"Bridging the Gap"
Assessment of Alternatives to Provide Continuous Chemical Weapons Destruction

ACWA
U.S. Army Element, Assembled Chemical Weapons Alternatives

9 December 2009

Presented to:

Colorado Chemical Demilitarization Citizens' Advisory Commission

Presented by:

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Agenda

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US Chemical Weapons Destruction Program Gap Analysis

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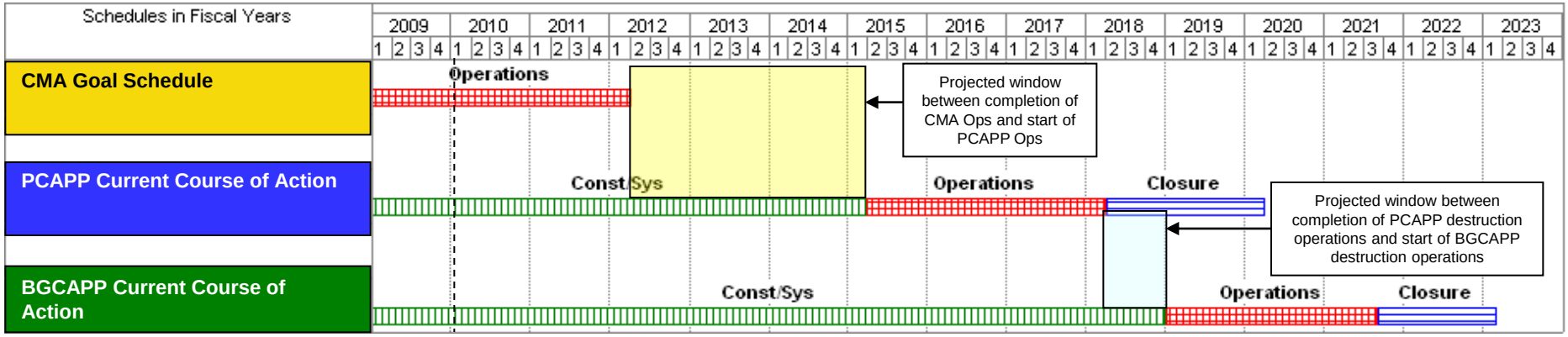
- ACWA has been requested to recommend safe, feasible and cost effective alternatives to eliminate the gaps that are currently projected to occur within the US chemical weapons destruction program.
- Two potential gaps exist in the US chemical weapons destruction program:
  - Gap between end of CMA destruction operations and start of PCAPP destruction operations (Jan 2012 – Jan 2015)
  - Gap between end of destruction at PCAPP and start of Blue Grass Chemical Agent-Destruction Pilot Plant (BGCAPP) (Dec 2017 – Oct 2018)



Some EDT Considerations

- Does it support continuity of chemical weapons destruction?
- What would be the cost impacts?
- Why should the US taxpayer consider this important?
- What would be the return on investment to the US taxpayer?
- What would be the impact be on the main destruction plant project?
- How would it be deployed and operated?
- How quickly could it be deployed?
- How would the technology be permitted and what is its permitting history?
- What process would the technology use to destroy the chemical agent?
- Has the technology been approved by the Department of Defense Explosives Safety Board?
- How would secondary wastes be handled?
- Are there known stakeholder issues associated with the technology?
- Could use of the technology decrease worker risk associated with handling problematic munitions?
- What would the impacts be on staffing?
- Would it increase confidence in meeting the 2017 Congressional mandate?

