Range Scrap (Firing Point) Study Characterization Strategy Report

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Prepared for

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

RANGE SCRAP (FIRING POINT) STUDY
CHARACTERIZATION STRATEGY REPORT

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

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ACRONYMS

AEC	U.S. Army Environmental Center
ASP	Ammunition Supply Point
BMP	Best Management Practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Chain-of-Custody
DNT	Dinitrotoluene
DoD	U.S. Department of Defense
DoDAC	DoD Ammunition Code
DoDIC	DoD Item Code
DQO	Data Quality Objective
DRMO	Defense Reutilization and Marketing Office
EPA	U.S. Environmental Protection Agency
FORSCOM	Forces Command
HC	Hexachloroethane
HE	High Explosive
HQDA	Headquarters U.S. Department of Army
HWM	Hazardous Waste Management
LDR	Land Disposal Restriction
MDL	Method Detection Limit
MIDAS	Munitions Items Disposition Action System
MRIC	Munitions Rule Implementation Council
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCB	Polychlorinated Biphenyl
PEP	Propellants, Explosives, and Pyrotechnics
PETN	Pentaerythritol Tetranitrate
ppm	parts per million
QA	Quality Assurance

ACRONYMS (Continued)

QC	Quality Control
Radian	Radian International
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
TRADOC	Training and Doctrine Command
UHC	Underlying Hazardous Constituent
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

The Headquarters U.S. Department of Army (HQDA) is working to promote a consistent approach to the management of range residues being removed from its training ranges. In support of HQDA, the U.S. Army Environmental Center has taken steps toward meeting this objective. This report provides a strategy for characterizing range scrap, particularly firing point scrap, items based on the regulatory framework and the inventory of firing point range scrap identified in an earlier phase of this project and presented in the *Range Scrap (Firing Point) Study Data Review and Inventory Report*, June 1999. "Firing point" range scrap as referred to in this report includes items that, under typical circumstances, are generated and removed from the firing point/line, as well as items that are routinely returned to Army installation ammunition supply points, recycle yards, Defense Reutilization and Marketing Office scrap yards, and range clearance scrap yards.

Accomplishment of the HQDA objective will require additional actions, including the development of item-specific waste profiles and best management practices (BMPs) for the inventory.

The range scrap inventory and regulatory framework provide a basis for a systematic approach to the development of item-specific profiles. The profiles will be created using existing information and, if necessary, through laboratory analysis as prescribed in this report. BMPs for the scrap inventory (firing point) will be developed in accordance with item profiles and in consideration of other regulatory requirements and scrap metal industry standards.

Completion of this study will assist generators of range scrap to manage those items in a consistent manner and in accordance with applicable regulatory requirements.

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1.0 INTRODUCTION

The U.S. Army Environmental Center (AEC) has initiated an inventory and characterization of solid waste on ranges. This strategy report addresses the characterization requirements for the inventory of firing point range scrap identified in Phase I of this project, *Range Scrap (Firing Point) Study Data Review and Inventory Report*, June 1999.

1.1 Background

During the development of the Munitions Rule Implementation Plan, the Munitions Rule Implementation Council (MRIC) recognized the emerging issues regarding the requirements for management of recyclable range scrap metal to comply with the Military Munitions Rule and existing Resource Conservation and Recovery Act (RCRA) requirements. In March 1998, MRIC requested the U.S. Department of Defense (DoD) Hazardous Waste Management (HWM) Subcommittee to determine whether DoD should undertake a waste characterization (hazardous or nonhazardous) of recyclable residue resulting from range operations. The DoD HWM Subcommittee assigned a working group to review the RCRA issues and to determine the requirements for a waste determination of recyclable range scrap metal.

The DoD HWM Subcommittee initially determined that DoD can either (1) take advantage of a RCRA exclusion for "excluded scrap metal" (in those few states that have adopted this provision) from the definition of a regulatory "solid waste" or (2) use process knowledge to declare scrap metal resulting from range operations as hazardous waste and take advantage of the exemption for "scrap metal" from the bulk of RCRA Subtitle C requirements. However, other related issues were raised that are not directly addressed by this approach, such as:

- Does the RCRA exclusion for "excluded scrap metal" and/or the exemption for "scrap metal" apply to residual constituents (e.g., explosive residue) that may be present on the scrap metal?

- By assuming all range scrap metal is hazardous, these items are potentially subject to overly strict regulatory RCRA interpretations by states and U.S. Environmental Protection Agency (EPA) regional offices.
- Are additional management procedures needed to ensure that these items will meet the definition of "excluded scrap metal" and "scrap metal"?
- Are additional management procedures needed to prevent release of hazardous constituents, which may be present on the scrap metal items, and to minimize concerns?

While DoD may take advantage of the exclusion for "excluded scrap metal" and the exemption for "scrap metal," the DoD HWM Subcommittee concluded that characterization and a regulatory framework are needed to:

- Address the unique characteristics of specific items (no "one size fits all"),
- Provide a consistent management approach for each item, and
- Provide the best benefit relative to regulatory position for addressing concerns.

In addition to compiling data to characterize those items that require a hazardous waste determination, sampling and analysis of range residues would:

- Support DoD decision-making on appropriate management practices;
- Avoid subjecting items to overly strict regulatory interpretations;
- Identify underlying hazardous constituents (UHCs);
- Minimize on-site RCRA corrective action liability associated with mismanaged items;
- Minimize long-term Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) liability;
- Provide assurance to downstream processors; and
- Provide a source of data for range evaluation and potential remedial actions.

To address the issues discussed above, AEC is conducting the Range Scrap Study to develop the regulatory framework for management of range residues, to compile data to characterize those items that require a waste characterization, and to recommend best management practices (BMPs) for managing these items in accordance with RCRA.

1.2 Project Requirements

The purpose of this project is to assist Headquarters U.S. Department of Army (HQDA) and AEC with identification and characterization of solid waste and range residue (range scrap) generated by military personnel from the intended use (firing and training) of munitions and other training propellants, explosives, and pyrotechnics (PEP) items at training ranges. The primary objective of this project is to perform a comprehensive inventory of the items utilized in support of Army training and mission activities on ranges at the firing point, characterize these items in accordance with RCRA, and develop environmental BMPs for these items, including all aspects from handling to final disposition.

This project is being executed in a phased approach to provide AEC/HQDA with:

Phase I

- Development of a regulatory framework for managing range scrap;
- An inventory of solid waste and residual material generated during training exercises;

Phase II

- Development of a characterization scheme for residual material, including analytical recommendations;
- Development of characterization and characterization profiles for the inventory; and

Phase III

- Development of BMPs for the inventory, consistent with profiles developed in the characterization phase.

This report presents the scheme for characterizing range scrap as required in Phase II. The regulatory framework and inventory developed in Phase I are utilized in this strategy report to identify the data needed to meet the objectives of this study.

1.3 Organization of Report

This strategy report includes the following sections:

- **Section 1** provides and introduction and description of the project.
- **Section 2** presents the data quality objectives (DQOs) developed for characterizing range scrap.
- **Section 3** discusses the general sampling and analytical methods to be performed.
- **Section 4** provides the characterization rationale for each waste stream and the specific sampling and analysis requirements for each scrap item.
- **Section 5** provides the data reduction, validation, and reporting requirements, as well as the approach for interpreting the results to satisfy the project DQOs.

2.0 PROJECT DQOs

The purpose of this project is to assist HQDA and AEC with the identification and characterization of solid waste and range residue (range scrap) generated by military personnel from the intended use (firing and training) of munitions and other training PEP items at training/testing ranges. The primary objective of this project is to perform a comprehensive inventory of the items used in support of Army training and range activities, characterize these items in accordance with the regulatory framework developed for the project, and develop environmental BMPs for these items, including all aspects from handling to final disposition.

The DQO process summarized in EPA QA/G-4, *Guidance Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objective Process*, was used to develop a logical and formal approach to characterization and development of BMPs and is presented in this strategy report. The DQO approach is a process for making decisions in an uncertain environment. It is a predicted iterative process that drives the collection of data for the purpose of characterization, technical evaluation, and election and implementation of BMPs.

The DQO process is listed below and described in the following sections.

1. State the problem,
2. Identify the decision,
3. Identify inputs to the decision,
4. Define study boundaries,
5. Develop a decision rule,
6. Specify limits on decision errors, and
7. Optimize the design for obtaining data.

2.1 Problem Statement

In response to many new challenges rising from an interest in safety and environmental issues associated with the disposition of residue from ranges, AEC is conducting an inventory and characterization of solid waste generated from the use of munitions on Army troop training ranges. *The overall goal is to promote a consistent approach to the management of these residue items and do so in accordance with environmental requirements*. Waste characterization must:

- Address the unique characteristics of specific items (no "one size fits all"),
- Provide a consistent management approach for each item, and
- Provide the best benefit relative to a regulatory position for addressing concerns.

To achieve this goal, each organization that has responsibilities for management of range residues was identified. These decision-makers and users are presented in Table 2-1, along with a summary of their impact within the decision-making process.

Site visits were conducted at the responsible organizations (Table 2-1) of three Army installations to aid in defining waste management activities/responsibilities and developing the inventory for this project. This element was crucial in identifying inputs to the decision, study boundaries, and decision rules for the project DQOs.

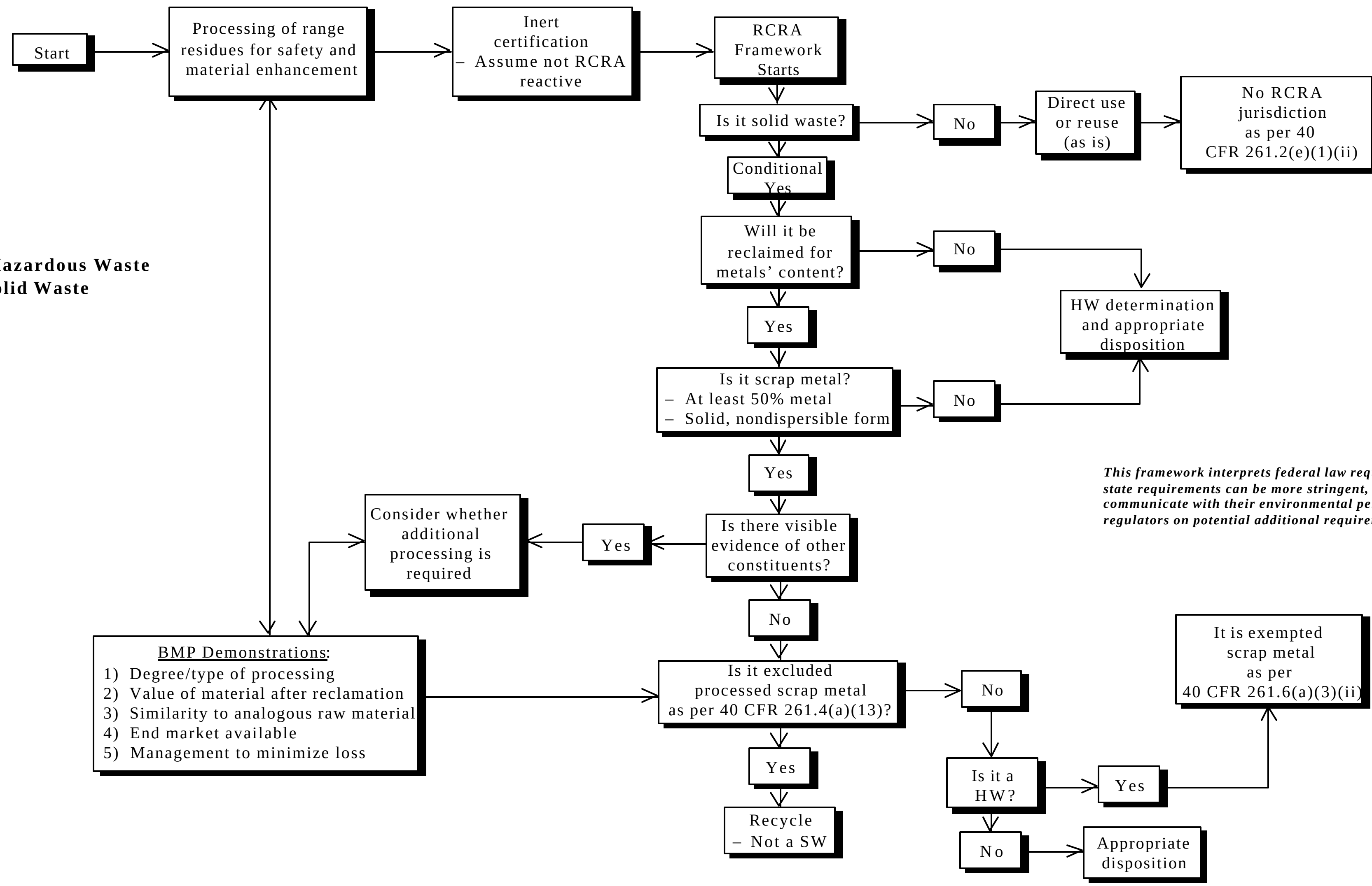
2.2 Identify the Decision

Decision Statement: Which range residues require characterization sampling to make a hazardous waste determination and validate long-term development of BMPs for effective range residue management?

Figure 2-1 provides the federal regulatory framework that drives overall range residue management. Using this flowchart, the project team analyzes each range residue

Table 2-1
Decision-Makers and Managers of Range Scrap

Office	Role
HQDA	• Develop range residue management policy and guidance.
AEC	• Provide data/information to develop range residue management policy for Army installation to meet the requirements of the Munitions Rule and applicable requirements.
Installation Defense Reutilization and Marketing Office (DRMO)	• Provide sales service for range residue scrap/recyclables and coordinate disposal contracts for hazardous waste.
Installation Ammunition Supply Point (ASP)	• Provide initial segregation and consolidation of range residues and scrap turned in by using units. Segregation includes sanitary waste, hazardous waste, scrap, recyclables, and "automatic returns" to Industrial Operations Command.
Installation Directorate of Public Works/Environmental Office	• Manage and set local policy concerning the installation hazardous waste program, including munitions waste. • Coordinate with ASP and DRMO to provide data needed to complete a Hazardous Waste Profile Sheet and Land Disposal Restriction (LDR) Notification/Certification in accordance with DoD 4160.21-M, Chapter 10. • Track range usage and document potential long-term environmental hazards resulting from military training.
Major Command hazardous waste manager	• Disseminate data, information, and guidance to installations regarding waste management issues related to range residues.
Installation munitions-using units	• Use the munitions for their intended purpose and manage residues in accordance with ASP disposal and recycling guidance. • Provide initial segregation of range residue prior to turn-in to ASP.
Installation Qualified Recycling Program	• Recycle range residues (e.g., brass cartridges) in accordance with DoD Instruction 4715.4. Operated for profit by Morale, Welfare, and Recreation. • Perform limited downrange recycling efforts in maneuver areas and from range clearance operations.
Army Safety Office	• "Inert" Certification



Key:
HW - Hazardous Waste
SW - Solid Waste

This framework interprets federal law requirements. Because state requirements can be more stringent, installations should communicate with their environmental personnel and state regulators on potential additional requirements.

Figure 2-1. Federal Regulatory Framework for Range Residue Management

waste stream (e.g., small arms ammunition) and recommends specific residues requiring characterization before management and final disposition requirements are defined.

The end result of this determination is a sampling priority list and protocol for characterization. Based on the regulatory framework presented in Figure 2-1, each residue or residue grouping will be classified into one of these potential outcomes:

- Nonhazardous solid waste subject to Subtitle D standards,
- Hazardous solid waste subject to RCRA regulation,
- Directly used/reused item excluded from the definition of RCRA solid waste,
- Processed scrap metal excluded from the definition of RCRA solid waste, and
- Scrap metal exempted from the bulk of RCRA requirements.

This study is designed to acquire information to support DoD decision-making on appropriate management practices mentioned earlier, particularly to support the position that metallic range residues are excluded "processed scrap metal." In addition to performing the hazardous waste determination, other data/analysis are required to address issues related to "other constituents" associated with scrap metal items and to address the five evaluation factors cited by EPA (Figure 2-1), as well as address standards set by the scrap metal recycling industry. These data requirements will provide:

- **Identification of UHCs**. For those range residues that are hazardous wastes that cannot be recycled (such as some smoke pots) and that, therefore, are subject to the RCRA land disposal restrictions (LDRs). As a generator, DoD must identify UHCs to the treatment or disposal facility to ensure proper treatment before land disposal.
- **Minimization of long-term CERCLA liability**. To the extent that scrap items have been adequately characterized and subject to appropriate management controls (at the front end), this risk may be minimized.
- **Assurance to downstream processors**. Currently, secondary smelting or furnace operations that input scrap metal are not subject to RCRA regulation because the scrap metal itself is not a "hazardous waste."[1] One of their biggest

[1] Smelters and furnaces that process hazardous waste (vs. excluded/exempt scrap metal) for metal recovery may be exempt from RCRA pursuant to 40 CFR 266.100(c) as long as certain demonstrations are made.

regulatory risks is that "suspect" scrap metal input could mean that EPA will apply the RCRA permitting and technical standards at 40 Code of Federal Regulations (CFR) 266 (industrial furnaces that process hazardous waste). Again, having a controlled and thorough characterization scheme at the generator end should minimize these concerns, both to industry as well as to EPA.

Characterization requirements must address these additional data needs for range scrap.

2.3 Identify Inputs to the Decision

A variety of sources are used to prioritize the characterization. The two primary sources of data are the inventory report generated during Phase I of the project and the technical expertise of the project staff members in the areas of munitions, environmental sampling, and regulatory analysis. Additional sources of information include the items listed below. As the project progresses, additional inputs may be identified and added to the source list.

- Previous sampling efforts conducted by the military (e.g., U.S. Army Center for Health Promotion and Preventive Medicine, Dugway Proving Ground) and civilian contractors (e.g., the Subpart X permit application prepared for Marine Corps Air Station Beaufort);
- U.S. military databases, such as Munitions Items Disposition Action System (MIDAS) and the Ammunition Book Complete;
- Ammunition Instruction Notices for disposition and management of munitions; and
- Guidance documents on environmental sampling techniques and statistical modeling.

2.3.1 Initial Screening

To initially screen the range scrap inventory presented in the *Range Scrap (Firing Point) Study Data Review and Inventory Report*, June 1999, the project team has used the input sources to consolidate and limit the residues, filtering out those items already having enough data to make a decision on disposition. Appendix A provides an updated version of the range scrap inventory. Some of the basic information that was used to screen the inventory includes constituent and materials listing, current disposition procedures, points of generation, and process knowledge.

The first step of the screening process was removal of residues classified as packaging materials and that are inert. Table 2-2 contains a listing of packing materials that were eliminated from sampling and analysis due to process knowledge. Second, after removal of the packaging items, items that were fired or used downrange (i.e., bullet slugs and rockets) were eliminated. These items are listed in Table 2-3. Finally, items used at the firing point or within the training maneuver area were removed if, due to process knowledge information (constituent makeup, MIDAS data, etc.), they contain no RCRA hazardous constituents or do not produce a firing point scrap item and do not require sampling and analysis. Table 2-4 lists those items removed by process knowledge of the residue.

2.3.2 Identifying Waste Streams for Characterization

After screening the inventory as discussed in Section 2.3.1, several munitions items [DoD Ammunition Codes (DoDACs)] remain that produce range scrap (firing point), which require characterization. Review of the remaining munitions items (DoDACs) in the inventory indicates that many items produce the same type of range scrap. For example, DoDACs 1305A059, 1305A062, 1305A063, 1305A064, 1305A065, 1305A068, 1305A071, 1305A075, and 1305A080 (various types of 5.56mm cartridges) all produce a 5.56mm cartridge case as a firing point range scrap item. The range scrap item (5.56mm cartridge case) is considered one waste stream with the associated DoDACs in the inventory as listed above. Table 2-5 provides the reduced/filtered inventory of range residue (firing point and training maneuver area) waste streams that require sampling due to suspected contaminants and/or lack of process knowledge information.

Since the various munitions items associated with a waste stream or scrap item may contain slightly different constituents/materials or constituents/materials in different amounts, this information was reviewed for all DoDACs within a waste stream to ensure there are no significant variations. This information may also be used to determine which munitions item (DoDAC) within the waste stream represents the most conservative choice for characterization. The characterization for this waste stream may then be focused on one DoDAC within the waste stream instead of designing a sampling program to account for all potential variations. Optimizing the characterization scheme in this way is discussed further is Section 2.7.2. This approach is also crucial in conserving limited project resources given the quantity of munitions items associated with the scrap items requiring characterization.

2.4 Define Study Boundaries

The overall study boundaries are training munitions used on U.S. Army Forces Command (FORSCOM) and U.S. Army Training and Doctrine Command (TRADOC) ranges and their residues that are generated either at the Ammunition Supply Point (ASP), the firing point, or within the training/maneuver area. It does not include items that are downrange or consumed completely in process. The inventory of range scrap collected from downrange is preliminary and will be addressed at a later date to supplement this effort. However, the regulatory framework (Figure 2-1) and the DQOs presented in this effort are applicable to all range residues.

2.5 Develop Decision Rules

The regulatory framework presented in Figure 2-1 provides the key decision points for this study, which infer the following “if/then” decision rules:

- If an item is determined not to be RCRA hazardous, then the item may be subject only to Subtitle D standards.
- If a nonrecyclable item is determined to be RCRA hazardous, then the item must be managed as RCRA hazardous waste.
- If a scrap metal item is determined to be RCRA hazardous, then management/processing (Figure 2-1 BMP demonstrations/five EPA evaluation factors) will be considered to take advantage of the RCRA exclusion and exemption.

Table 2-2

Residues Considered Packaging Material

Assembly, Container, Stainless Steel	Carton, Fiberboard, PA78
Assembly, Container, Paper	Carton, Paperboard
Assembly, Polyester/Plastic	Carton, Styrofoam
Assembly, Polyethylene Wrapper	Case, Liner, Cloth
Assembly, Strap F/Carton	Clamping Device, Plastic (F/Shock Tube)
Bag, Barrier Waterproof	Clip, Metal
Bag, Cloth	Clip, Safety
Bandoleer, Cloth	Coil, Steel and Roofing Nails (4)
Bandoleer, Cloth, M1	Container, Extension
Bandoleer, Cloth, M3	Container, Fiberboard
Bandoleer, Cloth, M4	Container, Fiberboard (8 lb Liquid)
Bandoleer, Cloth, M7	Container, Metal
Blasting Device, M576	Container, Plastic
Body Tubing Steel	Crate, Wood
Bottom Support	Disc, Metal F/Fiber Container
Box, Cardboard	Filler Material Polystyrene
Box, Fiberboard	Filler, Metal, F/M16
Box, Metal	Firing Device Demolition M1A1
Box, Metal F/Activator	Gasket, Rubber M13
Box, Metal F/Fuze	Gasket, Rubber M14
Box, Metal, M13	Grommet, Metal
Box, Metal, M14	Grommet, Type 1 (Plastic)
Box, Metal, M19A1	Holder, Propellant
Box, Metal, M2A1	Link, Ctg Metallic Belt, M13
Box, Metal, M415A1	Link, Ctg Metallic Belt, M14A2
Box, Metal, M548	Link, Ctg Metallic Belt, M15A2
Box, Metal, M621	Link, Ctg Metallic Belt, M16A2
Box, Metal, PA108	Link, Ctg Metallic Belt, M2
Box, Metal, PA116	Link, Ctg Metallic Belt, M27
Box, Metal, PA154	Link, Ctg Metallic Belt, M28
Box, Metal, PA37a1	Link, Ctg Metallic Belt, M29
Box, Metal, PA70	Link, Ctg Metallic Belt, M9
Box, Metal, XM592	Link, Ctg Plastic
Box, Paperboard	Magazine, Ammunition
Box, Plastic	Mounting Bracket Assembly, Steel
Box, Wood	Packing Material
Box, Wood, M105A2	Pail, Thickening Compound M4
Box, Wood, M105A3	Pallet Assembly (Top And Bottom)
Box, Wood, M1A2	Pallet, Cover, Metal
Box, Wood, PA30	Pallet, Metal

Table 2-2

(Continued)

Box, Wood, Waterproof	Pallet, Wood
Box, Wood, Wirebound W/Ends	Pallet, Wood, Specialized
Cable Assembly Steel	Plug, Closing
Canister Assembly Al Alloy and S. Steel Comp.	Plug, Closing, Metal
Carrying Case, Cloth M185	Plug, Lifting
Carton, Cardboard	Pull Ring, Grenade W/Safety Pin
Carton, Fiberboard	Pull Ring, Grenade, Expended
Carton, Fiberboard, M105 Series	Saddle, Front, Wood
Carton, Fiberboard, M185	Saddle, Rear, Wood
Carton, Fiberboard, M251 Series	Safety Lever
Carton, Fiberboard, M252A3	Separators, Plastic
Carton, Fiberboard, M252A3 or M252a4	Spool
Carton, Fiberboard, M314 or M316	Spool, Metal
Carton, Fiberboard, M316	Spool, Trip Wire Steel
Carton, Fiberboard, M34 Series	Stop, Packing
Carton, Fiberboard, M435	Test Set Electrical, M40
Carton, Fiberboard, M564	Top Support Plastic
Carton, Fiberboard, M576	Wrench, Arming
Carton, Fiberboard, PA153	Wrench, Arming M20
Carton, Fiberboard, PA44	Wrench, Arming M25 Steel
Carton, Fiberboard, PA46	Wrench, Arming M26

Table 2-3

Residues Fired Downrange

DoDAC	Packing Material
1305A010	CTG, 10 GA BLANK
1305A011	CTG, 12 GA BUCKSHOT M19
1305A014	CTG, 12 GA SHOTGUN BUCKSHOT M19
1305A017	CTG, 12 GA SHOTGUN PLASTIC CORE NO. 9 CHILLED SHOT
1305A059	CTG, 5.56MM BALL M855
1305A062	CTG, 5.56MM BALL M855 LNKD
1305A063	CTG, 5.56MM TR M856
1305A064	CTG, 5.56MM BALL TR 4/1 M855, M856
1305A065	CTG, 5.56MM PLASTIC M862
1305A068	CTG, 5.56MM TR M196
1305A071	CTG, 5.56MM BALL M193
1305A075	CTG, 5.56MM BLK M220 LNKD
1305A080	CTG, 5.56MM BLK M200
1305A091	CTG, CAL .22 LR BALL MATCH GRADE
1305A093	CTG, CAL .22 LR BALL
1305A106	CTG, CAL .22 LR BALL
1305A111	CTG, 7.62MM BLK M82 LNKD M13
1305A112	CTG, 7.62MM BLK M82 LNKD
1305A130	CTG, 7.62MM NATO BALL M80
1305A131	CTG, 7.62MM 4 BALL M59/M80/1 TR M62
1305A136	CTG, 7.62MM NATO SPEC BALL M118
1305A143	CTG, 7.62MM NATO BALL M80 LNKD
1305A151	CTG, 7.62MM 4 BALL M80/1 TR M62 OHF
1305A165	CTG, 7.62MM 4 BALL M80/1 TR M62 LNKD M13
1305A171	CTG, 7.62MM MATCH M852
1305A182	CTG, CAL .30 BALL M1
1305A212	CTG, CAL .30 BALL M2
1305A246	CTG, CAL .30 MATCH M72
1305A247	CTG, CAL .30 MATCH M72
1305A358	CTG, 9MM PRAC AT-4 M287
1305A363	CTG, 9MM BALL M882
1305A365	CTG, 14.5MM ARTY TRNG M181A1
1305A366	CTG, 14.5MM ARTY TRNG M182A1
1305A367	CTG, 14.5MM ARTY TRNG M183A1
1305A475	CTG, CAL .45 BALL M1911
1305A483	CTG, CAL .45 BALL MATCH M1911

Table 2-3

(Continued)

DoDAC	Packing Material
1305A520	CTG, CAL .50 4 BALL M33/1 TR M17
1305A540	CTG, CAL .50 4 API M8/1 TR M17 LNKD
1305A552	CTG, CAL .50 BALL M33
1305A555	CTG, CAL .50 4 BALL M33
1305A557	CTG, CAL .50 4 BALL M33/1 TR M17
1305A559	CTG, CAL .50 4 BLNK M1A
1305A570	CTG, CAL .50 TR M17
1305A572	CTG, CAL .50 TR M17
1305A576	CTG, CAL .50 4 API M8/1 API-T M20
1305A585	CTG, CAL .50 API-T M20
1305A598	CTG, CAL .50 BLK M1A1
1305A599	CTG, CAL .50 BLK M1A1
1305A602	CTG, CAL .50 PR PL 4/1
1305A896	CTG, 20MM 4 TP M55A2/1 TP-T M220
1305A940	CTG, 25MM TPDS-T M910
1305A965	CTG, 25.4MM DECOY M839
1305A976	CTG, 25MM TP-T M793
1305AA11	CTG, 7.62MM M118 LRA
1305B118	CTG, 30MM TP M788
1305B120	CTG, 30MM TP M788
1310B504	CTG, 40MM GRN STAR PARA M661
1310B505	CTG, 40MM RED STAR PARA M662
1310B506	CTG, 40MM RED SMK M713
1310B508	CTG, 40MM GREEN SMK M715
1310B509	CTG, 40MM YLW SMK M716
1310B519	CTG, 40MM TP M781
1310B535	CTG, 40MM WHT STAR PARA M583A1
1310B536	CTG, 40MM WHT STAR PARA M583A1
1310B542	CTG, 40MM HEDP M430 LNKD
1310B546	CTG, 40MM HEDP M433
1310B571	CTG, 40MM HE M383
1310B584	CTG, 40MM TP M918
1310B592	CTG, 40MM TP M918
1310B627	CTG, 60MM ILLUM M83A3
1310B630	CTG, 60MM SMK WP M302A1
1310B632	CTG, 60MM HE M49A4

Table 2-3

(Continued)

DoDAC	Packing Material
1310B642	CTG, 60MM HE M720
1310B646	CTG 60MM SMK WP M722 W/PD FUZE
1315C226	CTG, 81MM ILLUM M301A3 W/ FUZE
1315C236	CTG, 81MM HE M374A3
1315C256	CTG, 81MM HE M374A2 W/PD FUZE
1315C276	CTG, 81MM SMK WP M375A2 W/PD FUZE
1315C282	CTG, 90MM HEAT M371A1
1315C379	CTG, 120MM HE XM934
1315C410	CTG, 90MM CAN ANTIPERS M590
1315C440	CTG, 105MM BLK M395
1315C445	CTG, 105MM HE M1 W/O FUZE
1315C452	CTG, 105MM SMK HC BE M84 W/ FUZE
1315C454	CTG, 105MM SMK WP M60 W/ PD FUZE
1315C473	CTG, 105MM HE M760
1315C479	CTG, 105MM SMK HC M84A1
1315C511	CTG, 105MM TP-T M490
1315C520	CTG, 105MM TPDS-T M724A1
1315C542	CTG, 105MM SMK HC M84A1
1315C623	CTG, 120MM HE XM934
1315C650	CTG, 106MM HEAT M344A1
1315C651	CTG, 106MM HEP-T M346A1
1315C660	CTG, 106MM APERS-T M581 W/FUZE
1315C697	CTG, 4.2IN HE M329A2 W/O FUZE
1315C706	CTG, 4.2IN ILLUM M335A2 W/FUZE MT M565
1315C784	CTG, 120MM TP-T M831
1315C785	CTG, 120MM TPCSDS-T M865
1315C787	CTG, 120MM HEAT MP-T M830
1315C788	CASE, CTG, FIRED, STEEL
	CTG 120MM, MORTAR HE M57
1315C868	CASE, CTG, FIRED, STEEL
	CTG, 81MM HE M821 W/FUZE M734
1315C869	CASE, CTG, FIRED, STEEL
	CTG 81MM HE M889 W/FUZE M935
1315C870	CASE, CTG, FIRED, STEEL
	CTG, 81MM SMK RP M819

Table 2-3

(Continued)

DoDAC	Packing Material
1315C871	CASE, CTG, FIRED AL ALLOY
	CTG, 81MM ILLUM M853A1
1315C876	CASE, CTG, FIRED AL ALLOY
	CTG, 81MM TP-SR M880 W/ PD FUZE
1320C995	ROCKET, AT-4. 84MM HE M136
1320D505	PROJECTILE, 155MM, ILLUM M485E1
1320D510	PROJECTILE, 155MM, SMK WP M825
1320D513	PROJECTILE, 155MM PRAC M804
1320D544	PROJECTILE, 155MM HE M107 STEEL
1320D550	PROJECTILE, 155MM, SMK WP M110A1
1320D570	CTG, 165MM HEP M123A1
1320D579	PROJECTILE, 155MM HE RA M549
1320D590	CTG, 165MM HEP M123A1
1320D680	PROJECTILE, 8IN HE M106 STEEL
1330G815	GRENADE, HAND AND LAUNCHER SMK SCRN L8A3
1330G978	GRENADE, HAND AND LAUNCHER SMK SCRN M82
1340H108	ROCKET, MLRS, 298MM PRACTICE
1340H163	RCKT, HE 2.75IN W/WHD M151 & FUZE M423
	RCKT, MOTOR MK66 MOD 1 (W/ ROCKET)
1340H459	RCKT APERS 2.75IN W/WHD WDU 4A/A
	RCKT, MOTOR MK40 MOD 3 (W/ ROCKET)
1340H464	RCKT, HE 2.75IN W/WHD M261 & FUZE M439
	RCKT, MOTOR MK66 MOD 1 (W/ ROCKET)
1340H557	ROCKET, LAW 66MM M72A3
1340H708	ROCKET, PRACTICE 35MM SUBCALIBER
1340H974	RCKT PRAC 2.75IN W/WHD M267 & FUZE M439
	RCKT, MOTOR MK66 MOD 1 (W/ ROCKET)
1340H975	RCKT PRAC 2.75IN W/WHD M267 & FUZE M439
	RCKT, MOTOR MK66 MOD 3 (W/ ROCKET)
1340J143	ROCKET, MOTOR 5IN AL ALLOY
1345K002	ACTIVATOR, AT PRAC M1 STEEL
1345K068	ADAPTER & FUZE M624
1370L185	ROCKET, MLRS, 298MM PRACTICE
1370L367	CTG, PRACTICE TANK SIMULATOR
1370L410	CASING, CTG, AL ALLOY
	FLARE, ACFT COUNTERMEASURE, M206

Table 2-3

(Continued)

DoDAC	Packing Material
1370L477	CTG, FLARE MK 33 STEEL
1375M327	CTG, COUPLING BASE W/ PRIMER M27 TIN ALLOY
1375MD73	CTG, IMPULSE M796
1375ML04	CHARGE, CUTTER
1377M500	CTG, CUTTER REEF LINE
1390N278	FUZE, MECHANICAL TIME M564 PLASTIC/STAINLESS STEEL
1390N285	FUZE, MTSQ M577 STAINLESS STEEL
1390N286	FUZE, MTSO M582 STAINLESS STEEL
1390N335	FUZE, PD M557 MULTI MATERIALS
1390N340	FUZE, PD M739 MULTI MATERIALS
1390N402	FUZE, PROX M532 MULTI MATERIALS
1390N464	FUZE, PROX M732 MULTI MATERIALS
1410PB94	GM, TOW, SURF/ATK, BGM-71A-2
1410PB96	GM, TOW, TP, BTM-71A-2
1427PL23	GM AND LAUNCHER, DRAGON, M222 HEAT
1427PL90	GM, STINGER, BASIC, MSL RND
1427PL93	GM, STINGER, BASIC, WPN RND PARTIAL
1315C697	CTG 4.2IN HE M329A2 W/O FUZE
1315C706	CTG 4.2IN ILLUM M335A2 W/FUZE MT M565

Table 2-4

Residues Eliminated by Process Knowledge

DoDIC	Munition Item	Remarks
D533	CHG PROP 155MM M119	No suspected contaminant(s)
D540	CHG PROP 155MM GBM3 (M3A1)	No suspected contaminant(s)
D541	CHG PROP 155MM WBM4A1 (M4A1)	No suspected contaminant(s)
G826	GREN AND LAUNCHER SMK IR M76	Consumed in process
G878	FUZE GREN HAND PR M228	No hazardous materials present
G881	GREN HAND FRAG M67	Consumed in process
G922	GREN, HAND, SMK, RIOT M47 w/o FUZE	No suspected contaminant(s)
K010	BRSTR INCEND FIELD M4	Consumed in process
K022	DISP AND MINE GROUND M131 MOPMS	Consumed in process
K030	PRIMER IGNITER FUZE M10A1	Consumed in process
K040	CHG SPOTTING F/MINE AP PRAC M8	Consumed in process
K042	CANISTER MINE PRAC M88	No suspected contaminant(s)
K051	FUZE MINE AT PRAC M604	Consumed in process
K055	FUZE MINE COMB M10A1	Consumed in process
K058	FUZE, MINE M605 TIN ALLOY (AL ALLOY ALT)	No suspected contaminant(s), consumed in process
K092	MINE APERS M16A1 AND M16A2	Consumed in process
K143	MINE, AP M18A1 W/ ACCESSORIES	No suspected contaminant(s), consumed in process
K180	MINE, AT HEAVY M15	No suspected contaminant(s), consumed in process
K181	MINE, AT HEAVY M21	No suspected contaminant(s), consumed in process
K250	MINE, AT HEAVY M19 NONMETALLIC	No suspected contaminant(s), consumed in process
K765	RIOT CONTROL AGENT CS	Consumed in process
K768	CHEMICAL AGENT CS-1	Consumed in process
K917	THICKENING COMPOUND M4	Consumed in process
L305	SIGNAL ILLUM GRND PARA GRN STAR M195	No suspected contaminant(s)
L306	SIGNAL ILLUM GRND M158	No suspected contaminant(s)
L307	SIGNAL ILLUM GRND M159	No suspected contaminant(s)
L311	SIGNAL ILLUM GRND RED STAR PARA M126	No suspected contaminant(s)
L312	SIGNAL ILLUM GRND M127	No suspected contaminant(s)
L314	SIGNAL ILLUM GRND M125A1	No suspected contaminant(s)
L366	SIMULATOR, PROJ AIR BURST M74A1	No suspected contaminant(s)
L495	FLARE SURF TRIP M49	Consumed in process
L508	FUSEE SIGNAL WARNS RR RED	Consumed in process
L554	MARKER LOCATION MARINE MK25-3	Manufacturer did not provide constituent data to MIDAS but did state that all parts are inert and nonhazardous
L594	SIMULATOR PROJ GROUND BURST M115A2	Consumed in process
L595	SIMULATOR PROJ AIRBURST LIQ	No suspected contaminant(s)
L596	SIMULATOR FLASH ARTY M110	Consumed in process
L598	SIMULATOR BOOBY TRAP FLASH M117	Consumed in process
L599	SIMULATOR BOOBY TRAP ILLUM M118	Consumed in process
L600	SIMULATOR BOOBY TRAP M119 WHISTLE	Consumed in process

Table 2-4

(Continued)

DoDIC	Munition Item	Remarks
L601	SIMULATOR, HAND GREN M116A1	No suspected contaminant(s)
L602	SIMULATOR, FLASH ARTY M21	No suspected contaminant(s)
L709	SIMULATOR, TGH-HIT XM26	No suspected contaminant(s)
L715	SIMULATOR, AT GGM XM27	No suspected contaminant(s)
L720	SIMULATOR, TARGET KILL XM26	No suspected contaminant(s)
M023	CHG, DEMOLITION, M112	No suspected contaminant(s), consumed in process
M024	CHG, DEMOLITION, M118	No suspected contaminant(s), consumed in process
M028	DEMO KIT BANGALORE TORPEDO M1A2	No suspected contaminant(s), consumed in process
M030	CHG, DEMOLITION, BLOCK TNT 1/4 LB	No suspected contaminant(s), consumed in process
M032	CHG, DEMOLITION, BLOCK TNT 1 LB	No suspected contaminant(s), consumed in process
M039	CHG DEMO 40LB CRATERING	No suspected contaminant(s)
M060	CHG, DEMOLITION, ROLL	No suspected contaminant(s), consumed in process
M241	DESTRUCTOR HE UNIVERSAL M10	No suspected contaminant(s), consumed in process
M420	CHG DEMO SHAPED M2A3 15LB	No suspected contaminant(s)
M421	CHG DEMO SHAPED 40 L	No suspected contaminant(s)
M456	CORD DET REINFORCED	No suspected contaminant(s), consumed in process
M591	MILITARY DYNAMITE M1	No suspected contaminant(s), consumed in process
M626	FIRING DEVICE DEMOLITION M1A1	No suspected contaminant(s), consumed in process
M670	FUSE BLASTING TIME M700 4000 FT	No suspected contaminant(s)
M757	CHG DEMO M183	No suspected contaminant(s), consumed in process
M832	CHG, DEMOLITION, SHAPED MK74-1	No suspected contaminant(s), consumed in process
M833	CHG DEMO PRAC SHPD MK 74-1	No suspected contaminant(s), consumed in process
M913	CHG, LINE C-4 (MICLIC)	Consumed in process
M914	CHG, LINE INERT (MICLIC)	Consumed in process
M965	CHG, DEMOLITION, CRATERING M180	No suspected contaminant(s), consumed in process
MD73	CHG, IMPULSE M796	No suspected contaminant(s)
ML03	FIRING DEVICE DEMO, M142	No suspected contaminant(s), consumed in process
ML05	CHG CUTTER HE MK24-0	No suspected contaminant(s)
ML09	CHG, FLSC CONTAINER LEAD ANTIMONY	No suspected contaminant(s), consumed in process
ML15	CHG, DEMO FLSC	No suspected contaminant(s), consumed in process
ML45	HOLDER CAP BLASTING M9	No suspected contaminant(s)

Table 2-5

Residues (by Waste Stream) Requiring Sampling

DoDAC	Residue	Primary Munition
Fired 10 GA Shotgun Cases		
1305A010	CASE, CTG, FIRED, 10 GA SHOTGUN PAPER	CTG 10 GA SHOTGUN BLANK
Fired 12 GA Shotgun Cases		
1305A011	CASE, CTG, FIRED, BRASS AND PAPER/PLASTIC	CTG 12 GA SHOTGUN BUCKSHOT
1305A014	CASE, CTG, FIRED, BRASS AND PAPER/PLASTIC	CTG 12 GA SHOTGUN
1305A017	CASE, CTG, FIRED, BRASS AND PLASTIC	CTG 12 GA SHOTGUN #9 BUCKSHOT
Fired 5.56mm Brass Cartridge Cases		
1305A059	CASE, CTG, FIRED, BRASS	CTG 5.56MM BALL M855
1305A062	CASE, CTG, FIRED, BRASS	CTG 5.56MM BALL M855 LNKD
1305A063	CASE, CTG, FIRED, BRASS	CTG 5.56MM TR M856
1305A064	CASE, CTG, FIRED, BRASS	CTG 5.56MM BALL TR 4/1 M855, M856
1305A065	CASE, CTG, FIRED, BRASS	CTG 5.56MM PLASTIC M862
1305A068	CASE, CTG, FIRED, BRASS	CTG 5.56MM TR M196
1305A071	CASE, CTG, FIRED, BRASS	CTG 5.56MM BALL M193
1305A075	CASE, CTG, FIRED, BRASS	CTG 5.56MM BLK M200 LNKD
1305A080	CASE, CTG, FIRED, BRASS	CTG 5.56MM BLK M200
Fired .22 Caliber Brass Cartridge Cases		
1305A091	CASE, CTG, FIRED, BRASS	CTG CAL .22 LR BALL MATCH GRADE
1305A093	CASE, CTG, FIRED, BRASS	CTG CAL .22 LR BALL
1305A106	CASE, CTG, FIRED, BRASS	CTG CAL .22 LR BALL
Fired .30 Caliber Brass Cartridge Cases		
1305A182	CASE, CTG, FIRED, BRASS	CTG CAL .30 CARB BALL M1
1305A212	CASE, CTG, FIRED, BRASS	CTG CAL .30 BALL M2
1305A222	CASE, CTG, FIRED, BRASS	CTG CAL .30 BLK M1909
1305A246	CASE, CTG, FIRED, BRASS	CTG CAL .30 MATCH M72
1305A247	CASE, CTG, FIRED, BRASS	CTG CAL .30 MATCH M72
Fired 9mm Cartridge Cases		
1305A358	CASE, CTG, FIRED, BRASS OR AL ALLOY	CTG 9MM PRAC AT-4 M287
1305A363	CASE, CTG, FIRED, BRASS	CTG 9MM BALL M882
Fired .45 Caliber Brass Cartridge Cases		
1305A483	CASE, CTG, FIRED, BRASS	CTG CAL .45 BALL MATCH M1911
1305A475	CASE, CTG, FIRED, BRASS	CTG CAL .45 BALL M1911
Fired 7.62mm Brass Cartridge Cases		
1305A111	CASE, CTG, FIRED, BRASS	CTG 7.62MM BLK M82 LNKD M13
1305A112	CASE, CTG, FIRED, BRASS	CTG 7.62MM BLK M82 LNKD
1305A130	CASE, CTG, FIRED, BRASS	CTG 7.62MM NATO BALL M80
1305A131	CASE, CTG, FIRED, BRASS	CTG 7.62MM 4 BALL M59/M80/1 TR M62
1305A136	CASE, CTG, FIRED, BRASS	CTG 7.62MM NATO SPEC BALL M118
1305A143	CASE, CTG, FIRED, BRASS	CTG 7.62MM NATO BALL M80 LNKD
1305A151	CASE, CTG, FIRED, BRASS	CTG 7.62MM 4 BALL M80/1 TR M62 OHF
1305A165	CASE, CTG, FIRED, BRASS	CTG 7.62MM 4 BALL M80/1 TR M62 LNKD M13
1305A171	CASE, CTG, FIRED, BRASS	CTG 7.62MM MATCH M852
1305AA11	CASE, CTG, FIRED, BRASS	CTG 7.62MM M118 LRA

Table 2-5

(Continued)

DoDAC	Residue	Primary Munition
Fired .50 Caliber Cartridge Cases		
1305A520	CASE, CTG, FIRED, BRASS	CTG CAL .50 4 BALL M33/1 TR M17 LNKD M15A2
1305A540	CASE, CTG, FIRED, BRASS	CTG CAL .50 4 API M8/1 TR M17 LNKD
1305A552	CASE, CTG, FIRED, BRASS	CTG CAL .50 BALL M33
1305A555	CASE, CTG, FIRED, BRASS	CTG CAL .50 BALL M33 LNKD
1305A557	CASE, CTG, FIRED, BRASS	CTG CAL .50 4 BALL M33/1 TR M17 LNKD M9
1305A559	CASE, CTG, FIRED, BRASS	CTG CAL .50 4 BLNK M1A
1305A570	CASE, CTG, FIRED, BRASS	CTG CAL .50 TR M17
1305A572	CASE, CTG, FIRED, STEEL	CTG CAL .50 TR M17
1305A576	CASE, CTG, FIRED, STEEL	CTG CAL .50 4 API M8/1 API-T M20 LNKD
1305A585	CASE, CTG, FIRED, BRASS	CTG CAL .50 API-T M20 LNKD
1305A598	CASE, CTG, FIRED, STEEL	CTG CAL .50 BLK M1A1 LNKD
1305A599	CASE, CTG, FIRED, BRASS	CTG CAL .50 BLK M1A1 LNKD
1305A602	CASE, CTG, FIRED, STEEL	CTG CAL .50 PR PL 4/1
Fired 40mm Cartridge Cases		
1310B504	CASE, CTG, FIRED AL ALLOY	CTG 40MM GRN STAR PARA M661
1310B505	CASE, CTG, FIRED AL ALLOY	CTG 40MM RED STAR PARA M662
1310B506	CASE, CTG, FIRED AL ALLOY	CTG 40MM RED SMK M713
1310B508	CASE, CTG, FIRED AL ALLOY	CTG 40MM GREEN SMK M715
1310B509	CASE, CTG, FIRED AL ALLOY	CTG 40MM YLW SMK M716
1310B519	CASE, CTG, BRASS AND NYLON	CTG 40MM TP M781
1310B535	CASE, CTG, FIRED AL ALLOY	CTG 40MM WHT STAR PARA M583A1
1310B536	CASE, CTG, FIRED AL ALLOY	CTG 40MM WHT STAR CLUSTER
1310B542	CASE, CTG, FIRED AL ALLOY	CTG 40MM HEDP M430 LNKD
1310B546	CASE, CTG, FIRED AL ALLOY	CTG 40MM HEDP M433
1310B571	CASE, CTG, FIRED AL ALLOY	CTG 40MM HE M383 LNKD
1310B584	CASE, CTG, FIRED AL ALLOY	CTG 40MM TP M918 LNKD
1310B592	CASE, CTG, FIRED AL ALLOY	CTG 40MM TP M918
M201A1 Grenade Fuzes		
1330G945	FUZE, GREN, M201A1	GREN HAND SMK YELLOW M18
1330G950	FUZE, GREN, M201A1	GREN HAND SMK RED M18
1330G955	FUZE, GREN, M201A1	GREN HAND SMK VIOLET M18
1330G940	FUZE, GREN, M201A1	GREN HAND SMK GREEN M18
1330G930	FUZE, GREN, M201A1	GREN HAND SMK HC AN-M8
1330H050	FUZE, GREN, M201A1	GREN HAND SMK AND LAU M176
1330H051	FUZE, GREN, M201A1	GREN HAND SMK AND LAU M226
1330G963	FUZE, GREN, M201A1	GREN HAND SMK CS AN-M14
1330G900	FUZE, GREN, M201A1	GREN HAND INCND TH3 AN-M14
1330G982	FUZE, GREN, M201A1	GREN HAND SMK HC PRAC AN-M8
M227 Grenade Fuzes		
1330G922	FUZE, GREN, M227	GREN, HAND SMK RIOT M47
1330G932	FUZE, GREN, M227	GREN HAND SMK RED M48
AN-M8 HC Smoke Grenade		
1330G930	GRENADE, HAND SMK HC AN-M8	GREN HAND SMK HC AN-M8
1330G982	GRENADE, HAND SMK HC PRAC AN-N8	GREN HAND SMK HC PRAC AN-M8
M48 Red Smoke Grenade		
1330G932	GRENADE, HAND, SMK RED M48	GREN HAND SMK RED M48 W/O M227 FUZE

