Explo Systems/Camp Minden
Controlled Open Burning

On October 28, 2014, EPA signed an agreement with the Louisiana Military Department, U.S. Department of the Army, and Louisiana Department of Environmental Quality. This agreement became final on November 4, 2014, and outlined the responsibilities of the various parties and specified controlled open burning as the disposal method and required environmental monitoring and testing. Several alternative disposal approaches were considered. Due to the urgency of the situation, technology capacity/availability, and overall safety, controlled open burning in burn trays was selected as an appropriate action to reduce the likelihood of exposure and an explosion.

This selection is also in-line with the option identified by the Army's Explosive Safety Board (ESB). The Army's ESB made several trips to Camp Minden to assess the condition and hazards of the Explo material and to make recommendations to help mitigate risks. In the report dated June 13, 2013, from the Army's ESB visit on May 7 through May 9, 2013, the ESB identified the concern regarding the stability of the M-6 and made a recommendation regarding disposition of the M-6 along with an outline of propellant burning operations.

Open burning is a common disposal method for energetic waste such as propellant. According to the Federal Remediation Technologies Roundtable – *Remediation Technologies Screening Matrix and Reference Guide, Version 4*, open burn operations are conducted to destroy unserviceable, unstable, or unusable explosive materials. In addition, 40 CFR 265.382 states that Open burning of hazardous waste is prohibited except for the open burning and detonation of waste explosives. Waste explosives include waste which has the potential to detonate and bulk military propellants which cannot be safely disposed of through other modes of treatment. There are standard practices on how to manage these burning operations. One manual is the DOD 4145.26-M Contractor's Safety Manual for Ammunition and Explosives. This manual is referenced in the Louisiana Military Department's Request for Proposal for open burning at Camp Minden.

The largest amount of material remaining to be disposed of at Camp Minden is M-6 propellant. M-6 is composed mainly (87%) of nitrocellulose which is a flammable solid. M-6 also contains 10% dinitrotoluene which is used in the production of explosives as a gelatinizing and waterproofing agent. The remaining 3% is mainly dibutyl phthalate which is typically used to help make plastics soft with a small fraction of diphenylamine. M-6 burns at over 5000 degree Fahrenheit and results in small amounts residual material remaining in the burn pan along with the air emissions released from the burn. Camp Minden is a large facility and is almost 15,000 acres. This provides for a buffer and additional safety between the burn area and the facility boundary which is over 1 mile away.

The controlled burning will be conducted in burn trays on a pad constructed in the burn area. The residue in the pans will be collected, tested and disposed of appropriately based on the results. The volume of post burn residual is expected to be significantly less that the original volume of material. The burn trays and pad are expected to mitigate the potential for soil and groundwater contamination. As an added protection, the area will be sampled both pre and post operation.

To evaluate air emissions from the controlled burning, total emissions from the proposed open burning activities were calculated and associated air modeling was conducted. Emissions calculations relied on emission factors developed from opening burning experiments. The Army has conducted numerous open burning emission tests within a chamber (i.e., BangBox) for Military Services. Results from these tests have been compiled and validated in *Emission Factors for the Disposal of Energetic Materials by Open Burning and Open Detonation (OB/OD)*)EPA August 1998). While the range of materials evaluated for this document did not include M-6, the conclusion that "Based on their review of the test results, the U.S. Army concluded that the emission factors derived from the BangBox tests were: (1) more reliable and reproducible that those from the field tests; (2) were statistically equivalent to those determined from the field tests; and (3) supported the original assumption that the detonations and burns were producing emission products consistent with detonation theory." Therefore, the use of proven emission factors is a viable approach in determining the air emissions.

EPA Region 6 used the Open Burn/Open Detonation Dispersion Model (OBODM) developed by the Army West Desert Test Center to predict the concentrations of emitted constituents resulting from the proposed open burning. Because specific operating conditions for the proposed open burning are not known at this time, the following worst case operating scenario was assumed:

- All emissions from a single 10 ft X 25 ft burn tray (while multiple trays will be used in actual operations, utilizing a single source point concentrates the emissions for a worst case picture)
- Maximum Hourly Burn Rate of 22,000 pounds per hour
- Maximum Daily Burn Rate of 80,000 pounds per day
- Maximum Annual Burn Rate of 15,000,000 pounds per year

Using these worst case parameters along with site specific conditions, the results of the model indicated that all concentrations would be well below the associated ambient air standards. The Model Predicted versus Associated Standards table is attached. As you can see in the table, dinitrotoluene concentrations are at levels far below the Louisiana Department of Environmental Quality Ambient Air Standard for dinitrotoluene. In addition, EPA calculated the cumulative weight of emissions from the burning of all 15 million pounds of M-6. Less than 250 pounds of non-methane hydrocarbons are expected to be emitted from the burning of the M-6 propellant even though M-6 contains roughly 10% dinitrotoluene. The quantities of carbon monoxide, nitrogen dioxide and carbon dioxide will not pose an air pollution risk.

Dibutyl phthalate, one constituent in M-6, did not have an established emission factor. It is expected that any dibutyl phthalate emissions would be part of the particulate matter emissions. To assume a worst case possibility, it is assumed that 100% of the particulate matter 2.5 emissions is dibutyl phthalate which would calculate at 38.34 micrograms per cubic meter for an 8 hour average. If it is assumed that 100% of the particulate matter 10 emissions is dibutyl phthalate, it would calculate at 123.5 micrograms per cubic meter for an 8 hour average. The LDEQ Ambient Air Standard for dibutyl phthalate is 119 micrograms per cubic meter for an 8 hour average. There are no operational conditions where by 100% of the particulate matter will be dibutyl phthalate. Therefore, it is impracticable that the state standard will be exceeded. However, the worst case potential emissions can be reduced by lowering the burn rate per day.

The final constituent is diphenylamine. It is 1% or less of the M-6 material and is added to keep the nitrocellulose from reacting with itself and creating enough heat to auto ignite. The diphenylamine is depleting with age and the M-6 is becoming less stable. Louisiana did not have a standard for this constituent so we compared it to Texas Commission on Environmental Quality 1 hour Effects Screening Level. The attached table shows that the diphenylamine emissions are several orders of magnitude below the effects screening level.