The "Gap" and Its Importance

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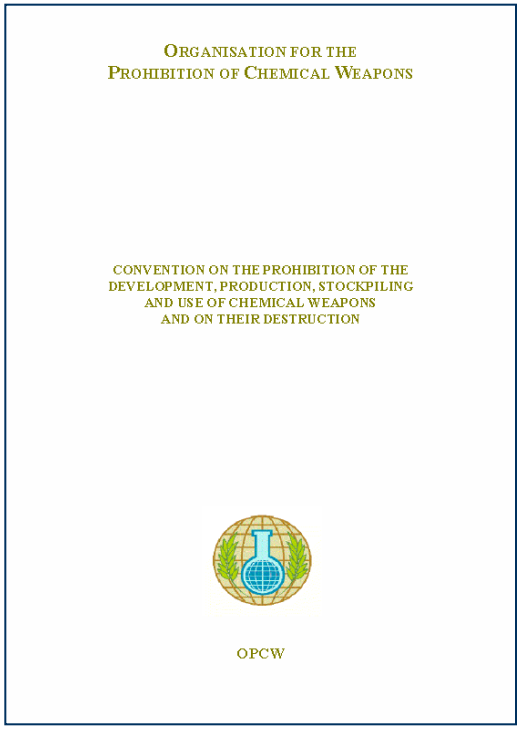
- Closing the gaps in the US chemical weapons destruction program are important in the context of U.S. leadership in the international effort to combat the proliferation of weapons of mass destruction and related technologies

- Finding ways by which these gaps can be filled can benefit the Pueblo and Blue Grass communities by further accelerating the program and eliminating the risk of continued storage sooner


ORGANISATION FOR THE
PROHIBITION OF CHEMICAL WEAPONS

CONVENTION ON THE PROHIBITION OF THE
DEVELOPMENT, PRODUCTION, STOCKPILING
AND USE OF CHEMICAL WEAPONS
AND ON THEIR DESTRUCTION

OPCW

Premises of Gap Analysis

- No adverse impact to the main Pueblo and Blue Grass plants
  - Maintain the basic technology for each chemical weapons destruction facility: chemical neutralization followed by on-site post treatment of hydrolysate
  - No impact on construction and start-up of the facilities; pilot plants will be used to destroy the majority of stockpiles
- Explore the use of the Explosive Destruction System (EDS) and/or a commercial Explosive Destruction Technology (EDT) to augment primary facility to close the gaps in the US chemical weapons destruction program
- Accelerate PCAPP and BGCAPP completion of operations to the extent possible while maintaining maximum protection

PCAPP Design Background

- PCAPP design and its Phase III Research, Development and Demonstration (RD&D) Permit have always incorporated two destruction technologies:
  - Chemical neutralization followed by biotreatment of the hydrolysate for the majority of the Pueblo stockpile
  - Explosive Destruction Technology (EDT), a non-specified commercial technology, to destroy the overpacked munitions and any munitions that could not be processed through the primary process; total estimated to be ~1,000 munitions
- Initially PCAPP intended to use an EDT at the end of the operations period to process the overpacked and rejected munitions
- In October 2008, CDPHE issued a RCRA permit modification requiring EDT construction at least 180 days prior to the start of agent munitions processing

Munition Handling Worker Risk Issues

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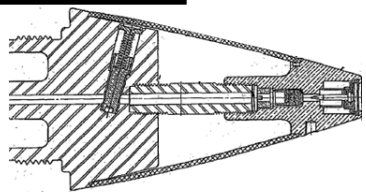
- **M57 Fuzed 105mm Munitions** –
  - The M57 with M22 Booster presents a challenge to the demilitarization program. There is no offset of the explosive train in this fuze/booster combination, which if initiated can result in the projectile exploding. There are 3 recorded incidents of this occurring at various locations.
  - The majority of the boxed 105mm munitions in the PCD stockpile are configured with the M57/M22 combination.
  - Each box contains two munitions that are packed in a fiber tube and bags of propellant, requiring extensive handling to prepare for demilitarization within the PCAPP plant.

- **M67 Propellant Bags** –
  - Some of the propellant bags associated with the boxed 105mm munitions are known to have become brittle. While they do not visibly show signs of deterioration, they can fall apart when handled.



Pueblo Chemical Weapons Stockpile

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Munition	Agent	Number
Overpacked*	HD/HT	**538**
Palletized Munitions		
- 155MM Projectiles	HD	
- 105mm Projectiles	HD	
Palletized Sub-Total		***84%***
Boxed Munitions		
- 105mm Cartridges	HD	
- 4.2” Cartridges	HD	
- 4.2” Cartridges	HT	
Boxed Munition Sub-Total		***16%***