Table 2-5

(Continued)

DoDAC	Residue	Primary Munition
M18 Red Smoke Grenade		
1330G950	GRENADE, HAND RED M18	GREN HAND SMK RED M18
Fired 14.5mm Aluminum Alloy Training Cartridge Cases		
1305A365	CASE, CTG, FIRED, BRASS	CTG 14.5MM ARTY TRNG M181A1
1305A366	CASE, CTG, FIRED, AL ALLOY	CTG 14.5MM ARTY TRNG M182A1
1305A367	CASE, CTG, FIRED, AL ALLOY	CTG 14.5MM ARTY TRNG M183A1
Fired 25mm Cartridge Cases		
1305A940	CASE, CTG, FIRED AL ALLOY	CTG 25MM TPDS-T M910
1305A976	CASE, CTG, FIRED, STEEL	CTG 25MM TP-T M793
Fired 30mm Aluminum Alloy Cartridge Cases		
1305B118	CASE, CTG, FIRED AL ALLOY	CTG 30MM TP M788
1305B120	CASE, CTG, FIRED, AL ALLOY	CTG 30MM TP M788 LINKED
Fired 75 to 120mm Cartridge Cases		
1315C025	CASE, CTG, FIRED AL ALLOY	CTG 75MM BLNK M337A2
1315C282	CASE, CTG, FIRED AL ALLOY	CTG 90MM HEAT M371A1
1315C440	CASE, CTG, FIRED, COPPER (STEEL/BRASS ALT)	CTG 105MM BLK M395
1315C445	CASE, CTG, FIRED, STEEL	CTG 105MM HE M1 W/O FUZE
1315C449	CASE, CTG, FIRED, BRASS (STEEL ALT)	CTG 105MM ILLUM M314A2
1315C452	CASE, CTG, FIRED, STEEL	CTG 105MM SMK HC BE M84 W/ FUZE
1315C454	CASE, CTG, FIRED, BRASS (STEEL ALT)	CTG 105MM SMK WP M60 W/ PD FUZE
1315C473	CASE, CTG, FIRED, STEEL	CTG 105MM HE M760
1315C479	CASE, CTG, FIRED, STEEL	CTG 105MM SMK HC M84A1
1315C542	CASE, CTG, FIRED, STEEL	CTG 105MM SMK HC M84A1
1315C650	CASE, CTG, FIRED, STEEL	CTG 106MM HEAT M344A1
1315C651	CASE, CTG, FIRED, STEEL	CTG 106MM HEP-T M346A1
1315C660	CASE, CTG, FIRED, STEEL	CTG 106MM APERS-T M581 W/FUZE
1315C511	CASE, CTG, FIRED, STEEL	CTG 105MM TP-T M490
1315C520	CASE, CTG, FIRED, STEEL (BRASS ALT)	CTG 105MM TPDS-T M724A1
1315C410	CASE, CTG, FIRED AL ALLOY	CTG 90MM CAN ANTIPERS M590
1315C623	CASE, CTG, FIRED, STEEL	CTG 120MM HE XM934
1315C379	CASE, CTG, FIRED, STEEL	CTG 120MM HE XM934
1315C784	CASE, CTG, FIRED, STEEL	CTG 120MM TP-T M831
1315C785	CASE, CTG, FIRED, STEEL	CTG 120MM TPCSDS-T M865
1315C787	CASE, CTG, FIRED, PAPER	CTG, 120MM HEAT MP-T M830
M18 Green Smoke Grenade		
1330G940	GRENADE, HAND SMK GRN M18	GREN HAND SMK GRN M18
M18 Yellow Smoke Grenade		
1330G945	GRENADE, HAND SMK YLW M18	GREN HAND SMK YLW M18
Fired M82 Percussion Primer Brass Cartridge Cases		
1390N525	CASE, CTG, FIRED, BRASS	Primer PERC M82
1390N523	CASE, CTG, FIRED BRASS	PRIMER PERC M82
M5 Steel Demolition Firing Devices		
1375M627	ASSEMBLY, FIRING DEVICE DEMOLITION M5 STEEL	FIRING DEVICE PRESSURE RELEASE M5
M60 Firing Devices		
1375M766	IGNITER, TIME BLASTING FUZE, M2	IGN TIME BLASTING M60

Table 2-5

(Continued)

DoDAC	Residue	Primary Munition
M81 Firing Devices		
1375MN08	IGNITER DEVICE PLASTIC	IGNITER TIME BLASTING FUSE M81
M6 Electric Blasting Cap		
1375M130	CAP, BLASTING ELECT M6 ASSY	CAP BLASTING ELECT M6
M7 Nonelectric Blasting Cap		
1375M131	CAP, BLASTING NONELECT M7 ASSY	CAP BLASTING NONELECT M7
M7A3 CS Riot Control Hand Grenade		
1330G963	GREN, HAND RIOT CS M7A3	GREN, HAND RIOT M7A3
TH3 AN-M14 Incendiary Hand Grenade		
1330G900	GREN, HAND, INCEND, TH3 AN-M14	GREN, HAND, INCEND, TH AN-M14 W/O FUZE
M1 HC 155mm Smoke Canisters		
1315D445	155MM SMK CANISTER	CANISTER 155MM SMK HC M1
M11 Nonelectric Blasting Cap (Donor Charge)		
1375ML47	SHOCK TUBE, SURLYN POLYETHYLENE W/DETONATOR	SHOCK TUBE, 30 FT, SURLYN POLYETHYLENE W/ DETONATOR
1375MN36	SHOCK TUBE, SURLYN POLYETHYLENE W/DETONATOR	SHOCK TUBE, 30 FT, SURLYN POLYETHYLENE W/ DETONATOR
M12 and M13 Nonelectric Blasting Cap (Primary Charge)		
1375MN02	SHOCK TUBE, SURLYN POLYETHYLENE W/DETONATOR	SHOCK TUBE, 500 FT, SURLYN POLYETHYLENE W/DETONATOR
1375MN35	SHOCK TUBE, SURLYN POLYETHYLENE W/DETONATOR	SHOCK TUBE, 500 FT, SURLYN POLYETHYLENE W/DETONATOR
1375MN03	SHOCK TUBE, SURLYN POLYETHYLENE W/DETONATOR	SHOCK TUBE, 1000 FT, SURLYN POLYETHYLENE W/DETONATOR
M14 Nonelectric Blasting Cap (Time Fuse)		
1375MN06	DETONATOR, TIME FUSE CLOTH/PLASTIC	DETONATOR, 7.5 FT TIME FUSE CLOTH/PLASTIC
1375MN37	DETONATOR, TIME FUSE CLOTH/PLASTIC	DETONATOR, 7.5 FT TIME FUSE CLOTH/PLASTIC
M15 Nonelectric Delay Blasting Cap		
1375MN07	DETONATOR, TIME FUSE CLOTH/PLASTIC	DETONATOR, 70 FT TIME FUSE CLOTH/PLASTIC
1375MN38	DETONATOR, TIME FUSE CLOTH/PLASTIC	DETONATOR, 70 FT TIME FUSE CLOTH/PLASTIC
Fired 20mm Steel Cartridge Cases		
1305A896	CASE, CTG, FIRED, STEEL	CTG, 20MM TP M55 A2/1 TP-T M220 LINKED M14A2
25.4mm Cartridge Cases		
1305A960	CASE, CTG, FIRED, AL ALLOY	CTG, 25.4MM DECOY M839
M4A2 HC Floating Smoke Pot		
1330K867	SMOKE POT M4A2 FLOATING TYPE	SMK POT FLOATING TYPE HC M4A2
ABC-M5 HC Smoke Pot		
1330K866	SMOKE POT M5 GROUND TYPE	SMK POT HC 30 LB ABCM5
M18 Violet Smoke Grenade		
1330G955	GRENADE, HAND SMK VIOLET M18	GREN HAND SMK VIOLET M18
Personal Distress Flare Kit		
1345L116	SIGNAL KIT, PERSONAL DISTRESS RED XM185 A/P92 S-5A	SIGNAL KIT, PERSONAL DISTRESS RED XM185 A/P92 S-5A

The decision rules listed above present RCRA hazardous waste determination and identification of UHCs for characteristically hazardous items as the primary characterization requirements. In addition to these regulatory driven data needs, data are also needed to address concerns associated with CERCLA liability and downstream processors, as well as to ensure appropriate management/processing practices are implemented to take advantage of the RCRA exclusion and exemption. Table 2-5 provides a summary of the characterization requirements, methods for achieving the requirements, and applicable regulatory limits/action levels. Table 2-6 indicates that contaminants of interest include metals, semivolatile organic compounds (SVOCs), and explosives.

Toxicity Characteristic Leaching Procedure (TCLP) extraction and metals analysis (SW-6010/7000+) will be performed for all TCLP metals suspected to be present in the scrap item. Since the entire scrap item represents a single waste stream, the material submitted for extraction shall consist of a homogenized sample representing the entire item. The TCLP metal results will be compared to TCLP limits and universal treatment standards, as required. These data are also useful to downstream processors in the event that the item is recycled. Hazardous constituents detected in scrap items will also be useful in evaluating the need for additional management/handling procedures.

To address toxicity for SVOCs, the following approach is taken:

1. Perform total SVOC analysis (SW-8270).
2. List all SVOCs detected in the total SVOC analysis as potential UHCs.
3. Compare total SVOC results to the maximum theoretical leaching limit (20 times the respective TCLP limit) to determine whether TCLP analysis is warranted for certain SVOCs.
4. Perform TCLP for SVOC analysis, if applicable.
5. If the item is determined to be RCRA hazardous, compare SVOCs detected in the total SVOC analysis to the universal treatment standards in order to identify UHCs.

Table 2-6

Method to Achieve Characterization Requirements

Characterization Requirement	Method	Applicable Limit/Threshold
Hazardous waste determination:		
Evaluate ignitability of item	Spent munitions residues certified inert by trained personnel are not "capable under standard temperature and pressure of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burn so vigorously and persistently that a hazard is created."[a]	Not applicable
Evaluate corrosivity of item	Spent munitions residues considered in this study are not "aqueous or liquid."[b]	Not applicable
Evaluate reactivity of item	Spent munitions residues certified inert by trained personnel do not exhibit any of the properties listed for reactivity in 40 CFR 261.23.	Not applicable
Evaluate toxicity of item: Metals	1. Process knowledge information: lack of RCRA TCLP metals in item. 2. Sampling and analysis: perform TCLP extraction and metals analysis (SW-6010/7000+) for suspected metals.	1. Not applicable 2. Applicable TCLP limits
Semivolatile Organic Compounds (SVOCs)	1. Process knowledge information: lack of RCRA TCLP SVOCs in item. 2. Sampling and analysis: perform SVOC analysis (SW-8270) for suspected compounds and compare to diluted TCLP limits.[c]	1. Not applicable 2. Maximum theoretical leaching limit
Volatile Organic Compounds (VOCs)/ pesticides/ herbicides/ polychlorinated biphenyls (PCBs)	Process knowledge information: Volatile compounds are consumed in process and lack of pesticides/herbicides/PCBs in item.	Not applicable
Identify UHCs:		
Metals	Sampling and analysis: metals identified in TCLP analysis.	Universal treatment standards (40 CFR 268.48)
SVOCs	Sampling and analysis: conduct SVOC analysis (SW-8270).	Universal treatment standards (40 CFR 268.48)
VOCs/pesticides/ herbicides/PCBs	Process knowledge information: Volatile compounds are consumed in process and lack of pesticides/herbicides/PCBs in item.	Not applicable
Secondary characterization requirements:		
Evaluate additional management/handling requirements	Sampling and analysis: provide data obtained for hazardous waste determination and identification of UHCs, if applicable, and perform analysis to determine the presence/level of explosive compounds (Method 8330).	Qualitative.[d]

Table 2-6

(Continued)

Characterization Requirement	Method	Applicable Limit/Threshold
Provide assurance for downstream processors	Sampling and analysis: provide data obtained for hazardous waste determination and identification of UHCs, if applicable, and perform analysis to determine the presence/level of explosive compounds (Method 8330).	Qualitative.[d]

[a]40 CFR 261.21.
[b]40 CFR 261.22.
[c]SVOCs present in the waste stream must be compared to universal treatment standards (40 CFR 268.48) by total analysis. Therefore, standard SVOC analysis (not leached) will be conducted and results will be compared to the universal treatment standards limits and 20 times (conservatively assuming 100% leach) the applicable TCLP limit. Waste streams with SVOCs detected above 20 times the applicable TCLP limit will be resubmitted for TCLP analysis.
[d]Identify the presence of RCRA hazardous constituents, UHCs, and explosive compounds. Recommendations for additional management/processing practices will be based on the presence of contaminants (leachable metals, leachable SVOCs, and/or energetic compounds) and the physical state of the range scrap item (high/moderate/low potential to release contaminants).

Conducting the total SVOC analysis prior to TCLP will also provide a more sensitive test for SVOCs since they are not expected to be present in high concentrations as compared to metals (i.e., a diluted TCLP sample result may indicate non-detect for SVOC in the diluted sample extract, but the total analysis may be able to detect the presence of SVOCs in an undiluted sample). This sample scheme will also provide useful data to downstream processors in the event the item is recycled, as well as provide data for evaluating the need for additional management/handling procedures.

Spent munitions residues certified inert by trained personnel do not exhibit any of the properties listed for RCRA reactivity in 40 CFR 261.23. *For recycled items, however*, characterization is required for low levels of explosives/energetics in order to provide data to downstream users and to assess the need for additional management/handling procedures to understand and minimize CERCLA liabilities. There are no RCRA or other waste classification limits published for energetic compounds except for dinitrotoluene (DNT), which will be detected by the traditional SVOC analysis provided above. Instead, characterization for energetic compounds will be used as a secondary data requirement to qualitatively address the DQOs. The metals, SVOCs, and energetic analyses combine to provide downstream users a complete listing of constituents of concern associated with the scrap item. Samples will be submitted for analysis by EPA Method 8330 for nitroaromatics and the method will be modified to detect and report nitrate esters including pentaerythritol tetranitrate (PETN) and nitroglycerin.

2.6 Specify Limits on Decision Errors

The key decision to be addressed by sampling and analysis of range residues is whether the item is a RCRA toxic hazardous waste. TCLP analysis will be conducted and the results will be compared to the TCLP limits. The sampling design for this effort will follow guidance contained in SW-846 methodology. The contaminants of concern will not be considered to be present in the item at a hazardous level if the upper limit of the confidence interval is less than the applicable TCLP limit. The factors that define the limits of the decision error are provided below:

$$CI = 0 +/- t_{.20}(s_x)$$

Where:

CI	=	80% Confidence interval,
0	=	Mean of measurement generated by sample (sample mean),
$t_{.20}$	=	Student’s “t” value for a two-tailed confidence interval and a probability of 0.20,
s_x	=	Standard error (also standard deviation of mean) of sample.

Limits for analytical accuracy and precision are specified within the prescribed EPA analytical methods and will be evaluated during review of the data. The sampling and analysis plan for this effort will summarize the quality assurance (QA)/quality control (QC) limits associated with each analytical method.

2.7 Optimize Design

The SW-846 methodology referenced above requires that the sampling design achieve sufficient degree of accuracy and precision to reliably estimate the level of contaminants of concern for an item for the purpose of comparing those levels to the TCLP limits.

Optimization of the general characterization scheme and approach for specific waste streams is discussed in Sections 2.7.1 and 2.7.2, respectively.

2.7.1 General Characterization Scheme

Sampling accuracy for this study will be addressed by developing and following sample collection procedures that are designed to minimize the introduction of errors to the associated analysis. Sampling precision is addressed by collecting the appropriate number of samples. Following the SW-846 methodology for characterizing solid waste, the appropriate number of samples is the least number of samples needed to demonstrate that the upper limit of the confidence interval for the mean is less than the applicable TCLP limit. The appropriate number of samples is calculated from an approximation of the mean and variance of the sample set based on limited previous sampling. In this case, the follow equation is employed:

$$n = (t_{.20}^2 * s^2)/(\text{TCLP limit} - 0)^2$$

Where:

n = Appropriate number of samples to collect to support evaluation,
$t_{.20}$ = Student’s “t” value based on the number of samples taken to date,
s^2 = Variance of sample based on the number of samples taken to date,
0 = Mean of measurements based on the number of samples taken to date.

However, there are no data on most of the range residue items to perform this estimate. Instead, best judgement must be used to determine the number of samples to be taken. The mean, confidence interval, and other parameters of the sample set may then be calculated and evaluated based on the data generated. Additional samples may be submitted for laboratory analysis, if necessary. In order to determine the number of samples to collect for each item, it is recommended that the relationship between the Student’s “t^2” value used in the equation above and the “number of samples collected” be evaluated (Figure 2-2). Review of this relationship reveals that the Student’s “t” statistic becomes asymptotic as the number of samples increases. The optimum number of samples to collect based on this relationship is approximately eight samples.

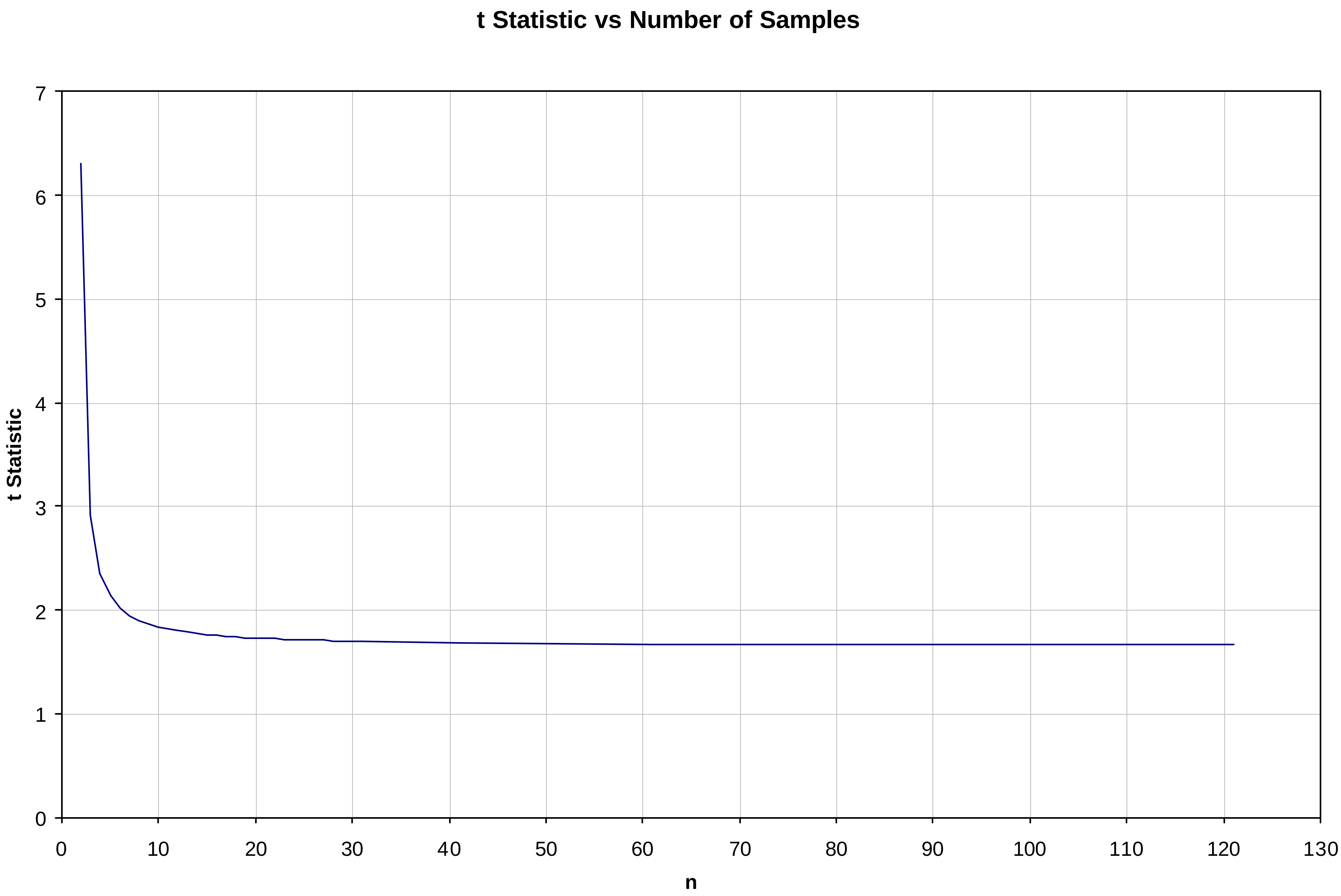


Figure 2-2. Student's t-Statistic Versus Number of Samples

To further optimize the sampling design, a minimum of three samples will be collected initially. The additional samples will be held and submitted for analysis after evaluating the upper confidence limits to applicable TCLP limits. This methodology will reduce cost, while still achieving the study objectives. Note that samples submitted for TCLP analysis will consist of the entire scrap item. This will be achieved by milling the scrap items down to sizes that meet TCLP extraction specifications and homogenizing that material prior to obtaining the laboratory sample.

To provide a statistically based estimation of the average concentration of UHCs and explosive compounds, a minimum of three samples will also be collected from each item for this purpose.

2.7.2 Characterization Approach for Specific Waste Streams

Waste streams or scrap items (Table 2-4) within the inventory that have only one DoDAC associated with them will be characterized as described in Section 2.7.1. However, the characterization of waste streams that have multiple DoDACs will be optimized to focus on the most conservative DoDAC. This approach is crucial in conserving limited project resources given the quantity of munitions items associated with the scrap items requiring characterization.

As discussed previously, the amount and type of constituents/materials will be reviewed for all DoDACs within a waste stream to ensure there are no significant variations. This information will also be used to determine which munitions item (DoDAC) within the waste stream represents the most conservative choice for characterization. This information will be presented in the following three ways:

- Scrap components and materials,
- Composition of reactive materials in the munitions item, and
- Maximum theoretical leaching limit evaluation.

A discussion of each factor is provided below.

2.7.2.1 Scrap components and materials

The composition of the inert material(s) of the range scrap item, such as the case, primer cup, anvil, etc., may consist of or contain metal and/or organic compounds that are listed as constituents of concern for this characterization. If these components are determined to be significant to the characterization, residual material(s) should be consistent among the waste streams with multiple DoDACs. The presence and concentration of contaminants of concern in scrap components and materials will also influence the selection of the most conservative item within the waste stream for sampling and analysis. A description of all significant materials will be provided for each waste stream.

2.7.2.2 Composition of reactive materials associated with the munitions items

Many of the contaminants (heavy metals, organic compounds, explosive residuals) suspected to be associated with range scrap items are the result of a small amount of the reactive components remaining on the item after use. The chemical makeup of the primers, propellants, etc., used in the munitions item and associated with the range scrap item must be consistent among the DoDACs within a waste stream with regard to the primary contaminants of concern. This information is also useful in determining which item in the waste stream represents the most conservative choice, if applicable, for sampling and analysis. For instance, all items within a waste stream may have the same constituent listing in their primer mix, but one item has a slightly greater amount of lead-containing constituents and represents the most conservative choice for sampling and analysis to represent the waste stream.

2.7.2.3 Maximum theoretical leaching limit evaluation

Review of the scrap item material composition and reactive components of the munitions item will identify the potential for contaminants of concern to be present. This information, together with the weight of the scrap item, provides sufficient data to determine the maximum theoretical leaching level for RCRA toxic compounds present in a particular item. The first use of this evaluation is to determine whether sampling and analysis is required to make the hazardous waste determination for a particular item. For example, the following steps demonstrate how this data may be used to determine whether sampling and analysis is required to determine whether an item will fail (exceed) the TCLP limit for lead (5 mg/L):

1. Determine the overall weight of the range scrap item.
2. Determine the combined weight of lead-containing constituents and materials.
3. Calculate the percent weight of lead per overall weight of item.
4. The TCLP maximum theoretical leaching limit for lead in a sample is 100 parts per million (ppm) (20 x 5 mg/L), assuming 100% leaching and a method dilution of 20. This value (100 ppm) expressed as a percentage is 0.01%.
5. If the percent weight of lead to overall weight of item is less than 0.01%, the range scrap item could not theoretically fail TCLP for lead (i.e., even if 100% of the lead remained on/in the scrap item and leaches during testing, there is not enough lead present to exceed the corresponding TCLP limit).

The second use of this data is to determine which DoDAC within a waste stream has the highest potential concentration of contaminants of concern. The maximum theoretical leaching limit evaluation takes into consideration all the factors discussed above (the maximum potential amount of a contaminant of concern present in scrap components/materials, composition of reactive materials, and the weight of the item) and provides a method of determining which DoDAC within a waste stream represents the most conservative choice for characterization.

3.0 GENERAL SAMPLING AND ANALYTICAL PROCEDURES

3.1 Characterization Scheme

A minimum of three samples will be prepared for analysis from each of the waste streams as discussed in Section 2.7. Range scrap items will be collected from Army installation ASPs, Defense Reutilization and Marketing Office (DRMO), range maintenance scrap yards, and/or directly from the range as close to the time of usage as possible (within 5 days, if practical). All analysis will be based on the entire (bulk) scrap item. Range scrap items will be prepared (size reduction) to meet the size requirements of the analytical procedures (Section 3.3.1), as necessary. This material will be homogenized for each sample and submitted for analysis. Table 3-1 summarizes the analytical requirements for this effort. If review of the analytical data (Section 5) indicates that additional analysis is required to meet project DQOs, additional range scrap items will be prepared and submitted for analysis, as required. Appendix E contains example statements of work for the sampling and analysis described in this section.

Table 3-1
General Sampling and Analysis Requirements for Each Waste Stream

Number of Samples	Leach Method	Prep Method	Analytical Method	Hold Time Extraction/ Analysis	Suspect Contaminants
3	SW-1311 (TCLP)	SW-3005A	SW-6010B (Metals)	14 days/6 months	Arsenic, barium, cadmium, chromium, lead, selenium, silver
3	NA	SW-3520C	SW-8270C (SVOCs)	14/40 days	All SVOCs specified for analytical method
3 (optional)	SW-1311 (TCLP)	SW-3520C	SW-8270C (SVOCs)	14/40 days	For any SVOCs that exceed the maximum theoretical leaching limit in the total analysis above
3 (optional)	SW-1311 (TCLP)	SW-3020A	SW-7470A (Mercury)	14/28 days	Mercury
3 (optional)	NA	NA	EPA 8330 (Nitro-aromatics)[a]	14/40 days	Nitroaromatics and nitrate esters

[a]Method 8330 will be modified to also include nitrate esters (PETN and nitroglycerin).

3.2 Sample Collection Procedures

The sample collection procedures presented in this section apply to collection of range scrap items for submittal to the sample preparation laboratory (Section 3.3).

3.2.1 Sample Collection

3.2.1.1 Sample collection performed by the project team

Range scrap items targeted for sampling may be collected from various Army installations across the country based on the availability of the item. Range scrap items stored at the ASP, DRMO, or other residue yard may be accumulated over various periods of time. In lieu of designing an extensive sampling approach that would account for the variability of item storage, this sampling effort will attempt to collect residues as close to the time of usage as possible. This approach will ensure that characterization of the range scrap items is consistent and the most conservative scenario.

The range scrap items will be collected, processed, and analyzed in an effort to meet the holding time requirements listed in Table 3-1. Range scrap items will be collected within 5 days from the date of usage to ensure the minimum holding time requirement (14 days) is met. Variances from the holding time requirements may be granted for items that are difficult to obtain due to the infrequency of use and will be evaluated on a case-by-case basis. After collecting the range scrap items, the project team will proceed to follow the requirements stated in Sections 3.2.2 through 3.2.8.

3.2.1.2 Sample collection performed by others

Sample collection may also be performed by other organizations and provided to the project team for characterization. The project team will coordinate with the other organization to prepare a listing of the range scrap items to be collected for characterization and the required quantities. The other organization must collect the range scrap items in a timely manner as stated in Section 3.2.1.1. The range scrap items shall be collected and shipped to the project team within 5 days of the date of usage. The sampling procedure is outlined below:

1. Don a new pair of disposable gloves between each type of range scrap collected.
2. Obtain/collect the range scrap items (specific items and quantities coordinated with the project team) as close to the date of usage as possible (refer to Section 3.2.1.1).
3. Perform "inert certification" (responsible organization) and retain a copy of the certification to accompany the samples.
4. Record the information requested on the Sample Collection Record provided in Appendix B.
5. Individually containerize (refer to Section 3.2.4) each range scrap item at the time of collection to prevent the loss of materials associated with the item. The project team may provide containers, sample labels, chain-of-custody (COC) records, sample seals, and/or sample coolers (shipping containers), if necessary.
6. Assign a sample identifier to each item by listing the DoD Item Code (DoDIC) of the item followed by an alphabetical code "A" through "Z" (for example: samples for the M18 red hand smoke grenade, DoDAC 1330G950, would have sample identifiers G950A, G950B, G950C, G950D, etc.) or as directed by the project team.
7. Label each containerized item with the sample identifier, date and time of collection, and sampler initials.
8. Place containerized samples in shipping coolers (refer to Section 3.2.4) and complete a shipping waybill for each cooler.
9. Prepare a COC record for each shipping container (refer to Section 3.2.7).
10. Include a copy of the corresponding COC record and "inert certification" in each shipping container and affix a sample seal to each container (refer to Section 3.2.6).
11. Retain a copy of COC record, Sample Collection Record, "inert certification," shipping waybill, and any other pertinent documentation for the files.
12. Ship the sample coolers to a location specified by the project team.

3.2.1.3 Health and Safety Precautions

The project team will be restricted to collecting range scrap items at the ASP, DRMO, and/or range clearance/maintenance yard where these items have been certified inert. Sampling personnel must be supervised/escorted at these locations and are not permitted to collect samples directly from range areas. Therefore, sampling personnel will adhere to the health and safety precautions prescribed by the local organization.

Other organizations collecting range scrap items for characterization should follow their own standard procedures for collecting range residues and performing “inert certification.”

A copy of the “inert certification” should be provided to and retained by each organization that handles the samples. This may include the project team, other organizations conducting sample collection, the sample preparation laboratory, and the analytical laboratory.

3.2.2 Field QA/QC Samples

Field QA samples are not required for this sampling effort. The sampling procedures do not require the addition of preservatives, use of sampling equipment, or other special sample management/handling techniques. Therefore, field QA samples, such as field blanks, rinsate blanks, or trip blanks, are not required.

Since the general sampling approach for this effort consists of obtaining multiple samples of the same type of scrap item, collection of additional QC samples (replicates) will not be necessary to evaluate the representativeness of the sampling approach. However, laboratory duplicates will be performed per the methods specified in Section 3.3.2. This data will determine the representativeness of the laboratory sample aliquot used for analyses and variation of concentration of constituents within the scrap item sample.

3.2.3 Sample Labeling and Handling

Samples will be labeled at the time of collection. The label will contain the following information:

- Sample identifier,
- Date and time of collection, and
- Sampler initials.

This information may be written directly on the sample container or on a label affixed to the container. Sample label information should be completed using indelible ink.

3.2.4 Sample and Shipping Containers

The range scrap items must be individually containerized at the time of collection to prevent loss or mixing of materials. The following types of containment may be employed:

1. Double bag and seal the containers with standard paper bags or other container (avoid using plastics due to SVOC contaminants) using quart, half-gallon, gallon, 20- x 20-in., 24- x 24-in., or other various sizes. The seal or open end of the bags shall be folded and secured with tape.
2. For larger range scrap items (will not fit in 24- x 24-in. plastic baggie), clear 6-mil plastic sheeting shall be used to wrap and enclose the item. Open edges of the plastic sheeting shall be folded and secured with duct tape. If there are loose, fine materials associated with the scrap item, these materials shall be emptied into containers as described above and placed inside the plastic sheeting with the scrap item.

Standard food/beverage coolers designated solely for sample shipment shall be used for shipping the range scrap samples collected for this effort. A copy of the COC record, shipping waybill, and “inert certification” shall be included in each shipping container. The contents of the shipping container should be specified as “environmental samples.”

3.2.5 Sample Preservation and Storage

It is not expected that the scrap items will undergo physical, biological, and/or chemical changes during sample handling due to their solid and stable nature. Consequently, no preservation or special storage techniques will be employed. The most likely cause of sample degradation is loss of solid materials from the samples, which is addressed in Section 3.2.4.

3.2.6 Sample Seals

Sample seals are used to preserve the integrity of the sample from the time it is collected until it is opened in the laboratory. Gummed paper or plastic is used as official sample seals. These seals will be applied to the outside of shipping packages.

3.2.7 Chain-of-Custody Record

All field samples submitted for sample preparation will be documented on a standard COC form. If samples are hand delivered, the sampler, the courier (if other than the sampler), and the receiver will sign the form. If samples are shipped via an overnight express service, the number of the waybill will be substituted for the receiver signature. The receiver must still sign the COC to acknowledge receipt at the sample preparation location.

The COC will include the following minimum information:

- Place of collection (sample identification),
- Data and time of collection,
- Sample type (grab or composite),
- Sample description,
- Number of containers,
- Signatures of personnel involved in the chain of possession, and
- Inclusive dates of possession.

3.2.8 Field Logbooks/Records

Field logbooks, field notes, COC/Analysis Request Forms, and any other field documentation generated to support this effort will be copied and retained in the record file for this project. The following information will be recorded for each group of scrap item collected:

- Date, time, and location (installation) of sample;
- Sampling personnel;
- Sample group, description, and number of scrap items collected;
- Sample identification code;
- COC number;
- Detailed sample location (e.g., ASP residue yard);
- How the item was stored (outdoor, open container, closed container, indoor, etc.);
- Estimated days since the item was expended and scrap created;
- Estimated days since the item has been stored at location;
- Description of other items stored/contained with this group (mixed storage);
- Description of packaging; and
- Other remarks.

The Sample Collection Record (Appendix B) may be used in addition to the field logbook to facilitate recording the sample collection information.

3.3 Sample Preparation

Prior to submitting the scrap items to the subcontract analytical laboratory, they will undergo size reduction at a subcontract materials engineering and/or testing laboratory experienced in preparing metallic samples for analysis. Items will be managed to ensure that materials (bulk or residual) are not lost from the sample. Scrap items will be reduced in size by hand tools or machined, as necessary, to achieve weight, size, and/or surface area requirements specified in the analytical procedures.

3.3.1 Specification

This section describes the requirements for performing the sample preparation (size reduction) required for range scrap items submitted for analysis.

3.3.1.1 TCLP particle size reduction

The range scrap items collected for this effort must be reduced in size per the requirements of the TCLP extraction method 1311: “particle size reduction is required, unless the solid has a surface area per gram of material equal to or greater than 3.1 cm^2, or is smaller than 1 cm in its narrowest dimension (i.e. is capable of passing through a 9.5 mm standard sieve). If the surface area is smaller or the particle size is larger than described above, prepare the waste for extraction by crushing, cutting, or grinding the waste to a surface area or particle size as described above.”

Size reduction for the metallic range scrap items may be accomplished by use of hand tools and/or machining tools. Hand tools, the preferred method, may include hand shears, diagonal cutters, pliers, tubing cutters, and/or other hand tools typically used in the laboratory for sample preparation. Electric or air-driven hand tools, such as an air-driven metal nibbler, that perform the same function of the hand tools previously mentioned may also be utilized. A hand hacksaw may be used on a limited basis, if necessary, for initial breakdown or separation of items.

Some metallic range scrap items may also require limited machining for initial breakdown or separation to accommodate use of the hand tools. Machining tools typically include lathes, milling machines, various saws, and grinders. Saws and grinders are not recommended for achieving size reduction due to the inability to control loss of materials. Saws tend to accumulate very fine materials in the internal components of the machine. Likewise, grinders tend to produce very fine particles that are hard to capture and account for. However, lathes and milling machines of various types produce chips of material in a controlled manner. Although both the lathe and milling machine can vary the width of chip of material produced, the type of metal limits the depth of the material taken out of the item. The lathe can typically achieve a depth closer to the TCLP requirement than a milling machine (2 – 9 mm for the lathe versus 2–5 mm for the milling machine). For this reason and because the lathe is a more common and readily available tool, the lathe is the recommended machining tool for use in preparing samples. Note that mechanical/machining tools should only be used on a limited basis to provide better access to materials for hand tools.

3.3.1.2 Loss of materials

The TCLP analysis must be based on the entire range scrap item. Therefore, the sample preparation methods must prevent the loss of materials during size reduction. This should be accomplished by ensuring that a container is always under the area of work to capture materials generated during size reduction. A glove box may also be used, if available, to prevent the loss of materials. Materials adhering to the surfaces of tools, which come into contact with the scrap item, should also be removed and captured by brushing the tool or equivalent method.

3.3.1.3 Cross-contamination

The tools used for sample preparation should be dedicated for this use and not used for maintenance or other activities. Cross-contamination between range scrap items will be avoided by decontaminating tool surfaces, which come into contact with the items, with a method that incorporates rinsing with a nitric acid solution (metal elimination) and isopropanol (organic elimination). Tools shall be decontaminated between each use. Disposable gloves shall also be used and changed for each sample processed.

3.3.1.4 Temperature control

There may be a concern with the loss of constituents of concern during sample preparation due to heating the surface of range scrap items, particularly when using a hacksaw or lathe as described above. Appendix C contains a solid flux analysis performed for three of the most volatile compounds on the analytical list [hexachloroethane (HC), nitroglycerin, and DNT] using a mass flow equation known as Stefan’s Law. The results of this analysis indicate that the rate of loss of material will be insignificant (less than 0.00012 mg/sec) while processing typical range scrap materials at temperatures of 60°C (140°F) or less.

The goal of this sample preparation method is to limit the temperature during all operations to a maximum of 60°C (140°F) for samples that will be analyzed for SVOCs or explosives. This temperature, 60°C (140°F), is noticeable to the touch and is the maximum temperature for handling materials without insulating gloves or other tools. It is anticipated that out of all the tools approved for use and listed in Section 3.3.1.1 the hacksaw may be the only one that will not achieve the temperature requirement. If this is the case, only the lathe will be used for breaking down items as described in Section 3.3.1.1. A thermocouple will initially be applied to the scrap item when using the lathe or hacksaw to demonstrate compliance with the temperature limitation.

3.3.1.5 Providing a representative sample for analysis

The size reduction required to be performed on the range scrap items prior to testing will physically separate the different components of an item (case body, primer assembly, base plate, etc.) into numerous individual pieces and separate the loose fine materials from the bulk materials. The different components of the scrap item may contain differing constituents of concerns and/or constituents at differing concentrations. These components must be managed and reconfigured in a way that provides a material representative of the entire scrap item to the analytical laboratory. This requirement presents the following challenge: The sample directly subjected to analytical testing must, to the extent practicable, contain the pieces of different bulk components and the fine materials in an amount proportional to their weight in relation to the entire scrap item.

In cases where an individual range scrap item weighs less than the minimum required sample weight (Section 3.3.5), representativeness is not as high of a concern regarding the bulk materials since all the separated components/materials of the scrap item will be placed into the sample container. However, in the cases where the scrap item weighs more than the minimum sample weight, there is a concern that some of the bulk components of the item will not be placed into the sample container. To ensure this does not happen when processing an item that weighs more than the minimum required sample weight, the pieces produced during size reduction of the different components will be segregated during sample preparation. The materials accumulated from each different component will be homogenized separately. The appropriate sample containers will then be filled proportionally with pieces from all the different components. The samples provided to the analytical laboratory will be further homogenized by manually mixing the materials prior to testing.

The presence of loose fine materials associated with the scrap item presents a different concern than that of the different bulk components. Even if a proportional amount of fine materials is placed in the sample container, typical homogenization techniques will only stratify the sample materials by size and weight, which will increase the likelihood that the fine materials will accumulate at the bottom of the container and not be included in the materials subjected to testing. Therefore, fine materials, when present, will be homogenized and containerized separately in an amount proportional to the amount of bulk materials containerized. Both containers will be submitted to the analytical laboratory with an attached record of the ratio of bulk to fine materials that is to be maintained throughout testing. The analytical laboratory must then composite the bulk and fine materials based on the weight ratio provided when preparing an aliquot of material for testing.

3.3.2 Sample Preparation Procedure

The following procedure shall be followed for preparation of the samples for analysis:

1. Follow an approved QA plan and subcontract laboratory standard procedure for sample receipt and internal COC. Obtain one field sample of the item to be prepared. If the weight of the item is less than 200 grams (minimum of 200 grams are required to conduct TCLP, total SVOC, and explosive analyses; however, only 160 grams are required to conduct TCLP and total SVOC analyses), obtain a sufficient number of additional items until the combined weight exceeds 200 grams (160 grams when performing TCLP and total SVOC analyses only). Record the combined weight of the items to be

processed to complete one sample on the Sample Preparation Record (Section 3.3.9).

2. Don a new pair of disposable gloves (avoid synthetic materials that may contain SVOCs) between samples to prevent cross-contamination.

3. If the sample does not contain fine materials that can be separated from the bulk item, then proceed to step 4. If the sample contains fine materials that can be separated from the bulk item, then perform the following:

   - Carefully open the plastic container for the item over a secondary container (Container A) to retain any loose materials.
   - Remove the remainder of loose materials with a stainless steel or disposable spoon/spatula or similar tool.
   - Record the weight of the fine material captured in Container A on the Sample Preparation Record (Section 3.3.9).

4. If no portion of the item can be processed (size reduction) using hand tools, proceed to step 5. Otherwise, reduce the size of the item to meet the sample preparation requirements using hand tools. Hand tools will consist of hand shears, diagonal cutters, pliers, tubing cutters, and an air-driven metal nibbler. A hand hacksaw may be used on a limited basis, if necessary, as described in Section 3.3.1.1. Perform size reduction over plastic sheeting or other container to collect materials. Hand tools will be used inside a dedicated glove box when possible. If any materials require processing by milling tools, proceed to step 5. If no portion of the item requires processing by milling tools, proceed to step 6.

5. Some metal items may require limited machining for initial breakdown. Using an acceptable milling tool (Section 3.3.1.1), reduce the size of those portions of the item that cannot be prepared with hand tools. Perform this size reduction over plastic sheeting or other container to collect materials. Use hand tools to further reduce the size of particles as needed (refer to step 4).

6. Consolidate materials from all containers or plastic linings, which have been used to control loss of materials, into Container B. Visually inspect the contents of Container B to identify any materials obviously not meeting the size reduction requirement (Section 3.3.1.1). Repeat steps 4 through 6 as necessary.

7. Sift the contents of Container B through a standard 9.5mm or 0.375-in. sieve and capture the materials in Container C. Return any materials not passing through the sieve to Container B and repeat steps 4 through 7.

8. Fill the sample container for TCLP analysis. TCLP analysis must be based on the entire scrap item to provide a representative sample (Section 3.3.1.5) by performing the following:

   - If the scrap item being sampled weighs less than or equal to 100 grams (bulk and fine materials combined, if applicable), process (size reduction) a sufficient number of items (always processing the entire scrap item) to exceed the 100 grams required for TCLP analysis and place all the material directly into the TCLP sample container (Section 3.3.5). If there are fine materials associated with the scrap item, refer to step 11.

- If the item being sampled weighs more than 100 grams (bulk and fine materials combined, if applicable), completely process one item. Segregate different components (primer components, base plate, case, etc.) of the item, if applicable. Homogenize (Section 3.3.4) materials accumulated from each different component separately. Fill the appropriate sample container (Section 3.3.5) with a minimum of 100 grams of material by placing a proportional amount of each different component into the container. Remaining material may be used to fill the container required for total SVOC and explosive analyses, step 9 and 10. If there are fine materials associated with the scrap item, refer to step 11.

9. Fill the sample container for total SVOC analysis. A representative sample will be provided by conducting the following:

   - If the scrap item being sampled weighs less than or equal to 30 grams (bulk and fine materials combined, if applicable), process (size reduction) a sufficient number of items (always processing the entire scrap item) to exceed the 30 grams required for total SVOC analysis and place all the material directly into the appropriate sample container (Section 3.3.5). If there are fine materials associated with the scrap item, refer to step 11.
   - If the item being sampled weighs more than 30 grams (bulk and fine materials combined, if applicable), completely process one item. Segregate different components (primer components, base plate, case, etc.) of the item, if applicable. Homogenize (Section 3.3.4) materials accumulated from each different component separately. Fill the appropriate sample container (Section 3.3.5) with a minimum of 30 grams of material by placing a proportional amount of each different component into the container. Remaining material may be used to fill the container required for explosive analysis, step 10. If there are fine materials associated with the scrap item, refer to step 11.

10. Fill the sample container for explosive analysis. A representative sample will be provided by conducting the following:

   - If the scrap item being sampled weighs less than or equal to 20 grams (bulk and fine materials combined, if applicable), process (size reduction) a sufficient number of items (always processing the entire scrap item) to exceed the 20 grams required for explosive analysis and place all the material directly into the appropriate sample container (Section 3.3.5). If there are fine materials associated with the scrap item, refer to step 11.
   - If the item being sampled weighs more than 20 grams (bulk and fine materials combined, if applicable), completely process one item. Segregate different components (primer components, base plate, case, etc.) of the item, if applicable. Homogenize (Section 3.3.4) materials accumulated from each different component separately. Fill the

appropriate sample container (Section 3.3.5) with a minimum of 20 grams of material by placing a proportional amount of each different component into the container. If there are fine materials associated with the scrap item, refer to step 11.

11. Fine materials must be managed in a way to ensure a representative aliquot of the sample is taken in the laboratory and subjected to the required testing (Section 3.3.1.5). Determine the ratio of fine material to bulk material from the information recorded in steps 1 and 3 in accordance with the instructions on the Sample Preparation Record (Section 3.3.9). Homogenize (Section 3.3.4) the fine materials accumulated and place the appropriate amount of fine material (based on the amount of bulk material containerized in steps 9, 10, and 11) into a separate container marked for the same analysis. Instructions must be sent with the COC/analytical request that provide the analytical laboratory with the ratio of bulk and fine materials to be maintained when preparing an aliquot of the sample for testing.
12. Label sample containers, apply sample seals, complete COC forms, and complete required documentation as discussed in Sections 3.3.6, 3.3.7, 3.3.8, and 3.3.9, respectively.
13. Decontaminate tools and equipment as described in Section 3.3.10.
14. Collect excess materials in plastic bags and record the scrap type on the exterior of the bag. Seal bags and return to the installation point of contact that provided the item. Otherwise, store the accumulated bags and dispose of the materials based on the results of the analytical testing and in accordance with federal, state, and local requirements.

