0.72	0.018	0.018	0.018	0.018	0.017	0.018
MOLECULAR WEIGHT (GAS)						28.01			25.36				28.04	25.62	28.47	28.01	22.76	28.01
Liquid Solution (including suspended solids and dissolved gases)																		
AGENT (GB)	LB/HR		69.01	34.50									3.5E-03		3.5E-03			
HF	LB/HR		1.9E-01	9.5E-02														
Nitrogen	LB/HR							120.64		1.09	5.53	2.18						
Tributylamine (TBA)	LB/HR		2.31	1.15				318.64		2.88	14.60	5.77						
Diisopropyl methylphosphonate (DIMP)	LB/HR		9.65	4.82														
Isopropyl Fluoride	LB/HR		2.6E-02	1.3E-02				3.48		3.2E-02	1.6E-01	6.3E-02						
1,3-Diisopropylurea (DIPU)	LB/HR		1.51	7.5E-01				208.42		1.89	9.55	3.77						
"GB"-Pyro-Na (Na-salt of isopropyl methylphosphonic acid)	LB/HR							12,073		109.29	553.37	218.57						
MPA-Na2 (Na-salt of methylphosphonic acid)	LB/HR																	
IPA (Isopropyl alcohol)	LB/HR		4.1E-01	2.0E-01				499.49		4.52	22.89	9.04						
Sodium fluoride	LB/HR							2,911.5		26.35	133.44	52.71						
Sodium chloride	LB/HR																	
Other organics	LB/HR		2.38	1.19				328.57		2.97	15.06	5.95						
NaOH	LB/HR				160.17			3,057.3		27.67	140.13	55.35						
Water	LB/HR	54.23		749.79	160.17		1527.4	138,690		1255.4	6356.6	2510.8						
Chloroform	LB/HR		6.0E-02	3.0E-02				8.18		7.4E-02	3.8E-01	1.5E-01						
Isopropyl methylphosphonic acid (IMPA)	LB/HR		4.6E-01	2.3E-01				63.78		5.8E-01	2.92	1.15						
Vapor																		
1,3-Diisopropylurea (DIPU)	LB/HR								2.5E-05					5.1E-05				
Tributylamine (TBA)	LB/HR								5.7E-05					1.1E-04				
Isopropyl Fluoride	LB/HR								4.1E-04					8.1E-04				
Diisopropyl methylphosphonate (DIMP)	LB/HR																	
Water	LB/HR								1.74					3.48			84.19	
Nitrogen	LB/HR					17.00			7.41				3.13	17.06	1.7E-01	2.96	163.59	2.24
IPA (Isopropyl alcohol)	LB/HR								1.2E-02					2.5E-02				
Chloroform	LB/HR								4.4E-04					8.7E-04				
Isopropyl methylphosphonic acid (IMPA)	LB/HR																	
Other organics	LB/HR								2.2E-05					4.5E-05				
N2O	LB/HR																3.0E-02	
NH3	LB/HR																10.02	
O2	LB/HR																1.9E-03	
HF	LB/HR																	
H2	LB/HR																TRACE	
TOTAL PEAK FLOW (Notes 2, 8)	LB/HR	54.23	86.00	792.79	320.33	17.00	1527.4	158284	9.16	1432.7	7254.7	2865.5	3.13	20.57	1.7E-01	2.96	257.83	2.24
NOTES						4		1	3		1		5	5		6		

NOTES:

1. THIS STREAM SHOWS ONLY THE INSTANTANEOUS COMPONENT FLOWS DURING COOLING.
2. THE PEAK CASE IS BASED ON MAXIMUM AGENT DRAIN RATE OF 5,160 LB/DAY.
3. INSTANTANEOUS RATE OF VENT IS BASED ON TEN PURGES OF HYDROLYZER HEADSPACE AT 3 PSIG OVER 30 MINUTES TO MITIGATE HYDROLYSATE FLASH POINT.
4. NITROGEN SUPPLY INSTANTANEOUS RATE BASED ON REACTOR EMPTYING RATE. NITROGEN SUPPLY PEAK RATE BASED ON REACTOR EMPTYING AND SWEEPING RATE.
5. PEAK RATE OF STREAM 452 INCLUDES ANS SAMPLING TANK AND AGENT HOLDING TANK OFFGAS. PEAK RATE OF STREAM 453 INCLUDES BOTH THE AGENT HYDROLYZERS AND SDS OFFGAS FROM STREAM 1619.
6. THE SAMPLING TANK VENTS ARE ASSUMED TO CONSIST OF NITROGEN ONLY.
7. TOTAL NUMBER OF BATCHES IS APPROXIMATELY BASED ON 1,560 GAL/BATCH.
8. AVERAGED FOR 24 HOURS.
9. BATCH STEPS FOR NEUTRALIZATION:

STEP	MIN.	PHASE ACTION
1	50	Charge reactor with process water
2	10	Feed caustic to reactor with vent opened
3	25	Agitate, recirculate, sweep with N2 (15 min) at 3psig, close the vent, and continue to heat up to 160°F.
4	35	Charge reactor with agent wash water with vent closed.
5	21.7	Feed agent to recirc. loop
6	3	Flush agent lines (time approximate)
7	50	Recirc. & maintain at 160°F, sweep & purge with nitrogen during the last 30 min. before cooling
8	50	Cool down to 100°F.
9	10	Pump out to agent hydrolysate sampling tank

TOTAL MIN/BATCH 254.7

10. DELETED
11. DELETED

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	6/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	JH	SH	JB	BB
5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	JH	SH	JB	BB
4	11/10/05	(IFD) LL FROM NEWPORT	JW	JH	SH	JB	PK
3	6/15/05	ISSUED FOR DESIGN (IFD)	JW	JH	SH	JB	JU
2	5/6/05	ISSUED FOR APPROVAL (IFA)	JW	JH	SH	JB	JU
1	10/26/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	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 NEUTRALIZATION PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-ANS-00001 | SHEET 3 OF 6 | REV 6

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BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-ANS-00001
AGENT NEUTRALIZATION SYSTEM - CASE AGENT VX CO-PROCESSING (RECIPE 16.6% VX, 17.44% CAUSTIC (50% NaOH), 65.96% H2O)

STREAM NUMBER		254	352	354	403	404	405	410	432	433	434	451	452	453	461	462	552	1619
LINE DESCRIPTION		AGENT WASH FOR FLUSHING AGENT LINES	DRAIN AGENT TO ONE AGENT HYDROLYZER	AGENT WASH WATER TO AGENT HYDROLYZERS	50% WT NaOH TO AGENT HYDROLYZERS	NITROGEN TO AGENT HYDROLYZERS	PROCESS WATER TO AGENT HYDROLYZERS	AGENT HYDROLYZER RECIRCULATION	AGENT HYDROLYZER VENT	AGENT HYDROLYSATE TO STORAGE TANK	FLOW TO THE HEAT EXCHANGER	TOTAL AGENT HYDROLYSATE TRANSFER	ANS VENT # 1 TO MPT	ANS VENT # 2 TO MPT	VENT FROM AGENT HOLDING TANK	VENT FROM SAMPLING TANK	ENR OFFGAS TO ANS	SDS OFFGAS TO ANS
TEMPERATURE	°F	99	77	99	80	77		100	194	100	100	100	77	183	77		240	99
PRESSURE	PSIA	34.23	174.23	34.23	34.23	94.23		24.23	17.23	51.23	180.00	51.23	14.00	14.00	14.00		40.00	14.00
INSTANTANEOUS FLOW - VOLUME	GPM (ACFM)	20.0	4.3	33.3	25.4	(7.3)		312	(34.2)	156.0	2.1	156	(0.7)	(84.6)	(0.70)		(36.80)	(2.0)
DENSITY	LB/FT3	61.99	62.95	61.99	94.86	0.463		66.32	0.066	66.32	66.32	66.32	0.068	0.055	0.068		0.125	0.065
VISCOSITY	cP	0.95	1.0	0.95	50	0.018		2.70	0.019	2.70	2.70	2.70	0.018	0.019	0.018		0.019	0.018
MOLECULAR WEIGHT (GAS)						28.24			26.93				28.01	27.07	28.01		23.25	28.01
Liquid Solution (including suspended solids and dissovled gases)																		
AGENT (VX)	LB/HR	3.1E-01	160.47	11.03														
Pyrodiester - (MeP(O) (Oet)]2O	LB/HR	5.0E-03	2.60	1.8E-01														
Free Mercaptan (R-SH)	LB/HR	2.3E-03	1.21	8.3E-02														
Diisopropylcarbodiimide (DICDI-stabilizer)	LB/HR	9.9E-04	5.2E-01	3.6E-02				82.66		5.4E-01	5.6E-01	1.07						
Diisopropylamine (DIPA)	LB/HR	5.3E-04	2.8E-01	1.9E-02				38.88		2.5E-01	2.6E-01	5.1E-01						
1,3-Dicyclohexyl-carbodiimide (DCCDI-stabilizer)	LB/HR	5.3E-03	2.77	1.9E-01				441.10		2.87	2.97	5.73						
Nitrogen	LB/HR							7.69		5.0E-02	5.2E-02	1.0E-01						
1,3-Diisopropylrurea (DIPU)	LB/HR	9.9E-05	5.2E-02	3.6E-03				8.27		5.4E-02	5.6E-02	1.1E-01						
EMPA Na (Na-isopropyl methylphosphonate)	LB/HR							13092		85.09	88.12	170.18						
MPA Na2 (Na2-methylphosphonate)	LB/HR							1338.3		8.70	9.01	17.40						
RS Na	LB/HR							17017		110.60	114.54	221.21						
Ethanol	LB/HR							390.74		2.54	2.63	5.08						
RSSR	LB/HR	2.3E-03	1.21	8.3E-02				826.57		5.37	5.56	10.74						
NaOH	LB/HR				188.27			6420.1		41.73	43.21	83.46						
Water	LB/HR	38.45		1385.7	188.27			125668		816.78	845.8	1633.6						
Organics	LB/HR	7.5E-03	3.93	2.7E-01				625.87		4.07	4.21	8.14						
Aluminum	LB/HR	TRACE	3.2E-04	2.2E-05				5.0E-02		3.3E-04	3.4E-04	6.5E-04						
Nickel	LB/HR	TRACE	TRACE	TRACE				3.7E-04		TRACE	TRACE	4.8E-06						
Copper	LB/HR	TRACE	1.0E-04	TRACE				1.6E-02		1.0E-04	1.1E-04	2.1E-04						
Iron	LB/HR	TRACE	4.2E-03	2.95E-04				6.6E-01		4.3E-03	4.5E-03	8.6E-03						
Calcium	LB/HR	5.1E-05	2.7E-02	1.8E-03				4.24		2.8E-02	2.9E-02	5.5E-02						
Silicon	LB/HR	4.1E-05	2.2E-02	1.5E-03				3.45		2.2E-02	2.3E-02	4.5E-02						
Other Metals	LB/HR	TRACE	6.5E-05	TRACE				1.0E-02		6.7E-05	6.9E-05	1.3E-04						
Vapor																		
AGENT (VX)	LB/HR												3.2E-06		3.2E-06			
Free Mercaptan (R-SH)	LB/HR																	
Ethanol	LB/HR								3.2E-01					6.5E-01				
Water	LB/HR								7.4E-01					1.48			87.82	
Nitrogen	LB/HR					10.74			5.32				3.7E-01	12.56	3.7E-01		175.27	1.92
Oxygen	LB/HR					4.1E-01											1.7E-03	
Diisopropylcarbodiimide (DICDI-stabilizer)	LB/HR								3.6E-04					6.8E-03				
RS Na	LB/HR								3.0E-03					6.1E-03				
RSSR	LB/HR								3.0E-03					6.1E-03				
Diisopropylamine (DIPA)	LB/HR								3.4E-02					6.8E-02				
1,3-Dicyclohexyl-carbodiimide (DCCDI-stabilizer)	LB/HR								2.4E-04					4.9E-04				
1,3-Diisopropylrurea (DIPU)	LB/HR								3.2E-05					6.4E-05				
Organics	LB/HR								TRACE					TRACE				
N2O	LB/HR																4.1E-02	
NH3	LB/HR																11.89	
H2	LB/HR																1.6E-06	
TOTAL PEAK FLOW (Notes 2, 8)	LB/HR	38.78	173.09	1397.6	376.54	11.15	NNF	165966	6.42	1078.7	1117.1	2157.4	3.7E-01	14.77	3.7E-01	NNF	275.02	1.92
NOTES						4,9		1	3		1		5	5		6		

NOTES:

1. THIS STREAM SHOWS ONLY THE INSTANTANEOUS COMPONENT FLOWS DURING COOLING
2. THE PEAK CASE IS BASED ON MAXIMUM AGENT DRAIN RATE OF 8,781 LB/DAY.
3. INSTANTANEOUS RATE OF VENT IS BASED ON TEN PURGES OF HYDROLYZER HEADSPACE AT 3 PSIG OVER 30 MINUTES TO MITIGATE HYDROLYSATE FLASH POINT.
4. NITROGEN SUPPLY INSTANTANEOUS RATE BASED ON REACTOR EMPTYING RATE. NITROGEN SUPPLY PEAK RATE BASED ON REACTOR EMPTYING AND SWEEPING RATE.
5. PEAK RATE OF STREAM 452 INCLUDES ANS SAMPLING TANK AND AGENT HOLDING TANK OFFGAS. PEAK RATE OF STREAM 453 INCLUDES BOTH THE AGENT HYDROLYZERS AND SDS OFFGAS FROM STREAM 1619.
6. VX AGENT HYDROLYSATE IS SAMPLED IN THE REACTORS, THEREFORE NO VENT GAS IS EXPECTED FROM THE HYDROLYSATE SAMPLING TANK DURING THE VX CAMPAIGN.
7. TOTAL NUMBER OF BATCHES BATCHES IS APPROXIMATELY BASED ON 1,560 GAL/BATCH.
8. AVERAGED FOR 24 HOURS.
9. OXYGEN AT APPROXIMATELY 0.01 LBMOL/LBMOL AGENT IS ASSUMED TO BE AVAILABLE FROM THE ENVIRONMENT FOR MINOR OXIDATION OF A SIDE REACTION, WHICH DOES NOT AFFECT THE AGENT DESTRUCTION REACTIONS.
10. BATCH STEPS FOR NEUTRALIZATION:

STEP	MIN.	PHASE ACTION
1	65	Charge reactor with agent wash water.
2	15	Feed caustic to reactor with vent opened.
3	60	Agitate, recirculate, sweep with N2 (15 min) at 3psig , close the vent, and continue to heat up to 194°F.
4	62	Feed agent to recirculation loop with vent closed.
5	3	Flush agent lines (time approximate)
6	150	Recirc. & maintain at 194°F, sweep & purge with nitrogen during the last 30 min. before cooling
7	80	Sample (15 min.) and cool down to 100°F
8	295	Wait for lab analysis.
9	10	Transfer acceptable hydrolysate to agent hydrolysate storage tank.
TOTAL MIN/BATCH	740	

11. DELETED

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	6/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	JH	SH	JB	BB
5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	JH	SH	JB	BB
4	11/10/05	(IFD) LL FROM NEWPORT	JW	JH	SH	JB	PK
3	6/15/05	ISSUED FOR DESIGN (IFD)	JW	JH	SH	JB	JU
2	5/6/05	ISSUED FOR APPROVAL (IFA)	JW	JH	SH	JB	JU
1	10/26/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	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 NEUTRALIZATION PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-ANS-00001
SHEET 4 OF 6
REV 6

PROFESSIONAL STAMP

DESIGN FILE: s:\2a\pr\07-m5-ans-1-4.pfz
PLOTTED BY: 5439 ON 6/21/2006 AT 3:12:29 PM

07-M5-ANS-1-4.PFZ BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-ANS-00001
AGENT NEUTRALIZATION SYSTEM - CASE AGENT H (REACTANT RECIPE: 8.6% H, AND 91.4% H2O)

STREAM NUMBER		254	352	354	403	404	405	410	432	433	434	451	452	453	461	462	552	1619
LINE DESCRIPTION		SPENT DECON FOR FLUSHING AGENT LINES	DRAINED AGENT TO ONE AGENT HYDROLYZER	AGENT WASH WATER TO AGENT HYDROLYZERS	50% WT NaOH TO AGENT HYDROLYZERS	NITROGEN TO AGENT HYDROLYZERS	PROCESS WATER TO AGENT HYDROLYZERS	AGENT HYDROLYZER RECIRCULATION	AGENT HYDROLYZER VENT	AGENT HYDROLYSATE FROM ONE HYDROLYZER TO SAMPLING TANK	FLOW TO THE HEAT EXCHANGER	TOTAL AGENT HYDROLYSATE TRANSFER	ANS VENT #1 TO MPT	ANS VENT #2 TO MPT	VENT FROM AGENT HOLDING TANK	VENT FROM SAMPLING TANKS	ENR OFFGAS TO ANS	SDS OFFGAS TO ANS
TEMPERATURE	°F	77	77	145	80	77	77	100	194	100	100	100	100	190	77	100	240	145
PRESSURE	PSIA	34.23	174.23	34.23	34.23	94.23	34.23	24.23	17.23	51.23	180	51.23	14.00	14.00	14.00	14.00	40	14.00
INSTANTANEOUS FLOW - VOLUME	GPM (ACFM)	20.0	4.4	43.1	11.5	(7.3)	2.4	312	(41.6)	156	22.3	156	(41.9)	(52.6)	(0.25)	(41.7)	(39.9)	(2.2)
DENSITY	LB/FT3	62.25	80.20	62.18	94.86	0.459	62.25	65.20	0.055	65.20	65.20	65.20	0.065	0.046	0.068	0.065	0.121	0.060
VISCOSITY	cP	0.89	5.8	0.45	50.0	0.018	0.89	0.68	0.016	0.68	0.68	0.68	0.018	0.016	0.018	0.018	0.019	0.019
MOLECULAR WEIGHT (GAS)						28.01			22.22				28.01	22.75	28.03	28.01	22.55	28.01
Liquid Solution (including suspended solids)																		
AGENT (HD)	LB/HR		17.26	84.52									5.2E-05		5.2E-05			
Dichloro ethane	LB/HR		2.6E-01	1.28														
O	LB/HR		2.44	11.97														
Vinyl-O	LB/HR																	
Isomers (CCBS)	LB/HR																	
Polysufides (HS3)	LB/HR		3.6E-01	1.77				109.34		1.25	7.81	2.50						
Sulfonium Ions	LB/HR		12.20	59.75														
Dithiane	LB/HR		5.6E-01	2.72				2190.3		25.00	156.55	50.00						
Trithiolane	LB/HR																	
TDG	LB/HR							4005.8		45.72	286.31	91.44						
O-OH	LB/HR							614.35		7.01	43.91	14.02						
(CH2)6(OH)2S	LB/HR																	
(CH2)6(S)2(OH)	LB/HR																	
Sodium chloride (NaCl)	LB/HR							6284.9		71.73	499.21	143.46						
NaOH	LB/HR				99.63			63.11		7.2E-01	4.51	1.44						
Water	LB/HR	68.39		2953.7	99.63		210.97	145415		1659.7	10393	3319.3						
Nitrogen	LB/HR							58.19		6.6E-01	4.16	1.33						
Ethylene Glycol	LB/HR							1093.3		12.48	78.14	24.96						
S6	LB/HR		5.47	26.76				1651.4		18.85	118.03	37.70						
Fe	LB/HR		5.49	26.87				1657.9		18.92	118.50	37.85						
RCRA 8	LB/HR		2.6E-03	1.3E-02				8.0E-01		9.1E-03	5.7E-02	1.8E-02						
Mn	LB/HR		4.3E-02	2.1E-01				12.93		1.5E-01	0.92	3.0E-01						
Si	LB/HR		7.5E-03	3.7E-02				2.26		2.6E-02	1.6E-01	5.2E-02						
Other Metals/Elements	LB/HR		1.4E-02	6.9E-02				4.27		4.9E-02	3.0E-01	9.7E-02						
Vapor																		
Dithiane	LB/HR								3.6E-04					7.2E-04				
Polysufides (HS3)	LB/HR								3.5E-04					6.9E-04				
HCl	LB/HR																	
O-OH	LB/HR								7.7E-05					1.5E-04				
Water	LB/HR								6.64					13.29			124.95	
Nitrogen	LB/HR					16.33			7.50				3.81	18.59	7.5E-02	3.73	163.60	3.58
Oxygen	LB/HR																1.4E-03	
Ethylene Glycol	LB/HR								6.0E-04					1.2E-03				
TDG	LB/HR								1.6E-04					3.3E-04				
N2O	LB/HR																	
NH3	LB/HR																1.6	
H2	LB/HR																2.8E-08	
VOC	LB/HR																	TRACE
TOTAL PEAK FLOW (Notes 2, 8)	LB/HR	68.39	44.11	3169.6	199.25	16.33	210.97	163163	14.15	1862.2	11622	3724.5	3.81	31.88	7.5E-02	3.73	290.15	3.58
NOTE						4		1	3		1		5	5		6		

NOTES:

1. THIS STREAM SHOWS ONLY THE INSTANTANEOUS COMPONENT FLOWS DURING COOLING.
2. THE PEAK CASE IS BASED ON MAXIMUM AGENT DRAIN RATE OF 7300 LB/DAY.
3. INSTANTANEOUS RATE OF VENT IS BASED ON TEN PURGES OF HYDROLYZER HEADSPACE AT 3 PSIG OVER 30 MINUTES TO MITIGATE HYDROLYSATE FLASH POINT.
4. NITROGEN SUPPLY INSTANTANEOUS RATE BASED ON REACTOR EMPTYING RATE. NITROGEN SUPPLY PEAK RATE BASED ON REACTOR EMPTYING AND SWEEPING RATE.
5. PEAK RATE OF STREAM 452 INCLUDES ANS SAMPLING TANK AND AGENT HOLDING TANK OFFGAS. PEAK RATE OF STREAM 453 INCLUDES BOTH THE AGENT HYDROLYZERS AND SDS OFFGAS FROM STREAM 1619.
6. THE SAMPLING TANK VENTS ARE ASSUMED TO CONSIST OF NITROGEN ONLY.
7. TOTAL NUMBER OF BATCHES IS APPROXIMATELY BASED ON 1,560 GAL/BATCH.
8. AVERAGED FOR 24 HOURS.
9. BATCH STEPS FOR NEUTRALIZATION:

STEP	MIN.	PHASE ACTION
1	65.2	Charge reactor with agent wash water and process water.
2	30	Agitate, recirculate, and sweep with N2 (15 min) at 3psig, close the vent, and continue to heat up to 194°F.
3	6.8	Feed agent to recirc. loop with vent closed.
4	3	Flush agent lines (time approximate)
5	35	Recirc. & Maintain at 194°F
6	10	Adjust pH with caustic.
7	10	Check pH.
8	45	Additional cook, sweep and purge with nitrogen during the last 30 min before cooling
9	40	Cool down to 100°F.
10	10	Pump out to agent hydrolysate sampling tank.
TOTAL MIN/BATCH	255	

10. DELETED

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7	6/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	JH	SH	JB	BB
6	4/19/06	ISSUED FOR DESIGN(IFD) REVISED M&E BAL	JW	JH	SH	JB	BB
5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	JH	SH	JB	BB
4	12/6/05	(IFD) LL FROM NEWPORT	JW	JH	SH	JB	PK
3	6/15/05	ISSUED FOR DESIGN (IFD)	JW	JH	SH	JB	JU
2	5/6/05	ISSUED FOR APPROVAL (IFA)	JW	JH	SH	JB	JU
1	10/26/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	EV	NI	SH	JB	JU

QUALITY ☒ Q ☐ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING AGENT NEUTRALIZATION PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M5-ANS-00001 | SHEET 6 OF 6 | REV 7

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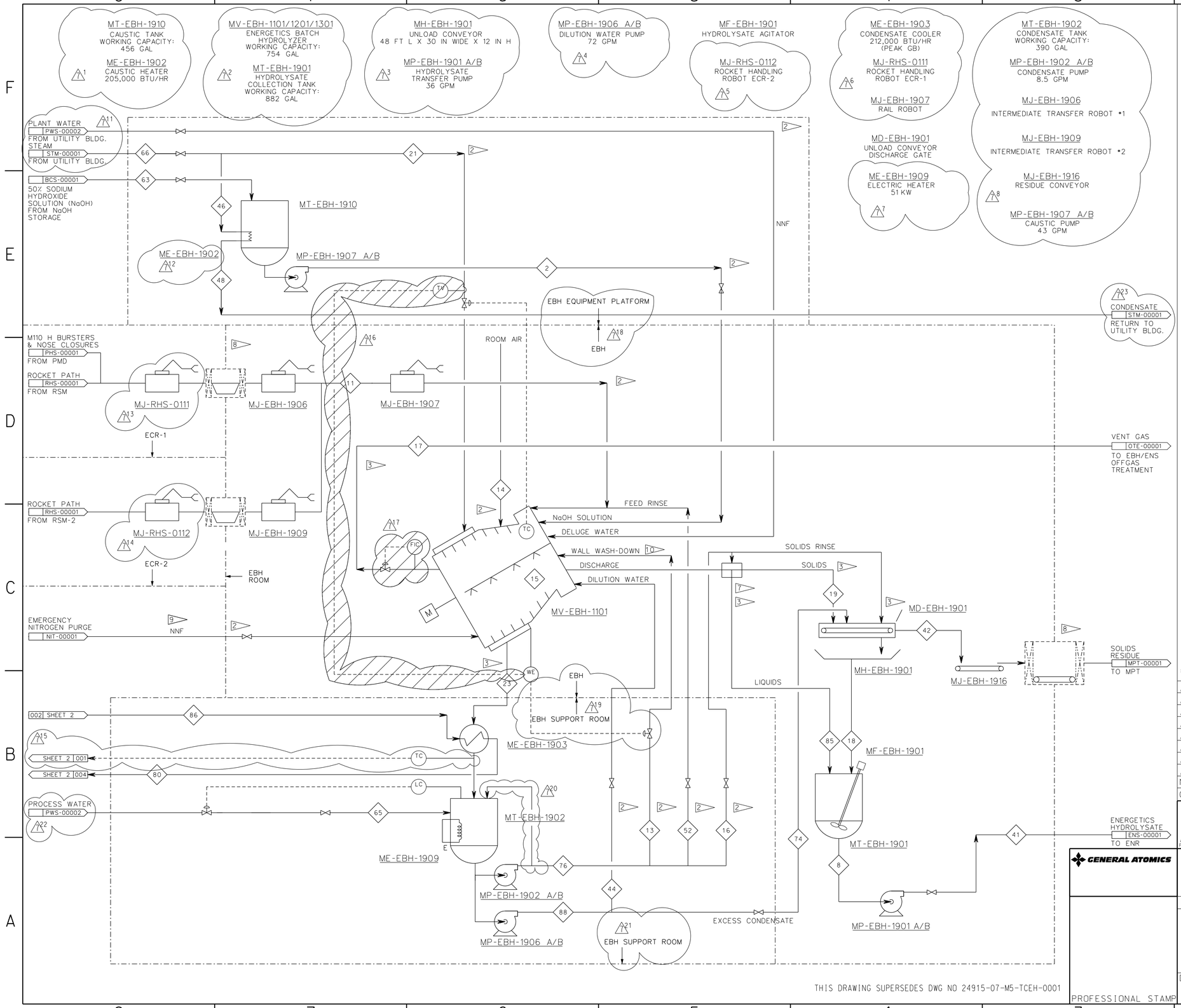

NOTES:

1. NOT USED.
2. LINE SPLITS TO 3 EBHS AT THIS POINT. ONLY 1 OF 3 EBHS IS SHOWN.
3. LINES FROM 3 EBHS COMBINE AT THIS POINT. ONLY 1 OF 3 EBHS IS SHOWN.
4. ITEMS IN EBH, EBH SUPPORT, AND ECR ROOMS ARE QUALITY LEVEL Q.
5. ITEMS ON THE EBH EQUIPMENT PLATFORM ARE QUALITY LEVEL NON-Q EXCEPT FOR THE CAUSTIC SUPPLY SYSTEM.
6. MINIMUM TIMES FOR BATCH SEQUENCE OF ROCKETS:
   0.25 HOURS LOAD 50% CAUSTIC AND DILUTION WATER
   3.0 HOURS LOAD WARHEAD + ALUMINUM PARTS
   2.25 HOURS HYDROLYZE
   0.5 HOURS REMOVE SOLIDS & HYDROLYSATE
7. SOLID LIQUID SEPARATION SCREEN LOCATED IN EBH UNLOAD CHUTE.
8. BY OTHERS.
9. ON LOSS OF OTE AND REDUCTION OF OTE VENTILATION AIR FLOW TO LESS THAN 25% OF NORMAL, OR INCREASE OF HYDROGEN IN EBH DRUM TO GREATER THAN 4% CONCENTRATION IN VENTILATION AIR,
   -CLOSE OTE DAMPER ON ACTIVE EBHS (TYPICALLY 2 EBHS ACTIVE)
   -INITIATE FIRST NITROGEN PURGE OF 3000 SCFM FOR 1 MINUTE TO REPLACE AIR IN DRUM WITH NITROGEN
   -CONTINUE 50 SCFM NITROGEN TRICKLE FLOW TO MAINTAIN NITROGEN ATMOSPHERE IN DRUM UNTIL OTE IS REPAIRED
   -INITIATE SECOND NITROGEN PURGE, 3000 SCFM FOR 1 MINUTE TO EVACUATE ACCUMULATED HYDROGEN FROM DRUM BEFORE OTE RESTART.
10. THE WALL WASH HAS SEPARATE PIPING FOR THE FORWARD/LOADING AND THE REVERSE/UNLOADING. ONLY FORWARD OR REVERSE WILL BE OPERATING AT ANY GIVEN TIME. ONLY ONE WALL WASH IS SHOWN TO SIMPLIFY DIAGRAM.
11. CAUSTIC HEATING CYCLE:
    0.5 HOURS TO LOAD-UP 50% CAUSTIC
    2.0 HOURS TO HEAT-UP
    0.25 HOURS TO TRANSFER
    0.25 HOURS TO IDLE

THIS DRAWING SUPERSEDES DWG NO 24915-07-M5-TCEH-0001

Shawn Kelly
cn=Shawn Kelly, o=Configuration Management, ou=ISSUED, c=US
Signature Valid 2006.04.07 13:21:01 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
23		INCORP NEW AVG THROUGHPUTS AND UPDATE (IFD)	JG	KM	RB	NW	VN
6	11/30/05	INCORP. CUST. COMMENTS, OTE VENT FLOW (IFD)	NL	JK	DG	NW	VN
5	8/17/05	ISSUED FOR DESIGN	NL	KM	DG	NW	VN
4	6/28/05	INCORPORATED DC43B (IFA) (SHEET REDRAWN)	NL	JK	DG	NW	VN
3	6/14/05	INCORPORATED DC1 & DC35 (IFA)	NL	JK	DG	NW	VN
2	12/23/04	INCORPORATED PARSONS COMMENTS (IFD)	NL	DG	BW	NW	VN
1	11/17/04	INCORPORATED GOV. COMMENTS (IFD)	NL	DG	BW	NW	VN
0	7/9/04	ISSUED FOR DESIGN	NL	DG	AS	NW	VN

QUALITY [X] Q [X] Non-Q

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GENERAL ATOMICS

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

ENERGETICS BATCH HYDROLYZER PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-EBH-00001 | SHEET 1 OF 8 | REV 7

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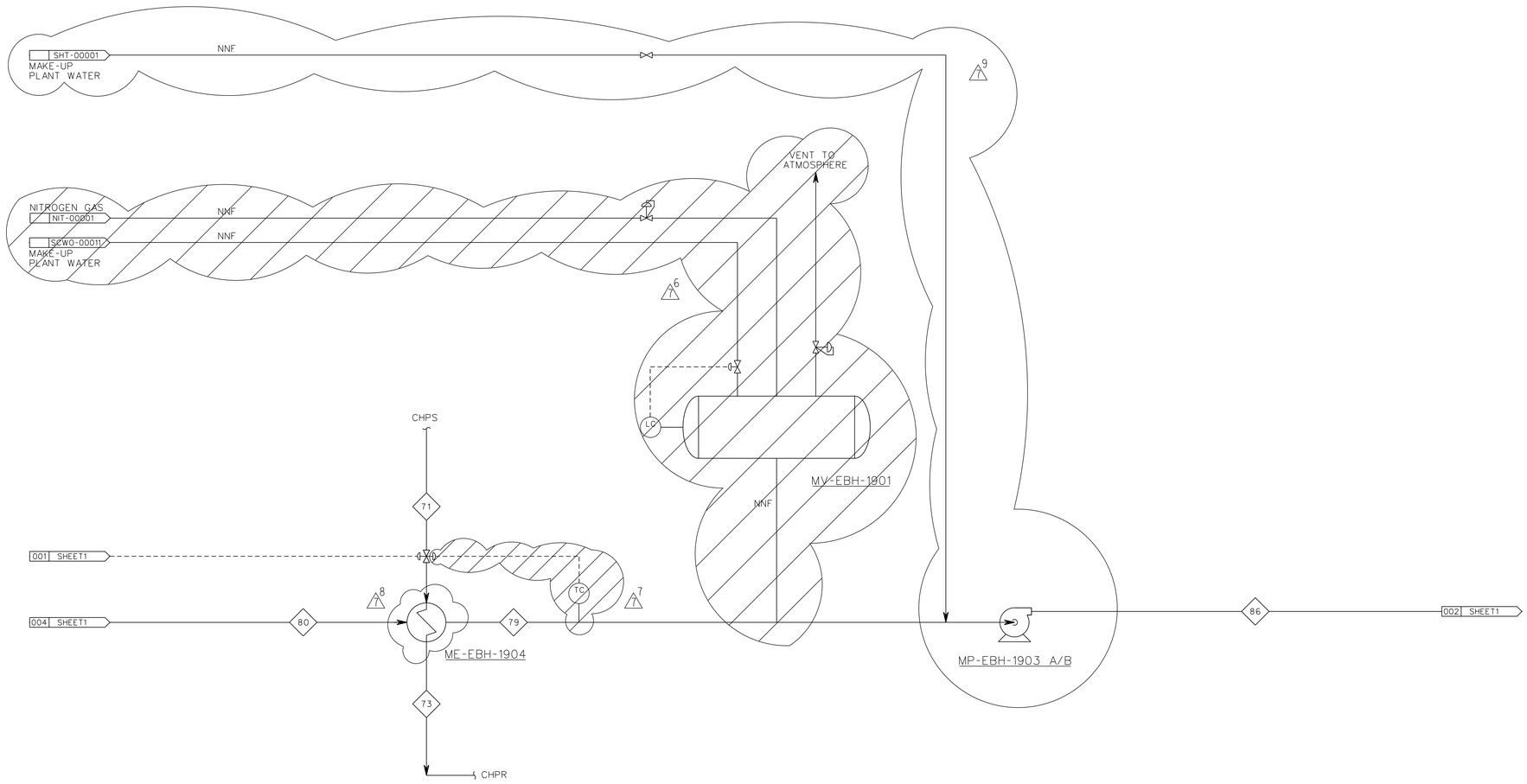
MV-EBH-1901
CHILLED SECONDARY COOLING LOOP FLUID EXPANSION TANK WORKING VOLUME 50 GAL

MP-EBH-1903 A/B
CHILLED SECONDARY COOLING LOOP PUMP
(11 GPM)
P 10 PSI

ME-EBH-1904
SECONDARY COOLING LOOP HX
212,000 BTU/HR
(PEAK GB)

NOTES:

1. ITEMS ON THIS PAGE ARE ON EBH EQUIPMENT PLATFORM.



Shawn Kelly
cn=Shawn Kelly, o=Configuration Management, ou=ISSUED, c=US
2006.04.07 13:21:22 -07'00'
Signature Valid

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
9		INCORP NEW AVG THROUGHPUT AND UPDATE (IFD)	JG	KM	RB	DNW	VN
6	11/30/05	INCORP. CUST. COMMENTS, OTE VENT FLOW (IFD)	NL	JK	DG	NW	VN
5	8/17/05	ISSUED FOR DESIGN	NL	KM	DG	NW	VN
4	6/28/05	INCORPORATED DC43B (IFA) (SHEET REDRAWN)	NL	JK	DG	NW	VN
3	6/14/05	INCORPORATED DC1 & DC35 (IFA)	NL	JK	DG	NW	VN
2	12/23/04	INCORPORATED PARSONS COMMENTS (IFD)	NL	DG	BW	NW	VN
1	11/17/04	INCORPORATED GOV. COMMENTS (IFD)	NL	DG	BW	NW	VN
0	7/9/04	ISSUED FOR DESIGN	NL	DG	AS	NW	VN

QUALITY [X] Q [X] Non-Q

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ENERGETICS BATCH HYDROLYZER PROCESS FLOW DIAGRAM

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DRAWING NUMBER 24915-07-M5-EBH-00001

SHEET 2 OF 8

REV 7

BGCAPP_D3.BDR

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CASE 1 – EBH M55 VX WARHEADS – RESULTS FOR 24 ROUNDS/HR PEAK PROCESSING RATE

Stream Number:	2	8	11	13	14	15	16	17	18	19	21	23	41	42	44	46	48	52	63	65	66	71	73	74	76	79	80	85	86	88
Stream Description	Heated Fresh Caustic Feed 50% NaOH	Hydrolysate Leaving Tank	Sheared WH Feed	EBH Wall Wash	Air Supply EBH	Representative Contents Inside WH EBH	Rinse Water Solids Discharge	Vent Discharge from EBH	Energetic Hydrolysate Exiting Conveyor	Solids Discharge from EBH	Steam Supply to EBH	Condensate from EBH	Energetic Hydrolysate to ENR	Solids Residues to MPT	Caustic Feed Dilution Water	Steam Supply to Caustic Tank	Condensate Return from Caustic Tank Heater	Feed Chute Rinse Water	Fresh Caustic Feed, 50% NaOH	Make-up Process Water EBH	Plant Steam Demand	Chilled Water to Secondary HX Condenser	Chilled Water from Secondary HX Condenser	Excess Condensate	Total Spray Water	Secondary Loop to Condensate Cooler, pump suction	Secondary Loop from Condensate Cooler	Liquids Discharge from EBH	Secondary Loop to Condensate Cooler, pump discharge	Condensate Usage
Temperature F	180	234.5	77	185	85	240.8	185	130	227.6	240.8	329	328	234.5	227.6	185	329	328	185	80	77	329	45	60		185	80	120	240.8	80	185
Pressure psia	38.23	14.23	14.23	74.23	14.23	14.23	74.23	14.23	14.23	14.23	100.23	100.23	67.23	14.23	31.23	100.23	100.23	74.23	63.23	94.23	100.23	164.23	154.23		74.23	114.23	129.23	14.23	144.23	31.23
Instantaneous Flow gpm (ACFM)	42.13	35.27	N/A	2.00	(13112.1)	N/A	4.00	(14873.4)	17.82	13.82	(98.0)	2.86	35.27	N/A	72.06	(19.3)	0.56	0.50	13.76	12.44	(117.3)	29.71	29.81		8.50	9.45	9.52	24.58	9.45	72.06
Density lb/cuft	91.933	80.98		60.475	0.07	83.3	60.475	0.063	77.87	83.3	0.22	56.365	80.98		60.467	0.22	56.365	60.475	93.819	62.267	0.22	64.014	63.792		60.475	62.247	61.739	83.3	62.249	60.467
Viscosity cP	5.0	12.34		0.326	0.018	12.34	0.326	0.02	12.34	12.34	0.015	0.151	12.34		0.326	0.015	0.151	0.326	48	0.764	0.015	1.428	1.139		0.326	0.743	0.524	12.34	0.743	0.326
Molecular Weight	24.842	24.057		18.015	28.623	25.921	18.015	28.179	22.821	25.056	18.015	18.015	23.753		18.015	18.015	18.015	18.015	24.842	18.015	18.015	25.933	25.933		18.015	18.015	18.015	25.056	18.015	18.015
Enthalpy MMBtu/hr	-9.915	-17.852	-0.353	-6.717	-4.096	-21.722	-2.239	-9.865	-7.852	-5.625	-7.332	-8.5	-17.972	-0.011	-6.521	-0.961	-1.115	-0.168	-10.069	-7.069	-8.293	-79.618	-79.43		-9.124	-32.173	-31.985	-10	-32.173	-6.521
Mass Flow Liquids, Gases lb/hr																														
N2	0	0	0	0	41681.99	0	0	41681.99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O2	0	0	0	0	12661.88	4.873	0	12666.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2O	0	0.046	0	0	0	6.703	0	6.657	0.017	0.017	0	0	0.046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.029	0	0
H2	0	0	0	0	0	17.322	0	17.321	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H2O	862.902	2024.563	49.94	1000	726.935	2800.275	333.333	1833.976	940.896	609.563	1293.428	1293.428	2024.563	2	970.765	169.597	169.597	25	862.902	1035.67	1463.026	9152.414	9152.414	0	1358.333	4716.035	4716.035	1083.667	4716.035	970.765
PROPYLENE GLYCOL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6101.609	6101.609	0	0	0	0	0	0	0
AMMONIA	0	0.132	0	0	0	14.894	0	14.763	0.047	0.047	0	0	0.132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.084	0	0
SODIUM HYDROXIDE	862.902	560.084	0	0	0	560.084	0	0	201.63	201.63	0	0	560.084	0	0	0	0	0	862.902	0	0	0	0	0	0	0	0	358.454	0	0
TETRYL	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
RDX	0	0.002	45.216	0	0	0.113	0	0.111	0.001	0.001	0	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0	0
TNT	0	0.003	30.144	0	0	0.003	0	0	0.001	0.001	0	0	0.003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.002	0	0
ALUMINUM	0	0	154.56	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
NANO2	0	30.171	0	0	0	30.171	0	0	10.861	10.861	0	0	30.171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19.309	0	0
NANO3	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
SODIUM FORMATE	0	86.552	0	0	0	86.552	0	0	31.159	31.159	0	0	86.552	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55.393	0	0
SODIUM ACETATE	0	10.886	0	0	0	10.886	0	0	3.919	3.919	0	0	10.886	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.967	0	0
NAALO2	0	469.554	0	0	0	469.554	0	0	169.04	169.04	0	0	469.554	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300.515	0	0
Mass Flow Solids lb/hr																														
STEEL	0	0	40.536	0	0	40.536	0	0	0	40.536	0	0	0	40.536	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Flow lb/hr	1725.804	3181.993	320.396	1000	55070.8	4041.966	333.333	56221.56	1357.571	1066.774	1293.428	1293.428	3181.993	42.536	970.765	169.597	169.597	25	1725.804	1035.67	1463.026	15254.02	15254.02	0	1358.333	4716.035	4716.035	1824.421	4716.035	970.765
Notes			1																											
1 - All components except water are in solid phase																														

Load time, hr	3
Density of initial fill, lb/cu.ft.	80.3
Initial EBH Drum Liquid Volume (gal)	754
Final Hydrolysate Weight (lb)	8923
Total Process Water Used (lb)	6987
Total Caustic Used (lb)	908

Shawn Kelly
cn=Shawn Kelly, o=Configuration Management, ou=ISSUED, c=US
2006.04.07 13:21:54 -07'00'
Signature Valid

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7	[1]	INCORP NEW AVG THROUGHPUTS AND UPDATE (IFD)	JG	KM	RB	DNW	VN
6	11/30/05	INCORP. CUST. COMMENTS, OTE VENT FLOW (IFD)	NL	JK	DG	NW	VN
5	8/17/05	ISSUED FOR DESIGN	NL	KM	DG	NW	VN
4	6/28/05	INCORPORATED DC43B (IFA) (SHEET REDRAWN)	NL	JK	DG	NW	VN
3	6/14/05	INCORPORATED DC1 & DC35 (IFA)	NL	JK	DG	NW	VN
2	12/23/04	INCORPORATED PARSONS COMMENTS (IFD)	NL	DG	BW	NW	VN
1	11/17/04	INCORPORATED GOV. COMMENTS (IFD)	NL	DG	BW	NW	VN
0	7/9/04	ISSUED FOR DESIGN	NL	DG	AS	NW	VN

QUALITY [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

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

ENERGETICS BATCH HYDROLYZER PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-EBH-00001 | SHEET 3 OF 8 | REV 7

THIS DRAWING SUPERSEDES DWG NO 24915-07-M5-TCEH-0001

PROFESSIONAL STAMP

BGCAPP_D3.BDR

CASE 2 – EBH M55 GB WARHEADS – RESULTS FOR 20 ROUNDS/HR PEAK PROCESSING RATE

Stream Number:	2	8	11	13	14	15	16	17	18	19	21	23	41	42	44	46	48	52	63	65	66	71	73	74	76	79	80	85	86	88
Stream Description	Heated Fresh Caustic Feed 50% NaOH	Hydrolysate Leaving Tank	Sheared WH Feed	EBH Wall Wash	Air Supply EBH	Representative Contents Inside WH EBH	Rinse Water Solids Discharge	Vent Discharge from EBH	Energetic Hydrolysate Exiting Conveyor	Solids Discharge from EBH	Steam Supply to EBH	Condensate from EBH	Energetic Hydrolysate to ENR	Solids Residues to MPT	Caustic Feed Dilution Water	Steam Supply to Caustic Tank	Condensate Return from Caustic Tank Heater	Feed Chute Rinse Water	Fresh Caustic Feed, 50% NaOH	Make-up Process Water EBH	Plant Steam Demand	Chilled Water to Secondary HX Condenser	Chilled Water from Secondary HX Condenser	Excess Condensate	Total Spray Water	Secondary Loop to Condensate Cooler, pump suction	Secondary Loop from Condensate Cooler	Liquids Discharge from EBH	Secondary Loop to Condensate Cooler, pump discharge	Condensate Usage
Temperature F	180	234.5	77	185	85	240.8	185	130	227.6	240.8	329	328	234.5	227.6	185	329	328	185	80	77	329	45	60		185	80	120	240.8	80	185
Pressure psia	38.23	14.23	14.23	74.23	14.23	14.23	74.23	14.23	14.23	14.23	100.23	100.23	67.23	14.23	31.23	100.23	100.23	74.23	63.23	94.23	100.23	164.23	154.23		74.23	114.23	129.23	14.23	144.23	31.23
Instantaneous Flow gpm (ACFM)	42.13	35.34	N/A	2.00	(13109.4)	N/A	4.00	(14873.4)	17.86	13.86	(110.1)	3.22	35.34	N/A	72.06	(19.3)	0.56	0.50	13.76	8.22	(129.4)	33.39	33.51		8.50	10.62	10.71	24.63	10.62	72.06
Density lb/cuft	91.933	80.99		60.475	0.07	83.3	60.475	0.063	77.88	83.3	0.22	56.365	80.99		60.467	0.22	56.365	60.475	93.819	62.267	0.22	64.014	63.792		60.475	62.247	61.739	83.3	62.249	60.467
Viscosity cP	5.0	12.34		0.326	0.018	12.34	0.326	0.02	12.34	12.34	0.015	0.151	12.34		0.326	0.015	0.151	0.326	48	0.764	0.015	1.428	1.139		0.326	0.743	0.524	12.34	0.743	0.326
Molecular Weight	24.842	24.052		18.015	28.623	25.806	18.015	28.193	22.819	25.048	18.015	18.015	23.746		18.015	18.015	18.015	18.015	24.842	18.015	18.015	25.933	25.933		18.015	18.015	18.015	25.048	18.015	18.015
Enthalpy MMBtu/hr	-8.263	-14.909	-1.152	-6.153	-4.095	-19.314	-1.866	-9.97	-6.554	-4.7	-8.242	-9.555	-15.01	-0.011	-5.434	-0.801	-0.929	-0.141	-8.39	-3.889	-9.043	-89.496	-89.284		-8.16	-36.164	-35.953	-8.355	-36.164	-5.434
Mass Flow Liquids, Gases lb/hr																														
N2	0	0	0	0	41673.32	0	0	41673.32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O2	0	0	0	0	12659.25	4.061	0	12663.31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2O	0	0.033	0	0	0	5.586	0	5.553	0.012	0.012	0	0	0.033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.021	0	0
H2	0	0	0	0	0	14.435	0	14.435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H2O	719.085	1691.222	166.42	916	726.783	2541.199	277.778	1852.539	785.338	509.56	1453.9	1453.9	1691.222	2	808.971	141.331	141.331	21	719.085	569.849	1595.231	10287.93	10287.93	0	1214.778	5301.138	5301.138	905.884	5301.138	808.971
PROPYLENE GLYCOL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6858.617	6858.617	0	0	0	0	0	0	0
AMMONIA	0	0.095	0	0	0	12.412	0	12.317	0.034	0.034	0	0	0.095	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.061	0	0
SODIUM HYDROXIDE	719.085	467.997	1.26	0	0	467.997	0	0	168.479	168.479	0	0	467.997	0	0	0	0	0	719.085	0	0	0	0	0	0	0	0	299.518	0	0
TETRYL	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
RDX	0	0.001	37.68	0	0	0.094	0	0.093	0	0	0	0	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0	0
TNT	0	0.003	25.12	0	0	0.003	0	0	0.001	0.001	0	0	0.003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.002	0	0
ALUMINUM	0	0	128.8	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
NANO2	0	25.142	0	0	0	25.142	0	0	9.051	9.051	0	0	25.142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16.091	0	0
NANO3	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
SODIUM FORMATE	0	72.126	0	0	0	72.126	0	0	25.966	25.966	0	0	72.126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46.161	0	0
SODIUM ACETATE	0	9.072	0	0	0	9.072	0	0	3.266	3.266	0	0	9.072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.806	0	0
NAALO2	0	391.295	0	0	0	391.295	0	0	140.866	140.866	0	0	391.295	0	0	0	0	0	0	0	0	0	0	0	0	0	0	250.429	0	0
Mass Flow Solids lb/hr																														
STEEL	0	0	33.78	0	0	33.78	0	0	0	33.78	0	0	0	33.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Flow lb/hr	1438.17	2656.986	393.06	916	55059.35	3577.202	277.778	56221.57	1133.013	891.015	1453.9	1453.9	2656.986	35.78	808.971	141.331	141.331	21	1438.17	569.849	1595.231	17146.54	17146.54	0	1214.778	5301.138	5301.138	1523.974	5301.138	808.971
Notes			1																											
1 - All components except water are in solid phase																														

Load time, hr	3.6
Density of initial fill, lb/cu.ft.	80.3
Initial EBH Drum Liquid Volume (gal)	754
Final Hydrolysate Weight (lb)	9376
Total Process Water Used (lb)	7285
Total Caustic Used (lb)	904

Shawn Kelly
cn=Shawn Kelly, o=Configuration Management, ou=ISSUED, c=US
2006.04.07 13:22:29 -07'00'
Signature Valid

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7 [1]		INCORP NEW AVG THROUGHPUTS AND UPDATE (IFD)	JG	KM	RB	DNW	VN
6	11/30/05	INCORP. CUST. COMMENTS, OTE VENT FLOW (IFD)	NL	JK	DG	NW	VN
5	8/17/05	ISSUED FOR DESIGN	NL	KM	DG	NW	VN
4	6/28/05	INCORPORATED DC43B (IFA) (SHEET REDRAWN)	NL	JK	DG	NW	VN
3	6/14/05	INCORPORATED DC1 & DC35 (IFA)	NL	JK	DG	NW	VN
2	12/23/04	INCORPORATED PARSONS COMMENTS (IFD)	NL	DG	BW	NW	VN
1	11/17/04	INCORPORATED GOV. COMMENTS (IFD)	NL	DG	BW	NW	VN
0	7/9/04	ISSUED FOR DESIGN	NL	DG	AS	NW	VN

QUALITY [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

ENERGETICS BATCH HYDROLYZER PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-EBH-00001 | SHEET 4 OF 8 | REV 7

THIS DRAWING SUPERSEDES DWG NO 24915-07-M5-TCEH-0001

PROFESSIONAL STAMP

BGCAPP_D2.BDR

CASE 3 – EBH M110 H PROJECTILES – RESULTS FOR 26 ROUNDS/HR PEAK PROCESSING RATE

Stream Number:	2	8	11	13	14	15	16	17	18	19	21	23	41	42	44	46	48	52	63	65	66	71	73	74	76	79	80	85	86	88
Stream Description	Heated Fresh Caustic Feed 50% NaOH	Hydrolysate Leaving Tank	Sheared Feed	EBH Wall Wash	Air Supply EBH	Representative Contents Inside EBH	Rinse Water Solids Discharge	Vent Discharge from EBH	Energetic Hydrolysate Exiting Conveyor	Solids Discharge from EBH	Steam Supply to EBH	Condensate from EBH	Energetic Hydrolysate to ENR	Solids Residues to MPT	Caustic Feed Dilution Water	Steam Supply to Caustic Tank	Condensate Return from Caustic Tank Heater	Feed Chute Rinse Water	Fresh Caustic Feed, 50% NaOH	Make-up Process Water EBH	Plant Steam Demand	Chilled Water to Secondary HX Condenser	Chilled Water from Secondary HX Condenser	Excess Condensate	Total Spray Water	Secondary Loop to Condensate Cooler, pump suction	Secondary Loop from Condensate Cooler	Liquids Discharge from EBH	Secondary Loop to Condensate Cooler, pump discharge	Condensate Usage
Temperature F	180	221.5	77	185	85	248	185	130	209.3	248	329	328	221.5	209.3	185	329	328	185	80	77	329	45	60	185	185	80	120	248	80	185
Pressure psia	38.23	14.23	14.23	74.23	14.23	14.23	74.23	14.23	14.23	14.23	100.23	100.23	67.23	14.23	31.23	100.23	100.23	74.23	63.23	94.23	100.23	164.23	154.23	31.25	74.23	114.23	129.23	14.23	144.23	31.23
Instantaneous Flow gpm (ACFM)	45.49	30.50	N/A	2.00	(6543.8)	N/A	4.00	(7320.5)	76.59	13.31	(87.5)	2.56	30.50	N/A	59.28	(20.8)	0.61	0.50	14.86	0.00	(108.3)	26.53	26.63	59.28	8.50	8.44	8.51	23.66	8.44	59.28
Density lb/cuft	91.933	80.26		60.475	0.07	83.3	60.475	0.064	78.82	83.3	0.22	56.365	80.26		60.467	0.22	56.365	60.475	93.819	62.267	0.22	64.014	63.792	60.467	60.475	62.247	61.739	83.3	62.249	60.467
Viscosity cP	5.0	12.34		0.326	0.018	12.34	0.326	0.02	12.34	12.34	0.015	0.151	12.34		0.326	0.015	0.151	0.326	48	0.764	0.015	1.428	1.139		0.326	0.743	0.524	12.34	0.743	0.326
Molecular Weight	24.842	20.228		18.015	28.623	22.972	18.015	28.25	19.117	22.972	18.015	18.015	20.209		18.015	18.015	18.015	18.015	24.842		18.015	25.933	25.933	18.015	18.015	18.015	18.015	22.972	18.015	18.015
Enthalpy MMBtu/hr	-1.606	-5.096	0	-4.03	-2.045	-5.93	-0.336	-5.338	-3.582	-0.852	-6.549	-7.592	-5.102	-0.013	-0.805	-0.156	-0.181	-0.181	-1.631	0	-6.704	-71.11	-70.942	-2.408	-4.548	-28.735	-28.567	-1.515	-28.735	-3.212
Mass Flow Liquids, Gases lb/hr																														
N2	0	0	0	0	20801.83	0	0	20801.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O2	0	0	0	0	6319.194	0	0	6319.192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2O	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
H2	0	0	0	0	0	0.175	0	0.175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H2O	139.764	666.27	0	600	362.836	884.799	50	987.78	499.963	93.548	1155.213	1155.213	666.27	2	119.798	27.47	27.47	27	139.764	0	1182.683	8174.389	8174.389	358.415	677	4212.08	4212.08	166.307	4212.08	478.213
PROPYLENE GLYCOL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5449.593	5449.593	0	0	0	0	0	0	0
AMMONIA	0	0.004	0	0	0	1.807	0	1.803	0.001	0.001	0	0	0.004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.003	0	0
SODIUM HYDROXIDE	139.764	124.156	0	0	0	124.156	0	0	44.696	44.696	0	0	124.156	0	0	0	0	0	139.764	0	0	0	0	0	0	0	0	79.46	0	0
TETRYL	0	0	7.46	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
RDX	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
TNT	0	0	3.2	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
ALUMINUM	0	0	1.56	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
NANO2	0	4.557	0	0	0	4.557	0	0	1.64	1.64	0	0	4.557	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.916	0	0
NANO3	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
SODIUM FORMATE	0	17.158	0	0	0	17.158	0	0	6.177	6.177	0	0	17.158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.981	0	0
SODIUM ACETATE	0	1.156	0	0	0	1.156	0	0	0.416	0.416	0	0	1.156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.74	0	0
NAALO2	0	4.739	0	0	0	4.739	0	0	1.706	1.706	0	0	4.739	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.033	0	0
Mass Flow Solids lb/hr																														
STEEL	0	0	56.42	0	0	56.42	0	0	0	56.42	0	0	0	56.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Flow lb/hr	279.528	818.04	68.64	600	27483.86	1094.967	50	28110.78	554.599	204.604	1155.213	1155.213	818.04	58.42	119.798	27.47	27.47	27	279.528	0	1182.683	13623.98	13623.98	358.415	677	4212.08	4212.08	263.44	4212.08	478.213

Notes

1 - All components except water are in solid phase

Load time, hr	20
Density of initial fill, lb/cu.ft.	81.9

Initial EBH Drum Liquid Volume (gal)	729
Final Hydrolysate Weight (lb)	8191
Total Process Water Used (lb)	15936
Total Caustic Used (lb)	312

Shawn Kelly
cn=Shawn Kelly,
o=Configuration Management,
ou=ISSUED, c=US
2006.04.07 13:22:53 -07'00'
Signature Valid

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7 [1]		INCORP NEW AVG THROUGHPUTS AND UPDATE (IFD)	JG	KM	RB	DNW	VN
6	11/30/05	INCORP. CUST. COMMENTS, OTE VENT FLOW (IFD)	NL	JK	DG	NW	VN
5	8/17/05	ISSUED FOR DESIGN	NL	KM	DG	NW	VN
4	6/28/05	INCORPORATED DC43B (IFA) (SHEET REDRAWN)	NL	JK	DG	NW	VN
3	6/14/05	INCORPORATED DC1 & DC35 (IFA)	NL	JK	DG	NW	VN
2	12/23/04	INCORPORATED PARSONS COMMENTS (IFD)	NL	DG	BW	NW	VN
1	11/17/04	INCORPORATED GOV. COMMENTS (IFD)	NL	DG	BW	NW	VN
0	7/9/04	ISSUED FOR DESIGN	NL	DG	AS	NW	VN

QUALITY [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

ENERGETICS BATCH HYDROLYZER PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-EBH-00001 | SHEET 5 OF 8 | REV 7

THIS DRAWING SUPERSEDES DWG NO 24915-07-M5-TCEH-0001

PROFESSIONAL STAMP

BGCAPP_D2.BDR

CASE 4 – EBH M55 VX WARHEADS – RESULTS FOR 11.2 ROUNDS/HR AVERAGE THROUGHPUT RATE

Stream Number:	2	8	11	13	14	15	16	17	18	19	21	23	41	42	44	46	48	52	63	65	66	71	73	74	76	79	80	85	86	88
Stream Description	Heated Fresh Caustic Feed 50% NaOH	Hydrolysate Leaving Tank	Sheared Feed	EBH Wall Wash	Air Supply EBH	Representative Contents Inside EBH	Rinse Water Solids Discharge	Vent Discharge from EBH	Energetic Hydrolysate Exiting Conveyor	Solids Discharge from EBH	Steam Supply to EBH	Condensate from EBH	Energetic Hydrolysate to ENR	Solids Residues to MPT	Caustic Feed Dilution Water	Steam Supply to Caustic Tank	Condensate Return from Caustic Tank Heater	Feed Chute Rinse Water	Fresh Caustic Feed, 50% NaOH	Make-up Process Water EBH	Plant Steam Demand	Chilled Water to Secondary HX Condenser	Chilled Water from Secondary HX Condenser	Excess Condensate	Total Spray Water	Secondary Loop to Condensate Cooler, pump suction	Secondary Loop from Condensate Cooler	Liquids Discharge from EBH	Secondary Loop to Condensate Cooler, pump discharge	Condensate Usage
Temperature F	180	234.5	77	185	85	240.8	185	130	227.6	240.8	329	328	234.5	227.6	185	329	328	185	80	77	329	45	60		185	80	120	240.8	80	185
Pressure psia	38.23	14.23	14.23	74.23	14.23	14.23	74.23	14.23	14.23	14.23	100.23	100.23	67.23	14.23	31.23	100.23	100.23	74.23	63.23	94.23	100.23	164.23	154.23		74.23	114.23	129.23	14.23	144.23	31.23
Instantaneous Flow gpm (ACFM)	42.13	36.62	N/A	2.00	(8746.9)	N/A	4.00	(9760.7)	18.44	14.44	(81.3)	2.37	36.62	N/A	72.06	(19.3)	0.56	0.50	13.76	7.23	(100.5)	24.64	24.72		8.50	7.83	7.90	25.67	7.83	72.06
Density lb/cuft	91.933	81.07		60.475	0.07	83.3	60.475	0.064	78.04	83.3	0.22	56.365	81.07		60.467	0.22	56.365	60.475	93.819	62.267	0.22	64.014	63.792		60.475	62.247	61.739	83.3	62.249	60.467
Viscosity cP	5.0	12.34		0.326	0.018	12.34	0.326	0.02	12.34	12.34	0.015	0.151	12.34		0.326	0.015	0.151	0.326	48	0.764	0.015	1.428	1.139		0.326	0.743	0.524	12.34	0.743	0.326
Molecular Weight	24.842	24.054		18.015	28.623	25.732	18.015	28.235	22.819	25.051	18.015	18.015	23.493		18.015	18.015	18.015	18.015	24.842	18.015	18.015	25.933	25.933		18.015	18.015	18.015	25.051	18.015	18.015
Enthalpy MMBtu/hr	-4.627	-8.665	-0.165	-4.924	-2.733	-11.681	-1.045	-6.495	-3.781	-2.747	-6.08	-7.049	-8.778	-0.011	-3.043	-0.449	-0.52	-0.081	-4.699	-1.918	-6.529	-66.026	-65.87		-6.049	-26.68	-26.524	-4.884	-26.68	-3.043
Mass Flow Liquids, Gases lb/hr																														
N2	0	0	0	0	27805.36	0	0	27805.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O2	0	0	0	0	8446.529	2.274	0	8448.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2O	0	0.017	0	0	0	3.128	0	3.111	0.006	0.006	0	0	0.017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.011	0	0
H2	0	0	0	0	0	8.083	0	8.083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H2O	402.688	1003.211	23.305	733	484.926	1573.462	155.556	1208.732	459.432	305.876	1072.621	1072.621	1003.211	2	453.024	79.145	79.145	12	402.688	280.959	1151.767	7589.962	7589.962	0	900.556	3910.938	3910.938	543.779	3910.938	453.024
PROPYLENE GLYCOL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5059.975	5059.975	0	0	0	0	0	0	0
AMMONIA	0	0.051	0	0	0	6.951	0	6.9	0.018	0.018	0	0	0.051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.032	0	0
SODIUM HYDROXIDE	402.688	261.373	0	0	0	261.373	0	0	94.094	94.094	0	0	261.373	0	0	0	0	0	402.688	0	0	0	0	0	0	0	0	167.278	0	0
TETRYL	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
RDX	0	0.001	21.101	0	0	0.053	0	0.052	0	0	0	0	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TNT	0	0.001	14.067	0	0	0.001	0	0	0.001	0.001	0	0	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0	0
ALUMINUM	0	0	72.128	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
NANO2	0	14.08	0	0	0	14.08	0	0	5.069	5.069	0	0	14.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.011	0	0
NANO3	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
SODIUM FORMATE	0	40.391	0	0	0	40.391	0	0	14.541	14.541	0	0	40.391	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25.85	0	0
SODIUM ACETATE	0	5.08	0	0	0	5.08	0	0	1.829	1.829	0	0	5.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.251	0	0
NAALO2	0	219.125	0	0	0	219.125	0	0	78.885	78.885	0	0	219.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	140.24	0	0
Mass Flow Solids lb/hr																														
STEEL	0	0	18.917	0	0	18.917	0	0	0	18.917	0	0	0	18.917	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Flow lb/hr	805.376	1543.33	149.518	733	36736.82	2152.918	155.556	37481.03	653.875	519.236	1072.621	1072.621	1543.33	20.917	453.024	79.145	79.145	12	805.376	280.959	1151.766	12649.94	12649.94	0	900.556	3910.938	3910.938	889.453	3910.938	453.024
Notes			1																											
1 - All components except water are in solid phase																														

Load time, hr	6.4
Density of initial fill, lb/cu.ft.	80.3
Initial EBH Drum Liquid Volume (gal)	754
Final Hydrolysate Weight (lb)	8916
Total Process Water Used (lb)	8702
Total Caustic Used (lb)	908

Shawn Kelly
cn=Shawn Kelly,
o=Configuration Management,
ou=ISSUED, c=US
Signature Valid 2006.04.07 13:23:13 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7 [1]		INCORP NEW AVG THROUGHPUTS AND UPDATE (IFD)	JG	KM	RB	DNW	VN
6	11/30/05	INCORP. CUST. COMMENTS, OTE VENT FLOW (IFD)	NL	JK	DG	NW	VN
5	8/17/05	ISSUED FOR DESIGN	NL	KM	DG	NW	VN
4	6/28/05	INCORPORATED DC43B (IFA) (SHEET REDRAWN)	NL	JK	DG	NW	VN
3	6/14/05	INCORPORATED DC1 & DC35 (IFA)	NL	JK	DG	NW	VN
2	12/23/04	INCORPORATED PARSONS COMMENTS (IFD)	NL	DG	BW	NW	VN
1	11/17/04	INCORPORATED GOV. COMMENTS (IFD)	NL	DG	BW	NW	VN
0	7/9/04	ISSUED FOR DESIGN	NL	DG	AS	NW	VN

QUALITY [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

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

ENERGETICS BATCH HYDROLYZER PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-EBH-00001 | SHEET 6 OF 8 | REV 7

THIS DRAWING SUPERSEDES DWG NO 24915-07-M5-TCEH-0001

PROFESSIONAL STAMP

BGCAPP_D3.BDR

CASE 5 – EBH M55 GB WARHEADS – RESULTS FOR 9.4 ROUNDS/HR AVERAGE THROUGHPUT RATE

Stream Number:	2	8	11	13	14	15	16	17	18	19	21	23	41	42	44	46	48	52	63	65	66	71	73	74	76	79	80	85	86	88
Stream Description	Heated Fresh Caustic Feed 50% NaOH	Hydrolysate Leaving Tank	Sheared Feed	EBH Wall Wash	Air Supply EBH	Representative Contents Inside EBH	Rinse Water Solids Discharge	Vent Discharge from EBH	Energetic Hydrolysate Exiting Conveyor	Solids Discharge from EBH	Steam Supply to EBH	Condensate from EBH	Energetic Hydrolysate to ENR	Solids Residues to MPT	Caustic Feed Dilution Water	Steam Supply to Caustic Tank	Condensate Return from Caustic Tank Heater	Feed Chute Rinse Water	Fresh Caustic Feed, 50% NaOH	Make-up Process Water EBH	Plant Steam Demand	Chilled Water to Secondary HX Condenser	Chilled Water from Secondary HX Condenser	Excess Condensate	Total Spray Water	Secondary Loop to Condensate Cooler, pump suction	Secondary Loop from Condensate Cooler	Liquids Discharge from EBH	Secondary Loop to Condensate Cooler, pump discharge	Condensate Usage
Temperature F	180	234.4	77	185	85	240.8	185	130	227.5	240.8	329	328	234.4	227.5	185	329	328	185	80	77	329	45	60		185	80	120	240.8	80	185
Pressure psia	38.23	14.23	14.23	74.23	14.23	14.23	74.23	14.23	14.23	14.23	100.23	100.23	67.23	14.23	31.23	100.23	100.23	74.23	63.23	94.23	100.23	164.23	154.23		74.23	114.23	129.23	14.23	144.23	31.23
Instantaneous Flow gpm (ACFM)	42.13	37.15	N/A	2.00	(8746.4)	N/A	4.00	(9760.7)	18.67	14.67	(87.6)	2.56	37.15	N/A	72.06	(19.3)	0.56	0.50	13.76	1.90	(106.8)	26.55	26.64		8.50	8.44	8.51	26.08	8.44	72.06
Density lb/cuft	91.933	81.10		60.475	0.07	83.3	60.475	0.064	78.10	83.3	0.22	56.365	81.10		60.467	0.22	56.365	60.475	93.819	62.267	0.22	64.014	63.792		60.475	62.247	61.739	83.3	62.249	60.467
Viscosity cP	5.0	12.34		0.326	0.018	12.34	0.326	0.02	12.34	12.34	0.015	0.151	12.34		0.326	0.015	0.151	0.326	48	0.764	0.015	1.428	1.139		0.326	0.743	0.524	12.34	0.743	0.326
Molecular Weight	24.842	24.042		18.015	28.623	25.631	18.015	28.245	22.806	25.043	18.015	18.015	23.393		18.015	18.015	18.015	18.015	24.842	18.015	18.015	25.933	25.933		18.015	18.015	18.015	25.043	18.015	18.015
Enthalpy MMBtu/hr	-3.884	-7.383	-0.542	-4.675	-2.732	-10.611	-0.877	-6.524	-3.216	-2.344	-6.552	-7.596	-7.493	-0.011	-2.554	-0.377	-0.437	-0.067	-3.944	-0.422	-6.929	-71.152	-70.984		-5.619	-28.752	-28.584	-4.167	-28.752	-2.561
Mass Flow Liquids, Gases lb/hr																														
N2	0	0	0	0	27803.86	0	0	27803.87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O2	0	0	0	0	8446.071	1.909	0	8447.983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2O	0	0.013	0	0	0	2.625	0	2.613	0.005	0.005	0	0	0.013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0	0
H2	0	0	0	0	0	6.784	0	6.784	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H2O	337.97	860.458	78.217	696	484.9	1459.973	130.556	1213.972	392.681	263.125	1155.895	1155.895	860.458	2	380.216	66.426	66.426	10	337.97	61.878	1222.32	8179.213	8179.213	0	836.556	4214.566	4214.566	467.777	4214.566	381.217
PROPYLENE GLYCOL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5452.808	5452.808	0	0	0	0	0	0	0
AMMONIA	0	0.038	0	0	0	5.834	0	5.796	0.014	0.014	0	0	0.038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.024	0	0
SODIUM HYDROXIDE	337.97	219.958	0.592	0	0	219.958	0	0	79.185	79.185	0	0	219.958	0	0	0	0	0	337.97	0	0	0	0	0	0	0	0	140.773	0	0
TETRYL	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
RDX	0	0	17.71	0	0	0.044	0	0.044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TNT	0	0.001	11.806	0	0	0.001	0	0	0	0	0	0	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0	0
ALUMINUM	0	0	60.536	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
NANO2	0	11.817	0	0	0	11.817	0	0	4.254	4.254	0	0	11.817	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.563	0	0
NANO3	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
SODIUM FORMATE	0	33.899	0	0	0	33.899	0	0	12.204	12.204	0	0	33.899	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21.695	0	0
SODIUM ACETATE	0	4.264	0	0	0	4.264	0	0	1.535	1.535	0	0	4.264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.729	0	0
NAALO2	0	183.909	0	0	0	183.909	0	0	66.207	66.207	0	0	183.909	0	0	0	0	0	0	0	0	0	0	0	0	0	0	117.702	0	0
Mass Flow Solids lb/hr																														
STEEL	0	0	15.877	0	0	15.877	0	0	0	15.877	0	0	0	15.877	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Flow lb/hr	675.94	1314.357	184.738	696	36734.83	1946.894	130.556	37481.06	556.085	442.406	1155.895	1155.895	1314.357	17.877	380.216	66.426	66.426	10	675.94	61.878	1222.321	13632.02	13632.02	0	836.556	4214.566	4214.566	758.272	4214.566	381.217
Notes			1																											
1 - All components except water are in solid phase																														

Load time, hr	7.7
Density of initial fill, lb/cu.ft.	80.3
Initial EBH Drum Liquid Volume (gal)	754
Final Hydrolysate Weight (lb)	9368
Total Process Water Used (lb)	9320
Total Caustic Used (lb)	904

Shawn Kelly
cn=Shawn Kelly, o=Configuration Management, ou=ISSUED, c=US
2006.04.07 13:23:34 -07'00'
Signature Valid

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7 [1]		INCORP NEW AVG THROUGHPUTS AND UPDATE (IFD)	JG	KM	RB	DNW	VN
6	11/30/05	INCORP. CUST. COMMENTS, OTE VENT FLOW (IFD)	NL	JK	DG	NW	VN
5	8/17/05	ISSUED FOR DESIGN	NL	KM	DG	NW	VN
4	6/28/05	INCORPORATED DC43B (IFA) (SHEET REDRAWN)	NL	JK	DG	NW	VN
3	6/14/05	INCORPORATED DC1 & DC35 (IFA)	NL	JK	DG	NW	VN
2	12/23/04	INCORPORATED PARSONS COMMENTS (IFD)	NL	DG	BW	NW	VN
1	11/17/04	INCORPORATED GOV. COMMENTS (IFD)	NL	DG	BW	NW	VN
0	7/9/04	ISSUED FOR DESIGN	NL	DG	AS	NW	VN

QUALITY [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

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

ENERGETICS BATCH HYDROLYZER PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-EBH-00001 | SHEET 7 OF 8 | REV 7

THIS DRAWING SUPERSEDES DWG NO 24915-07-M5-TCEH-0001

PROFESSIONAL STAMP

BGCAPP_D3.BDR

CASE 6 – EBH M110 H PROJECTILES – RESULTS FOR 9.9 ROUNDS/HR AVERAGE THROUGHPUT RATE

Stream Number:	2	8	11	13	14	15	16	17	18	19	21	23	41	42	44	46	48	52	63	65	66	71	73	74	76	79	80	85	86	88
Stream Description	Heated Fresh Caustic Feed 50% NaOH	Hydrolysate Leaving Tank	Sheared Feed	EBH Wall Wash	Air Supply EBH	Representative Contents Inside EBH	Rinse Water Solids Discharge	Vent Discharge from EBH	Energetic Hydrolysate Exiting Conveyor	Solids Discharge from EBH	Steam Supply to EBH	Condensate from EBH	Energetic Hydrolysate to ENR	Solids Residues to MPT	Caustic Feed Dilution Water	Steam Supply to Caustic Tank	Condensate Return from Caustic Tank Heater	Feed Chute Rinse Water	Fresh Caustic Feed, 50% NaOH	Make-up Process Water EBH	Plant Steam Demand	Chilled Water to Secondary HX Condenser	Chilled Water from Secondary HX Condenser	Excess Condensate	Total Spray Water	Secondary Loop to Condensate Cooler, pump suction	Secondary Loop from Condensate Cooler	Liquids Discharge from EBH	Secondary Loop to Condensate Cooler, pump discharge	Condensate Usage
Temperature F	180	213.4	77	185	85	248	185	130	197.4	248	329	328	213.4	197.4	185	329	328	185	80	77	329	45	60	185	185	80	120	248	80	185
Pressure psia	38.23	14.23	14.23	74.23	14.23	14.23	74.23	14.23	14.23	14.23	100.23	100.23	67.23	14.23	31.23	100.23	100.23	74.23	63.23	94.23	100.23	164.23	154.23	31.25	74.23	114.23	129.23	14.23	144.23	31.23
Instantaneous Flow gpm (ACFM)	45.68	32.93	N/A	2.00	(4331.6)	N/A	4.00	(4957.8)	76.93	13.39	(71.2)	2.08	32.93	N/A	59.54	(20.9)	0.61	0.50	14.92	0.00	(92.1)	21.57	21.65	59.54	8.50	6.86	6.92	23.81	6.86	59.54
Density lb/cuft	91.933	79.73		60.476	0.07	83.3	60.476	0.063	78.83	83.3	0.22	56.365	79.73		60.467	0.22	56.365	60.476	93.819	62.267	0.22	64.014	63.792	60.467	60.476	62.247	61.739	83.3	62.249	60.467
Viscosity cP	5.0	12.34		0.326	0.018	12.34	0.326	0.02	12.34	12.34	0.015	0.151	12.34		0.326	0.015	0.151	0.326	48	0.764	0.015	1.428	1.139	0.326	0.326	0.743	0.524	12.34	0.743	0.326
Molecular Weight	24.842	19.338		18.015	28.623	22.954	18.015	28.156	18.59	22.954	18.015	18.015	19.338		18.015	18.015	18.015	18.015	24.842		18.015	25.933	25.933	18.015	18.015	18.015	18.015	22.954	18.015	18.015
Enthalpy MMBtu/hr	-0.614	-3.214	0	-3.614	-1.353	-4.025	-0.128	-4.299	-2.634	-0.327	-5.324	-6.173	-3.214	-0.013	-0.308	-0.06	-0.069	-0.067	-0.624	0	-5.384	-57.816	-57.68	-2.193	-3.809	-23.363	-23.226	-0.581	-23.363	-2.5
Mass Flow Liquids, Gases lb/hr																														
N2	0	0	0	0	13769.74	0	0	13769.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O2	0	0	0	0	4182.982	0	0	4182.982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2O	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
H2	0	0	0	0	0	0.066	0	0.066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H2O	53.446	443.169	0	538	240.179	646.588	19.038	787.042	379.345	35.901	939.254	939.254	443.169	2	45.811	10.504	10.504	10	53.446	0	949.759	6646.247	6646.247	326.405	567.038	3424.663	3424.663	63.824	3424.663	372.216
PROPYLENE GLYCOL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4430.832	4430.832	0	0	0	0	0	0	0
AMMONIA	0	0.001	0	0	0	0.688	0	0.688	0	0	0	0	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SODIUM HYDROXIDE	53.446	47.508	0	0	0	47.508	0	0	17.103	17.103	0	0	47.508	0	0	0	0	0	53.446	0	0	0	0	0	0	0	0	30.405	0	0
TETRYL	0	0	2.84	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
RDX	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
TNT	0	0	1.22	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
ALUMINUM	0	0	0.59	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
NANO2	0	1.735	0	0	0	1.735	0	0	0.625	0.625	0	0	1.735	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.111	0	0
NANO3	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
SODIUM FORMATE	0	6.535	0	0	0	6.535	0	0	2.352	2.352	0	0	6.535	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.182	0	0
SODIUM ACETATE	0	0.441	0	0	0	0.441	0	0	0.159	0.159	0	0	0.441	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.282	0	0
NAALO2	0	1.792	0	0	0	1.792	0	0	0.645	0.645	0	0	1.792	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.147	0	0
Mass Flow Solids lb/hr																														
STEEL	0	0	21.48	0	0	21.48	0	0	0	21.48	0	0	0	21.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Flow lb/hr	106.892	501.181	26.13	538	18192.91	726.833	19.038	18740.52	400.229	78.265	939.254	939.254	501.181	23.48	45.811	10.504	10.504	10	106.892	0	949.759	11077.08	11077.08	326.405	567.038	3424.663	3424.663	100.951	3424.663	372.216

Notes

1 - All components except water are in solid phase

Load time, hr	52.5
Density of initial fill, lb/cu.ft.	81.9

Initial EBH Drum Liquid Volume (gal)	733
Final Hydrolysate Weight (lb)	8160
Total Process Water Used (lb)	32190
Total Caustic Used (lb)	312

Shawn Kelly
cn=Shawn Kelly,
o=Configuration Management,
ou=ISSUED, c=US
Signature Valid 2006.04.07 13:24:02 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7 [1]		INCORP NEW AVG THROUGHPUTS AND UPDATE (IFD)	JG	KM	RB	DNW	VN
6	11/30/05	INCORP. CUST. COMMENTS, OTE VENT FLOW (IFD)	NL	JK	DG	NW	VN
5	8/17/05	ISSUED FOR DESIGN	NL	KM	DG	NW	DJ
4	6/28/05	INCORPORATED DC43B (IFA) (SHEET REDRAWN)	NL	JK	DG	NW	DJ
3	6/14/05	INCORPORATED DC1 & DC35 (IFA)	NL	JK	DG	NW	DJ
2	12/23/04	INCORPORATED PARSONS COMMENTS (IFD)	NL	DG	BW	NW	DJ
1	11/17/04	INCORPORATED GOV. COMMENTS (IFD)	NL	DG	BW	NW	DJ
0	7/9/04	ISSUED FOR DESIGN	NL	DG	AS	NW	DJ

QUALITY [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

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

ENERGETICS BATCH HYDROLYZER PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-EBH-00001 | SHEET 8 OF 8 | REV 7

THIS DRAWING SUPERSEDES DWG NO 24915-07-M5-TCEH-0001

PROFESSIONAL STAMP

BGCAPP_D3.BDR

MF-ENS-0101/0102/0103
ENERGETICS NEUTRALIZATION
REACTOR AGITATOR

(NOTE 1)

MV-ENS-0101/0102/0103
ENERGETICS NEUTRALIZATION
REACTOR

7'-0" ID X 12'-0" TT

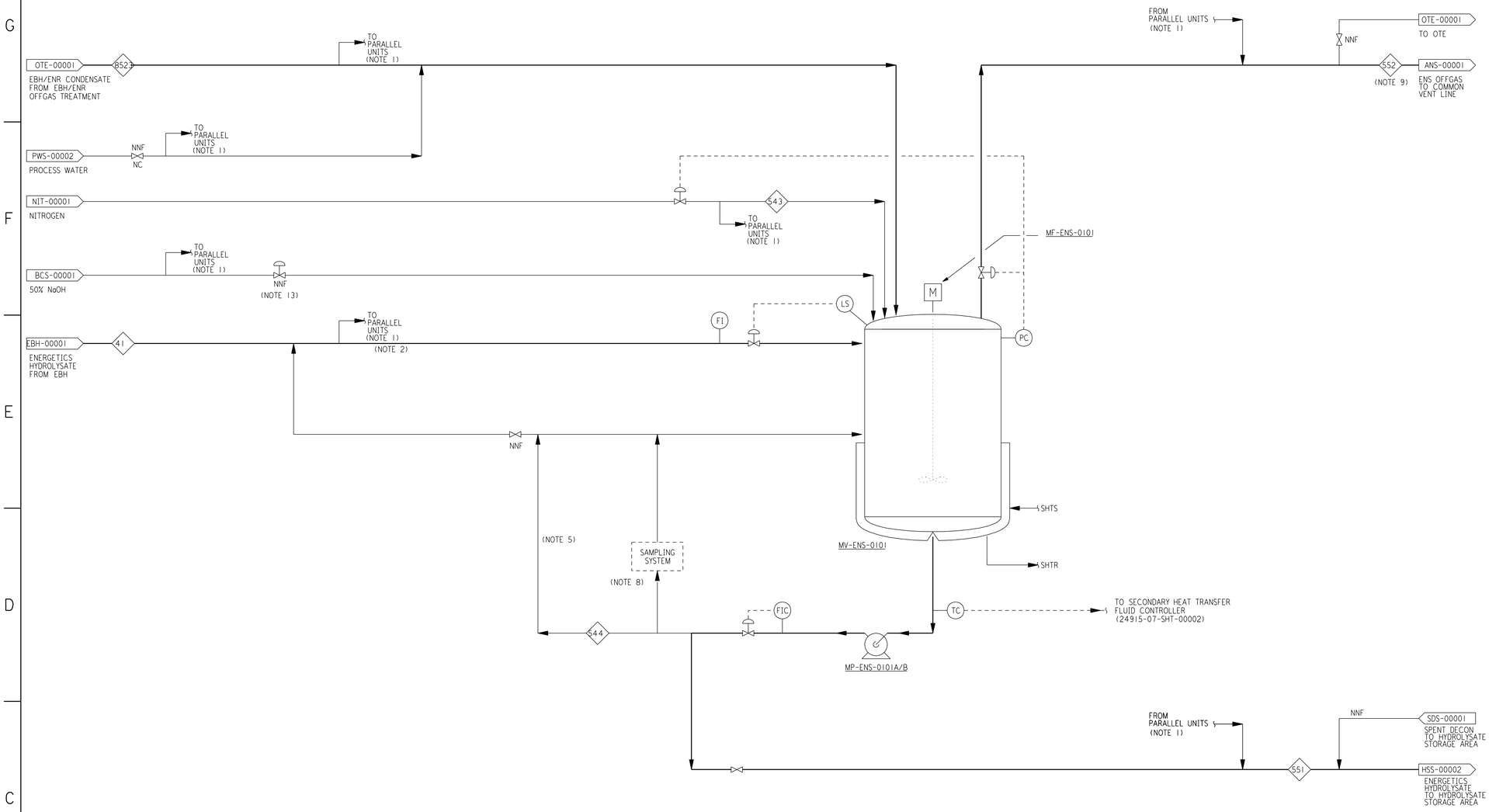
WORKING CAPACITY: 2591 GAL

(NOTES 1, 4)

MP-ENS-0101A/B
MP-ENS-0102A/B
MP-ENS-0103A/B
ENERGETICS NEUTRALIZATION REACTOR
RECIRCULATION PUMP & SPARE

100 GPM

(NOTE 1)



NOTES:

1. THERE ARE A TOTAL OF THREE ENERGETICS NEUTRALIZATION REACTORS AND ANCILLARY EQUIPMENT. ONLY ONE ENR IS FILLING AT A TIME OR ONLY ONE ENR IS DRAINING AT A TIME.
2. DO NOT POCKET.
3. DELETED
4. CROSS CONNECT REACTORS TO TRANSFER CONTENTS.
5. REACTOR CIRCULATION LOOP TO BE DRAINED AND FLUSHED UPON COMPLETION OF A BATCH CYCLE. ENERGETICS HYDROLYSATE IS NOT TO BE BLOCKED IN PIPED SECTIONS.
6. DELETED
7. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
8. SAMPLING SYSTEM IS LOCATED IN THE GLOVE BOX. LOCAL SAMPLE CONNECTION IS ALSO PROVIDED TO BE USED AS AND IF REQUIRED.
9. FOR MASS BALANCE PURPOSES, THE ENS OFFGAS TO THE OTM COMMON VENT HEADER IS CALCULATED BASED ON ONE REACTOR PURGING AND ONE REACTOR FILLING.
10. BATCH SEQUENCING:

GB BATCH CYCLE

STEP	ACTIVITY	DURATION HR:MIN
1	FILL WITH ENERGETICS HYDROLYSATE FROM EBH UNITS AND CONDENSATE FROM EBH/ENS OTS, WHILE HEATING THE MIXTURE TO 240 °F.	7:12
2	NITROGEN PURGING (15 MIN), AGITATION AND RECIRCULATION OF THE HYDROLYSATE WHILE MAINTAINING AT 240°F	1:00
3	SAMPLE AND HOLD FOR LABORATORY CONFIRMATION WHILE MAINTAINING AT 240°F	6:00
4	COOL REACTOR CONTENTS TO 140°F.	1:15
5	TRANSFER REACTOR CONTENTS TO THE ENERGETICS HYDROLYSATE STORAGE TANK	0:30
6	STANDBY OR ADDITIONAL REACTION IF REQUIRED	5:39
	TOTAL BATCH TIME	21:36

VX BATCH CYCLE

STEP	ACTIVITY	DURATION HR:MIN
1	FILL WITH ENERGETICS HYDROLYSATE FROM EBH UNITS AND CONDENSATE FROM EBH/ENS OTS, WHILE HEATING THE MIXTURE TO 240 °F.	6:00
2	NITROGEN PURGING (15 MIN), AGITATION AND RECIRCULATION OF THE HYDROLYSATE WHILE MAINTAINING AT 240°F	1:00
3	SAMPLE AND HOLD FOR LABORATORY CONFIRMATION WHILE MAINTAINING AT 240°F	6:00
4	COOL REACTOR CONTENTS TO 140°F.	1:15
5	TRANSFER REACTOR CONTENTS TO THE ENERGETICS HYDROLYSATE STORAGE TANK	0:30
6	STANDBY OR ADDITIONAL REACTION IF REQUIRED	3:15
	TOTAL BATCH TIME	18:00

H BATCH CYCLE

STEP	ACTIVITY	DURATION HR:MIN
1	FILL WITH ENERGETICS HYDROLYSATE FROM EBH UNITS AND CONDENSATE FROM EBH/ENS OTS, WHILE HEATING THE MIXTURE TO 240 °F.	20:00
2	NITROGEN PURGING (15 MIN), AGITATION AND RECIRCULATION OF THE HYDROLYSATE WHILE MAINTAINING AT 240°F	1:00
3	SAMPLE AND HOLD FOR LABORATORY CONFIRMATION WHILE MAINTAINING AT 240°F	6:00
4	COOL REACTOR CONTENTS TO 140°F.	1:15
5	TRANSFER REACTOR CONTENTS TO THE ENERGETICS HYDROLYSATE STORAGE TANK	0:30
6	STANDBY OR ADDITIONAL REACTION IF REQUIRED	11:15 *
	TOTAL BATCH TIME	40:00

* ONLY TWO REACTORS ARE USED DURING THE H CAMPAIGN.

11. DELETED
12. DELETED
13. 50% NaOH IS ADDED IN THE EVENT OF TWO POSITIVE TEST RESULTS FOR AGENT OR ENERGETICS FROM THE SAMPLING SYSTEM.
14. EQUIPMENT SIZING DATA FOR DESIGN SHOWN ON THIS SHEET IS BASED ON REV. 4, SHEET 2 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. (△6 1)

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
△6 1	4/19/06	ISSUED FOR DESIGN (IFD) ADD NOTE 14	NI	JH	SH	JB	BB
△5 2	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	NI	JH	SH	JB	BB
△4	8/12/05	ISSUED FOR DESIGN (IFD)	NI	JH	SH	JB	JU
△3	7/12/05	ISSUED FOR APPROVAL (IFA) DC-43B	NI	FJ	SH	JB	JU
△2	5/18/05	ISSUED FOR APPROVAL (IFA)	NI	FJ	SH	JB	JU
△1	11/3/04	ISSUED FOR DESIGN (IFD)	GD	WW	SH	JB	JU
△0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	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 ENERGETICS NEUTRALIZATION PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-ENS-00001 | SHEET 1 OF 4 | REV 6

PROFESSIONAL STAMP

2 07-M5-ENS-1-1.PFZ

BGCAPP_E2.BDR

DESIGN FILE: s:\24\gr\07-m5-ens-1-1.plt
PLOTTED BY: 51439 ON 4/21/2006 AT 8:08:13 AM

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-ENS-00001

NOTES:

ENERGETICS NEUTRALIZATION REACTOR
CASE: AGENT GB PROCESSING PEAK THROUGHPUT

STREAM NUMBER	41	543	544	551	552	8523
Description	Energetic Hydrolysate To ENR From EBH Train	N2 Sweep To ENR	ENR Recirculation Pump Discharge	Total ENR Energetic Hydrolysate To Storage Tanks	ENR Off Gas To MPT Offgas Treatment	OTE Condensate Return From OTE
Temperature, °F	235	77	240	140	240	101
Pressure, PSIA	67.23	40.00	75.00	75.00	40.00	95.00
Instantaneous Volume Flow, GPM (ACFM)	40	(14.0)	100	100	(34.5)	0.94
Density, LB/FT^3	67.42	0.195	65.51	80.57	0.124	65.72
Viscosity, CP	12.62	0.018	7.84	16.35	0.019	0.67
MW		28.01			23.22	
Enthalpy, MMBTU/HR	-15.493	-0.00004	-325.838	-19.193	-0.484	-3.218
Component Flows, LB/HR						
TNT	3.0E-03					
RDX	1.0E-03					9.3E-02
O2			5.9E-06	3.4E-07	1.9E-03	1.9E-03
N2		163.61	3.2E-01	1.9E-02	163.59	3.3E-03
H2			4.9E-09	2.9E-10	1.5E-06	1.5E-06
NH3	9.5E-02		40.98	2.38	10.023	2.8E-05
N2O	3.3E-02		7.6E-02	4.4E-03	3.0E-02	1.1E-03
H2O	1691.2		35461	2063.0	84.19	446.40
NAOH	468.00		7612.5	442.86		
H2SO4						1.9E-02
NA2SO4			882.07	51.31		
NANO2	25.14		432.18	25.14		
NANO3			1.40	8.1E-02		
(NH4)2SO4			4.6E-03	2.7E-04		47.60
NH4HSO4						1.0E-01
AL(OH)3			129.22	7.52		
SODIUM FORMATE	72.13		1241.5	72.22		
SODIUM ACETATE	9.07		155.94	9.07		
NAALO2	391.30		6590.3	383.39		
TOTAL PEAK THROUGHPUT, LB/HR	2657.0	163.6	52548	3057.0	257.8	494.2
TOTAL AVERAGE THROUGHPUT, LB/HR	1299.8	163.6	52548	1673.5	265.8	476.0

△6 1

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
△6	6/7/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	NI	JH	SH	JB	BB
△5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	NI	JH	SH	JB	BB
△4	8/12/05	ISSUED FOR DESIGN (IFD)	NI	JH	SH	JB	JU
△3	7/12/05	ISSUED FOR APPROVAL (IFA) DC-43B	NI	FJ	SH	JB	JU
△2	5/18/05	ISSUED FOR APPROVAL (IFA)	NI	FJ	SH	JB	JU
△1	11/3/04	ISSUED FOR DESIGN (IFD)	GO	WW	SH	JB	JU
△0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	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 ENERGETICS NEUTRALIZATION PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M5-ENS-00001 | SHEET 2 OF 4 | REV 6

DESIGN FILE: s:\24\pr\07-m5-ens-1-2.pfz
PLOTTED BY: 514.39 ON 6/21/2006 AT 3:12:30 PM

2 07-M5-ENS-1-2.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-ENS-00001

NOTES:

ENERGETICS NEUTRALIZATION REACTOR
CASE: AGENT VX PROCESSING PEAK THROUGHPUT

STREAM NUMBER	41	543	544	551	552	8523
Description	Energetic Hydrolysate To ENR From EBH Train	N2 Sweep To ENR	ENR Recirculation Pump Discharge	Total ENR Energetic Hydrolysate To Storage Tanks	ENR Off Gas To MPT Offgas Treatment	OTE Condensate Return From OTE
Temperature, °F	235	77	240	140	240	101
Pressure, PSIA	67.23	40.00	75.00	75.00	40.00	95.00
Instantaneous Volume Flow, GPM (ACFM)	40	(15.0)	100	100	(36.8)	0.91
Density, LB/FT^3	67.42	0.195	65.67	81.36	0.125	66.63
Viscosity, CP	12.62	0.018	8.44	17.67	0.019	0.67
MW		28.01			23.25	
Enthalpy, MMBTU/HR	-18.551	-0.00005	-325.905	-22.338	-0.507	-3.117
Component Flows, LB/HR						
TNT	3.0E-03					
RDX	2.0E-03					1.1E-01
O2			4.9E-06	3.3E-07	1.7E-03	1.7E-03
N2		175.29	3.2E-01	2.2E-02	175.27	3.0E-03
H2			4.9E-09	3.3E-10	1.6E-06	1.6E-06
NH3	1.3E-01		44.46	3.01	11.89	2.4E-05
N2O	4.6E-02		9.7E-02	6.5E-03	4.1E-02	1.2E-03
H2O	2024.6		35081	2374.9	87.82	426.31
NAOH	560.08		7821.7	529.51		
H2SO4						2.4E-02
NA2SO4			909.20	61.55		
NANO2	30.17		445.67	30.17		
NANO3			1.44	9.8E-02		
(NH4)2SO4			4.6E-03	3.1E-04		57.08
NH4HSO4						1.3E-01
AL(OH)3			121.09	8.20		
SODIUM FORMATE	86.55		1280.2	86.67		
SODIUM ACETATE	10.89		160.80	10.89		
NAALO2	469.55		6808.8	460.94		
TOTAL PEAK THROUGHPUT, LB/HR	3182.8	175.3	52674	3565.8	275.0	483.7
TOTAL AVERAGE THROUGHPUT, LB/HR	1515.6	175.3	52674	1884.0	280.7	473.8

△6 1

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
△6	6/7/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	NI	JH	SH	JB	BB
△5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	NI	JH	SH	JB	BB
△4	8/12/05	ISSUED FOR DESIGN (IFD)	NI	JH	SH	JB	JU
△3	7/12/05	ISSUED FOR APPROVAL (IFA) DC-43B	NI	FJ	SH	JB	JU
△2	5/18/05	ISSUED FOR APPROVAL (IFA)	NI	FJ	SH	JB	JU
△1	11/3/04	ISSUED FOR DESIGN (IFD)	GO	WW	SH	JB	JU
△0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	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

MUNITIONS DEMILITARIZATION BUILDING ENERGETICS NEUTRALIZATION PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M5-ENS-00001 | SHEET 3 OF 4 | REV 6

07-M5-ENS-1-3.PFZ

BGCAPP_E2.BDR

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MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-ENS-00001

ENERGETICS NEUTRALIZATION REACTOR
CASE: AGENT H PROCESSING PEAK THROUGHPUT

STREAM NUMBER	41	543	544	551	552	8523
Description	Energetic Hydrolysate To ENR From EBH Train	N2 Sweep To ENR	ENR Recirculation Pump Discharge	Total ENR Energetic Hydrolysate To Storage Tanks	ENR Off Gas To MPT Offgas Treatment	OTE Condensate Return From OTE
Temperature, °F	222	77	240	140	240	101
Pressure, PSIA	67.23	40.00	75.00	75.00	40.00	95.00
Instantaneous Volume Flow, GPM (ACFM)	40	(14.0)	100	100	(39.9)	0.57
Density, LB/FT^3	69.95	0.195	64.84	77.50	0.121	62.87
Viscosity, CP	13.45	0.018	5.77	11.80	0.019	0.67
MW		28.01			22.55	
Enthalpy, MMBTU/HR	-5.218	-0.00004	-331.579	-6.314	-0.708	-1.922
Component Flows, LB/HR						
TNT						
RDX						
O2			5.3E-06	9.9E-08	1.4E-03	1.4E-03
N2		163.61	3.8E-01	7.1E-03	163.60	2.5E-03
H2					2.8E-08	2.8E-08
NH3	4.0E-03		10.07	1.9E-01	1.60	1.9E-05
N2O						
H2O	666.27		43738	821.80	124.95	278.72
NAOH	124.16		6391.9	120.10		
H2SO4						3.4E-03
NA2SO4			397.06	7.46		
NANO2	4.56		242.53	4.56		
NANO3						
(NH4)2SO4			3.1E-03	5.8E-05		6.92
NH4HSO4						1.1E-02
AL(OH)3			15.02	2.8E-01		
SODIUM FORMATE	17.16		913.2	17.16		
SODIUM ACETATE	1.16		61.52	1.16		
NAALO2	4.74		236.43	4.44		
TOTAL PEAK THROUGHPUT, LB/HR	818.0	163.6	52006	977.2	290.2	285.7
TOTAL AVERAGE THROUGHPUT, LB/HR	501.2	163.6	52006	745.3	320.5	401.1

NOTES:

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	NI	JH	SH	JB	BB
4	8/12/05	ISSUED FOR DESIGN (IFD)	NI	JH	SH	JB	JU
3	7/12/05	ISSUED FOR APPROVAL (IFA) DC-43B	NI	FJ	SH	JB	JU
2	5/18/05	ISSUED FOR APPROVAL (IFA)	NI	FJ	SH	JB	JU
1	11/3/04	ISSUED FOR DESIGN (IFD)	GO	WW	SH	JB	JU
0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	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 ENERGETICS NEUTRALIZATION REACTORS PROCESS FLOW DIAGRAM

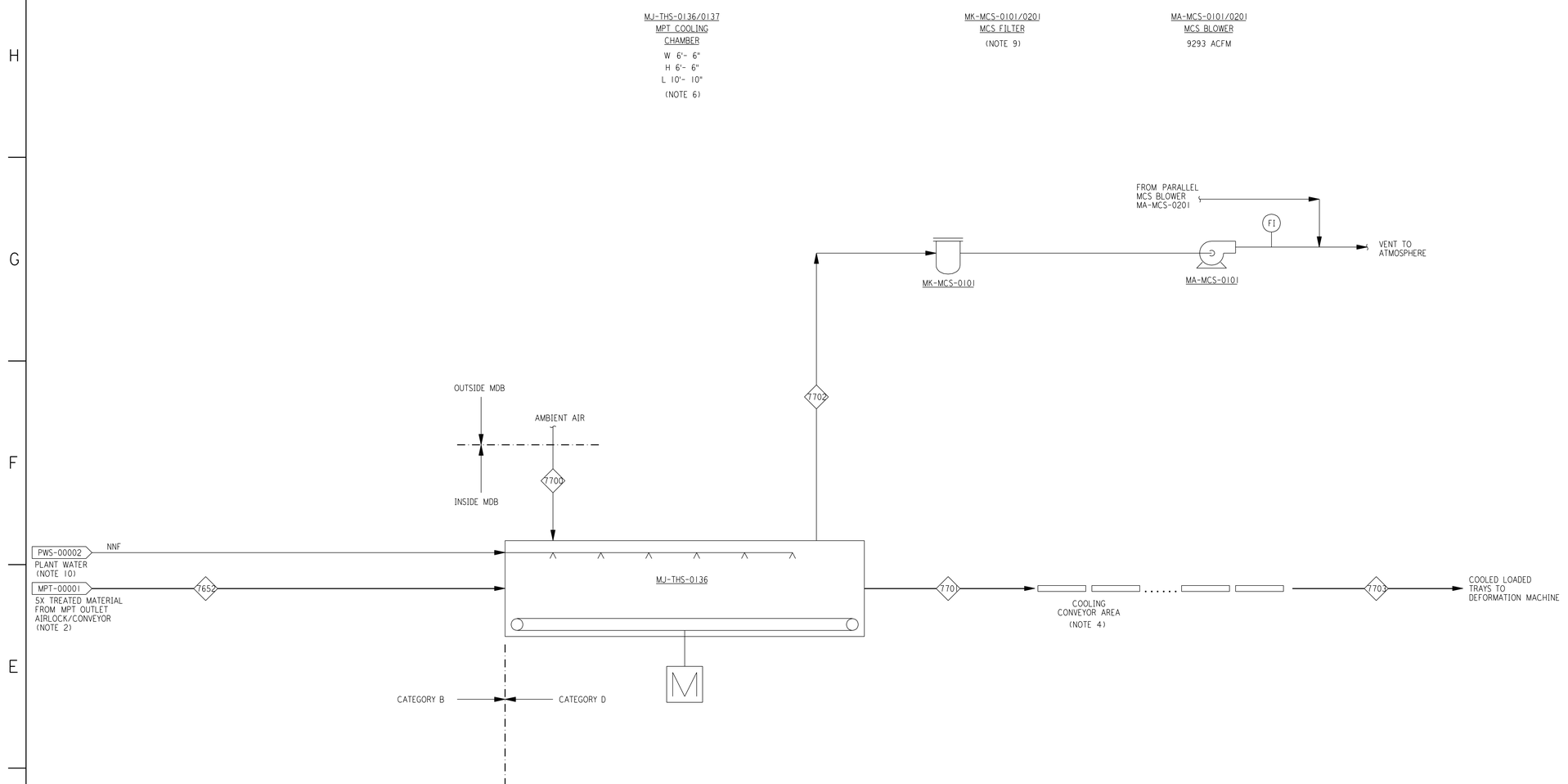
DRAWING NUMBER 24915-07-M5-ENS-00001 | SHEET 4 OF 4 | REV 5

PROFESSIONAL STAMP

DESIGN FILE: s:\2d\pr\07-m5-ens-1-4.pfz
PLOTTED BY: 5143 ON 4/6/2006 AT 2:55:08 PM

07-M5-ENS-1-4.PFZ

BGCAPP_E2.BDR



NOTES:

1. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
2. MPT COOLING CHAMBER SHALL BE INSTALLED ADJACENT TO THE MPT OUTLET AIRLOCK/CONVEYOR.
3. MPT OUTLET AIRLOCK/CONVEYOR WILL BE PURGED WITH NITROGEN FOR 40 MINUTES FOR MONITORING PURPOSES PRIOR TO COOLING IN THE CHAMBER WITH AIR FOR 55 MINUTES.
4. COOLING CONVEYOR AREA WILL INCLUDE SPACE FOR 8 MUNITION TRAYS (EQUIVALENT TO 8 HOURS) OR 6 SECONDARY WASTE TRAYS (EQUIVALENT TO 6 HOURS).
5. COOLING AIR REQUIREMENTS ARE BASED ON 24915-07-30R-M01-00005, "COOLING MUNITIONS AND SECONDARY WASTE TRAYS LEAVING MPT".
6. MPT COOLING CHAMBER SIZE IS APPROXIMATED.
7. TEMPERATURES SHOWN ARE THE AVERAGE TEMPERATURES AS DETERMINED BY 24915-07-30R-M01-00005,"COOLING MUNITIONS AND SECONDARY WASTE TRAYS LEAVING MPT".
8. AMBIENT AIR TEMPERATURE. STREAM 7700 TEMPERATURE IS THAT USED IN 24915-07-30R-M01-00005,"COOLING MUNITIONS AND SECONDARY WASTE TRAYS LEAVING MPT".
9. PARTICULATE FILTER.
10. WATER SPRAY NOZZLES INSIDE COOLING CHAMBER TO BE USED DURING SECONDARY WASTE PROCESSING, IF REQUIRED. WATER IS NORMALLY NO FLOW.