* Overpacked Munitions not deducted from projectile/cartridge quantities

Overpacked Munitions Assessment & Repackaging

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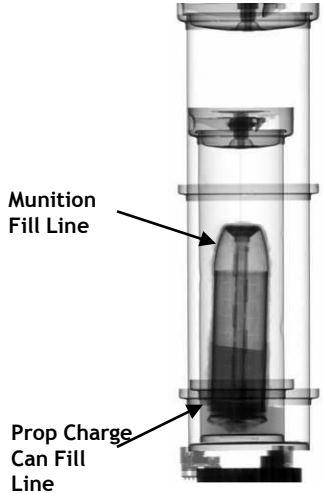
- Assess overpacked munitions non-intrusively using Digital Radiography Computed Tomography (DRCT) in or around the igloo containing overpacked munitions
- Selectively repackage munitions as required to support EDS or EDT operations
- Oversight by the CMA Non-Stockpile Chemical Materiel Project and operated by 20th Support Command's Chemical Biological Radiological Nuclear Explosives (CBRNE) Response Activity (both located in Maryland)

DRCT



X-Ray

Repackaging Operations

Explosive Destruction Technologies Summary

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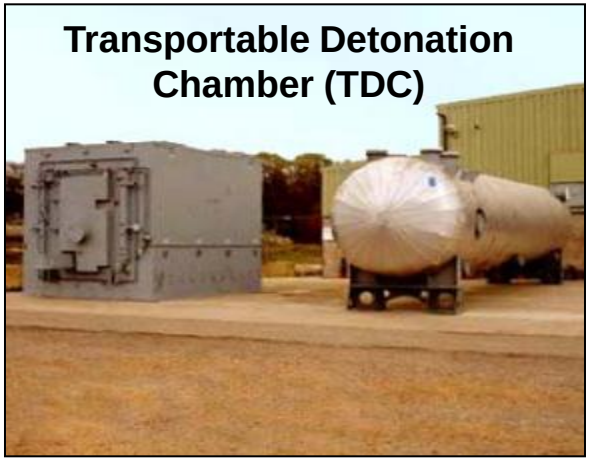
Explosive Destruction System (EDS)

Transportable Detonation Chamber (TDC)



Static Detonation Chamber (SDC)

Detonation of Ammunition in a Vacuum-Integrated Chamber (DAVINCH)

Potential Locations for PCAPP Bridging the Gap Systems

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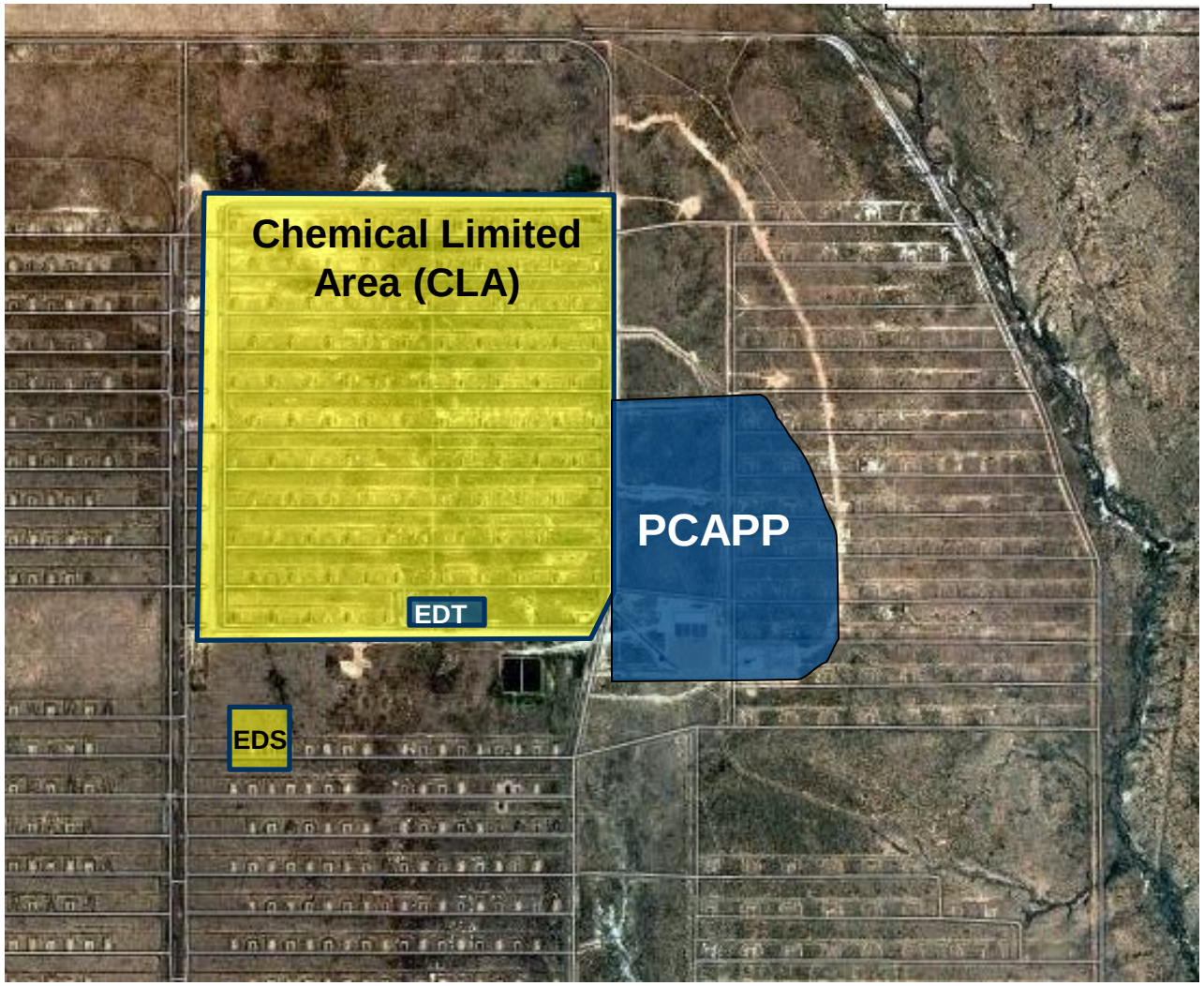

