The List of Documents:

Handbook on the Management of Munitions Response Actions
EPA 505-B-01-001
May 2005

R6 Response to Explo Open Burn/Open Detonation Comments
September 22, 2014

Explosive Safety Board reports to LMD – April & June 2013

DoD 4145.26-M
DOD Contractor's Safety Manual For Ammunition and Explosives
March 13, 2008
UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS

PREDICTION OF SAFE LIFE OF PROPELLANTS
N. S. Garman, et al
Picatinny Arsenal
Dover, New Jersey
May 1973

U.S. Army Toxic and Hazardous Materials Agency
ECONOMIC EVALUATION OF
PROPELLANT REUSE/RECOVERY
TECHNOLOGY
(TASK ORDER NO. 10)
December 1988
Contract No. DAAK11-85-D-0008

EXPLO Systems Inc., - Camp Minden, Louisiana
Request for Proposal
With my comments

FM 4-30.13 (FM 9-13)
AMMUNITION HANDBOOK:
TACTICS, TECHNIQUES, AND PROCEDURES FOR MUNITIONS HANDLERS
HEADQUARTERS DEPARTMENT OF THE ARMY

Department of the Army Technical Manual TM 9-1300-214
Military Explosives
September 1984

Report From ERRS contractor EQM

715166

025042

TDDF_0701-001-019 Disposal Pricing & Time Requirements
2/25/2013
May have Confidential Business Information

Explo alternatives for destruction
EPA, Fife 1/10/2014

5.2 Treatment of MEC

5.2.1 <u>Open Detonation</u>

In most situations, open detonation (OD) remains the safest and most frequently used method for treating UXO. When open detonation takes place where UXO is found, it is called blow-in-place. In munitions response, demolition is almost always conducted on-site, most frequently in the place it is found, because of the inherent safety concerns and the regulatory restrictions on transporting even disarmed explosive materials. Blow-in-place detonation is accomplished by placing and detonating a donor explosive charge next to the munition which causes a sympathetic detonation of the munition to be disposed of. Blow-in-place can also be accomplished using laser-initiated techniques and is considered by explosives safety experts to be the safest, quickest, and most cost-effective remedy for destroying UXO.

When open detonation takes place in an area other than that where the UXO was found, it is called consolidated detonation. In these cases, experts have determined that the location of the UXO poses an unacceptable risk to the public or critical assets (e.g., a hospital, natural or cultural resources, historic buildings) if it is blown in place. If the risk to the workers is deemed acceptable and the items can be moved, the munitions will be relocated to a place on-site that has minimal or no risk to the public or critical assets. Typically, when consolidated detonations are used on a site, multiple munition items are consolidated into one “shot” to minimize the threat to the public of multiple detonations. The decision to move the UXO from the location in which it is found is made by the explosives safety officer and is based on an assessment that the risks to workers and others in moving this material is acceptable. Movement of the UXO is rarely considered safe, and the safety officer generally tries to minimize the distance moved.

Open Detonation and DMM

Discarded Military Munitions are frequently tracked in the same manner as UXO and blown in place. However, it may be less risky to move DMM elsewhere. If there is any doubt about whether a munitions item is DMM or UXO, it must be tracked as if it is UXO.

Increasing regulatory restrictions and public concern over its human health and environmental impacts may create significant barriers to conducting open detonation in both BIP and consolidation detonation in the future. The development of alternatives to OD in recent years is a direct result of these growing concerns and increased restrictions on the use of OD (see text box on following page).

There are significant environmental and technical challenges to treating ordnance and explosives with OD.[1] These limitations include the following:

- **Restrictions on emissions** — Harmful emissions may pose human health and environmental risks and are difficult to capture sufficiently for treatment. Areas with emissions limitations may not permit OD operations.
- **Soil and groundwater contamination** — Soil and groundwater can become contaminated with byproducts of incomplete combustion and detonation as well as with residuals from donor charges.
- **Area of operation** — Large spaces are required for OD operations in order to maintain minimum distance requirements for safety purposes (see Chapter 6, "Explosives Safety").
- **Location** — Environmental conditions may constrain the use of OD. For example, in OD operations, emissions must be carried away from populated areas, so prevailing winds must be steady. Ideal wind speeds are 4-15 mph, because winds at these speeds are not likely to change direction and they tend to dissipate smoke rapidly. In addition, any type of storm (including sand, snow, and electrical) that is capable of producing static electricity can potentially cause premature detonation.
- **Legal restrictions** — Legal actions and regulatory requirements, such as restrictions on RCRA Subpart X permits, emissions restrictions, and other restrictions placed on OD, may reduce the use of OD in the future. However, for munitions responses addressed under CERCLA, no permits are currently required.
- **Noise** — Extreme noise created by a detonation limits where and when OD can be performed.

The Debate Over OD

Because of the danger associated with moving MEC, the conventional wisdom, based on DoD's explosive safety expertise, is to treat UXO on-site using OD, usually blow-in-place. However, coalitions of environmentalists, Native Americans, and community activists across the country have voiced concerns and filed lawsuits against military installations that perform OB/OD for polluting the environment, endangering their health, and diminishing their quality of life. While much of this debate has focused on high-throughput industrial facilities and active ranges, and not on the practices at ranges, similar concerns have also been voiced at ranges. Preliminary studies of OD operations at Massachusetts Military Reservation revealed that during the course of open detonation, explosive residues are emitted in the air and deposited on the soil in concentrations that exceed conservative action

[1] U.S. EPA Office of Research and Development. *Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes*, Handbook, September 1993.

levels more than 50 percent of the time. When this occurs, some response action or cleanup is required. It is not uncommon for these exceedances to be significantly above action levels.

Several debates are currently underway regarding the use of blow-in-place OD ranges. One debate is about whether OD is in fact a contributor to contamination and the significance of that contribution. A second debate is whether a contained detonation chamber (CDC) is a reasonable alternative that is cleaner than OD (albeit limited by the size of munitions it can handle, and the ability to move munitions safety). Another study at Massachusetts Military Reservation revealed that particulates trapped in the CDC exhaust filter contain levels of chlorinated and nitroaromatic compounds that must be disposed of as hazardous waste, thus suggesting the potential for hazardous air emissions in OD. The pea gravel at the bottom of the chamber, after repeated detonations, contains no detectable quantities of explosives, thus suggesting that the CDC is highly effective. The RPM at Massachusetts Military Reservation has suggested that when full life-cycle costs of OD are considered, including the cost of response actions at a number of the OD areas, the cost of using OD when compared to a CDC may be even more.

Additional information will help shed light on the costs and environmental OD versus CDC. The decision on which alternative to use, however, will involve explosive safety experts who must decide that the munitions are safe to move if they will be detonated in a CDC. In addition, current limitations on the size of munitions that can be handled in a CDC must also be considered.

UXO Model Clearance Project

In 1996 the U.S. Navy conducted a UXO Model Clearance Project at Kaho'olawe Island, Hawaii, that demonstrated the effectiveness of using protective works to minimize the adverse effects of detonation in areas of known cultural and/or historical resources. The results of the demonstrations and practical applications revealed that if appropriate protective works are used, the adverse effects of the blast and fragments resulting from a high-order UXO detonation are not as detrimental as originally anticipated. Protective works are physical barriers designed to limit, control, or reduce adverse effects of blast and fragmentation generated during the high-order detonation of UXO. Protective works used at Kaho'olawe included: tire barricades, deflector shields, trenches/pits, directional detonations, fragmentation blankets, and plywood sheets.

Source: UXO Model Clearance Report, Kaho'olawe Island, Hawaii, Protective Works Demonstration Report. Prepared for U.S. Navy Pacific Division Naval Facilities, Engineering Command, Kapolei, Ha. Contract No. N62742-93-D-0610 1996.

In open detonation, an explosive charge is used to create a sympathetic detonation in the energetic materials and munitions to be destroyed. Engineering controls and protective measures can be used, when appropriate, to significantly reduce the effects and hazards associated with blast and high-speed fragments during OD operations. Common techniques for reducing these effects include constructing berms and barricades that physically block and/or deflect the blast and fragments, tamping the explosives with sandbags and/or earth to absorb energy and fragmentation, using blast mitigation foams, and trenching to prevent transmission of blast-shock through the ground. These methods have been effective in reducing the size of exclusion zones required for safe OD and limiting local disruptions due to shock and noise. In some instances (e.g., low-explosive-weight MEC), well-engineered protective measures can reduce the effects and hazards associated with OD to levels comparable to contained detonation chambers (see Section 5.2.3.2).

5.2.2 Open Burning

Although open burning (OB) and open detonation (OD) are often discussed together, they are not often used at the same time. In fact, the use of open burning is limited today due to significant air emissions released during burning and strict environmental regulations that many times prohibit this. The environmental and technical challenges to using OB are the same as those listed in Section 5.2.1 for OD. When OB is used, it is usually applied to munitions areas for treatment of bulk explosives or excess propellant. OB operations have been implicated in the release of perchlorate into the environment, specifically groundwater.

5.2.3 Alternative Treatment Technologies

Because of growing concern and regulatory constraints on the use of OD, alternative treatments have been developed that aim to be safer, commercially available or readily constructed, cost-effective, versatile in their ability to handle a variety of energetics, and able to meet the needs of the Army.[2] Although some of these alternative treatments have applicability for field use, the majority are designed for industrial-level demilitarization of excess or obsolete munitions that have not been used.

5.2.3.1 *Incineration*

Incineration is primarily used to treat soils containing reactive and/or ignitable compounds. In addition, small quantities of MEC, bulk explosives, and debris containing reactive and/or ignitable material may be treated using incineration. Most MEC is not suitable for incineration. This technique may be used for small-caliber ammunition (less than 0.50 caliber), but even the largest incinerators with strong reinforcement cannot handle the detonations of very large munitions. Like OB/OD, incineration is not widely accepted by regulators and the public because of concerns over the environmental and health impacts of incinerator emissions and residues.

The strengths and weaknesses of incineration are summarized as follows:

---

[2] J. Stratta et al. *Alternatives to Open Burning/Open Detonation of Energetic Materials*, U.S. Army Corps of Engineers, Construction Engineering Research Lab, August 1998.

- •• **Effectiveness** — In most cases, incineration reduces levels of organics to nondetection levels, thus simplifying response efforts.
- •• **Proven success** — Incineration technology has been used for years, and many companies offer incineration services. In addition, a diverse selection of incineration equipment is available, making it an appropriate operation for sites of different sizes and containing different types of contaminants.
- •• **Safety issues** — The treatment of hazardous and reactive and/or ignitable materials with extremely high temperatures is inherently hazardous.
- •• **Emissions** — Incinerator stacks emit compounds that may include nitrogen oxides (NO_x), volatile metals (including lead) and products of incomplete combustion.
- •• **Noise** — Incinerators may have 400 to 500-horsepower fans, which generate substantial noise, a common complaint of residents living near incinerators.
- •• **Costs —** The capital costs of mobilizing and demobilizing incinerators can range from $1 million to $2 million. However, on a large scale (above 30,000 tons of soil treated), incineration can be a cost-effective treatment option. Specifically, at the Cornhusker Army Ammunition Plant, 40,000 tons of soil were incinerated at an average total cost of $260 per ton. At the Louisiana Army Ammunition Plant, 102,000 tons of soil were incinerated at $330 per ton.[3]
- •• **Public perception** — The public generally views incineration with suspicion and as a potentially serious health threat caused by possible emission of hazardous chemicals from incinerator smokestacks.
- •• **Trial burn tests** — An incinerator must demonstrate that it can remove 99.99 percent of organic material before it can be permitted to treat a large volume of hazardous waste.
- •• **Ash byproducts** — Like OB/OD, most types of incineration produce ash that contains high concentrations of inorganic contaminants.
- •• **Materials handling** — Soils with a high clay content can be difficult to feed into incinerators because they clog the feed mechanisms. Often, clayey soils require pretreatment in order to reduce moisture and viscosity.
- •• **Resource demands** — Operation of incinerators requires large quantities of electricity and water.

The most commonly used type of incineration system is the rotary kiln incinerator. Rotary kilns come in different capacities and are used primarily for soils and debris contaminated with reactive and/or ignitable material. Rotary kilns are available as transportable units for use on-site,

---

[3] U.S. EPA, Office of Research and Development. *Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes*, Handbook, September 1993.

or as permanent fixed units for off-site treatment. When considering the type of incinerator to use at your site, one element that you should consider is the potential risk of transporting reactive and/or ignitable materials.

The rotary kiln incinerator is equipped with an afterburner, a quench, and an air pollution control system to remove particulates and neutralize and remove acid gases. The rotary kiln serves as a combustion chamber and is a slightly inclined, rotating cylinder that is lined with a heat-resistant ceramic coating. This system has had proven success in reducing contamination levels to destruction and removal efficiencies (DRE) that meet RCRA requirements (40 CFR 264, Subpart O).[4]Specifically, reactive and/or ignitable soil was treated on-site at the former Nebraska Ordnance Plant site in Mead, Nebraska, using a rotary kiln followed by a secondary combustion chamber, successfully reducing constituents of concern that included TNT, RDX, TNB, DNT, DNB, HMX, tetryl, and NT to DRE of 99.99 percent.[5]

For deactivating large quantities of small arms munitions at industrial operations (e.g., small arms cartridges, 50-caliber machine gun ammunition), the Army generally uses deactivation furnaces. Deactivation furnaces have a thick-walled primary detonation chamber capable of withstanding small detonations. In addition, they do not completely destroy the vaporized reactive and/or ignitable material, but rather render the munitions unreactive.[6]

For large quantities of material, on-site incineration is generally more cost-effective than offsite treatment, which includes transportation costs. The cost of soil treatment at off-site incinerators ranges from $220 to $1,100 per metric ton (or $200 to $1,000 per ton).[7] At the former Nebraska Ordnance Plant site, the cost of on-site incineration was $394 per ton of contaminated material.[8]Two major types of incinerators used by the Army are discussed in Table 5-2. While incineration is used most often in industrial operations, it may be considered in the evaluation of alternatives for munitions responses as well.

