MEC Contained Detonation Chamber

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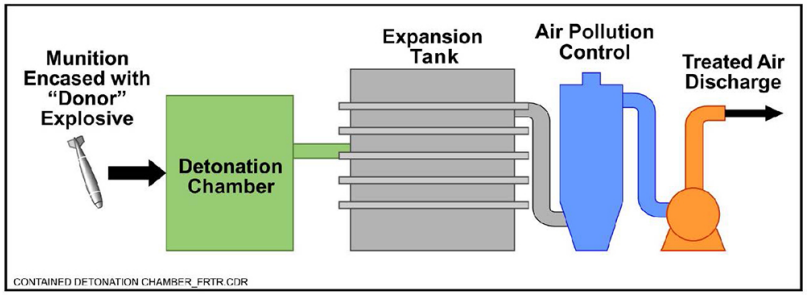
Schematic



Contained Detonation Chamber Schematic

(Note: Air pollution control unit will be designed as necessary to meet project and regulatory requirements for the treated air discharge.)

Introduction

Contained detonation chamber (CDC) is a method used to destroy allowable munitions and explosives of concern (MEC) in a closed chamber where technicians can detonate the item. If the risk to the workers is deemed acceptable and munitions can be moved, the items will be relocated and consolidated in a storage bunker. Then, when the CDC is available and on site, the munitions will be moved for destruction in the CDC. CDC treatment fully contains the blast pressure and debris.

Other Technology Names

Controlled Detonation Chamber
Blast Chamber
Transportable Detonation Chamber

Description

If MEC are determined to be acceptable to move using approved procedures, they can be consolidated and treated in a CDC. The chamber captures all fragments, a side chamber reduces the blast pressures by allowing expansion in a tank, and a baghouse captures fugitive emissions. These chambers successfully contain the hazardous components in the unit. Alternative techniques used for the treatment of MEC include blow-in-place (BIP)and consolidated detonation. With all of these techniques, the explosive materials in MEC are sympathetically detonated using donor explosives.

The difference between contained detonation and the other two commonly used methods of MEC treatment (i.e., consolidated detonation and BIP) is that the items are treated in a chamber rather than being open detonated. Unlike BIP, contained detonation requires additional handling of MEC for treatment and disposal. Unique CDC designs can also destroy chemical weapons in addition to conventional munitions. However, a chemical safety submission must be created to allow chemical weapons destruction prior to using the CDC in this capacity.

CDCs are capable of repeated detonations of a variety of ordnance items, with significant reductions in the air and noise pollution problems of open detonation. The walls are periodically replaced to ensure the integrity of the CDC and allow for repeated detonations. In general, blast chambers do not contain all of the detonation gases but vent them through an expansion vessel

and an air pollution control unit. Such a vented system minimizes the overpressure and shock wave hazards. In addition, CDCs contain debris from detonations as well, eliminating the fragmentation hazards.

Several models of CDCs are available to handle various sizes of MEC. The smallest mobile units can treat up to 13 lbs net explosive weight (NEW) (~105 mm) and the largest can treat up to 40 lbs NEW (~155 mm). MEC larger than 155 mm would need to be treated by alternative methods (i.e., BIP or consolidated detonation) or a permanent CDC would need to be built onsite.

The Department of Defense (DoD) has not implemented CDCs at many military installations because of safety issues relating to the moving of munitions, rate of throughput, transportability, schedule, permitting, and cost.

Development Status and Availability

The following checklist provides a summary of the development and implementation status of MEC CDCs:

- ☐ At the laboratory/bench scale and shows promise
- ☐ In pilot studies
- ☒ At full scale
- ☐ To remediate an entire site (source and plume)
- ☐ To remediate a source only
- ☐ As part of a technology train
- ☐ As the final remedy at multiple sites
- ☐ To successfully attain cleanup goals in multiple sites

MEC contained detonation technology is available through the following vendors:

- ☐ Commercially available nationwide

☒ Commercially available through limited vendors because of licensing or specialized equipment

☐ Research organizations and academia

Applicability

Contaminant Class Applicability Rating for Contained Detonation Chambers

(Rating codes: ● Demonstrated Effectiveness, ◐ Limited Effectiveness, ○ No Demonstrated Effectiveness, I/D Insufficient Data, N/A Not Applicable)

Nonhalogenated VOC	Halogenated VOC	Nonhalogenated SVOC	Halogenated SVOC	Fuels	Inorganics	Radionuclides	Munitions	Emerging Contaminants
N/A	N/A	N/A	N/A	N/A	N/A	N/A	●	N/A

Contained detonation is a technique that is only used to treat and dispose of MEC. In addition to unexploded ordnance (UXO) and discarded military munitions (DMM), MEC also includes munitions constituents (MC), if present at high enough concentrations to pose an explosive hazard; however, this technology is not appropriate for use on MC. It also is not appropriate for UXO known or suspected to contain chemical agents or for which the liquid fill cannot be determined unless site-specific DoD Explosives Safety Board (DDESB) approval is obtained. Contained detonation cannot be used as a remediation technology for any other type of contamination.