- EDS: Explosive Destruction System (Non-Stockpile system)
- EDT: Explosive Destruction Technology (1 of 3 commercial systems)
- PCAPP: Pueblo Chemical Agent Destruction Pilot Plant

EDS Conceptual Layout

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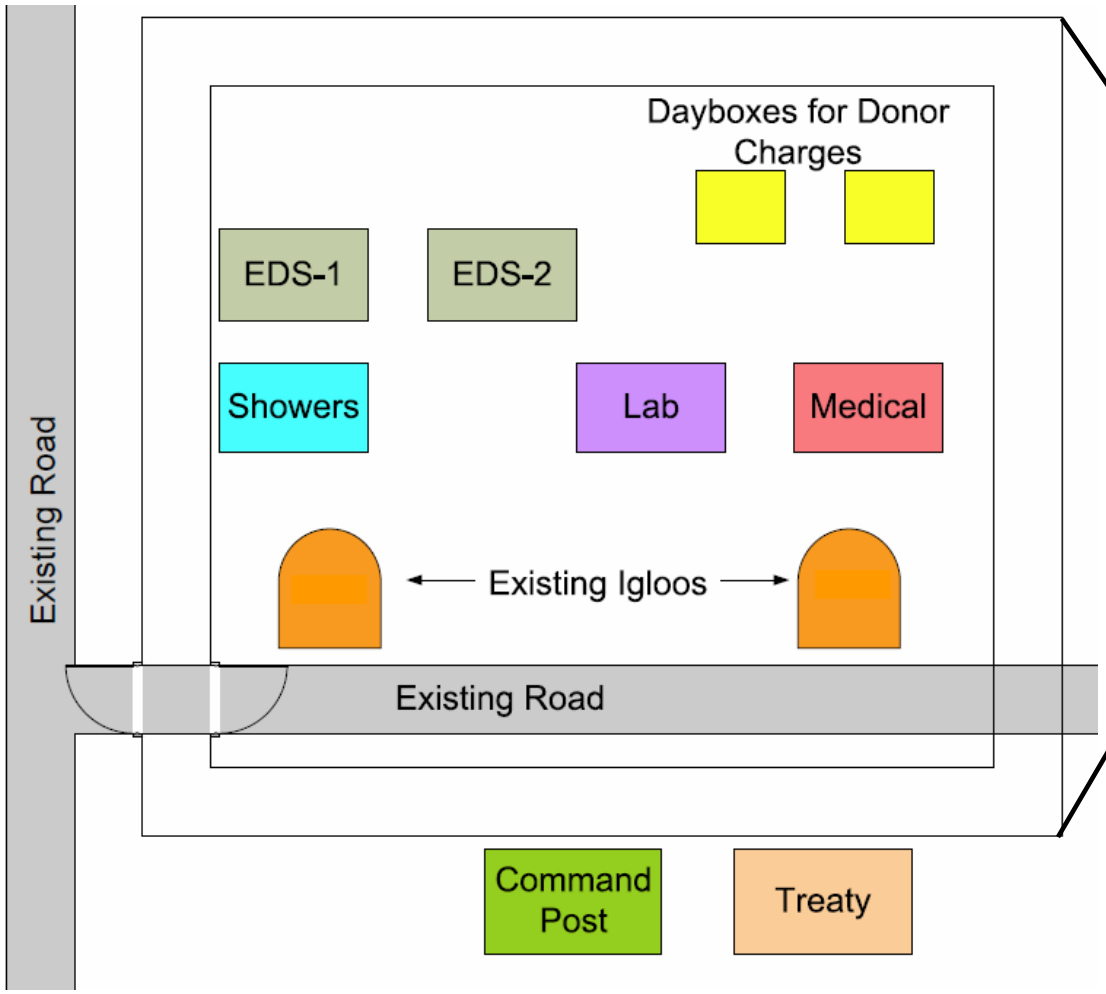