Figures 3-1 and 3-2 provide an example of the flow of sample preparation for a small and large scrap item, respectively.

3.3.3 Quality Assurance/Quality Control Samples

QA rinsate blank samples will be prepared at a rate of 1 blank per 20 samples prepared (5%). Equipment/tool rinsate blanks will be performed by collecting laboratory grade, deionized water that has been rinsed over decontaminated equipment/tool surfaces that contacted the range scrap item during sample preparation.

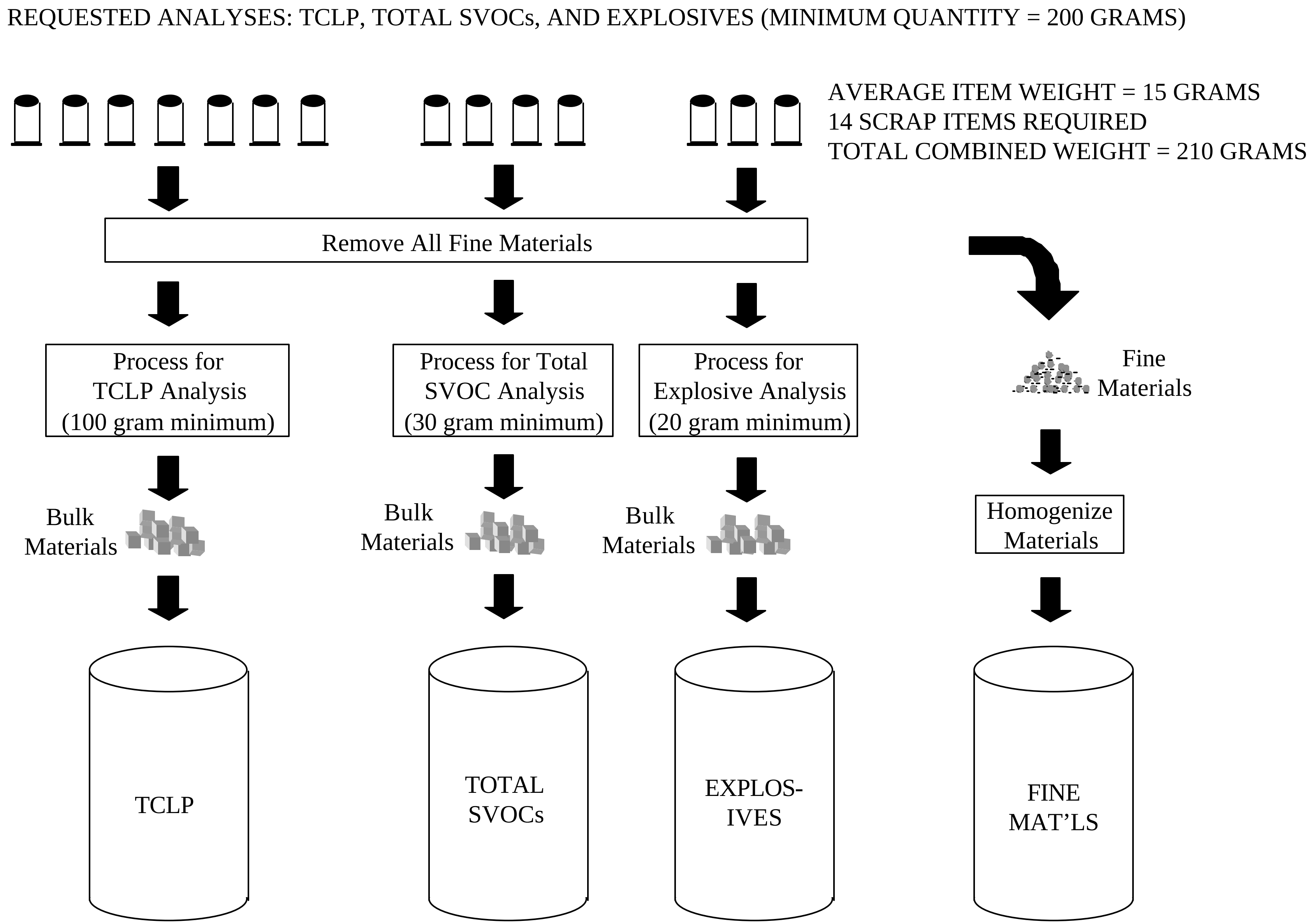


Figure 3-1. Sample Preparation Example Number 1: Small Scrap Item with Fine Material

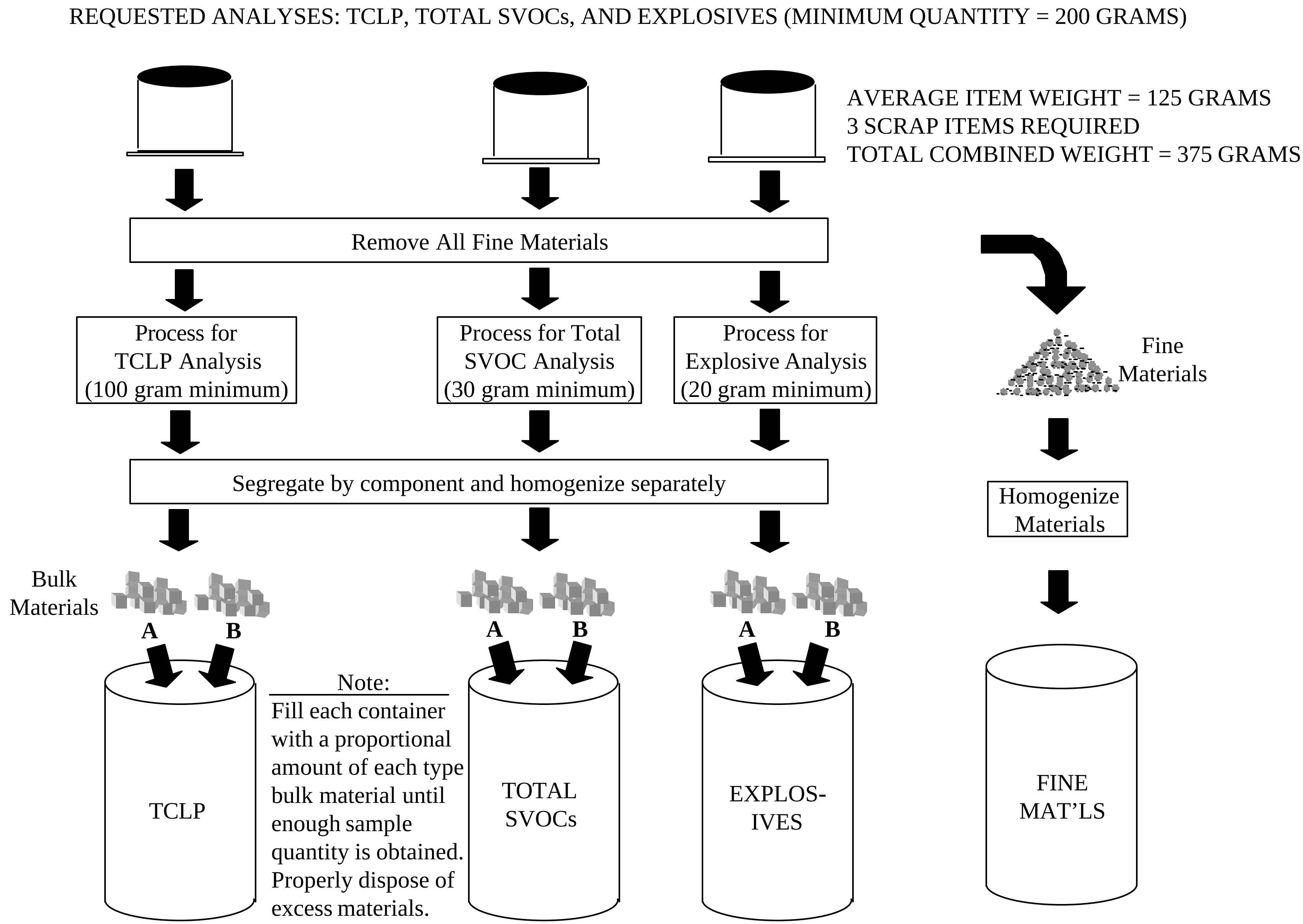


Figure 3-2. Sample Preparation Example Number 2: Large Scrap Item with Fine Material

QC split samples will be collected at a rate of 1 split sample per 20 samples prepared (5%). Samples targeted for QC will be prepared as stated in Section 3.3.2, but at least 400 grams of material will be processed. The QC split sample will be performed after the material has been homogenized by filling an additional sample container for each analysis. All sample containers will be filled simultaneously. Analysis of the split samples will be reviewed to assess the representativeness of the samples submitted to the laboratory.

3.3.4 Sample Homogenization

Applying proper homogenization techniques will help ensure that conditions are being accurately represented. Homogenization will be accomplished by mixing the entire contents of the sample thoroughly with a plastic or Teflon spatula/spoon. Adequate mixing is achieved by stirring the material in a circular manner and occasionally turning the material over. The extent of the mixing required will depend on the nature of the sample and will be done to achieve a consistent appearance prior to filling sample containers. In addition to the size reduction required for TCLP analysis (less than 1 cm in narrowest dimension), particles greater than 0.5 in. in their broadest dimension will be further reduced, if necessary, to provide materials of consistent size. Once mixing is completed, the sample will be divided in half within the mixing container and sample containers will be filled simultaneously by scooping sample material alternatively from each half.

3.3.5 Sample and Shipping Containers

Table 3-2 lists the sample containers and minimum sample amounts required to conduct the analyses for this effort.

Standard food/beverage coolers designated solely for sample shipment shall be used for shipping the samples prepared for this effort. A copy of the COC record, shipping waybill, and “inert certification” shall be included in each shipping container. The contents of the shipping container should be specified as “environmental samples.”

Table 3-2
Sample Containers and Minimum Sample Amounts

Analysis	Routine Container: Solid	Routine Container: Aqueous	Minimum Weight Required (grams)[a]	Recommended Weight (grams)[a]
TCLP	250-mL glass	Total metals – 250-mL plastic w/nitric	100	100+
Total SVOCs	250-mL glass	(2) 1-L amber glass	30	30-60[b]
Explosives	125-mL glass	(2) 1-L glass	20	20-40[b]

[a]Solid samples.
[b]Additional sample material will allow the analytical laboratory to reanalyze the sample, if needed.

3.3.6 Sample Labeling

Samples will be labeled at the time sample containers are filled. The label will contain the following information:

- Sample identifier,
- Requested analysis,
- Date and time of collection, and
- Sampler initials.

This information will be written on a label affixed to the container. Sample label information should be completed using indelible ink.

3.3.7 Sample Seals

Sample seals are used to preserve the integrity of the sample from the time it is collected until it is opened in the analytical laboratory. Gummed paper or plastic is used as official sample seals. These seals will be applied to the outside of shipping packages.

3.3.8 Sample COC and Analytical Request

All samples submitted to the analytical laboratory will be documented on a standard COC form. If samples are hand delivered to the laboratory, the sampler, the courier (if other than the sampler), and the receiver will sign the form. If samples are shipped via an overnight express service, the number of the waybill will be substituted for the receiver signature. The laboratory receiving clerk must still sign the COC to acknowledge receipt at the laboratory.

The COC/analytical request will include the following minimum information:

- Place of collection (sample identification),
- Data and time of collection,
- Sample type (grab or composite),
- Sample description,
- Requested analyses,
- Number of containers,
- Signatures of personnel involved in the chain of possession,
- Inclusive dates of possession, and
- Instructions or reference to an attachment that provides additional instructions to the analytical laboratory regarding non-routine activities.

3.3.9 Sample Preparation Documentation

Appendix D contains a Sample Preparation Record that will be used to record the sample preparation information.

3.3.10 Equipment/Tools Decontamination

Equipment and tools that are reused during sample preparation will be decontaminated as follows:

1. Wipe the equipment with a laboratory grade wipe that has been saturated with a 2% nitric acid solution.
2. Rinse thoroughly with distilled water.
3. Rinse with laboratory grade isopropanol.

4. Rinse thoroughly with laboratory grade organic-free water.
5. Dry the equipment with laboratory grade disposable wipes.

Unless the equipment is going to be used immediately, it should be stored in a clean place (on plastic sheeting).

3.4 Sample Analysis

3.4.1 Analytical Methods/Procedures

The subcontract laboratory used for this study will be certified by the U.S. Army Corps of Engineers Missouri River District for the applicable methods. The analytical procedures for this project are specified as a sample matrix in Table 3-1. Chemical analyses will be performed in accordance with the following guidelines:

- SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, EPA Office of Solid Waste and Emergency Response, November 1986 and
- EPA, *Method for Chemical Analysis of Water and Wastes*, EPA/600/4-79-020, March 1993.

As stated earlier, Modified Method 8330 will be used for the analysis of nitroglycerin and PETN. The difference between the two methods (8330 and Modified 8330) is the addition of a salting out procedure used for 8330. This procedure allows for lower (i.e., more sensitive) detection limits of the analytes.

Analytical data report packages will be provided at an EPA “Level III” format or U.S. Army Corps of Engineers standard data reporting format as discussed in Section 5.1.5.

3.4.2 Laboratory DQO Goals

DQOs define data quality requirements in order to obtain sufficient data of known defensible quality. These objectives are established based on the intended use of the data being generated (Section 2) and are represented by a set of parameters consisting of precision, accuracy, representativeness, completeness, and comparability (PARCC) and sensitivity requirements, which establish the standard criteria for reviewing project data results.

QC procedures are operations employed during chemical analysis in order to support and document the attainment of established QA objectives. The laboratory used to analyze the data is responsible for meeting the QA objectives by maintaining the PARCC and sensitivity requirements, as specified in Table 3-3. The laboratories that have been selected to provide analytical support for this project are EPA-certified laboratories that operate under approved QA plans.

Table 3-3

Acceptance Criteria

	Solid Criteria
Precision (% RPD)	
Method 6010	0–30
Method 7470	0–30
Method 8270	0–50
Method 8330	0–30
Accuracy (% Recovery)	
Method 6010	70–130
Method 7470	70–130
Method 8270	10–200
Method 8330	40–140
Completeness (%)	
All Methods	100

3.4.2.1 Precision

Precision is the agreement among the results from a set of duplicate analyses, regardless of the true value. Precision may be affected by the natural variation of the matrix or contamination within that matrix, as well as by errors made in the field and/or laboratory handling procedures. In order to assess this parameter, matrix spike/matrix spike duplicate samples will be analyzed. Two representative aliquots of the same sample matrix will be subjected to identical analytical procedures in order to assess the procedural precision of the method through the calculation of relative percent difference (RPD). This value will be used to ensure precision objectives have been met. Method-specific RPD limits will be provided in the laboratory-specific reports of results. The number of matrix spike and matrix spike duplicate samples will be determined in accordance with the specified methods.

3.4.2.2 Accuracy

Accuracy is defined as the closeness of agreement between the measured value and the true value and is calculated as percent recovery. Sources of error include the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques. Analytical accuracy will be assessed by measuring the percent recovery of known concentrations of target analytes spiked into a field sample (matrix spikes). Method-specific percent recovery limits will be provided in the laboratory-specific reports of results.

3.4.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population of samples or an environmental condition. Employing appropriate sampling strategies as described in Section 3.2 will ensure representativeness. In the laboratory, representativeness may be enhanced by making certain that all subsamples taken from a given sample are representative of the entire sample. Representativeness will be assessed by the use of duplicate field and laboratory samples.

For the laboratory (matrix) duplicates, two representative aliquots of the same sample matrix will be subjected to identical analytical procedures. The RPD between the two sample results will be calculated.

3.4.2.4 Comparability

Comparability is the confidence with which one data set can be compared to another. Sample data will be comparable with other measurement data for similar samples and sample conditions. This goal will be achieved by using standard methods for sample collection, sample analysis, data review, reporting data in standard units, and using standard and comprehensive reporting formats. Complete field documentation using a standardized data collection format also supports the assessment of comparability.

3.4.2.5 Completeness

Completeness is the percentage of measurements made that are judged to be valid measurements compared to the total number of measurements planned. Any critical samples will be identified to ensure that valid data are obtained in order to obtain the requisite type, quantity, and quality of data necessary to complete the project. The number of samples needed to meet project DQOs is discussed in Section 2 of this document.

3.4.3 Sample Custody and Holding Times

Requirements for sample custody and documentation during the fieldwork are discussed in Section 3.2.8. Custody requirements also apply to the receiving laboratory. Laboratory personnel will indicate transfer of custody by signing the COC record upon receiving the shipment of samples. Table 3-4 lists the holding time requirements for the analyses.

Table 3-4

Holding Times for Chemical Analyses on Solid Samples

Media	Parameter	Extraction	Analysis
Solid	Explosives	14 days	40 days
	Nitroglycerin and PETN	14 days	40 days
	Metals	Not applicable	180 days
	TCLP	14 days	Refer to Chemical Analysis
	Semivolatiles	14 days	40 days

3.4.4 Internal QC Checks

Internal QC checks are used to determine whether analytical operations are in control, as well as determining the affect the sample matrix may have on data being generated. These two aspects are described as batch QC and matrix-specific QC procedures, respectively. The type and frequency of specific QC samples performed by the laboratory will be in accordance with the specified analytical methods. Acceptance criteria and target ranges for the laboratory QC samples are presented within the analytical methods and summarized in Table 3-3. Data that vary from these target ranges will result in the implementation of appropriate corrective measures. Full documentation of all actions taken will be recorded within a case narrative.

3.4.4.1 Batch QC

Typical batch QC for analyses to be performed for this project is described below.

Method Blanks. Method blanks are analyzed to assess the level of background interference or contamination that exists in the analytical system and that might lead to the reporting of elevated concentration levels or false positive data. At least one method blank will be prepared and analyzed with every batch of samples processed. The concentration of all target analytes in the blank will be below the method detection limit (MDL) or 5% of the measured concentration in the sample. If the blank does not meet acceptance criteria, the source of contamination will be investigated and appropriate corrective action will be taken and documented. Corrective actions may include reanalysis of the blank and/or re-preparation and reanalysis of the blank and all associated samples at the laboratory's cost. Sample results will not be corrected for blank contamination.

Laboratory Control Samples. Laboratory performance QC will be based on the use of standard control matrices that are prepared independently from the standard solutions used in establishing the calibration curve, to calculate precision and accuracy data. These QC data will be compared on a per-batch basis, to the control limits of the methods, to verify compliance. This data, along with method blank data, will be used to assess laboratory performance.

Other QC Samples. In order to maintain the quality of the data and laboratory performance, the laboratory will implement the QC requirements and standards described in the reference methods that is uses. These method-specific QC requirements include the following:

- Initial Calibration (metals and SVOCs);
- Initial Calibration Verification (metals);
- Initial Calibration Blank and Continuing Calibration Blank (metals);
- Continuing Calibration Verification (metals, explosives, and SVOCs);
- Interference Check Sample (metals);
- Tune (SVOCs);
- Linear Range Analysis (metals);
- Method Blank (metals, explosives, and SVOCs);
- Serial Dilution (metals);
- Laboratory Control Sample (metals, explosives, and SVOCs);
- Surrogate Spike (SVOCs); and
- Matrix spikes (metals, explosives, and SVOCs).

3.4.4.2 Matrix-Specific QC

Matrix-specific QC will be based on the use of an actual environmental sample for precision and accuracy determinations and will rely on the analysis of matrix duplicates, surrogate compounds, matrix spikes, and matrix spike duplicates. The required frequency of these sample types is established within each specific analytical method. Results of these samples will be used to assess the affect of sample matrix conditions on analytical data.

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4.0 WASTE STREAM-SPECIFIC SAMPLING PROTOCOLS

This section discusses the sampling protocol for each type of range scrap item. Table 4-1 provides a summary of the sampling and analysis requirements for this characterization effort. The following information is detailed for each waste stream identified in Section 2 and listed in Table 4-1:

- **Overview.** An overview of the range scrap item identified as a waste stream within the inventory, including a general description and function of the associated munitions item(s). Available schematics of typical munitions items are also provided.
- **Characterization Rationale.** A discussion of the evaluation factors specific to characterizing each waste stream, which includes scrap components and materials, composition of reactive materials associated with the munitions item, and maximum theoretical leaching limit evaluation (Section 2.7.2). The purpose of this discussion is to provide the rationale for the characterization scheme and the data needed to determine which item within the waste stream represents the most conservative choice for sampling and analysis.

  Typically, two types of tables will be used to summarize data pertinent to the characterization scheme. The first type of table will summarize the composition of the reactive materials (primer, propellant, smoke filler, etc.) or other materials (e.g., lead solder), which contain contaminants of concern, present in the munitions items associated with the waste stream. The second type of table will summarize the maximum theoretical leaching limit evaluation for each DoDAC within the waste stream and provide the basis for selecting the most conservative DoDAC for characterization.
- **Sampling Protocol.** The waste stream-specific sampling protocol detailing which item will be selected for characterization and the corresponding analytical requirements.

Forty types of range scrap or waste streams are included in this characterization effort. These 40 waste streams include 133 separate DoDACs out of a total of 262 DoDACs identified in the munitions inventory for FORSCOM and TRADOC. The remaining DoDACs either do not generate range scrap items at the firing point or produce firing range scrap that is characterized through process knowledge. The munitions items associated with the 40 waste streams in this characterization represent over 97% of the annual munitions expenditure for TRADOC and FORSCOM. This is due to the extensive characterization of small

Table 4-1

Summary of Sampling and Analysis

Waste Stream No.	Range Scrap Waste Stream Description	Minimum Quantity of Samples for Analysis[a]				
		TCLP Metals[b]	Total SVOCs	Modified 8330	TCLP Mercury	TCLP SVOCs[c]
1	12 Gauge Shotgun Cartridge Case	3	3	3	-	TBD
2	5.56mm Cartridge Case	3	3	3	-	TBD
3	.22 Caliber Cartridge Case	3	3	3	-	TBD
4	.30 Caliber Cartridge Case	3	3	3	-	TBD
5	9mm Cartridge Case	3	3	3	-	TBD
6	.45 Caliber Cartridge Case	3	3	3	-	TBD
7	7.62mm Cartridge Case	3	3	3	-	TBD
8	.50 Caliber Cartridge Case	3	3	3	-	TBD
9	40mm Cartridge Case	3	3	3	-	TBD
10	M201A1 Grenade Fuze	3	3	3	-	TBD
11	M227 Grenade Fuze	3	3	-	-	TBD
12	AN-M8 HC Smoke Grenade	3	3	-	-	TBD
13	M48 Red Smoke Grenade	3	3	-	3	TBD
14	M18 Red Smoke Grenade	3	3	-	3	TBD
15	14.5mm Cartridge Case – Training	3	3	3	-	TBD
16	25mm Cartridge Case	3	3	3	-	TBD
17	30mm Cartridge Case	3	3	3	-	TBD
18	75 to 120mm Cartridge Case[d]	6	6	6	-	TBD
19	M18 Green Smoke Grenade	3	3	-	-	TBD
20	M18 Yellow Smoke Grenade	3	3	-	-	TBD
21	M82 Percussion Primer Cartridge Case	3	3	3	-	TBD
22	M60 Firing Device	3	3	3	-	TBD
23	M6 Electric Blasting Cap	3	3	-	-	TBD
24	M7 Nonelectric Blasting Cap	3	3	-	-	TBD
25	M5 Firing Device	3	3	3	-	TBD
26	M7A3 CS Riot Control Hand Grenade	3	3	-	-	TBD
27	ABC-M5 Smoke Pot HC	3	3	-	-	3 (HC)
28	TH3 AN-M14 Incendiary Hand Grenade	3	3	-	3	TBD
29	M18 Violet Smoke Hand Grenade	3	3	-	-	TBD
30	M4A2 HC Floating Smoke Pot	3	3	3	3	3 (HC)
31	M11 Nonelectric Blasting Cap	3	3	3	-	TBD
	M11 Shock Tubes	3	3	3	-	TBD
32	M12 and M13 Nonelectric Blasting Caps	3	3	3	-	TBD
	M12 and M13 Shock Tubes	3	3	3	-	TBD

Table 4-1

(Continued)

Waste Stream No.	Range Scrap Waste Stream Description	Minimum Quantity of Samples for Analysis[a]				
		TCLP Metals[b]	Total SVOCs	Modified 8330	TCLP Mercury	TCLP SVOCs[c]
33	M14 Nonelectric Delay Blasting Cap	3	3	3	-	TBD
34	M15 Nonelectric Delay Blasting Cap	3	3	3	-	TBD
	M15 Shock Tube	3	3	3	-	TBD
35	Personal Distress Flare Kit	3	3	3	-	TBD
36	M1 HC 155mm Smoke Canister	3	3	-	-	3 (HC)
37	10 Gauge Shotgun Cartridge Case	3	3	3	-	TBD
38	M81 Firing Device	3	3	3	-	TBD
39	20mm Steel Cartridge Case	3	3	3	-	TBD
40	25.4mm Cartridge Case	3	3	3	-	TBD
Total		132	132	93	12	TBD

[a]Additional samples may be required to achieve project DQOs as described in Section 3.1.
[b]Analysis includes arsenic, barium, cadmium, chromium, lead, selenium, and silver.
[c]TCLP SVOC analysis will be conducted for any SVOCs that exceed the maximum theoretical leaching limits as determined from the total SVOC analytical results.
[d]Two scrap items from this group will be characterized to provide negative documentation for this large grouping of artillery rounds as described in Section 4.18.
TBD = To Be Determined

arms munitions planned for this study, which represents the majority of munitions expenditure (by item) for the Army. Table 4-2 provides a comparison of different size descriptors used for some of the different munitions listed in Section 4. This will aid the reader in determining the relative size between cartridges, which produce the majority of scrap items included in this characterization.

Sections 4.1 through 4.40 provide details for each waste stream as outlined above.

Table 4-2

Comparison of Ammunition Size Designations

Ammunition Size	Diameter of Cartridge[a]		
	mm	cal	in.
Small Caliber (Small Arms)	**5.56**	21.890	0.22
	7.62	30	0.30
	7.8233	30.8	**0.308**
	9	35	.35
	9.6521	**38**	.38
	10.16	**40**	.40
	11.4301	**45**	.45
	12.7001	**50**	.50
Medium Caliber	**14.5**	57.086	0.57
	20	78.740	0.79
	25	98.424	0.98
	30	118.109	1.18
	35	137.794	1.38
	40	157.479	1.57
	45	177.164	1.77
Large Caliber (Artillery)	**76**	299.210	2.99
	90	354.328	3.54
	105	413.383	4.134
	120	472.437	4.72
	155	610.232	6.10
	165	649.601	6.50

[a] Cartridge highlighted in **BOLD** is the most commonly used name for the size designation.

4.1 Fired 12 Gauge Shotgun Cartridge Cases

4.1.1 Overview

Residues in this waste stream include expended 12 gauge cartridge cases from small arms ammunition used as shotgun rounds. The small arms ammunition is composed of either single-base or double-base propellant mix that ejects and then propels buckshot downrange. The propellant mix is initiated through a primer that is ignited by percussion pressure. Figure 4-1 provides a schematic of a typical 12 gauge shotgun cartridge.

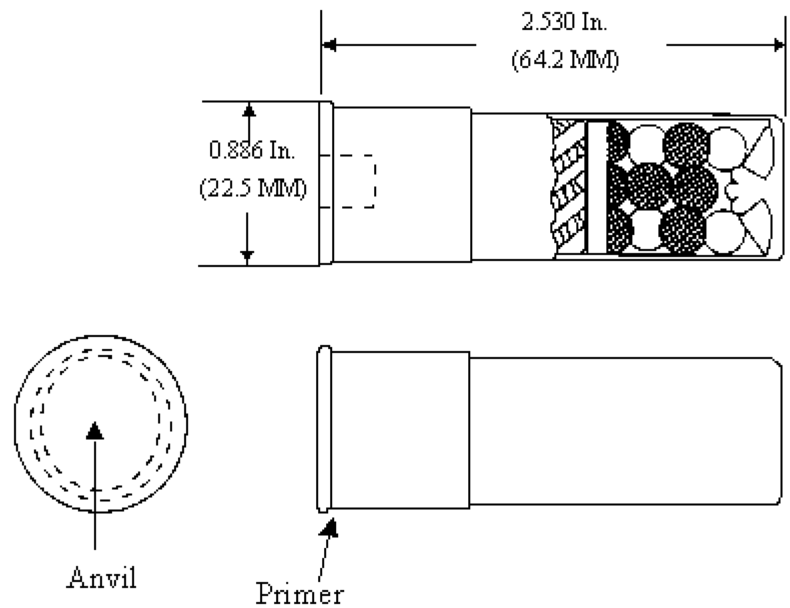


Figure 4-1. 12 Gauge Shotgun Cartridge

4.1.2 Characterization Rationale

4.1.2.1 Scrap components and materials

The cartridge cases for these munitions are composed of either paper or a plastic/paper combination with a brass cartridge head that acts as the initiator assembly. Suspected RCRA TCLP constituents in the cartridge case materials include lead found in the brass cartridge head. The brass cartridge head is a common material among the DoDACs in this waste stream. No information was available for DoDAC 1305A014; therefore, it is not included in this discussion. However, based on conversations with Olin-Winchester and Remington (ammunition manufacturers), all shotgun casings within this waste stream are consistent in both primer and propellant mix.

4.1.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in both the remaining munitions in this grouping is called Primer Mix #955. Table 4-3 lists the properties of Primer Mix #955. This primer mix contains lead from lead styphnate and barium from barium nitrate in the amounts shown in Table 4-3. The primer mix also contains PETN, which is a secondary constituent of concern for this characterization.

Table 4-3

Primer Mix for 12 Gauge Shotgun Cartridges

Compound	Residue Weight (lb)	Percentage of Primer Mix
Primer Mix #955 (0.90 grains)		
Lead Styphnate	5.14e-5	40%
PETN	6.42e-6	5%
Barium Nitrate	3.85e-5	30%
Strontium Sulfide	1.93e-5	15%
Aluminum Powder	7.71e-5	6%
Tetracene	5.14e-6	4%

Source: MIDAS Database

In addition to the primer, shotgun cartridges use two types of propellant mixes. These mixes are either single-base containing nitrocellulose mixed with the RCRA TCLP constituent DNT or double-base containing nitrocellulose and nitroglycerin. Other energetic compounds, such as nitroglycerin, are considered secondary constituents of concern for this characterization. Table 4-4 lists the propellant mixes associated with the 12 gauge shotgun cartridges represented in this waste stream. After each propellant mix in Table 4-4, the number in parenthesis corresponds to the propellant mix column of Table 4-5 [e.g., DoDAC 1305A017 uses propellant mix 1 (SR 7325)]. Propellant Mix Hercules also contains a minimal amount of barium from barium nitrate.

4.1.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-5. Note that data on material composition are only available for DoDAC 1305A011 at this time. However, DoDACs 1305A014 and 1305A017 should have the same percent lead since the brass cartridge head and primer are common to both DoDACs. The amount of lead present in DoDAC 1305A011 (0.022%) is greater than the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-4

Propellant Mixes for 12 Gauge Shotgun Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix SR 7325 (28 grains) (1)		
Nitrocellulose	3.92e-3	98.15%
Diphenylamine	3.24e-5	0.9%
Graphite	1.60e-5	0.4%
Dinitrotoluene	7.99e-6	0.2%
Propellant Mix Hercules (28 grains) (2)		
Nitrocellulose	2.86e-3	71.5%
Nitroglycerin	7.99e-4	20%
Potassium Nitrate	4.00e-5	1%
Barium Nitrate	4.00e-5	1%
Ethyl Centralite	2.60e-4	6.5%

Source: MIDAS Database

Table 4-5

12 Gauge Shotgun Cartridge Cases

Residue	DoDAC	Primary Munition	Propellant Mix	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS AND PAPER/PLASTIC	1305A011	CTG 12 GA SHOTGUN BUCKSHOT	2	1.33e-1	2.92e-5	0.022%
CASE, CTG, FIRED, BRASS AND PLASTIC	1305A017	CTG 12 GA SHOTGUN #9 BUCKSHOT	1	Not Available	Not Available	Not Available
CASE, CTG, FIRED, BRASS AND PLASTIC	1305A014	CTG 12 GA SHOTGUN #11	Unknown	Not Available	Not Available	Not Available

Source: MIDAS Database and Ammunition Book Complete

4.1.3 Sampling Protocol

DoDAC 1305A011 will be selected for characterization to represent this waste stream since the lead-containing components (cartridge head and primer mix) are consistent among the items in this waste stream. The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.2 Fired 5.56mm Brass Cartridge Cases

4.2.1 Overview

Residues in this waste stream include cartridge cases from small arms ammunition used in 5.56mm cartridges. The small arms ammunition is typically composed of a double-base propellant mix that ejects and then propels a bullet downrange. The propellant mix is initiated through a primer that is ignited by percussion pressure. Figure 4-2 provides a schematic of a typical 5.56mm blank cartridge.

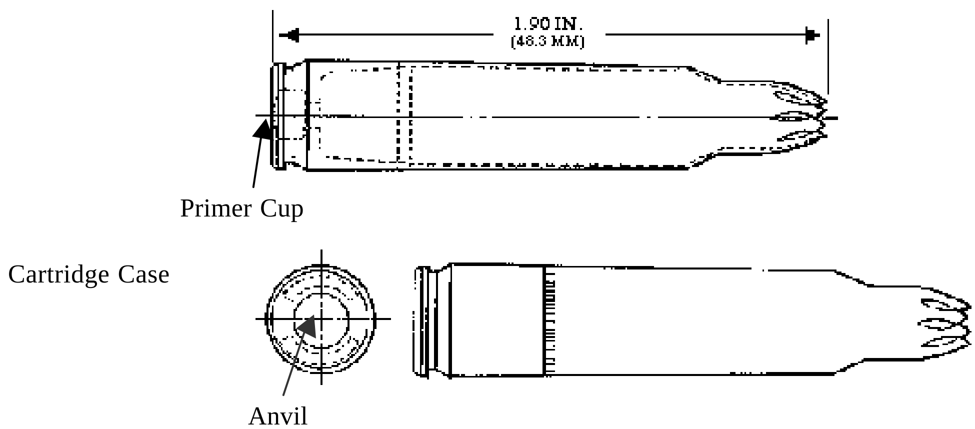


Figure 4-2. 5.56mm Blank Cartridge
(*Source:* MIDAS)

4.2.2 Characterization Rationale

4.2.2.1 Scrap components and materials

The cartridge cases for all the items in this waste stream are composed of brass, which contains a small percentage of lead. Additionally, the primer cup and anvil associated with all the items in this waste stream are brass and contain lead.

4.2.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in all the munitions in this waste stream is called Primer Mix FA-956. Table 4-6 lists the properties of Primer Mix FA-956. This primer mix contains the RCRA TCLP constituents lead in lead styphnate and barium in barium nitrate in the amounts shown in Table 4-6.

Table 4-6

Primer Mix for 5.56mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix FA-956 (0.60 grains)		
Lead Styphnate	3.17e-5	37%
PETN	4.28e-6	5%
Barium Nitrate	2.74e-5	32%
Strontium Sulfide	1.28e-5	15%
Aluminum Powder	5.99e-5	7%
Tetracene	3.43e-6	4%

Source: MIDAS Database

In addition to the primer, 5.56mm cartridges use four types of propellant mixes. These mixes are all double-base propellants using nitrocellulose and nitroglycerin as their primary components. Table 4-7 lists the propellant mixes associated with 5.56mm cartridges. After each propellant mix, the number in parenthesis corresponds to the propellant mix column of Table 4-8 [e.g., DoDAC 1305A059 uses propellant mix 1 (WC844)]. There are no RCRA TCLP constituents listed in the propellant mixes. However, the energetic compounds associated with the propellant mixes are considered secondary constituents of concern.

4.2.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-8. The percentage of lead associated with the items ranges from 0.07% (training and ballistic cartridges) to 0.13% (blank cartridges). The higher content of lead in the blank cartridges is due to the reduced amount of propellant (reduced overall weight of item) and the extension of the cartridge case (more brass). The amount of lead present in all the

Table 4-7

Propellant Mixes for 5.56mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix WC844 (28.5 grains) (1)		
Nitrocellulose	3.38e-3	83.22%
Nitroglycerin	4.07e-4	10%
Sodium Sulfate	2.03e-5	0.5%
Calcium Carbonate	1.02e-5	0.25%
Diphenylamine	5.29e-5	1.3%
Graphite	1.63e-5	0.4%
Dibutylphathalate	1.83e-4	4.5%
Propellant Mix WC844 (26.7 grains) (2)		
Nitrocellulose	3.54e-3	83%
Nitroglycerin	3.84e-4	10.1%
Sodium Sulfate	1.62e-5	0.5%
Calcium Carbonate	9.53e-6	0.25%
Diphenylamine	4.19e-5	1.1%
Graphite	1.52e-5	0.4%
Dibutylphathalate	1.81e-4	4.75%
Propellant Mix IMR 8208-M (25.3 grains) (3)		
Nitrocellulose	3.37e-3	93.2%
Potassium Sulfate	1.99e-5	0.55%
Diphenylamine	3.07r-5	0.85%
Graphite	1.44e-5	0.4%
Ethylene Dimethacryl	1.81e-4	5%
Propellant Mix HPC-13 (7.0 grains) (4)		
Nitrocellulose	6.60e-4	66.1%
Nitroglycerin	2.85e-4	28.5%
Potassium Sulfate	7.49e-6	0.75%
Ethyl Centralite	4.25e-5	4.25%
Graphite	4.00e-6	0.4%

Source: MIDAS Database

items (0.07% to 0.13%) is greater than the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this group.

4.2.3 Sampling Protocol

Either blank cartridge 1305A075 or 1305A080 (Figure 4-2) will be collected for sampling. Both items have the same amount of lead associated with the munitions item (1.96e-5 lb), which

Table 4-8

5.56mm Cartridge Cases

Residue	DoDAC	Primary Munition	Propellant Mix	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS	1305A059	CTG 5.56MM BALL M855	1	2.71e-2	1.93e-5	0.071%
CASE, CTG, FIRED, BRASS	1305A062	CTG 5.56MM BALL M855 LNKD	1	2.71e-2	1.93e-5	0.071%
CASE, CTG, FIRED, BRASS	1305A063	CTG 5.56MM TR M856	2	2.73e-2	1.93e-5	0.071%
CASE, CTG, FIRED, BRASS	1305A064	CTG 5.56MM BALL TR 4/1 M855, M856	1/2	Unknown	Unknown	Unknown
CASE, CTG, FIRED, BRASS	1305A065	CTG 5.56MM PLASTIC M862	1	2.71e-2	1.93e-5	0.071%
CASE, CTG, FIRED, BRASS	1305A068	CTG 5.56MM TR M196	3	2.53e-3	1.93e-5	0.076%
CASE, CTG, FIRED, BRASS	1305A071	CTG 5.56MM BALL M193	1	2.60e-2	1.93e-5	0.074%
CASE, CTG, FIRED, BRASS	1305A075	CTG 5.56MM BLK M200 LNKD	4	1.56e-2	1.96e-5	0.126%
CASE, CTG, FIRED, BRASS	1305A080	CTG 5.56MM BLK M200	4	1.56e-2	1.96e-5	0.126%

Source: MIDAS Database

is greater than any other item in the waste stream. The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.3 <u>Fired .22 Caliber Brass Cartridge Cases</u>

4.3.1 Overview

Residues in this waste stream include expended cartridge cases from small arms ammunition used in .22 caliber munitions. The small arms ammunition is composed of primarily double-base propellant mix that ejects and then propels a bullet downrange. The propellant mix is initiated through a primer that is ignited by percussion pressure. Figure 4-3 provides a schematic of a typical .22 caliber cartridge.

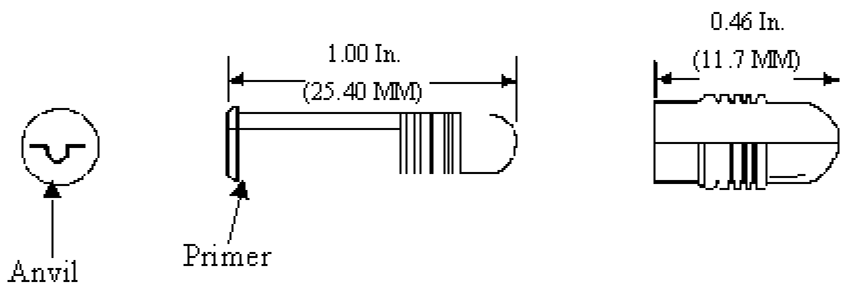


Figure 4-3. .22 Caliber Cartridge

4.3.2 Characterization Rationale

4.3.2.1 Scrap components and materials

The cartridge cases for the particular .22 caliber cartridges in this waste stream are composed of lead-containing brass.

4.3.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in the particular .22 caliber cartridges in this waste stream is called Primer Mix Cal .22 RF. Table 4-9 lists the properties of the primer mix. The primer mix contains the RCRA hazardous constituents lead and barium from lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-9.

Table 4-9

Primer Mix for .22 Caliber Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix Cal .22 RF (0.34 grains)		
Lead Styphnate	2.18e-5	45%
Barium Nitrate	1.31e-5	27%
Ground Glass	1.07e-5	22%
Gum	4.85e-7	1%
Tetracene	2.43e-7	5%

Source: MIDAS Database

In addition to the primer, the particular .22 caliber cartridges in this waste stream use one type of double-base propellant mix, Propellant Mix WRF360. Table 4-10 lists the composition of the propellant mix associated with .22 caliber cartridges. The propellant mix contains no RCRA TCLP constituents, but does contain a secondary constituent of concern, nitroglycerin.

Table 4-10

Propellant Mix for .22 Caliber Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix WRF360 (2.5 grains)		
Nitrocellulose	2.34e-4	83.34%
Nitroglycerin	5.35e-5	15%
Water	1.78e-6	0.06%
Polyester Adipate	2.14e-7	0.5%
Diphenylamine	9.14e-7	1%
Graphite	3.57e-8	0.1%

Source: MIDAS Database

4.3.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-11. The percentage of lead associated with the items is consistent among the waste stream at 0.15%, which is well above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-11

.22 Caliber Cartridge Cases

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS	1305A091	CTG CAL .22 LR BALL MATCH GRADE	7.43e-3	1.10e-5	0.148%
CASE, CTG, FIRED, BRASS	1305A093	CTG CAL .22 LR BALL	7.43e-3	1.10e-5	0.148%
CASE, CTG, FIRED, BRASS	1305A106	CTG CAL .22 LR BALL	7.43e-3	1.10e-5	0.148%

Source: MIDAS Database

4.3.3 Sampling Protocol

Any one of the three types of .22 caliber cartridge cases (DoDACs 1305A091, 1305A093, or 1305A106) will be sampled (based on availability), since the materials, primer mix, and percent lead are consistent among the waste stream. The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.4 <u>Fired .30 Caliber Brass Cartridge Cases</u>

4.4.1 Overview

Residues in this waste stream include expended cartridge cases from small arms ammunition used in .30 caliber cartridges. The small arms ammunition is composed of primarily double-base propellant mix that ejects and then propels a bullet downrange. The propellant mix is initiated through a primer that is ignited by percussion pressure. Figure 4-4 provides a schematic of a typical .30 caliber cartridge.

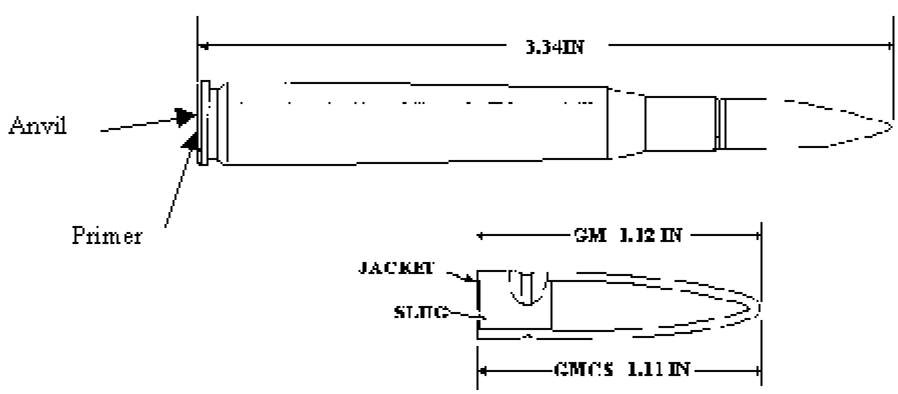


Figure 4-4. .30 Caliber Cartridge

4.4.2 Characterization Rationale

4.4.2.1 Scrap components and materials

The cartridge cases for the .30 caliber cartridges in this waste stream are composed of lead-containing brass. Additionally, all the cartridge cases in this grouping have lead-containing brass primer cups and brass anvils.

4.4.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in the .30 caliber cartridges is Primer Mix FA-956. Table 4-12 lists the properties of the primer mix. Primer Mix FA-956 contains the RCRA TCLP constituents lead and a minimal amount of barium in lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-12. The primer mix also contains PETN, which is a secondary constituent of concern.

Table 4-12
Primer Mix for .30 Caliber Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix FA-956 (0.60 grains)		
Lead Styphnate	3.17e-5	37%
PETN	4.28e-6	5%
Barium Nitrate	2.74e-5	32%
Strontium Sulfide	1.28e-5	15%
Aluminum Powder	5.99e-6	7%
Tetracene	3.43e-6	4%

Source: MIDAS Database
Note: The amount of primer in DoDAC 1305A182 is 58% of the primer amount found in DoDACs 1305A212, A222, A246, and A247.

In addition to the primer, the .30 caliber cartridges in this waste stream use four types of propellant mixes. These mixes are primarily either double-base and contain nitrocellulose and nitroglycerin or they use nitrocellulose mixed with the RCRA TCLP constituent DNT. Table 4-13 lists the propellant mixes associated with .30 caliber cartridges.

After each propellant mix, the number in parenthesis corresponds to the propellant mix column of Table 4-14 [e.g., DoDAC 1305A222 uses propellant mix 3 (WC BLK)].

Table 4-13
Propellant Mixes for .30 Caliber Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix HPC-5 (13.0 grains) (1)		
Nitrocellulose	1.48e-3	79.68%
Nitroglycerin	2.78e-4	15%
Diphenylamine	1.73e-5	0.93%
Graphite	7.42e-7	0.4%
Ethyl Centralite	7.42e-5	4%
Propellant Mix WC852 (58.0 grains) (2)		
Nitrocellulose	6.72e-3	81.18%
Nitroglycerin	7.86e-4	9.5%
Sodium Sulfate	4.14e-5	0.5%
Calcium Carbonate	9,28e-5	1%
Potassium Sulfate	6.62e-5	0.8%
Diphenylamine	9.35e-5	1.13%
Graphite	3.31e-5	0.4%
Dibutylphathalate	4.55e-4	5.5%
Propellant Mix WC BLK (12 grains) (3)		
Nitrocellulose	1.47e-3	85.46%
Nitroglycerin	1.71e-4	10%
Dibutylphthalate	2.59e-5	1.51%
Diphenylamine	1.94e-5	1.13%
Calcium Carbonate	1.71e-5	1%
Sodium Sulfate	8.57e-6	0.50%
Graphite	6.86e-6	0.40%
Propellant Mix IMR 4895 (50.0 grains) (4)		
Nitrocellulose	6.51e-3	91.18%
Dinitrotoluene	5.01e-4	7%
Potassium Sulfate	3.50e-6	0.55%
Graphite	2.85e-5	0.4%
Diphenylamine	6.07e-5	0.87%

Source: MIDAS Database

4.4.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-14. The amount of lead associated with the items in the grouping ranges from 0.06% to 0.11%, which is well above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-14

.30 Caliber Cartridge Cases

Residue	DoDAC	Primary Munition	Propellant Mix	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS	1305A182	CTG CAL .30 CARB BALL M1	1	2.80e-2	1.59e-5	0.057%
CASE, CTG, FIRED, BRASS	1305A212	CTG CAL .30 BALL M2	2	5.83e-2	3.50e-5	0.060%
CASE, CTG, FIRED, BRASS	1305A222	CTG CAL .30 BLK M1909	3	3.11e-2	3.50e-5	0.113%
CASE, CTG, FIRED, BRASS	1305A246	CTG CAL .30 MATCH M72	4	6.07e-2	3.50e-5	0.058%
CASE, CTG, FIRED, BRASS	1305A247	CTG CAL .30 MATCH M72	4	6.07e-2	3.50e-5	0.058%

Source: MIDAS Database

4.4.3 Sampling Protocol

DoDAC 1305A247 will be characterized to conservatively represent this waste stream since it is one of the items with the largest amount of lead (3.50e-5 lb) and it is the only cartridge that contains a propellant mix with DNT. The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.5 Fired 9mm Cartridge Cases

4.5.1 Overview

Residues in this waste stream include expended cartridge cases from small arms ammunition used in 9mm cartridges. The small arms ammunition is primarily composed of a double-base propellant mix that ejects and then propels a bullet downrange. The propellant mix is initiated through a primer that is ignited by percussion pressure. Figure 4-5 provides a schematic of a typical 9mm cartridge.