CASE: AGENT GB, INSTANTANEOUS CASE

STREAM NUMBER	7652	7700	7701	7702	7703
	5X Metal Parts to MPT Cooling Chamber	Ambient Air to MPT Cooling Chamber	5X Metal Parts to Cooling Conveyor	Hot Air to Atmosphere	5X Metal Parts to Demolition Machine
TEMPERATURE, °F	889 (NOTE 7)	77 (NOTE 8)	416 (NOTE 7)	100 (NOTE 7)	<130
PRESSURE, PSIA	14.23	14.23	14.23	14.23	14.23
INSTANTANEOUS FLOW, GPM (ACFM)		(8692)		(9293)	
DENSITY, LB/FT3		0.0709		0.0663	
VISCOSITY, CP		0.018		0.019	
MW		28.67		28.67	
COMPONENT INSTANTANEOUS FLOW, LB/HR					
N2		28,112		28,112	
O2		8,479.6		8,479.6	
H2O		374.90		374.90	
METAL	2,629.4		2,629.4		2,629.4
TOTAL INSTANTANEOUS FLOW, LB/HR	2,629.4	36,967	2,629.4	36,967	2,629.4
TOTAL AVERAGE THROUGHPUT, LB/HR	1,315.6	36,967	1,315.6	36,967	1,315.6

CASE: AGENT VX, INSTANTANEOUS CASE

STREAM NUMBER	7652	7700	7701	7702	7703
	5X Metal Parts to MPT Cooling Chamber	Ambient Air to MPT Cooling Chamber	5X Metal Parts to Cooling Conveyor	Hot Air to Atmosphere	5X Metal Parts to Demolition Machine
TEMPERATURE, °F	920 (NOTE 7)	77 (NOTE 8)	412 (NOTE 7)	114 (NOTE 7)	<130
PRESSURE, PSIA	14.23	14.23	14.23	14.23	14.23
INSTANTANEOUS FLOW, GPM (ACFM)		(8692)		(9293)	
DENSITY, LB/FT3		0.0709		0.0663	
VISCOSITY, CP		0.018		0.019	
MW		28.67		28.67	
COMPONENT INSTANTANEOUS FLOW, LB/HR					
N2		28,112		28,112	
O2		8,479.6		8,479.6	
H2O		374.90		374.90	
METAL	3,626.5		3,626.5		3,626.5
ALUMINUM	4.4E-04		4.4E-04		4.4E-04
NICKEL	3.2E-06		3.2E-06		3.2E-06
COPPER	1.4E-04		1.4E-04		1.4E-04
CALCIUM	3.7E-02		3.7E-02		3.7E-02
SILICON	3.0E-02		3.0E-02		3.0E-02
OTHER METALS	8.9E-05		8.9E-05		8.9E-05
TOTAL INSTANTANEOUS FLOW, LB/HR	3,626.5	36,967	3,626.5	36,967	3,626.5
TOTAL AVERAGE THROUGHPUT, LB/HR	800.76	36,967	800.76	36,967	800.76

CASE: AGENT H, INSTANTANEOUS CASE

STREAM NUMBER	7652	7700	7701	7702	7703
	5X Metal Parts to MPT Cooling Chamber	Ambient Air to MPT Cooling Chamber	5X Metal Parts to Cooling Conveyor	Hot Air to Atmosphere	5X Metal Parts to Demolition Machine
TEMPERATURE, °F	920 (NOTE 7)	77 (NOTE 8)	412 (NOTE 7)	114 (NOTE 7)	<130
PRESSURE, PSIA	14.23	14.23	14.23	14.23	14.23
INSTANTANEOUS FLOW, GPM (ACFM)		(8692)		(9293)	
DENSITY, LB/FT3		0.0709		0.0663	
VISCOSITY, CP		0.018		0.019	
MW		28.67		28.67	
COMPONENT INSTANTANEOUS FLOW, LB/HR					
N2		28,112		28,112	
O2		8,479.6		8,479.6	
H2O		374.90		374.90	
METAL	3,323.0		3,323.0		3,323.0
MANGANESE	1.6E-01		1.6E-01		1.6E-01
SILICON	2.7E-02		2.7E-02		2.7E-02
TITANIUM	5.1E-02		5.1E-02		5.1E-02
TOTAL INSTANTANEOUS FLOW, LB/HR	3,323.3	36,967	3,323.3	36,967	3,323.3
TOTAL AVERAGE THROUGHPUT, LB/HR	1,085.3	36,967	1,085.3	36,967	1,085.3

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
0	2/6/06	ISSUED FOR DESIGN (IFD)	FJ	JH	SH	JB	BB

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 COOLING SYSTEM PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-MCS-00001 | SHEET 1 OF 1 | REV 0

PROFESSIONAL STAMP

DESIGN FILE: S:\2D\pr\07-M5-MCS-1-1.pfz
PLOTTED BY: 51439 ON 2/9/2006 AT 8:25:10 AM

07-M5-MCS-1-1.PFZ BGCAPP_E2.BDR

MJ-THS-0114/0115
MPT INLET AIRLOCK/CONVEYOR
W 6'-6"
H 6'-6"
L 10'-10"

MJ-THS-0116/0117
MPT OUTLET AIRLOCK/CONVEYOR
W 6'-6"
H 6'-6"
L 10'-10"

ME-MPT-0101/0201
METAL PARTS TREATER
6'-4" ID X 17'-2" L
(NOTES 1,2,15)

ME-MPT-0105/0205
MPT STEAM SUPERHEATER
212 MBTU/HR
(RESISTANCE)
(NOTES 7,11)

MV-MPT-0103
NITROGEN
ACCUMULATOR
VESSEL
5'-0" ID X 13'-0" T-T
5 1

ANS-00001
AGENT HYDROLYZERS AND MV-SDS-0201/0301 VENT GAS
453 (NOTE 19)

ANS-00001
VENT GASES FROM AGENT HOLDING TANK, AGENT HYDROLYSATE SAMPLING TANK, ENS REACTOR, AND SPENT DECON HOLDING TANKS MV-SDS-0101/0201
(NOTE 19)

765 (NOTE 19) → OTM-00001 TO MPT OFFGAS TREATMENT

765 (NOTE 19)
763 (NOTE 8)
765A
765B
M
AI O_2
AI AGENT
RF GENERATOR
RF GENERATOR
ELECTRICAL POWER CABINET
ELECTRICAL POWER CABINET
AI O_2
AI H_2O
AI AGENT
FROM MPT DEMIN. COOLING WATER SYSTEM
764 (NOTE 14)
TO OTHER USERS
AI O_2
TIC
TIC
PIC
PIC
PIC

EBH-00001
SOLIDS RESIDUE FROM EBH

MWS-00001
TRAYS LOADED WITH MUNITIONS BODIES
204

RHS-00001
CONTAMINATED WOOD PALLETS/SHIPPING AND FIRING TUBES AND SECONDARY WASTE

MJ-THS-0114
ME-MPT-0101
MJ-THS-0116
765 → MCS-00001 5X TREATED MATERIAL TO COOLING CHAMBER
(NOTE 16)
(NOTE 17)
M STOP
FI
FI
N_2
MV-MPT-0103
763 (NOTE 18)
(NOTE 3)
FROM OTHER USERS
TO MPT DEMIN. COOLING WATER SYSTEM
764 (NOTE 14)
PURGE ONLY
M
763 (NOTE 18)
TO ME-MPT-0201
OTM-00001 HIGH MPT BULK OXIDIZER EFFLUENT TEMPERATURE SIGNAL

763
M
STEAM
(NOTE 9)
E
ME-MPT-0105
NNF
(NOTE 10)
TIC
TO ME-MPT-0201

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 MPTS. 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. MPT DEMINERALIZED COOLING WATER IS SUPPLIED TO COOL THE MPT COILS, DOORS, POWER SUPPLY PANEL, LOAD MATCHING PANEL, AND BUS BAR.
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 585.56 LB/HR
    20 MIN TO CREATE AN INERT ATMOSPHERE: FLOW REQUIRED IS 183.24 LB/HR
19. VENT LINES TO BULK OXIDIZER TO BE HEAT TRACED.
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. (5 2)

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5	4/19/06	ISSUED FOR DESIGN (IFD) ADD NOTE 20	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
2	5/11/05	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JB	JU
1	10/21/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	BC	WW	SH	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 METAL PARTS TREATMENT PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-MPT-00001
SHEET 1 OF 4
REV 5

PROFESSIONAL STAMP

DESIGN FILE: s:\2d\pr\07-m5-mpt-1-1.plz
PLOTTED BY: 51439 ON 4/21/2006 AT 8:08:13 AM

07-M5-MPT-1-1.PFZ
BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-MPT-00001

METAL PARTS TREATMENT
CASE: AGENT GB, INSTANTANEOUS CASE

STREAM NUMBER	204	453	7630	7631	7633	7637	7640	7641	7652	7653	7655	7656	7657
	Munitions Bodies	Agent Hydrolyzers and SDS (MV-SDS-0301)	MPT Nitrogen Purge	MPT Effluent Gas	Nitrogen to Air Lock/ Conveyor	Superheated Steam To MPT	Demin Cooling Water Supply To MPT	Demin Cooling Water Return From MPT	5X Metal Parts to Residue Handling	N2 Purge from MPT Airlocks	Combined Feed to Bulk Oxidizer Unit	MPT Outlet Airlock/Convey or N2 Purge	MPT Inlet Airlock/Convey or N2 Purge
TEMPERATURE, °F	80	157	NNF	1100	100	1000	95	106	1100	467	678	550	200
PRESSURE, PSIA	14.23	14.00		14.23	14.23	64.23	63.77	15.23	14.23	14.23	14.00	14.23	14.23
INSTANTANEOUS FLOW, GPM (ACFM)		(44)		(545)	(193)	(56)	292	292		(320)	(1122)	(265)	(54)
DENSITY, LB/FT3		0.0540		0.0153	0.0664	0.0741	62.07	61.92		0.0401	0.0273	0.0368	0.0563
VISCOSITY, CP		0.019		0.034	0.018	0.030	0.72	0.64		0.026	0.030	0.028	0.021
MW		25.49		18.04	28.01	18.02				28.01	23.59	28.01	28.01
COMPONENT INSTANTANEOUS FLOW, LB/HR													
GB	202.21										1.9E-01		
TBA	6.76	8.3E-04									8.3E-04		
MF				1.1E-06							1.1E-06		
DIPU		3.8E-04									3.8E-04		
IPA	1.19	1.8E-01									1.8E-01		
N2		117.02			768.80					768.80	1,216.62	585.56	183.24
O2											1.9E-03		
H2				24.63							24.63		
CO2				122.15							122.15		
CO				70.12							70.12		
CH4				44.47							44.47		
C2H6				9.3E-04							9.3E-04		
NH3				6.2E-01							10.64		
HCN				1.2E-03							1.2E-03		
SO2				2.56							2.56		
H2O		25.68		93.55		250.00	145,226	145,226			203.42		
HCL				1.9E-01							1.9E-01		
HF	5.5E-01			29.43							29.43		
P2O5				114.27							114.27		
METAL	2,624.3								2,624.3				
N2O											3.0E-02		
DIPU	4.43												
OTHER ORGANICS	6.98	3.3E-04									3.3E-04		
CHLOROFORM	1.7E-01	6.6E-03									6.6E-03		
C3H7F	7.4E-02	5.9E-03									5.9E-03		
DIMP	28.27												
IMPA	1.35												
TOTAL INSTANTANEOUS FLOW, LB/HR	2,876.3	142.89		502.00	768.80	250.00	145,226	145,226	2,624.3	768.80	1,838.9	585.56	183.24
TOTAL AVERAGE THROUGHPUT, LB/HR	1,314.3	142.89		252.18	768.80	250.00	145,226	145,226	1,315.6	768.80	1,597.1	585.56	183.24

5 1

NOTES:

1. THE MASS AND ENERGY BALANCES ARE BASED ON 2% HEEL FOR EQUIPMENT SIZING PURPOSES. NO HEEL (0%) IS NOT A CONTROLLING CASE FOR THE OTM DESIGN.
2. THE INSTANTANEOUS FLOW WAS DETERMINED BY THE EVAPORATION RATE OF THE OTM DESIGN.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5	7/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	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
2	5/11/05	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JB	JU
1	10/28/04	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	WW	JW	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	BC	WW	SH	JB	JU

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 METAL PARTS TREATMENT PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-MPT-00001 | SHEET 2 OF 4 | REV 5

PROFESSIONAL STAMP

DESIGN FILE: s:\2D\pr\07-M5-MPT-1-2.pfz ON 7/24/2006 AT 11:05:46 AM
PLOTTED BY: 51439

2 07-M5-MPT-1-2.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-MPT-00001
METAL PARTS TREATMENT
CASE: AGENT VX, INSTANTANEOUS CASE

STREAM NUMBER	204	453	7630	7631	7633	7637	7640	7641	7652	7653	7655	7656	7657
	Munitions Bodies	Agent Hydrolyzers and SDS (MV-SDS-0301)	MPT Nitrogen Purge	MPT Effluent Gas	Nitrogen to Air Lock/ Conveyor	Superheated Steam To MPT	Demin Cooling Water Supply To MPT	Demin Cooling Water Return From MPT	5X Metal Parts to Residue Handling	N2 Purge from MPT Airlocks	Combined Feed to Bulk Oxidizer Unit	MPT Outlet Airlock/Convey or N2 Purge	MPT Inlet Airlock/Convey or N2 Purge
TEMPERATURE, °F	80	183	NNF	1100	100	1000	95	106	1100	467	668	550	200
PRESSURE, PSIA	14.23	14.00		14.23	14.23	64.23	63.77	15.23	14.23	14.23	14.00	14.23	14.23
INSTANTANEOUS FLOW, GPM (ACFM)		(85)		(548)	(193)	(56)	292	292		(320)	(1118)	(265)	(54)
DENSITY, LB/FT3		0.0550		0.0148	0.0664	0.0741	62.07	61.93		0.0401	0.0270	0.0368	0.0563
VISCOSITY, CP		0.019		0.049	0.018	0.030	0.72	0.64		0.026	0.035	0.028	0.021
MW		27.09		17.35	28.01	18.02				28.01	23.33	28.01	28.01
COMPONENT INSTANTANEOUS FLOW, LB/HR													
VX	217.86										2.5E-05		
DICDI	7.0E-01	1.3E-01									1.3E-01		
PYRO	3.53												
R-SH	1.65												
DIPU	7.0E-02	1.2E-03									1.2E-03		
ETHANOL		12.29									12.29		
N2		237.53			768.80					768.80	1,184.5	585.56	183.24
O2											1.7E-03		
H2				23.56							23.56		
CO2				133.80							133.80		
CO				88.60							88.60		
NH3				14.29							26.18		
HCN				4.2E-02							4.2E-02		
H2S				27.88							27.88		
COS				4.2E-01							4.2E-01		
CH4				58.75							58.75		
C2H6				1.7E-03							1.7E-03		
H2O		27.99		77.56		250.00	145,226	145,226			193.36		
P2O5				60.01							60.01		
METAL	3620.0								3,620.0				
N2O											4.1E-02		
DIPA	3.8E-01	1.29									1.29		
DCCDI	3.76	9.3E-03									9.3E-03		
RSSR	1.65										1.2E-01		
RSNA		1.2E-01											
ORGANICS	5.33	9.6E-05									9.6E-05		
ALUMINUM	4.4E-04								4.4E-04				
NICKEL	3.2E-06								3.2E-06				
COPPER	1.4E-04								1.4E-04				
CALCIUM	3.7E-02								3.7E-02				
SILICON	3.0E-02								3.0E-02				
OTHER METALS	8.9E-05								8.9E-05				
TOTAL INSTANTANEOUS FLOW, LB/HR	3,855.0	279.35		484.93	768.80	250.00	145,226	145,226	3,620.1	768.80	1,811.0	585.56	183.24
TOTAL AVERAGE THROUGHPUT, LB/HR	724.96	279.35		250.96	768.80	250.00	145,226	145,226	728.36	768.80	1,582.6	585.56	183.24

NOTES:

1. THE MASS AND ENERGY BALANCES ARE BASED ON 2% HEEL FOR EQUIPMENT SIZING PURPOSES. NO HEEL (0%) IS NOT A CONTROLLING CASE FOR THE OTM DESIGN.
2. THE INSTANTANEOUS FLOW WAS DETERMINED BY THE EVAPORATION RATE OF THE OTM DESIGN.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5	7/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	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
2	5/11/05	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JB	JU
1	10/28/04	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	WW	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	BC	WW	SH	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 METAL PARTS TREATMENT PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-MPT-00001 | SHEET 3 OF 4 | REV 5

PROFESSIONAL STAMP

DESIGN FILE: s:\2d\pr\07-m5-mpt-1-3.pfz ON 7/24/2006 AT 11:05:46 AM
PLOTTED BY: SH439

07-M5-MPT-1-3.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-MPT-00001

METAL PARTS TREATMENT
CASE: AGENT H, INSTANTANEOUS CASE

STREAM NUMBER	204	453	7630	7631	7633	7637	7640	7641	7652	7653	7655	7656	7657
	Munitions Bodies	Agent Hydrolyzers and SDS (MV-SDS-0301)	MPT Nitrogen Purge	MPT Effluent Gas	Nitrogen to Air Lock/ Conveyor	Superheated Steam To MPT	Demin Cooling Water Supply To MPT	Demin Cooling Water Return From MPT	5X Metal Parts to Residue Handling	N2 Purge from MPT Airlocks	Combined Feed to Bulk Oxidizer Unit	MPT Outlet Airlock/Convey or N2 Purge	MPT Inlet Airlock/Convey or N2 Purge
TEMPERATURE, °F	80	190	NNF	1100	100	1000	75	89	1100	522	595	621	200
PRESSURE, PSIA	14.23	14.00		14.23	14.23	64.23	70.00	60.00	14.23	14.23	14.00	14.23	14.23
INSTANTANEOUS FLOW, GPM (ACFM)		(53)		(408)	(193)	(56)	290	291		(339)	(988)	(284)	(54)
DENSITY, LB/FT3		0.0458		0.0151	0.0664	0.0741	62.28	62.14		0.0378	0.0293	0.0344	0.0563
VISCOSITY, CP		0.018		0.036	0.018	0.030	0.78	0.69		0.028	0.028	0.029	0.021
MW		22.75		17.77	28.01	18.02				28.01	23.69	28.01	28.01
COMPONENT INSTANTANEOUS FLOW, LB/HR													
HD	62.61										2.2E-03		
O	8.85												
DITHIANE	2.03	3.3E-03									3.3E-03		
POLYSULFIDES	1.31	3.1E-03									3.1E-03		
DICHLOROETHANE	9.4E-01												
SULFONIUM IONS	44.26												
O-OH		6.8E-04									6.8E-04		
TDG		1.5E-03									1.5E-03		
EG		5.4E-03									5.4E-03		
N2		84.32			768.80					768.80	1,180.9	585.56	183.24
O2											1.4E-03		
H2				14.16							14.16		
CO2				105.79							105.79		
CO				21.87							21.87		
NH3											1.60		
H2S				34.21							34.21		
COS				2.1E-01							2.1E-01		
SO2				2.8E-07							2.8E-07		
CH4				2.95							2.95		
C2H6				7.1E-06							7.1E-06		
H2O		60.28		149.26		250.00	144,864	144,864			334.49		
HCL				41.55							41.55		
METAL	3,319.8								3,319.8				
MANGANESE	1.6E-01								1.6E-01				
SILICON	2.7E-02								2.7E-02				
TITANIUM	5.1E-02								5.1E-02				
TOTAL INSTANTANEOUS FLOW, LB/HR	3,440.0	144.62		370.00	768.80	250.00	144,864	144,864	3,320.0	768.80	1,737.78	585.56	183.24
TOTAL AVERAGE THROUGHPUT, LB/HR	814.41	144.62		251.74	768.80	250.00	144,864	144,864	814.8	768.80	1,649.88	585.56	183.24

CASE: IDLE; ONE MPT

STREAM NUMBER	204	453	7630	7631	7633	7637	7640	7641	7652	7653	7655	7656	7657
	Munitions Bodies	Agent Hydrolyzers and SDS (MV-SDS-0301)	MPT Nitrogen Purge	MPT Effluent Gas	Nitrogen to Air Lock/ Conveyor	Superheated Steam To MPT	Demin Cooling Water Supply To MPT	Demin Cooling Water Return From MPT	5X Metal Parts to Residue Handling	N2 Purge from MPT Airlocks	Combined Feed to Bulk Oxidizer Unit	MPT Outlet Airlock/Convey or N2 Purge	MPT Inlet Airlock/Convey or N2 Purge
TEMPERATURE, °F	80		NNF	1100	100	1000	75	89		300	761	400	200
PRESSURE, PSIA	14.23			14.23	14.23	64.23	70.00	60.00		14.23	14.23	14.23	14.23
INSTANTANEOUS FLOW, GPM (ACFM)				(272)	(92)	(56)	290	291		(125)	(414)	(71)	(54)
DENSITY, LB/FT3				0.0153	0.0664	0.0741	62.28	62.14		0.0489	0.0248	0.0432	0.0563
VISCOSITY, CP				0.032	0.018	0.030	0.91	0.77		0.023	0.031	0.025	0.021
MW				18.02	28.01	18.02				28.01	22.87	28.01	28.01
COMPONENT INSTANTANEOUS FLOW, LB/HR													
N2					366.47					366.47	366.47	183.24	183.24
H2O				250.00		250.00	144,864	144,864			250.00		
TOTAL INSTANTANEOUS FLOW, LB/HR	0.00	0.00		250.00	366.47	250.00	144,864	144,864	0.00	366.47	616.47	183.24	183.24

NOTES:

1. THE MASS AND ENERGY BALANCES ARE BASED ON 2% HEEL FOR EQUIPMENT SIZING PURPOSES. NO HEEL (0%) IS NOT A CONTROLLING CASE FOR THE OTM DESIGN.
2. THE INSTANTANEOUS FLOW WAS DETERMINED BY THE EVAPORATION RATE OF THE OTM DESIGN.

5 1

5 2

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5	4/4/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	FJ	JH	SH	JB	BB
4	12/16/05	(IFD) MUN. COOLING. LL FROM NECDF. ENS	FJ	JH	SH	JB	PK
3	12/1/05	(IFD) MUN. COOLING. LL FROM NECDF. ENS	FJ	JH	SH	JB	PK
2	5/11/05	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JB	JU
1	10/28/04	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	WW	FJ	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	BC	WW	SH	JB	JU

QUALITY ☒ Q ☐ Non-Q

BECHTEL PARSONS BLUE GRASS
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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 METAL PARTS TREATMENT PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-MPT-00001 | SHEET 4 OF 4 | REV 5

PROFESSIONAL STAMP

DESIGN FILE: s:\2a\pr\07-m5-mpt-1-4.pfz
PLOTTED BY: 5439 ON 4/13/2006 AT 2:48:47 PM

07-M5-MPT-1-4.PFZ

BGCAPP_E2.BDR

MY-NCR-0101
NOSE CLOSURE
REMOVAL SYSTEM

JW-MWS 0101
MWS
WEIGH SCALE

MJ-MWS-0101
MWS PROJECTILE
TRANSFER
ROBOT

MZ-MWS-0101 (VX AND H)
MZ-MWS-0104 (GB)
MWS CAM No.1
(NOTE 7)

MZ-MWS-0102 (VX AND H)
MZ-MWS-0105 (GB)
MWS CAM No.2
(NOTE 7)

MZ-MWS-0103A/B (VX AND H)
MWS CAM No.3
(NOTE 7)

MP-MWS-0102A/B
AGENT WASHOUT
PUMP
CAPACITY: 16 GPM

MP-MWS-0103A/B
DRAINED AGENT
PUMP
CAPACITY: 5.1 GPM

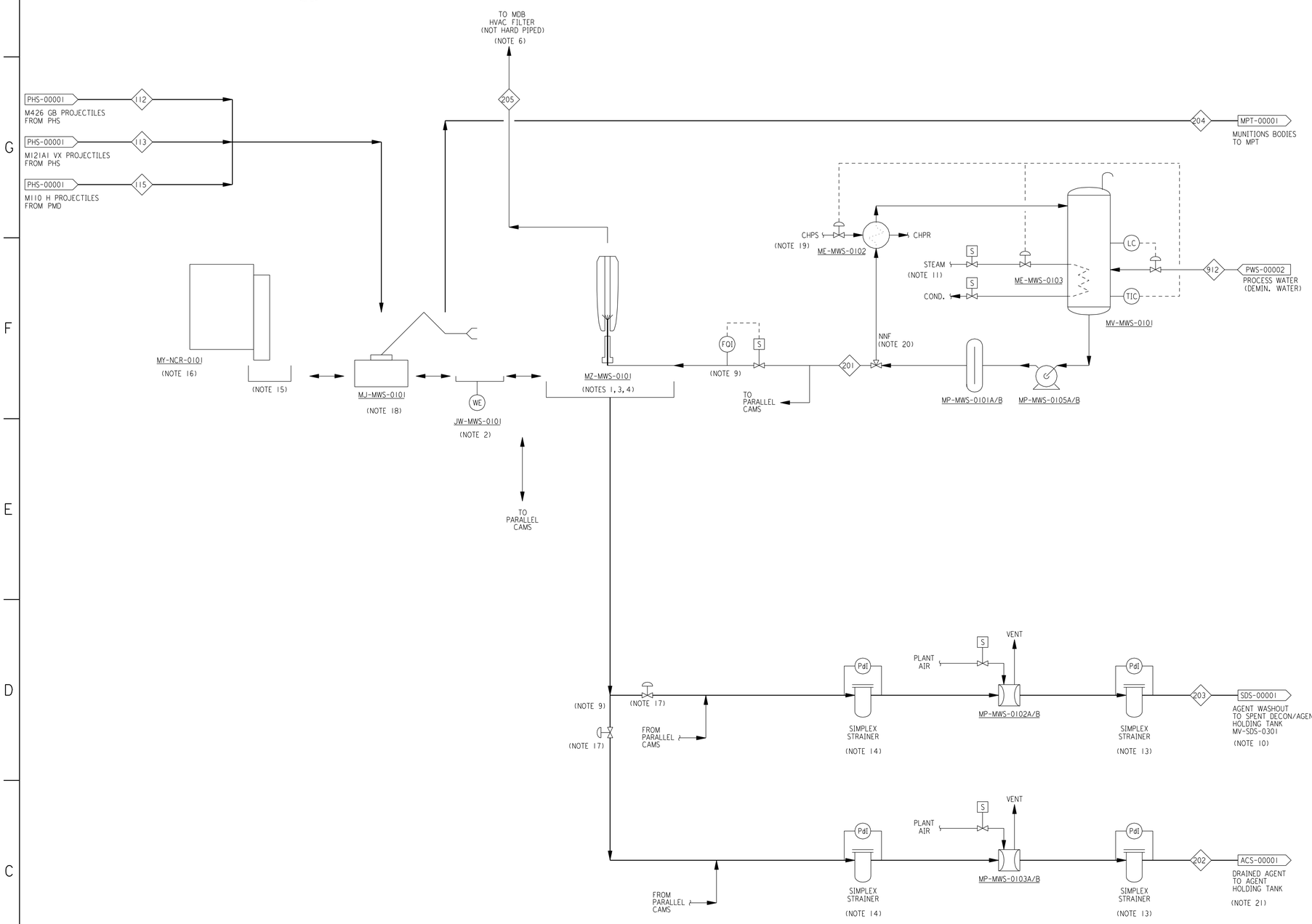
MP-MWS-0101A/B
WATER JET
PUMP & SPARE
CAPACITY: 15 GPM

MV-MWS-0101
WASHOUT WATER
STORAGE TANK
WORKING CAPACITY: 600 GAL

MP-MWS-0105A/B
WASH WATER BOOSTER
PUMP AND SPARE
CAPACITY: 15 GPM

ME-MWS-0103
WASH WATER
HEATER
DUTY: 198 MBTU/HR

ME-MWS-0102
WASH WATER
COOLER
DUTY: 224 MBTU/HR



NOTES:

1. MUNITIONS ARE FLUSHED BY USING HIGH PRESSURE WATER JETS.
2. THE DRAINED AGENT SHALL BE QUANTIFIED BY TAKING THE DIFFERENCE BETWEEN THE MUNITIONS WEIGHT BEFORE AND AFTER AGENT REMOVAL. THE QUANTIFICATION WILL BE ACCOMPLISHED BY WEIGHING INDIVIDUAL MUNITIONS AT JW-MWS-0101.
3. TO ACCESS AGENT IN PROJECTILES, THE BURSTER TUBE IS HYDRAULICALLY FAILED AT THE ADAPTER, AND THE TUBE IS COLLAPSED INTO THE AGENT CAVITY.
4. A ROBOT WILL TRANSFER THE MUNITIONS FROM THE TRAY TO THE CAM STATION. DRAINED AND WASHED MUNITIONS ARE REMOVED FROM THE CAM STATIONS, PUT BACK ONTO ANOTHER TRAY, AND CONVEYED TO THE MPT.
5. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
6. SOME ORGANIC VAPORS, INCLUDING HYDROGEN, WILL BE PRESENT INSIDE THE MUNITION HEADSPACE IN UNQUANTIFIABLE AMOUNTS, THEREFORE, THE MWS ROOM DESIGN SHOULD ACCOMODATE THE PRESENCE OF SUCH VAPORS. H PROJECTILE VAPOR WILL BE DISPERSED IN CATEGORY "A" ROOM. ESTIMATE BASED ON PREVIOUS MORTAR HEADSPACE DATA IS GIVEN IN MASS AND ENERGY BALANCES.
7. TWO CAMS OPERATING FOR GB AND VX CAMPAIGN, ONE COMMON STAND-BY (MZ-MWS-0103B) FOR VX AND H CAMPAIGNS ONLY. THREE CAMS OPERATING FOR H CAMPAIGN. AFTER VX CAMPAIGN, VX CAMS WILL BE RETOOLED FOR USE IN THE H CAMPAIGN.
8. DELETED
9. CONTROL VALVES ARE UNDER TIMER CONTROL TO ROUTE FLOW TO DRAINED AGENT LINE OR AGENT WASHOUT LINE. RESPECTIVE PUMPS ARE TURNED ON AND OFF PRIOR TO AND FOLLOWING CONTROL VALVE ACTION. HIGH PRESSURE RINSE WATER VALVE IS TURNED ON WHEN FLOW IS SWITCHED TO THE AGENT WASHOUT LINE AND CLOSED AFTER A PRESET VOLUME OF RINSE WATER.
10. MV-SDS-0301 IS USED TO STORE AGENT WASHOUT SOLUTION DURING OPERATION.
11. STEAM WILL BE USED FOR HEATING IN H CAMPAIGN TO MAINTAIN WASH WATER TEMPERATURE NO GREATER THAN 120°F INSIDE STORAGE TANK.
12. DELETED
13. PROVISION SHALL BE MADE FOR INSTALLING DISCHARGE STRAINERS FOR GB CAMPAIGN. FOR VX AND H CAMPAIGNS, DISCHARGE STRAINERS WILL BE REPLACED BY SPOOL PIECE FOR CONNECTIONS.
14. MAGNETIC ELEMENTS WILL BE INCLUDED IN UPSTREAM STRAINERS TO REMOVE METAL PARTICLES.
15. NOSE CLOSURE SYSTEM REMOVES THE LIFTNG PLUGS FOR GB AND VX CAMPAIGNS AND PUTS THEM INTO THE NOSE CLOSURE CONTAINER LOCATED ON THE TRAY.
16. THE NCR SYSTEM WILL REQUIRE MINOR RETOOLING BETWEEN GB AND VX CAMPAIGNS. M110 H DEBURSTERED PROJECTILES WITH AGENT WILL GO DIRECTLY TO THE MUNITIONS WASHOUT SYSTEM.
17. MANUAL FLUSHING AND NITROGEN PURGE CONNECTIONS ARE TO BE PROVIDED UPSTREAM OF THE CONTROL VALVE.
18. NECESSARY COLLECTION PAN SHOULD BE PROVIDED TO AVOID THE SPREAD OF AGENT CONTAMINATED MATERIAL AROUND THE CAM/ROBOT OPERATION AREA.
19. DURING GB AND VX CAMPAIGNS, ME-MWS-0102 WILL OPERATE TO MAINTAIN WASH WATER TEMPERATURE LOWER THAN 80 °F. DURING H CAMPAIGN, ME-MWS-0102 CHILLED WATER FLOW WILL BE SHUT OFF.
20. LINE WILL BE SIZED FOR FULL RECIRCULATION OF MP-MWS-0101.
21. PROVISION WILL BE MADE TO CONNECT DRAINED AGENT LINE TO THE AGENT WASH WATER LINE IN OR CLOSE TO THE ANS ROOM FOR SEPARATION OF LINE FLUSHING.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7	6/6/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	JH	SH	JB	BB
6	4/19/06	ISSUED FOR DESIGN (IFD) REVISE DWG.NO.	JW	NI	SH	JB	BB
5	3/8/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	NI	SH	JB	BB
4	6/8/05	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
3	5/2/4	ISSUED FOR APPROVAL (IFA)	PC	NI	SH	JB	JU
2	12/23/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	CH
1	10/5/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	PC	NI	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 MUNITIONS WASHOUT SYSTEM PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-MWS-00001
SHEET 1 OF 3
REV 7

PROFESSIONAL STAMP

DESIGN FILE: s:\2d\pr\07-m5-mws-1-1.plfz
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07-M5-MWS-1-1.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-MWS-00001

MUNITIONS WASHOUT SYSTEM - CASE AGENT GB PROCESSING
2 WT% AGENT HEEL TO MPT

PEAK CASE

STREAM NUMBER	112	201	202	203	204	205	912
DESCRIPTION	GB PROJECTILES FROM PHS	DEMIN WATER TO CAMS	DRAINED AGENT TO AGENT HOLDING TANK	AGENT WASHOUT TO SD/AGENT WASHOUT TANK	MUNITIONS BODIES TO MPT	VENT TO MDB HVAC FILTER	DEMIN WATER TO WASHOUT STORAGE TANK
TEMPERATURE, °F	77	110	77	108	77	77	77
PRESSURE, PSIA		10014.23	28.23	27.23		14.23	74.23
MUNITIONS/ HOUR	15				15		
INSTANTANEOUS FLOW, GPM/ (ACFM)		9.00	5.11	9.57			9.00
DENSITY, LB/FT3		63.61	67.97	62.04			62.26
VISCOSITY, cP		0.63	1.40	0.86			0.89
MOLECULAR WEIGHT	-	-	-	-	-		-
COMPONENT FLOWS, LB/HR							
GB	217.50		174.00	39.15	4.35		
VX							
H							
WATER		1148.0		1148.0			1148.0
STEEL	2624.3				2624.3		
NITROGEN (VAPOR)							
OXYGEN (VAPOR)							
HYDROGEN (VAPOR)							
CARBON DIOXIDE (VAPOR)							
ETHANE (VAPOR)	TRACE					TRACE	
VOCs (VAPOR)	TRACE					TRACE	
TOTAL PEAK, LB/HR	2841.8	1148.0	174.00	1187.1	2628.6	TRACE	1148.0
AVG THROUGHPUT, LB/HR	1420.9	573.98	87.00	593.56	1314.3		573.98
NOTES		1, 4					5

MUNITIONS WASHOUT SYSTEM - CASE AGENT VX PROCESSING
2 WT% AGENT HEEL TO MPT

PEAK CASE

STREAM NUMBER	113	201	202	203	204	205	912
DESCRIPTION	VX PROJECTILES FROM PHS	DEMIN WATER TO CAMS	DRAINED AGENT TO AGENT HOLDING TANK	AGENT WASHOUT TO SD/AGENT WASHOUT TANK	MUNITIONS BODIES TO MPT	VENT TO MDB HVAC FILTER	DEMIN WATER TO WASHOUT STORAGE TANK
TEMPERATURE, °F	77	110	77	110	77	77	77
PRESSURE, PSIA		10014.23	28.23	27.23		14.23	74.23
MUNITIONS/ HOUR	19.7				19.7		
INSTANTANEOUS FLOW, GPM/ (ACFM)		9.00	2.74	9.03			9.00
DENSITY, LB/FT3		63.61	62.95	61.86			62.26
VISCOSITY, cP		0.63	10.00	0.85			0.89
MOLECULAR WEIGHT	-	-	-	-	-		-
COMPONENT FLOWS, LB/HR							
GB							
VX	118.20		113.47	2.36	2.36		
H							
WATER		1130.7		1130.7			1130.7
STEEL	1782.9				1782.9		
NITROGEN (VAPOR)							
OXYGEN (VAPOR)							
HYDROGEN (VAPOR)							
CARBON DIOXIDE (VAPOR)							
ETHANE (VAPOR)	TRACE					TRACE	
VOCs (VAPOR)	TRACE					TRACE	
TOTAL PEAK, LB/HR	1901.1	1130.7	113.47	1133.1	1785.2	TRACE	1130.7
AVG THROUGHPUT, LB/HR	772.00	459.19	46.08	460.15	724.96		459.19
NOTES		1, 6					5

MUNITIONS WASHOUT SYSTEM - CASE AGENT H PROCESSING
2 WT% AGENT HEEL TO MPT

PEAK CASE

STREAM NUMBER	115	201	202	203	204	205	912
DESCRIPTION	H PROJECTILES FROM PHS	DEMIN WATER TO CAMS	DRAINED AGENT TO AGENT HOLDING TANK	AGENT WASHOUT TO SD/AGENT WASHOUT TANK	MUNITIONS BODIES TO MPT	VENT TO MDB HVAC FILTER	DEMIN WATER TO WASHOUT STORAGE TANK
TEMPERATURE, °F	77	150	77	145	77	77	77
PRESSURE, PSIA		10014.23	28.23	27.23		14.23	74.23
MUNITIONS/ HOUR	26				26		
INSTANTANEOUS FLOW, GPM/ (ACFM)		13.50	1.90	15.76		(0.20)	13.50
DENSITY, LB/FT3		62.95	80.20	62.16		0.048	62.26
VISCOSITY, cP		0.45	5.80	0.45		0.01	0.89
MOLECULAR WEIGHT	-	-	-	-	-	19.3	-
COMPONENT FLOWS, LB/HR							
GB							
VX							
H	304.20		88.22	209.90	6.08		
WATER		2953.6		2953.6			2953.6
STEEL	2132.0				2132.0		
NITROGEN (VAPOR)	0.45					0.45	
OXYGEN (VAPOR)	0.080					0.080	
HYDROGEN (VAPOR)	0.021					0.021	
CARBON DIOXIDE (VAPOR)	0.0008					0.0008	
ETHANE (VAPOR)	0.002					0.002	
VOCs (VAPOR)	0.002					0.002	
TOTAL PEAK, LB/HR	2436.8	2953.6	88.22	3163.5	2138.1	0.56	2953.6
AVG THROUGHPUT, LB/HR	927.8	1124.7	33.59	1204.6	814.1	0.21	1124.7
NOTES		7, 8				9	8

NOTES:

1. INSTANTANEOUS FLOWS ARE BASED ON 2 CAMS OPERATING SIMULTANEOUSLY.
2. DELETED
3. DELETED
4. WASH TIME FOR GB PROJECTILE IS 2 MINUTES PER PROJECTILE FOR MWS.
5. DEMINERALIZED WATER SUPPLIES TO TWO CAMS.
6. WASH TIME FOR VX PROJECTILE IS 1.5 MINUTES PER PROJECTILE FOR MWS.
7. WASH TIME FOR H PROJECTILE IS 3 MINUTES PER PROJECTILE FOR MWS.
8. INSTANTANEOUS FLOWS ARE BASED ON THREE CAMS OPERATING SIMULTANEOUSLY.
9. H PROJECTILE HEADSPACE VAPOR WILL BE DISPERSED IN CATEGORY "A" MWS ROOM. CONSTITUENTS ARE ESTIMATED BASED ON PREVIOUS MORTAR TEST DATA.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	6/6/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	JH	SH	JB	BB
5	3/8/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	NI	SH	JB	BB
4	6/8/05	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
3	5/2/4	ISSUED FOR APPROVAL (IFA)	PC	NI	SH	JB	JU
2	12/23/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	CH
1	10/5/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU

QUALITY ☒ Q ☐ Non-Q

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

MUNITIONS DEMILITARIZATION BUILDING MUNITIONS WASHOUT SYSTEM PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M5-MWS-00001

SHEET 2 OF 3

REV 6

DESIGN FILE: s:\24\pr\07-m5-mws-1-2.pfz
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07-M5-MWS-1-2.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-MWS-00001

MUNITIONS WASHOUT SYSTEM - CASE AGENT GB PROCESSING
0 WT% AGENT HEEL TO MPT

PEAK CASE

STREAM NUMBER	112	201	202	203	204	205	912
DESCRIPTION	GB PROJECTILES FROM PHS	DEMIN WATER TO CAMS	DRAINED AGENT TO AGENT HOLDING TANK	AGENT WASHOUT TO SD/AGENT WASHOUT TANK	MUNITIONS BODIES TO MPT	VENT TO MDB HVAC FILTER	DEMIN WATER TO WASHOUT STORAGE TANK
TEMPERATURE, °F	77	110	77	108	77	77	77
PRESSURE, PSIA		10014.23	28.23	27.23		14.23	74.23
MUNITIONS/ HOUR	15				15		
INSTANTANEOUS FLOW, GPM/ (ACFM)		9.00	5.11	9.64			9.00
DENSITY, LB/FT3		63.61	67.97	62.05			62.26
VISCOSITY, cP		0.63	1.40	0.86			0.89
MOLECULAR WEIGHT	-	-	-	-	-		-
COMPONENT FLOWS, LB/HR							
GB	217.50		174.00	43.50			
VX							
H							
WATER		1148.0		1148.0			1148.0
STEEL	2624.3				2624.3		
NITROGEN (VAPOR)							
OXYGEN (VAPOR)							
HYDROGEN (VAPOR)							
CARBON DIOXIDE (VAPOR)							
ETHANE (VAPOR)	TRACE					TRACE	
VOCs (VAPOR)	TRACE					TRACE	
TOTAL PEAK, LB/HR	2841.8	1148.0	174.00	1191.5	2624.3	TRACE	1148.0
AVG THROUGHPUT, LB/HR	1420.9	573.98	87.00	595.73	1312.1		573.98
NOTES		1, 4					5

MUNITIONS WASHOUT SYSTEM - CASE AGENT VX PROCESSING
0 WT% AGENT HEEL TO MPT

PEAK CASE

STREAM NUMBER	113	201	202	203	204	205	912
DESCRIPTION	VX PROJECTILES FROM PHS	DEMIN WATER TO CAMS	DRAINED AGENT TO AGENT HOLDING TANK	AGENT WASHOUT TO SD/AGENT WASHOUT TANK	MUNITIONS BODIES TO MPT	VENT TO MDB HVAC FILTER	DEMIN WATER TO WASHOUT STORAGE TANK
TEMPERATURE, °F	77	110	77	110	77	77	77
PRESSURE, PSIA		10014.23	28.23	27.23		14.23	74.23
MUNITIONS/ HOUR	19.7				19.7		
INSTANTANEOUS FLOW, GPM/ (ACFM)		9.00	2.74	9.06			9.00
DENSITY, LB/FT3		63.61	62.95	61.86			62.26
VISCOSITY, cP		0.63	10.00	0.85			0.89
MOLECULAR WEIGHT	-	-	-	-	-		-
COMPONENT FLOWS, LB/HR							
GB							
VX	118.20		113.47	4.73			
H							
WATER		1130.7		1130.7			1130.7
STEEL	1782.9				1782.9		
NITROGEN (VAPOR)							
OXYGEN (VAPOR)							
HYDROGEN (VAPOR)							
CARBON DIOXIDE (VAPOR)							
ETHANE (VAPOR)	TRACE					TRACE	
VOCs (VAPOR)	TRACE					TRACE	
TOTAL PEAK, LB/HR	1901.1	1130.7	113.47	1135.5	1782.9	TRACE	1130.7
AVG THROUGHPUT, LB/HR	772.00	459.19	46.08	461.11	724.00		459.19
NOTES		1, 6					5

MUNITIONS WASHOUT SYSTEM - CASE AGENT H PROCESSING
0 WT% AGENT HEEL TO MPT

PEAK CASE

STREAM NUMBER	115	201	202	203	204	205	912
DESCRIPTION	H PROJECTILES FROM PHS	DEMIN WATER TO CAMS	DRAINED AGENT TO AGENT HOLDING TANK	AGENT WASHOUT TO SD/AGENT WASHOUT TANK	MUNITIONS BODIES TO MPT	VENT TO MDB HVAC FILTER	DEMIN WATER TO WASHOUT STORAGE TANK
TEMPERATURE, °F	77	150	77	145	77	77	77
PRESSURE, PSIA		10014.23	28.23	27.23		14.23	74.23
MUNITIONS/ HOUR	26				26		
INSTANTANEOUS FLOW, GPM/ (ACFM)		13.50	1.90	15.82		(0.20)	13.50
DENSITY, LB/FT3		62.95	80.20	62.18		0.048	62.26
VISCOSITY, cP		0.45	5.80	0.45		0.01	0.89
MOLECULAR WEIGHT	-	-	-	-	-	19.3	-
COMPONENT FLOWS, LB/HR							
GB							
VX							
H	304.20		88.22	215.98			
WATER		2953.6		2953.6			2953.6
STEEL	2132.0				2132.0		
NITROGEN (VAPOR)	0.45					0.45	
OXYGEN (VAPOR)	0.080					0.080	
HYDROGEN (VAPOR)	0.021					0.021	
CARBON DIOXIDE (VAPOR)	0.0008					0.0008	
ETHANE (VAPOR)	0.002					0.002	
VOCs (VAPOR)	0.002					0.002	
TOTAL PEAK, LB/HR	2436.8	2953.6	88.22	3169.6	2132.0	0.56	2953.6
AVG THROUGHPUT, LB/HR	927.8	1124.7	33.59	1206.9	811.8	0.21	1124.7
NOTES		7, 8				9	8

NOTES:

1. INSTANTANEOUS FLOWS ARE BASED ON 2 CAMS OPERATING SIMULTANEOUSLY.
2. DELETED
3. DELETED
4. WASH TIME FOR GB PROJECTILE IS 2 MINUTES PER PROJECTILE FOR MWS.
5. DEMINERALIZED WATER SUPPLIES TO TWO CAMS.
6. WASH TIME FOR VX PROJECTILE IS 1.5 MINUTES PER PROJECTILE FOR MWS.
7. WASH TIME FOR H PROJECTILE IS 3 MINUTES PER PROJECTILE FOR MWS.
8. INSTANTANEOUS FLOWS ARE BASED ON THREE CAMS OPERATING SIMULTANEOUSLY.
9. H PROJECTILE HEADSPACE VAPOR WILL BE DISPERSED IN CATEGORY "A" MWS ROOM. CONSTITUENTS ARE ESTIMATED BASED ON PREVIOUS MORTAR TEST DATA.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	6/6/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	JH	SH	JB	BB
5	3/8/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	NI	SH	JB	BB
4	6/8/05	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
3	5/2/4	ISSUED FOR APPROVAL (IFA)	PC	NI	SH	JB	JU
2	12/23/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	CH
1	10/5/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	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 MUNITIONS WASHOUT SYSTEM PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-MWS-00001 | SHEET 3 OF 3 | REV 6

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DESIGN FILE: s:\2d\pr\07-m5-mws-1-3.pfz
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BGCAPP_E2.BDR

MX-OTE-0105
EBH SCRUBBER
SULFURIC ACID
METERING PACKAGE

MV-OTE-0105
EBH SCRUBBER
SULFURIC ACID
DAY TANK
CAPACITY: 72 GAL

MP-OTE-0105A/B
EBH SCRUBBER
SULFURIC ACID
METERING PUMP AND SPARE
0.05 GPM

MK-OTE-0103
EBH SCRUBBER
TOWER
6'-6" ID X 21'-5" T/T
(NOTE 7)

MA-OTE-0101A/B
EBH BLOWER
AND SPARE
17,705 ACFM
350 HP
(NOTES 3, 4)

ME-OTE-0105
EBH SCRUBBER
RECIRCULATION
CHILLED WATER COOLER
2.86 MMBTU/HR

MK-OTE-0104A/B
EBH OFFGAS FILTERS
(NOTE 2)

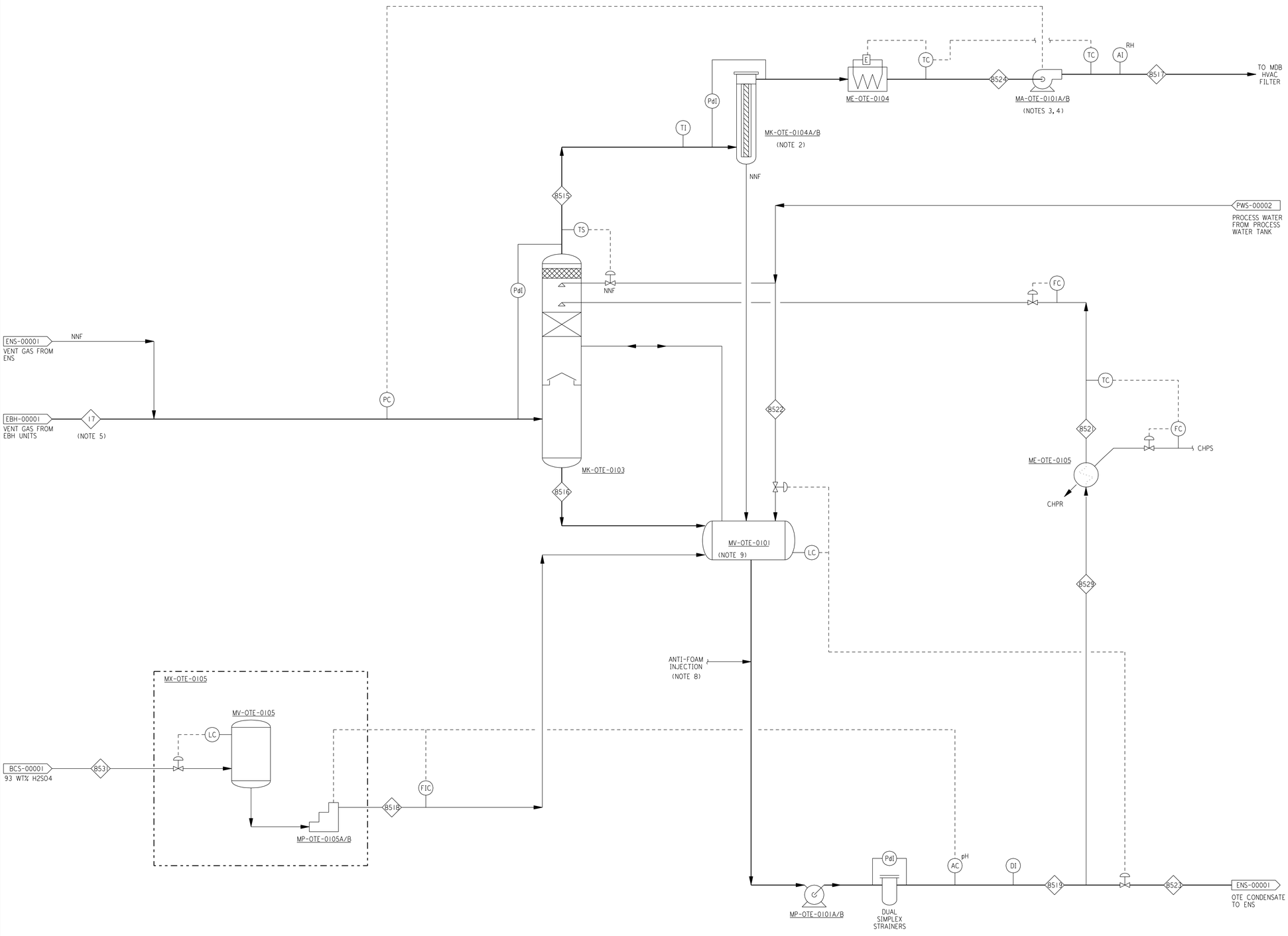
MP-OTE-0101A/B
EBH SCRUBBER
RECIRCULATION
PUMP & SPARE
180 GPM

ME-OTE-0104
AIR REHEATER
0.42 MMBTU/HR

MV-OTE-0101
EBH SCRUBBER
RECIRCULATION
SURGE TANK
WORKING CAPACITY: 1240 GAL
(NOTE 9)

NOTES:

1. FOR SYMBOL DEFINITION SEE DRAWINGS 24915-00-M5-00-00002.
2. FILTERS TO BE SIZED FOR REMOVAL OF PARTICLES GREATER THAN 3 MICRONS IN DIAMETER AT AN EFFICIENCY OF 99.9%.
3. VARIABLE SPEED DRIVE.
4. EMERGENCY POWER SUPPLY.
5. LINE IS HEAT TRACED TO MAINTAIN A TEMPERATURE OF 230 °F.
6. DELETED
7. DIMENSIONS ARE PRELIMINARY. FINAL DIMENSIONS TO BE VERIFIED BY VENDORS.
8. PROVIDE CONNECTION FOR ANTI-FOAM INJECTION ONLY.
9. LIQUID VOLUME IN SURGE TANK BETWEEN LOW LOW AND AND NORMAL LIQUID LEVELS TO BE 900 GALLONS TO ACCOMMODATE 5 MINUTES OF SURGE FOR THE RECIRCULATION PUMP. LIQUID VOLUME BETWEEN NORMAL AND HIGH LIQUID LEVELS TO BE 340 GALLONS TO ACCOMMODATE STORAGE NEEDED DURING A FAILED ENS BATCH.
10. EQUIPMENT SIZING DATA FOR DESIGN SHOWN ON THIS SHEET IS BASED ON REV. 5, 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 EXCEPT FOR EBH BLOWER AND SURGE TANK, WHICH ARE BASED ON THIS REVISION.



NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7	4/19/06	ISSUED FOR DESIGN (IFD) ADD NOTE 10	NI	JH	SH	JB	BB
6	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	NI	JH	SH	JB	BB
5	8/12/05	ISSUED FOR DESIGN (IFD)	NI	JH	SH	JB	JU
4	7/12/05	(IFA) SHEET REDRAWN DC-43B	NI	FJ	SH	JB	JU
3	5/18/05	ISSUED FOR APPROVAL(IFA)SHEET REDRAWN	NI	FJ	SH	JB	JU
2	1/4/05	ISSUED FOR DESIGN (IFD)	NI	WW	SH	JB	CH
1	11/3/04	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	NI	WW	SH	JB	JU
0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	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 OFFGAS TREATMENT EBH/ENR PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-OTE-00001
SHEET 1 OF 4
REV 7

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BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-OTE-00001

OFF GAS TREATMENT EBH/ENS
CASE: AGENT GB PROCESSING PEAK THROUGHPUT

STREAM NUMBER	17	8515	8516	8517	8518	8519	8521	8522	8523	8524	8529	8531
Description	Total Vent Gas From EBHs To Scrubber Tower	Scrubber Tower Overhead Vapor	Scrubber Tower Condensate to Surge Drum	EBH Offgas To HVAC Filter Units	93wt% H2SO4 Solution To Surge Tank	Scrubber Recirculation Pump Discharge	Cool Recirculation To Scrubber Tower	Makeup Water To Surge Tank	OTE Condensate Recycled To ENS	EBH Blower Suction	Scrubber Recirculation To Chilled Water Cooler	93wt% H_2SO_4 Solution To Day Tank
Temperature, °F	230	80	101	169	77	101	70		101	110	101	77
Pressure, PSIA	12.60	12.42	12.51	14.48	20.00	95.00	85.00		95.00	11.34	95.00	20.00
Instantaneous Volume Flow, GPM (ACFM)	(19527)	(15294)	180	(15290)	0.04	180	178	NNF	0.94	(17681)	179	6.0
Density, LB/FT³	0.048	0.061	65.69	0.061	113.7	65.72	66.05		65.72	0.053	65.72	113.7
Viscosity, CP	0.022	0.018	0.67	0.021	20	0.67	0.90		0.67	0.019	0.67	20
MW	28.19	28.32		28.32						28.32		
Enthalpy, MMBTU/HR	-8.559	-8.096	-617.427	-6.863	-0.156	-617.561	-616.964		-3.218	-7.680	-614.343	-0.156
Component Flows, LB/HR												
RDX	9.3E-02		17.85			17.85	17.76		9.3E-02		17.76	
O2	12663	12663.3	3.6E-01	12663		3.6E-01	3.6E-01		1.9E-03	12663	3.6E-01	
N2	41673	41673.3	6.3E-01	41673		6.3E-01	6.3E-01		3.3E-03	41673	6.3E-01	
H2	14.44	14.43	2.9E-04	14.43		2.9E-04	2.9E-04		1.5E-06	14.43	2.9E-04	
NH3	12.32	3.3E-02	8.19	3.3E-02		5.4E-03	1.2E-03		2.8E-05	3.3E-02	5.3E-03	
N2O	5.55	5.55	2.1E-01	5.55		2.1E-01	2.1E-01		1.1E-03	5.55	2.1E-01	
H2O	1852.5	1408.8	85671	1408.8	2.67	85674	85227		446.40	1408.8	85227	2.67
H2SO4			2.4E-03		35.43	3.72	5.26		1.9E-02		3.70	35.43
(NH4)2SO4			9114.2			9134.9	9089.5		47.60		9087.3	
NH4HSO4			1.2E-02			19.14	15.35		1.0E-01		19.04	
TOTAL PEAK THROUGHPUT, LB/HR	56222	55765	94813	55765	38.10	94851	94351		494.2	55765	94351	38.10
TOTAL AVERAGE THROUGHPUT, LB/HR	37481	37023	92083	37023	17.70	92101	91625		476.0	37023	91625	17.70

NOTES:

8 1

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
8	6/7/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	NI	JH	SH	JB	BB
7	4/19/06	ISSUED FOR DESIGN (IFD) REVISE Q LEVEL	NI	JH	SH	JB	BB
6	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	NI	JH	SH	JB	BB
5	8/12/05	ISSUED FOR DESIGN (IFD)	NI	JH	SH	JB	JU
4	7/12/05	(IFA) SHEET REDRAWN DC-43B	NI	FJ	SH	JB	JU
3	5/18/05	ISSUED FOR APPROVAL(IFA)SHEET REDRAWN	NI	FJ	SH	JB	JU
2	1/4/05	ISSUED FOR DESIGN (IFD)	NI	WW	SH	JB	CH
1	11/3/04	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	NI	WW	SH	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 OFFGAS TREATMENT EBH/ENR PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-OTE-00001 | SHEET 2 OF 4 | REV 8

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BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-OTE-00001

OFF GAS TREATMENT EBH/ENS
CASE: AGENT VX PROCESSING PEAK THROUGHPUT

NOTES:

STREAM NUMBER	17	8515	8516	8517	8518	8519	8521	8522	8523	8524	8529	8531
Description	Total Vent Gas From EBHs To Scrubber Tower	Scrubber Tower Overhead Vapor	Scrubber Tower Condensate to Surge Drum	EBH Offgas To HVAC Filter Units	93wt% H_2SO_4 Solution To Surge Tank	Scrubber Recirculation Pump Discharge	Cool Recirculation To Scrubber Tower	Makeup Water To Surge Tank	OTE Condensate Recycled To ENS	EBH Blower Suction	Scrubber Recirculation To Chilled Water Cooler	93wt% H_2SO_4 Solution To Day Tank
Temperature, °F	230	80	101	169	77	101	70		101	110	101	77
Pressure, PSIA	12.60	12.42	12.51	14.48	20.00	95.00	85.00		95.00	11.34	95.00	20.00
Instantaneous Volume Flow, GPM (ACFM)	(19537)	(15315)	180	(15311)	0.05	180	178	NNF	0.91	(17705)	179.00	7.2
Density, LB/FT^3	0.048	0.061	66.60	0.061	113.7	66.63	66.97		66.63		66.63	113.7
Viscosity, CP	0.022	0.018	0.67	0.021	20	0.67	0.90		0.67	0.019	0.67	20
MW	28.18	28.30		28.30						28.30		
Enthalpy, MMBTU/HR	-8.453	-8.104	-619.512	-6.869	-0.187	-619.677	-619.163		-3.117	-7.687	-616.560	-0.187
Component Flows, LB/HR												
RDX	1.1E-01		22.07			22.07	21.95		1.1E-01		21.95	
O2	12667	12667	3.4E-01	12667		3.4E-01	3.4E-01		1.7E-03	12667	3.39E-01	
N2	41682	41682	5.9E-01	41682		5.9E-01	5.9E-01		3.0E-03	41682	5.87E-01	
H2	17.32	17.32	3.3E-04	17.32		3.3E-04	3.3E-04		1.6E-06	17.32	3.26E-04	
NH3	14.76	3.0E-02	9.35	3.0E-02		4.8E-03	1.1E-03		2.4E-05	3.0E-02	4.76E-03	
N2O	6.66	6.66	2.4E-01	6.66		2.4E-01	2.4E-01		1.2E-03	6.66	2.40E-01	
H2O	1834.0	1410.9	84742	1410.9	3.20	84746	84319		426.31	1410.9	84319	3.20
H2SO4			2.4E-03		42.50	4.72	6.68		2.4E-02		4.69	42.50
(NH4)2SO4			11325			11347	11293		57.08		11290	
NH4HSO4			1.3E-02			25.56	20.74		1.3E-01		25.44	
TOTAL PEAK THROUGHPUT, LB/HR	56222	55784	96100	55784	45.70	96146	95682		483.86	55784	95662	45.70
TOTAL AVERAGE THROUGHPUT, LB/HR	37481	37028	92563	37028	20.90	92584	92110		473.78	37028	92110	20.90

△8 1

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
△8	6/7/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	NI	JH	SH	JB	BB
△7	4/19/06	ISSUED FOR DESIGN (IFD) REVISE Q LEVEL	NI	JH	SH	JB	BB
△6	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	NI	JH	SH	JB	BB
△5	8/12/05	ISSUED FOR DESIGN (IFD)	NI	JH	SH	JB	JU
△4	7/12/05	(IFA) SHEET REDRAWN DC-43B	NI	FJ	SH	JB	JU
△3	5/18/05	ISSUED FOR APPROVAL(IFA)SHEET REDRAWN	NI	FJ	SH	JB	JU
△2	1/4/05	ISSUED FOR DESIGN (IFD)	NI	WW	SH	JB	CH
△1	11/3/04	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	NI	WW	SH	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 OFFGAS TREATMENT EBH/ENR PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-OTE-00001 | SHEET 3 OF 4 | REV 8

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BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-OTE-00001

OFF GAS TREATMENT EBH/ENS
CASE: AGENT H PROCESSING PEAK THROUGHPUT

NOTES:

STREAM NUMBER	17	8515	8516	8517	8518	8519	8521	8522	8523	8524	8529	8531
Description	Total Vent Gas From EBHs To Scrubber Tower	Scrubber Tower Overhead Vapor	Scrubber Tower Condensate to Surge Drum	EBH Offgas To HVAC Filter Units	93wt% H_2SO_4 Solution To Surge Tank	Scrubber Recirculation Pump Discharge	Cool Recirculation To Scrubber Tower	Makeup Water To Surge Tank	OTE Condensate Recycled To ENS	EBH Blower Suction	Scrubber Recirculation To Chilled Water Cooler	93wt% H_2SO_4 Solution To Day Tank
Temperature, °F	230	80	101	148	77	101	70		101	110	101	77
Pressure, PSIA	12.48	12.43	12.45	14.29	20.00	95.00	85.00		95.00	12.18	95.00	20.00
Instantaneous Volume Flow, GPM (ACFM)	(9840)	(7602)	90	(7448)	0.01	90	89	NNF	0.57	(8190)	89	6.1
Density, LB/FT^3	0.048	0.061	62.85	0.062	113.7	62.87	63.19		62.87	0.057	62.87	113.7
Viscosity, CP	0.022	0.018	0.67	0.021	20	0.67	0.90		0.67	0.019	0.67	20
MW	28.25	28.41		28.41						28.41		
Enthalpy, MMBTU/HR	-4.634	-4.081	-304.882	-3.611	-0.023	-304.894	-304.329		-1.922	-3.873	-302.972	-0.023
Component Flows, LB/HR												
RDX												
O2	6319.2	6319.2	2.3E-01	6319.2		2.3E-01	2.3E-01		1.4E-03	6319.2	2.3E-01	
N2	20802	20802	4.0E-01	20802		4.0E-01	3.9E-01		2.5E-03	20802	3.9E-01	
H2	1.8E-01	1.7E-01	4.5E-06	1.7E-01		4.5E-06	4.4E-06		2.8E-08	1.7E-01	4.4E-06	
NH3	1.80	1.6E-02	1.35	1.6E-02		3.0E-03	6.5E-04		1.9E-05	1.6E-02	2.9E-03	
N2O												
H2O	987.78	709.45	44212	709.45	3.9E-01	44213	43934		278.72	709.45	43934	3.9E-01
H2SO4			1.2E-03		5.15	5.4E-01	7.5E-01		3.4E-03		5.4E-01	5.15
(NH4)2SO4			1094.0			1098.3	1091.7		6.92		1091.3	
NH4HSO4			3.7E-03			1.70	1.16		1.1E-02		1.69	
TOTAL PEAK THROUGHPUT, LB/HR	28111	27831	45308	27831	5.54	45314	45028		285.66	27831	45028	5.54
TOTAL AVERAGE THROUGHPUT, LB/HR	18741	18342	44994	18342	2.10	44996	44595		401.07	18342	44595	2.10

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7	4/19/06	ISSUED FOR DESIGN (IFD) REVISE Q LEVEL	NI	JH	SH	JB	BB
6	4/3/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	NI	JH	SH	JB	BB
5	8/12/05	ISSUED FOR DESIGN (IFD)	NI	JH	SH	JB	JU
4	7/12/05	(IFA) SHEET REDRAWN DC-43B	NI	FJ	SH	JB	JU
3	5/18/05	ISSUED FOR APPROVAL(IFA)SHEET REDRAWN	NI	FJ	SH	JB	JU
2	1/4/05	ISSUED FOR DESIGN (IFD)	NI	WW	SH	JB	CH
1	11/3/04	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	NI	WW	SH	JB	JU
0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	JB	JU

QUALITY ☐ Q ☒ Non-Q

1

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 OFFGAS TREATMENT EBH/ENR PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-OTE-00001 | SHEET 4 OF 4 | REV 7

PROFESSIONAL STAMP

2 07-M5-OTE-1-4.PFZ

BGCAPP_E2.BDR

DESIGN FILE: s:\2d\pr\07-m5-ote-1-4.pfz
PLOTTED BY: 5143 ON 4/21/2006 AT 8:08:15 AM

MK-OTM-0106/0206
MPT BULK OXIDIZER UNIT
7'-6" OD X 24'-10" H

MK-OTM-0107/0207
MPT CYCLONE
3'-4" OD X 12'-7" F/F

MK-OTM-0102
MPT VENTURI/SCRUBBER TOWER
VENTURI SECTION: 2'-6" ID X 11'-3" H
SUMP : 9'-11" H
TOWER: 4'-6" ID X 28'-6" F/F
(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
W 1'-4"
H 1'-4"
L 8"
(NOTE 3)

MA-OTM-0101A/B
MPT BLOWER AND SPARE
4010 ACFM
TBD HP

ME-OTM-0103
MPT AIR REHEATER
53.1 MBTU/HR
(NOTE 9)

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. DIMENSIONS ARE PRELIMINARY. THE VENTURI/SCRUBBER TOWER WILL BE SIZED BY VENDOR.
14. THE OXYGEN ANALYZER ASSURES THAT RESIDUAL OXYGEN LEVEL IN THE BULK OXIDIZER EFFLUENT IS AT LEAST 5%.
15. MAKE-UP AIR IS ADDED, IF NECESSARY, TO ASSURE THAT THE VOLUME RATE TO THE MPT VENTURI/SCRUBBER TOWER IS AT LEAST 35% OF DESIGN VALUE AT ALL TIMES DURING OPERATION.
16. DELETED
17. PLANT AIR IS REQUIRED IN THE AMOUNT OF 0.25 LB/LB OF PROCESS WATER ADDED FOR ATOMIZING.
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 BULK OXIDIZER VENDOR.
22. DELETED
23. DELETED
24. VENT LINES TO BULK OXIDIZER TO BE HEAT TRACED.
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.

FROM PARALLEL MPT CYCLONE MK-OTM-0207 (NOTE 12)
MPT-00001 HIGH SIGNAL TO STOP FEED AT MPT
AMBIENT AIR (NOTE 15)
S/D FEED (NOTE 5)
AGENT
HI/STOP FEED
INSIDE MDB
OUTSIDE MDB
(NOTE 14)
O2
PLANT AIR
MK-OTM-0107 (NOTE 20)
MK-OTM-0102 (NOTE 13)
(NOTE 19)
SUPERHEATING SECTION
AMBIENT AIR
NATURAL GAS (SUPPLEMENTAL FUEL)
MK-OTM-0106 (NOTE 21)
(NOTE 18)
MPT-00001 MPT OFFGAS (NOTE 24)
MK-OTM-0104A/B (NOTE 3)
ME-OTM-0103
MA-OTM-0101A/B (NOTES 6, 7)
TO MDB HVAC FILTER
PROCESS WATER WATER TANK PWS-00002
CHPS
ME-OTM-0104
ME-OTM-0102
CHPR
CWS
CWR
MV-OTM-0101
ANTI-FOAM (NOTE 4)
DUAL SIMPLEX STRAINERS
MP-OTM-0102A/B
MP-OTM-0101A/B
BCS-00001 18% CAUSTIC
SDS-00001 MPT CONDENSATE TO SPENT DECON STORAGE TANK MV-SDS-0301
HSS-00002 MPT CONDENSATE TO ENERGETICS HYDROLYSATE STORAGE TANKS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
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
2	5/18/04	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JB	JU
1	10/21/04	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	WW	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	BC	WW	SH	JB	JU

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
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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 NUMBER 24915-07-M5-OTM-00001
SHEET 1 OF 4
REV 5

PROFESSIONAL STAMP

DESIGN FILE: s:\24\gr\07-m5-otm-1-1.plt
PLOTTED BY: 51439 ON 4/21/2006 AT 8:08:15 AM

07-M5-OTM-1-1.PFZ
BGCAPP_E2.BDR

NOTES:

1. THE MASS AND ENERGY BALANCES ARE BASED ON 2% HEEL FOR EQUIPMENT SIZING PURPOSES. NO HEEL (0%) IS NOT A CONTROLLING CASE FOR THE OTM DESIGN.
2. THE INSTANTANEOUS FLOW WAS DETERMINED BY THE EVAPORATION RATE OF THE OTM DESIGN.
3. DELETED

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-OTM-00001
OFF GAS TREATMENT MPT
CASE: AGENT GB, INSTANTANEOUS CASE

STREAM NUMBER	802	804	805	806	807	808	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	830	831	832	833	7655
	Air To Bulk Oxidizer Unit	Cyclone Effluent Gas	Venturi Scrubber Sump Bottoms	Scrubber Tower Overhead to Filter	Blower Discharge to HVAC	Atomizing Air for Bulk Oxidizer Unit Water Feed	Recirculation Feed to Scrubber Tower	Makeup Water to Scrubber Tower	Water to Bulk Oxidizer Unit	Blower Suction	Caustic Feed To Scrubber Tower	Caustic Supply to Venturi Scrubber	Scrubber Recirculation Pump Discharge	Scrubber Recirculation Condensate To Sump	Venturi Scrubber Recirculation Pump Discharge	Condensate Recirculation return to Venturi	Scrubber Condensate to Energetics Hydrolysate	Makeup Water Supply to Venturi Scrubber	Scrubber Condensate to Surge Tank	Total Feed to Venturi Scrubber	MPT Cyclone-2 Effluent Gas	Make-Up Air to Venturi Scrubber	Condensate Recirculation To Trim Cooler	Bulk Oxidizer Unit Effluent Gas	Fuel Gas to Bulk Oxidizer Unit	Cooling Water to Bulk Oxidizer Unit	Atomizing Air for Bulk Oxidizer Unit Cooling Water Feed	MPT Offgas to Bulk Oxidizer Unit
TEMPERATURE, °F	77	1200	171	71	158	80	70		77	95	77	77	95	95	171	171	171		95	1200		77	95	1200	77	77	77	678
PRESSURE, PSIA	14.23	12.39	11.66	11.23	14.23	64.23	94.23		34.23	10.87	54.23	54.23	114.23	114.23	89.23	89.23	89.23		11.45	12.39		14.23	104.23	12.60	24.23	34.23	64.23	14.00
INSTANTANEOUS FLOW, GPM (ACFM)	(820)	(6714)	175	(1480)	(1360)	(5.56)	292		8.6E-01	(1598)	5.0E-02	2.09	300	6.49	175	169	6.10		300	(6714)		(24)	294	(6598)	1.90	(12.3)	(1122)	
DENSITY, LB/FT3	0.0709	0.0175	67.59	0.0566	0.0616	0.3213	62.48		62.25	0.0524	74.69	74.69	62.23	62.23	67.60	67.60	67.60		62.21	0.0175		0.071	62.23	0.0178	0.068	62.25	0.3213	0.0273
VISCOSITY, CP	0.018	0.041	0.37	0.018	0.020	0.018	0.98		0.89	0.018	2.9	2.9	0.72	0.72	0.37	0.37	0.37		0.72	0.041		0.018	0.72	0.041	0.011	0.89	0.018	0.030
MW	28.67	25.09		28.68	28.68	28.67				28.68										25.09		28.67		25.09	16.04		28.67	23.59
COMPONENT INSTANTANEOUS FLOW, LB/HR																												
GB																												1.9E-01
TBA																												8.3E-04
MF																												1.1E-06
DIPU																												3.8E-04
IPA																												1.8E-01
N2	2651.2	4138.0	2.8E-01	4138.0	4138.0	81.55	1.47			4138.0			1.50	3.2E-02	2.8E-01	2.7E-01	9.6E-03		1.50	4138.0			1.47	4138.0			180.83	1216.6
O2	799.69	449.02	5.1E-02	449.02	449.02	24.60	3.1E-01			449.02			3.1E-01	6.8E-03	5.1E-02	5.0E-02	1.8E-03		3.1E-01	449.02			3.1E-01	449.02			54.54	1.9E-03
H2		1.3E-04		1.3E-04	1.3E-04					1.3E-04										1.3E-04				1.3E-04				24.63
CO2		354.97	7.8E-01	329.90	329.90		2.20			329.90			2.44	5.3E-02	7.8E-01	7.6E-01	2.7E-02		5.61	354.97			2.39	354.97				122.15
CO		5.7E-04	3.0E-06	5.7E-04	5.7E-04		3.1E-05			5.7E-04			3.2E-05	6.9E-07	3.0E-06	2.9E-06	1.0E-07		3.2E-05	5.7E-04			3.1E-05	5.7E-04				70.12
CH4																												44.47
C2H6																												9.3E-04
NH3																												10.64
NO2		1.1E-02	1.4E-02	1.1E-02	1.1E-02		3.6E-01			1.1E-02			3.6E-01	7.9E-03	1.4E-02	1.4E-02	4.9E-04		3.6E-01	1.1E-02			3.6E-01	1.1E-02				
NO		2.00	6.3E-04	2.00	2.00		3.7E-02			2.00			3.8E-02	8.2E-04	6.3E-04	6.1E-04	2.2E-05		3.8E-02	2.00			3.7E-02	2.00				
HCN																												1.2E-03
SO2		2.56																		2.56				2.56				2.56
CL2		2.0E-01	5.8E-04	2.0E-01	2.0E-01		8.6E-03			2.0E-01			8.8E-03	1.9E-04	5.8E-04	5.6E-04	2.0E-05		8.8E-03	2.0E-01			8.6E-03	2.0E-01				
H2O	35.36	1959.7	84659	106.84	106.84	1.09	146004		428.97	106.84	24.60	1025.82	149230	3226.0	84659	81710	2949.0		149204	1959.7			146004	1959.7		951.15	2.41	203.42
NAOH			226.68				1.2E-02				5.40	225.17	2.8E-02	6.1E-04	226.68	218.78	7.90		1.2E-02				2.7E-02					
HCL																												1.9E-01
HF		29.46	5.3E-03												5.3E-03	5.1E-03	1.8E-04			29.46				29.46				29.43
P2O5		114.27																		114.27				114.27				114.27
H3PO4		1.3E-01	1.6E-06												1.6E-06	1.5E-06	5.6E-08			1.3E-01				1.3E-01				
NACL																												
NANO3			1.2E-06												1.2E-06	1.1E-06	4.1E-08											
NAHCO3			907.56				495.78						506.02	10.94	907.56	875.94	31.61		505.26				495.08					
NAF			1774.7				1.8E-03						1.8E-03	4.0E-05	1774.75	1712.92	61.82		1.8E-03				1.8E-03					
NA2CO3			586.53				11.04						11.71	2.5E-01	586.53	566.09	20.43		5.06				11.46					
NA3PO4			164.44												164.44	158.71	5.73											
NAH2PO4			15.67												15.67	15.12	5.5E-01											
NA2HPO4			6406.1												6406.08	6182.93	223.15											
N2O																												3.0E-02
DIPU																												
OTHER ORGANICS																												3.3E-04
CHLOROFORM																												6.6E-03
C3H7F																												5.9E-03
NAHSO3			1.9E-01				1.0E-06						1.6E-06	3.5E-08	1.9E-01	1.8E-01	6.5E-03		3.4E-06				1.6E-06					
NA2SO3			144.58				2.9E-05						2.9E-05	6.3E-07	144.58	139.55	5.04		2.7E-05				2.9E-05					
TOTAL INSTANTANEOUS FLOW, LB/HR	3,486.2	7,050.3	94,887	5,026.0	5,026.0	107.24	146,515	0.00	428.97	5,026.0	30.00	1,251.00	149,752	3,237.3	94,887	91,581	3,305.3	0.00	149,722	7,050.3	0.00	0.00	146,515	7,050.3	0.00	951.15	237.79	1,838.9
TOTAL AVERAGE THROUGHPUT, LB/HR	3,486.2	6,127.4	85,756	4,971.0	4,971.0	0.00	146,439	0.00	0.00	4,971.0	15.00	8.00	149,582	3,142.8	85,756	84,474	1,282.3	0.00	149,567	6,230.3	0.00	102.95	146,439	6,127.4	73.26	776.62	194.15	1,597.1

5 1

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5	7/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	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
2	5/18/04	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JB	JU
1	10/28/04	ISSUED FOR DESIGN (IFD)	WW	JW	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	BC	WW	SH	JB	JU

QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel Nationals, 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 OFFGAS TREATMENT MPT PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-OTM-00001 | SHEET 2 OF 4 | REV 5

PROFESSIONAL STAMP

DESIGN FILE: s:\26\pr\07-m5-otm-1-2.pfz
PLOTTED BY: 51439 ON 7/24/2006 AT 11:05:47 AM

2 07-M5-OTM-1-2.PFZ

BGCAPP_E2.BDR

NOTES:

1. THE MASS AND ENERGY BALANCES ARE BASED ON 2% HEEL FOR EQUIPMENT SIZING PURPOSES. NO HEEL (0%) IS NOT A CONTROLLING CASE FOR THE OTM DESIGN.
2. THE INSTANTANEOUS FLOW WAS DETERMINED BY THE EVAPORATION RATE OF THE OTM DESIGN.
3. DELETED
4. MASS AND ENERGY BALANCES HAVE BEEN UPDATED TO REV 4. THE UPDATE CONFIRMS THE ADEQUACY OF THE CURRENT EQUIPMENT DESIGN, THEREFORE, DUE TO THE LEVEL OF PROGRESS IN THE DESIGN, THE FIGURES ON SHEET 1 WILL NOT BE UPDATED.

