BACKGROUND DOCUMENT

REPORT ON REVISIONS TO 5TH EDITION AP-42 CHAPTER 15 - ORDNANCE DETONATION

EMISSION FACTORS DEVELOPED BASED ON PHASE IV-A TESTING CONDUCTED AT DUGWAY PROVING GROUND, UTAH

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NOTICE

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1.0 INTRODUCTION

Due to the lack of credible data concerning emissions from training ordnance when used in their tactical configurations, the U.S. Army Environmental Command (USAEC) established a program to quantify emissions from the detonation of ordnance. This document presents background information concerning the development of air emission factors for four ordnance types used during training exercises at U.S. Army installations. The air emission factors were developed from test data collected by USAEC. Ordnance for which emission factors have been developed and their corresponding AP-42 sections are identified in Table 1. To help readers easily find those emission factors of interest, the ordnance are organized according to their Department of Defense Identification Code (DODIC).

TABLE 1 ORDNANCE FOR WHICH EMISSION FACTORS WERE DEVELOPED

DODIC	Ordnance Description	AP-42 Section
M031	½-Pound Demolition Block Charge	15.9.3
M456	PETN Type 1 Detonating Cord	15.9.15
ML09	Linear Shaped Demolition Charge, 20 gr/ft	15.9.29
ML15	Linear Shaped Demolition Charge, 225 gr/ft	15.9.30

The emission factors described in this document are based on data obtained during testing conducted at Dugway Proving Ground, Utah, as presented in the final test report titled *Sampling Results for AEC Phase IV-A Exploding Ordnance Emission Characterization*[1] and the document titled *Detailed Test Plan for Phase IV-A Emission Characterization.*[2] These documents were supplemented by additional data provided by the testing contractor.[3] For each ordnance, two test runs were conducted. One item was detonated per test run for DODIC M031. Seventy linear feet, 168 linear feet, and 15 linear feet of DODICs M456, ML09, and ML15, respectively, were detonated per test run. Source test protocols were developed by USAEC before any testing was conducted and were reviewed by the U.S. Environmental Protection Agency's (EPA's) Emission Measurement Center. The tests were conducted between June 4 and 7, 2001.

The compounds that were measured included carbon monoxide (CO), carbon dioxide (CO_2), oxides of nitrogen (NO_x), sulfur dioxide (SO_2), total suspended particulate (TSP), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM-10), particulate matter with an aerodynamic diameter less than or equal to 2.5 microns (PM-2.5), metals, hydrogen chloride (HCl), chlorine (Cl_2), ammonia (NH_3), volatile organic compounds (VOC), semivolatile organic compounds (SVOC), formaldehyde, hydrogen cyanide, energetics, dioxins/furans (PCDD/PCDF), and sulfur hexafluoride (SF_6). Within each of the AP-42 sections, only emission factors for criteria pollutants, carbon dioxide, hazardous air pollutants (as defined by §112(b)(1) of the *Clean Air Act* [CAA]), and toxic chemicals (as defined by §313 of the *Emergency Planning and Community Right-to-Know Act* [EPCRA]) are presented.

The emission factors were developed on a "per item" basis and on a "per net explosive weight (NEW)" basis. Users should choose the appropriate emission factor to estimate emissions based upon the data available; either factor is equally valid. The NEW of each ordnance tested is provided in the corresponding AP-42 section and in Table 2.

This document includes five sections in addition to this Introduction. Section 2 of this document identifies the compounds measured during the test program and describes the emission measurement methods used. Section 3 includes a discussion of the emission factor final test report and ratings for the

TABLE 2 ORDNANCE NET EXPLOSIVE WEIGHT

DODIC	Ordnance Description	NEW (lb/item)[a,b]
M031	½-Pound Demolition Block Charge	4.90 E-01
M456	PETN Type 1 Detonating Cord	2.20 E-02[c]
ML09	Linear Shaped Demolition Charge, 20 gr/ft	2.86 E-03[d]
ML15	Linear Shaped Demolition Charge, 225 gr/ft	3.21 E-02[e]

[a] NEW values were obtained from References 1, 2, and 3.
[b] An M6 blasting cap was used to initiate each of the ordnance as would be used when the ordnance is tactically detonated. Each M6 blasting cap has an NEW of 2.93 E-03 pounds.
[c] The NEW for this ordnance is 2.20 E-03 pounds per linear foot of detonating cord. The complete ordnance includes 1,000 linear feet of charge and has an NEW of 22.0 pounds. During testing, a 70 linear foot section of charge was used with an NEW of 1.54 pounds.
[d] The NEW for this ordnance is 2.86 E-03 pounds per linear foot of demolition charge. The complete ordnance includes 4 linear feet of charge and has an NEW of 1.14 E-02 pounds. During testing, a 168 linear foot section of charge was used with an NEW of 4.80 E-01 pounds.
[e] The NEW for this ordnance is 3.21 E-02 pounds per linear foot of demolition charge. The complete ordnance includes 4 linear feet of charge and has an NEW of 1.28 E-01 pounds. During testing, a 15 linear foot section of charge was used with an NEW of 4.82 E-01 pounds.

test data contained therein. Section 4 describes the calculations and methodologies used to develop emission factors for each type of compound measured. Section 5 describes the methodology used to rate the emission factors and provides emission factor ratings for each type of compound measured. Section 6 includes a complete list of the references cited in this document.

There are two appendices included with this document. Appendix A identifies, by ordnance type, all of the compounds for which analyses were performed and the emission factors that were developed. [Note: Compounds present in the method blank at greater than 50 percent of test levels are excluded from Appendix A as described in Section 3.2.4.] Appendix A also identifies the minimum detection levels associated with all compounds that were not detected. Emission factors and minimum detection levels presented in Appendix A were determined from the most accurate method if two sampling or analytical methods were used to measure one compound. Appendix B presents the new AP-42 sections for the four ordnance that were tested.

In addition to this document, there are electronic databases available on the web (http://www.epa.gov/ttn/chief/ap42/index.html) that contain the data used in the development of the emission factors. The general procedures that were followed to develop these emission factors can be found at the same web address under the title *Procedures for Preparing Emission Factor Documents*.[4]

2.0 COMPOUNDS MEASURED AND EMISSION MEASUREMENT METHODS

The USAEC Phase IV-A series testing was conducted in a thermal treatment characterization facility known as the BangBox™ Test Chamber located at Dugway Proving Ground, Utah. The BangBox is a 50-foot diameter hemispheric dome with a total volume of 1,000 cubic meters. It is constructed of polyvinyl-chloride-coated polyester fabric anchored to a concrete pad. The structure is kept rigid by a constant injection of fresh air and a semi-rigid air lock. During sampling, fans inside the BangBox kept the gases and particles mixed while samplers located inside the chamber or connected to the chamber by

short probes measured the contaminants. Real-time analyzers were electronically connected to a data recorder. In addition to the samplers and fans, the BangBox contained a shrapnel shield, an automatically regulated inflation blower, and environmental control equipment.

A number of different test methods were employed to collect and analyze the emissions data that were used to develop emission factors for detonation of ordnance. Table 3 identifies each emission test method used; bracketed information identifies the purpose of using the method. The emissions data were collected using EPA test methods published in Title 40 of the Code of Federal Regulations, Part 50 (40 CFR 50); 40 CFR 60; and in *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*.[5] Some of the sample analytical procedures used were from EPA Office of Solid Waste (OSW) publication SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*.[6] Where necessary, the test methods were adapted to reflect application to the unique testing of ordnance detonation in the BangBox.

TABLE 3 SAMPLING AND ANALYTICAL METHODS USED

Compound	Test Method
CO	40 CFR 60, Appendix A, EPA Method 10 - *Determination of Carbon Monoxide Emissions from Stationary Sources* [sampling and analysis]
CO_2	40 CFR 60, Appendix A, EPA Method 3A - *Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)* [sampling and analysis]
NO_X	40 CFR 60, Appendix A, EPA Method 7E - *Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)* [sampling and analysis]
SO_2	40 CFR 60, Appendix A, EPA Method 6C - *Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)* [sampling and analysis]
TSP	40 CFR 50, Appendix B - *Reference Method for the Determination of Suspended Particulate Matter as in the Atmosphere (High Volume Method)* [sampling and analysis]
PM-10	40 CFR 50, Appendix J - *Reference Method for the Determination of Particulate Matter as PM-10 in the Atmosphere* [sampling and analysis]
	EPA Compendium Method IO-2.2 - *Sampling of Ambient Air for PM_{10} Using an Andersen Dichotomous Sampler* [sampling and analysis]
PM-2.5	EPA Compendium Method IO-2.2 - *Sampling of Ambient Air for PM_{10} Using an Andersen Dichotomous Sampler* [sampling and analysis]
	Tapered Element Oscillating Microbalance (TEOM) [sampling and analysis]
Metals	Metal sample was obtained from TSP sample [sampling]
	40 CFR 60, Appendix A, EPA Method 29 - *Determination of Metals Emissions from Stationary Sources* [analysis]
	SW-846 Method 6010A - *Inductively Coupled Plasma-Atomic Emission Spectrometry* [analysis for metals except mercury]
	SW-846 Method 7470 - *Mercury in Liquid Waste (Manual Cold-Vapor Technique)* [analysis mercury]

TABLE 3 (cont.)

Compound	Test Method
HCl, CL_2, and NH_3	40 CFR 60, Appendix A, EPA Method 26 - *Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources (Non-Isokinetic Method)* [sampling]
	SW-846 Method 9057 - *Determination of Chloride from HCl/Cl_2 Emission Sampling Train (Methods 0050 and 0051) by Anion Chromatography* [analysis]
VOC	EPA Compendium Method TO-12 - *Method for the Determination of Non-Methane Organic Compounds (NMOC) in Ambient Air Using Cryogenic Preconcentration and Direct Flame Ionization Detection (FID)* [sampling and analysis]
Speciated VOC	EPA Compendium Method TO-14 - *Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatographic Analysis* [sampling and analysis]
SVOC	EPA Compendium Method TO-13 - *Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air Using Gas Chromatography/Mass Spectrometry (GC/MS)* [sampling]
	SW-846 Method 8270 - *Semivolatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS)* [analysis]
Dioxins and Furans	EPA Compendium Method TO-9 - *Determination of Polychlorinated, Polybrominated, and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air* [sampling]
	SW-846 Method 8290 - *Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS)* [analysis]
Formaldehyde	EPA Compendium Method TO-11A - *Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)* [sampling and analysis]
Hydrogen Cyanide	EPA Conditional Test Method 033 - *Sampling and Analysis for Hydrogen Cyanide Emissions from Stationary Sources* [sampling and analysis]
Energetic Materials	EPA Compendium Method TO-13 - *Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air Using Gas Chromatography/Mass Spectrometry (GC/MS)* [sampling]
	SW-846 Method 8095 - *Explosives by Gas Chromatography* [analysis]
Tracer Compound (SF_6)	Grab sample [sampling]
	Gas Chromatograph/Electron Capture Detector [analysis]

The following sections identify and briefly describe the test methods used to measure each compound or group of compounds. Additional information regarding the operation of the BangBox and the test methods used is presented in Reference 1. EPA-approved methods were used by the laboratories that provided sampling and analysis data.

2.1 Carbon Monoxide, Carbon Dioxide, Oxides of Nitrogen, and Sulfur Dioxide

Real-time concentrations of CO, CO_2, NO_x, and SO_2 that resulted from the use of ordnance in the BangBox were measured using a continuous emissions measurement system (CEMS). CO sampling and analysis was conducted in accordance with 40 CFR Part 60, Appendix A, Method 10 - *Determination of Carbon Monoxide Emissions from Stationary Sources*. CO_2 sampling and analysis was conducted in accordance with 40 CFR Part 60, Appendix A, Method 3A - *Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources*. NO_x sampling and analysis was conducted in accordance with 40 CFR Part 60, Appendix A, Method 7E - *Determination of Nitrogen Oxides Emissions from Stationary Sources*. SO_2 sampling and analysis was conducted in accordance with 40 CFR Part 60, Appendix A, Method 6C- *Determination of Sulfur Dioxide Emissions from Stationary Sources*. For each run, the target minimum sampling time was 30 minutes.

2.2 Total Suspended Particulate

The TSP concentration that resulted from the use of ordnance in the BangBox was determined using a high-volume sampling and analysis procedure based on 40 CFR 50, Appendix B – *Reference Method for the Determination of Suspended Particulate Matter as in the Atmosphere (High-Volume Method)*. During each run, duplicate samples were obtained using two high-volume samplers operating simultaneously. Each sampler was equipped with a quartz-fiber filter that was weighed before and after sampling. For each run, the target minimum sampling time was 20 minutes. The sampling rate was recorded continuously using a computerized data acquisition system (DAS). The TSP concentration was computed by dividing the mass of TSP collected by the volume of air sampled, corrected to standard conditions.

2.3 Particulate Matter with an Aerodynamic Diameter Less than or Equal to 10 Microns

The PM-10 concentration that resulted from the use of ordnance in the BangBox was determined using two different sampling and analysis procedures. A high-volume sampler was used to obtain a sample for each run in accordance with 40 CFR 50, Appendix J - *Reference Method for the Determination of Particulate Matter as PM-10 in the Atmosphere*. The sampler was equipped with a quartz-fiber filter that was weighed before and after sampling. For each run, the target minimum sampling time was 20 minutes. The sampling rate was recorded continuously using a computerized DAS. The PM-10 concentration was computed by dividing the mass of PM-10 collected by the volume of air sampled, corrected to standard conditions.

A dichotomous sampler was also used to sample and analyze for PM-10 in accordance with EPA Compendium Method IO-2.2 - *Sampling of Ambient Air for PM_{10} Using an Andersen Dichotomous Sampler*. The sample stream initially passed through an impactor that removed particles larger than PM-10. The remaining particles were mechanically separated into fractions larger and smaller than PM-2.5 and were collected on two separate filters. The PM-10 concentration was computed by dividing the mass of particles collected on both filters by the total volume of air sampled, corrected to standard conditions.

2.4 Particulate Matter with an Aerodynamic Diameter Less than or Equal to 2.5 Microns

The PM-2.5 concentration that resulted from the use of ordnance in the BangBox was determined using two different sampling and analysis procedures. A dichotomous sampler was used to sample and analyze for PM-2.5 in accordance with EPA Compendium Method IO-2.2 - *Sampling of Ambient Air for PM_{10} Using an Andersen Dichotomous Sampler*. The sample stream initially passed through an impactor that removed particles larger than PM-10. The remaining particles were mechanically separated into

fractions larger and smaller than PM-2.5 and were collected on two separate filters. The PM-2.5 concentration was computed by dividing the mass of particles collected on the PM-2.5 and smaller filter by the volume of air sampled through that filter, corrected to standard conditions.

A real-time tapered element oscillating microbalance (TEOM) analyzer was also used to measure continuous PM-2.5 concentrations. The sample stream passed through a mechanical separator at a constant flow rate to remove particles larger than 2.5 microns. Particulate matter was collected on a hydrophobic filter material which was continuously weighed during each sampling run. The PM-2.5 concentration was computed by dividing the mass of particles collected by the volume of air sampled, corrected to standard conditions.

2.5 Metals

Metal concentrations that resulted from the use of ordnance in the BangBox were determined using particulate matter from the TSP samples collected as described in Section 2.2. After the TSP total weight gain was determined in the laboratory, a portion of the TSP filter was digested with concentrated hydrogen fluoride and nitric acid per 40 CFR 60, Appendix A, Method 29 - *Determination of Metals Emissions from Stationary Sources*. The digestate was then analyzed for metals (except mercury) using inductively coupled argon plasma (ICAP) emission spectroscopy in accordance with SW-846 Method 6010A - *Inductively Coupled Plasma-Atomic Emission Spectrometry*. Mercury was determined by cold vapor atomic absorption spectroscopy (CVAAS) in accordance with SW-846 Method 7470 - *Mercury in Liquid Waste (Manual Cold-Vapor Technique)*. The concentration of each target metal was computed by dividing the mass of metal collected by the volume of air sampled, corrected to standard conditions.

2.6 Hydrochloric Acid, Chlorine, and Ammonia

Hydrochloric acid (HCl), chlorine (Cl_2), and ammonia (NH_3) concentrations that resulted from the use of ordnance in the BangBox were sampled in accordance with 40 CFR Part 60, Appendix A, Method 26 - *Determination of Hydrogen Chloride Emissions from Stationary Sources*. During each run, chamber gases were pulled through two sets of impingers in series containing dilute sulfuric acid and sodium hydoxide solutions. Collected samples were analyzed using SW-846 Method 9057 - *Determination of Chloride from HCl/Cl_2 Emission Sampling Train (Methods 0050 and 0051) by Anion Chromatography*. The concentrations of HCl, Cl_2, and NH_3 were computed by dividing the mass collected by the volume of air sampled, corrected to standard conditions. HCl was also measured by a continuous analyzer, but these results were not used for development of emission factors. For each run, the target minimum sampling time was 30 minutes.

2.7 Volatile Organic Compounds

VOC concentrations that resulted from the use of ordnance in the BangBox were determined using two methods from the *Second Supplement to Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*: (1) Method TO-12 - *Method for the Determination of Non-methane Organic Compounds in Ambient Air using Cryogenic Preconcentration and Direct Flame Ionization Detection* and (2) Method TO-14 - *Determination of Volatile Organic Compounds in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatographic Analysis*. For both procedures, air samples were collected in stainless steel 6-liter SUMMA® canisters. The minimum sampling time for each VOC canister was 10 minutes.

2.8 Semivolatile Organic Compounds

SVOC concentrations that resulted from the use of ordnance in the BangBox were determined based on procedures found in Method TO-13 - *Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air Using Gas Chromatography/Mass Spectrometry (GC/MS)*. During each run, duplicate samples were collected using two PS-1 samplers that contained special sampling inlets (i.e., aluminum sampling modules) designed to hold quartz fiber filters to collect particulate matter, followed by XAD-2 adsorbent resin cartridges for collection of vapor phase SVOCs. A 20-minute sampling time was targeted. Following sampling, the filters and resin cartridges underwent solvent extraction and the mass of SVOC collected was quantitatively determined by GC/MS analysis following procedures in SW-846 Method 8270 - *Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*. Unknown compounds, if any, were tentatively identified using computerized mass spectral matching techniques of the highest non-target "peaks."

2.9 Dioxin and Furan Compounds

Dioxin and furan compound concentrations that resulted from the use of ordnance in the BangBox were determined based on procedures found in Method TO-9 - *Determination of Polychlorinated, Polybrominated, and Brominated/Chlorinated Dibenzo-p-Dioxins and Dibenzofurans in Ambient Air*. During each run, duplicate samples were obtained using two modified PS-1 samplers. The modified samplers used standard quartz filters, but the adsorbent cartridges contained XAD-2 resin sandwiched between polyurethane foam (PUF) plugs. A minimum sampling time of 20 minutes was targeted. After sampling, the filters and adsorbent cartridges underwent extraction with the appropriate solvent(s). The mass of dioxin and furan compounds collected was quantitatively determined following SW-846 Method 8290 - *Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS)*.

2.10 Formaldehyde

Formaldehyde concentrations that resulted from the use of ordnance in the BangBox were determined using EPA Compendium Method TO-11A - *Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)*, but using modified sampling and analytical procedures. Dinitrophenylhydrazine (DNPH) laden cartridge tubes were used as a direct probe to trap the formaldehyde. A minimum sampling time of 20 minutes was targeted. The tubes were analyzed by HPLC with an ultraviolet (UV) absorption detector.

2.11 Hydrogen Cyanide

Hydrogen cyanide (HCN) concentrations that resulted from the use of ordnance in the BangBox were determined using EPA Conditional Test Method (CTM) 033 - *Sampling and Analysis for Hydrogen Cyanide Emissions from Stationary Sources*. The sample gas was drawn through a heated quartz-fiber filter and two impingers containing 0.1 normal sodium hydroxide (NaOH). A minimum sampling time of 30 minutes was targeted. The impinger solution and extracted filter were analyzed by ion chromatography.

2.12 Energetic Materials

Energetic compound concentrations that resulted from the use of ordnance in the BangBox were determined using EPA Compendium Method TO-13 - *Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Ambient Air Using Gas Chromatography/Mass Spectrometry (GC/MS)*. During each run, duplicate samples were obtained using two modified PS-1 samplers. The modified samplers

used standard quartz filters, but the adsorbent cartridges contained XAD-2 resin. A minimum sampling time of 20 minutes was targeted. After sampling, the filters and adsorbent cartridge were extracted with acetonitrile. The effluent was then analyzed following the procedures outlined in SW-846 Method 8095 - *Explosives by Gas Chromatography*.

2.13 Tracer Compound

Sulfur hexafluoride (SF_6) was used as a tracer compound during each run to estimate the amount of sample dilution that occurred as a result of ambient air entering the BangBox during the run. Grab samples were collected five times during each run using evacuated canisters. A minimum sampling time of 2 minutes was targeted for each canister. The canisters were analyzed for the tracer compound using a GC with an electron capture detector.

3.0 TEST DATA ANALYSIS AND RATING

3.1 EPA Guidance Regarding Test Data Quality Ratings

Prior to inclusion of emission factors in AP-42, the reliability of the underlying emission test data must be appraised in accordance with the rating system specified in Reference 4. Under this rating system, test data are assigned a rating from A to D, where an "A" rating is assigned to the highest quality data. The criteria used to assign a specific data quality rating are summarized below.

A Tests are performed by using an EPA reference test method, or when not applicable, a sound methodology. Tests are reported in enough detail for adequate validation and raw data are provided that can be used to duplicate the emission results presented in the report.

B Tests are performed by a generally sound methodology, but lacking enough detail for adequate validation. Data are insufficient to completely duplicate the emission result presented in the report.

C Tests are based on an unproven or new methodology, or are lacking a significant amount of background information.

D Tests are based on a generally unacceptable method, but the method may provide an order-of-magnitude value for the source.