Cost

Consolidated detonation requires a detonation chamber and expansion tank. The primary labor associated with using contained detonation includes transportation of the CDC to the site, rental of the CDC, and transportation of

MEC to a location suitable for operation of the CDC, which includes detonation and cleanup of detonated materials.

Major cost drivers include:

Upfront Costs

- Chamber costs (e.g., use of a CDC would be subcontracted)
- Site location (transportation of explosives and the CDC can be costly)
- Number and type of MEC to be treated/disposed of at a site
- Regulatory requirements (e.g., permits)

Operation and Maintenance Costs

- Storage of MEC
- Setup of MEC detonation
- Off-gas monitoring and treatment (if required)
- Cleaning out and disposing of residual waste, which may contain hazardous waste

Click here for a general discussion on costing which includes definitions and repetitive costs for remediation technologies. A project-specific cost estimate can be obtained using an integrated cost-estimating application such as RACER® or consulting with a subject matter expert.

Duration

The duration of using the contained detonation method for MEC treatment and disposal is typically no longer than the length of time to complete a removal action at a munitions response site. However, typically the MEC are consolidated in one secured area and then treated during the latter portion of the removal action. In general, a CDC must be rented on a monthly basis.

The amount of MEC that can be treated each day in a CDC depends on the NEW of the MEC. The number of operations conducted at a site will depend on approved site procedures (e.g., are all MEC that are deemed acceptable to move treated daily). UXO/DMM must typically be destroyed, guarded, or moved to secure storage if approved on the day of discovery. With very few exceptions, it is forbidden to leave UXO/DMM unsecured or unguarded overnight. It is not common practice to bring a CDC on site for the duration of the project due to

costs of the system. The length of time to complete a removal action is dependent on the following conditions:

- Removal depth
- Size of site
- MEC concentration and distribution
- Soil type
- Climate (i.e., temperature, winds, and rain)

Implementability Considerations

The following are key considerations associated with implementing MEC contained detonation:

- CDC provides the maximum possible protection to the public and sensitive areas from detonation blasts, debris, and contamination of soil and groundwater.
- CDC eliminates exclusion zones since the chamber contains the fragments.
- Regulatory and community concerns that harmful emissions will contaminate air may need to be addressed.
- Transportation and operation of a CDC can be very costly compared to open detonation treatment of MEC.
- If the munitions are conventional and either high explosive or another fill already approved for use in the CDC, the site Explosive Safety Submission (ESS) must reference the appropriate CDC ESS. If the munitions are not already included in one of the approved CDC ESSs, i.e., are chemical, a site-specific Chemical Safety Submission (CSS) must be developed, staffed, and approved by the DDESB.
- The largest transportable CDC available can treat up to 155-mm projectiles. Larger munitions would need to be disposed of using other methods (e.g., BIP or consolidated detonation). A permanent CDC could be built on site to treat larger munitions; however, this option would be costly and could impact project schedules. Evaluation of which system is most appropriate to use versus size and fill of munitions must be performed early on in any consideration of use given the restrictions based on these variables.
- The availability of these types of chambers is very limited.

Resources

DoD. **DoD 6055.09-M Ammunition and Explosives Safety Standards (2008/2010) (PDF)** (39 pp, 214 KB)
This manual establishes explosives safety standards for the DoD. These standards are designed to manage risks associated with DoD-titled ammunition and explosives by providing protection criteria to minimize serious injury, loss of life, and damage to property. Volume 7 provides criteria for UXO, munitions response, waste military munitions, and material potentially presenting an explosive hazard (MPPEH).

EPA. **Handbook on the Management of Munitions Response Actions (2005) (PDF)** (315 pp, 2.65 MB)
This handbook provides an understanding of the technical issues that surround the munitions response actions at DoD facilities. The handbook was written for regulators and the interested public.

EPA. **Munitions Response Guidelines OSWER Directive 9200.1-101 (2010) (PDF)** (33 pp, 456 KB)
These guidelines provide a framework to EPA Regional offices overseeing responses involving MEC and MC at locations other than operational ranges where explosives hazards or environmental contamination are known or suspected to be present.

USACE. **Technical Guidance for Military Munitions Response Actions Engineer Manual EM 200-1-15 (2015) (PDF)** (443 pp, 12.7 MB)
This manual provides the USACE Project Delivery Team with the processes for executing the technical aspects of munitions response projects.

Controlled Detonation Chamber (CDC) Safety (2010) (PDF) (13 pp, 514 KB)
Presentation from the 34th DDESB Seminar, Portland, Oregon. Presented by Dan Young of CH2M Hill.

DoD. **DDESB Technical Paper 15, Revision 3 "Approved Protective Construction" (2010) (PDF)** (184 pp, 965 KB)
This publication documents historically significant information about the origin and evolution of protective construction design and the explosives safety criteria associated with them, as well as providing a consolidated listing of DDESB-approved protective construction.