

4.3.2.1 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

The results of the BangBox tests and the development of the validated database are described in [Emissions Factors for the Disposal of Energetic Materials by Open Burning and Open Detonation \(EPA/600/R-98/103\)](#). The emission factors for burns and detonations are contained in Appendices D and E, respectively.

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.

Emissions from other types of thermal treatment units can be characterized using methodologies used for combustion devices. If emissions are vented, then stack testing methods can be used to determine emissions. Stack testing methods are available in the SW-846 Compendium and discussed in Appendix B of the Risk Burn Guidance for Hazardous Waste Combustion Facilities available at <http://www.epa.gov/epaoswer/hazwaste/combust.htm>. If emissions are released from process or process equipment, the emission factors presented in EPA's AP-42 can be considered. Speciality software is also available for some equipment and processes.

Information on [estimating emissions](#) is also available at EPA's CHIEF website.