Four specific criteria are identified in Reference 5 for consideration to assist in the assignment of a test data quality rating. These four criteria are:

1. Source operation. If the manner in which the source was operated is well documented in the report and the source was operating within typical parameters during the test, an "A" rating should be assigned. If the report stated parameters that were typical, but lacked detailed information, a "B" rating should be assigned. If there is reason to believe the operation was not typical, a "C" or "D" rating should be assigned.
2. Test methods and sampling procedures. In developing the ratings, the estimated accuracy and precision of the test method as well as the adequacy of the documentation should be considered. In general, if a current EPA reference test method, appropriate for the source, was followed, the rating should be higher ("A" or "B"). If other methods were used, an assessment should be made of their validity. If it is judged that the method was likely to be inaccurate or biased, a lower rating ("C" or "D") should be given. A complete report should indicate whether any procedures deviated from standard methods and explain any deviations. If deviations were reported, an evaluation should be made of whether these were likely to influence the test results.

3. Process information. During testing, many variations in the process can occur without warning and sometimes without being noticed. Such variations can induce wide deviations in sampling results. If a large variation between test run results cannot be explained by information contained in the site final test report or from test reports of other sources, the data are suspect and should be given a lower rating or excluded. However, it should be recognized that a process may have highly variable emissions and a lower rating may not be appropriate solely on the basis of wide deviations in sampling results.

4. Analysis and calculations. Ideally, final test reports should contain original raw data sheets and other documentation such as gas parameters (dry cubic feet per minute, oxygen percentage), calculation sheets, or example calculations describing how the calculated emission results were obtained. If there are data sheets, the nomenclature and equations used should be compared to those specified by EPA to establish equivalency. The depth of review of the calculations should be dictated by the reviewers' confidence in the ability and conscientiousness of the tester, based on such factors as consistency of results and completeness of other areas of the final test report. Reports may indicate that raw data sheets were available, but were not included. If the final test report is of high quality based on the other criteria, the quality rating should not be lowered due to a lack of data sheets.

An overall test data quality rating should be assigned based upon the ratings assigned for each of the four criteria.

3.2 Analysis of Test Data

Data included in the final test report[1] were rated in accordance with the rating system described above. Results for each of the four criteria are presented in the following sections.

3.2.1 Source Operations

The manner by which the ordnance were deployed (i.e., used) is documented in the final test report. Each of the ordnance that was tested was deployed in a manner similar to that which would occur in the field. The tests appear to have replicated typical ordnance operating parameters; consequently, the test data should be assigned an "A" rating based on this criterion.

3.2.2 Test Methods and Sampling Procedures

The test methods and sampling procedures were evaluated as being appropriate and consistent with EPA test methods or sound methodology. Except as noted below, no problems of any significance were identified; consequently, the test data should be assigned an "A" rating based on this criterion.

3.2.2.1 CEMS-Measured Data

Although summaries of the CEMS data were provided for the tests,[1] raw CEMS data were not provided for the tests or for the pre- and post-test quality control (QC) activities. Furthermore, none of the calibration gas certifications were supplied. There was no evidence of bias in the data; however, based on the issues noted above, the test data for the CEMS-measured compounds (i.e., CO, CO_2, NO_x, and SO_2) should be assigned a "B" rating based on this criterion.

3.2.2.2 Compounds Sampled or Analyzed Using More than One Test Method or Analytical Method

Twenty-nine compounds were either sampled or analyzed using two methods; these compounds are identified in Table 4. For each of these compounds, emission factors were calculated based upon the

data measured using the more appropriate test or analytical method; data measured using the less appropriate method were ignored. The more appropriate method was identified by reviewing the methods and the target compound lists associated with each method. If a specific compound appeared on the target compound list for one method but not the other, the method targeting the compound was selected. If a specific compound appeared on the target compound lists for both methods, the method judged to provide the most accurate data was selected.

TABLE 4 SELECTED SAMPLING OR ANALYTICAL METHOD FOR COMPOUNDS MEASURED USING TWO SAMPLING OR ANALYTICAL METHODS

Compound	Selected Method	Other Method Employed
PM-10	40 CFR 50, Appendix J (PM-10)	IO-2.2 (PM-10)
PM-2.5	IO-2.2 (PM-2.5)	TEOM (PM-2.5)
Acetophenone	TO-14 (VOC)	SW8720 (SVOC)
Benzene	TO-14 (VOC)	TO-12 (VOC)
1,3-Butadiene	TO-14 (VOC)	TO-12 (VOC)
1,2-Dichlorobenzene	TO-14 (VOC)	SW8720 (SVOC)
1,3-Dichlorobenzene	TO-14 (VOC)	SW8720 (SVOC)
1,4-Dichlorobenzene	TO-14 (VOC)	SW8720 (SVOC)
1,3-Dinitrobenzene[a]	SW8095 (Energetics)	SW8720 (SVOC)
2,4-Dinitrotoluene[b]	SW8095 (Energetics)	SW8720 (SVOC)
2,6-Dinitrotoluene	SW8095 (Energetics)	SW8720 (SVOC)
Ethylbenzene	TO-14 (VOC)	TO-12 (VOC)
Hexachlorobutadiene	TO-14 (VOC)	SW8720 (SVOC)
Hexachloroethane	TO-14 (VOC)	SW8720 (SVOC)
Hydrochloric acid	40 CFR 60 Method 26 (HCl)	CEMS (HCl)
2-Methylnaphthalene[c]	TO-14 (VOC)	SW8720 (SVOC)
Methyl tert-butyl ether	TO-14 (VOC)	TO-12 (VOC)
Naphthalene	SW8720 (SVOC)	TO-14 (VOC)
Nitrobenzene	TO-14 (VOC)	SW8720 (SVOC)
Styrene	TO-14 (VOC)	TO-12 (VOC)
Toluene	TO-14 (VOC)	TO-12 (VOC)
1,2,4-Trichlorobenzene	TO-14 (VOC)	SW8720 (SVOC)
1,2,4-Trimethylbenzene	TO-14 (VOC)	TO-12 (VOC)
m-Xylene, p-Xylene	TO-14 (VOC)	TO-12 (VOC)
o-Xylene	TO-14 (VOC)	TO-12 (VOC)
p-Ethyltoluene	TO-14 (VOC)	TO-12 (VOC)
d-Limonene	TO-14 (VOC)	TO-12 (VOC)

TABLE 4 (cont.)

Compound	Selected Method	Other Method Employed
1,3,5-Trimethylbenzene	TO-14 (VOC)	TO-12 (VOC)
1,3,5-Trinitrobenzene[d]	SW8095 (Energetics)	SW8720 (SVOC)

[a] For DODIC ML15, data collected from the SVOC sampling method were used to develop emission factors because this compound had a relative percent difference greater than 100 percent between energetic test samples.

[b] For DODIC M456, data collected from the SVOC sampling method were used to develop emission factors because this compound had a relative percent difference greater than 100 percent between VOC test samples.

[c] For DODIC ML09, data collected from the SVOC sampling method were used to develop emission factors because this compound had a relative percent difference greater than 100 percent between VOC test samples.

[d] For DODIC ML09, data collected from the SVOC sampling method were used to develop emission factors because this compound had a relative percent difference greater than 100 percent between energetic test samples.

For PM-10, which was sampled using 40 CFR 50, Appendix J (high volume) and the IO-2.2 (dichotomous) methods, the Appendix J sampling method was judged to be more accurate because of the larger sample volume and was selected. For PM-2.5, which was sampled using the IO-2.2 (dichotomous) method and a TEOM, the IO-22 sampling method was judged to be more accurate and was therefore selected. For hydrochloric acid, which was analyzed using CEMS and 40 CFR 60 Method 26, the Method 26 analysis was judged to be more accurate and was selected. For compounds analyzed using both the TO-12 (VOC) and TO-14 (VOC) methods, the TO-14 method analysis was judged to be more accurate and was selected. For compounds analyzed using both the SW8270 (SVOC) and TO-14 (VOC) methods, the TO-14 method analysis was judged to be more accurate and was selected. [Note: Naphthalene was analyzed using both SW8270 (SVOC) and TO-14 (VOC), but only appears on the target compound list for SW8270; therefore, this method analysis was selected.] For compounds analyzed using both the SW8270 (SVOC) and SW8095 (energetics) methods, the SW8095 method analysis was judged to be more accurate and was selected.

Occasionally, the compound measurement from the less accurate method was chosen because the compound had poor precision between test runs for the sampling method that would have been more accurate under normal circumstances. These cases are noted in the footnotes to Table 4.

3.2.2.3 Tentatively Identified Compounds

During the analysis of the SVOC data, the highest nontarget “peaks” were tentatively identified using computerized mass spectral matching techniques. Emission factors were developed for these tentatively identified compounds (TICs) if all of the following criteria were met.

1. The TIC corresponded to a unique compound (e.g., ethylbenzene). Emission factors were not developed if the TIC corresponded to a class of compounds (e.g., unknown alcohol).
2. The TIC was not identified using another analysis method that provided higher confidence data. Emission factors were developed based upon the higher confidence analysis method if such data were available.
3. The TIC was not present in the method blank. Emission factors were not developed if the TIC was found in the corresponding method blank.

The number of SVOC that were tentatively identified as unique compounds, were not identified using a higher confidence method, and were not present in the method blank varied from eight to twelve compounds per ordnance. Emission factors were developed for all of these TICs, but because of the uncertainty in the true identity of the TICs, the test data were assigned a "C" rating.

3.2.3 Process Information

Ordnance are manufactured to tight tolerances and are expected to deploy in a very repeatable fashion. Consequently, the test data should be assigned an "A" rating based upon this criterion. However, large relative percent differences (i.e., greater than 100 percent) between test runs or sample trains were noted for several compounds. Specific instances in which these differences were noted are identified in Table 5. The equation below illustrates calculation of relative percent difference:

$$relative\ percent\ difference = \frac{test\ 1\ concentration - test\ 2\ concentration}{average\ of\ test\ 1\ and\ test\ 2\ concentrations}\ x\ 100\%$$

TABLE 5 COMPOUNDS FOR WHICH LARGE RELATIVE PERCENT DIFFERENCES WERE NOTED BETWEEN TEST RUNS OR SAMPLE TRAINS

Compound	Applicable DODIC
Sulfur dioxide	M031, ML15
Total nonmethane hydrocarbons	ML15
Acenaphthene	ML09
Acetonitrile	M456
Acrylonitrile	ML15
Benzo[k]fluoranthene	M456
n-Butanol	M456
Cumene	M456, ML09
Cyclohexane	ML15
Dibenzofuran	ML09
2,4-Dichlorophenol	ML09
Dimethyl phthalate	M031, M456, ML15
bis(2-Ethylhexyl)phthalate	ML09
Freon 113	M456
n-Hexane	ML15
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	ML09
1,2,3,4,6,7,8-Heptachlorodibenzofuran	ML09
1,2,3,4,7,8,9-Heptachlorodibenzofuran	ML09
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	M031, ML09
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	M031, ML09
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	M456, ML09

TABLE 5 (cont.)

Compound	Applicable DODIC
1,2,3,4,7,8-Hexachlorodibenzofuran	ML09
1,2,3,6,7,8-Hexachlorodibenzofuran	M031, M456, ML09
1,2,3,7,8,9-Hexachlorodibenzofuran	ML09
2,3,4,6,7,8-Hexachlorodibenzofuran	M031, M456, ML09
Mercury	ML09
Methylene chloride	ML15
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	ML09
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	ML09
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ML09
1,2,3,7,8-Pentachlorodibenzofuran	ML09
2,3,4,7,8- Pentachlorodibenzofuran	ML09
Pentachlorophenol	ML09
Phenol	M031, M456, ML09
Styrene	M456
2,3,7,8-Tetrachlorodibenzo-p-dioxin	ML09
2,3,7,8-Tetrachlorodibenzofuran	M031, M456, ML09
Thallium	ML15
1,1,1-Trichloroethane	ML09
1,2,4-Trimethylbenzene	M031
Acetone	ML09, ML15
i-Butane	ML15
n-Butane	ML15
CS2	ML15
Cyanogen	ML15
Cyclopentane	ML15
n-Decane	M031
2-3-Dimethylbutane	ML15
2-4-Dimethylpentane	ML15
2,2-Dimethylpropane	M031, ML09
Ethanol	ML09
Ethyl tert-butyl ether	M031
m-Ethyltoluene	M031, M456
o-Ethyltoluene	M031, M456

TABLE 5 (cont.)

Compound	Applicable DODIC
p-Ethyltoluene	M031
Hexanal	ML15
cis-2-Hexene	ML15
trans-2-Hexene	M031
Indane	M456
Methane, nitro	M031
Methylcyclopentane	ML15
2-Methylpentane	ML15
3-Methylpentane	ML15
2-Methyl-2-pentene	M031
i-Pentane	ML15
n-Pentane	ML15
cis-2-Pentene	M456
1-Pentene	ML09
trans-2-Pentene	ML15
n-Propylbenzene	M031
2,3,4,6-Tetrachlorophenol	ML09
1,3,5-Trimethylbenzene	M031, M456
2,2,4-Trimethylhexane	ML09, ML15
2,4,4-Trimethyl-1-pentene	ML15

Due to the large relative percent differences between test runs, the test data specifically identified in Table 5 were assigned a "C" rating. The remainder of the data should be assigned an "A" rating based on this criterion.

3.2.4 Analysis and Calculations

The test report,[1] detailed test plan,[2] and analytical data supporting the test report[3] were reviewed to determine whether they contained all of the original raw data, other documentation, and example calculations. Although the test report did not contain raw field data, the data were made available upon request. The test report also lacked certain calibration data. However, the missing information was judged insufficient to result in a downgrade of the test data quality rating.

The raw data and sample calculations presented in the final test report, detailed test plan, and analytical data supporting the test report were reviewed to determine if the emission factors presented in the report could be duplicated. Where differences were found between the emission factors calculated using the Excel spreadsheets and those presented in the test report, an examination was made to determine the reason for the differences.

Several minor errors were noted in the calculation of the emission factors within the test report, particularly with respect to the incorporation of "0" values into the emission factors (see Section 4.4). The emission factors presented in AP-42 are based upon the corrected spreadsheets. Based upon the raw data, other documentation, and the Excel spreadsheet calculations, the test data should be assigned an "A" rating.

Emission factors developed for compounds present in the method blank at levels of 20 percent to 50 percent of both test values were assumed to be biased high. Silver met this criterion for DODIC M031 and was assigned a "B" rating.

When compounds were found in the method blank at levels greater than 50 percent of both test values, the data were assumed to be suspect and no emission factors were developed. Silver met this criterion for DODIC M456, and selenium met this criterion for DODICs M031, M456, and ML15.

3.3 Test Data Quality Ratings

Upon completing the analysis described in the preceding section of this document, the test data quality ratings assigned as a result of the four criteria were reviewed. This review led to a downgrading of some of the test data from an "A" rating to either a "B" rating or a "C" rating. Table 6 identifies the data quality ratings for all compounds that did not receive an "A" rating.

TABLE 6 DOWNGRADED DATA QUALITY RATINGS

Compound	Data Quality Rating	Applicable DODIC
Carbon dioxide	B	All DODICs
Carbon monoxide	B	All DODICs
Oxides of nitrogen	B	All DODICs
Sulfur dioxide	B	M456, ML09
Sulfur dioxide	C	M031, ML15
Total nonmethane hydrocarbons	C	ML15
Acenaphthene	C	ML09
Acetonitrile	C	M456
Acrylonitrile	C	ML15
Benzo[k]fluoranthene	C	M456
n-Butanol	C	M456
2-Butoxyethanol	C	M031, ML15
Cumene	C	M456, ML09
Cyclohexane	C	ML15
Dibenzofuran	C	ML09
2,4-Dichlorophenol	C	ML09
Dimethyl phthalate	C	M031, M456, ML15
bis(2-Ethylhexyl)phthalate	C	ML09

TABLE 6 (cont.)

Compound	Data Quality Rating	Applicable DODIC
Freon 113	C	M456
n-Hexane	C	ML15
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	C	ML09
1,2,3,4,6,7,8-Heptachlorodibenzofuran	C	ML09
1,2,3,4,7,8,9-Heptachlorodibenzofuran	C	ML09
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	C	M031, ML09
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	C	M031, ML09
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	C	M456, ML09
1,2,3,4,7,8-Hexachlorodibenzofuran	C	ML09
1,2,3,6,7,8-Hexachlorodibenzofuran	C	M031, M456, ML09
1,2,3,7,8,9-Hexachlorodibenzofuran	C	ML09
2,3,4,6,7,8-Hexachlorodibenzofuran	C	M031, M456, ML09
Mercury	C	ML09
Methylene chloride	C	ML15
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	C	ML09
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	C	ML09
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	C	ML09
1,2,3,7,8-Pentachlorodibenzofuran	C	ML09
2,3,4,7,8- Pentachlorodibenzofuran	C	ML09
Pentachlorophenol	C	ML09
Phenol	C	M031, M456, ML09
Silver	B	M031
Styrene	C	M456
2,3,7,8-Tetrachlorodibenzo-p-dioxin	C	ML09
2,3,7,8-Tetrachlorodibenzofuran	C	M031, M456, ML09
Thallium	C	ML15
1,1,1-Trichloroethane	C	ML09
1,2,4-Trimethylbenzene	C	M031
Acetone	C	ML09, ML15
i-Butane	C	ML15
n-Butane	C	ML15
CS2	C	ML15
m-Cyamine	C	ML15

TABLE 6 (cont.)

Compound	Data Quality Rating	Applicable DODIC
Cyanogen	C	ML15
Cyclopentane	C	ML15
Cyclopentasiloxane, decamethyl-	C	M031, ML15
n-Decane	C	M031
Dimethylbenzamide	C	ML09
2-3-Dimethylbutane	C	ML15
2-4-Dimethylpentane	C	ML15
2,2-Dimethylpropane	C	M031, ML09
Ethanol	C	ML09
4-Ethenylcyclohexane	C	ML09
2-Ethyl-1,4-dimethylbenzene	C	M456
4-Ethyl-methylester-benzoic acid	C	ML15
Ethyl tert-butyl ether	C	M031
Ethyltoluene	C	M031, M456, ML09
m-Ethyltoluene	C	M031, M456
o-Ethyltoluene	C	M031, M456
p-Ethyltoluene	C	M031
Hexadecane	C	M456
n-Hexadecanoic acid	C	M031
1-Hexadecanol	C	M456
Hexanal	C	ML15
2-Hexanol	C	M031, ML09
Hexatriacontane	C	M031
cis-2-Hexene	C	ML15
trans-2-Hexene	C	M031
4-Hydroxy-4-methyl-2-pentanone	C	ML15
Indane	C	M456
Indene	C	ML15
Isophthalaldehyde	C	M031, M456, ML09, ML15
Methane, nitro	C	M031
Methenamine	C	ML09, ML15
Methylcyclopentane	C	ML15
2-Methylpentane	C	ML15

TABLE 6 (cont.)

Compound	Data Quality Rating	Applicable DODIC
3-Methylpentane	C	ML15
4-Methyl-2-pentanol	C	ML15
2-Methyl-2-pentene	C	M031
Methylpropylbenzene	C	M456, ML15
1-Methyl-3-propylbenzene	C	M031, M456, ML15
Nonaic acid	C	M031, ML09
1-Nonene	C	ML09
i-Pentane	C	ML15
n-Pentane	C	ML15
cis-2-Pentene	C	M456
1-Pentene	C	ML09
trans-2-Pentene	C	ML15
n-Propylbenzene	C	M031
1-Propynylbenzene	C	ML09
2,3,4,6-Tetrachlorophenol	C	ML09
Tricosane	C	M031, M456
1,2,3-Trimethylbenzene	C	ML09
1,3,5-Trimethylbenzene	C	M031, M456
2,2,4-Trimethylhexane	C	ML09, ML15
2,4,4-Trimethyl-1-pentene	C	ML15

4.0 EMISSION FACTOR CALCULATIONS

The methodologies and procedures that were used to develop emission factors from the test data are described in this section. A similar approach was used to calculate emission factors for TSP, PM-10, PM-2.5, metals, HCl, Cl_2, NH_3, SVOC, dioxin/furan compounds, formaldehyde, hydrogen cyanide, and energetic materials. The calculation steps that were performed for each sampling train and each run are summarized below.

1. For compounds for which more than one test sample was obtained, analytical detection limits were incorporated into the test data.
2. The background compound concentration was calculated by dividing the mass of compound detected during the background run by the background run sample volume.
3. The test compound concentration was calculated by dividing the mass of compound detected during the test run by the test run sample volume.

4. A background-corrected concentration was calculated by subtracting the background concentration from the test concentration.
5. A dilution-corrected concentration was calculated by dividing the background-corrected concentration by the dilution correction factor.
6. The mass of compound released during the test run was calculated by multiplying the dilution-corrected concentration by the volume of the BangBox.
7. Emission factors for each sample and sampling train or test run were calculated by dividing the mass of compound released by the number of ordnance detonated during the test run or by the NEW detonated during the test run, as appropriate.
8. Average emission factors were calculated for each compound.

Because concentration data (i.e., milligrams per cubic meter [mg/m^3], parts per million by volume [ppmv], or parts per billion by volume [ppbv]) were recorded for VOC and CEMS-measured compounds, it was not necessary to calculate background and test concentrations as described in steps 2 and 3. Detection limits were applied directly to test compound concentrations of VOC and CEMS-measured compounds, as described in step 1. Where present, ppmv and ppbv values were converted to mg/m^3. Emission factors for VOC and CEMS-measured compounds were then estimated in accordance with steps 4 through 8 described above.

The following sections describe each of the eight emission factor calculation steps listed above in more detail.

4.1 Incorporation of Analytical Detection-Limits to the Test Data

In many cases, more than one test sample was obtained for a specific compound (i.e., more than one sample was obtained for a given test run or more than one test run was conducted). When multiple samples were obtained for the same compound, a comparison was made of all the sample data collected. Based upon the results of the comparison, the following adjustments were made to the test data:

1. If all of the samples indicated that a compound was “not detected,” the sample data were not adjusted.
2. If all of the samples indicated that a compound was detected, the sample data were not adjusted.
3. If one or more of the samples indicated that a compound was detected and one or more of the samples indicated that a compound was not detected, the “not detected” values were replaced with a value equal to one half of the compound’s analytical detection limit. The assumption inherent to this adjustment was that the measured presence of a compound in one or more samples was indicative of the compound’s presence in all samples. The analytical detection limits for each sample were obtained from the test data report.