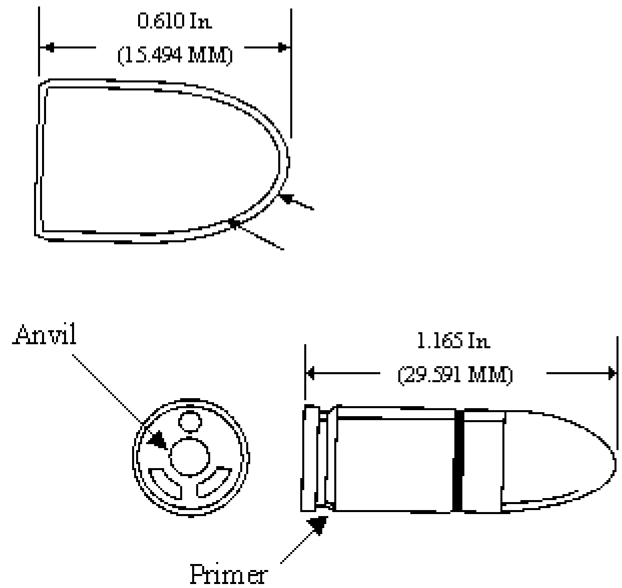


Figure 4-5. 9mm Cartridge

4.5.2 Characterization Rationale

4.5.2.1 Scrap components and materials

The cartridge case for DoDAC 1305A358 is primarily composed of lead-containing brass or aluminum as an alternate. The remaining cartridge case in the grouping, DoDAC 1305A363, is composed solely of lead-containing brass. Additionally, the primer cup and anvil of both the cartridge cases in this waste stream consist of lead-containing brass.

4.5.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in the 9mm cartridges represented in this waste stream is Winchester 116-282A. Table 4-15 lists the properties of the primer mix. Primer Mix Winchester 116-282A contains the RCRA TCLP constituents lead and a minimal amount of barium in lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-15. The primer mix also contains PETN, which is a secondary constituent of concern for this characterization.

Table 4-15

Primer Mix for 9mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Winchester 116-282A (0.39 grains)		
Lead Styphnate	2.23e-5	40%
PETN	3.34e-6	6%
Barium Nitrate	1.84e-5	33%
Strontium Sulfide	8.91e-5	16%
Tetracene	2.78e-6	5%

Source: MIDAS Database

In addition to the primer, 9mm cartridges in this waste stream use a double-base propellant mix containing nitrocellulose and nitroglycerin, Propellant Mix HPC-33. Table 4-16 lists the propellant mix associated with these 9mm cartridges. The propellant mix contains no RCRA TCLP constituents. However, nitroglycerin is present in the mix and is considered a secondary constituent of concern for this characterization.

Table 4-16

Propellant Mix for 9mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix HPC-33 (5.2 grains)		
Nitrocellulose	6.34e-4	85.45%
Nitroglycerin	5.20e-5	7%
Diphenylamine	7.05e-6	0.95%
Graphite	4.45e-6	0.6%
Potassium Nitrate	1.48e-6	2%
Vinsol	2.97e-6	4%

Source: MIDAS Database

4.5.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-17. The amount of lead associated with the brass cartridge cases in this grouping is 0.05%, which is well above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream. Note that data for the aluminum cartridge (DoDAC

1305A358) are not available at this time. However, the brass cartridge cases are considered to be the more conservative item for characterization due to the higher lead content.

Table 4-17

9mm Cartridge Cases

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS or AL ALLOY	1305A358	CTG 9MM PRAC AT-4 M287	TBD	TBD	TBD
CASE, CTG, FIRED, BRASS	1305A363	CTG 9MM BALL M882	2.56e-2	1.34e-5	0.052%

Source: MIDAS Database
TBD = To Be Determined

4.5.3 Sampling Protocol

Sampling will involve DoDAC 1305A363 since brass cartridge cases have a higher lead content than aluminum cartridge cases. The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.6 Fired .45 Caliber Brass Cartridge Cases

4.6.1 Overview

Residues in this waste stream include expended cartridge cases from small arms ammunition used in .45 caliber cartridges. The small arms ammunition is composed of a single-base propellant mix that ejects and then propels a slug downrange. The propellant mix is initiated through a primer that is ignited by percussion pressure. Figure 4-6 provides a schematic of a typical .45 caliber cartridge.

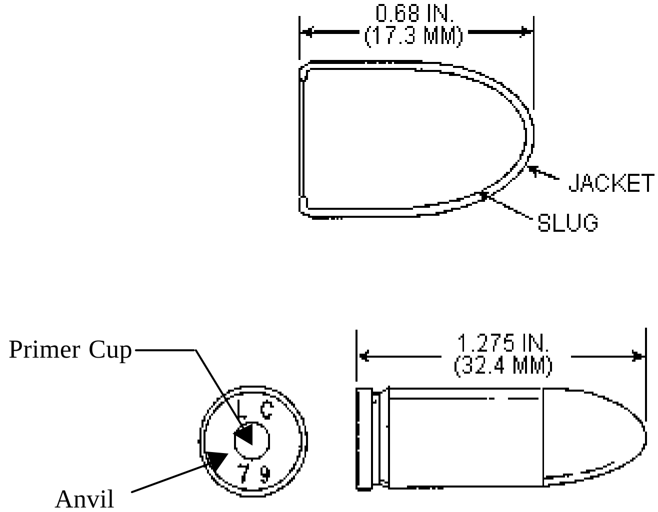


Figure 4-6. .45 Caliber, BALL M1911
(*Source:* MIDAS)

4.6.2 Characterization Rationale

4.6.2.1 Scrap components and materials

The cartridge case for the single .45 caliber cartridge included in this waste stream is composed of lead-containing brass. Other components containing lead include the brass primer cup and anvil.

4.6.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in the .45 caliber cartridge represented in this waste stream is Primer Mix 295A. Table 4-18 lists the properties of the primer mix. This mix contains the RCRA TCLP constituents lead and a minimal amount of barium in lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-18. The primer mix also contains PETN, which is a secondary constituent of concern for this characterization.

Table 4-18

Primer Mix for .45 Caliber Cartridge

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix 295A (0.46 grains)		
Lead Styphnate	2.43e-5	37%
PETN	3.28e-6	5%
Barium Nitrate	1.90e-5	29%
Strontium Sulfide	3.14e-5	19%
Lead Thiocyanate	3.28e-6	5%
Tetracene	3.28e-6	5%

Source: MIDAS Database

In addition to the primer, the .45 caliber cartridge uses a single-base propellant containing nitrocellulose mixed with the RCRA TCLP constituent DNT. Table 4-19 lists the propellant mix associated with the .45 caliber cartridge in this waste stream.

Table 4-19

Propellant Mix for .45 Caliber Cartridge

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix SR 7970 (5.0 grains)		
Nitrocellulose	6.87e-4	96.24%
Dinitrotoluene	1.78e-5	2.5%
Diphenylamine	6.14e-6	0.86%
Graphite	2.85e-6	0.4%

Source: MIDAS Database

4.6.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-20. The amount of lead associated with the cartridge in this grouping is 0.04%, which is well above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-20

.45 Caliber Cartridge Case

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS	1305A475	CTG CAL .45 BALL M1911	4.73e-2	2.09e-5	0.044%

Source: MIDAS Database

4.6.3 Sampling Protocol

The only item in this waste stream, DoDAC 1305A475, will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.7 Fired 7.62mm Brass Cartridge Cases

4.7.1 Overview

Residues in this waste stream include expended cartridge cases from small arms ammunition with a caliber of 7.62mm. These cartridges are primarily composed of either single-base or double-base propellants that eject and then propel a bullet downrange. The propellant mixes are initiated through a primer that is ignited by percussion pressure. Figure 4-7 provides a schematic of a typical 7.62mm cartridge.

4.7.2 Characterization Rationale

4.7.2.1 Scrap components and materials

The cartridge cases for all the items in this waste stream consist of lead-containing brass. Additionally, all the cartridge cases in the grouping have lead-containing brass primer cups and anvils.

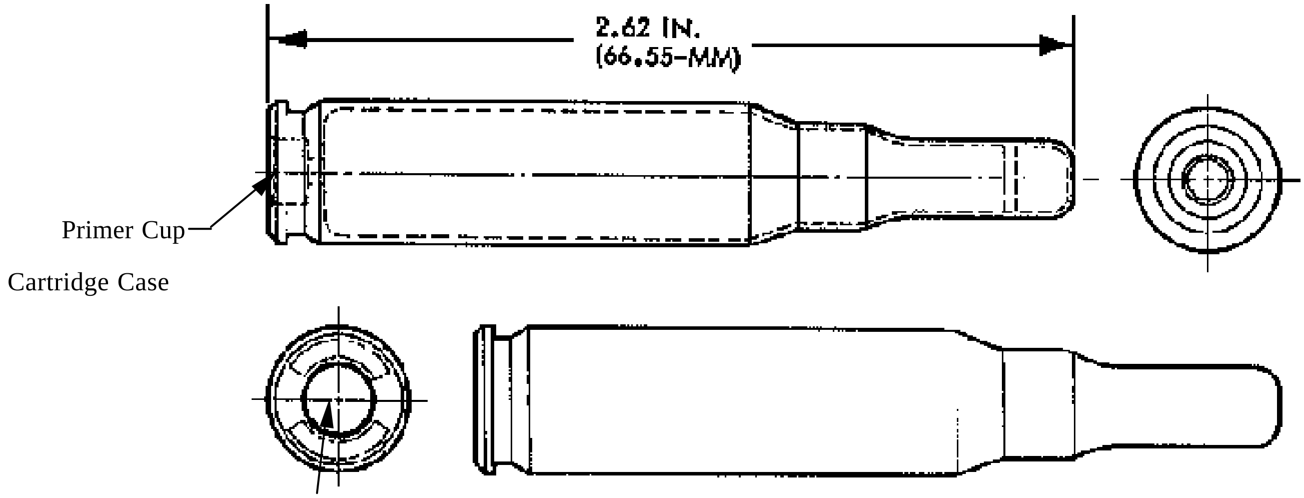


Figure 4-7. 7.62mm Blank Cartridge, M82
(*Source:* MIDAS)

4.7.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in the 7.62mm cartridges represented by this waste stream is either Primer FA-956 or Primer Mix FA-961. Table 4-21 lists the properties of the primer mixes. Both mixes contain the RCRA TCLP constituents lead and a minimal amount of barium in lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-21. The primer mixes also contain PETN, which is a secondary constituent of concern for this characterization.

In addition to the primer, 7.62mm cartridges in this waste stream use five types of propellant mixes. These mixes are either single-base mixes containing nitrocellulose mixed with the RCRA TCLP constituent DNT or double-base mixes containing nitrocellulose and nitroglycerin. Table 4-22 lists the propellant mixes associated with 7.62mm cartridges. After each propellant mix, the number in parenthesis corresponds to the propellant mix column of Table 4-23 [e.g., DoDAC 1305A111 uses propellant mix 1 (WC818)].

Table 4-21

Primer Mixes for 7.62mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix FA-956 (0.60 grains)		
Lead Styphnate	3.17e-5	37%
PETN	4.28e-6	5%
Barium Nitrate	2.74e-5	32%
Strontium Sulfide	1.28e-5	15%
Aluminum Powder	5.99e-5	7%
Tetracene	3.43e-6	4%
Primer Mix FA-961 (0.60 grains)		
Lead Styphnate	3.08e-5	36%
PETN	4.28e-6	5%
Barium Nitrate	2.48e-5	29%
Strontium Sulfide	7.71e-6	9%
Lead Dioxide	7.71e-6	9%
Tetracene	2.57e-6	3%
Zirconium	7.71e-6	9%

Source: MIDAS Database

Table 4-22

Propellant Mixes for 7.62mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix WC818 (16.7 grains) (1)		
Nitrocellulose	2.09e-3	87.95%
Nitroglycerin	1.91e-4	8%
Diphenylamine	1.79e-5	0.75%
Dibutylphathalate	3.57e-5	1.5%
Calcium Carbonate	2.38e-5	1%
Graphite	7.15e-6	0.3%
Sodium Sulfate	1.19e-5	0.5%
Propellant Mix SR 8231(15.0 grains) (2)		
Nitrocellulose	1.98e-5	92.45%
Dinitrotoluene	3.57e-5	5%
Diphenylamine	2.63e-5	1.23%
Graphite	6.42e-6	0.3%
Potassium Sulfide	2.14e-5	1%
Propellant Mix WC846 (46.0 gains) (3)		
Nitrocellulose	3.45e-3	82.97%
Nitroglycerin	6.24e-4	9.5%
Diphenylamine	2.42e-5	1.13%
Dibutylphathalate	3.45e-4	5.25%
Calcium Carbonate	1.64e-5	0.25%
Graphite	2.63e-5	0.4%
Sodium Sulfate	4.28e-5	0.5%

Table 4-22

(Continued)

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix Type II (47 grains) (4)		
Nitrocellulose	5.99e-3	89.3%
Dinitrotoluene	6.04e-4	9%
Diphenylamine	6.04e-5	0.9%
Calcium Carbonate	4.36e-5	0.65%
Sodium Sulfate	1.01e-5	0.15%
Propellant Mix IMR 4895 (42.0 grains) (5)		
Nitrocellulose	5.47e-3	91.2%
Dinitrotoluene	4.20e-4	7%
Potassium Sulfate	2.10e-5	0.35%
Graphite	2.40e-5	0.4%
Diphenylamine	5.10e-5	0.85%

Source: MIDAS Database

4.7.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-23. The percentage of lead associated with the items ranges from 0.06% (BALL and MATCH cartridges) to 0.11% (BLK cartridges). The higher content of lead in the blank cartridges is due to the reduced amount of propellant (reduced overall weight of item) and the extension of the cartridge case (more brass). The amount of lead present in all the items (0.06% to 0.11%) is greater than the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-23

7.62mm Cartridge Cases

Residue	DoDAC	Primary Munition	Propellant Mix	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS	1305A111	CTG 7.62MM BLK M82 LNKD M13	1	3.35e-2	3.63e-5	0.108%
CASE, CTG, FIRED, BRASS	1305A112	CTG 7.62MM BLK M82 LNKD	2	3.36e-2	3.63e-5	0.108%
CASE, CTG, FIRED, BRASS	1305A130	CTG 7.62MM NATO BALL M80	3	5.29e-2	3.40e-5	0.064%

Table 4-23
(Continued)

Residue	DoDAC	Primary Munition	Propellant Mix	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS	1305A131	CTG 7.62MM 4 BALL M59/M80/1 TR M62	3/4	5.29e-2 5.47e-2	3.40e-5 3.40e-5	0.064% 0.062%
CASE, CTG, FIRED, BRASS	1305A136	CTG 7.62MM NATO SPEC BALL M118	1	5.57e-2	4.03e-5	0.072%
CASE, CTG, FIRED, BRASS	1305A143	CTG 7.62MM NATO BALL M80 LNKD	3	5.29e-2	3.40e-5	0.064%
CASE, CTG, FIRED, BRASS	1305A151	CTG 7.62MM 4 BALL M80/1 TR M62 OHF	3/4	5.61e-2 5.53e-2	3.40e-5 3.40e-5	0.061% 0.062%
CASE, CTG, FIRED, BRASS	1305A165	CTG 7.62MM 4 BALL M80/1 TR M62 LNKD M13	3/4	5.28e-2 5.47e-2	3.40e-5 3.40e-5	0.064% 0.062%
CASE, CTG, FIRED, BRASS	1305A171	CTG 7.62MM MATCH M852	5	5.50e-2	3.39e-5	0.062%
CASE, CTG, FIRED, BRASS	1305AA11	CTG 7.62MM M118 LRA	5	Not available	Not available	Not available

Source: MIDAS Database

4.7.3 Sampling Protocol

DoDAC 1305A112 will be selected for characterization to represent the waste stream since the item has the highest lead content (3.63e-5) and also has DNT present in the primer mix. The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.8 Fired .50 Caliber Cartridge Cases

4.8.1 Overview

Residues in this waste stream include expended cartridge cases from small arms ammunition with a caliber of .50 in. These cartridges are considered the largest diameter in the small arms family and are primarily composed of single-, double-, and some triple-base propellants that eject and then propel a bullet downrange. The propellant mixes are initiated through a primer that is ignited by percussion pressure. Figure 4-8 provides a schematic of a typical .50 caliber cartridge.

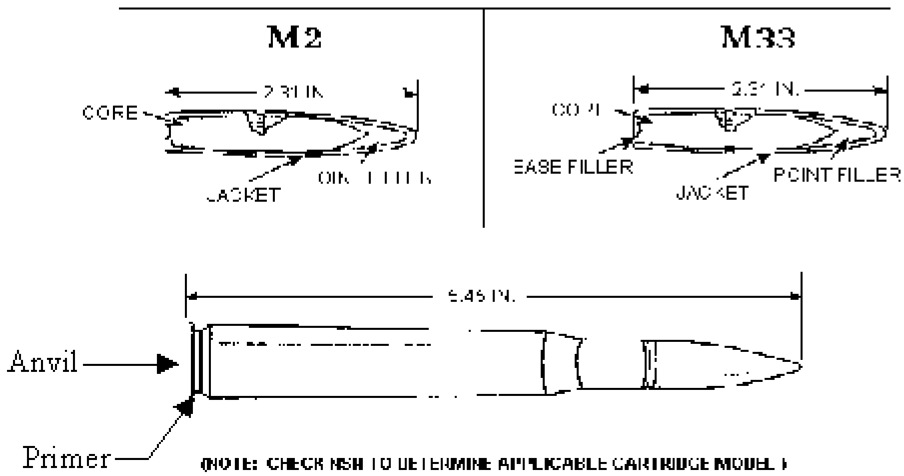


Figure 4-8. .50 Caliber Cartridge

4.8.2 Characterization Rationale

4.8.2.1 Scrap components and materials

The cartridge cases in this waste stream are made of either steel or lead-containing brass. Additionally, all the cartridge cases have lead-containing brass primer cups and anvils.

4.8.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in the .50 caliber cartridges represented in this waste stream is Primer Mix 5061W (#50 or 50M). Table 4-24 lists the properties of the primer mix. This mix contains the RCRA TCLP constituents lead and barium in lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-24.

Table 4-24

Primer Mix for .50 Caliber Cartridges

Compound	Residue weight (lb)	Percentage of Total Mix
Primer Mix 5061W (2.25 grains)		
Lead Styphnate	1.22e-4	38%
Barium Nitrate	1.38e-4	43%
Strontium Sulfide	2.89e-5	9%
Calcium Silicide	2.57e-5	8%
Tetracene	6.42e-6	2%

Source: MIDAS Database

In addition to the primer, .50 caliber cartridges represented in this waste stream use four types of propellant mixes. These mixes are either single-base containing nitrocellulose and the RCRA TCLP constituent DNT or double-base containing nitrocellulose and nitroglycerin. Table 4-25 lists the propellant mixes associated with .50 caliber cartridges. After each propellant mix, the number in parenthesis corresponds to the propellant mix column of Table 4-26 [e.g., DoDAC 1305A520 uses propellant mixes 1 and 3 (WC860/IMR 5010)].

Table 4-25

Propellant Mixes for .50 Caliber Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix WC860 (235 grains) (1)		
Nitrocellulose	2.64e-2	78.67%
Nitroglycerin	3.19e-3	9.5%
Diphenylamine	3.79e-4	1.13%
Dibutylphathalate	2.69e-3	8%
Calcium Carbonate	3.36e-4	1%
Graphite	1.34e-4	0.4%
Potassium Nitrate	2.67e-4	0.8%
Sodium Sulfate	1.67e-4	0.5%
Propellant Mix WC150 (46 grains) (2)		
Nitrocellulose	5.68e-3	86.48%
Nitroglycerin	6.24e-4	9.5%
Diphenylamine	7.36e-5	1.12%
Calcium Carbonate	6.57e-5	1%
Dibutylphthalate	6.57e-5	1%
Sodium Sulfate	3.29e-5	0.5%
Graphite	2.63e-5	0.4%

Table 4-25

(Continued)

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix IMR 5010 (240 grains) (3)		
Nitrocellulose	3.08e-2	89.92%
dinitrotoluene	2.83e-3	8.25%
Diphenylamine	3.02e-4	0.88%
Potassium Sulfide	1.89e-4	0.55%
Graphite	1.37e-4	0.4%
Propellant Mix HI SKOR 700X (44.6 grains) (4)		
Nitrocellulose	4.29e-3	67.4%
Nitroglycerin	1.91e-3	30%
Ethyl Centralite	9.56e-5	1.5%
Graphite	3.19e-5	0.5%
Potassium Nitrate	3.19e-5	0.5%
Ethyl Alcohol	6.37e-6	0.1%

Source: MIDAS Database

4.8.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-26. The percentage of lead associated with the items ranges from 0.06% (TR and BALL cartridges) to 0.11% (BLK cartridges). The higher content of lead in the blank cartridge cases is due to the reduced amount of propellant (reduced overall weight of item) and the extension of the cartridge case (more brass). The amount of lead present in all the items (0.06% to 0.11%) is greater than the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

4.8.3 Sampling Protocol

Either DoDAC 1305A598 or DoDAC 1305A599 will be selected for characterization (based on availability) to represent the waste stream since these items have the highest lead content (1.54e-4) and also have DNT present in the primer mix. The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

Table 4-26

.50 Caliber Cartridge Cases

Residue	DoDAC	Primary Munition	Propellant Mix	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS	1305A520	CTG CAL .50 4 BALL M33/1 TR M17 LNKD M15A2	1/3	2.54e-1 2.48e-1	1.43e-4 1.43e-4	0.056% 0.058%
CASE, CTG, FIRED, BRASS	1305A540	CTG CAL .50 4 API M8/1 TR M17 LNKD	1/3	2.52e-1	1.43e-4	0.057%
CASE, CTG, FIRED, BRASS	1305A552	CTG CAL .50 BALL M33	1	2.55e-1	1.44e-4	0.056%
CASE, CTG, FIRED, BRASS	1305A555	CTG CAL .50 BALL M33 LNKD	1	2.55e-1	1.44e-4	0.056%
CASE, CTG, FIRED, BRASS	1305A557	CTG CAL .50 4 BALL M33/1 TR M17 LNKD M9	1/3	2.54e-1 2.46e-1	1.43e-4 1.43e-4	0.056% 0.058%
CASE, CTG, FIRED, BRASS	1305A559	CTG CAL .50 4 BLK M1 LNKD	2	1.31e-1	1.42e-4	0.108%
CASE, CTG, FIRED, BRASS	1305A570	CTG CAL .50 TR M17	3	2.48e-1	1.44e-4	0.058%
CASE, CTG, FIRED, BRASS	1305A572	CTG CAL .50 TR M17	3	2.48e-1	1.44e-4	0.058%
CASE, CTG, FIRED, BRASS	1305A576	CTG CAL .50 4 API M8/1 API-T M20 LNKD	1	2.52e-1 2.45e-1	1.43e-4 1.44e-4	0.057% 0.058%
CASE, CTG, FIRED, BRASS	1305A585	CTG CAL .50 API-T M20 LNKD	3	2.45e-1	1.44e-4	0.058%
CASE, CTG, FIRED, BRASS	1305A598	CTG CAL .50 BLK M1A1 LNKD	4	1.34e-1	1.54e-4	0.114%
CASE, CTG, FIRED, BRASS	1305A599	CTG CAL .50 BLK M1A1 LNKD	4	1.34e-1	1.54e-4	0.114%
CASE, CTG, FIRED, STEEL	1305A602	CTG CAL .50 PR PL 4/1	1/3	*2.21e-1*	*1.19e-4*	*0.054%*

Source: MIDAS Database

4.9 Fired 40mm Cartridge Cases

4.9.1 Overview

Residues in this waste stream include cartridge cases from 40mm shells fired from weapons such as the M203 and MK19 grenade launchers. These cartridges are primarily composed of double-base propellants that eject and then propel a projectile downrange. The cartridge types [e.g., smoke, high explosive (HE), HEDP] are not included in the sampling since they are ejected downrange. The propellant mixes are initiated through a primer that is ignited by percussion pressure. Figure 4-9 provides a schematic of a typical 40mm cartridge.

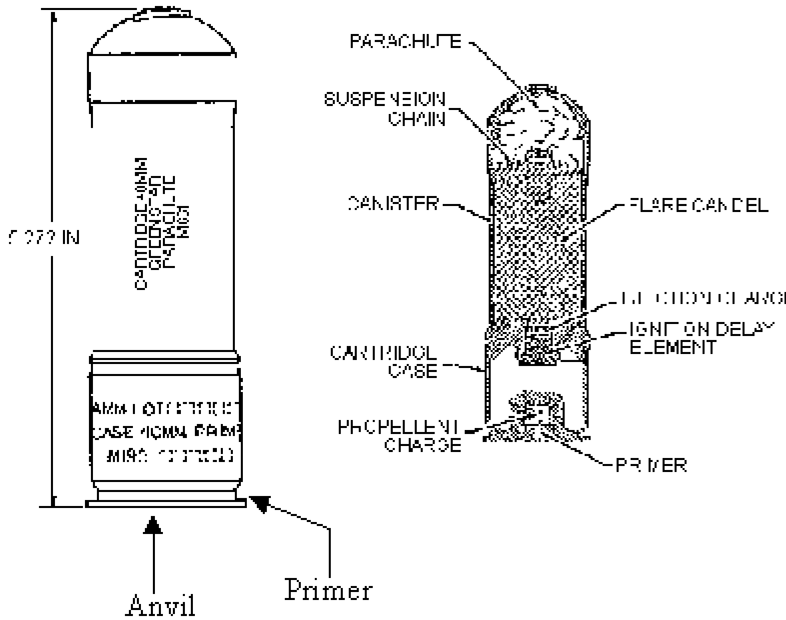


Figure 4-9. 40mm Cartridge

4.9.2 Characterization Rationale

4.9.2.1 Scrap components and materials

The cartridge cases of the items in this waste stream are made of either aluminum alloy or a nylon/brass combination. Several of the cartridge cases also contain brass powder charge cups. The brass components contain the RCRA TCLP constituent lead.

4.9.2.2 Composition of reactive materials associated with the munitions item

The primers used in the 40mm cartridges represented in this waste stream is primarily Primer Mix #K90 for non-HE cartridges and Primer Mix #100 for HE type cartridges. Table 4-27 lists the properties of the primer mixes. These mixes contain the RCRA TCLP constituents lead and barium in lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-27.

Table 4-27

Primer Mixes for 40mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix #K90 (0.33 grains)		
Lead Styphnate	1.88e-5	40%
Barium Nitrate	1.41e-5	30%
Strontium Sulfide	7.54e-6	16%
Double-base Propellant Fines	1.88e-6	4%
Tetracene	2.36e-6	5%
Aluminum Powder	2.36e-6	5%
Primer Mix #100 (5.0 grains)		
Lead Styphnate	2.57e-4	36%
Barium Nitrate	2.00e-4	28%
Strontium Sulfide	1.43e-4	20%
Tetracene	3.57e-5	5%
Aluminum Powder	7.85e-5	11%

Source: MIDAS Database

In addition to the primer, 40mm cartridges in this waste stream use two types of propellant mixes. These mixes are all double-base propellants using nitrocellulose and nitroglycerin as their primary components. Table 4-28 lists the propellant mixes associated with 40mm cartridges. After each propellant mix, the number in parenthesis corresponds to the propellant mix column of Table 4-29 [e.g., DoDAC 1305B504 uses propellant mix 1 (Prop M9)].

Table 4-28

Group 9 Propellant Mixes

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix M9 (330 mg) (1)		
Nitrocellulose	4.18e-4	57.52%
Nitroglycerin	2.90e-4	39.84%
Graphite	2.91e-6	0.4%
Potassium Nitrate	1.08e-5	1.49%
Ethyl Centralite	1.82e-6	0.25%
Propellant Mix M2 (4.64 grams) (2)		
Nitrocellulose	7.90e-3	77.21%
Nitroglycerin	1.99e-3	19.44%
Graphite	6.14e-5	0.6%
Potassium Nitrate	7.67e-5	0.75%
Ethyl Centralite	6.14e-5	0.6%
Barium Nitrate	1.43e-4	1.4%

Source: MIDAS Database

4.9.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste steam and the primary hazardous constituent are listed in Table 4-29. The percentage of lead associated with the items ranges from about 0.004% to 0.007%. The cartridge cases contain a percentage of lead that is theoretically slightly below the TCLP maximum theoretical leaching limit for lead (0.01%). However, to error on the side of conservatism, sampling and analysis will be conducted to perform a hazardous waste determination for this waste stream.

Table 4-29

40mm Cartridge Cases

Residue	DoDAC	Primary Munition	Propellant Mix	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED AL ALLOY	1310B504	CTG 40MM GRN STAR PARA M661	1	2.21e-1	8.28e-6	0.004%
CASE, CTG, FIRED AL ALLOY	1310B505	CTG 40MM RED STAR PARA M662	1	2.21e-1	8.28e-6	0.004%
CASE, CTG, FIRED AL ALLOY	1310B506	CTG 40MM RED SMK M713	1	1.79e-1	8.28e-6	0.005%
CASE, CTG, FIRED AL ALLOY	1310B508	CTG 40MM GREEN SMK M715	1	1.79e-1	8.28e-6	0.005%
CASE, CTG, FIRED AL ALLOY	1310B509	CTG 40MM YLW SMK M716	1	1.79e-1	8.28e-6	0.005%
CASE, CTG, BRASS AND NYLON	1310B519	CTG 40MM TP M781	1	1.93e-1	1.20e-5	0.006%
CASE, CTG, FIRED AL ALLOY	1310B535	CTG 40MM WHT STAR PARA M583A1	1	2.21e-1	8.28e-6	0.004%
CASE, CTG, FIRED AL ALLOY	1310B536	CTG 40MM WHT STAR CLUSTER	1	2.21e-1	8.28e-6	0.004%
CASE, CTG, FIRED AL ALLOY	1310B542	CTG 40MM HEDP M430 LNKD	2	2.25e-1	1.53e-5	0.007%
CASE, CTG, FIRED AL ALLOY	1310B546	CTG 40MM HEDP M433	1	1.79e-1	8.28e-6	0.005%
CASE, CTG, FIRED AL ALLOY	1310B571	CTG 40MM HE M383 LNKD	2	2.25e-1	1.53e-5	0.007%
CASE, CTG, FIRED AL ALLOY	1310B584	CTG 40MM TP M918 LNKD	2	2.25e-1	1.53e-5	0.007%
CASE, CTG, FIRED AL ALLOY	1310B592	CTG 40MM TP M918	2	2.25e-1	1.53e-5	0.007%

Source: MIDAS Database

4.9.3 Sampling Protocol

Any one of DoDACs 1310B542, 1310B571, 1310B584, or 1310B592 will be characterized to represent the waste stream since these items contain the highest percentage of lead (0.007%). The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.10 M201A1 Grenade Fuzes

4.10.1 Overview

Residues in this waste stream consist of the M201A1 grenade fuze, which is used on smoke and chemical grenades and may be returned back to the ASP after use. After use of the grenades, small amounts of residues may remain on the fuze assembly at the point of detonation or burn. Figure 4-10 provides a schematic of a typical smoke grenade with fuze.

4.10.2 Characterization Rationale

4.10.2.1 Scrap components and materials

The M201A1 grenade fuze is composed of composite materials and metals. RCRA TCLP constituents present in the material components include lead, which is present in the copper alloy (brass) body, anvil, and primer percussion cup.

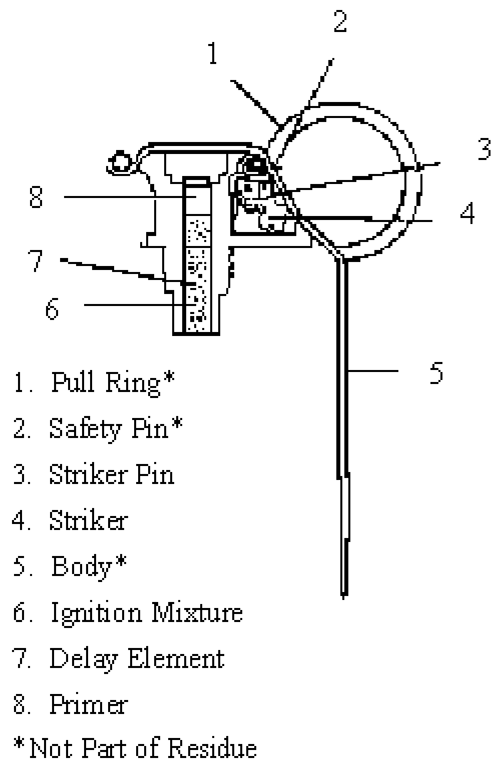


Figure 4-10. M201A1 Grenade Fuze

4.10.2.2 Composition of reactive materials associated with the munitions item

The M201A1 grenade fuze consist of four primary components: the first fire mix, the ignition mix, the delay mix, and the primer mix. Table 4-30 lists the breakdown of the constituents. Lead chromate, lead red, lead thiocyanate, and barium nitrate contain the RCRA TCLP constituents lead and barium. Trinitrotoluene is also present in the primer mix and is considered a secondary constituent of concern for this characterization.

4.10.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-31. The percentage of lead associated with the M201A1 grenade fuze is 0.29%, which is greater than the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-30

First Fire, Ignition, Delay, and Primer Mixes for the M201A1 Grenade Fuze

Component Mix	M201A1 Fuze Constituent	Residue Weight (lb)	Percentage in Mix
First Fire	Silicon	7.25e-4	24.38%
	Lead Red	7.25e-4	24.38%
	Titanium Powder	7.25e-4	24.38%
	Iron Oxide Red	7.25e-4	24.38%
	Nitrocellulose	7.27e-5	2.48%
Ignition	Acetone	1.65e-7	0.5%
	Potassium Perchlorate	9.75e-6	29.5%
	Titanium Powder	2.30e-5	69.5%
	Vinyl Alcohol	1.65e-7	0.5%
Delay	Magnesium Powder	5.55e-4	42%
	Barium Chromate	6.61e-5	5%
	Lead Chromate	7.00e-4	53%
Primer	Lead Thiocyanate	2.17e-5	38%
	Potassium Perchlorate	2.17e-5	36%
	Trinitrotoluene	3.43e-6	6%
	Barium Nitrate	5.14e-6	9%
	Ground Glass	6.28e-6	11%

Source: MIDAS Database

Table 4-31

Grenade Fuze (M201A1)

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
FUZE, GREN, M201A1	1330G945	GREN HAND SMK YELLOW M18	1.60e-1	4.66e-4	0.291%
FUZE, GREN, M201A1	1330G950	GREN HAND SMK RED M18	1.60e-1	4.66e-4	0.291%
FUZE, GREN, M201A1	1330G955	GREN HAND SMK VIOLET M18	1.60e-1	4.66e-4	0.291%
FUZE, GREN, M201A1	1330G940	GREN HAND SMK GREEN M18	1.60e-1	4.66e-4	0.291%
FUZE, GREN, M201A1	1330G930	GREN HAND SMK HC AN-M8	1.60e-1	4.66e-4	0.291%
FUZE, GREN, M201A1	1330G963	GREN HAND SMK CS M7	1.60E-1	4.66e-4	0.291%
FUZE, GREN, M201A1	13306900	GREN HAND INCND TH3 AN-M14	1.60E-1	4.66e-4	0.291%
FUZE, GREN, M201A1	1330H051	GREN HAND SMK AND LAU M226	1.60E-1	4.66e-4	0.291%
FUZE, GREN, M201A1	1330H050	GREN HAND SMK AND LAU M176	1.60E-1	4.66e-4	0.291%
FUZE, GREN, M201A1	1330G982	GREN HAND SMK HC PRAC AN-M8	1.60E-1	4.66e-4	0.291%

Source: MIDAS Database

4.10.3 Sampling Protocol

The M201A1 fuze will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.11 M227 Grenade Fuzes

4.11.1 Overview

Residues in this waste stream consist of the M277 grenade fuze, which is used on the M48 red smoke grenade (DoDAC 1330G932) and may be returned to the ASP after use. After use of the grenades, small amounts of residues may remain on the fuze assembly at the point of detonation or burn.

4.11.2 Characterization Rationale

4.11.2.1 Scrap components and materials

The M227 grenade fuze is composed of composite materials and metals. RCRA TCLP constituents present in the material components include lead, which is present in the copper alloy (brass) body, anvil, and primer percussion cup.

4.11.2.2 Composition of reactive materials associated with the munitions item

The M227 grenade fuze consists of four primary components: the first fire mix, the ignition mix, the delay mix, and the primer mix. Table 4-32 lists the breakdown of the constituents. Lead red, lead styphnate, and barium nitrate contain the RCRA TCLP constituents lead and barium.

Table 4-32

First Fire, Ignition, Delay, and Primer Mixes for M227 Grenade Fuze

Component Mix	M227 Fuze Constituent	Residue Weight (lb)	Percentage of Mix
First Fire	Silicon	1.25e-5	25%
	Lead Red	2.50e-5	50%
	Titanium Powder	1.25e-5	25%
Ignition	Iron Oxide	3.24e-4	49%
	Titanium Powder	2.11e-4	32%
	Iridium	1.14e-4	17.2%
	Nitrocellulose	5.73e-6	1.8%
Delay	Silicon	2.05e-4	20%
	Lead Red	2.83e-3	80%
Primer	Lead Styphnate	1.45e-4	60%
	Tetracene	1.21e-5	5%
	Strontium Sulfate	2.42e-5	10%
	Barium Nitrate	6.06e-5	25%

Source: MIDAS Database

4.11.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-33. The percentage of lead associated with the M227 grenade fuze is 0.36%, which is greater than the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-33

Grenade Fuze (M227)

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
FUZE, GREN, M201A1	1330G922	GREN HAND RIOT CS M47	1.19	5.82e-4	0.364%
FUZE, GREN, M227	1330G932	GREN HAND SMK RED M48	1.19	5.82e-4	0.364%

Source: MIDAS Database

4.11.3 Sampling Protocol

The M227 fuze will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will not be conducted since nitroaromatic compounds and nitrate esters are not present in the item.

4.12 AN-M8 HC Smoke Grenades

4.12.1 Overview

Residues from this waste stream are fragments from the AN-M8 chemical HC grenade. After use of the grenades, small amounts of residues may remain at the point of burn and the spent smoke grenade may be returned to the ASP. An image of an AN-M8 HC smoke grenade is shown in Figure 4-11.

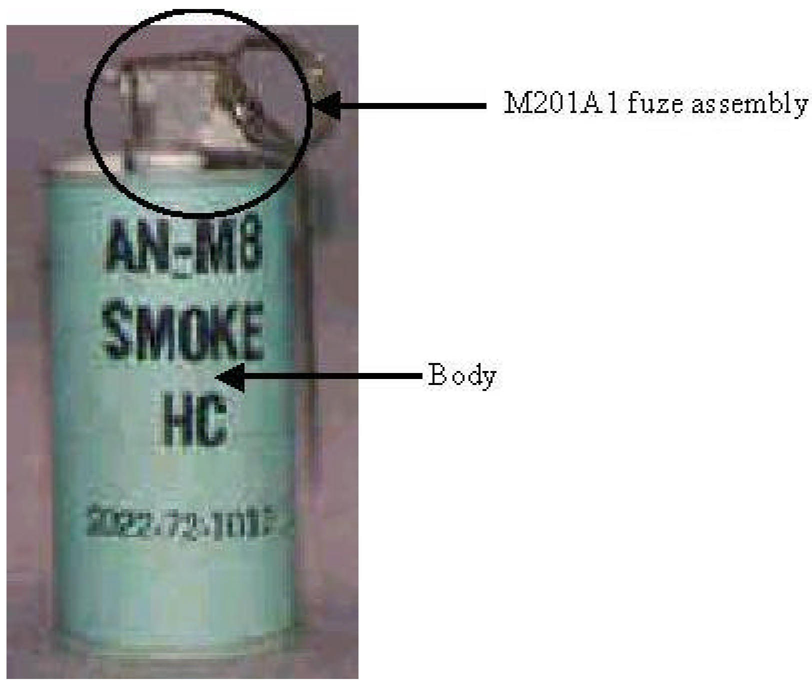


Figure 4-11. AN-M8 HC Smoke Grenade

4.12.2 Characterization Rationale

4.12.2.1 Scrap components and materials

Lead used in the solder of the grenade may remain as part of the spent grenade case/body returned to the issuing point or in the residual ash at the point of burn. Other components containing lead include the brass adapter on the top assembly of the grenade.

4.12.2.2 Composition of reactive materials associated with the munitions item

The primary component in the filler of the AN-M8 smoke grenade is the RCRA TCLP constituent HC. The fuze assembly, M201A1, is analyzed separately (Section 4.10). Table 4-34 lists the components of the main grenade.

Table 4-34

Filler and Solder Composition of AN-M8 Smoke Grenades

Compound	Residue Weight (lb)	Percentage of Total Mix
Main Filler (480 grams)		
Aluminum Powder	9.95e-2	9%
Hexachloroethane	4.71e-1	44.53%
Zinc Oxide	4.86e-1	46.47%
Solder (All Surface Connections) (0.03 oz.)		
Lead-Strontium	1.88e-3	100%

Source: MIDAS Database

4.12.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-35. The percentage of HC associated with the AN-M8 smoke grenade is 35.1%, which is greater than the TCLP maximum theoretical leaching limit for HC (0.006%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-35

Smoke Grenade (AN-M8 HC) Cases

Residue	DoDAC	Primary Munition	Residue Weight (lb)	HC in Residue (lb)	Percentage of HC in Residue
GRENADE, HAND SMK HC AN-N8	1330G930	GREN HAND SMK HC AN-M8	1.34	4.71e-1	35.1%

Source: MIDAS Database

HC = Hexachloroethane

4.12.3 Sampling Protocol

The AN-M8 grenade will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will not be conducted since nitroaromatic compounds and nitrate esters are not present in the munitions.

4.13 <u>M48 Red Smoke Grenades</u>

4.13.1 Overview

Residues in this waste stream consist of fragments from M48 red smoke grenades. After use of the grenades, small amounts of residues may remain on the case/body that is returned to the point of issue. An image of a M48 red smoke grenade is shown in Figure 4-12.

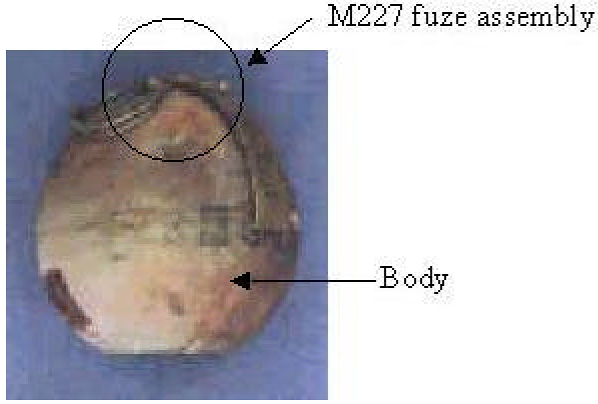


Figure 4-12. M48 Red Smoke Grenade

4.13.2 Characterization Rationale

4.13.2.1 Scrap components and materials

Lead used in the solder of the grenade may remain as part of the spent grenade case/body returned to the issuing point or in the residual ash at the point of burn. Other components containing lead include the brass adapter on the top assembly of the grenade.

4.13.2.2 Composition of reactive materials associated with the munitions item

The detailed chemical composition of the red dye in the filler has not been obtained at this time. However, previous TCLP analysis detected mercury in the ash residue of the spent red smoke grenades. As part of the filler composition, mercury is suspected to be used to provide the red color. The fuze assembly associated with the M48 smoke grenade, M227, is analyzed separately (Section 4.11). Table 4-36 lists the components of the main grenade.

Table 4-36

Filler and Solder Composition for M48 Red Smoke Grenades

Compound	Residue Weight (lb)	Percentage of Material
Main Filler (165 grams)		
Dye Red	2.31e-1	63.6%
Potassium Chlorate	8.98e-2	24.7%
Nitrocellulose	7.27e-3	2%
Lactose	3.53e-2	9.7%
Solder (All Surface Connections) (0.03 oz.)		
Lead-Strontium	1.88e-3	100%

Source: MIDAS Database

4.13.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-37. Although the use of mercury in the smoke grenade filler cannot be confirmed at this time, mercury was detected at hazardous levels in previous testing of ash residue. Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-37

Smoke Grenade (M48 Red) Case

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Mercury in Residue (lb)	Percentage of Mercury in Residue
GRENADE, HAND, SMK RED M48	1330G932	GREN HAND SMK RED M48 W/M227 FUZE	1.19	Unknown	Unknown

Source: MIDAS Database

4.13.3 Sampling Protocol

The M48 red smoke grenade will be sampled and analyzed for TCLP metals (including mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will not be conducted since nitroaromatic compounds and nitrate esters are not present in the munitions.

4.14 <u>M18 Red Smoke Grenades</u>

4.14.1 Overview

Residues in this waste stream consist of fragments from the M18 red smoke grenade. After use of the grenades, small amounts of residues may remain on the case/body that is returned to the point of issue. Figure 4-13 provides a schematic of a M18 red smoke grenade.

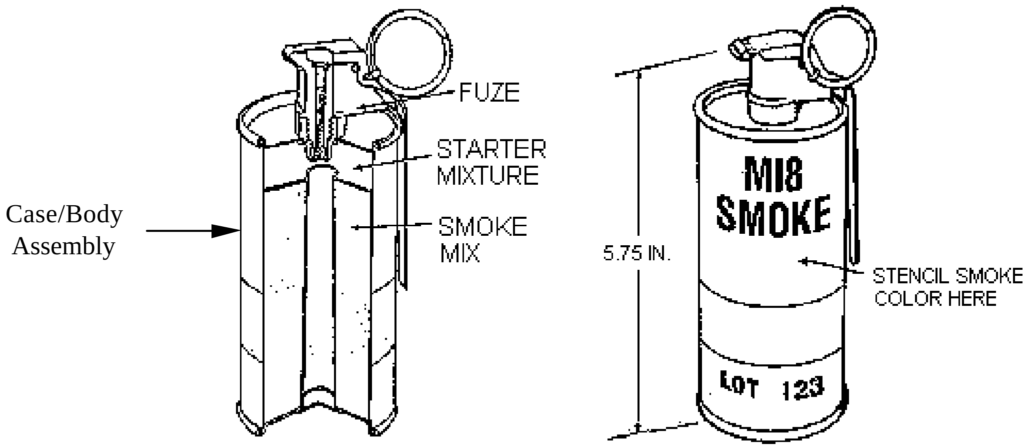


Figure 4-13. M18 Red Smoke Grenade

4.14.2 Characterization Rationale

4.14.2.1 Scrap components and materials

Lead used in the solder of the grenade may remain as part of the spent grenade case returned to the issuing point or in the residual ash at the point of burn. Other components containing lead include the brass adapter on the top assembly of the grenade.