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-OTM-00001
OFF GAS TREATMENT MPT
CASE: AGENT VX, INSTANTANEOUS CASE

STREAM NUMBER	802	804	805	806	807	808	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	830	831	832	833	7655
	Air To Bulk Oxidizer Unit	Cyclone Effluent Gas	Venturi Scrubber Sump Bottoms	Scrubber Tower Overhead to Filter	Blower Discharge to HVAC	Atomizing Air for Bulk Oxidizer Unit Water Feed	Recirculation Feed to Scrubber Tower	Makeup Water to Scrubber Tower	Water to Bulk Oxidizer Unit	Blower Suction	Caustic Feed To Scrubber Tower	Caustic Supply to Venturi Scrubber	Scrubber Recirculation Pump Discharge	Scrubber Recirculation Condensate To Sump	Venturi Scrubber Recirculation Pump Discharge	Condensate Recirculation Return to Venturi	Scrubber Condensate to Energetics Hydrolysate	Makeup Water Supply to Venturi Scrubber	Scrubber Condensate to Surge Tank	Total Feed to Venturi Scrubber	MPT Cyclone-2 Effluent Gas	Make-Up Air to Venturi Scrubber	Condensate Recirculation To Trim Cooler	Bulk Oxidizer Unit Effluent Gas	Fuel Gas to Bulk Oxidizer Unit	Cooling Water to Bulk Oxidizer Unit	Atomizing Air for Bulk Oxidizer Unit Cooling Water Feed	Combined Feed to Bulk Oxidizer Unit
TEMPERATURE, °F	77	1200	177	93	156	80	70		77	95	77	77	148	148	177	177	177		148	1198	1200		100	1200	77	77	80	668
PRESSURE, PSIA	14.23	12.39	11.66	11.23	14.23	64.23	94.23		34.23	10.87	54.23	54.23	114.23	114.23	89.23	89.23	89.23		11.45	12.39	12.39		104.23	12.60	24.23	34.23	64.23	14.00
INSTANTANEOUS FLOW, GPM (ACFM)	(1053)	(8285)	175	(3875)	(3411)	(9.05)	275		1.40	(4018)	3.3E-02	2.46	300	20.7	175	163	11.9		300	(16575)	(8285)		276	(8142)	(19)	2.33	(15.1)	(1118)
DENSITY, LB/FT3	0.0709	0.0173	65.04	0.0538	0.0612	0.3213	62.36		62.25	0.0519	74.69	74.69	61.28	61.28	65.05	65.05	65.05		61.26	0.0173	0.0173		62.05	0.0176	0.0677	62.25	0.3213	0.0270
VISCOSITY, CP	0.018	0.041	0.35	0.018	0.020	0.018	0.98		0.89	0.018	2.9	2.9	0.44	0.44	0.35	0.35	0.35		0.44	0.041	0.041		0.68	0.041	0.011	0.89	0.018	0.035
MW	28.67	24.89		28.40	28.40	28.67				28.40										24.89	24.89			24.89	16.04		28.67	23.33
COMPONENT INSTANTANEOUS FLOW, LB/HR																												
VX																												2.5E-05
DICDI																												1.3E-01
DIPU																												1.2E-03
ETHANOL																												12.29
N2	3406.0	4964.8	2.3E-01	9929.6	9929.6	132.62	8.7E-01			9929.6			9.3E-01	6.4E-02	2.3E-01	2.2E-01	1.6E-02		9.3E-01	9929.6	4964.8		8.7E-01	4964.8			221.05	1184.5
O2	1027.4	553.91	4.5E-02	1107.8	1107.8	40.00	1.7E-01			1107.8			1.8E-01	1.3E-02	4.5E-02	4.2E-02	3.0E-03		1.8E-01	1107.83	553.91		1.7E-01	553.91			66.68	1.7E-03
H2		1.8E-04		3.6E-04	3.6E-04					3.6E-04										3.6E-04	1.8E-04			1.8E-04				23.56
CO2		462.07	1.2E-02	923.33	923.33		2.6E-01			923.33			3.9E-01	2.7E-02	1.2E-02	1.2E-02	8.5E-04		2.80	924.15	462.07		2.9E-01	462.07				133.80
CO		7.4E-04	2.6E-06	1.5E-03	1.5E-03		1.3E-05			1.5E-03			1.4E-05	9.7E-07	2.6E-06	2.5E-06	1.8E-07		1.4E-05	1.5E-03	7.4E-04		1.3E-05	7.4E-04				88.60
NH3																												26.18
NO2		1.4E-02	9.1E-03	2.6E-02	2.6E-02		1.3E-01			2.6E-02			1.4E-01	1.0E-02	9.1E-03	8.4E-03	6.2E-04		1.4E-01	2.7E-02	1.4E-02		1.3E-01	1.4E-02				
NO		2.43	4.6E-04	4.87	4.87		4.6E-03			4.87			4.9E-03	3.4E-04	4.6E-04	4.3E-04	3.2E-05		4.9E-03	4.87	2.43		4.6E-03	2.43				
HCN																												4.2E-02
H2S																												27.88
COS																												4.2E-01
SO2		52.86		1.2E-05	1.2E-05					1.2E-05									2.7E-06	105.71	52.86			52.86				
CH4																												58.75
C2H6																												1.7E-03
H2O	45.42	2519.0	84692	548.06	548.06	1.77	137206		697.54	548.06	16.40	1209.3	147355	10150	84692	78931	5761.0		147338	5038.0	2519.0		137206	2519.0		1162.7	2.95	193.36
H2SO4		8.4E-05																		1.7E-04	8.4E-05			8.4E-05				
P2O5		60.01																		120.02	60.01			60.01				60.01
H3PO4		9.1E-06	1.0E-06												1.0E-06	9.3E-07	6.8E-08			1.8E-05	9.1E-06			9.1E-06				
NANO3			1.5E-06												1.5E-06	1.4E-06	1.0E-07											
NAHCO3			15.59				94.63						101.42	6.99	15.59	14.53	1.06		98.93				94.53					
NA2CO3			9.19				2.86						3.05	2.1E-01	9.19	8.56	6.3E-01		4.1E-01				2.91					
NA2SO4			3.6E-03												3.6E-03	3.3E-03	2.4E-04											
NA3PO4			70.39												70.39	65.60	4.79											
NAOH			1.36				1.9E-02				3.60	265.45	1.8E-01	1.3E-02	1.36	1.27	9.3E-02		2.5E-02				4.7E-02					
NA2SO3			3045.9				2.22						2.24	1.5E-01	3045.9	2838.7	207.19		1.41				2.17					
NAHSO3			9.57				6.1E-02						1.9E-01	1.3E-02	9.57	8.92	6.5E-01		8.7E-01				1.0E-01					
NAH2PO4			8.90												8.90	8.29	6.1E-01											
NA2HPO4			3457.6												3457.6	3222.4	235.20											
N2O																												4.1E-02
DIPA																												1.29
DCCDI																												9.3E-03
RSSR																												1.2E-01
TOTAL INSTANTANEOUS FLOW, LB/HR	4,478.8	8,615.1	91,311	12,514	12,514	174.39	137,307	0.00	697.54	12,514	20.00	1,474.8	147,464	10,157	91,311	85,100	6,211.3	0.00	147,444	17,230	8,615.1	0.00	137,307	8,615.1	0.00	1,162.7	290.68	1,811.0
TOTAL AVERAGE THROUGHPUT, LB/HR	4,478.8	7,276.7	85,424	11,821	11,821	0.00	141,377	0.00	0.00	11,821	6.75	2.5E-01	148,422	7,044.6	85,424	82,684	2,739.7	0.00	148,415	14,553	7,276.7	0.00	141,377	7,276.7	76.02	911.35	227.84	1,582.6

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5	7/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	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
2	5/18/04	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JB	JU
1	10/28/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	BC	WW	SH	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
OFFGAS TREATMENT MPT
PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-OTM-00001 | SHEET 3 OF 4 | REV 5

PROFESSIONAL STAMP

DESIGN FILE: s:\2d\pr\07-m5-otm-1-3.pfz
PLOTTED BY: 514.39 ON 7/24/2006 AT 11:05:47 AM

07-M5-OTM-1-3.PFZ

BGCAPP_E2.BDR

NOTES:

1. THE MASS AND ENERGY BALANCES ARE BASED ON 2% HEEL FOR EQUIPMENT SIZING PURPOSES. NO HEEL (0%) IS NOT A CONTROLLING CASE FOR THE OTM DESIGN.
2. THE INSTANTANEOUS FLOW WAS DETERMINED BY THE EVAPORATION RATE OF THE OTM DESIGN.
3. DELETED

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-OTM-00001

OFF GAS TREATMENT MPT
CASE: AGENT H, INSTANTANEOUS CASE

STREAM NUMBER	802	804	805	806	807	808	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	830	831	832	833	7655
	Air To Bulk Oxidizer Unit	Cyclone Effluent Gas	Venturi Scrubber Sump Bottoms	Scrubber Tower Overhead to Filter	Blower Discharge to HVAC	Atomizing Air for Bulk Oxidizer Unit Water Feed	Recirculation Feed to Scrubber Tower	Makeup Water to Scrubber Tower	Water to Bulk Oxidizer Unit	Blower Suction	Caustic Feed To Scrubber Tower	Caustic Supply to Venturi Scrubber	Scrubber Recirculation Pump Discharge	Scrubber Recirculation Condensate To Sump	Venturi Scrubber Recirculation Pump Discharge	Condensate Recirculation Return to Venturi	Scrubber Condensate to Drain	Makeup Water Supply to Venturi Scrubber	Scrubber Condensate to Surge Tank	Total Feed to Venturi Scrubber	Bulk Oxidizer Unit-2 Effluent Gas	Make-Up Air to Venturi Scrubber	Condensate Recirculation To Trim Cooler	Bulk Oxidizer Unit Effluent Gas	Fuel Gas to Bulk Oxidizer Unit	Cooling Water to Bulk Oxidizer Unit	Atomizing Air for Bulk Oxidizer Unit Cooling Water Feed	MPT Offgas to Bulk Oxidizer Unit
TEMPERATURE, °F	77	1200	154	71	157		70			95	77	77	88	88	154	154	154		88	698		77	89	1200	77	77	80	595
PRESSURE, PSIA	14.23	12.39	11.66	11.23	14.23		94.23			10.87	54.23	54.23	114.23	114.23	89.23	89.23	89.23		11.45	12.39		14.23	104.23	12.60	24.23	34.23	64.23	14.00
INSTANTANEOUS FLOW, GPM (ACFM)	(489)	(4307)	174	(2450)	(2247)		294			(2644)	2.5E-02	1.14	300	4.71	175	172	3.32		300	(5797)		(1126)	295	(4233)	(2.20)	1.17	(7.60)	(988)
DENSITY, LB/FT3	0.0709	0.0176	67.00	0.0562	0.0612		62.43			0.0520	74.69	74.69	62.26	62.26	67.22	67.22	67.22		62.24	0.0269		0.0709	62.26	0.0180	0.0677	62.25	0.3213	0.0293
VISCOSITY, CP	0.018	0.041	0.42	0.018	0.020		0.98			0.018	2.9	2.9	0.78	0.78	0.42	0.42	0.42		0.78	0.032		0.018	0.78	0.041	0.011	0.89	0.018	0.028
MW	28.67	25.37		28.48	28.48					28.48										26.96		28.67		25.37	16.04		28.67	23.69
COMPONENT INSTANTANEOUS FLOW, LB/HR																												
HD																												2.2E-03
DITHIANE																												3.3E-03
POLYSULFIDES																												3.1E-03
Q-OH																												6.8E-04
TDG																												1.5E-03
ETHYLENE GLYCOL																												5.4E-03
N2	1581.7	2874.7	2.7E-01	6515.9	6515.9		1.50			6515.9			1.52	2.4E-02	2.7E-01	2.6E-01	5.1E-03		1.52	6515.9		3641.3	1.50	2874.7			111.36	1180.9
O2	477.09	287.07	1.0E-01	1385.4	1385.4		6.1E-01			1385.4			6.2E-01	9.8E-03	1.0E-01	9.9E-02	1.9E-03		6.2E-01	1385.4		1098.3	6.1E-01	287.07			33.59	1.4E-03
H2		7.0E-05		7.0E-05	7.0E-05					7.0E-05										7.0E-05				7.0E-05				14.16
CO2		172.92	5.4E-01	172.62	172.62		1.00			172.62			1.09	1.7E-02	7.6E-02	7.4E-02	1.4E-03		1.97	172.92			1.07	172.92				105.79
CO		2.8E-04	1.1E-06	2.8E-04	2.8E-04		1.0E-05			2.8E-04			1.0E-05	1.6E-07	1.1E-06	1.1E-06	2.1E-08		1.0E-05	2.8E-04			1.0E-05	2.8E-04				21.87
NH3																												1.60
NO2		7.4E-03													3.7E-09	3.6E-09				7.4E-03				7.4E-03				
NO		1.34	4.9E-04	1.34	1.34		1.9E-02			1.34			1.9E-02	3.0E-04	4.9E-04	4.8E-04	9.3E-06		1.9E-02	1.34			1.9E-02	1.34				
HCN																												
H2S																												34.21
COS																												2.1E-01
SO2		64.55	3.9E-04	3.1E-08	3.1E-08		3.2E-09			3.1E-08			7.0E-09	1.1E-10	1.1E-05	1.1E-05	2.0E-07		2.2E-08	64.55			6.9E-09	64.55				2.8E-07
SO3																												
CL2		3.5E-02																		3.5E-02				3.5E-02				
CH4																									8.93			2.95
C2H6																												7.1E-06
H2O	21.09	1116.6	83522	179.27	179.27		147117			179.27	12.30	561.70	149462	2346.1	84138	82540	1598.4		149449	1165.2		48.56	147117	1116.6		585.72	1.48	334.49
NAOH			2.7E-02				1.9E-02				2.70	123.30	3.4E-02	5.3E-04	1.7E-01	1.7E-01	3.3E-03		1.9E-02				3.3E-02					
HCL		41.51	6.8E-09												1.1E-09	1.1E-09				41.51				41.51				41.55
HCLO		5.4E-03	5.6E-04	2.6E-02	2.6E-02		1.0E-01			2.6E-02			1.1E-01	1.7E-03	6.8E-05	6.7E-05	1.3E-06		1.7E-01	5.4E-03			1.0E-01	5.4E-03				
HNO3		1.8E-08																		1.8E-08				1.8E-08				
NACL			3504.1				1.7E-02						1.7E-02	2.7E-04	3504.1	3437.5	66.57		1.7E-02				1.7E-02					
NANO3			3.6E-01				2.0E-06						2.1E-06	3.3E-08	3.6E-01	3.5E-01	6.9E-03		2.1E-06				2.0E-06					
NANO2			2.9E-01				1.7E-06						1.7E-06	2.6E-08	2.9E-01	2.9E-01	5.6E-03		1.7E-06				1.7E-06					
NAHCO3			28.01				335.88						340.96	5.35	24.74	24.27	4.7E-01		343.11				335.61					
NA2CO3			1.14				10.62						10.95	1.7E-01	6.38	6.26	1.2E-01		6.12				10.78					
NAHSO3			380.24				3.2E-02						4.5E-02	7.0E-04	66.07	64.82	1.26		7.8E-02				4.4E-02					
NA2SO3			6224.4				1.25						1.25	2.0E-02	6604.9	6479.5	125.47		1.21				1.23					
NAOCL			3.9E-01				1.00						1.02	1.6E-02	3.9E-01	3.8E-01	7.4E-03		9.2E-01				1.00					
TOTAL INSTANTANEOUS FLOW, LB/HR	2,079.9	4,558.7	93,661	8,254.6	8,254.6	0.00	147,469	0.00	0.00	8,254.6	15.00	685.00	149,820	2,351.7	94,346	92,554	1,792.3	0.00	149,805	9,346.9	0.00	4,788.2	147,469	4,558.7	8.93	585.72	146.43	1,737.8
TOTAL AVERAGE THROUGHPUT, LB/HR	2,369.2	4,884.7	85,993	7,168.1	7,168.1	0.00	147,063	0.00	0.00	7,168.1	7.00	9.00	149,629	2,566.4	86,002	84,822	1,179.7	0.00	149,622	8,331.8	0.00	3,447.1	147,063	4,884.7	65.85	639.80	159.95	1,649.9

CASE: IDLE; ONE MPT

STREAM NUMBER	802	804	805	806	807	808	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	830	831	832	833	7655
	Air To Bulk Oxidizer Unit	Cyclone Effluent Gas	Venturi Scrubber Sump Bottoms	Scrubber Tower Overhead to Filter	Blower Discharge to HVAC	Atomizing Air for Bulk Oxidizer Unit Water Feed	Recirculation Feed to Scrubber Tower	Makeup Water to Scrubber Tower	Water to Bulk Oxidizer Unit	Blower Suction	Caustic Feed To Scrubber Tower	Caustic Supply to Venturi Scrubber	Scrubber Recirculation Pump Discharge	Scrubber Recirculation Condensate To Sump	Venturi Scrubber Recirculation Pump Discharge	Condensate Recirculation Return to Venturi	Scrubber Condensate to Drain	Makeup Water Supply to Venturi Scrubber	Scrubber Condensate to Surge Tank	Total Feed to Venturi Scrubber	MPT Cyclone-2 Effluent Gas	Make-Up Air to Venturi Scrubber	Condensate Recirculation To Trim Cooler	Bulk Oxidizer Unit Effluent Gas	Fuel Gas to Bulk Oxidizer Unit	Cooling Water to Bulk Oxidizer Unit	Atomizing Air for Bulk Oxidizer Unit Cooling Water Feed	Combined Feed to Bulk Oxidizer Unit
TEMPERATURE, °F	77	1200	166	71	157		70			95	77	77	92	92	166	166	166		92	1134		77	92	1200	77	77	80	761
PRESSURE, PSIA	14.23	12.39	11.66	11.23	14.23		94.23			10.87	54.23	54.23	114.23	114.23	89.23	89.23	89.23		11.45	12.39		14.23	104.23	12.60	24.23	34.23	64.23	14.23
INSTANTANEOUS FLOW, GPM (ACFM)	(1052)	(5636)	175	(1622)	(1488)		293			(1751)	1.8E-02	1.8E-04	300	5.62	175	173	2.23		300	(5796)		(112)	294	(5539)	(15.6)	1.50	(9.75)	(414)
DENSITY, LB/FT3	0.0709	0.0180	61.05	0.0564	0.0615		62.39			0.0523	74.69	74.69	62.19	62.19	61.06	61.06	61.06		62.16	0.0189		0.0709	62.18	0.0183	0.0677	62.25	0.3213	0.0248
VISCOSITY, CP	0.018	0.041	0.38	0.018	0.020		0.98			0.018	2.9	2.9	0.74	0.74	0.38	0.38	0.38		0.74	0.040		0.018	0.74	0.041	0.011	0.89	0.018	0.031
MW	28.67	25.90		28.60	28.60					28.60										26.09		28.67		25.90	16.04		28.67	22.87
COMPONENT INSTANTANEOUS FLOW, LB/HR																												
N2	3402.3	3910.3	4.0E-01	4273.7	4273.7		1.44			4273.7			1.47	2.8E-02	4.0E-01	3.9E-01	5.1E-03		1.47	4273.7		363.36	1.44	3910.3			142.86	366.47
O2	1026.2	815.84	1.5E-01	925.44	925.44		6.0E-01			925.44			6.1E-01	1.1E-02	1.5E-01	1.5E-01	1.9E-03		6.1E-01	925.44		109.60	6.0E-01	815.84			43.09	
H2		3.8E-05		3.8E-05	3.8E-05					3.8E-05										3.8E-05			1.6E-08	3.8E-05				
CO2		173.31	4.7E-01	171.26	171.26		1.27			171.26			1.37	2.6E-02	4.6E-01	4.6E-01	5.9E-03		2.81	173.31			1.34	173.31				
CO		1.8E-04	1.4E-06	1.8E-04	1.8E-04		9.7E-06			1.8E-04			9.9E-06	1.9E-07	1.4E-06	1.4E-06	1.8E-08		9.9E-06	1.8E-04			9.7E-06	1.8E-04				
NO2		2.3E-02	4.3E-02	2.3E-02	2.3E-02		6.9E-01			2.3E-02			7.1E-01	1.3E-02	4.3E-02	4.2E-02	5.5E-04		7.1E-01	2.3E-02			6.9E-01	2.3E-02				
NO		2.73	1.5E-03	2.73	2.73		5.3E-02			2.73			5.4E-02	1.0E-03	1.5E-03	1.5E-03	1.9E-05		5.4E-02	2.73			5.3E-02	2.73				
CH4																									63.18			
H2O	45.37	1190.6	85398	117.92	117.92		146611			117.92	9.02	9.0E-02	149410	2798.8	85398	84311	1086.7		149400	1195.4		4.85	146611	1190.6		751.43	1.91	250.00
HNO3		5.5E-08																		5.5E-08				5.5E-08				
NANO3			5.8E-06												5.8E-06	5.8E-06	7.4E-08											
NAHCO3			285.30				212.83						216.63	4.06	285.26	281.63	3.63		215.27				212.57					
NA2CO3			27.65				3.15						3.37	6.3E-02	27.69	27.34	3.5E-01		1.61				3.30					
NAOH			4.3E-01				9.2E-03				1.98	2.0E-02	1.9E-02	3.5E-04	4.3E-01	4.3E-01	5.5E-03		9.1E-03				1.9E-02					
TOTAL INSTANTANEOUS FLOW, LB/HR	4,473.9	6,092.8	85,712	5,491.1	5,491.1	0.00	146,831	0.00	0.00	5,491.1	11.00	1.1E-01	149,634	2,803.0	85,712	84,622	1,090.7	0.00	149,623	6,570.6	0.00	477.81	146,831	6,092.8	63.18	751.43	187.86	616.47

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5	4/4/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	FJ	JH	SH	JB	BB
4	12/16/05	(IFD) MUN. COOLING. LL FROM NECDF. ENS	FJ	JH	SH	JB	PK
3	12/1/05	(IFD) MUN. COOLING. LL FROM NECDF. ENS	FJ	JH	SH	JB	PK
2	5/18/04	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JB	JU
1	10/28/04	ISSUED FOR DESIGN (IFD)	WW	FJ	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	BC	WW	SH	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 OFFGAS TREATMENT MPT PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-OTM-00001 | SHEET 4 OF 4 | REV 5

PROFESSIONAL STAMP

DESIGN FILE: s:\26pr\07-m5-otm-1-4.pfz
PLOTTED BY: 5439 ON 4/13/2006 AT 2:48:49 PM

07-M5-OTM-1-4.PFZ

BGCAPP_E2.BDR

AD-RHS-0101
RSM/PMD
INPUT BLAST GATE, ECR-1

AD-EBH-0101
EBH BLAST AIRLOCK
INLET GATE, LINE-1

AD-PHS-0101
PROJECTILE DISCHARGE
BLAST GATE

MY-PHS-0101
PMD NOSE CLOSURE
REMOVAL
STATION

MY-PHS-0102
PMD MISCELLANEOUS
PARTS
REMOVAL
STATION

MY-PHS-0103
PMD BURSTER
REMOVAL
STATION

MJ-PHS-0103
PMD PROJECTILE
TRANSFER ROBOT

MJ-RHS-0111
ROCKET HANDLING
ROBOT ECR-1
(NOTE 6)

AD-EBH-0117
EBH BLAST AIRLOCK
OUTLET GATE, LINE-1

NOTES:

1. THERE ARE THREE TYPES OF PROJECTILES AT THE BLUEGRASS FACILITY: M110 H BURSTERED PROJECTILES, M426 GB DEBURSTERED PROJECTILES AND M121A1 VX DEBURSTERED PROJECTILES. EACH TYPE OF PROJECTILE WILL BE DEMILITARIZED IN A SEPARATE CAMPAIGN.
2. PROJECTILE DEMILITARIZATION MACHINE IS LOCATED WITHIN AN EXPLOSION CONTAINMENT ROOM (ECR).
3. ECR-1 WILL BE MODIFIED AND WILL HOUSE ONE PMD MACHINE FOR "H" CAMPAIGN ONLY.
4. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-MS-00-00002.
5. PROJECTILE TRANSFER ROBOT WILL TRANSFER THE M110 H PROJECTILES TO NOSE CLOSURE REMOVAL STATION, MISCELLANEOUS PARTS REMOVAL STATION AND BURSTER REMOVAL STATION IN SEQUENCE. NOSE CLOSURES, CUPS AND BURSTERS WILL BE COLLECTED, PUT IN A BUCKET AND TRANSFERRED TO THE ENERGETICS BATCH HYDROLYZER.
6. ROCKET HANDLING ROBOT WILL BE REPROGRAMMED TO TRANSFER THE BUCKET, WHICH CONTAINS NOSE CLOSURES, CUPS AND BURSTERS, TO THE ECR BLAST AIRLOCK.
7. UNCONTAMINATED WOOD WILL STAY INSIDE UNPACK AREA FOR SHIPMENT OUTSIDE LATER. CONTAMINATED WOOD WILL BE SENT TO MPT VIA TMA.

4 2

M426 GB PROJECTILES
M121A1 VX PROJECTILES
M110 H PROJECTILES
NOTE 1
MUNITIONS UNPACK AREA
UPA (NOTE 7)

M110 H PROJECTILES
111
AD-RHS-0101

NOSE CLOSURE REMOVAL STATION MY-PHS-0101
MISCELLANEOUS PARTS REMOVAL STATION MY-PHS-0102
BURSTER REMOVAL STATION MY-PHS-0103
PMD

MJ-RHS-0111 (NOTE 6)
AD-EBH-0101
AD-EBH-0117

MJ-PHS-0103
(NOTE 5)
ECR-1 (NOTE 3)
AD-PHS-0101

112 MWS-00001 M426 GB PROJECTILES TO NOSE CLOSURE REMOVAL SYSTEM
113 MWS-00001 M121A1 VX PROJECTILES TO NOSE CLOSURE REMOVAL SYSTEM
1 EBH-00001 M110 H BURSTERS, CUPS, AND NOSE CLOSURES TO ENERGETICS BATCH HYDROLYZER
115 MWS-00001 M110 H DEBURSTERED PROJECTILES WITH AGENT TO MUNITIONS WASHOUT SYSTEM

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
4	3/23/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JH	NI	SH	JB	BB
3	6/8/05	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
2	5/2/05	ISSUED FOR APPROVAL (IFA)	PC	NI	SH	JB	JU
1	10/5/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU

4 1
QUALITY ☒ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel Nationals, 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 PROJECTILE DEMILITARIZATION PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M5-PHS-00001
SHEET 1 OF 2
REV 4

07-M5-PHS-1-1.PFZ
BGCAPP_E2.BDR

DESIGN FILE: S:\2D\pr\07-M5-PHS-1-1.plz
PLOTTED BY: 51439 ON 3/28/2006 AT 7:46:42 AM

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-PHS-00001
PROJECTILE DEMILITARIZATION MACHINE

STREAM NUMBER	1	111	112	113	115
DESCRIPTION	M110 H BURSTERS, CUPS & NOSE CLOSURES TO EBH	H PROJECTILES TO PMD	GB PROJECTILES TO NCR/ MWS	VX PROJECTILES TO NCR/ MWS	H PROJECTILES TO MWS
TEMPERATURE, F	77	77	77	77	77
PRESSURE, PSIA					
MUNITIONS/ HOUR		26	15	19.7	26
GPM, INSTANTANEOUS FLOW	-	-	-	-	-
DENSITY, LB/FT3	-	-	-	-	-
COMPONENT FLOWS, LB/HR					
GB			217.50		
VX				118.20	
H		304.20			304.20
ENERGETIC	10.66	10.66			
STEEL	56.42	2188.4	2624.3	1782.9	2132.0
ALUMINUM	1.56	1.56			
HYDROGEN (VAPOR)		0.021			0.021
NITROGEN (VAPOR)		0.45			0.45
OXYGEN (VAPOR)		0.08			0.08
CARBON DIOXIDE (VAPOR)		0.0008			0.0008
ETHANE (VAPOR)		0.002	TRACE	TRACE	0.002
VOCs (VAPOR)		0.002	TRACE	TRACE	0.002
TOTAL PEAK, LB/HR	68.64	2505.4	2841.8	1901.1	2436.8
AVG THROUGHPUT, LB/HR	26.14	953.98	1420.9	772.00	927.84
NOTES		1	1		

△6 1

NOTES:

1. EACH TYPE OF PROJECTILE WILL BE DEMILITARIZED IN A SEPARATE CAMPAIGN.
2. DELETED
3. DELETED
4. DELETED
5. DELETED

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	6/2/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JH	JW	SH	JB	BB
5	3/23/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JH	NI	SH	JB	BB
4	6/8/05	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
3	5/2/05	ISSUED FOR APPROVAL (IFA)	PC	NI	SH	JB	JU
2	12/23/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	CH
1	10/5/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU

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 PROJECTILE DEMILITARIZATION PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M5-PHS-00001 | SHEET 2 OF 2 | REV 6

2 07-M5-PHS-1-2.PFZ

BGCAPP_E2.BDR

DESIGN FILE: s:\24\pr\07-m5-phs-1-2.pfz AT 3:12:27 PM
PLOTTED BY: 51439 ON 6/21/2006

MP-RHS-0101A/B
WATER JET
PUMP AND SPARE
CAPACITY: 28 GPM

MY-RHS-0101/0102
ROCKET SHEAR MACHINE

AD-RHS-0107/0108
UPA
BLAST GATE

MJ-RHS-0113/0114
ROCKET CUTTING
MACHINE

AD-RHS-0114/0115
MOTOR/SFT
ACCESS BLAST GATE
(NOTE 18)

MJ-RHS-0119
MOTOR/SFT
TRANSFER
ROBOT

AD-RHS-0101
RSM/PMD
INPUT BLAST GATE
ECR-1

AD-RHS-0102
RSM
INPUT BLAST GATE
ECR-2

AD-EBH-0101/0102
EBH BLAST AIRLOCK
IN-GATE

AD-EBH-0117/0118
EBH BLAST AIRLOCK
OUT-GATE

MP-RHS-0102/0103
DRAINED AGENT
PUMP
CAPACITY: 2.5 GPM

MJ-RHS-0111/0112
ROCKET HANDLING
ROBOT

MP-RHS-0106/0107
DRAINED AGENT/
AGENT WASHOUT
SPARE PUMPS
LINE-1/-2
CAPACITY: 5 GPM

MP-RHS-0104/0105
AGENT WASHOUT
PUMP
CAPACITY: 5 GPM
(NOTE 6)

BCS-00001
1% NaOH (DECON)

PWS-00002
PROCESS WATER
(DEMIN. WATER)

DECON (NOTE 14)

SPRAY WATER (NOTE 5)

MP-RHS-0101A/B

TO PARALLEL UNIT (NOTE 2)

ROCKETS
(M55 GB OR M55 VX)
(NOTE 1)

ROCKET UNPACK
(NOTE 11)

NON-CONTAMINATED
WOOD PALLETS
TO STORAGE

CONTAMINATED
WOOD PALLETS/SFTs
TO MPT

MJ-RHS-0113
ROCKET
CUTTING
MACHINE
(NOTE 15)

WARHEADS

PUNCH,
DRAIN
AND
WASH

MY-RHS-0101

CONTAINER

MJ-RHS-0111

AD-RHS-0107

AD-RHS-0101

AD-EBH-0101

AD-EBH-0117

EBH-00001
WARHEAD
SECTIONS
TO EBH

NON-CONTAMINATED
MOTORS/SFTs
(NOTE 18)

PLANT
AIR

VENT

Pdl

SIMPLEX
STRAINER
(NOTES 10, 17)

MP-RHS-0104/106
(NOTE 6)

SIMPLEX
STRAINER
(NOTES 9, 17)

SDS-00001
AGENT WASHOUT TO
SPENT DECON HOLDING/AGENT
WASHOUT TREATMENT TANK
MV-SDS-0301
(NOTE 7)

FROM
PARALLEL
UNIT
(NOTE 2)

MP-RHS-0102/106
(NOTE 6)

ACS-00001
DRAINED AGENT TO
AGENT HOLDING TANK
(NOTE 16)

ECV-1
NOTE 2

ECR-1
NOTE 2

AD-RHS-0114
(NOTE 18)

MJ-RHS-0119

ROCKET MOTORS/SFTs
TO STORAGE

WARHEAD SFTs
TO STORAGE

EMPTY ROCKETS
AND SFT BOXES

MPR

NOTES:

1. THERE ARE TWO TYPES OF ROCKETS AT THE BLUEGRASS FACILITY: M55 GB AND M55 VX. EACH TYPE OF ROCKET WILL BE DEMILITARIZED IN A SEPARATE CAMPAIGN.
2. ECV-1 AND ECV-2 EACH CONTAIN ONE RCM. ECR-1 AND ECR-2 EACH CONTAIN ONE RSM. ONE ROCKET PROCESSING LINE (RCM, RSM) IS OPERATING WHILE ONE LINE IS ON STAND-BY. INSTANTANEOUS FLOW IS FOR BOTH LINES OPERATING. PEAK FLOWRATE IS FOR ONE LINE OPERATING.
3. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
4. DELETED
5. WATER SPRAY WILL BE ON AT 4.0 GPM FOR ABOUT FOUR SECONDS PER CUT DURING ROCKET CUTTING. IT IS 0.25 GALLONS PER CUT, THREE CUTS TOTAL PER ROCKET.
6. MP-RHS-0106 IS THE COMMON SPARE FOR DRAINED AGENT PUMP AND AGENT WASHOUT PUMP IN LINE 1. MP-RHS-0107 IS THE COMMON SPARE FOR LINE 2.
7. MV-SDS-0301 IS USED TO STORE AGENT WASHOUT SOLUTION DURING OPERATION.
8. THREE WAY VALVE IS UNDER TIMER CONTROL TO SWITCH BETWEEN DRAINED AGENT LINE AND AGENT WASHOUT LINE. RESPECTIVE PUMPS ARE TURNED ON AND OFF PRIOR TO AND FOLLOWING THE VALVE SWITCHING. FORE AND AFT RINSE VALVES ARE OPENED WHEN THE THREE-WAY VALVE SWITCHES TO THE AGENT WASHOUT LINE AND CLOSED AFTER A PRESET VOLUME OF RINSE WATER.
9. PROVISION SHALL BE MADE FOR INSTALLING RSM LINE 2 PUMP DISCHARGE STRAINERS FOR GB CAMPAIGN IN ECR-2. THERE IS NO DISCHARGE STRAINER ON RSM LINE 1. FOR VX CAMPAIGN, RSM LINE 2 DISCHARGE STRAINERS WILL BE REPLACED BY SPOOL PIECE FOR CONNECTIONS.
10. MAGNETIC ELEMENTS WILL BE INCLUDED IN UPSTREAM STRAINERS TO REMOVE METAL PARTICLES.
11. OPERATOR WILL SEND THE PALLET TO MPT VIA TMA AS SOON AS IT IS DISCOVERED TO BE CONTAMINATED. UNCONTAMINATED WOOD WILL BE SHIPPED OFF-SITE AS SECONDARY WASTE.
12. AUTOMATED WATER FLUSHING DEVICE IS TO BE PROVIDED DOWNSTREAM OF THREE WAY VALVE.
13. DELETED
14. 1% NaOH IS USED DURING M55 GB CAMPAIGN ONLY. IT IS 0.75 GALLONS PER ROCKET.
15. INTERNAL LEAKERS WILL BE DEALT WITH AS THEY OCCUR. THE CONTAMINATED ROCKET MOTORS (CRMs) AND EQUIPMENT WILL BE DECONNED AND THE CRMs WILL BE STORED IN THE ECV UNTIL A CONVENIENT TIME TO PROCESS.
16. PROVISION WILL BE MADE TO CONNECT DRAINED AGENT LINE TO THE AGENT WASHOUT LINE IN OR CLOSE TO THE ANS ROOM FOR SEPARATION OF LINE FLUSHING.
17. STRAINERS SHALL HAVE A DISPOSABLE BAG, SIZED SUCH THAT THEY WILL NOT NEED CHANGING MORE THAN ONCE PER DAY.
18. BLAST GATE AD-RHS-0114 SEPARATES ECV-1 AND ECV-2. BLAST GATE AD-RHS-0115 SEPARATES ECV-2 AND MPR. WHEN PROCESSING IN ECV-1, NON-CONTAMINATED MOTORS AND SFTs WILL TRANSFER FROM ECV-1 THROUGH ECV-2 TO THE MPR.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
7	4/4/06	(IFD) INCORPORATION OF RCM	JH	NI	SH	JB	BB
6	3/23/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JH	NI	SH	JB	BB
5	3/20/06	(IFA) SHEET REDRAWN, TAA UPDATE	JH	NI	SH	JB	BB
4	8/12/05	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
3	7/12/05	ISSUED FOR APPROVAL (IFA) DC-43B	PC	NI	SH	JB	JU
2	5/2/05	ISSUED FOR APPROVAL (IFA)	PC	NI	SH	JB	JU
1	10/5/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU

QUALITY ☒ Q ☐ Non-Q

BECHTEL PARSONS BLUE GRASS
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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 ROCKET SHEAR MACHINE PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-RHS-00001 | SHEET 1 OF 2 | REV 7

PROFESSIONAL STAMP

DESIGN FILE: s:\2dwgs\07-m5-rhs-1-1.pfz
PLOTTED BY: 5439 ON 4/6/2006 AT 2:55:10 PM

07-M5-RHS-1-1.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-RHS-00001

ROCKET SHEAR MACHINE : CASE AGENT GB CO-PROCESSING (0 WT% AGENT HEEL TO EBH) — PEAK CASE

STREAM NUMBER	11	100	101	105	106	107	108	110	121	206	207	208
DESCRIPTION	SHEARED WARHEADS TO EBH	GB ROCKETS	DEMIN WATER FOR FORE PUNCH/ FLUSHING	TOTAL AGENT WASHOUT TO SD/ AGENT WASHOUT HOLDING TANK	TOTAL DRAINED AGENT TO AGENT HOLDING TANK	ROCKET MOTOR/SFTs TO STORAGE	WARHEAD SFTs TO STORAGE	DEMIN WATER FOR AFT PUNCH/ FLUSHING	NON-CONTAMINATED WOOD TO STORAGE	TOTAL DEMIN WATER SUPPLY FOR FLUSHING	TOTAL DEMIN WATER SUPPLY FOR ROCKET CUTTING	1% NaOH SUPPLY FOR CONTAINER
TEMPERATURE, F	77	77	77	77	77	77	77	77		77	77	77
PRESSURE, PSIA			444.23	21.23	55.23	14.23	14.23	444.23		74.23	74.23	44.23
MUNITIONS/ HOUR		20				20	20					
INSTANTANEOUS FLOW, GPM			7.00	5.00	2.50			7.00		28.00	8.00	8.00
DENSITY, LB/FT3			62.33	62.53	67.97			62.33		62.26	62.26	62.87
VISCOSITY, cP			0.89	0.89	1.4			0.89		0.89	0.89	0.89
COMPONENT FLOWS, LB/HR												
GB		215.00		43.00	172.00							
VX												
ENERGETICS	62.80	62.80										
PROPELLANT		386.00				386.00						
CELLULOSE ACETATE		18.46				18.46						
WATER	166.42		239.28	749.79				427.28		666.56	124.84	124.81
NaOH	1.26											1.26
STEEL	33.78	319.74				285.96						
ALUMINUM	128.80	213.00				54.20	30.00					
FIBERGLASS		273.66				152.03	121.63					
PCB		0.34				0.19	0.15					
WOOD PALLETS		253.33							253.33			
TOTAL PEAK, LB/HR	393.06	1742.33	239.28	792.79	172.00	896.84	151.78	427.28	253.33	666.56	124.84	126.07
AVG THROUGHPUT, LB/HR	182.77	810.19	111.26	368.65	79.98	417.03	70.58	198.69	117.80	309.95	58.05	58.62
NOTES	5,7		3	5				3		3	5	7

8 4

ROCKET SHEAR MACHINE : CASE AGENT VX CO-PROCESSING (0 WT% AGENT HEEL TO EBH) — PEAK CASE

STREAM NUMBER	11	100	101	105	106	107	108	110	121	206	207	208
DESCRIPTION	SHEARED WARHEADS TO EBH	VX ROCKETS	DEMIN WATER FOR FORE PUNCH/ FLUSHING	TOTAL AGENT WASHOUT TO SD/ AGENT WASHOUT HOLDING TANK	TOTAL DRAINED AGENT TO AGENT HOLDING TANK	ROCKET MOTOR/SFTs TO STORAGE	WARHEAD SFTs TO STORAGE	DEMIN WATER FOR AFT PUNCH/ FLUSHING	NON-CONTAMINATED WOOD TO STORAGE	TOTAL DEMIN WATER SUPPLY FOR FLUSHING	TOTAL DEMIN WATER SUPPLY FOR ROCKET CUTTING	1% NaOH SUPPLY FOR CONTAINER
TEMPERATURE, F	77	77	77	77	77	77	77	77		77	77	77
PRESSURE, PSIA			444.23	21.23	55.23	14.23	14.23	444.23		74.23	74.23	44.23
MUNITIONS/ HOUR		24				24	24					
INSTANTANEOUS FLOW, GPM			7.00	5.00	2.50			7.00		28.00	8.00	8.00
DENSITY, LB/FT3			62.33	62.26	62.95			62.33		62.26	62.26	62.87
VISCOSITY, cP			0.89	0.90	10			0.89		0.89	0.89	0.89
COMPONENT FLOWS, LB/HR												
GB												
VX		242.40		9.70	232.70							
ENERGETICS	75.36	75.36										
PROPELLANT		463.20				463.20						
CELLULOSE ACETATE		22.15				22.15						
WATER	49.94		189.44	549.80				260.49		449.93	149.81	0.00
NaOH												
STEEL	40.54	383.69				343.15						
ALUMINUM	154.56	255.60				65.04	36.00					
FIBERGLASS		328.39				182.44	145.95					
PCB		0.41				0.23	0.18					
WOOD PALLETS		304.00							304.00			
TOTAL PEAK, LB/HR	320.39	2075.20	189.44	559.50	232.70	1076.21	182.13	260.49	304.00	449.93	149.81	0.00
AVG THROUGHPUT, LB/HR	146.85	951.13	86.83	256.44	106.66	493.26	83.48	119.39	139.33	206.22	68.66	0.00
NOTES	5		4	5				4		4	5	7

8 3

ROCKET SHEAR MACHINE : CASE AGENT GB CO-PROCESSING (2 WT% AGENT HEEL TO EBH) — PEAK CASE

STREAM NUMBER	11	100	101	105	106	107	108	110	121	206	207	208
DESCRIPTION	SHEARED WARHEADS TO EBH	GB ROCKETS	DEMIN WATER FOR FORE PUNCH/ FLUSHING	TOTAL AGENT WASHOUT TO SD/ AGENT WASHOUT HOLDING TANK	TOTAL DRAINED AGENT TO AGENT HOLDING TANK	ROCKET MOTOR/SFTs TO STORAGE	WARHEAD SFTs TO STORAGE	DEMIN WATER FOR AFT PUNCH/ FLUSHING	NON-CONTAMINATED WOOD TO STORAGE	TOTAL DEMIN WATER SUPPLY FOR FLUSHING	TOTAL DEMIN WATER SUPPLY FOR ROCKET CUTTING	1% NaOH SUPPLY FOR CONTAINER
TEMPERATURE, F	77	77	77	77	77	77	77	77		77	77	77
PRESSURE, PSIA			444.23	21.23	55.23	14.23	14.23	444.23		74.23	74.23	44.23
MUNITIONS/ HOUR		20				20	20					
INSTANTANEOUS FLOW, GPM			7.00	5.00	2.50			7.00		28.00	8.00	8.00
DENSITY, LB/FT3			62.33	62.50	67.97			62.33		62.26	62.26	62.87
VISCOSITY, cP			0.89	0.89	1.4			0.89		0.89	0.89	0.89
COMPONENT FLOWS, LB/HR												
GB	4.30	215.00		38.70	172.00							
VX												
ENERGETICS	62.80	62.80										
PROPELLANT		386.00				386.00						
CELLULOSE ACETATE		18.46				18.46						
WATER	166.42		239.28	749.79				427.28		666.56	124.84	124.81
NaOH	1.26											1.26
STEEL	33.78	319.74				285.96						
ALUMINUM	128.80	213.00				54.20	30.00					
FIBERGLASS		273.66				152.03	121.63					
PCB		0.34				0.19	0.15					
WOOD PALLETS		253.33							253.33			
TOTAL PEAK, LB/HR	397.36	1742.33	239.28	788.49	172.00	896.84	151.78	427.28	253.33	666.56	124.84	126.07
AVG THROUGHPUT, LB/HR	184.77	810.19	111.26	366.65	79.98	417.03	70.58	198.69	117.80	309.95	58.05	58.62
NOTES	5,7		3	5				3		3	5	7

8 2

ROCKET SHEAR MACHINE : CASE AGENT VX CO-PROCESSING (2 WT% AGENT HEEL TO EBH) — PEAK CASE

STREAM NUMBER	11	100	101	105	106	107	108	110	121	206	207	208
DESCRIPTION	SHEARED WARHEADS TO EBH	VX ROCKETS	DEMIN WATER FOR FORE PUNCH/ FLUSHING	TOTAL AGENT WASHOUT TO SD/ AGENT WASHOUT HOLDING TANK	TOTAL DRAINED AGENT TO AGENT HOLDING TANK	ROCKET MOTOR/SFTs TO STORAGE	WARHEAD SFTs TO STORAGE	DEMIN WATER FOR AFT PUNCH/ FLUSHING	NON-CONTAMINATED WOOD TO STORAGE	TOTAL DEMIN WATER SUPPLY FOR FLUSHING	TOTAL DEMIN WATER SUPPLY FOR ROCKET CUTTING	1% NaOH SUPPLY FOR CONTAINER
TEMPERATURE, F	77	77	77	77	77	77	77	77		77	77	77
PRESSURE, PSIA			444.23	21.23	55.23	14.23	14.23	444.23		74.23	74.23	44.23
MUNITIONS/ HOUR		24				24	24					
INSTANTANEOUS FLOW, GPM			7.00	5.00	2.50			7.00		28.00	8.00	8.00
DENSITY, LB/FT3			62.33	62.25	62.95			62.33		62.26	62.26	62.87
VISCOSITY, cP			0.89	0.90	10			0.89		0.89	0.89	0.89
COMPONENT FLOWS, LB/HR												
GB												
VX	4.85	242.40		4.85	232.70							
ENERGETICS	75.36	75.36										
PROPELLANT		463.20				463.20						
CELLULOSE ACETATE		22.15				22.15						
WATER	49.94		189.44	549.80				260.49		449.93	149.81	0.00
NaOH												
STEEL	40.54	383.69				343.15						
ALUMINUM	154.56	255.60				65.04	36.00					
FIBERGLASS		328.39				182.44	145.95					
PCB		0.41				0.23	0.18					
WOOD PALLETS		304.00							304.00			
TOTAL PEAK, LB/HR	325.24	2075.20	189.44	554.65	232.70	1076.21	182.13	260.49	304.00	449.93	149.81	0.00
AVG THROUGHPUT, LB/HR	149.07	951.13	86.83	254.21	106.66	493.26	83.48	119.39	139.33	206.22	68.66	0.00
NOTES	5		4	5				4		4	5	7

8 1

NOTES:

1. DELETED
2. DELETED
3. WASH WATER VOLUME FOR GB ROCKET IS 4.0 GALLONS PER ROCKET MAXIMUM.
4. WASH WATER VOLUME FOR VX ROCKET IS 2.25 GALLONS PER ROCKET MAXIMUM.
5. WATER SPRAY WILL BE ON DURING ROCKET WARHEAD CUTTING. IT IS 0.25 GALLONS PER CUT, THREE CUTS TOTAL PER ROCKET. 0.5 GALLONS GO TO THE SDS, 0.25 GALLONS GO TO THE EBH.
6. DELETED
7. 1% NaOH DECON VOLUME FOR EACH GB ROCKET IS 0.75 GALLONS TOTAL. IT IS ADDED TO THE SHEARED ROCKET CONTAINER.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
8 4	6/2/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JH	JW	SH	JB	BB
7 3	4/4/06	(IFD) INCORPORATION OF RCM	JH	NI	SH	JB	BB
6	3/23/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JH	NI	SH	JB	BB
5	3/20/06	(IFA) SHEET REDRAWN, TAA UPDATE	JH	NI	SH	JB	BB
4 4	8/12/05	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
3 2	7/12/05	ISSUED FOR APPROVAL (IFA) DC-43B	PC	NI	SH	JB	JU
2 2	5/2/05	ISSUED FOR APPROVAL (IFA)	PC	NI	SH	JB	JU
1	10/5/04	ISSUED FOR DESIGN (IFD)	PC	NI	SH	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 ROCKET SHEAR MACHINE PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-07-M5-RHS-00001 SHEET 2 OF 2 REV 8

07-M5-RHS-1-2.PFZ BGCAPP_E2.BDR

DESIGN FILE: s:\2d\pr\07-m5-rhs-1-2.pfz AT 3:12:28 PM
PLOTTED BY: 51439 ON 6/21/2006

MP-SDS-0131
CATEGORY A
SUMP PUMP
CAPACITY: 20 GPM
(NOTE 13)

MP-SDS-0132
CATEGORY B
SUMP PUMP
CAPACITY: 20 GPM
(NOTE 13)

MP-SDS-0133
CATEGORY C
SUMP PUMP
CAPACITY: 20 GPM
(NOTE 13)

MF-SDS-0101/0201/0301
SPENT DECON HOLDING/
AGENT WASHOUT
TREATMENT
TANK AGITATOR
HP: TBD

MV-SDS-0101/0201/0301
SPENT DECON HOLDING/AGENT
WASHOUT TREATMENT TANK
WORKING CAPACITY: 5200 GAL
(NOTES 3, 4)

MP-SDS-0101A/B
SPENT DECON
FEED PUMP AND
SPARE
CAPACITY: 43 GPM

MP-SDS-0102A/B
SPENT DECON/AGENT WASHOUT
FEED PUMP AND
SPARE
CAPACITY: 43 GPM

PLANT AIR
VENT TO ROOM
701A 702A
(NOTE 21)
MP-SDS-0133
(NOTE 17)
TYPICAL CATEGORY C SUMPS

PLANT AIR
VENT TO ROOM
701B 702B
(NOTE 21)
MP-SDS-0132
TYPICAL CATEGORY B SUMPS

PLANT AIR
VENT TO ROOM
701C 702C
(NOTE 21)
MP-SDS-0131
TYPICAL CATEGORY A SUMPS

6 1

ANS-00001
SPENT DECON FROM
AGENT REACTORS/
HYDROLYZERS
NNF
REMOVABLE SPOOL

ACS-00001
AGENT SPILL TO
AGENT SURGE TANK
NNF
(NOTES 9, 19)

ACS-00001
AGENT SPILL TO
AGENT SURGE TANK
NNF
(NOTES 9, 19)

BCS-00001
50% NaOH
NNF
(NOTE 15)

0.4 PSIG
0.20 PSIG
1616
1615
MF-SDS-0101
M
LS
(NOTE 5)
MV-SDS-0101
(NOTE 3)

0.4 PSIG
0.20 PSIG
1616
1615
MF-SDS-0201
M
LS
MV-SDS-0201
(NOTE 3)

REMOVABLE SPOOL (NOTE 4)
REMOVABLE SPOOL (NOTE 4)
REMOVABLE SPOOL (NOTE 14)

0.4 PSIG
0.20 PSIG
1618
1617
MF-SDS-0301
M
LS
MV-SDS-0301
(NOTE 18)
(NOTE 16)

NIT-00001
NITROGEN
(FOR INTERMITTENT PURGING)
(NOTE 20)

MWS-00001
AGENT WASH WATER
FROM MWS
203

RHS-00001
AGENT WASH WATER
FROM RSM
105
255

ANS-00001
TO ANS VENT

AGENT SAMPLING SYSTEM
(NOTES 10, 11)

MP-SDS-0101A
(NOTE 8)

313

ENS-00001
CLEARED
SPENT DECON TO
ENERGETICS HYDROLYSATE
STORAGE TANK
(AGENT CHANGEOVER)

NNF

ANS-00001
CLEARED
SPENT DECON TO
AGENT HYDROLYSATE
STORAGE TANK
(AGENT CAMPAIGN)

6 2

FQI
254
(NOTE 12)
ANS-00001
TO AGENT REACTORS/
HYDROLYZERS
FOR FLUSHING

MP-SDS-0101B
(NOTE 8)
FLEXIBLE HOSE (NOTE 4)
(NOTE 14)

1619
ANS-00001
TO ANS COMMON
VENT LINE
(NOTE 16)

454
ANS-00001
TO AGENT REACTORS/
HYDROLYZERS

MP-SDS-0102A
(NOTE 8)

MP-SDS-0102B
(NOTE 8)

NOTES:

1. ALL STORAGE TANK COMPONENTS ARE LOCATED INSIDE AGENT NEUTRALIZATION ROOM.
2. DELETED
3. SPENT DECON COLLECTED IN THE TANKS WILL BE TESTED FOR THE PRESENCE OF AGENT. NORMALLY, AGENT IS NOT EXPECTED TO BE PRESENT AND CLEARED SPENT DECON WILL BE SENT TO THE AGENT HYDROLYSATE STORAGE TANKS THROUGH THE ANS DISCHARGE LINE. IF AGENT IS DETECTED, SPENT DECON WILL BE SENT TO THE AGENT HYDROLYZERS. DURING AGENT CAMPAIGN CHANGEOVER, IF NO AGENT IS DETECTED, THE CLEARED SPENT DECON SOLUTION IS THEN TRANSFERRED TO THE ENERGETICS HYDROLYSATE STORAGE TANKS. (6 3)
4. DURING OPERATION, TANK MV-SDS-0301 IS ISOLATED FROM TANKS MV-SDS-0101 AND MV-SDS-0201. MV-SDS-0301 WILL SERVE AS AN AGENT WASH WATER BUFFER TANK BEFORE SENDING TO AGENT REACTORS/HYDROLYZERS.
5. TANKS SHOULD BE FILLED ONE AT A TIME.
6. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
7. DELETED (6 4)
8. MP-SDS-0101A/B TAKE SUCTION FROM ONLY TWO TANKS MV-SDS-0101 AND 0201. MP-SDS-0102A/B TAKE SUCTION FROM ANY OF THE THREE TANKS MV-SDS-0101/0201/0301. THESE FOUR PUMPS WILL NOT TAKE SUCTION FROM THE SAME TANK CONCURRENTLY.
9. IN CASE OF AGENT SPILL IN CATEGORY "A" AND "B", SUMP PUMPS CAN PUMP SPILLED AGENT DIRECTLY TO THE AGENT SURGE TANK.
10. SAMPLING SYSTEM IS LOCATED IN THE WALL GLOVE PORT. LOCAL SAMPLE CONNECTION IS ALSO PROVIDED TO BE USED AS AND IF REQUIRED.
11. SAMPLE STREAMS WILL RETURN TO THE SAME TANK, SEE DRAWING 24915-07-M5-ANS-00002.
12. AGENT WASH WATER WILL BE USED TO FLUSH AGENT LINES AFTER AGENT INJECTION FOR VX CAMPAIGN. FOR GB AND H CAMPAIGNS, SPENT DECON WILL BE USED. SERVICE IS INTERMITTENT.
13. QUANTITY OF CATEGORY "A", "B", AND "C" SUMP PUMPS CAN BE FOUND ON DRAWING 24915-07-M6-SDS-00006, 00007, AND 00008 RESPECTIVELY.
14. MV-SDS-0201 IS A SPARE FOR MV-SDS-0301. A REMOVABLE SPOOL PIECE AND ISOLATION VALVE WILL BE PROVIDED FOR ISOLATION IF NOT IN USE.
15. 50% CAUCTIC LINE IS ROUTED TO EACH TANK. LINE SHOULD BE SIZED FOR 25 GPM. (6 5)
16. WHEN TANK MV-SDS-0301 IS USED FOR AGENT WASHOUT STORAGE, AGENT SAMPLING IS NOT REQUIRED. PROPER POSITIVE ISOLATION SHALL BE PROVIDED BETWEEN THE TANK AND THE SAMPLING SYSTEM FOR THIS OPERATION.
17. CATEGORY "C" SPENT DECON WILL USE APPROVED SURFACTANT WITH A 1O:1 DILUTION RATIO WITH WATER TO MINIMIZE FOAMING IN THE SDS TANKS.
18. PROVISION WILL BE MADE TO CONNECT DRAINED AGENT LINE TO THE AGENT WASH WATER LINE IN OR CLOSE TO THE ANS ROOM FOR SEPARATION OF LINE FLUSHING.
19. FILLING OF THE ACS SURGE TANK FROM PURE AGENT SPILL IS UNDER SUPERVISORY CONTROL.
20. NITROGEN LINE SHOULD BE SIZED FOR 6 SCFM. THIS IS AN INTERMITTENT SERVICE.
21. STREAM 701 INCLUDES SPENT DECON GENERATION DURING GB AND H CAMPAIGNS. STREAM 702 INCLUDES SPENT DECON GENERATED DURING VX CAMPAIGNS. (6 6)

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	6/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	NI	SH	JB	BB
5	4/4/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	ND	SH	JB	BB
4	8/12/05	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
3	7/12/05	ISSUED FOR APPROVAL (IFA) DC-43B	PC	NI	SH	JB	JU
2	5/11/05	ISSUED FOR APPROVAL (IFA)	PC	NI	SH	JB	JU
1	10/13/04	ISSUED FOR DESIGN (IFD)	PC	EV	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	PC	EV	SH	JB	JU

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 SPENT DECONTAMINATION SYSTEM PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-SDS-00001
SHEET 1 OF 2
REV 6

PROFESSIONAL STAMP

DESIGN FILE: s:\26\pr\07-m5-sds-1-1.pfz
PLOTTED BY: 51439 ON 6/30/2006 AT 9:45:55 AM

2 07-M5-SDS-1-1.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-07-M5-SDS-00001

SPENT DECON SYSTEM — PEAK CASE DURING AGENT CHANGEOVER PERIOD

STREAM NUMBER	313A	313B	701A	701B	701C	702A	702B	702C	1615	1616	1619
DESCRIPTION	GB & H SD TO HSS-AGENT/ HSS-ENERGETICS/ DCS TANKS	VX SD TO HSS-AGENT/ HSS-ENERGETICS/ DCS TANKS	GB & H SD TO SPENT DECON HOLDING TANKS (CATEGORY A)	GB & H SD TO SPENT DECON HOLDING TANKS (CATEGORY B)	GB & H SD TO SPENT DECON HOLDING TANKS (CATEGORY C)	VX SD TO SPENT DECON HOLDING TANKS (CATEGORY A)	VX SD TO SPENT DECON HOLDING TANKS (CATEGORY B)	VX SD TO SPENT DECON HOLDING TANKS (CATEGORY C)	NITROGEN TO SPENT DECON TANK	SDS TANK OFFGAS	SDS OFFGAS TO ANS
TEMPERATURE, F	77	77	77	77	77	77	77	77	77	77	77
PRESSURE, PSIA	20.25	20.25	24.25	24.25	24.25	24.25	24.25	24.25	14.43	14.63	14.00
INSTANTANEOUS FLOW, GPM (ACFM)	42.62	42.62	20.00	20.00	20.00	20.00	20.00	20.00	(5.7)	(2.7)	(2.8)
DENSITY, LB/FT3	65.82	64.82	66.13	66.13	62.63	65.03	65.03	62.63	0.070	0.071	0.068
VISCOSITY, cP	1.15	0.89	1.3	1.3	0.89	0.89	0.89	0.89	0.018	0.018	0.018
MOLECULAR WEIGHT	-	-			-			-	28.01	28.01	28.01
COMPONENT FLOWS, LB/HR											
WATER	376.50	382.67	241.42	103.46	31.62	245.73	105.31	31.62			
SOAP	1.87	1.87			1.87			1.87			
SODIUM HYDROXIDE	23.26		16.28	6.98							
SODIUM HYPOCHLORITE		11.15				7.80	3.34				
NITROGEN									0.43	0.43	0.43
VOCs (VAPOR)											
TOTAL PEAK, LB/HR	401.63	395.69	257.70	110.44	33.49	253.54	108.66	33.49	0.43	0.43	0.43
AVG THROUGHPUT, LB/HR	92.11	95.11	48.85	20.93	22.33	50.95	21.83	22.33	0.10	0.10	0.10
NOTES	1, 2, 10	1, 3, 10	1, 2, 10, 11	1, 2, 10, 11	1, 2, 10, 11	1, 3, 10, 11	1, 3, 10, 11	1, 3, 10, 11			

SPENT DECON SYSTEM — DURING AGENT GB CO-PROCESSING PERIOD

STREAM NUMBER	105	203	254	255	354	1617	1618	1619
DESCRIPTION	RSM AGENT WASHOUT TO SD/ AGENT WASHOUT TANK	MWS AGENT WASHOUT TO SD/ AGENT WASHOUT TANK	SD FOR FLUSHING AGENT LINES	TOTAL AGENT WASHOUT TO SD/ AGENT WASHOUT TANK	TOTAL AGENT WASH WATER TO AGENT HYDROLYZERS	NITROGEN TO SD/ AGENT WASHOUT TANK	SDS TANK OFFGAS	SDS OFFGAS TO ANS
TEMPERATURE, F	77	108	77	96	96	77	96	96
PRESSURE, PSIA	21.23	27.23	34.23	27.23	34.23	14.43	14.63	14.00
INSTANTANEOUS FLOW, GPM (ACFM)	5.00	9.64	20.00	14.64	26.6	(3.6)	(2.0)	(2.0)
DENSITY, LB/FT3	62.53	62.05	62.25	62.24	62.24	0.070	0.069	0.066
VISCOSITY, cP	0.89	0.86	0.89	0.95	0.95	0.018	0.018	0.018
MOLECULAR WEIGHT	-	-	-	-	-	28.01	28.01	28.01
COMPONENT FLOWS, LB/HR								
GB	43.00	43.50		86.50	86.50			
VX								
H								
WATER	749.79	1148.0	109.09	1897.8	1897.8			
NITROGEN						2.24	2.24	2.24
VOCs (VAPOR)								
TOTAL PEAK, LB/HR	792.79	1191.5	109.09	1984.3	1984.3	2.24	2.24	2.24
AVG THROUGHPUT, LB/HR	368.65	595.75	53.02	964.40	964.40	1.09	1.09	1.09
NOTES			7, 8					

SPENT DECON SYSTEM — DURING AGENT VX CO-PROCESSING PERIOD

STREAM NUMBER	105	203	254	255	354	1617	1618	1619
DESCRIPTION	RSM AGENT WASHOUT TO SD/ AGENT WASHOUT TANK	MWS AGENT WASHOUT TO SD/ AGENT WASHOUT TANK	AGENT WASH WATER FOR FLUSHING AGENT LINES	TOTAL AGENT WASHOUT TO SD/ AGENT WASHOUT TANK	TOTAL AGENT WASH WATER TO AGENT HYDROLYZERS	NITROGEN TO SD/ AGENT WASHOUT TANK	SDS TANK OFFGAS	SDS OFFGAS TO ANS
TEMPERATURE, F	77	110	99	99	99	77	99	99
PRESSURE, PSIA	21.23	27.23	34.23	27.23	34.23	14.43	14.63	14.00
INSTANTANEOUS FLOW, GPM (ACFM)	5.00	9.06	20.00	14.06	33.1	(4.4)	(1.8)	(2.0)
DENSITY, LB/FT3	62.26	61.86	61.99	61.99	61.99	0.070	0.065	0.065
VISCOSITY, cP	0.90	0.85	0.95	0.95	0.95	0.018	0.018	0.018
MOLECULAR WEIGHT	-	-	-	-	-	28.01	28.01	28.01
COMPONENT FLOWS, LB/HR								
GB								
VX	9.70	4.73	0.33	14.43	11.90			
H								
WATER	549.80	1130.7	38.45	1680.5	1385.7			
NITROGEN						1.92	1.92	1.92
VOCs (VAPOR)								
TOTAL PEAK, LB/HR	559.50	1135.5	38.78	1695.0	1397.6	1.92	1.92	1.92
AVG THROUGHPUT, LB/HR	256.44	461.11	16.42	717.55	591.66	0.81	0.81	0.81
NOTES			7, 8					

SPENT DECON SYSTEM — DURING AGENT H PROCESSING PERIOD

STREAM NUMBER	105	203	254	255	354	1617	1618	1619
DESCRIPTION	RSM AGENT WASHOUT TO SD/ AGENT WASHOUT TANK	MWS AGENT WASHOUT TO SD/ AGENT WASHOUT TANK	SD FOR FLUSHING AGENT LINES	TOTAL AGENT WASHOUT TO SD/ AGENT WASHOUT TANK	TOTAL AGENT WASH WATER TO AGENT HYDROLYZERS	NITROGEN TO SD/ AGENT WASHOUT TANK	SDS TANK OFFGAS	SDS OFFGAS TO ANS
TEMPERATURE, F		145	77	145	145	77	145	145
PRESSURE, PSIA		27.23	34.23	27.23	34.23	14.43	14.63	14.00
INSTANTANEOUS FLOW, GPM (ACFM)		15.82	20.00	15.82	43.1	(5.8)	(2.1)	(2.2)
DENSITY, LB/FT3		62.18	62.25	62.18	62.18	0.070	0.063	0.060
VISCOSITY, cP		0.45	0.89	0.45	0.45	0.018	0.019	0.019
MOLECULAR WEIGHT		-	-	-	-	28.01	28.01	28.01
COMPONENT FLOWS, LB/HR								
GB								
VX								
H		215.98		215.98	215.98			
WATER		2953.6	68.39	2953.6	2953.6			
NITROGEN						3.58	3.58	3.58
VOCs (VAPOR)								
TOTAL PEAK, LB/HR	0	3169.6	68.39	3169.6	3169.6	3.58	3.58	3.58
AVG THROUGHPUT, LB/HR		1206.9	26.04	1206.9	1206.9	1.36	1.36	1.36
NOTES			7, 8					

NOTES:

1. EACH TYPE OF AGENT WILL BE PROCESSED IN A SEPARATE CAMPAIGN. TOTAL PEAK CASE REPRESENTS PEAK SPENT DECON CONSUMPTION DURING AGENT CHANGEOVER PERIOD. AVERAGE THROUGHPUT CASE REPRESENTS NORMAL SPENT DECON CONSUMPTION DURING AGENT PROCESSING OPERATION.
2. STREAM 313A AND 701A ARE DEDICATED FOR AGENT GB AND H.
3. STREAM 313B AND 701B ARE DEDICATED FOR AGENT VX.
4. DELETED
5. DELETED
6. DELETED
7. THE CAUSTIC CONTENT OF THE SPENT DECON HAS NOT BEEN TAKEN INTO ACCOUNT IN THE NEUTRALIZATION RECIPE.
8. AGENT WASH WATER WILL BE USED TO FLUSH AGENT LINES AFTER AGENT INJECTION FOR VX CAMPAIGN. FOR GB AND H CAMPAIGNS, SPENT DECON WILL BE USED.
9. THE CARBON SLURRY/SUSPENSION TANKS REQUIRE A MAXIMUM TOTAL INSTANTANEOUS FLOW RATE OF 6.7 GPM AS NEEDED.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	6/20/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JW	NI	SH	JB	BB
5	4/4/06	ISSUED FOR DESIGN (IFD) INCLUDE RCM	JW	ND	SH	JB	BB
4	8/12/05	ISSUED FOR DESIGN (IFD)	PC	NI	SH	JB	JU
3	7/12/05	ISSUED FOR APPROVAL (IFA) DC-43B	PC	NI	SH	JB	JU
2	5/11/05	ISSUED FOR APPROVAL (IFA)	PC	NI	SH	JB	JU
1	10/28/04	ISSUED FOR DESIGN (IFD)	PC	EV	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	PC	EV	SH	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 SPENT DECONTAMINATION SYSTEM PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-07-M5-SDS-00001 | SHEET 2 OF 2 | REV 6

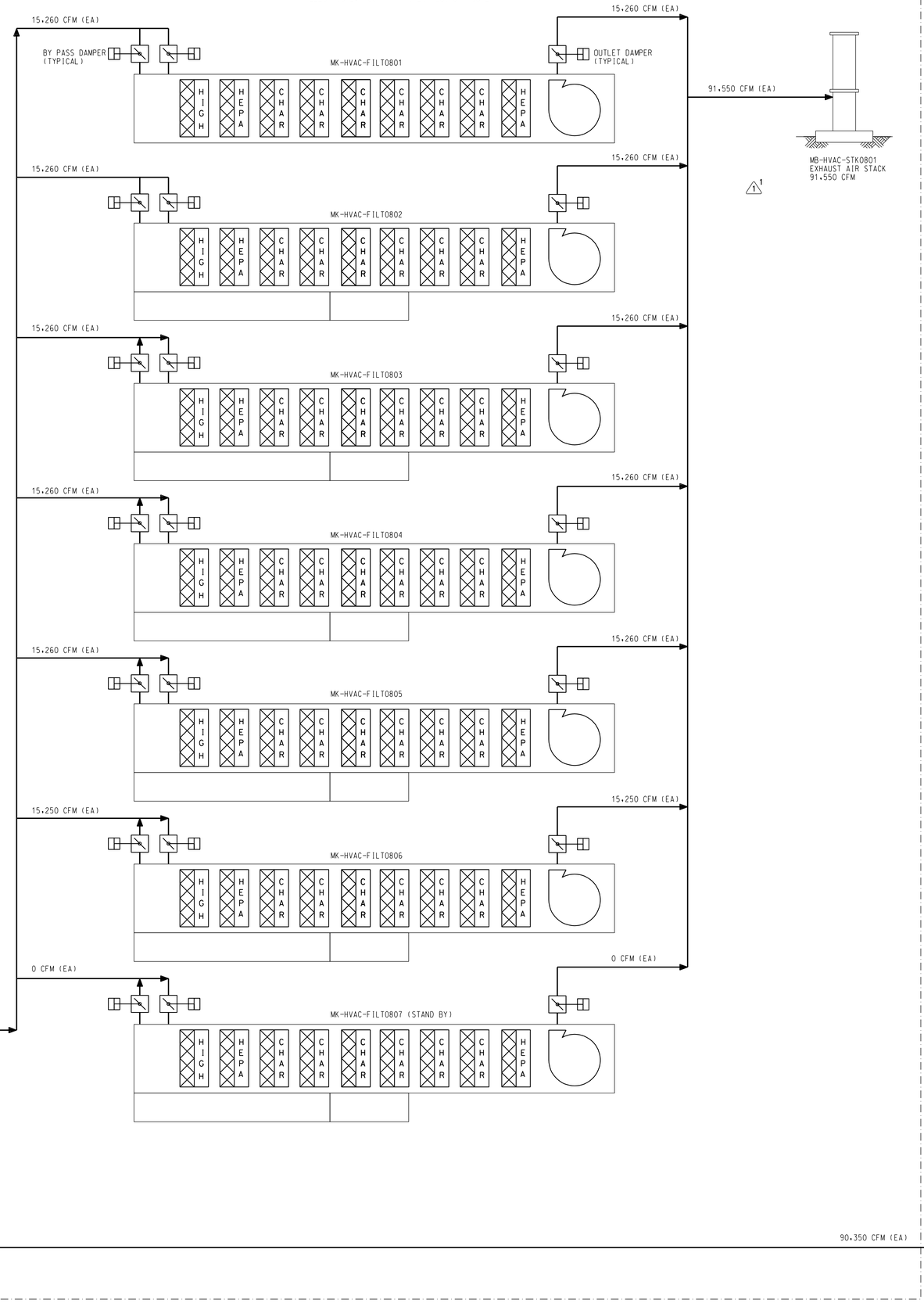
PROFESSIONAL STAMP

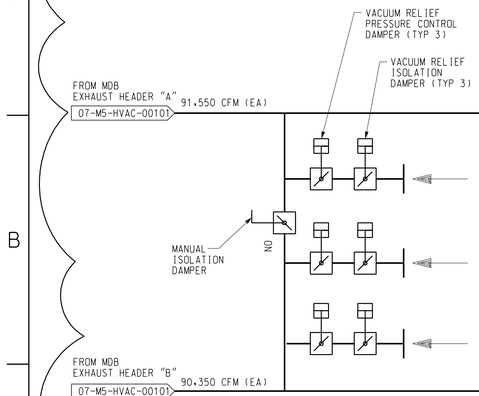
DESIGN FILE: s:\2d\pr\07-m5-sds-1-2.pfz
PLOTTED BY: 514.39 ON 6/30/2006 AT 9:45:56 AM

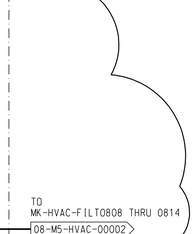
2 07-M5-SDS-1-2.PFZ

1 BGCAPP_E2.BDR

MK-HVAC-FILT0801 thru FILT0807
MDB CASCADE SYSTEM EXHAUST AIR FILTER UNITS
6- OPERATING: 1- STANDBY
RATED/DESIGN CFM : 16000/15,260 CFM EA @ 24" WG
ELECTRICAL: 100 HP W/ VFD, 460V/3PH/60HZ







NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M07-HVAC-00001 AND 00002.
2. DRAWING NUMBERS IN CONTINUATION FLAGS ARE TRUNCATED BY NOT SHOWING PROJECT NUMBER "24915".
3. ALL EQUIPMENT NUMBERS ARE PREFIXED "08" UNLESS OTHERWISE NOTED.
4. FOR CASCADING VENTILATION SYSTEM AIR FLOW DIAGRAMS GENERAL NOTES SEE DRAWING 24915-07-M5-HVAC-00001.
5. FILT0801 THRU 0807 SHALL UTILIZE REFURBISHED DOWNSTREAM SECTION FROM JACADS

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
1	8/15/06	REVISED FILTER UNITS QTY (IFD)	DJB	MB	ME	JB	BBB
0	1/12/05	ISSUED FOR DESIGN	DJB	AA	ME	JB	BBB

QUALITY [X] 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

FILTER AREA
CASCADE SYSTEM FILTER UNITS
HVAC AIR FLOW DIAGRAM

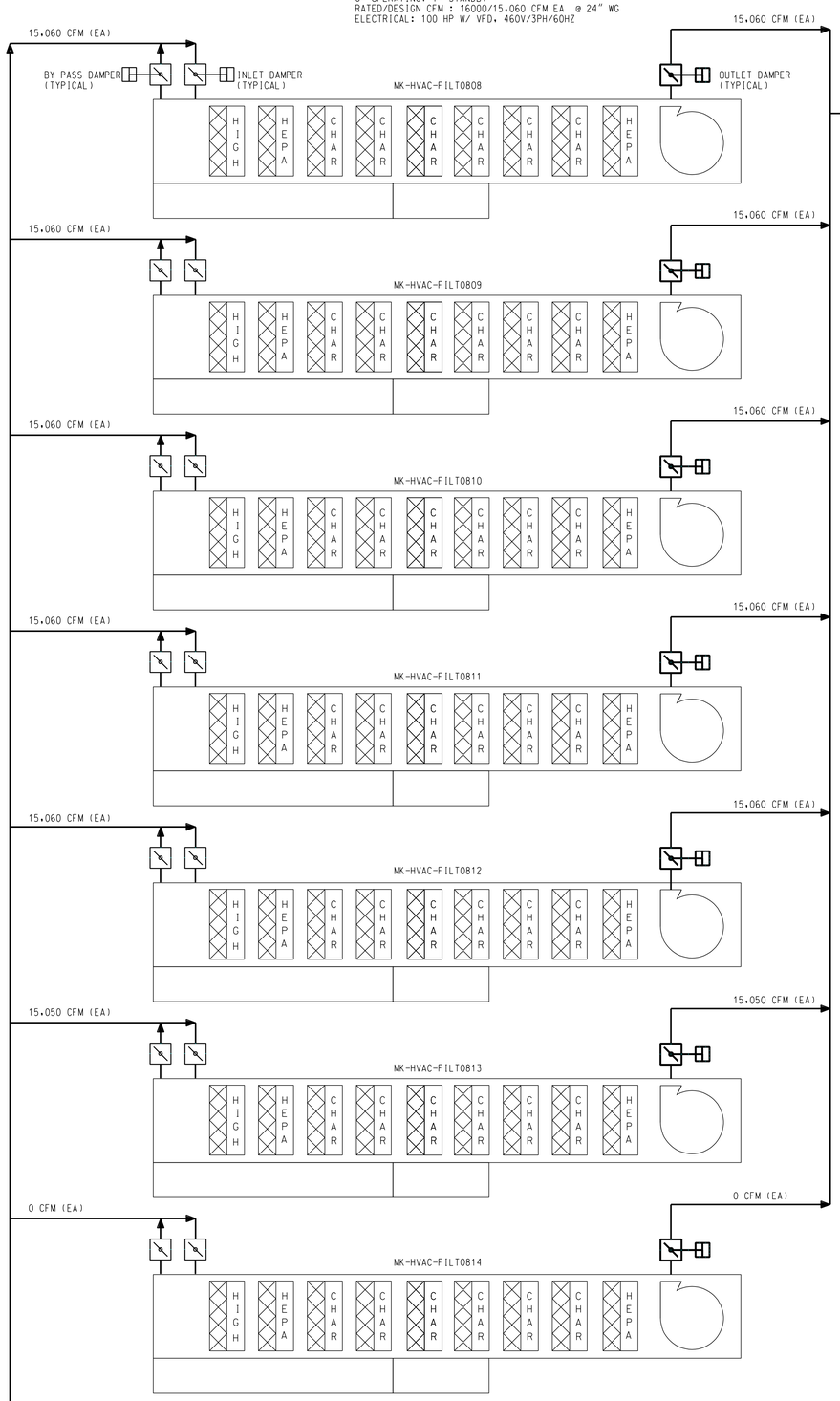
DRAWING NUMBER 24915-08-M5-HVAC-00001
SHEET 1 OF 1
REV 1

PROFESSIONAL STAMP

DESIGN FILE: S:\3D\mu\08-m5-hv-01.fdz
PLOTTED BY: 78472 ON 8/16/2006 AT 2:29:18 PM

08-m5-hv-01.fdz BGCAPP_E3.BDR

MK-HVAC-FILT0808 thru FILT0814
MDB CASCADE SYSTEM EXHAUST AIR FILTER UNITS
6- OPERATING: 1- STANDBY
RATED/DESIGN CFM : 16000/15,060 CFM EA @ 24" WG
ELECTRICAL: 100 HP W/ VFD, 460V/3PH/60HZ



NOTES:

1. FOR SYMBOLS AND LEGEND, SEE DRAWINGS 24915-00-M07-HVAC-00001 AND 00002.
2. DRAWING NUMBERS IN CONTINUATION FLAGS ARE TRUNCATED BY NOT SHOWING PROJECT NUMBER "24915".
3. ALL EQUIPMENT NUMBERS ARE PREFIXED "08" UNLESS OTHERWISE NOTED.
4. FOR CASCADING VENTILATION SYSTEM AIR FLOW DIAGRAMS GENERAL NOTES SEE DRAWING 24915-07-M5-HVAC-00001.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
1	8/15/06	REVISED FILTER UNITS QTY (IFD)	DJB	MB	ME	JB	BBB
0	1/12/05	ISSUED FOR DESIGN	DJB	AA	ME	JB	BBB

QUALITY [X] 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

FILTER AREA CASCADE SYSTEM FILTER UNITS HVAC AIR FLOW DIAGRAM

DRAWING NUMBER 24915-08-M5-HVAC-00002 | SHEET 1 OF 1 | REV 1

PROFESSIONAL STAMP

DESIGN FILE: s:\3d\vnu\08-m5-hv-02.fdz
PLOTTED BY: 78472 ON 8/16/2006 AT 2:29:18 PM

08-m5-hv-02.fdz

BGCAPP_E3.BDR

MT-AFS-1010/2010
FEED TANK
WORKING CAPACITY:
1 891 GAL (NOTE 12)

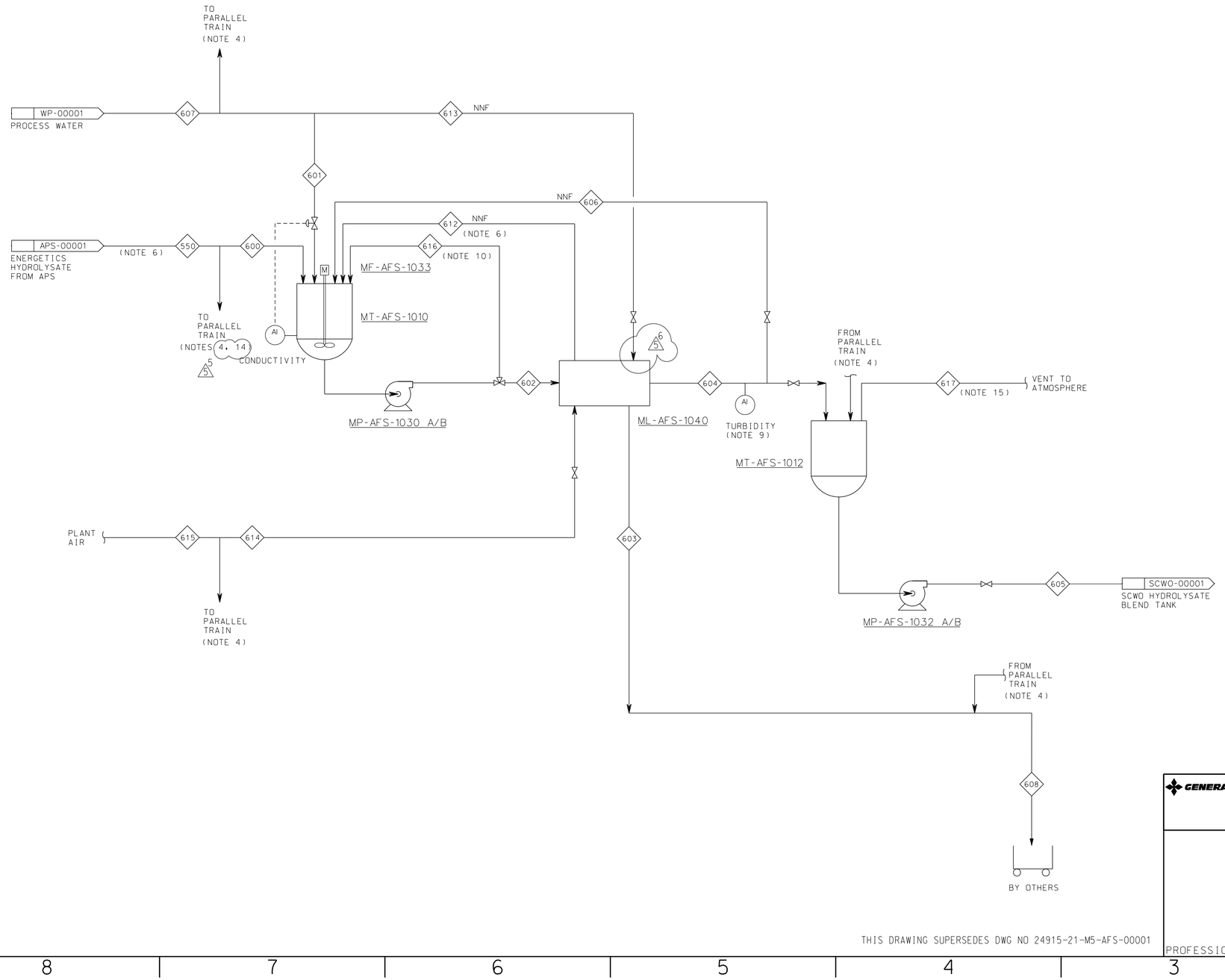
MP-AFS-1030 A/B /2030 A/B
FILTER PUMP
2 41 GPM

ML-AFS-1040/2040
AUTOMATIC PRESSURE
FILTER 50 FT²

MT-AFS-1012
FILTRATE TANK
WORKING CAPACITY:
3 2722 GAL (NOTE 13)

MP-AFS-1032 A/B
FILTRATE PUMP TO SCWO
4 31 GPM

MF-AFS-1033/2033
FEED TANK AGITATOR



THIS DRAWING SUPERSEDES DWG NO 24915-21-M5-AFS-00001

NOTES:

1. ALL INFORMATION, CALCULATIONS, AND ASSUMPTIONS USED IN THE DETERMINATION OF STREAM DATA MAY BE FOUND IN THE "MASS AND ENERGY BALANCE FOR THE ALUMINUM FILTRATION (AFS) SYSTEM - BGCAPP" GA DOCUMENT NO. 24915-10-M4-AFS-00002.
2. ⟨XXX⟩ REPRESENTS M & EB STREAM NUMBERS.
3. COMPONENTS NUMBERED 2XXX ARE PART OF A PARALLEL TRAIN.
4. THERE ARE A TOTAL OF TWO 75% AUTOMATIC PRESSURE FILTERS.
5. BATCH SEQUENCING:
   THE TWO ALUMINUM FILTRATION PRESSES ARE OPERATED IN PARALLEL.
   2 MIN FILL FILTER CAVITY
   12 MIN PRESSURIZED FILTERING
   2 MIN AIR DRY
   2 MIN DISCHARGE/BELT ADVANCE
6. EQUIPMENT DRAIN.
7. DELETED.
8. DELETED.
9. TURBIDITY ANALYZER WILL BE USED TO MONITOR QUALITY OF FILTRATE. IF TURBIDITY ALARMS HIGH PROCESSING WILL STOP.
10. STREAM 616 IS A RECIRCULATION LINE TO REDUCE SETTLING IN THE FEED TANK. THE STREAM RECEIVES THE FULL FLOW FROM PUMP MP-AFS-1030 EXCEPT WHEN THE THREE-WAY VALVE ROTATES TO FILL THE FILTER.
11. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
12. EACH FEED TANK IS SIZED TO HOLD A BATCH FROM ONE ALUMINUM PRECIPITATION REACTOR.
13. THE FILTRATE TANK IS SIZED TO PROVIDE 12 HOURS OF DEMAND FOR THE SCWO BLEND TANK.
14. SINCE EACH FILTER IS SIZED FOR 75% OF AFS DESIGN CAPACITY, THE OPERATION OF THE SECOND FILTER WILL NOT BE CONTINUOUS. IT WILL BE AS REQUIRED. FOR AVERAGE CASES, FLOW IS SPLIT EQUALLY TO THE TWO TRAINS.
15. A PEAK FLOW OF APPROXIMATELY 250 SCFM AIR IS VENTED FROM THE FILTER THROUGH THE FILTRATE TANK FOR 2 MIN DURING EACH 20-MIN FILTER CYCLE FOR A MAXIMUM OF 12 MIN/HR FOR BOTH FILTERS.

cn=Judy Dishon, o=Configuration Management, ou=Issued, c=US
Signature Valid 2006.08.21 07:57:40 -08'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
5		INCORPORATED NEW AVERAGE THROUGHPUTS (IFD)	JG	KM	KD	NW	VN
4	10/28/05	INCORPORATED TANK CAPACITIES AND VENTS (IFD)	NL	HD	KD	NW	VN
3	8/26/05	INCORPORATED CHANGE IN APS M&EB (IFD)	NL	HD	DG	NW	DJ
2	8/8/05	INCORPORATED DC43B (IFA)	NL	DG	DG	NW	DJ
1	4/18/05	UPDATED (IFD)	NL	DG	BW	NW	DJ
0	1/17/05	ISSUED FOR DESIGN	NL	DG	BW	NW	DJ

QUALITY ☐ Q ☒ Non-Q

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US ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

GENERAL ATOMICS

PROFESSIONAL STAMP

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

ALUMINUM FILTRATION SYSTEM PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-AFS-00001
SHEET 1 OF 2
REV 5

BGCAPP_D3.BDR

...\24915-10-M5-AFS-00001S01.dgn 08/09/2006 12:48:00 PM

GB CASE

Stream Number:	550	600	601	602	603	604	605	607	608	614	615	617
Stream Description:	Energetic Hydrolysate from APS	Energetic Hydrolysate to Feed Tank	Process Water to Feed Tank	Hydrolysate to Filter	Filter Cake from Filter	Clarified Hydrolysate Leaving Filter	Combined Clarified Hydrolysate to Hydrolysate Blend Tank	Process Water Supply	Combined Filter Cake from Filter	Plant Air	Combined Plant Air	Filter Vent
Temperature, F	110	110	77	110	110	110	110	77	110	80	80	80
Pressure, psia	79.23	79.23	120	54.23	14.23	54.23	54.23	120	14.23	139.23	139.23	14.23
Inst. Flow, gpm (lb/min) [SCFM]	59.4	59.4	NA	40.8	(88.9)	4.7	30.3	NA	(177.7)	[250]	[500]	[500]
Density, lb/cuft	71.9	71.9	62.27	71.9	74.4	70.67	70.67	62.27	74.4	0.696	0.696	0.071
Viscosity, cP	10	10	0.764	10	NA	1.24	1.24	0.764	NA	0.018	0.018	0.018
Molecular Weight	NA	NA	18.01	NA	NA	NA	NA	18.01	NA	28.85	28.85	28.85
Energy Flow, MMBtu/hr	-16.624	-8.312	NA	-8.312	-1.672	-6.64	-13.28	NA	-3.343	0	0	0
Mass Flow lb/hr												
AL(OH)3	160.58	80.29	0	80.29	80.09	0.201	0.403	0	160.18	0	0	0
WATER	2104.8	1052.4	0	1052.4	195.5	856.9	1713.8	0	391.0	0	0	0
O2	0.82	0.41	0	0.41	0.099	0.311	0.622	0	0.198	21.65	43.3	32.8
N2	1.9	0.95	0	0.95	0.229	0.721	1.441	0	0.459	71.3	142.6	108.2
N2O	0.001	0.001	0	0.001	0	0	0.001	0	0	0	0	0
NH3	0.42	0.21	0	0.21	0.051	0.159	0.319	0	0.101	0	0	0
(NH4)2SO4	1.31	0.655	0	0.655	0.158	0.497	0.994	0	0.316	0	0	0
SODIUM FORMATE	33.71	16.86	0	16.86	4.07	12.78	25.57	0	8.14	0	0	0
SODIUM ACETATE	4.23	2.12	0	2.12	0.51	1.60	3.21	0	1.02	0	0	0
NANO3	0.037	0.018	0	0.018	0.004	0.014	0.028	0	0.009	0	0	0
NANO2	11.74	5.87	0	5.87	1.418	4.452	8.905	0	2.835	0	0	0
NACL	149.10	74.55	0	74.55	18.00	56.55	113.09	0	36.01	0	0	0
NAOH	0.001	0	0	0	0	0	0.001	0	0	0	0	0
NA2SO4	359.02	179.51	0	179.51	43.35	136.16	272.31	0	86.71	0	0	0
ALPO4	20.71	10.36	0	10.36	10.36	0.00	0.00	0	20.71	0	0	0
NA3PO4	0.028	0.014	0	0.014	0.014	0	0	0	0.028	0	0	0
NA2HPO4	5.84	2.92	0	2.92	1.603	1.317	2.633	0	3.207	0	0	0
NAH2PO4	0.033	0.017	0	0.017	0.017	0	0	0	0.033	0	0	0
Total Average Flow lb/hr	2854.3	1427.1	0	1427.1	355.5	1071.7	2143.4	0	710.9	93.0	185.9	141.0

VX CASE

Stream Number:	550	600	601	602	603	604	605	607	608	614	615	617
Stream Description:	Energetic Hydrolysate from APS	Energetic Hydrolysate to Feed Tank	Process Water to Feed Tank	Hydrolysate to Filter	Filter Cake from Filter	Clarified Hydrolysate Leaving Filter	Combined Clarified Hydrolysate to Hydrolysate Blend Tank	Process Water Supply	Combined Filter Cake from Filter	Plant Air	Combined Plant Air	Filter Vent
Temperature, F	110	110	77	110	110	110	110	77	110	80	80	80
Pressure, psia	79.23	79.23	120	54.23	14.23	54.23	54.23	120	14.23	139.23	139.23	14.23
Inst. Flow, gpm (lb/min) [SCFM]	59.3	59.3	NA	40.8	(89.2)	4.7	30.2	NA	(178.5)	[250]	[500]	[500]
Density, lb/cuft	72.04	72.04	62.27	72.04	74.4	70.69	70.69	62.27	74.4	0.696	0.696	0.071
Viscosity, cP	9.9	9.9	0.764	9.9	NA	1.24	1.24	0.764	NA	0.018	0.018	0.018
Molecular Weight	NA	NA	18.01	NA	NA	NA	NA	18.01	NA	28.85	28.85	28.85
Energy Flow, MMBtu/hr	-16.644	-8.322	NA	-8.322	-1.687	-6.635	-13.269	NA	-3.374	0	0	0
Mass Flow lb/hr												
AL(OH)3	159.13	79.57	0	79.57	79.36	0.201	0.403	0	158.73	0	0	0
WATER	2103.7	1051.9	0	1051.9	196.3	855.5	1711.0	0	392.7	0	0	0
O2	0.82	0.41	0	0.41	0.098	0.312	0.625	0	0.195	21.65	43.3	32.8
N2	1.89	0.945	0	0.945	0.225	0.72	1.44	0	0.45	71.3	142.6	108.2
N2O	0.001	0.001	0	0.001	0	0	0.001	0	0	0	0	0
NH3	0.21	0.105	0	0.105	0.025	0.08	0.16	0	0.05	0	0	0
(NH4)2SO4	2.17	1.085	0	1.085	0.258	0.827	1.653	0	0.517	0	0	0
SODIUM FORMATE	33.86	16.93	0	16.93	4.03	12.90	25.79	0	8.07	0	0	0
SODIUM ACETATE	4.25	2.13	0	2.13	0.51	1.62	3.24	0	1.01	0	0	0
NANO3	0.038	0.019	0	0.019	0.005	0.014	0.029	0	0.009	0	0	0
NANO2	11.79	5.895	0	5.895	1.404	4.491	8.981	0	2.809	0	0	0
NACL	149.44	74.72	0	74.72	17.80	56.92	113.84	0	35.60	0	0	0
NAOH	0.00	0.00	0	0.00	0.00	0.00	0.00	0	0.00	0	0	0
NA2SO4	358.94	179.47	0	179.47	42.76	136.71	273.42	0	85.52	0	0	0
ALPO4	24.14	12.07	0	12.07	12.07	0	0	0	24.14	0	0	0
NA3PO4	0.016	0.008	0	0.008	0.008	0	0	0	0.016	0	0	0
NA2HPO4	6.8	3.4	0	3.4	2.084	1.316	2.633	0	4.167	0	0	0
NAH2PO4	0.059	0.029	0	0.029	0.029	0	0	0	0.059	0	0	0
Total Average Flow lb/hr	2857.3	1428.6	0	1428.6	357.0	1071.6	2143.3	0	714.0	93.0	185.9	141.0

H BLENDED CASE

Stream Number:	550	600	601	602	603	604	605	607	608	614	615	617
Stream Description:	Energetic Hydrolysate from APS	Energetic Hydrolysate to Feed Tank	Process Water to Feed Tank	Hydrolysate to Filter	Filter Cake from Filter	Clarified Hydrolysate Leaving Filter	Combined Clarified Hydrolysate to Hydrolysate Blend Tank	Process Water Supply	Combined Filter Cake from Filter	Plant Air	Combined Plant Air	Filter Vent
Temperature, F	110	110	77	110	110	110	110	77	110	80	80	80
Pressure, psia	79.23	79.23	120	54.23	14.23	54.23	54.23	120	14.23	139.23	139.23	14.23
Inst. Flow, gpm (lb/min) [SCFM]	35.6	35.6	NA	24.5	(11.5)	3.5	22.3	NA	(23.1)	[250]	[500]	[500]
Density, lb/cuft	66.91	66.91	62.27	66.91	74.2	67.08	67.08	62.27	74.2	0.696	0.696	0.071
Viscosity, cP	14	14	0.764	14	NA	0.92	0.92	0.764	NA	0.018	0.018	0.018
Molecular Weight	NA	NA	18.01	NA	NA	NA	NA	18.01	NA	28.85	28.85	28.85
Energy Flow, MMBtu/hr	-10.096	-5.048	NA	-5.048	-0.236	-4.811	-9.623	NA	-0.473	0	0	0
Mass Flow lb/hr												
AL(OH)3	15.89	7.95	0	7.95	7.80	0.141	0.282	0	15.61	0	0	0
WATER	1361.7	680.9	0	680.9	25.3	655.5	1311.0	0	50.7	0	0	0
O2	0.58	0.29	0	0.29	0.02	0.27	0.54	0	0.04	21.65	43.3	32.8
N2	1.52	0.76	0	0.76	0.053	0.707	1.414	0	0.106	71.3	142.6	108.2
N2O	0	0	0	0	0	0	0	0	0	0	0	0
NH3	0.13	0.065	0	0.065	0.005	0.06	0.121	0	0.009	0	0	0
(NH4)2SO4	0.36	0.18	0	0.18	0.013	0.167	0.335	0	0.025	0	0	0
SODIUM FORMATE	13.81	6.91	0	6.91	0.48	6.43	12.85	0	0.96	0	0	0
SODIUM ACETATE	1.16	0.58	0	0.58	0.04	0.54	1.08	0	0.08	0	0	0
NANO3	0.004	0.002	0	0.002	0	0.002	0.004	0	0	0	0	0
NANO2	3.99	1.995	0	1.995	0.139	1.856	3.713	0	0.277	0	0	0
NACL	52.88	26.44	0	26.44	1.84	24.60	49.21	0	3.68	0	0	0
NAOH	0.001	0	0	0	0	0	0.001	0	0	0	0	0
NA2SO4	126.00	63.00	0	63.00	4.38	58.62	117.24	0	8.76	0	0	0
ALPO4	10.75	5.38	0	5.38	5.38	0.00	0.00	0	10.75	0	0	0
NA3PO4	0.017	0.009	0	0.009	0.009	0	0	0	0.017	0	0	0
NA2HPO4	3.03	1.515	0	1.515	0.594	0.921	1.842	0	1.188	0	0	0
NAH2PO4	0.02	0.01	0	0.01	0.01	0	0	0	0.02	0	0	0
Total Average Flow lb/hr	1591.8	795.9	0	795.9	46.1	749.8	1499.6	0	92.2	93.0	185.9	141.0

△5 3

cn=Judy Dishon,
o=Configuration Management,
ou=Issued, c=US
2006.08.21 07:57:55 -08'00'
Signature Valid

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
△5		INCORPORATED NEW AVERAGE THROUGHPUTS (IFD)	JG	KM	KD	NW	VN
△4	10/28/05	INCORPORATED TANK CAPACITIES AND VENTS (IFD)	NL	HD	KD	NW	VN
△3	8/26/05	INCORPORATED CHANGE IN APS M&EB (IFD)	NL	HD	DG	NW	DJ
△2	8/8/05	INCORPORATED DC43B (IFA)	NL	DG	DG	NW	DJ
△1	4/18/05	UPDATED (IFD)	NL	DG	BW	NW	DJ
△0	1/17/05	ISSUED FOR DESIGN	NL	DG	BW	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

ALUMINUM FILTRATION SYSTEM PROCESS FLOW DIAGRAM

THIS DRAWING SUPERSEDES DWG NO 24915-21-M5-AFS-00001

PROFESSIONAL STAMP

DRAWING NUMBER	SHEET	REV
24915-10-M5-AFS-00001	2 OF 2	5

BGCAPP_D3.BDR

MX-HCL-0102
HCL FUME
SCRUBBER PACKAGE
CIRCULATION PUMP: 33 GPM
(NOTE 11)

MV-APS-0103
PHOSPHORIC
ACID TANK
WORKING CAPACITY: 420 GAL
(NOTE 16)

MV-APS-0104
HYDROCHLORIC ACID
DAY TANK
WORKING CAPACITY: 765 GAL
(NOTE 13)

MK-APS-0102/0103
DESICCANT
FILTERS

MV-APS-0105
SULFURIC ACID
DAY TANK
WORKING CAPACITY: 450 GAL
(NOTE 13)

MP-APS-0105A/B/C
SULFURIC ACID
INJECTION
PUMPS & SPARE
0.45 GPM
(NOTES 8, 17)

MP-APS-0103A/B/C
PHOSPHORIC ACID
INJECTION
PUMPS & SPARE
0.50 GPM
(NOTES 8, 17)

MP-APS-0104A/B/C
HYDROCHLORIC ACID
INJECTION
PUMPS & SPARE
0.70 GPM
(NOTES 8, 17)

MF-APS-0101/0102
ALUMINUM PRECIPITATION
REACTOR AGITATOR
(NOTE 1)

MV-APS-0101/0102
ALUMINUM PRECIPITATION
REACTOR
5'-0" ID X 9'-0" TT
WORKING CAPACITY: 891 GAL
(NOTE 1)

MK-APS-0101A/B
APS CARBON
FILTER

MP-APS-0101A/B/C
ALUMINUM PRECIPITATION REACTOR
PUMPS & SPARE
60 GPM
(NOTES 8, 17, 19)

MK-APS-0103
VENT (NOTE 10)
MV-APS-0103
BCS-00001 75% PHOSPHORIC ACID (NOTE 16)
MX-HCL-0102
VENT (NOTE 10)
PWS-00001 PROCESS WATER
NNF
RO-00002 SPENT ACID TO WATER RECOVERY
MV-APS-0104
BCS-00001 35% WT HCl (NOTE 13)
MP-APS-0103A
TO PARALLEL UNIT (NOTE 1)
MK-APS-0102
VENT (NOTE 10)
MV-APS-0105
BCS-00001 93% WT H2SO4 (NOTE 13)
MP-APS-0104A
TO PARALLEL UNIT (NOTE 1)
SCWO-00001 35% WT HCl TO HCl SCWO FEED ADDITIVE METERING PUMP
MP-APS-0105A
TO PARALLEL UNIT (NOTE 1)
SCWO-00001 93% WT H2SO4 TO H2SO4 SCWO FEED ADDITIVE METERING PUMP
PWS-00001 PROCESS WATER
NNF NC
TO PARALLEL UNIT (NOTE 1)
HSS-00002 ENERGETICS HYDROLYSATE FROM HYDROLYSATE STORAGE AREA
PLANT AIR
TO PARALLEL UNIT (NOTE 1)
MF-APS-0101
MV-APS-0101
MP-APS-0101A/B/C
STEAM (NOTE 21)
CHPS
CHPR
CONDENSATE
NC
FROM PARALLEL UNIT (NOTE 1)
(NOTE 14)
(NOTE 15)
(NOTE 20)
(NOTE 6)
(NOTE 7)
FROM PARALLEL UNIT (NOTE 1)
MK-APS-0101A/B
(NOTE 12)
VENT TO ATMOSPHERE
AFS-00001 ENERGETICS HYDROLYSATE TO ALUMINUM FILTERING

NOTES:

1. THERE ARE A TOTAL OF TWO 75% ALUMINUM PRECIPITATION REACTORS. SIZING IS BASED ON THE GB AVERAGE PROCESSING CASE.
2. DELETED
3. DELETED
4. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
5. DELETED
6. CHILLED WATER VALVE IS OPEN ONLY WHEN ACIDS ARE BEING INJECTED INTO THE REACTOR AND SUBSEQUENTLY TO COOL NEUTRALIZED HYDROLYSATE FROM 140°F TO 110°F.
7. VALVE SHALL ONLY BE OPEN FOR PUMPING OUT REACTOR CONTENTS.
8. MP-APS-0101C, MP-APS-0103C, MP-APS-0104C AND MP-APS-0105C ARE COMMON SPARES.
9. BATCH SEQUENCING FOR ONE REACTOR:

60 MIN	LOADING AND HEATING TO 140°F
15 MIN	PHOSPHORIC ACID LOADING
120 MIN	NEUTRALIZATION AT 140°F WITH MIXED ACID
30 MIN	COOLING FROM 140°F TO 110°F
15 MIN	DRAINING
240 MIN	TOTAL

10. VENT TO ATMOSPHERE AT A SAFE LOCATION.
11. MX-HCL-0102 IS A HYDROCHLORIC ACID TANK SCRUBBER PACKAGE FURNISHED BY VENDOR. THE INSTANTANEOUS RATE OF HYDROCHLORIC FUME IS ABOUT 1.7 ACFM. THE ACID SOLUTION IN THE HCl FUME SCRUBBER NEEDS TO BE REPLACED EVERY 23 TANK FILLING CYCLES. THAT IS EVERY 23 DAYS OF CONTINUOUS OPERATION. THE AMOUNT OF FRESH PROCESS WATER NEEDED TO REPLENISH THE SCRUBBER IS 92 GALLONS (TO BE VERIFIED BY HCl FUME SCRUBBER VENDOR).
12. CARBON FILTER SHALL HAVE AN INSTALLED SPARE.
13. THE HYDROCHLORIC ACID AND SULFURIC ACID DAY TANKS ARE EACH DESIGNED TO PROVIDE ONE DAY OF OPERATION. THE FLOW RATES SHOWN FOR BOTH ACIDS ARE THE NOMINAL FILLING RATES FOR THE TANKS AND ARE REQUIRED FOR ABOUT AN HOUR ONCE EVERY DAY.
14. LEAK-PROOF POSITIVE SHUT-OFF VALVES ARE OPENED ONLY BEFORE THE START OF THE ACID METERING PUMPS.
15. THE pH CONTROLLER SHALL HAVE A LOW ALARM.
16. THE PHOSPHORIC ACID TANK IS SIZED TO PROVIDE ONE WEEK OF CONTINUOUS OPERATION FOR THE CONTROLLING DESIGN CASE. THE FEED RATE IS A NOMINAL VALUE THAT WOULD FILL UP AN EMPTY TANK IN ONE HOUR.
17. SINCE EACH APR IS SIZED FOR 75% OF APS DESIGN CAPACITY, THE OPERATION OF THE SECOND REACTOR WILL NOT BE CONTINUOUS. IT WILL BE AS REQUIRED.
18. DELETED
19. PUMPS ARE ON EMERGENCY POWER.
20. SCREENED VORTEX BREAKER.
21. STEAM IS USED TO HEAT THE REACTOR CONTENTS TO 140°F AFTER AN EXTENDED PROCESS DELAY.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	8/9/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JH	FJ	SH	JH	BB
5	7/14/06	ISSUED FOR APPROVAL (IFA) TAA UPDATE	JH	FJ	SH	JH	BB
4	10/21/05	(IFD) REVISED TO ADD TAG NUMBER	JH	JW	SH	JH	PK
3	8/17/05	(IFD) REVISED TO INCLUDE DC 43B	FJ	JH	SH	JH	JU
2	7/18/05	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JH	JU
1	3/8/05	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	FJ	NI	SH	JH	JU
0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	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

SCWO PROCESSING BUILDING ALUMINUM PRECIPITATION PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-APS-00001
SHEET 1 OF 3
REV 6

PROFESSIONAL STAMP

DESIGN FILE: S:\2D\pr\10-M5-APS-1-1.pfz
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10-M5-APS-1-1.PFZ
BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-10-M5-APS-00001
ALUMINUM PRECIPITATION SYSTEM

CASE: AGENT GB, AVERAGE THROUGHPUT

STREAM NUMBER	540	541	542	543	546	547	548	549	550	560	561	1154	1164
LINE DESCRIPTION	93% H2SO4 To Each APR	35% HCl To Each APR	75% H3PO4 To Each APR	Plant air Sweep To Each APR	Energetic Hydrolysate To APS	Energetic Hydrolysate To Each APR	APR Vent To Each Carbon Filter	APS Vent To Atmosphere	Neutralized Energetic Hydrolysate To AFS	APR Recirculation	Makeup 75% H3PO4 To Phosphoric Acid Tank	Makeup 35% HCl to Hydrochloric Acid Day Tank	Makeup 93% H2SO4 To Sulfuric Acid Day Tank
TEMPERATURE, °F	77	77	77	77	77	77	140	140	110	140	77	77	77
PRESSURE, PSIA	44.23	44.23	44.23	25.23	75.00	60.00	25.23	14.23	79.23	79.23	44.23	44.23	44.23
INSTANTANEOUS FLOW, GPM (ACFM)	0.41	0.68	0.42	(7.94)	21.92	10.96	(1.15)	(2.04)	59.39	29.88	5.89	12.69	7.15
DENSITY, LB/FT3	113.69	73.03	98.27	0.126	78.77	78.77	0.108	0.061	71.90	71.47	98.27	73.03	113.69
VISCOSITY, CP	21	2.0	19	1.8E-02	25	25	1.9E-02	1.9E-02	10	6.5	19	2.0	21
MW				28.85			27.44	27.44					
COMPONENT AVERAGE FLOW, LB/HR													
O2				5.8E-01	2.5E-07	1.2E-07	1.7E-01	3.4E-01	8.2E-01	4.94			
N2				1.93	1.1E-02	5.4E-03	9.8E-01	1.97	1.90	11.41			
NH3					7.6E-01	3.8E-01	1.9E-03	3.8E-03	4.2E-01	2.51			
N2O					1.1E-03	5.4E-04	2.0E-05	4.0E-05	1.0E-03	6.2E-03			
H2O	8.74	86.37	3.45		1843.7	921.85	8.2E-02	1.6E-01	2104.8	12629	1160.1	4832.3	456.51
NAOH					208.01	104.00			7.1E-04	4.3E-03			
HCL		46.51										2602.0	
H2SO4	116.17												6065.1
H3PO4			10.36								3480.2		
NANO2					11.74	5.87			11.74	70.42			
NANO3					3.7E-02	1.9E-02			3.7E-02	2.2E-01			
NACL									149.10	894.58			
NA2SO4					23.93	11.97			359.02	2154.1			
(NH4)2SO4					1.4E-04	6.8E-05			1.31	7.83			
NH4HSO4									2.0E-05	1.2E-04			
AL(OH)3					5.97	2.98			160.58	963.47			
ALPO4									20.71	124.24			
NA3PO4									2.8E-02	1.7E-01			
NA2HPO4									5.84	35.06			
NAH2PO4									3.3E-02	2.0E-01			
SODIUM FORMATE					33.71	16.86			33.71	202.28			
SODIUM ACETATE					4.23	2.12			4.23	25.41			
NaALO2					176.39	88.19							
TOTAL AVERAGE THROUGHPUT, LB/HR	124.92	132.88	13.81	2.51	2308.5	1154.3	1.24	2.47	2854.3	17126	4640.2	7434.4	6521.6
NOTES	4	4	4	4	1, 3	1, 4	4		1, 3, 6	1, 5			

CASE: AGENT VX, AVERAGE THROUGHPUT

STREAM NUMBER	540	541	542	543	546	547	548	549	550	560	561	1154	1164
LINE DESCRIPTION	93% H2SO4 To Each APR	35% HCl To Each APR	75% H3PO4 To Each APR	Plant air Sweep To Each APR	Energetic Hydrolysate To APS	Energetic Hydrolysate To Each APR	APR Vent To Each Carbon Filter	APS Vent To Atmosphere	Neutralized Energetic Hydrolysate To AFS	APR Recirculation	Makeup 75% H3PO4 To Phosphoric Acid Tank	Makeup 35% HCl to Hydrochloric Acid Day Tank	Makeup 93% H2SO4 To Sulfuric Acid Day Tank
TEMPERATURE, °F	77	77	77	77	77	77	140	140	110	140	77	77	77
PRESSURE, PSIA	44.23	44.23	44.23	25.23	75.00	60.00	25.23	14.23	79.23	79.23	44.23	44.23	44.23
INSTANTANEOUS FLOW, GPM (ACFM)	0.41	0.68	0.49	(7.93)	21.97	10.98	(1.15)	(2.04)	59.34	29.85	6.86	12.42	7.24
DENSITY, LB/FT3	113.69	73.03	98.27	0.126	78.51	78.51	0.108	0.061	72.04	71.60	98.27	73.03	113.69
VISCOSITY, CP	21	2.0	19	1.8E-02	24	24	1.9E-02	1.9E-02	9.9	6.3	19	2.0	21
MW				28.85			27.44	27.44					
COMPONENT AVERAGE FLOW, LB/HR													
O2				5.8E-01	2.1E-07	1.1E-07	1.7E-01	3.4E-01	8.2E-01	4.93			
N2				1.93	1.0E-02	5.1E-03	9.8E-01	1.97	1.89	11.37			
NH3					7.7E-01	3.9E-01	2.0E-03	3.9E-03	2.1E-01	1.29			
N2O					1.3E-03	6.5E-04	2.5E-05	4.9E-05	1.3E-03	7.5E-03			
H2O	8.76	86.57	4.03		1839.9	919.97	8.2E-02	1.6E-01	2103.7	12622	1352.7	4728.1	462.36
NAOH					207.92	103.96			1.7E-04	1.3E-03			
HCL		46.62										2545.9	
H2SO4	116.44												6142.8
H3PO4			12.08								4058.0		
NANO2					11.79	5.89			11.79	70.72			
NANO3					3.8E-02	1.9E-02			3.8E-02	2.3E-01			
NACL									149.44	896.67			
NA2SO4					24.00	12.00			358.94	2153.8			
(NH4)2SO4					1.2E-04	6.1E-05			2.17	12.83			
NH4HSO4									1.8E-05	3.8E-04			
AL(OH)3					5.19	2.59			159.13	954.76			
ALPO4									24.14	144.87			
NA3PO4									1.6E-02	6.2E-02			
NA2HPO4									6.80	40.42			
NAH2PO4									5.9E-02	7.2E-01			
SODIUM FORMATE					33.86	16.93			33.86	203.15			
SODIUM ACETATE					4.25	2.13			4.25	25.52			
NaALO2					177.99	89.00							
TOTAL AVERAGE THROUGHPUT, LB/HR	125.21	133.19	16.10	2.51	2305.7	1152.9	1.24	2.48	2857.3	17144	5410.7	7274.0	6605.2
NOTES	4	4	4	4	1, 3	1, 4	4		1, 3, 6	1, 5			

NOTES:

1. STREAMS 546, 547, 550 AND 560 CONTAIN SUSPENDED ALUMINUM SALT PARTICLES (AI(OH)3).
2. PEAK AND AVERAGE RATES ARE THE SAME BECAUSE THE UNITS WILL BE OPERATING AT A RATE TO SUPPLY THE SCWO REACTORS, WHICH OPERATE AT A CONSTANT FEED RATE.
3. STREAMS 546 AND 550 ARE BASED ON EIGHT BATCHES PER DAY. THE INSTANTANEOUS RATE OF STREAM 546 (FOR SIZING PURPOSES) IS BASED ON BOTH REACTORS FILLED SIMULTANEOUSLY.
4. THERE ARE A TOTAL OF EIGHT BATCHES PER DAY. EACH REACTOR, ON AVERAGE, PROCESSES FOUR BATCHES PER DAY. INSTANTANEOUS RATE IS BASED ON FOUR BATCHES PER REACTOR PER DAY.
5. RECIRCULATION RATE IS BASED ON RECIRCULATING ONE REACTOR BATCH VOLUME (AT THE END OF ACID ADDITION) IN 30 MINUTES.
6. TRANSFER RATE TO APS IS BASED ON ONE REACTOR BATCH VOLUME TRANSFERRED IN 15 MINUTES.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	8/9/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JH	FJ	SH	JH	BB
5	7/14/06	ISSUED FOR APPROVAL (IFA) TAA UPDATE	JH	FJ	SH	JH	BB
4	10/21/05	(IFD) REVISED TO ADD TAG NUMBER	JH	JW	SH	JH	PK
3	8/17/05	(IFD) REVISED TO INCLUDE DC 43B	FJ	JH	SH	JH	JU
2	7/18/05	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JH	JU
1	3/8/05	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	FJ	NI	SH	JH	JU
0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	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

SCWO PROCESSING BUILDING ALUMINUM PRECIPITATION PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M5-APS-00001 | SHEET 2 OF 3 | REV 6

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MATERIAL BALANCE TABLE FOR PFD: 24915-10-M5-APS-00001
ALUMINUM PRECIPITATION SYSTEM

CASE: AGENT H (BLENDED), AVERAGE THROUGHPUT

STREAM NUMBER	540	541	542	543	546	547	548	549	550	560	561	1154	1164
LINE DESCRIPTION	93% H2SO4 To Each APR	35% HCl To Each APR	75% H3PO4 To Each APR	Plant air Sweep To Each APR	Energetic Hydrolysate To APS	Energetic Hydrolysate To Each APR	APR Vent To Each Carbon Filter	APS Vent To Atmosphere	Neutralized Energetic Hydrolysate To AFS	APR Recirculation	Makeup 75% H3PO4 To Phosphoric Acid Tank	Makeup 35% HCl to Hydrochloric Acid Day Tank	Makeup 93% H2SO4 To Sulfuric Acid Day Tank
TEMPERATURE, °F	77	77	77	77	77	77	140	140	110	140	77	77	77
PRESSURE, PSIA	44.23	44.23	44.23	25.23	75.00	60.00	25.23	14.23	79.23	79.23	44.23	44.23	44.23
INSTANTANEOUS FLOW, GPM (ACFM)	0.15	0.24	0.22	(4.76)	12.73	6.37	(0.47)	(0.83)	35.59	17.92	3.06	3.86	2.33
DENSITY, LB/FT3	113.69	73.03	98.27	0.126	81.83	81.83	0.107	0.061	66.91	66.46	98.27	73.03	113.69
VISCOSITY, CP	21	2.0	19	1.8E-02	34	34	1.9E-02	1.9E-02	14	8.7	19	2.0	21
MW				28.85			27.33	27.33					
COMPONENT AVERAGE FLOW, LB/HR													
O2				3.5E-01	2.5E-07	1.3E-07	6.1E-02	1.2E-01	5.8E-01	3.45			
N2				1.16	1.2E-02	5.8E-03	4.0E-01	8.1E-01	1.52	9.10			
NH3					2.3E-01	1.1E-01	2.5E-04	5.0E-04	1.3E-01	7.9E-01			
N2O					1.5E-04	7.6E-05	1.5E-06	3.0E-06	1.5E-04	8.9E-04			
H2O	3.10	30.63	1.79		1248.7	624.34	3.6E-02	7.2E-02	1361.7	8170.0	602.5	1470.3	148.85
NAOH					93.78	46.89			8.5E-04	5.1E-03			
HCL		16.49										791.70	
H2SO4	41.20												1977.6
H3PO4			5.38								1807.6		
NANO2					3.99	1.99			3.99	23.93			
NANO3					4.4E-03	2.2E-03			4.4E-03	2.7E-02			
NACL									52.88	317.25			
NA2SO4					7.06	3.53			126.00	756.02			
(NH4)2SO4					8.0E-05	4.0E-05			3.6E-01	2.14			
NH4HSO4									8.8E-06	5.3E-05			
AL(OH)3					1.08	5.4E-01			15.89	95.35			
ALPO4									10.75	64.53			
NA3PO4									1.7E-02	1.0E-01			
NA2HPO4									3.03	18.18			
NAH2PO4									2.0E-02	1.2E-01			
SODIUM FORMATE					13.81	6.90			13.81	82.83			
SODIUM ACETATE					1.16	5.8E-01			1.16	6.96			
NaALO2					22.79	11.40							
TOTAL AVERAGE THROUGHPUT, LB/HR	44.30	47.12	7.17	1.50	1392.6	696.30	5.0E-01	1.00	1591.8	9550.8	2410.1	2262.0	2126.4
NOTES	4	4	4	4	1, 3	1, 4	4		1, 3, 6	1, 5			

NOTES:

1. STREAMS 546, 547, 550 AND 560 CONTAIN SUSPENDED ALUMINUM SALT PARTICLES (AL(OH)3).
2. PEAK AND AVERAGE RATES ARE THE SAME BECAUSE THE UNITS WILL BE OPERATING AT A RATE TO SUPPLY THE SCWO REACTORS, WHICH OPERATE AT A CONSTANT FEED RATE.
3. STREAMS 546 AND 550 ARE BASED ON EIGHT BATCHES PER DAY. THE INSTANTANEOUS RATE OF STREAM 546 (FOR SIZING PURPOSES) IS BASED ON BOTH REACTORS FILLED SIMULTANEOUSLY.
4. THERE ARE A TOTAL OF EIGHT BATCHES PER DAY. EACH REACTOR, ON AVERAGE, PROCESSES FOUR BATCHES PER DAY. INSTANTANEOUS RATE IS BASED ON FOUR BATCHES PER REACTOR PER DAY.
5. RECIRCULATION RATE IS BASED ON RECIRCULATING ONE REACTOR BATCH VOLUME (AT THE END OF ACID ADDITION) IN 30 MINUTES.
6. TRANSFER RATE TO APS IS BASED ON ONE REACTOR BATCH VOLUME TRANSFERRED IN 15 MINUTES.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6	8/9/06	ISSUED FOR DESIGN (IFD) TAA UPDATE	JH	FJ	SH	JH	BB
5	7/14/06	ISSUED FOR APPROVAL (IFA) TAA UPDATE	JH	FJ	SH	JH	BB
4	10/21/05	(IFD) REVISED TO ADD TAG NUMBER	JH	JW	SH	JH	PK
3	8/17/05	(IFD) REVISED TO INCLUDE DC 43B	FJ	JH	SH	JH	JU
2	7/18/05	ISSUED FOR APPROVAL (IFA)	FJ	JH	SH	JH	JU
1	3/8/05	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	FJ	NI	SH	JH	JU
0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	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

SCWO PROCESSING BUILDING ALUMINUM PRECIPITATION PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-APS-00001 | SHEET 3 OF 3 | REV 6

PROFESSIONAL STAMP

DESIGN FILE: s:\2d\pr\10-m5-aps-1-3.pfz
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BGCAPP_E2.BDR

ML-RO-0102
CLARIFIER
1 4

MP-RO-0102A/B
CLARIFIER
UNDERFLOW PUMP
CAPACITY: 55 GPM
1 5

MX-RO-0103
SPB WATER
SOFTENER PACKAGE
ML-RO-0103A/B
SPB WATER
SOFTENER
ML-RO-0104
SPB BRINE MEASURING
TANK
FLOW: 100 GPM
(NOTE 21)

MT-RO-0101
CLEAR WELL
TANK
WORKING CAPACITY: 1,850 GAL
1 6

MF-RO-0102
CLARIFIER
RAKE
0.5 HP

ML-RO-0101/0201/0301
R.O. UNITS & SPARE
(NOTE 7)
1 7

MP-RO-0101/0201/0301
R.O. UNIT FEED
PUMPS & SPARE
CAPACITY: 46 GPM
(NOTE 5)
1 8

MP-RO-0105/0205/0305
R.O. HIGH PRESSURE
PUMPS & SPARE
CAPACITY: 46 GPM
1 9

NOTES:

1. THERE ARE A TOTAL OF THREE R.O. PACKAGES, TWO 50% UNITS WITH ONE 50% SPARE.
2. CHEMICAL INJECTION FOR R.O. UNIT AND CLARIFIER WILL BE VIA TOTE BINS.
3. EQUIPMENT SHOWN ON THIS DRAWING FOR THE R.O. UNIT IS INCLUDED AS A PACKAGE UNIT IN THE MEL.
4. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
5. MP-RO-0301 IS A COMMON SPARE.
6. FLOW IS INTERMITTENT.