EDS in Environmental Enclosure

EDT Conceptual Layout

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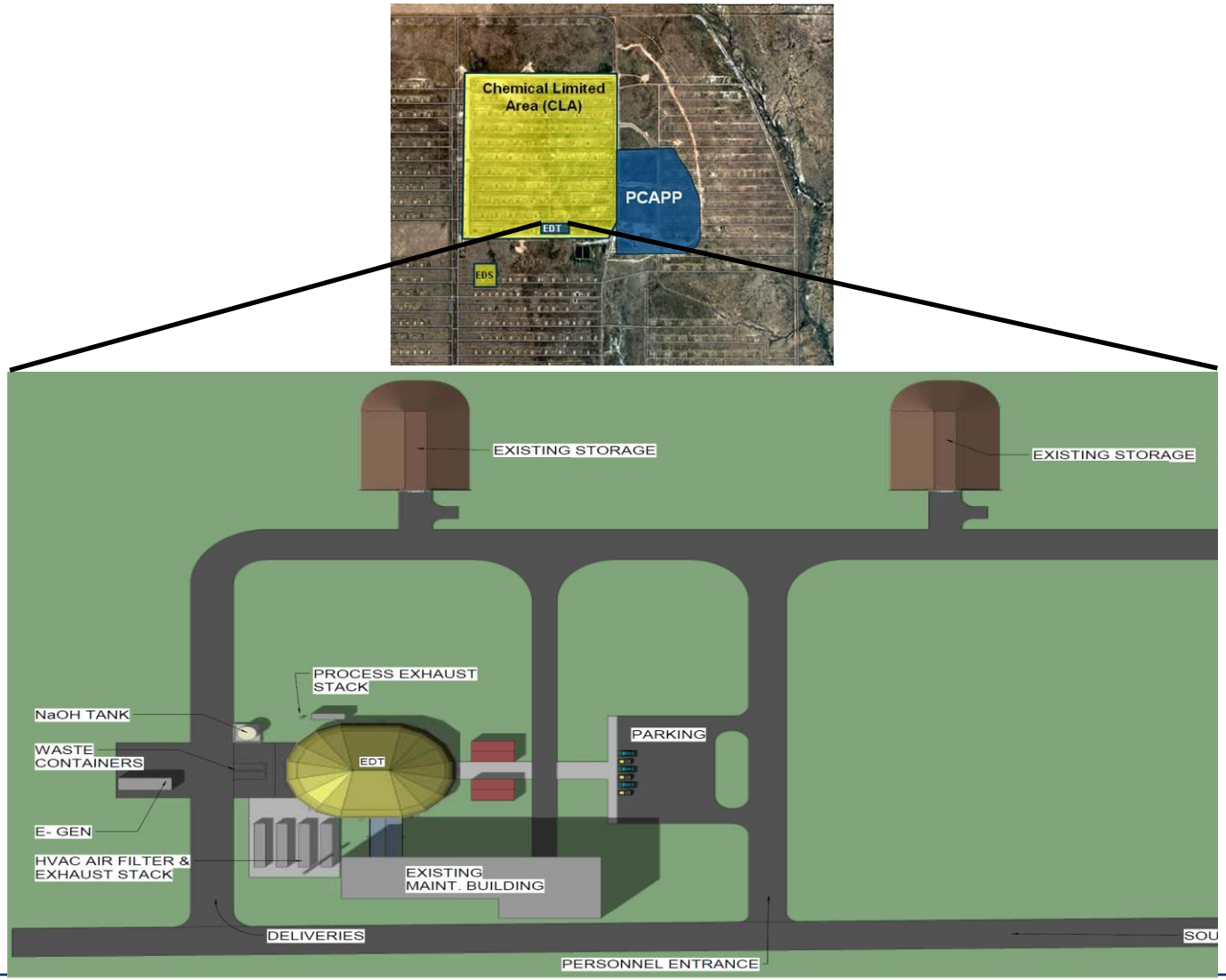