4.14.2.2 Composition of reactive materials associated with the munitions item

The detailed chemical composition of the red dye in the filler has not been obtained at this time. However, previous TCLP analysis detected mercury in the ash residue of the spent grenade. As part of the filler composition, mercury is suspected to be used to provide the red color. The fuze assembly, M201A1, is analyzed separately (Section 4.10). Table 4-38 lists the components of the main grenade.

Table 4-38

Filler and Solder Composition for M18 Red Smoke Grenades

Compound	Residue Weight (lb)	Percentage of Material
Main Filler (Red Mix 3) (11.50 oz.)		
Dye Red	2.95e-1	41%
Sodium Bicarbonate	1.80e-1	25%
Potassium Chlorate	1.80e-1	25%
Sulfur	6.47e-2	9%
Solder (All Surface Connections) (0.03 oz.)		
Lead-Strontium	1.88e-3	100%

Source: MIDAS Database

4.14.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-39. Although the use of mercury in the smoke grenade filler cannot be confirmed at this time, mercury was detected at hazardous levels in previous testing of ash residue. Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-39

Smoke Grenade (M18 Red) Case

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Mercury in Residue (lb)	Percentage of Mercury in Residue
GRENADE, HAND RED M18	1330G950	GREN HAND SMK RED M18	1.19	Unknown	Unknown

Source: MIDAS Database

4.14.3 Sampling Protocol

The M18 red smoke grenade will be sampled and analyzed for TCLP metals (including mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will not be conducted since nitroaromatic compounds and nitrate esters are not present in the munitions.

4.15 <u>Fired 14.5mm Aluminum Alloy Training Cartridge Cases</u>

4.15.1 Overview

Residues in this waste stream include cartridge cases from training ammunition. The cases for these cartridges are 14.5mm in diameter and use a single propellant mix that ejects and propels a projectile downrange. The propellant mixes are initiated through a primer that is ignited by a percussion primer. Figure 4-14 provides a schematic of a 14.5mm cartridge.

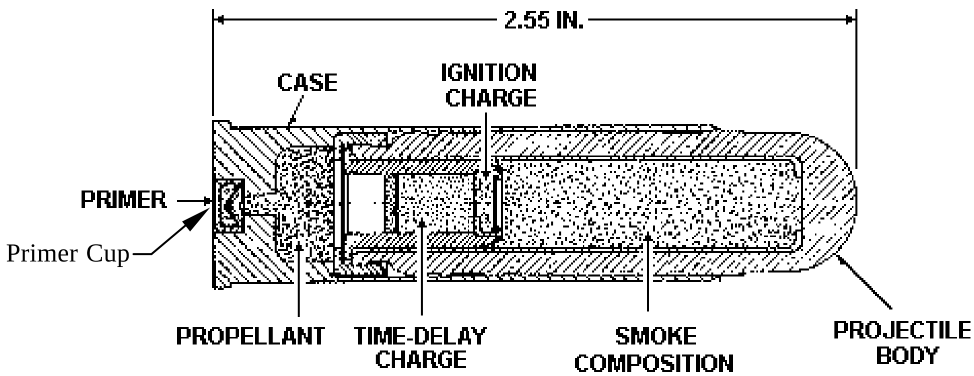


Figure 4-14. 14.5mm Cartridge, M181A1 Training Artillery

4.15.2 Characterization Rationale

4.15.2.1 Scrap components and materials

The cartridge cases of these shells are made of aluminum alloy with lead-containing (e.g., brass) copper alloy used in the cup and anvil of the percussion primer.

4.15.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in the 14.5mm training cartridges represented in this waste stream is FA-1023. Table 4-40 lists the properties of the primer mix. This mix contains the

RCRA TCLP constituents lead and barium in lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-40.

Table 4-40

Primer Mix Composition for 14.5mm Training Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix FA-1023 (5.15 grains)		
Lead Styphnate	2.79e-4	38%
Barium Nitrate	2.87e-4	39%
Strontium Sulfide	8.82e-5	12%
Aluminum Powder	5.15e-7	7%
Tetracene	2.94e-5	4%

Source: MIDAS Database

In addition to the primer, these 14.5mm cartridges use the same type of propellant mix. This mix is a double-base containing nitrocellulose and nitroglycerin. Table 4-41 lists the propellant mix associated with the 14.5mm training cartridges.

Table 4-41

Propellant Mix Composition for 14.5mm Training Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix HI SKOR 700X (2.80 grains)		
Nitrocellulose	2.69e-4	67.4%
Nitroglycerin	1.20e-4	30%
Graphite	2.00e-6	0.5%
Potassium nitrate	2.00e-6	0.5%
Ethyl Centralite	6.00e-6	1.5%
Ethyl Alcohol	4.00e-7	0.1%

Source: MIDAS Database

4.15.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-42. The amount of lead associated with the items in the grouping is consistent at 0.05%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-42

14.5mm Training Cartridge Cases

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, AL ALLOY	1305A365	CTG 14.5MM ARTY TRNG M181A1	1.48e-1	7.27e-5	0.049%
CASE, CTG, FIRED, AL ALLOY	1305A366	CTG 14.5MM ARTY TRNG M182A1	1.48e-1	7.27e-5	0.049%
CASE, CTG, FIRED, AL ALLOY	1305A367	CTG 14.5MM ARTY TRNG M183A1	1.48e-1	7.27e-5	0.049%

Source: MIDAS Database

4.15.3 Sampling Protocol

Any one of the DoDACs listed in Table 4-42 may be selected for characterization to represent the waste stream since the residue material, chemical composition, and weight are consistent among the items. The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.16 Fired 25mm Cartridge Cases

4.16.1 Overview

Residues in this waste stream consist of 25mm cartridge cases. The cases for these cartridges contain a double-base propellant that ejects and propels a small projectile downrange. The propellant mixes are initiated by percussion pressure. Figure 4-15 provides a schematic of a 25mm cartridge.

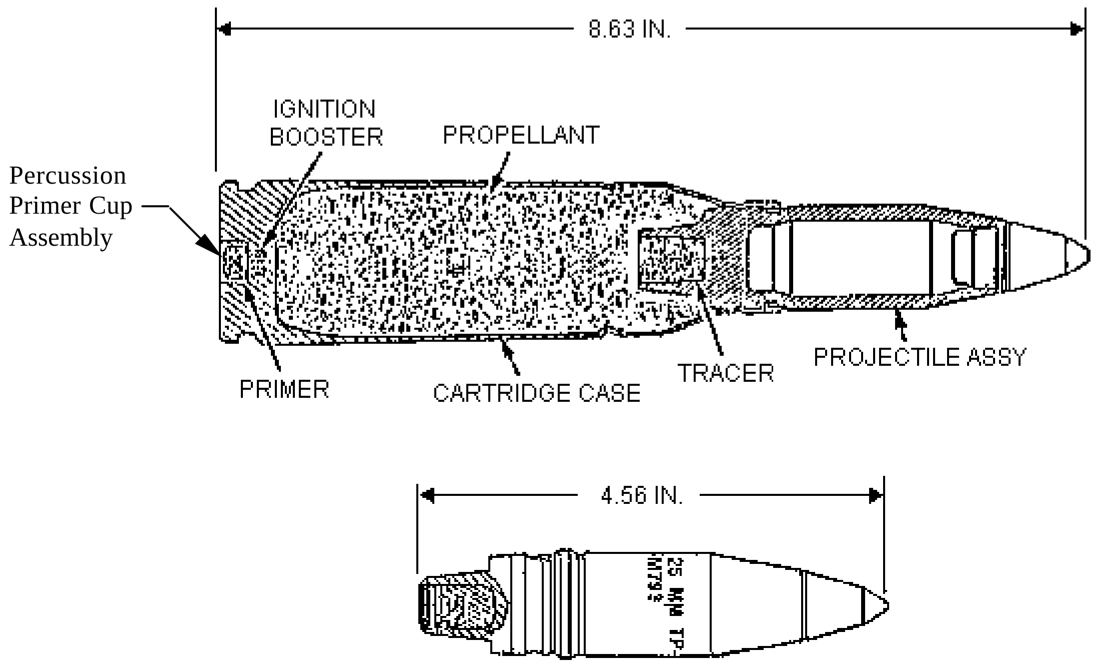


Figure 4-15. 25mm Cartridge, TP-T M793 (similar to other cartridges in waste stream)

4.16.2 Characterization Rationale

4.16.2.1 Scrap components and materials

The cartridge cases of these shells are made of either steel or aluminum alloy. Components containing lead (e.g., brass) include the copper alloy used in the flash tube of cartridge, the cup, and anvil of the percussion primer.

4.16.2.2 Composition of reactive materials associated with the munitions item

The FA-956 primer mix is used in the 25mm cartridge. Table 4-43 lists the properties of the primer mix. This mix contains the RCRA TCLP constituents lead and barium from lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-43. The primer mix also contains PETN, which is a secondary constituent of concern for this characterization.

Table 4-43

Primer Mix Composition for 25mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix FA-956 (3.98 grains)		
Lead Styphnate	2.10e-4	37%
PETN	2.84e-5	5%
Barium Nitrate	1.82e-4	32%
Strontium Sulfide	8.53e-5	15%
Aluminum Powder	3.98e-5	7%
Tetracene	2.27e-5	4%

Source: MIDAS Database

The 25mm cartridges in this waste stream use a primed case (flash tube) assembly to initiate the primer. Table 4-44 lists the constituents found in this primed case. The flash tube contains no constituents of concern for this effort.

Table 4-44

Flash Tube Composition for 25mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primed Case/Flash Tube IB-52 Ignition Compound (34.4 grains)		
Potassium Nitrate	3.31e-3	67.5%
Graphite	2.21e-4	4.5%
Z-nitrophenylamine	7.36e-6	0.15%
Polyvinyl Acetate	2.21e-4	4.5%
B Amorphous Powder	6.62e-4	13.5%
Nitrocellulose	4.84e-4	9.85%

Source: MIDAS Database

Finally, the 25mm cartridges represented in this waste stream use two types of propellant mixes. These mixes are double-base mixed and contain the RCRA TCLP constituent DNT. Table 4-45 lists the propellant mixes associated with the 25mm cartridges in this waste stream. Propellant Mix WC890 also contains nitroglycerin, which is a secondary constituent of concern for this characterization.

Table 4-45

Propellant Mix Compositions for 25mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix 25MM TPDS-T (M910 cartridge) (93.5 grams)		
Nitrocellulose	1.99e-1	96.6%
Potassium Nitrate	1.03e-3	0.5%
Potassium Sulfate	1.03e-3	0.5%
Methyl Centralite	4.12e-3	2%
Diphenylamine	2.06e-3	1%
Graphite	8.24e-4	0.4%
Propellant Mix WC890 (M793 cartridge) (1390 grains)		
Nitrocellulose	1.55e-1	77.97%
Dinitrotoluene	1.48e-3	1%
Nitroglycerin	1.98e-2	10%
Sodium Sulfate	9.92e-4	0.5%
Calcium Carbonate	4.96e-4	0.25%
Potassium Nitrate	1.49e-3	0.75%
Potassium Sulfate	1.49e-3	0.75%
Potassium Oxalate	1.49e-3	0.75%
Diphenylamine	2.24e-3	1.13%
Graphite	7.94e-4	0.4%
Dibutylphathalate	9.42e-4	0.5%

Source: MIDAS Database

4.16.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-46. The amount of lead associated with the items in the grouping is similar at 0.014%, which is slightly above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-46

25mm Cartridge Cases

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED AL ALLOY	1305A940	CTG 25MM TPDS-T M910	7.05e-1	9.99e-5	0.014%
CASE, CTG, FIRED, STEEL	1305A976	CTG 25MM TP-T M793	6.99e-1	9.99e-5	0.014%

Source: MIDAS Database

4.16.3 Sampling Protocol

DoDAC 1305A976 will be selected for characterization to represent this waste stream since this item has a slightly larger percentage of the primary constituent of concern, lead. The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.17 Fired 30mm Aluminum Alloy Cartridge Cases

4.17.1 Overview

Residues in this waste stream consist of 30mm cartridge cases. The cases for these cartridges contain a double-base propellant that ejects and propels a small projectile downrange. The propellant mixes are initiated by percussion pressure. Figure 4-16 illustrates the M788 30mm TP cartridge.

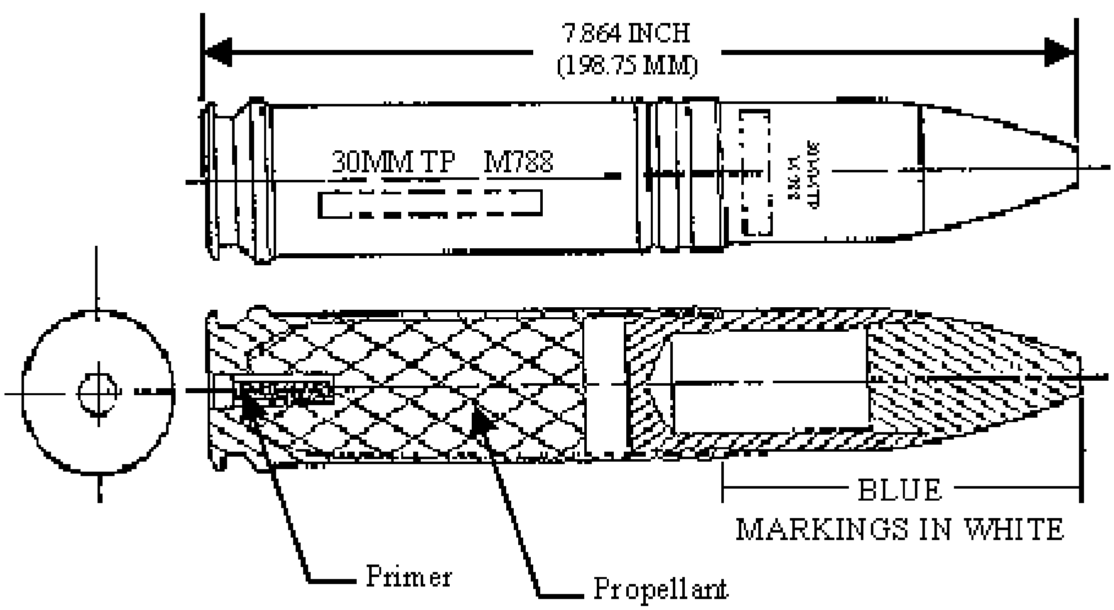


Figure 4-16. M788 30mm TP Cartridge.

4.17.2 Characterization Rationale

4.17.2.1 Scrap components and materials

The 30mm cartridge cases in this waste stream are made of aluminum alloy. Components containing lead (e.g., brass) include the copper alloy used in the flash tube of the cartridge and the copper alloy/brass of the outer and closure cups and tapered button.

4.17.2.2 Composition of reactive materials associated with the munitions item

The PA-520 primer mix is used in the TP M788 30mm cartridges associated with this waste stream. Table 4-47 lists the properties of the primer mix. This mix contains the RCRA TCLP constituents lead and barium from lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-47.

Table 4-47

Primer Mix Composition for 30mm Cartridge

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix PA-520 (Primary 0.45 grains, Booster 1.80 grains)		
Lead Styphnate (Primary)	6.39e-5	99.5%
Gum (Primary)	3.21e-7	0.5%
Barium Nitrate (Booster)	1.15e-4	44.6%
Calcium Silicide (Booster)	3.37e-5	13.1%
Gum (Booster)	2.57e-6	1%
Lead Styphnate (Booster)	1.04e-4	40.3%
Trinitroresorcinol (Booster)	2.57e-6	1%

Source: MIDAS Database

The TP M788 30mm cartridges associated with this waste stream also use a primed case (flash tube) assembly to initiate the primer. Table 4-48 lists the constituents found in this primed case. The flash tube contains no constituents of concern for this characterization effort.

Table 4-48

Flash Tube Composition for 30mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primed Case/Flash Tube IB-52 Ign Compound (34.4 grains)		
Potassium Nitrate	3.31e-3	67.5%
Graphite	2.21e-4	4.5%
Z-nitrophenylamine	7.36e-6	0.15%
Polyvinyl Acetate	2.21e-4	4.5%
B Amorphous Powder	6.62e-4	13.5%
Nitrocellulose	4.84e-4	9.85%

Source: MIDAS Database

Finally, the 30mm cartridges associated with this waste stream use a double-base mix, which contains the RCRA TCLP constituent DNT. Table 4-49 lists the propellant mix, WC855, associated with the 30mm cartridges in this waste stream. Propellant Mix WC855 also contains nitroglycerin, which is a secondary constituent of concern for this characterization.

Table 4-49

Propellant Mix Composition for 30mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix WC855 (M788 cartridge) (990 grains)		
Nitrocellulose	1.02e-1	75.47%
Dinitrotoluene	1.41e-3	1%
Nitroglycerin	1.41e-2	10%
Sodium Sulfate	7.07e-4	0.5%
Calcium Carbonate	1.41e-3	1%
Potassium Nitrate	2.12e-3	1.5%
Potassium Sulfate	2.12e-3	1.5%
Potassium Oxalate	3.12e-3	1.5%
Diphenylamine	1.60e-3	1.13%
Graphite	5.65e-4	0.4%
Dibutylphathalate	8.48e-3	6%

Source: MIDAS Database

4.17.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-50. The amount of lead associated with the 30mm cartridges cases in this waste stream is 0.019%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-50

30mm Cartridge Cases

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED AL ALLOY	1305B118	CTG 30MM TP M788	4.29e-1	8.06e-5	0.019%
CASE, CTG, FIRED AL ALLOY	1305B120	CTG 30MM TP M788, LNKD	4.29e-1	8.06e-5	0.019%

Source: MIDAS Database

4.17.3 Sampling Protocol

The 30mm cartridge cases in this waste stream, either DoDAC 1305B118 or DoDAC 1305B120, will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions item.

4.18 Fired 75 to 120mm Cartridge Cases

4.18.1 Overview

Residues in this group include cartridge cases from artillery ammunition. The cases for these cartridges range in diameter from 75 to 120mm. The cartridge cases primarily contain a single-base propellant mix that ejects and propels the projectile downrange. The propellant mixes are initiated through a primer that is initiated by percussion pressure. Figure 4-17 provides a schematic of a typical artillery cartridge.

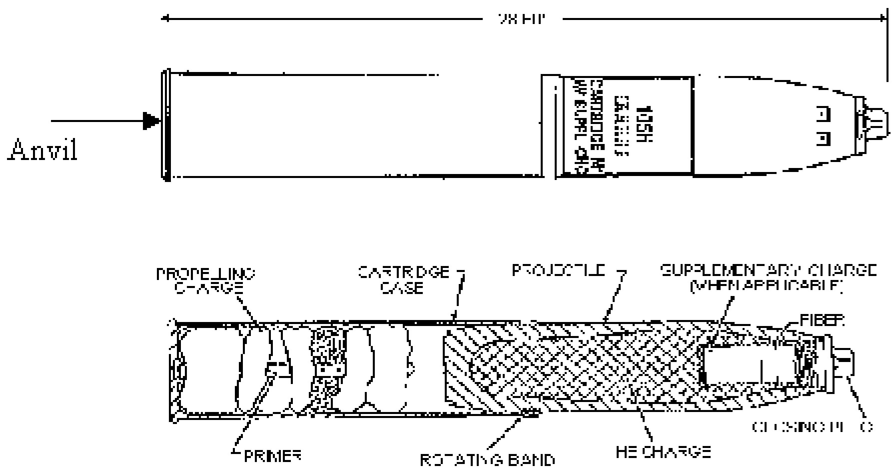


Figure 4-17. Typical Artillery Cartridge

4.18.2 Characterization Rationale

4.18.2.1 Scrap components and materials

The cartridge cases of the artillery rounds in this grouping are made of lead-containing copper alloy (brass) or steel. The primer percussion associated with these items also contains lead-containing components, such as the head, body, cup, and firing plug.

4.18.2.2 Composition of reactive materials associated with the munitions item

Due to the wide variety and size range of the rounds in this group, a listing of all primer and propellant constituents is not provided. The MIDAS database provides a listing of the constituents associated with each of the items in this grouping. The primary constituents of concern associated with these items are the RCRA TCLP constituent lead in brass, lead styphnate, and lead thiocyanate associated with all items in this grouping and DNT in the propellant mixes of 105mm cartridges. Nitroaromatic compounds and nitrate esters are also present in the munitions items. This large caliber range of this grouping is primarily a result of the belief that the percentage of lead and DNT associated with the energetic mixes to the overall mass of the cartridge case is so small that, upon testing, the constituents of concern will be greatly below regulatory levels.

4.18.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this grouping and the primary hazardous constituents are listed in Table 4-51. DoDAC 1315C025, 75mm cartridge, contains the highest percentage of lead at 0.051%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). DoDAC 1315C454, a 105mm cartridge, contains the highest percent of DNT in the grouping at 2.42%, which is well above the TCLP maximum theoretical leaching limit for DNT (0.00026). Therefore, sampling and analysis is required to perform a hazardous waste determination for this group.

Table 4-51

75 to 165mm Cartridge Cases

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, CU ALLOY	1315C025	CTG 75MM BLK SALUTING ROUND, M337A2	3.25	1.91e-3 (lead)	0.051% (lead)
CASE, CTG, FIRED AL ALLOY	1315C282	CTG 90MM HEAT M371A1	3.31	6.48e-4	0.020%
CASE, CTG, FIRED, COPPER (STEEL/BRASS ALT)	1315C440	CTG 105MM BLK M395	6.24	3.03e-3	0.049%
CASE, CTG, FIRED, STEEL	1315C445	CTG 105MM HE M1 W/O FUZE	1.08e+1	3.31e-2	0.307%
CASE, CTG, FIRED, BRASS (STEEL ALT)	1315C449	CTG 105MM ILLUM M314A2	3.79e+1	3.31e-2	0.279%
CASE, CTG, FIRED, STEEL	1315C452	CTG 105MM SMK HC BE M84 W/ FUZE	3.71e+1	2.90e-2	0.268%
CASE, CTG, FIRED, BRASS (STEEL ALT)	1315C454	CTG 105MM SMK WP M60 W/ PD FUZE	9.09	3.31e-2	0.314%
CASE, CTG, FIRED, STEEL	1315C473	CTG 105MM HE M760	1.12e+1	1.77e-3	0.016%
CASE, CTG, FIRED, STEEL	1315C479	CTG 105MM SMK HC M84A1	1.18e+1	2.90e-2	0.268%
CASE, CTG, FIRED, STEEL	1315C542	CTG 105MM SMK HC M84A1	3.08e+1	3.31e-2	0.281%
CASE, CTG, FIRED, STEEL	1315C650	CTG 106MM HEAT M344A1	1.97e+1	5.52e-5	0.00028%
CASE, CTG, FIRED, STEEL	1315C651	CTG 106MM HEP-T M346A1	1.97e+1	5.52e-5	0.00028%
CASE, CTG, FIRED, STEEL	1315C660	CTG 106MM APERS-T M581 W/FUZE	1.97e+1	5.52e-5	0.00028%
CASE, CTG, FIRED, STEEL	1315C511	CTG 105MM TP-T M490	2.27e+1	9.06e-5	0.00040%
CASE, CTG, FIRED, STEEL (BRASS ALT)	1315C520	CTG 105MM TPDS-T M724A1	2.41e+1	8.86e-5	0.00037%
CASE, CTG, FIRED AL ALLOY	1315C410	CTG 90MM CAN ANTIPERS M590	Not Available	Not Available	Not Available
CASE, CTG, FIRED, STEEL	1315C379	CTG 120MM HE XM934	Not Available	Not Available	Not Available
CASE, CTG, FIRED, STEEL	1315C623	CTG 120MM HE XM934	Not Available	Not Available	Not Available

Table 4-51

(Continued)

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, STEEL	1315C784	CTG 120MM TP-T M831	Not Available	Not Available	Not Available
CASE, CTG, FIRED, STEEL	1315C785	CTG 120MM TPCSDS-T M865	Not Available	Not Available	Not Available
CASE, CTG, FIRED, PAPER	1315C787	CTG, 120MM HEAT MP-T M830	Not Available	Not Available	Not Available

Source: MIDAS Database

4.18.3 Sampling Protocol

Sampling of the artillery cartridge cases is intended to demonstrate that these large size cases do not fail TCLP for the constituents of concern. To demonstrate this, the items with the highest lead and DNT content will be characterized to represent this artillery grouping. Sampling will involve DoDAC 1315C025, 75mm cartridge, and DoDAC 1315C454, a 105mm cartridge, which contain the highest lead and DNT content, respectively. Both items will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.19 <u>M18 Green Smoke Grenades</u>

4.19.1 Overview

Residues in this waste stream consist of fragments from the M18 green smoke grenade. After use of the grenades, small amounts of residues may remain on the canister that is returned to the point of issue. Figure 4-18 provides a schematic of a M18 smoke grenade.

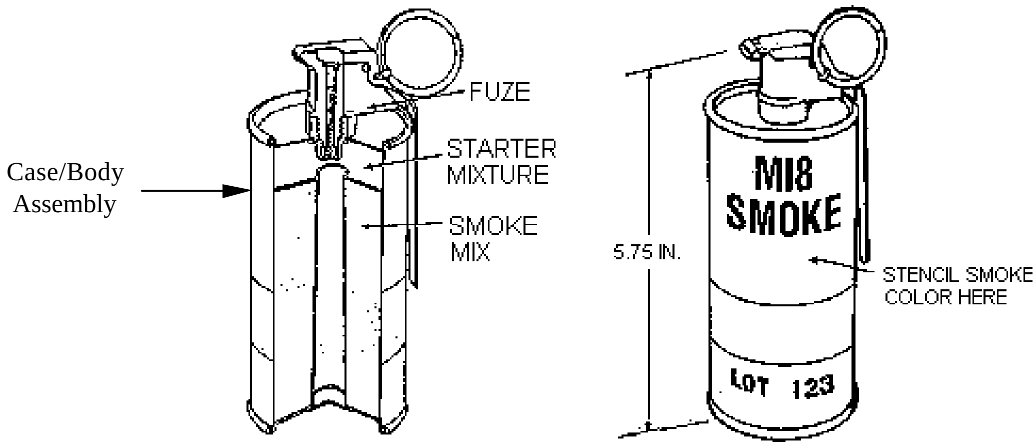


Figure 4-18. M18 Smoke Grenade (Green)

4.19.2 Characterization Rationale

4.19.2.1 Scrap components and materials

Lead used in the solder of the grenade may remain as part of the spent grenade case returned to the issuing point or in the residual ash at the point of burn. Other components containing lead include the brass adapter on the top assembly of the grenade.

4.19.2.2 Composition of reactive materials associated with the munitions item

The detailed chemical composition of the green and yellow dyes in the filler has not been obtained at this time. However, previous TCLP analysis has not detected any hazardous constituents in the ash residue of the spent grenade. The fuze assembly, M201A1, is analyzed separately (Section 4.10). Table 4-52 lists the components of the main grenade.

Table 4-52

Filler and Solder Composition for M18 Green Smoke Grenade

Compound	Residue Weight (lb)	Percentage of Material
Main Filler (11.50 oz.)		
Dye Solvent Green	2.12e-1	29.5%
Sodium Bicarbonate	1.22e-1	17%
Potassium Chlorate	1.76e-1	24.5%
Dye Solvent Yellow	8.94e-2	12.5%
Sugar	1.19e-1	16.5%
Solder (All Surface Connections) (0.03 oz.)		
Lead-Strontium	1.88e-3	100%

Source: MIDAS Database

4.19.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-53. Previous analysis of ash residue of the spent grenade did not indicate that hazardous constituents are present in this media. In addition, the percentage of lead in the scrap item, 0.0011%, is below the RCRA TCLP maximum theoretical leaching limit for lead (0.01%). However, sampling and analysis is required to perform a hazardous waste determination on the entire item and to confirm the results of the limited sampling previously conducted for this waste stream.

Table 4-53

M18 Green Smoke Grenade

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
GRENADE, HAND SMK GRN M18	1330G940	GREN HAND SMK GRN M18	1.03	1.09e-5	0.0011%

Source: MIDAS Database

4.19.3 Sampling Protocol

DoDAC 1330G940, M18 green smoke grenade (without the fuze), will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will not be conducted since nitroaromatic compounds and nitrate esters are not present in the munitions.

4.20 <u>M18 Yellow Smoke Grenades</u>

4.20.1 Overview

Residues in this waste stream consist of fragments from the M18 yellow smoke grenade. After use of the grenades, small amounts of residues may remain on the canister that is returned to the point of issue. Figure 4-19 provides a schematic of a M18 smoke grenade.

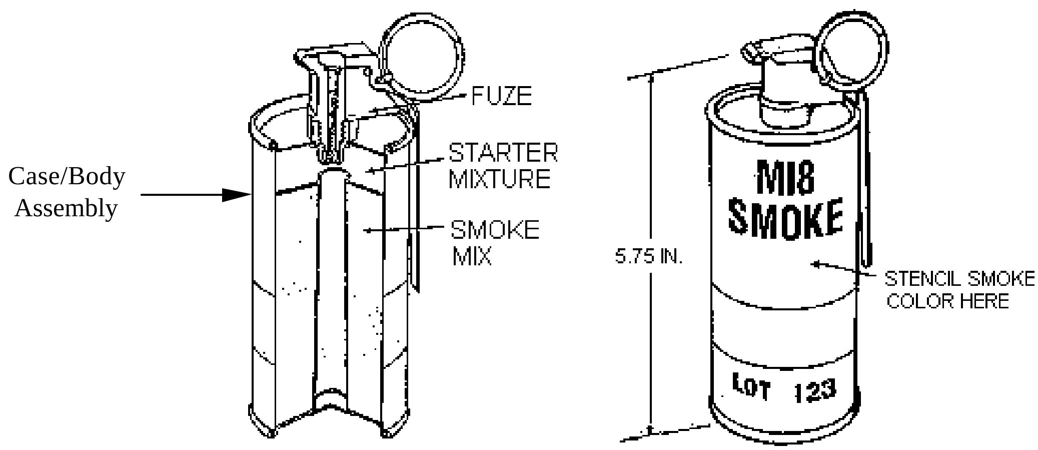


Figure 4-19. M18 Smoke Grenade (Yellow)

4.20.2 Characterization Rationale

4.20.2.1 Scrap components and materials

Lead used in the solder of the grenade may remain as part of the spent grenade case returned to the issuing point or in the residual ash at the point of burn. Other components containing lead include the brass adapter on the top assembly of the grenade.

4.20.2.2 Composition of reactive materials associated with the munitions item

The detailed chemical composition of the yellow dye in the filler has not been obtained at this time. However, previous TCLP analysis has not detected any hazardous constituents in the ash residue of the spent grenade. The fuze assembly, M201A1, is analyzed separately under Group 10. Table 4-54 lists the components of the main grenade.

Table 4-54

Filler and Solder Composition for M18 Yellow Smoke Grenade

Compound	Residue Weight (lb)	Percentage of Material
Main Filler (11.5 oz.)		
Dye Solvent Yellow 33	3.02e-1	42%
Sodium Bicarbonate	1.73e-1	24%
Potassium Chlorate	1.80e-1	25%
Sulfur	6.49e-3	9%
Solder (All Surface Connections) (0.03 oz.)		
Lead-Strontium	1.88e-3	100%

Source: MIDAS Database

4.20.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-55. Previous analysis of ash residue of the spent grenade did not indicate that hazardous constituents are present in this media. In addition, the percentage of lead in the scrap item, 0.0011%, is below the RCRA TCLP maximum theoretical leaching limit for lead (0.01%). However, sampling and analysis is required to perform a hazardous waste determination on the entire item and to confirm the results of the limited sampling previously conducted for this group.

Table 4-55

M18 Yellow Smoke Grenade

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
GRENADE, HAND SMK YLW M18	1330G945	GREN HAND SMK YLW M18	1.03	1.09e-5	0.0011%

Source: MIDAS Database

4.20.3 Sampling Protocol

DoDAC 1330G945, M18 yellow smoke grenade (without the fuze), will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will not be conducted since nitroaromatic compounds and nitrate esters are not present in the munitions.

4.21 Fired M82 Percussion Primer Brass Cartridge Cases

4.21.1 Overview

Residues in this waste stream consist of the M82 percussion primer cartridge case. The M82 percussion primer is used to initiate the M437 projectile for the 175mm M107 self-propelled gun used by field artillery. Figure 4-20 provides a schematic of the M82 percussion primer cartridge.

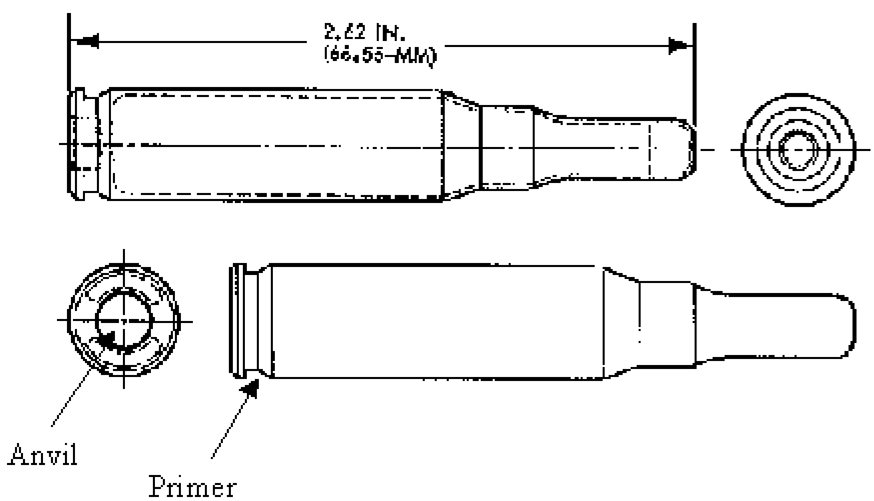


Figure 4-20. M82 Percussion Primer Cartridge

4.21.2 Characterization Rationale

4.21.2.1 Scrap components and materials

The cartridge case for M82 percussion primer is composed of lead-containing brass. Other components containing lead (e.g., brass) include the brass used in the body and plunger assemblies, the ignition cup, the percussion primer cup, and anvil and the container tube and cup of the container charge assembly.

4.21.2.2 Composition of reactive materials associated with the munitions item

The cartridge consists of an ignition element, propellant, and a primer percussion similar to that found in small arms ammunition. The ignition element is 100% black powder class 3, while the primer mix is component FA-956. Table 4-56 lists the properties of the primer mix.

Table 4-56
Primer Mix Composition for M82 Percussion Primer Cartridge

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix FA-956 (0.60 grains)		
Lead Styphnate	3.17e-5	37%
PETN	4.28e-6	5%
Barium Nitrate	2.74e-5	32%
Strontium Sulfide	1.28e-5	15%
Aluminum Powder	5.99e-6	7%
Tetracene	3.43e-6	4%

Source: MIDAS Database

In addition to the primer, the M82 primers use the WC844 propellant, a double-base propellant containing nitrocellulose and nitroglycerin as the primary constituents. Table 4-57 lists the constituents associated with the WC844 propellant.

Table 4-57

Propellant Mix Composition for M82 Percussion Primer Cartridge

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix WC844 (1.36 grams)		
Nitrocellulose	2.49e-2	83.22%
Nitroglycerin	3.00e-4	10%
Sodium Sulfate	1.50e-5	0.5%
Calcium Carbonate	7.49e-6	0.25%
Diphenylamine	3.86e-6	1.3%
Graphite	1.20e-5	0.4%
Dibutylphathalate	1.35e-4	4.5%

Source: MIDAS Database

4.21.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-58. The amount of lead associated with the M82 primer percussion is 0.026%, which is slightly above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-58

M82 Percussion Primer Cartridge Case

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED BRASS	1390N523	PRIMER PERC M82	2.00e-1	5.10e-5	0.026%

Source: MIDAS Database

4.21.3 Sampling Protocol

The cartridge case from DoDAC 1390N523, M82 primer percussion, will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.22 M60 Firing Device

4.22.1 Overview

The residues for this waste stream consist of the expended plastic cases from firing devices used to initiate demolition charges. The device in this waste stream is composed solely of a percussion primer. The primer is initiated by the mechanical pull and release of a charging piston. When released, the piston strikes the primer, which ignites the demolition chain. After use, the firing device is returned to the issuing office. Figure 4-21 provides a schematic of an M60 firing device.

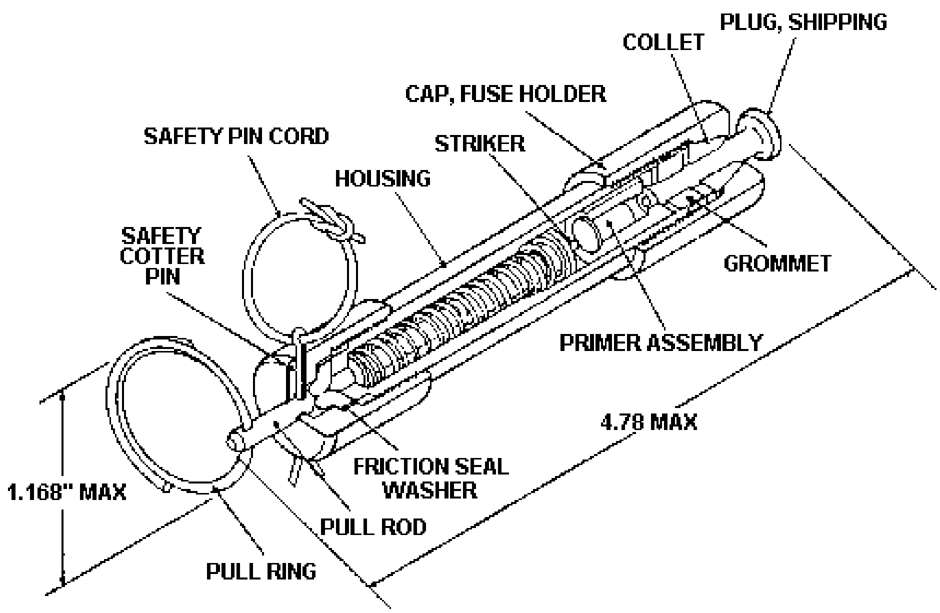


Figure 4-21. M60 Firing Device

4.22.2 Characterization Rationale

4.22.2.1 Scrap components and materials

The body/case of the M60 firing device is composed of plastic, steel, and brass components. The brass components containing lead include the primer percussion body, anvil and cup.

4.22.2.2 Composition of reactive materials associated with the munitions item

Table 4-59 lists the composition of the primer mix used in the M60 firing device (M39A1 primer assembly). This mix contains the RCRA TCLP constituents lead and barium from lead thiocyanate and barium nitrate, respectively, in the amounts shown in Table 4-59. The primer mix also contains trinitrotoluene, which is a secondary constituent of concern for this characterization.

Table 4-59

Primer Mix Composition for M60 Firing Device

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix (M39A1 Assy) (16.40 grains)		
Potassium Chlorate	8.69e-4	37.05%
Lead Thiocyanate	8.92e-4	38.13%
Trinitrotoluene	1.28e-4	5.69%
Barium Nitrate	2.04e-4	8.68%
Ground Glass	2.45e-4	10.45%

Source: MIDAS Database

4.22.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-60. The amount of lead associated with the M60 firing device is 0.033%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-60

M60 Firing Device

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
IGNITER, TIME BLASTING FUZE, M2	1375M766	IGN TIME BLASTING M60	5.00e-2	1.64e-5	0.033%

Source: MIDAS Database

4.22.3 Sampling Protocol

The M60 firing device will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.23 M6 Electric Blasting Cap

4.23.1 Overview

The residues in this waste stream consist of initiation components for demolitions. The purpose of blasting caps is to provide the direct initiation of the explosive material used in the demolition. The cap is crimped (attached) to detonation cord, which is initiated by the mechanical firing device such as the M60 firing device. Figure 4-22 provides a schematic of an electric blasting cap.

4.23.2 Characterization Rationale

4.23.2.1 Scrap components and materials

The blasting cap in this waste stream consists of composite materials with a lead-containing brass plug assembly.

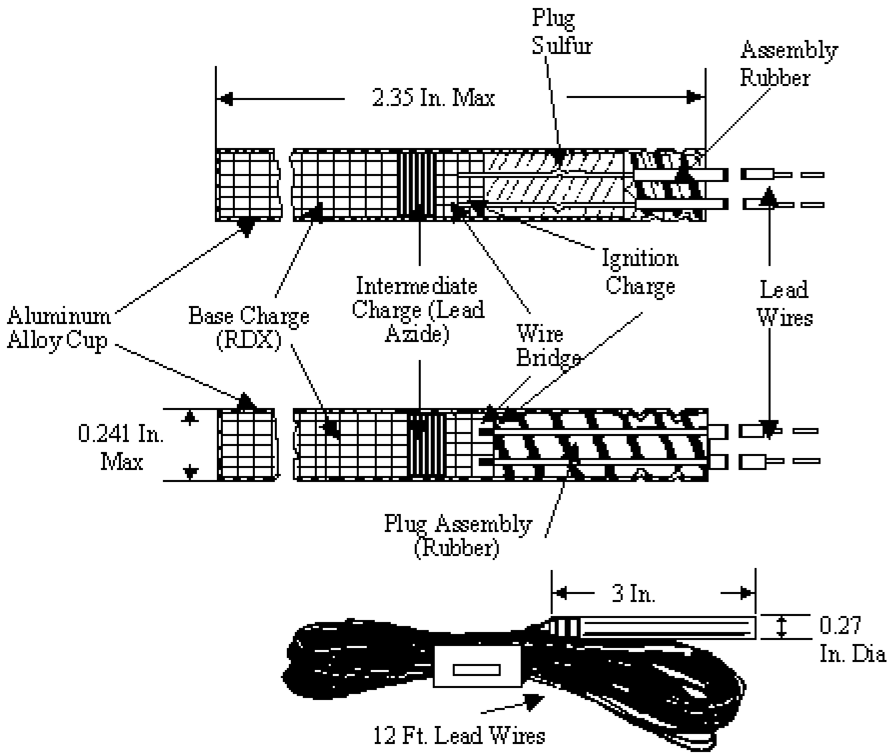


Figure 4-22. M6 Electric Blasting Cap

4.23.2.2 Composition of reactive materials associated with the munitions item

The electric blasting cap consists of a main charge and an ignition charge. Table 4-61 lists the composition of these charges. These charges contain the RCRA TCLP constituent lead from lead-sodium and lead aside constituents in the amounts shown in Table 4-61.

Table 4-61

Ignition and Main Charge Composition for M6 Electric Blasting Cap

Component Mix	M6 Electric Blasting Cap		
	Constituent	Residue Weight (lb)	Percentage of Charge
Ignition Charge	Smokeless Powder	1.28e-4	50%
	Lead-Sodium Dinitro Ortho	6.42e-5	25%
	Potassium Chlorate	6.42e-5	25%
Main Charge	RDX	5.95e-4	98.2%
	Lead Aside	3.92e-4	1.8%

Source: MIDAS Database

4.23.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-62. The amount of lead associated with the M6 electric blasting cap is 0.72%, which is well above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-62

M6 Electric Blasting Cap

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CAP, BLASTING ELECT M6 ASSY	1375M130	CAP BLASTING ELECTRIC M6	7.00e-2	5.05e-4	0.722%

Source: MIDAS Database

4.23.3 Sampling Protocol

The M6 blasting cap will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will not be conducted since nitroaromatic compounds and nitrate esters are not present in the munitions.

4.24 <u>M7 Nonelectric Blasting Cap</u>

4.24.1 Overview

The residues in this waste stream consist of initiation components for demolitions. The purpose of blasting caps is to provide the direct initiation of the explosive material used in the demolition. The cap is crimped (attached) to detonation cord, which is initiated by the mechanical firing device such as the M60 firing device. Figure 4-23 provides a schematic of a nonelectric blasting cap.

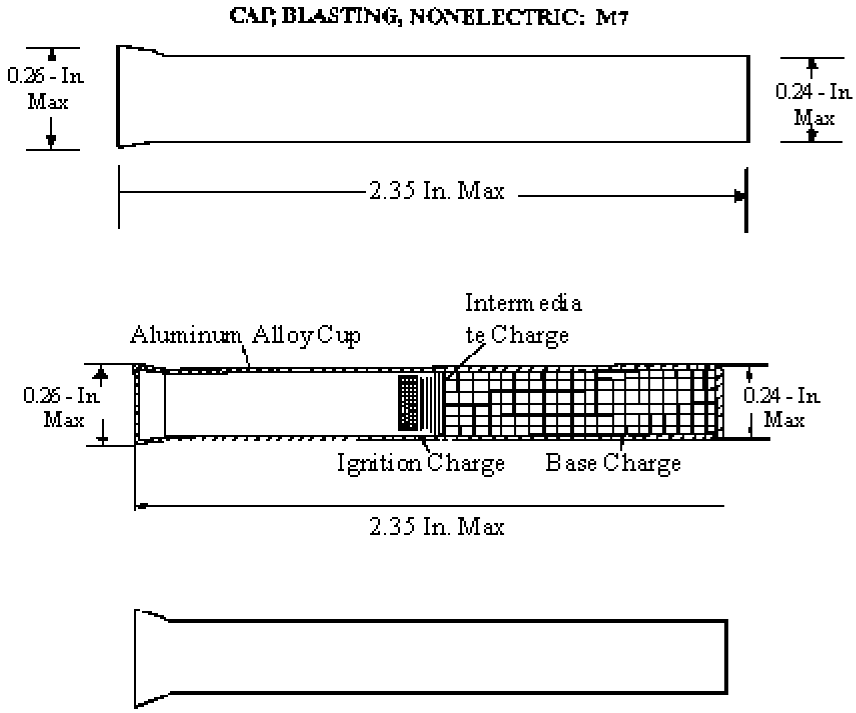


Figure 4-23. M7 Nonelectric Blasting Cap

4.24.2 Characterization Rationale

4.24.2.1 Scrap components and materials

The blasting cap in this waste stream consists of composite materials with a lead-containing brass cup.

4.24.2.2 Composition of reactive materials associated with the munitions item

The nonelectric blasting cap consists of a main charge. Table 4-63 lists the composition of the charge. This charge contains the RCRA TCLP constituent lead from lead styphnate and lead aside constituents in the amounts shown in Table 4-63.

Table 4-63

Main Charge Composition for M7 Nonelectric Blasting Cap

Component Mix	M7 Nonelectric Blasting Cap Constituent	Residue Weight (lb)	Percentage of Charge
Main Charge	RDX	2.07e-3	90%
	Lead Azide	5.28e-4	6%
	Lead Styphnate	1.57e-4	4%

Source: MIDAS Database

4.24.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-64. The amount of lead associated with the M7 nonelectric blasting cap is 11.23%, which is well above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-64

M7 Nonelectric Blasting Cap

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CAP, BLASTING NONELEC	1375M131	CAP BLASTING NONELEC M7	4.00e-3	4.49e-4	11.234%

Source: MIDAS Database

4.24.3 Sampling Protocol

The M7 blasting cap will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will not be conducted since nitroaromatic compounds and nitrate esters are not present in the munitions.

4.25 M5 Steel Demolition Firing Devices

4.25.1 Overview

The residues for this waste stream consist of the expended M5 steel cases used to initiate demolition charges. The device in this waste stream is composed solely of a percussion primer. The primer is initiated by the mechanical pull and release of a charging piston. When released, the piston strikes the primer, which ignites the demolition chain. After use, the firing device is returned to the issuing office. Figure 4-24 provides a schematic of an M5 firing device.