1 10
7. TWO 50% REVERSE OSMOSIS UNITS WILL BE INCLUDED ON THE SAME SKID. ANOTHER 50% REVERSE OSMOSIS UNIT WILL BE PLACED PARALLEL TO THE FIRST SKID WITH A MINIMUM MAINTENANCE WIDTH OF THREE FEET BETWEEN THE TWO SKIDS. A MINIMUM OF FIVE FEET ON EACH SIDE (LENGTHWISE) OF R.O. UNITS SHALL BE PROVIDED FOR INSERTION AND REMOVAL OF R.O. MEMBRANES.
8. DELETED
9. EQUIPMENT SHOWN ON THIS DRAWING FOR THE CLARIFIER UNIT IS INCLUDED AS A PACKAGE UNIT IN THE MEL.
10. ESTIMATED MINIMUM INLET PRESSURE FOR THE R.O. UNIT IS 450 PSIG.

1 11
11. DELETED
12. MAXIMUM SUSPENDED SOLIDS IN CLARIFIER OVERFLOW WILL BE 20 MG/L (LESS THAN 1% BY VOLUME).
13. TWO WATER SOFTENERS (EACH 100%) WILL BE INCLUDED. ONE WILL BE OPERATING WHILE THE OTHER IS REGENERATING.
14. R.O. REJECT TANK AND RELATED EQUIPMENT IS NOW SHOWN ON PFD 24915-10-M5-RO-00002.
15. NORMALLY OPEN VALVE TO ISOLATE R.O. SYSTEM WHEN BYPASSED.

1 12
16. DELETED
17. LINE WILL BE SIZED SIMILAR TO STREAM 1061.

1 13
18. DURING GB AND VX CASE, CLARIFIER WILL BE BYPASSED.
19. PROCESS WATER TO BE USED FOR BACKWASH OF MULTIMEDIA FILTERS DURING MAINTENANCE.
20. CLARIFIER WILL INCLUDE TOP COVER FOR REDUCTION OF WATER EVAPORATION TO THE SPB ROOM.
21. SPB BRINE MEASURING TANK AND SPB WATER SOFTENERS ARE INCLUDED IN WATER SOFTENER PACKAGE.

1 2

PWS-00002
PROCESS WATER
(NOTE 19)

NNF

RO-00002
TO SCWO
EFFLUENT TANK
PUMP DISCHARGE

CLARIFIER PACKAGE - MX-RO-0102 (NOTE 9)

(NOTE 18)

MF-RO-0102 M

1 1

ML-RO-0102
(NOTE 20)

(NOTE 12)

1066

MT-RO-0101

LC

RO-00002
FROM SCWO
EFFLUENT TANKS

150

LS

COAGULANT AND POLYMER INJECTION SKID

HYPOCHLORITE INJECTION SKID

MP-RO-0101

1061

FC

TO PARALLEL R.O. UNIT FEED PUMP

NO
(NOTE 15)

R.O. PACKAGE - RO-PKG-0101 (NOTES 1, 2, 3)

ACID INJECTION SKID

ANTISCALANT INJECTION SKID

MULTIMEDIA FILTER

CANISTER FILTER

MP-RO-0105

FI

TI

(NOTE 10)

ML-RO-0101 (NOTE 7)

PdI

CI

R.O. PERMEATE FROM PARALLEL UNITS

1060

RO-00002
R.O. PERMEATE
TO R.O. PERMEATE
TANKS

BISULFITE INJECTION SKID

NNF

NNF
(NOTE 17)

BACK WASH FLUID

R.O. REJECT

1069

1063

RO-00002
R.O. REJECT
TO R.O. REJECT
TANKS

R.O. REJECT FROM PARALLEL R.O. UNIT

RO-00002
LEVEL SWITCH
FROM MT-SWS-0101/0201

M

MP-RO-0102A/B

(NOTE 6)

1067

1 3

WATER SOFTENER PACKAGE
MX-RO-0103
(NOTE 13)

STM-00001
BLOWDOWN
DRUM

151

1068

REGENERATION WASTE STREAM

NNF

1 15

RO-00002
SOFTENED WATER
TO SCWO EFFLUENT
TANK

1 14

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
1	8/17/06	ISSUED FOR APPROVAL (IFA) TAA UPDATE	JW	JH	SH	JH	BB
0	9/13/05	IFD - REVISED FOR DC #43B	JW	JH	SH	JH	JU

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel Nationals, 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 WATER RECOVERY - R.O. UNIT PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-RO-00001 | SHEET 1 OF 2 | REV 1

PROFESSIONAL STAMP

DESIGN FILE: S:\2D\pr\10-M5-RO-1-1.plt
PLOTTED BY: 51439 ON 8/21/2006 AT 1:38:58 PM

10-M5-RO-1-1.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-10-M5-RO-00001

REVERSE OSMOSIS SYSTEM - PEAK CASE - EFFLUENT FROM 3 AGENT (GB) SCWO UNITS

STREAM NUMBER		150	1060	1061	1063	1066	1067	1068	1069	1511
LINE DESCRIPTION		SCWO EFFLUENT TO CLARIFIER	RO PERMEATE	RO PACKAGE INLET	RO REJECT AND CLARIFIER UNDERFLOW COMBINED	CLARIFIER OVERFLOW	CLARIFIER UNDERFLOW	WATER SOFTENER OUTLET	RO REJECT	COMBINED BLOWDOWN FROM STEAM AND EVAPORATIVE COOLER
TEMPERATURE	°F	110	110	110	110	110		96	110	96
PRESSURE	PSIA	30.23	30.23	30.23	14.23	14.23		14.23	14.23	50
INSTANTANEOUS FLOW - VOLUME	GPM	92.1	64.3	46.0	27.8	92.1		100.0	27.8	100.0
DENSITY	LB/FT3	62.5	61.9	62.5	63.9	62.5		62.1	63.9	62.1
Peak Mass Flow										
H2O	LB/HR	45603	31922	22802	13681	45603		9860	13681	9860
CO2	LB/HR	3.1E-02		1.5E-02	3.1E-02	3.1E-02			3.1E-02	
HCl	LB/HR	8.2E-05	TRACE	4.1E-05	8.2E-05	8.2E-05		8.2E-05	8.2E-05	8.2E-05
H2SO4	LB/HR									
NaOH	LB/HR	3.0E-02	8.6E-04	1.5E-02	2.9E-02	3.0E-02			2.9E-02	
O2	LB/HR	3.3E-02		1.7E-02	3.3E-02	3.3E-02			3.3E-02	
N2	LB/HR	2.9E-01		1.4E-01	2.9E-01	2.9E-01			2.9E-01	
ARGON	LB/HR	3.43		1.72	3.43	3.43			3.43	
H3PO4	LB/HR	TRACE	TRACE	TRACE	TRACE	TRACE			TRACE	
N2O	LB/HR	3.0E-03		1.5E-03	3.0E-03	3.0E-03			3.0E-03	
NaCl	LB/HR	143.12	4.14	71.56	138.98	143.12		2.01	138.98	9.8E-01
NaF	LB/HR	16.31	4.7E-01	8.16	15.84	16.31		2.1E-02	15.84	
Na2HPO4	LB/HR	60.99	1.76	30.49	59.23	60.99			59.23	
Na2SO4	LB/HR	320.28	9.25	160.14	311.03	320.28		9.9E-01	311.03	
NaHSO4	LB/HR	1.3E-04	3.7E-06	6.3E-05	1.2E-04	1.3E-04			1.2E-04	
NaH2PO4	LB/HR	1.45	4.2E-02	7.3E-01	1.41	1.45			1.41	
Na3PO4	LB/HR	7.5E-02	2.2E-03	3.8E-02	7.3E-02	7.5E-02			7.3E-02	
Al2O3	LB/HR	2.6E-01		1.3E-01	2.6E-01	2.6E-01			2.6E-01	
NaHCO3	LB/HR	14.86	4.3E-01	7.43	14.43	14.86		8.25	14.43	
NaNO3	LB/HR	2.6E-03	7.5E-05	1.3E-03	2.5E-03	2.6E-03		2.6E-03	2.5E-03	
CaCl2	LB/HR									9.8E-01
CaSO4	LB/HR									9.5E-01
CaF2	LB/HR									2.0E-02
CaCO3	LB/HR									
Fe2O3	LB/HR									
Na2CO3	LB/HR	3.4E-01	1.0E-02	1.7E-01	3.3E-01	3.4E-01			3.3E-01	
NiO	LB/HR									
CuO	LB/HR									
TiO2	LB/HR	3.1E-01		1.5E-01	3.1E-01	3.1E-01			3.1E-01	
Ca(HCO3)2	LB/HR									7.96
Ba(NO3)2	LB/HR	1.1E-03	3.2E-05	5.5E-04	1.1E-03	1.1E-03		1.1E-03	1.1E-03	1.1E-03
Ca(NO2)2	LB/HR									3.5E-03
NaNO2	LB/HR	3.6E-03	1.0E-04	1.8E-03	3.5E-03	3.6E-03		3.6E-03	3.5E-03	
Ca(NO3)2	LB/HR									9.5E-04
TOC	LB/HR	1.4E-01		6.9E-02	1.4E-01	1.4E-01		1.4E-01	1.4E-01	1.4E-01
Other Metals	LB/HR	3.1E-03		1.6E-03	3.1E-03	3.1E-03		3.1E-03	3.1E-03	3.1E-03
Total Peak Mass Flow	LB/HR	46165	31938	23083	14227	46165	NNF	9872	14227	9871
Average Mass Flow	LB/HR	32316	22357	16158	9959	32316		6910	9959	6910
Notes		1	1,2		1					

REVERSE OSMOSIS SYSTEM - PEAK CASE - EFFLUENT FROM 3 AGENT (H) SCWO UNITS

STREAM NUMBER		150	1060	1061	1063	1066	1067	1068	1069	1511
LINE DESCRIPTION		SCWO EFFLUENT TO CLARIFIER	RO PERMEATE	RO PACKAGE INLET	RO REJECT AND CLARIFIER UNDERFLOW COMBINED	CLARIFIER OVERFLOW	CLARIFIER UNDERFLOW	WATER SOFTENER OUTLET	RO REJECT	COMBINED BLOWDOWN FROM STEAM AND EVAPORATIVE COOLER
TEMPERATURE	°F	110	110	110	110	110	110	96	110	96
PRESSURE	PSIA	30.23	30.23	14.23	14.23	14.23	30.23	14.23	14.23	50
INSTANTANEOUS FLOW - VOLUME	GPM	92.1 / 46.0	64.3 / 32.2	46.0	83.9	92.1 / 46.0	55.1	100.0	27.8 / 13.9	100.0
DENSITY	LB/FT3	62.6	61.9	62.6	64.1	62.6	65.2	62.1	64.0	62.1
Peak Mass Flow										
H2O	LB/HR	33071	22863	16331	10207	32662	408.61	9590	9799	9590
CO2	LB/HR	1.7E-02		8.6E-03	1.7E-02	1.7E-02	2.2E-04		1.7E-02	
HCl	LB/HR	8.0E-05	TRACE	4.0E-05	8.0E-05	7.9E-05	9.9E-07	8.0E-05	7.9E-05	8.0E-05
H2SO4	LB/HR									
NaOH	LB/HR	1.9E-02	4.9E-04	9.4E-03	1.8E-02	1.9E-02	2.3E-04		1.8E-02	
O2	LB/HR	2.1E-02		1.0E-02	2.1E-02	2.1E-02	2.6E-04		2.1E-02	
N2	LB/HR	2.0E-01		9.6E-02	2.0E-01	1.9E-01	2.4E-03		1.9E-01	
ARGON	LB/HR	2.18		1.08	2.18	2.15	2.7E-02		2.15	
H3PO4	LB/HR	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE		TRACE	
N2O	LB/HR									
NaCl	LB/HR	132.06	3.44	65.21	128.61	130.42	1.63	1.96	126.98	9.5E-01
NaF	LB/HR	2.1E-02	5.5E-04	1.0E-02	2.0E-02	2.1E-02	2.6E-04	2.1E-02	2.0E-02	
Na2HPO4	LB/HR	2.16	5.6E-02	1.06	2.10	2.13	2.7E-02		2.07	
NA2SO4	LB/HR	296.08	7.72	146.21	288.35	292.42	3.66	9.6E-01	284.70	
NaHSO4	LB/HR	1.1E-04	2.8E-06	5.3E-05	1.1E-04	1.1E-04	1.3E-06		1.0E-04	
NaH2PO4	LB/HR	4.8E-02	1.3E-03	2.4E-02	4.7E-02	4.8E-02	5.9E-04		4.6E-02	
Na3PO4	LB/HR	2.9E-03	7.6E-05	1.4E-03	2.8E-03	2.9E-03	3.6E-05		2.8E-03	
Al2O3	LB/HR	1.9E-01		2.3E-03	1.9E-01	4.7E-03	1.8E-01		4.7E-03	
NaHCO3	LB/HR	11.75	3.1E-01	5.80	11.44	11.60	1.5E-01	8.02	11.29	
CaCl2	LB/HR									9.5E-01
CaSO4	LB/HR									9.2E-01
CaF2	LB/HR									1.9E-02
CaCO3	LB/HR									
Fe2O3	LB/HR	21.83		2.7E-01	21.83	5.5E-01	21.29		5.5E-01	
Na2CO3	LB/HR	2.1E-01	5.4E-03	1.0E-01	2.0E-01	2.0E-01	2.6E-03		2.0E-01	
Mn2O3	LB/HR	1.7E-01		2.2E-03	1.7E-01	4.3E-03	1.7E-01		4.3E-03	
SiO2	LB/HR	2.1E-02		2.6E-04	2.1E-02	5.3E-04	2.0E-02		5.3E-04	
NiO	LB/HR									
CuO	LB/HR									
TiO2	LB/HR	6.0E-03		7.5E-05	6.0E-03	1.5E-04	5.9E-03		1.5E-04	
Ba(NO3)2	LB/HR	1.1E-03	2.9E-05	5.4E-04	1.1E-03	1.1E-03	1.4E-05	1.1E-03	1.1E-03	1.1E-03
Ca(NO2)2	LB/HR									3.4E-03
Ca(NO3)2	LB/HR									9.2E-04
Ca(HCO3)2	LB/HR									7.74
NaNO3	LB/HR	2.5E-03	6.5E-05	1.2E-03	2.4E-03	2.5E-03	3.1E-05	2.5E-03	2.4E-03	
NaNO2	LB/HR	3.5E-03	9.1E-05	1.7E-03	3.4E-03	3.5E-03	4.3E-05	3.5E-03	3.4E-03	
TOC	LB/HR	1.3E-01		1.7E-03	1.3E-01	3.3E-03	1.3E-01	1.3E-01	3.3E-03	1.3E-01
Other Metals	LB/HR	3.0E-03		3.8E-05	3.0E-03	7.6E-05	3.0E-03	3.0E-03	7.6E-05	3.0E-03
Total Peak Mass Flow	LB/HR	33538	22875	16551	10663	33102	435.90	9601	10227	9601
Average Mass Flow	LB/HR	23476	16012	11586	7464	23171	305.13	6721	7159	6721
Notes		1,3	1,2,3		1,3	5	3,4			

NOTES:

1. EACH OF THE TWO R.O. UNITS IS DESIGNED TO HANDLE 50% OF THE SHOWN PEAK FLOW.
2. MAXIMUM DISSOLVED SOLIDS IN THE R.O. PERMEATE IS 500 MG/L.
3. DURING VX AND H OPERATION, REVERSE OSMOSIS UNITS WILL BE CYCLED BETWEEN ONE R.O. OPERATION AND TWO R.O. OPERATIONS TO EMPTY THE SCWO EFFLUENT TANK IN THE SPECIFIED FILL TIME TO PREVENT NO FLOW TO THE CLARIFIER. INSTANTANEOUS FLOW FOR TWO R.O. OPERATIONS AND ONE R.O. OPERATION ARE SHOWN. PEAK FLOW RATES ARE BASED ON TWO R.O. OPERATIONS.
4. CLARIFIER UNDERFLOW IS INTERMITTENT AND WILL OCCUR FOR 20 MINUTES DURING EACH CAMPAIGN. TIME BETWEEN UNDERFLOW OPERATION IS 11 HOURS DURING H CAMPAIGN.
5. CLARIFIER OVERFLOW DURING CLARIFIER OPERATION HAS A MAXIMUM SUSPENDED SOLIDS CONCENTRATION OF 20 MG/L (APPROXIMATELY 20 PPMW).

REVERSE OSMOSIS SYSTEM - PEAK CASE - EFFLUENT FROM 3 AGENT (VX) SCWO UNITS

STREAM NUMBER		150	1060	1061	1063	1066	1067	1068	1069	1511
LINE DESCRIPTION		SCWO EFFLUENT TO CLARIFIER	RO PERMEATE	RO PACKAGE INLET	RO REJECT AND CLARIFIER UNDERFLOW COMBINED	CLARIFIER OVERFLOW	CLARIFIER UNDERFLOW	WATER SOFTENER OUTLET	RO REJECT	COMBINED BLOWDOWN FROM STEAM AND EVAPORATIVE COOLER
TEMPERATURE	°F	110	110	110	110	110		95	110	95
PRESSURE	PSIA	30.23	30.23	14.23	14.23	14.23		14.23	14.23	50
INSTANTANEOUS FLOW - VOLUME	GPM	92.1 / 46.0	64.3 / 32.2	46.0	27.8 / 13.9	92.1 / 46.0		100.0	27.8 / 13.9	100.0
DENSITY	LB/FT3	62.9	61.9	62.9	65.1	62.9		62.1	65.1	62.1
Peak Mass Flow										
H2O	LB/HR	33588	23511	16794	10076	33588		11562	10076	11562
CO2	LB/HR	1.5E-02		7.7E-03	1.5E-02	1.5E-02			1.5E-02	
HCl	LB/HR	9.7E-05	TRACE	4.9E-05	9.7E-05	9.7E-05		9.7E-05	9.7E-05	9.7E-05
H2SO4	LB/HR									
NaOH	LB/HR	2.0E-02	4.6E-04	1.0E-02	2.0E-02	2.0E-02			2.0E-02	
O2	LB/HR	1.8E-02		9.0E-03	1.8E-02	1.8E-02			1.8E-02	
N2	LB/HR	1.8E-01		9.2E-02	1.8E-01	1.8E-01			1.8E-01	
ARGON	LB/HR	2.03		1.01	2.03	2.03			2.03	
H3PO4	LB/HR	TRACE	TRACE	TRACE	TRACE	TRACE			TRACE	
N2O	LB/HR	6.0E-03		3.0E-03	6.0E-03	6.0E-03			6.0E-03	
NaCl	LB/HR	173.11	3.15	86.55	169.96	173.11		2.37	169.96	1.15
NaF	LB/HR	2.5E-02	4.6E-04	1.3E-02	2.5E-02	2.5E-02		2.5E-02	2.5E-02	
Na2HPO4	LB/HR	74.91	1.36	37.45	73.54	74.91			73.54	
Na2SO4	LB/HR	388.71	7.07	194.36	381.64	388.71		1.16	381.64	
NaHSO4	LB/HR	1.0E-04	1.8E-06	5.0E-05	9.8E-05	1.0E-04			9.8E-05	
NaH2PO4	LB/HR	1.24	2.3E-02	6.2E-01	1.21	1.24			1.21	
Na3PO4	LB/HR	1.5E-01	2.8E-03	7.6E-02	1.5E-01	1.5E-01			1.5E-01	
Al2O3	LB/HR	2.6E-01		1.3E-01	2.6E-01	2.6E-01			2.6E-01	
NaHCO3	LB/HR	13.34	2.4E-01	6.67	13.10	13.34		9.71	13.10	
NaNO3	LB/HR	3.1E-03	5.6E-05	1.6E-03	3.0E-03	3.1E-03		3.1E-03	3.0E-03	
CaCl2	LB/HR									1.16
CaSO4	LB/HR									1.11
CaF2	LB/HR									2.3E-02
CaCO3	LB/HR									
Fe2O3	LB/HR	6.0E-03		3.0E-03	6.0E-03	6.0E-03			6.0E-03	
Na2CO3	LB/HR	2.7E-01	5.0E-03	1.4E-01	2.7E-01	2.7E-01			2.7E-01	
CaO	LB/HR	3.0E-02		1.5E-02	3.0E-02	3.0E-02			3.0E-02	
NiO	LB/HR	2.2E-06		1.1E-06	2.2E-06	2.2E-06			2.2E-06	
CuO	LB/HR	1.0E-04		5.2E-05	1.0E-04	1.0E-04			1.0E-04	
TiO2	LB/HR	8.9E-01		4.4E-01	8.9E-01	8.9E-01			8.9E-01	
SiO2	LB/HR	1.8E-02		9.0E-03	1.8E-02	1.8E-02			1.8E-02	
Ca(HCO3)2	LB/HR									9.37
Ba(NO3)2	LB/HR	1.3E-03	2.4E-05	6.5E-04	1.3E-03	1.3E-03		1.3E-03	1.3E-03	1.3E-03
Ca(NO2)2	LB/HR									4.1E-03
NaNO2	LB/HR	4.3E-03	7.8E-05	2.2E-03	4.2E-03	4.3E-03		4.3E-03	4.2E-03	
Ca(NO3)2	LB/HR									1.1E-03
TOC	LB/HR	1.6E-01		8.1E-02	1.6E-01	1.6E-01		1.6E-01	1.6E-01	1.6E-01
Other Metals	LB/HR	2.8E-03		1.4E-03	2.8E-03	2.8E-03		3.7E-03	2.8E-03	3.7E-03
Total Peak Mass Flow	LB/HR	34243	23523	17121	10720	34243	NNF	11575	10720	11575
Average Mass Flow	LB/HR	23970	16466	11985	7504	23970		8103	7504	8102
Notes		1,3	1,2,3		1					

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
1	8/17/06	ISSUED FOR APPROVAL (IFA) TAA UPDATE	JW	JH	SH	JH	BB
0	9/13/05	IFD - REVISED FOR DC #43B	JW	JH	SH	JH	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

SCWO PROCESSING BUILDING WATER RECOVERY - R.O. UNIT PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M5-RO-00001 SHEET 2 OF 2 REV 1

10-M5-RO-1-2.PFZ BGCAPP_E2.BDR

DESIGN FILE: s:\2d\pr\10-m5-ro-1-2.pfz ON 8/21/2006 AT 1:38:59 PM
PLOTTED BY: 51439

MT-RO-0106/0206
R.O. REJECT
TANKS
WORKING CAPACITY: 56,000 GAL

MF-RO-0106/0206
R.O. REJECT
TANK AGITATORS
HP: TBD

MP-RO-0106A/B
R.O. REJECT TANK
PUMP AND SPARE
CAPACITY: 200 GPM
(NOTE 3)

MT-SCWO-0101/0201/0301
SCWO EFFLUENT TANK
WORKING CAPACITY: 36,000 GAL

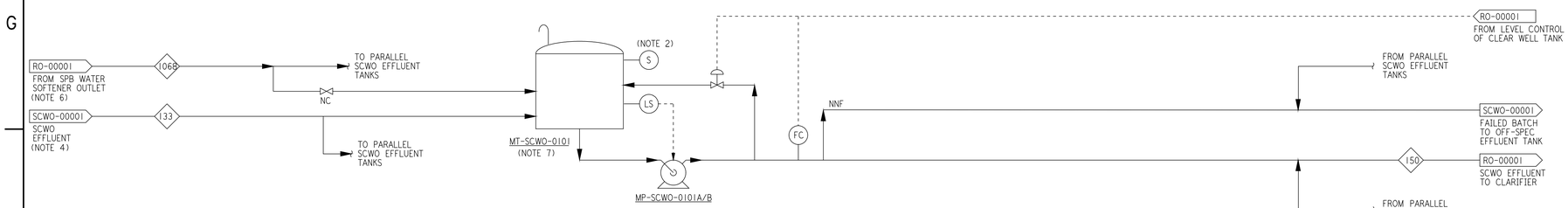
MP-SCWO-0101A/B
MP-SCWO-0201A/B
MP-SCWO-0301A/B
SCWO EFFLUENT TANK
PUMPS AND SPARES
CAPACITY: 85 GPM

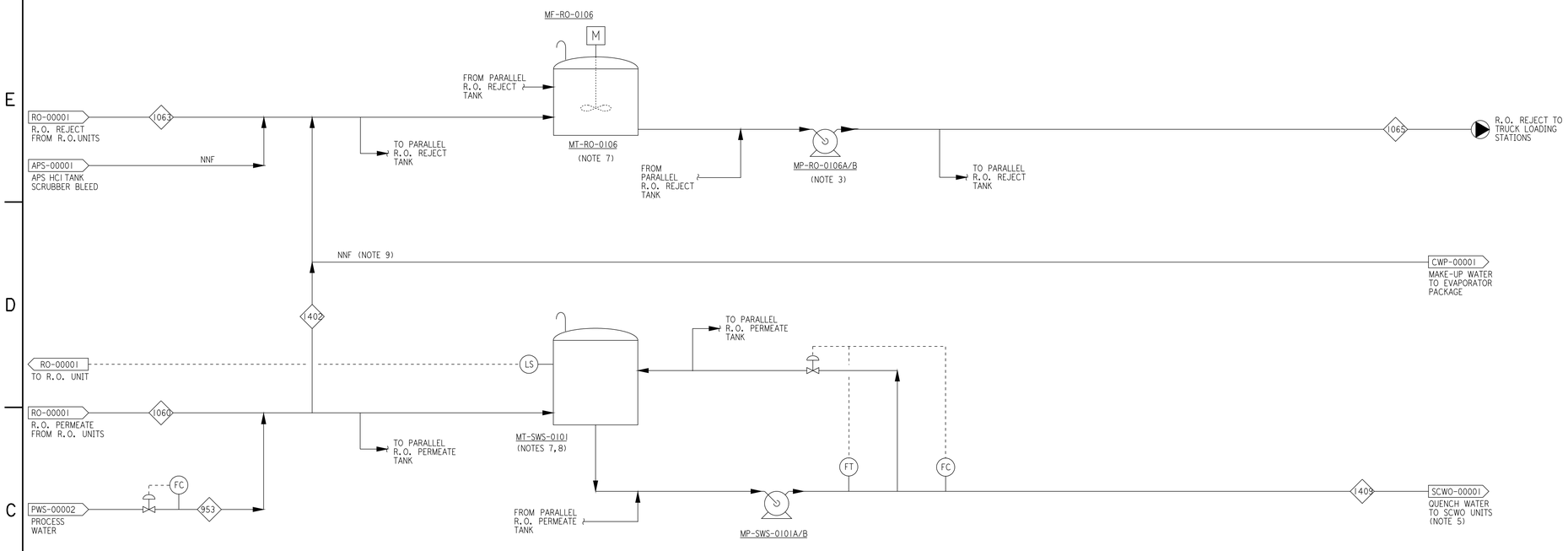
MT-SWS-0101/0201
R.O. PERMEATE
TANKS
WORKING CAPACITY: 43,000 GAL

MP-SWS-0101A/B
R.O. PERMEATE
PUMP AND SPARE
CAPACITY: 67 GPM

NOTES:

1. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
2. PROVIDE LOCAL SAMPLE CONNECTION TO VERIFY THE ABSENCE OF AGENT AND ACCEPTABLE CONCENTRATION OF TOTAL ORGANICS.
3. ONE OPERATING PUMP AND ONE SPARE. BOTH PUMPS CAN OPERATE SIMULTANEOUSLY AND DRAW SUCTION FROM THE SAME TANK AND TRANSFER TANK CONTENTS TO THE OTHER AND VICE VERSA.
4. STREAM 133 DENOTES FLOW FROM ALL THREE SCWO UNITS.
5. STREAM 1409 DENOTES QUENCH WATER FLOW TO ALL THREE SCWO UNITS.
6. WATER SOFTENER OUTLET WILL BE ROUTED TO THE SCWO EFFLUENT TANK THAT IS FEEDING THE CLARIFIER AT THE TIME.
7. SCWO EFFLUENT TANK AND RELATED EQUIPMENT WAS PREVIOUSLY SHOWN ON PFD 24915-10-M5-SCWO-00011. R.O. PERMEATE TANK AND RELATED EQUIPMENT WAS PREVIOUSLY SHOWN ON PFD 24915-10-M5-SCWO-00011. R.O. REJECT TANK AND RELATED EQUIPMENT WAS PREVIOUSLY SHOWN ON PFD 24915-10-M5-RO-00001.
8. R.O. PERMEATE WILL COOL IN THE R.O. PERMEATE TANK FROM 110 °F TO 77 °F. IN-LINE COOLING, IF NECESSARY, WILL BE PROVIDED.
9. LINE WILL BE SIZED SIMILAR TO STREAM 1402.





THE RATES AND COMPOSITIONS SHOWN MAY CHANGE SUBJECT TO FINALIZATION OF COOLING WATER SYSTEM AND SCWO EFFLUENT ANALYSIS UNDER TEST AT PRESENT

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
0	9/13/05	IFD - REVISED FOR DC #43B	JW	JH	SH	JH	JU

QUALITY ☐ LEVEL 1 ☐ LEVEL 2 ☒ LEVEL 3 ☐ ALL

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel National, Inc. and Parsons Infrastructure & Technology Group Inc.

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RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING WATER RECOVERY - TANKS PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-10-M5-RO-00002 | SHEET 1 OF 2 | REV 0

PROFESSIONAL STAMP

DESIGN FILE: S:\2D\pr\10-M5-RO-2-1.pfz
PLOTTED BY: SI439 ON 15-SEP-2005 AT 16:16 USING Color Table- S:\3DStds\ge\edeplotOrg\bw.ctb & Pen Table- S:\3DStds\ge\edeplotOrg\Bluegrass_F.tbl

10-M5-RO-2-1.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-10-M5-RO-00002

SCWO EFFLUENT TANKS - PEAK CASE - EFFLUENT FROM 3 AGENT (GB) SCWO UNITS

STREAM NUMBER		133	150	953	1060	1063	1065	1068	1402	1409
LINE DESCRIPTION		SCWO EFFLUENT TANKS INLET	SCWO EFFLUENT TO CLARIFIER	MAKEUP WATER TO RO PERMEATE TANKS	RO PERMEATE	RO REJECT AND CLARIFIER UNDERFLOW COMBINED	RO REJECT TO TRUCK LOADING STATIONS	WATER SOFTENER OUTLET	EXCESS RO PERMEATE TO RO REJECT TANKS	QUENCH WATER TO SCWOs
TEMPERATURE	°F	139	110	77	110	110	110	90		77
PRESSURE	PSIA	30.23	30.23	44.23	30.23	14.23	14.23	14.23		54.23
INSTANTANEOUS FLOW - VOLUME	GPM (ACFM)	74.4	84.5	9.4	57.9	106.8	200.0	100.0		66.9
DENSITY	LB/FT3	62.1	62.6	62.3	61.9	63.8	63.8	62.2		62.3
MASS FLOW LIQUID										
DIPU										
H2O	LB/HR	36524	41832	4695.6	28709	13123	13123	5308.5		33405
IPA	LB/HR									
CO2	LB/HR	3.63	3.63			3.63	3.63			
HCl	LB/HR		TRACE		TRACE	TRACE	TRACE	TRACE		
H2SO4	LB/HR									
NaOH	LB/HR									
O2	LB/HR	3.6E-02	3.6E-02			3.6E-02	3.6E-02			
N2	LB/HR	3.1E-01	3.1E-01			3.1E-01	3.1E-01			
H2	LB/HR									
N2O	LB/HR	3.0E-03	3.0E-03			3.0E-03	3.0E-03			
P2O5	LB/HR									
NH3	LB/HR									
K2SO4	LB/HR									
NaCl	LB/HR	127.05	127.95		3.75	124.20	124.20	8.9E-01		3.75
NaF	LB/HR	18.50	18.50		5.4E-01	17.95	17.95			5.4E-01
NaHSO4	LB/HR									
NA2SO4	LB/HR	279.23	280.52		8.22	272.31	272.31	1.29		8.22
NaH2PO4	LB/HR	55.17	55.17		1.62	53.55	53.55			1.62
HF	LB/HR									
Al2O3	LB/HR	5.2E-01	5.2E-01			5.2E-01	5.2E-01			
Pb3O4	LB/HR									
NaHCO3	LB/HR	9.09	9.09		2.7E-01	8.83	8.83			
NaNO3	LB/HR									
CaCl2	LB/HR									
CaSO4	LB/HR									
CaF2	LB/HR									
CaCO3	LB/HR									
Fe2O3	LB/HR	3.7E-04	3.7E-04			3.7E-04				
Na2CO3	LB/HR		3.68		1.1E-01	3.57	3.57	3.68		1.1E-01
NiO	LB/HR	4.2E-02	4.2E-02			4.2E-02	4.2E-02			
CuO	LB/HR	2.1E-03	2.1E-03			2.1E-03	2.1E-03			
TiO2	LB/HR	43.90	43.90			43.90	43.90			
CYANIDE	LB/HR		2.8E-04		8.1E-06	2.7E-04	2.7E-04	2.8E-04		8.1E-06
FLUORIDE	LB/HR		5.6E-03		1.6E-04	5.4E-03	5.4E-03	5.6E-03		1.6E-04
NITRATE	LB/HR		1.4E-03		4.1E-05	1.3E-03	1.3E-03	1.4E-03		4.1E-05
NITRITE	LB/HR		1.4E-03		4.1E-05	1.3E-03	1.3E-03	1.4E-03		4.1E-05
Other Metals	LB/HR		2.1E-03			2.1E-03	2.1E-03	2.1E-03		
TOTAL LIQUID	LB/HR	37061	42375	4695.6	28723	13652	13652	5314.4	NNF	33419
Notes			1		1,2	1				

SCWO EFFLUENT TANKS - PEAK CASE - EFFLUENT FROM 3 AGENT (VX) SCWO UNITS

STREAM NUMBER		133	150	953	1060	1063	1065	1068	1402	1409
LINE DESCRIPTION		SCWO EFFLUENT TANKS INLET	SCWO EFFLUENT TO CLARIFIER	MAKEUP WATER TO RO PERMEATE TANKS	RO PERMEATE	RO REJECT AND CLARIFIER UNDERFLOW COMBINED	RO REJECT TO TRUCK LOADING STATIONS	WATER SOFTENER OUTLET	EXCESS RO PERMEATE TO RO REJECT TANKS	QUENCH WATER TO SCWOs
TEMPERATURE	°F	139	110		110	110	110	90	110	77
PRESSURE	PSIA	30.23	30.23		30.23	14.23	14.23	14.23	14.23	54.23
INSTANTANEOUS FLOW - VOLUME	GPM (ACFM)	45.2	83.8 / 41.9		57.7 / 28.9	105.5	200.0	100.0	1.4	38.5
DENSITY	LB/FT3	62.8	63.1		61.9	65.3	65.3	62.2	61.9	62.3
MASS FLOW LIQUID										
DIPU										
H2O	LB/HR	22156	29015		19958	9056.9	9056.9	6859.1	708.3	19250
IPA	LB/HR									
CO2	LB/HR	1.94	1.94			1.94	1.94			
HCl	LB/HR		TRACE		TRACE			TRACE	TRACE	TRACE
H2SO4	LB/HR									
NaOH	LB/HR									
O2	LB/HR	2.1E-02	2.1E-02			2.1E-02	2.1E-02			
N2	LB/HR	1.9E-01	1.9E-01			1.9E-01	1.9E-01			
H2	LB/HR									
N2O	LB/HR	3.0E-03	3.0E-03			3.0E-03	3.0E-03			
P2O5	LB/HR									
NH3	LB/HR									
K2SO4	LB/HR									
NaCl	LB/HR	155.20	156.35		2.52	153.84	153.84	1.15	8.9E-02	2.43
NaF	LB/HR									
NaHSO4	LB/HR									
NA2SO4	LB/HR	386.60	388.17		6.25	381.93	381.93	1.58	2.2E-01	6.03
NaH2PO4	LB/HR	67.17	67.17		1.08	66.09	66.09		3.8E-02	1.04
HF	LB/HR									
Al2O3	LB/HR	2.9E-01	2.9E-01			2.9E-01	2.9E-01			
Pb3O4	LB/HR									
NaHCO3	LB/HR	9.11	9.11		1.5E-01	8.96	8.96		5.2E-03	1.4E-01
NaNO3	LB/HR									
CaCl2	LB/HR									
CaSO4	LB/HR									
CaF2	LB/HR									
CaCO3	LB/HR									
Fe2O3	LB/HR	9.9E-02	9.9E-02			9.9E-02	9.9E-02			
Na2CO3	LB/HR	3.0E-03	4.75		7.7E-02	4.68	4.68	4.75	2.7E-03	7.4E-02
NiO	LB/HR	3.0E-03	3.0E-03			3.0E-03	3.0E-03			
CuO	LB/HR	1.1E-03	1.1E-03			1.1E-03	1.1E-03			
TiO2	LB/HR	27.26	27.26			27.26	27.26			
CYANIDE	LB/HR		3.6E-04		5.8E-06	3.5E-04	3.5E-04	3.6E-04	2.1E-07	5.6E-06
FLUORIDE	LB/HR		7.2E-03		1.2E-04	7.1E-03	7.1E-03	7.2E-03	4.1E-06	1.1E-04
NITRATE	LB/HR		1.8E-03		2.9E-05	1.8E-03	1.8E-03	1.8E-03	1.0E-06	2.8E-05
NITRITE	LB/HR		1.8E-03		2.9E-05	1.8E-03	1.8E-03	1.8E-03	1.0E-06	2.8E-05
Other Metals	LB/HR		2.8E-03			2.8E-03	2.8E-03	2.8E-03		
TOTAL LIQUID	LB/HR	22804	29670	NNF	19968	9702.3	9702.3	6866.6	708.6	19259
Notes			1	3	1,2	1				

SCWO EFFLUENT TANKS - PEAK CASE - EFFLUENT FROM 3 AGENT (H) SCWO UNITS

STREAM NUMBER		133	150	953	1060	1063	1065	1068	1402	1409
LINE DESCRIPTION		SCWO EFFLUENT TANKS INLET	SCWO EFFLUENT TO CLARIFIER	MAKEUP WATER TO RO PERMEATE PUMP	RO PERMEATE	RO REJECT AND CLARIFIER UNDERFLOW COMBINED	RO REJECT TO TRUCK LOADING STATIONS	WATER SOFTENER OUTLET	EXCESS RO PERMEATE TO RO REJECT TANKS	QUENCH WATER TO SCWOs
TEMPERATURE	°F	139	110		110	110	110	90	110	77
PRESSURE	PSIA	30.23	30.23		30.23	14.23	14.23	14.23	14.23	54.23
INSTANTANEOUS FLOW - VOLUME	GPM (ACFM)	46.4	83.6 / 41.8		57.8 / 28.9	106.1	200.0	100.0	0.5	38.6
DENSITY	LB/FT3	62.6	62.9		61.9	64.7	64.7	62.2	61.9	62.3
MASS FLOW LIQUID										
DIPU										
H2O	LB/HR	22754	28351		19558	8792.8	8792.8	5596.8	261.6	19297
IPA	LB/HR									
CO2	LB/HR	1.98	1.98			1.98	1.98			
HCl	LB/HR		TRACE		TRACE	TRACE	TRACE	TRACE	TRACE	TRACE
H2SO4	LB/HR									
NaOH	LB/HR									
O2	LB/HR	2.1E-02	2.1E-02			2.1E-02	2.1E-02			
N2	LB/HR	2.0E-01	2.0E-01			2.0E-01	2.0E-01			
H3PO4	LB/HR									
N2O	LB/HR									
P2O5	LB/HR									
NH3	LB/HR									
K2SO4	LB/HR									
NaCl	LB/HR	149.70	150.64		2.95	147.69	147.69	9.4E-01	3.9E-02	2.91
NaF	LB/HR									
NaHSO4	LB/HR	3.80	3.80		7.4E-02	3.72	3.72		9.9E-04	7.3E-02
NA2SO4	LB/HR	342.71	344.00		6.74	337.26	337.26	1.29	9.0E-02	6.65
NaH2PO4	LB/HR	1.55	1.55		3.0E-02	1.52	1.52		4.1E-04	3.0E-02
HF	LB/HR									
Al2O3	LB/HR	1.9E-01	1.9E-01			1.9E-01	1.9E-01			
Pb3O4	LB/HR									
NaHCO3	LB/HR									
NaNO3	LB/HR									
CaCl2	LB/HR									
CaSO4	LB/HR									
CaF2	LB/HR									
CaCO3	LB/HR									
Fe2O3	LB/HR	22.03	22.03			22.03	22.03			
Na2CO3	LB/HR		3.88		7.6E-02	3.81	3.81	3.88	1.0E-03	7.5E-02
Mn2O3	LB/HR	1.7E-01	1.7E-01			1.7E-01	1.7E-01			
SiO2	LB/HR	2.1E-02	2.1E-02			2.1E-02	2.1E-02			
NiO	LB/HR									
CuO	LB/HR									
CYANIDE	LB/HR		2.9E-04		5.7E-06	2.9E-04	2.9E-04	2.9E-04	7.7E-08	5.7E-06
FLUORIDE	LB/HR		5.9E-03		1.1E-04	5.7E-03	5.7E-03	5.9E-03	1.5E-06	1.1E-04
NITRATE	LB/HR		1.5E-03		2.9E-05	1.4E-03	1.4E-03	1.5E-03	3.8E-07	2.8E-05
NITRITE	LB/HR		1.5E-03		2.9E-05	1.4E-03	1.4E-03	1.5E-03	3.8E-07	2.8E-05
Other Metals	LB/HR		2.8E-06			2.8E-06	2.8E-06	2.8E-06		
TOTAL LIQUID	LB/HR	23277	28880	NNF	19568	9311.4	9311.4	5602.9	261.8	19307
Notes			1	3	1,2	1				

NOTES:

1. EACH OF THE TWO R.O. UNITS IS DESIGNED TO HANDLE 50% OF THE SHOWN PEAK FLOW.
2. MAXIMUM DISSOLVED SOLIDS IN THE R.O. PERMEATE IS 500 MG/L.
3. MAKE-UP WATER IS SET AT NNF FOR VX AND H CAMPAIGN BASED ON DURING TWO REVERSE OSMOSIS OPERATIONS, LEVEL IN R.O. PERMEATE TANK WATER LEVEL WILL INCREASE AND DURING ONE R.O. OPERATION THE R.O. PERMEATE TANK WATER LEVEL WILL DECREASE. SINCE THE NET WATER VOLUME LEVEL WILL INCREASE, THERE IS NO NEED FOR MAKE-UP PROCESS WATER TO SUPPLEMENT THE SCWO QUENCH WATER USAGE DURING NORMAL OPERATION.

THE RATES AND COMPOSITIONS SHOWN MAY CHANGE SUBJECT TO FINALIZATION OF COOLING WATER SYSTEM AND SCWO EFFLUENT ANALYSIS UNDER TEST AT PRESENT

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
0	9/13/05	IFD - REVISED FOR DC #43B	JW	JH	SH	JH	JU

QUALITY ☐ LEVEL 1 ☐ LEVEL 2 ☒ LEVEL 3 ☐ ALL

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DRAWING NUMBER 24915-10-M5-RO-00002 | SHEET 2 OF 2 | REV 0

PROFESSIONAL STAMP

DESIGN FILE: S:\2D\pr\10-M5-RO-2-2.plz
PLOTTED BY: 51439 ON 15-SEP-2005 AT 16:52 USING Color Table= S:\3DStds\ge\edeplotOrg\bw.ctb & Pen Table= S:\3DStds\ge\edeplotOrg\Bluegrass_F.tbl

10-M5-RO-2-2.PFZ

BGCAPP_E2.BDR

MS-SCWO-0020
FLUSH WATER HEATER
DUTY: 0.20 MMBTU/HR

MF-SCWO-0030/0031
HYDROLYSATE BLEND TANK 1/2 AGITATOR
MOTOR HP: 1.5 EA.
2 6

MT-SCWO-0020
CARBON SLURRY FEED TANK
CAPACITY: 1900 GAL

MP-SCWO-0020
LP CARBON SLURRY FEED PUMP
CAPACITY: 2.5 GPM

MP-SCWO-0024
HP CARBON SLURRY FEED PUMP
CAPACITY: 0.1/1.0 GPM

MX-SCWO-1000
MX-SCWO-2000
MX-SCWO-3000
MX-SCWO-4000
HIGH PRESSURE AIR COMPRESSOR SYSTEM
CAPACITY: 555 SCFM EA.

MH-SCWO-0001
SALT FEED ADDITIVE WEIGH HOPPER
CAPACITY: 4.7 CU FT

MH-SCWO-0002/0003
SALT FEED ADDITIVE SCREW CONVEYOR NO. 1/NO. 2
CAPACITY: 7.9 FT3/HR EA.

MH-SCWO-0004
BULK BAG UNLOADER
CAPACITY: 2,000 LB BAG

MH-SCWO-0005
AUTOMATED BULK BAG ADAPTER DISPENSER
CAPACITY: 4.7 CU FT

MP-SCWO-0034 A/B
HCl SCWO FEED ADDITIVE METERING PUMP
CAPACITY: 1.3 GPM

MP-SCWO-0035 A/B
H2SO4 SCWO FEED ADDITIVE METERING PUMP
CAPACITY: 0.5 GPM

MT-SCWO-0030/0031
HYDROLYSATE BLEND TANK 1/2
WORKING CAPACITY: 4,666 GAL EA.

MP-SCWO-0030/0031
LP BLEND PUMP 1/2
CAPACITY: 19.4 GPM EA.
3 6

MT-SCWO-0032
BATCH HYDROLYSATE HOLDING TANK
WORKING CAPACITY: 4,666 GAL

MP-SCWO-0032
BATCH HYDROLYSATE PUMP
CAPACITY: 19.4 GPM

ME-SCWO-0001/0002
HYDROLYSATE BLEND TANK 1/2 HEATER
DUTY: 0.48 MMBTU/HR

ME-SCWO-0003
HYDROLYSATE BATCH TANK HEATER
DUTY: 0.48 MMBTU/HR

MV-SCWO-0010
HP CONDENSATE COLLECTION POT
CAPACITY: 32 GAL

MF-SCWO-0020
CARBON SLURRY FEED TANK AGITATOR
MOTOR HP: 2.0

MF-SCWO-0032
BATCH HYDROLYSATE HOLDING TANK AGITATOR
MOTOR HP: 1.5

BY GA | BY PARSONS

BLENDED HYDROLYSATE FROM SCWO TRAIN 3

BLENDED HYDROLYSATE FROM SCWO TRAIN 2

SHEET 2
BLENDED HYDROLYSATE FROM MP-SCWO-0030/0031

HSS-00001
AGENT HYDROLYSATE

AFS-00001
ENERGETICS HYDROLYSATE

SHEET 3
OFF-SPEC EFFLUENT FROM MP-SCWO-0041

APS-00001
35% HCL

PWS-00002
PROCESS WATER
8 6

APS-00001
93% H2SO4

BCS-00001
18% NaOH

SCWO-00011
PROCESS WATER

DPS-00001
CARBON SLURRY

14 6
PWS-00002
PROCESS WATER

NITROGEN
NNF
MF-SCWO-0030/0031
MT-SCWO-0030/0031
MP-SCWO-0030/0031
ME-SCWO-0001/0002
CONDENSATE STEAM
632
633
634
635
636
637
638
639
640
641
642
643
644
646
647
648
649
652

HVAC-00001
NITROGEN TO SPB HVAC

SHEET 2
BLENDED HYDROLYSATE TO MP-SCWO-1020

BLENDED HYDROLYSATE TO SCWO TRAIN 2

BLENDED HYDROLYSATE TO SCWO TRAIN 3

MH-SCWO-0003
MH-SCWO-0004
MH-SCWO-0005
MH-SCWO-0002
MH-SCWO-0001

MF-SCWO-0032
ME-SCWO-0003
MT-SCWO-0032
MP-SCWO-0032

MP-SCWO-0034 A/B
MP-SCWO-0035 A/B

MF-SCWO-0020
MT-SCWO-0020
MP-SCWO-0020
MP-SCWO-0024
FIC

SHEET 2
CARBON SLURRY TO MV-SCWO-1030

MS-SCWO-0020

SHEET 2
FLUSH WATER TO MP-SCWO-1020

FLUSH WATER TO SCWO TRAIN 2

FLUSH WATER TO SCWO TRAIN 3

SHEET 2
CONDENSATE FROM MV-SCWO-1010

CONDENSATE FROM SCWO TRAIN 2

CONDENSATE FROM SCWO TRAIN 3

MV-SCWO-0010

55 GAL DRUM

MX-SCWO-1000/2000/3000/4000
PROCURED PACKAGE 4

SHEET 2
HP AIR TO MV-SCWO-1010

HP AIR TO SCWO TRAIN 2

HP AIR TO SCWO TRAIN 3

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. 13 6
4. PACKAGE WILL CONSIST OF MULTIPLE HIGH PRESSURE AIR COMPRESSOR UNITS.
5. BULK BAGS OF NaCl WILL BE DELIVERED TO THE SALT 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. 15 6
   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. THE DSH SYSTEM CURRENTLY USES NaOCl FOR CARBON DECONTAMINATION. IF CHANGED TO NaOH, THE SCWO M&EB/PFD WILL BE UPDATED, AND HCl WILL BECOME A REQUIRED ADDITIVE FOR THE CARBON SLURRY FEED.
8. BECAUSE ONLY ONE CARBON SLURRY FEED TANK IS INCLUDED IN THE SCWO SYSTEM DESIGN, CARBON SLURRY FEED MUST BE TAKEN OFF-LINE PERIODICALLY TO ALLOW FOR RECEIPT OF A NEW FEED BATCH FROM THE DSH SYSTEM AND FOR ADDITION OF FEED ADDITIVES. FEED BATCH TRANSFER FROM THE DSH SYSTEM WILL OCCUR AT 24-HR INCREMENTS WITH 2 HR OF THE 24 ALLOCATED FOR OFF-LINE FEED PREPARATION. THE APPROXIMATE FEED BATCH PREPARATION SEQUENCE OCCURS AS FOLLOWS:
   0-0.5 HRS: TRANSITION SCWO UNIT FROM NOMINAL OPERATION TO IDLE
   0.5-1 HRS: TRANSFER CARBON SLURRY FEED BATCH FROM DSH SYSTEM
   1-1.5 HRS: FEED ADDITIVE ADDITION AND MIXING
   1.5-2 HRS: TRANSITION FROM IDLE TO NOMINAL OPERATION
   2-24 HRS: NOMINAL SCWO UNIT OPERATION, PROCESSING CARBON SLURRY FEED 1 6

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NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6 15		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 [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

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING
SCWO PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 1 OF 9 | REV 6

BGCAPP_D3.BDR

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MP-SCWO-1010/2010/3010
HP FUEL PUMPS
CAPACITY: 0.6 GPM EA.

MP-SCWO-1020/2020/3020
HP HYDROLYSATE FEED PUMPS
CAPACITY: 2.2 GPM EA.

MP-SCWO-1021/2021/3021
FEED WATER PUMPS
CAPACITY: 1.3 GPM EA.

MS-SCWO-1021/2021/3021
FEED WATER PREHEATERS
DUTY: 0.89 MMBTU/HR

MP-SCWO-1022/2022/3022
QUENCH WATER PUMPS
CAPACITY: 21.8 GPM EA.

MV-SCWO-1030/2030/3030
SCWO REACTORS
PROCESS VOLUME: 3.2 CU FT EA.

ME-SCWO-1040/1041/1042/1043
ME-SCWO-2040/2041/2042/2043
ME-SCWO-3040/3041/3042/3043
EFFLUENT HEAT EXCHANGER 1/2/3/4
DUTY: 0.56 MMBTU/HR EA.

MV-SCWO-1010/2010/3010
HP CONTROL AIR RECEIVER TANKS
CAPACITY: 4.7 CU FT EA.

BY GA | BY PARSONS

BCS-00002 FUEL

MP-SCWO-1010

SHEET 1 BLENDED HYDROLYSATE FROM MP-SCWO-0030/0031

SHEET 1 BLENDED HYDROLYSATE TO MT-SCWO-0030/0031

MP-SCWO-1020

SHEET 1 FLUSH WATER FROM MS-SCWO-0020

NNF

PWS-00002 PROCESS WATER

MP-SCWO-1021

MS-SCWO-1021

TRAIN 1 ONLY

SHEET 1 CARBON SLURRY FROM MP-SCWO-0024

FROM O2 SENSOR (SHEET 3)

SHEET 1 HP AIR FROM MX-SCWO-1000

MV-SCWO-1010

NNF SHEET 1 CONDENSATE TO MV-SCWO-0010

TO PRESSURE CONTROL LOOP (SHEET 3)

MV-SCWO-1030

RO-00002 PROCESS WATER FROM MP-SWS-0101 A/B

MP-SCWO-1022

FROM REACTOR FLANGES

CWP-00001 COOLING WATER RETURN

TO REACTOR FLANGES

CWP-00001 COOLING WATER SUPPLY

ME-SCWO-1040/1041/1042/1043

SHEET 3 SCWO EFFLUENT TO MV-SCWO-1050

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. PLANNED FUEL IS 70 WT% ISOPROPANOL. OTHER FUEL MAY BE SUBSTITUTED AS REQUIRED (E.G., KEROSENE, FUEL OIL).

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Signature Valid 2006.08.09 14:55:40 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		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 [X] Q [X] Non-Q

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GENERAL ATOMICS

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 9 | REV 6

PROFESSIONAL STAMP

BGCAPP_D3.BDR

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MF-SCWO-0041
OFF-SPEC EFFLUENT TANK AGITATOR
MOTOR HP: 1.5

MV-SCWO-1050/2050/3050
HP GAS/LIQUID SEPARATORS
PROCESS VOLUME: 4.7 CU FT EA.

MV-SCWO-1052/2052/3052
LP GAS/LIQUID SEPARATORS
PROCESS VOLUME: 31.2 CU FT EA.

MP-SCWO-1052 A/B
MP-SCWO-2052 A/B
MP-SCWO-3052 A/B
LIQUID EFFLUENT PUMPS
CAPACITY: 24.9 GPM EA.

MT-SCWO-0041
OFF-SPEC EFFLUENT TANK
WORKING CAPACITY: 2,241 GAL

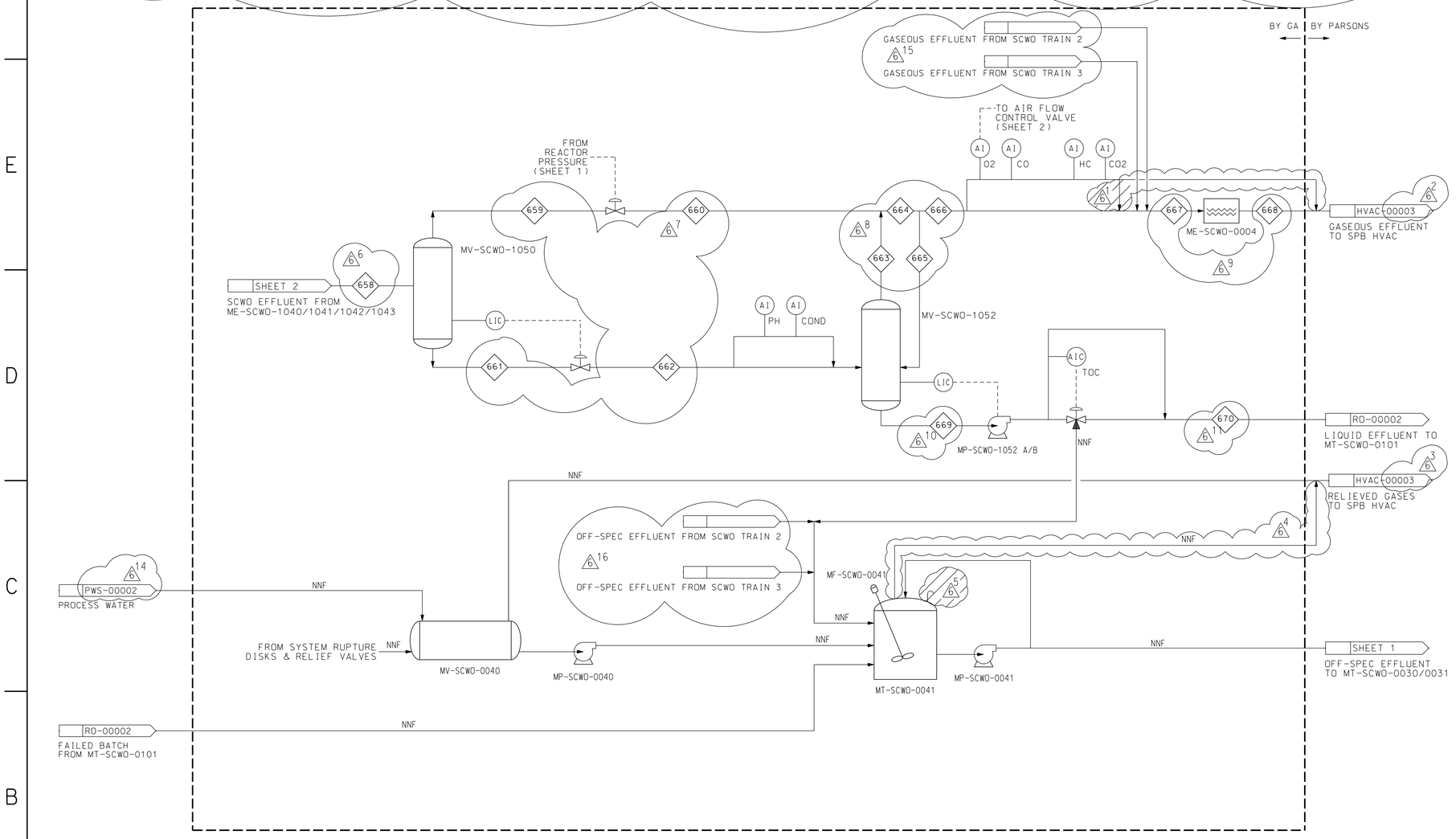
MP-SCWO-0041
OFF-SPEC EFFLUENT PUMP
CAPACITY: 18.7 GPM

MV-SCWO-0040
EMERGENCY RELIEF TANK
WORKING CAPACITY: 10,380 GAL

MP-SCWO-0040
EMERGENCY RELIEF TANK TRANSFER PUMP
CAPACITY: 14.3 GPM

ME-SCWO-0004
GAS EFFLUENT DUCT HEATER
DUTY: 0.03 MMBTU/HR

△6 12



NOTES:

1. DRAWING REPRESENTS A SINGLE SCWO TRAIN. THREE IDENTICAL SCWO TRAINS ARE PROVIDED. △6 13
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 IT'S 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

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Signature Valid 2006.08.09 14:55:54 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
△6	16	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 [X] Q [X] Non-Q

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GENERAL ATOMICS

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 3 OF 9 | REV 6

BGCAPP_D3.BDR

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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
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
TEMPERATURE	F	77	78.4	70	110	80	110	77	77			100.7	110	327.9	327.9	110	110
PRESSURE	PSIA	44.23	3665	14.67	14.67	64.23	54.23	44.23	44.23			39.23	39.23	100	100	39.23	39.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	0.510	0.509	(0.756)	(1.820)	1.690	3.781	0.074	0.030			16.722	16.722	(6.267)	0.183	5.566	1.855
*** VAPOR PHASE ***																	
DENSITY	LB/FT3			0.072	0.068									0.22			
VISCOSITY	cP			0.018	0.018									0.015			
*** LIQUID PHASE ***																	
DENSITY	LB/FT3	52.742	52.866			63.25	70.668	73.03	113.69			68.7	68.7		56.368	68.7	68.7
VISCOSITY	cP	1.074	1.056			0.72	0.742	2	21			1.091	1.063		0.151	1.063	1.063
MOLECULAR WEIGHT		32.992	32.992	28.013	28.447	19.94	21.509	21.891	74.807			21.184	21.184	18.015	18.015	21.176	21.176
ENTHALPY	MM BTU/HR	-0.836	-0.835	0	-0.003	-5.441	-12.309	-0.212	-0.105			-54.2	-54.125	-0.469	-0.544	-18.038	-6.013
VAPOR																	
H2O	LB/HR			0	0.396									82.729			
IPA	LB/HR			0	0.001									0			
CO2	LB/HR			0	0									0			
HCL	LB/HR			0	1.079									0			
H2SO4	LB/HR			0	1.49E-08									0			
NAOH	LB/HR			0	0									0			
IPMPANA	LB/HR			0	0									0			
MPA-NA2	LB/HR			0	0									0			
DIPU	LB/HR			0	4.54E-05									0			
O2	LB/HR			0	0.615									0			
N2	LB/HR			3.266	5.332									0			
ARGON	LB/HR			0	0									0			
H2	LB/HR			0	0									0			
N2O	LB/HR			0	9.30E-04									0			
AMMONIA	LB/HR			0	9.39E-04									0			
NH4CL	LB/HR			0	0									0			
(NH4)2SO4	LB/HR			0	0									0			
TBA	LB/HR			0	2.93E-06									0			
CH3F	LB/HR			0	0									0			
CH2F2	LB/HR			0	0									0			
CLOFORM	LB/HR			0	4.36E-05									0			
C3H7F	LB/HR			0	1.72E-04									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			
GLYCEROL	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	3.3	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.7	0.0	0.0	0.0
LIQUID (including dissolved gases)																	
H2O	LB/HR	75.915	75.915			751.2	1713.82	28.359	1.916			7485.883	7485.883		82.729	2494.899	831.633
IPA	LB/HR	139.937	139.937			2.706	0	0	0			8.118	8.118		0	2.705	0.902
CO2	LB/HR	0	0			0	0	0	0			0	0		0	0	0
HCL	LB/HR	0	0			0	0	15.27	0			45.81	45.81		0	14.191	4.73
H2SO4	LB/HR	0	0			0	0	0	25.45			76.351	76.351		0	25.45	8.483
NAOH	LB/HR	0	0			16.563	0.001	0	0			49.692	49.692		0	16.564	5.521
IPMPANA	LB/HR	0	0			65.4	0	0	0			196.2	196.2		0	65.4	21.8
MPA-NA2	LB/HR	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
O2	LB/HR	0	0			0	0.621	0	0			1.863	1.863		0	0.006	0.002
N2	LB/HR	0	0			0.654	1.44	0	0			6.282	6.282		0	0.028	0.009
ARGON	LB/HR	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
N2O	LB/HR	0	0			0	0.001	0	0			0.003	0.003		0	0	0
AMMONIA	LB/HR	0	0			0	0.318	0	0			0.954	0.954		0	0.317	0.106
NH4CL	LB/HR	0	0			0	0	0	0			0	0		0	0	0
(NH4)2SO4	LB/HR	0	0			0	0.996	0	0			2.988	2.988		0	0.996	0.332
TBA	LB/HR	0	0			1.725	0	0	0			5.175	5.175		0	1.725	0.575
CH3F	LB/HR	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
CLOFORM	LB/HR	0	0			0.045	0	0	0			0.135	0.135		0	0.045	0.015
C3H7F	LB/HR	0	0			0.021	0	0	0			0.063	0.063		0	0.021	0.007
IMPA	LB/HR	0	0			0.345	0	0	0			1.035	1.035		0	0.345	0.115
NANO2	LB/HR	0	0			0	8.907	0	0			26.721	26.721		0	8.907	2.969
NANO3	LB/HR	0	0			0	0.027	0	0			0.081	0.081		0	0.027	0.009
SODIUM FORMATE	LB/HR	0	0			0	25.569	0	0			76.707	76.707		0	25.569	8.523
SODIUM ACETATE	LB/HR	0	0			0	3.21	0	0			9.63	9.63		0	3.21	1.07
GLYCEROL	LB/HR	0	0			0	0	0	0			0	0		0	0	0
NACL	LB/HR	0	0			0	113.091	0	0			339.273	339.273		0	113.091	37.697
NAF	LB/HR	0	0			15.771	0	0	0			47.313	47.313		0	15.771	5.257
NAHSO4	LB/HR	0	0			0	0	0	0			0	0		0	0	0
NA2SO4	LB/HR	0	0			0	272.316	0	0			816.948	816.948		0	272.316	90.772
NAH2PO4	LB/HR	0	0			0	0	0	0			0	0		0	0	0
NA2HPO4	LB/HR	0	0			0	2.631	0	0			7.893	7.893		0	2.631	0.877
NAHCO3	LB/HR	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
HF	LB/HR	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
NICKEL	LB/HR	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
IRON	LB/HR	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
AL2O3	LB/HR	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
NIO	LB/HR	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
FE2O3	LB/HR	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
AL(OH)3	LB/HR	0	0			0	0.402	0	0			1.206	1.206		0	0.402	0.134
C10H22S	LB/HR	0	0			1.782	0	0	0			5.346	5.346		0	1.782	0.594
TOTAL LIQUID	LB/HR	215.9	215.9	0.0	0.0	857.3	2143.4	43.6	27.4	0.0	0.0	9215.1	9215.1	0.0	82.7	3067.5	1022.5
AVERAGE FLOW	LB/HR	215.9	215.9	3.3	7.4	857.3	2143.4	43.6	27.4	0.0	0.0	9215.1	9215.1	82.7	82.7	3067.5	1022.5
INSTANTANEOUS FLOW	LB/HR	215.9	215.9	3.3	12.2	12000.0	12000.0	523.5	328.4	0.0	0.0	9215.1	9215.1	82.7	82.7	3067.5	1022.5
NOTES				1		1	1	1	1	1	1					2	

STREAM NUMBER		646	647	648	649	650	651	652	653	654	655	656	657	658	659	660
LINE DESCRIPTION		HP Blended Hydrolysate Feed	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	111.8				106.2	70	70	70	1200	77	77.9	266	140	140	45
PRESSURE	PSIA	3665				3665	3665	3665	3415	3415	54.23	3415	3415	3415	3415	14.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	1.855				2.364	(1.897)	(1.803)	(0.099)	(10.934)	21.778	21.562	82.566	40.433	(1.534)	(301.103)
*** VAPOR PHASE ***																
DENSITY	LB/FT3						17.845	17.845	16.822	4.831			4.337	15.315	15.315	0.078
VISCOSITY	cP						0.026	0.026	0.025	0.034			0.027	0.026	0.026	0.018
*** LIQUID PHASE ***																
DENSITY	LB/FT3	68.7				65.3					62.231	62.855	57.554	60.808		
VISCOSITY	cP	1.064				1.049					0.765	0.758	0.206	0.447		
MOLECULAR WEIGHT		21.176				22.586	28.863	28.863	28.863	25.283	18.022	18.022	19.316	19.316	29.708	29.708
ENTHALPY	MM BTU/HR	-6.003				-6.839	-0.125	-0.04	-0.002	-6.526	-74.174	-74.065	-80.578	-82.152	-0.769	-0.78
VAPOR																
H2O	LB/HR						0	0	0	1093.003			27.236	3.284	2.463	2.463
IPA	LB/HR						0	0	0	0			0	0	0	0
CO2	LB/HR						1.174	1.116	0.058	345.23			280.948	261.521	196.139	196.139
HCL	LB/HR						0	0	0	0			0	0	0	0
H2SO4	LB/HR						0	0	0	0			0	0	0	0
NAOH	LB/HR						0	0	0	0			0	0	0	0
IPMPANA	LB/HR						0	0	0	0			0	0	0	0
MPA-NA2	LB/HR						0	0	0	0			0	0	0	0
DIPU	LB/HR						0	0	0	0			0	0	0	0
O2	LB/HR						470.092	446.944	23.148	74.421			94.13	94.994	71.246	71.246
N2	LB/HR						1533.352	1457.847	75.505	1459.241			1526.175	1510.977	1133.234	1133.234
ARGON	LB/HR						26.169	24.88	1.289	24.88			25.303	7.854	5.891	5.891
H2	LB/HR						0	0	0	0			0	0	0	0
N2O	LB/HR						0	0	0	0.3			0.239	0.251	0.188	0.188
AMMONIA	LB/HR						0	0	0	0			0	0	0	0
NH4CL	LB/HR						0	0	0	0			0	0	0	0
(NH4)2SO4	LB/HR						0	0	0	0			0	0	0	0
TBA	LB/HR						0	0	0	0			0	0	0	0
CH3F	LB/HR						0	0	0	0			0	0	0	0
CH2F2	LB/HR						0	0	0	0			0	0	0	0
CLOFORM	LB/HR						0	0	0	0			0	0	0	0
C3H7F	LB/HR						0	0	0	0			0	0	0	0
IMPA	LB/HR						0	0	0	0			0	0	0	0
NANO2	LB/HR						0	0	0	0			0	0	0	0
NANO3	LB/HR						0	0	0	0			0	0	0	0
SODIUM FORMATE	LB/HR						0	0	0	0			0	0	0	0
SODIUM ACETATE	LB/HR						0	0	0	0			0	0	0	0
GLYCEROL	LB/HR						0	0	0	0			0	0	0	0
NACL	LB/HR						0	0	0	45.816			0	0	0	0
NAF	LB/HR						0	0	0	5.255			0	0	0	0
NAHSO4	LB/HR						0	0	0	0			0	0	0	0
NA2SO4	LB/HR						0	0	0	103.756			0	0	0	0
NAH2PO4	LB/HR						0	0	0	17.156			0	0	0	0
NA2HPO4	LB/HR						0	0	0	0			0	0	0	0
NAHCO3	LB/HR						0	0	0	0			0	0	0	0
NA2CO3	LB/HR						0	0	0	0			0	0	0	0
HF	LB/HR						0	0	0	0			0	0	0	0
ALUMINUM	LB/HR						0	0	0	0			0	0	0	0
NICKEL	LB/HR						0	0	0	0			0	0	0	0
COPPER	LB/HR						0	0	0	0			0	0	0	0
IRON	LB/HR						0	0	0	0			0	0	0	0
H3PO4	LB/HR						0	0	0	0			0	0	0	0
AL2O3	LB/HR						0	0	0	0.088			0	0	0	0
MN2O3	LB/HR						0	0	0	0			0	0	0	0
NIO	LB/HR						0	0	0	0			0	0	0	0
CUO	LB/HR						0	0	0	0			0	0	0	0
FE2O3	LB/HR						0	0	0	0			0	0	0	0
TIO2	LB/HR						0	0	0	0.102			0	0	0	0
AL(OH)3	LB/HR						0	0	0	0			0	0	0	0
C10H22S	LB/HR						0	0	0	0			0	0	0	0
TOTAL VAPOR	LB/HR	0.0	0.0	0.0	0.0	0.0	2030.8	1930.8	100.0	3169.2	0.0	0.0	1954.0	1878.9	1409.2	1409.2
LIQUID (including dissolved gases)																
H2O	LB/HR	831.633				907.548					10866.71	10866.71	11932.47	11956.43		
IPA	LB/HR	0.902				140.839					0	0	0	0		
CO2	LB/HR	0				0					0	0	64.325	83.753		
HCL	LB/HR	4.73				4.73					0	0	0	0		
H2SO4	LB/HR	8.483				8.483					0	0	0	0		
NAOH	LB/HR	5.521				5.521					0	0	0	0		
IPMPANA	LB/HR	21.8				21.8					0	0	0	0		
MPA-NA2	LB/HR	0				0					0	0	0	0		
DIPU	LB/HR	0.376				0.376					0	0	0	0		
O2	LB/HR	0.002				0.002					0	0	3.439	2.575		
N2	LB/HR	0.009				0.009					0	0	8.571	23.769		
ARGON	LB/HR	0				0					0	0	0.867	18.315		
H2	LB/HR	0				0					0	0	0	0		
N2O	LB/HR	0				0					0	0	0.061	0.048		
AMMONIA	LB/HR	0.106				0.106					0	0	0	0		
NH4CL	LB/HR	0				0					0	0	0	0		
(NH4)2SO4	LB/HR	0.332				0.332					0	0	0	0		
TBA	LB/HR	0.575				0.575					0	0	0	0		
CH3F	LB/HR	0				0					0	0	0	0		
CH2F2	LB/HR	0				0					0	0	0	0		
CLOFORM	LB/HR	0.015				0.015					0	0	0	0		
C3H7F	LB/HR	0.007				0.007					0	0	0	0		
IMPA	LB/HR	0.115				0.115					0	0	0	0		
NANO2	LB/HR	2.969				2.969					0	0	0	0		
NANO3	LB/HR	0.009				0.009					0	0	0	0		
SODIUM FORMATE	LB/HR	8.523				8.523					0	0	0	0		
SODIUM ACETATE	LB/HR	1.07				1.07					0	0	0	0		
GLYCEROL	LB/HR	0				0					0	0	0	0		
NACL	LB/HR	37.697				37.697					1.22	1.22	47.036	47.036		
NAF	LB/HR	5.257				5.257					0.176	0.176	5.43	5.43		
NAHSO4	LB/HR	0				0					0	0	0	0		
NA2SO4	LB/HR	90.772				90.772					2.674	2.674	106.43	106.43		
NAH2PO4	LB/HR	0				0					0.527	0.527	17.683	17.683		
NA2HPO4	LB/HR	0.877				0.877					0	0	0	0		
NAHCO3	LB/HR	0				0					0	0	0.057	0.057		
NA2CO3	LB/HR	0				0					0.036	0.036	0	0		
HF	LB/HR	0				0					0	0	0	0		
ALUMINUM	LB/HR	0				0					0	0	0	0		
NICKEL	LB/HR	0				0					0	0	0	0		
COPPER	LB/HR	0				0					0	0	0	0		
IRON	LB/HR	0				0					0	0	0	0		
H3PO4	LB/HR	0				0					0	0	0	0		
AL2O3	LB/HR	0				0					0	0	0.088	0.088		
MN2O3	LB/HR	0				0					0	0	0	0		
NIO	LB/HR	0				0					0	0	0	0		
CUO	LB/HR	0				0					0	0	0	0		
FE2O3	LB/HR	0				0					0	0	0	0		
TIO2	LB/HR	0				0					0	0	0.102	0.102		
AL(OH)3	LB/HR	0.134				0.134					0	0	0	0		
C10H22S	LB/HR	0.594				0.594					0	0	0	0		
TOTAL LIQUID	LB/HR	1022.5	0.0	0.0	0.0	1238.4	0.0	0.0	0.0	0.0	10871.3	10871.3	12186.6	12261.7	0.0	0.0
AVERAGE FLOW	LB/HR	1022.5	0.0	0.0	0.0	1238.4	2030.8	1930.8	100.0	3169.2	10871.3	10871.3	14140.6	14140.6	1409.2	1409.2
INSTANTANEOUS FLOW	LB/HR	1022.5	0.0	0.0	0.0	1238.4	2030.8	1930.8	100.0	3169.2	10871.3	10871.3	14140.6	14140.6	1409.2	1409.2
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	97.4	97.4	97.4	97.4	110	139.6	139.6	90	90	106	118.9
PRESSURE	PSIA	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	65	65	45	45
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	28.962	1373.801	(180.341)	3706.127	0.020	(495.469)	(1486.407)	(1507.949)	24.871	24.869	114.685	9.030	9.059	115.4113
*** VAPOR PHASE ***															
DENSITY	LB/FT3	15.315	0.063	0.063	0.07		0.07	0.07	0.069						
VISCOSITY	cP	0.026	0.020	0.020	0.019		0.019	0.019	0.019						
*** LIQUID PHASE ***															
DENSITY	LB/FT3	60.808	60.449		62.019	62.019				60.45	60.454	62.129	62.129	61.926	61.738
VISCOSITY	cP	0.452	0.459		0.634	0.634				0.459	0.459	0.677	0.677	0.589	0.529
MOLECULAR WEIGHT		18.596	18.596	28.625	29.346	18.017	29.434	29.434	29.434	18.235	18.235	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-81.573	-81.572	-1.059	-1.839	-0.067	-1.771	-5.314	-5.295	-80.58	-80.58	-389.35	-30.655	-30.583	-387.705
VAPOR															
H2O	LB/HR	0.821	86.761	86.761	79.345		79.345	238.036	238.036						
IPA	LB/HR	0	0	0	0		0	0	0						
CO2	LB/HR	65.382	147.954	147.954	344.091		344.091	1032.274	1032.274						
HCL	LB/HR	0	0	0	0		0	0	0						
H2SO4	LB/HR	0	0	0	0		0	0	0						
NAOH	LB/HR	0	0	0	0		0	0	0						
IPMPANA	LB/HR	0	0	0	0		0	0	0						
MPA-NA2	LB/HR	0	0	0	0		0	0	0						
DIPU	LB/HR	0	0	0	0		0	0	0						
O2	LB/HR	23.748	26.312	26.312	97.558		97.558	292.673	292.673						
N2	LB/HR	377.743	401.416	401.416	1534.65		1534.65	4603.951	4603.951						
ARGON	LB/HR	1.963	19.135	19.135	25.026		25.026	75.077	75.077						
H2	LB/HR	0	0	0	0		0	0	0						
N2O	LB/HR	0.063	0.111	0.111	0.299		0.299	0.897	0.897						
AMMONIA	LB/HR	0	0	0	0		0	0	0						
NH4CL	LB/HR	0	0	0	0		0	0	0						
(NH4)2SO4	LB/HR	0	0	0	0		0	0	0						
TBA	LB/HR	0	0	0	0		0	0	0						
CH3F	LB/HR	0	0	0	0		0	0	0						
CH2F2	LB/HR	0	0	0	0		0	0	0						
CLOFORM	LB/HR	0	0	0	0		0	0	0						
C3H7F	LB/HR	0	0	0	0		0	0	0						
IMPA	LB/HR	0	0	0	0		0	0	0						
NANO2	LB/HR	0	0	0	0		0	0	0						
NANO3	LB/HR	0	0	0	0		0	0	0						
SODIUM FORMATE	LB/HR	0	0	0	0		0	0	0						
SODIUM ACETATE	LB/HR	0	0	0	0		0	0	0						
GLYCEROL	LB/HR	0	0	0	0		0	0	0						
NACL	LB/HR	0	0	0	0		0	0	0						
NAF	LB/HR	0	0	0	0		0	0	0						
NAHSO4	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						
NAHCO3	LB/HR	0	0	0	0		0	0	0						
NA2CO3	LB/HR	0	0	0	0		0	0	0						
HF	LB/HR	0	0	0	0		0	0	0						
ALUMINUM	LB/HR	0	0	0	0		0	0	0						
NICKEL	LB/HR	0	0	0	0		0	0	0						
COPPER	LB/HR	0	0	0	0		0	0	0						
IRON	LB/HR	0	0	0	0		0	0	0						
H3PO4	LB/HR	0	0	0	0		0	0	0						
AL2O3	LB/HR	0	0	0	0		0	0	0						
MN2O3	LB/HR	0	0	0	0		0	0	0						
NIO	LB/HR	0	0	0	0		0	0	0						
CUO	LB/HR	0	0	0	0		0	0	0						
FE2O3	LB/HR	0	0	0	0		0	0	0						
TIO2	LB/HR	0	0	0	0		0	0	0						
AL(OH)3	LB/HR	0	0	0	0		0	0	0						
C10H22S	LB/HR	0	0	0	0		0	0	0						
TOTAL VAPOR	LB/HR	469.7	681.7	681.7	2081.0	0.0	2081.0	6242.9	6242.9	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)															
H2O	LB/HR	11956.43	11870.49		9.879	9.879				11880.37	11880.37	57154.49	4500	4500	57154.49
IPA	LB/HR	0	0		0	0				0	0	0	0	0	0
CO2	LB/HR	83.753	1.181		0.001	0.001				1.182	1.182	0	0	0	0
HCL	LB/HR	0	0		0	0				0	0	0	0	0	0
H2SO4	LB/HR	0	0		0	0				0	0	0	0	0	0
NAOH	LB/HR	0	0		0	0				0	0	0	0	0	0
IPMPANA	LB/HR	0	0		0	0				0	0	0	0	0	0
MPA-NA2	LB/HR	0	0		0	0				0	0	0	0	0	0
DIPU	LB/HR	0	0		0	0				0	0	0	0	0	0
O2	LB/HR	2.575	0.011		0	0				0.011	0.011	0	0	0	0
N2	LB/HR	23.769	0.095		0	0				0.096	0.096	0	0	0	0
ARGON	LB/HR	18.315	1.143		0.001	0.001				1.144	1.144	0	0	0	0
H2	LB/HR	0	0		0	0				0	0	0	0	0	0
N2O	LB/HR	0.048	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
NH4CL	LB/HR	0	0		0	0				0	0	0	0	0	0
(NH4)2SO4	LB/HR	0	0		0	0				0	0	0	0	0	0
TBA	LB/HR	0	0		0	0				0	0	0	0	0	0
CH3F	LB/HR	0	0		0	0				0	0	0	0	0	0
CH2F2	LB/HR	0	0		0	0				0	0	0	0	0	0
CLOFORM	LB/HR	0	0		0	0				0	0	0	0	0	0
C3H7F	LB/HR	0	0		0	0				0	0	0	0	0	0
IMPA	LB/HR	0	0		0	0				0	0	0	0	0	0
NANO2	LB/HR	0	0		0	0				0	0	0	0	0	0
NANO3	LB/HR	0	0		0	0				0	0	0	0	0	0
SODIUM FORMATE	LB/HR	0	0		0	0				0	0	0	0	0	0
SODIUM ACETATE	LB/HR	0	0		0	0				0	0	0	0	0	0
GLYCEROL	LB/HR	0	0		0	0				0	0	0	0	0	0
NACL	LB/HR	47.036	47.036		0	0				47.036	47.036	0	0	0	0
NAF	LB/HR	5.43	5.43		0	0				5.43	5.43	0	0	0	0
NAHSO4	LB/HR	0	0		0	0				0	0	0	0	0	0
NA2SO4	LB/HR	106.43	106.43		0	0				106.43	106.43	0	0	0	0
NAH2PO4	LB/HR	17.683	17.683		0	0				17.683	17.683	0	0	0	0
NA2HPO4	LB/HR	0	0		0	0				0	0	0	0	0	0
NAHCO3	LB/HR	0.057	0.057		0	0				0.057	0.057	0	0	0	0
NA2CO3	LB/HR	0	0		0	0				0	0	0	0	0	0
HF	LB/HR	0	0		0	0				0	0	0	0	0	0
ALUMINUM	LB/HR	0	0		0	0				0	0	0	0	0	0
NICKEL	LB/HR	0	0		0	0				0	0	0	0	0	0
COPPER	LB/HR	0	0		0	0				0	0	0	0	0	0
IRON	LB/HR	0	0		0	0				0	0	0	0	0	0
H3PO4	LB/HR	0	0		0	0				0	0	0	0	0	0
AL2O3	LB/HR	0.088	0.088		0	0				0.088	0.088	0	0	0	0
MN2O3	LB/HR	0	0		0	0				0	0	0	0	0	0
NIO	LB/HR	0	0		0	0				0	0	0	0	0	0
CUO	LB/HR	0	0		0	0				0	0	0	0	0	0
FE2O3	LB/HR	0	0		0	0				0	0	0	0	0	0
TIO2	LB/HR	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
C10H22S	LB/HR	0	0		0	0				0	0	0	0	0	0
TOTAL LIQUID	LB/HR	12261.7	12049.7	0.0	9.9	9.9	0.0	0.0	0.0	12059.6	12059.6	57154.5	4500.0	4500.0	57154.5
AVERAGE FLOW	LB/HR	12731.4	12731.4	681.7	2090.9	9.9	2081.0	6242.9	6242.9	12059.6	12059.6	57154.5	4500.0	4500.0	57154.5
INSTANTANEOUS FLOW	LB/HR	12731.4	12731.4	681.7	2090.9	9.9	2081.0	6242.9	6242.9	12059.6	12059.6	57154.5	4500.0	4500.0	57154.5
NOTES								4	4						

1 - Represents feed to hydrolysate blend tanks
2 - Represents blended hydrolysate flow to three SCWO trains.
3 - Components in the supercritical phase may appear in the Aspen Model as liquid, gas, or a combination thereof. In these instances, the reported phase should not be considered representative of the actual system.
4 - Represents flow from three SCWO trains.