National Research Council Assessment of EDTs

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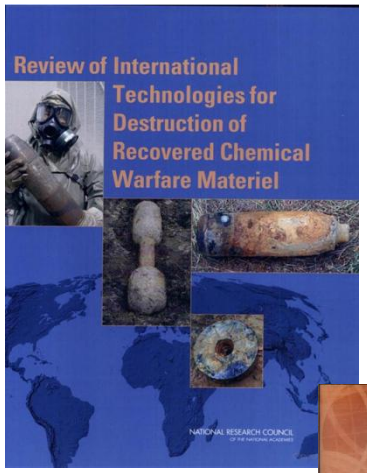
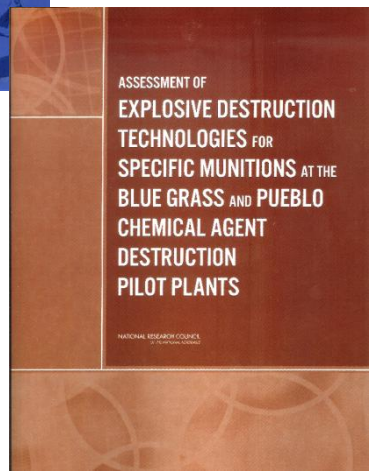
- National Research Council (NRC) has examined the Explosive Destruction Technologies twice for the US chemical weapons destruction program:
  - 2006: *Review of International Technologies for Destruction of Recovered Chemical Warfare Material*
  - 2009: *Assessment of Explosive Destruction Technology for Specific Munitions at the Blue Grass and Pueblo Chemical Agent Destruction Pilot Plants*
    - *BGCAPP: 15,000 Mustard-filled 155mm projectiles*
    - *PCAPP: Overpacked & Rejected Mustard-filled projectiles*
- Findings
  - EDTs are mature technologies for chemical munition destruction; that have been used primarily for recovered chemical weapon destruction
  - The systems are safe and the committee is confident all can meet US regulatory requirements





The US chemical weapons destruction program could be enhanced by the selection and acquisition of appropriate EDTs to augment the main destruction technologies…

Explosive Destruction System (EDS)

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- Application: recovered chemical warfare materiel within the United States
  - Owned by the US Army Chemical Materials Agency's Nonstockpile Chemical Materiel Project (NSCMP)
- EDS is a trailer-mounted mobile system designed to destroy chemical munitions in a safe, environmentally sound manner
- Sealed, stainless steel vessel contains the blast, vapor and fragments generated by the process
- EDS uses explosive cutting charges to access the munition and destroy its explosive components; the chemical content of the munition is then neutralized by a reagent appropriate to the type of agent present
- Agent destruction is confirmed by sampling both the residual liquid and air before reopening the vessel; process waste products are removed, packaged and shipped to an approved disposal facility for final disposition

Static Detonation Chamber (SDC)