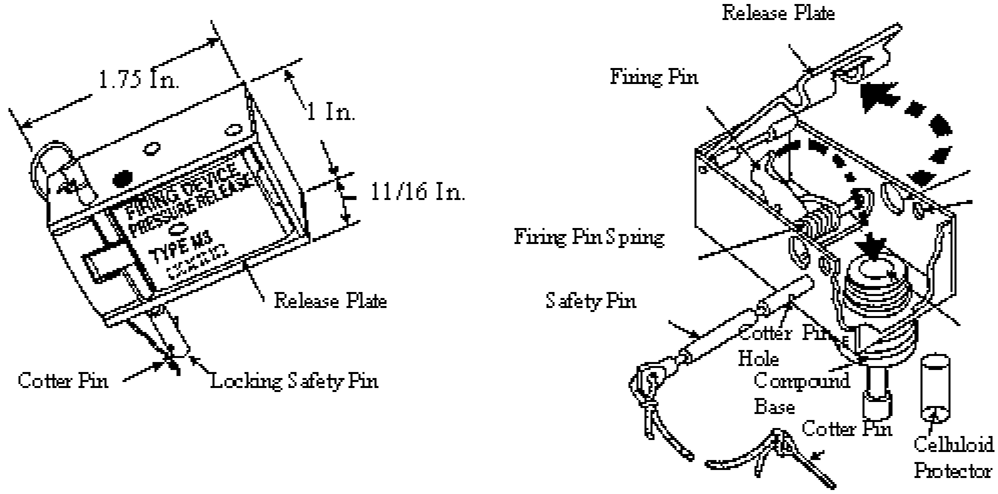


Figure 4-24. M5 Firing Device

4.25.2 Characterization Rationale

4.25.2.1 Scrap components and materials

The body/case of the M5 firing device is composed of steel and brass components. The brass components containing lead include the primer percussion body, anvil, and cup. The steel components may also contain small amounts of cadmium in cadmium chromate and cadmium plating.

4.25.2.2 Composition of reactive materials associated with the munitions item

Table 4-65 lists the composition of the primer mix used in the M5 firing device (M39A1 primer assembly). This mix contains the RCRA TCLP constituents lead and barium from lead thiocyanate and barium nitrate, respectively, in the amounts shown in Table 4-65. The primer mix also contains trinitrotoluene, which is a secondary constituent of concern for this characterization.

Table 4-65

Primer Mix Composition for M5 Firing Device

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix (M39A1 Assy) (16.40 grains)		
Potassium Chlorate	8.69e-4	37.05%
Lead Thiocyanate	8.92e-4	38.13%
Trinitrotoluene	1.28e-4	5.69%
Barium Nitrate	2.04e-4	8.68%
Ground Glass	2.45e-4	10.45%

Source: MIDAS Database

4.25.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-66. The amount of lead associated with the M5 firing device is 0.018%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-66

M5 Firing Device

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
ASSEMBLY, FIRING DEVICE DEMOLITION M5 STEEL	1375M627	FIRING DEVICE PRESSURE RELEASE M5	9.00e-2	1.64e-5	0.018%

Source: MIDAS Database

4.25.3 Sampling Protocol

The M5 firing device will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroaromatic compounds and nitrate esters are present in the munitions.

4.26 <u>M7A3 CS Riot Control Hand Grenade</u>

4.26.1 Overview

The residues for this waste stream consist of a chemical agent pellet, fuel and starter mixtures, top assembly, and body assembly—all components except the M201A1 fuze. An image of an M7A3 hand grenade is shown in Figure 4-25.

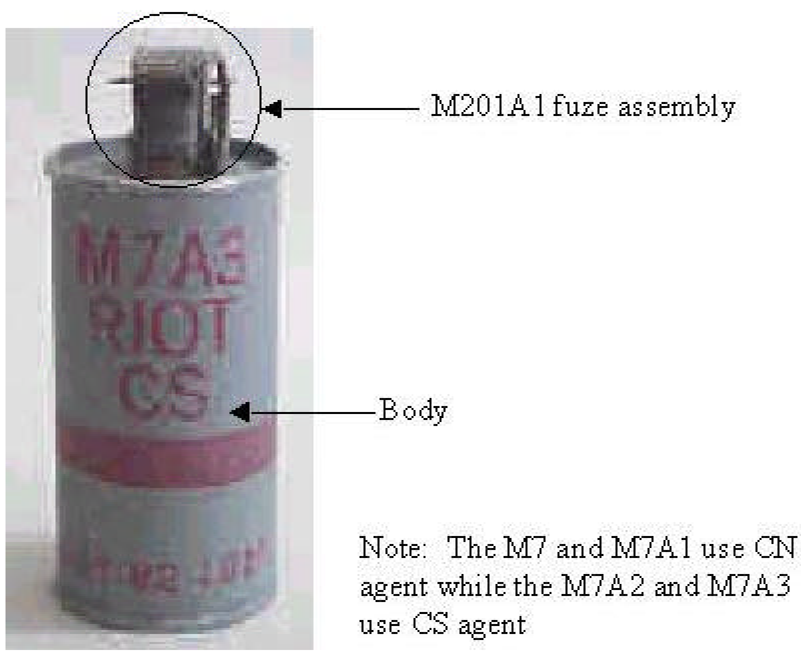


Figure 4-25. M7A3 CS Riot Control Hand Grenade

4.26.2 Characterization Rationale

4.26.2.1 Scrap components and materials

The top assembly of the grenade is composed of steel, and the body assembly is mostly tin plate. The tin plate parts contain small amounts of tin-lead solder. The steel components may also contain small amounts of cadmium in cadmium chromate and cadmium plating.

4.26.2.2 Composition of reactive materials associated with the munitions item

The fuel and starter mixes do not contain any constituents of concern for this study.

4.26.2.3 Maximum theoretical leaching limit evaluation

The weight of the riot hand grenade and the primary hazardous constituent are listed in Table 4-67. The amount of lead associated with the hand grenade is 0.154%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-67

Riot Control Hand Grenade CS M7A3

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
HAND GRENADE, RIOT CS M7A3	1330G963	GREN HAND RIOT CS M7A3	8.09e-1	1.24e-3	0.154%

Source: MIDAS Database

4.26.3 Sampling Protocol

The grenade residues will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1.

4.27 ABC-M5 HC Smoke Pot

4.27.1 Overview

The residues for this waste stream consist of the entire smoke pot, the major portion of which is White Smoke Mix 2.

4.27.2 Characterization Rationale

4.27.2.1 Scrap components and materials

The 33-lb smoke pot contains 31 lb of smoke mix, with the remaining 2 lb (0.06% of the total weight) composed of energetic compounds and steel and brass components of unknown weight. The quantities of lead and possibly cadmium that are present in brass and steel components are minimal.

4.27.2.2 Composition of reactive materials associated with the munitions item

Table 4-68 lists the composition of the white smoke mixes used in the smoke pot. These mixes contain HC, a RCRA TCLP constituent.

Table 4-68

Smoke Mix Compositions for ABC-M5 HC Smoke Pot

Compound	Residue Weight (lb)	Percentage of Total Mix
White Smoke Mix 1 (1.0 lb)		
Hexachloroethane	4.45e-1	44.53%
Zinc Oxide	4.65e-1	46.47%
Aluminum Powder	9.00e-2	9%
White Smoke Mix 2 (30.0 lb)		
Hexachloroethane	1.38e+1	46%
Zinc Oxide	1.44e+1	48%
Aluminum Powder	1.8e+0	6%

Source: MIDAS Database

4.27.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-69. The amount of HC associated with the smoke pot is 43.17%, which is above the TCLP maximum theoretical leaching limit. Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-69

ABC-M5 HC Smoke Pot

Residue	DoDAC	Primary Munition	Residue Weight (lb)	HC in Residue (lb)	Percentage of HC in Residue
SMOKE POT, HC ABC-M5	1365K866	SMK POT HC 30LB ABC-M5	3.30e+1	1.42e+1	43.17%

HC = hexachloroethane
Source: MIDAS Database

4.27.3 Sampling Protocol

The HC smoke pot will be sampled and analyzed for TCLP metals and SVOCs in accordance with the procedures outlined in Section 3.1.

4.28 <u>TH3 AN-M14 Incendiary Hand Grenade</u>

4.28.1 Overview

The residues for this waste stream consist of the steel top and body assemblies and the incendiary and first fire mixes. An image of a TH3 AN-M14 Incendiary Hand Grenade is shown in Figure 4-26.

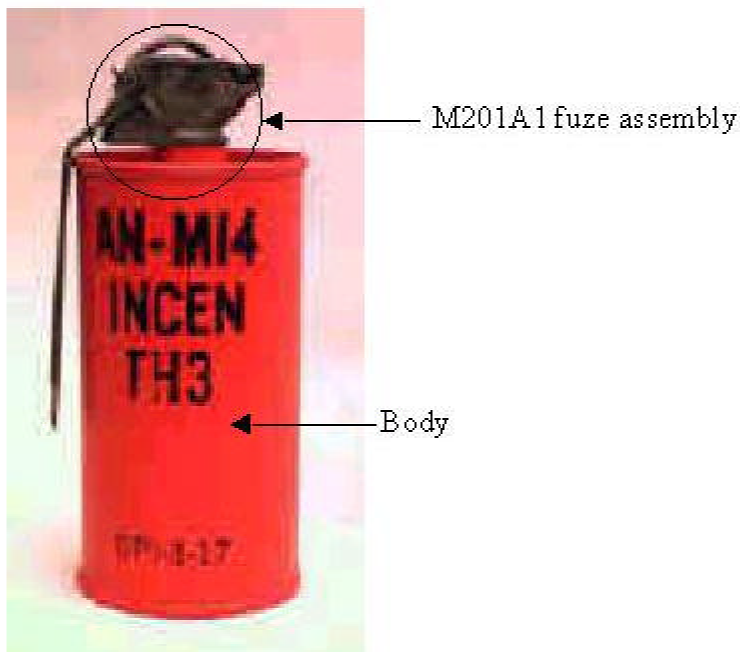


Figure 4-26. TH3 AN-M14 Incendiary Hand Grenade

4.28.2 Characterization Rationale

4.28.2.1 Scrap components and materials

The body of the hand grenade, excluding the fuze, is composed of steel components that may contain small amounts of cadmium.

4.28.2.2 Composition of reactive materials associated with the munitions item

Table 4-70 lists the composition of the incendiary and first fire mixes used in the incendiary hand grenade. These mixes contain the RCRA TCLP constituents lead and barium from red lead and barium nitrate, respectively, in the amounts shown in Table 4-70.

Table 4-70

Primer Mix Composition for TH3 AN-M14 Incendiary Hand Grenade

Compound	Residue Weight (lb)	Percentage of Total Mix
Incendiary Mix TH3 (660 grams)		
Iron Oxide	6.40e-1	44%
Barium Nitrate	4.22e-1	29%
Aluminum Powder	3.64e-1	25%
Sulfur	2.91e-2	2%
First Fire Mix 7 (43 grams)		
Red Lead	2.31e-2	24.38%
Titanium Powder	2.31e-2	24.38%
Red Iron Oxide	2.31e-2	24.38%
Silicon	2.31e-2	24.38%
Nitrocellulose	2.35e-3	2.48%

Source: MIDAS Database

4.28.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-71. The amount of lead associated with the munition item is 0.754%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-71

TH3 AN-M14 Incendiary Hand Grenade

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
HAND GRENADE, INCENDIARY TH3 AN-M14	1330G900	GREN HAND INCND TH3 AN-M14	2.78	2.10e-2	0.754%

Source: MIDAS Database

4.28.3 Sampling Protocol

The incendiary hand grenade will be sampled and analyzed for TCLP metals (including mercury) and SVOCs in accordance with the procedures outlined in Section 3.1.

4.29 M18 Violet Smoke Hand Grenade

4.29.1 Overview

The residues for this waste stream consist of the violet smoke mix and the body, top, and expulsion ignition starter assemblies. The M201A1 Fuze is addressed separately in Section 4-10. Figure 4-27 provides a schematic of an M18 smoke hand grenade.

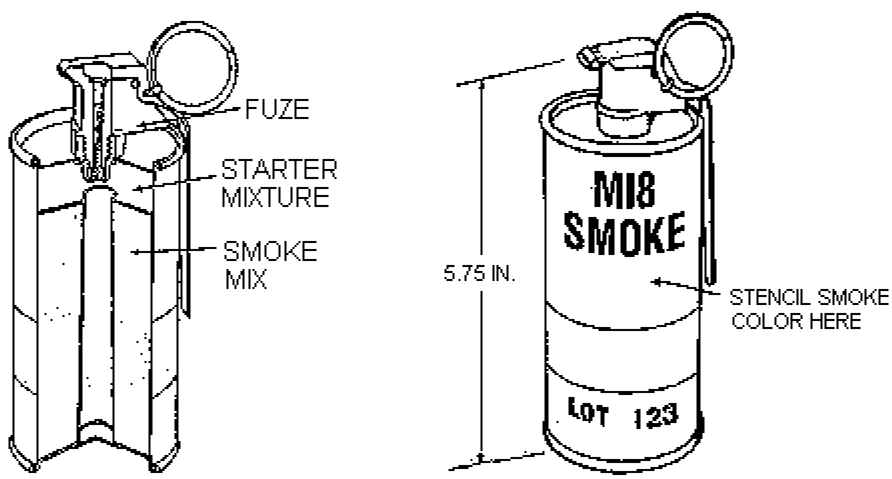


Figure 4-27. M18 Smoke Hand Grenade

4.29.2 Characterization Rationale

4.29.2.1 Scrap components and materials

The body of the smoke grenade is composed of tin plate, brass, and plastic components. The brass component containing lead is the adapter, and the tin plate body and grenade top contain tin-lead solder.

4.29.2.2 Composition of reactive materials associated with the munitions item

The violet smoke mix and starter mix used in the smoke grenade contain no known constituents of concern. However, limited data are available regarding composition of the smoke mix.

4.29.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-72. The amount of lead associated with the smoke grenade is 0.194%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-72

M18 Violet Smoke Hand Grenade

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
HAND GRENADE, VIOLET SMOKE M18	1330G955	GREN HAND SMK VIO M18	1.03	1.99e-3	0.194%

Source: MIDAS Database

4.29.3 Sampling Protocol

The smoke grenade will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1.

4.30 Floating Smoke Pot Type HC M4A2

4.30.1 Overview

The residues for this waste stream consist of the entire smoke pot, including steel, brass, and plastic body parts, smoke mixes, and energetics. A schematic of an M4A2 floating smoke pot is not available.

4.30.2 Characterization Rationale

4.30.2.1 Scrap components and materials

The body of the M4A2 floating smoke pot is composed of steel, brass, and plastic components. The brass components containing lead include the primer percussion body, anvil and cup. The steel components may contain small amounts of cadmium in cadmium chromate and cadmium plating.

4.30.2.2 Composition of reactive materials associated with the munitions item

Table 4-73 lists the composition of the various energetic materials used in the floating smoke pot. This mix contains the RCRA TCLP constituents lead (from red lead, lead thiocyanate, and lead chromate), barium (from barium nitrate and barium chromate), and HC in the amounts shown in Table 4-73. The primer mix also contains trinitrotoluene, which is a secondary constituent of concern for this characterization.

4.30.2.3 Maximum theoretical leaching limit evaluation

The weight of the smoke pot in this waste stream and the amount of lead and HC are listed in Table 4-74. The amount of lead associated with the floating smoke pot is 0.060%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Also, HC amounts to 35% of the total weight of the floating smoke pot. For these reasons, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-73

Energetic Composition for Floating Smoke Pot Type HC M4A2

Compound	Residue Weight (lb)	Percentage of Mix
White Smoke Mix 1 (454 grams)		
Zinc Oxide	4.65e-1	46.47%
Hexachloroethane	4.46e-1	44.53%
Aluminum Powder	9.00e-2	9%
White Smoke Mix 2 (28 lb)		
Zinc Oxide	1.34e+1	48%
Hexachloroethane	1.29e+1	46%
Aluminum Powder	1.68e+0	6%
First Fire Mix 6 (Ign Tube Assy) (2 grams)		
Red Lead	2.38e-3	54.01%
Silicon	1.43e-3	32.41%
Titanium Powder	5.19e-4	11.78%
Nitrocellulose	7.94e-5	1.8%
Delay Mix 7 (Ign Tube Assy) (13 grams)		
Red Lead	2.21e-2	77.01%
Silicon	3.89e-3	13.59%
Diatomaceous Earth	2.01e-3	7%
Nitrocellulose	5.16e-4	1.8%
Graphite	1.72e-4	0.6%
Graphite	1.72e-4	0.6%
Delay Comp Mix (Ctg Delay Assy) (600 milligrams)		
Lead Chromate	7.01e-4	53%
Manganese Powder	5.56e-4	42%
Barium Chromate	6.61e-5	5%
Primer Mix (Perc Primer M39A1 Assy) (0.40 grains)		
Lead Thiocyanate	2.18e-5	38.13%
Potassium Chlorate	2.12e-5	37.05%
Ground Glass	5.97e-6	10.45%
Barium Nitrate	4.96e-6	8.68%
Trinitrotoluene	3.25e-6	5.69%

Source: MIDAS Database

Table 4-74

Floating Smoke Pot Type HC M4A2

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
SMOKE POT, FLOATING TYPE HC M4A2	1365K867	SMK POT FLOATING TYPE HC M4A2	38	2.26E-2 1.33e+1 (HC)	0.060% 35% (HC)

Source: MIDAS Database

HC = Hexachloroethane

4.30.3 Sampling Protocol

The floating smoke pot will be sampled and analyzed for TCLP metals (including mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since trinitrotoluene is present in the smoke pot.

4.31 <u>M11 Nonelectric Blasting Cap (Primary Detonator)</u>

4.31.1 Overview

The nonelectric blasting cap (M11) is used to detonate all standard military explosives or initiate shock tube blasting caps. The blasting caps are small aluminum tubes filled with explosives (lead azide and RDX) and then factory-crimped to shock tube (M11 has 30 ft). The shock tube is a thin plastic tube with a thin layer of explosive (betabiazochloric formalin-pentoxide (BHT added as preservative) material deposited on its interior surface. A plastic connector, called a “J hook,” is attached to the sealed end of the shock tube that is seated with a small cover. The “J hook” allows for easy connection of standard blasting caps to the assembly. The M11 must be initiated with a blasting cap.

Residues from the detonator and shock tube assemblies consist of the fired aluminum detonator and the actual shock tube (30 ft length). The “J hook” assembly may or may not be returned. Figure 4-28 provides a schematic of the M11 nonelectric blasting cap and shock tube assembly.

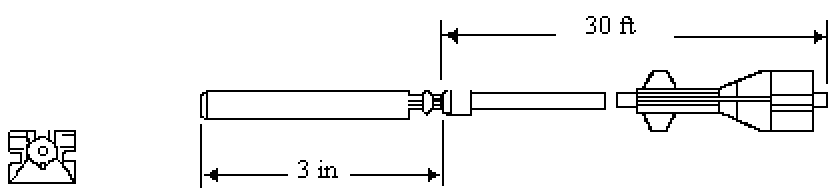


Figure 4-28. M11 Nonelectric Blasting Cap

4.31.2 Characterization Rationale

4.31.2.1 Scrap components and materials

The body/case of the munition item is composed of an aluminum blasting cap assembly and a surlyn polyester covered with polyethylene plastic. The blasting cap assembly contains small amounts of lead aside and PETN. The shock tube assembly contains betabiazochloric formalin-pentoxide (with BHT added as preservative) in the M11.

4.31.2.2 Composition of reactive materials associated with the munitions item

Table 4-75 lists the composition of the detonator and shock tube mixtures used in the munition item (DODIC ML47). This mix contains the RCRA TCLP constituent lead and the secondary constituent of PETN. No specific data were available listing the exact quantity of each in the munition assembly. The overall net explosive weight for the entire assembly is 0.0792 lb.

Table 4-75

Primer Mix Composition for Nonelectric Blasting Cap M11

Compound	Residue Weight (lb)	Percentage of Total Mix
Detonator, M11		
PETN	Unavailable	Unknown
Lead azide	Unavailable	Unknown
Shock Tube, M11		
Betabiazochloric formalin-pentoxide	Unavailable	100

Source: TM 43-0001-38

4.31.2.3 Maximum theoretical leaching limit evaluation

The items in this waste stream are listed in Table 4-76. Although the constituent weights are unknown, sampling and analysis will be conducted to determine whether constituents of concern are present above action levels.

Table 4-76

M11 Nonelectric Blasting Cap

Nonelectric Blasting Cap M11Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
BLASTING CAP, NONELECTRIC M11	1375MN36	CAP BLASTING NONELEC M11	Unknown	Unknown	Unknown
BLASTING CAP, NONELECTRIC M11	1375ML47	CAP BLASTING NONELEC M11	Unknown	Unknown	Unknown

Source: TM 43-0001-38

4.31.3 Sampling Protocol

The M11 blasting cap and shock tube item will be sampled and analyzed separately for TCLP metals (excluding mercury), SVOCs, and explosives in accordance with the procedures outlined in Section 3.1.

4.32 M12 and M13 Nonelectric Blasting Cap (Donor Detonator)

4.32.1 Overview

The nonelectric blasting caps (M12 and M13) are used to relay a shock tube detonation impulse from an initiator (or another relay cap) to another relay cap or to a high strength shock tube blasting cap (e.g., the M11) that initiates standard military explosives. The blasting caps are small aluminum tubes filled with explosives (PETN in the M12 and M13) and then factory-crimped to shock tube (M12 has 500 ft and M13 has 1000 ft). The shock tube is a thin plastic tube with a thin layer of explosives (HMX and aluminum in the M12 and M13) material deposited on its interior surface. A plastic connector, called a "J hook," is attached to the sealed end of the shock tube that is seated with a small cover. The "J hook" allows for easy connection of standard blasting caps to the assembly. The M12 and M13 are initiated by the M81 Time Blasting Fuse Igniter.

Residues from the detonator and shock tube assemblies consist of the fired aluminum detonator and the actual shock tube (either 500 ft or 1000 ft lengths). The "J hook" assembly may or may not be returned. Figure 4-29 provides a schematic of the M12 nonelectric blasting cap and shock tube assembly .

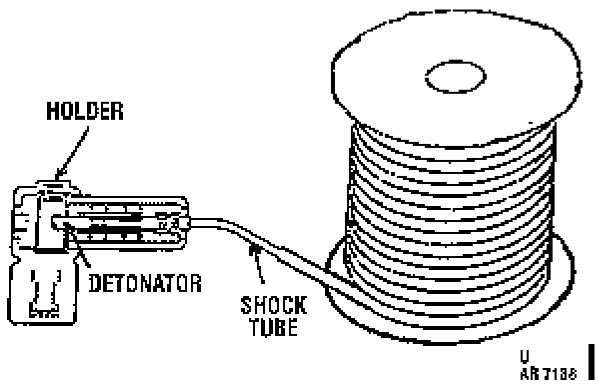


Figure 4-29. M12 Nonelectric Blasting Cap

4.32.2 Characterization Rationale

4.32.2.1 Scrap components and materials

The body/case of the munition item is composed of an aluminum blasting cap assembly and a surlyn polyester covered with polyethylene plastic. The blasting cap assembly contains small amounts of RDX and PETN. The shock tube assembly contains a mixture of HMX and aluminum.

4.32.2.2 Composition of reactive materials associated with the munitions item

Table 4-77 lists the composition of the detonator and shock tube mixtures used in the munition item. This mix contains the RCRA TCLP constituent lead and the secondary constituent of PETN. No specific data were available listing the exact quantity of each in the munition assembly. The overall net explosive weight for the entire assembly is 2.58 grams per cap.

Table 4-77

Primer Mix Composition for Nonelectric Blasting Cap M12 and M13

Compound	Residue Weight (lb)	Percentage of Total Mix
Detonator, M12/M13		
PETN	Unavailable	Unknown
RDX	Unavailable	Unknown
Shock Tube, M12/M13		
HMX	Unavailable	Unknown
Aluminum	Unavailable	Unknown

Source: TM 43-0001-38

4.32.2.3 Maximum theoretical leaching limit evaluation

The items in this waste stream are listed in Table 4-78. Although the constituent weights are unknown, sampling and analysis will be conducted to determine whether constituents of concern are present above action levels. Since the two charge assemblies are identical except for the length of the shock tube, there is no need to differentiate which item may have higher potential of failure of TCLP. Sampling and analysis will consist of sampling of the cap assembly and a section of the shock tube. The results of the shock tube analysis will be used for the M12 and M13.

Table 4-78

Nonelectric Blasting Cap M12/M13

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
BLASTING CAP, NONELECTRIC M12	1375MN02	CAP BLASTING NONELEC M12	Unknown	Unknown	Unknown
BLASTING CAP, NONELECTRIC M12	1375MN35	CAP BLASTING NONELEC M12	Unknown	Unknown	Unknown
BLASTING CAP, NONELECTRIC M13	1375MN03	CAP BLASTING NONELEC M13	Unknown	Unknown	Unknown

Source: TM 43-0001-38

4.32.3 Sampling Protocol

The blasting cap and shock tube from any of the three DoDACs will be sampled and analyzed separately for TCLP metals (excluding mercury), SVOCs, and explosives in accordance with the procedures outlined in Section 3.1.

4.33 M14 Nonelectric Blasting Cap (Time Fuse)

4.33.1 Overview

Nonelectric blasting cap M14 is used to detonate all standard military explosives or to initiate shock tube blasting caps approximately 5 minutes after it is ignited by the user. The M14 is a small aluminum tubes filled with explosives (lead aside, lead styphnate, and PETN) and then factory-crimped to an approximately 7-1/2 ft length of time blasting fuse. The M14 functions by transmitting an initiating flame (from a blasting fuse igniter or a match) slowly burning through its length of time blasting fuse into its detonator. The flame coming through the fuse initiates a small amount of explosives in the detonator. This, in turn, initiates a larger amount of primary explosives.

Residues from the detonator and time blasting fuze assemblies consist of the fired aluminum detonator and the actual fuze (7-1/2 ft length). Figure 4-30 provides a schematic of the M14 nonelectric blasting cap and fuze assembly.

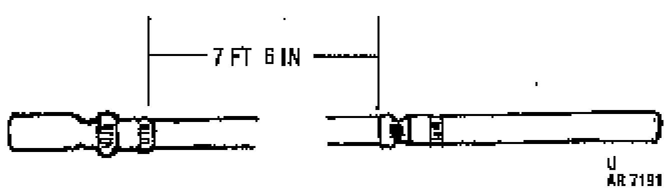


Figure 4-30. M14 Nonelectric Blasting Cap

4.33.2 Characterization Rationale

4.33.2.1 Scrap components and materials

The body/case of the munition item is composed of an aluminum blasting cap assembly and a surlyn polyester covered with polyethylene plastic. The blasting cap assembly contains small amounts of lead aside, lead styphnate, and PETN. The time blasting fuze assembly contains black powder.

4.33.2.2 Composition of reactive materials associated with the munitions item

Table 4-79 lists the composition of the detonator and fuze mixtures used in the munition item. This mix contains the RCRA TCLP constituent lead and the secondary constituent of PETN. No specific data were available listing the exact quantity of each in the munition assembly. The overall net explosive weight for the entire assembly is 0.0792 lb. There are no constituents of concern associated with the time blasting fuze.

Table 4-79

Primer Mix Composition for Nonelectric Blasting Cap M14

Compound	Residue Weight (lb)	Percentage of Total Mix
Detonator, M14		
PETN	Unavailable	Unknown
Lead Styphnate	Unavailable	Unknown
Lead aside	Unavailable	Unknown
Time Blasting Fuze, M14		
Black Powder	Unavailable	100

Source: TM 43-0001-38

4.33.2.3 Maximum theoretical leaching limit evaluation

The items in this waste stream are listed in Table 4-80. Although the constituent weights are unknown, sampling and analysis will be conducted to determine whether constituents of concern are present above action levels..

Table 4-80

Nonelectric Blasting Cap M14

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
BLASTING CAP, NONELECTRIC DELAY M14	MN06	CAP BLASTING NONELEC DELAY M14	Unknown	Unknown	Unknown
BLASTING CAP, NONELECTRIC DELAY M14	MN37	CAP BLASTING NONELEC DELAY M14	Unknown	Unknown	Unknown

Source: TM 43-0001-38

4.33.3 Sampling Protocol

The M14 blasting cap will be sampled and analyzed for TCLP metals (excluding mercury), SVOCs, and explosives in accordance with the procedures outlined in Section 3.1.

4.34 M15 Nonelectric Delay Blasting Cap

4.34.1 Overview

The M15 nonelectric blasting cap is used to provide a delay element in a shock tube blasting cap priming system to obtain staged detonations such as those used in quarrying operations. Normally, several M15s are used in tandem to obtain a multi-stage detonation with a slight delay between each stage to allow the outer layer of rock to start moving before the next layer's detonation occurs.

The M15 consists of two small aluminum tubes (detonators) filled with explosives and factory-crimped to each end of a 70-ft length of shock tube. Shock tube is a thin polyethylene tube with a layer of explosives deposited on its interior surface. The detonators are different sizes and contain different delay elements. The shorter piece initiates additional detonators, while the longer piece initiates the explosives. A "J hook" is used to attach the multiple shock tube assemblies. A blasting cap must initiate the M15. Figure 4-31 illustrates the M15 assembly.

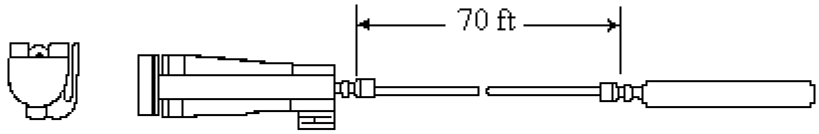


Figure 4-31. M15 Nonelectric Delay Blasting Cap

4.34.2 Characterization Rationale

4.34.2.1 Scrap components and materials

The body/case of the munition item is composed of an aluminum blasting cap assembly and a surlyn polyester covered with polyethylene plastic. The blasting cap assembly contains small amounts of lead aside and PETN. The shock tube assembly contains HMX and aluminum.

4.34.2.2 Composition of reactive materials associated with the munitions item

Table 4-81 lists the composition of the detonator and shock tube mixtures used in the munition item. This mix contains the RCRA TCLP constituent lead and the secondary constituents of PETN and HMX. No specific data were available listing the exact quantity of each in the munition assembly. The overall net explosive weight for the entire assembly is 1.63 grams.

Table 4-81

Primer Mix Composition for Nonelectric Blasting Cap M15

Compound	Residue Weight (lb)	Percentage of Total Mix
Detonator, M15		
PETN	Unavailable	Unknown
Lead aside	Unavailable	Unknown
Shock Tube, M15		
HMX	Unavailable	Unknown
Aluminum	Unavailable	Unknown

Source: TM 43-0001-38

4.34.2.3 Maximum theoretical leaching limit evaluation

The items in this waste stream are listed in Table 4-82. Although the constituent weights are unknown, sampling and analysis will be conducted to determine whether constituents of concern are present above action levels..

Table 4-82

Nonelectric Blasting Cap M15

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
BLASTING CAP, NONELECTRIC DELAY M15	MN07	CAP BLASTING NONELEC DELAY M15	Unknown	Unknown	Unknown
BLASTING CAP, NONELECTRIC DELAY M15	MN38	CAP BLASTING NONELEC DELAY M15	Unknown	Unknown	Unknown

Source: TM 43-0001-38

4.34.3 Sampling Protocol

The M15 blasting cap and shock tube will be sampled and analyzed separately for TCLP metals (excluding mercury), SVOCs, and explosives in accordance with the procedures outlined in Section 3.1.

4.35 <u>Personal Distress Flare Kit</u>

4.35.1 Overview

The residues for this waste stream consist of the initiator assembly and empty casings from the Personal Distress Signal Kit XM185. The kit consists of an instruction card, signal surface projector (similar to gun), and multiple hand fired signals. The whole assembly is wrapped in a polyethylene plastic bandoleer. A schematic of a personal distress flare kit is not available.

4.35.2 Characterization Rationale

4.35.2.1 Scrap components and materials

The projector assembly is composed of either stainless steel or aluminum and contains no hazardous constituents. Each hand-fired signal cartridge has an enclosed cap and primer assembly and a flare that goes downrange. This primer assembly is itself made of aluminum alloy.

4.35.2.2 Composition of reactive materials associated with the munitions item

Table 4-83 lists the composition of the primer mix used in each hand-fired signal. It is assumed that during use, from one to six (maximum carried) signals may be returned. The table provides the constituent breakdown for a single signal.

Table 4-83

Primer Mix Composition for Personal Distress Flare Kit

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Percussion M42A2 (Mix #793)		
TNT	1.46e-6	3%
Strontium Sulfide	1.46e-5	30%
Calcium Silicide	7.30e-6	15%
Potassium Chlorate	1.70e-5	35%
Lead Thiocyanate	8.26e-6	17%

Source: MIDAS Database

4.35.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-84. The amount of lead associated with the munition item is 0.71%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-84

Personal Distress Flare Kit

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
SIGNAL HAND FIRED	1370L116	KIT FLARE PERS DIST XM185	3.31e-2	1.56e-5	0.71%

Source: MIDAS Database

4.35.3 Sampling Protocol

The munition item will be sampled and analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since TNT is present in the munitions.

4.36 <u>HC M1 155mm Smoke Canister</u>

4.36.1 Overview

The residues for this waste stream consist of the entire smoke canister, including steel and aluminum body parts and white smoke mix. A schematic of a 155mm smoke canister is not available.

4.36.2 Characterization Rationale

4.36.2.1 Scrap components and materials

The body of the smoke canister is composed of steel, zinc, and aluminum alloy components. The steel components may contain small amounts of cadmium in cadmium chromate and cadmium plating.

4.36.2.2 Composition of reactive materials associated with the munitions item

Table 4-85 lists the composition of the white smoke mix used in the smoke canister. This mix contains HC, a RCRA TCLP constituent.

Table 4-85

White Smoke Mix Composition for 155mm Smoke Canister, HC M1

Compound	Residue Weight (lb)	Percentage of Total Mix
White Smoke Mix 1 (3 lb)		
Zinc Oxide	1.39e+0	46.47%
Hexachloroethane	1.34e+0	44.53%
Aluminum Powder	2.70e-1	9%

Source: MIDAS Database

4.36.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-86. The amount of HC associated with the smoke canister is 18.23%, which is above the TCLP maximum theoretical leaching limit. Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-86

155mm Smoke Canister, HC M1

Residue	DoDAC	Primary Munition	Residue Weight (lb)	HC in Residue (lb)	Percentage of HC in Residue
SMOKE CANISTER, 155MM HC M1	1320D445	CANISTER 155MM SMK HC M1	7.35	1.34	18.23%

HC = hexachloroethane
Source: MIDAS Database

4.36.3 Sampling Protocol

The smoke canister will be sampled and analyzed for TCLP metals and SVOCs in accordance with the procedures outlined in Section 3.1.

4.37 Fired 10 Gauge Shotgun Cartridge Cases

4.37.1 Overview

This residue is the expended 10 gauge cartridge case. The small arms ammunition is composed of a black powder propellant initiated by a percussion primer. The blank is used for reveille and retreat salutes and is fired in the 3-in. gun, 75mm gun, 75mm howitzer, and 105mm howitzer. The cartridge is similar to standard shotgun rounds but contains no lead shot. It has a paper case with the forward closing disc marked "BLANK." The cartridge produces a sound when initiated and is inserted either in a prepared cartridge case or in a breech block of the weapon being used. Figure 4-32 provides a schematic of a typical 10 gauge shotgun cartridge.

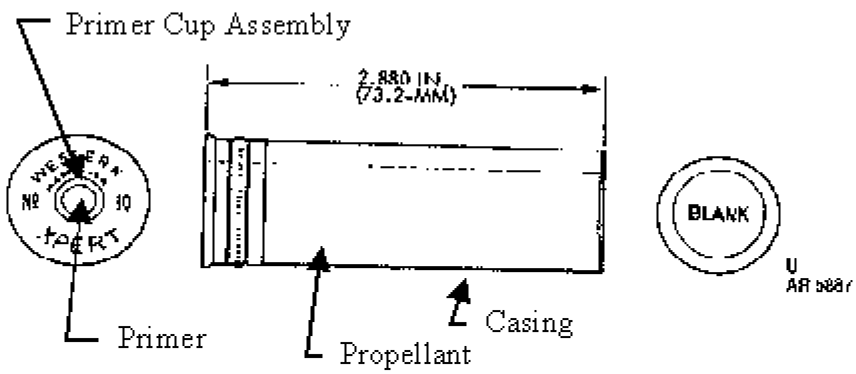


Figure 4-32. 10 Gauge Shotgun Cartridge

4.37.2 Characterization Rationale

4.37.2.1 Scrap components and materials

According to the DoD references, the cartridge cases for these munitions are composed of paper with a brass cartridge head that acts as the primer assembly. However, discussions with both Olin-Winchester and Remington (government ammunition manufacturers) indicate that the paper-casing munitions were all replaced with plastic-only casings within the past 5 years. There are no suspected RCRA TCLP constituents in the cartridge case materials; the casing is composed of polyethylene with a copper and zinc cartridge head.

4.37.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in the cartridge contains lead from lead styphnate and barium from barium nitrate in the amounts shown in Table 4-87. Constituent data for this munition are not available in MIDAS. Therefore, constituent information was obtained from Olin-Winchester on the typical composition of a 10 gauge shotgun blank round.

Table 4-87

Primer Mix for 10 Gauge Shotgun Cartridges

Compound	Residue Weight (lb)	Percentage of Primer Mix
Primer Mix		
Lead Styphnate (5.6 to 10%)	Unknown	Unknown
Iron (50 to 56%)	Unknown	Unknown
Copper (2.8 to 20%)	Unknown	Unknown
Zinc (5.6 to 10%)	Unknown	Unknown
Barium Nitrate (5.6 to 10%)	Unknown	Unknown

Source: Olin-Winchester MSDS

The propellant for the 10 gauge shotgun blank is black powder. Therefore, no hazardous constituents of concern are present in the propellant to warrant additional investigation, sampling, or analysis.

4.37.2.3 Maximum theoretical leaching limit evaluation

The item in this waste stream is listed in Table 4-88. Note that data on material composition are only available from a Material Safety Data Sheet provided by Olin-Winchester, a small arms ammunition manufacturer. Therefore, the exact percentage of lead in the primer is unavailable. Sampling and analysis is recommended since all remaining small arms ammunition that is larger and smaller in caliber are being sampled and these residues all contain lead concentrations in the primer greater than the 0.01% theoretical leaching limit for TCLP.

Table 4-88

10 Gauge Shotgun Cartridge Cases

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED, BRASS AND PAPER/PLASTIC	1305A010	CTG 10 GA SHOTGUN BUCKSHOT BLANK	Unknown	Unknown	Unknown

Source: MIDAS Database

4.37.3 Sampling Protocol

The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will not be conducted since no explosive constituents are present in the munition.

4.38 M81 Firing Device

4.38.1 Overview

The M81 igniter is used to ignite the time blasting fuse or to initiate the shock tube of the new shock tube non-electric blasting caps. The M81 is a small plastic tube with a pull ring on a thin rod projecting from one end, a safety (cotter) pin that goes laterally through the tube and a screw cap that secures a holding mechanism for the fuse or shock tube on the other end.

The M81 is manually initiated by the operator. The cut end of either the time blasting fuse or shock tube is inserted in the hole where the plug is removed. The cotter pin is then removed and the operator pulls the pull ring. This action pulls the firing pin back; when released, the firing pin is forced into the M42 primer (located within the assembly), which fires with a flame and an explosive shock igniting the fuse or initiating the shock tube. Figure 4-33 shows the M81 firing device

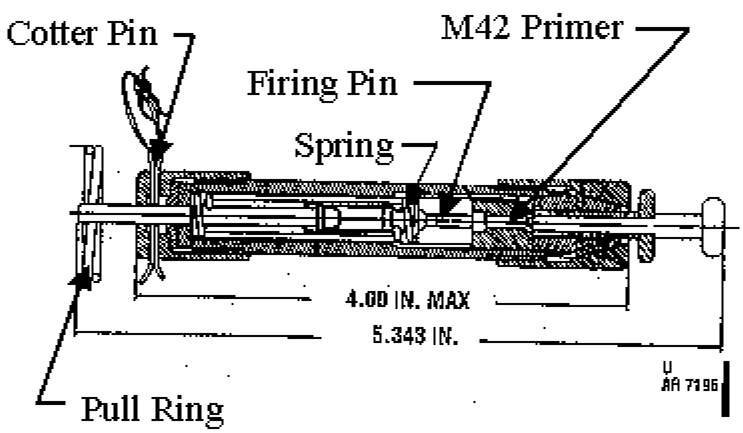


Figure 4-33. M81 Firing Device

4.38.2 Characterization Rationale

4.38.2.1 Scrap components and materials

The M81 firing device is composed of a plastic casing and steel metal components for the cotter pin, firing pin, pull ring, and spring assemblies. Once the M81 firing device is no longer useable, the entire assembly is considered scrap.

4.38.2.2 Composition of reactive materials associated with the munitions item

The primer for the M81 firing device is the M42 primer assembly. Table 4-89 lists the properties of the primer mix. This mix contains the RCRA TCLP constituent lead from the lead thiocyanate in the amounts shown in Table 4-89. The primer mix also contains TNT, which is a secondary constituent of concern for this characterization.

Table 4-89

Primer Mix Composition for M81 Firing Device

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix (M42 assembly) (0.36 grains)		
TNT	4.29e-6	3%
Strontium Sulfide	4.29e-5	30%
Calcium Silicide	2.14e-5	15%
Potassium Chlorate	5.00e-5	35%
Lead Thiocyanate	2.43e-5	17%

Source: MIDAS Database

4.38.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-90. The amount of lead associated with the item is 0.018%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-90

M81 Firing Device

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
FIRING DEVICE, M81	1375MN08	FIRING DEVICE, M81	5.71e-4	9.05e-6	0.018%

Source: MIDAS Database

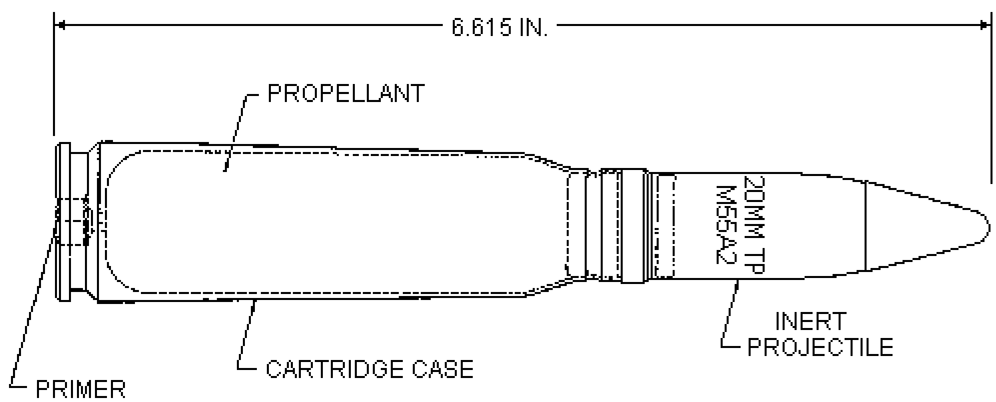
4.38.3 Sampling Protocol

The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will be conducted since TNT is present in the munition.

4.39 Fired 20mm Cartridge Cases

4.39.1 Overview

Residues in this waste stream consist of 20mm cartridge cases. The cases for these cartridges contain a double-base propellant that ejects and propels a small projectile downrange. The propellant mixes are initiated by percussion pressure. Figure 4-34 provides a schematic of a 20mm cartridge.



Note: The 20mm M220 TP-T linked to the M55A2 has the same casing, primer and propellant mix. The only difference is the M220 is a tracer round.

Figure 4-34. 20mm Cartridge, M552A2 TP and M220 TP-T Linked

4.39.2 Characterization Rationale

4.39.2.1 Scrap components and materials

The cartridge cases of these shells are made of either brass or steel (alternate). Components containing lead (e.g., brass) include the casing, and the cup and anvil of the M52A3B1 percussion primer.

4.39.2.2 Composition of reactive materials associated with the munitions item

The FA-874 primer mix is used in the 20mm cartridge. Table 4-91 lists the properties of the primer mix. This mix contains the RCRA TCLP constituents lead and barium from lead styphnate and barium nitrate, respectively, in the amounts shown in Table 4-91. The primer mix also contains TNT, which is a secondary constituent of concern for this characterization.

Table 4-91

Primer Mix Composition for 20mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Primer Mix FA-874 (2.63 grains)		
Acetylene Black	1.07e-6	0.75%
Barium Nitrate	6.32e-5	44.25%
Calcium Silicide	1.86e-5	13%
Acacia Technical	1.43e-6	1%
Lead Styphnate	5.71e-5	40%
TNT	1.43e-6	1%

Source: MIDAS Database

The 20mm cartridge represented in this waste stream use propellant mix WC872. This mix are double-base mixed. Table 4-92 lists the propellant mixes associated with the 20mm cartridges in this waste stream. Propellant Mix WC872 also contains nitroglycerin and TNT, which is a secondary constituent of concern for this characterization.

Table 4-92

Propellant Mix Compositions for 20mm Cartridges

Compound	Residue Weight (lb)	Percentage of Total Mix
Propellant Mix WC872 (M55A2 and M220 cartridges) (600 grains)		
Graphite	5.71e-6	0.40%
Potassium Nitrate	1.14e-6	0.80%
Sodium Sulfate	7.14e-7	0.50%
Calcium Carbonate	1.43e-6	1.00%
Nitroglycerin	1.21e-5	8.50%
Diphenylamine	1.61e-6	1.13%
Tin Dioxide	1.67e-6	1.17%
Nitrocellulose	1.24e-4	86.50%

Source: MIDAS Database

4.39.2.3 Maximum theoretical leaching limit evaluation

The weight of the items in this waste stream and the primary hazardous constituent are listed in Table 4-93. The amount of lead associated with the items in the waste stream is 0.014%, which is above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-93

20mm Cartridge Cases

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED BRASS	1305A896	CTG 20MM 4 TP M55A2/1 TP-T M220 LNKD M14A2	7.05e-1	9.99e-5	0.014%

Source: MIDAS Database

4.39.3 Sampling Protocol

The samples will be analyzed for TCLP metals (excluding mercury) and SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will be conducted since TNT and nitroglycerin are present in the munitions.

4.40 Fired 25.4mm Decoy Cartridge Cases

4.40.1 Overview

The M839 cartridge is used as a countermeasures weapon on military aircraft. The cartridge consists of a plastic outer case 1 x 1 x 8 in. and a payload made up of approximately 390,000 strands of aluminum-coated glass fibers. The charge assembly is held in place with a plastic end cap and initiated by an M976 impulse cartridge. The expelling charge is a Hercules bulls eye smokeless powder. Figure 4-35 shows a schematic of the 25.4mm munition.

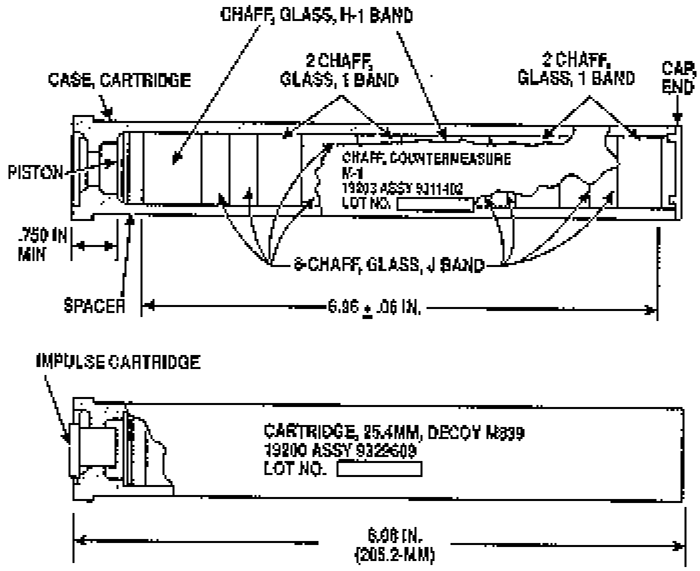


Figure 4-35. 25.4mm Decoy Cartridge Case

4.40.2 Characterization Rationale

4.40.2.1 Scrap components and materials

Once used, the plastic casing, fired impulse cartridge, and plastic piston assembly are removed from the aircraft as residue. The only component suspected of containing hazardous constituents is the impulse cartridge, which uses nitroglycerin as its propellant powder.