GENERAL NOTES:

1. ALL INFORMATION, CALCULATIONS, AND ASSUMPTIONS 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. 7, AUGUST 2006.
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.

6 1

cn=Blayne Monen, o=Configuration Management, ou=Issued, c=US
Signature Valid 2006.08.09 14:56:10 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6 1		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 [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

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING SCWO PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M5-SCWO-00001
SHEET 4 OF 9
REV 6

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
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
TEMPERATURE	F	77	78.4	70	110	80	110	77	77		80	101.3	110
PRESSURE	PSIA	44.23	3665	14.67	14.67	64.23	54.23	44.23	44.23		14.23	39.23	39.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	0.439	0.438	(0.745)	(1.613)	1.612	3.780	0.071	0.028		0.055	16.631	16.631
*** VAPOR PHASE ***													
DENSITY	LB/FT3			0.072	0.068								
VISCOSITY	cP			0.018	0.018								
*** LIQUID PHASE ***													
DENSITY	LB/FT3	52.742	52.866			66.32	70.692	73.03	113.69		72	69.7	69.7
VISCOSITY	cP	1.074	1.056			2.7	0.743	2	21		574.273	1.657	1.619
MOLECULAR WEIGHT		32.992	32.992	28.013	28.461	22.595	21.537	21.891	74.807		58.442	22.102	22.102
ENTHALPY	MM BTU/HR	-0.72	-0.719	0	-0.003	-4.953	-12.314	-0.201	-0.099		-0.085	-52.954	-52.886
VAPOR													
H2O	LB/HR			0	0.346								
IPA	LB/HR			0	0								
ETHANOL	LB/HR			0	0.001								
CO2	LB/HR			0	0								
HCL	LB/HR			0	0.941								
H2SO4	LB/HR			0	1.29E-08								
NAOH	LB/HR			0	0								
MPA-NA2	LB/HR			0	0								
DIPU	LB/HR			0	1.65E-06								
DIPA	LB/HR			0	8.11E-05								
RSSR	LB/HR			0	0								
EMPA-NA	LB/HR			0	0								
RS-NA	LB/HR			0	1.04E-08								
O2	LB/HR			0	0.62								
N2	LB/HR			3.218	4.67								
ARGON	LB/HR			0	0								
H2	LB/HR			0	0								
N2O	LB/HR			0	0.001								
AMMONIA	LB/HR			0	4.21E-04								
NH4CL	LB/HR			0	0								
NH42SO4	LB/HR			0	0								
NANO2	LB/HR			0	0								
NANO3	LB/HR			0	0								
SODFORM	LB/HR			0	0								
SODACET	LB/HR			0	0								
GLYCEROL	LB/HR			0	0								
C21H36	LB/HR			0	0								
NACL	LB/HR			0	0								
NAHCO3	LB/HR			0	0								
NA2CO3	LB/HR			0	0								
NAHSO4	LB/HR			0	0								
NA2SO4	LB/HR			0	0								
NAH2PO4	LB/HR			0	0								
NA2HPO4	LB/HR			0	0								
HF	LB/HR			0	0								
H3PO4	LB/HR			0	0								
SULFUR	LB/HR			0	0								
ALUMINUM	LB/HR			0	0								
IRON	LB/HR			0	0								
NICKEL	LB/HR			0	0								
COPPER	LB/HR			0	0								
SILICON	LB/HR			0	0								
CALCIUM	LB/HR			0	0								
AL2O3	LB/HR			0	0								
FE2O3	LB/HR			0	0								
NIO	LB/HR			0	0								
CUO	LB/HR			0	0								
AL(OH)3	LB/HR			0	0								
SIO2	LB/HR			0	0								
CAO	LB/HR			0	0								
TIO2	LB/HR			0	0								
DICDI	LB/HR			0	0								
DCCDI	LB/HR			0	0								
TOTAL VAPOR	LB/HR	0.0	0.0	3.2	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)													
H2O	LB/HR	65.328	65.328			649.142	1711.043	26.871	1.815		0	7166.614	7166.614
IPA	LB/HR	120.422	120.422			0	0	0	0		0	0	0
ETHANOL	LB/HR	0	0			2.019	0	0	0		0	6.057	6.057
CO2	LB/HR	0	0			0	0	0	0		0	0	0
HCL	LB/HR	0	0			0	0	14.469	0		0	43.407	43.407
H2SO4	LB/HR	0	0			0	0	0	24.114		0	72.342	72.342
NAOH	LB/HR	0	0			33.165	0	0	0		0	99.495	99.495
MPA-NA2	LB/HR	0	0			6.915	0	0	0		0	20.745	20.745
DIPU	LB/HR	0	0			0.045	0	0	0		0	0.135	0.135
DIPA	LB/HR	0	0			0.201	0	0	0		0	0.603	0.603
RSSR	LB/HR	0	0			4.269	0	0	0		0	12.807	12.807
EMPA-NA	LB/HR	0	0			67.626	0	0	0		0	202.878	202.878
RS-NA	LB/HR	0	0			87.903	0	0	0		0	263.709	263.709
O2	LB/HR	0	0			0	0.627	0	0		0	1.881	1.881
N2	LB/HR	0	0			0.039	1.44	0	0		0	4.437	4.437
ARGON	LB/HR	0	0			0	0	0	0		0	0	0
H2	LB/HR	0	0			0	0	0	0		0	0	0
N2O	LB/HR	0	0			0	0.001	0	0		0	0.003	0.003
AMMONIA	LB/HR	0	0			0	0.162	0	0		0	0.486	0.486
NH4CL	LB/HR	0	0			0	0	0	0		0	0	0
NH42SO4	LB/HR	0	0			0	1.653	0	0		0	4.959	4.959
NANO2	LB/HR	0	0			0	8.979	0	0		0	26.937	26.937
NANO3	LB/HR	0	0			0	0.03	0	0		0	0.09	0.09
SODFORM	LB/HR	0	0			0	25.791	0	0		0	77.373	77.373
SODACET	LB/HR	0	0			0	3.237	0	0		0	9.711	9.711
GLYCEROL	LB/HR	0	0			0	0	0	0		0	0	0
C21H36	LB/HR	0	0			3.234	0	0	0		0	9.702	9.702
NACL	LB/HR	0	0			0	113.838	0	0		31.5	436.014	436.014
NAHCO3	LB/HR	0	0			0	0	0	0		0	0	0
NA2CO3	LB/HR	0	0			0	0	0	0		0	0	0
NAHSO4	LB/HR	0	0			0	0	0	0		0	0	0
NA2SO4	LB/HR	0	0			0	273.423	0	0		0	820.269	820.269
NAH2PO4	LB/HR	0	0			0	0	0	0		0	0	0
NA2HPO4	LB/HR	0	0			0	2.634	0	0		0	7.902	7.902
HF	LB/HR	0	0			0	0	0	0		0	0	0
H3PO4	LB/HR	0	0			0	0	0	0		0	0	0
SULFUR	LB/HR	0	0			0	0	0	0		0	0	0
ALUMINUM	LB/HR	0	0			2.58E-04	0	0	0		0	7.74E-04	7.74E-04
IRON	LB/HR	0	0			0.003	0	0	0		0	0.01	0.01
NICKEL	LB/HR	0	0			8.40E-05	0	0	0		0	2.52E-04	2.52E-04
COPPER	LB/HR	0	0			3.00E-06	0	0	0		0	9.00E-06	9.00E-06
SILICON	LB/HR	0	0			0.018	0	0	0		0	0.054	0.054
CALCIUM	LB/HR	0	0			0.021	0	0	0		0	0.063	0.063
AL2O3	LB/HR	0	0			0	0	0	0		0	0	0
FE2O3	LB/HR	0	0			0	0	0	0		0	0	0
NIO	LB/HR	0	0			0	0	0	0		0	0	0
CUO	LB/HR	0	0			0	0	0	0		0	0	0
AL(OH)3	LB/HR	0	0			0	0.402	0	0		0	1.206	1.206
SIO2	LB/HR	0	0			0	0	0	0		0	0	0
CAO	LB/HR	0	0			0	0	0	0		0	0	0
TIO2	LB/HR	0	0			0	0	0	0		0	0	0
DICDI	LB/HR	0	0			0.426	0	0	0		0	1.278	1.278
DCCDI	LB/HR	0	0			2.277	0	0	0		0	6.831	6.831
TOTAL LIQUID	LB/HR	185.8	185.8	0.0	0.0	857.3	2143.3	41.3	25.9	0.0	31.5	9298.0	9298.0
AVERAGE FLOW	LB/HR	185.8	185.8	3.2	6.6	857.3	2143.3	41.3	25.9	0.0	31.5	9298.0	9298.0
INSTANTANEOUS FLOW	LB/HR	185.8	185.8	3.2	12.0	12000.0	12000.0	744.1	466.7	0.0	567.0	9298.0	9298.0
NOTES				1		1	1	1	1	1	1		

STREAM NUMBER		642	643	644	645	646	647	648	649	650	651	652	653
LINE DESCRIPTION		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	HP Reaction Air	Liner Purge Air
TEMPERATURE	F	327.9	327.9	110	110	112.7				107.6	70	70	70
PRESSURE	PSIA	100	100	39.23	39.23	3665				3665	3665	3665	3415
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	(5.724)	0.167	5.538	1.846	1.846				2.286	(2.034)	(1.941)	(0.099)
*** VAPOR PHASE ***													
DENSITY	LB/FT3	0.22									17.845	17.845	16.822
VISCOSITY	cP	0.015									0.026	0.026	0.025
*** LIQUID PHASE ***													
DENSITY	LB/FT3		56.368	69.7	69.7	69.7				66.4			
VISCOSITY	cP		0.151	1.619	1.619	1.621				1.6			
MOLECULAR WEIGHT		18.015	18.015	22.096	22.096	22.096				23.268	28.863	28.863	28.863
ENTHALPY	MM BTU/HR	-0.428	-0.497	-17.625	-5.875	-5.865				-6.584	-0.134	-0.043	-0.002
VAPOR													
H2O	LB/HR	75.557									0	0	0
IPA	LB/HR	0									0	0	0
ETHANOL	LB/HR	0									0	0	0
CO2	LB/HR	0									1.259	1.201	0.058
HCL	LB/HR	0									0	0	0
H2SO4	LB/HR	0									0	0	0
NAOH	LB/HR	0									0	0	0
MPA-NA2	LB/HR	0									0	0	0
DIPU	LB/HR	0									0	0	0
DIPA	LB/HR	0									0	0	0
RSSR	LB/HR	0									0	0	0
EMPA-NA	LB/HR	0									0	0	0
RS-NA	LB/HR	0									0	0	0
O2	LB/HR	0									504.188	481.04	23.148
N2	LB/HR	0									1644.566	1569.061	75.505
ARGON	LB/HR	0									28.067	26.778	1.289
H2	LB/HR	0									0	0	0
N2O	LB/HR	0									0	0	0
AMMONIA	LB/HR	0									0	0	0
NH4CL	LB/HR	0									0	0	0
NH42SO4	LB/HR	0									0	0	0
NANO2	LB/HR	0									0	0	0
NANO3	LB/HR	0									0	0	0
SODFORM	LB/HR	0									0	0	0
SODACET	LB/HR	0									0	0	0
GLYCEROL	LB/HR	0									0	0	0
C21H36	LB/HR	0									0	0	0
NACL	LB/HR	0									0	0	0
NAHCO3	LB/HR	0									0	0	0
NA2CO3	LB/HR	0									0	0	0
NAHSO4	LB/HR	0									0	0	0
NA2SO4	LB/HR	0									0	0	0
NAH2PO4	LB/HR	0									0	0	0
NA2HPO4	LB/HR	0									0	0	0
HF	LB/HR	0									0	0	0
H3PO4	LB/HR	0									0	0	0
SULFUR	LB/HR	0									0	0	0
ALUMINUM	LB/HR	0									0	0	0
IRON	LB/HR	0									0	0	0
NICKEL	LB/HR	0									0	0	0
COPPER	LB/HR	0									0	0	0
SILICON	LB/HR	0									0	0	0
CALCIUM	LB/HR	0									0	0	0
AL2O3	LB/HR	0									0	0	0
FE2O3	LB/HR	0									0	0	0
NIO	LB/HR	0									0	0	0
CUO	LB/HR	0									0	0	0
AL(OH)3	LB/HR	0									0	0	0
SIO2	LB/HR	0									0	0	0
CAO	LB/HR	0									0	0	0
TIO2	LB/HR	0									0	0	0
DICDI	LB/HR	0									0	0	0
DCCDI	LB/HR	0									0	0	0
TOTAL VAPOR	LB/HR	75.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2178.1	2078.1	100.0
LIQUID (including dissolved gases)													
H2O	LB/HR		75.557	2388.525	796.175	796.175				861.503			
IPA	LB/HR		0	0	0	0				120.422			
ETHANOL	LB/HR		0	2.018	0.673	0.673				0.673			
CO2	LB/HR		0	0	0	0				0			
HCL	LB/HR		0	13.528	4.509	4.509				4.509			
H2SO4	LB/HR		0	24.114	8.038	8.038				8.038			
NAOH	LB/HR		0	33.165	11.055	11.055				11.055			
MPA-NA2	LB/HR		0	6.915	2.305	2.305				2.305			
DIPU	LB/HR		0	0.045	0.015	0.015				0.015			
DIPA	LB/HR		0	0.201	0.067	0.067				0.067			
RSSR	LB/HR		0	4.269	1.423	1.423				1.423			
EMPA-NA	LB/HR		0	67.626	22.542	22.542				22.542			
RS-NA	LB/HR		0	87.903	29.301	29.301				29.301			
O2	LB/HR		0	0.007	0.002	0.002				0.002			
N2	LB/HR		0	0.027	0.009	0.009				0.009			
ARGON	LB/HR		0	0	0	0				0			
H2	LB/HR		0	0	0	0				0			
N2O	LB/HR		0	0	0	0				0			
AMMONIA	LB/HR		0	0.162	0.054	0.054				0.054			
NH4CL	LB/HR		0	0	0	0				0			
NH42SO4	LB/HR		0	1.653	0.551	0.551				0.551			
NANO2	LB/HR		0	8.979	2.993	2.993				2.993			
NANO3	LB/HR		0	0.03	0.01	0.01				0.01			
SODFORM	LB/HR		0	25.791	8.597	8.597				8.597			
SODACET	LB/HR		0	3.237	1.079	1.079				1.079			
GLYCEROL	LB/HR		0	0	0	0				0			
C21H36	LB/HR		0	3.234	1.078	1.078				1.078			
NACL	LB/HR		0	145.338	48.446	48.446				48.446			
NAHCO3	LB/HR		0	0	0	0				0			
NA2CO3	LB/HR		0	0	0	0				0			
NAHSO4	LB/HR		0	0	0	0				0			
NA2SO4	LB/HR		0	273.423	91.141	91.141				91.141			
NAH2PO4	LB/HR		0	0	0	0				0			
NA2HPO4	LB/HR		0	2.634	0.878	0.878				0.878			
HF	LB/HR		0	0	0	0				0			
H3PO4	LB/HR		0	0	0	0				0			
SULFUR	LB/HR		0	0	0	0				0			
ALUMINUM	LB/HR		0	2.58E-04	8.60E-05	8.60E-05				8.60E-05			
IRON	LB/HR		0	0.003	0.001	0.001				0.001			
NICKEL	LB/HR		0	8.40E-05	2.80E-05	2.80E-05				2.80E-05			
COPPER	LB/HR		0	3.00E-06	1.00E-06	1.00E-06				1.00E-06			
SILICON	LB/HR		0	0.018	0.006	0.006				0.006			
CALCIUM	LB/HR		0	0.021	0.007	0.007				0.007			
AL2O3	LB/HR		0	0	0	0				0			
FE2O3	LB/HR		0	0	0	0				0			
NIO	LB/HR		0	0	0	0				0			
CUO	LB/HR		0	0	0	0				0			
AL(OH)3	LB/HR		0	0.402	0.134	0.134				0.134			
SIO2	LB/HR		0	0	0	0				0			
CAO	LB/HR		0	0	0	0				0			
TIO2	LB/HR		0	0	0	0				0			
DICDI	LB/HR		0	0.426	0.142	0.142				0.142			
DCCDI	LB/HR		0	2.277	0.759	0.759				0.759			
TOTAL LIQUID	LB/HR	0.0	75.6	3096.0	1032.0	1032.0	0.0	0.0	0.0	1217.7	0.0	0.0	0.0
AVERAGE FLOW	LB/HR	75.6	75.6	3096.0	1032.0	1032.0	0.0	0.0	0.0	1217.7	2178.1	2078.1	100.0
INSTANTANEOUS FLOW	LB/HR	75.6	75.6	3096.0	1032.0	1032.0	0.0	0.0	0.0	1217.7	2178.1	2078.1	100.0
NOTES				2									

STREAM NUMBER		654	655	656	657	658	659	660	661	662	663	664	665
LINE DESCRIPTION		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
TEMPERATURE	F	1200	77	77.9	356	140	140	45	140	139.4	139.4	95.5	95.5
PRESSURE	PSIA	3415	54.23	3415	3415	3415	3415	14.23	3415	14.23	14.23	14.23	14.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	(10.898)	12.694	12.568	42.006	32.592	(1.667)	(329.465)	20.123	1375.886	(181.845)	0.000	0.021
*** VAPOR PHASE ***													
DENSITY	LB/FT3	5.041			11.02	15.416	15.416	0.078	15.416	0.063	0.063	0.07	
VISCOSITY	cP	0.034			0.028	0.026	0.026	0.018	0.026	0.020	0.020	0.019	
*** LIQUID PHASE ***													
DENSITY	LB/FT3		62.225	62.848	54.61	59.937			59.937	59.626		62.039	62.039
VISCOSITY	cP		0.765	0.758	0.138	0.459			0.459	0.468		0.645	0.645
MOLECULAR WEIGHT		25.774	18.023	18.023	20.152	20.152	29.827	29.827	18.993	18.993	28.337	29.351	18.017
ENTHALPY	MM BTU/HR	-6.349	-43.227	-43.164	-49.693	-51.528	-0.897	-0.907	-50.631	-50.594	-0.999	-1.906	-0.071
VAPOR													
H2O	LB/HR	1050.946			105.984	3.603	2.702	2.702	0.901	87.713	87.713	80.012	
IPA	LB/HR	0			0	0	0	0	0	0	0	0	
ETHANOL	LB/HR	0			0	0	0	0	0	0	0	0	
CO2	LB/HR	360.284			326.199	305.009	228.757	228.757	76.252	130.941	130.941	359.697	
HCL	LB/HR	0			0	0	0	0	0	0	0	0	
H2SO4	LB/HR	0			0	0	0	0	0	0	0	0	
NAOH	LB/HR	0			0	0	0	0	0	0	0	0	
MPA-NA2	LB/HR	0			0	0	0	0	0	0	0	0	
DIPU	LB/HR	0			0	0	0	0	0	0	0	0	
DIPA	LB/HR	0			0	0	0	0	0	0	0	0	
RSSR	LB/HR	0			0	0	0	0	0	0	0	0	
EMPA-NA	LB/HR	0			0	0	0	0	0	0	0	0	
RS-NA	LB/HR	0			0	0	0	0	0	0	0	0	
O2	LB/HR	80.112			102.165	101.694	76.271	76.271	25.423	26.982	26.982	103.253	
N2	LB/HR	1572.353			1635.103	1633.261	1224.946	1224.946	408.315	422.852	422.852	1647.797	
ARGON	LB/HR	26.778			21.338	11.651	8.738	8.738	2.913	18.654	18.654	27.391	
H2	LB/HR	0			0	0	0	0	0	0	0	0	
N2O	LB/HR	0.716			0.711	0.646	0.484	0.484	0.162	0.231	0.231	0.715	
AMMONIA	LB/HR	0			0	0	0	0	0	0	0	0	
NH4CL	LB/HR	0			0	0	0	0	0	0	0	0	
NH42SO4	LB/HR	0			0	0	0	0	0	0	0	0	
NANO2	LB/HR	0			0	0	0	0	0	0	0	0	
NANO3	LB/HR	0			0	0	0	0	0	0	0	0	
SODFORM	LB/HR	0			0	0	0	0	0	0	0	0	
SODACET	LB/HR	0			0	0	0	0	0	0	0	0	
GLYCEROL	LB/HR	0			0	0	0	0	0	0	0	0	
C21H36	LB/HR	0			0	0	0	0	0	0	0	0	
NACL	LB/HR	56.114			0	0	0	0	0	0	0	0	
NAHCO3	LB/HR	0			0	0	0	0	0	0	0	0	
NA2CO3	LB/HR	0			0	0	0	0	0	0	0	0	
NAHSO4	LB/HR	0			0	0	0	0	0	0	0	0	
NA2SO4	LB/HR	127.201			0	0	0	0	0	0	0	0	
NAH2PO4	LB/HR	21.21			0	0	0	0	0	0	0	0	
NA2HPO4	LB/HR	0			0	0	0	0	0	0	0	0	
HF	LB/HR	0			0	0	0	0	0	0	0	0	
H3PO4	LB/HR	0			0	0	0	0	0	0	0	0	
SULFUR	LB/HR	0			0	0	0	0	0	0	0	0	
ALUMINUM	LB/HR	0			0	0	0	0	0	0	0	0	
IRON	LB/HR	0			0	0	0	0	0	0	0	0	
NICKEL	LB/HR	0			0	0	0	0	0	0	0	0	
COPPER	LB/HR	0			0	0	0	0	0	0	0	0	
SILICON	LB/HR	0			0	0	0	0	0	0	0	0	
CALCIUM	LB/HR	0			0	0	0	0	0	0	0	0	
AL2O3	LB/HR	0.088			0	0	0	0	0	0	0	0	
FE2O3	LB/HR	0.002			0	0	0	0	0	0	0	0	
NIO	LB/HR	7.22E-07			0	0	0	0	0	0	0	0	
CUO	LB/HR	3.47E-05			0	0	0	0	0	0	0	0	
AL(OH)3	LB/HR	0			0	0	0	0	0	0	0	0	
SIO2	LB/HR	0.006			0	0	0	0	0	0	0	0	
CAO	LB/HR	0.01			0	0	0	0	0	0	0	0	
TIO2	LB/HR	0.296			0	0	0	0	0	0	0	0	
DICDI	LB/HR	0			0	0	0	0	0	0	0	0	
DCCDI	LB/HR	0			0	0	0	0	0	0	0	0	
TOTAL VAPOR	LB/HR	3296.1	0.0	0.0	2191.5	2055.9	1541.9	1541.9	514.0	687.4	687.4	2218.9	0.0
LIQUID (including dissolved gases)													
H2O	LB/HR		6332.833	6332.833	7277.791	7380.172			7380.172	7293.36		10.404	10.404
IPA	LB/HR		0	0	0	0			0	0		0	0
ETHANOL	LB/HR		0	0	0	0			0	0		0	0
CO2	LB/HR		0	0	34.133	55.322			55.322	0.633		0.001	0.001
HCL	LB/HR		0	0	0	0			0	0		0	0
H2SO4	LB/HR		0	0	0	0			0	0		0	0
NAOH	LB/HR		0	0	0	0			0	0		0	0
MPA-NA2	LB/HR		0	0	0	0			0	0		0	0
DIPU	LB/HR		0	0	0	0			0	0		0	0
DIPA	LB/HR		0	0	0	0			0	0		0	0
RSSR	LB/HR		0	0	0	0			0	0		0	0
EMPA-NA	LB/HR		0	0	0	0			0	0		0	0
RS-NA	LB/HR		0	0	0	0			0	0		0	0
O2	LB/HR		0	0	1.094	1.565			1.565	0.006		0	0
N2	LB/HR		0	0	12.756	14.598			14.598	0.061		0	0
ARGON	LB/HR		0	0	6.729	16.416			16.416	0.675		0.001	0.001
H2	LB/HR		0	0	0	0			0	0		0	0
N2O	LB/HR		0	0	0.005	0.071			0.071	0.002		0	0
AMMONIA	LB/HR		0	0	0	0			0	0		0	0
NH4CL	LB/HR		0	0	0	0			0	0		0	0
NH42SO4	LB/HR		0	0	0	0			0	0		0	0
NANO2	LB/HR		0	0	0	0			0	0		0	0
NANO3	LB/HR		0	0	0	0			0	0		0	0
SODFORM	LB/HR		0	0	0	0			0	0		0	0
SODACET	LB/HR		0	0	0	0			0	0		0	0
GLYCEROL	LB/HR		0	0	0	0			0	0		0	0
C21H36	LB/HR		0	0	0	0			0	0		0	0
NACL	LB/HR		0.799	0.799	56.913	56.913			56.913	56.913		0	0
NAHCO3	LB/HR		0.046	0.046	0.085	0.085			0.085	0.085		0	0
NA2CO3	LB/HR		0.024	0.024	0	0			0	0		0	0
NAHSO4	LB/HR		0	0	0	0			0	0		0	0
NA2SO4	LB/HR		1.984	1.984	129.185	129.185			129.185	129.185		0	0
NAH2PO4	LB/HR		0.342	0.342	21.552	21.552			21.552	21.552		0	0
NA2HPO4	LB/HR		0	0	0	0			0	0		0	0
HF	LB/HR		0	0	0	0			0	0		0	0
H3PO4	LB/HR		0	0	0	0			0	0		0	0
SULFUR	LB/HR		0	0	0	0			0	0		0	0
ALUMINUM	LB/HR		0	0	0	0			0	0		0	0
IRON	LB/HR		0	0	0	0			0	0		0	0
NICKEL	LB/HR		0	0	0	0			0	0		0	0
COPPER	LB/HR		0	0	0	0			0	0		0	0
SILICON	LB/HR		0	0	0	0			0	0		0	0
CALCIUM	LB/HR		0	0	0	0			0	0		0	0
AL2O3	LB/HR		0	0	0.088	0.088			0.088	0.088		0	0
FE2O3	LB/HR		0	0	0.002	0.002			0.002	0.002		0	0
NIO	LB/HR		0	0	7.22E-07	7.22E-07			7.22E-07	7.22E-07		0	0
CUO	LB/HR		0	0	3.47E-05	3.47E-05			3.47E-05	3.47E-05		0	0
AL(OH)3	LB/HR		0	0	0	0			0	0		0	0
SIO2	LB/HR		0	0	0.006	0.006			0.006	0.006		0	0
CAO	LB/HR		0	0	0.01	0.01			0.01	0.01		0	0
TIO2	LB/HR		0	0	0.296	0.296			0.296	0.296		0	0
DICDI	LB/HR		0	0	0	0			0	0		0	0
DCCDI	LB/HR		0	0	0	0			0	0		0	0
TOTAL LIQUID	LB/HR	0.0	6336.0	6336.0	7540.6	7676.3	0.0	0.0	7676.3	7502.9	0.0	10.4	10.4
AVERAGE FLOW	LB/HR	3296.1	6336.0	6336.0	9732.1	9732.1	1541.9	1541.9	8190.2	8190.2	687.4	2229.3	10.4
INSTANTANEOUS FLOW	LB/HR	3296.1	6336.0	6336.0	9732.1	9732.1	1541.9	1541.9	8190.2	8190.2	687.4	2229.3	10.4
NOTES													

STREAM NUMBER		666	667	668	669	670	671	672	673	674
LINE DESCRIPTION		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	95.5	95.5	110	139.4	139.4	90	90	106	119
PRESSURE	PSIA	14.23	14.23	14.23	14.23	30.23	65	65	45	45
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	(528.301)	(1584.904)	(1607.873)	15.708	15.707	132.268	9.030	9.059	133.110
*** VAPOR PHASE ***										
DENSITY	LB/FT3	0.07	0.07	0.069						
VISCOSITY	cP	0.019	0.019	0.019						
*** LIQUID PHASE ***										
DENSITY	LB/FT3				59.628	59.632	62.129	62.129	61.926	61.736
VISCOSITY	cP				0.468	0.468	0.677	0.677	0.589	0.528
MOLECULAR WEIGHT		29.438	29.438	29.438	18.436	18.436	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-1.835	-5.506	-5.482	-49.665	-49.665	-449.042	-30.655	-30.583	-447.135
VAPOR										
H2O	LB/HR	80.012	240.036	240.036						
IPA	LB/HR	0	0	0						
ETHANOL	LB/HR	0	0	0						
CO2	LB/HR	359.697	1079.091	1079.091						
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	103.253	309.759	309.759						
N2	LB/HR	1647.797	4943.391	4943.391						
ARGON	LB/HR	27.391	82.173	82.173						
H2	LB/HR	0	0	0						
N2O	LB/HR	0.715	2.145	2.145						
AMMONIA	LB/HR	0	0	0						
NH4CL	LB/HR	0	0	0						
NH42SO4	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						
GLYCEROL	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	2218.9	6656.6	6656.6	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)										
H2O	LB/HR				7303.764	7303.764	65917.05	4500	4500	65917.05
IPA	LB/HR				0	0	0	0	0	0
ETHANOL	LB/HR				0	0	0	0	0	0
CO2	LB/HR				0.633	0.633	0	0	0	0
HCL	LB/HR				0	0	0	0	0	0
H2SO4	LB/HR				0	0	0	0	0	0
NAOH	LB/HR				0	0	0	0	0	0
MPA-NA2	LB/HR				0	0	0	0	0	0
DIPU	LB/HR				0	0	0	0	0	0
DIPA	LB/HR				0	0	0	0	0	0
RSSR	LB/HR				0	0	0	0	0	0
EMPA-NA	LB/HR				0	0	0	0	0	0
RS-NA	LB/HR				0	0	0	0	0	0
O2	LB/HR				0.006	0.006	0	0	0	0
N2	LB/HR				0.061	0.061	0	0	0	0
ARGON	LB/HR				0.676	0.676	0	0	0	0
H2	LB/HR				0	0	0	0	0	0
N2O	LB/HR				0.002	0.002	0	0	0	0
AMMONIA	LB/HR				0	0	0	0	0	0
NH4CL	LB/HR				0	0	0	0	0	0
NH42SO4	LB/HR				0	0	0	0	0	0
NANO2	LB/HR				0	0	0	0	0	0
NANO3	LB/HR				0	0	0	0	0	0
SODFORM	LB/HR				0	0	0	0	0	0
SODACET	LB/HR				0	0	0	0	0	0
GLYCEROL	LB/HR				0	0	0	0	0	0
C21H36	LB/HR				0	0	0	0	0	0
NACL	LB/HR				56.913	56.913	0	0	0	0
NAHCO3	LB/HR				0.085	0.085	0	0	0	0
NA2CO3	LB/HR				0	0	0	0	0	0
NAHSO4	LB/HR				0	0	0	0	0	0
NA2SO4	LB/HR				129.185	129.185	0	0	0	0
NAH2PO4	LB/HR				21.552	21.552	0	0	0	0
NA2HPO4	LB/HR				0	0	0	0	0	0
HF	LB/HR				0	0	0	0	0	0
H3PO4	LB/HR				0	0	0	0	0	0
SULFUR	LB/HR				0	0	0	0	0	0
ALUMINUM	LB/HR				0	0	0	0	0	0
IRON	LB/HR				0	0	0	0	0	0
NICKEL	LB/HR				0	0	0	0	0	0
COPPER	LB/HR				0	0	0	0	0	0
SILICON	LB/HR				0	0	0	0	0	0
CALCIUM	LB/HR				0	0	0	0	0	0
AL2O3	LB/HR				0.088	0.088	0	0	0	0
FE2O3	LB/HR				0.002	0.002	0	0	0	0
NIO	LB/HR				7.22E-07	7.22E-07	0	0	0	0
CUO	LB/HR				3.47E-05	3.47E-05	0	0	0	0
AL(OH)3	LB/HR				0	0	0	0	0	0
SIO2	LB/HR				0.006	0.006	0	0	0	0
CAO	LB/HR				0.01	0.01	0	0	0	0
TIO2	LB/HR				0.296	0.296	0	0	0	0
DICDI	LB/HR				0	0	0	0	0	0
DCCDI	LB/HR				0	0	0	0	0	0
TOTAL LIQUID	LB/HR	0.0	0.0	0.0	7513.3	7513.3	65917.1	4500.0	4500.0	65917.1
AVERAGE FLOW	LB/HR	2218.9	6656.6	6656.6	7513.3	7513.3	65917.1	4500.0	4500.0	65917.1
INSTANTANEOUS FLOW	LB/HR	2218.9	6656.6	6656.6	7513.3	7513.3	65917.1	4500.0	4500.0	65917.1
NOTES			4	4						

1 - Represents feed to hydrolysate blend tanks
2 - Represents blended hydrolysate flow to three SCWO trains.
3 - Components in the supercritical phase may appear in the Aspen Model as liquid, gas, or a combination thereof. In these instances, the reported phase should not be considered representative of the actual system.
4 - Represents flow from three SCWO trains.

GENERAL NOTES:

1. ALL INFORMATION, CALCULATIONS, AND ASSUMPTIONS 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. 7, AUGUST 2006.
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.

6 (rev. triangle) 1

Signature Valid: cn=Blayne Monen, o=Configuration Management, ou=Issued, c=US 2006.08.09 14:56:27 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		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 [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

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)

RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING SCWO PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 5 OF 9 | REV 6

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
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
TEMPERATURE	F	77	78.4	70	110	80	110			77	80	92.5	110	327.9	327.9	110	110
PRESSURE	PSIA	44.23	3665	14.67	14.67	64.23	54.23			29.23	14.23	39.23	39.23	100	100	39.23	39.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	0.578	0.576	(0.854)	(1.647)	2.867	2.787			0.794	0.035	19.452	19.452	(14.103)	0.412	6.479	2.160
*** VAPOR PHASE ***																	
DENSITY	LB/FT3			0.072	0.066									0.22		0.074	0.074
VISCOSITY	cP			0.018	0.018									0.015		0.013	0.013
*** LIQUID PHASE ***																	
DENSITY	LB/FT3	52.742	52.866			65.2	67.083			74.69	72	67.2	67.2		56.368	67.2	67.2
VISCOSITY	cP	1.074	1.056			0.68	0.66			1.403	574.273	0.8	0.763		0.151	0.763	0.763
MOLECULAR WEIGHT		32.992	32.992	28.013	27.38	19.671	20.052			19.993	58.442	19.954	19.954	18.015	18.015	19.95	19.95
ENTHALPY	MM BTU/HR	-0.947	-0.946	0	-0.002	-9.408	-9.209			-2.688	-0.054	-64.079	-63.911	-1.055	-1.223	-21.301	-7.1
VAPOR																	
H2O	LB/HR			0	0.392									186.153			
IPA	LB/HR			0	0									0			
C2H6O2	LB/HR			0	5.59E-06									0			
TDG	LB/HR			0	1.23E-06									0			
Q-OH	LB/HR			0	2.89E-07									0			
C6H13S2O	LB/HR			0	0									0			
HS3	LB/HR			0	6.66E-07									0			
DITHIANE	LB/HR			0	8.90E-07									0			
CL2	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			
HCLO	LB/HR			0	0									0			
O2	LB/HR			0	0.533									0			
N2	LB/HR			3.688	5.598									0			
ARGON	LB/HR			0	0									0			
H2	LB/HR			0	0									0			
N2O	LB/HR			0	0									0			
H3PO4	LB/HR			0	0									0			
AMMONIA	LB/HR			0	2.96E-04									0			
NH4CL	LB/HR			0	0									0			
(NH4)2SO4	LB/HR			0	0									0			
GLYCEROL	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			
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			
IRON	LB/HR			0	0									0			
MANGANESE	LB/HR			0	0									0			
S6	LB/HR			0	0									0			
SULFUR	LB/HR			0	0									0			
SILICON	LB/HR			0	0									0			
FE2O3	LB/HR			0	0									0			
AL2O3	LB/HR			0	0									0			
MN2O3	LB/HR			0	0									0			
SIO2	LB/HR			0	0									0			
TIO2	LB/HR			0	0									0			
AL(OH)3	LB/HR			0	0									0			
TOTAL VAPOR	LB/HR	0.0	0.0	3.7	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	186.2	0.0	0.0	0.0
LIQUID (including dissolved gases)																	
H2O	LB/HR	85.928	85.928			1336.5	1311.014			389.937	0	9112.352	9112.352		186.153	3037.059	1012.353
IPA	LB/HR	158.394	158.394			0	0			0	0	0	0		0	0	0
C2H6O2	LB/HR	0	0			10.05	0			0	0	30.15	30.15		0	10.05	3.35
TDG	LB/HR	0	0			36.819	0			0	0	110.457	110.457		0	36.819	12.273
Q-OH	LB/HR	0	0			5.646	0			0	0	16.938	16.938		0	5.646	1.882
C6H13S2O	LB/HR	0	0			0	0			0	0	0	0		0	0	0
HS3	LB/HR	0	0			1.005	0			0	0	3.015	3.015		0	1.005	0.335
DITHIANE	LB/HR	0	0			20.133	0			0	0	60.399	60.399		0	20.133	6.711
CL2	LB/HR	0	0			0	0			0	0	0	0		0	0	0
CO2	LB/HR	0	0			0	0			0	0	0	0		0	0	0
HCL	LB/HR	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
NAOH	LB/HR	0	0			0.582	0.002			85.596	0	258.538	258.538		0	86.179	28.726
HCLO	LB/HR	0	0			0	0			0	0	0	0		0	0	0
O2	LB/HR	0	0			0	0.54			0	0	1.62	1.62		0	0.006	0.002
N2	LB/HR	0	0			0.534	1.413			0	0	5.841	5.841		0	0.036	0.012
ARGON	LB/HR	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
N2O	LB/HR	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
AMMONIA	LB/HR	0	0			0	0.12			0	0	0.36	0.36		0	0.12	0.04
NH4CL	LB/HR	0	0			0	0			0	0	0	0		0	0	0
(NH4)2SO4	LB/HR	0	0			0	0.333			0	0	0.999	0.999		0	0.333	0.111
GLYCEROL	LB/HR	0	0			0	0			0	0	0	0		0	0	0
NANO2	LB/HR	0	0			0	3.714			0	0	11.142	11.142		0	3.714	1.238
NANO3	LB/HR	0	0			0	0.003			0	0	0.009	0.009		0	0.003	0.001
SODIUM FORMATE	LB/HR	0	0			0	12.849			0	0	38.547	38.547		0	12.849	4.283
SODIUM ACETATE	LB/HR	0	0			0	1.08			0	0	3.24	3.24		0	1.08	0.36
NACL	LB/HR	0	0			57.762	49.206			0	20.25	381.654	381.654		0	127.218	42.406
NAF	LB/HR	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
NA2SO4	LB/HR	0	0			0	117.243			0	0	351.729	351.729		0	117.243	39.081
NAH2PO4	LB/HR	0	0			0	0			0	0	0	0		0	0	0
NA2HPO4	LB/HR	0	0			0	1.842			0	0	5.526	5.526		0	1.842	0.614
NAHCO3	LB/HR	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
HF	LB/HR	0	0			0	0			0	0	0	0		0	0	0
IRON	LB/HR	0	0			15.282	0			0	0	45.846	45.846		0	15.282	5.094
MANGANESE	LB/HR	0	0			0.12	0			0	0	0.36	0.36		0	0.12	0.04
S6	LB/HR	0	0			15.18	0			0	0	45.54	45.54		0	15.18	5.06
SULFUR	LB/HR	0	0			0.006	0			0	0	0.018	0.018		0	0.006	0.002
SILICON	LB/HR	0	0			0.021	0			0	0	0.063	0.063		0	0.021	0.007
FE2O3	LB/HR	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
MN2O3	LB/HR	0	0			0	0			0	0	0	0		0	0	0
SIO2	LB/HR	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
AL(OH)3	LB/HR	0	0			0	0.282			0	0	0.846	0.846		0	0.282	0.094
TOTAL LIQUID	LB/HR	244.322	244.322	0	0	1499.64	1499.641	0	0	475.533	20.25	10485.189	10485.189	0	186.153	3492.226	1164.075
AVERAGE FLOW		244.3	244.3	3.7	6.5	1499.6	1499.6	0.0	0.0	475.5	20.3	10485.2	10485.2	186.2	186.2	3492.2	1164.1
INSTANTANEOUS FLOW		244.3	244.3	3.7	12.5	12000.0	12000.0	0.0	0.0	5706.4	243.0	10485.2	10485.2	186.2	186.2	3492.2	1164.1
NOTES				1		1	1	1	1	1	1					2	

STREAM NUMBER		646	647	648	649	650	651	652	653	654	655	656	657	658	659	660
LINE DESCRIPTION		HP Blended Hydrolysate Feed	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	111.6				106.3	70	70	70	1200	77	77.9	383	140	140	45
PRESSURE	PSIA	3665				3665	3665	3665	3415	3415	54.23	3415	3415	3415	3415	14.23
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	2.160				2.739	(2.210)	(2.117)	(0.099)	(12.499)	13.224	13.093	46.702	34.823	(1.806)	(356.755)
*** VAPOR PHASE ***																
DENSITY	LB/FT3						17.845	17.845	16.822	4.9			10.632	15.404	15.404	0.078
VISCOSITY	cP						0.026	0.026	0.025	0.035			0.029	0.026	0.026	0.018
*** LIQUID PHASE ***																
DENSITY	LB/FT3	67.2				64.1					62.222	62.845	54.101	60.449		
VISCOSITY	cP	0.764				0.754					0.765	0.758	0.123	0.455		
MOLECULAR WEIGHT		19.95				21.419	28.863	28.863	28.863	24.885	18.023	18.023	20.053	20.053	29.814	29.814
ENTHALPY	MM BTU/HR	-7.089				-8.035	-0.145	-0.046	-0.002	-7.804	-45.032	-44.966	-52.881	-55.117	-0.966	-0.978
VAPOR																
H2O	LB/HR						0	0	0	1312.119			158.983	3.905	2.929	2.929
IPA	LB/HR						0	0	0	0			0	0	0	0
C2H6O2	LB/HR						0	0	0	0			0	0	0	0
TDG	LB/HR						0	0	0	0			0	0	0	0
Q-OH	LB/HR						0	0	0	0			0	0	0	0
C6H13S2O	LB/HR						0	0	0	0			0	0	0	0
HS3	LB/HR						0	0	0	0			0	0	0	0
DITHIANE	LB/HR						0	0	0	0			0	0	0	0
CL2	LB/HR						0	0	0	0			0	0	0	0
CO2	LB/HR						1.368	1.31	0.058	387.4			352.111	328.635	246.476	246.476
HCL	LB/HR						0	0	0	0			0	0	0	0
H2SO4	LB/HR						0	0	0	0			0	0	0	0
NAOH	LB/HR						0	0	0	0			0	0	0	0
HCLO	LB/HR						0	0	0	0			0	0	0	0
O2	LB/HR						547.773	524.625	23.148	87.356			109.439	108.851	81.638	81.638
N2	LB/HR						1786.73	1711.225	75.505	1712.044			1774.596	1771.917	1328.938	1328.938
ARGON	LB/HR						30.493	29.204	1.289	29.204			24.109	12.679	9.51	9.51
H2	LB/HR						0	0	0	0			0	0	0	0
N2O	LB/HR						0	0	0	0.182			0.181	0.164	0.123	0.123
H3PO4	LB/HR						0	0	0	0			0	0	0	0
AMMONIA	LB/HR						0	0	0	0			0	0	0	0
NH4CL	LB/HR						0	0	0	0			0	0	0	0
(NH4)2SO4	LB/HR						0	0	0	0			0	0	0	0
GLYCEROL	LB/HR						0	0	0	0			0	0	0	0
NANO2	LB/HR						0	0	0	0			0	0	0	0
NANO3	LB/HR						0	0	0	0			0	0	0	0
SODIUM FORMATE	LB/HR						0	0	0	0			0	0	0	0
SODIUM ACETATE	LB/HR						0	0	0	0			0	0	0	0
NACL	LB/HR						0	0	0	42.371			0	0	0	0
NAF	LB/HR						0	0	0	0			0	0	0	0
NAHSO4	LB/HR						0	0	0	0			0	0	0	0
NA2SO4	LB/HR						0	0	0	96.069			0	0	0	0
NAH2PO4	LB/HR						0	0	0	0.613			0	0	0	0
NA2HPO4	LB/HR						0	0	0	0			0	0	0	0
NAHCO3	LB/HR						0	0	0	0			0	0	0	0
NA2CO3	LB/HR						0	0	0	0			0	0	0	0
HF	LB/HR						0	0	0	0			0	0	0	0
IRON	LB/HR						0	0	0	0			0	0	0	0
MANGANESE	LB/HR						0	0	0	0			0	0	0	0
S6	LB/HR						0	0	0	0			0	0	0	0
SULFUR	LB/HR						0	0	0	0			0	0	0	0
SILICON	LB/HR						0	0	0	0			0	0	0	0
FE2O3	LB/HR						0	0	0	7.277			0	0	0	0
AL2O3	LB/HR						0	0	0	0.062			0	0	0	0
MN2O3	LB/HR						0	0	0	0.058			0	0	0	0
SIO2	LB/HR						0	0	0	0.007			0	0	0	0
TIO2	LB/HR						0	0	0	0.002			0	0	0	0
AL(OH)3	LB/HR						0	0	0	0			0	0	0	0
TOTAL VAPOR	LB/HR	0.0	0.0	0.0	0.0	0.0	2366.4	2266.4	100.0	3674.8	0.0	0.0	2419.4	2226.2	1669.6	1669.6
LIQUID (including dissolved gases)																
H2O	LB/HR	1012.353				1098.281					6597.104	6597.104	7750.24	7905.318		
IPA	LB/HR	0				158.394					0	0	0	0		
C2H6O2	LB/HR	3.35				3.35					0	0	0	0		
TDG	LB/HR	12.273				12.273					0	0	0	0		
Q-OH	LB/HR	1.882				1.882					0	0	0	0		
C6H13S2O	LB/HR	0				0					0	0	0	0		
HS3	LB/HR	0.335				0.335					0	0	0	0		
DITHIANE	LB/HR	6.711				6.711					0	0	0	0		
CL2	LB/HR	0				0					0	0	0	0		
CO2	LB/HR	0				0					0	0	35.346	58.822		
HCL	LB/HR	0				0					0	0	0	0		
H2SO4	LB/HR	0				0					0	0	0	0		
NAOH	LB/HR	28.726				28.726					0	0	0	0		
HCLO	LB/HR	0				0					0	0	0	0		
O2	LB/HR	0.002				0.002					0	0	1.066	1.654		
N2	LB/HR	0.012				0.012					0	0	12.954	15.632		
ARGON	LB/HR	0				0					0	0	6.384	17.814		
H2	LB/HR	0				0					0	0	0	0		
N2O	LB/HR	0				0					0	0	0.001	0.018		
H3PO4	LB/HR	0				0					0	0	0	0		
AMMONIA	LB/HR	0.04				0.04					0	0	0	0		
NH4CL	LB/HR	0				0					0	0	0	0		
(NH4)2SO4	LB/HR	0.111				0.111					0	0	0	0		
GLYCEROL	LB/HR	0				0					0	0	0	0		
NANO2	LB/HR	1.238				1.238					0	0	0	0		
NANO3	LB/HR	0.001				0.001					0	0	0	0		
SODIUM FORMATE	LB/HR	4.283				4.283					0	0	0	0		
SODIUM ACETATE	LB/HR	0.36				0.36					0	0	0	0		
NACL	LB/HR	42.406				42.406					0.995	0.995	43.365	43.365		
NAF	LB/HR	0				0					0	0	0	0		
NAHSO4	LB/HR	0				0					0.025	0.025	0	0		
NA2SO4	LB/HR	39.081				39.081					2.273	2.273	98.372	98.372		
NAH2PO4	LB/HR	0				0					0.01	0.01	0.624	0.624		
NA2HPO4	LB/HR	0.614				0.614					0	0	0	0		
NAHCO3	LB/HR	0				0					0	0	0.023	0.023		
NA2CO3	LB/HR	0				0					0.026	0.026	0	0		
HF	LB/HR	0				0					0	0	0	0		
IRON	LB/HR	5.094				5.094					0	0	0	0		
MANGANESE	LB/HR	0.04				0.04					0	0	0	0		
S6	LB/HR	5.06				5.06					0	0	0	0		
SULFUR	LB/HR	0.002				0.002					0	0	0	0		
SILICON	LB/HR	0.007				0.007					0	0	0	0		
FE2O3	LB/HR	0				0					0	0	7.277	7.277		
AL2O3	LB/HR	0				0					0	0	0.062	0.062		
MN2O3	LB/HR	0				0					0	0	0.058	0.058		
SIO2	LB/HR	0				0					0	0	0.007	0.007		
TIO2	LB/HR	0				0					0	0	0.002	0.002		
AL(OH)3	LB/HR	0.094				0.094					0	0	0	0		
TOTAL LIQUID	LB/HR	1164.075	0	0	0	1408.397	0	0	0	0	6600.433	6600.433	7955.781	8149.048	0	0
AVERAGE FLOW		1164.1	0.0	0.0	0.0	1408.4	2366.4	2266.4	100.0	3674.8	6600.4	6600.4	10375.2	10375.2	1669.6	1669.6
INSTANTANEOUS FLOW		1164.1	0.0	0.0	0.0	1408.4	2366.4	2266.4	100.0	3674.8	6600.4	6600.4	10375.2	10375.2	1669.6	1669.6
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	139.3	139.3	95.4	95.4	95.4	95.4	110	139.3	139.3	90	90	106	119.2
PRESSURE	PSIA	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	65	65	45	45
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	21.310	1486.268	(196.490)	4276.250	0.023	(571.689)	(1715.066)	(1739.922)	16.546	16.545	159.173	9.030	9.059	160.1945
*** VAPOR PHASE ***															
DENSITY	LB/FT3	15.404	0.063	0.063	0.07		0.07	0.07	0.069						
VISCOSITY	cP	0.026	0.020	0.020	0.019		0.019	0.019	0.019						
*** LIQUID PHASE ***															
DENSITY	LB/FT3	60.449	60.08		62.041	62.041				60.082	60.085	62.129	62.129	61.926	61.733
VISCOSITY	cP	0.455	0.464		0.645	0.645				0.464	0.464	0.677	0.677	0.589	0.527
MOLECULAR WEIGHT		18.869	18.869	28.319	29.337	18.017	29.424	29.424	29.424	18.299	18.299	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-54.151	-54.111	-1.075	-2.053	-0.077	-1.976	-5.928	-5.902	-53.112	-53.112	-540.386	-30.655	-30.583	-538.078
VAPOR															
H2O	LB/HR	0.976	94.703	94.703	86.378		86.38	259.14	259.14						
IPA	LB/HR	0	0	0	0		0	0	0						
C2H6O2	LB/HR	0	0	0	0		0	0	0						
TDG	LB/HR	0	0	0	0		0	0	0						
Q-OH	LB/HR	0	0	0	0		0	0	0						
C6H13S2O	LB/HR	0	0	0	0		0	0	0						
HS3	LB/HR	0	0	0	0		0	0	0						
DITHIANE	LB/HR	0	0	0	0		0	0	0						
CL2	LB/HR	0	0	0	0		0	0	0						
CO2	LB/HR	82.158	140.309	140.309	386.784		386.784	1160.352	1160.352						
HCL	LB/HR	0	0	0	0		0	0	0						
H2SO4	LB/HR	0	0	0	0		0	0	0						
NAOH	LB/HR	0	0	0	0		0	0	0						
HCLO	LB/HR	0	0	0	0		0	0	0						
O2	LB/HR	27.213	28.859	28.859	110.497		110.497	331.492	331.492						
N2	LB/HR	442.979	458.546	458.546	1787.484		1787.484	5362.451	5362.451						
ARGON	LB/HR	3.17	20.257	20.257	29.766		29.766	89.297	89.297						
H2	LB/HR	0	0	0	0		0	0	0						
N2O	LB/HR	0.041	0.058	0.058	0.181		0.181	0.544	0.544						
H3PO4	LB/HR	0	0	0	0		0	0	0						
AMMONIA	LB/HR	0	0	0	0		0	0	0						
NH4CL	LB/HR	0	0	0	0		0	0	0						
(NH4)2SO4	LB/HR	0	0	0	0		0	0	0						
GLYCEROL	LB/HR	0	0	0	0		0	0	0						
NANO2	LB/HR	0	0	0	0		0	0	0						
NANO3	LB/HR	0	0	0	0		0	0	0						
SODIUM FORMATE	LB/HR	0	0	0	0		0	0	0						
SODIUM ACETATE	LB/HR	0	0	0	0		0	0	0						
NACL	LB/HR	0	0	0	0		0	0	0						
NAF	LB/HR	0	0	0	0		0	0	0						
NAHSO4	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						
NAHCO3	LB/HR	0	0	0	0		0	0	0						
NA2CO3	LB/HR	0	0	0	0		0	0	0						
HF	LB/HR	0	0	0	0		0	0	0						
IRON	LB/HR	0	0	0	0		0	0	0						
MANGANESE	LB/HR	0	0	0	0		0	0	0						
S6	LB/HR	0	0	0	0		0	0	0						
SULFUR	LB/HR	0	0	0	0		0	0	0						
SILICON	LB/HR	0	0	0	0		0	0	0						
FE2O3	LB/HR	0	0	0	0		0	0	0						
AL2O3	LB/HR	0	0	0	0		0	0	0						
MN2O3	LB/HR	0	0	0	0		0	0	0						
SIO2	LB/HR	0	0	0	0		0	0	0						
TIO2	LB/HR	0	0	0	0		0	0	0						
AL(OH)3	LB/HR	0	0	0	0		0	0	0						
TOTAL VAPOR	LB/HR	556.5	742.7	742.7	2401.1	0.0	2401.1	7203.3	7203.3	0.0	0.0	0.0	0.0	0.0	0.0
LIQUID (including dissolved gases)															
H2O	LB/HR	7905.318	7811.592		11.254	11.254				7822.846	7822.846	79325.83	4500	4500	79325.83
IPA	LB/HR	0	0		0	0				0	0	0	0	0	0
C2H6O2	LB/HR	0	0		0	0				0	0	0	0	0	0
TDG	LB/HR	0	0		0	0				0	0	0	0	0	0
Q-OH	LB/HR	0	0		0	0				0	0	0	0	0	0
C6H13S2O	LB/HR	0	0		0	0				0	0	0	0	0	0
HS3	LB/HR	0	0		0	0				0	0	0	0	0	0
DITHIANE	LB/HR	0	0		0	0				0	0	0	0	0	0
CL2	LB/HR	0	0		0	0				0	0	0	0	0	0
CO2	LB/HR	58.822	0.672		0.001	0.001				0.673	0.673	0	0	0	0
HCL	LB/HR	0	0		0	0				0	0	0	0	0	0
H2SO4	LB/HR	0	0		0	0				0	0	0	0	0	0
NAOH	LB/HR	0	0		0	0				0	0	0	0	0	0
HCLO	LB/HR	0	0		0	0				0	0	0	0	0	0
O2	LB/HR	1.654	0.007		0	0				0.007	0.007	0	0	0	0
N2	LB/HR	15.632	0.065		0	0				0.065	0.065	0	0	0	0
ARGON	LB/HR	17.814	0.726		0.001	0.001				0.727	0.727	0	0	0	0
H2	LB/HR	0	0		0	0				0	0	0	0	0	0
N2O	LB/HR	0.018	0		0	0				0	0	0	0	0	0
H3PO4	LB/HR	0	0		0	0				0	0	0	0	0	0
AMMONIA	LB/HR	0	0		0	0				0	0	0	0	0	0
NH4CL	LB/HR	0	0		0	0				0	0	0	0	0	0
(NH4)2SO4	LB/HR	0	0		0	0				0	0	0	0	0	0
GLYCEROL	LB/HR	0	0		0	0				0	0	0	0	0	0
NANO2	LB/HR	0	0		0	0				0	0	0	0	0	0
NANO3	LB/HR	0	0		0	0				0	0	0	0	0	0
SODIUM FORMATE	LB/HR	0	0		0	0				0	0	0	0	0	0
SODIUM ACETATE	LB/HR	0	0		0	0				0	0	0	0	0	0
NACL	LB/HR	43.365	43.365		0	0				43.365	43.365	0	0	0	0
NAF	LB/HR	0	0		0	0				0	0	0	0	0	0
NAHSO4	LB/HR	0	0		0	0				0	0	0	0	0	0
NA2SO4	LB/HR	98.372	98.372		0	0				98.372	98.372	0	0	0	0
NAH2PO4	LB/HR	0.624	0.624		0	0				0.624	0.624	0	0	0	0
NA2HPO4	LB/HR	0	0		0	0				0	0	0	0	0	0
NAHCO3	LB/HR	0.023	0.023		0	0				0.023	0.023	0	0	0	0
NA2CO3	LB/HR	0	0		0	0				0	0	0	0	0	0
HF	LB/HR	0	0		0	0				0	0	0	0	0	0
IRON	LB/HR	0	0		0	0				0	0	0	0	0	0
MANGANESE	LB/HR	0	0		0	0				0	0	0	0	0	0
S6	LB/HR	0	0		0	0				0	0	0	0	0	0
SULFUR	LB/HR	0	0		0	0				0	0	0	0	0	0
SILICON	LB/HR	0	0		0	0				0	0	0	0	0	0
FE2O3	LB/HR	7.277	7.277		0	0				7.277	7.277	0	0	0	0
AL2O3	LB/HR	0.062	0.062		0	0				0.062	0.062	0	0	0	0
MN2O3	LB/HR	0.058	0.058		0	0				0.058	0.058	0	0	0	0
SIO2	LB/HR	0.007	0.007		0	0				0.007	0.007	0	0	0	0
TIO2	LB/HR	0.002	0.002		0	0				0.002	0.002	0	0	0	0
AL(OH)3	LB/HR	0	0		0	0				0	0	0	0	0	0
TOTAL LIQUID	LB/HR	8149.048	7962.852	0	11.256	11.256	0	0	0	7974.108	7974.108	79325.83	4500	4500	79325.83
AVERAGE FLOW		8705.6	8705.6	742.7	2412.3	11.3	2401.1	7203.3	7203.3	7974.1	7974.1	79325.8	4500.0	4500.0	79325.8
INSTANTANEOUS FLOW		8705.6	8705.6	742.7	2412.3	11.3	2401.1	7203.3	7203.3	7974.1	7974.1	79325.8	4500.0	4500.0	79325.8
NOTES								4	4						

NOTES
1 - Represents feed to hydrolysate blend tanks
2 - Represents blended hydrolysate flow to three SCWO trains.
3 - Components in the supercritical phase may appear in the Aspen Model as liquid, gas, or a combination thereof. In these instances, the reported phase should not be considered representative of the actual system.
4 - Represents flow from three SCWO trains.

GENERAL NOTES:

1. ALL INFORMATION, CALCULATIONS, AND ASSUMPTIONS 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. 7, AUGUST 2006.
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.

6 1

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NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6 (1)		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 [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

GENERAL ATOMICS

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING SCWO PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 6 OF 9 | REV 6

BGCAPP_D3.BDR

CASE 4: PRE-IGNITION 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	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		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	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																		77	77.9	1000	1000	70	70	70	631.7	77	77.9	383	140	140	45	140	139.6	139.6	94.8	94.8	94.8	94.8	110	139.6	139.6	90	90	106	117.5
PRESSURE	PSIA																		99.23	3665	3665	3665	3665	3665	3415	3415	54.23	3415	3415	3415	3415	3415	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	14.23	30.23	65	65	45	45
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)																		1.301	1.288	(2.033)	(2.033)	(0.432)	(0.338)	(0.099)	14.624	3.407	3.374	11.247	8.656	(0.388)	(74.515)	5.751	300.194	(39.500)	879.447	0.005	(117.573)	(352.716)	(963.407)	4.741	4.741	51.440	9.030	9.059	51.748
*** VAPOR PHASE ***																																													
DENSITY	LB/FT3																				5.328	5.328	17.85	17.85	16.826	8.301			10.155	14.584	14.584	0.076	14.584	0.06	0.06	0.068		0.068	0.068	0.066						
VISCOSITY	cP																				0.03	0.03	0.026	0.026	0.025	0.026			0.029	0.026	0.026	0.018	0.026	0.020	0.020	0.019		0.019	0.019	0.019						
*** LIQUID PHASE ***																																													
DENSITY	LB/FT3																		62.267	62.928						41.306	62.249	62.872	55.019	61.536			61.536	61.376		62.059	62.059				61.376	61.38	62.129	62.129	61.926	61.759
VISCOSITY	cP																		0.913	0.902						0.07	0.913	0.904	0.137	0.469			0.469	0.476		0.741	0.741				0.476	0.476	0.783	0.783	0.657	0.584
MOLECULAR WEIGHT																			18.015	18.015	18.015	18.015	28.863	28.863	28.863	20.635	18.022	18.022	19.208	19.208	28.85	28.85	18.368	18.368	26.862	28.234	18.016	28.311	28.311	28.311	18.021	18.021	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR																		-4.433	-4.427	-3.54	-3.54	-0.028	-0.007	-0.002	-3.664	-11.603	-11.586	-15.237	-15.868	-0.003	-0.006	-15.865	-15.865	-0.109	-0.116	-0.016	-0.1	-0.301	-0.295	-15.771	-15.771	-174.524	-30.635	-30.564	-173.822
VAPOR																																													
H2O	LB/HR																				650	650	0	0	0	602.175			31.449	0.74	0.555	0.555	0.185	19.281	19.281	17.542		17.542	52.627	52.627						
IPA	LB/HR																				0	0	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
N2	LB/HR																				0	0	349.136	273.631	75.505	273.271			345.104	344.757	258.567	258.567	86.189	90.55	90.55	349.117		349.117	1047.352	1047.352						
O2	LB/HR																				0	0	107.037	83.889	23.148	83.713			105.411	104.739	78.554	78.554	26.185	28.472	28.472	107.027		107.027	321.081	321.081						
ARGON	LB/HR																				0	0	5.959	4.67	1.289	4.66			4.406	2.611	1.958	1.958	0.653	3.788	3.788	5.746		5.746	17.238	17.238						
CO2	LB/HR																				0	0	0.267	0.209	0.058	0.209			0.229	0.208	0.156	0.156	0.052	0.108	0.108	0.264		0.264	0.793	0.793						
NAF	LB/HR																				0	0	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	0	0						
NACL	LB/HR																				0	0	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	0	0						
NA2SO4	LB/HR																				0	0	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NAH2PO4	LB/HR																				0	0	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	0	0						
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	0.0	0.0	650.0	650.0	462.4	362.4	100.0	964.0	0.0	0.0	486.6	453.1	339.8	339.8	113.3	142.2	142.2	479.7	0.0	479.7	1439.1	1439.1	0.0	0.0	0.0	0.0	0.0	0.0
Mass Flow LIQUID lb/hr																																													
H2O	LB/HR																		650	650						47.825	1700.7	1700.7	2319.251	2349.96			2349.96	2330.864		2.294	2.294				2333.158	2333.158	25635.58	4500	4500	25635.58
IPA	LB/HR																		0	0						0	0	0	0	0			0	0		0	0				0	0	0	0	0	0
N2	LB/HR																		0	0						0.36	0	0	4.032	4.38			4.38	0.019		0	0				0.019	0.019	0	0	0	0
O2	LB/HR																		0	0						0.177	0	0	1.627	2.298			2.298	0.011		0	0				0.011	0.011	0	0	0	0
ARGON	LB/HR																		0	0						0.01	0	0	1.553	3.348			3.348	0.213		0	0				0.213	0.213	0	0	0	0
CO2	LB/HR																		0	0						0	0	0	0.038	0.059			0.059	0.003		0	0				0.003	0.003	0	0	0	0
NAF	LB/HR																		0	0						0	0.027	0.027	0.027	0.027			0.027	0.027		0	0				0.027	0.027	0	0	0	0
NAHCO3	LB/HR																		0	0						0	0	0	0	0			0	0		0	0				0	0	0	0	0	0
NACL	LB/HR																		0	0						0	0.191	0.191	0.191	0.191			0.191	0.191		0	0				0.191	0.191	0	0	0	0
NA2CO3	LB/HR																		0	0						0	0.006	0.006	0.006	0.006			0.006	0.006		0	0				0.006	0.006	0	0	0	0
NA2SO4	LB/HR																		0	0						0	0.418	0.418	0.418	0.418			0.418	0.418		0	0				0.418	0.418	0	0	0	0
NAH2PO4	LB/HR																		0	0						0	0.082	0.082	0.082	0.082			0.082	0.082		0	0				0.082	0.082	0	0	0	0
AL2O3	LB/HR																		0	0						0	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	0	0	0	0	0	0	0	0	0	650	650	0	0	0	0	0	48.372	1701.424	1701.424	2327.225	2360.769	0	0	2360.769	2331.834	0	2.294	2.294	0	0	0	2334.128	2334.128	25635.58	4500	4500	25635.58
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	650.0	650.0	650.0	650.0	462.4	362.4	100.0	1012.4	1701.4	1701.4	2813.8	2813.8	339.8	339.8	2474.0	2474.0	142.2	482.0	2.3	479.7	1439.1	1439.1	2334.1	2334.1	25635.6	4500.0	4500.0	25635.6
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	650.0	650.0	650.0	650.0	462.4	362.4	100.0	1012.4	1701.4	1701.4	2813.8	2813.8	339.8	339.8	2474.0	2474.0	142.2	482.0	2.3	479.7	1439.1	1439.1	2334.1	2334.1	25635.6	4500.0	4500.0	25635.6
NOTES																																							1	1						

1 - Represents flow from three SCWO trains.

GENERAL NOTES:

1. ALL INFORMATION, CALCULATIONS, AND ASSUMPTIONS 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. 7, AUGUST 2006.

△6

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NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		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

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 7 OF 9 | REV 6

BGCAPP_D2.BDR

CASE 5: IGNITION 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	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		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	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	77	78.5																77	77.9	1000	928.9	70	70	70	1200	77	77.9	383	140	140	45	140	139.5	139.5	97.2	97.2	97.2	97.2	110	139.5	139.4	90	90	106	118.3
PRESSURE	PSIA	44.23	3665																99.23	3665	3665	3665	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	14.23	30.23	65	65	45	45
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	0.088	0.087																1.301	1.288	(2.033)	(1.879)	(0.446)	(0.352)	(0.099)	(3.886)	5.893	5.835	14.014	11.149	(0.371)	(72.153)	8.377	328.734	(42.967)	886.649	0.005	(118.562)	(355.687)	(360.917)	7.348	7.346	72.809	9.030	9.059	73.258
*** VAPOR PHASE ***																																													
DENSITY	LB/FT3																				5.328	6.099	17.85	17.85	16.826	4.568			10.415	14.988	14.988	0.077	14.988	0.062	0.062	0.069		0.069	0.069	0.068							
VISCOSITY	cP																				0.03	0.028	0.026	0.026	0.025	0.039			0.029	0.026	0.026	0.018	0.026	0.020	0.020	0.019		0.019	0.019	0.019							
*** LIQUID PHASE ***																																													
DENSITY	LB/FT3	53.313	53.439																62.267	62.928							62.249	62.872	54.88	61.278			61.278	61.379		62.024	62.024				61.379	61.382	62.129	62.129	61.926	61.748
VISCOSITY	cP	1.218	1.194																0.913	0.902							0.913	0.904	0.136	0.467			0.467	0.477		0.722	0.722				0.477	0.477	0.783	0.783	0.657	0.58
MOLECULAR WEIGHT		32.992	32.992																18.015	18.015	18.015	18.473	28.863	28.863	28.863	20.941	18.022	18.022	18.874	18.874	29.327	29.327	18.3	18.3	28.124	28.926	18.017	29.01	29.01	29.01	18.022	18.022	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-0.145	-0.145																-4.433	-4.427	-3.54	-3.665	-0.029	-0.008	-0.002	-3.764	-20.067	-20.038	-23.79	-24.738	-0.112	-0.115	-24.627	-24.635	-0.213	-0.328	-0.016	-0.312	-0.936	-0.931	-24.437	-24.437	-247.025	-30.635	-30.564	-246.005
VAPOR																																													
H2O	LB/HR																				650	663.191	0	0	0	692.348			31.369	0.754	0.566	0.566	0.189	20.636	20.636	18.867		18.867	56.602	56.602							
IPA	LB/HR																				0	24.315	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0							
N2	LB/HR																				0	0	360.507	285.002	75.505	285.002			353.832	353.291	264.968	264.968	88.323	95.51	95.51	360.478		360.478	1081.435	1081.435							
O2	LB/HR																				0	0	110.623	87.375	23.148	29.114			50.993	50.486	37.865	37.865	12.622	14.38	14.38	52.254		52.254	156.762	156.762							
ARGON	LB/HR																				0	0	6.153	4.864	1.289	4.864			3.986	2.25	1.688	1.688	0.562	4.127	4.127	5.814		5.814	17.442	17.442							
CO2	LB/HR																				0	0	0.276	0.218	0.058	53.639			42.739	37.681	28.261	28.261	9.42	25.174	25.174	53.434		53.434	160.302	160.302							
NAF	LB/HR																				0	0	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	0	0							
NACL	LB/HR																				0	0	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	0	0							
NA2SO4	LB/HR																				0	0	0	0	0	0			0	0	0	0	0	0	0	0		0	0	0							
NAH2PO4	LB/HR																				0	0	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	0	0							
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	0.0	0.0	650.0	687.5	477.5	377.5	100.0	1065.0	0.0	0.0	482.9	444.5	333.3	333.3	111.1	159.8	159.8	490.8	0.0	490.8	1472.5	1472.5	0.0	0.0	0.0	0.0	0.0	0.0
Mass Flow LIQUID lb/hr																																													
H2O	LB/HR	13.191	13.191																650	650							2941.406	2941.406	3602.383	3632.998			3632.998	3612.551		2.334	2.334				3614.885	3614.885	36285.179	4500	4500	36285.179
IPA	LB/HR	24.315	24.315																0	0							0	0	0	0			0	0		0	0				0	0	0	0	0	0
N2	LB/HR	0	0																0	0							0	0	6.675	7.217			7.217	0.029		0	0				0.029	0.029	0	0	0	0
O2	LB/HR	0	0																0	0							0	0	1.269	1.776			1.776	0.008		0	0				0.008	0.008	0	0	0	0
ARGON	LB/HR	0	0																0	0							0	0	2.167	3.903			3.903	0.339		0	0				0.339	0.339	0	0	0	0
CO2	LB/HR	0	0																0	0							0	0	10.954	16.012			16.012	0.258		0	0				0.258	0.258	0	0	0	0
NAF	LB/HR	0	0																0.048	0.048							0.048	0.048	0.048	0.048			0.048	0.048		0	0				0.048	0.048	0	0	0	0
NAHCO3	LB/HR	0	0																0	0							0	0	0.015	0.015			0.015	0.015		0	0				0.015	0.015	0	0	0	0
NACL	LB/HR	0	0																0	0							0.33	0.33	0.33	0.33			0.33	0.33		0	0				0.33	0.33	0	0	0	0
NA2CO3	LB/HR	0	0																0	0							0.01	0.01	0	0			0	0		0	0				0	0	0	0	0	0
NA2SO4	LB/HR	0	0																0	0							0.724	0.724	0.724	0.724			0.724	0.724		0	0				0.724	0.724	0	0	0	0
NAH2PO4	LB/HR	0	0																0	0							0.143	0.143	0.143	0.143			0.143	0.143		0	0				0.143	0.143	0	0	0	0
AL2O3	LB/HR	0	0																0	0							0	0	0	0			0	0		0	0				0	0	0	0	0	0
TOTAL LIQUID	LB/HR	37.506	37.506	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	650	650	0	0	0	0	0	0	2942.661	2942.661	3624.708	3663.166	0	0	3663.166	3614.445	0	2.334	2.334	0	0	0	3616.779	3616.779	36285.179	4500	4500	36285.179
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	650.0	650.0	650.0	687.5	477.5	377.5	100.0	1065.0	2942.7	2942.7	4107.6	4107.6	333.3	333.3	3774.3	3774.3	159.8	493.2	2.3	490.8	1472.5	1472.5	3616.8	3616.8	36285.2	4500.0	4500.0	36285.2
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	650.0	650.0	650.0	687.5	477.5	377.5	100.0	1065.0	2942.7	2942.7	4107.6	4107.6	333.3	333.3	3774.3	3774.3	159.8	493.2	2.3	490.8	1472.5	1472.5	3616.8	3616.8	36285.2	4500.0	4500.0	36285.2
NOTES																																							1	1						

1 - Represents flow from three SCWO trains.

GENERAL NOTES:

1. ALL INFORMATION, CALCULATIONS, AND ASSUMPTIONS 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. 7, AUGUST 2006.

△6 1

cn=Blayne Monen, o=Configuration Management, ou=Issued, c=US
Signature Valid 2006.08.09 14:58:06 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
6		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 [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

GENERAL ATOMICS

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 9 | REV 6

BGCAPP_D3.BDR

CASE 6: IDLE 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	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		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	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	77	78.5																77	77.9	77.9	78.1	70	70	70	1200	77	77.9	383	140	140	45	140	137.5	137.5	93.2	93.2	93.2	93.2	110	137.5	137.4	90	90	106	119
PRESSURE	PSIA	44.23	3665																99.23	3665	3665	3665	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	14.23	30.23	65	65	45	45
AVERAGE VOLUMETRIC FLOW	GPM (ACFM)	0.557	0.556																1.301	1.288	1.288	1.843	(2.332)	(2.239)	(0.099)	(11.436)	10.033	9.933	43.755	31.788	(1.956)	(384.614)	17.143	1522.027	(201.897)	4546.094	0.023	(607.763)	(1823.290)	(1876.916)	11.861	11.860	126.786	9.030	9.059	127.593
*** VAPOR PHASE ***																																														
DENSITY	LB/FT3																						17.85	17.85	16.826	4.789			10.584	15.33	15.33	0.078	15.33	0.063	0.063	0.07		0.07	0.07	0.068						
VISCOSITY	cP																						0.026	0.026	0.025	0.041			0.029	0.026	0.026	0.018	0.026	0.020	0.020	0.019		0.019	0.019	0.019						
*** LIQUID PHASE ***																																													
DENSITY	LB/FT3	53.313	53.439																62.267	62.928	62.928	60.071					62.245	62.868	54.781	60.946			60.946	61.408		62.066	62.066				61.408	61.412	62.129	62.129	61.926	61.736
VISCOSITY	cP	1.218	1.194																0.913	0.902	0.902	0.945					0.913	0.904	0.135	0.46			0.46	0.485		0.754	0.754				0.485	0.485	0.783	0.783	0.657	0.576
MOLECULAR WEIGHT		32.992	32.992																18.015	18.015	18.015	20.513	28.863	28.863	28.863	25.35	18.022	18.022	20.434	20.434	29.743	29.743	18.822	18.822	28.209	29.265	18.018	29.347	29.347	29.347	18.023	18.015	18.015	18.015	18.015	18.015
ENTHALPY	MM BTU/HR	-0.922	-0.921																-4.433	-4.427	-4.427	-5.348	-0.153	-0.049	-0.002	-5.47	-34.159	-34.109	-39.566	-41.318	-0.89	-0.903	-40.428	-40.383	-0.974	-1.877	-0.078	-1.799	-5.397	-5.366	-39.486	-39.486	-430.157	-30.635	-30.564	-428.335
VAPOR																																													
H2O	LB/HR																						0	0	0	919.002			169.546	4.169	3.127	3.127	1.042	95.092	95.092	86.728		86.728	260.185	260.185						
IPA	LB/HR																						0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
N2	LB/HR																						1885.9	1810.395	75.505	1810.395			1875.278	1874.211	1405.659	1405.659	468.553	480.193	480.193	1885.852		1885.852	5657.555	5657.555						
O2	LB/HR																						578.176	555.028	23.148	184.937			206.543	205.878	154.408	154.408	51.469	53.667	53.667	208.075		208.075	624.225	624.225						
ARGON	LB/HR																						32.185	30.896	1.289	30.896			26.081	14.80576	11.10447	11.104	3.701	20.469	20.469	31.573		31.573	94.718	94.718						
CO2	LB/HR																						1.444	1.386	0.058	340.725			316.412	302.174	226.631	226.631	75.544	113.749	113.749	340.379		340.379	1021.136	1021.136						
NAF	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						
NACL	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						
NA2SO4	LB/HR																						0	0	0	0			0	0	0	0	0	0	0	0		0	0	0						
NAH2PO4	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						
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	0.0	0.0	0.0	0.0	2497.7	2397.7	100.0	3286.0	0.0	0.0	2593.9	2401.2	1800.9	1800.9	600.3	763.2	763.2	2552.6	0.0	2552.6	7657.8	7657.8	0.0	0.0	0.0	0.0	0.0	0.0
Mass Flow LIQUID lb/hr																																													
H2O	LB/HR	83.792	83.792																650	650	650	733.792					5006.973	5006.973	5756.426	5921.802			5921.802	5827.752		11.491	11.49				5839.243	5839.243	63185.25	4500	4500	63185.25
IPA	LB/HR	154.457	154.457																0	0	0	154.457					0	0	0	0			0	0		0	0				0	0	0	0	0	0
N2	LB/HR	0	0																0	0	0	0					0	0	10.622	11.689			11.689	0.048		0	0				0.049	0.049	0	0	0	0
O2	LB/HR	0	0																0	0	0	0					0	0	1.542	2.207			2.207	0.01		0	0				0.01	0.01	0	0	0	0
ARGON	LB/HR	0	0																0	0	0	0					0	0	6.104	17.37984			17.38032	0.612		0.001	0.001				0.612991	0.612991	0	0	0	0
CO2	LB/HR	0	0																0	0	0	0					0	0	24.362	38.599			38.599	0.394		0.001	0.001				0.395	0.395	0	0	0	0
NAF	LB/HR	0	0																0	0	0	0					0.038	0.038	0.038	0.038			0.038	0.038		0	0				0.038	0.038	0	0	0	0
NAHCO3	LB/HR	0	0																0	0	0	0					0	0	0.033	0.033			0.033	0.033		0	0				0.033	0.033	0	0	0	0
NACL	LB/HR	0	0																0	0	0	0					0.617	0.617	0.617	0.617			0.617	0.617		0	0				0.617	0.617	0	0	0	0
NA2CO3	LB/HR	0	0																0	0	0	0					0.021	0.021	0	0			0	0		0	0				0	0	0	0	0	0
NA2SO4	LB/HR	0	0																0	0	0	0					1.309	1.309	1.309	1.309			1.309	1.309		0	0				1.309	1.309	0	0	0	0
NAH2PO4	LB/HR	0	0																0	0	0	0					0.262	0.262	0.262	0.262			0.262	0.262		0	0				0.262	0.262	0	0	0	0
AL2O3	LB/HR	0	0																0	0	0	0					0.003	0.003	0.003	0.003			0.003	0.003		0	0				0.003	0.003	0	0	0	0
TOTAL LIQUID	LB/HR	238.249	238.249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	650	650	650	888.249	0	0	0	0	5009.223	5009.223	5801.318	5993.939	0	0	5993.939	5831.078	0	11.49319725	11.4922	0	0	0	5842.572	5842.572	63185.25	4500	4500	63185.25
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	650.0	650.0	650.0	888.2	2497.7	2397.7	100.0	3286.0	5009.2	5009.2	8395.2	8395.2	1800.9	1800.9	6594.2	6594.2	763.2	2564.1	11.5	2552.6	7657.8	7657.8	5842.6	5842.6	63185.2	4500.0	4500.0	63185.2
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	650.0	650.0	650.0	888.2	2497.7	2397.7	100.0	3286.0	5009.2	5009.2	8395.2	8395.2	1800.9	1800.9	6594.2	6594.2	763.2	2564.1	11.5	2552.6	7657.8	7657.8	5842.6	5842.6	63185.2	4500.0	4500.0	63185.2
NOTES																																							1	1						
1 - Represents flow from three SCWO trains.																																													

GENERAL NOTES:

1. ALL INFORMATION, CALCULATIONS, AND ASSUMPTIONS 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. 7, AUGUST 2006.

△6 1

Signature Valid
cn=Blayne Monen,
o=Configuration Management,
ou=Issued, c=US
2006.08.09 14:58:24 -07'00'

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
△6		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

BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT PROJECT (BGCAPP)
RICHMOND, KENTUCKY

CONTRACT NO. DAAA09-03-D-0023

SCWO PROCESSING BUILDING
SCWO
PROCESS FLOW DIAGRAM

PROFESSIONAL STAMP

DRAWING NUMBER 24915-10-M5-SCWO-00001 | SHEET 9 OF 9 | REV 6

BGCAPP_D3.BDR

MP-HSS-0104A/B
MP-HSS-0105A/B
MP-HSS-0106A/B
ORGANIC HYDROLYSATE
PUMPS & SPARES
CAPACITY: 0.6 GPM

MP-HSS-0107A/B
MP-HSS-0108A/B
MP-HSS-0109A/B
AQUEOUS HYDROLYSATE
PUMPS & SPARES
CAPACITY: 23.4 GPM

MT-HSS-0105/0106
AGENT HYDROLYSATE
STORAGE TANKS
WORKING CAPACITY: 315,000 GAL EA
(NOTE 7)

MT-HSS-0104
AGENT HYDROLYSATE
STORAGE TANK
WITH AGITATOR
WORKING CAPACITY: 80,000 GAL
(NOTES 7,9)

MF-HSS-0104
AGENT HYDROLYSATE
STORAGE TANK
AGITATOR
HP: TBD
2 8

NOTES:

1. DELETED
2. NITROGEN IS USED FOR BLANKETING. PRESSURE IN TANK IS TO BE 0.2 PSIG MINIMUM.
3. THERE ARE TWO PARALLEL STATIC MIXERS, ONE IS USED AS A SPARE.
4. FLOW IS INTERMITTENT.
5. FLOATING SUCTION WILL BE USED FOR VX AND GB CAMPAIGNS IF REQUIRED.
6. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
7. TANKS ARE FIXED ROOF, 315,000 GALLON TANKS ARE USED FOR GB/H HYDROLYSATE STORAGE. AGITATOR TO BE INSTALLED IN 80,000 GALLON TANK FOR THOROUGH MIXING OF ORGANIC AND AQUEOUS LAYERS OF VX HYDROLYSATE.
8. SAMPLE CONNECTION IS PROVIDED TO BE USED AS AND IF REQUIRED.
9. TANK AND ASSOCIATED TRANSFER LINES TO BE INSULATED AND HEAT TRACED, IF REQUIRED, TO MAINTAIN 77 TO 100°F.

2 9

2 7

152

HSS-00002
TO COMMON
VENT LINE

2 6

MF-HSS-0104

SIC

M

151

(NOTE 2)

NIT-00001
NITROGEN

ANS-00001
AGENT HYDROLYSATE
TO/FROM ANS

451

(NOTE 8) SC

FIC

NNF

FC

ORGANIC LAYER
(NOTES 4,5)

MP-HSS-0104A/B

2 3

PdI

FFIC

AQUEOUS LAYER
(NOTE 4)

MP-HSS-0107A/B

STATIC
MIXER
(NOTE 3)

2 1

634

SCWO-00001
TO HYDROLYSATE
BLEND TANK

MT-HSS-0104
(NOTES 7,9)

2 5

151

(NOTE 2)

152

HSS-00002
TO COMMON
VENT LINE

2 4

(NOTE 8) SC

FIC

NNF

FC

ORGANIC LAYER
(NOTES 4,5)

MP-HSS-0105A/B

2 2

PdI

FFIC

AQUEOUS LAYER
(NOTE 4)

MP-HSS-0108A/B

STATIC
MIXER
(NOTE 3)

MT-HSS-0105

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
3	6/27/06	(IFA) UPDATE FOR DC's	NI	FJ	SH	JB	BB
1	10/25/04	ISSUED FOR DESIGN (IFD) SHEET REDRAWN	EV	PC	SH	JB	JU
0	6/11/04	ISSUED FOR DESIGN (IFD)	EV	PC	SH	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

HYDROLYSATE STORAGE AREA (HSA) AGENT HYDROLYSATE PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-11-M5-HSS-00001
SHEET 1 OF 2
REV 2

PROFESSIONAL STAMP

DESIGN FILE: s:\2d\pr\11-m5-hss-1-1.pfz
PLOTTED BY: 514.39 ON 6/30/2006 AT 9:45:56 AM

2 11-M5-HSS-1-1.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-11-M5-HSS-00001

AGENT HYDROLYSATE SYSTEM - CASE AGENT GB CO-PROCESSING

STREAM NUMBER	451	634	1510	1511	1520	1521
DESCRIPTION	TOTAL AGENT HYDROLYSATE FROM ANS	AGENT HYDROLYSATE TO SCWO BLEND TANKS	NITROGEN TO AGENT HYDROLYSATE STORAGE TANK 0104	NITROGEN TO AGENT HYDROLYSATE STORAGE TANKS 0105/0106	AGENT HYDROLYSATE STORAGE TANK 0104 VENT	AGENT HYDROLYSATE STORAGE TANKS 0105/0106 VENT
TEMPERATURE, °F	100	77	77	77	77	77
PRESSURE, PSIA	51.23	64.23	14.43	14.43	14.33	14.33
INSTANTANEOUS FLOW RATE, GPM (ACFM)	156	24	(4)	(9)	(22)	(27)
DENSITY, LB/FT3	63.25	63.50	0.070	0.070	0.070	0.070
VISCOSITY, cP	0.72	0.72	0.018	0.018	0.018	0.018
MW			28.01	28.01	28.01	28.01
COMPONENT FLOWS, LB/HR						
Nitrogen	4.39	6.5E-01	1.57	99.02	1.57	99.02
Tributylamine (TBA)	11.60	1.73				
Isopropyl Fluoride	1.3E-01	1.9E-02				
1,3-Diisopropylurea (DIPU)	7.59	1.13				
"GB"-Pyro-Na (Na-salt of isopropyl methylphosphonic acid)	439.68	65.39				
IPA (Isopropyl alcohol)	18.19	2.70				
Sodium fluoride	106.03	15.77				
Other organics	11.97	1.78				
NaOH	111.35	16.56				
Water	5050.3	751.03				
Chloroform	3.0E-01	4.4E-02				
Isopropyl methylphosphonic acid (IMPA)	2.32	3.5E-01				
TOTAL THROUGHPUT LB/HR (Note 1)	5763.8	857.14	1.57	99.02	1.57	99.02
NOTE(S)		2	5	6	5	6

AGENT HYDROLYSATE SYSTEM - CASE AGENT VX CO-PROCESSING

STREAM NUMBER	451	634	1510	1511	1520	1521
DESCRIPTION	TOTAL AGENT HYDROLYSATE FROM ANS	AGENT HYDROLYSATE TO SCWO BLEND TANKS	NITROGEN TO AGENT HYDROLYSATE STORAGE TANK 0104	NITROGEN TO AGENT HYDROLYSATE STORAGE TANKS 0105/0106	AGENT HYDROLYSATE STORAGE TANK 0104 VENT	AGENT HYDROLYSATE STORAGE TANKS 0105/0106 VENT
TEMPERATURE, °F	100	77	77	77	77	77
PRESSURE, PSIA	51.23	64.23	14.43	14.43	14.33	14.33
INSTANTANEOUS FLOW RATE, GPM (ACFM)	156	24	(4)	(9)	(22)	(27)
DENSITY, LB/FT3	66.32	73.34	0.070	0.070	0.070	0.070
VISCOSITY, cP	2.70	6.30	0.018	0.018	0.018	0.018
MW			28.01	28.01	28.01	28.01
COMPONENT FLOWS, LB/HR						
Diisopropylcarbodiimide (DICDI-stabilizer)	1.07	4.3E-01				
Diisopropylamine (DIPA)	5.1E-01	2.0E-01				
1,3-Dicyclohexyl-carbodiimide (DCCDI-stabilizer)	5.73	2.28				
Nitrogen	1.0E-01	4.0E-02	1.57	99.02	1.57	99.02
1,3-Diisopropylrurea (DIPU)	1.1E-01	4.3E-02				
EMPA Na (Na-isopropyl methylphosphonate)	170.18	67.61				
MPA Na2 (Na2-methylphosphonate)	17.40	6.91				
RS Na	221.21	87.89				
Ethanol	5.08	2.02				
RSSR	10.74	4.27				
NaOH	83.46	33.16				
Water	1633.6	649.02				
Organics	8.14	3.23				
Aluminum	6.5E-04	2.6E-04				
Nickel	4.8E-06	1.9E-06				
Copper	2.1E-04	8.2E-05				
Iron	8.6E-03	3.4E-03				
Calcium	5.5E-02	2.2E-02				
Silicon	4.5E-02	1.8E-02				
Other Metals	1.3E-04	5.3E-05				
TOTAL THROUGHPUT LB/HR (Note 1)	2157.4	857.14	1.57	99.02	1.57	99.02
NOTE(S)	3	2,3	5	6	5	6

AGENT HYDROLYSATE SYSTEM - CASE AGENT H

STREAM NUMBER	451	634	1510	1511	1520	1521
DESCRIPTION	TOTAL AGENT HYDROLYSATE FROM ANS	AGENT HYDROLYSATE TO SCWO BLEND TANKS	NITROGEN TO AGENT HYDROLYSATE STORAGE TANK 0104	NITROGEN TO AGENT HYDROLYSATE STORAGE TANKS 0105/0106	AGENT HYDROLYSATE STORAGE TANK 0104 VENT	AGENT HYDROLYSATE STORAGE TANKS 0105/0106 VENT
TEMPERATURE, °F	100	77	77	77	77	77
PRESSURE, PSIA	51.23	64.23	14.43	14.43	14.33	14.33
INSTANTANEOUS FLOW RATE, GPM (ACFM)	156	24	(4)	(9)	(22)	(27)
DENSITY, LB/FT3	65.20	65.20	0.070	0.070	0.070	0.070
VISCOSITY, cP	0.68	1.35	0.018	0.018	0.018	0.018
MW			28.01	28.01	28.01	28.01
COMPONENT FLOWS, LB/HR						
Polysufides (HS3)	2.50	1.01				
Dithiane	50.00	20.14				
TDG	91.44	36.83				
Q-OH	14.02	5.65				
Sodium chloride (NaCl)	143.46	57.78				
NaOH	1.44	0.58				
Water	3319.3	1336.8				
Nitrogen	1.33	5.3E-01	1.57	99.02	1.57	99.02
Ethylene Glycol	24.96	10.05				
S6	37.70	15.18				
Fe	37.85	15.24				
RCRA 8	1.8E-02	7.3E-03				
Mn	3.0E-01	1.2E-01				
Si	5.2E-02	2.1E-02				
Other Metals/Elements	9.7E-02	3.9E-02				
TOTAL THROUGHPUT LB/HR (Note 1)	3724.5	1500.0	1.57	99.02	1.57	99.02
NOTE(S)		2	5	6	5	6

NOTES:

1. AVERAGED FOR 24 HOURS.
2. HOURLY FLOWRATE TO THE SCWO DAY TANK IS FOR FOUR SCWO UNITS AND IS BASED ON GA SUGGESTED ENERGETIC AND AGENT HYDROLYSATE BLENDING RATIO AS FOLLOWS:
   VX - 3.5:1
   GB - 3.5:1
   H - 1:1
3. ORGANIC LAYER IS APPROXIMATELY 2.5% OF THE TOTAL FLOW IN STREAM 451.
4. INSTANTANEOUS FLOW RATE IS BASED ON THE BLEND TANK CAPACITY. CASE H IS THE CONTROLLING CASE.
5. NITROGEN FEED AND VENT FOR 80,000 GALLON HYDROLYSATE TANK.
6. NITROGEN FEED AND VENT FOR TWO 315,000 GALLON HYDROLYSATE TANKS.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
2	6/27/06	(IFA) UPDATE FOR DC's	NI	FJ	SH	JB	BB
1	10-28-04	ISSUED FOR DESIGN (IFD)	EV	PC	SH	JB	JU
0	6-11-04	ISSUED FOR DESIGN (IFD)	EV	PC	SH	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

HYDROLYSATE STORAGE AREA (HSA) AGENT HYDROLYSATE PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-11-M5-HSS-00001 | SHEET 2 OF 2 | REV 2

PROFESSIONAL STAMP

DESIGN FILE: s:\2dvgn\11-m5-hss-1-2.pfz
PLOTTED BY: 51439 ON 6/30/2006 AT 9:45:56 AM

11-M5-HSS-1-2.PFZ

BGCAPP_E2.BDR

MP-HSS-0604A/B
MP-HSS-0605A/B
ENERGETICS HYDROLYSATE
PUMPS & SPARES
CAPACITY: 22 GPM
3 3

MT-HSS-0604/0605
ENERGETICS HYDROLYSATE
STORAGE TANKS
WORKING CAPACITY: 180,000 GAL EA
(NOTE 6)
3 4

MF-HSS-0604/0605
ENERGETICS HYDROLYSATE
STORAGE TANK
SIDE AGITATORS
HP: TBD

NOTES:

1. DELETED
2. NITROGEN IS USED FOR BLANKETING. PRESSURE IN TANK IS TO BE 0.2 PSIG MINIMUM.
3. DELETED
4. FOR SYMBOL DEFINITION SEE DRAWING 24915-00-M5-00-00002.
5. SAMPLE CONNECTION TO BE USED AS REQUIRED.
6. TANKS SHOULD BE INERCONNECTED IF MAINTENANCE IS NEEDED ON ANY FILLED TANK.
7. CARBON CANISTER FILTER SHALL HAVE AN INSTALLED SPARE.
8. ID FAN MAY BE REQUIRED DEPENDING ON PIPING CONFIGURATION.

