Recent Advances in the Explosive Destruction System

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What is the Explosive Destruction System (EDS)?

A transportable system that:

- Destroys fuzed and armed chemical munitions
- Contains all blast, fragments, and gases
- Chemically treats the munitions’ fill
- Confirms destruction by sampling
- Repackages the waste into commercial containers
EDS Was Designed for Rapid Response to Small Quantities of Munitions

Original Requirements

• Portable

• 3 munitions types
  – 75 mm
  – 4.2 inch
  – Livens

• 2 chemical agents
  – Mustard
  – Phosgene

• 1 lb explosive weight

• 1 Munition/operation

• Multi-day operation
  – Process time didn’t matter

• Use once or twice a year

• No incineration
Typical EDS P2 System Layout
Spring Valley, DC: chemical weapons found

ASME Task Group formed

Code Case #2564 approved by ASME

Multiple Munitions

Concept definition

Prototype

POC

P1

P2U1

P1U2

P2U3

TBE

AFSS

GTR

P2P

P2R

P2A

1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016

P1 test in UK

RMA (CO)

Camp Sibert (AL)

Spring Valley (DC)

Dugway (UT)

Dover (DE)*

Redstone (AL)

Pueblo (CO)

ACWA

Tooele (UT)

Pine Bluff (AR)

Schofield (HI)

* Subsequent operations not shown
The Mission and Capabilities of EDS Have Increased

- Vessel Size: 6.5 ft\(^3\) to 21.9 ft\(^3\)
- Explosive capacity
  - Small vessel: 1 lb TNT to 1.5 lb TNT
  - Large vessel: 4.8 lb TNT to 9 lb TNT
- Process time: 2 days to 1 day
- Number of agents: 2 to 15+
- Types of munitions: 3 to 15+
- Number of munitions per batch: 1 to 3 to 6
- Deployments: a few munitions per site to continuous operation for months or years
EDS Evolution

Proof of Concept

Phase 1, Unit 1

Phase 1, Unit 2,3

Phase 2

Phase 2 Retrofit

Phase 2 ACWA
P2 Retrofit (P2R)

• Retrofitted P2U3 System
  – Designed to reduce process time
  – Completed May 2014

• Substantial modifications
  – Replaced Containment Vessel
  – Rebuilt Reagent Supply Wing
  – Added Boiler/Chiller Container (BCC)
  – Added Intermediate Skid
  – Added Waste IBC skid
  – Added Reagent Skid
P2R Improvements - Containment Vessel

- Built per ASME Code Case
  - Increased explosive rating of 9 lbs
  - Tested with 11.25 lbs TNT eq.
  - Used High Speed Digital Image Comparison to better characterize vessel response

- Added nut runners for more rapid clamp closure
P2R Improvements - Vessel Heating and Cooling

- Steam Injection is used to heat the vessel
- Hot effluent is transferred to intermediate tank to cool
- Cold water is used to cool and rinse the vessel
  - Steam Generator and chiller are located in the BCC
  - Rotating Union allows vessel to rotate while heating
  - Steam flow is regulated to control vessel temperature
  - Heating and cooling times are reduced from hours to tens of minutes
Other P2R Improvements

• Larger pumps for faster fluid transfer
• Intermediate Bulk Containers for Waste and Reagent
• HMI to display data on the trailer and in the Command Post
P2A

- Built specifically for use at PCAPP
- Built on ISO frames
  - Intended to stay for longer times
  - Easier access (no stairs)
  - More working area
  - Greater access for maintenance
  - Still easily transported on standard trucks
- Has all of the P2R improvements
  - Uses same BCC as P2R
- Has several additional improvements
P2A Layout

- Reagent Waste Frame (RWF)
- Process Control Frame (PCF)
- Boiler Chiller Container (BCC)
- Vessel Support Frame (VSF)
P2A Improvements - Containment Vessel

• Three piece clamp
  – Single drive screw
  – Pneumatic wrenches
  – Closes in minutes
  – Relieves large work load

• Improved hinge design
  – Door is opened and closed easily by one person
  – Latch holds the door in the desired location
P2A Improvements - Liquid Sample Collection

• Sample bottle with Septum
  – Easier to attach and remove the bottle
  – Visual indication that sample has been collected
  – Much easier for lab to transfer sample
  – Demonstrated safety and reliability
Other P2A Improvements

- Larger supply tanks
  - 125 gallons
- Improved reagent tank heater
- Oil free helium leak detector
- Simpler connections to waste IBCs
- Improved venting of IBCs
Comparison of P2R and P2A Footprints
Conclusions

- The mission and capabilities of EDS have expanded over the years
- EDS provides flexibility to treat a wide variety of munitions and agents
- P2R and P2A systems have decreased the process time and increased the throughput