4.2 Determination of Background Concentration

For TSP, PM-10, PM-2.5, metals, HCl, Cl_2, NH_3, SVOC, dioxin/furan compounds, formaldehyde, hydrogen cyanide, and energetic materials, the background compound concentration (BC) was calculated by dividing the mass of compound detected during the background run (Bkgd mass) by the background run sample volume (Bkgd V). This calculation is illustrated by the following equation:

$$BC = \frac{Bkgd\ mass}{Bkgd\ V}$$

For VOC compounds, the background run data were used directly. Background data for CEMS-measured compounds were recorded for each test run between the time the CEMS began sampling and the time of detonation. The background concentrations were assumed to equal representative values over the sampling period.

4.3 Determination of Test Compound Concentration

For TSP, PM-10, PM-2.5, metals, HCl, Cl_2, NH_3, SVOC, dioxin/furan compounds, formaldehyde, hydrogen cyanide, and energetic materials, the test compound concentration (TC) was calculated by dividing the mass of compound measured during the test run (Test mass) by the test run sample volume (Test V). This calculation is illustrated by the following equation:

$$TC = \frac{Test\ mass}{Test\ V}$$

For VOC compounds, the test run data were used directly. For CEMS-measured compounds, the test compound concentration was determined as the arithmetic mean of the test data collected from the initial steady-state point until the end of the test.

4.4 Determination of Background-Corrected Concentration

For all compounds, the calculation of the background-corrected concentration (BCC) was dependent on whether the background (BC) and test (TC) concentrations were detected and whether they were less than, equal to, or greater than one another. The procedures used to calculate the background-corrected concentration for each sampling train and compound are described below and are displayed graphically in Figure 1.

1. If the test concentration was not detected (ND), the background-corrected concentration equaled ND.
2. If the test concentration was detected and the background concentration was not detected, the background-corrected concentration equaled the test concentration.
3. If the test and background concentrations were detected and the test concentration was less than or equal to the background concentration, the background-corrected concentration equaled 0.
4. If the test and background concentrations were detected and the test concentration was greater than the background concentration, the background concentration was subtracted from the test concentration. This calculation is illustrated by the following equation:

$$BCC = TC - BC$$

4.5 Determination of Dilution-Corrected Concentration

The dilution-corrected concentration (DCC) was calculated by dividing the background-corrected concentration by the applicable dilution correction factor (DCF). This calculation is illustrated by the following equation:

$$DCC = \frac{BCC}{DCF}$$

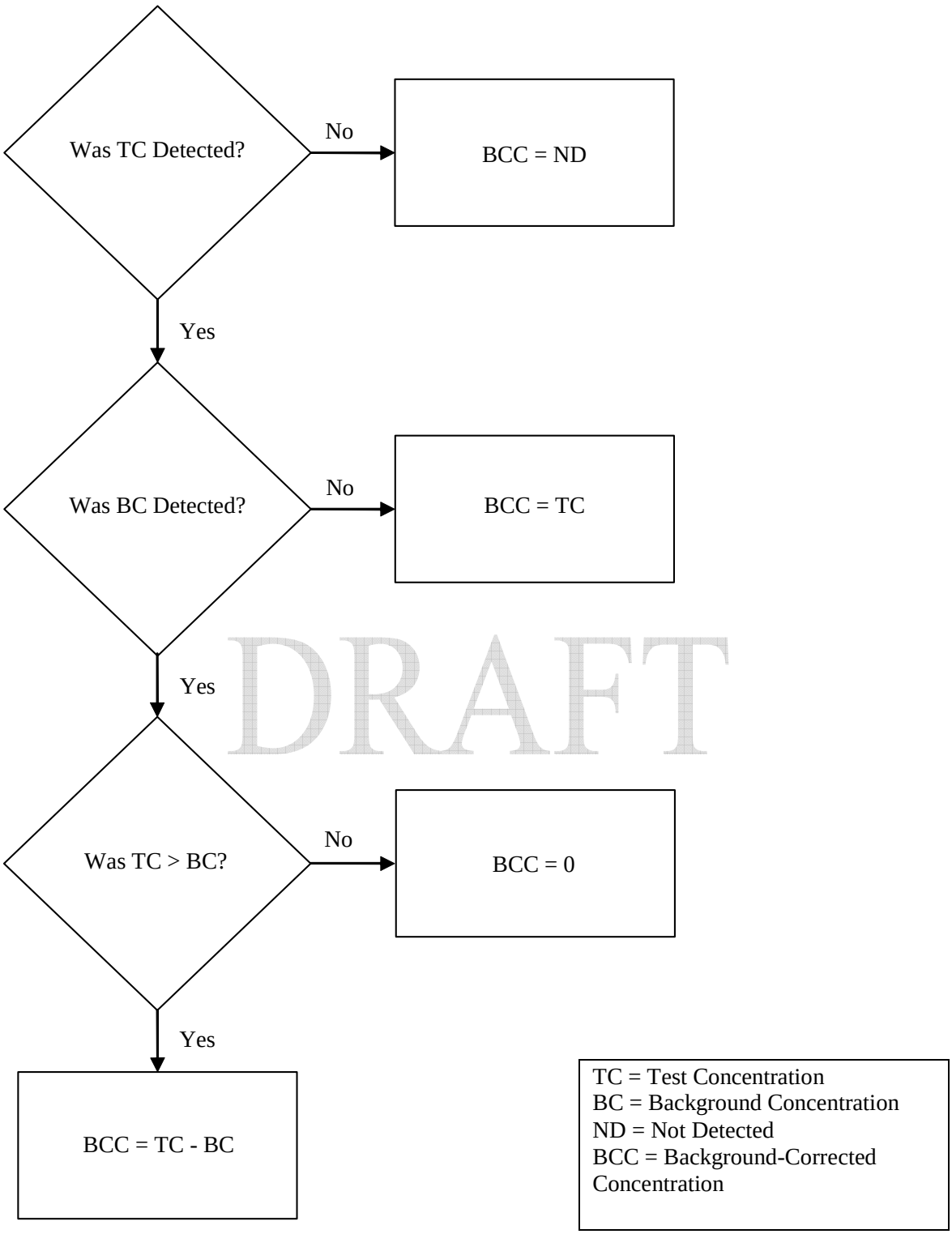

Figure 1 Calculation of background-corrected concentration (BCC).

4.6 Determination of Mass of Compound Released

The mass of compound released was calculated by multiplying the dilution-corrected concentration by the volume of the BangBox. This calculation is illustrated by the following equation:

Mass compound released = DCC x BangBox volume

4.7 Determination of Emission Factors

Once the mass of compound released was calculated, two emission factors were developed for each sample or sampling train and for each test run: the mass of compound released per item (i.e., per single ordnance) and the mass of compound released per pound NEW. The NEW for all ordnance were determined from References 1 and 3.

4.8 Determination of Average Emission Factors

Steps 1 through 7, as described in Sections 4.1 through 4.7, are applicable to individual samples or sampling trains within individual test runs. The final step in the emission factor calculation process was to calculate average emission factors for each compound in terms of mass released per item and mass released per pound NEW. The average emission factors for each compound were calculated as the arithmetic mean of the individual samples associated with the compound. If all samples indicated that the compound was not detected (ND), then the average emission factor was assigned a value of ND. [Note: The minimum detection levels associated with the compounds that were not detected are presented in Appendix A.] Total dioxin/furan emission factors were calculated by summing the average emission factors for all dioxin/furan compounds.

5.0 EMISSION FACTOR RATINGS

The emission factors were appraised in accordance with the rating system specified in Reference 4. Under this rating system, emission factors are assigned a rating from A to E, where an "A" rating is assigned to the highest quality factors. The criteria used to assign a specific emission factor rating are summarized below.

A Excellent. The emission factor was developed primarily from A- and B-rated source test data taken from many randomly chosen facilities in the industry population. The source category population was sufficiently specific to minimize variability.

B Above average. The emission factor was developed primarily from A- or B-rated test data from a moderate number of facilities. Although no specific bias was evident, it was not clear if the facilities tested represented a random sample of the industry. As with the "A" rating, the source category population was sufficiently specific to minimize variability.

C Average. The emission factor was developed primarily from A-, B- and/or C-rated test data from a reasonable number of facilities. Although no specific bias was evident, it was not clear if the facilities tested represented a random sample of the industry. As with the "A" rating, the source category population was sufficiently specific to minimize variability.

D Below average. The emission factor was developed primarily from A-, B-, and C-rated test data from a small number of facilities, and there may have been reason to suspect that these facilities did not represent a random sample of the industry. There also may have been evidence of variability within the source category population.

E Poor. The emission factor was developed from C- and D-rated test data from a very limited number of facilities, and there may have been reason to suspect that the facilities tested did not represent a random sample of the industry. There also may have been evidence of variability within the source category population.

Two analyses were conducted to assign ratings to the ordnance emission factors. First, an analysis was conducted on an ordnance-specific basis. Second, an analysis was conducted using all available ordnance emission factor data. The second analysis was conducted to determine whether a sufficient correlation existed between emission factors for different but similar ordnance to allow the number of test data points to be increased to the point that higher emission factor ratings could be assigned than were possible when using the ordnance-specific approach. Both analyses are described below.

5.1 Emission Factor Ratings Assigned – Based on Ordnance-Specific Test Data

As previously described, emission factor ratings are dependent upon the test data quality, the number of test data points, the amount of variability present within a source category population, and the randomness of the source category sample. The following test data facts pertain to these rating criteria:

1. As described in Section 3 of this Background Document, the ordnance test data was primarily rated A or B. The test data for a few compounds was rated C.
2. Two tests were conducted or two sampling trains were used per ordnance.
3. Ordnance are manufactured to very tight tolerance levels so there is little variability within a specific type of ordnance.
4. There was no evidence that suggested the tested items within each type of ordnance were specially selected.

Emission factor ratings were assigned based upon these facts. The rationale used to accept or reject specific emission factor ratings follow.

A: Rejected. The number of test data points was deemed to be insufficient to assign an A emission factor rating.

B: Rejected. The number of test data points was deemed to be insufficient to assign a B emission factor rating.

C: Accepted for most ordnance. The emission factors were developed using A- and B-rated test data, there is little variability among items, and there was no evidence that suggested the tested items were specially selected. Because of the limited number of data points, a C rating was deemed appropriate for this set of circumstances.

D: Accepted for some ordnance. The emission factors were developed using C-rated test data, there is little variability among items, and there was no evidence that suggested the tested items were specially selected. Because of the limited number of data points, a D rating was deemed appropriate for this set of circumstances.

E: Rejected. The ordnance described in this report were developed primarily using A- and B-rated test data rather than C- or D-rated data, there is little variability among items, and there was no evidence that suggested the tested items were specially selected. Therefore, an E emission factor rating was deemed inappropriate.

5.2 Emission Factor Ratings Assigned – Based on All Available Test Data

The proceeding sections of this Background Document concern the emission measurement methods, data analysis, and calculations used to develop emission factors for specific ordnance. However, USAEC's ordnance emission factor development program includes more than 200 ordnance that have been tested under more than 25 separate test series. Because many of these ordnance are similar in size and/or chemical composition, a statistical analysis was conducted to assess the similarity of the emission factors developed for similar ordnance. The results of this analysis were used to reevaluate the emission factor ratings assigned on an ordnance-specific basis.

USAEC characterized individual ordnance as falling into one of 17 separate categories, depending upon the size and/or chemical composition of the ordnance. The ordnance and their respective categories are identified in Table 7 along with a comment field describing the number of data points.

TABLE 7 ORDNANCE CATEGORIZATION FOR EMISSION FACTOR CORRELATION ASSESSMENT

Category	DODIC	Ordnance Description	Test Series	Comment
CS	G963[a]	M73A CS Riot Control Agent Hand Grenade	DPG VI	Data not yet available
	K765[a]	CS Riot Control Agent Capsule	DPG VI	
Demolition	G900	TH3 AN-M14 Incendiary Grenade	EO5	20+ data points
	G911	MK3A2 Offensive Hand Grenade	EO2	
	G911	MK3A2 Offensive Hand Grenade	EO6	
	K010	M4 Field Incendiary Burster	EO5	
	K145	M18A1 Antipersonnel Mine	EO2	
	M023	M112 Demolition Block Charge	EO1	
	M030	1/4-Pound Demolition Block Charge	EO1	
	M030	1/4-Pound Demolition Block Charge	EO3	
	M031	1/2-Pound Demolition Block Charge	DPG IVA	
	M032	1-Pound Demolition Block Charge	EO2	
	M032	1-Pound Demolition Block Charge	EO3	
	M130[a]	M6 Electric Blasting Cap	DPG VII	
	M130[a]	M6 Electric Blasting Cap	EO7	
	M131[a]	M7 Blasting Cap	EO7	
	M241	M10 High Explosive Universal Destructor	DPG IVB	
	M456	PETN Type 1 Detonating Cord	DPG IVA	
	M500[a]	M21 REEF Line Cutter	FP10	
	M591	M1 Military Dynamite Demolition Block Charge	EO1	

TABLE 7 (cont.)

Category	DODIC	Ordnance Description	Test Series	Comment
Demolition, continued	M913	M58A3 Linear Demolition Charge	EO3	20+ data points
	ML05[a]	MK24 High Explosive Cutter	EO11	
	ML09	Linear Demolition Charge, Shaped 20 gr/ft	DPG IVA	
	ML15	Linear Demolition Charge, Shaped 225 gr/ft	DPG IVA	
	ML47[a]	M11 Blasting Cap	EO7	
	MM50[a]	M221 Shaped Charge	EO11	
	MN02[a]	M12 Blasting Cap	EO7	
	MN03[a]	M13 Blasting Cap	EO7	
	MN06[a]	M14 Blasting Cap	EO7	
	MN07[a]	M15 Delay Blasting Cap	EO11	
	MN08[a]	M81 Igniter	EO9	
	MN68[a]	M151 Booster Demolition Charge	DPG VIII	
	None	PAX-11, Granular Powder Burn	EO4	
	None	PAX-11, Molded Pellet Detonation	EO4	
Fuze	G878[a]	M228 Practice Hand Grenade Fuse	DPG VI	<10 data points
	K051	M604 Anti-Tank Practice Mine Fuze	EO6	
	N278[a]	M564 MTSQ Fuze	EO11	
	N285[a]	M577 Fuze	EO9	
	N286[a]	M582 Fuze	EO7	
	N335	M557 Point Detonating Fuze	EO5	
	N340	M739A1 Point Detonating Fuze	EO5	
	N464[a]	M732 Fuze	EO9	
Grenade	G881	M67 Fragmentation Grenade	EO1	<10 data points
	G978	M82 Smoke Simulant Screening Grenade Launcher	DPG V	
	G982	Terephthalic Acid Smoke Hand Grenade	DPG V	
	GG09[a]	M84 Non-Lethal Stun Hand Grenade	EO12	
Illumination	B535	M583A1 40-mm White Star Parachute Cartridge	DPG IVB	20+ data points
	B536	M585 40-mm White Star Cluster Cartridge	DPG IVB	

TABLE 7 (cont.)

Category	DODIC	Ordnance Description	Test Series	Comment
Illumination, continued	B627	M83A3, M83A2, & M83A1 60-mm Illuminating Cartridge with Fuze	DPG V	20+ data points
	D505	M485A2 155-mm Illumination Round (projectile)	DPG I	
	L305	M195 Green Star Parachute Signal Flare	DPG I	
	L306	M158 Red Star Cluster Signal Illumination	DPG II	
	L307	M159 White Star Cluster Signal Illumination	DPG II	
	L311	M126A1 Red Star Parachute Signal Flare	DPG II	
	L312	M127A1 White Star Parachute Signal Flare	DPG I	
	L314	M125A1 Green Star Cluster Signal Flare	DPG I	
	L367[a]	M22 Anti-Tank, Guided Missile, and Rocket Launching Simulator	DPG VI	
	L410[a]	M206 Aircraft Countermeasure Flare	DPG VI	
Inert	HA11[a]	Rocket, 2.75-inch Flechette with M255A1 Warhead	DPG VIII	Data not yet available
Large	C511	M490 105-mm Target Practice Tracer Cartridge (tracer)	EO6	Only 1 data point yet available
	C784[a]	M831 120-mm Target Practice Tracer Cartridge	EO12	
	C785[a]	M865 120-mm Target Practice Discarding Sabot Tracer Cartridge	EO12	
Medium	BA11[a]	M1001 40-mm HVCC Cartridge	EO12	Data not yet available
	BA15[a]	M769 60-mm FRP Cartridge	EO12	
Medium-FP	A652	M220 20-mm TP-T Cartridge	FP9	10+ data points
	A940	M910 25-mm Target Practice Discarding Sabot Tracer Cartridge	FP8	
	A976	M793 25-mm Target Practice Tracer Cartridge	FP8	
	B129[a]	M789 30 mm CTG	EO9	
	B519	M781 40-mm Practice Cartridge	FP2	
	B584	M918 40-mm Practice Cartridge	FP2	
	B505[a]	M662 40-mm Red Star Parachute Cartridge	DPG VIII	

TABLE 7 (cont.)

Category	DODIC	Ordnance Description	Test Series	Comment
Mine	K042[a]	M88 Volcano Practice Canister Mine	DPG VIII	Data not yet available
Mortar	CA03	XM929 120 mm Smoke Cartridge with M7334A1 Fuze	DPG V	Only 1 data point
Projectile	B542	M430 40-mm High Explosive Dual Purpose (HEDP) Cartridge (projectile)	EO3	10+ data points
	B571	M383 40-mm High Explosive Cartridge (projectile)	EO3	
	B632	M49A4 60-mm High Explosive Cartridge (projectile)	EO3	
	B642	M720 60-mm High Explosive Cartridge (projectile)	EO6	
	BZ-13[a]	M888 60-mm Cartridge with M935 PD Fuze	EO11	
	C995	M136 AT4 Recoilless Rifle, 84-mm Cartridge (projectile)	EO3	
	H557	M72A3 66-mm High Explosive Antitank Rocket (warhead)	EO1	
	H708[a]	M73 35-mm Subcaliber Practice Rocket	DPG VIII	
	None[a]	PAX-21, 60-mm Mortar	EO8	
	PJ02	FIM-92A Stinger-Basic Guided Missile (warhead)	EO6	
Propellant	B642	M720 60-mm High Explosive Cartridge (propelling charge)	FP4	20+ data points
	B653[a]	M766 60-mm Short Range Practice Mortar Cartridge	FP10	
	C226	M301A3 81-mm Illuminating Cartridge (propelling charge)	FP4	
	C379	M934 120-mm High Explosive Cartridge (Zone 1 - propelling charge)	FP8	
	C511	M490 105-mm Target Practice Tracer Cartridge (propelling charge)	FP5	
	C784	M831 120-mm Target Practice Tracer Cartridge (propelling charge)	FP5	
	C785	M865 120-mm Target Practice Discarding Sabot Tracer Cartridge (propelling charge)	FP5	
	C868	M821 81-mm High Explosive Cartridge (propelling charge)	FP4	

TABLE 7 (cont.)

Category	DODIC	Ordnance Description	Test Series	Comment
Propellant, continued	C876	M880 81-mm Target Practice Short Range Cartridge (propelling charge)	FP4	20+ data points
	CA09	M931 120-mm Full Range Practice Cartridge (Zone 1 - propelling charge)	FP8	
	CA09	M931 120-mm Full Range Practice Cartridge (Zone 4 - propelling charge)	FP8	
	D533	M119A2 155-mm Propelling Charge (Zone 7)	FP5	
	D540	M3 155-mm Propelling Charge (Zone 3, M199 Cannon)	FP1	
	D540	M3 155-mm Propelling Charge (Zone 3, M199 Cannon)	FP5	
	D540	M3 155-mm Propelling Charge (Zone 3, M284 Cannon)	FP1	
	D540	M3 155-mm Propelling Charge (Zone 5, M199 Cannon)	FP1	
	D540	M3A1 155-mm Propelling Charge (Zone 3, M199 Cannon)	FP1	
	D540	M3A1 155-mm Propelling Charge (Zone 3, M284 Cannon)	FP1	
	D541	M4A2 155-mm Propelling Charge (Zone 7)	FP5	
	M174[a]	MK209 Impulse Cartridge	FP10	
	M842[a]	M1 Squib	EO7	
	M842[a]	M79 Igniter	EO9	
	MD73[a]	M796 Impulse Cartridge	FP10	
	PJ02	FIM-92A Stinger-Basic Guided Missile (flight motor)	FP7	
	PJ02	FIM-92A Stinger-Basic Guided Missile (launch motor)	EO5	
Pyrotechnic	H975[a]	M274 2.75-inch Signature Smoke with H872 Warhead	DPG VIII	20+ data points
	L366	M74A1 Projectile Air Burst Simulator	DPG IVB	
	L495	M49A1 Surface Trip Flare	DPG II	
	L508[a]	M72 Red Railroad Warning Fuse	DPG VI	

TABLE 7 (cont.)

Category	DODIC	Ordnance Description	Test Series	Comment
Pyrotechnic, continued	L592	TOW Blast Simulator	DPG V	20+ data points
	L594	M115A2 Ground Burst Simulator	DPG I	
	L595[a]	M9 Liquid Projectile Air Burst Simulator	EO12	
	L596	M110 Flash Artillery Simulator	DPG I	
	L598	M117 Flash Booby Trap Simulator	DPG I	
	L599	M118 Illuminating Booby Trap Simulator	DPG II	
	L600	M119 Whistling Booby Trap Simulator	DPG II	
	L601	M116A1 Hand Grenade Simulator	DPG I	
	L602	M21 Artillery Flash Simulator	DPG IVB	
	L709	M25 Target Hit Simulator	EO2	
	L709	XM25 Target Hit Simulator	DPG V	
	L720	M26 Target Kill Simulator	EO6	
	M327[a]	Coupling Base Firing Device	FP10	
	M448[a]	M2 Percussion Detonator	EO11	
	M626[a]	M1 Push Igniter	EO9	
	M627[a]	M5 Pressure Release Igniter	FP10	
	M630	M1 Pull Igniter	DPG V	
	M630[a]	M1 Pull Igniter	EO9	
	M670[a]	M700 Blasting Fuse	EO11	
	M766[a]	M60 Igniter	EO9	
	ML03[a]	M142 Firing Device	EO11	
Rocket/Missile	H459	Rocket, 2.75-inch Flechette, MK40 Mod 3 Motor (propelling rocket)	FP7	10+ data points
	H557	M72A3 66-mm High Explosive Antitank Rocket (propelling rocket)	FP4	
	H557	M72A3 66-mm High Explosive Antitank Rocket (propelling rocket)	FP7	
	H708	M73 35-mm Subcaliber Practice Rocket Motor	FP9	
	H974	Rocket, 2.75-inch M267 Practice Warhead, MK66 Mod 3 Motor (propelling rocket)	FP7	

TABLE 7 (cont.)