3 6

HSS-00001
FROM HSS-0104
152

HSS-00001
FROM HSS-0105
AND HSS-0106
152

NIT-00001
NITROGEN
153

154

3 5

CARBON
CANISTER
(NOTE 7)

TOC
AI

542

VENT TO
ATMOSPHERE
AT AN ELEVATED
LOCATION
(NOTE 8)

OTM-00001
MPT CONDENSATE
FROM OTM
820

ENS-00001
ENERGETICS HYDROLYSATE
FROM ENS
551

3 2

(NOTE 2)

LC

M
MF-HSS-0604

MT-HSS-0604
(NOTE 6)
3 1

MP-HSS-0604A/B

(NOTE 5)
SC

3 7
FC

546
APS-00001
TO ALUMINUM
PRECIPITATION

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
3	6/27/06	(IFA) UPDATE FOR DC's	NI	JW	SH	JB	BB
2	12/23/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	JB	CH
1	11/3/04	ISSUED FOR DESIGN (IFD)	WW	GO	SH	JB	JU
0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	NI	SH	JB	JU

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

HYDROLYSATE STORAGE AREA (HSA) ENERGETICS HYDROLYSATE PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-11-M5-HSS-00002
SHEET 1 OF 2
REV 3

PROFESSIONAL STAMP

DESIGN FILE: s:\2d\pr\11-m5-hss-2-1.pfz
PLOTTED BY: 51439 ON 6/30/2006 AT 9:45:57 AM

11-M5-HSS-2-1.PFZ

BGCAPP_E2.BDR

MATERIAL BALANCE TABLE FOR PFD: 24915-11-M5-HSS-00002
HYDROLYSATE STORAGE AREA (HSA) - ENERGETIC HYDROLYSATE

CASE: AGENT GB PROCESSING THROUGHPUT

STREAM NUMBER	546	551	820	1520	1521	1531	1541	1542
Description	ENERGETIC HYDROLYSATE TO APS	ENERGETIC HYDROLYSATE TO STORAGE TANKS	OTM SCRUBBER CONDENSATE (Note 3)	AGENT HYDROLYSATE STORAGE TANK 0104 VENT	AGENT HYDROLYSATE STORAGE TANKS 0105/0106 VENT	NITROGEN TO 0604/0605 STORAGE TANKS	VENT FROM 0604/0605 STORAGE TANKS	COMBINED VENT TO ATM
Temperature, °F	77	140	170	77	77	77	77	77
Pressure, PSIA	75	75	89.23	14.33	14.33	14.43	14.33	14.23
Instantaneous Volume Flow, GPM (ACFM)	21.9	100	6.10	(22)	(27)	(6)	(17)	(44)
Density, LB/FT3	73.80	77.24	61.10	0.070	0.070	0.070	0.070	0.069
Viscosity, CP	13.05	11.45	0.36	0.018	0.018	0.018	0.018	0.018
MW				28.01	28.01	28.01	28.01	28.01
Component Flows, LB/HR								
O2	1.1E-03	2.5E-07	1.3E-03					
N2	1.3E-02	1.1E-02	5.7E-03	1.57	99.02	62.61	62.61	163.20
H2	2.1E-10	1.4E-10	1.4E-10					
CO2	6.2E-03		8.0E-03					
CO	2.4E-08		3.0E-08					
CL2	4.9E-07		6.3E-07					
F2								
NH3	5.9E-01	7.6E-01						
N2O	8.3E-04	1.1E-03						
NO	1.2E-05		1.6E-05					
NO2	3.2E-04		4.1E-04					
SO2	2.3E-10		2.9E-10					
H2O	1941.1	1210.5	1274.9					
NAOH	161.84	207.20	2.8E-02					
HCL								
H2SO4								
H3PO4	9.0E-09		1.1E-08					
HF	1.2E-05		1.6E-05					
HNO3								
NA2SO4	18.62	23.84						
NANO2	9.13	11.69						
NANO3	2.9E-02	3.7E-02	4.9E-08					
NA2CO3	3.2E-01		4.1E-01					
NA2HPO4	1.66		2.12					
NA3PO4	3.3E-03		4.2E-03					
NAF	4.6E-01		5.9E-01					
NAHCO3	3.29		4.21					
NAH2PO4	2.5E-02		3.1E-02					
(NH4)2SO4	1.1E-04	1.3E-04						
NAHSO3	9.2E-04		1.2E-03					
NA2SO3	3.3E-02		4.2E-02					
NH4HSO4								
AMMHCO3								
NH4CL(S)								
AL(OH)3	4.64	5.95						
ALPO4								
SODIUM FORMATE	26.23	33.58						
SODIUM ACETATE	3.29	4.22						
GLYCEROL								
NAALO2	137.22	175.70						
TOTAL THROUGHPUT, LB/HR (Note 2)	2308.5	1673.5	1282.3	1.57	99.02	62.61	62.61	163.20

CASE: AGENT VX PROCESSING THROUGHPUT

STREAM NUMBER	546	551	820	1520	1521	1531	1541	1542
Description	ENERGETIC HYDROLYSATE TO APS	ENERGETIC HYDROLYSATE TO STORAGE TANKS	OTM SCRUBBER CONDENSATE (Note 3)	AGENT HYDROLYSATE STORAGE TANK 0104 VENT	AGENT HYDROLYSATE STORAGE TANKS 0105/0106 VENT	NITROGEN TO 0604/0605 STORAGE TANKS	VENT FROM 0604/0605 STORAGE TANKS	COMBINED VENT TO ATM
Temperature, °F	77	140	169	77	77	77	77	77
Pressure, PSIA	75	75	89.23	14.33	14.33	14.43	14.33	14.23
Instantaneous Volume Flow, GPM (ACFM)	22.0	100	11.90	(22)	(27)	(6)	(17)	(44)
Density, LB/FT3	70.60	78.10	60.86	0.070	0.070	0.070	0.070	0.069
Viscosity, CP	7.75	12.62	0.36	0.018	0.018	0.018	0.018	0.018
MW				28.01	28.01	28.01	28.01	28.01
Component Flows, LB/HR								
O2	1.6E-03	2.5E-07	3.3E-03					
N2	1.2E-02	1.2E-02	1.2E-02	1.57	99.02	62.61	62.61	163.20
H2	2.1E-10	1.6E-10	2.5E-10					
CO2	8.5E-03		1.7E-02					
CO	3.1E-08		6.2E-08					
CL2								
F2								
NH3	4.5E-01	9.0E-01						
N2O	7.6E-04	1.5E-03						
NO	1.9E-05		3.8E-05					
NO2	4.6E-04		9.2E-04					
SO2	4.4E-07		8.8E-07					
H2O	2032.0	1337.5	2737.2					
NAOH	121.64	243.92	1.0E-03					
HCL								
H2SO4								
H3PO4	4.6E-07		9.3E-07					
HF								
HNO3								
NA2SO4	14.04	28.15	7.4E-07					
NANO2	6.90	13.83						
NANO3	2.2E-02	4.5E-02	1.7E-05					
NA2CO3	1.9E-03		3.9E-03					
NA2HPO4	0.37		7.5E-01					
NA3PO4	3.1E-05		6.2E-05					
NAF								
NAHCO3	3.5E-01		7.0E-01					
NAH2PO4	9.7E-02		1.9E-01					
(NH4)2SO4	7.1E-05	1.4E-04						
NAHSO3	1.4E-01		2.8E-01					
NA2SO3	2.6E-01		5.1E-01					
NH4HSO4								
AMMHCO3								
NH4CL(S)								
AL(OH)3	3.04	6.09						
ALPO4								
SODIUM FORMATE	19.81	39.72						
SODIUM ACETATE	2.49	4.99						
GLYCEROL								
NAALO2	104.13	208.81						
TOTAL THROUGHPUT, LB/HR (Note 2)	2305.7	1884.0	2739.7	1.57	99.02	62.61	62.61	163.20

CASE: AGENT H PROCESSING THROUGHPUT

STREAM NUMBER	546	551	820	1520	1521	1531	1541	1542
Description	ENERGETIC HYDROLYSATE TO APS	ENERGETIC HYDROLYSATE TO STORAGE TANKS	OTM SCRUBBER CONDENSATE (Note 3)	AGENT HYDROLYSATE STORAGE TANK 0104 VENT	AGENT HYDROLYSATE STORAGE TANKS 0105/0106 VENT	NITROGEN TO 0604/0605 STORAGE TANKS	VENT FROM 0604/0605 STORAGE TANKS	COMBINED VENT TO ATM
Temperature, °F	77	140	157	77	77	77	77	77
Pressure, PSIA	75	75	89.23	14.33	14.33	14.43	14.33	14.23
Instantaneous Volume Flow, GPM (ACFM)	12.7	100	3.32	(22)	(27)	(6)	(17)	(44)
Density, LB/FT3	68.34	72.54	61.27	0.070	0.070	0.070	0.070	0.069
Viscosity, CP	4.97	6.24	0.40	0.018	0.018	0.018	0.018	0.018
MW				28.01	28.01	28.01	28.01	28.01
Component Flows, LB/HR								
O2	1.6E-03	1.5E-07	2.2E-03					
N2	9.6E-03	6.9E-03	6.4E-03	1.57	99.02	62.61	62.61	163.20
H2	1.1E-10		1.5E-10					
CO2	3.5E-03		4.8E-03					
CO	2.2E-08		3.0E-08					
CL2								
F2								
NH3	6.5E-02	9.0E-02						
N2O								
NO	9.2E-06		1.3E-05					
NO2	1.2E-10		1.6E-10					
SO2	1.3E-08		1.8E-08					
H2O	1346.0	685.85	1174.7					
NAOH	33.34	46.08	3.2E-03					
HCL								
H2SO4								
H3PO4								
HCLO	2.2E-06		3.1E-06					
HNO3								
NA2SO4	2.05	2.83						
NANO2	1.26	1.74	6.0E-03					
NANO3	5.4E-03		7.5E-03					
NA2CO3	1.0E-01		1.4E-01					
NA2HPO4								
NA3PO4								
NACL	7.0E-01		9.7E-01					
NAHCO3	1.44		2.00					
NAH2PO4								
(NH4)2SO4	3.2E-05	4.4E-05						
NAHSO3	4.8E-02		6.7E-02					
NA2SO3	1.28		1.77					
NH4HSO4								
NAOCL	3.1E-05		4.2E-05					
NH4CL(S)								
AL(OH)3	2.3E-01	3.2E-01						
ALPO4								
SODIUM FORMATE	4.73	6.54						
SODIUM ACETATE	3.2E-01	0.44						
GLYCEROL								
NAALO2	1.06	1.46						
TOTAL THROUGHPUT, LB/HR (Note 2)	1392.6	745.3	1179.7	1.57	99.02	62.61	62.61	163.20

NOTES:

1. FLOWRATE TO THE SCWO BLEND TANK IS FOR THREE SCWO UNITS AND IS BASED ON GA SUGGESTED ENERGETIC AND AGENT HYDROLYSATE BLENDING RATIO.
2. THE PEAK AND AVERAGE COMPOSITION OF THE ENERGETICS HYDROLYSATE TO THE APS ARE THE SAME AND ARE CALCULATED BASED ON THE REQUIRED PROCESSING RATES OF THE DOWNSTREAM SYSTEMS, I.E. APS, AFS, AND SCWO UNITS.
3. OTM CONDENSATE COMPOSITION IS BASED ON AVERAGE OPERATING RATE OF THE MPT/OTM, EXCEPT FOR THE INSTANTANEOUS VOLUMETRIC FLOW, WHICH IS BASED ON THE INSTANTANEOUS AGENT VAPORIZATION RATE FOR THE MPT/OTM.

NO.	DATE	DESCRIPTION	DR	CK	DL	PE	APPD
2	6/27/06	(IFA) UPDATE FOR DC's	NI	JW	SH	JB	BB
1	11/4/04	ISSUED FOR DESIGN (IFD)	WW	GO	SH	JB	JU
0	7/2/04	ISSUED FOR DESIGN (IFD)	WW	EV	SH	JB	JU

QUALITY ☐ Q ☒ Non-Q

BECHTEL PARSONS BLUE GRASS
A Joint Venture of Bechtel Nationals, 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 (HSA) ENERGETICS HYDROLYSATE PROCESS FLOW DIAGRAM

DRAWING NUMBER 24915-11-M5-HSS-00002 | SHEET 2 OF 2 | REV 2

PROFESSIONAL STAMP

DESIGN FILE: s:\26dpr\11-m5-hss-2-2.plt
PLOTTED BY: 51439 ON 6/30/2006 AT 9:45:57 AM

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BGCAPP_E2.BDR

Appendix D Contents

Material Safety Data Sheets (MSDSs)

List of MSDS

1. **Distilled Mustard (HD) (MSDS for H is not available)**
2. Lethal Nerve Agent VX
3. Lethal Nerve Agent GB
4. RDX (Cyclonitrile)
5. trinitrotoluene (TNT)
6. tetryl
7. nitroglycerin (the explosive chemical, not the medicine)
8. nitrocellulose (the explosive chemical, not the lacquer filler)
9. diethylphthlate
10. Glycerine Triacetate - triacetin
11. lead azide
12. lead stearate
13. 2-nitrodiphenylamine

Material Safety Data Sheet

Distilled Mustard (HD)

Revised: 15 March 2006

Section I - General Information

Manufacturer's Address:
U.S. Army Edgewood Chemical Biological Center (ECBC)
ATTN: AMSRD-ECB-CB-CR
Aberdeen Proving Ground, MD 21010-5424
Business Phone: 410-436-4411 or 4414, Monday through Friday during the hours of 8:00 AM to 4:30 PM EDT

CAS Registry Number: 505-60-2

Chemical Name: Bis- (2-chloroethyl) sulfide

Trade name and synonyms:
H; HD; HS
Mustard Gas
Sulfur mustard; Sulphur mustard gas
Sulfide, bis (2-chloroethyl)
Bis (beta-chloroethyl) sulfide
1,1'-thiobis(2-chloroethane)
1-chloro-2 (beta-chloroethylthio) ethane
Beta, beta'-dichlorodiethyl sulfide
2,2'dichlorodiethyl sulfide
Di-2-chloroethyl sulfideBeta, beta'-dichloroethyl sulfide
2,2'-dichloroethyl sulfide
EA 1033
Iprit
Kampstoff "Lost"; Lost
S-Lost; S-yperite; Schewefel-lost
Senfgas
Yellow Cross Liquid
Yperite;Y

Chemical Family: Chlorinated sulfur compound

Molecular Formula and Structural Formula:

$C_4 H_8 Cl_2 S$

$ClCH_2CH_2SCH_2CH_2Cl$

1

NFPA 704 Signal:

Health - 4
Flammability - 1
Reactivity - 1
Special - 0

Section II - Ingredients

Ingredients/Name: Sulfur Mustard
Percentage by Weight: 100%

Section III - Physical Data

Boiling Point: 218 °C (424.4 °F); at atmospheric pressure HD starts to decompose below the boiling point.

Vapor Pressure (torr): 0.106 @ 25 °C

Vapor Density (relative to air): 5.5

Solubility: HD is practically insoluble in water; solubility of HD in distilled water is 0.92 g HD/100 g @ 22 °C. HD is freely soluble in fats and oils, gasoline, kerosene, most organic solvents and chemical warfare agents.

Specific Gravity (H_20=1): 1.27 @ 25 °C

Freezing/Melting Point (°C): 14.45 °C

Liquid Density (g/mL): 1.2685 g/mL @ 25 °C

Volatility (mg/m^3): 906 @ 25 °C

Viscosity (Centipoise): 5.175 @ 20 °C

Molecular Weight: 159.07

Appearance and Odor: Pale yellow to dark brown oily liquid; colorless when pure. Garlic-like or horseradish odor.

Section IV - Fire and Explosion Data

Flashpoint: 105 °C

Flammability Limits (% by volume): Unknown

Extinguishing Media: Water, fog, foam and CO_2. Avoid use of extinguishing methods that will cause splashing or spreading of HD.

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Special Fire Fighting Procedures: All persons not engaged in extinguishing the fire should be immediately evacuated from the area. Fires involving HD should be contained to prevent contamination to uncontrolled areas. When responding to a fire alarm in buildings or areas containing agents, fire-fighting personnel should wear full firefighter protective clothing (flame resistant) during chemical agent fire-fighting and fire rescue operations. Respiratory protection is required. Positive pressure, full facepiece, NIOSH-approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI) operations officer. In cases where fire fighters are responding to a chemical accident/incident for rescue/reconnaissance purposes they will wear appropriate levels of protective clothing (See Section VIII).

Do not breathe fumes. Skin contact with agent must be avoided at all times. Although the fire may destroy most of the agent, care must still betaken to assure the agent or contaminated liquids do not further contaminate other areas or sewers. Contact with the agent liquid or vapor can be fatal.

Section V - Health Hazard Data

Airborne Exposure Limits (AEL) [2]:

Worker Population Limit (WPL) 8-hr TWA [1] mg/m^3	STEL 15-min TWA [1] mg/m^3	IDLH [1] mg/m^3	General Population Limit (GPL) 12-hr TWA [1] mg/m^3
0.0004	0.003	0.7	0.00002

[1] These values can be found in the DA, Office of the Assistant Secretary, Installations and Environment memo, subject: Implementation Guidance Policy for New Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT, 18 June 2004.
[2] To date, the Occupational Safety and Health Administration (OSHA) have not promulgated a permissible exposure concentration for HD.

Routes of Entry: The routes of entry for mustard agents are inhalation and ingestion, as well as eye and skin contact.

Effects Of Exposure: HD is a vesicant (causing blisters) and alkylating agent producing cytotoxic action on the hematopoietic (blood-forming) tissues, which are especially sensitive. The rate of detoxification of HD in the body is very slow and repeated exposures produce a cumulative effect.

HD is a human carcinogen as cited by the International Agency for Research on Cancer (IARC). HD has also been shown to be mutagenic in animals.

Signs and Symptoms: The acute signs and symptoms following mustard exposure are not immediate; they are delayed in appearance. The duration of the latent period and the degree of injury are both dependent on the severity of exposure as well as organs affected. The delay of onset is dose-dependent and may range from hours to days. The latency period for ocular (eye) effects is shorter than that for other tissues.

Mild eye exposure symptoms to mustard include inflammation, conjunctivitis possibly with lacrimation, grittiness in the eye, and erythema (reddening) of the lids and conjunctiva. Severe symptoms include photophobia, blepharospasm, pain, corneal erosion, iritis, conjunctival vascularization, ulceration and corneal opacification (blindness).

Skin exposure to mustard vapor is marked by delayed appearance. Mild symptoms include erythema, edema, itching, burning and pain. Severe symptoms include vesication or blisters. Liquid mustard exposure on skin may

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result in an area of gray-white necrotic skin surrounded by erythema and vesication.

Inhalation of mustard vapor causes damage primarily to the nasopharygeal, larygeal and tracheobronchial mucosa. Respiratory symptoms to mustard vapor vary in degree of onset and intensity related to the degree of exposure. Mild symptoms to the airway include hoarseness, inflammation of the respiratory mucosa, congestion, coughing and edema. Severe symptoms include necrosis, sloughing of the mucosa and chemical pneumonia. Repeated exposures or prolonged inhalation can cause bronchiectasis or chronic bronchitis.

Gastrointestinal symptoms of intense mustard exposure include nausea and vomiting.

Like other alkylating agents, systemic absorption results in injury to the bone marrow, lymph nodes, and spleen producing leukopenia and thrombocytopenia. Other systemic effects include: fever; CNS depression; bradycardia or cardiac irregularities; hemoconcentration; and shock.

Chronic Exposure: Chronic mustard-induced illnesses are most common in the eyes, skin, respiratory track or bone marrow. Delayed, recurrent keratoconjunctivitis of the eyes has been documented in some cases as long as 45 years from original exposure. Healing of mustard blisters may result in skin exfoliation and areas of hypo- or hyperpigmentation. Exposure can cause chronic lung impairment (productive cough, shortness of breath, chest pain, frequent pulmonary infections and bronchitis). Prolonged human exposure has been associated with cancer of the tongue, paranasal sinus, larynx, bronchus, lung, and mediastinum (cavity between the right and left lung). Tumors observed have been of squamous (scale like) or undifferentiated (alterated) cell types. Consider the possibility of skin cancer because of the frequency of this lesion in animal studies. Since sulfur mustard agent is similar in its effects to nitrogen mustard, which has been associated with human leukemia, this disease might also be expected to occur in humans chronically exposed to mustard.

Toxicity Values:

Vapor (Inhalation/Ocular)[1]
ECt50 (Mild) = 25 mg-min/m^3
ECt50 (Severe)[2] = 100 mg-min/m^3 [3]
LCt50 = 1000 mg-min/m^3

Vapor (Percutaneous)[4,5]
ECt50 (Mild) = 50 mg-min/m^3
ECt50 (Severe)[2] = 500 mg-min/m^3
LCt50 = 10000 mg-min/m^3

Liquid (Percutaneous)
ED50 = 600 mg/70 kg man
LD50 = 1400 mg/70 kg man

[1] Estimates for inhalation vapor exposure are based on a minute volume (MV) of 15 liters. The exposure time is 2 minutes. The concentration-time profile for lethality is described by the toxic load model ($C^n t=k$). The toxic load exponent (n) for lethality is 1.5.
[2] Based on ocular (eye) effects.
[3] Recent analysis of archival human data has indicated that this value may be 75 mg-min/m^3.
[4] Personnel are masked.
[5] Values for percutaneous vapor are for moderate temperatures (85 °F and below). The effective dosages for hot temperatures (85 °F and above) will be less by at least a factor of 2.

Emergency And First Aid Procedures:

Prior to rendering first aid, take steps for self protection such as donning a protective mask and other protective equipment. **Immediately** remove individual from contaminated area. Decontaminate the individual as indicated

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below.

Vapor Exposure: Vapor-exposed mustard agent casualties should be decontaminated by removing all clothing in a clean air environment and shampooing or rinsing the hair to prevent vapor off-gassing.

Liquid Exposure: Wash the skin surface and hair in warm or hot water at least three times. The rapid physical removal of a chemical agent is essential. Scrubbing of exposed skin with a stiff brush or bristles is discouraged, because skin damage may occur and may increase absorption of agent. Use liquid soap (dispose of container after use and replace), copious amounts of water, and mild to moderate friction with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse with copious amounts of warm or hot water. Shampoo can be used to wash the hair. If warm or hot water is not available, but cold water is, use cold water. Do not delay decontamination to obtain warm water. Two permissible alternative skin decontaminants include the M291 Skin Decontaminating Kit (SDK) and a 0.5% sodium hypochlorite solution. (**NOTE:** The use of the M291 SDK and/or 0.5% sodium hypochlorite on skin is appropriate in situations where soap and water may not be as efficacious in physically removing particular types of mustard agents, such as those used in certain research and development laboratories. Neither soap and water, 0.5% sodium hypochlorite or the M291 SDK have been shown to be more efficacious than the other for physically removing every type of mustard agent from the skin.) If used, the 0.5% sodium hypochlorite should be applied with mild to moderate friction, with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse to remove any residual sodium hypochlorite with copious amounts of warm or hot water.

Eye Contact: Immediately leave area of contamination and begin flushing eyes, mucous membranes, or open wounds with sterile saline or water. Flush the eyes **Immediately** with sterile saline or water by tilting the head to the side, pulling the eyelids apart with gloved fingers and pouring slowly into the eyes. A Morgan lens may also be used for continuous eye irrigation.

Ingestion: Do not induce vomiting. First symptoms are likely to be gastrointestinal. Seek medical attention **Immediately. Do not handle vomited material to avoid further contamination.**

Inhalation: If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. Do not use mouth-to-mouth resuscitation when facial contamination is present. Seek medical attention **Immediately**.

NOTE: The Office of the Surgeon General is responsible the medical guidance provided in this MSDS. Questions concerning medical guidance provided in the this MSDS may be addressed to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-3258.

Section VI - Reactivity Data

Stability: A small amount of degradation occurs when stored in steel containers for over 50 years. This degradation appears to be caused by the formation of solid deposits "heels" comprised of a six membered ring cyclic sulfonium ion {1-(2-chloroethyl)-1, 4-dithianium chloride}, HD and Fe, which are detected at the bottom of containers.

Decomposition Temperature: 180 °C

Rate of Hydrolysis: HD on or under water undergoes hydrolysis only if dissolved. The rate of HD hydrolysis is controlled by the rate of mass transfer and is very slow.

Hydrolysis Products: Hydrogen chloride, thiodiglycol and sulfonium ion aggregates one of which is also very toxic.

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Action on Metals and Other Materials: Very little when pure. The corrosion rate of HD on steel is 0.0001 in./month @ 65 °C using munitions grade HD.

Hazardous Polymerization: Does not occur.

Section VII - Spill, Leak, And Disposal Procedures

Steps To Be Taken In Case Material Is Released Or Spilled: Only personnel in full protective clothing (See Section VIII) will be allowed in an area where HD is spilled. See Section V for emergency and first aid instructions.

Recommended Field Procedures: The HD should be contained using vermiculite, diatomaceous earth, clay or fine sand and neutralized as soon as possible using copious amounts of nominal 5% sodium hypochlorite solution. Scoop up all material and place in an approved DOT container. Cover the contents with decontaminating solution as above. The exterior of the container will be decontaminated and labeled according to EPA and DOT regulations. All leaking containers will be over packed with sorbent (e.g. vermiculite) placed between the interior and exterior containers. Decontaminate and label according to EPA and DOT regulations. Dispose of the material in accordance with waste disposal methods provided below. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the STEL (See Sections V and VIII).

If 5% sodium hypochlorite solution is not available then the following decontaminants may be used instead and are listed in the order of preference: **Calcium Hypochlorite and Super Tropical Bleach Slurry (STB).

****WARNING:** DO NOT USE PURE SOLID, UNDILUTED CALCIUM HYPOCHLORITE (HTH); it will BURN UPON CONTACT with liquid mustard.

Leaking munitions should be processed in accordance with established chemical demilitarization SOPs, see "DA Pam 385-61, Toxic Chemical Agent Safety Standards".

Recommended Laboratory Procedures: Use a minimum of 65 grams of decontamination solution for each gram of HD. Allow 24 hours for decontamination to take place. Agitate solution at least one hour. Agitation is not necessary after the first hour. Test for presence of active chorine by use of acidic potassium iodide solution to give free iodine color. Adjust the resulting solution pH to between 10 and 11.

Place three millileters (ml) of decontaminated solution in a test tube. Add several crystals of potassium iodine and swirl to dissolve. Add 3 ml of 50 wt.% sulfuric acid: water and swirl. Immediate iodine color shows the presence of active chlorine. If negative, add additional decontaminate to the decontaminated solution, wait two hours and test again for active chlorine. This works for either 5.5% sodium hypochlorite or 10% calcium hypochlorite decontamination solutions. Scoop up all materials and clothing and place in an approved DOT container. The exterior of the container will be decontaminated and labeled according to EPA and DOT regulations. All leaking containers will be over packed with sorbent (e.g. vermiculite) placed between the interior and exterior containers. Decontaminate and label according to EPA and DOT regulations. Dispose of contents according to Federal, state and local regulations. Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the STEL (See Sections V and VIII).

NOTE: Surfaces contaminated with HD, then rinsed and decontaminated may evolve sufficient HD vapor to produce a physiological response. HD on laboratory glassware may be oxidized by its vigorous reaction with concentrated nitric acid.

Waste Disposal Method: Open pit burning or burying of HD or items containing or contaminated with HD in any quantity is prohibited. Waste HD and associated decontamination solutions may be Resource Conservation and Recovery Act (RCRA) regulated hazardous wastes due to a State listing of the chemical agent, or the characteristics of the waste, to include contaminates. An evaluation of the Federal and State waste disposal regulations must be

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conducted to determine the appropriate disposal method.

Section VIII - Special Protection Information

Exposure Limits for Respiratory Protection for HD:

Unprotected Workers:

Concentration (mg/m^3)	Time Limits
Less than or equal to 0.0004[1]	8 hours
Up to or less than 0.0016	2 hours[2]

Protected Workers:

Type of Respiratory Protection Worn (based on air monitoring results):

1. M40 Military Mask, CBRN NIOSH Approved Full Face Air Purifying Respirator

Concentration (mg/m^3)	Time Limits
$\leq$ 0.003	Time limit will be kept at a minimum to perform the operation, and will be dictated by the local Heat Stress Program for personal protective equipment and clothing[3]

2. Pressure Demand Supplied Air Respirator with Full Face Respirator

Concentration (mg/m^3)	Time Limits[4]
0.0004 to 0.7[5]	Time limit will be kept at a minimum to perform the operation, and will be dictated by the local Heat Stress Program for personal protective equipment and clothing.

3. Pressure Demand Supplied Air Respirator with Full Face Respirator in combination with an Auxiliary Self-contained Breathing Apparatus (SCBA) or just SCBA

Concentration (mg/m3)	Time Limits[4]
Greater than 0.7	These concentrations should be expected only in emergency situations. Operations should not be conducted at these concentrations.

[1] As an 8-hr TWA average.
[2] Maximum continuous time at this concentration. Equivalent to 8-hr TWA. Source: Implementation Guidance Policy for Revised Airborne Limits for GB, GA, GD, GF, VX, H, HD, and HT, Dept of Army, Office of the Assistant Secretary of the Army Installations and Environment, 18 June 2004. See Table 5.
[3] The M40 mask may be used for escape from environments containing concentrations above the STEL. The M40 mask may used for routine entry with real-time monitoring for the STEL and historical monitoring for the WPL. The M40 mask will not be used for routine protection above the STEL or in the absence of WPL monitoring.

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[4] For SCBA wearers, time limit is constrained by life of the air cylinder (maximum of 30 to 45 minutes). For Air Supply wearers, time limits should be kept to a minimum. Should use of the auxiliary SCBA be necessary, time limit will be constrained by the life of the breathing air cylinder, and egress from the area must be performed before its expiration.
[5] The Immediately Dangerous to Life and Health Value.

Ventilation

Local Exhaust: Mandatory. Must be filtered or scrubbed to limit exit concentrations. Air emissions shall meet local, state and federal regulations.

Special: Chemical laboratory hoods will have an average inward face velocity of 100 linear feet per minute (lfpm) +/- 20% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods will have an inward face velocity of 150 lfpm +/- 20%. Laboratory hoods will be located such that cross drafts do not exceed 20% of the inward face velocity. A visual performance test using smoke producing devices will be performed in assessing the ability of the hood to contain agent HD.

Other: Recirculation of exhaust air from agent areas is prohibited. No connection between agent area and other areas through the ventilation system is permitted. Emergency backup power is necessary. Hoods should be tested semiannually or after modification or maintenance operations. Operations should be performed 20 centimeters inside hoods.

Protective Gloves: Butyl Rubber gloves M3 and M4
Norton, Chemical Protective Glove Set

Eye Protection: As a minimum, safety glasses with side shields will be worn. For splash hazards use goggles and face shield. Maintain eyewash facilities in work area.

Other Protective Equipment: For laboratory operations, wear lab coats, gloves and have mask readily accessible. In addition, daily clean smocks, foot covers, and head covers will be required when handling contaminated lab animals. In the case of a spill, the minimum protective clothing should be Level B after the site has been evaluated, otherwise Level A.

Monitoring: Available monitoring equipment for agent HD is the M8/M9 detector paper, blue band tube, M256/M256A1 kits, bubbler, Depot Area Air Monitoring System (DAAMS), Automated Continuous Air Monitoring System (ACAMS), CAM-M1, Hydrogen Flame Photometric Emission Detector (HYFED), the Miniature Chemical Agent Monitor (MINICAM), and Real Time Analytical Platform (RTAP). Real-time, low-level monitors (with alarm) are required for HD operations. In their absence, an Immediately Dangerous to Life and Health (IDLH) atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

Section IX - Special Precautions

Precautions To Be Taken In Handling and Storing: When handling agents, the buddy system will be incorporated. No smoking, eating, or drinking in areas containing agents is permitted. Containers should be periodically inspected for leaks, (either visually or using a detector kit). Stringent control over all personnel practices must be exercised. Decontaminating equipment will be conveniently located. Exits must be designed to permit rapid evacuation. Chemical showers, eyewash stations, and personal cleanliness facilities must be provided. Wash hands before meals and, as appropriate, shower thoroughly with special attention given to hair, face, neck, and hands using plenty of soap and water before leaving at the end of the workday.

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Other Precautions: HD should be stored in containers made of glass for Research, Development, Test and Evaluation (RDTE) quantities or one-ton steel containers for large quantities. Agent containers will be stored in a single containment system with in a laboratory hood or in double containment system.

For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program," "DA Pam 385-61, Toxic Chemical Agent Safety Standards," and "DA Pam 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT"; and DA Implementation Guidance Policy for New Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT dated 18 June 2004.

Section X - Transportation Data

NOTE: Forbidden for transport other than via military (Technical Escort Unit) transport according to 49 CFR Part 173.7(b), DOD 4500.9-R and AR 50-6.

Proper Shipping Name: Toxic liquids, organic, n.o.s. (Bis- (2-chloroethyl) sulfide)

UN ID Number: UN2810

DOT Hazard Class: 6.1, Packing Group I, Inhalation Hazard Zone A

DOT Label: Poison Inhalation Hazard or Toxic Inhalation Hazard. See 49 CFR 172.400a(a)(3) for exceptions to unit packaging labeling and 173.7(b) for other exceptions when material is transported by Technical Escort Units.

NOTE: "Poison" and "Toxic" are used interchangeably for all markings, labels and placards in continental US transportation. "Toxic" is required for international transportation.

DOT Marking: Toxic liquids, organic, n.o.s. (Bis- (2-chloroethyl) sulfide) UN 2810, Inhalation Hazard Zone A

DOT Placard: Poison Inhalation Hazard or Toxic Inhalation Hazard

Emergency Accident Precautions and Procedures: See Sections IV, VII and VIII.

Precautions To Be Taken In Transportation: Motor vehicles will be placarded regardless of quantity. Drivers will be given full information regarding shipment and conditions in case of an emergency. AR 50-6 deals specifically with the shipment of chemical agents.

The Edgewood Chemical Biological Center (ECBC), Department of the Army believes that the data contained herein are actual and are the results of the tests conducted by ECBC experts. The data are not to be taken as a warranty or representation for which the Department of the Army or ECBC assumes legal responsibility. They are offered solely for consideration. Any use of this data and information contained in this MSDS must be determined by the user to be in accordance with applicable Federal, State, and local laws and regulations.

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Material Safety Data Sheet

Lethal Nerve Agent (VX)

Revised: 15 March 2006

Section I - General Information

Manufacturer's Address:
U.S. Army Edgewood Chemical Biological Center (ECBC)
ATTN: AMSRD-ECB-CB-CR
Aberdeen Proving Ground, MD 21010-5424
Business Phone: 410-436-4411 or 4414, Monday through Friday during the hours of 8:00 AM to 4:30 PM EDT

CAS Registry Numbers:
50782-69-9, 51848-47-6, 53800-40-1, 70938-84-0

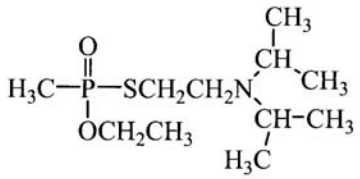
Chemical Name:
O-Ethyl-S-(2-diisoproylaminoethyl) methyl phosphonothiolate

Trade Name And Synonyms:
Phosphonothioic acid, methyl-, S- (2-bis (1-methylethylamino) ethyl) 0-ethyl ester
O-ethyl S- (2-diisopropylaminoethyl) methylphosphonothiolate
S-2-Diisopropylaminoethyl O-ethyl methylphosphonothioate
S-2 ((2-Diisopropylamino) ethyl) O-ethyl methylphosphonothiolate
O-ethyl S- (2-diisopropylaminoethyl) methylphosphonothioate
O-ethyl S- (2-diisopropylaminoethyl) methylthiolphosphonoate
S- (2-diisopropylaminoethyl) o-ethyl methyl phosphonothiolate
Ethyl-S-dimethylaminoethyl methylphosphonothiolate
VX
EA 1701
TX60

Chemical Family: Sulfonated organophosphorous compound

Molecular Formula and Chemical Structure:

$C_{11}H_{26}NO_2PS$



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NFPA 704 Signal:

Health - 4
Flammability - 1
Reactivity - 1
Special - 0

Section II - Ingredients

Ingredients/Name: VX
Percentage by Weight: 100%

Section III - Physical Data

Boiling Point: 292 °C (557.6 °F)

Vapor Pressure (torr): 0.000878 @ 25 °C; 0.0000422 @ 0 °C

Vapor Density (relative to air): 9.2

Solubility: Water solubility of VX is 5 % @ 21.5°C and miscible with water @ 9.4 °C. Soluble in common organic solvents.

Specific Gravity (H_20=1g/mL): 1.0113 @ 25 °C

Freezing/Melting Point (°C): Below -51 °C

Liquid Density (g/mL): 1.0083 @ 25 °C

Volatility (mg/m^3): 12.6 @ 25 °C; 0.662 @ 0 °C

Viscosity (CENTISTOKES): 9.958 @ 25 °C

Molecular Weight: 267.37

Appearance and Odor: Colorless liquid when pure. Odorless when pure.

Section IV - Fire and Explosion Data

Flashpoint: 127 °C (continuously closed cup method)

Flammability Limits (% By Volume): Not Available

Lower Explosive Limit: Not Applicable

Upper Explosive Limit: Not Applicable

Extinguishing Media: Water mist, fog, foam and CO_2. Avoid using extinguishing methods that will cause splashing or spreading of the VX.

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Special Fire Fighting Procedures: All persons not engaged in extinguishing the fire should be immediately evacuated from the area. Fires involving VX should be contained to prevent contamination to uncontrolled areas. When responding to a fire alarm in buildings or areas containing VX, fire-fighting personnel should wear full firefighter protective clothing during chemical agent fire-fighting and fire rescue operations. Respiratory protection is required. Positive pressure, full-face piece, NIOSH-approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI) operations officer. In cases where firefighters are responding to a chemical accident/incident for rescue/reconnaissance purposes they will wear appropriate levels of protective clothing (See Section VIII).

Do not breathe fumes. Skin contact with nerve agents must be avoided at all times. Although the fire may destroy most of the agent, care must still be taken to assure the agent or contaminated liquids do not further contaminate other areas or sewers. Contact with liquid VX or vapors can be fatal.

Unusual Fire And Explosion Hazards: None known.

Section V - Health Hazard Data

Airborne Exposure Limits (AEL) [2]:

Worker Population Limit (WPL) 8-hr TWA [1] mg/m^3	STEL 15-min TWA [1] mg/m^3	IDLH [1] mg/m^3	General Population Limit (GPL) 12-hr TWA [1] mg/m^3
0.000001	0.00001	0.003	0.0000006

[1] These values can be found in the DA, Office of the Assistant Secretary, Installations and Environment memo, subject: Implementation Guidance Policy for New Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT, 18 June 2004.
[2] To date, the Occupational Safety and Health Administration (OSHA) have not promulgated a permissible exposure concentration for VX.

VX is not listed by the International Agency for Research on Cancer (IARC), American Conference of Governmental Industrial Hygienists (ACGIH), Occupational Safety and Health Administration (OSHA), or National Toxicology Program (NTP) as a carcinogen.

Routes of Entry: Primary route of entry for VX is often thought to be liquid contact with skin. Although, it is less volatile than other nerve agents, it is extremely potent and even very low concentrations of airborne vapor are extremely hazardous. Additionally, a secondary route of entry can be through ingestion.

Effects of Exposure: Nerve agents are readily absorbed and are hazardous through all routes of exposure. The most prominent physiological effects results from the inhibition of ChE in the central nervous system. The result produces effects including miosis, rhinorrhea, bronchoconstriction, increased gastrointestinal motility, muscle fasciculations, weakness, flaccid paralysis, difficulty in concentrating, anxiety, insomnia, restlessness, depression of the respiratory center, convulsions and death.

Signs and Symptoms: The onset of the signs and symptoms following exposure to nerve agents may occur within seconds, minutes, or hours, depending upon concentration, dosage, and route of entry, as well as the type and physical state of the nerve agent.

VX poses both a liquid and vapor hazard to the unprotected worker. The first noticeable vapor effects are miosis, tight chest and/or rhinorrhea. These signs can occur in the absence of measurable ChE inhibition in the blood. Later, mild signs and symptoms of vapor exposure include conjunctival injection, pain behind the eyes, dimness or

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blurred vision and excessive salivation.

Moderate signs and symptoms of vapor exposure may include mild signs and symptoms of exposure plus: increased shortness of breath, coughing, wheezing, voluminous bronchorrhea, nausea, vomiting and diarrhea.

Severe signs and symptoms of vapor exposure may include moderate signs and symptoms of exposure plus: generalized weakness or fasciculations/twitching, loss of consciousness (within seconds), convulsions (within minutes), severe respiratory distress, flaccid paralysis and apnea.

Effects from liquid percutaneous exposures to nerve agents are slower to develop and slower to reach their peak when compared to vapor exposures of the eyes or respiratory tract. Mild signs and symptoms of liquid nerve agent skin exposure include localized sweating at the site of exposure and fine muscle fasciculations/twitching. **(NOTE:** Miosis is not an early sign of liquid skin exposure. This is only true for exposures that include contact with airborne vapor with the eyes. In cases of nerve agent exposure not involving vapor contact with the eyes, miosis may be one of the last effects to occur. In such cases, the dosages of liquid exposure which produces miosis are not significantly different than lethal doses.)

Toxicity Values:

Vapor (Inhalation/Ocular)[1]
ECt50 (Mild) = 0.1 mg-min/m^3[2]
ECt50 (Severe)[3] = 10 mg-min/m^3
LCt50 = 15 mg-min/m^3

Vapor (Percutaneous)[4,5]
ECt50 (Threshold)[6] = 10 mg-min/m^3
ECt50 (Severe)[3] = 25 mg-min/m^3
LCt50 = 150 mg-min/m^3

Liquid (Percutaneous)
ED50 = 2 mg/70 kg man
LD50 = 5 mg/70 kg man[7]

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[1] Estimates for inhalation vapor exposure are based on a minute volume (MV) of 15 liters. The exposure time is 2 minutes.
[2] Recent data indicate that this value may be as low as 0.04 mg-min/m^3.
[3] Severe effects may also include death.
[4] Personnel are masked.
[5] Values for percutaneous vapor are for moderate temperatures (85 °F and below). The effective dosages for hot temperatures (85 °F and above) will be less by at least a factor of 2.
[6] Threshold refers to a slight ChE inhibition.
[7] Recent modeling of the VX Data indicates that the LD50 could be as low as 2 mg/70 kg man.

Emergency and First Aid Procedures:

Prior to rendering first aid, take steps for self protection such as donning a protective mask and other protective equipment. **Immediately** remove individual from contaminated area. Decontaminate the individual as indicated below.

Vapor Exposure: Vapor exposed nerve agent casualties should be decontaminated by removing all clothing in a clean air environment and shampooing or rinsing the hair to prevent vapor off gassing.

Liquid Skin Exposure: Leave area of contamination as quickly as possible. Remove clothing in a clean air environment and wash the skin surface and hair in warm or hot water at least three times. The rapid physical

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removal of a chemical agent is essential. Scrubbing of exposed skin with a stiff brush or bristles is discouraged, because skin damage may occur and may increase absorption of agent. Use liquid soap (dispose of container after use and replace), copious amounts of water, and mild to moderate friction with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse with copious amounts of warm or hot water. Shampoo can be used to wash the hair. If warm or hot water is not available, but cold water is, use cold water. Do not delay decontamination to obtain warm water. Two permissible alternative skin decontaminants include the M291 Skin Decontaminating Kit (SDK) and a 0.5% sodium hypochlorite solution. (**NOTE:** The use of the M291 SDK and/or 0.5% sodium hypochlorite on skin is appropriate in situations where soap and water may not be as efficacious in physically removing particular types of nerve agents, such as those used in certain research and development laboratories. Neither soap and water, 0.5% sodium hypochlorite or the M291 SDK have been shown to be more efficacious than the other for physically removing every type of nerve agent from the skin.) If used, the 0.5% sodium hypochlorite should be applied with mild to moderate friction, with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse to remove any residual sodium hypochlorite with copious amounts of warm or hot water.

Eye Contact: Immediately leave area of contamination and begin flushing eyes, mucous membranes, or open wounds with sterile saline or water. Flush the eyes immediately with sterile saline or water by tilting the head to the side, pulling the eyelids apart with gloved fingers and pouring slowly into the eyes. A Morgan lens may also be used for continuous eye irrigation. Although miosis (pinpointing of the pupils) may be an early sign of agent exposure, an injection will not be administered when miosis is the only sign present. Instead, the individual will be taken **Immediately** to a medical treatment facility for observation.

Ingestion: Do not induce vomiting. First symptoms are likely to be gastrointestinal. **Immediately** administer Nerve Agent Antidote Kit, Mark I. Seek medical attention **Immediately. Do not handle vomited material to avoid further contamination.**

Inhalation: If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. Do not use mouth-to-mouth resuscitation when facial contamination is present. Seek medical attention **Immediately**.

Nerve Emergency Treatment: An individual who has received a known nerve agent exposure and has progressive signs and symptoms of nerve agent exposure may receive up to three sets of the Nerve Agent Antidote Kit (Mark I). Injections may be administered at 5 to 20 minute intervals; no more than three (3) injector sets will be given unless directed by medical personnel. If severe signs of agent exposure appear [signs and symptoms of moderate exposure, plus generalized weakness or fasciculation/twitching, loss of consciousness (within seconds), convulsions (within minutes), severe respiratory distress, flaccid paralysis and apnea], immediately administer, in rapid succession, all three sets of the Mark I. In addition, a record will be maintained of all injections given.

NOTE: The Office of the Surgeon General is responsible the medical guidance provided in this MSDS. Questions concerning medical guidance provided in the this MSDS may be addressed to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-3258.

Section VI - Reactivity Data

Stability: Relatively stable at ambient temperature. Unstabilized VX of 95% purity decomposes at a rate of 5% a month at 71 °C. Highly purified VX is stable in both glass and steel.

Decomposition Temperature: $t_{1/2}$ = 502 days @ 71 °C; $t_{1/2}$ = 41 days @ 100 °C; $t_{1/2}$ = 34.5 hr @ 150 °C; $t_{1/2}$ = 10 hr @ 170 °C; $t_{1/2}$ = 1.6 hr @ 200 °C; $t_{1/2}$ = 4 min @ 250 °C; $t_{1/2}$ = 36 sec @ 295 °C.

Rate of Hydrolysis: Hydrolysis rate of VX varies with temperature and concentration. At 22 °C $t_{1/2}$ = 1.8 min in 1.25M NaOH; $t_{1/2}$ = 10.8 min in 0.25M NaOH; $t_{1/2}$ = 31 min in 0.10M NaOH; $t_{1/2}$ = 3.3 hr in 0.01M NaOH; and $t_{1/2}$ =

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60 hr in pure water.

Hydrolysis Products: VX hydrolyzes via three different pathways (P-S, P-O and C-S), which vary significantly with temperature and pH. At pH below 12, the P-O bond cleavage path produces ethyl methylphosphonate (EMPA) and the toxic S-[2-diisopropylaminoethyl] methylphosphonothiolate ion (EA 2192). At room temperature EA 2192 reacts slowly with OH^- [EA 2192, $t_{1/2}$ = 7.4 days in 1.0M NaOH], eventually producing less toxic products. Using an equimolar ratio of VX and water at elevated temperatures appears to reduce the persistency of EA 2192.

Action on Metals and Other Materials: Negligible on brass, steel and aluminum. Slight corrosion with copper.

Hazardous Polymerization: Does not occur.

Section VII - Spill, Leak, And Disposal Procedures

Steps To Be Taken In Case Material Is Released Or Spilled: If leaks or spills of VX occur, only personnel in full protective clothing will remain in the area (See Section VIII). In case of personnel contamination see Section V for emergency and first aid instructions.

Recommended Field Procedures (For Quantities Greater Than 50 Grams): Spills must be contained by covering with vermiculite, diatomaceous earth, clay or fine sand. An alcoholic HTH mixture is prepared by adding 100 milliliters of denatured ethanol to a 900-milliliter slurry of 10% HTH in water. This mixture should be made just before use since the HTH can react with the ethanol. Fourteen grams of alcoholic HTH solution are used for each gram of VX. Agitate the decontamination mixture as the VX is added. Continue the agitation for a minimum of one hour. This reaction is reasonably exothermic and evolves substantial off gassing. The evolved reaction gases should be routed through a decontaminate filled scrubber before release through filtration systems. After completion of the one-hour minimum agitation, 10% sodium hydroxide is added in a quantity equal to that necessary to assure that a pH of 12.5 is maintained for a period not less than 24 hours. Hold the material at a pH between 10 and 12 for a period not less than 90 days to ensure that a hazardous intermediate material is not formed (See Section VI). Scoop up all material and place in a DOT approved container. Cover the contents with decontaminating solution consisting of an alcoholic HTH mixture of 100 milliliters of denatured ethanol to a 900 milliliter slurry of 10% HTH in water. After sealing, decontaminate the exterior container and labeled according to EPA and DOT regulations. All leaking containers will be over packed with sorbent (e.g. vermiculite) placed between the interior and exterior containers and labeled according to EPA and DOT regulations. Dispose of decontaminate according to Federal, state, and local laws. Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the AELs (See Sections V and VIII).

If the alcoholic HTH mixture is not available then the following decontaminants may be used instead and are listed in the order of preference: Super Tropical Bleach Slurry (STB) and Sodium Hypochlorite.

Leaking munitions should be processed in accordance with established chemical demilitarization SOPs, see "DA Pam 385-61, Toxic Chemical Agent Safety Standards".

Recommended Laboratory Procedures (For Quantities Less Than 50 Grams): If the active chlorine of the Calcium Hypochlorite (HTH) is at least 55%, then 80 grams of a 10% slurry are required for each gram of VX. Proportionally more HTH is required if the chlorine activity of the HTH is lower than 55%. The mixture is agitated as the VX is added and the agitation is maintained for a minimum of one hour. Upon completion of the one hour agitation the decontamination mixture will be adjusted to a pH between 10 and 11. If phasing of the VX/decon solution continues after 5 minutes, an amount of denatured ethanol equal to a 10 wt.% of the total agent/decon will be added to help miscibility*. Place all material in a DOT approved container and cover the contents with additional decontaminating solution. After sealing, decontaminate the exterior of the container and label according to EPA and DOT regulations. All leaking containers will be over packed with sorbent placed between the interior and exterior containers and label according to EPA and DOT regulations. Dispose of according to Federal, State, and

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local laws. Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the AELs (See Sections V and VIII).

***NOTE:** Ethanol Should Be Reduced To Prevent The Formation Of A Hazardous Waste.

Waste Disposal Method: Open pit burning or burying of VX or items containing or contaminated with VX in any quantity is prohibited. Waste VX and associated decontamination solutions may be Resource Conservation and Recovery Act (RCRA) regulated hazardous wastes due to a State listing of the chemical agent, or the characteristics of the waste, to include contaminates. An evaluation of the Federal and State waste disposal regulations must be conducted to determine the appropriate disposal method.

Section VIII - Special Protection Information

Exposure Limits for Respiratory Protection for VX:

Unprotected Workers:

Concentration (mg/m^3)	Time Limits
Less than or equal to 0.000001[1]	8 hours
Up to or less than 0.000004	2 hours[2]

Protected Workers:

Type of Respiratory Protection Worn (based on monitoring results):

1. M40 Military Mask, CBRN NIOSH Approved Full Face Air Purifying Respirator

Concentration (mg/m^3)	Time Limits
Not greater than 0.00005	Up to 8 hours[3]
Greater than 0.00005 and less than 0.00007	Up to 6 hours
Greater than 0.00007 and less than 0.0001	Up to 4 hours
Greater than 0.0001 and less than 0.0002	Up to 2 hours
Not greater than 0.0005	Up to 15 minutes[4]

2. Pressure Demand Supplied Air Respirator with Full Face Respirator

Concentration (mg/m^3)	Time Limits[6]
0.000001 to 0.003[5]	Time limit will be kept at a minimum to perform the operation, and will be dictated by the local Heat Stress Program for personal protective equipment and clothing.

3. Pressure Demand Supplied Air Respirator with Full Face Respirator in combination with an Auxiliary Self-contained Breathing Apparatus (SCBA) or just SCBA

Concentration (mg/m^3)	Time Limits[6]

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Greater than 0.003	These concentrations should be expected only in emergency situations. Operations should not be conducted at these concentrations.

[1] As an 8-hr TWA average.
[2] Maximum continuous time at this concentration. Equivalent to 8-hr TWA. Source: Implementation Guidance Policy for Revised Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT, Dept of Army, Office of the Assistant Secretary o the Army Installations and Environment, 18 June 2004. See Table 4.
[3] Canister for M40 Mask must be changed out every 6 hours of use.
[4] Based on APF of 50 times the STEL (0.00001 mg/m^3), which is a 15 minute TWA. Only one excursion to this concentration is allowed during an 8 hour workday.
[5] The Immediately Dangerous to Life and Health Value.
[6] For SCBA wearers, time limit is constrained by life of the air cylinder (maximum of 30 to 45 minutes). For Air Supply wearers, time limits should be kept to a minimum. Should use of the auxiliary SCBA be necessary, time limit will be constrained by the life of the breathing air cylinder, and egress from the area must be performed before its expiration.

Ventilation:

Local exhaust: Mandatory. Must be filtered or scrubbed to limit exit concentrations. Air emissions will meet local, state and federal regulations.

Special: Chemical laboratory hoods will have an average inward face velocity of 100 linear feet per minute (lfpm) +/- 20% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods will have an inward face velocity of 150 lfpm +/- 20%. Laboratory hoods will be located such that cross-drafts do not exceed 20% of the inward face velocity. A visual performance test using smoke-producing devices will be performed in assessing the ability of the hood to contain agent VX.

Other: Recirculation or exhaust air from chemical areas is prohibited. No connection between chemical areas and other areas through ventilation system is permitted. Emergency backup power is necessary. Hoods should be tested at least semiannually or after modification or maintenance operations. Operations should be performed 20 centimeters inside hood face.

Protective Gloves: Butyl Rubber Glove M3 and M4
Norton, Chemical Protective Glove Set

Eye Protection: At a minimum safety glasses with side shields will be worn. For splash hazards use goggles and face shield. Maintain eyewash facilities in work area.

Other Protective Equipment: For laboratory operations, wear lab coats, gloves and have mask readily accessible. In addition, daily clean smocks, foot covers, and head covers will be required when handling contaminated lab animals. In the case of a spill, the minimum protective clothing should be Level B after the site has been evaluated, otherwise Level A.

Monitoring: Available monitoring equipment for agent VX is the M8/M9 detector paper, detector ticket, M256/M256A1 kits, bubbler, Depot Area Air Monitoring System (DAAMS), Automated Continuous Air Monitoring System (ACAMS), Real-Time Monitor (RTM), Demilitarization Chemical Agent Concentrator (DCAC), M8/M43, M8A1/M43A1, CAM-M1, Hydrogen Flame Photometric Emission Detector (HYFED), the Miniature Chemical Agent Monitor (MINICAM), and the Real Time Analytical Platform (RTAP).

Real-time, low-level monitors (with alarm) are required for VX operations. In their absence, an Immediately Dangerous to Life and Health (IDLH) atmosphere must be presumed. Laboratory operations conducted in

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appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

Section IX - Special Precautions

Precautions To Be Taken In Handling and Storing: When handling agents, the buddy system will be incorporated. No smoking, eating, or drinking in areas containing agents is permitted. Containers should be periodically inspected for leaks, (either visually or using a detector kit). Stringent control over all personnel practices must be exercised. Decontaminating equipment will be conveniently located. Exits must be designed to permit rapid evacuation. Chemical showers, eyewash stations, and personal cleanliness facilities must be provided. Wash hands before meals and, as appropriate, shower thoroughly before leaving at the end of the workday with special attention given to hair, face, neck, and hands using plenty of soap and water.

Other Precautions: Agent containers will be stored in a double containment system within a laboratory hood.

For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program," "DA Pam 385-61, Toxic Chemical Agent Safety Standards," and "DA Pam 40-8, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX"; and DA Implementation Guidance Policy for New Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT dated 18 June 2004.

Section X - Transportation Data

NOTE: Forbidden for transport other than via military (Technical Escort Unit) transport according to 49 CFR Part 173.7(b), DOD 4500.9-R and AR 50-6.

Proper Shipping Name: Toxic liquids, organic, n.o.s. (O-ethyl-S-(2-diisopropylaminoethyl) methyl phosphonothiolate)

UN ID Number: UN2810

DOT Hazard Class: 6.1, Packing Group I, Inhalation Hazard Zone A

DOT Label: Poison Inhalation Hazard or Toxic Inhalation Hazard. See 49 CFR 172.400a(a)(3) for exceptions to unit packaging labeling and 173.7(b) for other exceptions when material is transported by Technical Escort Units.

NOTE: "Poison" and "Toxic" are used interchangeably for all markings, labels and placards in continental US transportation. "Toxic" is required for international transportation.

DOT Marking: Toxic liquids, organic, n.o.s. (O-ethyl-S-(2-diisopropylaminoethyl) methyl phosphonothiolate) UN 2810, Inhalation Hazard Zone A

DOT Placard: Poison Inhalation Hazard or Toxic Inhalation Hazard

Emergency Accident Precautions And Procedures: See Sections IV, VII and VIII.

Precautions To Be Taken In Transportation: Motor vehicles will be placarded regardless of quantity. Drivers will be given full information regarding shipment and conditions in case of an emergency. AR 50-6 deals specifically with the shipment of chemical agents.

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The Edgewood Chemical Biological Center (ECBC), Department of the Army believes that the data contained herein are actual and are the results of the tests conducted by ECBC experts. The data is not to be taken as a warranty or representation for which the Department of the Army or ECBC assumes legal responsibility. This information is offered solely for consideration. Any use of this data and information contained in this MSDS must be determined by the user to be in accordance with applicable Federal, State, and local laws and regulations.

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Material Safety Data Sheet

Lethal Nerve Agent (GB)

Revised: 15 March 2006

Section I - General Information

Manufacturer's Address:
U.S. Army Edgewood Chemical Biological Center (ECBC)
ATTN: AMSRD-ECB-CB-CR
Aberdeen Proving Ground, MD 21010-5424
Business Phone: 410-436-4411 or 4414, Monday through Friday during the hours of 8:00 AM to 4:30 PM EDT

CAS Registry Numbers:
107-44-8, 50642-23-4

Chemical Name:
Isopropyl methylphosphonofluoridate

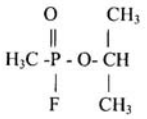
Alternate Chemical Names:
O-Isopropyl Methylphosphonofluoridate
Phosphonofluoridic acid, methyl-, isopropyl ester
Phosphonofluoridic acid, methyl-, 1-methylethyl ester

Trade Name and Synonyms:
Isopropyl ester of methylphosphonofluoridic acid
Methylisopropoxyfluorophosphine oxide
Isopropyl Methylfluorophosphonate
O-Isopropyl Methylisopropoxfluorophosphine oxide
Methylfluorophosphonic acid, isopropyl ester
Isopropoxymethylphosphonyl fluoride
Isopropyl methylfluorophosphate
Isopropoxymethylphosphoryl fluoride
GB
Sarin

Chemical Family: Fluorinated organophosphorous compound

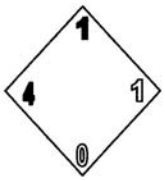
Molecular Formula and Chemical Structure:

$C_4 H_{10} F O_2 P$



NFPA 704 Signal:

Health - 4
Flammability - 1
Reactivity - 1
Special - 0



Section II - Ingredients

Ingredients/Name: GB
Percentage by Weight: 100%

Section III - Physical Data

Boiling Point: 150 °C (302 °F)

Vapor Pressure (torr): 2.48 @ 25 °C; 0.41 @ 0 °C

Vapor Density (relative to air): 4.8

Solubility: Completely miscible in water and common organic solvents.

Specific Gravity (H_20=1g/mL): 1.0919 @ 25 °C

Freezing/Melting Point (°C): -56 °C

Liquid Density (g/mL): Pure: 1.0887 @ 25 °C
Munitions grade: 1.0964 @ 25 °C

Volatility (mg/m^3): 18,700 @ 25 °C; 3,370 @ 0 °C

Viscosity (CENTISTOKES): 1.283 @ 25 °C

Molecular Weight: 140.09

Appearance and Odor: Colorless liquid. Odorless in pure form.

Section IV - Fire and Explosion Data

Flashpoint: Did not flash to 280 °F (McCutchan - Young)

Flammability Limits (% By Volume): Not Applicable

Lower Explosive Limit: Not Applicable

Upper Explosive Limit: Not Applicable

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Extinguishing Media: Water mist, fog, foam and CO_2. Avoid using extinguishing methods that will cause splashing or spreading of the GB.

Special Fire Fighting Procedures: All persons not engaged in extinguishing the fire should be immediately evacuated from the area. Fires involving GB should be contained to prevent contamination to uncontrolled areas. GB will react with steam or water to produce toxic and corrosive vapors. When responding to a fire alarm in buildings or areas containing GB, fire-fighting personnel should wear full firefighter protective clothing during chemical agent firefighting and fire rescue operations. Respiratory protection is required. Positive pressure, full-face piece, NIOSH-approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI) operations officer. In cases where firefighters are responding to a chemical accident/incident for rescue/reconnaissance purposes they will wear appropriate levels of protective clothing (See Section VIII).

Do not breathe fumes. Skin contact with nerve agents must be avoided at all times. Although the fire may destroy most of the agent, care must still be taken to assure the agent or contaminated liquids do not further contaminate other areas or sewers. Contact with liquid GB or vapors can be fatal.

Unusual Fire and Explosion Hazards: Hydrogen may be present.

Section V - Health Hazard Data

Airborne Exposure Limits (AEL) [2]:

Worker Population Limit (WPL) 8-hr TWA [1] mg/m^3	STEL 15-min TWA [1] mg/m^3	IDLH [1] mg/m^3	General Population Limit (GPL) 12-hr TWA [1] mg/m^3
0.00003	0.0001	0.1	0.000001

[1] These values can be found in the DA, Office of the Assistant Secretary, Installations and Environment memo, subject: Implementation Guidance Policy for New Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT, 18 June 2004.
[2] To date, the Occupational Safety and Health Administration (OSHA) have not promulgated a permissible exposure concentration for GB.

GB is not listed by the International Agency for Research on Cancer (IARC), American Conference of Governmental Industrial Hygienists (ACGIH), Occupational Safety and Health Administration (OSHA), or National Toxicology Program (NTP) as a carcinogen.

Routes of Entry: The primary routes of exposure for GB are inhalation and ocular exposure of vapor and liquid contact with skin. A secondary and less likely route of entry can be through ingestion.

Effects of Exposure: Nerve agents are readily absorbed and are hazardous through all routes of exposure. The most prominent physiological effects result primarily from inhibition of the ChE in the central nervous system. The result produces effects including miosis, rhinorrhea, bronchoconstriction, increased gastrointestinal motility, muscle fasciculations, weakness, flaccid paralysis, difficulty in concentrating, anxiety, insomnia, restlessness, depression of the respiratory center, convulsions and death.

Signs and Symptoms: The onset of the signs and symptoms following exposure to nerve agents may occur within seconds, minutes, or hours, depending upon concentration, dosage, and route of entry, as well as the type and physical state of the nerve agent.

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GB poses primarily a vapor hazard to the unprotected worker. The first noticeable effects are miosis, tight chest and/or rhinorrhea. These signs can occur in the absence of measurable ChE inhibition in the blood. Later, mild signs and symptoms of vapor exposure include conjunctival injection, pain behind the eyes, dimness or blurred vision and excessive salivation.

Moderate signs and symptoms of vapor exposure may include mild signs and symptoms of exposure plus: increased shortness of breath, coughing, wheezing, voluminous bronchorrhea, nausea, vomiting and diarrhea.

Severe signs and symptoms of vapor exposure may include moderate signs and symptoms of exposure plus: generalized weakness or fasciculations/twitching, loss of consciousness (within seconds), convulsions (within minutes), severe respiratory distress, flaccid paralysis and apnea.

Effects from liquid percutaneous exposures to nerve agents are slower to develop and slower to reach their peak when compared to vapor exposures of the eyes or respiratory tract. Mild signs and symptoms of liquid nerve agent skin exposure include localized sweating at the site of exposure and fine muscle fasciculations/twitching. **(NOTE:** Miosis is not an early sign of liquid skin exposure. This is only true for exposures that include contact with airborne vapor with the eyes. In cases of nerve agent exposure not involving vapor contact with the eyes, miosis may be one of the last effects to occur. In such cases, the dosages of liquid exposure which produces miosis are not significantly different than lethal doses.)

Toxicity Values:

Vapor (Inhalation/Ocular)[1]
ECt50 (Mild) = 1 mg-min/m^3 [2]
ECt50 (Severe)[3] = 25 mg-min/m^3
LCt50 = 35 mg-min/m^3

Vapor (Percutaneous)[4,5]
ECt50 (Threshold)[6] = 1200 mg-min/m^3
ECt50 (Severe)[3] = 8000 mg-min/m^3
LCt50 = 12000 mg-min/m^3

Liquid (Percutaneous)
ED50 = 1000 mg/70 kg man
LD50 = 1700 mg/70 kg man

[1] Estimates for inhalation vapor exposure are based on a minute volume (MV) of 15 liters and a 2 minute exposure. The effective dosages will increase with lower MV and decrease for a higher MV. The concentration-time profile is described by the toxic load model ($C^n t=k$). The toxic load exponent (n) is 1.5. The dose-response curve is very steep.
[2] Based on recent studies estimates for this value, dosage may actually be 0.4 mg-min/m^3.
[3] Severe effects may also include death.
[4] Personnel are masked.
[5] Values for percutaneous vapor are for moderate temperatures (85 °F and below). The effective dosages for hot temperatures (85 °F and above) will be less by at least a factor of 2.
[6] Threshold refers to a slight ChE inhibition.

Emergency and First Aid Procedures:

Prior to rendering first aid, take steps for self protection such as donning a protective mask and other protective equipment. **Immediately** remove individual from contaminated area. Decontaminate the individual as indicated below.

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Vapor Exposure: Vapor exposed nerve agent casualties should be decontaminated by removing all clothing in a clean air environment and shampooing or rinsing the hair to prevent vapor off gassing.

Liquid Skin Exposure: Leave area of contamination as quickly as possible. Remove clothing in a clean air environment and wash the skin surface and hair in warm or hot water at least three times. The rapid physical removal of a chemical agent is essential. Scrubbing of exposed skin with a stiff brush or bristles is discouraged, because skin damage may occur and may increase absorption of agent. Use liquid soap (dispose of container after use and replace), copious amounts of water, and mild to moderate friction with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse with copious amounts of warm or hot water. Shampoo can be used to wash the hair. If warm or hot water is not available, but cold water is, use cold water. Do not delay decontamination to obtain warm water. Two permissible alternative skin decontaminants include the M291 Skin Decontaminating Kit (SDK) and a 0.5% sodium hypochlorite solution. (**NOTE:** The use of the M291 SDK and/or 0.5% sodium hypochlorite on skin is appropriate in situations where soap and water may not be as efficacious in physically removing particular types of nerve agents, such as those used in certain research and development laboratories. Neither soap and water, 0.5% sodium hypochlorite or the M291 SDK have been shown to be more efficacious than the other for physically removing every type of nerve agent from the skin.) If used, the 0.5% sodium hypochlorite should be applied with mild to moderate friction, with a single-use sponge or washcloth in the first and second washes. The third wash should be a rinse to remove any residual sodium hypochlorite with copious amounts of warm or hot water.

Eye Contact: **Immediately** leave area of contamination and begin flushing eyes, mucous membranes, or open wounds with sterile saline or water. Flush the eyes immediately with sterile saline or water by tilting the head to the side, pulling the eyelids apart with gloved fingers and pouring slowly into the eyes. A Morgan lens may also be used for continuous eye irrigation. Although miosis (pinpointing of the pupils) may be an early sign of agent exposure, an injection will not be administered when miosis is the only sign present. Instead, the individual will be taken **Immediately** to a medical treatment facility for observation.

Ingestion: Do not induce vomiting. First symptoms are likely to be gastrointestinal. **Immediately** administer Nerve Agent Antidote Kit, Mark I. Seek medical attention **Immediately. Do not handle vomited material to avoid further contamination.**

Inhalation: If breathing is difficult, administer oxygen. If breathing has stopped, give artificial respiration. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. Do not use mouth-to-mouth resuscitation when facial contamination is present. Seek medical attention **Immediately**.

Nerve Emergency Treatment: An individual who has received a known nerve agent exposure and has progressive signs and symptoms of nerve agent exposure may receive up to three sets of the Nerve Agent Antidote Kit (Mark I). Injections may be administered at 5 to 20 minute intervals; no more than three (3) injector sets will be given unless directed by medical personnel. If severe signs of agent exposure appear [signs and symptoms of moderate exposure, plus generalized weakness or fasciculation/twitching, loss of consciousness (within seconds), convulsions (within minutes), severe respiratory distress, flaccid paralysis and apnea], immediately administer, in rapid succession, all three sets of the Mark I. In addition, a record will be maintained of all injections given.

NOTE: The Office of the Surgeon General is responsible the medical guidance provided in this MSDS. Questions concerning medical guidance provided in the this MSDS may be addressed to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-3258.

Section VI - Reactivity Data

Stability: GB stabilized with tributylamine can be stored in steel containers for at least 5 to 10 years at ambient temperatures. At elevated temperatures up to 71 °C, storage life deceases slightly.

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Decomposition Temperature: Decomposes completely at 150 °C within 2 ½ hours.

Rate of Hydrolysis: Varies with pH and temperature. At 20 °C, $t_{1/2}$ = 27 min @ pH 1; $t_{1/2}$ = 3 ½ hr @ pH 2; $t_{1/2}$ = 80 hr @ pH 7; $t_{1/2}$ = 5.4 min @ pH 10 and $t_{1/2}$ = 0.6 min @ pH 11.

Hydrolysis Products: Under acidic conditions, hydrogen fluoride (HF) and isopropyl methylphosphonic acid (IMPA) are formed which further hydrolyze to produce methylphosphonic acid (MPA) and isopropanol. Under alkaline conditions, methylfluorophosphonic acid (MFPA) and isopropyl alcohol are formed and further hydrolyze to produce MPA and HF.

Action on Metals and Other Materials: @ 71 °C, slightly corrosive on steel, copper, brass, inconel, K-monel and lead as well as slight to severe amounts of corrosions on aluminum.

Hazardous Polymerization: Does not occur.

Section VII - Spill, Leak, And Disposal Procedures

Steps To Be Taken In Case Material Is Released Or Spilled: If leaks or spills of GB occur, only personnel in full protective clothing will remain in the area (See Section VIII). In case of personnel contamination see Section V for emergency and first aid instructions.

Recommended Field Procedures: Spills must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, and paper or cloth towels. Decontaminate with copious amounts of aqueous sodium hydroxide solution (a minimum 10 wt.%). Scoop up all material and place in a DOT approved container. Cover the contents with decontaminating solution consisting of aqueous sodium hydroxide solution (a minimum 10 wt.%). After sealing, decontaminate the exterior container and labeled according to EPA and DOT regulations. All leaking containers will be over packed with sorbent (e.g. vermiculite) placed between the interior and exterior containers. Decontaminate and label according to EPA and DOT regulations. Dispose of decontaminate according to Federal, state, and local laws. Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the AELs (See Sections V and VIII).

If 10 wt.% aqueous sodium hydroxide is not available then the following decontaminants may be used instead and are listed in the order of preference: Sodium Carbonate and Super tropical Bleach Slurry (STB)

Leaking munitions should be processed in accordance with established chemical demilitarization SOPs, see "DA Pam 385-61, Toxic Chemical Agent Safety Standards".

Recommended Laboratory Procedures: A minimum of 56 grams of decon solution is required for each gram of GB. Decontaminant and agent solution is allowed to agitate for a minimum of one hour. Agitation is not necessary following the first hour. At the end of one hour, the resulting solution should be adjusted to a pH greater than 11.5. If the pH is below 11.5 NaOH should be added until a pH above 11.5 can be maintained for 60 minutes. An alternate solution for the decontamination of GB is 10 wt.% sodium carbonate in place of the 10% sodium hydroxide solution above. Continue with 56 grams of decon for each gram of agent. Agitate for one hour but allow three hours for the reaction. The final pH should be adjusted to above zero. It is also permitted to substitute 5.25% sodium hypochlorite or 25 wt.% Monoethylamine (MEA) for the 10% sodium hydroxide solution. MEA must be completely dissolved in water before addition of the agent. Continue with 56 grams of decon for each gram of GB and provide agitation for one hour. Continue with same ratios and time stipulations. Scoop up all material and clothing. Place all material in a DOT approved container. Cover the contents with decontaminating solution as above. After sealing, decontaminate the exterior of the container and label according to EPA and DOT regulations. All leaking containers will be over packed with sorbent placed between the interior and exterior containers. Decontaminate and label according to EPA and DOT regulations. Dispose of decontaminate according to Federal, State, and local laws. Conduct general area monitoring to confirm that the atmospheric concentrations do not

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exceed the AELs (See Sections V and VIII).

Waste Disposal Method: Open pit burning or burying of GB or items containing or contaminated with GB in any quantity is prohibited. Waste GB and associated decontamination solutions may be Resource Conservation and Recovery Act (RCRA) regulated hazardous wastes due to a State listing of the chemical agent, or the characteristics of the waste, to include contaminates. An evaluation of the Federal and State waste disposal regulations must be conducted to determine the appropriate disposal method.

Section VIII - Special Protection Information

Exposure Limits for Respiratory Protection for GB:

Unprotected Workers:

Concentration (mg/m^3)	Time Limits
Less than or equal to 0.00003[1]	8 hours
Up to or less than 0.00006	4 hours[2]

Protected Workers:

Type of Respiratory Protection Worn (based on monitoring results):

1. M40 Military Mask, CBRN NIOSH Approved Full Face Air Purifying Respirator

Concentration (mg/m^3)	Time Limits
Not greater than 0.0015	Up to 8 hours[3]
Greater than 0.0015 and less than 0.002	Up to 6 hours
Greater than 0.002 and less than 0.003	Up to 4 hours
Not greater than 0.005	Up to 15 minutes[4]

2. Pressure Demand Supplied Air Respirator with Full Face Respirator

Concentration (mg/m^3)	Time Limits[6]
0.00003 to 0.1[5]	Time limit will be kept at a minimum to perform the operation, and will be dictated by the local Heat Stress Program for personal protective equipment and clothing

3. Pressure Demand Supplied Air Respirator with Full Face Respirator in combination with an Auxiliary Self-contained Breathing Apparatus (SCBA) or just SCBA

Concentration (mg/m^3)	Time Limits[6]
Greater than 0.1	These concentrations should be expected only in emergency situations. Operations

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should not be conducted at these concentrations.

[1] As an 8-hr TWA average.
[2] Maximum continuous time at this concentration. Equivalent to 8-hr TWA. Source: Implementation Guidance Policy for Revised Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT, Dept of Army, Office of the Assistant Secretary o the Army Installations and Environment, 18 June 2004. See Table 2.
[3] Canister for M40 Mask must be changed out every 6 hours of use.
[4] Based on APF of 50 times the STEL (0.0001 mg/m^3), which is a 15 minute TWA. Only 4 excursions to this concentration with a 60 minute interval between each one is allowed during an 8 hour workday.
[5] The Immediately Dangerous to Life and Health Value.
[6] For SCBA wearers, time limit is constrained by life of the air cylinder (maximum of 30 to 45 minutes). For Air Supply wearers, time limits should be kept to a minimum. Should use of the auxiliary SCBA be necessary, time limit will be constrained by the life of the breathing air cylinder, and egress from the area must be performed before its expiration.

Ventilation:

Local exhaust: Mandatory. Must be filtered or scrubbed to limit exit concentrations. Air emissions will meet local, state and federal regulations.

Special: Chemical laboratory hoods will have an average inward face velocity of 100 linear feet per minute (lfpm) +/- 20% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods will have an inward face velocity of 150 lfpm +/- 20%. Laboratory hoods will be located such that cross-drafts do not exceed 20% of the inward face velocity. A visual performance test using smoke-producing devices will be performed in assessing the ability of the hood to contain agent GB.

Other: Recirculation or exhaust air from chemical areas is prohibited. No connection between chemical areas and other areas through ventilation system is permitted. Emergency backup power is necessary. Hoods should be tested at least semiannually or after modification or maintenance operations. Operations should be performed 20 centimeters inside hood face.

Protective Gloves: Butyl Rubber Glove M3 and M4
Norton, Chemical Protective Glove Set

Eye Protection: At a minimum safety glasses with side shields will be worn. For splash hazards use goggles and face shield. Maintain eyewash facilities in work area.

Other Protective Equipment: For laboratory operations, wear lab coats, gloves and have mask readily accessible. In addition, daily clean smocks, foot covers, and head covers will be required when handling contaminated lab animals. In the case of a spill, the minimum protective clothing should be Level B after the site has been evaluated, otherwise Level A.

Monitoring: Available monitoring equipment for agent GB is the M8/M9 detector paper, detector ticket, M256/M256A1 kits, bubbler, Depot Area Air Monitoring System (DAAMS), Automated Continuous Air Monitoring System (ACAMS), Real-Time Monitor (RTM), Demilitarization Chemical Agent Concentrator (DCAC), M8/M43, M8A1/M43A1, CAM-M1, Hydrogen Flame Photometric Emission Detector (HYFED), the Miniature Chemical Agent Monitor (MINICAM), and the Real Time Analytical Platform (RTAP).

Real-time, low-level monitors (with alarm) are required for GB operations. In their absence, an Immediately Dangerous to Life and Health (IDLH) atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

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Section IX - Special Precautions

Precautions To Be Taken In Handling And Storing: When handling agents, the buddy system will be incorporated. No smoking, eating, or drinking in areas containing agents is permitted. Containers should be periodically inspected for leaks, (either visually or using a detector kit). Stringent control over all personnel practices must be exercised. Decontaminating equipment will be conveniently located. Exits must be designed to permit rapid evacuation. Chemical showers, eyewash stations, and personal cleanliness facilities must be provided. Wash hands before meals and, as appropriate, shower thoroughly with special attention given to hair, face, neck, and hands using plenty of soap and water before leaving at the end of the workday.

Other Precautions: Agent containers will be stored in a single containment system within a laboratory hood or in a double containment system.

For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program," "DA Pam 385-61, Toxic Chemical Agent Safety Standards," and "DA Pam 40-8, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents GA, GB, GD, and VX"; and DA Implementation Guidance Policy for New Airborne Exposures Limits for GB, GA, GD, GF, VX, H, HD, and HT dated 18 June 2004.

Section X - Transportation Data

NOTE: Forbidden for transport other than via military (Technical Escort Unit) transport according to 49 CFR Part 173.7(b), DOD 4500.9-R and AR 50-6.

Proper Shipping Name: Toxic liquids, organic, n.o.s. (Isopropyl methylphosphonofluoridate)

UN ID Number: UN2810

DOT Hazard Class: 6.1, Packing Group I, Inhalation Hazard Zone A

DOT Label: Poison Inhalation Hazard or Toxic Inhalation Hazard. See 49 CFR 172.400a(a)(3) for exceptions to unit packaging labeling and 173.7(b) for other exceptions when material is transported by Technical Escort Units.

NOTE: "Poison" and "Toxic" are used interchangeably for all markings, labels and placards for continental US transportation. "Toxic" is required for international transportation.

DOT Marking: Toxic liquids, organic, n.o.s. (Isopropyl methylphosphonofluoridate) UN 2810, Inhalation Hazard Zone A

DOT Placard: Poison Inhalation Hazard or Toxic Inhalation Hazard

Emergency Accident Precautions And Procedures: See Sections IV, VII and VIII.

Precautions To Be Taken In Transportation: Motor vehicles will be placarded regardless of quantity. Drivers will be given full information regarding shipment and conditions in case of an emergency. AR 50-6 deals specifically with the shipment of chemical agents.

The Edgewood Chemical Biological Center (ECBC), Department of the Army believes that the data contained herein are actual and are the results of the tests conducted by ECBC experts. The data are not to be taken as a warranty or representation for which the Department of the Army or ECBC assumes legal responsibility. They are

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offered solely for consideration. Any use of this data and information contained in this MSDS must be determined by the user to be in accordance with applicable Federal, State, and local laws and regulations.

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CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

RDX(CYCLONITE)

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

The information in this document is compiled from information maintained by the United States Department of Defense (DOD). Anyone using this information is solely reponsible for the accuracy and applicability of this information to a particular use or situation.
Cornell University does not in any way warrant or imply the applicability, viability or use of this information to any person or for use in any situation.

Section 1 - Product and Company Identification
RDX(CYCLONITE)

Product Identification: RDX(CYCLONITE)
Date of MSDS: 01/01/1985 **Technical Review Date:** 01/05/1982
FSC: 6850 **NIIN: LIIN:** 00D000069
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

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Manufacturer's Information

Manufacturer's Name: CONSOLIDATED CONTROLS CORP.
Manufacturer's Address1:
Manufacturer's Address2: N/P, NK 00000
Manufacturer's Country: NK
General Information Telephone:
Emergency Telephone: 213-772-5301
Emergency Telephone: 213-772-5301
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 09790
Special Project Code: N

Contractor Information

Contractor's Name: CONSOLIDATED CONTROLS CORPORATION
Contractor's Address1: UNKNOWN
Contractor's Address2: UNKNOWN, NK 00000
Contractor's Telephone: UNKNOWN
Contractor's CAGE: 09790

Section 2 - Compositon/Information on Ingredients
RDX(CYCLONITE)

Ingredient Name: CYCLONITE
Ingredient CAS Number: 121-82-4 **Ingredient CAS Code:** M
RTECS Number: XY9450000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100.
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: S, 1.5 MG/M3 **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: S, 1.5MG/M3; 9192 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
RDX(CYCLONITE)

Health Hazards Acute & Chronic: N/P

Signs & Symptoms of Overexposure:
N/A

Medical Conditions Aggravated by Exposure:
N/P

LD50 LC50 Mixture: N/P

Route of Entry Indicators:
Inhalation: N/P
Skin: N/P
Ingestion: N/P

Carcenogenicity Indicators
NTP: N/P
IARC: N/P
OSHA: N/P

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
RDX(CYCLONITE)

First Aid:
N/A

Section 5 - Fire Fighting Measures
RDX(CYCLONITE)

Fire Fighting Procedures:
ISOLATION
Unusual Fire or Explosion Hazard:
N/A
Extinguishing Media:
N/A
Flash Point: Flash Point Text: N/A

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 400F
Upper Limit(s): N/A

Section 6 - Accidental Release Measures
RDX(CYCLONITE)

Spill Release Procedures:
NO

Section 7 - Handling and Storage
RDX(CYCLONITE)

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
RDX(CYCLONITE)

Repiratory Protection:
N/A
Ventilation:
N/P
Protective Gloves:
N/P
Eye Protection: N/P
Other Protective Equipment: N/P
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: ITEM IS A 1.5 GRAM EXPLOSIVE IS CONTAINED IN AN ASSEMBLY P/N 200WSS-6

Section 9 - Physical & Chemical Properties
RDX(CYCLONITE)

HCC: E2
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: N/A
Melting/Freezing Point: Melting/Freezing Text: N/A
Decomposition Point: Decomposition Text: N/A
Vapor Pressure: N **Vapor Density:** N/A
Percent Volatile Organic Content:
Specific Gravity: N/A
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/A
Solubility in Water: N/A
Appearance and Odor: SOLID 1.5 GM EXPLOSIVE
Percent Volatiles by Volume: N/A
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
RDX(CYCLONITE)

Stability Indicator: YES
Materials to Avoid:
N/A
Stability Condition to Avoid:
UNIT CAN ONLY BE IGNITED BY APPLICATION OF 4 AMPS DC TO CIRS
Hazardous Decomposition Products:
N/A
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NONE

Section 11 - Toxicological Information
RDX(CYCLONITE)

Toxicological Information:
N/P

Section 12 - Ecological Information
RDX(CYCLONITE)

Ecological Information:
N/P

Section 13 - Disposal Considerations
RDX(CYCLONITE)

Waste Disposal Methods:
N/A

Section 14 - MSDS Transport Information
RDX(CYCLONITE)

Transport Information:
N/P

Section 15 - Regulatory Information
RDX(CYCLONITE)

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
RDX(CYCLONITE)

Other Information:
N/P

HMIS Transportation Information
Product Identification: RDX(CYCLONITE)

Transporation ID Number: 435
Responsible Party CAGE: 09790
Date MSDS Prepared: 01/01/1985
Date MSDS Reviewed: 01/05/1982
MFN: 01/05/1982
Submitter: D DG
Status Code: C

Container Information
Unit of Issue: NK
Container Quantity: NK
Type of Container:
Net Unit Weight:

Article without MSDS: N
Technical Entry NOS Shipping Number: NOT ACCEPTABLE FOR SHIPMENT
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information
DOT Proper Shipping Name: CYCLOTRIMETHYLENETRINITRAMINE, WETTED OR CYCLONITE, WETTED OR HEXOGEN, WETTED OR RDX, WETTED
DOT PSN Code: EET
Symbols:
DOT PSN Modifier: WITH NOT LESS THAN 15 PER CENT WATER BY MASS.
Hazard Class: 1.1D
UN ID Number: UN0072
DOT Packaging Group: II
Label: EXPLOSIVE 1.1D
Special Provision(s):
Packaging Exception:
Non Bulk Packaging: 62
Bulk Packaging: NONE
Maximimum Quanity in Passenger Area: FORBIDDEN
Maximimum Quanity in Cargo Area: FORBIDDEN
Stow in Vessel Requirements: B
Requirements Water/Sp/Other: 1E,5E

IMO Detail Information
IMO Proper Shipping Name: CYCLONITE, WETTED

IMO PSN Code: EYX
IMO PSN Modifier: WITH NOT LESS THAN 15% WATER, BY MASS
IMDG Page Number: 1106
UN Number: 0072
UN Hazard Class: 1.1 D
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 1-01
Medical First Aid Guide Number: 235

IATA Detail Information

IATA Proper Shipping Name: FORBIDDEN BY THIS MODE OF TRANSPORTATION
IATA PSN Code: ZZY
IATA PSN Modifier:
IATA UN Id Number: N/R
IATA UN Class: N/R
Subsidiary Risk Class: N/R
UN Packaging Group: N/R
IATA Label: N/R
Packaging Note for Passengers: N/R
Maximum Quantity for Passengers: N/R
Packaging Note for Cargo: N/R
Maximum Quantity for Cargo: N/R
Exceptions: N/R

AFI Detail Information

AFI Proper Shipping Name: CYCLOTRIMETHYLENETRINITRAMINE, CYCLONITE, HEXOGEN, RDX, WETTED
AFI Symbols:
AFI PSN Code: IBK
AFI PSN Modifier: ,WITH NOT LESS THAN 15% WATER, BY MASS
AFI UN Id Number: UN0072
AFI Hazard Class: 1.1D
AFI Packing Group: II
AFI Label:
Special Provisions: P4
Back Pack Reference: A5.37

HAZCOM Label Information

Product Identification: RDX(CYCLONITE)
CAGE: 09790
Assigned Individual: N
Company Name: CONSOLIDATED CONTROLS CORPORATION
Company PO Box:
Company Street Address1: UNKNOWN
Company Street Address2: UNKNOWN, NK 00000 NK
Health Emergency Telephone: 213-772-5301
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: G

Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Product Identification: TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM
Date of MSDS: 07/02/1991 **Technical Review Date:** 09/10/1991
FSC: 1376 **NIIN: LIIN:** 00N018210
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: HERCULES INCORPORATED
Manufacturer's Address1: RADFORD ARMY AMMUNITION PLANT
Manufacturer's Address2: RADFORD, VA 24141
Manufacturer's Country: US
General Information Telephone: 703-639-7294
Emergency Telephone: 703-639-7294
Emergency Telephone: 703-639-7294
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 2D295
Special Project Code: N

Contractor Information

Contractor's Name: HERCULES INC
Contractor's Address1: RADFORD ARMY AMMUNITION PLANT
Contractor's Address2: RADFORD, VA 24141
Contractor's Telephone: 703-639-7294
Contractor's CAGE: 2D881

Contractor Information

Contractor's Name: HERCULES INCORPORATED
Post Office Box: N/K
Contractor's Address1: 84 5TH AVE
Contractor's Address2: NEW YORK, NY 10011-7603
Contractor's Telephone: UNKNOWN
Contractor's CAGE: 2D295

Section 2 - Compositon/Information on Ingredients
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Ingredient Name: 2,4,6-TRINITROTOLUENE (TNT)
Ingredient CAS Number: 118-96-7 **Ingredient CAS Code:** M
RTECS Number: XU0175000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 99
% Enviromental Weight:

Other REC Limits: N/K
OSHA PEL: S, 1.5 MG/M3 **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: S, 0.5 MG/M3; 9293 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Health Hazards Acute & Chronic: ALLERGENIC, CAN CAUSE DERMATITIS. DISCOLOR SKIN AND HAIR PALE YELLOW. CAUSES NAUSEA, VOMITING AND ANOREXIA ALSO LIVER AND BLOOD DAMAGE, AND APLASTIC ANEMIA.

Signs & Symptoms of Overexposure:
SEE HEALTH HAZARDS.

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route of Entry Indicators:
Inhalation: YES
Skin: NO
Ingestion: NO

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT.

Section 4 - First Aid Measures
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

First Aid:
EYE:IMEEDIATELY FLUSH THOROUGHLY WITH LARGE AMOUNTS OF LOW PRESSURE WATER FOR AT LEAST 25 MINUTES. REMOVE CONTACT LENSES TO ASSURE THOROUGH FLUSHING. CALL MD. SKIN:WASH WITH TNT INDICATOR SOAP AND RUN NING WATER. INHAL:REMOVE TO FRESH AIR. TREAT ANY IRRITATION SYMPTOMATICALLY. CALL MD. INGEST:CALL MD IMMEDIATELY (FP N).

Section 5 - Fire Fighting Measures
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Fire Fighting Procedures:

WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).
EVACUATE THE AREA.
Unusual Fire or Explosion Hazard:
HIGHLY DANGEROUS-SHOCK WILL EXPLODE IT. WILL DETONATE IF CONFINED AND EXPOSED TO EXTRME HEAT.
Extinguishing Media:
DELUGE WITH WATER-USE LARGE QUANTITIES.
Flash Point: Flash Point Text: EXPLODES

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/A
Upper Limit(s): N/A

Section 6 - Accidental Release Measures
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Spill Release Procedures:
CLEAN UP SPILL IMMEDIATELY USING A SOFT BRISTLE BRUSH AND A CONDUCTIVE RUBBER OR PLASTIC SHOVEL.

Section 7 - Handling and Storage
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Repiratory Protection:
NIOSH/MSHA APPROVED RESPIRATOR FOR DUSTS.
Ventilation:
MECHANICAL (GENERAL) VENTILATION.
Protective Gloves:
COTTON OR LEATHER GLOVES.
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: FLAME-PROOF COVERALLS AND CONDUCTIVE SHOES.
Work Hygenic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Health & Safety Information: NONE SPECIFIED BY MANUFACTURER.

Section 9 - Physical & Chemical Properties
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

HCC: E1
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 464F,240C
Melting/Freezing Point: Melting/Freezing Text: N/K

Decomposition Point: Decomposition Text: N/K
Vapor Pressure: N/K **Vapor Density:** N/A
Percent Volatile Organic Content:
Specific Gravity: 1.5-1.6
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: NOT APPLICABLE
Solubility in Water: 0.01% @ 25C
Appearance and Odor: FLAKES, PALE YELLOW IN COLOR.
Percent Volatiles by Volume: <0.1
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Stability Indicator: YES
Materials to Avoid:
SODIUM HYDROXIDE, POTASSIUM HYDROXIDE AND OTHER HIGHLY ALKALINE MATERIALS.
Stability Condition to Avoid:
AVOID CONTACT WITH ALKALINE MATERIALS. WILL DETONATE IF CONFINED AND EXPOSED TO EXTREME HEAT.
Hazardous Decomposition Products:
NOX.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Toxicological Information:
N/P

Section 12 - Ecological Information
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Ecological Information:
N/P

Section 13 - Disposal Considerations
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Waste Disposal Methods:
BURN ON OPEN BURNING GROUND IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS. MAY ALSO BE BURNED IN AN INCINERATOR APPROVED FOR EXPLOSIVES. DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULAT IONS (FP N).

Section 14 - MSDS Transport Information

TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Transport Information:
N/P

Section 15 - Regulatory Information
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM

Other Information:
N/P

HMIS Transportation Information
Product Identification: TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM
Transporation ID Number: 22878
Responsible Party CAGE: 2D295
Date MSDS Prepared: 07/02/1991
Date MSDS Reviewed: 10/21/1991
MFN: 10/21/1991
Submitter: N TN
Status Code: C

Container Information
Unit of Issue: NK
Container Quantity: NK
Type of Container:
Net Unit Weight:

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: CYCLOTETRAMETHYLENETETRANITRAMINE, WETTED OR HMX, WETTED OR OCTOGEN, WETTED
DOT PSN Code: EEL
Symbols:
DOT PSN Modifier: WITH NOT LESS THAN 15 PER CENT WATER, BY MASS
Hazard Class: 1.1D
UN ID Number: UN0226
DOT Packaging Group: II
Label: EXPLOSIVE 1.1D
Special Provision(s):
Packaging Exception:
Non Bulk Packaging: 62
Bulk Packaging: NONE
Maximimum Quanity in Passenger Area: FORBIDDEN
Maximimum Quanity in Cargo Area: FORBIDDEN
Stow in Vessel Requirements: B
Requirements Water/Sp/Other: 1E,5E

IMO Detail Information

IMO Proper Shipping Name: TRINITROTOLUENE
IMO PSN Code: PBV
IMO PSN Modifier: ,DRY OR WETTED WITH LESS THAN 30% WATER, BY MASS
IMDG Page Number: 1144
UN Number: 0209
UN Hazard Class: 1.1 D
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 1-01
Medical First Aid Guide Number: *

IATA Detail Information

IATA Proper Shipping Name: N/A
IATA PSN Code: YYG
IATA PSN Modifier: TRINITROTOLUENE, DRY OR WETTED WITH LESS THAN 30% WATER, BY WEIGHT
IATA UN Id Number: 0209
IATA UN Class: 1.1D
Subsidiary Risk Class:
UN Packaging Group:
IATA Label:
Packaging Note for Passengers: FORB
Maximum Quantity for Passengers: FORB
Packaging Note for Cargo: FORB
Maximum Quantity for Cargo: FORB
Exceptions:

AFI Detail Information

AFI Proper Shipping Name: TETRAHYDROFURAN
AFI Symbols:
AFI PSN Code: XSI
AFI PSN Modifier:

AFI UN Id Number: UN2056
AFI Hazard Class: 3
AFI Packing Group: II
AFI Label:
Special Provisions: P5
Back Pack Reference: A7.3

HAZCOM Label Information

Product Identification: TRINITROTOLUENE (TNT) TYPE 1 FLAKE FORM
CAGE: 2D295
Assigned Individual: N
Company Name: HERCULES INCORPORATED
Company PO Box: N/K
Company Street Address1: 84 5TH AVE
Company Street Address2: NEW YORK, NY 10011-7603 US
Health Emergency Telephone: 703-639-7294
Label Required Indicator: Y
Date Label Reviewed: 09/10/1991
Status Code: C
Manufacturer's Label Number:
Date of Label: 09/10/1991
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Slight
Contact Hazard: Slight
Fire Hazard: Severe
Reactivity Hazard: Severe

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Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
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TETRYL

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
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Section 1 - Product and Company Identification
TETRYL

Product Identification: TETRYL
Date of MSDS: 04/30/1991 **Technical Review Date:** 02/14/1992
FSC: 1375 **NIIN: LIIN:** 00N026374
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: ENSIGN-BICKFORD CO
Manufacturer's Address1: 660 HOPMEADOW ST
Manufacturer's Address2: SIMSBURY, CT 06070
Manufacturer's Country: US
General Information Telephone: 203-658-4411;203-843-2276
Emergency Telephone: 203-658-4411;203-843-2276
Emergency Telephone: 203-658-4411;203-843-2276
MSDS Preparer's Name: T.A. SHREVE
Proprietary: N
Reviewed: N
Published: Y
CAGE: 0B1W4
Special Project Code: N

Contractor Information

Contractor's Name: ENSIGN-BICKFORD CO
Contractor's Address1: 660 HOPMEADOW ST
Contractor's Address2: SIMSBURY, CT 06070
Contractor's Telephone: (203) 658-4411 OR (203) 843-22
Contractor's CAGE: 0B1W4

Contractor Information

Contractor's Name: THE ENSIGN-BICKFORD CO
Contractor's Address1: 660 HOPMEADOW ST
Contractor's Address2: SIMSBURY, CT 06070
Contractor's Telephone: (203) 658-4411
Contractor's CAGE: 0B2N1

Section 2 - Compositon/Information on Ingredients
TETRYL

Ingredient Name: ANILINE, N-METHYL-N,2,4,6-TETRANITRO-; (TRINITRO-2,4,6-PHENYLMETHYLMITRAMINE)
Ingredient CAS Number: 479-45-8 **Ingredient CAS Code:** M
RTECS Number: BY6300000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100
% Enviromental Weight:

Other REC Limits: N/K
OSHA PEL: S, 1.5 MG/M3 **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 1.5 MG/M3; 9293 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Ingredient Name: ING 3:SENSITIVE TO DETONATION. IF POSS, SEPARATE ANY MATL THAT APPEARS TO BE UNCONTAMD FROM MATL THAT APPEARS TO (ING 5)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 4:BE GRIT CONTAMD. STORE COLLECTED MATL FOR PROPER DISP.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M

OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 6:RECOM MET OF DISP OF WASTE EXPLO IS BY OPEN BURN/OPEN DETONATION. TETRYL MAY BE DESTROYED BY BOIL IN SOLN (ING 8)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 7:OF SODIUM CARBONATE. BY-PROD & SPECIFICS OF RXN ARE NOT AVAILABLE.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:

ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SPILL PROC:FRICTION/IMPACT. PLACE MATL IN VELOSTAT BAG. CONTAM OF MATL W/SAND/DIRT/OTHER GRIT WILL RENDER IT MORE(ING 4)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: SUPP DATA:IT DOES NOT DETONATE, IT WILL BURN VIGOROUSLY.DEFLAGRATION TEMPERATURE IS 185C (365F).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M

ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: VENT:STRONGLY RECOMMENDED TO MINIMIZE EMPLOYEE EXPOSURE.
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: WASTE DISP METH:LBLG/PACKAGING/STOR & TRANSPORTATION) MUST BE PERFOMRED I/A/W ALL APPLIC LOC/ST/FED LAWS & REGS. (ING 7)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**

EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview
TETRYL

Health Hazards Acute & Chronic: EYE:MAY CAUSE IRRITATION, POSSIBLE EYE DAMAGE. SKIN:SKIN MAY TURN YELLOW & DERMATITIS MAY DEVELOP. INHAL:IRRITATION TO UPPER RESPIRATORY TRACT & POSSIBLE DEATH. INGEST:POISONING IS ACCOMPAINED BY FOLL OWING SYMPTOMS:LACK OF APPETITE, INSOMNIA, & GIDDINESS. SYMPTOMS USUALLY BEGIN AFTER 2-3 WEEKS OF BEING EXPOS TO TETRYL.

Signs & Symptoms of Overexposure:
SEE HEALTH HAZARDS.

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route of Entry Indicators:
Inhalation: YES
Skin: NO
Ingestion: YES

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT.

Section 4 - First Aid Measures
TETRYL

First Aid:
EYE:FLUSH IMMED UNDER RUNNING WATER FOR AT LEAST 15 MIN, SEEK MED ATTN IMMED. SKIN:FLUSH IMMED UNDER RUNNING WATER FOR AT LEAST 15 MIN, SEEK MED ATTN IMMED. INHAL:GET VICTIM TO FRESH AIR. GIVE ARTF RE SP IF BRTHG HAS STOPPED.SEEK MED ATTN IMMED. INGEST:INDUCE VOMIT IMMED BY STICKING FINGER DOWN THROAT. SEEK MED ATTN IMMED.