4.40.2.2 Composition of reactive materials associated with the munitions item

The primer mix used in the impulse cartridge consists of an initiation charge, booster charge, and propellant. Table 4-94 lists the properties of the primer mix. This mix contains only the secondary constituent of concern nitrogylcerin.

Table 4-94

Primer Mix Composition for 25.4mm Cartridge

Compound	Residue Weight (lb)	Percentage of Total Mix
Initiation Charge (100 mg)		
Boron Amorphorous Powder	4.41e-5	20%
Calcium Chromate	1.76e-4	80%
Booster Charge (70 mg)		
Boron Amorphorous Powder	2.78e-5	18%
Potassium nitrate	1.27e-4	82%
Propellant Charge		
Nitrocellulose	2.35e-4	57.6%
Ethyl Centralite	3.06e-6	0.75%
Nitroglycerin	1.63e-4	40.00%
Potassium Sulfate	5.10e-6	1.25%
Graphite	1.63e-6	0.40%

Source: MIDAS Database

4.40.2.3 Maximum theoretical leaching limit evaluation

The weight of the item in this waste stream and the primary hazardous constituent are listed in Table 4-95. The amount of lead associated with the 25.4mm cartridge in this waste stream is 0.019%, which is slightly above the TCLP maximum theoretical leaching limit for lead (0.01%). Therefore, sampling and analysis is required to perform a hazardous waste determination for this waste stream.

Table 4-95

25.4mm Cartridge Case

Residue	DoDAC	Primary Munition	Residue Weight (lb)	Lead in Residue (lb)	Percentage of Lead in Residue
CASE, CTG, FIRED AL ALLOY	1305A965	CTG, 25.4MM DECOY M839	4.29e-1	8.06e-5	0.019%

Source: MIDAS Database

4.40.3 Sampling Protocol

The 25.4mm cartridge case in this waste stream, DoDAC 1305A965, will be sampled and analyzed for SVOCs in accordance with the procedures outlined in Section 3.1. Energetic analysis (EPA Method 8330) will also be conducted since nitroglycerin is present in the munitions item. Testing for TCLP metals will not occur since there are no known metals of concern (e.g., lead) in the munition residue.

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5.0 DATA INTERPRETATION AND REPORTING

5.1 <u>Data Reduction, Validation, and Reporting</u>

5.1.1 Data Reduction

Data reduction will be completed by the analytical and QA laboratories in accordance with their published QA plans.

5.1.2 Calculation of Data Quality Indicators

5.1.2.1 Precision

For chemical analysis of environmental samples for this project, precision will be determined from duplicate laboratory sample analyses; therefore, precision will be expressed as RPD. Every batch of samples analyzed will include matrix spikes and/or matrix spike duplicates to evaluate precision. Precision determined by RPD will be calculated as follows.

$$RPD = \{[\text{absolute value of } (X_1 - X_2)]/[(X_1 + X_2)/2]\} \times 100\%$$

Where:

X_1 = primary sample result,
X_2 = duplicate sample result.

5.1.2.2 Accuracy

Accuracy will be determined from spiked samples (laboratory control and matrix spike samples) for this project and will be expressed as percent recovery (%R). Accuracy determined by percent recovery is calculated as follows:

$$\%R = [(X_S - X_U)/K] \times 100\%$$

Where:

X_S = measured value of the spiked sample,
X_U = measured value of the unspiked sample,
K = known amount of the spike in the sample.

5.1.2.3 Completeness

Completeness, expressed as percent complete (%C), will be calculated for the project as a whole as follows:

$$\%C = (V/N) \times 100\%$$

Where:

V = number of measurements judged valid,
N = number of valid measurements needed to achieve DQOs.

5.1.2.4 Method Detection Limits

MDL studies will follow the procedures outlined in 40 CFR 136.

5.1.3 Data Review

The analyst who generates the analytical data has prime responsibility for the correctness and completeness of data. Data review will be completed by the analytical and QA laboratories in accordance with their published QA plans. All data generated and reduced will follow well-documented laboratory protocols, which will consist of the following, at a minimum.

Level 1 Technical Data Review. Analysts will review the quality of their work based on an established set of guidelines as specified in each method. Level 1 data review will be documented by using a checklist form with a signature and date entered by the reviewer.

Level 2 Technical Review. Level 2 review will be performed by a supervisor or data review specialist whose function is to provide an independent review of the data package. This review will also be conducted in accordance with an established set of guidelines. Level 2 review will be structured so that all calibration data and QC sample results are reviewed and all the analytical results from at least 10% of the samples are checked back to the sample preparation and analytical bench sheets. If any problems are found with the data package, an additional 10% of the sample results will be checked back to the sample preparatory and analytical bench sheets. This cycle then repeats until either no errors are found in the data set checked or all data have been checked. All errors and corrections noted will be documented. Level 2 data review will also be documented on a checklist with the signature and date of the reviewer.

Level 3 Administrative Review. Level 3 review will be performed by the laboratory QA officer or the program administrator. This review will be similar to the review as provided in Level 2 except that it will provide a total overview of the data package to ensure its consistency and compliance. All errors noted will be corrected and documented. Level 3 data review will also be documented on a dated checklist with the signature of the reviewer.

5.1.4 Data Validation

Full independent validation of data packages is not required for this project. The project team will review all analytical results, QA/QC reports, and case narratives reported by the laboratories.

5.1.5 Data Reporting

A standard reporting format will be used to report all data along with the supporting QC information. The standard data reporting format will include, at a minimum, a general discussion, analytical data for field samples and QC samples, calibration information, laboratory performance and matrix-specific information, and any other information that is pertinent to the project samples. Electronic format will be provided in Microsoft Excel.

5.1.6 Laboratory Turnaround Time

Turnaround time for reporting will be 21 calendar days for delivery from the time of sample receipt.

5.2 Project DQOs

The overall objective of this effort is to promote a consistent approach to the management of range scrap items and do so in accordance with environmental requirements. This characterization effort must be completed to:

- Address the unique characteristics of specific items (no “one size fits all”),
- Provide a consistent management approach for each item, and
- Provide the best benefit relative to a regulatory position for addressing concerns.

The primary characterization requirements identified to meet these objectives include (1) hazardous waste determination and (2) identification of UHCs for characteristically hazardous items. Conducting a comprehensive characterization including energetic compounds, as well as metals and SVOCs, for the scrap items was also identified as a secondary data requirement to address concerns associated with CERCLA liability and downstream processors. These characterization requirements must be satisfactorily fulfilled in order to achieve the objectives of this study. The methodology for evaluating the sampling and analysis data and characterization requirements is provided below.

5.2.1 Hazardous Waste Determination

Hazardous waste determination will be made by conducting TCLP analysis on a sufficient number of samples as described in Section 3.1 and comparing the results to the TCLP limits. As discussed in Section 2.6, the contaminants of concern will not be considered to be present in the item at a hazardous level if the upper limit of the confidence interval is less than the applicable TCLP limit. The equation for calculating the confidence interval is:

$$CI = 0 \pm t_{.20}(s_x)$$

Where:	CI	=	80% Confidence interval,
	0	=	Mean of measurement generated by sample (sample mean),
	$t_{.20}$	=	Student’s “t” value for a two-tailed confidence interval and a probability of 0.20,
	s_x	=	Standard error (also standard deviation of mean) of sample.

In the case where samples representing the same waste stream or grouping contain some detects and some non-detects, a value equivalent to the detection limit will be used for non-detects when calculating the statistics of the group.

5.2.2 Identification of UHCs

TCLP results for metals and SVOC analytical results will be compared to the respective limits listed in the Universal Treatment Standards (40 CFR 268.48) by calculating the confidence interval in the same manner as described in Section 5.2.1.

5.2.3 Concerns Associated with CERCLA Liability and Downstream Processors

Results of the metals, SVOC, and energetics analyses planned for this effort will be used collectively to provide managers of range scrap and downstream processors a comprehensive characterization of the scrap items that includes all suspected contaminants.

Better management practices are currently being evaluated throughout the Army and by this study to provide increased security and accountability of range scrap items prior to sale, disposal, or recycling. Many of the measures being evaluated for this purpose, such as secured containers, also serve as good environmental practices. The data generated by this effort will also be used to evaluate the need for additional environmental management/processing practices to take advantage of the RCRA exclusion and exemption. The additional management/processing practices may include providing overhead cover, impermeable pad, segregation of items, etc. Recommendations for additional management/processing practices will be based on the presence of contaminants (leachable metals, leachable SVOCs, and/or energetic compounds) and the physical state of the range scrap item (high/moderate/low potential to release contaminants).

5.3 Profile Sheets

After the sampling and analysis data have been evaluated as described in Sections 5.1 and 5.2, profile sheets will be prepared for each range scrap item. The profile sheets will be organized to include the following:

- Identifying data;
- Hazardous waste determination;
- Other characterization data (UHCs, compounds detected, etc.);
- Waste management options (solid waste, recycle, reuse, or hazardous waste disposal);
- Applicable BMPs; and
- Analytical results.

The profile sheets may be used by those who manage range scrap to:

- Complete waste profile sheets;
- Complete LDR notification/certification;
- Provide data to buyers, recycle companies, scrap dealers, and disposal and treatment facilities;
- Determine BMPs applicable to their operation; and
- Review disposal options.

Appendix A

RANGE SCRAP INVENTORY SUMMARY REPORT

Appendix A

Range Scrap Inventory Summary Report

DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1305A010	CTG 10 GA SHOTGUN BLANK	FP	BOX, PAPERBOARD	10
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, 10 GA SHOTGUN PAPER	500
		DR	CTG, 10 GA BLANK	500
1305A011	CTG 12 GA SHOTGUN BUCKSHOT	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, PAPERBOARD	25
		FP	CASE, CTG, FIRED, BRASS AND PAPER/PLASTIC	500
		DR	CTG, 12 GA BUCKSHOT M19	500
1305A014	CTG 10 GA SHOTGUN #11	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, PAPERBOARD	25
		FP	CASE, CTG, FIRED, BRASS AND PAPER/PLASTIC	500
		DR	CTG, 12 GA SHOTGUN BUCKSHOT M19	500
1305A017	CTG 12 GA SHTOGUN #9 BUCKSHOT	FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, PAPERBOARD	25
		FP	CASE, CTG, FIRED, BRASS AND PLASTIC	500
		DR	CTG, 12 GA SHOTGUN PLATIC CORE NO. 9 CHILLED SHOT	500
1305A059	CTG 5.56MM BALL M855	FP	BANDOLEER, CLOTH, M3	12
		FP	BOX, CARDBOARD	64
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	1680
		FP	CLIP, METAL	168
		DR	CTG, 5.56MM BALL M855	1680
		FP	FILLER, METAL, F/M16	24
1305A062	CTG 5.56MM BALL M855 LINKED	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	800
		DR	CTG, 5.56MM BALL M855 LINKED	800
		FP	LINK, CTG METALLIC BELT, M27	800
1305A063	CTG 5.56MM TR M856	FP	BANDOLEER, CLOTH, M3	12
		FP	BOX, CARDBOARD	64
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	1680
		FP	CLIP, METAL	168
		DR	CTG, 5.56MM TR M856	1680
		FP	FILLER, METAL, F/M16	12
1305A064	CTG 5.56MM BALL TR 4/1 M855, M856	FP	BANDOLEER, CLOTH, M4	4
		FP	BOX, METAL, PA108	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED BRASS	800
		DR	CTG, 5.56MM BALL TR 4/1 M855, M856	800
		FP	LINK, CTG PLASTIC	800
1305A065	CTG 5.56MM PLASTIC M862	FP	BOX, CARDBOARD	40
		FP	BOX, PLASTIC	50
		FP	BOX, WOOD	1
		FP	CASE, CTG, FIRED, BRASS	2000
		DR	CTG, 5.56MM PLASTIC M862	2000
1305A068	CTG 5.56MM TR M196	FP	BANDOLEER, CLOTH, M3	12
		FP	BOX, CARDBOARD	82
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	1640
		FP	CLIP, METAL	164
		DR	CTG, 5.56MM TR M196	1640
		FP	FILLER, METAL, F/M16	24

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

Appendix A

(Continued)

DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1305A071	CTG 5.56MM BALL M193	FP	BANDOLEER, CLOTH, M3	14
		FP	BOX, CARDBOARD	28
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	1680
		FP	CLIP, METAL	168
		DR	CTG, 5.56MM BALL M193	1680
		FP	FILLER, METAL, F/M16	28
1305A075	CTG 5.56MM BLK M200 LINKED	FP	BANDOLEER, CLOTH, M3	2
		FP	BOX, METAL, PA108	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	1600
		DR	CTG, 5.56MM BLK M220 LINKED	1600
		FP	LINK, CTG METALLIC BELT, M27	1600
		FP	MAGAZINE, AMMUNITION	8
1305A080	CTG 5.56MM BLK M200	FP	BOX, CARDBOARD	57
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	2280
		DR	CTG, 5.56MM BLK M200	2280
1305A091	CTG CAL .22 LR BALL MATCH GRADE	FP	BOX, CARDBOARD	10
		FP	BOX, CARDBOARD	100
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, STYROFOAM	100
		FP	CASE, CTG, FIRED, BRASS	5000
		DR	CTG, CAL .22 LR BALL MATCH GRADE	5000
1305A093	CTG CAL .22 LR BALL	FP	BOX, CARDBOARD	100
		FP	BOX, CARDBOARD	10
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, STYROFOAM	100
		FP	CASE, CTG, FIRED, BRASS	5000
		DR	CTG, CAL .22 LR BALL	5000
1305A106	CTG CAL .22 LR BALL	FP	BOX, CARDBOARD	10
		FP	BOX, CARDBOARD	100
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, STYROFOAM	100
		FP	CASE, CTG, FIRED, BRASS	5000
		DR	CTG, CAL .22 LR BALL	5000
1305A111	CTG 7.62MM BLK M82 LINKED M13	FP	BANDOLEER, CLOTH, M4	8
		FP	BOX, CARDBOARD	8
		FP	BOX, METAL, M19A1	4
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	800
		DR	CTG, 7.62MM BLK M82 LINKED M13	800
		FP	LINK, CTG METALLIC BELT, M13	800
1305A112	CTG 7.62MM BLK M82 LINKED	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	20
		FP	CASE, CTG, FIRED, BRASS	1200
		DR	CTG, 7.62MM BLK M82 LINKED	1200
1305A130	CTG 7.62MM NATO BALL M80	FP	BANDOLEER, CLOTH, M1	12
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	840
		FP	CLIP, METAL	84
		DR	CTG, 7.62MM NATO BALL M80	840

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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(Continued)

DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1305A131	CTG 7.62MM 4 BALL M59/M80/1 TR M62	FP	BANDOLEER, CLOTH, M4	6
		FP	BOX, METAL, M2A1	2
		FP	CARTON, CARDBOARD	6
		FP	CASE, CTG, FIRED, BRASS	600
		DR	CTG, 7.62MM 4 BALL M59/M80/1 TR M62	600
		FP	LINK, CTG METALLIC BELT, M13	600
1305A136	CTG 7.62MM NATO SPEC BALL M118	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD	23
		FP	CASE, CTG, FIRED, BRASS	920
		DR	CTG, 7.62MM NATO SPEC BALL M118	920
1305A143	CTG 7.62MM NATO BALL M80 LINKED	FP	BANDOLEER, CLOTH, M4	8
		FP	BOX, METAL, M19A1	4
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	8
		FP	CASE, CTG, FIRED, BRASS	800
		DR	CTG, 7.62MM NATO BALL M80 LINKED	800
		FP	LINK, CTG METALLIC BELT, M13	800
1305A151	CTG 7.62MM 4 BALL M80/1 TR M62 OHF	FP	BANDOLEER, CLOTH, M4	8
		FP	BOX, METAL, M19A1	4
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	8
		FP	CASE, CTG, FIRED, BRASS	800
		DR	CTG, 7.62MM 4 BALL M80/1 TR M62 OHF	800
		FP	LINK, CTG METALLIC BELT, M13	800
1305A165	CTG 7.62MM 4 BALL M80/1 TR M62 LINKED M13	FP	BOX, METAL, M548	1
		FP	CASE, CTG, FIRED, BRASS	1500
		DR	CTG, 7.62MM 4 BALL M80/1 TR M62 LINKED M13	1500
		FP	LINK, CTG METALLIC BELT, M13	1500
1305A171	CTG 7.62MM MATCH M852	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD	23
		FP	CASE, CTG, FIRED, BRASS	920
		DR	CTG, 7.62MM MATCH M852	920
1305A182	CTG CAL .30 CARB BALL M1	FP	BOX, FIBERBOARD	16
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED BRASS	800
		DR	CTG, CAL .30 BALL M1	800
1305A212	CTG CAL .30 BALL M2	FP	BOX, FIBERBOARD	16
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED BRASS	800
		DR	CTG, CAL .30 BALL M2	800
1305A222	CTG CAL .30 BLK M1909		NO INFORMATION FOUND TO DATE	0
1305A246	CTG CAL .30 MATCH M72	FP	BANDOLEER, CLOTH	4
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	4
		FP	CASE, CTG, FIRED, BRASS	160
		DR	CTG, CAL .30 MATCH M72	160
1305A247	CTG CAL .30 MATCH M72	FP	BANDOLEER, CLOTH	4
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	4
		FP	CASE, CTG, FIRED, BRASS	160
		DR	CTG, CAL .30 MATCH M72	160

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

Appendix A

(Continued)

DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1305A358	CTG 9MM PRAC AT-4 M287	FP	BAG, BARRIER WATERPROOF	12
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	60
		FP	CASE, CTG, FIRED, BRASS	3000
		DR	CTG, 9MM PRAC AT-4 M287	3000
1305A363	CTG 9MM BALL M882	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, STYROFOAM	40
		FP	CASE, CTG, FIRED, BRASS	2000
		DR	CTG, 9MM BALL M882	2000
1305A365	CTG 14.5MM ARTY TRNG M181A1	FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	50
		FP	CASE, CTG, FIRED, BRASS	500
		DR	CTG, 14.5MM ARTY TRNG M181A1	500
1305A366	CTG 14.5MM ARTY TRNG M182A1	FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	50
		FP	CASE, CTG, FIRED, AL ALLOY	500
		DR	CTG, 14.5MM ARTY TRNG M182A1	500
1305A367	CTG 14.5MM ARTY TRNG M183A1	FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	50
		FP	CASE, CTG, FIRED, AL ALLOY	500
		DR	CTG, 14.5MM ARTY TRNG M183A1	500
1305A403	.38 BLNK (SENTRY DUB		NO INFORMATION FOUND TO DATE	0
1305A475	CTG CAL .45 BALL M1911	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	20
		FP	CASE, CTG, FIRED, BRASS	2000
		DR	CTG, CAL .45 BALL M1911	2000
		FP	FILLER MATERIAL POLYSTYRENE	20
1305A483	CTG CAL .45 BALL MATCH M1911	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, CARDBOARD	20
		FP	CASE, CTG, FIRED, BRASS	2000
		DR	CTG, CAL .45 BALL MATCH M1911	2000
1305A520	CTG CAL .50 4 BALL M33/1 TR M17 LINKED M15A2	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	170
		DR	CTG, CAL .50 4 BALL M33/1 TR M17	170
		FP	LINK, CTG METALLIC BELT, M15A2	170
1305A540	CTG CAL .50 4 API M8/1 TR M17 LINKED	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	200
		DR	CTG, CAL .50 4 API M8/1 TR M17 LINKED	200
		FP	LINK, CTG METALLIC BELT, M9	200
1305A552	CTG CAL .50 BALL M33	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	240
		DR	CTG, CAL .50 BALL M33	240
1305A555	CTG CAL .50 BALL M33 LINKED	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	200
		DR	CTG, CAL .50 4 BALL M33	200
		FP	LINK, CTG METALLIC BELT, M9	200
1305A557	CTG CAL .50 4 BALL M33/1 TR M17 LINKED M9	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	200
		DR	CTG, CAL .50 4 BALL M33/1 TR M17	200
		FP	LINK, CTG METALLIC BELT, M9	200

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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(Continued)

DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1305A559	CTG CAL .50 4 BLNK M1A	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	200
		DR	CTG, CAL .50 4 BLNK M1A	200
		FP	LINK, CTG METALLIC BELT, M2	200
1305A570	CTG CAL .50 TR M17	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	240
		DR	CTG, CAL .50 TR M17	240
1305A572	CTG CAL .50 TR M17	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, STEEL	200
		DR	CTG, CAL .50 TR M17	200
		FP	LINK, CTG METALLIC BELT, M9 OR M2	200
1305A576	CTG CAL .50 4 API M8/1 API-T M20 LINKED	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, STEEL	200
		DR	CTG, CAL .50 4 API M8/1 API-T M20	200
		FP	LINK, CTG METALLIC BELT, M2	200
1305A585	CTG CAL .50 API-T M20 LINKED	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	200
		DR	CTG, CAL .50 API-T M20	200
		FP	LINK, CTG METALLIC BELT, M9	200
1305A598	CTG CAL .50 BLK M1A1 LINKED	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, STEEL	200
		DR	CTG, CAL .50 BLK M1A1	200
		FP	LINK, CTG METALLIC BELT, M9	200
1305A599	CTG CAL .50 BLK M1A1 LINKED	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, BRASS	170
		DR	CTG, CAL .50 BLK M1A1	170
		FP	LINK, CTG METALLIC BELT, M15A2	170
1305A602	CTG CAL .50 PR PL 4/1	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, STEEL	200
		DR	CTG, CAL .50 PR PL 4/1	200
		FP	LINK, CTG METALLIC BELT, M9	200
1305A896	CTG 20MM 4 TP M55A2/1 TP-T M220 LINKED M14A2	FP	BOX, METAL, M548	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, STEEL	100
		DR	CTG, 20MM 4 TP M55A2/1 TP-T M220	100
		FP	LINK, CTG METALLIC BELT, M14A2	100
1305A940	CTG 25MM TPDS-T M910	FP	BOX, METAL, M621	1
		FP	CASE, CTG, FIRED AL ALLOY	30
		DR	CTG, 25MM TPDS-T M910	30
		FP	LINK, CTG METALLIC BELT, M28	30
		FP	SABOT, BASE NLON/ALUMINUM	30
		FP	SEPARATORS, PLASTIC	2
1305A965	CTG 25.4MM DECOY M839	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, AL ALLOY	240
		DR	CTG, 25.4MM DECOY M839	240
1305A976	CTG 25MM TP-T M793	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD	2
		FP	CASE, CTG, FIRED, STEEL	50
		DR	CTG, 25MM TP-T M793	50

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1305AA11	CTG 7.62MM M118 LRA	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD	23
		FP	CASE, CTG, FIRED, BRASS	920
		DR	CTG, 7.62MM M118 LRA	920
1305B118	CTG 30MM TP M788	FP	BOX, METAL, XM592	1
		FP	CASE, CTG, FIRED AL ALLOY	121
		DR	CTG, 30MM TP M788	121
1305B120	CTG 30MM TP M788 LINKED	FP	BOX, METAL	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED, AL ALLOY	144
		DR	CTG, 30MM TP M788	144
		FP	LINK, CTG METALLIC BELT, M29	144
1310B504	CTG 40MM GRN STAR PARA M661	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	44
		DR	CTG, 40MM GRN STAR PARA M661	44
1310B505	CTG 40MM RED STAR PARA M662	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	44
		DR	CTG, 40MM RED STAR PARA M662	44
1310B506	CTG 40MM RED SMK M713	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	44
		DR	CTG, 40MM RED SMK M713	44
1310B508	CTG 40MM GREEN SMK M715	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	44
		DR	CTG, 40MM GREEN SMK M715	44
1310B509	CTG 40MM YLW SMK M716	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	44
		DR	CTG, 40MM YLW SMK M716	44
1310B519	CTG 40MM TP M781	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD	4
		FP	CASING, .38 CAL BRASS AND M212 NYLON	100
		DR	CTG, 40MM TP M781	100
1310B535	CTG 40MM WHT STAR PARA M583A1	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	44
		DR	CTG, 40MM WHT STAR PARA M583A1	44
1310B536	CTG 40MM WHT STAR CLUSTER	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	44
		DR	CTG, 40MM WHT STAR PARA M583A1	44
1310B542	CTG 40MM HEDP M430 LINKED	FP	BOX, METAL, M548	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	48
		DR	CTG, 40MM HEDP M430 LINKED	48
		FP	LINK, CTG METALLIC BELT, M16A2	48
1310B546	CTG 40MM HEDP M433	FP	BANDOLEER, CLOTH	12
		FP	CARTON, FIBERBOARD	12
		FP	CASE, CTG, FIRED AL ALLOY	72
		DR	CTG, 40MM HEDP M433	72

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1310B571	CTG 40MM HE M383 LINKED	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD	1
		FP	CASE, CTG, FIRED AL ALLOY	50
		DR	CTG, 40MM HE M383	50
		FP	LINK, CTG METALLIC BELT, M16A2	50
1310B584	CTG 40MM TP M918 LINKED	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, METAL, M548	1
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	48
		DR	CTG, 40MM TP M918	48
		FP	LINK, CTG METALLIC BELT, M16A2	48
1310B592	CTG 40MM TP M918	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, METAL, M548	1
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CASE, CTG, FIRED AL ALLOY	60
		DR	CTG, 40MM TP M918	60
1310B610	CTG 35MM AND LAU TACTICAL C		NO INFORMATION FOUND TO DATE	0
1310B627	CTG 60MM ILLUM M83A3	FP	BODY TUBING STEEL	9
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD, PA44	9
		DR	CTG, 60MM ILLUM M83A3	9
1310B630	CTG 60MM SMK WP M302A1	FP	BODY TUBING STEEL	9
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD, M576	9
		DR	CTG, 60MM SMK WP M302A1	9
1310B632	CTG 60MM HE M49A4	FP	BODY TUBING STEEL	12
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD, M576	12
		DR	CTG, 60MM HE M49A4	12
1310B642	CTG 60MM HE M720	FP	BOX, METAL, PA70	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD, PA78	16
		DR	CTG, 60MM HE M720	16
1310B646	CTG 60MM SMK WP M722 W/ POINT DETONATING FUZE	FP	BOX, METAL, PA70	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD, PA78	16
		DR	CTG 60MM SMK WP M722 W/ PT DET FUZE	16
1315C045	81MM REFUB KIT F/MB		NO INFORMATION FOUND TO DATE	0
1315C226	CTG 81MM ILLUM M301A3 W/ FUZE	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M252A3	3
		DR	CTG, 81MM ILLUM M301A3 W/ FUZE	3
		FP	STOP, PACKING	2
1315C236	CTG 81MM HE M374A3	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M252A3	3
		DR	CTG, 81MM HE M374A3	3
		FP	PLUG, CLOSING	2
		FP	STOP, PACKING	2
1315C256	CTG 81MM HE M374A2 W/POINT DETONATING FUZE	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M252A3 OR M252A4	3
		DR	CTG, 81MM HE M374A2 W/PD FUZE	3
		FP	STOP, PACKING	3
1315C276	CTG 81MM SMK WP M375A2 W/ POINT DETONATING FUZE	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M252A3 OR M252A4	3
		DR	CTG, 81MM SMK WP M375A2 W/PD FUZE	3
		FP	STOP, PACKING	3
1315C279	CHG PROP M90A1 CHG A & B	TMA	CHARGE, PROPELLING M90A1 (193 GR EA X 2)	

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1315C282	CTG 90MM HEAT M371A1	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M252A3 OR M252A4	2
		FP	CASE, CTG, FIRED AL ALLOY	2
		DR	CTG, 90MM HEAT M371A1	2
1315C379	CTG, 120MM HE XM934	FP	BOX, METAL, PA154	1
		FP	CARTON, FIBERBOARD, PA153	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 120MM HE XM934	2
1315C410	CTG 90MM CAN ANTIPERS M590	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M252A3 OR M252A4	6
		FP	CASE, CTG, FIRED AL ALLOY	6
		DR	CTG, 90MM CAN ANTIPERS M590	6
1315C440	CTG 105MM BLK M395	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M34 SERIES	10
		FP	CASE, CTG, FIRED, COPPER (STEEL/BRASS ALT)	10
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM BLK M395	10
1315C445	CTG 105MM HE M1 W/O FUZE	FP	BOX, WOOD, M105A2	1
		FP	CARTON, FIBERBOARD, PA153	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM HE M1 W/O FUZE	2
1315C449	CTG 105MM ILLUM M314A2	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M105 SERIES	2
		FP	CASE, CTG, FIRED, BRASS (STEEL ALT)	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM ILLUM M314A3	2
		FP	STOP, PACKING	1
1315C452	CTG 105MM SMK HC BE M84 W/ FUZE	FP	BOX, WOOD, M105A2	1
		FP	CARTON, FIBERBOARD, PA153	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM SMK HC BE M84 W/ FUZE	2
1315C454	CTG 105MM SMK WP M60 W/ POINT DETONATING FUZE	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M105 SERIES	2
		FP	CASE, CTG, FIRED, BRASS (STEEL ALT)	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM SMK WP M60 W/ PD FUZE	2
		FP	STOP, PACKING	1
1315C473	CTG 105MM HE M760	FP	BOX, WOOD, M105A3	1
		FP	CARTON, FIBERBOARD, PA153	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM HE M760	2
1315C479	CTG 105MM SMK HC M84A1	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM SMK HC M84A1	2
		FP	STOP, PACKING	1
1315C511	CTG 105MM TP-T M490	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M435	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM TP-T M490	2

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1315C520	CTG 105MM TPDS-T M724A1	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M105 SERIES	2
		FP	CASE, CTG, FIRED, STEEL (BRASS ALT)	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM TPDS-T M724A1	2
		FP	SABOT, BASE NLON/ALUMINUM	2
1315C542	CTG 105MM SMK HC M84A1	FP	BOX, WOOD, M105A3	1
		FP	CARTON, FIBERBOARD, PA153	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 105MM SMK HC M84A1	2
1315C623	CTG 120MM HE XM934	FP	BOX, METAL, PA154	2
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, PA153	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 120MM HE XM934	2
1315C650	CTG 106MM HEAT M344A1	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M316	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 106MM HEAT M344A1	2
1315C651	CTG 106MM HEP-T M346A1	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M314 OR M316	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 106MM HEP-T M346A1	2
1315C660	CTG 106MM APERS-T M581 W/FUZE	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M564	2
		FP	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG, 106MM APERS-T M581 W/FUZE	2
1315C697	CTG 4.2IN HE M329A2 W/O FUZE	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, PA46	2
		FP	CASE, CTG, FIRED AL ALLOY	2
		DR	CTG, 4.2IN HE M329A2 W/O FUZE	2
1315C706	CTG 4.2IN ILLUM M335A2 W/FUZE MT M565	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M251 SERIES	2
		FP	CASE, CTG, FIRED AL ALLOY	2
		FP	CONTAINER, EXTENSION	2
		DR	CTG, 4.2IN ILLUM M335A2 W/FUZE MT M565	2
		FP	DISC, METAL F/FIBER CONTAINER	2
		FP	HOLDER, PROPELLANT	2
		FP	PIN, F/OBTURATING MECHANISM	2
		FP	PLUG, CLOSING, METAL	2
		FP	STOP, PACKING	2
1315C784	CTG 120MM TP-T M831	FP	BOX, METAL, PA116	30
		FP	CASE, CTG, FIRED, STEEL	30
		DR	CTG, 120MM TP-T M831	30
		FP	PALLET, WOOD	1
1315C785	CTG 120MM TPCSDS-T M865	FP	BOX, METAL, PA116	30
		FP	CASE, CTG, FIRED, STEEL	30
		DR	CTG, 120MM TPCSDS-T M865	30
		FP	PALLET, WOOD	1
		FP	SABOT, BASE NLON/ALUMINUM	30

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1315C787	CTG, 120MM HEAT MULTI-PURPOSE-TRACER M830	FP	BOX, METAL, PA116	30
		FP	CASE, CTG, FIRED, PAPER	30
		DR	CTG, 120MM HEAT MP-T M830	30
		FP	PALLET, WOOD	1
1315C788	CTG 120MM, MORTAR HE M57	FP	BOX, METAL, PA154	1
		FP	CARTON, FIBERBOARD, PA153	2
		DR	CASE, CTG, FIRED, STEEL	2
		FP	CASING, LINER, CLOTH	2
		DR	CTG 120MM, MORTAR HE M57	2
1315C790	CTG 120MM ILLUM M91		NO INFORMATION FOUND TO DATE	0
1315C868	CTG 81MM HE M821 W/FUZE M734	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	3
		DR	CASE, CTG, FIRED, STEEL	3
		DR	CTG, 81MM HE M821 W/FUZE M734	3
1315C869	CTG 81MM HE M889 W/FUZE M935	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	3
		DR	CASE, CTG, FIRED, STEEL	3
		DR	CTG 81MM HE M889 W/FUZE M935	3
1315C870	CTG 81MM SMK RACKET PROPELLED M819	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	3
		DR	CASE, CTG, FIRED, STEEL	3
		DR	CTG, 81MM SMK RP M819	3
1315C871	CTG 81MM ILLUM M853A1	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	3
		DR	CASE, CTG, FIRED AL ALLOY	3
		DR	CTG, 81MM ILLUM M853A1	3
1315C876	CTG 81MM TARGET PRACTICE-SHORT RANGE M880 W/ POINT DETONATING FUZE	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	8
		DR	CASE, CTG, FIRED AL ALLOY	8
		DR	CTG, 81MM TP-SR M880 W/ PD FUZE	8
1320C995	ROCKET, AT-4. 84MM HE M136	FP	BOX, WOOD	1
		DR	ROCKET, AT-4. 84MM HE M136	1
1320D505	PROJ 155MM ILLUM M485E1	FP	GROMMET, METAL	8
		FP	GROMMET, TYPE 1 (PLASTIC)	8
		FP	PALLET ASSEMBLY (TOP AND BOTTOM)	1
		FP	PLUG, LIFTING	8
		DR	PROJECTILE, 155MM, ILLUM M485E1	8
1320D510	PROJECTILE 155MM HE CPHD	FP	GROMMET, METAL	6
		FP	GROMMET, TYPE 1 (PLASTIC)	6
		FP	PALLET ASSEMBLY (TOP AND BOTTOM)	1
		FP	PLUG, LIFTING	6
		DR	PROJECTILE, 155MM, SMK WP M825	6
1320D513	PROJ 155MM PRAC M804	FP	GROMMET, METAL	8
		FP	GROMMET, TYPE 1 (PLASTIC)	8
		FP	PALLET ASSEMBLY (TOP AND BOTTOM)	1
		FP	PLUG, LIFTING	8
		DR	PROJECTILE, 155MM PRAC M804	8
1320D528	PROJ 155MM SMK WP M825	FP	GROMMET, METAL	8
		FP	GROMMET, TYPE 1 (PLASTIC)	8
		FP	PALLET ASSEMBLY (TOP AND BOTTOM)	1
		FP	PLUG, LIFTING	8
		DR	PROJECTILE, 155MM, SMK WP M825	8
1320D533	CHG PROP 155MM M119	FP	BAG, CLOTH	30
		FP	BOX, METAL, PA37A1	30
		TMA	CHG PROP 155MM M119 (21LB)	30
		FP	PALLET, WOOD, SPECIALIZED	1

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1320D540	CHG PROP 155MM GB M3	FP	BOX, METAL, M14	84
		TMA	CHARGE, PROPELLING 155MM M3A1 (5 LB NEW EA)	168
		FP	GASKET, RUBBER M14	84
		FP	PALLET, WOOD	1
1320D541	CHG PROP 155MM WB M4A1	FP	BOX, METAL, M13	25
		TMA	CHARGE, PROPELLING 155MM M4A1 (13 LB NEW EA)	25
		FP	GASKET, RUBBER M13	25
		FP	PALLET, WOOD	1
1320D544	PROJ 155MM HE M107	FP	GROMMET, METAL	8
		FP	GROMMET, TYPE 1 (PLASTIC)	8
		FP	PALLET ASSEMBLY (TOP AND BOTTOM)	1
		FP	PLUG, LIFTING	8
		DR	PROJECTILE, 155MM HE M107 STEEL	8
1320D550	PROJ 155MM SMK WP M110A1	FP	GROMMET, METAL	8
		FP	GROMMET, TYPE 1 (PLASTIC)	8
		FP	PALLET ASSEMBLY (TOP AND BOTTOM)	1
		FP	PLUG, LIFTING	8
		DR	PROJECTILE, 155MM, SMK WP M110A1	8
1320D570	CTG 165MM HEPLASTIC M123A1 (COMP) A3	FP	BOX, FIBERBOARD	1
		FP	BOX, WOOD	1
		FP	CASING, CTG, FIRED STEEL	1
		DR	CTG, 165MM HEP M123A1	1
1320D579	PROJECTILE 155MM HE ROCKET ASSISTED M549	FP	GROMMET, METAL	8
		FP	GROMMET, TYPE 1 (PLASTIC)	8
		FP	PALLET ASSEMBLY (TOP AND BOTTOM)	1
		FP	PLUG, LIFTING	8
		DR	PROJECTILE, 155MM HE RA M549	8
1320D590	CTG 165MM TARGET PRACTICE M623	FP	BOX, FIBERBOARD	1
		FP	BOX, WOOD	1
		FP	CASING, CTG, FIRED STEEL	1
		DR	CTG, 165MM HEP M123A1	1
1320D680	PROJ 8IN HE M106 W/O FUZE	FP	GROMMET, METAL	6
		FP	GROMMET, TYPE 1 (PLASTIC)	6
		FP	PALLET ASSEMBLY (TOP AND BOTTOM)	1
		FP	PLUG, LIFTING	6
		DR	PROJECTILE, 8IN HE M106 STEEL	6
1330G815	GREN LNCHR SMK SCREENING RP UNITED KINGDOM L8A3	FP	BOX, METAL, M2A1	144
		FP	CARTON, FIBERBOARD	576
		DR	GRENADE, HAND AND LAUNCHER SMK SCRN L8A3	576
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE, EXPENDED	576
		FP	SAFETY LEVER	576
1330G826	GREN & LAUNCHER SMK INFRA-RED M76	FP	BOX, METAL, M2A1	8
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		FP	CARTON, FIBERBOARD	8
		FP	GRENADE, HAND AND LAUNCHER SMK IR M76	64
		FP	PULL RING, GRENADE, EXPENDED	64
		FP	SAFETY LEVER	64
1330G841	CTG 5.56MM GREN RIFLE M195		NO INFORMATION FOUND TO DATE	0
1330G878	FUZE GREN HAND PRACTICE M228	FP	BAG, BARRIER WATERPROOF	8
		TMA	BODY FUZE, HAND GRENADE, EXPENDED M228	200
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	8
		TMA	FUZE, HAND GRENADE, PRACTICE	200
		FP	PULL RING, GRENADE, EXPENDED	200
		FP	SAFETY LEVER	200

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1330G881	GREN HAND FRAGMENTATION M67	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	30
		TMA	GRENADE, HAND, FRAGMENTATION M67	30
		FP	PULL RING, GRENADE W/ SAFETY PIN	30
		FP	SAFETY LEVER	30
1330G900	GREN HAND INCENDIARY THERMITE 3 AN-M14	FP	BOX, METAL, M415A1	24
		FP	CARTON, FIBERBOARD	720
		TMA	GRENADE, HAND, INCENDIARY TH3 AN-M14	720
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE W/ SAFETY PIN	720
		FP	SAFETY LEVER	720
1330G922	GREN HAND RIOT CS M47 W/FUZE M227	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	20
		TMA	GRENADE, HAND, RIOT CS M47	20
		FP	PULL RING, GRENADE W/ SAFETY PIN	20
		FP	SAFETY LEVER	20
1330G930	GREN HAND SMK HC AN-M8	FP	BOX, WOOD	53
		FP	CARTON, FIBERBOARD	848
		TMA	GRENADE, HAND SMK HC AN-N8	848
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE W/ SAFETY PIN	848
		FP	SAFETY LEVER	848
1330G932	GREN HAND SMK RED M48 W/M227 FUZE	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	20
		TMA	GRENADE, HAND, SMK RED M48	20
		FP	PULL RING, GRENADE W/ SAFETY PIN	20
		FP	SAFETY LEVER	20
1330G940	GREN HAND SMK GRN M18	FP	BOX, WOOD	53
		FP	CARTON, FIBERBOARD	848
		TMA	GRENADE, HAND SMK GRN M18	848
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE W/ SAFETY PIN	848
		FP	SAFETY LEVER	848
1330G945	GREN HAND SMK YLW M18	FP	BOX, WOOD	53
		FP	CARTON, FIBERBOARD	848
		TMA	GRENADE, HAND SMK YLW M18	848
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE W/ SAFETY PIN	848
		FP	SAFETY LEVER	848
1330G950	GREN HAND SMK RED M18	FP	BOX, WOOD	53
		FP	CARTON, FIBERBOARD	848
		TMA	GRENADE, HAND RED M18	848
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE W/SAFETY PIN	848
		FP	SAFETY LEVER	848
1330G955	GREN HAND SMK VIOLET M18	FP	BOX, WOOD	53
		FP	CARTON, FIBERBOARD	848
		TMA	GRENADE, HAND SMK VIO M18	848
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE W/ SAFETY PIN	848
		FP	SAFETY LEVER	848
1330G963	GREN HAND RIOT CS M7A3	FP	BOX, METAL	53
		TMA	GRENADE, HAND AND LAUNCHER	64
		TMA	GRENADE, HAND RIOT CS M7A3	848
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE W/SAFETY PIN	848
		FP	SAFETY LEVER	848

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1330G978	GREN LAU SMK SIMULANT SCREENING M82	FP	BOX, WOOD	64
		FP	CARTON, FIBERBOARD	384
		DR	GRENADE, HAND AND LAUNCHER SMK SCREEN M82	384
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE, EXPENDED	384
		FP	SAFETY LEVER	384
1330G982	GRENADE HAND SMK HC PRAC AN-M8	FP	BOX, WOOD	53
		FP	CARTON, FIBERBOARD	848
		TMA	GRENADE, HAND SMK HC PRAC AN-N8	848
		FP	PALLET, WOOD	1
		FP	PULL RING, GRENADE W/ SAFETY PIN	848
		FP	SAFETY LEVER	848
1340H108	ROCKET POD 298MM PRAC M28 MULTI-LAUNCH ROCKET SYSTEM	FP	ROCKET POD, MLRS, 298MM PRACTICE	1
		DR	ROCKET, MLRS, 298MM PRACTICE	6
1340H163	ROCKET HE 2.75IN W/WARHEAD M151 & FUZE M423	FP	BOX, WOOD, PA30	1
		DR	RCKT, HE 2.75IN W/WHD M151 & FUZE M423	4
		DR	RCKT, MOTOR MK66 MOD 1 (W/ROCKET)	4
1340H459	ROCKET ANTIPERSONNEL 2.75IN W/WARHEAD WARHEAD -DISPENSING UNIT 4A/A	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	4
		DR	RCKT APERS 2.75IN W/WHD WDU 4A/A	4
		DR	RCKT, MOTOR MK40 MOD 3 (W/ ROCKET)	4
1340H464	RCKT HE 2.75IN W/WHD M261 & FUZE M439	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	4
		DR	RCKT, HE 2.75IN W/WHD M261 & FUZE M439	4
		DR	RCKT, MOTOR MK66 MOD 1 (W/ ROCKET)	4
1340H557	RCKT HE 66MM AT M72/M72A3	FP	ASSEMBLY, STRAP F/ CARTON	3
		FP	BAG, BARRIER WATERPROOF	3
		FP	BOX, CARDBOARD	5
		FP	BOX, WOOD, WIREBOUND W/ENDS	3
		FP	LAUNCHER, ROCKET, M72A2, EXPENDED	15
		FP	PRIMER BLOCK, EXPENDED	15
		DR	ROCKET, LAW 66MM M72A3	15
		FP	SADDLE, FRONT, WOOD	3
		FP	SADDLE, REAR, WOOD	3
1340H708	RCKT PRAC 35MM SUBCAL M73	FP	BOX, WOOD, WIREBOUND W/ENDS	6
		FP	CARTON, FIBERBOARD	18
		FP	CLIP, SAFETY	540
		FP	PALLET, WOOD	1
		FP	PRIMER BLOCK, EXPENDED	540
		DR	ROCKET, PRACTICE 35MM SUBCALIBER	540
1340H974	RCKT PRAC 2.75IN W/WHD M267 & FUZE M439	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	4
		DR	RCKT PRAC 2.75IN W/WHD M267 & FUZE M439	4
		DR	RCKT, MOTOR MK66 MOD 1 (W/ ROCKET)	4
1340H975	RCKT PRAC SMK 2.75IN W/WHD M274	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	4
		DR	RCKT PRAC 2.75IN W/WHD M267 & FUZE M439	4
		DR	RCKT, MOTOR MK66 MOD 3 (W/ ROCKET)	4
1340J143	MTR RKT 5 IN (MICLIC)	FP	BOX, WOOD, WATERPROOF	8
		FP	CABLE ASSEMBLY STEEL	8
		FP	PALLET, WOOD, SPECIALIZED	1
		DR	ROCKET, MOTOR 5IN AL ALLOY	8
1345K002	ACT AT MINE MI	DR	ACTIVATOR, AT PRAC M1 STEEL	3240
		FP	BOX, METAL	3240
		FP	BOX, WOOD	18
		FP	PALLET, WOOD	1

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1345K010	BRSTR INCEND FIELD M4	FP	BOX, WOOD	1
		TMA	BURSTER, INCENDIARY M4	20
		FP	CONTAINER, METAL	20
1345K022	DISP & MINE GRND M131	TMA	CASE, MOPMS, MULTI COMP	6
		FP	PALLET, WOOD	1
1345K030	PRIMER IGNITER FUZE M10A1	FP	BOX, WOOD	1
		TMA	PRIMER, FUZE IGNITOR M10A1 AL ALLOY	300
1345K040	CHG SPOTTING F/MINE AP PRAC M8	FP	BOX, WOOD	1
		TMA	CHARGE, SPOTTING AP PRAC M8 STEEL AND BRASS	300
1345K042	CANISTER MINE PRAC M88	FP	BOX, WOOD	1
		FP	CANISTER ASSEMBLY AL ALLOY AND S.STEEL COMP.	2
1345K051	FUZE MINE AT PRAC M604	FP	BAG, BARRIER WATERPROOF	27
		FP	BOX, WOOD	27
		FP	CONTAINER, METAL	4860
		TMA	FUZE, MINE AT PRAC M604 TIN ALLOY (STEEL ALT)	4860
		FP	PALLET, WOOD	1
1345K055	FUZE MINE COMB M10A1	FP	BAG, BARRIER WATERPROOF	53
		FP	BOX, WOOD	53
		FP	CARTON, FIBERBOARD	954
		TMA	FUZE, MINE AT M10A1 TIN ALLOY (AL ALLOY ALT)	9540
		FP	PALLET, WOOD	1
1345K058	FUZE MINE M605	FP	BOX, METAL, M19A1	4
		FP	BOX, WOOD	1
		TMA	FUZE, MINE M605 TIN ALLOY (AL ALLOY ALT)	240
1345K068	ADAPTER & FUZE M624	DR	ADAPTER & FUZE M624	12
		FP	BOX, METAL, M19A1	4
		FP	BOX, WOOD	1
1345K092	MINE APERS M16A1 OR M16A2	FP	BOX, METAL	4
		FP	BOX, WOOD	1
		TMA	MINE, APERS M16A1 OR M16A2	4
		FP	SPOOL, TRIP WIRE STEEL	16
		FP	WRENCH, ARMING M25 STEEL	4
1345K143	MINE APERS M18A1 W/ACCESSORIES	FP	BANDOLEER, CLOTH, M7	192
		FP	BLASTING DEVICE, M576	192
		FP	BOX, WOOD	32
		TMA	CAP, BLASTING, M46	384
		TMA	MINE, AP M18A1	192
		FP	PALLET, WOOD	1
		FP	TEST SET ELECTRICAL, M40	32
1345K180	MINE AT HEAVY M15	TMA	ACTIVATOR, M1	30
		TMA	ASSEMBLY, AT MINE STEEL	30
		FP	BOX, METAL F/ ACTIVATOR	30
		FP	BOX, METAL F/ FUZE	30
		FP	BOX, WOOD	30
		TMA	FUZE, M603	30
		TMA	MINE, AT HEAVY M15	30
		FP	PALLET, WOOD	1
		FP	WRENCH, ARMING M20	30
1345K181	MINE AT HEAVY M21	FP	BAG, BARRIER WATERPROOF	24
		TMA	BOOSTER, M1204	48
		FP	BOX, WOOD, WIREBOUND W/ENDS	12
		TMA	FUZE, M607	48
		TMA	MINE, AT HE HEAVY M21	48
		FP	PALLET, WOOD	1
		FP	WRENCH, ARMING M26	24

