MEC Consolidated Detonation

On this page:

Schematic

None.

Introduction

Consolidated detonation is a method used to destroy munitions and explosives of concern (MEC), by use of donor explosives, at a location other than that where the MEC was found. It must be conducted in accordance with an approved explosive safety plan. If the risk to munitions response workers is deemed acceptable and the items can be moved, the munitions are relocated to a place on site that has minimal or no risk to the public or critical assets. Consolidated treatment allows for fewer detonations, which may improve efficiency; however, any time an item is moved, there is increased risk of unintentional detonation. Consolidated treatment may also improve control over the destruction by establishing safe zones around the open detonation [OD] area and using safety devices such as blast boxes and burn trays.

Other Technology Names

Consolidated shot
Consolidate and blow

Description

If MEC is determined to be acceptable to move using approved procedures, it can be consolidated so that several MEC items can be detonated simultaneously. There are no safe procedures for moving, rendering safe, or destroying MEC, but merely procedures considered less dangerous. Alternative techniques used for the treatment of MEC include: blow-in-place (BIP), and contained detonation. With these techniques, the explosive materials in MEC are sympathetically detonated using donor explosives.

The difference between consolidated detonation and BIPis if the item is transported to a central treatment location (consolidated detonation) or if the item is treated in place (BIP). If MEC are determined to be acceptable to move using approved procedures, they can be consolidated so that several MEC can be detonated simultaneously. Consolidated detonation may be conducted at a designated treatment area within the site or in areas heavily contaminated with unexploded ordnance (UXO) or discarded military munitions (DMM), by co-positioning multiple approved-to-move munitions at a single location. The tools required to conduct consolidated detonations include:

- **Digging tools**, such as a shovel to dig around the MEC to move it to an area to be treated;
- **Donor explosives**, such as jet perforators or trinitrotoluene (TNT) blocks;
- **Priming materials**, such as firing wire, time fuse or blasting caps;
- **A firing device**, such as a fuse igniter or blasting machine; and
- **Safety materials**, such as sand bags, barricades and radios.

Treatment by detonation is accomplished by placing donor explosives (e.g., explosive charges such as TNT blocks or specialty charges such as jet perforators) on the munition, priming the charges, and initiating the detonation from a safe distance. Consolidated detonation procedures can use either an electric or a nonelectric initiation. Electric firing systems are the required method unless site conditions dictate using nonelectric systems (e.g., proximity to electromagnetic radiation or other source of induced electricity).

The electric firing system consists of an electric blasting machine, a firing wire, and an electric blasting cap. A nonelectric system consists of a fuse igniter, time blasting fuse, and nonelectric blasting cap. Multiple munitions may be detonated simultaneously using a detonating cord to connect and initiate multiple donor charges that can be initiated from a single point.

Engineering controls such as sand bags are used to reduce the fragmentation distance and mitigate fragmentation and blast hazards. The Explosive Safety Quantity Distance (ESQD) arc for intentional detonations depend on the engineering controls (if used) implemented for a consolidated detonation operation. Traffic route closures and building evacuations may be required if the size of the ESQD arc poses a safety hazard to the public.

Development Status and Availability

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

☐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 consolidated 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 Consolidated Detonation

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

Nonhalogenated VOC	Halogenated VOC	Nonhalogenated SVOC	Halogenated SVOC	Fuels	Inorganics	Radionuclides	Munitions	Emerging Contaminants
○	○	○	○	○	○	○	●	○

Consolidated detonation is a technique that is only used to treat MEC. In addition to UXO and DMM, MEC also includes munitions constituents (MC) if they are present at high enough concentrations to pose an explosive hazard; however, this technology is not appropriate for use on all types of MC. It also is not appropriate for UXO known or suspected to contain chemical agents or for which any liquid fill cannot be determined. Military Munitions Response Program (MMRP) sites are not suspected to contain chemical warfare materiel (CWM). However, if suspect CWM is encountered during any phase of site activities, the operator must immediately withdraw upwind from the work area, secure the site, and contact responsible parties. No other types of contamination can use consolidated detonation as a remediation technology.

Cost

Consolidated detonation is a technology that typically requires no major equipment. The typical setup includes donor explosives, priming materials, a firing device, and safety materials. The costs of these items are relatively low (although some secure, coded remote firing devices are expensive). The primary labor associated with using consolidated detonation includes transportation of MEC to a location suitable for detonation, site preparation (e.g., engineering controls, such as sand bags to control fragmentation and noise; setup of exclusion zones; managing traffic, etc.), setup of the donor explosives and firing train, detonation, site reconnaissance to ensure all hazards have been eliminated, and cleanup of materials. This labor must be performed by specially-trained explosive ordnance disposal (EOD) personnel, and therefore the cost to perform these activities is considerably greater than that for excavation, transportation, and treatment of other types of materials. Major cost drivers include:

Upfront Costs

- Site location (transportation of explosives can be costly)
- Site climate
- Number of MEC to be treated of at a site
- Size of treatment area, topography, and soil type
- Regulatory requirements (e.g., protective measures and post-detonation sampling)
- Distance to public or sensitive areas (e.g., evacuations of buildings/areas and additional equipment to protect public or sensitive areas)

Typically, no operation and maintenance costs are associated with consolidated detonation. Once a MEC item has been treated, no additional costs are incurred unless residues left after detonation contaminate the soil. If post-detonation sampling results indicate the soil is contaminated with MC, treatment of soil may be required.

Click here for a general description of 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 consolidated detonation method for MEC treatment is typically limited to the length of time to complete an investigation and a remedial or removal action at a munitions response site. Each consolidated detonation operation can take up to several hours. The number of operations conducted at a site depends on approved site procedures (e.g., daily treatment of all removed MEC or removal with less frequent treatment). 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. 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 precipitation).

Implementability Considerations

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

- Mitigation measures may be required to reduce potential impacts to worker and public safety, the environment, and cultural resources.
- Regulatory and community concerns that harmful emissions and residues will contaminate air, soil, and groundwater may need to be addressed.
- Large spaces may be required for OD to maintain minimum distance requirements for safety purposes, depending on the size of the item and the engineering controls employed.
- Protective barriers such as tire barricades, deflector shields, trenches/pits, directional detonations, fragmentation blankets and plywood sheets may be used to protect sensitive areas.
- Consolidated detonations may only be conducted if there is an approved Munitions Response Explosive Safety Submission (MRESS), Explosive Site Plan (ESP), Munitions Response Chemical Safety Submission (MRCSS) or Chemical Site Plan (CSS) in place. The phase and activities underway at the site will

determine which safety document is required. The approval process may include multiple agencies; thus, schedules may be impacted.

Resources

DoD. DoD 6055.09-M Ammunition and Explosives Safety Standards (2008/2010)
This manual establishes explosives safety standards for the Department of Defense (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. Munitions Response Guidelines OSWER Directive 9200.1-101 (2010)
These guidelines provide a framework to EPA Regional Offices overseeing responses involving MEC and MC at locations other than operational ranges where explosive hazards or environmental contamination are known or suspected to be present.

ITRC. Survey of Munitions Response Technologies (2006)
This document provides an overview of the technologies used for munitions response actions, and evaluates their performance capabilities.

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