

Camp Minden Air Modeling Summary

Background

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. Because burning of M-6 will cause air pollution, the potential impact (what, where and how) needs to be determined.

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 about 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.

Air Dispersion Modeling

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. According to the ARMY ARMAMENT, MUNITIONS AND CHEMICAL COMMAND FINAL REPORT - DEVELOPMENT OF A METHODOLOGY AND TECHNOLOGY FOR IDENTIFYING AND QUANTIFYING EMISSION PRODUCTS FROM OPEN BURNING AND OPEN DETONATION THERMAL TREATMENT METHODS. I FIELD TEST SERIES A, B, AND C * VOLUME 2, PART A QUALITY ASSURANCE AND QUALITY CONTROL, JANUARY 1992 DSN: 793-3980/551 Commercial: 309-782-3980/5534, "The BangBox Test involved the detonation of 0.5-lb amounts of trinitrotoluene (TNT) and the burning of 1-lb amounts of propellants in an air chamber (approximately 1000 cubic meters). By suspending the TNT charges above metal plates and by burning the propellant in metal pans, no soil was introduced into the resulting cloud of emission products. This test was designed to evaluate the various chemical and physical measurement systems that were being considered for use aboard the sampling aircraft in the field tests and to validate the carbon balance method of estimating emission factors (EF) for

selected combustion products of detonation/burning.” 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 than 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.” Based on these Army analyses, the use of proven emission factors is a viable approach in determining the air emissions.

In an emergency situation where definitive studies may not be on point, the best available information must be used. At Camp Minden, the deterioration of the M-6 and the resulting threat of potential explosions required that the EPA 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. Additionally, the first priority of EPA’s work is the protection of the public and the environment. The predictive modelling and other work is for that purpose only. EPA develops a worst case scenario to set limits on how work can be performed safely and be protective of the public. Where actual data exists, EPA compares this to health based standards for air/soil/water to determine compliance. Where data does not exist modelling is used to approximate the levels based on the worst case. 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

The Model Predicted versus Associated Standards table is attached. 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. 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 are relatively low and equal to about 10 to 15 cars per year.

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 may be impracticable that the state standard will be exceeded. This will be addressed 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.

The controlled burning would be conducted in burn trays on a pad that is specifically designed constructed in the burn area to prevent soil and groundwater contamination. 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 than the original volume of material. As an added protection, the area will be sampled both pre and post operation.

Modelling Results vs Operational Controls

Based on the modelling results, EPA determined that several additional controls need to be in place regarding any thermal destruction.

1. Develop appropriate Contingency and Emergency Response Plans (Coordinated with state and local Emergency Planners), Site Safety Plans, and Data Quality Plans for local notification and release of data;
2. Design and deployment of ambient air monitors capable of capturing and measuring constituents of concern. Measurement of air quality needs to commence prior to any operations and continue for a period of time post operations;
3. Effective design and construction of the burn trays to assure the thorough and complete combustion of the M-6;
4. Effective design and construction of the burn area to create exclusion and buffer zones during operations;
5. Effective monitoring of the operations and inventory control to assure that only the prescribed amounts are burned;
6. Review of inventory to prioritize the burning of the M-6 based on the deterioration and risk;
7. Deploy a site team to work closely with the LMD, LDEQ and local authorities to assure that the site plans and work is implemented safely and does not impact the public;

8. Keep open the possibility that better cleaner alternatives may become available for use at Camp Minden at some future date and the operations can transition to these alternatives;
9. Hold regular meetings with concerned citizens and local officials;
10. Before full scale operations begin, conduct a series of small scale operational tests to assess the effectiveness of the plans and operational guides that are approved. These small scale tests should be thorough documented (process and environmental monitoring) and the results provided to the local officials and the public;
11. Upon completion of the operational tests, the full scale operations should begin to transition in a gradual manner. This transition period will allow time for testing and proving the monitoring concepts and assuring that any operational issues are resolved before full scale operations.
12. EPA, and LMD will reserve the right to stop any unsafe practices as well as cease or suspend operations if data indicates that the public might become impacted. Operations will not resume until all issues are resolved.

These Operational controls are not intended to be exhaustive, but rather highlight some key measures to measures that public is protected.

The following excerpt is taken from EPA Subpart X Guidance: Information Requirements:

3.4.2.1 Air Emissions

OB/OD thermal treatment methods are currently the primary means of demilitarization employed by DoD for the disposal of energetic materials. To meet the need for identification and quantification of emissions from these treatment methods, DoD instituted a comprehensive test program commonly referred to as the "BangBox" study. The primary objective of the program was to provide waste characterization data for subpart X permit applications. The program consisted of two test phases: the controlled chamber (BangBox) test phase and the full-scale field-test phase.

In 1988, a DoD technical steering committee developed a list of volatile and semivolatile organic compounds and metals that are potential contaminants of either soil or atmosphere from OB/OD processes. Between 1988 and 1989, chamber (BangBox) tests were conducted at Sandia National Laboratories to examine instrumentation, technology, methodology, and analytical procedures that were proposed for follow-on field tests. The field tests were required to obtain data to validate the technology and methodology for characterizing full scale OB/OD operations and establishing correlations between small-scale, controlled testing and full-scale operations. Representatives of EPA provided technical guidance and quality assurance and quality control support during all phases of planning and execution of the tests. EPA also reviewed data collection and analytical procedures throughout the program.

The BangBox tests evaluated emission factors (EF) from the open detonation of TNT, and the open burning of a double-based and a composite propellant. TNT was selected as a worst-case

example because it is the most oxygen-deficient explosive and therefore the one most dependent on environmental oxygen. The carbon balancing method was used to calculate EFs because total volumes of clouds and total concentrations of products over the entire "volume" do not need to be known and only "grab samples" taken within the cloud by sampling aircraft were necessary. Supercritical-fluid chromatography and gas chromatography techniques were used to test for semivolatile organic combustion products. The BangBox tests confirmed the technologies, methodologies, and analytical procedures employed. The study also provided information about airborne particulate materials and polychlorinated dibenzodioxins (PCDD) and dibenzofurans (PRCF).

Emissions and residues from single-base, double-base, and composite propellants and from TNT, Explosive D, RDX, and Composition B were characterized during field tests conducted at Dugway Proving Grounds between 1989 and 1990. For these field tests, sampling instruments placed on a fixed-wing aircraft flying through OB and OD-generated plumes were used. Comparable EFs were found during the BangBox testing and the field testing of TNT. Other similarities among EFs, combustion products, and concentration levels resulting from the OD of TNT, Composition B, Explosive D, and RDX also were observed. The relationships indicated that small-scale, chamber-type OD tests may be sufficient to provide the data needed to characterize large-scale field OD treatment operations and improve current OB/OD models.