- Application:
  - Münster, Germany for destruction of recovered chemical weapons
  - Selected by CMA to augment the Anniston Chemical Agent Disposal Facility
  - Manufacturer: Dynasafe AB
- The SDC is a nearly spherical, armored, high-alloy steel vessel
- Chemical munitions are placed in a carrier, conveyed to the top of the vessel and fed into an electrically heated detonation chamber
- The high heat (approx. 600°C or 1,100°F) detonates the munition and the chemical agent is destroyed by shock and thermal decomposition
- Gases generated by the detonation are treated by an off-gas system that includes a flameless thermal oxidizer that converts carbon monoxide and hydrogen to CO_2 and water
- The SDC produces no liquid waste; scrap metal is recycled and salts from the off-gas system are treated and disposed of in compliance with applicable state and federal regulations

Transportable Detonation Chamber (TDC)

- Application:
  - Poelkapelle, Belgium; recovered chemical weapons
  - Schofield Barracks: phosgene-filled 155mm projectiles
  - Undergoing testing at Edgewood, MD
  - Manufacturer: CH2M Hill
- Self contained, totally enclosed system consisting of a detonation chamber, expansion chamber, and emissions control system
- Munitions are wrapped in explosive, placed in detonation chamber and detonated. Bags of water in the chamber absorb blast energy and produce steam which reacts with the chemical agent
- Resulting gases are vented to the expansion chamber and then to the emissions control system
- In the emissions control system a catalytic oxidation unit oxidizes hydrogen, carbon monoxide and organic vapors before the gas stream is vented through a carbon adsorption bed and released
- TDC produces no liquid waste; scrap metal is recycled and emission control system solid wastes are treated and disposed of in compliance with applicable federal and state regulations

DAVINCH (Detonation of Ammunition in a Vacuum-Integrated Chamber)

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- Application:
  - Kanda Port, Japan: recovered chemical weapons
  - Poelkapelle, Belgium; recovered chemical weapons
  - No US experience to date
  - Manufacturer: Kobe Steel, Ltd.
- DAVINCH technology uses a double walled steel vacuum detonation chamber and an off-gas system
- Chemical munitions are placed in the detonation chamber and destroyed by the detonation of donor explosives surrounding the munitions
- Munitions are shattered by the detonation and the agent is destroyed by the shock and heat of the explosion
- Off-gas system employs a cold plasma oxidizer which converts carbon monoxide to CO2
- In addition to the scrap metal which is recycled, DAVINCH produces a small amount of liquid waste from off-gas condensate and rinsate used to cleanse the vessel. Liquid waste are treated and disposed of in accordance with applicable state and federal regulations.

EDT Technology Selection Criteria

- EDT proposals would be evaluated based upon performance standards:
  - Safety
  - Throughput
  - Maturity/past performance
  - Turn-key capability
  - Waste generation
  - Logistic support
  - Staffing requirements
- EDT acquisition is the early critical path – vendor data is needed for the permitting process

Environmental Considerations

- National Environmental Policy Act (NEPA) Process/Environmental Assessment Schedule
  - EDT and EDS action covered by one Environmental Assessment (EA)
  - 3-4 months for EA Assessment Process
- Research Conservation and Recovery Act (RCRA) Permit & Related Activities
  - RD&D permit transitions to a full RCRA Part B permit application
  - Update to Multi-Pathway Health Risk Assessment
  - RCRA Baseline Sampling of selected site
  - Facility Construction Certification
- Other Permits
  - Pueblo County Certificate of Designation modification (Class C)
  - Modification to Air Permit to Construct
  - National Pollutant Discharge Elimination System general permits for construction and operations

Future Steps…

- Meet with the public and Congressional staffs prior to final decision is made to describe the issue and concept and to understand concerns and/or opposition:
  - CO Citizens' Advisory Commission (CAC) Leadership: 17 Nov
  - CO Congressional Staffs: 19 Nov
  - KY Congressional Staffs: 24 Nov, 3 Dec
  - KY CAC Meeting: 8 Dec
  - CO CAC Meeting: 9 Dec
- PM ACWA to make recommendation to Office of the Secretary of Defense (OSD): 15 Dec
- Anticipated OSD Direction: Jan 2010
- Complete National Environmental Policy Act process including public comment

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Questions/Discussion