Category	DODIC	Ordnance Description	Test Series	Comment
Small Arm-FP	A010	M220 10 Gage Blank/Subcaliber Salute Cartridge	FP9	20+ data points
	A011	12 Gage #00 Shot Cartridge	FP9	
	A017[a]	12 Gage #9 Shot Cartridge	FP10	
	A059	M855 5.56-mm Ball Cartridge (fired from the M16A1 Rifle)	FP3	
	A059	M855 5.56-mm Ball Cartridge (fired from the M16A2 Rifle)	FP3	
	A059	M855 5.56-mm Ball Cartridge (No-Lead)	FP4	
	A063	M856 5.56-mm Tracer Cartridge	FP3	
	A065	M862 5.56-mm Practice Ball Cartridge	FP3	
	A066	M193 5.56-mm Ball Cartridge	FP6	
	A068	M196 5.56-mm Tracer Cartridge	FP6	
	A080	M200 5.56-mm Blank Cartridge	FP3	
	A086	.22 Caliber Long Rifle Ball Cartridge	FP4	
	A106	.22 Caliber Standard Velocity Long Rifle Ball Cartridge	FP4	
	A111	M82 7.62-mm Blank Cartridge	FP3	
	A131	M62 7.62-mm Tracer Cartridge	FP6	
	A136	M118 7.62-mm Ball Match Cartridge	FP6	
	A143	M80 7.62-mm Ball Cartridge	FP3	
	A171	M852 7.62-mm Ball Match Cartridge	FP6	
	A182	M1 .30 Caliber Ball Cartridge	FP6	
	A212	M2 .30 Caliber Ball Cartridge	FP6	
	A218	M25 .30 Caliber Tracer Cartridge	FP9	
	A247	M72 .30 Caliber Ball Match Cartridge	FP6	
	A363	M882 9-mm Ball Cartridge	FP3	
	A365	M181 14.5-mm Trainer-Spotter Cartridge with 3-sec Delay (Artillery)	DPG V	
	A366[a]	M182 14.5-mm Cartridge	EO11	
	A400	M41 .38 Caliber Special Ball Cartridge	FP9	
	A403	.38 Caliber Special Blank Cartridge	FP9	

TABLE 7 (cont.)

Category	DODIC	Ordnance Description	Test Series	Comment
Small Arm-FP, continued	A475	M1911 .45 Caliber Ball Cartridge	FP3	20+ data points
	A518	M903 .50 Caliber SLAP Cartridge	FP9	
	A518[a]	M962 .50 Caliber SLAP/T	FP10	
	A525	M2 .50 Caliber Armor Piercing Cartridge	FP8	
	A557	M17 .50 Caliber Tracer Cartridge	FP3	
	A557	M33 .50 Caliber Ball Cartridge	FP3	
	A598	M1A1 .50 Caliber Blank Cartridge	FP3	
Smoke	C870[a]	M819 (IUK) 81-mm Red Phosphorus Smoke	DPG VII	10+ data points
	G815[a]	Red Phosphorus Smoke Screening Grenade Launcher (UK)	DPG VII	
	G930	Hexachloroethane Smoke Grenade	DPG V	
	G940	M18 Green Smoke Hand Grenade	DPG III	
	G945	M18 Yellow Smoke Hand Grenade	DPG III	
	G950	M18 Red Smoke Hand Grenade	DPG III	
	G950	M18 Red Smoke Hand Grenade (new formulation)	DPG V	
	G955	M18 Violet Smoke Hand Grenade	DPG III	
	G955	M18 Violet Smoke Hand Grenade (new formulation)	DPG V	
	K866[a]	ABC-M5 HC Ground Smoke Pot (MILES)	DPG VII	
	K867[a]	M4A2 Floating Smoke Pot	DPG VII	

[a] Although testing may have been completed, emission factors for this ordnance have not yet been analyzed for inclusion in AP-42; therefore, these data were not included when the data correlation was assessed.

Within each of the 17 ordnance categories identified by USAEC, emission factors for each compound were compared. To allow the comparison of emission factors for ordnance with similar constituents but significant differences in net explosive weight, the comparison was made using the normalized emission factor units of mass of compound released per pound NEW. Based upon information provided by EPA,[7] the following procedures were used to assess the data correlation:

1. The relative standard deviation, defined as the standard deviation divided by the mean, was calculated for each compound within each ordnance category.
2. If the relative standard deviation was less than 1.0, the evaluated emission factors were considered to demonstrate good correlation. As such, the rating for these emission factors could be elevated to a maximum of an A, depending on the number of data points within the evaluated ordnance category.

3. If the relative standard deviation was between 1.0 and 2.0, the evaluated emission factors were considered to demonstrate fair correlation. As such, the rating for these emission factors could be elevated to a maximum of a B, depending on the number of data points within the evaluated ordnance category.
4. If the relative standard deviation was greater than 2.0, the evaluated emission factors were considered to demonstrate poor correlation. As such, the emission factor rating could not be elevated, regardless of the amount of data available.

A poor correlation between emission factors was not necessarily construed as being indicative of poor test data. Rather, a poor correlation was more likely to indicate that the ordnance included in the category were not as similar in nature as anticipated by USAEC when the ordnance categories were defined.

In addition to assessing the data correlation, an assessment was made of the number of test data points available within each of the 17 ordnance categories. Because each ordnance test consisted of two test data points (i.e., two test runs per ordnance or two independent sampling trains were used during an ordnance test), the number of test data points available in each of the ordnance categories varied from 2 to 68. Based upon information provided by EPA,[7] the following assumptions were used to assess whether sufficient category-specific test data points were available to justify elevating the emission factor ratings based on ordnance-specific data only:

1. If 20 or more data points were available, the emission factor rating could be elevated to a maximum of an A, provided that the data also demonstrated a good correlation.
2. If at least 10 but less than 20 data points were available, the emission factor rating could be elevated to a maximum of a B, provided that the data also demonstrated a good correlation.
3. If less than 10 data points were available, the emission factor rating could not be elevated, regardless of the data correlation.
4. If the data demonstrated a fair correlation and 20 or more data points were available, the emission factor rating could be elevated to a maximum of a B.
5. If the data demonstrated a fair correlation and at least 10 but less than 20 data points were available, the emission factor rating could be elevated to a maximum of a C.

Using the criteria specified above, the emission factor ratings assigned to ordnance in each of the 17 ordnance categories were reevaluated. This evaluation indicated that some of the emission factor ratings associated with ordnance included in nine categories could be elevated from a C or D rating to an A or B rating. These nine categories are:

1. Demolition
2. Illumination
3. Medium – Firing Point
4. Projectiles
5. Propellants
6. Pyrotechnics
7. Rocket/Missile
8. Small Arms – Firing Point
9. Smokes

A final assessment was made as to the emission factor rating assigned based on ordnance-specific test data only. If the original emission factor data rating assigned was a C, then the emission factor rating was elevated to an A or B, as appropriate, based upon the data for the whole ordnance category. If the original emission factor data rating assigned was a D, then the emission factor rating was elevated to a B

or C, as appropriate, based upon the data for the whole ordnance category. The analysis is documented in an Excel spreadsheet that is located on the EPA website at: http://www.epa.gov/ttn/chief/ap42/index.html.

All four ordnance contained in the current test series were included in the Demolition category, which included more than 20 test data points. As a result, some emission factor ratings associated with these ordnance were elevated. The emission factor ratings assigned are presented in Appendix A.

6.0 REFERENCES

1. *Sampling Results for AEC Phase IV-A Exploding Ordnance Emission Characterization,* URS Group, Inc., Oak Ridge, TN, June 2003.

2. *Detailed Test Plan for Phase IV-A Emission Characterization, Exploding Ordnance: M118 Block Demolition Charge, ½-lb TNT Block Demolition Charge, PETN Type 1 Detonating Cord, and 20 gr/ft and 225 gr/ft Flexible Linear-Shaped Demolition Charges,* West Desert Test Center, U.S. Army Dugway Proving Ground, UT, May 2001.

3. Supporting information including Excel spreadsheets supplied upon request by the U.S. Army Dugway Proving Ground test support contractor, URS Group, Inc., Oak Ridge, TN, January 2005.

4. *Procedures for Preparing Emission Factor Documents,* EPA-454/R-95-015, U.S. Environmental Protection Agency, Research Triangle Park, NC, November 1997.

5. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air,* Second Supplement, EPA/600/4-89/017, U.S. Environmental Protection Agency, Research Triangle Park, NC, June 1988.

6. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846),* U.S. Environmental Protection Agency, http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm.

7. Information regarding the relationship between emission factor data correlation, the number of data points available, and the resulting emission factor rating assigned supplied upon request by Mr. Ron Myers, Measurement Policy Group, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC, June 2006.

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APPENDIX A

COMPOUNDS ANALYZED AND EMISSION FACTORS DEVELOPED FOR ORDNANCE INCLUDED IN PHASE IV-A TESTING AT DUGWAY PROVING GROUND, UTAH

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TABLE A1 COMPOUNDS ANALYZED AND EMISSION FACTORS DEVELOPED FOR DODIC M031, ½-POUND DEMOLITION BLOCK CHARGE

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m[3,e]
		lb per item	lb per lb NEW[d]	
Carbon Dioxide, Criteria Pollutants, Total Nonmethane Hydrocarbons, and Total Suspended Particulate				
124-38-9	Carbon dioxide[f]	7.2 E-01	1.5	--
630-08-0	Carbon monoxide[g]	1.1 E-02	2.3 E-02	--
7439-92-1	Lead	1.1 E-04	2.2 E-04	--
--	Oxides of nitrogen[f]	7.4 E-03	1.5 E-02	--
--	PM-2.5[g]	6.4 E-03	1.3 E-02	--
--	PM-10	6.7 E-02	1.4 E-01	--
7446-09-5	Sulfur dioxide[h]	7.5 E-07	1.5 E-06	--
--	Total nonmethane hydrocarbons[g]	2.3 E-03	4.7 E-03	--
12789-66-1	Total suspended particulate	1.7 E-01	3.4 E-01	--
Hazardous Air Pollutants and Toxic Chemicals				
83-32-9	Acenaphthene	ND	ND	5.0 E-05
208-96-8	Acenaphthylene[g]	ND	ND	5.8 E-05
75-07-0	Acetaldehyde[g]	ND	ND	1.8 E-04
75-05-8	Acetonitrile[g]	ND	ND	1.7 E-04
98-86-2	Acetophenone	ND	ND	5.0 E-04
53-96-3	2-Acetylaminofluorene	ND	ND	8.2 E-05
107-02-8	Acrolein	ND	ND	2.3 E-04
107-13-1	Acrylonitrile[g]	ND	ND	2.2 E-04
107-05-1	Allyl chloride	ND	ND	3.2 E-04
7429-90-5	Aluminum[g]	5.6 E-03	1.1 E-02	--
92-67-1	4-Aminobiphenyl	ND	ND	2.8 E-03
7664-41-7	Ammonia	ND	ND	3.7 E-02
62-53-3	Aniline	ND	ND	2.8 E-04
120-12-7	Anthracene[g]	ND	ND	5.3 E-05
7440-36-0	Antimony	3.2 E-05	6.5 E-05	--
7440-38-2	Arsenic	4.7 E-06	9.6 E-06	--
7440-39-3	Barium	1.9 E-04	3.9 E-04	--
71-43-2	Benzene[g]	3.7 E-05	7.5 E-05	--
92-87-5	Benzidine	ND	ND	4.6 E-03
56-55-3	Benzo[a]anthracene	ND	ND	6.8 E-05
205-99-2	Benzo[b]fluoranthene	ND	ND	5.8 E-05
207-08-9	Benzo[k]fluoranthene	ND	ND	6.9 E-05

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^3[,e]
		lb per item	lb per lb NEW[d]	
191-24-2	Benzo[g,h,i]perylene	ND	ND	9.4 E-05
50-32-8	Benzo[a]pyrene	ND	ND	6.9 E-05
100-44-7	Benzyl chloride	ND	ND	5.3 E-04
7440-41-7	Beryllium	3.9 E-07	7.9 E-07	--
74-83-9	Bromomethane	ND	ND	4.0 E-04
101-55-3	4-Bromophenylphenylether	ND	ND	5.9 E-05
106-99-0	1,3-Butadiene[g]	6.0 E-06	1.2 E-05	--
123-72-8	Butanal	ND	ND	3.0 E-04
71-36-3	n-Butanol	2.7 E-07	5.5 E-07	--
111-76-2	2-Butoxyethanol[i]	1.4 E-05	2.9 E-05	--
85-68-7	Butylbenzylphthalate[f]	3.1 E-06	6.3 E-06	--
7440-43-9	Cadmium	6.7 E-06	1.4 E-05	--
86-74-8	Carbazole	ND	ND	4.1 E-05
56-23-5	Carbon tetrachloride	7.5 E-07	1.5 E-06	--
7782-50-5	Chlorine	ND	ND	2.0 E-02
106-47-8	p-Chloroaniline	ND	ND	1.3 E-04
108-90-7	Chlorobenzene	ND	ND	4.7 E-04
510-15-6	Chlorobenzilate	ND	ND	5.4 E-05
75-00-3	Chloroethane	ND	ND	2.7 E-04
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	8.3 E-05
111-44-4	bis(2-Chloroethyl)ether	ND	ND	6.3 E-05
67-66-3	Chloroform	ND	ND	5.0 E-04
108-60-1	bis(2-Chloroisopropyl)ether	ND	ND	7.1 E-05
74-87-3	Chloromethane[g]	ND	ND	2.1 E-04
91-58-7	2-Chloronaphthalene	ND	ND	7.5 E-05
7005-72-3	4-Chlorophenylphenyl ether	ND	ND	4.1 E-05
7440-47-3	Chromium[g]	3.9 E-04	7.9 E-04	--
218-01-9	Chrysene	ND	ND	4.5 E-05
7440-48-4	Cobalt[g]	4.4 E-06	8.9 E-06	--
7440-50-8	Copper[g]	1.6 E-03	3.2 E-03	--
98-82-8	Cumene[g]	8.7 E-07	1.8 E-06	--
110-82-7	Cyclohexane[g]	4.7 E-06	9.6 E-06	--
2303-16-4	Diallate	ND	ND	7.7 E-05
53-70-3	Dibenz[a,h]anthracene	ND	ND	7.0 E-05
132-64-9	Dibenzofuran	ND	ND	3.8 E-05

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^3[e]
		lb per item	lb per lb NEW[d]	
106-93-4	1,2-Dibromoethane	ND	ND	7.8 E-04
84-74-2	Dibutyl phthalate[f]	1.8 E-06	3.7 E-06	--
95-50-1	1,2-Dichlorobenzene	ND	ND	6.1 E-04
541-73-1	1,3-Dichlorobenzene	ND	ND	6.1 E-04
106-46-7	1,4-Dichlorobenzene	ND	ND	6.1 E-04
91-94-1	3,3'-Dichlorobenzidine	ND	ND	3.3 E-04
107-06-2	1,2-Dichloroethane	ND	ND	4.1 E-04
75-71-8	Dichlorodifluoromethane[g]	ND	ND	5.0 E-04
75-34-3	1,1-Dichloroethane	ND	ND	4.1 E-04
540-59-0	1,2-Dichloroethene	ND	ND	4.0 E-04
76-14-2	Dichlorotetrafluoroethane	ND	ND	7.1 E-04
120-83-2	2,4-Dichlorophenol	ND	ND	7.6 E-05
78-87-5	1,2-Dichloropropane	ND	ND	4.7 E-04
10061-02-6	trans-1,3-Dichloro-1-propene	ND	ND	4.6 E-04
60-11-7	p-Dimethylaminoazobenzene	ND	ND	8.5 E-05
57-97-6	7,12-Dimethylbenz[a]anthracene	ND	ND	1.2 E-04
119-93-7	3,3'-Dimethylbenzidine	ND	ND	4.5 E-03
131-11-3	Dimethyl phthalate[h]	3.0 E-07	6.2 E-07	--
105-67-9	2,4-Dimethylphenol	ND	ND	2.4 E-04
99-65-0	1,3-Dinitrobenzene	2.9 E-07	5.9 E-07	--
534-52-1	4,6-Dinitro-o-cresol	ND	ND	1.5 E-03
51-28-5	2,4-Dinitrophenol	ND	ND	3.6 E-03
121-14-2	2,4-Dinitrotoluene	4.6 E-07	9.5 E-07	--
606-20-2	2,6-Dinitrotoluene	6.0 E-06	1.2 E-05	--
--	Total dioxin/furan compounds	1.4 E-09	2.8 E-09	--
100-41-4	Ethylbenzene[g]	0	0	--
74-85-1	Ethylene[g]	7.8 E-05	1.6 E-04	--
117-81-7	bis(2-Ethylhexyl)phthalate[f]	2.2 E-05	4.4 E-05	--
206-44-0	Fluoranthene[g]	1.4 E-07	2.9 E-07	--
86-73-7	Fluorene[g]	ND	ND	6.2 E-05
50-00-0	Formaldehyde	5.4 E-05	1.1 E-04	--
76-13-1	Freon 113[g]	5.0 E-08	1.0 E-07	--
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	1.3 E-10	2.7 E-10	--

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^{3}[e]
		lb per item	lb per lb NEW[d]	
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	6.1 E-11	1.2 E-10	--
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	ND	ND	7.1 E-10
118-74-1	Hexachlorobenzene	ND	ND	7.1 E-05
87-68-3	Hexachlorobutadiene	ND	ND	1.1 E-03
77-47-4	Hexachlorocyclopentadiene	ND	ND	7.8 E-04
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[h]	3.7 E-12	7.5 E-12	--
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[h]	5.0 E-12	1.0 E-11	--
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	6.3 E-12	1.3 E-11	--
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	5.8 E-12	1.2 E-11	--
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[h]	3.7 E-12	7.5 E-12	--
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	ND	ND	4.4 E-10
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[h]	4.7 E-12	9.5 E-12	--
67-72-1	Hexachloroethane	ND	ND	9.8 E-04
110-54-3	n-Hexane	1.2 E-05	2.3 E-05	--
7647-01-0	Hydrochloric acid	ND	ND	3.7 E-02
1634-04-4	Hydrogen cyanide	1.9 E-06	3.9 E-06	--
193-39-5	Indeno[1,2,3-cd]pyrene	ND	ND	7.4 E-05
78-59-1	Isophorone	ND	ND	3.5 E-04
67-63-0	Isopropyl alcohol	ND	ND	2.5 E-04
120-58-1	Isosafrole	ND	ND	3.3 E-04
7439-92-1	Lead	1.1 E-04	2.2 E-04	--
7439-96-5	Manganese[g]	1.2 E-04	2.4 E-04	--
7439-97-6	Mercury	3.3 E-08	6.8 E-08	--
56-49-5	3-Methylcholanthrene	ND	ND	1.8 E-04
75-09-2	Methylene chloride[g]	3.7 E-02	7.5 E-02	--
108-10-1	Methyl isobutyl ketone	ND	ND	4.2 E-04
556-61-6	Methyl isothiocyanate	ND	ND	3.0 E-04
90-12-0	1-Methylnaphthalene	ND	ND	5.9 E-04
91-57-6	2-Methylnaphthalene	ND	ND	5.9 E-04
95-48-7	2-Methylphenol	ND	ND	5.9 E-05

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^3[e]
		lb per item	lb per lb NEW[d]	
109-06-8	2-Methylpyridine	ND	ND	3.5 E-04
1634-04-4	Methyl tert-butyl ether	ND	ND	3.7 E-04
91-20-3	Naphthalene[g]	3.7 E-06	7.6 E-06	--
130-15-4	1,4-Naphthoquinone	ND	ND	1.2 E-04
134-32-7	1-Naphthylamine	ND	ND	3.6 E-03
91-59-8	2-Naphthylamine	ND	ND	4.2 E-03
7440-02-0	Nickel[g]	1.3 E-05	2.6 E-05	--
100-01-6	4-Nitroaniline	ND	ND	1.5 E-04
98-95-3	Nitrobenzene	ND	ND	5.1 E-04
88-75-5	2-Nitrophenol	ND	ND	3.8 E-05
100-02-7	4-Nitrophenol	ND	ND	6.3 E-04
56-57-5	4-Nitroquinoline-1-oxide	ND	ND	1.1 E-03
924-16-3	N-Nitroso-di-n-butylamine	ND	ND	8.1 E-05
55-18-5	N-Nitrosodiethylamine	ND	ND	7.7 E-05
62-75-9	N-Nitrosodimethylamine	ND	ND	9.4 E-05
621-64-7	N-Nitroso-di-n-propylamine	ND	ND	1.6 E-04
59-89-2	N-Nitrosomorpholine	ND	ND	1.4 E-04
100-75-4	N-Nitrosopiperidine	ND	ND	9.2 E-05
99-55-8	5-Nitro-o-toluidine	ND	ND	1.2 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	1.0 E-09	2.1 E-09	--
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran	8.9 E-11	1.8 E-10	--
608-93-5	Pentachlorobenzene	ND	ND	5.5 E-05
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	2.3 E-12	4.7 E-12	--
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	ND	ND	4.2 E-10
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.9 E-12	3.8 E-12	--
76-01-7	Pentachloroethane	ND	ND	1.1 E-04
82-68-8	Pentachloronitrobenzene	ND	ND	5.3 E-04
87-86-5	Pentachlorophenol	ND	ND	1.0 E-03
85-01-8	Phenanthrene[g]	3.5 E-07	7.1 E-07	--
108-95-2	Phenol	3.8 E-06	7.7 E-06	--
7723-14-0	Phosphorus[g]	1.7 E-04	3.5 E-04	--
23950-58-5	Pronamide	ND	ND	7.6 E-05
115-07-1	Propylene[g]	2.1 E-05	4.3 E-05	--