The operation and maintenance requirements of incineration include sorting and blending wastes to achieve levels safe for handling (below 12 percent explosive concentration for soils), burning

---

[4] U.S. EPA, Office of Solid Waste and Emergency Response, Technology Innovation Office. *On-Site Incineration at the Celanese Corporation Shelby Fiber Operations Superfund Site, Shelby, North Carolina*, October 1999.

[5] Federal Remediation Technologies Roundtable. *Incineration at the Former Nebraska Ordnance Plant Site, Mead, Nebraska*, Roundtable Report, October 1998.

[6] U.S. EPA, Office of Research and Development. *Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes*, Handbook, September 1993.

[7] DoD, Environmental Technology Transfer Committee. *Remediation Technologies Screening Matrix and Reference Guide*, Second Edition, October 1994.

[8] Federal Remediation Technologies Roundtable, *Incineration at the Former Nebraska Ordnance Plant Site, Mead, Nebraska*, Roundtable Report, October 1998.

wastes, and treating gas emissions to control air pollution. Additional operation and maintenance factors to consider include feed systems that are likely to clog when soils with high clay content are treated, quench tanks that are prone to clog from slag in the secondary combustion chamber, and the effects of cold temperatures, which have been known to exacerbate these problems.

Table 5-2. Characteristics of Incinerators

Incinerator Type	Description	Operating Temps	Strengths and Weaknesses	Effective Uses
Rotary Kiln	A rotary kiln is a combustion chamber that may be designed to withstand detonations. The secondary combustion chamber destroys residual organics from off-gases. Off-gases then pass into the quench tank for cooling. The air pollution control system consists of a venturi scrubber, baghouse filters, and/or wet electrostatic precipitators, which remove particulates prior to release from the stack.	Primary chamber – Gases: 800-1,500 ••F Soils: 600-800 ••F Secondary chamber – Gases: 1,400-1,800 ••F	Renders munitions unreactive. Debris or reactive and/or ignitable materials must be removed from soils prior to incineration; quench tank clogs; clayey, wet soils can jam the feed system; cold conditions exacerbate clogging problems. Requires air pollution control devices.	Commercially available for destruction of bulk explosives and small MEC, as well as contaminated soil and debris.
Deactivation Furnace	Designed to withstand small detonations from small arms. Operates in a manner similar to the rotary kiln except it does not have a secondary combustion chamber.	1,200-1,500 ••F	Renders munitions unreactive.	Large quantities of small arms cartridges, 50caliber machine gun ammunition, mines, and grenades.

Source: U.S. EPA, Office of Research and Development. *Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes*, Handbook, September 1993.

New incineration systems under development include a circulating fluidized bed that uses high-velocity air to circulate and suspend waste particles in a combustion loop. In addition, an infrared unit uses electrical resistance heating elements or indirect-fired radiant U-tubes to heat material passing through the chamber on a conveyor belt.

5.2.3.2 *Contained Detonation Chambers*

Contained detonation chambers (CDCs) are capable of repeated detonations of a variety of ordnance items, with significant reductions in the air and noise pollution problems of OD; however, the use of CDCs assumes that the munition item is safe to move. CDCs, or blast chambers, are used by the Army at a few ammunition plants to treat waste pyrotechnics, explosives, and propellants. In addition, several types of transportable detonation chambers are available for emergency responses for small quantities of MEC. 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 manufacturers have developed CDCs for both commercial and military use. However, DoD has not implemented CDCs at many military installations because of safety issues relating to the moving of munitions, rate of throughput, transportability, and cost.

Both industrial-level (fixed) and mobile (designed for use in the field) CDCs display a range of capabilities. CDCs designed for field use are limited in the amount of explosives they can contain, the types of munitions they can handle, and their throughput capability. Portable units have size constraints and are not designed to destroy munitions larger than 81 mm HE or 10 pounds of HMX, but the nonportable units can handle munitions up to 155 mm or 100 pounds of HMX (130 lb TNT equivalent).[9]

[9] DeMil International, Inc. *The "Donovan Blast Chamber" Technology for Production Demilitarization at Blue Grass Army Depot and for UXO Remediation*, Paper presented at the Global Demilitarization Symposium and Exhibition, 1999.

5.1.1 Safe Handling of MEC

The safety of handling MEC depends on the types of munitions found and the site-specific situation. There is no single approach for every munition, or every site. The complete identification and disarming of munitions is often dangerous and difficult, if not impossible. In most cases, the safest method to address munition items is open detonation (OD) using blow-in-place (BIP) methods. This is particularly true when the munition is located in an area where its detonation would not place the public at risk. It is most appropriate when the munition or its fuzing mechanism cannot be identified, or identification would place a response worker at unacceptable risk. Great weight and deference will be given, with regard to the appropriate treatment, to the explosives safety expertise of on-site technical experts. When required, DDESB-approved safety controls (e.g., sandbagging) can be used to provide additional protection to potential harmful effects of BIP. In cases in which experts determine that BIP poses an unacceptable risk to the public or critical assets (e.g., natural or cultural resources) and the risk to workers is acceptable, munitions items may be transported to another, single location for consolidated detonation. This location is one where the threats to the critical assets and the public can be minimized. Such transport must be done carefully under the supervision of experts, taking into account safety concerns. Movement with remote-control systems sometimes will be appropriate to minimize danger to personnel. Instead of detonating all MEC items in place, consolidated treatment allows for improved efficiency and control over the destruction (e.g., safe zones surround the OD area; blast boxes and burn trays are used).

5.1.2 Render-Safe Procedures

In rare cases when munitions pose an immediate, certain, and unacceptable risk to personnel, critical operations, facilities, or equipment, as determined by on-scene EOD personnel, render-safe procedures (RSPs) may be performed to reduce or eliminate the explosive hazards. For ordnance of questionable condition, RSPs may be unsafe, are not 100 percent effective, and can result in an accidental high-order detonation. RSPs are conducted by active duty military EOD experts and typically involve disarming MEC (removing or disabling the fuze and/or detonator), or using specialized procedures. Such procedures can dramatically increase explosives safety risks to EOD personnel, and DoD considers their use only in the most extraordinary circumstances. During these procedures, blast mitigation factors are taken into account (i.e., distance and engineering controls), and EOD personnel disarm the MEC items and move them from the location at which they were found to a central area on-site for destruction.

5.2 Treatment of MEC

5.2.1 Open Detonation

In most situations, open detonation (OD) remains the safest and most frequently used method for treating UXO. When open detonation takes place where UXO is found, it is called blow-in-place. In munitions response, demolition is almost always conducted on-site, most frequently in the place it is found, because of the inherent safety concerns and the regulatory restrictions on transporting even disarmed explosive materials. Blow-in-place detonation is accomplished by placing and detonating a donor explosive charge next to the munition which causes a sympathetic detonation of the munition to be disposed of. Blow-in-place can also be accomplished using laser-initiated techniques and is considered by explosives safety experts to be the safest, quickest, and most cost-effective remedy for destroying UXO.

When open detonation takes place in an area other than that where the UXO was found, it is called consolidated detonation. In these cases, experts have determined that the location of the UXO poses an unacceptable risk to the public or critical assets (e.g., a hospital, natural or cultural resources, historic buildings) if it is blown in place. If the risk to the workers is deemed acceptable and the items can be moved, the munitions will be relocated to a place on-site that has minimal or no risk to the public or critical assets. Typically, when consolidated detonations are used on a site, multiple munition items are consolidated into one "shot" to minimize the threat to the public of multiple detonations. The decision to move the UXO from the location in which it is found is made by the explosives safety officer and is based on an assessment that the risks to workers and others in moving this material is acceptable. Movement of the UXO is rarely considered safe, and the safety officer generally tries to minimize the distance moved.

Open Detonation and DMM

Discarded Military Munitions are frequently tracked in the same manner as UXO and blown in place. However, it may be less risky to move DMM elsewhere. If there is any doubt about whether a munitions item is DMM or UXO, it must be tracked as if it is UXO.

Increasing regulatory restrictions and public concern over its human health and environmental impacts may create significant barriers to conducting open detonation in both BIP and consolidation detonation in the future. The development of alternatives to OD in recent years is a direct result of these growing concerns and increased restrictions on the use of OD (see text box on following page).

There are significant environmental and technical challenges to treating ordnance and explosives with OD.[71] These limitations include the following:

- **Restrictions on emissions** — Harmful emissions may pose human health and environmental risks and are difficult to capture sufficiently for treatment. Areas with emissions limitations may not permit OD operations.
- **Soil and groundwater contamination** — Soil and groundwater can become contaminated with byproducts of incomplete combustion and detonation as well as with residuals from donor charges.
- **Area of operation** — Large spaces are required for OD operations in order to maintain minimum distance requirements for safety purposes (see Chapter 6, "Explosives Safety").
- **Location** — Environmental conditions may constrain the use of OD. For example, in OD operations, emissions must be carried away from populated areas, so prevailing winds must be steady. Ideal wind speeds are 4-15 mph, because winds at these speeds are not likely to change direction and they tend to dissipate smoke rapidly. In addition, any type of storm (including sand, snow, and electrical) that is capable of producing static electricity can potentially cause premature detonation.

[71] U.S. EPA Office of Research and Development. *Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes*, Handbook, September 1993.

- **Legal restrictions** — Legal actions and regulatory requirements, such as restrictions on RCRA Subpart X permits, emissions restrictions, and other restrictions placed on OD, may reduce the use of OD in the future. However, for munitions responses addressed under CERCLA, no permits are currently required.
- **Noise** — Extreme noise created by a detonation limits where and when OD can be performed.

The Debate Over OD

Because of the danger associated with moving MEC, the conventional wisdom, based on DoD's explosive safety expertise, is to treat UXO on-site using OD, usually blow-in-place. However, coalitions of environmentalists, Native Americans, and community activists across the country have voiced concerns and filed lawsuits against military installations that perform OB/OD for polluting the environment, endangering their health, and diminishing their quality of life. While much of this debate has focused on high-throughput industrial facilities and active ranges, and not on the practices at ranges, similar concerns have also been voiced at ranges. Preliminary studies of OD operations at Massachusetts Military Reservation revealed that during the course of open detonation, explosive residues are emitted in the air and deposited on the soil in concentrations that exceed conservative action levels more than 50 percent of the time. When this occurs, some response action or cleanup is required. It is not uncommon for these exceedances to be significantly above action levels.

Several debates are currently underway regarding the use of blow-in-place OD ranges. One debate is about whether OD is in fact a contributor to contamination and the significance of that contribution. A second debate is whether a contained detonation chamber (CDC) is a reasonable alternative that is cleaner than OD (albeit limited by the size of munitions it can handle, and the ability to move munitions safety). Another study at Massachusetts Military Reservation revealed that particulates trapped in the CDC exhaust filter contain levels of chlorinated and nitroaromatic compounds that must be disposed of as hazardous waste, thus suggesting the potential for hazardous air emissions in OD. The pea gravel at the bottom of the chamber, after repeated detonations, contains no detectable quantities of explosives, thus suggesting that the CDC is highly effective. The RPM at Massachusetts Military Reservation has suggested that when full life-cycle costs of OD are considered, including the cost of response actions at a number of the OD areas, the cost of using OD when compared to a CDC may be even more.

Additional information will help shed light on the costs and environmental OD versus CDC. The decision on which alternative to use, however, will involve explosive safety experts who must decide that the munitions are safe to move if they will be detonated in a CDC. In addition, current limitations on the size of munitions that can be handled in a CDC must also be considered.

UXO Model Clearance Project

In 1996 the U.S. Navy conducted a UXO Model Clearance Project at Kaho`olawe Island, Hawaii, that demonstrated the effectiveness of using protective works to minimize the adverse effects of detonation in areas of known cultural and/or historical resources. The results of the demonstrations and practical applications revealed that if appropriate protective works are used, the adverse effects of the blast and fragments resulting from a high-order UXO detonation are not as detrimental as originally anticipated. Protective works are physical barriers designed to limit, control, or reduce adverse effects of blast and fragmentation generated during the high-order detonation of UXO. Protective works used at Kaho`olawe included: tire barricades, deflector shields, trenches/pits, directional detonations, fragmentation blankets, and plywood sheets.

Source: UXO Model Clearance Report, Kaho`olawe Island, Hawaii, Protective Works Demonstration Report. Prepared for U.S. Navy Pacific Division Naval Facilities, Engineering Command, Kapolei, Ha. Contract No. N62742-93-D-0610 1996.

In open detonation, an explosive charge is used to create a sympathetic detonation in the energetic materials and munitions to be destroyed. Engineering controls and protective measures can be used, when appropriate, to significantly reduce the effects and hazards associated with blast and high-speed fragments during OD operations. Common techniques for reducing these effects include constructing berms and barricades that physically block and/or deflect the blast and fragments, tamping the explosives with sandbags and/or earth to absorb energy and fragmentation, using blast mitigation foams, and trenching to prevent transmission of blast-shock through the ground. These methods have been effective in reducing the size of exclusion zones required for safe OD and limiting local disruptions due to shock and noise. In some instances (e.g., low-explosive-weight MEC), well-engineered protective measures can reduce the effects and hazards associated with OD to levels comparable to contained detonation chambers (see Section 5.2.3.2).

5.2.2 Open Burning

Although open burning (OB) and open detonation (OD) are often discussed together, they are not often used at the same time. In fact, the use of open burning is limited today due to significant air emissions released during burning and strict environmental regulations that many times prohibit this. The environmental and technical challenges to using OB are the same as those listed in Section 5.2.1 for OD. When OB is used, it is usually applied to munitions areas for treatment of bulk explosives or excess propellant. OB operations have been implicated in the release of perchlorate into the environment, specifically groundwater.

5.2.3 Alternative Treatment Technologies

Because of growing concern and regulatory constraints on the use of OD, alternative treatments have been developed that aim to be safer, commercially available or readily constructed, cost-effective, versatile in their ability to handle a variety of energetics, and able to meet the needs of the Army.[72] Although some of these alternative treatments have applicability for field use, the majority are designed for industrial-level demilitarization of excess or obsolete munitions that have not been used.