Section 5 - Fire Fighting Measures
TETRYL

Fire Fighting Procedures:
NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP(FP N). DO NOT FIGHT FIRES INVOLVING TETRYL! PROD IS PRIMARY (INITIATING) EXPLO & MAY DETONATE WHEN EXPOS TO (SUPP DATA)

Unusual Fire or Explosion Hazard:
TETRYL IS PRIMARY(INITIATING) EXPLO. PROD IS LIKELY TO DETONATE WHEN EXPOS TO SHOCK/HEAT/IMPACT/SPARKS/FRICTION. PROD SHOULD BE HNDLD ONLY BY (SUPP DATA)
Extinguishing Media:
MEDIA SUITABLE FOR SURROUNDING FIRE (FP N).
Flash Point: Flash Point Text: N/K

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/K
Upper Limit(s): N/K

Section 6 - Accidental Release Measures
TETRYL

Spill Release Procedures:
ISOLATE SPILL AREA, KEEP ALL SOURCES OF IGNIT AWAY FROM SPILL & EVACUATE ALL NONESSENTIAL PERS TO SAFE DISTANT LOCATION. REMOVE ALL EXPLO THAT WERE NOT INVOLVED IN SPILL FROM SPILL AREA. CAREFULLY COL LECT SPILLED MATL, AVOID ANY EXCESS (ING 3)

Section 7 - Handling and Storage
TETRYL

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TETRYL

Repiratory Protection:
NIOSH/MSHA APPROVED DUST RESPIRATOR SHOULD BE WORN WHEN HANDLING TETRYL.
Ventilation:
LOC EXHAUST:STRONGLY RECOM TO MINIMIZE EMPLOYEE EXPOS. SPECIAL:TETRYL DUST IS POISONOUS. MECH:EXHAUST VENT (ING 9)
Protective Gloves:
BUTYL RUBBER GLOVES.
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: COTTON COVERALLS (ANTISTATIC) WHICH WILL PROTECT AGAINST POWDER SPLASHES; SHOULD BE REPLACED WHEN CONTAMINATED.
Work Hygenic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Health & Safety Information: FIRE FIGHT PROC:HEAT/FLAMES.DO NOT ATTEMPT TO FIGHT TETRYL FIRES!ISOLATE AFFECTED AREA & EVACUATE ALL PERS TO DISTANT,SAFE AREA.EXPLO HAZ:QUALIFIED INDIVIDUALS WHO ARE THORO FAMILIAR W/PROPER EXPLO HN DLG PROC.HAZ GASES (NITROGEN OXIDES, NO*X'S) MAY BE REL WHEN TETRYL BURNS/DETONATES.IF TETRYL IS EXPOS TO FIRE & (ING 2)

Section 9 - Physical & Chemical Properties
TETRYL

HCC: E2
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: N/A
Melting/Freezing Point: Melting/Freezing Text: 265F,129C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: N/A **Vapor Density:** N/A
Percent Volatile Organic Content:
Specific Gravity: N/K
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: NOT APPLICABLE
Solubility in Water: INSOLUBLE
Appearance and Odor: LIGHT YELLOW CRYSTALS.
Percent Volatiles by Volume: 100%
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
TETRYL

Stability Indicator: YES
Materials to Avoid:
CARBON STEEL IS EASILY CORRODE BY TETRYL A SLIGHT CORROSION IS FOUND WITH ZINC AND ZINC PLATED STEEL.
Stability Condition to Avoid:
EXPOSURE TO SHOCK, SPARKS, PRESSURE, OR IMPACT MAY RESULT IN DETONATION.
Hazardous Decomposition Products:
THERMAL DECOMPOSITION MAY PRODUCE OXIDES OF CARBON & NITROGEN.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
TETRYL

Toxicological Information:
N/P

Section 12 - Ecological Information
TETRYL

Ecological Information:
N/P

Section 13 - Disposal Considerations
TETRYL

Waste Disposal Methods:
WASTE TETRYL IS HAZ WASTE AS DEFINED UNDER RESOURCE CONSERVATION & RECOVERY ACT (RCRA) REGS, & MUST BE DISP OF @ PROPERLY PERMITTED TRTMT/STOR/DISP FACILITY (TSD). WASTE TETRYL DISP & ALL RELATED, REG ULATED ACTIVITIES (INCL BUT NOT LIM TO (ING 6)

Section 14 - MSDS Transport Information
TETRYL

Transport Information:
N/P

Section 15 - Regulatory Information
TETRYL

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
TETRYL

Other Information:
N/P

HMIS Transportation Information

Product Identification: TETRYL
Transporation ID Number: 31002
Responsible Party CAGE: 0B1W4
Date MSDS Prepared: 04/30/1991
Date MSDS Reviewed: 05/13/1992
MFN: 05/13/1992
Submitter: N TN
Status Code: C

Container Information
Unit of Issue: NK
Container Quantity: NK
Type of Container:
Net Unit Weight:

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P

AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: CYCLOTETRAMETHYLENETETRANITRAMINE, WETTED OR HMX, WETTED OR OCTOGEN, WETTED
DOT PSN Code: EEL
Symbols:
DOT PSN Modifier: WITH NOT LESS THAN 15 PER CENT WATER, BY MASS
Hazard Class: 1.1D
UN ID Number: UN0226
DOT Packaging Group: II
Label: EXPLOSIVE 1.1D
Special Provision(s):
Packaging Exception:
Non Bulk Packaging: 62
Bulk Packaging: NONE
Maximimum Quanity in Passenger Area: FORBIDDEN
Maximimum Quanity in Cargo Area: FORBIDDEN
Stow in Vessel Requirements: B
Requirements Water/Sp/Other: 1E,5E

IMO Detail Information

IMO Proper Shipping Name: TETRYL
IMO PSN Code: ONJ
IMO PSN Modifier:
IMDG Page Number: 1112
UN Number: 0208
UN Hazard Class: 1.1 D
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 1-01
Medical First Aid Guide Number: T

IATA Detail Information

IATA Proper Shipping Name: N/A
IATA PSN Code: YXR
IATA PSN Modifier: TRINITROPHENYLMETHYLNITRAMINE
IATA UN Id Number: 0208
IATA UN Class: 1.1D
Subsidiary Risk Class:
UN Packaging Group:
IATA Label:
Packaging Note for Passengers: FORB
Maximum Quantity for Passengers: FORB
Packaging Note for Cargo: FORB

Maximum Quantity for Cargo: FORB
Exceptions:

AFI Detail Information

AFI Proper Shipping Name: TRINITROPHENYLMETHYLNITRAMINE OR TETRYL
AFI Symbols:
AFI PSN Code: YXR
AFI PSN Modifier:
AFI UN Id Number: UN0208
AFI Hazard Class: 1.1D
AFI Packing Group: II
AFI Label:
Special Provisions: P4
Back Pack Reference: A5.47

HAZCOM Label Information

Product Identification: TETRYL
CAGE: 0B1W4
Assigned Individual: N
Company Name: ENSIGN-BICKFORD CO
Company PO Box:
Company Street Address1: 660 HOPMEADOW ST
Company Street Address2: SIMSBURY, CT 06070 US
Health Emergency Telephone: 203-658-4411;203-843-2276
Label Required Indicator: Y
Date Label Reviewed: 02/14/1992
Status Code: C
Manufacturer's Label Number:
Date of Label: 02/14/1992
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: None
Reactivity Hazard: Severe

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MATERIAL SAFETY DATA SHEET (MSDS)

Serial No. 5801

(Assigned by Code 04)

Identity (As Used on Label)	Other Names
Nitroglycerin	NG, nitrate ester

Section I. General

Manufacturer Indian Head Division Naval Surface Warfare Center 101 Strauss Avenue Indian Head, MD 20640-5035	**Emergency Telephone Number**	301-744-4438
	Telephone Number for Information	301-744-4924
	Date Prepared	29 July 03

Section II. Summary of Hazards

The first symptoms of exposure to nitroglycerin are usually a headache, nausea or vomiting. Nitroglycerin is an irritant through inhalation, skin contact and eye contact. Exposure to nitroglycerin effects central nervous system depressant and methemoglobin formation. Persons at greatest risk when exposed include those with hypotension, anemia, hyperthyroidism and cardiovascular disease.

This document is the MSDS for **Nitroglycerin.**

Section III. Emergency and First Aid

Inhalation	Remove to fresh air immediately. If breathing has stopped, give artificial respiration. Seek medical attention.
Eye Contact	Wash eyes immediately with large amounts of water or saline solution, occasionally lifting upper and lower lids, for at least 15 minutes. Seek medical attention.
Skin Contact	Remove contaminated clothing immediately. Wash affected area with soap and water for at least 15 minutes. Seek medical attention if irritation persists.
Ingestion	DO NOT INDUCE VOMITING. Qualified medical personnel should remove chemical by gastric lavage or catharsis. Activated charcoal is useful. Seek medical attention.
Emergency Medical Treatment Procedures	Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. Keep victim quiet and maintain normal body temperature. Effects may be delayed; keep victim under observation.

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Identity	Nitroglycerin	
Section IV. Health Hazards/Symptoms of Exposure		
Summary of Acute Hazards	Symptoms include headache, nausea, vomiting and skin irritation.	
ROUTE OF EXPOSURE	SIGNS AND SYMPTOMS	PRIMARY ROUTE OF ENTRY
Inhalation:	Headache, conjunctivitis, nausea, vomiting, visual disturbances and mental confusion.	X
Eye Contact:	Local irritation, decreased visual acuity, systematic effects of headache, nausea, vomiting and other symptoms of narcosis.	
Skin Contact:	Local irritation and systematic effects of headache, nausea, vomiting and other symptoms of narcosis.	X
Ingestion:	Ingestion may cause numbness of extremities, tingling sensation, excitement, headache, hypotension, nausea, vomiting, abdominal cramps, gastroenteric irritation and respiratory difficulty.	
Chronic Hazards (Long Term)	Symptoms include headache, nausea, vomiting, hallucinations, hypotension, mental confusion, skin rashes, conjunctivitis and numbness. Long term exposure may result in acclimatization to discomforts produced by acute effects. Exposure also targets the skin, blood and cardiovascular system. NG is not a suspected carcinogen.	
Section V. Protective Equipment and Control Measures		
Respiratory:	Organic vapor respirator/supplied air respirator is required if exposed to levels above OSHA limits.	
Eye:	Chemical splash goggles and face shield are recommended when handling.	
Skin:	Nitrile Buna-rubber gloves and flame-resistant powder uniform are recommended when handling.	
Engineering Controls:	Use general or local exhaust ventilation to satisfy exposure limits. Ventilation equipment must be explosion-proof.	
Other Hygienic and Work Practices:	Wear flame-resistant powder uniform, flame-resistant soft cap, and conductive-soled shoes. Have an eyewash and safety shower nearby. There should be no smoking or eating in the workplace.	

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Identity	Nitroglycerin		
Section VI. Fire and Explosion			
Flash Point (method):	**Autoignition Temp (method)**	**Flammable Limits (% vol in air)**	
		Lower	**Upper**
Explodes	518 °F (270 °C)	Unknown	Unknown
Fire And Explosion Hazards:	Dangerously explosive. Moderate fire hazard when exposed to heat or flame.		
Extinguishing Media:	Water sprinkler/deluge system recommended.		
Special Fire Fighting Procedures:	Do not attempt to manually extinguish fires. Burning explosives may accelerate to a detonation at any time when subjected to confinement, shock or other sufficient initiation source. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighter's protective clothing will provide limited protection. Withdraw from area and let fire burn. Promptly isolate the scene by removing all persons from the vicinity of the scene and away from windows.		
Section VII. Spill and Disposal			
Large Spill:	Shut off all sources of ignition. Do not touch spilled material. Smoking and open flames are strictly prohibited in the area. Evacuate area to a distance of 2500-feet in all directions. Control access to area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Keep unnecessary people away.		
Small Spill:	Wipe up spill with an acetone-dampened sponge. Use conductive containers and ground all containers before transferring explosives between containers. Avoid metal-to-metal contact, impact, friction or other situations, which may initiate the explosive. Avoid sand, glass, grit and metal fragments which may sensitize the material to impact or friction.		
Waste Disposal Methods:	Store and handle waste as a Class A explosive. Transport in accordance with Department of Transportation regulations for Class A explosives. Obtain approval from appropriate agencies prior to disposal. Consult manufacturer for recommended methods of destroying explosive materials. Comply with all Federal, State and local regulations. NG solutions must be disposed of as a hazardous waste per 40 CFR 262.		
Section VIII. Handling and Storage			
General Handling Procedures:	Avoid contact with heat, sparks, flames or other sources of ignition. Avoid friction, shock and impact. Use all required personal protective equipment. Explosives must be tested for compatibility with any materials which they contact. Wash thoroughly after handling. Wash contaminated clothing before use. Avoid pinching material, metal-to-metal contact, impact, friction, shock or other mechanical stimuli.		
Storage Requirements:	Storage must be performed in accordance with appropriate safety regulations concerning quantity distance, barricading, personnel exposure and handling equipment. Storage containers should be grounded. Observe all federal, state and local regulations.		

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Identity	Nitroglycerin

Section IX. Stability and Reactivity

Stable Conditions	Yes	No	Conditions To Avoid:
	X		Avoid heat, sparks, open flame and other sources of ignition. Avoid impact, shock, friction and electrostatic discharge. High explosives will detonate when exposed to sufficient mechanical and thermal stimuli.

Incompatibility (Materials to avoid): Acids, oxidizers and ozone.

Hazardous Decomposition By-Products: Carbon monoxide, carbon dioxide, oxides of nitrogen

Hazardous Polymerization	Yes	No	Conditions To Avoid:
		X	Not applicable

Impact Sensitivity (mm)	8.4 mm for 50% height (NOS)	**Other**
Friction Sensitivity (psig)	Unknown	**Other**
ESD Sensitivity (joules)	≥12.5	**Other**

Section X. Hazardous Ingredients/Identity Information

Hazardous Components	OSHA PEL	ACGIH TLV	Other Limits
Nitroglycerin (CAS# 55-63-0)	2.0 mg/m^3	0.5 mg/m^3	

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Identity	Nitroglycerin

Section XI. Physical and Chemical Data

Boiling Point (indicate °F or °C)	424 °F (218 °C)	**Specific Gravity (water = 1)**	1.6
Vapor Pressure (mm Hg)	0.0015 @ 20 °C	**Melting Point (indicate °F or °C)**	55 °F (13 °C)
Vapor Density (Air = 1)	7.8	**Evaporation Rate (Butyl Acetate = 1)**	Unknown
Solubility in Water:	0.125%		
Appearance and Odor:	Colorless to pale yellow slightly viscous liquid with a sweet burning taste.		

Section XII. Other Information

Health (blue)		2
Contact (white)		2
Fire (red)		3
Reactivity (yellow)		1.1

Hazardous Material Warning Label
(for Naval Surface Warfare Center, Indian Head Division use only)

0 = no significant hazard

1 = slight hazard

2 = moderate hazard

3 = severe hazard

1.3 = mass fire explosive

1.1 = mass detonating explosive

ND = hazard has not yet been determined

Shipping Name:	Explosive A		
UN or North American Identification Number	Explosive A	**Hazard Class and Packing Group**	Class 1 Division 1.1 Explosives
TSCA Status	All components are listed in the TSCA chemical inventory.		
CERCLA/SARA:	Report spills per 40 CFR 302.6 and 40 CFR 372.30.		
RCRA:	Discarded Nitroglycerin solution is a D003 (reactive) RCRA hazardous waste. Dispose of according to federal, state and local regulations.		
State Regulatory Information:	This material contains nitroglycerin and is thus a P081 (reactive) COMAR hazardous waste.		

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NEXPLO BOFORS

SAFETY DATA SHEET

Issued by, Department, Telephone	Date	Edition number	Document number
Birgitta Pettersson, XM3, 83535	1999-03-29	1	

Product denomination: Nitrocellulose NSC 830

1 Identification of the substance and of the company/undertaking

Product name	Nitrocellulose
Chemical name	Nitrocellulose, NSC 830
Company/Manufacturer	NEXPLO BOFORS AB
Company address	S-691 86 KARLSKOGA , SWEDEN
Telephone number	46-586-830 50
Telefax number	46-586-853 10
Emergency telephone number	46-586-832 00, ERC + m 46-0(8)-33 70 43
Contact person	Birgitta Pettersson/XM 3
Dangerous Goods, documentation	Birgitta Pettersson

2 Composition/Information on ingredients

Identification of product	Substances	CAS-number	%	Risk phrases
Nitrocellulose, N-content < 12.6 %	NC, wetted	9004-70-0	100	11

3 Hazard Identification

Health hazard	-
Inhalation	May irritate respiratory organs and lungs. May cause headache.
Skin contact	May irritate.
Eye contact	May irritate.
Ingestion	May irritate and cause headache.
Fire and explosion hazards	HIGHLY FLAMMABLE.

NOTE ! Risk that fire continues into explosion. Nitrocellulose is in dry or slightly wetted condition a heavy explosive. It can easily be ignated or explode by shock, friction, sparks or contact with hot surfaces. In disadvantageous cases dust or dry NC can be ignitated by sweeping with a hard brush, for example. Dry NC may self-ignate, for example exposed in sunshine. NC developes toxic smoke at heating/combustion.

NEXPLO BOFORS

SAFETY DATA SHEET 2 (7)

Issued by, Department, Telephone	Date	Edition number	Document number
Birgitta Pettersson, XM3, 83535	1999-03-29	1	
Product designation			
Nitrocellulose NSC 830			

Environmental hazards	Waste of wetted nitrocellulose must immediately be taken care of. Dry product must be wetted before it can be taken care of. Product in the nature may cause overfeeding through Nitrogen-addition.

4 First-aid measures

After inhalation	Inhalation of gases from fire: Fresh air, warmth and rest, in halfsitting position. Avoid strain - increased risk for affection on the lungs. Use octogen, go to hospital aven by small troubles.
After skin contact	Take off contaminated clothes/shoes. Wash with soap and water.
After eye contact	Rinse with water.
After ingestion	No harmful effects known.

5 Fire-fighting measures

Extinguishing media

- Suitable extinguishing media	Use copious volumes of water, sprinkler.
- Extinguishing media not to be used	NOT fire - extinction powder.
Special exposure causing hazard	Nitrous gases.
Special protective equipment for fire-fighters	Full protection including compressed air mask.

6 Accidental release measures

Personal precautions	Flame-protection treated clothes, protecting against direct contact, and gloves.
Environmental precautions	Production as far as possible in closed systems. Containers must be kept well closed. Working place and methods must be planned in such a way that direct contact with NC is prevented and potential wastage from leaking production kettles can be taken care of before product is getting dry and contaminating the sewage system. Special explosive separators must exist in resp. room. Rooms and equipment must regarly be rinsed with water for removal of wastage.

NEXPLO BOFORS

SAFETY DATA SHEET 3 (7)

Issued by, Department, Telephone	Date	Edition number	Document number
Birgitta Pettersson, XM3, 83535	1999-03-29	1	

Product denomination: Nitrocellulose NSC 830

Methods for cleaning up	Product, wetted with water, shall be collected and put into special and marked containers. Waste shall be burned in open air and set to fire from a protected place. Destruction shall be carried out by experts. Contact fire-brigade.

7 Handling and storage

Handling	Product must be kept wet. Containers keeps wetted and must continuesly be tested concerning moisture content. Explosive classified electric equipment must be used. Equipment well earthed.
Storage	Must always be stored wetted with water in tight closing containers, only in places approved for explosives. Keep protected from warmth. By intermediate soring, for example in production stores, the water-content must be checked every week, especially by sunshine and hot weather.

8 Personal protection/Exposure controls

Engineering measures	Must only be handled in rooms where water pouring is possible. Keep containers well closed. Working place and methods must be planned in such a way that direct contact with NC is avoided. No smoking, fire, sparks or welding. Prevent sparks caused by static elecuicity. Use explosion protected el-equipment.
Personal protection equipment	
Respiratory protection	Inhalation protection with dust-filter P2 is recommended at cleaning of rooms, machine equipment, transportators etc., which are swept by brushes, before pouring with water.
Hand protection	Tightly lined gloves, of plastic or plastic gloves with cotton inside glove.
Eye protection	Face screen or glasses with side-protection is recommended by cleaning.
Skin protection	Flame-protection treated clothes, as close-fitted as possible, when direct contact is risked.
Specific hygienic measures	-
Further information	Because of the explosion risk must the product be kept wetted.

NEXPLO BOFORS **SAFETY DATA SHEET** 4 (7)

Issued by, Department, Telephone	Date	Edition number	Document number
Birgitta Pettersson, XM3, 83535	1999-03-29	1	
Product denomination: Nitrocellulose NSC 830			

9 Physical and chemical properties

Appearance	Fibres
Colour	White
Odour	-
Decomposition point (°C)	Heated NC during a longer period of time decomposition can happen with a temperature > 100 °C.
Melting point/range (°C)	-
Flash point (°C)	-
Autoignition temperature (°C)	185 - 190 (Explosive temp.)
Explosion properties	Explosive
Boiling point/range (°C)	-
Relative density (kg/m^3)	~1160
Solubility in water	Insoluble
Solubility in other solvents	Ketones and esters.
Partition coefficient n-octanol/water	-
Other data	-

10 Stability and reactivity

Conditions to avoid	Risk for fire. Shock, friction, sparks, electrostatic electricity must be avoided. Must not be stored in temperatures higher than normal room temperature. Must be producted against getting dry.
Materials to avoid	Alkaline substances and strong acids.
Hazardous decomposition products	Nitrous gases.
Other information	

11 Toxicological information

LD_{50} oral rat	> 2000 mg/kg
Hazardous ingredients	No harmful effects known from available literature.

NEXPLO BOFORS

SAFETY DATA SHEET 5 (7)

Issued by, Department, Telephone	Date	Edition number / Document number
Birgitta Pettersson, XM3, 83535	1999-03-29	1
Product denomination		
Nitrocellulose NSC 830		

Immediate health effects	-
Delayed health effects	Not known
Acute toxicity	Not known
Chronic toxicity (long-term)	Not known
Carcinogenicity	-
Mutagenicity	-
Reproductive toxicity	-
Inhalation	Irritates the respiratory organs.
Skin	Irritates
Eye	Irritates
Ingestion	May cause headache.
Hygienic standards and recommendations	Swedish limit value not existing.

12 Ecological information

Microtox (mg/ml, LC_{50})/(mg/ml, EC_{50})	96-HR LC50, Brachydanio Rerio(Zebrafish) > 10000 mg/l
Mobility	-
Persistence degradability	28 days = 10 % at 10 mg/l, COD 0.463 g/g
Bioaccumulative potential	-
Aquatic toxicity and other data	-
Marine pollutant (IMDG Code)	-

13 Disposal considerations

Disposal of waste materials	Wastage, wetted with water, shall be collected and put in special container. At destruction experts shall be called upon.Contact fire-brigade.
Contaminated packaging	Must be disposed of in a safe way.

NEXPLO BOFORS

SAFETY DATA SHEET 7 (7)

Issued by, Department, Telephone	Date	Edition number	Document number
Birgitta Pettersson, XM3, 83535	1999-03-29	1	
Product denomination: Nitrocellulose NSC 830			

Symbols	F, Extremely flammable.
Risk phrases	R11, Highly flammable.
Safety phrases	S16, Keep away from sources of ignition - No smoking.
	S33, Take precautionary measures against static electricity.
	S37, Wear suitable gloves.
	S39, Wear eye/face protection.

16 Other information

References	SAX'S DANGEROUS PROPERTIES OF INDUSTRIAL MATERIALS.
	Arbetarskyddsstyrelsens författningssamling 1993:9

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** TOTAL PAGE.08 **

CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

DIETHYL PHTHALATE, H944

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
DIETHYL PHTHALATE, H944

Product Identification: DIETHYL PHTHALATE, H944
Date of MSDS: 08/15/1996 **Technical Review Date:** 12/22/1997
FSC: 6810 **NIIN: LIIN:** 00N062225
Submitter: N EN
Status Code: C
MFN: 02
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: J.T. BAKER INC
Manufacturer's Address1: 222 RED SCHOOL LANE
Manufacturer's Address2: PHILLIPSBURG, NJ 08885-2219
Manufacturer's Country: US
General Information Telephone: 908-859-2151
Emergency Telephone: 800-424-6802;800-424-9300(CHEMTREC)
Emergency Telephone: 800-424-6802;800-424-9300(CHEMTREC)
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: JO091
Special Project Code: N

Contractor Information

Contractor's Name: J.T. BAKER INC
Contractor's Address1: 222 RED SCHOOL LANE
Contractor's Address2: PHILLIPSBURG, NJ 08885-2219
Contractor's Telephone: 908-859-2151
Contractor's CAGE: JO091

Contractor Information

Contractor's Name: MALLINCKRODT BAKER, INC. (FORMERLY J.T. BAKER INC)
Contractor's Address1: 222 RED SCHOOL LANE
Contractor's Address2: PHILLIPSBURG, NJ 08865-2219
Contractor's Telephone: 800-582-2537
Contractor's CAGE: 70829

Section 2 - Compositon/Information on Ingredients
DIETHYL PHTHALATE, H944

Ingredient Name: PHTHALIC ACID, DIETHYL ESTER; (DIETHYL PHTHALATE) (SARA 313) (CERCLA). LD50:(ORAL,RAT) 8600 MG/KG.
Ingredient CAS Number: 84-66-2 **Ingredient CAS Code:** M
RTECS Number: TI1050000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 99-100
% Enviromental Weight:

Other REC Limits: N/K
OSHA PEL: 5 MG/M3 **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 5 MG/M3 **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1000 LBS
DOT Reporting Quantity: 1000 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
DIETHYL PHTHALATE, H944

Health Hazards Acute & Chronic: ACUTE:INHALATION:IRRITATION OF MUCOUS MEMBRANES, COUGHING, DIFFICULT BREATHING, MAY CAUSE NARCOSIS. SKIN/EYE CONTACT:IRRITATION. SKIN ABSORPTION:NONE IDENTIFIED. INGESTION:IRRITATION OF MUCOUS MEMBRAN ES, HEADACHE, NAUSEA, VOMITING, DIZZINESS, GASTROINTESTINAL IRRITATION, CENTRAL NERVOUS SYSTEM DEPRESS.(EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ:CHRONIC:SOME REPORTS HAVE INDICATED THAT THIS SUBSTANCE MAY BE TERATOGENIC.

Medical Conditions Aggravated by Exposure:
NONE IDENTIFIED.

LD50 LC50 Mixture: SEE INGREDIENT 1.

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT

Section 4 - First Aid Measures
DIETHYL PHTHALATE, H944

First Aid:
INGEST:IF CONSCIOUS, IMMEDIATELY INDUCE VOMITING. INHAL:IF PERSON BREATHES IN LARGE AMOUNTS, MOVE EXPOSED PERSON TO FRESH AIR. SKIN:IMMEDIATELY WASH W/PLENTY OF SOAP & WATER FOR AT LEAST 15 MINUTES. E YES:IMMEDIATELY FLUSH W/PLENTY OF WATERFOR AT LEAST 15 MINUTES.

Section 5 - Fire Fighting Measures

DIETHYL PHTHALATE, H944

Fire Fighting Procedures:
USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N). MOVE CNTNRS FROM FIRE AREA IF IT CAN BE DONE W/OUT RISK. USE WATER TO KEEP FIRE-EXPOS CNTNRS COOL.
Unusual Fire or Explosion Hazard:
CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE.
Extinguishing Media:
USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.
Flash Point: Flash Point Text: 322F,160C

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 0.07%
Upper Limit(s): N/A

Section 6 - Accidental Release Measures
DIETHYL PHTHALATE, H944

Spill Release Procedures:
WEAR SUITABLE PROTECTIVE CLOTHING. TAKE UP W/SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL & PLACE INTO CONTAINER FOR LATER DISPOSAL. FLUSH SPILL AREA W/WATER. REPORTABLE QUANTITY:1000 LBS.

Section 7 - Handling and Storage
DIETHYL PHTHALATE, H944

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
DIETHYL PHTHALATE, H944

Repiratory Protection:
NIOSH APPROVED RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 25 PPM, A NIOSH APPROVED HIGH-EFFICIENCY PARTICULATE RESPIRATOR IS REC. ABOVE THIS LEVEL, A NIOSH APPROVED SCBA IS ADVISED.
Ventilation:
USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.
Protective Gloves:
NEOPRENE GLOVES.
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: ANSI APPRVD EYE WASH FOUNTAIN & DELUGE SHOWER (FP N). UNIFORM & APRON ARE REC. LAB COAT. NOTE:WHEN HNDLG LIQ (SUPP DATA)
Work Hygenic Practices: WASH THOROUGHLY AFTER HANDLING.
Supplemental Health & Safety Information: OTHER PROT EQUIP:PRODUCTS, SECONDARY

PROTECTIVE CONTAINERS MUST BE USED FOR CARRYING.

Section 9 - Physical & Chemical Properties
DIETHYL PHTHALATE, H944

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 568F,298C
Melting/Freezing Point: Melting/Freezing Text: -40F,-40C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: <1 @ 20C **Vapor Density:** 7.6
Percent Volatile Organic Content:
Specific Gravity: 1.12 (H*2O=1)
Volatile Organic Content Pounds per Gallon:
pH: N/A
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: NOT APPLICABLE
Solubility in Water: NEGLIGIBLE (<0.1%)
Appearance and Odor: COLORLESS VISCOUS LIQUID; ODORLESS.
Percent Volatiles by Volume: 100
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
DIETHYL PHTHALATE, H944

Stability Indicator: YES
Materials to Avoid:
STRONG OXIDIZING AGENTS, STRONG ACIDS, NITRIC ACID, STRONG BASES.
Stability Condition to Avoid:
HEAT, FLAME, OTHER SOURCES OF IGNITION.
Hazardous Decomposition Products:
CARBON MONOXIDE, CARBON DIOXIDE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT

Section 11 - Toxicological Information
DIETHYL PHTHALATE, H944

Toxicological Information:
N/P

Section 12 - Ecological Information
DIETHYL PHTHALATE, H944

Ecological Information:
N/P

Section 13 - Disposal Considerations
DIETHYL PHTHALATE, H944

Waste Disposal Methods:
DISPOSE I/A/W ALL APPLICABLE FEDERAL, STATE & LOCAL ENVIRONMENTAL REGULATIONS. EPA HAZARDOUS WASTE NUMBER:U088 (TOXIC WASTE).

Section 14 - MSDS Transport Information
DIETHYL PHTHALATE, H944

Transport Information:
N/P

Section 15 - Regulatory Information
DIETHYL PHTHALATE, H944

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
DIETHYL PHTHALATE, H944

Other Information:
N/P

HAZCOM Label Information
Product Identification: DIETHYL PHTHALATE, H944
CAGE: JO091
Assigned Individual: Y
Company Name: J.T. BAKER INC
Company PO Box:
Company Street Address1: 222 RED SCHOOL LANE
Company Street Address2: PHILLIPSBURG, NJ 08885-2219 US
Health Emergency Telephone: 800-424-6802;800-424-9300(CHEMTREC)
Label Required Indicator: Y
Date Label Reviewed: 12/22/1997
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/22/1997
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: Slight
Reactivity Hazard: None

CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

104 0724 TRIACETIN

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
104 0724 TRIACETIN

Product Identification: 104 0724 TRIACETIN
Date of MSDS: 05/14/1986 **Technical Review Date:** 08/11/1998
FSC: 6810 **NIIN: LIIN:** 00F014969
Submitter: F BT
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: EASTMAN KODAK CO
Post Office Box: N/K
Manufacturer's Address1: 343 STATE ST
Manufacturer's Address2: ROCHESTER, NY 14650-1115
Manufacturer's Country: US
General Information Telephone: 716-724-6481/716-722-5151
Emergency Telephone: 716-722-5151/716-724-4501
Emergency Telephone: 716-722-5151/716-724-4501
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 19139
Special Project Code: N

Preparer Information

Preparer's Name: EASTMAN KODAK CO GOVERNMENT MARKETS CONTRACTS
Preparer's Address1: 343 STATE ST
Preparer's Address2: ROCHESTER, NY 14650-1115
Preparer's CAGE: 19139
Assigned Individual: N

Contractor Information

Contractor's Name: EASTMAN KODAK CO GOVERNMENT MARKETS CONTRACTS
Contractor's Address1: 343 STATE ST
Contractor's Address2: ROCHESTER, NY 14650-1115
Contractor's Telephone: 716-722-5151/(800) 242-2424
Contractor's CAGE: 19139

Section 2 - Compositon/Information on Ingredients
104 0724 TRIACETIN

Ingredient Name: TRIACETIN *98-2*
Ingredient CAS Number: 102-76-1 **Ingredient CAS Code:** M
RTECS Number: AK3675000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100
% Enviromental Weight:

Other REC Limits: N/K
OSHA PEL: N/K **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
104 0724 TRIACETIN

Health Hazards Acute & Chronic: EYES: TRANSIENT IRRITATION.
INHALATION/INGESTION/SKIN: LOW HAZARD.

Signs & Symptoms of Overexposure:
IRRITATION

Medical Conditions Aggravated by Exposure:
N/K

LD50 LC50 Mixture: N/K

Route of Entry Indicators:
Inhalation: NO
Skin: NO
Ingestion: NO

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NONE

Section 4 - First Aid Measures
104 0724 TRIACETIN

First Aid:
EYES: FLUSH W/PLENTY OF WATER. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Section 5 - Fire Fighting Measures
104 0724 TRIACETIN

Fire Fighting Procedures:
N/K
Unusual Fire or Explosion Hazard:
N/K
Extinguishing Media:
WATER SPRAY, DRY CHEMICAL, CO2, & ALCOHOL FOAM.

Flash Point: Flash Point Text: 308F

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/K
Upper Limit(s): N/K

Section 6 - Accidental Release Measures
104 0724 TRIACETIN

Spill Release Procedures:
ABSORB MATERIAL IN VERMICULITE/OTHER SUITABLE ABSORBENT & PLACE IN IMPERVIOUS CONTAINER.

Section 7 - Handling and Storage
104 0724 TRIACETIN

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
104 0724 TRIACETIN

Repiratory Protection:
N/K
Ventilation:
GOOD VENTILATION SHOULD BE SUFFICIENT.
Protective Gloves:
N/K
Eye Protection: SAFETY GLASSES
Other Protective Equipment: N/K
Work Hygenic Practices: N/K
Supplemental Health & Safety Information: N/K

Section 9 - Physical & Chemical Properties
104 0724 TRIACETIN

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 496F
Melting/Freezing Point: Melting/Freezing Text: N/K
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 1 **Vapor Density:** N/K
Percent Volatile Organic Content:
Specific Gravity: 1.16
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:

Viscosity: N/P
Evaporation Weight and Reference: (N-BU AC = 1): <0.1
Solubility in Water: 1-10%
Appearance and Odor: COLORLESS LIQUID
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
104 0724 TRIACETIN

Stability Indicator: YES
Materials to Avoid:
STRONG OXIDIZERS
Stability Condition to Avoid:
N/K
Hazardous Decomposition Products:
CO2 & CO.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
N/K

Section 11 - Toxicological Information
104 0724 TRIACETIN

Toxicological Information:
N/P

Section 12 - Ecological Information
104 0724 TRIACETIN

Ecological Information:
N/P

Section 13 - Disposal Considerations
104 0724 TRIACETIN

Waste Disposal Methods:
DISPOSE BY INCINERATION/CONTRACT W/LICENSED CHEMICAL WASTE DISPOSAL AGENCY. DISCHARGE, TREATMENT/DISPOSAL SHOULD BE IAW/LOCAL, STATE & FEDERAL REGULATIONS.

Section 14 - MSDS Transport Information
104 0724 TRIACETIN

Transport Information:
N/P

Section 15 - Regulatory Information
104 0724 TRIACETIN

SARA Title III Information:
N/P

Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
104 0724 TRIACETIN

Other Information:
N/P

HAZCOM Label Information

Product Identification: 104 0724 TRIACETIN
CAGE: 19139
Assigned Individual: N
Company Name: EASTMAN KODAK CO GOVERNMENT MARKETS CONTRACTS
Company PO Box:
Company Street Address1: 343 STATE ST
Company Street Address2: ROCHESTER, NY 14650-1115 US
Health Emergency Telephone: (716) 722-5151
Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

8/8/2002 8:21:45 AM

ENSIGN-BICKFORD CO -- LEAD DIAZIDE

MSDS Safety Information

MSDS Date: 03/12/1993
MSDS Num: CKLHH
Product ID: LEAD DIAZIDE
MFN: 01
Responsible Party
Cage: 96336
Name: ENSIGN-BICKFORD CO
Address: 660 HOPMEADOW STREET
Box: 483
City: SIMSBURY CT 06070-0483
Info Phone Number: 203-843-2276
Emergency Phone Number: 203-658-441
Preparer's Name: T A SHREVE
Review Ind: Y
Published: Y

Contractor Summary

Cage: 96336
Name: ENSIGN-BICKFORD CO
Address: 660 HOPMEADOW STREET
Box: 483
City: SIMSBURY CT 06070-0483
Phone: 1-801-798-8613

Ingredients

Cas: 13424-46-9
RTECS #: OF8650000
Name: LEAD AZIDE (PB(N3)2)
Percent by Wt: 91.5
OSHA PEL: 50 MG/M3 (PB)
ACGIH TLV: 0.15 MG/M3 (PB)

Health Hazards Data

Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO

Effects of Exposure: EYE CONTACT: MAY CAUSE IRRITATION, POSSIBLE CORNEAL
INJURY. SKIN CONTACT: EXPOSURE MAY CAUSE IRRITATION & DERMATITIS.
INHALATION: MAY CAUSE NASAL & RESPIRATORY IRRITATION. INGESTION: MAY BE
FATAL OR C AUSE POISONING IF INGESTED. TOXICITY OF LEAD AZIDE HAS BEEN LINKED
TO AZOMIDE RADICAL AS WELL AS PRESENCE OF LEAD. MAJOR SYMPTOMS OF AZIDE
POISONING ARE SEVERE HYPOTENSION & PARALYSIS. SYMPTOMS OF LEA D POISONING
INCLUDE LOSS OF APPETITE, ANEMIA, SLEEP DISORDERS, & FATIGUE. CHRONIC:
LEAD AZIDE APPEARS ON NAVY LISTING OF OCCUPATIONAL CHEMICAL REPRODUCTIVE
HAZARDS. SEEK CONSULTATION FROM APPROPRIATE HEALTH (EFTS OF OVEREXP)
Explanation Of Carcinogenicity: LEAD OZIDE IS NOT LISTED AS A POTENTIAL
CARCINOGEN BY (NTP) (IARC) (OSHA).
Signs And Symptions Of Overexposure: HLTH HAZ: PROFESSIONALS CONCERNING LATEST
HAZARD LIST INFORMATION AND SAFE HANDLING AND EXPOSURE INFORMATION (FP N).
THRESHOLD LIMIT VALUE: 0.15 MG/M3 AS LEAD (PB) (ACGIH).
First Aid: EYE CONTACT: FLUSH IMMEDIATELY UNDER RUNNING WATER FOR AT LEAST
FIFTEEN MINUTES, SEEK MEDICAL ATTENTION. SKIN CONTACT: FLUSH IMMEDIATELY
UNDER RUNNING WATER FOR AT LEAST FIFTEEN MINUTES. IF SKIN IRRIT ATION OCCURS,
SEEK MEDICAL ATTENTION. INHALATION: MOVE VICTIM TO FRESH AIR. GIVE ARTIFICIAL
RESPIRATION IF BREATHING HAS STOPPED. SEEK MEDICAL ATTENTION IMMEDIATELY.
INGESTION: IF INGESTED, INDUCE VOM ITING IMMEDIATELY BY STICKING FINGER DOWN
VICTIM'S THROAT! SEEK MEDICAL ATTENTION IMMEDIATELY.

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Handling and Disposal

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Spill Release Procedures: ISOLATE SPILL AREA, KEEP ALL SOURCES OF IGNITION AWAY
FROM SPILL, & EVACUATE ALL NON-ESSENTIAL PERS TO SAFE DISTANT LOCATION.

REMOVE ALL EXPLOSIVES THAT WERE NOT INVOLVED IN SPILL FROM SPILL AREA. LEA D
AZIDE IS EXTREMELY SENSITIVE EXPLOSIVE. IT IS POSSIBLE TO STEP ON LEAD AZIDE
& HAVE IT DETONATE. DO NOT MOVE UNLESS THERE IS CLEAR PATH AWAY FROM
SPILL AREA. SPILLED LEAD AZIDE SHOULD BE (SUPDAT)
Waste Disposal Methods: WASTE LEAD AZIDE SHOULD BE CHEMICALLY DESTROYED USING
20% CERRIC AMMONIUM NITRATE & H*2O KILLING SOLN. THOROUGHLY POUR LIBERAL
AMTS OF KILLING SOLN OVER EXCESS LEAD AZIDE. RSLTG CHEM RXN WILL LIBERATE
HYDRAZOIC ACID (HN*3). USE NIOSH APPRVD SCBA/USE WELL VENT AREA TO PVNT INHAL
OF FUMES. ALTHOUGH RS LTG SOLN IS NOT EXPLOSIVE IT SHOUD BE (OTHER INFO)
Handling And Storage Precautions: HANDLE AND STORE IN ACCORDANCE WITH ALL
APPLICABLE REGULATIONS AND INDUSTRY PRACTICES GOVERNING CLASS A PRIMARY
(INITIATING)/HAZARD CLASS 1.1A EXPLOSIVE (SEE REACTIVITY DATA SECTION).
Other Precautions: LEAD AZIDE WILL ALWAYS BE SHIPPED WET WITH A MINIMUM OF 20%
AQUEOUS ETHANOL (CAS 64-17-5) DENATURED WITH METHANOL (CAS 67-56-1). REFER TO
THE ENCLOSED MATERIAL DATA SHEETS FOR THE PROPERTIES OF THESE MATERIALS IF
APPLICABLE.

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Fire and Explosion Hazard Information

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Autoignition Temp: =275.C, 527.F
Extinguishing Media: MEDIA SUITABLE FOR SURROUNDING FIRE (FP N). AUTO IGNITION
TEMP: 275C (527F) MINIMUM TEMPERATURE FOR IGNTION IN 5 SECONDS FOR
DEXTRINATED LEAD AZIDE. U S ARMY REFERENCE.
Fire Fighting Procedures: USE NIOSH APPROVED SCBA & FULL PROTECTIVE
EQUIPMENT (FP N). DO NOT FIGHT FIRES INVOLVING LEAD AZIDE! PRODUCT IS A
PRIMARY (INITIATING) EXPLOSIVE AND MAY DETONATE WHEN EXPOSED TO HEAT OR
FLAMES. ISOLAT E THE AFFECTED AREA AND EVACUATE ALL PERSONNEL TO A DISTANT,

SAFE AREA.
Unusual Fire/Explosion Hazard: LEAD AZIDE IS PRIMARY (INITIATING) EXPLO. THIS
PROD IS LIKELY TO DETONATE WHEN EXPOSED TO SHOCK, HEAT, IMPACT, ELECTROSTATIC
DISCHARGE (SPARKS)/FRICTION. PROD SHOULD BE HANDLED ONLY BY QUALIFIED INDIV
IDUALS WHO ARE THOROUGHLY FAMILIAR W/PROPER PRIMARY EXPLOSIVES HANDLING
PROCS. HAZ GASES (LEAD VAP, HYDRAZOIC (TOX INFO)

Control Measures

Respiratory Protection: NIOSH APROVED DUST RESPIRATOR SHOULD BE WORN WHEN
HANDLING DRY LEAD AZIDE. NIOSH APPROVED ORGANIC VAPOR RESPIRATOR SHOULD BE
USED WHEN HANDLING WET LEAD AZIDE.
Ventilation: LOCAL EXHAUST: NONE REC DUE TO EXPLOSION HAZ. SPECIAL: FOR
ADDITIONAL INFO ON LEAD SEE 29 CFR 1910.1025. MECH: EXHAUST VENT REC TO MIN
EMPLOYEE EXPOSURE.
Protective Gloves: BUTYL RUBBER GLOVES.
Eye Protection: ANSI APPROVED CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: EYE WASH & DELUGE SHWR MTG ANSI DESIGN CRITERIA (FP
N). COTTON COVERALLS TO PROTECT AGAINST EMPLOYEE CONT WLEAD AZIDE; SHOULD BE
REPLACED WHEN CONTAM. CONDUCTIVE FOOTWEAR & FLOORING IS ALSO RECOMMENDED.
Work Hygienic Practices: PHYSICAL DATA: DENSITY: 4.38 GM/CM3.
Supplemental Safety and Health: SPILL PROC: CAREFULLY WIPED UP LIBERALLY USING
SOPON & H*2O SOLN/KILLED W/KILLING SOLN OF 1 PART CERRIC AMMONIUM NITRATE
& 6 PARTS H*2O (APPROX 20%). DISPOSE OF SOPON/H*2O SOLN BY ADDING ABOVE
REFEREN CED KILLING SOLN. TREAT ALL MATL TREATED W/KILLING SOLN AS LEAD (PB)
WASTE. ALWAYS KILL LEAD AZIDE IN (OTHER INFO)

Physical/Chemical Properties

Melt/Freeze Pt: >275.C, 527.F
M.P/F.P Text: EXPLODES

Spec Gravity: 4.38
Solubility in Water: SLIGHT (0.02% @ 18C (64F)
Appearance and Odor: WHITE TO LIGHT BUFF CRYSTALS, ODORLESS.

Reactivity Data

Stability Indicator: YES
Stability Condition To Avoid: DO NOT STORE AT TEMP >66C (150F). ALWAYS SHIP &
STORE BULK LEAD AZIDE WET W/ALCOHOL TO PVNT FREEZING. EXPOS TO SHOCK, HEAT,
SPKS, PRESS/IMPACT MAY RSLT IN (ECOLOGICAL INFO)
Materials To Avoid: COPPER AND COPPER ALLOYS, SILVER, MERCURY, CADMIUM NICKEL,
ACIDS, AND OXIDANTS.
Hazardous Decomposition Products: IN PRESENCE OF MOISURE (H*2O), LEAD AZIDE
REACTS W/COPPER (CU) & COPPER BEARING ALLOYS TO FORM UNSTABLE BY-PRODUCTS.
LEAD AZIDE SHOULD NOT BE MFRD, STORED/LOADED IN COPPER/COPPER ALLOY (TOX
INFO)
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: WILL NOT OCCUR.

Toxicological Information

Toxicological Information: N/P. HAZ DECOMP PROD: CONTAINERS (I.E. BRASS OR
BRONZE). HAZARADOUS DECOMPOSITION GASES ARE LEAD VAPOR AND HYPRAZOIC ACID
(HN*3). EXPLO HAZ: ACID, & NITROGEN OXIDES (NO*X'S) MAY BE RELEASED WHEN
LEAD AZIDE BURNS OR DETONATES. IF LEAD AZIDE IS EXPOSED TO FIRE AND IT DOES
NOT DETONATE, IT WILL BURN VIGOROUSLY.

Ecological Information

Ecological: N/P. DETONATION. (ENERGY VALUES AS LOW AS 2X10 JOULES HAVE BEEN
SHOWN TO INITIATE LEAD AZIDE W/METAL TO METAL CNTCT IN LAB EXPERIMENTS).

MSDS Transport Information

Transport Information: SHIPPING INFORMATION: SHIPPING NAME: LEAD AZIDE. HAZARD
CLASS: 1.14. UN NO.: 0129. LABEL: EXPLOSIVE. SPECIAL: LEAD AZIDE, WETTED,
FORBIDDEN.

Regulatory Information

Sara Title III Information: SARA 313 NOTIFICATION: "THIS PRODUCT CONTAINS LEAD
& LEAD COMPOUNDS THAT ARE SUBJECT TO THE REPORTING REQUIREMENTS OF
SECTION 313 TITLE III OF THE SUPERFUND AMENDMENT AND REAUTHORIZATION ACT OF
1986 4 0 CR PART 372."
State Regulatory Information: CALIFORNIA PROPOSITION 65 NOTIFICATION: "LEAD
& LEAD COMPOUNDS ARE LISTED ON CALIFORNIA SAFE DRINKING WATER & TOXIC
ENFORCEMENT ACT OF 1986 (PROPOSITION 65) AS A CHEMICAL KNOWN TO THE STATE TO
CAUSE C ANCER. LEAD IS LISTED AS A CHEMICAL KNOWN TO THE STATE TO CAUSE
REPRODUCTIVE TOXICITY."

Other Information

Other Information: CHEM NAME: LEAD AZIDE. CHEM FAMILY: METAL SALT OF INORG
ACID. FORMULA: PB(N3)2. SUPDAT: WELL VENT AREA/USE NIOSH APPRVD SCBA TO
PREVENT INHAL OF HYDRAZOIC ACID (HN*3) FUMES. WASTE DISP METH:TREATED AS
LEAD (PB) WASTE. LEAD WASTE IS HAZ WASTE AS DEFINED UNDER RCRA REGULATIONS,
& MUST BE DISPOSED OF AT PROPERLY PERMITTED TREATMENT/STORAGE/DISPOSAL
FACILITY (TSD). LEAD AZIDE DISPOSAL & ALL RELATED, REGULATED ACTIVITIES,
(INCLUDING BUT NOT LIMITED TO HANDLING, LABELING, PACKAGING, STORAGE, AND
TRANSPORTATION MUST BE PERFORMED IN ACCORDANCE WITH ALL APPLICABLE LOCAL,
STATE, AND FEDERAL LAWS & REG ULATIONS.

HAZCOM Label

Product ID: LEAD DIAZIDE
Cage: 96336
Company Name: ENSIGN-BICKFORD CO
Street: 660 HOPMEADOW STREET
PO Box: 483
City: SIMSBURY CT
Zipcode: 06070-0483
Health Emergency Phone: 203-658-441
Label Required IND: Y
Date Of Label Review: 05/11/2000
Status Code: A
Origination Code: F
Chronic Hazard IND: Y
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: Slight
Reactivity Hazard: Severe
Hazard And Precautions: EXPLOSIVE! ACUTE: EYE CONTACT: MAY CAUSE IRRITATION,
POSSIBLE CORNEAL INJURY. SKIN CONTACT: EXPOSURE MAY CAUSE IRRITATION &
DERMATITIS. INHALATION: MAY CAUSE NASAL & RESPIRATORY IRRITATION.
INGESTION: MAY BE FATAL OR CAUSE POISONING IF INGESTED. TOXICITY OFLEAD
AZIDE HAS BEEN LINKED TO AZOMIDE RADICAL AS WELL AS PRESENCE OF LEAD. MAJOR
SYMPTOMS OF AZIDE POISONING ARE SEVERE HYPOTENSION & PARALYSIS . SYMPTOMS
OF LEAD POISONING INCLUDE LOSS OF APPETITE, ANEMIA, SLEEP DISORDERS,&
FATIGUE. CHRONIC: LEAD AZIDE APPEARS ON NAVY LISTING OF OCCUPATIONAL CHEMICAL
REPRODUCTIVE HAZARDS (FP N).

Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever expressly or implied warrants, states, or intends said information to have any application, use or viability by or to any person or persons outside the Department of Defense nor any person or persons contracting with any instrumentality of the United

States of America and disclaims all liability for such use. Any person utilizing this instruction who is not a military or civilian employee of the United States of America should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation regardless of similarity to a corresponding Department of Defense or other government situation.

lead stearate.txt

SPRAYLAT CORP -- SC-1073 BLUE

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MSDS Safety Information

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FSC: 8030
MSDS Date: 01/12/1993
MSDS Num: BWZBJ
LIIN: 00N057955
Product ID: SC-1073 BLUE
MFN: 01
Responsible Party
Cage: 87354
Name: SPRAYLAT CORP
Address: 716 SOUTH COLUMBUS AVE
City: MT VERNON NY 10550
Info Phone Number: 914-699-3030
Emergency Phone Number: 800-424-9300 (CHEMTREC)
Preparer's Name: MICHAEL A SPATH
Published: Y

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Contractor Summary

==========

Cage: 87354
Name: SPRAYLAT CORPORATION
Address: 716 SOUTH COLUMBUS AVENUE
City: MT. VERNON NY 10550
Phone: 914-699-3030;310-559-2335

==========

Ingredients

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Cas: 56189-09-4
Name: LEAD STEARATE (SARA 313) (CERCLA)
% Wt: <10
OSHA PEL: SEE 1910.1025
ACGIH TLV: 0.15 MG(PB)/M3

Cas: 1317-80-2
RTECS #: VM2940000
Name: RUTILE; (TITANIUM DIOXIDE)
% Wt: <10
OSHA PEL: 10 MG/M3 TDUST Z1A
ACGIH TLV: 10 MG/M3 8990

Name: HLTH HAZ: CONSULT FROM APPROP HLTH PROFESSIONALS CONCERNING LATEST HAZ LIST INFO & SAFE HNDLG & EXPOS INFO (FP N).

Name: FIRST AID: BY A PHYSICIAN. CONTACT A PHYSICIAN IMMEDIATELY.

Name: RESP PROT: APPRVD) DURING & AFTER APPLICATN UNLESS AIR MONITORING DEMONSTRATES VAP/MIST LEVELS ARE BELOW

Name: RESP PROT: APPLICABLE LIMITS. FOLLOW RESP MFR DIRECTIONS FOR USE.

Name: PROT GLOVES: CONT. WEAR RESIST GLOVES SUCH AS NATRL RUB, NEOPRENE, BUNA N/NITRILE.

Name: VENT: NIOSH/MSHA APPROVED RESP TO PREVENT OVEREXPOS. FOR ING 1, SEE OSHA STD. 29 CFR 1910-1025.

Name: SPILL PROC: NOTIFY LOCAL HEALTH & POLLUTION CONTROL AGENCIES. CALL SPILL RESPONSE TEAMS IF SPILL IS LARGE.

Name: SPILL PROC: DO NOT FLUSH TO SEWER, WATERSHED OR WATERWAY.

Page 1

lead stearate.txt

Name: FIRE FIGHT PROC: SAFE DISTANCE OR A PROTECTED LOCATION.

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Health Hazards Data

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LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ING 1: CHRONIC OVEREXP OR INGEST MAY CAUSE POSS KIDNEY DMG, CNS DEPRESS/DISORDER, DELAYED EFTS INVOLVING BLOOD, GI, NERV & REPRO SYS, HDCH, NAUS, VOMIT, DIZZ/LOSS OF CONSCIOUSNESS, REPROD SYS DMG IN S OME LAB ANIMALS, TESTICULAR INJURY. MAYCAUSE APPETITE LOSS. INGEST/EXCESSIVE INHAL MAY BE FATAL.
Explanation Of Carcinogenicity: NOT RELEVANT.
Signs And Symptions Of Overexposure: MAY RESULT IN TOXIC LEAD LEVELS IN BODY. SEE OSHA STD 29 CFR 1910.1025. MAY CAUSE NOSE, THROAT & UPPER RESP TRACT IRRIT. SPRAY MIST/VAPS OF SPRAY PAINTS MAY CAUSE IRRIT TO THE EYES, NOSE, THROAT, UPPE R RESP TRACT, MUCOUS MEMBRANES & SKIN. INGEST WILL AT FIRST ACT AS A STIMULANT, FOLLOWED BY SYMP OF MENTAL (SUP DAT)
Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.
First Aid: EYES: FLUSH W/LUKE WARM WATER FOR AT LEAST 15 MIN. SEEK MD IMMED. SKIN: FLUSH W/COPIOUS AMTS OF LUKE WARM WATER. REMOVE CONTAM CLTH PROMPTLY. CONT MD IMMED. INHAL: REMOVE EXPOS PERS TO FRESH AIR. REST ORE BRTHG IF REQUIRED. CONT MD IMMED. INGEST: RINSE MOUTH IMMED. GIVE EXPOS PERS 6 TO 8 OUNCES OF LIQUID. (NEVER GIVE ANYTHING BY MOUTH TO UNCONSCIOUS PERS). DO NOT INDUCE VOMIT UNLESS ADVISED

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Handling and Disposal

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Spill Release Procedures: STAY UPWIND & AWAY FROM SPILL UNLESS WEARING APPROPRIATE PROT EQUIP. STOP &/CONTAIN DISCHARGE IF IT MAY BE DONE SAFELY. KEEP ALL IGNITION SOURCES AWAY. VENT AREA OF SPILL. KEEP OUT OF DRAINS, SEWERS/W ATERWAYS. CONT FIRE AUTH.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Methods: DISPOSE OF PRODUCT IN ACCORDANCE WITH APPLICABLE LOCAL, COUNTY, STATE AND FEDERAL REGULATIONS.
Handling And Storage Precautions: KEEP PROD CONTRS COOL & DRY. USE & STORE THIS PROD W/ADEQUATE VENT. DO NOT SMOKE IN STOR AREAS. KEEP CONTRS TIGHTLY CLOSED WHEN NOT IN USE.
Other Precautions: PERS SHOULD AVOID INHAL OF VAPS/MIST. PERS CONT W/PROD SHOULD BE AVOIDED. CONTRS OF THIS MATL MAY BE HAZ WHEN EMPTIED. EMPTIED CONTRS RETAIN PROD RESIDUES (VAP, LIQUID, &/SOLID), OBSERVE ALL HAZARD PR ECAUTIONS.

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Fire and Explosion Hazard Information

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Extinguishing Media: CARBON DIOXIDE, DRY CHEMICALS, FOAM OR WATER FOG.
Fire Fighting Procedures: WEAR NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP (FP N). CLEAR FIRE AREA OF UNPROT PERS. DO NOT ENTER CONFINED SPACE WITHOUT PERMISSION. FIGHT FIRE FROM A
Unusual Fire/Explosion Hazard: NONE SPECIFIED BY MANUFACTURER.

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Control Measures

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Respiratory Protection: USE NIOSH/MSHA APPRVD DUST MASK/RESPIRATOR IF CONC IS HIGH. BASED ON ING 1, SEE OSHA STD. 29 CFR 1910.1025 FOR APPROP RESP & OTHER PROT EQUIP. DO NOT BRTH MIST/VAPS OF ANY SPRAY PAINT. WEAR APPROP, PR OPERLY FITTED RESP (NIOSH/MSHA
Ventilation: USE AS REQUIRED TO CONTROL VAP/DUST/MIST CONC. AVOID

Page 2

PRLNG/REPEATED BRTH OF VAPS. IF EXPOS EXCEEDS TLV USE A
Protective Gloves: REQUIRED FOR PROLONGED/REPEATED
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES (FP N).
Other Protective Equipment: EYEWASH STATIONS & SAFETY SHOWERS SHOULD BE READILY AVAILABLE IN USE & HANDLING AREAS. WEAR APRON TO AVOID SKIN CONT.
Work Hygienic Practices: WASH HANDS THORO BEFORE EATING & USING WASHROOM. REMOVE CONTAMD CLTHG IMMED & DO NOT REUSE UNTIL PROPERLY LAUNDERED.
Supplemental Safety and Health: HLTH HAZ: EXCITEMENT, DEPRESS, DROW, IMPAIRED VISION, ATAXIA, & STUPOR AS INTAKE LEVEL IS INCR. LGE DOSES CAN AFFECT GI TRACT & CNS. ING 2: MAY CAUSE LUNG INJURY, IRRIT, DRYING, CRACKING/DERM ON PRLNG EXPOS TO SKIN. NOTE: LEAD APPEARS ON THE NAVY LISTING OF OCCUPATIONAL CHEMICAL REPRODUCTIVE HAZARDS. SEEK

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Physical/Chemical Properties

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B.P. Text: >200F,>93C
Spec Gravity: 1.04 (FPN)
Solubility in Water: SOLUBLE
Appearance and Odor: BLUE LIQUID WITH MILD ODOR.

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Reactivity Data

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Stability Indicator: YES
Stability Condition To Avoid: AVOID EXPOSURE TO SPARKS, OPEN FLAME, HOT SURFACES, & ALL SOURCES OF HEAT & IGNITION.
Materials To Avoid: BASED ON INGREDIENT 2 THIS PRODUCT IS INCOMPATIBLE WITH STRONG OXIDIZERS. MAY CAUSE FIRE OR EXPLOSION ON CONTACT.
Hazardous Decomposition Products: IN PRESENCE OF AIR MAY YIELD CO &/CO*2. BASED ON INGRED 1 MAY FORM LEAD/CHROMIUM OXIDES.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT.

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Toxicological Information

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Ecological Information

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MSDS Transport Information

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Regulatory Information

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Other Information

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HAZCOM Label

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Product ID: SC-1073 BLUE
Cage: 87354
Company Name: SPRAYLAT CORPORATION
Street: 716 SOUTH COLUMBUS AVENUE
City: MT. VERNON NY
Zipcode: 10550
Health Emergency Phone: 800-424-9300 (CHEMTREC)
Label Required IND: Y
Date Of Label Review: 03/10/1995
Status Code: C
Label Date: 03/10/1995
Origination Code: G
Chronic Hazard IND: Y
Eye Protection IND: YES

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Skin Protection IND: YES
Signal Word: WARNING
Respiratory Protection IND: YES
Health Hazard: Moderate
Contact Hazard: Slight
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE: LOSS OF APPETITE, CNS DEPRESSION, LUNG INJURY, IRRITATION OF EYES, NOSE, THROAT, UPPER RESP TRACT, MUCOUS MEMBRANES & SKIN. INGEST: CAN BE FATAL. CHRONIC: LEAD APPEARS ON THE NAVY OCCUPATION CH EMICAL REPRODUCTIVE HAZARDS LIST (FP N). INGEST: KIDNEY DAMAGE, CNS DEPRESSION/DISORDER. OVEREXPOSURE MAY CAUSE BLOOD & GI EFFECTS, HEADACHE, NAUSEA, VOMITING, DIZZINESS/LOSS OF CONSCIOUSNESS.

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CORNELL

Material Safety Data Sheets

Division of Facilities Services

DOD Hazardous Material Information (ANSI Format)
For Cornell University Convenience Only

2-NITRODIPHENYLAMINE, 98%, 157171

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

The information in this document is compiled from information maintained by the United States Department of Defense (DOD). Anyone using this information is solely reponsible for the accuracy and applicability of this information to a particular use or situation.
Cornell University does not in any way warrant or imply the applicability, viability or use of this information to any person or for use in any situation.

Section 1 - Product and Company Identification
2-NITRODIPHENYLAMINE, 98%, 157171

Product Identification: 2-NITRODIPHENYLAMINE, 98%, 157171
Date of MSDS: 09/07/1993 **Technical Review Date:** 07/07/1994
FSC: 6810 **NIIN: LIIN:** 00N050296
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: ALDRICH CHEMICAL CO INC
Post Office Box: 355
Manufacturer's Address1:
Manufacturer's Address2: MILWAUKEE, WI 53201
Manufacturer's Country: US
General Information Telephone: 414-273-3850
Emergency Telephone: 414-273-3850
Emergency Telephone: 414-273-3850
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 60928
Special Project Code: N

Contractor Information

Contractor's Name: ALDRICH CHEMICAL CO INC
Post Office Box: 355
Contractor's Address1: 1001 WEST ST PAUL AVE
Contractor's Address2: MILWAUKEE, WI 53233
Contractor's Telephone: 414-273-3850
Contractor's CAGE: 60928

Section 2 - Compositon/Information on Ingredients
2-NITRODIPHENYLAMINE, 98%, 157171

Ingredient Name: 2-NITRODIPHENYLAMINE
Ingredient CAS Number: 119-75-5 **Ingredient CAS Code:** M
RTECS Number: RTECS Code: X
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 98
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:

Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
2-NITRODIPHENYLAMINE, 98%, 157171

Health Hazards Acute & Chronic: ACUTE:MAY BE HARMFUL BY INHALATION, INGESTION OR SKIN ABSORPTION. CAUSES EYE & SKIN IRRITATION. MATERIAL IS IRRITATING TO MUCOUS MEMBRANES & UPPER RESPIRATORY TRACT. TO THE BEST OF MFR'S KNOWLEDGE, TH E CHEMICAL, PHYSICAL & TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.

Signs & Symptoms of Overexposure:
SEE HEALTH HAZARDS.

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcenogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT

Section 4 - First Aid Measures
2-NITRODIPHENYLAMINE, 98%, 157171

First Aid:
EYES:IMMEDIATELY FLUSH W/COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. SKIN:IMMEDIATELY WASH W/SOAP & COPIOUS AMOUNTS OF WATER. WASH CONTAMINATED CLOTHING BEFORE REUSE. INHAL:REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. INGEST:WASH OUT MOUTH W/WATER PROVIDED PERSON IS CONSCIOUS. CALL MD.

Section 5 - Fire Fighting Measures
2-NITRODIPHENYLAMINE, 98%, 157171

Fire Fighting Procedures:
USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.
Extinguishing Media:

WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
Flash Point: Flash Point Text: N/K

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/K
Upper Limit(s): N/K

Section 6 - Accidental Release Measures
2-NITRODIPHENYLAMINE, 98%, 157171

Spill Release Procedures:
WEAR NIOSH/MSHA APPROVED SCBA, RUBBER BOOTS & HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN A BAG & HOLD FOR WASTE DISPOSAL. AVOID RAISING DUST. VENTILATE AREA & WASH SPILL SITE AFTER MATERIAL PICKUP IS COM PLETE.

Section 7 - Handling and Storage
2-NITRODIPHENYLAMINE, 98%, 157171

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
2-NITRODIPHENYLAMINE, 98%, 157171

Repiratory Protection:
NIOSH/MSHA APPROVED RESPIRATOR.
Ventilation:
MECHANICAL EXHAUST REQUIRED.
Protective Gloves:
RUBBER GLOVES.
Eye Protection: ANSI APPROVD CHEM WORKER GOGGLES (FP N).
Other Protective Equipment: EMERGENCY EYE WASH AND DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA (FP N).
Work Hygenic Practices: WASH THOROUGHLY AFTER HANDLING.
Supplemental Health & Safety Information: NONE SPECIFIED BY MANUFACTURER.

Section 9 - Physical & Chemical Properties
2-NITRODIPHENYLAMINE, 98%, 157171

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: N/K
Melting/Freezing Point: Melting/Freezing Text: >165F,>74C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: N/K **Vapor Density:** 10.7
Percent Volatile Organic Content:
Specific Gravity: N/K

Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: N/K
Solubility in Water: N/K
Appearance and Odor: RED-ORANGE CRYSTALS.
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
2-NITRODIPHENYLAMINE, 98%, 157171

Stability Indicator: YES
Materials to Avoid:
STRONG OXIDIZING AGENTS, STRONG ACIDS, STRONG BASES.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
TOXIC FUMES OF: CARBON MONOXIDE, CARBON DIOXIDE, NITROGEN OXIDES.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT

Section 11 - Toxicological Information
2-NITRODIPHENYLAMINE, 98%, 157171

Toxicological Information:
N/P

Section 12 - Ecological Information
2-NITRODIPHENYLAMINE, 98%, 157171

Ecological Information:
N/P

Section 13 - Disposal Considerations
2-NITRODIPHENYLAMINE, 98%, 157171

Waste Disposal Methods:
DISSOLVE OR MIX THE MATERIAL W/COMBUSTIBLE SOLVENT & BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AFTERBURNER & SCRUBBER. OBSERVE ALL FEDERAL, STATE & LOCAL ENVIRONMENTAL REGULATIONS.

Section 14 - MSDS Transport Information
2-NITRODIPHENYLAMINE, 98%, 157171

Transport Information:
N/P

Section 15 - Regulatory Information
2-NITRODIPHENYLAMINE, 98%, 157171

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
2-NITRODIPHENYLAMINE, 98%, 157171

Other Information:
N/P

HAZCOM Label Information
Product Identification: 2-NITRODIPHENYLAMINE, 98%, 157171
CAGE: 60928
Assigned Individual: N
Company Name: ALDRICH CHEMICAL CO INC
Company PO Box: 355
Company Street Address1: 1001 WEST ST PAUL AVE
Company Street Address2: MILWAUKEE, WI 53233 US
Health Emergency Telephone: RUBBER GLOVES.
Label Required Indicator: Y
Date Label Reviewed: 07/07/1994
Status Code: C
Manufacturer's Label Number:
Date of Label: 07/07/1994
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word: CAUTION
Health Hazard: Slight
Contact Hazard: Slight
Fire Hazard: None
Reactivity Hazard: None

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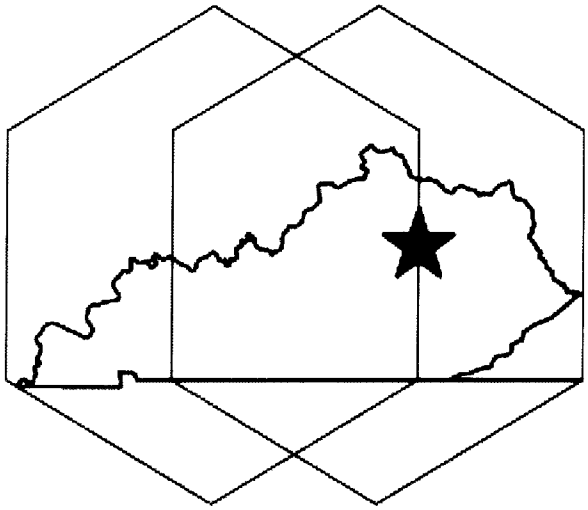
Appendix E Contents

GB Material Balances for BGCAPP .....See Appendix C

Appendix F Contents

RD&D Permit Pre-Application Meeting Documentation



Blue Grass Chemical
Stockpile Outreach Office

RCRA Research, Development & Demonstration

Pre-application Public Meeting

January 22, 2004

Eastern Kentucky University

Carl D. Perkins Conference Center

Kit Carson Drive, Richmond, KY

6-8 p.m.

NEWSPAPER/BROADCAST ADS

The Department of Defense's Program Manager for Assembled Chemical Weapons Alternatives and Bechtel Parsons Blue Grass Invite Discussion

On a permit application to allow construction, systemization and pilot testing of the Blue Grass Chemical Agent - Destruction Pilot Plant at the Blue Grass Army Depot.

The Program Manager for Assembled Chemical Weapons Alternatives (PMACWA) and its systems contractor Bechtel Parsons Blue Grass (BPBG) plan to build and pilot test a treatment, storage, and disposal facility at the U.S. Army Blue Grass Army Depot (BGAD), Kentucky. This facility will pilot test the destruction of chemical weapons containing blister and nerve agents. BPBG and the Army (the "Applicants") plan to submit an application to the Kentucky Department for Environmental Protection (KDEP) for a Research Development and Demonstration (RD&D) permit to build and operate the full-scale pilot plant.

The Applicants will conduct a pilot test with KDEP oversight of the proposed neutralization system and on the basis of the results will decide whether to treat the remainder of the chemical weapons stockpile in the proposed neutralization system.

The Applicants will submit its permit application to KDEP in March 2004. This public availability session will be held to explain the proposed neutralization system to the public and solicit public input before submitting the application.

The public is invited to obtain information and ask questions about the facility and the permitting process at a meeting to be held as follows:

PUBLIC MEETING

Thursday, January 22, 2004

Carl D. Perkins Conference Center

Eastern Kentucky University

521 Lancaster Avenue

Richmond, KY 40475

6 p.m. to 8 p.m.

PURPOSE OF THE MEETING

The Applicants must obtain a Research Development and Demonstration Permit under the Resource Conservation and Recovery Act (RCRA) from KDEP in order to build and operate the plant. The first step in that process is a "pre-application" public meeting, which will be the first of many opportunities for the public to participate. At the meeting, the Applicants will provide information about the proposed facility, to include:

- Location and general description
- Processes involved in operations
- Types of wastes generated and managed
- Waste minimization and pollution control measures
- The permitting process

BACKGROUND

The Blue Grass Army Depot stores chemical weapons comprised of rockets and projectiles containing 523 tons of blister and nerve agents. The ACWA program is responsible for destroying these weapons in accordance with Public Law 107-248. Bechtel Parsons Blue Grass will design, build and pilot test a plant to destroy the weapons and will be a co-applicant for the RD&D RCRA permit, along with the depot.

DESCRIPTION OF PROPOSED FACILITY

The Department of Defense is proposing to build the neutralization system adjacent to the chemical limited area at BGAD. The munitions will be transferred from the storage igloos to the neutralization system. The chemical agent and energetics will be treated using neutralization followed by supercritical water oxidation (SCWO). Here is how that process works:

- Munitions are disassembled by modified reverse assembly. The chemical agent and energetics are separated. Agent and energetics are chemically decomposed and neutralized by caustic or water hydrolysis. The resulting chemical compounds are known as hydrolysates.

- The agent and energetic hydrolysates are destroyed using SCWO units. SCWO subjects the hydrolysate to very high temperatures and pressures, breaking them down into carbon dioxide, water and salts.
- Metal parts are thermally decontaminated by heating to 1,000 degrees Fahrenheit for a minimum of 15 minutes.
- Solid and liquid effluents are recycled or tested prior to disposal in permitted landfills. Gas effluents are recycled or filtered before released to the atmosphere. The water will be recycled into the pilot plant facility and reused as part of the destruction process.

In order to encourage an open dialogue, the format for the meeting will be poster session followed by a presentation and question and answer session. Citizens are encouraged to ask questions of the individuals who will be available at each of the poster stations.

QUESTIONS? SPECIAL NEEDS? WANT MORE INFORMATION?

If you need special access or other assistance to participate in the meeting, please contact the offices listed below at least three working days in advance of the meeting.

If you have any questions about the meeting, please contact:

Dave Easter

Public Affairs Officer

Blue Grass Army Depot

2091 Kingston Highway

Richmond, KY 40475-5008

859-625-6221

dave.easter@bluegrass.army.mil

Richard Sloan

Public Affairs Officer

Blue Grass Chemical Activity

2091 Kingston Highway

Richmond, KY 40475-5008

859-625-6897

Richard.sloan@apgea.army.mil

Mickey Morales

Bechtel Parsons Blue Grass
301 Highland Park Drive
Richmond, KY 40475
859-625-1291
mlmorale@bechtel.com

Sandra Plant
Blue Grass Chemical Stockpile Outreach Office
370 Highland Park Drive, Suite 2
Richmond, KY 40475
859-626-8944
swplant@bechtel.com

The meeting location is wheelchair accessible.

RCRA Public Meeting-Ad Cost Schedule
Thursday, January 22, 2004.
6-8 p.m.
Eastern Kentucky University – Carl D. Perkins Conference
Kit Carson Drive
Richmond Kentucky 40475

DISPLAY ADVERTISEMENTS/COSTS

Name of Publication	Publication Dates	Contact Information	Ad Information	Cost	Circulation #'	Completed
The Richmond Register Richmond, Kentucky	17 Dec.	Sue Curtis Phone: (859) 623-1669 Fax: (859) 623-2337	Display Ad (3x14) Classified Legal Display Ad (2x14) First ad will be full price, Second ad Pick-up Rate discounted	$325.36 $335.16 ($227.64)	10,000	
Lexington Herald-Leader Lexington, KY	17 Dec.	Christine Templin Phone: (859) 231-1361 Fax: (859) 231-1371 ctemplin@herald-leader.com	Display Ad Community Ad Classified Legal Ad	$1,202.00 $1,200.00	250,000	
Berea Citizen Berea, Kentucky	18 Dec.	Kristi Johnson Phone: (859) 986-0959 Fax: (859) 986-0960	Display Ad (2x18) Classified Legal Ad (2x18)	$198.00 $198.00	3,500	
Wallingford Richmond, Kentucky	18, 19 Dec.	Todd Chaney Phone: (859) 623-1386 coyote@chpl.net	10 -(30) second ads on 5 stations WEKY-Richmond WCYO-Regional WLFX-Richmond Berea WIRB-Irvine WKXO-Berea	$24.00 per x 5 ads 10-30 second spots		

The Department of Defense's Program Manager for Assembled Chemical Weapons Alternatives and Bechtel Parsons Blue Grass invite discussion on a permit application to allow construction, systemization and pilot testing of the Blue Grass Chemical Agent - Destruction Pilot Plant at the Blue Grass Army Depot.

The Program Manager for Assembled Chemical Weapons Alternatives (PMACWA) and its systems contractor Bechtel Parsons Blue Grass (BPBG) plan to build and pilot test a treatment, storage, and disposal facility at the U.S. Army Blue Grass Army Depot (BGAD), Kentucky. This facility will pilot test the destruction of chemical weapons containing blister and nerve agents. BPBG and the Army (the "Applicants") plan to submit an application to the Kentucky Department for Environmental Protection (KDEP) for a Research Development and Demonstration (RD&D) permit to build and operate the full-scale pilot plant.

The Applicants will conduct a pilot test with KDEP oversight of the proposed neutralization system and on the basis of the results will decide whether to treat the remainder of the chemical weapons stockpile in the proposed neutralization system.

The Applicants will submit its permit application to KDEP in March 2004. This public availability session will be held to explain the proposed neutralization system to the public and solicit public input before submitting the application.

The public is invited to obtain information and ask questions about the facility and the permitting process at a meeting to be held as follows:

PUBLIC MEETING

Thursday, January 22, 2004
Carl D. Perkins Conference Center
Eastern Kentucky University
Kit Carson Drive
Richmond, KY 40475
6 p.m. to 8 p.m.

PURPOSE OF THE MEETING

The Applicants must obtain a Research Development and Demonstration Permit under the Resource Conservation and Recovery Act (RCRA) from KDEP in order to build and operate the plant. The first step in that process is a "pre-application" public meeting, which will be the first of many opportunities for the public to participate. At the meeting, the Applicants will provide information about the proposed facility, to include:

- Location and general description
- Processes involved in operations
- Types of wastes generated and managed
- Waste minimization and pollution control measures
- The permitting process

BACKGROUND

The Blue Grass Army Depot stores chemical weapons comprised of rockets and projectiles containing 523 tons of blister and nerve agents. The ACWA program is responsible for destroying these weapons in accordance with Public Law 107-248. Bechtel Parsons Blue Grass will design, build and pilot test a plant to destroy the weapons, and will be a co-applicant for the RD&D RCRA permit, along with the depot.

DESCRIPTION OF PROPOSED FACILITY

The Department of Defense is proposing to build the neutralization system adjacent to the chemical limited area at BGAD. The munitions will be transferred from the storage igloos to the neutralization system. The chemical agent and energetics will be treated using neutralization followed by supercritical water oxidation (SCWO). Here is how that process works:

- Munitions are disassembled by modified reverse assembly. The chemical agent and energetic are separated. Agent and energetics are chemically decomposed and neutralized by caustic or water hydrolysis. The resulting chemical compounds are known as hydrolysates.
- The agent and energetic hydrolysates are destroyed using SCWO units. SCWO subjects the hydrolysate to very high temperatures and pressures, breaking them down into carbon dioxide, water and salts.
- Metal parts are thermally decontaminated by heating to 1,000 degrees Fahrenheit for a minimum of 15 minutes.
- Solid and liquid effluents are recycled or tested prior to disposal in permitted landfills. Gas effluents are recycled or filtered before release to the atmosphere. The water will be recycled into the pilot plant facility and reused as part of the destruction process.

In order to encourage an open dialogue, the format for the meeting will be poster session followed by a presentation and question and answer session. Citizens are encouraged to ask questions of the individuals who will be available at each of the poster stations.

QUESTIONS? SPECIAL NEEDS? WANT MORE INFORMATION?

If you need special access or other assistance to participate in the meeting, please contact the offices listed below at least three working days in advance of the meeting.

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mmorale@bechtel.com

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The meeting location is wheelchair accessible

Richmond Register 12/17/03 Page A9

Lexington Herald - Leader December 17, 2003

The Department of Defense's Program Manager for Assembled Chemical Weapons Alternatives and Bechtel Parsons Blue Grass Invite Discussion

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Richard Sloan
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Blue Grass Chemical Activity
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Richmond, KY 40475-5008
859-625-6307

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mlmorale@bechtel.com

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Eastern Kentucky University

Kit Carson Drive, Richmond, Kentucky 40475

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Public Affairs Officer
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2091 Kingston Highway
Richmond, KY 40475-5008
859-625-6224
dave.eszler@blue-grass.army.mil

Richard Sloan
Public Affairs Officer
Blue Grass Chemical Activity
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Richard.sloan@apgea.army.mil

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mlmorale@bechtel.com

Sandra Plant
Blue Grass Chemical Stockpile Outreach Office
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Richmond, KY 40475
859-626-8944
swplant@bechtel.com

The meeting location is wheelchair accessible.

Berea Citizen Dec 18, 2003, Pg. A9

BGCAPP PUBLIC MEETING ANNOUNCEMENT

CITIZENS OF MADISON COUNTY AND THE SURROUNDING COMMUNITY ARE ENCOURAGED TO ATTEND A MEETING TO DISCUSS STATE ENVIRONMENTAL PERMITS NEEDED TO BEGIN CONTRUCTION OF THE BLUE GRASS CHEMICAL AGENT DESTRUCTION PILOT PLANT TO BE LOCATED AT THE BLUE GRASS ARMY DEPOT.

THE MEETING WILL BE HELD THURSDAY, JANUARY TWENTY-SECOND FROM SIX TO EIGHT P.M. AT EASTERN KENTUCKY UNIVERSITY'S PERKINS CENTER LOCATED ON KIT CARSON DRIVE.

FOR FURTHER INFORMATION, PLEASE CALL 626-8944.

TRI-CITY AM
P.O. BOX 281
IRVINE, KENTUCKY 40336

606-723-5138

****
* STATEMENT *
****

Bechtel-Parsons Blue Grass
Accounts Payable
301 Highland Park Drive
Richmond KY 40475

625-129-1291

Date
12/31/03

Client
Number
1 - 668

Bill Cycle: Monthly Sales Staff # 10: Todd Chaney

Ref #	Posted	Qty	Description	Gross	Agy Disc	Tax	Amount	Balance
120584	12/31	25	TRI--AM Commercials	150.00		0.00	150.00	150.00

Balance Due: $150.00

Payment due: 01/31/04

Miguel L Morales
Miguel L Morales
149808
249/55-850-P7

Last Pymt	Aging Analysis: 0-30	31-60	61-90	91-120	121+ Days
00/00	$150.00	$0.00	$0.00	$0.00	$0.00

WEKY-RICHMOND WIRV-IRVINE WKXO-BEREA

****
* Affidavit of Performance *
****

Radio Station TRI-CITY AM
P. O. Box 281
Irvine KY 40336

Invoice Number: 120584
Billing Type : M
Acct Exec : Todd Chaney
Commercial Length: 30
State of Kentucky)
)SS:
City of Irvine)

Bechtel-Parsons Blue Grass
301 Highland Park Drive
Richmond KY 40475

Client # 668
Bechtel-Parsons BlueGrassCommercials

Order # 1

Before me, a Notary Public, personally appeared Kelly T Wallingford
who affirms
that he is President of Radio Station TRI-CITY AM, and that
broadcasts were made during the period: 12/01/03 - 12/31/03.

Date	Times					
Dec 18	10:13A	10:24A	11:23A	1:13P	1:24P	2:13P
Dec 18	3:12P	3:24P	3:50P	4:12P	4:36P	5:21P
Dec 19	6:49A	7:37A	8:12A	9:13A	10:13A	11:13A
Dec 19	1:13P	2:13P	3:12P	4:13P	5:12P	5:37P
Dec 19	6:37P					

Gross Invoice: $150.00 plus Sales Tax: 0.00
DUE DATE: 01/31/04 NET AMOUNT DUE: $150.00

I certify that the above units were aired within 10 minutes
of the times listed.

Signed: Kelly T Wallingford

Affirmed this 06 Day of January, 2004
In testimony whereof I have set my Hand and Seal the day and year aforesaid.
My commission expires 06/06/2004

Wanda G Brown
Notary Public

****
* Affidavit of Performance *
****

Radio Station WLFX-FM
P.O. Box 281
Irvine, KY 40336

Bechtel-Parsons Blue Grass
301 Highland Park Drive
Richmond KY 40475

Order # 1

Invoice Number: 120375
Billing Type : M
Acct Exec : Todd Chaney
Commercial Length: 30
State of Kentucky)
)SS:
City of Irvine)

Client # 515
Bechtel-Parsons BlueGrassCommercials

Before me, a Notary Public, personally appeared Kelly T Wallingford, who affirms that he is President of Radio Station WLFX-FM, and that broadcasts were made during the period: 12/01/03 - 12/31/03.

Date	Times					
Dec 18	10:22A	10:43A	11:41A	11:54A	12:56P	1:54P
Dec 18	3:15P	3:57P	4:43P	5:27P	6:13P	6:55P
Dec 19	6:27A	7:15A	7:56A	8:57A	10:21A	10:54A
Dec 19	11:42A	1:21P	2:42P	3:17P	4:14P	4:57P
Dec 19	6:15P					

Total: 25 at 0.00 each.
Gross Invoice: $0.00 plus Sales Tax: 0.00
DUE DATE: N/A NET AMOUNT DUE: $0.00

I certify that the above units were aired within 10 minutes of the times listed.

Signed: _____

firmed this 06 Day of January, 2004

... testimony whereof I have set my Hand and Seal the day and year aforesaid.

My commission expires 06/06/2004

Wanda G. Bowles
Notary Public

****

* Affidavit of Performance *

****

Radio Station WCYO-FM
P.O. Box 281
Irvine, KY 40336

Invoice Number: 120734
Billing Type : M
Acct Exec : Todd Chaney
Commercial Length: 30
State of Kentucky)
)SS:
City of Irvine)

Bechtel-Parsons Blue Grass
301 Highland Park Drive
Richmond KY 40475

Client # 539
Bechtel-Parsons BlueGrassCommercials

Order # 1

Before me, a Notary Public, personally appeared Kelly T Wallingford, who affirms that he is President of Radio Station WCYO-FM, and that broadcasts were made during the period: 12/01/03 - 12/31/03.

Date	Times					
Dec 18	10:22A	11:22A	12:25P	1:22P	2:22P	2:56P
Dec 18	3:34P	4:26P	4:57P	5:43P	6:26P	6:56P
Dec 19	6:13A	6:39A	7:22A	8:22A	10:22A	11:22A
Dec 19	11:56A	1:22P	2:22P	3:27P	4:27P	4:57P
Dec 19	6:26P					

Total: 25 at 0.00 each.
Gross Invoice: $0.00 plus Sales Tax: 0.00
DUE DATE: N/A NET AMOUNT DUE: $0.00

I certify that the above units were aired within 10 minutes of the times listed.

Signed: _____

Affirmed this 06 Day of January, 2004
In testimony whereof I have set my Hand and Seal the day and year aforesaid.
My commission expires 06/06/2004

Wanda L Bowles
Notary Public

PUBLIC MEETING ANNOUNCEMENT

Regarding the Destruction of Chemical Weapons Stored at the Blue Grass Army Depot

Thursday, January 22, 2004
6-8 p.m.
Carl D. Perkins Conference Center
Eastern Kentucky University
Kit Carson Drive, Richmond, Kentucky

The public is invited to attend a meeting to discuss the submission of a permit to the Kentucky Department for Environmental Protection required to begin construction of the Blue Grass Chemical Agent-Destruction Pilot Plant.

This meeting is being held to explain the proposed plan to destroy the chemical weapons and to solicit public input before submitting the application for the permit.

5:30-6:00 p.m.	Open Poster Session for one-on-one questions
6:00-7:00 p.m.	Public Meeting
7:00-8:00 p.m.	Reopen Poster Session

Public participation and comments are an important part of this effort.

If you have questions, special needs, or want more information, please contact the:

Blue Grass Chemical Stockpile Outreach Office
370 Highland Park Dr., Suite 2
Richmond, KY 40475
(859) 626-8944
BGOutreach@bechtel.com

Update hearing set on weapons destruction

By Peter Mathews
CENTRAL KENTUCKY BUREAU

RICHMOND — This week, the agencies that will carry out the destruction of chemical weapons at Blue Grass Army Depot will give the public a look at what they are up to.

A public hearing Thursday is part of the process of obtaining a permit from the Kentucky Department of Environmental Protection to build and operate the plant where the weapons will be destroyed.

The two-hour session at Eastern Kentucky University will bring people up to date on the $2 billion project, explain the permitting and neutralization processes and give the public a chance to make comments, said officials at Bechtel Parsons Blue Grass.

Bechtel Parsons was selected last June to design, build and eventually close the plant where the 523 tons of nerve and blister agent will be chemically neutralized.

The facility will be built near where the

See WEAPONS, B2

IF YOU GO

Public hearing

What: A "pre-application" public meeting to discuss the process for disposing of chemical weapons at Blue Grass Army Depot.

When: 6 to 8 p.m. Thursday.

Where: Carl D. Perkins Conference Center at Eastern Kentucky University, 521 Lancaster Avenue in Richmond.

Lexington Herald-Leader
January 20, 2004
Page B1

WEAPONS | Public may air concerns

From Page B1

weapons are stored at the depot, which is southeast of Richmond.

Any valid concerns raised at the meeting can be incorporated into the permit document, which is to be submitted to the state in March, said Kevin Regan of Bechtel Parsons.

The depot is the smallest of eight chemical weapons storage sites in the continental United States. It guards about 2 percent of the original stockpile.

Under an international treaty, the United States is supposed to have its chemical weapons destroyed by April 2012.

In Richmond, construction of the neutralization plant will take about three years and is expected to begin in 2005.

There will be other opportunities for public input as the process goes forward, in addition to Thursday's meeting.

Recently, Kentucky Sens. Jim Bunning and Mitch McConnell fended off an effort within the Pentagon to shift some of the funding away from neutralization efforts at the depot and its sister site in Pueblo, Colo., said Craig Williams, executive director of the Berea-based Chemical Weapons Working Group.

The money would have been used for cost overruns and other problems at sites incinerating their stockpiles, said Williams, whose organization opposes burning the weapons.

Officials hope to speed up the destruction process in Madison County by at least a year by taking on some of the bureaucratic requirements simultaneously instead of in sequence, Williams said.

That will save money in the long run but require more spending now — and the Pentagon shift would have jeopardized that, he said.

RCRA Public Meeting-Ad Cost Schedule
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Richmond Kentucky 40475

DISPLAY ADVERTISEMENTS

Name of Publication	Publication Dates	Ad Information
The Richmond Register Richmond, Kentucky	15 Jan.	Display Ad (3x14) Classified Legal Display Ad (2x14) First ad will be full price, Second ad Pick-up Rate discounted
Richmond Advertiser (Published by Richmond Register)	14 Jan.	
Berea Citizen Berea, Kentucky	15 Jan.	Display Ad (2x18) Classified Legal Ad (2x18)
EKU Progress	15 Jan.	Display Ad (1/8)
Wallingford Richmond, Kentucky	Week of 19 Jan.	10 -(30) second ads on 5 stations WEKY-Richmond WCYO-Regional WLFX-Richmond Berea WIRB-Irvine WKXO-Berea
City of Richmond Government Access Channel	Jan. 8-22	

Public Meeting Announcement
Wednesday, January 14, 2004
Madison County Advertiser
Page 2

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The Richmond Register
January 15, 2004
Page A-7

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The Berea Citizen
January 15, 2004
Page B-2

PUBLIC MEETING ANNOUNCEMENT

Regarding the Destruction of Chemical Weapons Stored at the Blue Grass Army Depot

Thursday, January 22
6-8 p.m.
Carl D. Perkins Conference Center
Eastern Kentucky University
Kit Carson Drive, Richmond, Kentucky

The public is invited to attend a meeting to discuss the submission of a permit to the Kentucky Department for Environmental Protection required to begin construction of the Blue Grass Chemical Agent-Destruction Pilot Plant.

This meeting is being held to explain the proposed plan to destroy the chemical weapons and to solicit public input before submitting the application for the permit.

5:30-6 p.m.	Open Poster Session for one-on-one questions
6-7 p.m.	Public Meeting
7-8 p.m.	Reopen Poster Session

Public participation and comments are an important part of this effort.

If you have questions, special needs, or want more information, please contact the:

Blue Grass Chemical Stockpile Outreach Office
370 Highland Park Dr., Suite 2
Richmond, KY 40475
(859) 626-8944
Outreach@bechtel.com

The Eastern Progress
January 15, 2004
Page A-2

****
* Affidavit of Performance *
****

Radio Station TRI-CITY AM
P. O. Box 281
Irvine KY 40336

Bechtel-Parsons Blue Grass
301 Highland Park Drive
Richmond KY 40475

Order # 1

Invoice Number: 10656
Billing Type : M
Acct Exec : Todd Chaney
Commercial Length: 30
State of Kentucky)
)SS:
City of Irvine)

Client # 668
Bechtel-Parsons BluegrassCommercials

Before me, a Notary Public, personally appeared Kelly T Wallingford ,
who affirms
that he is President of Radio Station TRI-CITY AM, and that
broadcasts were made during the period: 01/01/04 - 01/31/04.

Date	Times			
Jan 15	7:36A	1:37P	5:13P	7:35P
Jan 16	8:36A	11:36A	5:34P	9:19P
Jan 19	6:23A	2:36P	5:49P	10:35P
Jan 20	9:36A	2:51P	5:36P	8:18P
Jan 21	8:19A	2:51P	4:22P	9:20P
Jan 22	7:37A	10:36A	6:37P	8:36P

Gross Invoice: $150.00 plus Sales Tax: 0.00
DUE DATE: 02/29/04 NET AMOUNT DUE: $150.00

I certify that the above units were aired within 10 minutes
of the times listed.

Signed: Kelly T Wallingford

Affirmed this 06 Day of February, 2004
In testimony whereof I have set my Hand and Seal the day and year aforesaid.
My commission expires 06/06/2004

Wanda G Bowles
Notary Public

****
* Affidavit of Performance *
****

Radio Station WCYO-FM
P.O. Box 281
Irvine, KY 40336

Bechtel-Parsons Blue Grass
301 Highland Park Drive
Richmond KY 40475

Order # 1

Invoice Number: 10891
Billing Type : M
Acct Exec : Todd Chaney
Commercial Length: 30
State of Kentucky)
)SS:
City of Irvine)

Client # 539
Bechtel Parsons-BlueGrassCommercials

Before me, a Notary Public, personally appeared Kelly T Wallingford, who affirms that he is President of Radio Station WCYO-FM, and that broadcasts were made during the period: 01/01/04 - 01/31/04.

Date	Times			
Jan 15	6:49A	12:23P	4:32P	11:38P
Jan 16	6:37A	10:36A	4:31P	10:36P
Jan 19	6:21A	10:20A	3:54P	8:20P
Jan 20	9:51A	10:37A	4:27P	10:55P
Jan 21	9:37A	10:54A	5:43P	9:19P
Jan 22	6:50A	1:55P	4:33P	11:54P

Total: 24 at 0.00 each.
Gross Invoice: $0.00 plus Sales Tax: 0.00
DUE DATE: N/A NET AMOUNT DUE: $0.00

I certify that the above units were aired within 10 minutes of the times listed.

Signed: Kelly T Wallingford

Affirmed this 06 Day of February, 2004
In testimony whereof I have set my Hand and Seal the day and year aforesaid.
My commission expires 06/06/2004

Wanda G. Bowles
Notary Public

****
* Affidavit of Performance *
****

Radio Station WLFX-FM
P.O. Box 281
Irvine, KY 40336

Bechtel-Parsons Blue Grass
301 Highland Park Drive
Richmond KY 40475

Order # 1

Invoice Number: 10416
Billing Type : M
Acct Exec : Todd Chaney
Commercial Length: 30
State of Kentucky)
)SS:
City of Irvine)

Client # 515
Bechtel-parsons BluegrassCommercials

Before me, a Notary Public, personally appeared Kelly T Wallingford, who affirms that he is President of Radio Station WLFX-FM, and that broadcasts were made during the period: 01/01/04 - 01/31/04.

Date	Times			
Jan 15	8:54A	12:53P	5:53P	7:36P
Jan 16	7:43A	11:18A	5:55P	9:52P
Jan 19	7:42A	12:37P	6:43P	9:53P
Jan 20	8:43A	12:53P	4:43P	10:38P
Jan 21	7:27A	1:41P	6:42P	7:52P
Jan 22	6:43A	12:38P	5:43P	9:52P

Total: 24 at 0.00 each.
Gross Invoice: $0.00 plus Sales Tax: 0.00
DUE DATE: N/A NET AMOUNT DUE: $0.00

I certify that the above units were aired within 10 minutes of the times listed.

Signed: _____

Affirmed this 06 Day of February, 2004
In testimony whereof I have set my Hand and Seal the day and year aforesaid.
My commission expires 06/06/2004

_____
Notary Public

P.01
ID=6066231341
12-16-03 12:21 WALLINGFORD BROADCASTING CO.

Advertising Order/Production Request/Traffic Instructions
Wallingford Broadcasting Company

Date 12-16-03
Client Code
Station Code(s) All 5
Product Code
Sales Rep Code Judd

Client Name Bechtel-Parsons Blue Grass
Address
City State Zip
Contact Telephone Number
Confirmation Needed Yes No Fax Number
Scheduling Plan Program Name
Schedule Start Date 1-19-04 Schedule End Date 1-22-04

New Order Copy Change

Talent

Copy Information

Copy #1 Title
System# Start Date Length :30 End Date

Copy #2 Title
System# Start Date Length End Date

#1

Schedule will air on these stations

WEKY - 1340 AM
WKXO - 1500 AM
WIRV - 1550 AM
#2 WCYO - FM 100.7
WLFX - FM 106.7

→ Normally this would pay for 12 spots, but due to the nature of the ad, we will match the schedule at No Charge

Location Description

Client Signature
Sales Rep Signature Judd Chang Date
Copy Approved By: Date Time

Daypart Schedule:

	M	T	W	Th	F	S	S	Weekly Totals
6a-10a	2	2	2	2				8
10a-3p	3	3	3	2				11
3p-7p	2	2	2					6
7p-12m								
12m-6a								

Weekly/Monthly Schedule:

	M 1/19/04	T 1/20	W 1/21	Th 1/22	F	S	S	Weekly Totals
Week 1	7	7	7	4				25
Week 2								
Week 3								
Week 4								

Total Rate ____ X Quantity 25 = Total Order $ Value $150

Billing Cycle & Method: Broadcast ____ Calendar ____ Gross ____ Net ____

Copy Rotation:

Copy Title ____ % ____
Length ____ Start ____ End ____ Co-op ____
Copy Title ____ % ____
Length ____ Start ____ End ____ Co-op ____

Special Instructions:

ORDER NUMBER ____

Interested in Learning about the Plan to Destroy Chemical Weapons Stored at the Blue Grass Army Depot?

Please plan to attend a public meeting being held
Thursday, January 22
6-8 p.m.
Carl D. Perkins Conference Center
Eastern Kentucky University
Kit Carson Drive, Richmond, Kentucky

Public participation and comments are encouraged.