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^3[e]
		lb per item	lb per lb NEW[d]	
123-38-6	Propionaldehyde	ND	ND	2.4 E-04
129-00-0	Pyrene[g]	1.3 E-07	2.7 E-07	--
110-86-1	Pyridine	ND	ND	3.3 E-04
94-59-7	Safrole	ND	ND	7.1 E-05
7440-22-4	Silver	3.3 E-07	6.7 E-07	--
100-42-5	Styrene	ND	ND	4.3 E-04
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	ND	ND	4.2 E-10
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[h]	3.7 E-12	7.6 E-12	--
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	7.0 E-04
127-18-4	Tetrachloroethylene	ND	ND	6.9 E-04
7440-28-0	Thallium	2.6 E-07	5.2 E-07	--
108-88-3	Toluene[g]	2.3 E-05	4.7 E-05	--
95-53-4	o-Toluidine	ND	ND	1.1 E-04
120-82-1	1,2,4-Trichlorobenzene	ND	ND	5.1 E-05
71-55-6	1,1,1-Trichloroethane	ND	ND	5.5 E-04
79-00-5	1,1,2-Trichloroethane	ND	ND	5.5 E-04
79-01-6	Trichloroethylene	ND	ND	5.4 E-04
75-69-4	Trichloromonofluoromethane	2.4 E-07	4.9 E-07	--
95-95-4	2,4,5-Trichlorophenol	ND	ND	1.8 E-04
88-06-2	2,4,6-Trichlorophenol	ND	ND	1.4 E-04
96-18-4	1,2,3-Trichloropropane	ND	ND	6.1 E-04
95-63-6	1,2,4-Trimethylbenzene	1.4 E-06	2.9 E-06	--
540-84-1	2,2,4-Trimethylpentane[g]	7.7 E-06	1.6 E-05	--
75-01-4	Vinyl chloride	ND	ND	2.6 E-04
75-35-4	Vinylidene chloride	ND	ND	4.0 E-04
106-42-3, 108-38-3	m-Xylene, p-Xylene[g]	0	0	--
95-47-6	o-Xylene[g]	0	0	--
7440-66-6	Zinc[g]	8.5 E-04	1.7 E-03	--
Other Pollutants				
64-19-7	Acetic acid	ND	ND	2.5 E-04
67-64-1	Acetone	7.3 E-07	1.5 E-06	--
592-20-1	1-Acetoxyacetone	ND	ND	4.8 E-04
74-86-2	Acetylene[g]	5.0 E-05	1.0 E-04	--

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^3[,e]
		lb per item	lb per lb NEW[d]	
100-52-7	Benzaldehyde	ND	ND	4.4 E-04
271-89-6	Benzofuran	ND	ND	4.9 E-04
65-85-0	Benzoic acid	0	0	--
100-47-0	Benzonitrile	ND	ND	4.3 E-04
100-51-6	Benzyl alcohol	ND	ND	2.3 E-04
107-04-0	1-Bromo-2-chloroethane	ND	ND	5.9 E-04
123-73-9	trans-2-Butenal	ND	ND	2.9 E-04
75-28-5	i-Butane	3.3 E-06	6.7 E-06	--
106-97-8	n-Butane	5.7 E-06	1.2 E-05	--
431-03-8	2,3-Butanedione	ND	ND	3.6 E-04
106-98-9	1-Butene	9.3 E-06	1.9 E-05	--
115-11-7	i-Butene	3.9 E-06	7.9 E-06	--
590-18-1	cis-2-Butene	6.9 E-07	1.4 E-06	--
624-64-6	trans-2-Butene[g]	3.3 E-06	6.8 E-06	--
109-69-3	1-Chlorobutane	ND	ND	3.9 E-04
622-98-0	1-Chloro-4-ethylbenzene	ND	ND	5.8 E-04
95-49-8	1-Chloro-2-methylbenzene	ND	ND	5.3 E-04
108-41-8	1-Chloro-3-methylbenzene	ND	ND	5.3 E-04
59-50-7	4-Chloro-3-methylphenol	ND	ND	1.5 E-04
95-57-8	2-Chlorophenol	ND	ND	7.8 E-05
2698-41-1	CS2	ND	ND	3.2 E-04
2074-87-5	Cyanogen	ND	ND	1.1 E-04
287-92-3	Cyclopentane[g]	1.2 E-06	2.4 E-06	--
120-92-3	Cyclopentanone	ND	ND	3.5 E-04
541-02-6	Cyclopentasiloxane, decamethyl-[i]	1.4 E-05	2.8 E-05	--
142-29-0	Cyclopentene	8.3 E-07	1.7 E-06	--
930-30-3	2-Cyclopenten-1-one	ND	ND	3.4 E-04
124-18-5	n-Decane	0	0	--
13466-78-9	delta 3-Carene	ND	ND	1.0 E-04
3018-12-0	Dichloroacetonitrile	ND	ND	4.6 E-04
616-21-7	1,2-Dichlorobutane	ND	ND	5.3 E-04
32768-54-0	1,2-Dichloro-3-methylbenzene	ND	ND	6.7 E-04
594-37-6	1,2-Dichloro-2-methylpropane	ND	ND	5.3 E-04
87-65-0	2,6-Dichlorophenol	ND	ND	6.7 E-05
513-88-2	1,1-Dichloro-2-propanone	ND	ND	5.3 E-04

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^3[e]
		lb per item	lb per lb NEW[d]	
10061-01-5	cis 1,3-Dichloro-1-propene	ND	ND	4.6 E-04
84-66-2	Diethylphthalate[g]	3.9 E-07	7.9 E-07	--
75-83-2	2,2-Dimethylbutane[g]	1.2 E-06	2.5 E-06	--
79-29-8	2,3-Dimethylbutane	1.7 E-06	3.5 E-06	--
624-92-0	Dimethyldisulfide	ND	ND	3.9 E-04
625-86-5	2,5-Dimethylfuran	ND	ND	4.0 E-04
1071-26-7	2,2-Dimethylheptane	ND	ND	1.0 E-04
584-94-1	2,3-Dimethylhexane	0	0	--
589-43-5	2,4-Dimethylhexane[g]	9.9 E-07	2.0 E-06	--
592-13-2	2,5-Dimethylhexane	0	0	--
565-59-3	2,3-Dimethylpentane[g]	2.2 E-06	4.5 E-06	--
108-08-7	2,4-Dimethylpentane[g]	1.0 E-06	2.1 E-06	--
--	Dimethylphenethylamine	ND	ND	0
463-82-1	2,2-Dimethylpropane[h]	8.1 E-08	1.6 E-07	--
3658-80-8	Dimethyltrisulfide	ND	ND	5.2 E-04
117-84-0	Di-n-octylphthalate[g]	5.4 E-06	1.1 E-05	--
74-84-0	Ethane[g]	5.7 E-06	1.2 E-05	--
64-17-5	Ethanol	ND	ND	1.9 E-04
637-92-3	Ethyl tert-butyl ether[h]	1.7 E-07	3.5 E-07	--
1678-91-7	Ethylcyclohexane	ND	ND	1.0 E-04
619-99-8	3-Ethylhexane	0	0	--
62-50-0	Ethyl methanesulfonate	ND	ND	3.1 E-05
25550-14-5	Ethyltoluene[i]	6.9 E-06	1.4 E-05	--
620-14-4	m-Ethyltoluene	5.2 E-07	1.1 E-06	--
611-14-3	o-Ethyltoluene	1.1 E-06	2.3 E-06	--
622-96-8	p-Ethyltoluene	1.1 E-06	2.2 E-06	--
--	F22	5.3 E-05	1.1 E-04	--
98-01-1	2-Furaldehyde	ND	ND	4.0 E-04
498-60-2	3-Furaldehyde	ND	ND	4.0 E-04
110-00-9	Furan	ND	ND	2.8 E-04
111-71-7	Heptanal	ND	ND	4.7 E-04
142-82-5	n-Heptane[g]	4.6 E-06	9.3 E-06	--
110-43-0	2-Heptanone	ND	ND	4.7 E-04
1888-71-7	Hexachloropropene	ND	ND	1.1 E-04
57-10-3	n-Hexadecanoic acid[i]	9.5 E-06	1.9 E-05	--

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^3[,e]
		lb per item	lb per lb NEW[d]	
66-25-1	Hexanal	ND	ND	4.2 E-04
626-93-7	2-Hexanol[i]	1.9 E-05	3.9 E-05	--
591-78-6	2-Hexanone	ND	ND	4.2 E-04
630-06-8	Hexatriacontane[i]	9.7 E-06	2.0 E-05	--
592-41-6	1-Hexene[g]	5.5 E-06	1.1 E-05	--
7688-21-3	cis-2-Hexene[g]	1.7 E-07	3.5 E-07	--
4050-45-7	trans-2-Hexene	3.5 E-07	7.1 E-07	--
496-11-7	Indane	ND	ND	4.9 E-04
78-79-5	Isoprene	ND	ND	1.0 E-04
626-19-7	Isophthalaldehyde[i]	3.2 E-05	6.5 E-05	--
5989-27-5	d-Limonene	ND	ND	1.0 E-04
7439-95-4	Magnesium[g]	4.3 E-03	8.8 E-03	--
78-85-3	Methacrolein	ND	ND	2.9 E-04
75-52-5	Methane, nitro	9.6 E-07	2.0 E-06	--
91-80-5	Methapyrilene	ND	ND	5.0 E-03
104-85-8	4-Methylbenzoitrile	ND	ND	4.9 E-04
563-80-4	3-Methyl-2-butanone	ND	ND	3.6 E-04
563-45-1	3-Methyl-1-butene[g]	5.0 E-07	1.0 E-06	--
563-46-2	2-Methyl-1-butene	3.4 E-07	6.8 E-07	--
513-35-9	2-Methyl-2-butene	ND	ND	1.0 E-04
108-87-2	Methylcyclohexane[g]	3.7 E-06	7.6 E-06	--
96-37-7	Methylcyclopentane[g]	4.7 E-06	9.6 E-06	--
78-93-3	Methyl ethyl ketone[f]	3.1 E-06	6.4 E-06	--
620-02-0	5-Methyl-2-furaldehyde	ND	ND	4.6 E-04
534-22-5	2-Methylfuran	ND	ND	3.4 E-04
930-27-8	3-Methylfuran	ND	ND	3.4 E-04
592-27-8	2-Methylheptane	0	0	--
591-76-4	2-Methylhexane[g]	4.8 E-06	9.8 E-06	--
589-34-4	3-Methylhexane[g]	6.6 E-06	1.3 E-05	--
66-27-3	Methyl methanesulfonate	ND	ND	7.4 E-05
624-91-9	Methylnitrite	ND	ND	2.5 E-04
107-83-5	2-Methylpentane	7.6 E-06	1.6 E-05	--
96-14-0	3-Methylpentane	6.8 E-06	1.4 E-05	--
763-29-1	2-Methyl-1-pentene	ND	ND	1.0 E-04
625-27-4	2-Methyl-2-pentene	3.5 E-07	7.1 E-07	--

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^3[e]
		lb per item	lb per lb NEW[d]	
691-37-2	4-Methyl-1-pentene	ND	ND	1.0 E-04
691-38-3	cis-4-Methyl-2-pentene	ND	ND	1.0 E-04
1074-43-7	1-Methyl-3-propylbenzene[i]	4.9 E-06	1.0 E-05	--
554-14-3	2-Methylthiophene	ND	ND	4.1 E-04
616-44-4	3-Methylthiophene	ND	ND	4.1 E-04
479-45-8	Methyl-2,4,6-trinitrophenylnitramine	ND	ND	7.0 E-05
78-94-4	Methyl vinyl ketone	ND	ND	2.9 E-04
88-74-4	2-Nitroaniline	ND	ND	7.3 E-05
99-09-2	3-Nitroaniline	ND	ND	1.9 E-04
10595-95-6	N-Nitrosomethylethylamine	ND	ND	1.6 E-04
930-55-2	N-Nitrosopyrrolidine	ND	ND	5.5 E-04
112-05-0	Nonaic acid[i]	8.1 E-06	1.6 E-05	--
124-19-6	Nonanal	ND	ND	5.9 E-04
111-84-2	n-Nonane	0	0	--
821-55-6	2-Nonanone	ND	ND	5.9 E-04
--	OCS	ND	ND	2.5 E-04
124-13-0	Octanal	ND	ND	5.3 E-04
111-65-9	n-Octane	0	0	--
1600-37-9	1,1,2,3,3-Pentachloro-1-propene	ND	ND	8.9 E-04
110-62-3	Pentanal	ND	ND	3.6 E-04
78-78-4	i-Pentane	6.3 E-06	1.3 E-05	--
109-66-0	n-Pentane	5.6 E-06	1.1 E-05	--
600-14-6	2,3-Pentanedione	ND	ND	4.2 E-04
107-87-9	2-Pentanone	ND	ND	3.6 E-04
96-22-0	3-Pentanone	ND	ND	3.6 E-04
109-67-1	1-Pentene	1.6 E-07	3.3 E-07	--
627-20-3	cis-2-Pentene	3.4 E-07	6.8 E-07	--
646-04-8	trans-2-Pentene	9.9 E-07	2.0 E-06	--
1629-58-9	1-Penten-3-one	ND	ND	3.5 E-04
625-33-2	3-Penten-2-one	ND	ND	3.5 E-04
62-44-2	Phenacetin	ND	ND	8.5 E-05
536-74-3	Phenylacetylene	ND	ND	6.1 E-04
80-56-8	alpha-Pinene	ND	ND	1.0 E-04
127-91-3	beta-Pinene	ND	ND	1.0 E-04

TABLE A1 (cont.)

CASRN[a]	Compound	Emission Factor[b,c]		Minimum Detection Level mg/m^3[e]
		lb per item	lb per lb NEW[d]	
74-98-6	Propane	1.9 E-06	3.8 E-06	--
103-65-1	n-Propylbenzene[h]	0	0	--
121-82-4	RDX	2.5 E-07	5.1 E-07	--
95-94-3	1,2,4,5-Tetrachlorobenzene	ND	ND	9.4 E-05
58-90-2	2,3,4,6-Tetrachlorophenol	ND	ND	4.3 E-04
109-99-9	Tetrahydrofuran	8.4 E-07	1.7 E-06	--
110-02-1	Thiophene	ND	ND	3.5 E-04
98-03-3	2-Thiophenecarboxaldehyde	ND	ND	4.7 E-04
546-06-2	Trichloroacetonitrile	ND	ND	6.0 E-04
638-67-5	Tricosane[i]	8.7 E-06	1.8 E-05	--
108-67-8	1,3,5-Trimethylbenzene	3.5 E-07	7.2 E-07	--
16747-26-5	2,2,4-Trimethylhexane	0	0	--
565-75-3	2,3,4-Trimethylpentane[g]	3.2 E-07	6.6 E-07	--
107-39-1	2,4,4-Trimethyl-1-pentene	ND	ND	1.0 E-04
107-40-4	2,4,4-Trimethyl-2-pentene	ND	ND	1.0 E-04
99-35-4	1,3,5-Trinitrobenzene[g]	8.8 E-06	1.8 E-05	--
118-96-7	2,4,6-Trinitrotoluene	ND	ND	2.4 E-05

[a] CASRN = Chemical Abstracts Service Registry Number.
[b] ND = nondetected.
[c] Emission factors rated C unless otherwise noted.
[d] NEW = net explosive weight. The NEW for this ordnance is 5.00 E-01 pounds per item.
[e] Data provided for compounds that were not detected.
[f] Emission factor rated A because of correlation with emission factors for similar ordnance and number of test data points.
[g] Emission factor rated B because of correlation with emission factors for similar ordnance and number of test data points.
[h] Emission factor rated D because the factor is based upon C-rated test data.
[i] Emission factor rated D because the factor is for a tentatively identified compound.

TABLE A2 COMPOUNDS ANALYZED AND EMISSION FACTORS DEVELOPED FOR DODIC M456, PETN TYPE 1 DETONATING CORD

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
Carbon Dioxide, Criteria Pollutants, Total Nonmethane Hydrocarbons, and Total Suspended Particulates			
124-38-9	Carbon dioxide[f]	1.6	--
630-08-0	Carbon monoxide[g]	1.5 E-02	--
7439-92-1	Lead	2.3 E-05	--
--	Oxides of nitrogen[f]	2.2 E-03	--
--	PM-2.5[g]	3.5 E-03	--
--	PM-10	5.1 E-02	--
7446-09-5	Sulfur dioxide	0	--
--	Total nonmethane hydrocarbons[g]	1.8 E-03	--
12789-66-1	Total suspended particulate	1.2 E-01	--
Hazardous Air Pollutants and Toxic Chemicals			
83-32-9	Acenaphthene[g]	ND	4.7 E-05
208-96-8	Acenaphthylene[g]	1.1 E-06	--
75-07-0	Acetaldehyde[g]	ND	1.8 E-04
75-05-8	Acetonitrile	2.2 E-07	--
98-86-2	Acetophenone	ND	5.0 E-04
53-96-3	2-Acetylaminofluorene	ND	7.8 E-05
107-02-8	Acrolein	ND	2.3 E-04
107-13-1	Acrylonitrile[g]	ND	2.2 E-04
107-05-1	Allyl chloride	ND	3.2 E-04
7429-90-5	Aluminum[g]	5.2 E-03	--
92-67-1	4-Aminobiphenyl	ND	2.6 E-03
7664-41-7	Ammonia	ND	3.4 E-02
62-53-3	Aniline	ND	2.7 E-04
120-12-7	Anthracene[g]	1.3 E-07	--
7440-36-0	Antimony	2.4 E-05	--
7440-38-2	Arsenic	3.5 E-06	--
7440-39-3	Barium	1.4 E-04	--
71-43-2	Benzene[g]	1.1 E-04	--
92-87-5	Benzidine	ND	4.4 E-03
56-55-3	Benzo[a]anthracene	ND	6.4 E-05
205-99-2	Benzo[b]fluoranthene	1.5 E-07	--
207-08-9	Benzo[k]fluoranthene[h]	3.5 E-07	--

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
191-24-2	Benzo[g,h,i]perylene	ND	6.6 E-05
50-32-8	Benzo[a]pyrene	2.2E-09	--
100-44-7	Benzyl chloride	ND	5.3 E-04
7440-41-7	Beryllium	3.2E-07	--
74-83-9	Bromomethane	ND	4.0 E-04
101-55-3	4-Bromophenylphenylether	ND	5.6 E-05
106-99-0	1,3-Butadiene[g]	4.1E-05	--
123-72-8	Butanal	2.9E-07	3.0 E-04
71-36-3	n-Butanol[h]	ND	--
85-68-7	Butylbenzylphthalate[f]	2.0E-06	--
7440-43-9	Cadmium	5.2E-06	--
86-74-8	Carbazole	ND	3.9 E-05
56-23-5	Carbon tetrachloride	ND	6.4 E-04
7782-50-5	Chlorine	ND	1.7 E-02
106-47-8	p-Chloroaniline	ND	1.2 E-04
108-90-7	Chlorobenzene	ND	4.7 E-04
510-15-6	Chlorobenzilate	ND	5.2 E-05
75-00-3	Chloroethane	5.0 E-04	2.7 E-04
111-91-1	bis(2-Chloroethoxy)methane	ND	7.9 E-05
111-44-4	bis(2-Chloroethyl)ether	ND	6.0 E-05
67-66-3	Chloroform	ND	5.0 E-04
108-60-1	bis(2-Chloroisopropyl)ether	ND	6.7 E-05
74-87-3	Chloromethane[g]	ND	2.1 E-04
91-58-7	2-Chloronaphthalene	ND	7.1 E-05
7005-72-3	4-Chlorophenylphenyl ether	ND	3.9 E-05
7440-47-3	Chromium[g]	ND	--
218-01-9	Chrysene	2.3E-04	4.3 E-05
7440-48-4	Cobalt[g]	ND	--
7440-50-8	Copper[g]	3.3E-06	--
98-82-8	Cumene	4.2E-04	--
110-82-7	Cyclohexane[g]	3.3E-07	--
2303-16-4	Diallate	0.0E+00	7.3 E-05
53-70-3	Dibenz[a,h]anthracene	ND	6.6 E-05
132-64-9	Dibenzofuran	ND	--
106-93-4	1,2-Dibromoethane	1.3E-07	7.8 E-04

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
84-74-2	Dibutyl phthalate[f]	ND	--
95-50-1	1,2-Dichlorobenzene	ND	6.1 E-04
541-73-1	1,3-Dichlorobenzene	ND	6.1 E-04
106-46-7	1,4-Dichlorobenzene	ND	6.1 E-04
91-94-1	3,3'-Dichlorobenzidine	ND	3.2 E-04
107-06-2	1,2-Dichloroethane	ND	4.1 E-04
75-71-8	Dichlorodifluoromethane[g]	ND	5.0 E-04
75-34-3	1,1-Dichloroethane	ND	4.1 E-04
540-59-0	1,2-Dichloroethene	ND	4.0 E-04
76-14-2	Dichlorotetrafluoroethane	ND	7.1 E-04
120-83-2	2,4-Dichlorophenol	ND	7.3 E-05
78-87-5	1,2-Dichloropropane	ND	4.7 E-04
10061-02-6	trans-1,3-Dichloro-1-propene	ND	4.6 E-04
60-11-7	p-Dimethylaminoazobenzene	ND	8.1 E-05
57-97-6	7,12-Dimethylbenz[a]anthracene	ND	1.1 E-04
119-93-7	3,3'-Dimethylbenzidine	ND	4.3 E-03
131-11-3	Dimethyl phthalate[h]	ND	--
105-67-9	2,4-Dimethylphenol	0	2.3 E-04
99-65-0	1,3-Dinitrobenzene	1.6 E-07	--
534-52-1	4,6-Dinitro-o-cresol	ND	1.4 E-03
51-28-5	2,4-Dinitrophenol	ND	3.4 E-03
121-14-2	2,4-Dinitrotoluene	ND	4.0 E-04
606-20-2	2,6-Dinitrotoluene	2.6 E-06	--
--	Total dioxin/furan compounds	8.9 E-10	--
100-41-4	Ethylbenzene[g]	1.2 E-05	--
74-85-1	Ethylene[g]	1.9 E-05	--
117-81-7	bis(2-Ethylhexyl)phthalate[f]	5.4 E-07	--
206-44-0	Fluoranthene[g]	2.6 E-07	--
86-73-7	Fluorene[g]	1.5 E-04	--
50-00-0	Formaldehyde	1.2 E-06	--
76-13-1	Freon 113	9.1 E-11	--
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	4.2 E-11	--
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	ND	--