5.2.3.1 *Incineration*

Incineration is primarily used to treat soils containing reactive and/or ignitable compounds. In addition, small quantities of MEC, bulk explosives, and debris containing reactive and/or ignitable material may be treated using incineration. Most MEC is not suitable for incineration. This technique may be used for small-caliber ammunition (less than 0.50 caliber), but even the largest incinerators with strong reinforcement cannot handle the detonations of very large munitions. Like OB/OD, incineration is not widely accepted by regulators and the public because of concerns over the

[72] J. Stratta et al. *Alternatives to Open Burning/Open Detonation of Energetic Materials*, U.S. Army Corps of Engineers, Construction Engineering Research Lab, August 1998.

025055

environmental and health impacts of incinerator emissions and residues.

The strengths and weaknesses of incineration are summarized as follows:

- **Effectiveness** — In most cases, incineration reduces levels of organics to nondetection levels, thus simplifying response efforts.
- **Proven success** — Incineration technology has been used for years, and many companies offer incineration services. In addition, a diverse selection of incineration equipment is available, making it an appropriate operation for sites of different sizes and containing different types of contaminants.
- **Safety issues** — The treatment of hazardous and reactive and/or ignitable materials with extremely high temperatures is inherently hazardous.
- **Emissions** — Incinerator stacks emit compounds that may include nitrogen oxides (NO_x), volatile metals (including lead) and products of incomplete combustion.
- **Noise** — Incinerators may have 400 to 500-horsepower fans, which generate substantial noise, a common complaint of residents living near incinerators.
- **Costs —** The capital costs of mobilizing and demobilizing incinerators can range from $1 million to $2 million. However, on a large scale (above 30,000 tons of soil treated), incineration can be a cost-effective treatment option. Specifically, at the Cornhusker Army Ammunition Plant, 40,000 tons of soil were incinerated at an average total cost of $260 per ton. At the Louisiana Army Ammunition Plant, 102,000 tons of soil were incinerated at $330 per ton.[73]
- **Public perception** — The public generally views incineration with suspicion and as a potentially serious health threat caused by possible emission of hazardous chemicals from incinerator smokestacks.
- **Trial burn tests** — An incinerator must demonstrate that it can remove 99.99 percent of organic material before it can be permitted to treat a large volume of hazardous waste.
- **Ash byproducts** — Like OB/OD, most types of incineration produce ash that contains high concentrations of inorganic contaminants.
- **Materials handling** — Soils with a high clay content can be difficult to feed into incinerators because they clog the feed mechanisms. Often, clayey soils require pretreatment in order to reduce moisture and viscosity.
- **Resource demands** — Operation of incinerators requires large quantities of electricity and water.

The most commonly used type of incineration system is the rotary kiln incinerator. Rotary kilns come in different capacities and are used primarily for soils and debris contaminated with reactive and/or ignitable material. Rotary kilns are available as transportable units for use on-site, or as permanent fixed units for off-site treatment. When considering the type of incinerator to use at your site, one element that you should consider is the potential risk of transporting reactive and/or ignitable materials.

The rotary kiln incinerator is equipped with an afterburner, a quench, and an air pollution

[73] U.S. EPA, Office of Research and Development. *Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes*, Handbook, September 1993.

control system to remove particulates and neutralize and remove acid gases. The rotary kiln serves as a combustion chamber and is a slightly inclined, rotating cylinder that is lined with a heat-resistant ceramic coating. This system has had proven success in reducing contamination levels to destruction and removal efficiencies (DRE) that meet RCRA requirements (40 CFR 264, Subpart O).[74] Specifically, reactive and/or ignitable soil was treated on-site at the former Nebraska Ordnance Plant site in Mead, Nebraska, using a rotary kiln followed by a secondary combustion chamber, successfully reducing constituents of concern that included TNT, RDX, TNB, DNT, DNB, HMX, tetryl, and NT to DRE of 99.99 percent.[75]

For deactivating large quantities of small arms munitions at industrial operations (e.g., small arms cartridges, 50-caliber machine gun ammunition), the Army generally uses deactivation furnaces. Deactivation furnaces have a thick-walled primary detonation chamber capable of withstanding small detonations. In addition, they do not completely destroy the vaporized reactive and/or ignitable material, but rather render the munitions unreactive.[76]

For large quantities of material, on-site incineration is generally more cost-effective than off-site treatment, which includes transportation costs. The cost of soil treatment at off-site incinerators ranges from $220 to $1,100 per metric ton (or $200 to $1,000 per ton).[77] At the former Nebraska Ordnance Plant site, the cost of on-site incineration was $394 per ton of contaminated material.[78] Two major types of incinerators used by the Army are discussed in Table 5-2. While incineration is used most often in industrial operations, it may be considered in the evaluation of alternatives for munitions responses as well.

The operation and maintenance requirements of incineration include sorting and blending wastes to achieve levels safe for handling (below 12 percent explosive concentration for soils), burning wastes, and treating gas emissions to control air pollution. Additional operation and maintenance factors to consider include feed systems that are likely to clog when soils with high clay content are treated, quench tanks that are prone to clog from slag in the secondary combustion chamber, and the effects of cold temperatures, which have been known to exacerbate these problems.

---

[74]U.S. EPA, Office of Solid Waste and Emergency Response, Technology Innovation Office. *On-Site Incineration at the Celanese Corporation Shelby Fiber Operations Superfund Site, Shelby, North Carolina*, October 1999.

[75]Federal Remediation Technologies Roundtable. *Incineration at the Former Nebraska Ordnance Plant Site, Mead, Nebraska*, Roundtable Report, October 1998.

[76]U.S. EPA, Office of Research and Development. *Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes*, Handbook, September 1993.

[77] DoD, Environmental Technology Transfer Committee. *Remediation Technologies Screening Matrix and Reference Guide*, Second Edition, October 1994.

[78]Federal Remediation Technologies Roundtable, *Incineration at the Former Nebraska Ordnance Plant Site, Mead, Nebraska*, Roundtable Report, October 1998.

025057

Table 5-2. Characteristics of Incinerators

Incinerator Type	Description	Operating Temps	Strengths and Weaknesses	Effective Uses
Rotary Kiln	A rotary kiln is a combustion chamber that may be designed to withstand detonations. The secondary combustion chamber destroys residual organics from off-gases. Off-gases then pass into the quench tank for cooling. The air pollution control system consists of a venturi scrubber, baghouse filters, and/or wet electrostatic precipitators, which remove particulates prior to release from the stack.	Primary chamber – Gases: 800-1,500 °F Soils: 600-800 °F Secondary chamber – Gases: 1,400-1,800 °F	Renders munitions unreactive. Debris or reactive and/or ignitable materials must be removed from soils prior to incineration; quench tank clogs; clayey, wet soils can jam the feed system; cold conditions exacerbate clogging problems. Requires air pollution control devices.	Commercially available for destruction of bulk explosives and small MEC, as well as contaminated soil and debris.
Deactivation Furnace	Designed to withstand small detonations from small arms. Operates in a manner similar to the rotary kiln except it does not have a secondary combustion chamber.	1,200-1,500 °F	Renders munitions unreactive.	Large quantities of small arms cartridges, 50-caliber machine gun ammunition, mines, and grenades.

Source: U.S. EPA, Office of Research and Development. *Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes*, Handbook, September 1993.

New incineration systems under development include a circulating fluidized bed that uses high-velocity air to circulate and suspend waste particles in a combustion loop. In addition, an infrared unit uses electrical resistance heating elements or indirect-fired radiant U-tubes to heat material passing through the chamber on a conveyor belt.

5.2.3.2 *Contained Detonation Chambers*

Contained detonation chambers (CDCs) are capable of repeated detonations of a variety of ordnance items, with significant reductions in the air and noise pollution problems of OD; however, the use of CDCs assumes that the munition item is safe to move. CDCs, or blast chambers, are used by the Army at a few ammunition plants to treat waste pyrotechnics, explosives, and propellants. In addition, several types of transportable detonation chambers are available for emergency responses for small quantities of MEC. 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 manufacturers have developed CDCs for both commercial and military use. However, DoD has not implemented CDCs at many military installations because of safety issues relating to the moving of munitions, rate of throughput, transportability, and cost.

Both industrial-level (fixed) and mobile (designed for use in the field) CDCs display a range of capabilities. CDCs designed for field use are limited in the amount of explosives they can contain, the types of munitions they can handle, and their throughput capability. Portable units have size constraints and are not designed to destroy munitions larger than 81 mm HE or 10 pounds of HMX, but the nonportable units can handle munitions up to 155 mm or 100 pounds of HMX (130 lb TNT equivalent).[79]

5.3 Treatment of Soils That Contain Reactive and/or Ignitable Compounds

Some of the technologies described in Section 5.2 can also be used to treat reactive and/or ignitable soil (e.g., thermal treatment). However, there are a number of alternative treatment technologies that are specifically applicable to soils containing reactive and/or ignitable materials. These are described in the sections that follow.

5.3.1 Biological Treatment Technologies

Biological treatment, or bioremediation, is a broad category of systems that use microorganisms to decompose reactive and ignitable residues in soils into byproducts such as water and carbon dioxide. Bioremediation includes ex-situ treatments such as composting and slurry reactor biotreatment that require the excavation of soils and debris, as well as in-situ methods such as bioventing, monitored natural attenuation, and nutrient amendment. Bioremediation is used to treat large volumes of contaminated soils, and it is generally more publicly accepted than incineration. However, highly contaminated soils may not be treatable using bioremediation or may require pretreatment, because high concentrations of reactive and/or ignitable materials, heavy metals, or inorganic salts are frequently toxic to the microorganisms that are the foundation of biological systems. Blending highly reactive material with clean soil is frequently used to ensure that the explosive content of the soil is below 10 percent. This is not considered treatment but rather is a preparation technique to allow the waste to be safely treated.

While biological treatment systems generally require significantly lower capital investments than incinerators or other technology-intensive systems, they also often take longer to achieve cleanup goals. Therefore, the operation and monitoring costs of bioremediation must be taken into account. Because bioremediation includes a wide range of technological options, its costs can vary dramatically from site to site. The benefits and limitations of bioremediation include the following:

- **Easily implemented** — Bioremediation systems are simple to operate and can be implemented using commercially available equipment.
- **Relatively low costs** — In general, the total cost of bioremediation is significantly less than more technology-intensive treatment options.
- **Suitability for direct land application** — In general, soil treated using most bioremediation systems is suitable for land application.
- **Limited concentrations of reactive and/or ignitable materials and other contaminants** — Soil with very high levels of reactive and/or ignitable material may not

[79] DeMil International, Inc. *The "Donovan Blast Chamber" Technology for Production Demilitarization at Blue Grass Army Depot and for UXO Remediation*, Paper presented at the Global Demilitarization Symposium and Exhibition, 1999.

R6 Response to Explo Open Burn/Open Detonation Comments
September 22, 2014

Comments on Feb 13, 2014 Draft 7003 Order for Camp Minden, LA
Comments on the Work Plan requirement to include on-site open burning/open detonation (OB/OD), para 73:
Para 73 says "The M6 Propellant Work Plan shall include an on-site open burning/open detonation remedy."
Because alternatives to open burning are available, we should not require, or even encourage, OB in this case. The RCRA and Superfund experiences, and DOD research, show that open burning/open detonation (OB/OD) is a relatively uncontrolled, dirty, polluting technology that should therefore be reserved for situations when there are no practical alternatives or for time-critical explosives safety emergencies, and with the understanding that there will be an extensive and costly clean-up/remedial action needed at closure, which is especially true in this case when considering the volume to be treated at Camp Minden and the presence of DNT. If, on the other hand, there is a known category D M6 propellant (i.e., a time-critical situation) and the alternatives are not yet as readily available, open burning may make sense.

RESPONSE:

Following the explosion at Camp Minden in October 2012, the discovery of the illegally and dangerously stored explosives was made in November 2012. At that time, EPA Region 6 began researching and identifying technologies and equipment to address the situation. The 16 months that have passed since then due to administrative and enforcement activities have resulted in limiting the options and made time an increasingly important factor. Even now, if the action was approved immediately, crews would have a difficult time completing the removal action (by OBOD or any means) in the remaining time before the M6 stability starts to fail. Feed rates and production rates for other technologies cannot meet the time constraint IF the equipment was even available.

EPA Region 6 and ORD met with several companies with "alternative technologies" for burning the M6 in a rotary kiln, turning the M6 into fertilizer, or neutralizing the explosive components of the M6. The technologies were not pursued due to the exponential increase in cost and time required to perform the removal, the production of ash, residue or liquids (potentially wastes) that still require disposal, and the unavailability of the technology at this time. Rotary kiln technology either cannot accommodate the required process rate to meet the schedule dictated by safety (15 M lbs. of M6 in less than 12 months), the equipment is not available (needs to be built or DoD/Army denied availability), and poses significant safety risks for M6 propellant burning requiring Quantitive Distance/Minimum Safe Distance that is unavailable at Camp Minden.

M6 is a smokeless powder. The combustion products are vapors; H_20, CO_2, CO, N_2 with traces of NO_x and H_2. Much of the concern about OBOD is from material that will result in residue contaminates. Such explosives as fireworks contain a considerable amount of heavy metals for effect and color. Black powder is known for its abundant smoke plumes and up to 55% solid residuals.

The connotation of OBOD is not quite the appropriate description for the destruction by burning method. Recent depictions in presentations and discussion portray the process as simply spreading the explosive onto the barren ground and blowing it up. In fact, no contact with soil will be made

other than potential spills. The method that EPA has selected utilizes burn trays that are raised above the ground. The burn trays will be placed on impermeable materials, loaded with minimal depth of M6 to prevent a load that would result in detonation, and are designed to restrict/eliminate "pop outs" of the M6 pellets while burning. The destruction process is a burn or deflagration and not an explosion. The ash will be contained within the burn trays and will be collected and disposed of in a separate waste stream. Any "clean up" post burn would be minimal to nonexistent due to engineering controls throughout the process.

