FRTR
Remediation Technologies Screening Matrix and Reference Guide, Version 4.0

2.10.2.2 Thermal Treatment Technologies for Explosives

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Hot gas decontamination: Hot gas decontamination is a technology still in the pilot-scale of development that can be used for decontamination of explosives-contaminated masonry or metallic structures. The method involves sealing and insulating the structures, heating with hot gas stream to 260 °C (500 °F) for a prescribed period of time, volatilizing the explosive contaminants, and destroying them in an afterburner. Operating conditions are site-specific. Contaminants are completely destroyed.

Incineration: Incineration processes can be used to treat the following wastestreams: explosive-contaminated soil and debris, explosives with other organic or metals, initiating explosives, some bulk explosives, unexploded ordnance, bulk explosive waste, and pyrophoric waste. In addition, incineration can be applied to sites with a mixture of media, such as sand, clay, water, and sludge, provided the media can be fed to the incinerator and heated for a sufficient period of time. With the approval of the DOD Explosives Safety Board, the Army considers incineration of materials containing less than 10% explosives by weight to be a nonexplosive operation. Soil with less than 10% explosives by weight has been shown by USAEC to be nonreactive; that is, not to propagate a detonation throughout the mass of soil. (The military explosives to which this limit applies are secondary explosives such as TNT and RDX and their manufacturing byproducts).

The Army primarily uses three types of incineration devices: the rotary kiln incinerator, deactivation furnace, and contaminated waste processor.

The rotary kiln incinerator is used primarily to treat explosives-contaminated soils. In rotary kiln incineration, soils are fed into a primary combustion chamber, or rotary kiln, where organic constituents are destroyed. The temperature of gases in the primary chamber ranges from 427 °C to 649 °C (800 °F to 1,200 °F), and the temperature of soils ranges from 316 °C to 427 °C (600 °F to 800 °F). Retention time in the primary chamber, which is varied by changing the rotation speed of the kiln, is approximately 30 minutes. Off gases from the primary chamber pass into a secondary combustion chamber, which destroys any residual organics. Gases from the secondary combustion chamber pass into a quench tank where they are cooled from approximately 2,000 °C to 200 °C (3,600 °F to 400 °F). From the quench tank, gases pass through a Venturi scrubber and a series of baghouse filters, which remove particulates prior to release from the stack. The treated product of rotary kiln incineration is ash (or treated soil), which drops from the primary combustion chamber after organic contaminants have been destroyed. This product is routed into a wet quench or a water spray to remoisturize it, then transported to an interim storage area pending receipt of chemical analytical results.

The deactivation furnace is also referred to as Army Peculiar Equipment (APE) 1236 because it is used almost exclusively by the Army to deactivate large quantities of small arms cartridges, and 50-caliber machine gun ammunition, mines, and grenades. The deactivation furnace is similar to the rotary kiln incinerator except it is equipped with a thick-walled primary combustion chamber capable of withstanding small detonations. Deactivation furnaces do not have secondary combustion chambers because they are intended not to completely destroy the vaporized explosives but to render the munitions unreactive. Most deactivation furnaces are equipped with air pollution control equipment to limit lead emissions. The operating temperature of deactivation furnaces is approximately

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650 °C to 820 °C (1,200 °F to 1,500 °F).

The contaminated waste processor handles materials, such as surface-contaminated debris, that are lighter and less reactive than those processed in the deactivation furnace. Contaminated waste processors are thin-walled, stationary ovens that heat contaminated materials to about 600 °C (1,100 °F) for 3 to 4 hours. The purpose of this process is not to destroy contaminated debris but to sufficiently lower contaminant levels through volatilization to meet Army safety standards. USAEC currently is helping to develop standardized time and temperature processing requirements to meet these safety standards.

Open Burn/Open Detonation: Open burn (OB) and open detonation (OD) operations are conducted to destroy unserviceable, unstable, or unusable munitions and explosive materials. In OB operations, explosives or munitions are destroyed by self-sustained combustion, which is ignited by an external source, such as flame, heat, or a detonation wave. In OD operations, detonable explosives and munitions are destroyed by a detonation initiated by a disposal charge. OB/OD operations require regulatory permits. These permits must be obtained from the appropriate regulatory agency on a case-by-case basis.

OB/OD operations can destroy many types of explosives, pyrotechnics, and propellants. OB areas must be able to withstand accidental detonation of any or all explosives being destroyed, unless the characteristic of the materials involved is such that orderly burning without detonation can be ensured. Personnel with this type of knowledge must be consulted before any attempt is made at OB disposal, especially if primary explosives are present in any quantity.

OB and OD can be initiated either by electric or burning ignition systems. In general, electric systems are preferable because they provide better control over the timing of the initiation. In an electric system, electric current heats a bridge wire, which ignites a primary explosive or pyrotechnic, which in turn ignite or detonate the material slated to be burned or detonated. If necessary, safety fuses, which consist of propellants wrapped in plastic weather stripping, are used to initiate the burn or detonation.