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	ND	7.7 E-10
118-74-1	Hexachlorobenzene	ND	6.8 E-05
87-68-3	Hexachlorobutadiene	ND	1.1 E-03
77-47-4	Hexachlorocyclopentadiene	ND	7.4 E-04
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	1.9 E-12	--
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	3.6 E-12	--
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[h]	2.7 E-12	--
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	6.3 E-12	--
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran[h]	2.5 E-12	--
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	ND	5.4 E-10
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[h]	3.0 E-12	--
67-72-1	Hexachloroethane	ND	9.8 E-04
110-54-3	n-Hexane	2.7 E-06	--
7647-01-0	Hydrochloric acid	ND	3.4 E-02
1634-04-4	Hydrogen cyanide	6.6 E-05	--
193-39-5	Indeno[1,2,3-cd]pyrene	ND	7.0 E-05
78-59-1	Isophorone	ND	3.3 E-04
67-63-0	Isopropyl alcohol	ND	2.5 E-04
120-58-1	Isosafrole	ND	3.2 E-04
7439-92-1	Lead	2.3 E-05	4.3 E-03
7439-96-5	Manganese[g]	1.0 E-04	--
7439-97-6	Mercury	2.1 E-08	--
56-49-5	3-Methylcholanthrene	ND	1.7 E-04
75-09-2	Methylene chloride[g]	5.5 E-02	--
108-10-1	Methyl isobutyl ketone	ND	4.2 E-04
556-61-6	Methyl isothiocyanate	ND	3.0 E-04
90-12-0	1-Methylnaphthalene	ND	5.9 E-04
91-57-6	2-Methylnaphthalene	ND	5.9 E-04
95-48-7	2-Methylphenol	ND	5.6 E-05
109-06-8	2-Methylpyridine	ND	3.3 E-04

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
1634-04-4	Methyl tert-butyl ether	ND	3.7 E-04
91-20-3	Naphthalene[g]	8.4 E-06	--
130-15-4	1,4-Naphthoquinone	ND	1.1 E-04
134-32-7	1-Naphthylamine	ND	3.4 E-03
91-59-8	2-Naphthylamine	ND	4.0 E-03
7440-02-0	Nickel[g]	9.8 E-06	--
100-01-6	4-Nitroaniline	ND	1.5 E-04
98-95-3	Nitrobenzene	ND	5.1 E-04
88-75-5	2-Nitrophenol	ND	3.6 E-05
100-02-7	4-Nitrophenol	ND	6.0 E-04
56-57-5	4-Nitroquinoline-1-oxide	ND	1.0 E-03
924-16-3	N-Nitroso-di-n-butylamine	ND	7.7 E-05
55-18-5	N-Nitrosodiethylamine	ND	7.3 E-05
62-75-9	N-Nitrosodimethylamine	ND	8.9 E-05
621-64-7	N-Nitroso-di-n-propylamine	ND	1.5 E-04
59-89-2	N-Nitrosomorpholine	ND	1.3 E-04
100-75-4	N-Nitrosopiperidine	ND	8.8 E-05
99-55-8	5-Nitro-o-toluidine	ND	1.1 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	6.6 E-10	--
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran	7.5 E-11	--
608-93-5	Pentachlorobenzene	ND	5.2 E-05
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ND	7.3 E-10
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	ND	5.1 E-10
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	ND	5.1 E-10
76-01-7	Pentachloroethane	ND	1.1 E-04
82-68-8	Pentachloronitrobenzene	ND	5.1 E-04
87-86-5	Pentachlorophenol	ND	9.5 E-04
85-01-8	Phenanthrene[g]	1.2 E-06	--
108-95-2	Phenol[h]	1.5 E-06	--
7723-14-0	Phosphorus[g]	1.5 E-04	--
23950-58-5	Pronamide	ND	7.3 E-05
115-07-1	Propylene[g]	2.5 E-04	--
123-38-6	Propionaldehyde	ND	2.4 E-04

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
129-00-0	Pyrene[g]	2.5 E-06	--
110-86-1	Pyridine	ND	3.1 E-04
94-59-7	Safrole	ND	6.7 E-05
100-42-5	Styrene[h]	8.0 E-06	--
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	ND	5.5 E-10
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[h]	2.6 E-11	--
79-34-5	1,1,2,2-Tetrachloroethane	ND	7.0 E-04
127-18-4	Tetrachloroethylene	ND	6.9 E-04
7440-28-0	Thallium	4.2 E-07	--
108-88-3	Toluene[g]	1.9 E-04	--
95-53-4	o-Toluidine	ND	1.1 E-04
120-82-1	1,2,4-Trichlorobenzene	ND	7.5 E-04
71-55-6	1,1,1-Trichloroethane	ND	5.5 E-04
79-00-5	1,1,2-Trichloroethane	ND	5.5 E-04
79-01-6	Trichloroethylene	ND	5.4 E-04
75-69-4	Trichloromonofluoromethane	1.6 E-06	--
95-95-4	2,4,5-Trichlorophenol	ND	1.7 E-04
88-06-2	2,4,6-Trichlorophenol	ND	1.4 E-04
96-18-4	1,2,3-Trichloropropane	ND	6.1 E-04
95-63-6	1,2,4-Trimethylbenzene[g]	8.6 E-05	--
540-84-1	2,2,4-Trimethylpentane[g]	2.7 E-05	--
75-01-4	Vinyl chloride	ND	2.6 E-04
75-35-4	Vinylidene chloride	ND	4.0 E-04
106-42-3, 108-38-3	m-Xylene, p-Xylene[g]	2.1 E-04	--
95-47-6	o-Xylene[g]	7.6 E-05	--
7440-66-6	Zinc[g]	1.8 E-03	--
Other Pollutants			
64-19-7	Acetic acid	ND	2.5 E-04
67-64-1	Acetone	ND	2.4 E-04
592-20-1	1-Acetoxyacetone	ND	4.8 E-04
74-86-2	Acetylene[g]	1.2 E-03	--
100-52-7	Benzaldehyde	ND	4.4 E-04
271-89-6	Benzofuran	ND	4.9 E-04
65-85-0	Benzoic acid	ND	5.0 E-03

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
100-47-0	Benzonitrile	ND	4.3 E-04
100-51-6	Benzyl alcohol	1.7 E-06	--
107-04-0	1-Bromo-2-chloroethane	ND	5.9 E-04
123-73-9	trans-2-Butenal	ND	2.9 E-04
75-28-5	i-Butane	4.6 E-05	--
106-97-8	n-Butane	8.2 E-05	--
431-03-8	2,3-Butanedione	ND	3.6 E-04
106-98-9	1-Butene	1.6 E-04	--
115-11-7	i-Butene	4.0 E-05	--
590-18-1	cis-2-Butene	1.5 E-05	--
624-64-6	trans-2-Butene[g]	4.0 E-05	--
109-69-3	1-Chlorobutane	ND	3.9 E-04
622-98-0	1-Chloro-4-ethylbenzene	ND	5.8 E-04
95-49-8	1-Chloro-2-methylbenzene	ND	5.3 E-04
108-41-8	1-Chloro-3-methylbenzene	ND	5.3 E-04
59-50-7	4-Chloro-3-methylphenol	ND	1.4 E-04
95-57-8	2-Chlorophenol	ND	7.4 E-05
2698-41-1	CS2	ND	3.2 E-04
2074-87-5	Cyanogen	ND	1.1 E-04
287-92-3	Cyclopentane[g]	3.4 E-06	--
120-92-3	Cyclopentanone	ND	3.5 E-04
142-29-0	Cyclopentene	8.6 E-06	--
930-30-3	2-Cyclopenten-1-one	ND	3.4 E-04
124-18-5	n-Decane[g]	3.7 E-06	--
13466-78-9	delta 3-Carene	ND	1.0 E-04
3018-12-0	Dichloroacetonitrile	ND	4.6 E-04
616-21-7	1,2-Dichlorobutane	ND	5.3 E-04
32768-54-0	1,2-Dichloro-3-methylbenzene	ND	6.7 E-04
594-37-6	1,2-Dichloro-2-methylpropane	ND	5.3 E-04
87-65-0	2,6-Dichlorophenol	ND	6.4 E-05
513-88-2	1,1-Dichloro-2-propanone	ND	5.3 E-04
10061-01-5	cis 1,3-Dichloro-1-propene	ND	4.6 E-04
84-66-2	Diethylphthalate	4.7 E-07	--
75-83-2	2,2-Dimethylbutane[g]	9.0 E-06	--
79-29-8	2,3-Dimethylbutane[g]	4.1 E-06	--

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
624-92-0	Dimethyldisulfide	ND	3.9 E-04
625-86-5	2,5-Dimethylfuran	ND	4.0 E-04
1071-26-7	2,2-Dimethylheptane	ND	1.0 E-04
584-94-1	2,3-Dimethylhexane	0	--
589-43-5	2,4-Dimethylhexane[g]	6.0 E-06	--
592-13-2	2,5-Dimethylhexane	0	--
565-59-3	2,3-Dimethylpentane[g]	0	--
108-08-7	2,4-Dimethylpentane[g]	6.9 E-07	--
--	Dimethylphenethylamine	ND	0
463-82-1	2,2-Dimethylpropane	6.6 E-06	--
3658-80-8	Dimethyltrisulfide	ND	5.2 E-04
117-84-0	Di-n-octylphthalate[g]	1.5 E-05	--
74-84-0	Ethane[g]	2.0 E-04	--
64-17-5	Ethanol	ND	1.9 E-04
637-92-3	Ethyl tert-butyl ether	2.6 E-06	--
1678-91-7	Ethylcyclohexane	ND	1.0 E-04
1758-88-9	2-Ethyl-1,4-dimethylbenzene[i]	9.7 E-05	--
619-99-8	3-Ethylhexane	2.7 E-06	--
62-50-0	Ethyl methanesulfonate	ND	3.0 E-05
25550-14-5	Ethyltoluene[i]	1.3 E-04	--
620-14-4	m-Ethyltoluene	2.3 E-05	--
611-14-3	o-Ethyltoluene	1.4 E-05	--
622-96-8	p-Ethyltoluene[g]	4.9 E-05	--
--	F22	8.4 E-04	--
98-01-1	2-Furaldehyde	ND	4.0 E-04
498-60-2	3-Furaldehyde	ND	4.0 E-04
110-00-9	Furan	ND	2.8 E-04
111-71-7	Heptanal	ND	4.7 E-04
142-82-5	n-Heptane[g]	1.4 E-06	--
110-43-0	2-Heptanone	ND	4.7 E-04
1888-71-7	Hexachloropropene	ND	1.0 E-04
544-76-3	Hexadecane[i]	2.7 E-05	--
124-29-8	1-Hexadecanol[i]	1.9 E-05	--
66-25-1	Hexanal	ND	4.2 E-04
591-78-6	2-Hexanone	ND	4.2 E-04

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
592-41-6	1-Hexene[g]	8.2 E-05	--
7688-21-3	cis-2-Hexene[g]	2.0 E-06	--
4050-45-7	trans-2-Hexene[g]	4.8 E-06	--
496-11-7	Indane[h]	1.8 E-06	--
78-79-5	Isoprene	ND	1.0 E-04
626-19-7	Isophthalaldehyde[i]	6.7 E-05	--
5989-27-5	d-Limonene	ND	1.0 E-04
7439-95-4	Magnesium[g]	1.0 E-02	--
78-85-3	Methacrolein	ND	2.9 E-04
75-52-5	Methane, nitro[g]	1.2 E-05	--
91-80-5	Methapyrilene	ND	4.8 E-03
104-85-8	4-Methylbenzonitrile	ND	4.9 E-04
563-80-4	3-Methyl-2-butanone	ND	3.6 E-04
563-45-1	3-Methyl-1-butene[g]	5.2 E-06	--
563-46-2	2-Methyl-1-butene	1.3 E-05	--
513-35-9	2-Methyl-2-butene	ND	1.0 E-04
108-87-2	Methylcyclohexane[g]	4.5 E-07	--
96-37-7	Methylcyclopentane[g]	0	--
78-93-3	Methyl ethyl ketone[f]	6.8 E-06	--
620-02-0	5-Methyl-2-furaldehyde	ND	4.6 E-04
534-22-5	2-Methylfuran	ND	3.4 E-04
930-27-8	3-Methylfuran	ND	3.4 E-04
592-27-8	2-Methylheptane	3.2 E-06	--
591-76-4	2-Methylhexane[g]	0	--
589-34-4	3-Methylhexane	5.8 E-06	--
66-27-3	Methyl methanesulfonate	ND	7.0 E-05
624-91-9	Methylnitrite	ND	2.5 E-04
107-83-5	2-Methylpentane[g]	1.4 E-05	--
96-14-0	3-Methylpentane[g]	5.2 E-06	--
763-29-1	2-Methyl-1-pentene	ND	1.0 E-04
625-27-4	2-Methyl-2-pentene[g]	3.5 E-06	--
691-37-2	4-Methyl-1-pentene	ND	1.0 E-04
691-38-3	cis-4-Methyl-2-pentene	ND	1.0 E-04
1074-17-5	Methylpropylbenzene[i]	6.7 E-05	--
1074-43-7	1-Methyl-3-propylbenzene[i]	2.2 E-05	--

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
554-14-3	2-Methylthiophene	ND	4.1 E-04
616-44-4	3-Methylthiophene	ND	4.1 E-04
479-45-8	Methyl-2,4,6-trinitrophenylnitramine	ND	6.2 E-05
78-94-4	Methyl vinyl ketone	ND	2.9 E-04
88-74-4	2-Nitroaniline	ND	6.9 E-05
99-09-2	3-Nitroaniline	ND	1.9 E-04
10595-95-6	N-Nitrosomethylethylamine	ND	1.6 E-04
930-55-2	N-Nitrosopyrrolidine	ND	5.3 E-04
124-19-6	Nonanal	ND	5.9 E-04
111-84-2	n-Nonane	3.3 E-05	--
821-55-6	2-Nonanone	ND	5.9 E-04
--	OCS	ND	2.5 E-04
124-13-0	Octanal	ND	5.3 E-04
111-65-9	n-Octane	1.3 E-05	--
1600-37-9	1,1,2,3,3-Pentachloro-1-propene	ND	8.9 E-04
110-62-3	Pentanal	ND	3.6 E-04
78-78-4	i-Pentane	1.0 E-04	--
109-66-0	n-Pentane	6.5 E-05	--
600-14-6	2,3-Pentanedione	ND	4.2 E-04
107-87-9	2-Pentanone	ND	3.6 E-04
96-22-0	3-Pentanone	ND	3.6 E-04
109-67-1	1-Pentene	3.9 E-06	--
627-20-3	cis-2-Pentene[h]	3.4 E-06	--
646-04-8	trans-2-Pentene	1.6 E-05	--
1629-58-9	1-Penten-3-one	ND	3.5 E-04
625-33-2	3-Penten-2-one	ND	3.5 E-04
62-44-2	Phenacetin	ND	8.1 E-05
536-74-3	Phenylacetylene	ND	6.1 E-04
80-56-8	alpha-Pinene	ND	1.0 E-04
127-91-3	beta-Pinene	ND	1.0 E-04
74-98-6	Propane	5.9 E-05	--
103-65-1	n-Propylbenzene	1.4 E-05	--
121-82-4	RDX	1.7 E-06	--
95-94-3	1,2,4,5-Tetrachlorobenzene	ND	9.0 E-05

TABLE A2 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
58-90-2	2,3,4,6-Tetrachlorophenol	ND	4.1 E-04
109-99-9	Tetrahydrofuran	3.1 E-07	--
110-02-1	Thiophene	ND	3.5 E-04
98-03-3	2-Thiophenecarboxaldehyde	ND	4.7 E-04
546-06-2	Trichloroacetonitrile	ND	6.0 E-04
638-67-5	Tricosane[i]	3.0 E-05	--
108-67-8	1,3,5-Trimethylbenzene	3.0 E-05	--
16747-26-5	2,2,4-Trimethylhexane	0	--
565-75-3	2,3,4-Trimethylpentane[g]	1.8 E-06	--
107-39-1	2,4,4-Trimethyl-1-pentene	ND	1.0 E-04
107-40-4	2,4,4-Trimethyl-2-pentene	ND	1.0 E-04
99-35-4	1,3,5-Trinitrobenzene[g]	5.0 E-07	--
118-96-7	2,4,6-Trinitrotoluene	ND	2.1 E-05

[a] CASRN = Chemical Abstracts Service Registry Number.
[b] ND = nondetected.
[c] Emission factors rated C unless otherwise noted.
[d] NEW = net explosive weight. The NEW for this ordnance is 7.00 E-03 pounds per linear foot of demolition charge. The complete ordnance includes 1,000 linear feet of charge and has an NEW of 7.00 pounds. During testing, a 70 linear foot section of charge was used with an NEW of 4.90 E-01 pounds. Because the length of charge used may vary, emission factors are not presented in terms of pounds of emissions per item.
[e] Data provided for compounds that were not detected.
[f] Emission factor rated A because of correlation with emission factors for similar ordnance and number of test data points.
[g] Emission factor rated B because of correlation with emission factors for similar ordnance and number of test data points.
[h] Emission factor rated D because the factor is based upon C-rated test data.
[i] Emission factor rated D because the factor is for a tentatively identified compound.

TABLE A3 COMPOUNDS ANALYZED AND EMISSION FACTORS DEVELOPED FOR DODIC ML09, LINEAR SHAPED DEMOLITION CHARGE, 20 GR/FT

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
Carbon Dioxide, Criteria Pollutants, Total Nonmethane Hydrocarbons, and Total Suspended Particulates			
124-38-9	Carbon dioxide[f]	2.4 E-01	--
630-08-0	Carbon monoxide[g]	1.7 E-01	--
7439-92-1	Lead	3.4 E-01	--
--	Oxides of nitrogen[f]	4.2 E-02	--
--	PM-2.5[g]	1.3 E-02	--
--	PM-10	4.3 E-01	--
7446-09-5	Sulfur dioxide	0	--
--	Total nonmethane hydrocarbons[g]	2.1 E-02	--
12789-66-1	Total suspended particulate	1.6	--
Hazardous Air Pollutants and Toxic Chemicals			
83-32-9	Acenaphthene	6.9 E-07	--
208-96-8	Acenaphthylene[g]	2.7 E-06	--
75-07-0	Acetaldehyde[g]	ND	1.8 E-04
75-05-8	Acetonitrile[g]	1.7 E-04	--
98-86-2	Acetophenone	ND	5.0 E-04
53-96-3	2-Acetylaminofluorene	ND	7.8 E-05
107-02-8	Acrolein	ND	2.3 E-04
107-13-1	Acrylonitrile[g]	1.8 E-05	--
107-05-1	Allyl chloride	ND	3.2 E-04
7429-90-5	Aluminum[g]	5.0 E-03	--
92-67-1	4-Aminobiphenyl	ND	2.7 E-03
7664-41-7	Ammonia	2.9 E-02	--
62-53-3	Aniline	ND	2.7 E-04
120-12-7	Anthracene[g]	2.7 E-07	--
7440-36-0	Antimony	9.2 E-02	--
7440-38-2	Arsenic	3.6 E-04	--
7440-39-3	Barium	1.3 E-04	--
71-43-2	Benzene[g]	4.4 E-04	--
92-87-5	Benzidine	ND	4.4 E-03
56-55-3	Benzo[a]anthracene	ND	6.5 E-05
205-99-2	Benzo[b]fluoranthene	ND	5.6 E-05
207-08-9	Benzo[k]fluoranthene	ND	6.6 E-05
191-24-2	Benzo[g,h,i]perylene	ND	9.0 E-05

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
50-32-8	Benzo[a]pyrene	3.7 E-07	--
100-44-7	Benzyl chloride	ND	5.3 E-04
7440-41-7	Beryllium	6.9 E-07	--
74-83-9	Bromomethane	ND	4.0 E-04
101-55-3	4-Bromophenylphenylether	ND	5.6 E-05
106-99-0	1,3-Butadiene[g]	8.3 E-05	--
123-72-8	Butanal	ND	3.0 E-04
71-36-3	n-Butanol	ND	3.1 E-04
85-68-7	Butylbenzylphthalate[f]	4.1 E-06	--
7440-43-9	Cadmium	8.6 E-06	--
86-74-8	Carbazole	ND	4.0 E-05
56-23-5	Carbon tetrachloride	1.2 E-06	--
7782-50-5	Chlorine	ND	1.9 E-02
106-47-8	p-Chloroaniline	ND	1.2 E-04
108-90-7	Chlorobenzene	ND	4.7 E-04
510-15-6	Chlorobenzilate	ND	5.2 E-05
75-00-3	Chloroethane	ND	2.7 E-04
111-91-1	bis(2-Chloroethoxy)methane	ND	7.9 E-05
111-44-4	bis(2-Chloroethyl)ether	ND	6.1 E-05
67-66-3	Chloroform	ND	5.0 E-04
108-60-1	bis(2-Chloroisopropyl)ether	ND	6.8 E-05
74-87-3	Chloromethane[g]	ND	2.1 E-04
91-58-7	2-Chloronaphthalene	ND	7.2 E-05
7005-72-3	4-Chlorophenylphenyl ether	ND	4.0 E-05
7440-47-3	Chromium[g]	6.0 E-04	--
218-01-9	Chrysene	ND	4.3 E-05
7440-48-4	Cobalt[g]	5.9 E-06	--
7440-50-8	Copper[g]	1.0 E-03	--
98-82-8	Cumene	3.5 E-06	--
110-82-7	Cyclohexane[g]	1.4 E-05	--
2303-16-4	Diallate	ND	7.4 E-05
53-70-3	Dibenz[a,h]anthracene	ND	6.7 E-05
132-64-9	Dibenzofuran[h]	3.8 E-07	--
106-93-4	1,2-Dibromoethane	ND	7.8 E-04
84-74-2	Dibutyl phthalate[f]	1.1 E-06	--