The other waste streams are expected to be the ash residue, the pad material, and the trays. The Administrative Order on Consent requires representative sampling and profiling for disposal. The analytes for the sampling are to include the combustion products and partial combustion products. The analytes consider those included in an EPA study and an Environment Canada study on the M6 propellant. The EPA study included the burning of the dunnage bags that have been eliminated from the Explo stockpile. Soil sampling will include those analytes as well. Air sampling will include the gaseous components as well.

EPA's log-standing position under RCRA and the CAA is that OB/OD is appropriate for the demilitarization of explosives wastes only in situations where there are no alternatives. OB/OD is not necessarily cheaper and more expedient than other options, and will result in an environmental mess that someone will need to clean up. Although cheaper initially, the full life cycle costs and environmental consequences of open burning can be significant.
Alternatives do exist (I previously provided a list to Region 6). Probably the most attractive in terms of mobilization, through-put, and environmental protection is transportable rotary kiln incineration (mobile treatment units). Hundreds of thousands of tons of explosives-contaminated soils have been treated by this method, including DNT-contaminated soils at multiple Army Ammunition Plants (AAPs) and Depots. Further, the Army currently treats excess propellants at AAPs with Explosive Waste Incinerators at about 8 or 9 facilities. These facilities have high throughput (tons/hr treatment rates), with controlled feed rates, temperature, and residence times. If more through-put is needed, multiple units can be deployed.

RESPONSE:

While there are technologies that exist and there is some equipment, it is not available to be used at Camp Minden. The kilns at Army depots exist for long term use, making the investment into a treatment system feasible. At Army depots, the Army has complete control of the property, constant security, no travel costs, and the large investment of the treatment units can be distributed over many years. The Army also has a great advantage of an actual and credible stability monitoring program that allows several years in advance to schedule the destruction of M6 propellant. Many of the Army's on-depot disposal systems are in the pilot stage. One reason that the Army contracted with Explo Systems for disposal of the M6 is that the volume of M6 exceeded the capacity of the Army's disposal systems.

EPA has no evidence that rotary kilns are available for use at Camp Minden and the statement "that multiple units can be deployed" is not valid. EPA and EPA's clean up contractors searched for availability of equipment as well as technologies. The Army has denied the use of any existing kilns at Camp Minden for M6 burning, the money required to invest in building an onsite kiln, and the time required to build the kiln is unavailable considering the immediate need of this removal action and the volume of the material. Burning M6 propellant by rotary kiln cannot meet required disposal rate to

meet the schedule dictated by safety (15 M lbs. of M6 in less than 12 months). Multiple kilns would be necessary, requiring large Quantitative Distance/minimum safe distance exclusion zones not available at Camp Minden due to existing operations and infrastructure.

A number of other technologies exist…many of which the Army (and Navy) have previously tested and proven (thermal treatment without flame, chemical treatment, conversion to fertilizer, reuse, etc.) Perhaps a combination of a number of these could/should be used/demonstrated to achieve the desired through-put. [See, for example: "Alternatives to Open Burning/Open Detonation of Energetic Materials: A Summary of Current Technologies," US Army Corps of Engineers, August 1998; "Development of US-ROK Joint Munitions Demilitarization Facility Concept and Demilitarization of Propellants," US Army Joint Munitions Command, Defense Ammunition Center, 10 May 2007.]

RESPONSE:

Due to the urgency of eliminating the risk of the 15 million pounds of M6 in less than 12 months, disposal treatment and reuse options are limited. However, Region 6 investigated several options prior to selecting destruction by burning. Below is a summary of our investigations into these other options.

Region 6 Superfund briefed Regional Senior Management in February 2013 and January 2014 on the alternate technologies evaluated by Superfund and ORD. Management's decision was to pursue destruction by burning with careful and thorough consideration and evaluations of multiple factors (safety, time required, cost, overall efficiency, legitimacy, and proven technology). Due to the time constraints at the site (15M lbs. of M6 in less than 12 months), additional evaluation of other technologies is not prudent. While other technologies are proven, there are no commercial facilities available at this time; or the time to build, test, and permit such facilities is prohibitive due to safety, schedule, and cost constraints.

One technology that EPA R6 Superfund and ORD evaluated involved breaking M6 down into a high nitrogen fertilizer (the Actodemil process). The Army has a pilot plant of this technology in operation. The through put of that pilot plant translates to more than 34 years to complete the Actomil process on 15 M pounds of M6. That deployment at McAlester of the pilot was a $6,000,000 investment to build the pilot system, in addition to the operational costs. To scale up and build a facility to meet the time restrains would require orders of magnitude higher funds than that to conduct the open burning. The process would produce high nitrogen fertilizers that encourage rapid plant growth. Contrary to the claim by Actodemil, the use of the fertilizer on roadsides and medians is not a welcome thing by highway departments. They don't want accelerated growth on areas that they have to bush hog and maintain. The end results of the process for EPA is the storage, use, or disposal of 7,000,000 gallons of nitrogen rich liquid waste.

A modified rotary kiln option was presented to the LA National Guard and witnessed by EPA. The presenter is in the asphalt business (Madden Contracting) and uses rotary kilns used to make asphalt. Madden claims they have the capability to use the rotary kilns, while partnering with another firm, to destroy the M6. However, he does not currently have a rotary kiln for that use and has not conducted M6 disposal by rotary kiln. Madden has no permits to operate in Louisiana, no test results on the

performance, and lacks the understanding of the control of the M6 feed into the kiln to control rapid gas production/detonation or destruction of the kiln by excessive heat production. Madden's disposal rate is considerably longer than OBOD even though the thermodynamic aspects of the process (listed above) are ignored. Kiln or open burning results in the same combustion products, although open burning can produce more NOx, etc. as incomplete combustion products.

The option to include M6 in Asphalt is not practical and would result in increasing the decay of the asphalt due to the decomposition products of the M6.

Remanufacture of M6 into small arms ammunition has several hurdles. One is the unattractive rate of burn of the M6. It is slow compared to most military propellants and too slow to be of commercial use in small arms. Currently, the configuration of the M6 propellant at Camp Minden is small rods, about the diameter of a pencil about an inch long. Small arms propellants are shaped in discs and even smaller rods. While the chemical composition is important, the performance of the propellant is also a function of size, shape and homogeneity of the powder. It would be extremely expensive to build the facility to re-mill the M6 into a useful product for small arms. The resulting ammunition would be less effective than anything on the market.

Natural attenuation of the M6 is an option that involves spreading it out at a depth that would not cause it to explode, i.e. no confinement or compression. It could result in fires, would require exceptionally large areas of uninhabited/unused land, would require an undetermined period of time to degrade, and is not feasible.

Supercritical Water Oxidation (SCWO) is an enticing technology that applies to the destruction of the propellants. The Explo facility was participating in a pilot of a SCWO system. It uses water at above its critical point of about 705° F and 3206 PSIA. At that point, water becomes a very powerful oxidizer. The result is "waterburning", or thermal destruction. Unfortunately, there are no commercially available units at this time.

Note: **para 8** under "Findings of Fact" admits that "Burning and demolition activities were also performed to destroy explosives and explosive wastes…. The above activities resulted in soil and groundwater contamination. EPA placed LAAP on the National Priorities List in March 1989." Does EPA really want to continue those open burning activities that lead to the NPL listing, and significantly add to the contamination already there (or replace the contaminants already remediated)?

RESPONSE:

The LAAP was placed on the NPL because of groundwater contamination by the handling of TNT and red water wastes. The burning was not of M6 or any other smokeless powder. Red water was stored in ponds at several locations around LAAP. The groundwater at LAAP is still contaminated. As part of the remedy, institutional controls were implemented. One of the controls is the restriction that only other explosives companies are allowed to operate in certain areas. Because the ground is still contaminated or has unexploded ordinance, the institutional controls limits those companies that are familiar with those conditions to operate at the Site. The handling of red water wastes that lead to the ground water contamination is not the same material, not the some chemistry, not the same process, and not the same receptors.

Camp Minden has a designated and permitted burn area for the onsite disposal of the energetic material. LMD has coordinated with LDEQ on permitting for onsite burns. Pre-burn and post-burn sampling of the soil and assessment of the air during burning activities will be conducted for any potential contaminants present in the materials to be disposed of through onsite burning.

Comments on the OB/OD Work Plan, para 74:

Para 74. k. Given the extensive contamination that is expected from open burning, this subparagraph addressing closure requirements needs to be more specific, e.g., "the respondent shall include in the closure plan the need for taking discrete soil and ground water (and if present, surface water) samples to identify the contaminants of concern, their concentrations, and the geographical extent of contamination. The list of contaminants to be monitored must include DNT (dinitrotoluene)…M6 has 100,000 ppm DNT…and dioxin (a common contaminant at OB/OD sites). 2,4-Dinitrotoluene is a 40 CFR 261.24 Toxicity Characteristic contaminant, with a regulatory level of 0.13 mg/L (this was the quantitation limit at the time this regulation was issued, which was greater than the calculated regulatory level, so therefore the quantitation limit became the regulatory level). DNT has a NIOSH and OSHA time-weighted average (TWA) exposure limit of 1.5 mg/m3 [skin].

Question: If EPA issues an order that requires the use of a known polluting technology (open burning) that results in the need for remediation, doesn't this ultimately reflect back on EPA?

RESPONSE:

Where is the dioxin? How could dioxin be formed? There is no chlorine in the mix. M6 does not contain any chlorine.

M6 is a smokeless powder. It does contain DNT. However, the combustion products are vapors; H_20, CO_2, CO, N_2 with traces of NO_x and H_2. The presence of dioxin at other sites does not indicate that dioxin will be produced from chemicals that lack the chemical building blocks for that contaminant.

Open burning will not result in the need for additional remediation at Camp Minden. The E-Line area within Camp Minden is a designated burning area. The area will be cleared of vegetation. Impermeable pads will be constructed and metal trays will be fabricated specifically for burning of propellants and placed on the pads. The construction of the pads includes barriers that provide protection from contamination and will be removed at the end of use. Distances between trays, the quantity of propellant on each tray, ignition procedures, worker protection, public safety, and other aspects will all be according to the DoD 4145.26 Manual.

Para 74. l. "Air monitoring and waste sampling activities" should be changed to read: "Residue and soil sampling (and possibly surface water if present and ground water sampling) activities." Also add at end: "Sampling is to include DNT and dioxin. The monitoring plan is to include for each burn, the observation and recording of the extent of visible particulate/smoke plume and kick-out, to determine if changes are needed to the operating plan (under para 74 q (iv)), and to indicate the extent of soil sampling needed at closure (under para 74 k)."

Note: There are no EPA recognized protocols for air monitoring of open burning sites. Most of the methods tried (e.g., plane, helicopter, balloons, backstops, nets, and pans on the ground) have been demonstrated to be meaningless. The best surrogate for air monitoring is targeted soil sampling.

RESPONSE:

Air monitoring is conducted routinely at removal sites and at emergency responses. Monitors, as well as sample collectors are placed at the perimeters, downwind, in sensitive areas, etc. Air monitoring is as standard operationally as any procedure at the sites. Many decisions to make engineering changes, to call for evacuation, or to warrant soil sampling are routinely based on air monitoring results.

The EPA Air Monitoring Plan will include perimeter air monitoring. That will provide near real time information on particulates, volatiles, and even CO_2 concentration. This will facilitate making engineering control changes to limit the discharge. In addition to perimeter monitoring, an emphasis on downwind monitoring will be employed. Sensitive areas such as schools, shopping centers and other places where people tend to congregate outside will be monitored. Even though those places are well beyond any realistic expectation of contamination reaching them, monitoring will be conducted.

Likewise, samples of air will be collected and analyzed at a laboratory. The locations will be similar to those of the monitoring locations. Samples will also be collected by high-volume air samples which can collect particulates and organic compounds adsorbs onto media.

The basis for the air monitoring and air sampling protocols and design include the following EPA courses:

Air Monitoring for Hazardous Materials
Offered by Environmental Response Training Program (ERTP)
ERT - OSRTI

Air Monitoring for Emergency Response
Offered by Environmental Response Training Program (ERTP)
ERT - OSRTI

One example is the Vieques NPL site where open detonation of munitions were performed. The explosives involved there were formulations that contained mercury, lead, copper, magnesium, lithium, perchlorate, TNT, napalm, and RDX. In coordination with ERT, multiple air sampling events were conducted and no air impacts were observed.

"Waste sampling" seems not to be the term meant since we already know the ingredients of M6, and EPA has apparently decided NOT to do further sampling of the stabilizers to determine stability (if stabilizer sampling is desired, which it should be, it should be so specified instead of "waste sampling"). It seems "environmental sampling," not "waste sampling" is the term meant here.

RESPONSE:

Waste sampling is part of the requirement of disposal of other waste streams that will be generated at the Site. Supersacks, bags, boxes, cans, strapping, plastic wrap, and more will have to be disposed of offsite. There is also the waste stream of the generated ash and residue from the trays. The facility

receiving those waste streams will insist on waste sampling in order to profile the waste to determine the concentration of the residual M6 components.

The idea of stability sampling remains an issue, in particular to those people who do not have the advantage of seeing the site and the conditions of the M6 storage. To reestablish the stability monitoring program; the time, personnel, and resources required to do it would require ¾ of the time it would require to complete the burning of the M6. It would include triple handling of the M6, require additional magazines since the M6 cannot be restacked safely in the same positions, and still leave the task of disposal to be completed. The Lots of M6 propellant have been mixed into boxes, drums, and 880 lb. supersacks. The collection of a homogeneous or representative sample of M6 propellant from an 880 lb. is impossible. Without representative samples, the quality of the stability data is questionable at best. And the stability monitoring sampling does not reduce the cost, labor, or resources to dispose of the M6.