If you have questions, special needs, or want more information, please contact the:

Blue Grass Chemical Stockpile Outreach Office
370 Highland Park Dr., Suite 2
Richmond, KY 40475
(859) 626-8944
Outreach@bechtel.com

PLANNING DOCUMENTS

Update – 1/23/04

Checklist for RCRA Public Meeting – January 22, 2004

Action	Responsible	Due Date	Notes
Reserve room	Diane	**Done**	EKU Perkins Building, Quads A&B, 12 – 9 p.m.
Meet with EKU re room arrangements	Diane/Sandra	**Done – Dec. 17**	Arrangements made for room set up, sound system, sound tech, backup projector, directional signs, security, load slides for meeting and prepare back up CD
Arrange for refreshments	Diane	**Done**	Contact Gary Collins at 622-2512
Prepare schematic of room arrangement.	Diane/Sandra	**Dec. 17** **Done**	
Clean up and scan schematic	Diane	**Done**	
Prepare draft print ad	Mickey	**Done**	
Coordinate review of draft print ad	Mickey	**Done**	Input from Environmental
Update matrix of publication dates for print and broadcast ads	Diane	**Done**	See attached matrix.
Distribute print and broadcast ads to media	Diane	**Done**	Placed week of Dec. 15, 2003
Draft copy for broadcast ad	Mickey	**Done**	
Re-advertise on local radio stations.	Diane	**Done**	Will run week of Jan. 19
Place large type version of ad in window at ORO	Diane	Week of Dec. 15 **Done**	
Place public meeting announcement on local cable TV	Jill	Week of Jan. 5 **Done**	Get information on guidelines for placement. Prepare list of contact names and guidelines.
Prepare list of all posters and fact sheets for use at meeting.	Mickey	Week of Jan. 12	**Final done 1/15/04**
Prepare meeting flyer for mailing	Diane/Jill	Week of Dec. 22 **Done**	
Distribute flyer on meeting to local distribution list	Diane/Jill	Mail week of Jan. 7 **Done**	To be mailed Friday, Jan.9
Prepare and reproduce sign up sheets for event	Jill	Week of Jan. 12 **Done**	

E-mail meeting flyer to CAC, CDCAB	Mickey	Jan. 7 **Done**	
Contact local news media/invite to cover meeting	Mickey	Week of 19 **Done**	
Prepare and reproduce comment card for event	Jill	Week of Jan. 12 **Done**	Use comment cards in stock
Draft agenda for meeting	Sandra	Rev. 0/Done Review by Chris TBD **Done**	Discussed with Mickey, Tom K. Ready for review by Chris.
Draft facilitator script	Sandra	Week of Jan. 5 **Done**	**1/13/04 Chris has reviewed and commented.**
Order name tags for ORO staff	Devon	Week of Dec. 15 **Done**	Will be delivered week of Jan. 12 **Done**
Name tags for speakers/customer, etc.	Jill	Week of Jan. 12 **Done**	Use blank name tags **Done**
Purchase name tag blanks for use at meeting	Jill	Week of Jan. 12 **Done**	
Prepare Environmental posters	Parsons	Week of Jan. 12	Tom Kurkjy to follow up with Parsons **Mickey to check w/Tom**
Prepare process posters/Outreach office posters	Bechtel graphics with input from Sandra/Mickey	Week of Jan. 12	File sent to Kristen at Bechtel Graphics should receive 16 Jan. **Kristen has provided review copies to Mickey & Sandra. Comments provided 1/14/04**
Reproduce fact sheets and prepare handouts for Outreach table	Mickey/Jill	Week of Jan. 19	**Kristen has provided review copies to Mickey & Sandra. Comments provided 1/14/04. Printing of fact sheets to be handled by ORO Staff with Kentucky Printing.**
Package handouts in one set.	Sandra	CD to Kentucky Printing on January 19, 2004.	**Sandra to pick up completed posters and CD on 1/16/04.**
Briefing for CAC	Mickey/Kevin	Week of Jan. 12 6p.m. Berea **Done**	Mickey to discuss with Chris/arrange for briefing
Prepare draft slides for Tom Kurkjy	Mickey	**Done**	Sent to Tom & Chris for comment.
Prepare slides for Lt. Col. Cantwell	Mickey	**Done**	
Place all completed	Diane/Jill	Jan. 20, 2004	

meeting materials in container for transport to meeting. To include: Pens, Pencils, Comment Cards, Magnets and etc.		**Done**	
Staff registration table	Jill/Diane/ Diane C.	Jan. 22	Materials on table to include copy of slides, comment cards, sign up sheets and speaker sign up sheets
Staff Outreach tables (2)	ORO Team	Jan. 22	Check with Dave Easter and Michael Bryant
Staff to assist with welcome/refreshments, etc.	ORO Team	Jan. 22	Check with Diane Claybaugh
Make arrangements for hearing impaired	Sandra/Diane Deadline for requests 1/19/04	Week of Jan. 5 **Done**	Check with EKU **Diane has made arrangements w/EKU if we have requests.**
Prepare three notebooks for regulatory agencies and customer. Copies of all ads, handouts, flyers, etc. to document compliance	Jill	Week of Jan. 26	**Jill has begun preparing folders.**
Hold a meeting run through at Perkins Bldg.	Mickey	Jan. 22, 4:30 p.m.	Run through with microphones and audiovisuals
Transcribe meeting notes	Jill	Week of Jan. 23	Get audiotape from EKU and locate transcription services
Review meeting notes and notebooks.	Tom K.	Week of Jan. 26	
Prepare documentation package for regulators	Mickey/Jill	Week of Jan. 26	
Prepare Public Involvement Plan for meeting	Sandra	By January 9	**Sandra is working this.**
Complete housekeeping at ORO before Jan. 21 Roles and Responsibilities meeting	Jill	January 21	**Have hired a cleaning person and ORO staff is reviewing surplus materials.**
Prepare day of meeting checklist	Sandra	Jan. 9 **Done**	
Prepare list of handouts	Mickey	Jan. 9	**Done 1/15/04**
Have copies of all handouts, presentations, comment cards and	Diane/Jill	Jan. 20	2-4 slides per page Information Package

agenda			
Give status of Public Meeting at POW meeting	Mickey/Sandra/ Jill	Week of Jan. 19 **Done**	E-mail will be sent to BPBG Team since Jan. 19 is holiday.

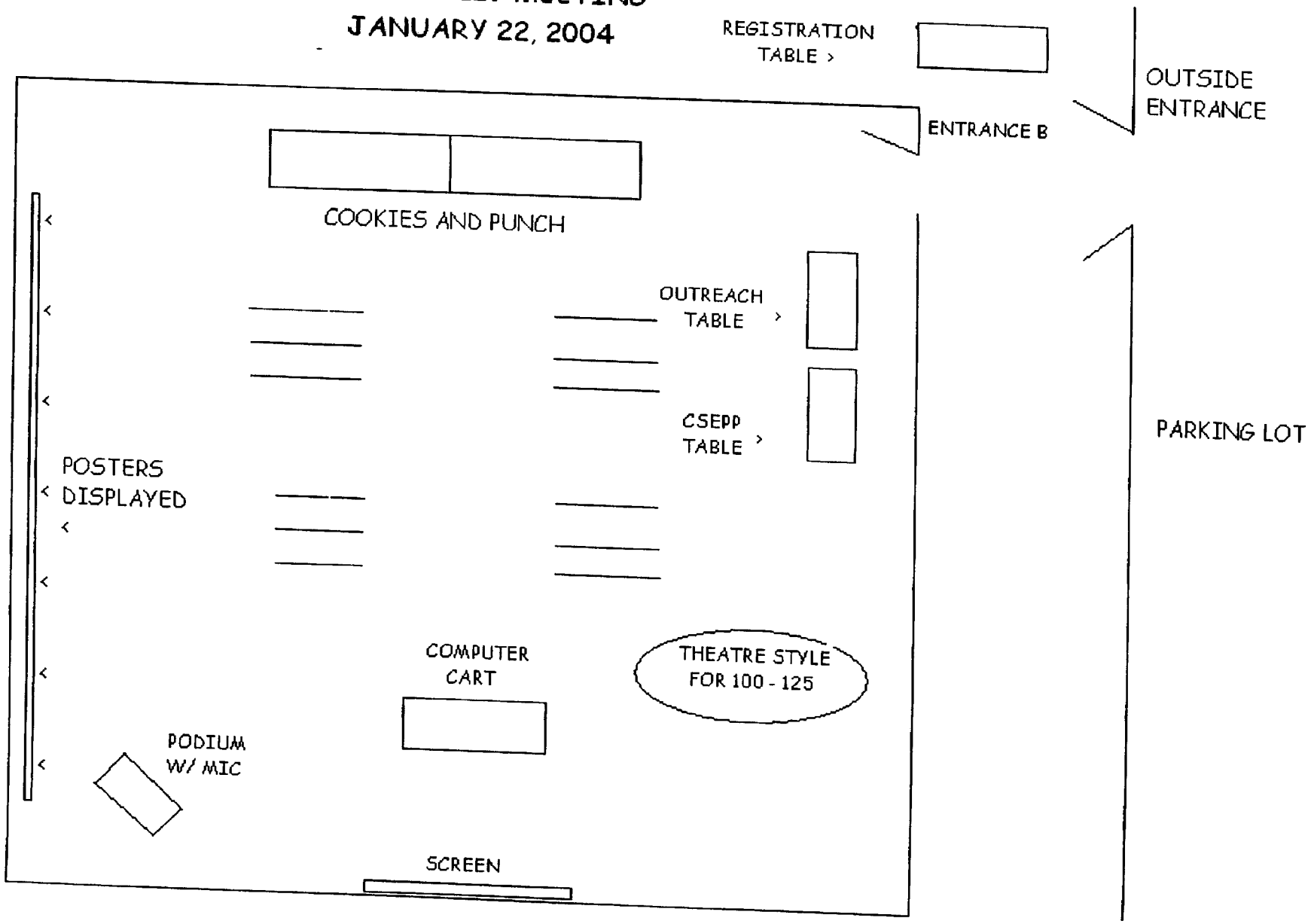
Checklist for January 22
Day of RCRA Public Meeting

Action	Responsible	Due Date	Notes	Completed
Hold pre-meeting to verify posters are on site and that presentation materials are approved	Mickey/Tom K.	By 8 a.m.	Need to get OPSEC approval also.	**Done**
E-mail to BPBG team, Dave Easter, Dick Sloan and Michael Bryant with 2nd reminder of meeting	Jill	By 8 a.m. Jan. 22, 2004	Attach short meeting announcement and layout.	**Done**
Send e-mail to Col. Cantwell, Dave Easter, Dick Sloan, Dan Jensen, John Ursullo, Kevin Regan, April Webb, Leo Weitzman and Diane Claybaugh	Jill/Sandra	1/15/04	Attach agenda & layout	**Done**
Double check and transport handouts to meeting site	Diane/Jill	By 12 Noon		**Done**
Transport easels and posters to meeting site	Diane/Jill	By 12 Noon		**Done**
Load presentation slides on computer; prepare backup CD and/or overheads	Diane/Jill	By 12 Noon or as soon as we get it.	Check with state regarding slides for presentation.	**Done**
Verify all room and equipment arrangements with EKU, including backup projector and sound system	Diane/Jill	By 9 a.m.		**Done**
Verify EKU catering order	Diane	By 9 a.m.		**Done**
Verify names and titles of VIP	Sandra/Mickey	By 12 Noon	Notify Chris M. and Kathy	**Done**

attendees			DeWeese	
Verify names of staff to coordinate refreshments	Diane/Jill		POC is Diane Claybaugh	**Done**
Set up shared tables for Outreach Office, CSEPP, and BGAD			Double check with Dave Easter and Michael Bryant	**Done**
Verify sound tech, audio equipment and audio taping	Diane/Sandra	By 12 Noon	Sandra/Diane to follow up	**Done**
Transport registration table materials to meeting including sign in sheets, comment cards, name tags, speaker sign ups	Diane/Jill	By 12 Noon		**Done**
Set up Posters	Kathy DeWeese	Jan. 22		**Done**
Verify that EKU has completed signage and room set up	Diane/Jill	By 12 Noon		**Done**
Finalize arrangements for hearing impaired and handicap access if need has been determined in advance	Diane	By 12 Noon		**Done**
Make final media contacts/provide background material if requested	Mickey	By 9 a.m.		**Done**
Make sure photos will be taken for the record and/or newsletter	Mickey/Stephanie			**Done**
Coordinate meeting run through at Perkins Building	Sandra/Mickey	4:30 p.m.		**Done**
Pick up CD at end	Jill		Requested from	

of meeting			Paul Ramsey CD will call Sandra when it is ready	
Load and return easels, posters, etc. to Outreach Office	All BPBG attendees	After 8 p.m.		**Done**
Coordinate cleanup with EKU staff	Diane/Jill	After 8 p.m.		**Done**
Make notes on meeting follow up required	Mickey/Sandra	During meeting	**In progress 1/28/04**	
Coordinate meeting follow up	Mickey/Sandra	Week of Jan. 26	**In progress 1/28/04**	
Coordinate follow up with news media	Mickey	Week of Jan. 26	**In progress 1/28/04**	
Prepare 3 notebooks of meeting documentation	Jill	Week of Jan. 26	**In progress 1/28/04**	
Prepare meeting notes	Jill	Week of Jan. 26	**In progress 1/28/04**	
Distribute meeting notes	Jill	Week of Jan. 26	**In progress 1/28/04**	
Fed Ex meeting documentation to customer and regulators	Jill	Week of Jan. 26	**In progress 1/28/04**	

RCRA PUBLIC MEETING
JANUARY 22, 2004



MEETING AGENDA

Agenda
RCRA Pre-Application Public Meeting
Blue Grass Chemical Agent – Destruction Pilot Plant
Thursday, January 22
Carl D. Perkins Conference Center
Eastern Kentucky University
Richmond, Kentucky

General Meeting: 6-7 p.m.

Introduction	Sandra Plant, Moderator
Opening Remarks	Chris Midgett, Project Manager
	Lt. Col. Dennis Cantwell, Commander
Blue Grass Chemical Activity	Lt. Col. Dennis Cantwell, Commander
Project Background	Tom Kurkjy, Environmental Manager
Permitting Process	Kevin Regan, Environmental Permitting Mgr
KY Dept for Environmental Protection	April Webb, Supervisor for RCRA Permitting
Questions & Answers	Sandra Plant, Moderator

Refreshments and Public Availability/Poster Session: 7-8 p.m.

Draft 1-22-04

Safety Minute for Public Meeting

Everyone who is working on the Blue Grass Chemical Agent-Destruction Pilot Project is committed to safety. And that means safety of our employees and the safety of our community.

We believe very strongly that there is NOTHING that we do, either on our jobs or in our homes that is so important that we cannot take the time to do it safely. Let me say this one more time: There is nothing that we do that is so important that we cannot take the time to do it safely.

Shortcuts can be deadly. We don't take shortcuts.

Final

Moderator's Comments
Blue Grass Chemical Agent-Destruction Pilot Plant
Pre-Application Public Meeting
January 22, 2004

Sandra W. Plant

TITLE SLIDE

- Give Emergency exit information...
- Give a safety minute...

Good evening and welcome to the Pre-Application Public Meeting. The purpose of this meeting is to discuss the submission of a permit to the Kentucky Department for Environmental Protection. As many of you know, this meeting is an important step in the process required before beginning construction of the Blue Grass Chemical Agent-Destruction Pilot Plant.

This meeting is being held to explain the proposed plan to destroy the chemical weapons and to solicit public input before submitting an application for the permit. The joint

applicants for the permit are the U.S. Army and the government's contractor for this project, Bechtel Parsons Blue Grass. Your questions and your comments are an important part of this process. We are glad you are here.

You will note that representatives of the Army and the contractor are here tonight, as well as the Kentucky Department for Environmental Protection. Each entity here is eager to provide information about the environmental permitting process, to hear your comments and to answer your questions.

Before I walk you through the agenda for this evening, let me introduce myself. My name is Sandra Plant, and I have recently moved to Richmond where I live on Oak Street. For the past 13 years, I have been employed by Bechtel National Inc., one of the partners in the contract.

My work has largely been to ensure that the public involvement requirement is met on a number of large Federal environmental projects. And that is my role tonight -- to make sure that everyone here who wishes to ask a question or make a comment is given time to be heard and your comments noted.'

On behalf of the Army and Bechtel Parsons Blue Grass, I thank you for your attendance and for participating in this evening. We hope you will stay involved in future stages of the permit application process.

SLIDE 2 - AGENDA

Let me begin by reviewing the agenda for the meeting. First you will hear opening remarks from senior representatives of the co-applicants for the permit. I will introduce Mr. Chris Midgett, who is Project Manager for Bechtel Parsons Blue Grass.

Next you will hear from Lt. Col. Dennis Cantwell, who is the Commander of the Blue Grass Chemical Activity at the Blue Grass Army Depot. Lt. Col. Cantwell will also give you background information on the Army Depot.

Mr. Tom Kurkjy, who is Environmental Manager for Bechtel Parsons Blue Grass, will follow Lt. Col. Cantwell. Tom will present project background.

Next you will hear from Mr. Kevin Regan, who is Environmental Permitting Manager on the project. Kevin will walk you through the permitting process.

The final presentation will be from Ms. April Webb, Supervisor for RCRA Permitting. She is representing the Kentucky Department for Environmental Protection. Following the presentation by Ms. Webb, I will return to the podium where I will moderate the question and comment period.

We had 1 member of the community who signed up to speak. I will call on each speaker in the order in which they signed up.]

Following their comments, I will ask for additional comments and questions from the audience. To the extent possible, the applicants will answer questions as they are asked.

For more complex questions, the applicants will provide written answers during the permit process.

Depending on the number of speakers, we may take a break during the question and comment period.

Now I will introduce Chris Midgett to give background on the project.

MIDGETT MAKES PRESENTATION, INTRODUCES CANTWELL

CANTWELL MAKES PRESENTATION, INTRODUCES KURKJY

KURKJY MAKES PRESENTATION, INTRODUCES REGAN

REGAN MAKES PRESENTATION, INTRODUCES MS. WEBB

MS. WEBB MAKES PRESENTATION AND TURNS PODIUM OVER TO SANDRA PLANT FOR COMMENT PERIOD

That concludes the presentations. We will now hear from those of you who signed up to speak **[or]** we will now take comments and questions from the audience about the design concept or the permitting process. If you have questions about issues other than the design concept or the permitting process, please hold those for later. I will call on people in the order in which they signed up at the registration table. If you didn't sign up and wish to speak, I will call on you after the others have spoken.

[I will give guidelines outlining the amount of time each will have to speak; I suggest no more than 5 minutes with a signal from me when they are at the 4-minute mark.]

Again, all relevant comments and questions received tonight will be submitted with the permit application. Questions that have a short simple answer will be addressed by the applicants as they are asked. Otherwise, all relevant questions and comments will be addressed during the permitting process.

Our first speaker is.

COMMENT PERIOD

Please feel welcome to stay for further informal discussions with the project representatives here tonight, and join us for refreshments.

A Partnership for Safe Chemical Weapons Destruction

Pre-Application Public Meeting

Resource Conservation & Recovery Act
Research, Development & Demonstration Permit

Blue Grass Chemical Agent-Destruction Pilot Plant

Perkins Building
Eastern Kentucky University
Richmond, Kentucky
January 22, 2004

BECHTEL PARSONS BLUE GRASS

ACWA

Agenda

A Partnership for Safe Chemical Weapons Destruction

▪ Introduction	Sandra Plant, Moderator
▪ Project Update	Chris Midgett, Project Manager
▪ Blue Grass Chemical Activity	LTC Dennis Cantwell, Commander
▪ Project Background	Tom Kurkjy, Environmental Mgr
▪ Permitting Process	Kevin Regan, Permitting Manager
▪ Dept for Environ Protection	April Webb, KDEP RCRA Permitting
▪ Questions & Answers	Sandra Plant, Moderator
▪ Poster Session	

Tonight's Meeting

A Partnership for Safe Chemical Weapons Destruction

- Notice of intent to submit a permit application
- Inform community of proposed facility
- Solicit comments from the community
- A summary of the comments will be submitted with the Research, Development and Demonstration (RD&D) Resource Conservation and Recovery Act (RCRA) permit application

A Partnership for Safe Chemical Weapons Destruction

Bechtel Parsons Blue Grass

Chris Midgett
Project Manager
Bechtel Parsons Blue Grass Team

Project Status

A Partnership for Safe Chemical Weapons Destruction

- Staffing
  - 100 personnel working on project today
  - 15 home based in Richmond, 85 in Pasadena, CA
- Major Accomplishments
  - Design Build Plan submitted and approved on September 18, 2003, ahead of schedule. Design is 5% complete
  - Draft RD&D environmental permit application submitted on December 31, 2003, ahead of schedule
  - Integrated Master Schedule submitted and Government comments have been incorporated
  - Initial Site Plan and equipment layout for the Munitions Demilitarization Building have been drafted
  - Risk reduction testing and studies are on going in San Diego, CA; Tooele, UT; and Columbus, OH.

Project Status

A Partnership for Safe Chemical Weapons Destruction

- Upcoming Milestones
  - Submit Process Design to Government for review by January 31, 2004 (10% design)
  - Submit RD&D permit application to Commonwealth of Kentucky by March 16, 2004
  - Submit Initial Design package to Government by July 31, 2004
- Safety
  - Project has worked 70,000 hours without an injury or first aid incident
  - Project safety initiative being implemented in February 2004 to assist in Project's "Zero Accident" philosophy

Blue Grass Chemical Activity

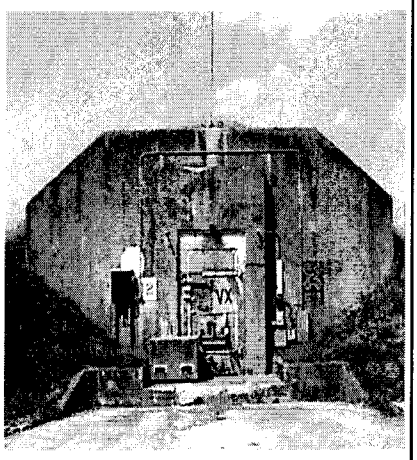
LTC Dennis Cantwell
Commander

Mission

Safe storage and monitoring of the Chemical Weapons Stockpile until Demil is complete

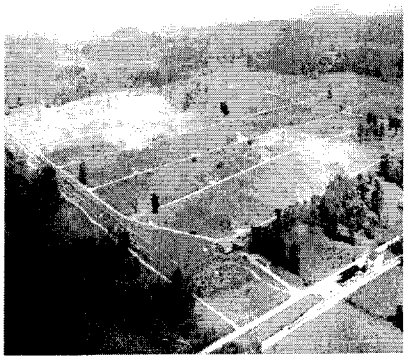
Partner with community for an Emergency Preparedness Program

Comply with all International Treaty requirements



History

1944 - First Mustard (H) chemical projectiles
1962 - Nerve Agent (VX) M55 rockets arrive
1963 - Nerve Agent (GB) M55 rockets
1965 - Nerve Agent (GB) 8 in. projectiles
1966 - Nerve Agent (VX) 155mm projectiles
1995 - Blue Grass Chemical Activity Activated

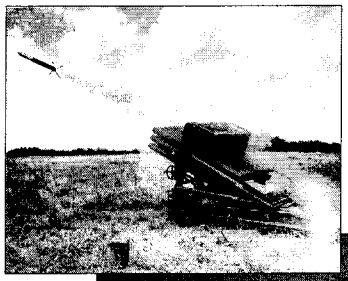


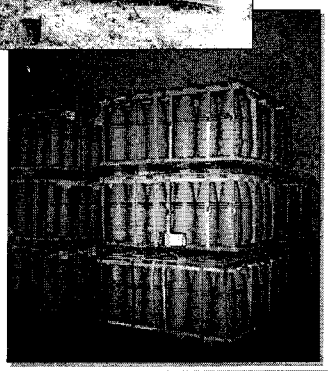
Chemical Limited Area

- 250 acres
  - 49 igloos (45 with chemical agent)
  - 523 tons of blister and nerve agents in rockets and projectiles

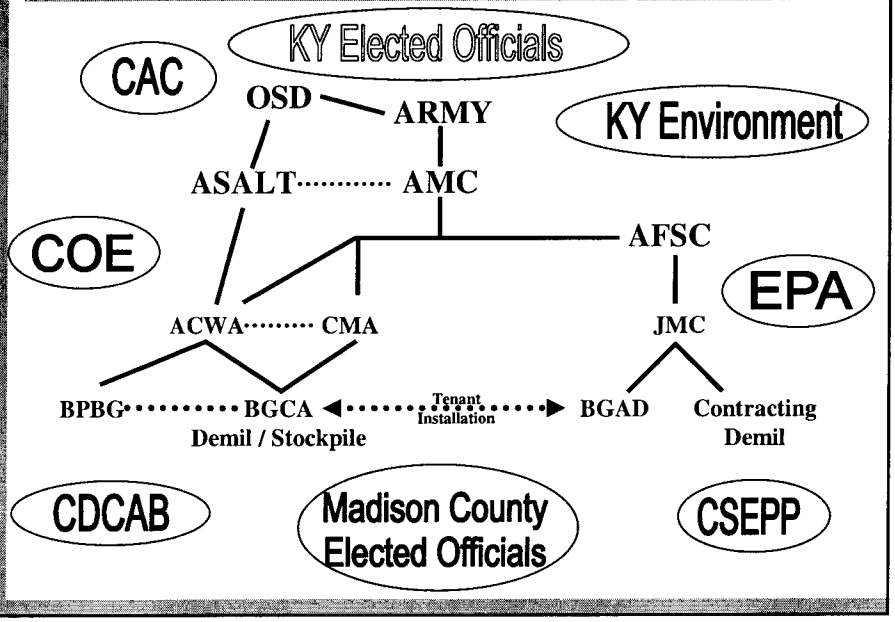
Chemical Munitions

- GB (Sarin) Nerve Agent
  - 8 inch projectiles, M55 rockets
- VX Nerve Agent
  - 155 mm projectiles, M55 rockets
- H Mustard Agent
  - 155 mm projectiles



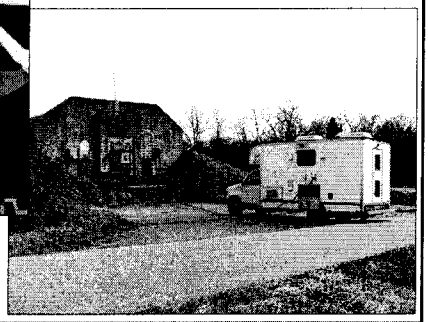


Operating Environment



Environmental Stewardship

24/7



Blue Grass Chemical Agent-Destruction Pilot Plant

A Partnership for Safe Chemical Weapons Destruction

Bechtel Parsons Blue Grass

Tom Kurkjy
Environmental Manager
Bechtel Parsons Blue Grass Team

Background

A Partnership for Safe Chemical Weapons Destruction

- The Program Manager Assembled Chemical Weapons Alternatives (PMACWA) and its systems contractor, Bechtel Parsons Blue Grass, plan to build and operate a Resource Conservation Recovery Act Treatment, Storage, and Disposal Facility at the Blue Grass Army Depot.
- This facility will pilot test the destruction of chemical weapons containing blister and nerve agents and agent related secondary wastes.

Background (Continued)

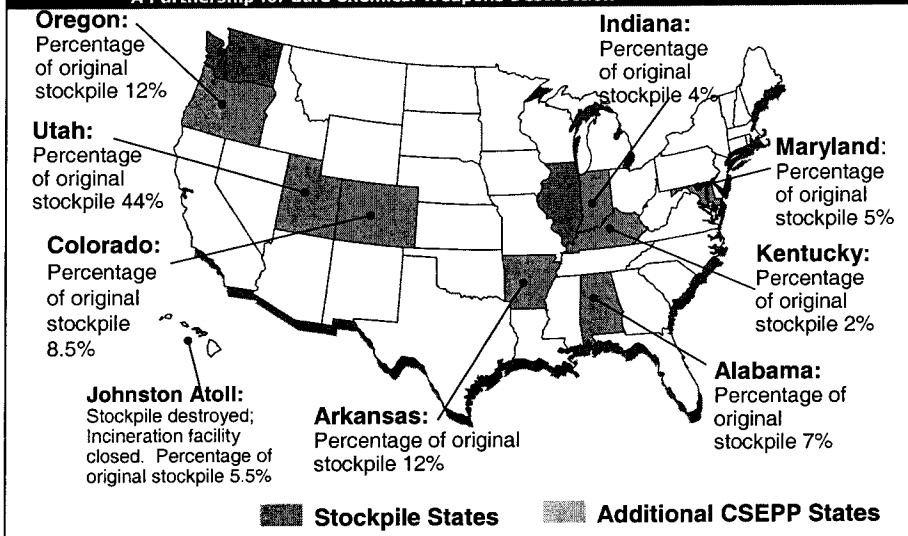
A Partnership for Safe Chemical Weapons Destruction

- Bechtel Parsons Blue Grass, PMACWA and the Army (the "Applicants") plan to submit an application to the Kentucky Department for Environmental Protection (KDEP) for a permit required to build and operate the Blue Grass Chemical Agent -Destruction Pilot Plant.
- The application will be a Research, Development & Demonstration Permit under applicable state and federal regulations.

Chemical Weapons Sites
Original Stockpile Percentages

Blue Grass Chemical Agent-Destruction Pilot Plant

A Partnership for Safe Chemical Weapons Destruction



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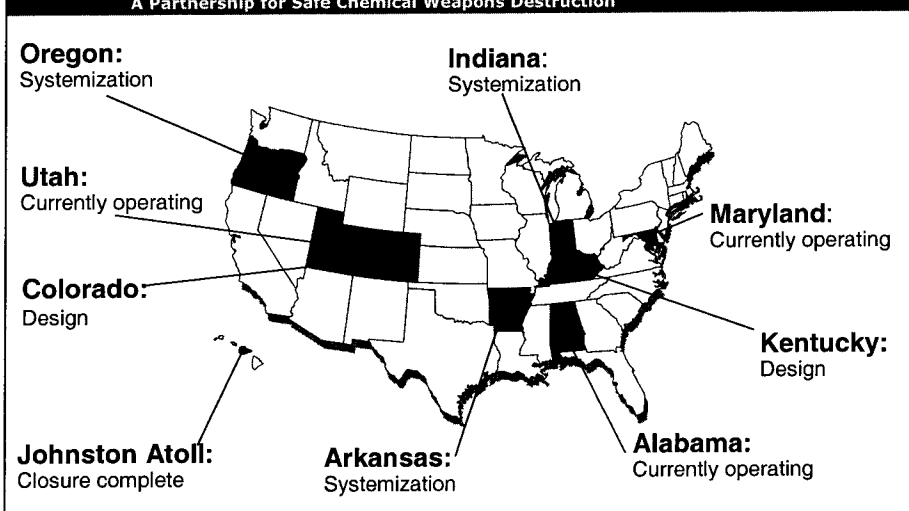
Chemical Weapons Sites
Stages of Destruction

Blue Grass Chemical Agent-Destruction Pilot Plant

A Partnership for Safe Chemical Weapons Destruction



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Why destroy chemical weapons?

A Partnership for Safe Chemical Weapons Destruction

- Weapons are old and beginning to deteriorate
- Weapons are obsolete
- Risk of continued storage increasing
- Congress mandated their destruction
- Chemical Weapons treaty mandates destruction

Chemical Weapons Destruction Timeline

A Partnership for Safe Chemical Weapons Destruction

- **November 2002**
  - Department of Defense announces neutralization followed by supercritical water oxidation as "agency-preferred alternative"
- **December 2002**
  - Final Environmental Impact Statement published
- **February 2003**
  - Under Secretary of Defense for Acquisition, Technology and Logistics approves neutralization followed by supercritical water oxidation in a decision memorandum
  - The Record of Decision completed the National Environmental Policy Act (NEPA) process for the Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP)
- **June 2003**
  - Systems contract awarded to Bechtel Parsons Blue Grass to design, construct, test, operate and close the Blue Grass Chemical Agent-Destruction Pilot Plant
- **January 2004**
  - Permitting process begins

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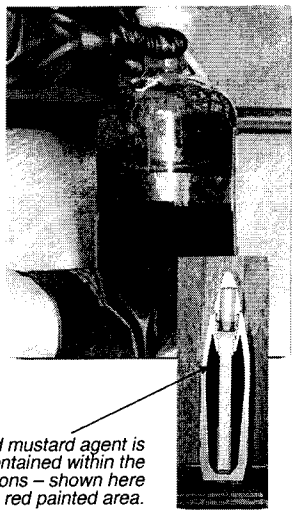
Characteristics of Mustard Agent

A Partnership for Safe Chemical Weapons Destruction



Liquid mustard agent is contained within the weapons – shown here by the red painted area.

- **Thick, heavy liquid**
- **Yellow-brown color**
- **Garlic-like odor**
- **Freezes at 56 degrees F**
- **Causes blisters**
- **Designed to injure enemy troops**

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Characteristics of Nerve Agents

A Partnership for Safe Chemical Weapons Destruction

- Nerve Agents are members of the same chemical family as pesticides. They attack the body's nervous system:
- Sarin (GB)
  - Clear, colorless liquid
  - Evaporates at the same rate as water
  - Highly toxic in liquid and vapor form
- VX
  - Oily liquid that is odorless and colorless
  - Evaporates more than 2,000 times slower than water
  - Main hazard is through skin absorption

Neutralization followed by Supercritical Water Oxidation

A Partnership for Safe Chemical Weapons Destruction

- Explosives and propellants, also known as energetics, removed from weapons by modified reverse assembly
- Chemical agent in projectile accessed via the burster well, liquid agent washed out with high-pressure water
- Rocket shear machine punches warhead, drains chemical agent, flushes cavity and shears rocket into segments. Rocket motors, bursters and warheads go to energetics batch hydrolyzers (EBH)
- The drained chemical agent is mixed with water or a caustic solution (sodium hydroxide) to neutralize the agent and form a liquid called "hydrolysate"
- Hydrolysates are tested to ensure agent destruction before secondary treatment
- Hydrolysate fed to supercritical water oxidation units for mineralization which destroy the organic materials

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Neutralization followed by SCWO (continued)

A Partnership for Safe Chemical Weapons Destruction

- SCWO subjects hydrolysates to high temperatures and pressures breaking them down into carbon dioxide, water and salts
- Salts dried and shipped to permitted hazardous waste disposal facilities
- Energetics treated in the same manner as the chemical agent
- Metal parts decontaminated by high pressure water washout and heat and can be recycled
- Gas effluents are filtered before release to the atmosphere. Water will be recycled into the pilot plant facility and reused as part of the destruction process.

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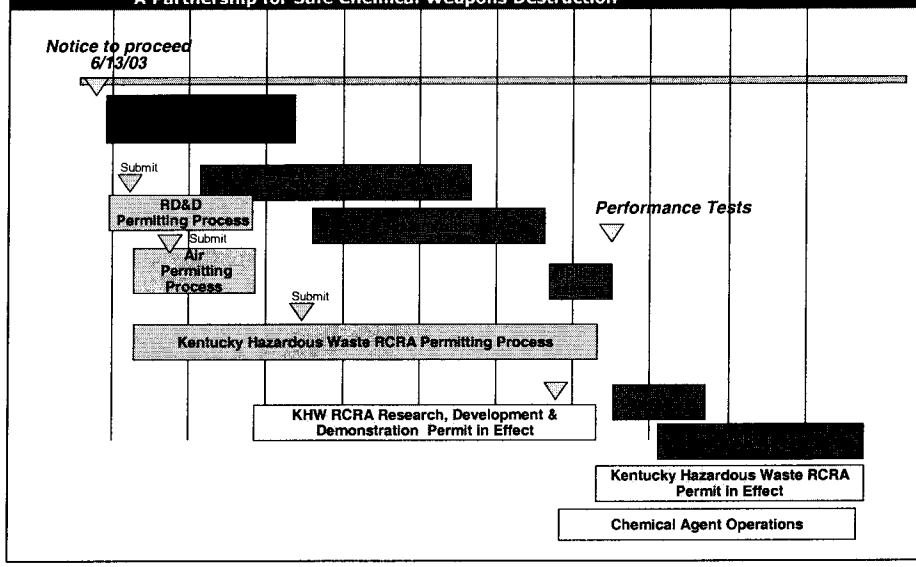
BGCAPP Schedule

A Partnership for Safe Chemical Weapons Destruction



A Partnership for Safe Chemical Weapons Destruction

Bechtel Parsons Blue Grass

Kevin Regan
Environmental Permitting
Bechtel Parsons Blue Grass Team

Permitting Agencies

A Partnership for Safe Chemical Weapons Destruction

- Kentucky Department for Environmental Protection (KDEP)
  - Division for Air Quality
  - Division of Water
  - Division of Waste Management
- U.S. Environmental Protection Agency
  - Resource Conservation Recovery Act (RCRA) Programs Branch
  - Toxic Substances Control Act Branch
- Madison County
  - BGCAPP will participate in the county's integrated six week planning process

Agency Responsibilities

A Partnership for Safe Chemical Weapons Destruction

- KDEP, Division for Air Quality
  - Modify existing Blue Grass Army Depot air permit to incorporate BGCAPP
- KDEP, Division of Water
  - Issue Stormwater Permit
- KDEP, Division of Waste Management
  - ***Issue Research, Development &Demonstration (RD&D) Permit***
  - Issue Kentucky Hazardous Waste Permit
- U.S. Environmental Protection Agency
  - Provide technical input/concurrence on RD&D and Kentucky Hazardous Waste permits
  - Issue Toxic Substances Control Act permit

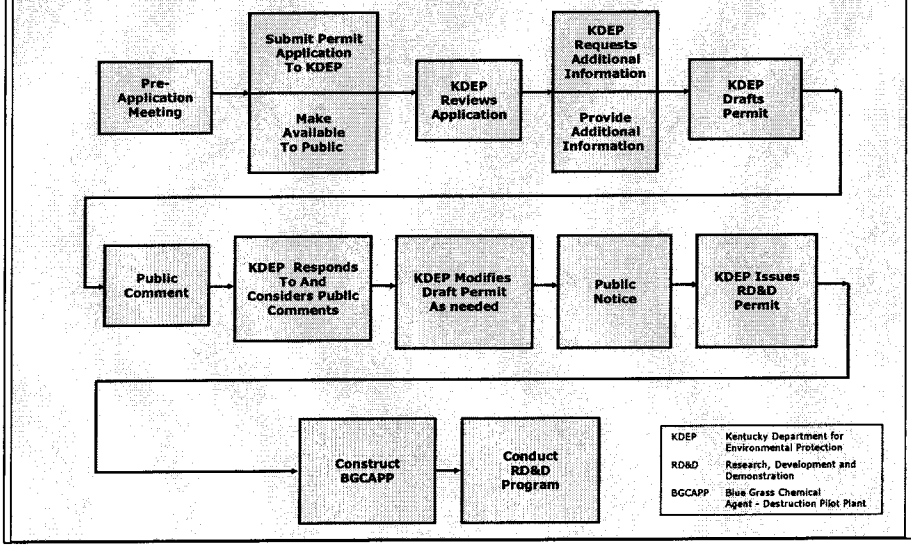
Division of Waste Management

A Partnership for Safe Chemical Weapons Destruction

- Review Application and Issue Research, Development and Demonstration Permit
  - RD&D Permit needed to perform research recommended by the National Research Council
  - Kentucky Hazardous Waste permit application prepared in conjunction with construction and systemization
  - Signatories will be Blue Grass Army Depot (Owner), Bechtel Parsons Blue Grass & the Program Manager for Assembled Chemical Weapons Alternatives (Co-operators)

Environmental Permitting Process for Blue Grass Chemical Agent – Destruction Pilot Plant

A Partnership for Safe Chemical Weapons Destruction



Disposal of Process Residues

A Partnership for Safe Chemical Weapons Destruction

- Metal
  - Decontaminated material to be shipped offsite
- Salts and Brines
  - Tested and shown to be free of agent
  - Disposal at permitted Hazardous Waste Facility

Conclusion

A Partnership for Safe Chemical Weapons Destruction

- The RD&D Permit is being requested to conduct RD&D to integrate the proven operations per recommendation of National Research Council.
- The application will be reviewed for safety and regulatory compliance.
- Application will be made available to public at the same time as it is submitted to KDEP:
  - Madison County Public Libraries
  - Chemical Stockpile Outreach Office
  - Other public locations to be announced
- Opportunities for public comments.

Commonwealth of Kentucky Environmental and Public Protection Cabinet

Permitting Process

Blue Grass Army Depot

RCRA Permit

Resource **C**onservation & **R**ecovery **A**ct

- Enacted by U.S. Congress in 1976 with major amendments in 1984.
- Industries must manage hazardous waste from the cradle to the grave.
- Permits are administered by the Commonwealth of Kentucky (KDEP).

Typical Process for Permits

- Applicant holds public meeting prior to submitting permit application.
- Applicant submits application to Division (DWM).
- Division announces receipt of application, and makes available for public review and comment.
- Division reviews application; use standard technical checklist.
- Division issues notice of deficiency if necessary.

Typical Process for Permits

- The Applicant addresses the concerns in the notice of deficiency.
- The Division will deny or approve the application; if approved, issue a draft permit.
- The Division holds a public hearing presenting the draft permit (or the draft major modifications) or reasons to deny a permit, and receives comments.
- The Division reviews public comments; if no cause to deny, DWM issues a final permit.

Parts of a RCRA Permit Application

Part A

- A- Identify Waste Streams, Waste Codes

Part B

- B- Facility Description
- C- Waste Analysis Plan
- D- Process Information
- E- Groundwater Monitoring

Parts of a RCRA Permit Application

Part B

- F- Procedures to Prevent Hazards
- G- Contingency Plan (not CSEPP)
- H- Personnel Training (OSHA)
- I - Closure Plan or Post-Closure Plan

Parts of a RCRA Permit Application

Part B

- J - Other Federal Laws (Endangered Species Act, Historic Sites, etc.)
- K- Waste Minimization Plan
- L- Signatures

Two RCRA Permits for BGAD

1. Non-Chemical Storage (conventional munitions)
   - Baghouse dust from de-rusting.
   - Miscellaneous solvents, washed munitions.
   - Normal industrial hazardous waste (PPE).
2. Chemical Storage (chemical agent munitions)
   - Obsolete chemical munitions: GB, H, VX
   - Agent related hazardous waste (PPE, secondary waste, etc.).

Non-Chemical Storage Permit

- Intend to issue in 2004 (early Spring)
- Will allow for public comments prior to issuing the final permit.

Chemical Storage Permit

- Projected issuance in 2004 (early Fall)
- RD&D Permit Application for demilitarization plant to be reviewed as a major modification
- Will allow for public comments prior to issuing permit and modification.

Research, Development and Demonstration (RD&D)

- Emissions are controlled.
- Operations are protective of human health.
- Risk for off-site releases are minimized.
- CSEPP is agreed upon.
- Facility is in compliance with all applicable statutes and regulations (KRS 224.50-130, KRS 224.46-520,Title 401 KAR 34:350)

Commonwealth of Kentucky Environmental and Public Protection Cabinet

Ultimate Goal:

... to protect human health and the environment.

Blue Grass Chemical Agent-Destruction Pilot Plant

Blue Grass: A Partnership for Safe Chemical Weapons Destruction

A Partnership for Safe Chemical Weapons Destruction

Information

The Blue Grass Army Depot, located near Richmond, Ky., safeguards a ready supply of conventional munitions and provides chemical defense equipment and special operations support to the U.S. Department of Defense. The Blue Grass Chemical Activity, a tenant of the 15,000-acre depot, is responsible for the safekeeping of a portion of the nation's chemical weapons stockpile. Together the Army and the community surrounding the depot are working toward a committed partnership to support the safe destruction of the Blue Grass chemical weapons stockpile.

What are the chemical weapons?

The chemical weapons stockpile is comprised of 523 tons of blister agent in projectiles and nerve agent in projectiles and rockets. Contrary to popular belief, these chemicals are not gases. In their original form, they are actually liquids. When stored for a long period of time, they can become thick and sludge-like.

What is the Blue Grass Chemical Agent-Destruction Pilot Plant?

The plant will be a state-of-the-art, full-scale pilot facility designed to safely and efficiently neutralize the Blue Grass chemical weapons stockpile. In June 2003, a systems contract was awarded to Bechtel Parsons Blue Grass to design, build, construct, test, operate and ultimately close this facility.

How will the weapons be destroyed?

After a comprehensive evaluation process, the Department of Defense selected neutralization followed by supercritical water oxidation, or SCWO, as the method of destruction on Feb. 3, 2003. During the neutralization process, munitions are disassembled using modified reverse assembly. After the agent and energetics are separated, they are chemically decomposed and neutralized by caustic or water hydrolysis. The resulting chemical compounds are known as "hydrolysates." The agent hydrolysate and the energetics hydrolysate are destroyed using SCWO units. The SCWO process subjects the hydrolysates to very high temperature and pressure, breaking them down into carbon dioxide, water, and salts. Metal parts are thermally decontaminated in a heated discharge conveyor. Dunnage, or materials such as the wooden pallets upon which the weapons are stored, are destroyed in the SCWO process. Solid effluents are recycled or tested prior to disposal in permitted landfills. Gas effluents are recycled or filtered and monitored before release to the atmosphere.

Who will destroy the weapons?

The destruction facility will be operated by the systems contractor, Bechtel Parsons Blue Grass. The Assembled Chemical Weapons Alternatives program, known as ACWA and headquartered at Aberdeen Proving Ground, Md., has been charged with

responsibility for safely disposing of the Blue Grass stockpile. Many other organizations are working in partnership with ACWA to complete this mission successfully. Among these organizations are the Chemical Materials Agency, Joint Munitions Command, Kentucky Department for Environmental Protection and Kentucky Division of Emergency Management.

How long will it take to destroy the weapons?

Bechtel Parsons Blue Grass is in the process of completing of the design. Once this phase is complete, a schedule will be developed. Subsequent phases will include construction, systemization, pilot testing, operations and ultimately, closure. The goal is to complete operations by the current Chemical Weapons Convention, or treaty, deadline, which is April 2012.

How will the environment be protected?

Protection of the unique environment surrounding the Blue Grass Army Depot is one of the Army's top considerations. Therefore, the permits for the facility will be based on special environmental studies conducted locally. Additionally, during disposal activities, the environment will be monitored continually to ensure that operations are protective of the area

What will happen to the facility and the depot once the weapons are gone?

The areas of the facility that have come in contact with chemical agent will be decontaminated and the equipment dismantled. The disposition of the remainder of the facility has not yet been determined and will be negotiated among the Commonwealth of Kentucky, ACWA and Blue Grass Army Depot.

What is the Kentucky Environmental Working Integrated Process Team?

The WIPT was chartered by the Department of Defense to expedite the planning, development and implementation of all aspects of the environmental permitting process for a chemical weapons disposal facility at the Blue Grass Army Depot. The Blue Grass WIPT meetings are held approximately every other month in Lexington or Richmond and are open to the public. Meetings are advertised in the Richmond Register, Berea Citizen and other local newspapers.

What is the Kentucky Chemical Demilitarization Citizens' Advisory Commission?

This commission, known as the CAC, is made up of nine members appointed by the governor of Kentucky. Seven are local citizens and two are representatives of state agencies that work closely with the chemical weapons disposal program. The purpose of this organization is to provide a link between the community and the Army. The members provide a local perspective to the Army so that the public is as actively involved as possible in the disposal program.

Local citizens may request to receive meeting notices and minutes by mail or email. For information on the current issues the commission is considering, to find out the upcoming meeting schedule, or to be added to the mailing list please contact the CAC secretary at 859-625-1528 or fax at 859-625-1502.

What is the Chemical Destruction Community Advisory Board?

The Chemical Destruction Community Advisory Board, or CDCAB, is comprised of representatives of the community, board members and their respective organizations who have been selected to provide advice on major policy issues regarding all aspects of the Blue Grass Chemical Agent-Destruction Pilot Plant.

Board member representatives were selected throughout a series of community forums and meetings earlier this year. The continuation of community interest and participation will be a key factor in the successful launch of this board.

In its mission statement, board members have identified the following primary activities:

- Promoting the safe, expeditious destruction of the weapons
- Ensuring the protection of the community and facility workers
- Encouraging sustainable economic development of the community
- Articulating community priorities regarding the facility
- Guiding public outreach and information sharing with the community.

How can I learn more?

The Army opened the Blue Grass Chemical Stockpile Outreach Office in 1996 as a "one-stop" source of information about the chemical disposal program. The office staff works closely with the Army public affairs team, the state regulatory offices and local and state emergency preparedness offices to ensure a comprehensive public involvement and outreach program. The office also regularly schedules speaking presentations for community groups and serves as a resource for locating Army points of contact and subject matter experts. You can reach the outreach office staff at 859-626-8944 or via email at outreach@bechtel.com. You also are invited to visit the office at 301 Highland Park Drive, in Richmond. The office is open weekdays from 8 a.m. to 5 p.m. Additional office hours are available upon request.

FOR MORE INFORMATION CONTACT: Additional information on chemical stockpile disposal is available at the Blue Grass Chemical Stockpile Outreach Office, 301 Highland Park Drive, Richmond, KY 40475. Telephone: 859-626-8944. Email address: outreach@bechtel.com. For additional information, please contact the Blue Grass Army Depot Public Affairs Officer at 859-625-6221 or the Blue Grass Chemical Activity Public Affairs Officer at 859-625-6898.

Blue Grass Chemical Agent-Destruction Pilot Plant

Resource Conservation and Recovery Act

A Partnership for Safe Chemical Weapons Destruction

Information

The Resource Conservation and Recovery Act, or RCRA, ensures the safe treatment, storage and disposal of hazardous waste generated nationwide. The Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP) is subject to RCRA and must obtain a permit before construction of the facility can begin.

What Is A RCRA Permit?

A RCRA permit is a legally binding document that establishes the waste management activities that a facility can conduct and the conditions under which it can conduct them. The permit outlines facility design and operation, lays out safety standards, and describes activities that the facility must perform, such as monitoring and reporting. Permits typically require facilities to develop emergency plans, and train employees to handle hazards. Permits also can include facility-specific requirements such as air monitoring. The permitting agency has the authority to issue or deny permits and is responsible for monitoring the facility to ensure that it is complying with the conditions in the permit. According to RCRA and its regulations, a Treatment, Storage and Disposal Facility (TSDF) cannot operate without a permit, with a few exceptions.

RCRA, implemented by the U.S. Environmental Protection Agency (EPA) and the Kentucky Department for Environmental Protection (KDEP), regulates the management of hazardous waste from the moment it is generated until final disposition. Several aspects of RCRA affect the pilot plant, specifically the standards for generators and treatment, storage, and disposal facilities. The EPA has given KDEP the authority to implement RCRA under the Kentucky Hazardous Waste Regulations which parallel the Federal RCRA regulation.

Generators

Generators of hazardous waste must comply with standards for storage, waste tracking, labeling, recordkeeping and reporting. The pilot plant will generate hazardous waste as a residual of operations. These wastes include such things as spent charcoal filters, salts and used personal protective equipment.

Treatment, Storage, and Disposal Facilities

Facilities that wish to treat, store or dispose of hazardous waste must first obtain a RCRA permit. RCRA requires these facilities to manage hazardous waste in a manner that is fully protective of human health and the environment. Since the BGCAPP will treat and store hazardous waste, RCRA permits are required.

Permitting Process

The BGCAPP must obtain a RCRA permit to manage hazardous wastes. The process of obtaining a permit is long and complex, with oversight from both federal EPA and KDEP. Public participation is also required throughout the process.

The Program Manager for Assembled Chemical Weapons Alternatives (PMACWA) and its systems contractor Bechtel Parsons Blue Grass (BPBG) plan to build and pilot test a treatment, storage, and disposal facility at the U.S. Army Blue Grass Army Depot (BGAD), Kentucky. This facility will pilot test the destruction of chemical weapons containing blister and nerve agents. BGAD, as the owner (applicant), BPBG, and PMACWA as the co-operators (applicants) are required to submit an application to KDEP for a Research Development and Demonstration (RD&D) permit to build and operate the full-scale pilot plant. The RD&D permit will allow BGAD, BPBG, and PMACWA to build and operate the pilot plant for the purpose of evaluation. Although the plant consists of proven processes and components, the National Research Council recommended that the integrated plant should be tested under a research and development program before full operations. This will help to provide maximum safety to the worker and the public. Ultimately, the plant will be operated under a type of RCRA permit known as a "Part B".

The BGAD commander is responsible for ensuring all environmental regulations and laws are followed for all operations occurring on the depot and is a signatory to the permit. As such, all elements related to the permit, including correspondence, applications and modifications are coordinated with the BGAD Environmental Office.

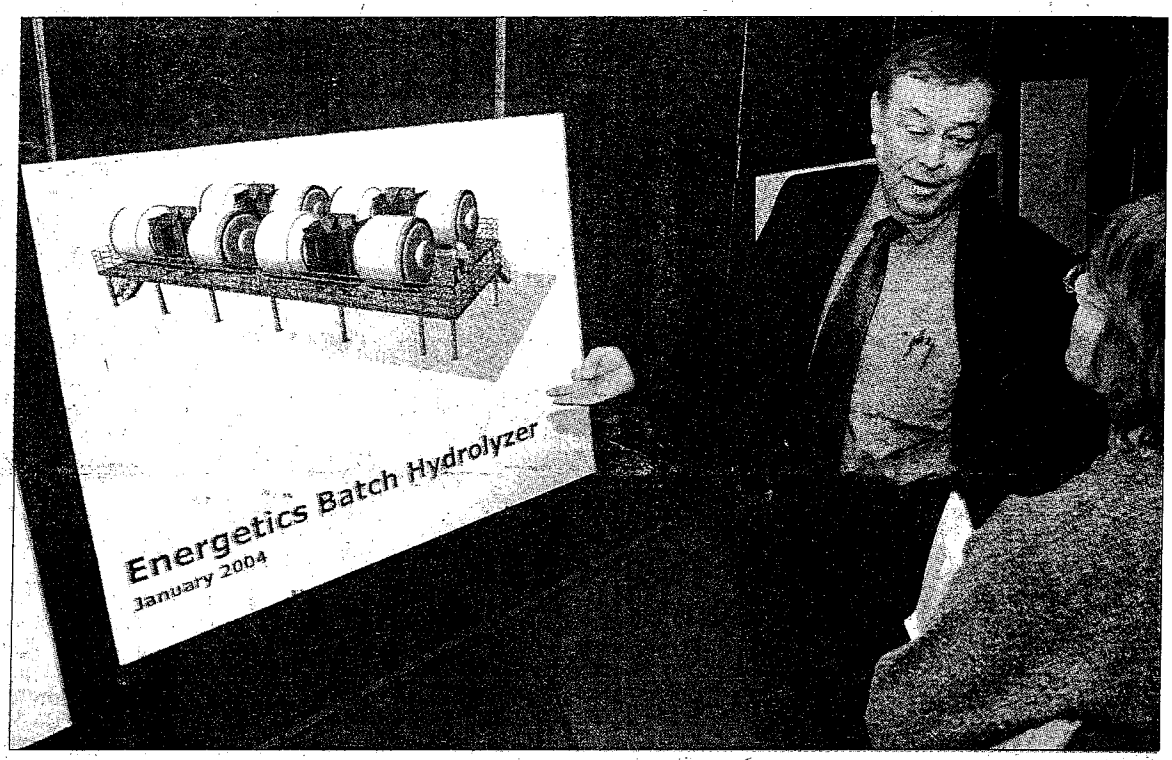
To receive a RCRA permit, BGAD, PMACWA, and BPBG must submit a detailed permit application describing how the BGCAPP will be built and operated to comply with RCRA regulations. Prior to submitting the permit application, the applicants must hold a pre-application meeting to inform the public of their intent to submit an application and to obtain comments. KDEP then reviews the application, generally requests additional information and/or clarification, develops draft permit conditions, and issues a draft permit for public comment. During this comment period, there are public meetings and a public hearing. After comments are received and incorporated, a final RCRA RD&D permit is issued. With KDEP oversight, the applicants will conduct a pilot test of the proposed neutralization system. On the basis of the results, the applicants will decide whether to treat the remainder of the chemical weapons stockpile in the proposed neutralization system. Construction and operation of the plant may not begin until the Army is issued a permit.

Public Participation

Public participation is a vital component of the permitting process. Members of the public can contribute valuable information and ideas that improve the quality of both agency decisions and permit applications. The public is encouraged to ask questions and provide input throughout the entire life cycle of the permitting process.

For More Information Contact: Additional information on chemical stockpile disposal is available at the Blue Grass Chemical Stockpile Outreach Office, 301 Highland Park Drive, Richmond, KY 40475. Telephone: 859-626-8944. Email address: outreach@bechtel.com. For additional information, please contact the Blue Grass Army Depot Public Affairs Officer at 859-625-6221 or the Blue Grass Chemical Activity Public Affairs Officer at 859-625-6898.

Answering questions



NANCY TAGGART/THE REGISTER

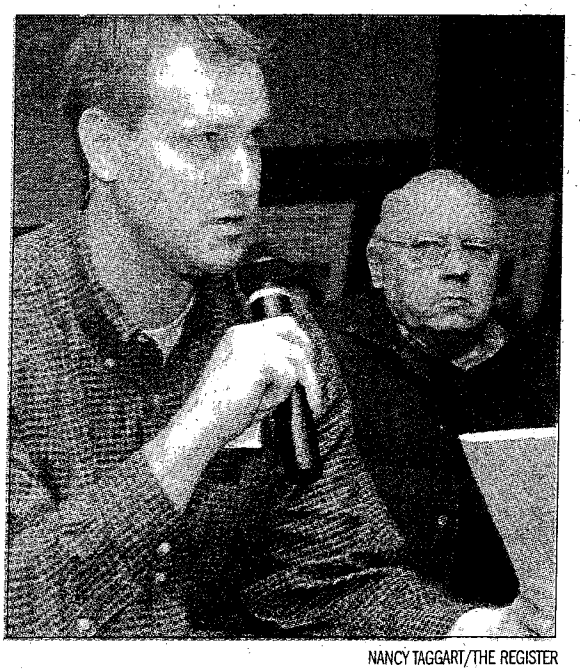
Leo Weitzman, who works in environmental management at Bechtel Parsons Blue Grass, explains chemical neutralization to Karen Mattingly of Berea after a public meeting Thursday night concerning the disposal of chemical weapons at the Blue Grass Army Depot.

Officials host public meeting to answer community's questions

Dozens of Madison County residents attended a public meeting Thursday hosted by Bechtel Parsons Blue Grass, the Program Manager for Assembled Chemical Weapons Alternatives, and the Blue Grass Army Depot to hear details on how the 523 tons of chemical weapons stored at the depot will be demilitarized. The meeting was part of the permitting process, allowing residents to voice their concerns before a final permit is issued.

NANCY TAGGART/THE REGISTER

A large crowd gathered in the Perkins Building at Eastern Kentucky University Thursday night for a pre-application public meeting.



NANCY TAGGART/THE REGISTER

Ed Bergstrom, a student at the University of Kentucky, asks members of Bechtel Parsons Blue Grass about the chemical weapon disposal process after their presentation at a public meeting at Eastern Kentucky University Thursday night.

Richmond Register
Jan. 23, 2004
Page 1

MEETING NOTES

Resource Conservation and Recovery Act
Pre-Application Public Meeting
January 22, 2004
Carl D. Perkins Building
Eastern Kentucky University
Richmond, Kentucky

Ms. Sandra Plant, Bechtel Parsons Blue Grass, Moderator, called the meeting to order at 6:05 p.m. Ms. Plant gave instruction on emergency exit and a short safety briefing. She recognized Paul Ramsey, Eastern Kentucky University Media Resource Department, the audio equipment operator. Ms. Plant explained that the purpose of the meeting was to solicit public input on the Resource Conservation and Recovery Act (RCRA) Research, Development and Demonstration (RD&D) permit application to destroy the chemical weapons stored at the Blue Grass Army Depot. Ms. Plant also went through the agenda so that stakeholders would know what to expect from the meeting.

Mr. Chris Midgett, Project Manager, BPBG, gave a brief overview of the current status of the Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP). Mr. Midgett covered the milestones, which include the design build plan, the integrated master schedule, completion of 5 percent of the initial design, and risk reduction studies. BPBG has completed more than 70,000 hours without a recordable injury or workday case. Staffing at this time is 100 people, 15 in the Richmond office and the rest in the Pasadena, California office. An Initial Process Design Package (10% design completion) will be submitted to the Army by January 31, 2004. The Initial Design (30% design completion) is scheduled for submission to the Army by July 31, 2004.

LTC Dennis Cantwell, Commander, Blue Grass Chemical Activity (BGCA), provided a brief history of Blue Grass Chemical Activity and reminded all in attendance of the meeting's purpose. The Blue Grass Army Depot has 2 percent of the nation's original chemical weapons stockpile. The Chemical Weapons Convention treaty mandates that the weapons be destroyed. LTC Cantwell commented that the BGCA is operating 24 hours a day, seven days a week, 365 days a year.

The employees are committed to environmental stewardship, and the safe and secure storage of the stockpile.

Mr. Tom Kurkjy, BPBG Environmental Manager, provided background information on the proposed facility. Mr. Kurkjy spoke about the permit application, which will be submitted to the Kentucky Department for Environmental Protection (KDEP) to build and operate the pilot plant.

Mr. Kevin Regan, BPBG Environmental Permitting Manager, briefed the public on the procedures required by the applicants to obtain environmental permits from KDEP. Mr. Regan also spoke about the KDEP, Division for Air Quality, Division of Water, Division of Waste Management and U.S. Environmental Protection Agency responsibilities with regards to chemical weapons stockpile. He presented background information on the steps required to receive a permit to conduct a RD&D program.

Ms. April Webb, Supervisor for RCRA Permitting, KDEP, Commonwealth of Kentucky Environmental and Public Protection Cabinet, provided an overview on the permitting process from the state's perspective. U.S. Congress enacted RCRA in 1976 with major amendments in 1984. Ms. Webb also said that KDEP could issue permit in early Spring 2004 for non-chemical storage. KDEP will allow for public comments prior to issuance of the permit. The projected issuance for the chemical storage permit will be in early Fall 2004. The ultimate goal of KDEP is to protect human health and the environment.

Following the five presentations, the moderator called on the one speaker who had signed up to make a five-minute statement. Mr. William Scrivner spoke on the topic of emergency preparedness and the Chemical Stockpile Emergency Preparedness Program (CSEPP). A copy of his statement can be found in Annex A of this document. After the presentation, the public had the opportunity to ask questions of the five presenters. The questions were:

- (Q.) Mr. Craig Williams, Director of the Chemical Weapons Working Group and member of the Chemical Destruction Community Advisory Board (CDCAB): On page 12 of the

handout, there was some overlapping of the RD&D permitting Process and Construction. Please explain.

- (A) Mr. Midgett, Project Manager gave the explanation that access roads would need to be built prior to construction of the Disposal facility on BGAD. Construction of this road and associated entry facility, do not require an RD&D permit prior to the start of construction.

- (Q.) Ms. Jessica Richardson, Berea College student, asked if there were any efforts to extend information to Berea College?

- (A) Mr. Midgett said he had met with the President of Berea College. He noted that the Outreach effort extends beyond Madison County and includes a seven county area.

- (Q.) Ms. Stephanie McSpirit, asked how the Permitting Process, Contingency Plan and Emergency Response were in regards to the community.

- (A) Mr. Regan, stated that before any operations involving live agent can occur, the plant operators would be required to have a contingency plan in place. This plan has to be approved by the installation and the state. The county and the state are responsible for responding to an event that effects residents outside the installation and the Army would be responsible for responding to an incident or accident on the installation. Ms. Plant requested that Ms. McSpirit state her question in writing so that the government could provide a response in writing. LTC Cantwell added that chemical accident emergency exercises are held on a regular basis.

- (Q.) Mr. Mike Cannon, What is the plan for the facility after chemicals are disposed of?

- (A.) Mr. Midgett responded that the contract states that BPBG and the Army are required by public law to close the facility, and return the area back to original state. BGAD, after

negotiations with the state and the public, may choose to keep some of the facilities associated with the project.

- (Q.) Mr. Greg Burnett, EKU student, had several questions. He was asked to write them down and submit them to the outreach staff. Mr. Burnett submitted questions and his answers are in the process of being responded to.

- (Q.) Mr. Williams requested from the Madison County Emergency Management Agency (EMA) the date, time and location of the CSEPP public hearing. He asked that two separate issues be put on agenda, 1. Off-site response, 2. On-site response.

- (A.) Mr. Carl Richards, Madison County EMA informed the public that the meeting will beheld in Posey Auditorium on Eastern Kentucky University's campus, February 5 from 6-8 p.m.

- (Q.) Sandra (last name not given), of the Kentucky Job Center, asked when jobs at the facility were going to be available. She said she receives inquiries on jobs on a daily basis.

- (A.) Mr. Midgett answered that jobs would be available before the start of construction. Hiring should take place around mid-summer 2005.

- (Q.) Mr. Ed Bergstrom, University of Kentucky student, had several questions about the project.

- (A.) He was asked to submit in writing and will forward to appropriate person.

The formal meeting ended at approximately 8 p.m. and attendees were invited to have refreshments and to continue to review posters and talk with project personnel.

WRITTEN PUBLIC COMMENTS

20 JANUARY 2004

PO BOX 5108, RICHMOND KY 40475

A PETITION

FROM THE CITIZENS AND WORKERS OF MADISON COUNTY

SEEKING REDRESS OF SAFETY GRIEVANCES RELATING TO CSEPP AND

CHEMICAL DISASTER EMERGENCY AND

RELATING TO THE PERMITTING PROCESS

A PETITION BY CONCERNED CITIZENS AND WORKERS FOR CSEPP COMPLIANCE AND MAXIMUM CHEMICAL DISASTER EMERGENCY RESPONSE PROTECTION FOR MADISON COUNTY KENTUCKY, A TOXIC CHEMICAL WEAPONS STORAGE SITE

PO Box 5108
Richmond Ky 40475
January 20 2004

TO:

Public Meeting on Permitting, 22 January 2004 Moderator

Kentucky Department Environmental Protection
Kentucky Division Emergency Management
Governor Fletcher

Sen.Mitch McConnell
Sen. Jim Bunning
Rep Hal Rogers
Mr. Ben Chandler
Mrs. Forgy Kerr

Judge Kent Clark

DoA Under Secretary CSAPP
DoA Under Secretary Safety

FEMA

OSHA

EPA

A list of questions were submitted publically to a CSEPP forum reluctantly attended by DoA and FEMA officials in January 2000. That was the first and last time that any CSEPP officials ever presented themselves to Madison County public. However, public information as specified by law was not forth coming as both the DoA and FEMA ignored the citizens concerns and issues.

Again we submit our issues, grievances, and fears to federal agencies and officials for redress and correction. This is timely as the rush to obtain a Kentucky permit has speeded up, but the related safety factors continue to lag.

As public information and citizens input has been deliberately made nonexistent here, we do not expect a reply this time either. Hopefully some of the influential copy furnished groups will help us obtain answers.

It is a relatively easy matter to create credibility, just be proactive not cavalier; provide public information; seek citizen and worker input; establish oversight councils for stakeholders; schedule and conduct regular CSEPP and chemical site safety meetings by DoA, FEMA, state and local officials for the public and workers.

Essentially. all that we have continually asked for is our due. good offices

Without maximum protection, public information, or citizens input, all that we can depend on is the discretion of the Kentucky state division that will issue the permit after approval of CSEPP as set forth in KRS 224.50-130. Unfortunately they do not direct compliance, only approval of the final product before issuing a permit; sowe may be without adequate protection for yet many more years-an unconscionable situation.

If, responsible governments and their agencies, and representatives will not redress safety deficiencies the alternative is thru the courts.

Addendum

We see no difference between R D&D permit and a regular production permit from a CSEPP application.

Please comment.

Citizens and chemical storage site workers concerns and questions concerning the readiness to deal with a chemical Disaster emergency (CDE) response.

Does the Army have a contract with all of Madison County that public safety is number 1 regardless?

Is our community entitled to maximum protection (MP) from a chemical disaster emergency (CDE) under federal law? What is MP and why have we never heard it defined?

Does the chemical storage emergency preparedness plan (CSEPP) entail citizen input and public information?

Are the nearly 1,000 chemical storage site workers protected from CDE by OSHA, CSEPP and Kentucky statues?

Of the aspects CSEPP, DEMIL, Permitting, ACWA, don't you think that CDE plan is the most important?

The answers are obviously "yes", so why have none of these vital safety protective measures not been fully implemented here?

Why is the permit in process when the agencies responsible for maximum protection are all cognizant of the deficiencies?

When will maximum protection measures be completed here?

Why has it gone unattended these many years by DoA and FEMA?

Is there a quid pro quo whereby max protection measures will be held up until a Kentucky DEMIL permit is issued?

Compare the more extensive protection available at Anniston and Umatilla where state permits are in effect, with regards to number of schools, universities, and hospitals over-pressurized (OP) and hoods issued to here in Madison County?

Does the technical literature make reference to the danger for a CDE while the TCW are being stored as greater than for a DEMIL operation?

If so, why then is MP not yet available here?

Do you plan to pursue a permit for a pilot plant even though long over due maximum protection is yet to be in place for citizens and workers?

Don't you think that the permit process should be halted until you bring MP to its entitlements?

Since you have failed to issue protective hoods neither to citizens in the chemical disaster danger zones nor to workers near ground zero, can you provide us with the source of the hoods so that we may purchase them for our families and for ourselves at the chemical storage work site?

The only CDE plan for site workers, vague as it is, relies upon evacuation. Does the DoA now advocate SIP? Does this disparity not pose unnecessary risks?

Were you aware that EOC manager of BGAD stated publicly that no finds are available for training of BGAD workers or for disaster exercises?

Why does not the CSI do a real evaluation of the chemical stockpile here and include a review of the site chemical disaster emergency plan?

Does CSEPP have even a minimal quality assurance (QA) plan as is certainly needed? Is QA in place to monitor the status of the alert radios, provide basic instructions for shelter-in-place especially for those requiring special assistance such as the elderly and handicapped?

Five to ten years ago the county EOC relied solely upon a ridiculous 7- ½ hour evacuation plan
Why did not CSEPP evaluate and make SIP and OP available?
Why did not CSEPP fund roads to facilitate evacuation?
Why was the citizenry not informed of such a glaring defect?

CSEPP IPT meets regularly and its discussions would alarm most of us. Why not make the present and past meeting minuets public as should be done? Why not meet during non-working hours so citizens can attend and ask questions?

Under the freedom of information we request this IPT information as well as information on the other issues brought forth above.

A child born here today will probably graduate from high school before the chemicals are destroyed.
Were you aware that the citizens of Madison County never got to vote by referendum on how to deal with TCW destruction.? They did not get to choose between shipping the chemicals to an incineration already established, neutralization especially after 9-11, DEMIL as soon as possible using the best available technology, or wait an indefinite time for the perfect methodology.

We will submit more questions from time to time.

Copies Furnished:

IAM & AW 859
Harold Green

Rep Moberly
Sn. Whorley
Sn. Napier
Mr.Metcalf

Madison County Magistrates

Madison County Board

Richmond Mayor
Richmond City Council
Richmond City Council

Berea Mayor
Berea City Council

EKU president

Lexington Mayor

Irvine Mayor
Estill County Judge

Lexington Herald
Louisville Courier Journal
Richmond Register
Berea Citizen
Citizens Voice & Times (Irvine)

US News & World Report
Time
Sixty Minutes
USA Today
Fox
Anniston Star

Channel 27
Channel 36

Channel 18
Channel 56

CAC

Others as identified

We, the stakeholders listed below, want the maximum protection from chemical disaster emergencies that workers and citizens in Madison County deserve and have been entitled to receive under law to finally be completed. We expect that citizens and workers input, public information, and oversight councils will also be organized as part of the maximum protection entitlement.

The alternative is for us to seek relieve of these grievances and safety omissions in federal court and obtain a halt to the entire proceedings.

Gary W Abner

Walter R Kisilak

Dan Chris

Toni S. Thompson

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Norman K. Hall

Barkley W. Hilton

William R. Scruggs

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William R. SCRIVNER William R. Scrivner

SAMUEL D Merrick Samuel D Merrick

HENRY TURPIN Henry M. Turpin

Chester Woods Chester Woods

Johnny Brooks

Mark Cates

Harold Tipton Harold Tipton

HENRY MARSHALL Henry Marshall

~~Bill~~ Bill MAYFIELD Bill Mayfield

Ronnie Anderson

Jimmy Bowden

Roxana E. Hall Roxana E. Hall

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>Explain the several memorandums of understanding and why they are not completed?

>Why has detailed public information been with held? Is it not required by law?

>When was the request for Madison collective protection budget received by FEMA \ DOA?

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> We expect a search and rescue as part of response, how will it work?
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Why has it been delayed here. At least selected private homes could have received a $2 video as they did expensive radios
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>>Many people feel that CSEPP is more important than DEMIL or Treaty.

Jan 05 2001

CAC CSEPP COMMITTEE PAPER NUMBER ONE

JANUARY 05 2000

To: CAC and the Public

The following is a list of our expectations for the January CSEPP forum and we would like them to address their response in writing for the public record:

1. Publicize the federal CSEPP DOA \ FEMA chain of authority and responsibility by the individual, office, address, and numbers for their phone, fax, and email to insure public participation and a response to the stakeholders concerns, fears, and questions.

2. Establish a public information center at the Madison County library that will encompass *all* issues and areas that concern or effect public safety vis-a-vis toxic chemical weapon storage at this site in our community. This committee can oversee it with permission from the library

3. Arrange for unlimited access to information that will enable filing and distribution for *all* CSEPP and chemical related activities. Such information will include but not be restricted to reports, evaluations, meeting minutes (IPT, SURETY), exercises (CSEPP), inspections (CSI), recommendations, memorandums of understanding, and policy papers.

4. Set up a procedure so that the public is regularly informed as to the status, problems, gridlock, and completion of *every* phase of the CSEPP process, including past elements. Allow for periodic forums through the CAC.

5. Issue a complete financial statement for CSEPP expenditures that breaks down expenses for completed, on going, and planned costs at each level and site.

6. Committee members will all have a place at the table.

7. Field public questions.

CSEPP Committee

Good evening and welcome to tonight's forum on Chemical Stockpile Emergency Preparedness Program (CSEPP). All communities that host toxic chemical weapons storage sites are guaranteed Maximum Protection for their citizens by federal law. Unfortunately we have to fight for ours.

The Concerned Citizens for CSEPP Compliance, known as CCCC has generated this gathering.

Our goal here tonight is to inform and thus bring about public participation to resolve public safety issues and problems with our Chemical Disaster Emergency Response that are of 10 years standing.

The main safety issues and concerns are listed below but are not limited to:

1. Chemical Disaster Emergency Response has relied solely upon vehicular evacuations using our roads and highways that are impossible to provide a speedy retreat to safety.

2. Collective protection has not been implemented to protect our children while they are at their school. Umatilla Oregon has had 11 schools constructed for Over-Pressurization for some time. EKU and Pattie A. Clay are in this category also.

3. Homes of our elderly, ill, and mothers with children have not been provided basic safety assistance of Shelter-In Place that is commonplace in other communities.

4. Public information and participation has not been delivered as required by the responsible agencies. The overwhelming majority of Madison County citizens know nothing of these issues.

5. There has not been leadership from the high level of federal government to solve problems, insure the implementation of best safety measures, and overcome gridlock among the agencies, even though that is where the ultimate responsibility lies.

Community awareness and involvement is the only way to insure our over due enablement to maximum public safety.

I support this petition by the Concerned Citizen's for ***CSEPP*** (Chemical Stockpile Emergency Preparedness Program) Compliance in securing a Maximum Protection Chemical Disaster Emergency Response for Madison County Kentucky.

CSEPP is Public Law *entitlement* for all Army toxic chemical weapons storage sites. The Department of the Army has a contract with our community: **Public Safety is Number One, Unconditionally.** Yet after a decade, they have produced a woefully inadequate plan for *chemical disaster emergency response*--- a 7-hour evacuation by vehicle on Richmond and Madison County's crowded roads; not Over-Pressurization for our children's schools or Home Shelter-In Place for our house bound citizens as has been implemented at Umatilla Oregon years ago by DOA \ FEMA.

They have *failed* miserably in their basic mission to inform and educate our populace concerning CSEPP, particularly on their 7-hour incident. The citizens of Madison need help: I ask you, our senators, congressman, governor, state agencies, county judge and officials, to honor this petition and act to intercede with DOA \ FEMA to start and complete action on the level of maximum protection that they are responsible to provide this community.

The top CSEPP DOA \ FEMA authorities *owe* us a public meeting to address our concerns. We want them to explain their CSEPP deficiencies and responsibilities, and define our CSEPP entitlements.

These CSEPP issues are especially *time critical* for our safety as a special interest group is secretly working to revise Kentucky Law KRS-224 this legislative session. If allowed to pass, this revision will allow Kentucky Environmental Protection Cabinet to accept the DOA's application for a permit to store and destroy the chemicals, <u>without</u> our vital present guarantee of CSEPP demonstration. They and their KRS224 Revision will effectively kill the long overdue chemical disaster emergency response for Madison and surrounding Counties because the DOA will no longer have to comply with Kentucky law. We need to preserve our protective laws and to expand the maxim protection.

NAME \ DATE	ADDRESS	PHONE
Flossie Stiles November 2, 1999	Flossie Stiles 435 Concord Rd. Richmond, Ky. 40475	606-623-4385

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NAME \ DATE	ADDRESS	PHONE
Brian Whicker	349 Woodland Ave,	623-8644
Mary Whicker	349 Woodland	623-8644
Elynor James	150 NORTHLAND DR	252-1425
Jamie Whicker	101 Holly Hill	985-0868
Melissa Pierce	320 Preston Ave.	266-4123
Michael Pierce	320 preston ave	266-4123
Richard Zerbee	210 S. 3rd St. Apt 12	
Rose M. Bailey	#3 BARON AVENUE	253-9457
Jason Palmer	102 Manna Dr.	626-3905
Barry Garth		
Wayne Bailey	Huntsville Rd.	

25 September, 1999

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PETITIONER'S NAME	MADISON COUNTY KY ADDRESS	HOME PHONE NUMBER
Karen Hall	112 Winston Dr.	623-4103
Michele Bing	100 Wanda Dr.	624-3998
Gwendolyn Camp	204 Goodloe Chapel Road	(606) 369-5749
Lillyane Holt	125 N. Oakland	624-9562
Jennifer Mockbee	117 Israel Dr.	623-5141
Anne Dean	705 North Powell Ave.	986-8649
Sallie Todd	109 W. Bennington Ln.	623-7082
Ann Mullikin	1045 Elizabeth	623-1954
Kim Cates	1041 Brandy Ln. #8	626-5195
Diane Joyner	146 Lakeshore Dr.	623-8492
Pamela Dexter	1041 Brandy Lane #3	625-5970
Elizabeth Horn	1530 McKee Rd Berea	986-8540
Patty Curry	105 Southland Dr	623-8455
Bobbie Taylor	256 Fike Rd. Waco Richmond	
Lynnie Clark	311 Moberly Ave. Richmond	623-8326
Debra Brown	113 Redlands Dr	624-2333
LG Goodloe		
Teresa Brown	Elmwood Apt #1 Berea	
Becky Moberly	225 Beechwood Dr.	986-5698
Tony Reynolds	33 Herons Landing	369-3225
Ty Parsons	507 Martin Dr.	623-4112
Lynn Clark	324 Gunn St. Apt B Lexington	225-0036
[illegible]	[illegible]	[illegible]
Travis Hall	130 Beaver Dr	623-7476

→

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NAME \ DATE	ADDRESS	PHONE
Edith Hendricks 10-29-99	1408 Providence Rd. Richmond, Ky.	606-623-2626
Patricia Larson 10-29-99	319 Bard Farms Dr. Richmond, KY	606-623-6835
Frances R. Newman 10-30-99	1431 Fairlane Dr. Richmond Ky	606-623-4713
Sheree Rose 10-30-99	211 Layne Ct Apt. 1 Berea Ky	606 985-0953
Kathy Salmons 10-30-99	230½ Jeffersons Berea Ky.	606-986-4486
Virginia Turner 10-30-99	1423 Fairlane dr Richmond, Ky.	606-623-2480
Lorraine King 11-2-99	316 14th St	606-623-5384
Danny W. Mason 11-2-99	326 W. Lexington ave Winchester Ky	606-744-065
Sara Lee Pigg 11/3/99	924 Sombrero Dr. Richmond, Ky	606-624-2542
Ronnie Spicer 11/3/99	204½ S. 3rd St. Richmond, Ky	606-623-9375
R Hall 11/4 99	1420 Finland Rd Richmond Ky	606 623-583
Eva Adams 11/4/99	167 Meadowlark Dr, Richmond, Ky	606-623-3595
Betty Blakemore 11/10/99	205 Clay Dr.	606-623-9457
Arkadna Rollins 11/11/99	1410 Providence Rd Richmond, Ky	606-624-9347

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NAME \ DATE	ADDRESS	PHONE
Joey Ruckus	P.O. Box 485 WACO	(606)369-3637
Betty Jurgensen	350 Woodland ave	624-9268
Robin Foley	125 Jack Ware Dr.	624-2168
Jerry Whitis	349 Woodland Ave	623-8644
Elvis Terry	351 Woodland Ave	623-8587
Amanda Rollins	1410 Providence Rd	624-93470
Arch Terry	351 Woodland Ave.	623-8581
Mike Moreland	110 Keenfield	—

Tamara Emerson 143 Durbin Rm - Richmond 40475
Charles W Bolin 124 Maple Hill Dr #4 Richmond
Michelle Turner 1168 Menelaus Rd. Berea, Ky 40403 985-0187
James L. Turner 1168 Menelaus Rd., Berea, Ky. 40403 (985-0187)
Shane Bey 100 Wanda DR Richmond KY 40475 624-3958
David Hall 112 Winton Dr. Rich. Ky. 40475
Jack Matlock 1117 Menelaus Pk. Berea Ky 40403 985-0210
Shayne S. Emerson
Candy McCloud 417 Garden City Dr. #20 Richmond, Ky 40475 625-0638
Jason Hall 105 Sycamore Dr, Richmond, Ky 40475 624-1851
Charles McKenney 105 Sycamore Dr Richmond KY 40475 624-1851
Caroline McKenney 105 Sycamore Dr Richmond KY 40475 624-1851

Tracy Compton 401 Murray St. 223-5481

Becky Wesley 107 Overlook Ct. Danville 606 854-6186

Theresa Ford 606-365-7147

Jenda Fowles 119 Longview Dr. 624-5793

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These items presented to ARMY/FEMA JAN. 2000. at CSEPP forum.
Totally ignored

ACWA
Program Manager Assembled Chemical Weapons Alternatives

comment card

Please Print Clearly:

Event: ~~1-22-04~~

Date: 1-22-04

Name: April Payne

Street Address: 209 Ralno Ct

City: Richmond State: Ky Zip Code: 40475

Telephone (optional): 859-893-1267

E-mail: paynea@adelphia.net

Your comments:

Are there any programs available to pay for a private citizen to build a safe Room in there home. Ie to construct a 20x20 basement room that would be safe in the event of a incident

How useful is the information provided to you?

- ☐ Very Useful
- ☐ Useful
- ☐ Not Useful
- ☐ No Opinion

Could you refer us to another club or organization for a future presentation?

Organization Name: _____

POC: _____

Phone Number: _____

Would you like to join our mailing list?

- ☒ Yes
- ☐ No
- ☐ Already on List

A Partnership for Safe Chemical Weapons Destruction

ACWA
Program Manager Assembled Chemical Weapons Alternatives

comment card

Please Print Clearly:

Event: Pre-application Public Meeting

Date: 1-22-04

Name: Susan Shower

Street Address: 204 Eagle Dr

City: Richmond State: Ky Zip Code: 40475

Telephone (optional): 625-1918

E-mail: Shuma236@hotmail.com

Your comments:

Closed well

How useful is the information provided to you?

- ☐ Very Useful
- ☐ Useful
- ☐ Not Useful
- ☐ No Opinion

Could you refer us to another club or organization for a future presentation? American Red Cross

Organization Name: Daniel Boone Chapter

POC: 213 West Main St Richmond Ky 40475

Phone Number: 623-1336

Would you like to join our mailing list?

- ☐ Yes
- ☐ No
- ☑ Already on List

A Partnership for Safe Chemical Weapons Destruction

ACWA
Program Manager Assembled Chemical Weapons Alternatives

comment card

Please Print Clearly:

Event: _____

Date: 1/22/04

Name: Jim Beck

Street Address: 301 BlueSky Pkwy

City: Lexington State: KY Zip Code: 40509

Telephone (optional): 859-263-5178

E-mail: jbeck@skilton.com

Your comments:

_____

_____

_____

How useful is the information provided to you?

- [x] Very Useful
- [ ] Useful
- [ ] Not Useful
- [ ] No Opinion

Could you refer us to another club or organization for a future presentation?

Organization Name: _____

POC: _____

Phone Number: _____

Would you like to join our mailing list?

- [ ] Yes
- [ ] No
- [x] Already on List

A Partnership for Safe Chemical Weapons Destruction

ACWA
Program Manager Assembled Chemical Weapons Alternatives

comment card

Please Print Clearly:

Event: RCPA

Date: 1/22/04

Name: NANCY HINDMAN

Street Address: 300 CENTER ST

City: BEREA State: KY Zip Code: 40403

Telephone (optional): 859 985 00 22

E-mail: NANCY.HINDMAN@EKU.EKU

Your comments:

Excellent meeting
well run - Positive!

How useful is the information provided to you?

- [x] Very Useful
- [ ] Useful
- [ ] Not Useful
- [ ] No Opinion

Could you refer us to another club or organization for a future presentation?

Organization Name: LEAGUE of WOMEN voters

POC:

Phone Number:

Would you like to join our mailing list?

- [x] Yes
- [ ] No
- [ ] Already on List

A Partnership for Safe Chemical Weapons Destruction

Speaker Sign-In Sheet

If you wish to voice your comments or questions during the Public Comment Period, please sign in. You will be called in the order listed below.

	Name (Please print clearly)	Organization/Affiliation
1	WM. SCRIVNER	Concerned Citizen for CSEP Compliance
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122 total

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Please print: N... ...ess

			Phone	Fax	Email Address	Affiliation
1	Elizabeth Crowe	501 Center St.	859-986-0868	—	elizabeth@cwwg.org	CWWG / KEI
2	Karen Mattingly	~~104 Van Winkle Berea~~ Berea	(859)985-9912	—	jmnigro@adelphia.net	—
3	NANCY HINDMAN	300 Center St	(859)985-0022			
4	Casey Poynter	1963 Hwy 1016 Berea ky	859-200-8407		kc1919@hotmail.com	—
5	Michael Bryant	560 S. Kennland dr	859-624-4767		mfk6@juno.com	MADISON CO CSEPP
6	Sanjay Saraiya	APG, MD	410-436-9631		Sanjay Saraiya@us.army.mil	SAIC
7	John Marks	141 N Eagle Creek #100	859 264-8555		JMRAINCI@MSN	CONTRACTOR
8	Stephen McSpir	1425 Fairmane Drive	859-625-5377		Stgr	
9	Teresa Smith	207 W Dixie London	606 330 0585			
10	Roger Barger	316 Boone Way	623-8906		County	Magistrate
11	Robert [illegible]	1018 E-New Circle lex.	859-252-8872		Ibew.lexnath@verizon.net	Ibew
12	[illegible]	90 Airport Rd	607-5719			
13	J. Christman	501 Brockton	(859) 22-2516	—	john and jess@netzero.com	EKU-EHS dept
14	M. HANNON	248 APACHE DR PAINT LICK 40461	859 986 7186			
15	M.A. Ghosal	110 Chestnut Ct. Berea 40403	859-986-7449		maryann.ghosal@eku.edu	~~DEPP DA~~
16	Herbert Campbell	803 Schenkel Ln. Frankfort	502 573 3382			DEPP DAQ
17	LYLE A. WALKER	P.O. BOX 143 MUIREE KY 40457	606-965-3151			M.A. WALKER LLC
18	Sue Chenault	POB 414	859 623 2935		SRchenault@ipro.net	
19	David Stipes	133 Saratoga Circle Rich.	859-624-9812			
20	JOHN CAPILLO	PO Box 467 BEREA	859 986 0868			

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Please print:	Name	Address	Phone	Fax	Email Address	Affiliation
1	Rick Howard		865-220-2234			BNI
2	Aaron JAMISON	4790 Todds Rd Lex, KY 40509	859 260 7760	260 1256	ajamison@MICAHGROUP.com	MICAH
3	April Payne	209 RaNo Ct Richa ky 40475	859-893-1267		payne@adelphia.Net	
4	Robert Payne	209 RaNo Ct Richl ky 40475	859-893-1267	—	—	—
5	Gary Risk	2375 Calalpa Loop Rd	859-623-4167	623-6365		
6	Kai Burk	413 Corman Dr. Nicholasville KY 40356	859-881-4286			
7	Craig Williams	P.O. Box 467 Berea KY 40403	859 986 7565	859 986 2695	Craig@cwwg.org	CWWG
8	Jeremy Rigney	4346 Simpson Lane Richm	859-623-5794		jeremy.rigney@suntrust.com	
9	Don MARIFJEREN	307 BROOKS Rd RICH	859 623-2380			
10	Colleen Kaelin	156 Pinehurst Dr Frankfort	(502) 875-4921		Colleen.Kaelin@KY.gov	KY DPH
11	Hal Holmes	412 Springfield Dr. Richmond KY	623-7419			
12	E. Everard	306b Remington Ct	—			
13	Danielle Capillo	CPO 348 Berea KY 40404	—	—		Berea College HEAL
14	Corrie Stotts	EKU	622-2961		corrie.stotts@eku.edu	
15	CHARLES SCHINDLER	311 FOREST STREET BEREA 40403	(859) 986-1834	-	schindlers2@alltel.net	AIR BREATHER, H_2O DRINKER, FOOD EATER
16	Roenke	814 Edgewood Dr Lex 40515	859 971 0180			BGAD
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(3) ✓

	Please print: Name	Address	Phone	Fax	Email Address	Affiliation
1	Peyton Creighton	121 Sundale Lane Richmond	6245269	622 1939	Peyton.Creighton@eku.edu	EKU
2	Donny Brown	239 Dinsley Bypass	622 1992	622 1939	Donny.Brown@eku.edu	EKU
3	Carolyn Harvey	403 Chas Claybourne Gate 2	622-6342	622-1939	carolyn.harvey@eku.edu	EKU
4	Nancy Taggart	380 Big Hill Ave				Richmond Register
5	Robin Reed	266 W. Lee 5th. Berea	986-0692			
6	Tower Pum	114 Redwood Dr Richmond	623 4280			
7	Mac Pum	" "	" "			
8	Lazy Dixon	300 Anglewood Dr Richmond, KY	626-1457			Rdc
9	Ralph Collins	KY DEP - FRANKFORT	502-564-2150		RALPH.COLLINS@KY.GOV	DEP
10	Cindy Gardner	110 Old Wallaceton Berea	859-985-8733		cpopham@adelphia.net	TPS
11	Pat Tucker	105 Winesap Dr.	859-625-5509			
12	Robert E. Bagby	120 Pleasant Ridge drive	859 623-8542			Civic Rep.
13	Dot [illegible]	125 Meadowlark	200-4489			ME
14	LOGAN Wheiler	856 Smeeth Loop	859 200 7471			
15	Kirk Lopitzke	1171 Lakewood Hgts	859 268-8221			BGCA
16	Jim Jones	12005 Irvine Rd Winchester KY 40391	859-278-8458			
17	LYLE Cook	109 PARKHILLS Ct	859-624-3971			EKU
18	Keith Mahon	5 Wellington Ct	859-626-0567	8596260567	nohow2004@ipcorp.net	
19	Gary Abney	113 Brookview Dr.	858-625-2107			
20	ANDY BURNS	923 Turnberry	8596084428			

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Please print:	Name	Address	Phone	Fax	Email Address	Affiliation
1	William Crase	802 Pau Ferro Ct Berea 40403	986-4727			
2	Jessica Richardson	115 Haiti Rd Berea	228-0135			CWWG
3	Doug Windman	300 Center St Berea	985-0022			Ky CAC
4	Melissa Neal	257 Maryland Dr. Apt. 13	200-3652			CSEPD
5	Roger Osborne	224 Patsy Dr. Apt 4	624-0829			Progress
6	Jim Lawson	Ellicott Ky	7946280			
7	Brenda Fary	411 Wallace Ct Berea	623-1139			
8	Jesse Cain	129 E. Walnut	623-6816			City Richmond
9	[illegible]	27 Connie Way	552-7396			OccMed
10	Paul Bell	4315 Preston Hwy	502-368-2568		pbell@rbewlocal369.com	
11	Christina Shackelford	239 Waterford Way, Somerset	606-678-9744		crshackel@yahoo.com	EKU Stud.
12	Robert Miller	416 Bethlehem Rd, Dreyfus	859-986-3921			CAC, CDCAB
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Please print:	Name	Address	Phone	Fax	Email Address	Affiliation
1	ED BERGSTROM	370 ROSE ST. #6	(859) 494-0703		etbergstrom@yahoo.com	UK student
2	ERIC RINGO	KYDEP 14 Reilly Rd Frankfort KY	502 564-6716		ERIC.RINGO@KY.GOV	KYDEP
3	April Webb	KYDEP 14 Reilly Rd Frankfort	502 564-6716		April.Webb@ky.gov	KYDEP
4	Dennis Cantwell	2091 Kingston Hwy, Richmond	625 6889		dennis.cantwell@us.army.mil	BGCA
5	Jim Richmond	APG, MD	410-436-5524		james.a.richmond@us.army.mil	PMACWA
6	Wm SCRIVNER	310 Savannah Dr Rich	624-6888		WR.SCRIVNER@Yahoo.com	Citizen
7	Scott McCoy	510 Letcher Ave.	(859) 623-6640			
8	Tommy Adams	100 W. WALNUT, PASADENA, CA	626-440-3078		tmadams@bechtel.com	BPBGT
9	Dale Ballinger	110 Old Wallaceton Berea	859 985-8733		daleballinger@tpscabling.com	
10	Jim Beck	301 Blue Sky Pkwy Lex.	859-263-5178		jbeck@skilton.com	
11	[illegible]	H-L				
12	Bill Vall	220 TAZWELL dr	859-626-3247			
13	Worley Johnson	100 Boone Way	859-622-1940		worley.johnson@eku.edu	
14	Peter Mathews	334 Highland Park Dr	859-626-5878		pmathews@herald-leader.com	
15	Kathy Flood	P.O. Box 463 Richmond	859-623-7429			Mad Co. Concerned Citizens
16	LARRY NOLAN	9801 Dobney Corr Dr	502-326-0976		lnolan@resonleasing.com	Reson
17	RICHARD SMART	419 W. MAIN ST.	859 623-7876		smart@bennetthouse.bb.com	THE BENNETT HOUSE
18	Diane Claybaugh	P.O. Box 937, Richmond KY	859-625-0997		dbclayba@Bechtel.Com	BPBG
19	Kelley McBride	110 Bolt-O-Link Dr.				Citizen
20	Jody McBride	" "				

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Please print:	Name	Address	Phone	Fax	Email Address	Affiliation
1	Jay Dixon	2008 Lucile Dr Richmond	369-5188	369-5468		
2	Amy Hall	333 Charlie Norris Rd Richmond	369-5192		hugatree99@yahoo.com	
3	Jim Rooney	2300 Red House Rd				
4	Bryan Makinen	646 Univ. Shop. Ctr Richmond	623-0535			PAC
5	Doris Wyatt	225 Bryon Ave Berea	986-9204			Housing Authority of Berea
6	George Wyatt	"	"			Berea City Council
7	Greg Burnett	251 Mt Rushmore Dr #7	624-9882			EKU
8	Jim Rousey	422 ESTILL ST, BEREA	985-0289			MCMD
9	Ken Liberty	301 Highland Park	625-1665			
10	CARL RICHARDS	560 S Keene Land Dr.	624-4787			MADISON Co EMA/CSEPP
11	Todd Willis	6436 Spreans Point Lane Lexington Ky	273 7486			
12	Mel Moliarra		625-0962			Bechtel
13	Neal Miesen		625-6918			BGCA
14	Joe Elliott		625-5615			BGAD
15	Tim Griffitts	163 Courage Rd. Waco	985-0777			I.U.O.E. 181
16	Mike Colle	Clearfield Ky	780-4483			
17	Susan Shomer	Daniel Boone Chap ARC	623-1336		arcsusan@qx.net	Red Cross
18	Jack Smith	162 Mt VIEW DR BEREA	986-2887			
19	Ken Ruhl	107 Whispering Woods - Rd	623 3252			
20	GARRY IRWIN	175 E. HAITI Rd Berea Ky	985-9561	Same	THEIRWINS@Alltel.Net	—

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	Please print: Name	Address	Phone	Fax	Email Address	Affiliation
1	Doug Engel	1255 N. Senate Indianapolis, IN 46202	317-917-5065	317-638-6146	doug.t.engel@jci.com	Johnson Controls, Inc.
2	Steve McKnight	9864 Richmond Rd, Paint Lick	859-925-4710		civguy@alltel.com	
3	Janet Scanlon	1308 Continental Dr Ste J	443 372-129-		jscanlon@geo-centers.com	FOCIS
4	Henry Moskal	187 General Claiborne Dr	8596260302		rcm125@adelphia.net	FOCIS
5	Logan Weiler III	90 Airport Rd. Frankfort 40601	5026075705		logan.weiler@ky.ngb.army.mil	KyEM
6	Steve Weaver	2721 Rotsbinsville Loop	859-624-9583			
7	Tom Frazier	110 Castle Dr. Berea Ky	859-228-0030		jtbereaky@adelphia.net	
8	Dave Weigand	750 Bratcher Ln. Berea 40403	228-0186		DLWeigand@Netcom.Net	Berea for Peace
9	Bill St. Pierre	202 Perkins Richmond	622-8852		bill.stpierre@eku.edu	EKU
10	WADE ALEXANDER	520 GENERAL DR RUFI	626-1009		RICHMOND.WADE@AOL.COM	
11	JON WARE	ACWA APC	410-436-2726			
12	Robert R Blythe	1006 Altamont St Rich 40475	859 624 1390		rblythe@richmond.ky.us	
13	Bob Helton	1509 Pine Needles LN	859-223-4703		bob.helton@chemicalcountermeasures.com	
14	Stephanie McSpirit	1025 Fair Lane Drive Richmond KY 40475	859.625.5377		StephanieMcSpirit@eku.edu	
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