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
95-50-1	1,2-Dichlorobenzene	ND	6.1 E-04
541-73-1	1,3-Dichlorobenzene	ND	6.1 E-04
106-46-7	1,4-Dichlorobenzene	ND	6.1 E-04
91-94-1	3,3'-Dichlorobenzidine	ND	3.2 E-04
107-06-2	1,2-Dichloroethane	ND	4.1 E-04
75-71-8	Dichlorodifluoromethane[g]	ND	5.0 E-04
75-34-3	1,1-Dichloroethane	ND	4.1 E-04
540-59-0	1,2-Dichloroethene	ND	4.0 E-04
76-14-2	Dichlorotetrafluoroethane	ND	7.1 E-04
120-83-2	2,4-Dichlorophenol[h]	9.2 E-07	--
78-87-5	1,2-Dichloropropane	ND	4.7 E-04
10061-02-6	trans-1,3-Dichloro-1-propene	ND	4.6 E-04
60-11-7	p-Dimethylaminoazobenzene	ND	8.1 E-05
57-97-6	7,12-Dimethylbenz[a]anthracene	ND	1.1 E-04
119-93-7	3,3'-Dimethylbenzidine	ND	4.3 E-03
131-11-3	Dimethyl phthalate	ND	4.7 E-05
105-67-9	2,4-Dimethylphenol	ND	2.3 E-04
99-65-0	1,3-Dinitrobenzene	1.0 E-05	--
534-52-1	4,6-Dinitro-o-cresol	ND	1.4 E-03
51-28-5	2,4-Dinitrophenol	ND	3.4 E-03
121-14-2	2,4-Dinitrotoluene	ND	3.9 E-05
606-20-2	2,6-Dinitrotoluene	3.0 E-06	--
--	Total dioxin/furan compounds	4.5 E-07	--
100-41-4	Ethylbenzene[g]	2.7 E-05	--
74-85-1	Ethylene[g]	2.1 E-03	--
117-81-7	bis(2-Ethylhexyl)phthalate[g]	1.5 E-05	--
206-44-0	Fluoranthene[g]	9.4 E-07	--
86-73-7	Fluorene[g]	1.3 E-06	--
50-00-0	Formaldehyde	6.7 E-03	--
76-13-1	Freon 113[g]	6.8 E-07	--
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin[h]	1.1 E-07	--
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran[h]	3.8 E-09	--
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran[h]	3.6 E-09	--

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
118-74-1	Hexachlorobenzene	ND	6.9 E-05
87-68-3	Hexachlorobutadiene	ND	1.1 E-03
77-47-4	Hexachlorocyclopentadiene	ND	7.5 E-04
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin[h]	6.2 E-09	--
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin[h]	1.6 E-08	--
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin[h]	2.0 E-08	--
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran[h]	1.6 E-09	--
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	1.1 E-09	--
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran[h]	4.3 E-10	--
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran[h]	1.4 E-09	--
67-72-1	Hexachloroethane	ND	9.8 E-04
110-54-3	n-Hexane	7.7 E-06	--
7647-01-0	Hydrochloric acid	ND	3.8 E-02
1634-04-4	Hydrogen cyanide	2.3 E-02	--
193-39-5	Indeno[1,2,3-cd]pyrene	ND	7.1 E-05
78-59-1	Isophorone	ND	3.4 E-04
67-63-0	Isopropyl alcohol	ND	2.5 E-04
120-58-1	Isosafrole	ND	3.2 E-04
7439-92-1	Lead	3.4 E-01	4.3 E-03
7439-96-5	Manganese[g]	9.5 E-05	--
7439-97-6	Mercury[h]	6.8 E-08	--
56-49-5	3-Methylcholanthrene	ND	1.7 E-04
75-09-2	Methylene chloride	1.5 E-01	--
108-10-1	Methyl isobutyl ketone	ND	4.2 E-04
556-61-6	Methyl isothiocyanate	ND	3.0 E-04
90-12-0	1-Methylnaphthalene	ND	5.9 E-04
91-57-6	2-Methylnaphthalene	5.3 E-06	--
95-48-7	2-Methylphenol	ND	5.7 E-05
109-06-8	2-Methylpyridine	ND	3.4 E-04
1634-04-4	Methyl tert-butyl ether	ND	3.7 E-04

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
91-20-3	Naphthalene[g]	2.2 E-05	--
130-15-4	1,4-Naphthoquinone	ND	1.1 E-04
134-32-7	1-Naphthylamine	ND	3.4 E-03
91-59-8	2-Naphthylamine	ND	4.0 E-03
7440-02-0	Nickel[g]	2.2 E-05	--
100-01-6	4-Nitroaniline	ND	1.5 E-04
98-95-3	Nitrobenzene	ND	5.1 E-04
88-75-5	2-Nitrophenol	ND	3.7 E-05
100-02-7	4-Nitrophenol	ND	6.0 E-04
56-57-5	4-Nitroquinoline-1-oxide	ND	1.0 E-03
924-16-3	N-Nitroso-di-n-butylamine	ND	7.8 E-05
55-18-5	N-Nitrosodiethylamine	ND	7.4 E-05
62-75-9	N-Nitrosodimethylamine	ND	9.0 E-05
621-64-7	N-Nitroso-di-n-propylamine	ND	1.5 E-04
59-89-2	N-Nitrosomorpholine	ND	1.3 E-04
100-75-4	N-Nitrosopiperidine	ND	8.9 E-05
99-55-8	5-Nitro-o-toluidine	ND	1.1 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin[h]	2.7 E-07	--
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran[h]	7.4 E-09	--
608-93-5	Pentachlorobenzene	ND	5.3 E-05
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin[h]	7.1 E-09	--
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran[h]	5.6 E-10	--
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran[h]	6.8 E-10	--
76-01-7	Pentachloroethane	ND	1.1 E-04
82-68-8	Pentachloronitrobenzene	ND	5.1 E-04
87-86-5	Pentachlorophenol[h]	1.8 E-05	--
85-01-8	Phenanthrene[g]	2.5 E-06	--
108-95-2	Phenol	2.5 E-05	--
7723-14-0	Phosphorus[g]	2.4 E-04	--
23950-58-5	Pronamide	ND	7.3 E-05
115-07-1	Propylene[g]	9.6 E-04	--
123-38-6	Propionaldehyde	ND	2.4 E-04
129-00-0	Pyrene[g]	1.6 E-06	--

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
110-86-1	Pyridine	ND	3.2 E-04
94-59-7	Safrole	ND	6.8 E-05
7440-22-4	Silver	3.5 E-05	--
100-42-5	Styrene	2.2 E-05	--
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin[h]	1.1 E-09	--
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran[h]	7.1 E-10	--
79-34-5	1,1,2,2-Tetrachloroethane	ND	7.0 E-04
127-18-4	Tetrachloroethylene	ND	6.9 E-04
7440-28-0	Thallium	1.5 E-05	--
108-88-3	Toluene[g]	1.7 E-04	--
95-53-4	o-Toluidine	ND	1.1 E-04
120-82-1	1,2,4-Trichlorobenzene	ND	4.9 E-05
71-55-6	1,1,1-Trichloroethane[h]	4.8 E-06	--
79-00-5	1,1,2-Trichloroethane	ND	5.5 E-04
79-01-6	Trichloroethylene	ND	5.4 E-04
75-69-4	Trichloromonofluoromethane	0	--
95-95-4	2,4,5-Trichlorophenol	ND	1.7 E-04
88-06-2	2,4,6-Trichlorophenol	ND	1.4 E-04
96-18-4	1,2,3-Trichloropropane	ND	6.1 E-04
95-63-6	1,2,4-Trimethylbenzene[g]	3.8 E-05	--
540-84-1	2,2,4-Trimethylpentane[g]	4.9 E-05	--
75-01-4	Vinyl chloride	ND	2.6 E-04
75-35-4	Vinylidene chloride	ND	4.0 E-04
106-42-3, 108-38-3	m-Xylene, p-Xylene[g]	7.1 E-05	--
95-47-6	o-Xylene[g]	2.7 E-05	--
7440-66-6	Zinc[g]	1.0 E-03	--
Other Pollutants			
64-19-7	Acetic acid	ND	2.5 E-04
67-64-1	Acetone[h]	2.2 E-06	--
592-20-1	1-Acetoxyacetone	ND	4.8 E-04
74-86-2	Acetylene[g]	7.1 E-04	--
100-52-7	Benzaldehyde	6.4 E-06	--
271-89-6	Benzofuran	ND	4.9 E-04

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
65-85-0	Benzoic acid	3.1 E-05	--
100-47-0	Benzonitrile	ND	4.3 E-04
100-51-6	Benzyl alcohol	1.6 E-06	--
107-04-0	1-Bromo-2-chloroethane	ND	5.9 E-04
123-73-9	trans-2-Butenal	ND	2.9 E-04
75-28-5	i-Butane	0	--
106-97-8	n-Butane	1.9 E-06	--
431-03-8	2,3-Butanedione	ND	3.6 E-04
106-98-9	1-Butene	1.9 E-04	--
115-11-7	i-Butene	3.6 E-04	--
590-18-1	cis-2-Butene	4.2 E-05	--
624-64-6	trans-2-Butene[g]	6.0 E-05	--
109-69-3	1-Chlorobutane	ND	3.9 E-04
622-98-0	1-Chloro-4-ethylbenzene	ND	5.8 E-04
95-49-8	1-Chloro-2-methylbenzene	ND	5.3 E-04
108-41-8	1-Chloro-3-methylbenzene	ND	5.3 E-04
59-50-7	4-Chloro-3-methylphenol	ND	1.4 E-04
95-57-8	2-Chlorophenol	ND	7.5 E-05
2698-41-1	CS2	ND	3.2 E-04
2074-87-5	Cyanogen	6.5 E-04	--
287-92-3	Cyclopentane[g]	1.6 E-06	--
120-92-3	Cyclopentanone	ND	3.5 E-04
142-29-0	Cyclopentene	ND	1.0 E-04
930-30-3	2-Cyclopenten-1-one	ND	3.4 E-04
124-18-5	n-Decane[g]	2.9 E-06	--
13466-78-9	delta 3-Carene	ND	1.0 E-04
3018-12-0	Dichloroacetonitrile	ND	4.6 E-04
616-21-7	1,2-dichlorobutane	ND	5.3 E-04
32768-54-0	1,2-Dichloro-3-methylbenzene	ND	6.7 E-04
594-37-6	1,2-Dichloro-2-methylpropane	ND	5.3 E-04
87-65-0	2,6-Dichlorophenol	ND	6.4 E-05
513-88-2	1,1-Dichloro-2-propanone	ND	5.3 E-04
10061-01-5	cis 1,3-Dichloro-1-propene	ND	4.6 E-04
84-66-2	Diethylphthalate	1.9 E-07	--
5580-33-6	Dimethylbenzamide[f]	2.2 E-05	--

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
75-83-2	2,2-Dimethylbutane[g]	1.8 E-05	--
79-29-8	2,3-Dimethylbutane[g]	0	--
624-92-0	Dimethyldisulfide	ND	3.9 E-04
625-86-5	2,5-Dimethylfuran	ND	4.0 E-04
1071-26-7	2,2-Dimethylheptane	ND	1.0 E-04
584-94-1	2,3-Dimethylhexane	0	--
589-43-5	2,4-Dimethylhexane[g]	4.8 E-06	--
592-13-2	2,5-Dimethylhexane	2.9 E-06	--
565-59-3	2,3-Dimethylpentane[g]	5.9 E-06	--
108-08-7	2,4-Dimethylpentane[g]	6.8 E-06	--
--	Dimethylphenethylamine	ND	0
463-82-1	2,2-Dimethylpropane[h]	2.8 E-05	--
3658-80-8	Dimethyltrisulfide	ND	5.2 E-04
117-84-0	Di-n-octylphthalate[g]	6.0 E-06	--
74-84-0	Ethane[g]	5.0 E-04	--
64-17-5	Ethanol[h]	6.0 E-07	--
100-40-3	4-Ethenylcyclohexane[i]	1.6 E-05	--
637-92-3	Ethyl tert-butyl ether	4.5 E-06	--
1678-91-7	Ethylcyclohexane	ND	1.0 E-04
619-99-8	3-Ethylhexane	3.2 E-06	--
62-50-0	Ethyl methanesulfonate	ND	3.0 E-05
25550-14-5	Ethyltoluene[i]	3.5 E-05	--
620-14-4	m-Ethyltoluene[g]	6.2 E-06	--
611-14-3	o-Ethyltoluene[g]	5.8 E-06	--
622-96-8	p-Ethyltoluene[g]	3.8 E-05	--
--	F22	6.8 E-04	--
98-01-1	2-Furaldehyde	ND	4.0 E-04
498-60-2	3-Furaldehyde	ND	4.0 E-04
110-00-9	Furan	ND	2.8 E-04
111-71-7	Heptanal	ND	4.7 E-04
142-82-5	n-Heptane[g]	1.4 E-05	--
110-43-0	2-Heptanone	ND	4.7 E-04
1888-71-7	Hexachloropropene	ND	1.0 E-04
66-25-1	Hexanal	ND	4.2 E-04
626-93-7	2-Hexanol[i]	6.3 E-05	--

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
591-78-6	2-Hexanone	ND	4.2 E-04
592-41-6	1-Hexene[g]	9.6 E-05	--
7688-21-3	cis-2-Hexene[g]	4.2 E-06	--
4050-45-7	trans-2-Hexene[g]	7.8 E-06	--
496-11-7	Indane	8.2 E-07	--
78-79-5	Isoprene	ND	1.0 E-04
626-19-7	Isophthalaldehyde[i]	4.7 E-05	--
5989-27-5	d-Limonene	ND	1.0 E-04
7439-95-4	Magnesium[g]	3.5 E-03	--
78-85-3	Methacrolein	ND	2.9 E-04
75-52-5	Methane, nitro[g]	2.1 E-05	--
91-80-5	Methapyrilene	ND	4.8 E-03
100-97-0	Methenamine[i]	1.1 E-04	--
104-85-8	4-Methylbenzonitrile	ND	4.9 E-04
563-80-4	3-Methyl-2-butanone	ND	3.6 E-04
563-45-1	3-Methyl-1-butene[g]	1.6 E-05	--
563-46-2	2-Methyl-1-butene	3.6 E-05	--
513-35-9	2-Methyl-2-butene	ND	1.0 E-04
108-87-2	Methylcyclohexane[g]	7.7 E-06	--
96-37-7	Methylcyclopentane[g]	5.8 E-06	--
78-93-3	Methyl ethyl ketone[f]	9.7 E-06	--
620-02-0	5-Methyl-2-furaldehyde	ND	4.6 E-04
534-22-5	2-Methylfuran	ND	3.4 E-04
930-27-8	3-Methylfuran	ND	3.4 E-04
592-27-8	2-Methylheptane	3.6 E-06	--
591-76-4	2-Methylhexane[g]	4.8 E-06	--
589-34-4	3-Methylhexane	2.2 E-05	--
66-27-3	Methyl methanesulfonate	ND	7.1 E-05
624-91-9	Methylnitrite	ND	2.5 E-04
107-83-5	2-Methylpentane[g]	2.6 E-06	--
96-14-0	3-Methylpentane[g]	1.3 E-05	--
763-29-1	2-Methyl-1-pentene	ND	1.0 E-04
625-27-4	2-Methyl-2-pentene[g]	7.5 E-06	--
691-37-2	4-Methyl-1-pentene	ND	1.0 E-04
691-38-3	cis-4-Methyl-2-pentene	ND	1.0 E-04

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
554-14-3	2-Methylthiophene	ND	4.1 E-04
616-44-4	3-Methylthiophene	ND	4.1 E-04
479-45-8	Methyl-2,4,6-trinitrophenylnitramine	ND	6.7 E-05
78-94-4	Methyl vinyl ketone	ND	2.9 E-04
88-74-4	2-Nitroaniline	ND	7.0 E-05
99-09-2	3-Nitroaniline	ND	1.9 E-04
10595-95-6	N-Nitrosomethylethylamine	ND	1.6 E-04
930-55-2	N-Nitrosopyrrolidine	ND	5.3 E-04
112-05-0	Nonaic acid[i]	1.9 E-05	--
124-19-6	Nonanal	ND	5.9 E-04
111-84-2	n-Nonane	2.8 E-05	--
821-55-6	2-Nonanone	ND	5.9 E-04
124-11-8	1-Nonene[i]	2.0 E-05	--
--	OCS	ND	2.5 E-04
124-13-0	Octanal	ND	5.3 E-04
111-65-9	n-Octane	9.7 E-06	--
1600-37-9	1,1,2,3,3-Pentachloro-1-propene	ND	8.9 E-04
110-62-3	Pentanal	ND	3.6 E-04
78-78-4	i-Pentane	0	--
109-66-0	n-Pentane	0	--
600-14-6	2,3-Pentanedione	ND	4.2 E-04
107-87-9	2-Pentanone	ND	3.6 E-04
96-22-0	3-Pentanone	ND	3.6 E-04
109-67-1	1-Pentene[h]	3.5 E-05	--
627-20-3	cis-2-Pentene	1.3 E-05	--
646-04-8	trans-2-Pentene	2.5 E-05	--
1629-58-9	1-Penten-3-one	ND	3.5 E-04
625-33-2	3-Penten-2-one	ND	3.5 E-04
62-44-2	Phenacetin	ND	8.1 E-05
536-74-3	Phenylacetylene	ND	6.1 E-04
80-56-8	alpha-Pinene	ND	1.0 E-04
127-91-3	beta-Pinene	ND	1.0 E-04
74-98-6	Propane	8.0 E-05	--
103-65-1	n-Propylbenzene	5.8 E-06	--

TABLE A3 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[e]
673-32-5	1-Propynylbenzene[i]	2.8 E-05	--
121-82-4	RDX	2.3 E-02	--
95-94-3	1,2,4,5-Tetrachlorobenzene	ND	9.0 E-05
58-90-2	2,3,4,6-Tetrachlorophenol[h]	1.0 E-05	--
109-99-9	Tetrahydrofuran	ND	3.0 E-04
110-02-1	Thiophene	ND	3.5 E-04
98-03-3	2-Thiophenecarboxaldehyde	ND	4.7 E-04
546-06-2	Trichloroacetonitrile	ND	6.0 E-04
526-73-8	1,2,3-Trimethylbenzene[i]	3.0 E-05	--
108-67-8	1,3,5-Trimethylbenzene[g]	1.0 E-05	--
16747-26-5	2,2,4-Trimethylhexane[h]	2.0 E-06	--
565-75-3	2,3,4-Trimethylpentane[g]	6.8 E-06	--
107-39-1	2,4,4-Trimethyl-1-pentene	8.4 E-06	--
107-40-4	2,4,4-Trimethyl-2-pentene	ND	1.0 E-04
99-35-4	1,3,5-Trinitrobenzene[g]	ND	1.2 E-04
118-96-7	2,4,6-Trinitrotoluene	ND	2.3 E-05

[a] CASRN = Chemical Abstracts Service Registry Number.
[b] ND = nondetected.
[c] Emission factors rated C unless otherwise noted.
[d] NEW = net explosive weight. The NEW for this ordnance is 2.86 E-03 pounds per linear foot of demolition charge. The complete ordnance includes 4 linear feet of charge and has an NEW of 1.14 E-02 pounds. During testing, a 168 linear foot section of charge was used with an NEW of 4.80 E-01 pounds. Because the length of charge used may vary, emission factors are not presented in terms of pounds of emissions per item.
[e] Data provided for compounds that were not detected.
[f] Emission factor rated A because of correlation with emission factors for similar ordnance and number of test data points.
[g] Emission factor rated B because of correlation with emission factors for similar ordnance and number of test data points.
[h] Emission factor rated D because the factor is based upon C-rated test data.
[i] Emission factor rated D because the factor is for a tentatively identified compound.