The Cardinal Rules of Explosive Safety are to handle the smallest volume of explosives, for the shortest period of time, by the fewest number of people. This reduces the risk of injury caused by an explosive incident significantly and is quoted and followed by DoD and all explosive workers. Stability monitoring at the Camp Minden site violates every rule of explosive safety by exposing more people than necessary to more explosives than necessary for a period of time that is unnecessary. The DoD rules that apply to the situation recognize that stability monitoring is no longer an option and prescribes the immediate destruction of the M6 as the appropriate remedy. Stability monitoring at this site will not provide quality data that increases safety or reduces the explosive risk at Camp Minden.

Para 74 q (iv). Since these are not specified elsewhere, and they are very important to this project, this section should be expanded to read as follows: "Provide any other limitations to protect personnel and nearby communities (such as weather, wind speed and direction, and inversions)…."

RESPONSE:

These are included in the DoD Manual 4145.26 and as part of the HASP.

Other Comments:
Para 71. To expect DOD to develop a Work Plan as specified, including an assessment of technical options, in **15 days** is unreasonable.

RESPONSE:

We disagree.

Para 75. There seems to be a problem with the use of the word : "open" in the phrase "each open shall address."
Para 88. Something seems to be missing in the phrase: "**'Day' or 'day'** shall mean a calendar day."

State of Louisiana

Bobby Jindal
Governor

Louisiana National Guard
Office of the Adjutant General
6400 St. Claude Avenue
Jackson Barracks
New Orleans, LA 70117

Glenn H. Curtis
Major General
The Adjutant General

May 8, 2013

Paige Delgado
U.S. EPA Region 6
On-Scene Coordinator
1445 Ross Avenue
Suite 1200 (6SF-PE)
Dallas, TX 75202

Dear Ms. Delgado:

Please find attached a copy of a Department of the Army report entitled "Report of Explosive Safety Assistance Visit to Louisiana Army National Guard's Camp Minden". The report was prepared by DA on April 18, 2013 at the request of Major General Glenn Curtis, The Adjutant General of the Louisiana National Guard.

This information is being provided pursuant your request under the Louisiana Public Records Law, Louisiana Revised Statutes 44:1, et seq.

The point of contact for this action is MAJ Dirk Thibodeaux, SMD Executive Counsel, (225) 319-4674 or dirk.thibodeaux@us.army.mil.

Sincerely,

Joanne F. Sheridan
Brigadier General, LAARNG
Assistant Adjutant General - Army

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY
INSTALLATIONS, ENERGY AND ENVIRONMENT
110 ARMY PENTAGON
WASHINGTON DC 20310-0110

18 April 2013

MG Glenn H. Curtis
The Adjutant General
Louisiana National Guard
6400 St. Claude Avenue
Jackson Barracks
New Orleans, LA 70117

Dear General Curtis:

Enclosed is the report from the technical assistance visit you requested in your letter of March12, 2013 regarding the potential short- and long-term hazards associated with the M6 propellant that Explo Systems, Inc. (Explo) stores and processes for recycling and commercial sale at the Louisiana National Guard's (LANG) Camp Minden. The attached report provides recommendations LANG and the Louisiana State Police (LASP) may consider to improve the explosives safety posture at Camp Minden.

The Army's technical assistance team, which conducted its review on 2 and 3 April 2012, focused on Explo's storage and processing of M6 propellant The team did not review Explo's personnel qualifications, operating procedures, and/or its procedures for security or accountability of explosives. LANG may want to consider evaluating these matters.

The team was informed there may be other commercial entities performing operations involving explosives at Camp Minden, and that LANG may also be leasing facilities to other commercial entities for non-munitions-related work. LANG did not request the team evaluate these areas or operations, nor did it make them available for the team's evaluation. Because operations of this nature may be cause for concern, LANG is encouraged to evaluate all operations at Camp Minden to help ensure the safety of personnel working on Camp Minden, the security of LANG's operations, and the safety of the public. I recommend LANG contact the National Guard Bureau's Quality Assurance Specialist (Ammunition Surveillance), Mr. Clark Holmes, to request any assistance it may need to address these and other explosives safety-related matters.

The team that visited Camp Minden remains available to LANG to provide further advice on the Explo materials at Camp Minden. Additionally, the US Army Technical Center for Explosives Safety is a valuable resource for all Army and National Guard activities.

I understand Explo continues to reduce the quantity of propellant it stores at Camp Minden and is moving remaining propellant into storage. As such, the explosive hazards posed on Camp Minden and to nearby communities are substantially reduced. This is good news for Camp Minden's neighboring communities and for state officials who are providing oversight of the situation. My point of contact for this matter is Mr. J. C. King, Director for Munitions and Chemical Matters, and the Army's Department of Defense Explosives Safety Board Voting Member, at (703) 697-5564; james.c.king4.civ@mail.mil.

Sincerely,

Hershell E. Wolfe
Acting Deputy Assistant Secretary of the Army
(Environment, Safety and Occupational Health)

Enclosure

FOR OFFICIAL USE ONLY

THIS IS A COVER SHEET

FOR UNCLASSIFIED INFORMATION

ALL INDIVIDUALS HANDLING THIS INFORMATION ARE REQUIRED TO PROTECT IT FROM UNAUTHORIZED DISCLOSURE.

HANDLING, STORAGE, REPRODUCTION AND DISPOSITION OF THE ATTACHED DOCUMENT MUST BE IN ACCORDANCE WITH APPLICABLE AGENCY POLICY.

THE ATTACHED MATERIALS ARE TO BE DISSEMINATED ONLY ON A "NEED TO KNOW" BASIS AND WHEN UNATTENDED, MUST BE STORED IN A LOCKED CONTAINER OR AREA WITH SUFFICIENT PROTECTION AGAINST THEFT, COMPROMISE, AND UNAUTHORIZED DISCLOSURE.

(This cover sheet is unclassified.)

FOR OFFICIAL USE ONLY

Department of Army

Report
of
Explosives Safety Assistance Visit
to
Louisiana Army National Guard's
Camp Minden

April 18, 2013

Final Report of Explosives Safety Assistance Visit to Camp Minden

1. Background.

a. On 12 March 2013, The Adjutant General (TAG), Louisiana National Guard (LANG) requested (Enclosure) the Army provide a technical assistance team to assess stored propellant at the State-owned Camp Minden, Louisiana (LA), and make recommendations for potential mitigation measures. TAG specifically, requested the team conduct an assessment of the potential short- and long-term hazards associated with M6 propellant being processed and stored on Camp Minden by Explo Systems, Inc. (Explo), a commercial firm. Explo has a lease from the State for certain property on Camp Minden, which it uses for the purpose of conducting demilitarization operations under Contract W52P1J-10-C-0025 for the demilitarization of D533 Charges, Propellant, 155mm, M119A2, and Explo's subsequent commercial recycling operations of the demilitarized propellant.

b. On 2 and 3 April, a team, under the leadership of COL Leo Bradley, Army Military Representative to the Department of Defense Explosives Safety Board (DDESB), conducted the requested technical assistance visit (TAV). The team consisted of:

- COL Leo Bradley, DDESB
- Mr. James Young, Quality Assurance Specialist (Ammunition Surveillance), Department of the Army, G4
- Mr. Paul Cummins, Mr. Greg Heles, and Ms. Libzent Odom, US Army Technical Center for Explosives Safety (USATCES)
- Mr. James Lane, Defense Ammunition Center.

c. COL Bradley provided COL Ronnie D. Stuckey, Commander, Camp Minden, an initial report of the team's assessment. This is the final report of that visit.

2. Executive Summary. COL Stuckey, and Officer John Porter, Deputy Command Technician, and Shelly Hopkins, Criminal Investigator, LA State Police's (LASP) Hazardous Material and Explosives Control Unit, provided the team a thorough in-briefing. After touring the portion of the facility leased and used by Explo and gaining access to installation facility maps, the team conducted an explosives safety quantity distance (ESQD) analysis. This analysis detailed the original situation in Explo's area of operations (Figure 1) in November 2012, as the LASP described; the situation on 2 and 3 April (the current situation) (Figure 2); and a proposed solution (Figure 3) that would provide improved public safety by making changes to Explo's explosives-related operations and propellant storage locations. During the TAV, the team observed several deviations from standard Department of Defense (DoD) explosives safety practices as identified in DoD 6055.09-M (Volumes 1 to 8), DoD Ammunition and Explosives Safety Standards. Based on its assessment, the team recommends LANG initiate the following actions as quickly as possible:

- Consider all areas within the S-Line (an Explo facility) as an explosives storage site, and prohibit explosives operations within the area, including Explo's current repacking operation and its proposed aluminum reclamation operation.

- Reduce the quantity of propellant in building 1607 to 591,805 lbs of M6 propellant. Reduce the amount of M6 propellant in other buildings to the quantities provided in Figure 3.

- Identify the location of all M6 propellant from Lot IND82E-070170, segregate, and dispose of it as soon as possible. The team's review of the DoD lot numbers shipped to Camp Minden revealed that this Lot has been classified with stability category "C."

- Move the LASP's administrative offices outside of the "marginal" arc of Figure 3.

3. Way Ahead. Since November 2012, when LASP discovered the potential explosive hazards posed by M6 propellant at Camp Minden, LANG and LASP have taken effective action to protect the public. Implementation of the above recommendations will further increase public safety; however, their implementation will not bring the S-Line into conformity with DoD 6055.09-M. The team strongly recommends LANG and the Commander, Camp Minden, consult with explosives safety experts at the National Guard Bureau and, if required, seek further advice from the technical assistance team as the situation at the Explo's area of operations at Camp Minden improves.

Explosives Safety Quantity Distance (ESQD) Analysis

In its ESQD analysis, the team applied the below universal assumptions:

- The TNT equivalency of M6 propellant is 0.65 (65 percent (%)).
- The responsible authority accepts the hazards and risks to the rail yard, rail cars, and any other facilities within ESQD arcs.
- The explosives limits shown on the drawing are not exceeded.

<u>S-Line ESQD Analysis</u>:

Original Situation November 2012 (Figure 1)

Figure 1 shows the situation on the S-Line in November 2012. The ESQD situation depicted is for 6.5M lbs of TNT, which is the TNT equivalency of 10M lbs of M6 propellant. The team calculated the TNT equivalency by simply adding all the explosives material present on the S-Line at that time.

In its ESQD analysis of the S-Line's original situation, the team assumed that all 10M lbs of M6 propellant on the line in November 2012 would react with a prompt propagation as a Hazard Division (HD) 1.1 – a reaction of 6.5M lbs net explosives weight (NEW).

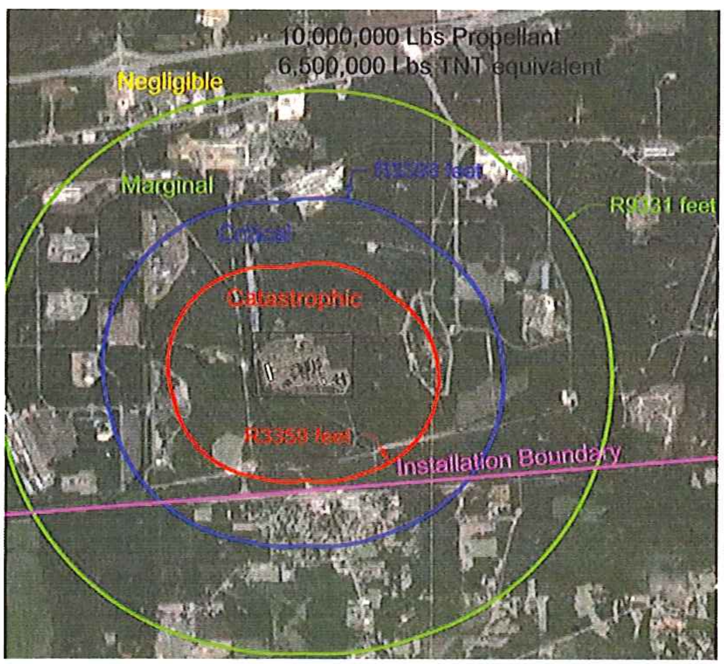


Figure 1 – Original Situation (November 2012)

Current Situation April 2013 (Figure 2)

Figure 2 shows the current situation. The ESQD situation depicts the team's "best estimate" of the NEW of M6 propellant on the S-Line as of April 2013.

In its ESQD analysis of the current situation, the team assumed:

- The S-Line is only an explosives storage site. Only operations directly related to the storage of explosives would be allowed to be performed within the S-Line. Therefore, the repackaging operations currently performed at the S-Line would be discontinued. Additionally, among other non-storage related activities, the shipping and receiving office would be moved, and aluminum recovery operations as well as demilitarization-related operations would not be allowed to be preformed within the S-Line.
- There are three inter-magazine distance (IMD) violations on S-line.
  - The first is from building 1607 to building 1645. Considering both buildings only contain M6 propellant, it is not anticipated that propagation will occur between these buildings. Therefore, the IMD violation will be discounted.
  - The second is from building 1607 to building 1610. Considering both buildings only contain M6 propellant, it is not anticipated that propagation will occur between these buildings. Therefore, the IMD violation will be discounted.
  - The third is between buildings 1610 and 1650. Therefore, for the "Current Situation" analysis, buildings 1610 and 1650 will be referred to as the "group of 2," with the explosives totaled and treated as one explosives storage location. IMD is maintained between the "group of 2" and all other explosives storage buildings.
- The small wing on building 1607 that extends east towards building 1610 does not contain any explosives materials. Non-explosives materials are allowed.

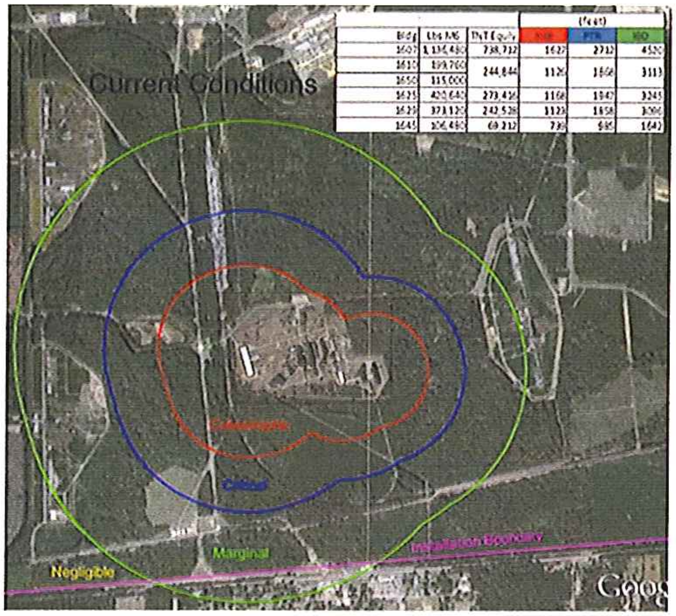


Figure 2 – Current Situation (Apr 13)

Proposed Solution (Figure 3)

Figure 3 shows the proposed solution. The proposed solution is a "future state" that will meet DoD 6055.09-M's criteria and reduce the threat to the public to a "negligible" level.

In its ESQD analysis for the proposed solution, the team assumed:

- S-Line is only an explosives storage site. Only operations directly related to the storage of explosives should be allowed to be performed within the S-Line. Therefore, the repackaging operations currently performed at the S-Line would be discontinued. Additionally, among other non-storage related activities, the shipping and receiving office would be moved, and aluminum recovery operations as well as demilitarization-related operation would not be allowed to be preformed within the S-Line.

- For the proposed solution, buildings 1610, 1617, 1619, and 1650 will be referred to as the "group of 4," with the explosives totaled and treated as one explosives storage location. IMD is maintained between the "group of 4" and all other explosives storage facilities. Grouping these four buildings as one explosives location maximizes the allowable explosives storage within S-line.

- The proposed solution meets DoD 6055.09-M's criteria, with respect to IMD, and provides an acceptable level of protection for the public.

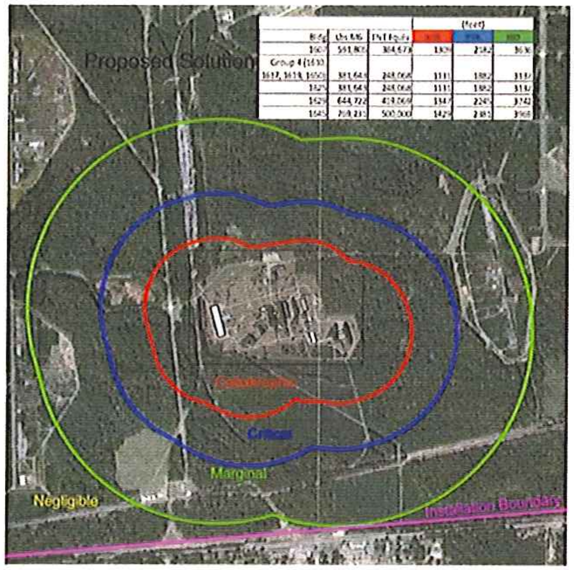


Figure 3 – Proposed Solution

Hazard Zone Definitions

The below provide a broad definition of the different types of consequences expected within the ESQD hazard zones depicted in Figures 1 through 3.

- Catastrophic: Delayed propagation of an explosion may occur from fire brands or equipment failure at the exposed sites. Personnel in the open will likely be killed by direct action of blast, by being struck by fragments and building debris, or by physically being thrown against a hard surface. Personnel in buildings may be injured or killed by destruction/collapse of the building. Damage to un-strengthened buildings will be serious and approximate 50 percent or more of the total replacement cost (minimum). Transport vehicles will incur extensive, but not severe, body and glass damage consisting mainly of dishing of body panels and cracks in shatter-resistant window glass.

- Critical: Personnel in the open are likely to be injured or killed by fragments and debris, depending largely upon the structure housing the explosives, the amount of explosives, and its fragmentation characteristics. Injuries are principally caused by broken glass and internal building debris. Un-strengthened buildings are likely to sustain damage approximating 20 to 50 percent of the replacement cost depending on building type and distance. Vehicles on the road should suffer little damage unless hit by a fragment or unless the blast wave causes momentary loss of control.

- Marginal: Personnel in structures are provided a high degree of protection from death or serious injury, with likely injuries principally being caused by broken glass and building debris. Personnel in the open are not expected to be injured seriously directly by the blast but these personnel may receive injuries and possible death from fragments and debris, depending largely upon the structure and the amount of explosives and its fragmentation characteristics. Facility structure and fragmentation characteristics will determine the probability of marginal .vs. negligible consequences. Un-strengthened buildings are likely to sustain damage from 5 to 20 percent of the replacement cost depending on distance. Exposed equipment and material may be damaged by fragments and become unusable.

- Negligible: Personnel beyond the green arc are not likely to be injured or killed by fragments. Fragments can occur at these distances, but the probability of hitting a person is unlikely. On DoD installations, DoD accepts this level of risk through policy and regulation. Un-strengthened buildings are likely to sustain only minor damage, 5 percent maximum, primarily from fragments and glass breakage.

Additional Observations and Recommendations

- **Observation**: Building 1607 is used as a storage location for approximately 1M lbs of M6 propellant. In addition, Explo conducts operations involving the receipt, repackaging, and shipment of M6 propellant this site.

  Recommendation: Prohibit Explo from repackaging propellant in building 1607 and move the repackaging operation to another location that complies with DoD 6055.09-M. Limit building 1607's use to storage of M6 propellant.

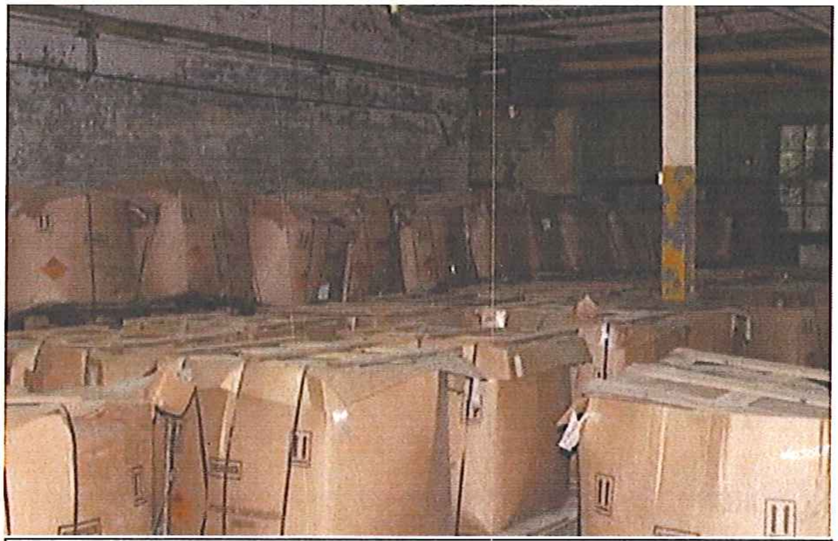
  Reference: DA Pam 385-64, Ammunition and Explosives Safety Standards, paragraph 2-5, Personnel and Explosives Limits.

Propellant repackaging operations in building 1607

- **Observation**: The amount of propellant in storage in building 1607 creates ESQD violations.

  Recommendation: Reduce the propellant in storage in building 1607 to no more than 591K lbs. Limit building 1607's use to storage of M6 propellant. Prohibit the storage of hazardous materials, other than M6 propellant.

  Reference: DA Pam 385-64, Chapter 8, Explosives Safety Separation Distance (Quantity-Distance).



M6 Propellant in 880 lb bulk pack, Bldg 1610 (typical)

- **Observation**: The explosives in S-Line violate DoD 6055.09-M's explosives safety compatibility rules - if IMD is not met, all explosives must be treated as being at one location. M6 propellant, Tritonal, hazardous waste (pink water) and explosives residue (i.e., tar mixed with TNT) from a previous TNT/Tritonal melt-out operation, and Explosive D (ammonium picrate) are all stored within the S-Line (in buildings1619 and 1617).

  Recommendation: Remove, segregate and store explosives per DoD 6055.09-M's explosives safety compatibility and mixing rules. Comply with DoD 6055.09-M's criteria for storage of waste military munitions. Prohibit the storage of hazardous waste with explosives.

  References:

  - DoD 6055.09-M, V1, Table 7-2, Storage Compatibility Group (SCG) Mixing Chart for Storage.
  - DoD 6055.09-M, V7, Enclosure 5, Special Storage Procedures for Waste Military Munitions.

  DA Pam 385-64, paragraph 2-7.a.(4) – *At a minimum, hazardous waste material will be removed from AE and other operating facilities and taken to an approved disposal area or temporary collection point at the end of each shift. (b) Hazardous waste material should not be "stored" in the disposal area, but disposed of as soon as possible after arrival.*

Tritonal Flaking Belt – Building 1619

Tritonal scraps located in Building 1619 generated from Tritonal flaking operation

TNT Contaminated Water (red water/pink water)

- **Observation**: There was no static-electrical grounding or bonding on metal conveyers or hoppers (bonded and/or grounded conductive work surfaces). Personal protective equipment (PPE) (e.g., conductive shoes, wrist-stats, cotton garments) is not being used to prevent buildup of static electrical charges.

  Recommendation: Prohibit the use of this equipment until it is grounded and/or bonded per DA PAM 385-64. Provide operators appropriate PPE.

  References:

  - DA Pam 385-64, Section II, Static Electricity, paragraph 17-10. *General requirements – All machinery and equipment such as mixers for pyrotechnic, propellant, and explosive compositions, screening and sifting devices, assembly and disassembly machines, elevators, defusing machines, presses, hoppers, and all associated equipment involved in loading or processing explosives or explosives materials will be bonded to the earth electrode subsystem.*
  - DA Pam 385-64, Chapter 2, General Safety
  - 29 CFR 1910, Subpart 1 - personal protective equipment.

- **Observation**: The electric scale used to weigh propellant drums is connected to a standard 110 volt outlet (spark hazard). The outlet is located directly above open containers of bulk propellant. Several pallets of loaded drums are stored within 5 feet of the scale and download operation. Loose propellant observed wedged between the base of the scale and the platform.

Recommendation: Discontinue this operation until the above are addressed. Determine the requirement for explosion proof electrical connections and install where required. Perform a comprehensive cleanup of the area to remove lose and/or visible propellant and other explosive residues. Develop spill cleanup procedures and implement them.

Reference: DoD Manual 6055.09-M, V2, Enclosure 3, Electrical Standards; NFPA 70.

- **Observation**: Equipment used at propellant repack operations have electric motors, but explosive proof electrical outlets are not installed.

  Recommendation: Determine if this operation is a Class II hazardous location. Determine if the proper equipment and electrical connections are being used. If not, install and use.

  Reference: DA Pam 385-64, paragraph 17-6, Electrical Motors for Hazardous Locations: *Electrical motors should not be installed in a room or building which is a Class I or II hazardous location. They should have no connection to the building except through glands or apertures adequately sealed against entrance of hazardous materials either into the location or into the motor itself.*

- **Observation**: Deluge systems are not in place at the propellant download operation.

  Recommendation: Apply the "best practice" for operations involving exposed propellant by installing required deluge systems.

  References:

  - DoD Manual 6055.09-M, V, Enclosure 9, Personnel Protection, V1.E9.3.2.4. *Personnel protection may be achieved by: using fire detection and extinguishing systems (e.g., infrared actuated deluge system) in those areas where exposed, thermally energetic materials that have a high probability of ignition and a large thermal output are handled.*
  - DA Pam 385-64, paragraph 6-19, Deluge Systems for Explosives Operations.

- **Observation**: Exposed electrical wires and motors are on equipment used to crush metal containers.

  Recommendation: Discontinue use of this equipment until it meets electrical safety standards and is in proper working order.

  Reference: DA Pam 385-64, Chapter 17, Electrical Hazards and Protection.

- **Observation**: Tools used in the repack operations are not the non-sparking variety normally required for explosive operations.

  Recommendation: Ensure the proper hand tools be used for explosive operations.

  Reference: DA Pam 385-64, paragraph 2-6 h. – *Only authorized and properly maintained tools, including hand tools, that are approved for use in locations having hazardous concentrations of flammable dusts, gases, vapors, or exposed explosives will be used. Safety hand tools will be constructed of non-sparking and /or spark-resistant materials (wood, brass, titanium) that under normal conditions of use will not produce sparks.*

- **Observation**: Cleaning supplies and flammable chemicals (sweeping compound, cleaners, solvents, paints, anti freeze, hydraulic fluid, and acetone) are stored and scattered throughout the S-Line. A considerable amount of scrap wood, trash, and paper debris, litters the building as well.

  Recommendation: Remove cleaning supplies and/or flammable chemicals from the operations and storage areas of the S-Line. Store this type material in a secure location, separate from explosives storage or operating area. Perform general housekeeping by removing scrap wood, trash, and combustible packing materials.

  Reference: DA Pam 385-64, paragraph 2-7: *Ammunition AE storage, handling and operating facilities and area (AE facilities) will be maintained free of debris and rubbish, particularly the accumulation of oily rags or other material subject to spontaneous ignition. Paragraph 17-10 (3) (C) Solvents.*

- **Observation**: Diesel powered forklifts are being used in operational areas where M6 propellant is present. The team observed sparks emitting from an engine compartment of one forklift.

  Recommendation: Discontinue use of diesel forklifts in buildings and storage magazines containing explosives. Use electric forklifts and pallet jacks in operational areas.

  Reference: DA Pam 385-64, paragraph 2-17 (6) – *When necessary for efficient operation, battery-powered MHE is permitted to be used in buildings or magazines containing AE or other hazardous materials.*

- **Observation**: Lightning protection appeared to be deficient or in disrepair. Building 1607 had been an inert warehouse. As such, lightning protection for this building may have been omitted or designed to a lesser standard.

Recommendation: Implement procedures to warn of an approaching electrical storm, discontinue explosive operations, and leave the explosive area during such storms. Upgrade the lightning protection of all explosives storage locations to comply with NFPA 780, DOD 6055.09-M and DA Pam 385-64.

Reference: As stated.

- **Observation**: Inadequate grounds keeping at S-Line increases the likelihood of a fire reaching the stored explosives within the S-Line.