TABLE A4 COMPOUNDS ANALYZED AND EMISSION FACTORS DEVELOPED FOR DODIC ML15, LINEAR SHAPED DEMOLITION CHARGE, 225 GR/FT

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
Carbon Dioxide, Criteria Pollutants, Total Nonmethane Hydrocarbons, and Total Suspended Particulates			
124-38-9	Carbon dioxide[f]	4.4 E-01	--
630-08-0	Carbon monoxide[g]	1.8 E-01	--
7439-92-1	Lead	8.5 E-01	--
--	Oxides of nitrogen[f]	4.6 E-02	--
--	PM-2.5[g]	8.1 E-02	--
--	PM-10	2.3	--
7446-09-5	Sulfur dioxide[h]	7.4 E-07	--
--	Total nonmethane hydrocarbons	2.0 E-02	--
12789-66-1	Total suspended particulate	5.1	--
Hazardous Air Pollutants and Toxic Chemicals			
83-32-9	Acenaphthene[g]	4.3 E-07	--
208-96-8	Acenaphthylene[g]	2.9 E-06	--
75-07-0	Acetaldehyde[g]	ND	1.8 E-04
75-05-8	Acetonitrile[g]	7.4 E-05	--
98-86-2	Acetophenone	ND	5.0 E-04
53-96-3	2-Acetylaminofluorene	ND	1.4 E-04
107-02-8	Acrolein	ND	2.3 E-04
107-13-1	Acrylonitrile	3.3 E-06	--
107-05-1	Allyl chloride	ND	3.2 E-04
7429-90-5	Aluminum[g]	7.7 E-03	--
92-67-1	4-Aminobiphenyl	ND	4.9 E-03
7664-41-7	Ammonia	2.3 E-02	--
62-53-3	Aniline	ND	5.0 E-04
120-12-7	Anthracene[g]	4.0 E-07	--
7440-36-0	Antimony	3.0 E-01	--
7440-38-2	Arsenic	8.3 E-04	--
7440-39-3	Barium	2.2 E-04	--
71-43-2	Benzene[g]	5.9 E-04	--
92-87-5	Benzidine	ND	8.0 E-03
56-55-3	Benzo[a]anthracene	ND	1.2 E-04
205-99-2	Benzo[b]fluoranthene	ND	1.0 E-04
207-08-9	Benzo[k]fluoranthene	ND	1.2 E-04

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
191-24-2	Benzo[g,h,i]perylene	6.9 E-07	--
50-32-8	Benzo[a]pyrene	ND	1.2 E-04
100-44-7	Benzyl chloride	ND	5.3 E-04
7440-41-7	Beryllium	3.5 E-06	--
74-83-9	Bromomethane	ND	4.0 E-04
101-55-3	4-Bromophenylphenylether	ND	1.0 E-04
106-99-0	1,3-Butadiene[g]	6.9 E-05	--
123-72-8	Butanal	ND	3.0 E-04
71-36-3	n-Butanol	ND	3.1 E-04
111-76-2	2-Butoxyethanol[i]	9.4 E-05	--
85-68-7	Butylbenzylphthalate[f]	5.0 E-06	--
7440-43-9	Cadmium	1.9 E-05	--
86-74-8	Carbazole	ND	7.2 E-05
56-23-5	Carbon tetrachloride	2.9 E-07	--
7782-50-5	Chlorine	ND	2.1 E-02
106-47-8	p-Chloroaniline	ND	2.2 E-04
108-90-7	Chlorobenzene	ND	4.7 E-04
510-15-6	Chlorobenzilate	ND	9.5 E-05
75-00-3	Chloroethane	ND	2.7 E-04
111-91-1	bis(2-Chloroethoxy)methane	ND	1.4 E-04
111-44-4	bis(2-Chloroethyl)ether	ND	1.1 E-04
67-66-3	Chloroform	ND	5.0 E-04
108-60-1	bis(2-Chloroisopropyl)ether	ND	1.2 E-04
74-87-3	Chloromethane[g]	ND	2.1 E-04
91-58-7	2-Chloronaphthalene	ND	1.3 E-04
7005-72-3	4-Chlorophenylphenyl ether	ND	7.2 E-05
7440-47-3	Chromium[g]	3.7 E-03	--
218-01-9	Chrysene	ND	7.8 E-05
7440-48-4	Cobalt[g]	3.2 E-05	--
7440-50-8	Copper[g]	4.4 E-03	--
98-82-8	Cumene[g]	3.6 E-06	--
110-82-7	Cyclohexane	8.0 E-06	--
2303-16-4	Diallate	ND	1.3 E-04
53-70-3	Dibenz[a,h]anthracene	ND	1.2 E-04
132-64-9	Dibenzofuran	2.0 E-06	--

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
106-93-4	1,2-Dibromoethane	ND	7.8 E-04
84-74-2	Dibutyl phthalate[f]	2.0 E-06	--
95-50-1	1,2-Dichlorobenzene	ND	6.1 E-04
541-73-1	1,3-Dichlorobenzene	ND	6.1 E-04
106-46-7	1,4-Dichlorobenzene	ND	6.1 E-04
91-94-1	3,3'-Dichlorobenzidine	ND	5.9 E-04
75-71-8	Dichlorodifluoromethane[g]	ND	5.0 E-04
75-34-3	1,1-Dichloroethane	ND	4.1 E-04
107-06-2	1,2-Dichloroethane	ND	4.1 E-04
540-59-0	1,2-Dichloroethene	ND	4.0 E-04
76-14-2	Dichlorotetrafluoroethane	ND	7.1 E-04
120-83-2	2,4-Dichlorophenol	ND	1.3 E-04
78-87-5	1,2-Dichloropropane	ND	4.7 E-04
10061-02-6	trans-1,3-Dichloro-1-propene	ND	4.6 E-04
60-11-7	p-Dimethylaminoazobenzene	ND	1.5 E-04
57-97-6	7,12-Dimethylbenz[a]anthracene	ND	2.0 E-04
119-93-7	3,3'-Dimethylbenzidine	ND	7.8 E-03
131-11-3	Dimethyl phthalate[h]	6.7 E-07	--
105-67-9	2,4-Dimethylphenol	ND	4.2 E-04
99-65-0	1,3-Dinitrobenzene	ND	2.3 E-04
534-52-1	4,6-Dinitro-o-cresol	ND	2.6 E-03
51-28-5	2,4-Dinitrophenol	ND	6.2 E-03
121-14-2	2,4-Dinitrotoluene	ND	6.9 E-05
606-20-2	2,6-Dinitrotoluene	1.1 E-05	--
--	Total dioxin/furan compounds	2.2 E-07	--
100-41-4	Ethylbenzene[g]	6.2 E-05	--
74-85-1	Ethylene[g]	2.3 E-03	--
117-81-7	bis(2-Ethylhexyl)phthalate[f]	1.9 E-05	--
206-44-0	Fluoranthene[g]	9.4 E-07	--
86-73-7	Fluorene[g]	1.5 E-06	--
50-00-0	Formaldehyde	2.4 E-03	--
76-13-1	Freon 113[g]	8.3 E-07	--
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	5.2 E-08	--

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	1.1 E-09	--
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	1.0 E-09	--
118-74-1	Hexachlorobenzene	ND	1.2 E-04
87-68-3	Hexachlorobutadiene	ND	1.1 E-03
77-47-4	Hexachlorocyclopentadiene	ND	1.4 E-03
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	1.6 E-09	--
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	4.3 E-09	--
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	5.0 E-09	--
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	3.8 E-10	--
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	2.8 E-10	--
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	9.5 E-11	--
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	3.6 E-10	--
67-72-1	Hexachloroethane	ND	9.8 E-04
110-54-3	n-Hexane[h]	2.0 E-05	--
7647-01-0	Hydrochloric acid	ND	3.9 E-02
1634-04-4	Hydrogen cyanide	6.3 E-03	--
193-39-5	Indeno[1,2,3-cd]pyrene	ND	1.3 E-04
78-59-1	Isophorone	ND	6.1 E-04
67-63-0	Isopropyl alcohol	ND	2.5 E-04
120-58-1	Isosafrole	ND	5.9 E-04
7439-92-1	Lead	8.5 E-01	--
7439-96-5	Manganese[g]	1.7 E-04	--
7439-97-6	Mercury	4.2 E-07	--
56-49-5	3-Methylcholanthrene	ND	3.1 E-04
75-09-2	Methylene chloride	1.1 E-01	--
108-10-1	Methyl isobutyl ketone	ND	4.2 E-04
556-61-6	Methyl isothiocyanate	ND	3.0 E-04
90-12-0	1-Methylnaphthalene	1.5 E-06	--
91-57-6	2-Methylnaphthalene	9.0 E-07	--
95-48-7	2-Methylphenol	ND	1.0 E-04
109-06-8	2-Methylpyridine	ND	6.1 E-04

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
1634-04-4	Methyl tert-butyl ether	ND	3.7 E-04
91-20-3	Naphthalene[g]	1.8 E-05	--
130-15-4	1,4-Naphthoquinone	ND	2.0 E-04
134-32-7	1-Naphthylamine	ND	6.3 E-03
91-59-8	2-Naphthylamine	ND	7.3 E-03
7440-02-0	Nickel[g]	4.8 E-05	--
100-01-6	4-Nitroaniline	ND	2.7 E-04
98-95-3	Nitrobenzene	ND	5.1 E-04
88-75-5	2-Nitrophenol	ND	6.7 E-05
100-02-7	4-Nitrophenol	ND	1.1 E-03
56-57-5	4-Nitroquinoline-1-oxide	ND	1.9 E-03
924-16-3	N-Nitroso-di-n-butylamine	ND	1.4 E-04
55-18-5	N-Nitrosodiethylamine	ND	1.3 E-04
62-75-9	N-Nitrosodimethylamine	ND	1.6 E-04
621-64-7	N-Nitroso-di-n-propylamine	ND	2.8 E-04
59-89-2	N-Nitrosomorpholine	ND	2.4 E-04
100-75-4	N-Nitrosopiperidine	ND	1.6 E-04
99-55-8	5-Nitro-o-toluidine	ND	2.0 E-04
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	1.5 E-07	--
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran	2.4 E-09	--
608-93-5	Pentachlorobenzene	ND	9.6 E-05
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1.8 E-09	--
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	1.3 E-10	--
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	1.5 E-10	--
76-01-7	Pentachloroethane	ND	2.0 E-04
82-68-8	Pentachloronitrobenzene	ND	9.3 E-04
87-86-5	Pentachlorophenol	ND	1.7 E-03
85-01-8	Phenanthrene[g]	2.4 E-06	--
108-95-2	Phenol	2.6 E-05	--
7723-14-0	Phosphorus[g]	4.9 E-04	--
23950-58-5	Pronamide	ND	1.3 E-04
115-07-1	Propylene[g]	6.4 E-04	--
123-38-6	Propionaldehyde	ND	2.4 E-04

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
129-00-0	Pyrene[g]	1.5 E-06	--
110-86-1	Pyridine	ND	5.7 E-04
94-59-7	Safrole	ND	1.2 E-04
7440-22-4	Silver	1.1 E-04	--
100-42-5	Styrene	3.3 E-05	--
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	2.9 E-10	--
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	2.1 E-10	--
79-34-5	1,1,2,2-Tetrachloroethane	ND	7.0 E-04
127-18-4	Tetrachloroethylene	ND	6.9 E-04
7440-28-0	Thallium[h]	3.3 E-05	--
108-88-3	Toluene[g]	3.0 E-04	--
95-53-4	o-Toluidine	ND	2.0 E-04
120-82-1	1,2,4-Trichlorobenzene	ND	7.5 E-04
71-55-6	1,1,1-Trichloroethane	ND	5.5 E-04
79-00-5	1,1,2-Trichloroethane	ND	5.5 E-04
79-01-6	Trichloroethylene	ND	5.4 E-04
75-69-4	Trichloromonofluoromethane	0	--
95-95-4	2,4,5-Trichlorophenol	ND	3.1 E-04
88-06-2	2,4,6-Trichlorophenol	ND	2.5 E-04
96-18-4	1,2,3-Trichloropropane	ND	6.1 E-04
95-63-6	1,2,4-Trimethylbenzene[g]	8.4 E-05	--
540-84-1	2,2,4-Trimethylpentane[g]	7.5 E-05	--
75-01-4	Vinyl chloride	ND	2.6 E-04
75-35-4	Vinylidene chloride	ND	4.0 E-04
106-42-3, 108-38-3	m-Xylene, p-Xylene[g]	2.4 E-04	--
95-47-6	o-Xylene[g]	8.3 E-05	--
7440-66-6	Zinc[g]	5.3 E-03	--
Other Pollutants			
64-19-7	Acetic acid	ND	2.5 E-04
67-64-1	Acetone[h]	1.6 E-06	--
592-20-1	1-Acetoxyacetone	ND	4.8 E-04
74-86-2	Acetylene[g]	5.6 E-04	--
100-52-7	Benzaldehyde	1.2 E-05	--
271-89-6	Benzofuran	ND	4.9 E-04

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
65-85-0	Benzoic acid	ND	9.3 E-03
100-47-0	Benzonitrile	ND	4.3 E-04
100-51-6	Benzyl alcohol	1.3 E-05	--
107-04-0	1-Bromo-2-chloroethane	ND	5.9 E-04
123-73-9	trans-2-Butenal	ND	2.9 E-04
75-28-5	i-Butane[h]	4.3 E-05	--
106-97-8	n-Butane[h]	8.0 E-05	--
431-03-8	2,3-Butanedione	ND	3.6 E-04
106-98-9	1-Butene	2.3 E-04	--
115-11-7	i-Butene	1.3 E-04	--
590-18-1	cis-2-Butene	1.3 E-05	--
624-64-6	trans-2-Butene[g]	9.1 E-05	--
109-69-3	1-Chlorobutane	ND	3.9 E-04
622-98-0	1-Chloro-4-ethylbenzene	ND	5.8 E-04
95-49-8	1-Chloro-2-methylbenzene	ND	5.3 E-04
108-41-8	1-Chloro-3-methylbenzene	ND	5.3 E-04
59-50-7	4-Chloro-3-methylphenol	ND	2.6 E-04
95-57-8	2-Chlorophenol	ND	1.4 E-04
2698-41-1	CS2[h]	2.2 E-05	--
535-77-3	m-Cyamine[i]	4.2 E-05	--
2074-87-5	Cyanogen[h]	9.4 E-05	--
287-92-3	Cyclopentane	6.2 E-06	--
120-92-3	Cyclopentanone	ND	3.5 E-04
541-02-6	Cyclopentasiloxane, decamethyl-[i]	2.7 E-05	--
142-29-0	Cyclopentene	2.1 E-05	--
930-30-3	2-Cyclopenten-1-one	ND	3.4 E-04
124-18-5	n-Decane[g]	7.5 E-06	--
13466-78-9	delta 3-Carene	ND	1.0 E-04
3018-12-0	Dichloroacetonitrile	ND	4.6 E-04
616-21-7	1,2-dichlorobutane	ND	5.3 E-04
32768-54-0	1,2-Dichloro-3-methylbenzene	ND	6.7 E-04
594-37-6	1,2-Dichloro-2-methylpropane	ND	5.3 E-04
87-65-0	2,6-Dichlorophenol	ND	1.2 E-04
513-88-2	1,1-Dichloro-2-propanone	ND	5.3 E-04
10061-01-5	cis 1,3-Dichloro-1-propene	ND	4.6 E-04

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
84-66-2	Diethylphthalate	1.0 E-07	--
75-83-2	2,2-Dimethylbutane[g]	2.2 E-05	--
79-29-8	2,3-Dimethylbutane	3.3 E-06	--
624-92-0	Dimethyldisulfide	ND	3.9 E-04
625-86-5	2,5-Dimethylfuran	ND	4.0 E-04
1071-26-7	2,2-Dimethylheptane	ND	1.0 E-04
584-94-1	2,3-Dimethylhexane	4.9 E-06	--
589-43-5	2,4-Dimethylhexane[g]	6.9 E-06	--
592-13-2	2,5-Dimethylhexane	8.7 E-06	--
565-59-3	2,3-Dimethylpentane[g]	3.7 E-06	--
108-08-7	2,4-Dimethylpentane	7.7 E-06	--
--	Dimethylphenethylamine	ND	0
463-82-1	2,2-Dimethylpropane	ND	1.0 E-04
3658-80-8	Dimethyltrisulfide	ND	5.2 E-04
117-84-0	Di-n-octylphthalate[g]	1.0 E-05	--
74-84-0	Ethane[g]	4.1 E-04	--
64-17-5	Ethanol	ND	1.9 E-04
637-92-3	Ethyl tert-butyl ether	4.8 E-06	--
1678-91-7	Ethylcyclohexane	ND	1.0 E-04
619-99-8	3-Ethylhexane	1.4 E-05	--
62-50-0	Ethyl methanesulfonate	ND	5.5 E-05
7364-20-7	4-Ethyl-methylester-benzoic acid[i]	2.9 E-05	--
620-14-4	m-Ethyltoluene[g]	1.8 E-05	--
611-14-3	o-Ethyltoluene[g]	1.5 E-05	--
622-96-8	p-Ethyltoluene[g]	5.1 E-05	--
--	F22	2.3 E-04	--
98-01-1	2-Furaldehyde	ND	4.0 E-04
498-60-2	3-Furaldehyde	ND	4.0 E-04
110-00-9	Furan	ND	2.8 E-04
111-71-7	Heptanal	ND	4.7 E-04
142-82-5	n-Heptane[g]	2.8 E-05	--
110-43-0	2-Heptanone	ND	4.7 E-04
1888-71-7	Hexachloropropene	ND	1.9 E-04
66-25-1	Hexanal[h]	6.0 E-06	--
591-78-6	2-Hexanone	ND	4.2 E-04

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
592-41-6	1-Hexene[g]	1.4 E-04	--
7688-21-3	cis-2-Hexene	1.8 E-06	--
4050-45-7	trans-2-Hexene[g]	6.5 E-06	--
123-42-2	4-Hydroxy-4-methyl-2-pentanone[i]	2.5 E-05	--
496-11-7	Indane	1.9 E-06	--
95-13-6	Indene[i]	2.7 E-05	--
78-79-5	Isoprene	ND	1.0 E-04
626-19-7	Isophthalaldehyde[i]	3.3 E-05	--
5989-27-5	d-Limonene	ND	1.0 E-04
7439-95-4	Magnesium[g]	7.8 E-03	--
78-85-3	Methacrolein	ND	2.9 E-04
75-52-5	Methane, nitro[g]	1.2 E-05	--
91-80-5	Methapyrilene	ND	8.7 E-03
100-97-0	Methenamine[i]	2.9 E-05	--
104-85-8	4-Methylbenzonitrile	ND	4.9 E-04
563-80-4	3-Methyl-2-butanone	ND	3.6 E-04
563-45-1	3-Methyl-1-butene[g]	8.1 E-06	--
563-46-2	2-Methyl-1-butene	1.8 E-05	--
513-35-9	2-Methyl-2-butene	ND	1.0 E-04
108-87-2	Methylcyclohexane[g]	2.2 E-05	--
96-37-7	Methylcyclopentane	1.2 E-05	--
78-93-3	Methyl ethyl ketone[f]	5.8 E-06	--
620-02-0	5-Methyl-2-furaldehyde	ND	4.6 E-04
534-22-5	2-Methylfuran	ND	3.4 E-04
930-27-8	3-Methylfuran	ND	3.4 E-04
592-27-8	2-Methylheptane	1.3 E-05	--
591-76-4	2-Methylhexane[g]	1.1 E-05	--
589-34-4	3-Methylhexane	6.9 E-05	--
66-27-3	Methyl methanesulfonate	ND	1.3 E-04
624-91-9	Methylnitrite	ND	2.5 E-04
107-83-5	2-Methylpentane	1.5 E-05	--
96-14-0	3-Methylpentane	1.8 E-05	--
763-29-1	2-Methyl-1-pentene	ND	1.0 E-04
625-27-4	2-Methyl-2-pentene[g]	6.2 E-06	--
691-37-2	4-Methyl-1-pentene	ND	1.0 E-04

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
691-38-3	cis-4-Methyl-2-pentene	ND	1.0 E-04
108-11-2	4-Methyl-2-pentanol[i]	6.4 E-05	--
1074-17-5	Methylpropylbenzene[i]	4.2 E-05	--
1074-43-7	1-Methyl-3-propylbenzene[i]	4.1 E-05	--
554-14-3	2-Methylthiophene	ND	4.1 E-04
616-44-4	3-Methylthiophene	ND	4.1 E-04
479-45-8	Methyl-2,4,6-trinitrophenylnitramine	ND	1.2 E-04
78-94-4	Methyl vinyl ketone	ND	2.9 E-04
88-74-4	2-Nitroaniline	ND	1.3 E-04
99-09-2	3-Nitroaniline	ND	3.4 E-04
10595-95-6	N-Nitrosomethylethylamine	ND	2.9 E-04
930-55-2	N-Nitrosopyrrolidine	ND	9.7 E-04
124-19-6	Nonanal	ND	5.9 E-04
111-84-2	n-Nonane	3.8 E-05	--
821-55-6	2-Nonanone	ND	5.9 E-04
--	OCS	ND	2.5 E-04
124-13-0	Octanal	ND	5.3 E-04
111-65-9	n-Octane	2.6 E-05	--
1600-37-9	1,1,2,3,3-Pentachloro-1-propene	ND	8.9 E-04
110-62-3	Pentanal	ND	3.6 E-04
78-78-4	i-Pentane[h]	1.0 E-04	--
109-66-0	n-Pentane[h]	7.3 E-05	--
600-14-6	2,3-Pentanedione	ND	4.2 E-04
107-87-9	2-Pentanone	ND	3.6 E-04
96-22-0	3-Pentanone	ND	3.4 E-04
109-67-1	1-Pentene	6.8 E-06	--
627-20-3	cis-2-Pentene	8.5 E-06	--
646-04-8	trans-2-Pentene[h]	5.7 E-06	--
1629-58-9	1-Penten-3-one	ND	3.5 E-04
625-33-2	3-Penten-2-one	ND	3.5 E-04
62-44-2	Phenacetin	ND	1.5 E-04
536-74-3	Phenylacetylene	ND	6.1 E-04
80-56-8	alpha-Pinene	ND	1.0 E-04
127-91-3	beta-Pinene	ND	1.0 E-04

TABLE A4 (cont.)

CASRN[a]	Compound	Emission Factor lb per lb NEW[b,c,d]	Minimum Detection Level mg/m^3[3,e]
74-98-6	Propane	9.1 E-05	--
103-65-1	n-Propylbenzene	1.5 E-05	--
121-82-4	RDX	2.1 E-02	--
95-94-3	1,2,4,5-Tetrachlorobenzene	ND	1.6 E-04
58-90-2	2,3,4,6-Tetrachlorophenol	ND	7.5 E-04
109-99-9	Tetrahydrofuran	3.6 E-07	--
110-02-1	Thiophene	ND	3.5 E-04
98-03-3	2-Thiophenecarboxaldehyde	ND	4.7 E-04
546-06-2	Trichloroacetonitrile	ND	6.0 E-04
108-67-8	1,3,5-Trimethylbenzene[g]	2.5 E-05	--
16747-26-5	2,2,4-Trimethylhexane[h]	3.0 E-06	--
565-75-3	2,3,4-Trimethylpentane[g]	9.9 E-06	--
107-39-1	2,4,4-Trimethyl-1-pentene[h]	3.5 E-06	--
107-40-4	2,4,4-Trimethyl-2-pentene	ND	1.0 E-04
99-35-4	1,3,5-Trinitrobenzene[g]	2.5 E-06	--
118-96-7	2,4,6-Trinitrotoluene	ND	4.1 E-05

[a] CASRN = Chemical Abstracts Service Registry Number.
[b] ND = nondetected.
[c] Emission factors rated C unless otherwise noted.
[d] NEW = net explosive weight. The NEW for this ordnance is 3.21 E-02 pounds per linear foot of demolition charge. The complete ordnance includes 4 linear feet of charge and has an NEW of 1.28 E-01 pounds. During testing, a 15 linear foot section of charge was used with an NEW of 4.82 E-01 pounds. Because the length of charge used may vary, emission factors are not presented in terms of pounds of emissions per item.
[e] Data provided for compounds that were not detected.
[f] Emission factor rated A because of correlation with emission factors for similar ordnance and number of test data points.
[g] Emission factor rated B because of correlation with emission factors for similar ordnance and number of test data points.
[h] Emission factor rated D because the factor is based upon C-rated test data.
[i] Emission factor rated D because the factor is for a tentatively identified compound.

APPENDIX B

NEW AP-42 SECTIONS FOR ORDNANCE INCLUDED IN PHASE IV-A TESTING AT DUGWAY PROVING GROUND, UTAH

Electronic versions of the new AP-42 sections for ordnance included in Phase IV-A testing at Dugway Proving Ground, Utah, are located on the EPA website at: http://www.epa.gov/ttn/chief/ap42/index.html.

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