  Recommendation: Maintain a 50-foot fire break around the S-Line. Remove large accumulations of combustible materials (grasses, trees, pine needles, inert storage, etc.) within the S-Line.

  Reference: DA Pam 385-64, paragraph 6-8, Fire Prevention Requirements

- **Observation**: Explosive operators were wearing gloves, but no other PPE, such as coveralls and eye protection was observed.

  Recommendation: Ensure personnel wear the proper PPE.

  References:

  - DA Pam 385-64, Chapter 2, General Safety
  - 29 CFR 1910 subpart 1- personal protective equipment.

- **Observation**: Emergency destruction of 2.5M pounds of propellant may be required at some point.

  Recommendation: Ensure the proper equipment, facilities, explosive weights, and separation distances are used in burning of propellant.

  Reference: DoD 5055.09-M, V5, Enclosure 3, Areas Used for Intentional Burns and Detonations.

- **Observation**: M6 Propellant Lot IND82E-070170 is stability category "C," indicating it is approaching a potentially hazardous stability condition. (See the below explanation for the Stability Category Codes.)

  Recommendation: Any lot found with Lot Index Number 070170 should be segregated and disposed of as soon as possible per Army Notices of Ammunition Reclassifications (NAR) 11-0967.

  Reference: Propellant management Guide, December 2003 (see table below).

PROPELLANT MANAGEMENT GUIDE DECEMBER 2003

Table 2-1 Stability Category Codes

STABILITY CATEGORY	PERCENT STABILIZER	EFFECTIVE
A	0.30 or MORE	
C	0.29 - 0.20	
D	LESS THAN 0.20	

A – Acceptable stabilizer loss. Lot is safe for storage until next required retest date.
C – Significant stabilizer loss. Lot does not represent an immediate hazard, but is approaching a potentially hazardous stability condition. This level of stabilizer loss does not adversely affect functioning in a finished round configuration.
D – Unacceptable stabilizer loss. The lot presents a potential safety hazard and is an unacceptable risk for continued storage as bulk propellant, bulk-packed components, or as separate loading propelling charges. The risk of autoignition of propellant in SC-D increases with time. Demilitarization must be completed within **60 days** of notification for bulk propellant, bulk-packed components, and separate loading propelling charges.

- **Observation**: Some M6 propellant storage boxes were not labeled with the manufacturer's propellant lot number and/or the lot number was not readable. Propellants with lost manufacturer lot identity represent a potential safety hazard.

  Recommendation: Develop a local numbering system for any propellant that is not clearly labeled with the manufacturer's lot number. Immediately test this propellant for stabilizer content. Dispose of propellant that is not stable as a first priority, and propellant without a known manufacturer lot number as a second priority. DoD guidance requires disposal within 60 days.

  Reference: Supply Bulletin 742-1, Ammunition Surveillance Procedures, paragraph 13-14, "Lost Lot Identity".

- **Observation**: None of the M6 propellant observed was in its original propellant charge cans.

  Recommendation: Do not download M6 propellant from propellant charge cans into other containers unless final disposition of the material within a year is guaranteed.

- **Observation**: Although the team did not fully investigate the propellant surveillance program being used to monitor the remaining effective stabilizer in the M6 propellant being stored or processed, it appeared that only Ammunition Peculiar Equipment 1995 Near-Infrared Spectroscopy data is being used.

  Recommendation: Develop a propellant surveillance program for the M6 propellants that incorporates recommendations made by Mr. Lewis Kansas, Energetics Materials Analysis Branch, ARDEC, Picatinny Arsenal, in his 20 December 2012 trip report.

  Reference: As stated.

- **Observation**: The preponderance of evidence indicates that the probability of an explosives event directly related to the long-term storage of M6 propellant at Minden is likely. That is: (a) anecdotal evidence indicates that the "kicker boxes" of propellant may contain multiple Lots, instead of the single Lot number indicated on the "blue" labels; (b) due to the unknown storage conditions for M6 propellant after its removal from the propellant charge cans, the propellant's stability cannot be guaranteed; and (c) the bulk packaging (white bag, fiber drum or cardboard box) is not a standard packaging method for long-term storage of M6 propellant. The use of such bulk packaging may (a) not prevent the loss of stabilizer; (b) allow moisture intrusion; and (c) increase nitro-cellulose decomposition rates. These factors, combined with nitro-cellulose's ability to auto ignite, increase the probability of a detonation within a storage structure at Camp Minden within 10 years.

  Recommendation: Aggressively pursue methods to reduce the quantities of the downloaded M6 propellant at Minden to include the use of both controlled open burning and sale. Develop a working group to study unique solutions for the disposal of large quantities of M6 propellant.

  Reference: Supply Bulletin 742-1, Ammunition Surveillance Procedures, paragraph 13-14, "Lost Lot Identity."

Enclosure

12 March 2013

The Adjutant General and Louisiana National Guard Request for Technical Assistance

DEPARTMENTS OF THE ARMY AND AIR FORCE
JOINT FORCE HEADQUARTERS-LOUISIANA
OFFICE OF THE ADJUTANT GENERAL
JACKSON BARRACKS
NEW ORLEANS, LOUISIANA 70117

NGLA-TAG 12 March 2013

MEMORANDUM FOR Assistant Secretary of the Army for Environment, ATTN: DASA-ESOH, Mr. James C. King

SUBJECT: Request for Army Technical Assessment Team

1. Request a Department of the Army Technical Assessment Team to assess stored explosives at Camp Minden, LA. Specifically, request the team conduct an assessment of the potential short and long term hazards associated with the M6 propellant and make recommendations for potential mitigation measures.

2. The M6 propellant is a hazardous material derived from the demilitarization of the M119A2 Propelling Charge by Explo Systems, Inc. ("Explo"), a tenant of the Louisiana Military Department at Camp Minden. The propellant was used in connection with an activity of the DoD as provided in 10 U.S.C. 2692 (b)(1). The excess propellant was produced by Explo under the terms and conditions of its contract with DoD (contract no. W52P1J-10-C-0025). While performing work for the DoD under its contract, Explo illegally and improperly stored large amounts of M6 propellant on the premises of Camp Minden without the knowledge or consent of the State of Louisiana. Explo's actions in this regard violate state and federal law. Explo's illegal activities were discovered by the Louisiana State Police during a routine inspection of their operations. The State of Louisiana has requested assistance from the Department of Defense for the transportation and storage of the excess M6 propellant and is currently awaiting a determination.

3. Point of contact is the undersigned at (318) 613-5313 or email glenn.h.curtis.mil@mail.mil.

Glenn H. Curtis

GLENN H. CURTIS
MG, LAARNG
The Adjutant General

LOUISIANA NATIONAL GUARD
PROTECT WHAT MATTERS

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY
INSTALLATIONS, ENERGY AND ENVIRONMENT
110 ARMY PENTAGON
WASHINGTON DC 20310-0110

20 JUN 2013

MG Glenn H. Curtis
The Adjutant General
Louisiana National Guard
6400 St. Claude Avenue
Jackson Barracks
New Orleans, LA 70117

Dear General Curtis:

Enclosed is the report from the technical assistance visit (TAV) the Army provided 7 - 9 May 2013 at the Louisiana National Guard's (LANG) Camp Minden. The Army provided this TAV as a follow-up to a TAV it had provided on 2 and 3 April 2012 in response to your request of 12 March 2013. The Commander, Camp Minden and Louisiana State Police (LASP) requested this follow-up on 1 May 2013 to assess the potential hazards associated with approximately 130,000 pounds (lbs) of Tritonal that Explo Systems, Inc. (Explo) had stored in Building 1650, and other explosives Explo has in storage at Camp Minden. The attached report provides recommendations LANG and the Louisiana State Police (LASP) may consider to improve the explosives safety posture at Camp Minden.

As requested, the Army's technical assistance team focused its assessment on the hazards associated with the handling and storage of Tritonal in Building 1650 and other explosives Explo stored at Camp Minden. The TAV team did not review Explo's personnel qualifications, operating procedures, and/or its procedures for security or accountability of explosives. LANG may want to consider evaluating these matters.

During this TAV, the TAV team:

a. Assessed the hazards associated with the handling and storage of Tritonal in Building 1650, offered to LANG a demilitarization plan for propellant and explosives generated by Explo, and recommended an approach for establishing a propellant stability program for approximately 15M lbs of M6 propellant remaining at Camp Minden for which lot identity has been lost, pending the final disposition of the M6.

b. Identified some explosives the condition of which posed a serious explosive hazard. As a result, the TAV team recommended LASP, in coordination with LANG, request follow-on technical assistance from an Army Explosive Ordnance Disposal unit. Subsequently, LASP has requested EOD's assistance in assessing the condition of these explosives and recommending to LASP courses of action for LASP to dispose of it safely.

The team that visited Camp Minden remains available to LANG to provide further advice on the Explo materials at Camp Minden. Additionally, the US Army Technical Center for Explosives Safety is a valuable resource for all Army and National Guard activities.

Explosive safety oversight of explosive operations of the nature Explo performed at Camp Minden requires expertise in explosives safety management. Should LANG continue to lease Camp Minden's facilities for operations such as those Explo conducted, I strongly recommend it consider developing this expertise within the Camp Minden staff through attendance at explosive safety training programs the Defense Ammunition Center (DAC) offers. Although some training may require attendance at the DAC, which is located on McAlester Army Ammunition Depot, McAlster, OK, DAC offers many of its course as self-paced, distance-learning courses (see http://ammo.okstate.edu). Additionally, I recommend LANG contact the National Guard Bureau's Senior Quality Assurance Specialist (Ammunition Surveillance), Mr. Clark Combs, to request any assistance it may need to address explosives safety-related matters.

My point of contact for this matter is Mr. J. C. King, Director for Munitions and Chemical Matters, and the Army's Department of Defense Explosives Safety Board Voting Member, at (703) 697-5564; james.c.king4.civ@mail.mil.

Sincerely,

HEWolfe

Hershell E. Wolfe
Deputy Assistant Secretary of the Army
(Environment, Safety and Occupational Health)

Enclosure

Department of Army

Report

of

Explosives Safety Assistance Visit
(7 to 9 May 2013)

to

Louisiana National Guard's
Camp Minden

June 13, 2013

ENCLOSURE

025092

Final Report of Explosives Safety Assistance Visit to Camp Minden (7 to 9 May 2013)

1. Background.

a. On 1 May 2013, COL Ronnie D. Stuckey, Commander, Camp Minden, Louisiana National Guard (LANG) and Lieutenant John Porter, Deputy Command Technician, LA State Police (LASP) requested the Army provide an additional technical assistance visit (TAV) to assess the potential hazards associated with approximately 130,000 pounds (lbs) of Tritonal (80 percent (%) TNT and 20% aluminum powder) stored by Explo Systems, Inc. (Explo) in building 1650 at Camp Minden, LA. LASP and LANG believed these explosives posed a potential explosive hazard to an on-post public traffic route. LASP and LANG requested the TAV also assess other explosives that Explo has in storage at Camp Minden. This was a follow-up to a TAV provided by the Army on 2 and 3 April 2013. The Army provided the report of that visit dated 18 April 2013, to The Adjutant General of the Louisiana National Guard.

b. During 7 to 9 May 2013, a team, under the direction of Mr. James Young, Headquarters, Department of the Army, G-4, conducted the requested TAV. The team consisted of:

- Mr. James Young, Quality Assurance Specialist (Ammunition Surveillance), Department of the Army, G-4
- Mr. James Lane, Defense Ammunition Center (DAC)
- Mr. Russel Ingle, DAC
- Mr. Terry Trivitt, US Army Technical Center for Explosives Safety (USATCES)
- Mr. Paul Cummins, USATCES

2. Executive Summary.

a. As requested, this TAV team assessed the hazards associated with the handling and storage of Tritonal in building 1650, offered to the LANG a demilitarization plan for propellant and explosives generated by Explo, and recommended an approach for establishing a propellant stability program for approximately 15M lbs of M6 propellant remaining at Camp Minden for which lot identity has been lost, pending the final disposition of the M6.

b. The TAV team observed additional explosives that Explo had in storage beyond the M6 propellant addressed by the initial TAV, which was conducted 2 and 3 April 2013, and the Tritonal in building 1650. The Tritonal in building 1650 was the primary subject of this TAV. Recommendations to address the potential explosive hazards associated with these additional observations are made below. The total quantity of Explo explosive material the TAV team observed at Camp Minden included:

- 128 lbs of Black Powder
- 200 lbs of Composition H6

- 4 50-gallon drums of Ammonium perchlorate
- 2 50-gallon drums and 150-lb boxes Explosive D (ammonium picrate)
- 109,000 lbs of M30 Propellant
- 320,000 lbs of Clean Burning Incendiary (CBI)
- 661,000 lbs of Nitrocellulose
- 1.817M lbs of Tritonal, mixed with tar
- 15M lbs of M6 propellant

c. The recommendations from both the initial TAV (conducted 2 and 3 April 2013), which focused on the explosive safety hazards posed by approximately 18M lbs of M6 propellant, and this TAV were offered to LASP and LANG for consideration for reducing the potential explosive hazards posed to the public by Explo's operations. On 20 May 2013, the Commander, Camp Minden informed the Army that effective 1200 hrs, on 20 May 2013, Explo-related public safety issues had been resolved, and LASP had revoked Explo's explosive license pending resolution of criminal charges.

Observations and Recommendations

Building 1650

Observation: The only building on Camp Minden's S-line that continues to store Explo's explosives is building 1650. This is a metal structure containing approximately 130,000 lbs of Tritonal (80% TNT and 20% aluminum powder, with some tar contamination). The Tritonal in this building is contained in palletized, cardboard boxes. The explosives safety quantity distance arcs from this building extend over 3rd Avenue, which is an on-post road that is used as a local school bus route; therefore, it is considered a public traffic route. LASP and LANG consider this a public safety issue. The TAV team agreed this public exposure poses a potential catastrophic risk that should be addressed.

Recommendation: The TAV team believes, based on its observations and the condition of this Tritonal, that this Tritonal is safe to handle, transport, and store in its current configuration on post. However, some boxes may need to be re-palletized. The TAV surveyed 20 earth-covered magazines during the course of its review and identified storage space appropriate for the Tritonal currently in building 1650. The TAV team recommends the Tritonal be re-warehoused to the earth-covered magazines identified, as soon as possible. Once this is accomplished, the potential explosives safety hazards on the S-Line in building 1650, which are of concern to the LASP and LANG, will be eliminated. This will be a significant accomplishment to reduce public risk.

Disposition of M6 Propellant and other Explosives

Observation: The TAV team surveyed an area for burning explosives (potential burning ground), primarily the M6 propellant. This area, which is next to Camp Minden's E-Line, could be used for open burning (treatment) of propellants (Hazard Classification {HC} 1.3) and potentially for explosives (e.g., Tritonal), which are HC 1.1, and explosive-contaminated material (e.g., red water). (See Figure 1.)

Recommendation: The TAV team recommends (a) vegetation be cleared in and around the potential burning grounds; (b) access to areas to be used for burn pans, staging and explosives handling, and to the storage area for support material and equipment be improved; (c) crushed rock be added throughout the burning grounds; and (d) a personnel operating structure be sited outside of K-24 for the crew's use during burns. The TAV team also recommends consideration be given to installing barrier material to minimize potential environmental contamination due to residues from treatment of propellant and other materials. Applicable environmental requirements under federal, state and local laws pertaining to waste storage, treatment, and disposal operations involving burning, including permitting, which are not otherwise discussed in this report, should be

025095

addressed by the LANG. The burning grounds may be sited to accommodate 10 burn pans, each capable of holding up to 4,000 pounds of propellant per burn. Assuming LANG could conduct 2 burns of up to 80,000 lbs per day, the remaining M6 propellant (approximately 15M pounds) might be destroyed in less than a year.

Propellant Burning Operations

Observation: Open burning of propellant and other explosives is an extremely hazardous operation that requires a comprehensive explosives safety management program (ESMP).

Recommendation: If LANG decides to conduct these burning operations, the TAV team recommends LANG or LASP begin planning for the equipment and support needed for this operation. To assist in planning, the TAV recommends LANG and/or LASP consider the actions listed below prior to conducting burning operations.

- Determine the ownership of the materials to be disposed, and LANG's or LASP's authority to dispose of these materials.
- Seek the assistance needed, if any, to carry out the recommended actions.
- Coordinate with environmental regulators and obtain environmental permits, if any, required by applicable federal, state, or local laws or regulations.
- Develop:
  - Burning ground site safety plan.
  - Standing Operating Procedures.
  - Qualifications and responsibilities or tasks for the personnel involved (e.g., supervisor, technical support, surveillance personnel).
  - Procedures for physical security and access control that are required to ensure worker and public safety.
  - Spill response plan.
- Fabricate burn pans and equipment required to load propellants into the burn pans.
- Clear vegetation, conduct surface improvements and any required construction.
- Establish and site an operating building for the crew's use during burning operations.
- Determine the:
  - Type of firefighting equipment needed on site, and coordinate with local medical and fire departments for contingency support.
  - Tools, Material Handling Equipment, and personnel protective equipment (PPE) required for the conduct of operations.
  - Electrical support, including grounding systems, required for safe operations.
  - Federal, state, or local regulatory requirements that may apply to closure of the burning grounds after these operations are complete.

- Plan and implement solid and hazardous waste (e.g., ash) collection, sampling and disposal procedures.

M6 Propellant Stability

Observation: Low stability content can result in auto-ignition of propellant in storage, causing a detonation. At Camp Minden, Explo's operations appear to have resulted in the loss of lot identity for the M6 propellant that Explo has in storage. Explo's packaging configurations (e.g., incorrect lot markings on containers and outer-packs, multiple markings); storage procedures, which exposed some of the packaged propellant to the environment; and packaging process, which may have mixed lots led the TAV team to conclude that lot identity was, at a minimum, questionable. Explo did not have a propellant stability monitoring program in place. Although the transfer of M6 propellant to earth-covered storage has reduced the risk to public safety, an explosive event (i.e., a detonation) from auto-ignition is very possible without a propellant stability monitoring program in place to track the propellant's stabilizer content and address potentially unstable propellant.

Recommendation: The TAV team recommends a plan for establishing a propellant stability monitoring program at Camp Minden be developed. The potential risks associated with the continued storage of propellant should be conveyed to all concerned, including commercial contractors located on Camp Minden. The TAV team also recommends LANG seek the assistance it needs, if any, to develop this plan.

Other Matters:

- **Observation:** The TAV team surveyed 20 earth-covered magazines, operating buildings, and the Super Critical Water Oxidation (SCWO) operating building. Explo reportedly was developing the SCWO under a sub-contract with General Atomics. In addition to the M6 propellant and Tritanol, Explo had in storage: Explosive D (ammonium picrate); Composition H6; black powder; M30 propellant; nitrocellulose in water (marked ATK-Radford AAA), and clean burning incendiary (CBI). Explo stored M6 propellant in 3 configurations: 880 lb sacks, 110 lb drums, and 32 lb cardboard boxes. These materials are discussed in other observations below and quantities are summarized here.

  Recommendation: Based on the condition and known hazards associated with the above mentioned explosives, the TAV team recommends disposal of this material in the order of priority indicated below. The recommended method of treatment is also provided.

  - Explosive D in drums, which may have crystallized, making it more sensitive, should be disposed of as soon as practical. (LASP has requested Army Explosive Ordnance Disposal (EOD) assistance in assessing the condition of

these explosives and recommending to LASP courses of action for LASP to dispose of it safely.) Quantity: 2 50-gal drums (1 metal, 1 plastic) and 3 50-lb boxes.
- Ammonium perchlorate, which may have crystallized, making it more sensitive, should be disposed. Quantity: 4 50-gal drums (plastic).
- SCWO influent, unknown quantity or composition. Quantity: several 16 oz bottles and a large tank.
- Black powder, nitrocellulose, in water and CBI – destroy by burning. (Quantity: 128 lbs of black powder, 661,000 lbs of nitrocellulose, and 320,000 lbs of CBI).
- M30 Propellant – destroy by burning. Quantity: 109K lbs.
- Composition M6 Propellant – commercial sales or, if necessary, destroy by burning. Quantity: 15M lbs.
- Tritonal – destroy by burning or open detonation. Quantity: 1.817M lbs.
- Composition H6 – destroy by burning or open detonation. Quantity: 200 lbs.

- **Observation:** Building 1619 contains equipment for demilitarizing 750 lb bombs including equipment for melting out explosives and flaking Composition H6. This equipment and material, which is heavily contaminated with explosives residues, includes: autoclaves, kettles, re-melter, flaker belts, pumps, piping, rails, and platforms. In addition, the building that housed this operation is heavily contaminated. Among other contamination, the TAV team observed explosive-contaminated fixtures, sprinkler systems, walls, floors, and ceilings.

  Recommendation: The TAV team recommends LANG explore the feasibility of decontaminating; disassembling, with additional decontamination, as required; and disposal of explosive-contaminated material that cannot be decontaminated. The TAV team also recommended LANG seek the assistance it needs, if any, to develop a plan for decontaminating this explosive-contaminated material.

- **Observation:** Approximately 200 lbs of Composition H6 is in building 1619 near the Composition H6 flaking operation.

  Recommendation: The TAV team recommends LANG prepare a plan for collecting and packaging the explosives left in this building and moving it to earth-covered storage.

- **Observation:** Inside building 1619 (between the 750 lb bomb demilitarization operation and Composition H6 flaker belts) is a hazardous waste storage area holding with 3, 50-pound boxes of Explosive D.

  Recommendation: These explosives are recommended to be disposed as waste in coordination with the appropriate regulatory agency. (LASP has requested Army EOD assistance in assessing the condition of these explosives and recommending to LASP courses of action for LASP to dispose of it safely.)

- **Observation:** The SCWO is not operational, but four drums of ammonium perchlorate mixed with water and two drums of ammonium picrate (Explosive D) mixed with water, which were used as feedstock for the SCWO, remain.

  Recommendation: These drums are recommended to be disposed as waste, in coordination with the appropriate regulatory agency. (LASP has requested Army EOD assistance in assessing the condition of these explosives and recommending to LASP courses of action for LASP to dispose of it safely.)

- **Observation:** There are two large effluent tanks in the SCWO building that contain unknown material. According to Explo personnel, these tanks only contain iron oxide in water, and were reportedly tested by Toxicity Characteristics Leaching Procedure (TCLP) analysis.

  Recommendation: Ownership and responsibility for SCWO-related materials should be determined by the LANG. LANG may coordinate with the owner to arrange for suitable chemical analysis and seek the material's proper disposal in compliance with applicable federal and state laws.

- **Observation:** A refrigerator in the SCWO building contains several 16oz plastic containers of test influent that was intended as input for the SCWO.

  Recommendation: LANG may coordinate with the material's owner to arrange for suitable chemical analysis and then seek the materials proper disposal in compliance with applicable federal and state laws. (LASP has requested Army EOD assistance in assessing the condition of these explosives and recommending to LASP courses of action for LASP to dispose of it safely.)

- **Observation:** A large stainless steel tank in the SCWO building contains an unknown chemical influent intended as input for the SCWO. This container potentially contains Explosive D and/or ammonium perchlorate.

  Recommendation: This container should not be moved, handled, or its contents removed until its contents are analyzed and identified, and proper disposition is determined. LANG may coordinate with the material's owner to arrange for suitable chemical analysis and proper disposal in compliance with applicable federal and state laws.

- **Observation:** The TAV team recommends that safety clearance zones near the E-line be established for the potential burning grounds.

  Recommendation: Figure 1 (below) depicts the safety clearance zones the TAV team recommends for the burning grounds. With the recommended safety clearance, the burning grounds should be able to accommodate safely 10 burn pans, each one capable of holding up to 4,000 pounds of propellant.

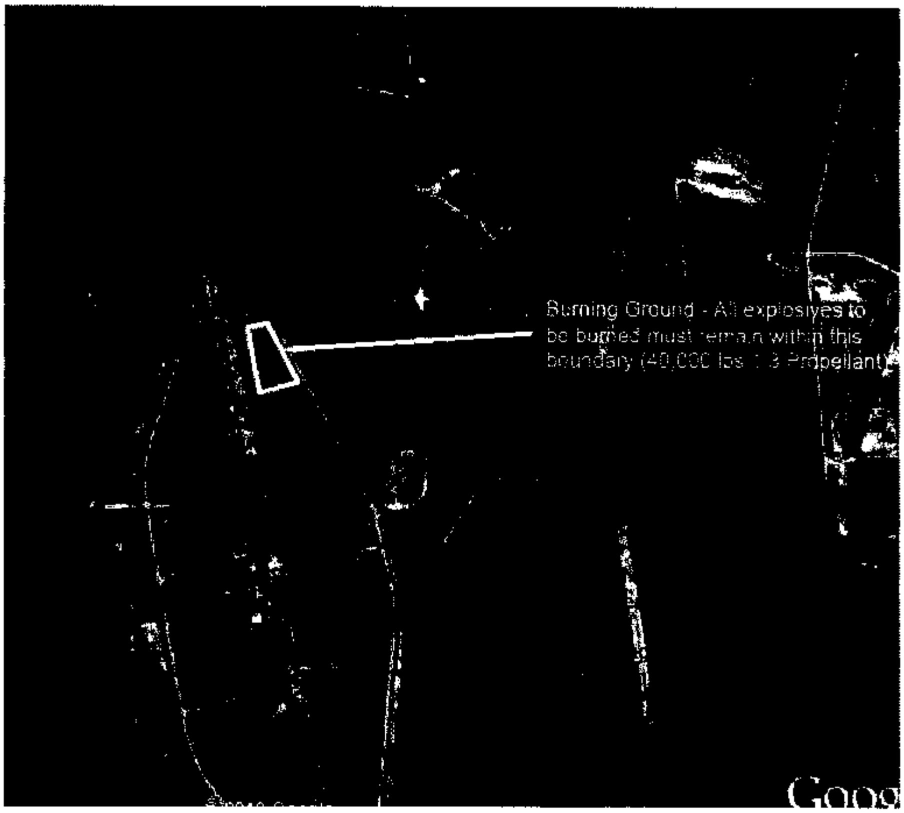


Figure 1

025100

EPA has not dictated any particular method for the disposal of the M6. Several aspects have become obvious that would rule out some options. The M6 must be disposed of quickly, before the degradation makes it unstable.

- Reuse. Reuse in the mining industry or other industries was supposedly how Explo Systems, Inc. sought to dispose of the M6. However, the blasting power of the M6 is too low to be sought after by those industries. The end product does not justify the cost of the preparation and placement of the M6, regardless of any cost of the M6.
- Off-site Disposal. The locations for off-site thermal disposal are extremely limited. The amount that can be disposed of at any time is limited as well. The cost of this option is cost prohibitive and the time it would take to dispose of it all is well beyond the time when the M6 becomes unstable. The condition of the M6 also requires a great deal of handling and repackaging.
- Decomposition treatments. There has been some work on decomposing the munitions and creating a nitrogen rich fertilizer. The technology has reached a pilot plant phase. The size of the equipment needed and the time involved to treat 15 million pounds is well beyond practical.
- On-site thermal treatment. This is the use of kilns, much like the off-site disposal method. The M6 is fed into a kiln and is incinerated. A vendor performed an onsite demonstration using a mock up. The technology associated with the kiln is in use. However, no such mobile unit exists. The vendor had visions but no equipment. For such option to be considered by EPA, the equipment must be tested, proven, and permitted. This method does not add value to open burning.
- Open burning. The open burning is the primary method used by the Army to dispose of unwanted, unsafe, or excess propellants. The M6 is laid out on trays and ignited. Specifications are listed in the Department of Defense Contractor Manual. Because the M6 is a “smokeless” powder, very little particulates or ash is formed. When burned, the M6 turns into several gases and vapors. Much more M6 can be burned in the same amount of time. A kiln does not add any value to the open burning.