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1345K250	MINE AT HEAVY M19 NON METALLIC	TMA	ACTIVATOR, M2	48
		FP	BAG, BARRIER WATERPROOF	24
		FP	BOX, WOOD	24
		TMA	FUZE, M606	48
		TMA	MINE, AT HEAVY M19	48
		FP	PALLET, WOOD	1
		FP	WRENCH, ARMING	24
1365K765	RIOT CNTRL AGENT CS	FP	BOX, METAL	1
		TMA	RIOT CONTROL AGENT, CS CAPSULE	50
1365K768	CHEMICAL AGENT, CS-1	FP	BOX, WOOD	1
		FP	CONTAINER, FIBERBOARD (8LB LIQUID)	5
1365K866	SMK POT HC 30LB ABC-M5	FP	BOX, WOOD	1
		TMA	SMOKE POT, M5 GROUND TYPE	1
1365K867	SMK POT FLOATING TYPE HC M4A2	FP	BOX, WOOD	1
		TMA	SMOKE POT, M4A2, FLOATING TYPE	1
1365K917	THICKENING COMPND M4	FP	BOX, WOOD	1
		TMA	PAIL, THICKENING COMPUND M4	16
1370L116	KIT FLARE PERS DIST	FP	BAG, BARRIER WATERPROOF	4
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD, M185	4
		TMA	PROJECTOR, XM20	240
		TMA	SIGNAL KIT, PERSONAL DISTRESS, RED XM185	840
1370L119	SIG KIT FOLIAGE PENE		NO INFORMATION FOUND TO DATE	0
1370L185	RCKT POD 298MM PRAC M28 MLRS	FP	ROCKET POD, MLRS, 298MM PRACTICE	1
		DR	ROCKET, MLRS, 298MM PRACTICE	6
1370L305	SIGNAL ILLUM GRND PARA GRN STAR M195	TMA	ASSEMBLY, CONTAINER STAINLESS STEEL	36
		FP	BOX, WOOD	1
1370L306	SIGNAL ILLUM GRND M158	TMA	ASSEMBLY, CONTAINER STAINLESS STEEL	36
		FP	BOX, WOOD	1
1370L307	SIGNAL ILLUM GRND M159	TMA	ASSEMBLY, CONTAINER STAINLESS STEEL	36
		FP	BOX, WOOD	1
1370L311	SIGNAL ILLUM GRND RED STAR PARA M126	TMA	ASSEMBLY, CONTAINER STAINLESS STEEL	36
		FP	BOX, WOOD	1
1370L312	SIGNAL ILLUM GRND M127	TMA	ASSEMBLY, CONTAINER STAINLESS STEEL	36
		FP	BOX, WOOD	1
1370L314	SIGNAL ILLUM GRND M125A1	TMA	ASSEMBLY, CONTAINER STAINLESS STEEL	36
		FP	BOX, WOOD	1
1370L366	SIMULATOR PROJ AIR BURST M74A1	FP	BOX, WOOD	1
		FP	CONTAINER, FIBERBOARD	10
		FP	SIMULATOR, PROJ AIR BURST M74A1	80
1370L367	ATWESS (MILES)	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	24
		DR	CTG, PRACTICE TANK SIMULATOR	240
1370L410	FLARE ACFT COUNTERMEASURE M206	DR	CASING, CTG, AL ALLOY	1
		DR	FLARE, ACFT COUNTERMEASURE, M206	1
1370L477	FLARE, IR TRK MK33	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		DR	CTG, FLARE MK 33 STEEL	50
1370L495	FLARE SURF TRIP M49	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	32
		FP	COIL STEEL AND ROOFING NAILS (2)	32
		TMA	CTG, FLARE, TRIP M49 STEEL	32
		FP	MOUNTING BRACKET ASSEMBLY, STEEL	32
1370L508	FUSEE SIGNAL WARNS RR RED	TMA	ASSEMBLY, CONTAINER PAPER	40
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	4
		TMA	STRIKER CAP	40
1370L554	SEA FLARE RED MK25	TMA	NO INFORMATION FOUND TO DATE	0
1370L592	TOW BLAST SIMULATOR		NO INFORMATION FOUND TO DATE	0

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

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DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1370L594	SIMULATOR PROJ GRND BURST M115A2	FP	BAG, BARRIER WATERPROOF	25
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	25
		TMA	SIMULATOR, PROJECTILE GRND BURST M115A2	25
1370L595	SIMULATOR PROJ AIRBURST LIQ	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	30
		TMA	SIMULATOR, PROJECTILE AIRBURST LIQUID	30
1370L596	SIMULATOR FLASH ART M110	TMA	ASSEMBLY, SIMULATOR M110 PLASTIC	30
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	30
1370L598	SIMULATOR BOOBY TRAP FLASH M117	TMA	ASSEMBLY, SIMULATOR M117 PAPER	2700
		FP	BAG, BARRIER WATERPROOF	54
		FP	BOX, WOOD	18
		FP	PALLET, WOOD	1
1370L599	SIMULATOR BOOBY TRAP ILLUM M118	TMA	ASSEMBLY, SIMULATOR M118 PAPER	2700
		FP	BAG, BARRIER WATERPROOF	54
		FP	BOX, WOOD	18
		FP	PALLET, WOOD	1
1370L600	SIMULATOR BOOBY TRAP M119 WHISTLE	TMA	ASSEMBLY, SIMULATOR M119 PAPER	2700
		FP	BAG, BARRIER WATERPROOF	54
		FP	BOX, WOOD	18
		FP	PALLET, WOOD	1
1370L601	SIMULATOR HAND GREN M116A1	TMA	ASSEMBLY, SIMULATOR M116A1 PAPER	2700
		FP	BAG, BARRIER WATERPROOF	54
		FP	BOX, WOOD	18
		FP	PALLET, WOOD	1
1370L602	SIMULATOR FLASH ARTY M21	TMA	ASSEMBLY, SIMULATOR M21 PAPER POLYETHYLENE PLASTIC	1944
		FP	BAG, BARRIER WATERPROOF	216
		FP	BOX, WOOD	12
		FP	CARTON, FIBERBOARD	216
		FP	PALLET, WOOD	1
1370L709	SIMULATOR TGT-HIT XM26	FP	BOX, CARDBOARD	9
		FP	BOX, WOOD	1
		TMA	SIMULATOR, TGT-HIT XM26	162
1370L715	SIMULATOR AT GGM MS XM27	FP	BOX, WOOD	1
		TMA	SIMULATOR, AT GGM MS XM27	12
1370L720	SIMULATOR TARGET KILL XM26	FP	BOX, FIBERBOARD	2
		FP	BOX, WOOD	1
		TMA	SIMULATOR, TGT-HIT XM26	60
1375M023	CHG DEMOLITION M112	FP	ASSEMBLY, POLYESTER/PLASTIC	30
		FP	BOX, WOOD	1
		TMA	CHARGE, DEMOLITION BLOCK 1-1/4LB C-4	30
1375M024	CHG DEMOLITION M118	FP	BOX, WOOD, WIREBOUND W/ENDS	1
		TMA	CHARGE, DEMOLITION BLOCK 2LB PETN CELLOPHANE MYLAR	20
1375M028	DEMOLITION KIT BANGALORE TORPEDO M1A2	FP	BOX, WOOD, M1A2	1
		TMA	DEMOLITION KIT, BANGELORE TORPEDO M1A1	1
1375M030	CHG DEMOLITION BLOCK TNT 1/4 LB	FP	ASSEMBLY, POLYETHYLENE WRAPPER	50
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	200
		TMA	CHARGE, DEMOLITION BLOCK 1/4LB TNT	200
1375M032	CHG DEMOLITION BLOCK TNT 1 LB	FP	ASSEMBLY, POLYETHYLENE WRAPPER	50
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	50
		TMA	CHARGE, DEMOLITION BLOCK 1LB TNT	50
1375M039	CHG DEMOLITION 40 LB CRATERING	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, WOOD	1
		TMA	CHARGE, DEMOLITION BLOCK 40LB CRATERING	1

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

Appendix A

(Continued)

DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1375M060	CHARGE DEMOLITION ROLL	FP	BAG, BARRIER WATERPROOF	4
		FP	BOX, WOOD	1
		TMA	CHARGE, DEMOLITION BLOCK 25LB H-6	4
		FP	CONTAINER, PLASTIC	4
1375M130	CAP BLASTING ELECTRIC M6	FP	BAG, BARRIER WATERPROOF	10
		FP	BOX, WOOD	1
		TMA	CAP, BLASTING NONELEC W/ WIRE (12 FT) M7	900
		FP	CARTON, FIBERBOARD	10
1375M131	CAP BLASTING NONELECTRIC M7	FP	BAG, BARRIER WATERPROOF	50
		FP	BOX, PAPERBOARD	50
		FP	BOX, WOOD	1
		TMA	CAP, BLASTING	500
		FP	CARTON, FIBERBOARD	10
1375M241	DESTRUCTOR HE UNIVERSAL M10	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	50
		TMA	CTG, DESTRUCTOR, HE UNIVERSAL M10 STEEL AND BRASS	50
1375M327	COUPLING BASE W/PRIMER	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	50
		DR	CTG, COUPLING BASE W/ PRIMER M27 TIN ALLOY	500
1375M420	CHG DEMOLITION SHAPED M2A3 15LB	TMA	ASSEMBLY, CHARGE MOLDED FIBER	3
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	3
		TMA	CHARGE, DEMOLITION SHAPED 15LB M2A3	3
1375M421	CHG DEMOLITION SHAPED 40 L	TMA	ASSEMBLY, CHARGE STEEL	1
		FP	BOX, WOOD	1
		TMA	CHARGE, DEMOLITION SHAPED 40LB M3	1
1375M456	CORD DETONATION REINFORCED	FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	3
		TMA	CORD, DETONATING REINFORCED PLASTIC 3000 FT	3
		FP	SPOOL	3
1375M591	MILITARY DYNAMITE M1	TMA	ADAPTER, PRIMING, M144	12
		FP	BOX, WOOD	1
		TMA	CHARGE, DEMOLITION DYNAMITE M1	48
		TMA	CTG, PAPER (MANILLIA PAPER)	48
1375M626	FIRING DEVICE DEMOLITION M1A1	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	10
		TMA	FIRING DEVICE DEMOLITION M1A1	350
1375M627	FIRING DEVICE PRESSURE RELEASE M5	TMA	ASSEMBLY, FIRING DEVICE DEMOLITION M5 STEEL	19
		FP	BOX, WOOD	1
		FP	CARTON, PAPERBOARD	19
1375M670	FUSE BLASTING TIME M700 4000 FT	FP	BOX, METAL	8
		FP	BOX, WOOD	1
		TMA	FUZE, BLASTING TIME M700 PLASTIC/YARN 100 FT EA	400
1375M757	CHG DEMOLITION M183	FP	BOX, WOOD	1
		FP	CARRYING CASE, CLOTH M185	2
		TMA	CHARGE, ASSEMBLY DEMOLITION M183	2
1375M766	IGN TIME BLASTING M60	FP	BOX, PLASTIC	60
		FP	BOX, WOOD	1
		FP	IGNITER, TIME BLASTING FUZE, M2	300
1375M832	CHG DEMOLITION SHAPED MK74-1	FP	BOX, WOOD	1
		TMA	CHARGE, ASSEMBLY PLASTIC, PHENOLIC OR.COPPER	4
		TMA	CHARGE, DEMOLITION SHAPED MK74-1	4

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

Appendix A

(Continued)

DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1375M833	CHG DEMOLITION PRAC SHAPED	FP	BOX, WOOD	1
		TMA	CHARGE, ASSEMBLY PLASTIC, PHENOLIC OR.COPPER	4
		TMA	CHARGE, DEMOLITION SHAPED	4
1375M913	LINE CHG (MICLIC)	TMA	CHARGE, LINK C-4 (MICLIC)	1
		FP	PALLET, COVER, METAL	1
		FP	PALLET, METAL	1
1375M914	LINE CHARGE INERT MI	TMA	CHARGE, LINE INERT (MICLIC)	1
		FP	PALLET, COVER, METAL	1
		FP	PALLET, METAL	1
1375M965	CHG, DEMO CRATERING, M180	FP	BOX, WOOD	1
		TMA	CHG, DEMOLITION CRATERING, M180	1
1375MD73	CTG IMPULSE M796	FP	BOX, FIBERBOARD	1
		FP	BOX, METAL	6
		FP	CASE, CTG FIRED AL ALLOY	360
		DR	CTG, IMPULSE M796	360
1375ML03	FIRING DEVICE DEMOLITION, M142	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		TMA	FIRING DEVICE, DEMOLITION, M142	38
		FP	CONTAINER, FIBERBOARD	38
1375ML04	CUTTER HE MK23-0	FP	BOX, METAL, M2A1	1
		DR	CHARGE, CUTTER	6
1375ML05	CHG CUTTER HE MK24-0	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD, WIREBOUND W/ENDS	1
		TMA	CHG CUTTER HE MK24-0	4
1375ML09	CHG DEMO FLEXIBLE LINEAR SHAPED CHARGE 20 GRAIN	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, WOOD	1
		TMA	FLEXIBLE LINEAR SHAPED CHARGE CONTAINER LEAD ANTIMONY	6
1375ML15	CHG DEMO FLEXIBLE LINEAR SHAPED CHARGE	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, WOOD	3
		TMA	CHG, DEMO FLEXIBLE LINEAR SHAPED CHARGE	3
1375ML45	HOLDER CAP BLASTING M9	TMA	CLAMPING DEVICE, PLASTIC (F/SHOCK TUBE)	1
1375ML47	CAP BLASTING NONELEC M11	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	6
		TMA	DETONATOR AL	60
		TMA	SHOCK TUBE 30 FT SURLYN COVERED POLYETHYLENE	60
1375MN02	CAP BLASTING NONELEC M12	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	6
		TMA	DETONATOR AL	48
		TMA	SHOCK TUBE 500 FT SURLYN COVERED POLYETHYLENE	48
		FP	SPOOL, METAL	48
1375MN03	CAP BLASTING NONELEC M13	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	6
		TMA	DETONATOR AL	24
		TMA	SHOCK TUBE 1000 FT SURLYN COVERED POLYETHYLENE	24
		FP	SPOOL, METAL	24
1375MN06	CAP BLASTING NONELEC DELAY M14	FP	BOX, WOOD	1
		TMA	DETONATOR AL WITH 7.5 FT TIME FUSE CLOTH/PLASTIC	60
1375MN07	CAP BLASTING NONELEC DELAY M15	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	4
		TMA	DETONATOR AL W/ 70 FT TIME FUSE SHOCK TUBE	120

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

Appendix A

(Continued)

DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1375MN08	IGNITER TIME BLASTING FUSE M81	FP	BAG, BARRIER WATERPROOF	6
		FP	BOX, WOOD	1
		FP	CARTON, PAPERBOARD	6
		FP	IGNITER DEVICE PLASTIC	300
1375MN11	FD DTD M147 48/BX		NO INFORMATION FOUND TO DATE	0
1375MN35	CAP BLASTING NONELEC M12	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	6
		TMA	DETONATOR AL	48
		TMA	SHOCK TUBE 500 FT SURLYN COVERED POLYETHYLENE	48
		FP	SPOOL, METAL	48
1375MN36	CAP BLASTING NONELECT M11	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	6
		TMA	DETONATOR AL	60
		TMA	SHOCK TUBE 30 FT SURLYN COVERED POLYETHYLENE	60
1375MN37	CAP BLASTING NONELEC DELAY M14	FP	BOX, WOOD	1
		TMA	DETONATOR AL WITH 7.5 FT TIME FUSE CLOTH/PLASTIC	60
1375MN38	CAP BLASTING NONELEC DELAY M15	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	4
		TMA	DETONATOR AL WITH 70 FT TIME FUSE SHOCK TUBE	120
1377M500	CUTTER REEF LINE M21	FP	BAG, BARRIER WATERPROOF	1
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	80
		DR	CTG, CUTTER REEF LINE	80
1377M842	FIRING DEVICE DEMO M1 PRESSURE RELEASE	FP	BOX, WOOD	1
		FP	CARTON, CARDBOARD	10
		FP	FIRING DEVICE DEMOLITION M1A1	500
1385M174	CTG CAL .50 BLK ELECT MK209		NO INFORMATION FOUND TO DATE	0
1390N278	FUZE MECHANICAL TIME SUPERQUICK M564	FP	BOTTOM SUPPORT	1
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		DR	FUZE, MECHANICAL TIME M564 PLASTIC/STAINLESS STEEL	16
		FP	TOP SUPPORT PLASTIC	1
1390N285	FUZE MECHANICAL TIME SUPERQUICK M577	FP	BOTTOM SUPPORT	1
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		DR	FUZE, MTSQ M577 STAINLESS STEEL	16
		FP	TOP SUPPORT PLASTIC	1
1390N286	FUZE MECHANICAL TIME SUPERQUICK M582	FP	BOTTOM SUPPORT	1
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		DR	FUZE, MTSO M582 STAINLESS STEEL	16
		FP	TOP SUPPORT PLASTIC	1
1390N335	FUZE POINT DETONATING M557	FP	BOTTOM SUPPORT	1
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		DR	FUZE, POINT DETONATING M557 MULTI MATERIALS	16
		FP	TOP SUPPORT PLASTIC	1
1390N340	FUZE POINT DETONATING M739	FP	BOTTOM SUPPORT	1
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		DR	FUZE, POINT DETONATING M739 MULTI MATERIALS	16
		FP	TOP SUPPORT PLASTIC	1

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

Appendix A

(Continued)

DoDAC	Nomenclature	Solid Waste Location	Packing Material	Quantity per Unit of Issue
1390N402	FUZE PROXIMITY M532	FP	BOTTOM SUPPORT	1
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		DR	FUZE, PROXIMITY M532 MULTI MATERIALS	16
		FP	TOP SUPPORT PLASTIC	1
1390N464	FUZE PROXIMITY M732	FP	BOTTOM SUPPORT	1
		FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		DR	FUZE, PROXIMITY M732 MULTI MATERIALS	16
		FP	TOP SUPPORT PLASTIC	1
1390N523	PRIMER PERCUSSION M82	FP	BAG, BARRIER WATERPROOF	25
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	25
		FP	CASE, CTG, FIRED BRASS	500
		FP	PRIMER, PERCUSSION M82	500
1390N525	PRIMER PERCUSSION MK2A4	FP	BOX, METAL, M2A1	2
		FP	BOX, WOOD	1
		FP	CARTON, FIBERBOARD	10
		FP	CASE, CTG, FIRED BRASS	500
		FP	PRIMER, PERCUSSION M82	500
1410PB94	TOW HEAT	FP	CRATE, WOOD	1
		DR	GM, TOW, SURF/ATK, BGM-71A-2	1
1410PB96	TOW PRAC (INERT)	FP	CRATE, WOOD	1
		DR	GM, TOW, TP, BTM-71A-2	1
1410PD68	HELLFIRE AGM-114C MI		NO INFORMATION FOUND TO DATE	0
1410PV04	TOW PRACTICE		NO INFORMATION FOUND TO DATE	0
1427PL23	DRAGON HEAT	FP	CRATE, WOOD	1
		DR	GM AND LAUNCHER, DRAGON, M222 HEAT	1
1427PL85	STINGER LAUNCH SIMULATE		NO INFORMATION FOUND TO DATE	0
1427PL90	STINGER	FP	CRATE, WOOD	1
		DR	GM, STINGER, BASIC, MSL RND	1
1427PL93	STINGER	FP	CRATE, WOOD	1
		DR	GM, STINGER, BASIC, WPN RND PARTIAL	1
1315D445	PROJECTILE, 155MM SMK ILLUM	TMA	PROJECTILE, 155MM SMK ILLUM	
1315C276	CTG, 75MM BLNK M120 SALUTING ROUND	TMA	CASE, CTG, FIRED, AL ALLOY	

DR = Downrange
FP = Firing Point
IP = Consumed In Process
TMA = Training and Maneuver Area

Table 2-1. Packaging Materials	Table 2-2. Downrange Items Eliminated	Table 2-3. Firing Point/Training Maneuver Area Eliminated	Table 2-4. Residues Sampled.

Appendix B

SAMPLE COLLECTION RECORD

AEC Range Scrap (Firing Point) Study
Sample Collection Record

The following information should be recorded for each type of scrap item collected:

- Date, time, and location (installation) of sample:
  ____
  ____
- Sampling personnel: ____
  ____
- Sample description:

Muntions Item:		**NSN: DoDAC:**		**Scrap Item:**	
Sample ID	**COC#**	**Sample ID**	**COC#**	**Sample ID**	**COC#**

*Use Continuation Sheet if more information is required.

- Detailed sample location (e.g., ASP residue yard or policed from Range 1A):
  ____
  ____
- How the item was stored (outdoor, open container, closed container, indoor, etc.), if applicable:
  ____
  ____
- Estimated days since the item was expended and scrap created: ____________________

  (Should be as close to the date used as possible – within 5 days of usage)
- Estimated days since the item has been stored at location, if applicable: ______________
- Description of the weather conditions that the items has been exposed to while in storage, if applicable: ____
  ____
  ____
- Description of other items stored/contained with this group (mixed storage), if applicable:
  ____
  ____
- Description of packaging (e.g., individually containerized):
  ____
- Shipping date: ____
- Other remarks:

Appendix C

SOLID FLUX ANALYSIS

SOLID FLUX ANALYSIS FOR CONSTITUENTS SUSPECTED IN RANGE SCRAP ITEMS

Solid flux analysis using Stefan's Law

Consider the isothermal evaporation from a solid residue on the surface of a brass casing and the subsequent diffusion through a stagnant air layer. Assume the following:

1. Assume a new surface was exposed during the milling/sawing process.
2. Assume the evaporation rate does not decrease during milling.
3. Assume the rate is not limited by diffusion through or adsorption onto the particles.
4. Assume the total pressure remains constant.
5. Assume the system is at steady state.

Basis of relationship: a bulk mass movement upward of a chemical with a velocity just large enough to balance the diffusion of air downward. Note that this is a very conservative analysis because the resistance to diffusing within a particle is likely to be much greater than the theoretical evaporation of a chemical from a particle surface.

The mass flow of the chemical from the residue was estimated using Stefan's Law.

Stefan's Law:

$$m = \frac{DpM_wA}{RT\,(x_2 - x_1)}\ln\left(\frac{p}{p_1}\right)$$

Where:

m = mass flux (g/sec)
D = diffusivity (cm^2/sec)
p = total pressure (mm Hg)
M_w = molecular weight (g/mol)
A = area (cm^2)
R = ideal gas constant
T = temperature (K)
x_2-x_1 = length of casing (cm)
Note: Half the length was used due to the fact the casing was cut in half.
p_1 = total pressure minus the partial pressure of substance (mm Hg).

Estimated Rate of Loss for Contaminants on Range Scrap Items

To determine an acceptable temperature range for performing size reduction on range scrap items, the list of munitions items, as well as the associated chemicals/constituents, were compared to the organic compounds listed on the analysis to be performed (SW-846 8270 for semivolatile compounds and SW-846 8330 for explosive compounds). A common munitions constituent (for smokes), hexachloroethane, is one of the more volatile compounds listed in the 8270 analysis. Nitroglycerin and dinitrotoluene are common constituents found in the primer and propellant mixes of projectiles and are two of the more volatile compounds listed in the 8330 analysis.

The following spreadsheet summarizes the solid flux analysis using Stephan's Law for hexachloroethane, nitroglycerin, and dinitrotoluene as they are found in the HC AN-M8 Smoke Hand Grenade (DoDAC 1330G930), 40 MM Cartridge Case (DoDAC 1310B506), and the 7.62 MM Cartridge Case (DoDAC 1305A112), respectively. The data and characteristics of the munitions items used in the analysis are also summarized on the spreadsheet.

The results of this analysis indicate that the rate of loss of material will be insignificant (less than 0.00012 mg/sec) while processing typical range scrap materials at temperatures of 60°C (140°F) or less.

Solid Flux Analysis Using Stefan's Law for Compounds Suspected in Range Scrap Items

Compound	Temp (°C)	Diffusivity (cm^2/s)	Vapor Pressure[a] (mm Hg)	Mole Fraction	Estimated Vapor Pressure[b] (mm Hg)	MW	Temp (°K)	Total Pressure (mm Hg)	Maximum Evaporation Rate ($g/sec/cm^2$)	Case Diameter (cm)	Case 1/2 Length[c] (cm)	Rate of Loss (μg/sec)	Amt Lost in 5 sec (μg)
Hexachloroethane[d]	20	0.0025	0.52	0.188	0.09776	237	293	760	3.17E-09	6	7.3	0.0123	0.0614
	60	0.0025	5.82	0.188	1.09416	237	333	760	3.12E-08	6	7.3	0.1209	0.6047
Nitroglycerin[e]	20	0.0211	0.0018	0.38	0.00068	227	293	760	1.79E-10	4	2.65	0.0008	0.0042
	60	0.0211	0.031	0.38	0.01178	227	333	760	2.72E-09	4	2.65	0.0129	0.0644
2,4-Dintrotoluene[f]	20	0.203	0.0055	0.0568	0.00031	182	293	760	6.32E-10	0.762	2.5	0.0001	0.0006
	60	0.203	0.088	0.0568	0.00500	182	333	760	8.89E-09	0.762	2.5	0.0016	0.0081

[a] Vapor pressure of a pure substance.
[b] Vapor pressure of the chemical in a mixture.
[c] The case length is shown as 1/2 length since the case will be cut in half.
[d] Hexachloroethane found in HC AN-M8 Smoke Hand Grenade.
[e] Nitroglycerin found in 40mm Red Smoke M713.
[f] 2,4-Dintrotoluene found in 7.62mm Cartridge Propellant, Propellant Mix SR 8231.

Note: Diffusivity coefficients were found in CHEMDAT8, EPA software available on the web.
Note: Vapor pressures were extrapolated from Perry's Chemical Engineering Handbook.

Data and Characteristics of the Munitions Items Analyzed

Chemical Name	Detection Limit (μg/kg)[a]	Amount at DL (μg)[b]	Mol Fraction	Length (cm)	Dimensions L/2 (cm)[c]	Diameter (cm)
HC AN-M8 Hand Smoke Grenade, Canister:						
Hexachloroethane	330	56	0.188	14.605	7.3025	6
40mm Red Smoke M713, Cartridge Case:						
Nitroglycerine	250	19	0.38	5.3	2.65	4
7.62mm, Cartridge Case:						
DNT	250	3.802	0.0568	5.007	2.5035	0.762

[a]Analytical laboratory's detection limit for the applicable method.
[b]This amount equates to the amount of the compound required to result in a concentration equal to the detection limit based on the weight of the item.
[c]L/2 is used for the length in the calculation because the cartridge case will be cut in half.

Appendix D

SAMPLE PREPARATION RECORD

AEC RANGE SCRAP (FIRING POINT) STUDY
SAMPLE PREPARATION RECORD

The following information shall be recorded for each sample prepared for analysis.

- Date: __________ Personnel: ____
- Project Team Sample ID: __________ COC#: __________
- Requested Analyses (check one):

Analyses	Minimum Sample Quantity
TCLP metals, SVOCs, and Explosives	200 Grams
TCLP metals and SVOCs	160 Grams
TCLP metals including mercury and SVOCs	160 Grams
Add matrix spike and matrix spike duplicate	Triple the applicable quantity above
Other:	Specify:

- Sample Preparation:

Field ID	Lab ID	Item Weight	Field ID	Lab ID	Item Weight

Calculate the following:
A = Total combined weight of items: ______ grams Exceeds min. quantity (Y/N): __
B = Ave. total weight of item = A/No. of items = _____ grams

- Fines accumulated (Y/N): _____ If Yes, calculate the following:
  C = Total weight of fines: _____ grams
  D = Ave. weight of fines per item = C/no. of items = _____ grams
  E = Ave weight of bulk component per item = B – D = _____ grams
  Percent Bulk Material = E/B x 100% = _____

- Sample preparation tools used: ____
  ____
- Highest temperature recorded (optional): __________
- QA/QC: Matrix Spike (Y/N): _____ Field Sample ID#: __________
  Matrix Spike Duplicate (Y/N): _____ Field Sample ID#: __________
- Other Notes: ____
  ____

Appendix E

EXAMPLE STATEMENT OF WORK FOR SAMPLING AND ANALYSIS

Appendix E-1

GENERAL SAMPLE COLLECTION PROCEDURES

1.0 CHARACTERIZATION SCHEME

A minimum of three samples will be prepared for analysis from each of the waste streams. Range scrap items will be collected from Army installation ASPs, DRMO, range maintenance scrap yards, and/or directly from the range as close to the time of usage as possible (within five days, if practical). All analysis will be based on the entire (bulk) scrap item. Range scrap items will be prepared (size reduction) to meet the size requirements of the analytical procedures, as necessary. This material will be homogenized for each sample and submitted for analysis. Table 1 summarizes the analytical requirements for this effort. If review of the analytical data indicates that additional analysis is required to meet project DQOs, additional range scrap items will be prepared and submitted for analysis, as required.

Table 1

General Sampling and Analysis Requirements for Each Waste Stream/Group

Number of Samples	Leach Method	Prep Method	Analytical Method	Hold Time Extraction/ Analysis	Suspect Contaminants
3	SW-1311 (TCLP)	SW-3005A	SW-6010B (Metals)	14 days/ 6 month	Arsenic, barium, cadmium, chromium, lead, selenium, silver
3	NA	SW-3520C	SW-8270C (SVOCs)	14/40 days	All SVOCs specified for analytical method
3 (optional)	SW-1311 (TCLP)	SW-3520C	SW-8270C (SVOCs)	14/40 days	For any SVOCs that exceed the maximum theoretical leaching limit in the total analysis above
3 (optional)	SW-1311 (TCLP)	SW-3020A	SW-7470A (Mercury)	14/28 days	Mercury
3 (optional)	NA	NA	EPA 8330 (Nitro-aromatics)[a]	14/40 days	Nitroaromatics and nitrate esters

[a]Method 8330 will be modified to also include nitrate esters (PETN and nitroglycerin).

2.0 SAMPLE COLLECTION PROCEDURES

The sample collection procedures presented in this section apply to collection of range scrap items to be submitted for sample preparation (size reduction) by a subcontract laboratory or the project team.

2.1 Sample Collection

2.1.1 Sample collection performed by the project team

Range scrap items targeted for sampling may be collected from various Army installations across the country based on the availability of the item. Range scrap items stored at the ASP, DRMO, or other residue yard may be accumulated over various periods of time. In lieu of designing an extensive sampling approach that would account for the variability of item storage, this sampling effort will attempt to collect residues as close to the time of usage as possible. This approach will ensure that characterization of the range scrap items is consistent and the most conservative scenario.

The range scrap items will be collected, processed, and analyzed in an effort to meet the holding time requirements listed in Table 1. Range scrap items will be collected within 5 days from the date of usage to ensure the minimum holding time requirement (14 days) is met. Variances from the holding time requirements may be granted for items that are difficult to obtain due to the infrequency of use and will be evaluated on a case by case basis. After collecting the range scrap items, the project team will proceed to follow the requirements stated in Sections 2.2 through 2.8.

2.1.2 Sample collection performed by others

Sample collection may also be performed by other organizations and provided to the project team for characterization. The project team will coordinate with the other organization to prepare a listing of the range scrap items to be collected for characterization and the required quantities. The other organization must collect the range scrap items in a timely manner as stated in Section 2.1.1. The range scrap items shall be collected and shipped to the project team within 5 days of the date of usage. The sampling procedure is outlined below:

1. Don a new pair of disposable gloves (avoid contacting samples with synthetic materials, which could be a source of SVOC contamination) between each type of range scrap collected.
2. Obtain/collect the range scrap items (specific items and quantities coordinated with the project team) as close to the date of usage as possible (refer to Section 2.1.1).
3. Perform "inert certification" (responsible organization) and retain a copy of the certification to accompany the samples.
4. Record the information requested on the Sample Collection Record provided in Attachment A.
5. Individually containerize (refer to Section 2.4) each range scrap item at the time of collection to prevent the loss of materials associated with the item. The project team may provide plastic baggies, plastic sheeting, sample labels, COC records, sample seals, and/or sample coolers (shipping containers), if necessary.
6. Assign a sample identifier to each item by listing the DoDIC of the item followed by an alphabetical code "A" through "Z" (for example: samples for the M18 red hand smoke grenade, DoDAC 1330G950, would have sample identifiers G950A, G950B, G950C, G950D, etc.) or as directed by the project team.
7. Label each containerized item with the sample identifier, date and time of collection, and sampler initials.
8. Place containerized samples in shipping coolers (refer to Section 2.4) and complete a shipping waybill for each cooler.
9. Prepare a COC record for each shipping container (refer to Section 2.7).
10. Include a copy of the corresponding COC record and "inert certification" in each shipping container and affix a sample seal to each container (refer to Section 2.6).
11. Retain a copy of COC record, Sample Collection Record, "inert certification", shipping waybill, and any other pertinent documentation for your files.
12. Ship the sample coolers to the project team as instructed.

2.1.3 Health and Safety Precautions

The project team will be restricted to collecting range scrap items at the ASP, DRMO, and/or range clearance/maintenance yard where these items have been certified inert. Sampling personnel must be supervised/escorted at these locations and are not permitted to collect samples directly from range areas. Therefore, sampling personnel will adhere to the health and safety precautions prescribed by the local organization.

Other organizations collecting range scrap items for characterization should follow their own standard procedures for collecting range residues and performing "inert certification".

A copy of the "inert certification" should be provided to and retained by each organization that handles the samples. This may include the project team, other organizations conducting sample collection, the sample preparation laboratory, and the analytical laboratory.

2.2 Field QA/QC Samples

Field QA samples are not required for this sampling effort. The sampling procedures do not require the addition of preservatives, use of sampling equipment, or other special sample management/handling techniques. Therefore, field QA samples, such as field blanks, rinsate blanks, or trip blanks, are not required.

Since the general sampling approach for this effort consists of obtaining multiple samples of the same type of scrap item, collection of additional QC samples (replicates) will not be necessary to evaluate the representativeness of the sampling approach. However, laboratory duplicates will be performed per the methods specified in Table 1. This data will determine the representativeness of the laboratory sample aliquot used for analyses and variation of concentration of constituents within the scrap item sample.

2.3 Sample Labeling and Handling

Samples will be labeled at the time of collection. The label will contain the following information:

- Sample identifier,
- Date and time of collection, and
- Sampler initials.

This information may be written directly on the sample container or on a label affixed to the container. Sample label information should be completed using indelible ink.

2.4 Sample and Shipping Containers

The range scrap items must be individually containerized at the time of collection to prevent loss or mixing of materials. The following types of containment may be employed:

1. Double bag and seal the containers with standard bags using quart, half-gallon, gallon, 20- x 20-in, 24- x 24-in., or other various sizes. The seal or open end of the bags shall be folded and secured with tape.
2. For larger range scrap items (will not fit in 24- x 24-in plastic baggie), clear 6-mil plastic sheeting shall be used to wrap and enclose the item. Open edges of the plastic sheeting shall be folded and secured with duct tape. If there are loose, fine materials associated with the scrap item, these materials shall be emptied into bags as described above and placed inside the plastic sheeting with the scrap item.

Standard food/beverage coolers designated solely for sample shipment shall be used for shipping the range scrap samples collected for this effort. A copy of the COC record, shipping waybill, and "inert certification" shall be included in each shipping container. The contents of the shipping container should be specified as "environmental samples".

2.5 Sample Preservation and Storage

It is not expected that the scrap items will undergo physical, biological, and/or chemical changes during sample handling due to their solid and stable nature. Consequently, no preservation or special storage techniques will be employed. The most likely cause of sample degradation is loss of solid materials from the samples, which is addressed in Section 2.4. However, if extreme high temperatures are anticipated during shipping/handling, keep the samples cooled to a temperature of 4°C.

2.7 Sample Seals

Sample seals are used to preserve the integrity of the sample from the time it is collected until it is opened in the laboratory. Gummed paper or plastic is used as official sample seals. These seals will be applied to the outside of shipping packages.

2.8 Chain-of-Custody Record

All field samples submitted for sample preparation will be documented on a standard COC form. If samples are hand delivered, the sampler, the courier (if other than the sampler), and the receiver will sign the form. If samples are shipped via an overnight express service, the number of the waybill will be substituted for the receiver signature. The receiver must still sign the COC to acknowledge receipt at the sample preparation location.

The COC will include the following minimum information:

- Place of collection (sample identification),
- Data and time of collection,
- Sample type (grab or composite),
- Sample description,
- Number of containers,

- Signatures of personnel involved in the chain of possession, and
- Inclusive dates of possession.

2.9 Field Logbooks/Records

Field logbooks, field notes, COC/Analysis Request Forms, and any other field documentation generated to support this effort will be copied and retained in the record file for this project. The following information will be recorded for each group of scrap item collected:

- Date, time, and location (installation) of sample;
- Sampling personnel;
- Sample group, description, and number of scrap items collected;
- Sample identification code;
- COC number;
- Detailed sample location (e.g., ASP residue yard);
- How the item was stored (outdoor, open container, closed container, indoor, etc.);
- Estimated days since the item was expended and scrap created;
- Estimated days since the item has been stored at location;
- Description of other items stored/contained with this group (mixed storage);
- Description of packaging; and
- Other remarks.

The Sample Collection Record (Attachment A) may be used in addition to the field logbook to facilitate recording the sample collection information.

Attachment E-1

SAMPLE COLLECTION RECORD

SAMPLE COLLECTION RECORD

The following information should be recorded for each type of scrap item collected:

- Date, time, and location (installation) of sample:
  ____
  ____
- Sampling personnel: ____
  ____
- Sample description:

Muntions Item:		**NSN: DoDAC:**		**Scrap Item:**	
Sample ID	**COC#**	**Sample ID**	**COC#**	**Sample ID**	**COC#**

*Use Continuation Sheet if more information is required.

- Detailed sample location (e.g., ASP residue yard or policed from Range 1A):
  ____
  ____
- How the item was stored (outdoor, open container, closed container, indoor, etc.), if applicable:
  ____
  ____
- Estimated days since the item was expended and scrap created: ____________________
  (Should be as close to the date used as possible – within 5 days of usage)
- Estimated days since the item has been stored at location, if applicable: ______________
- Description of the weather conditions that the items has been exposed to while in storage, if applicable: ____
  ____
  ____
- Description of other items stored/contained with this group (mixed storage), if applicable:
  ____
  ____
- Description of packaging (e.g., individually containerized):
  ____
- Shipping date: ____
- Other remarks:

Appendix E-2

RANGE SCRAP SAMPLE PREPARATION PROCEDURES

1.0 CHARACTERIZATION SCHEME

A minimum of three samples will be prepared for analysis from each of the waste streams. Range scrap items will be collected from Army installation ASPs, DRMO, range maintenance scrap yards, and/or directly from the range as close to the time of usage as possible (within five days, if practical). All analysis will be based on the entire (bulk) scrap item. Range scrap items will be prepared (size reduction) to meet the size requirements of the analytical procedures, as necessary. This material will be homogenized for each sample and submitted for analysis. Table 1 summarizes the analytical requirements for this effort. If review of the analytical data indicates that additional analysis is required to meet project DQOs, additional range scrap items will be prepared and submitted for analysis, as required.

Table 1

General Sampling and Analysis Requirements for Each Waste Stream/Group

Number of Samples	Leach Method	Prep Method	Analytical Method	Hold Time Extraction/ Analysis	Suspect Contaminants
3	SW-1311 (TCLP)	SW-3005A	SW-6010B (Metals)	14 days/ 6 month	Arsenic, barium, cadmium, chromium, lead, selenium, silver
3	NA	SW-3520C	SW-8270C (SVOCs)	14/40 days	All SVOCs specified for analytical method
3 (optional)	SW-1311 (TCLP)	SW-3520C	SW-8270C (SVOCs)	14/40 days	For any SVOCs that exceed the maximum theoretical leaching limit in the total analysis above
3 (optional)	SW-1311 (TCLP)	SW-3020A	SW-7470A (Mercury)	14/28 days	Mercury
3 (optional)	NA	NA	EPA 8330 (Nitro-aromatics)[a]	14/40 days	Nitroaromatics and nitrate esters

[a]Method 8330 will be modified to also include nitrate esters (PETN and nitroglycerin).

2. SAMPLE PREPARATION

Prior to submitting the scrap items to the analytical laboratory, they will undergo size reduction at the project team's facility or a materials engineering laboratory experienced in preparing metallic samples for analysis. Items will be managed to ensure that materials (bulk or residual) are not lost from the sample. Scrap items will be reduced in size by hand tools or machined, as necessary, to achieve weight, size, and/or surface area requirements specified in the analytical procedures.

2.1 Specification

This section describes the requirements for performing the sample preparation (size reduction) required for range scrap items submitted for analysis.

2.1.1 TCLP particle size reduction

The range scrap items collected for this effort must be reduced in size per the requirements of the TCLP extraction method 1311: "particle size reduction is required, unless the solid has a surface area per gram of material equal to or greater than 3.1 cm^2, or is smaller than 1 cm in its narrowest dimension (i.e. is capable of passing through a 9.5 mm standard sieve). If the surface area is smaller or the particle size is larger than described above, prepare the waste for extraction by crushing, cutting, or grinding the waste to a surface area or particle size as described above."

Size reduction for the metallic range scrap items may be accomplished by use of hand tools and/or machining tools. Hand tools may include hand shears, diagonal cutters, pliers, tubing cutters, and/or other hand tools typically used in the laboratory for sample preparation. Electric or air-driven hand tools, such as an air-driven metal nibbler, that perform the same function of the hand tools previously mentioned may also be utilized. A hand hacksaw may be used on a limited basis, if necessary, for initial breakdown or separation of items.

Some metallic range scrap items may also require limited machining for initial breakdown or separation to accommodate use of the hand tools. Machining tools typically include lathes, milling machines, various saws, and grinders. Saws and grinders are not recommended for achieving size reduction due to the inability to control loss of materials. Saws tend to accumulate very fine materials in the internal components of the machine. Likewise, grinders tend to produce very fine particles that are hard to capture and account for. However, lathes and milling machines of various types produce chips of material in a controlled manner. Although both the lathe and milling machine can vary the width of chip of material produced, the type of metal limits the depth of the material taken out of the item. The lathe can typically achieve a depth closer to the TCLP requirement than a milling machine (2–9 mm for the lathe versus 2 – 5 mm for the milling machine). For this reason and because the lathe is a more common and readily available tool, the lathe is the recommended machining tool for use in preparing samples. Note that mechanical/machining tools should only be used on a limited basis to provide better access to materials for hand tools.

2.1.2 Loss of materials

The TCLP analysis must be based on the entire range scrap item. Therefore, the sample preparation methods must prevent the loss of materials during size reduction. This should be accomplished by ensuring that a container is always under the area of work to capture materials generated during size reduction. A glove box may also be used, if available, to prevent the loss of materials. Materials adhering to the surfaces of tools, which come into contact with the scrap item, should also be removed and captured by brushing the tool or equivalent method.

2.1.3 Cross contamination

The tools used for sample preparation should be dedicated for this use and not used for maintenance or other activities. Cross contamination between range scrap items will be avoided by decontaminating tool surfaces, which come into contact with the items, with a method that incorporates rinsing with a nitric acid solution (metal elimination) and isopropanol (organic elimination). Tools shall be decontaminated between each use. Disposable gloves shall also be used and changed for each sample processed.

2.1.4 Temperature control

There may be a concern with the loss of constituents of concern during sample preparation due to heating the surface of range scrap items, particularly when using a hacksaw or lathe as described above. The goal of this sample preparation method is to limit the temperature during all operations to a maximum of 60°C (140°F) for samples that will be analyzed for SVOCs or explosives. This temperature, 60°C (140°F), is noticeable to the touch and is the maximum temperature for handling materials without insulating gloves or other tools. It is anticipated that out of all the tools approved for use and listed in Section 2.1.1, the hacksaw may be the only one that will not achieve the temperature requirement. If this is the case, only the lathe will be used for breaking down items as described in Section 2.1.1. A thermocouple should be applied to the scrap item when using the lathe or hacksaw if the temperature threshold will potentially be exceeded.

2.1.5 Providing a representative sample for analysis

The size reduction required to be performed on the range scrap items prior to testing will physically separate the different components of an item (casing body, primer assembly, base plate, etc.) into numerous individual pieces and separate the loose fine materials from the bulk materials. The different components of the scrap item may contain differing constituents of concerns and/or constituents at differing concentrations. These components must be managed and reconfigured in a way that provides a material representative of the entire scrap item to the analytical laboratory. This requirement presents the following challenge: The sample directly subjected to analytical testing must, to the extent practical, contain the pieces of different bulk components and the fine materials in an amount proportional to their weight in relation to the entire scrap item.

In cases where an individual range scrap item weighs less than the minimum required sample weight (Section 2.5), representativeness is not as high of a concern regarding the bulk materials since all the separated components/materials of the scrap item will be placed into the sample container. However, in the cases where the scrap item weighs more than the minimum sample weight, there is a concern that some of the bulk components of the item will not be placed into the sample container. To ensure this does not happen when processing an item that weighs more than the minimum required sample weight, the pieces produced during size reduction of the different components will be segregated during sample preparation. The materials accumulated from each different component will be homogenized separately. The appropriate sample containers will then be filled proportionally with pieces from all the different components. The samples provided to the analytical laboratory will be further homogenized by manually mixing the materials prior to testing.

The presence of loose fine materials associated with the scrap item presents a different concern than that of the different bulk components. Even if a proportional amount of fine materials are placed in the sample container, typical homogenization techniques will only stratify the sample materials by size and weight, which will increase the likelihood that the fine materials will accumulate at the bottom of the container and not be included in the materials subjected to testing. Therefore, fine materials, when present, will be homogenized and containerized separately in an amount proportional to the amount of bulk materials containerized. Both containers will be submitted to the analytical laboratory with an attached record of the ratio of bulk to fine materials that is to be maintained throughout testing. The analytical laboratory must then composite the bulk and fine materials based on the weight ratio provided when preparing an aliquot of material for testing.

2.2 Sample Preparation Procedure

The following procedure shall be followed for preparation of the samples for analysis:

1. Follow an approved quality assurance plan and laboratory standard procedure for sample receipt and internal COC. Obtain one field sample of the item to be prepared. If the weight of the item is less than 200 grams (minimum of 200 grams are required to conduct TCLP, total SVOC, and explosive analyses, however, only 160 grams are required to conduct TCLP and total SVOC analyses), obtain a sufficient number of additional items until the combined weight exceeds 200 grams (160 grams when performing TCLP and total SVOC analyses only). Confirm the minimum required sample weight with the specific analytical laboratory to be used. Record the combined weight of the

items to be processed to complete one sample on the Sample Preparation Record (Section 2.9).

2. Don a new pair of disposable gloves between samples to prevent cross contamination.

3. If the sample does not contain fine materials that can be separated from the bulk item, then proceed to step 4. If the sample contains fine materials that can be separated from the bulk item, then perform the following:

   - Carefully open the plastic container for the item over a secondary container (Container A) to retain any loose materials.
   - Remove the remainder of loose materials with a stainless steel or disposable spoon/spatula or similar tool.
   - Record the weight of the fine material captured in Container A on the Sample Preparation Record (Section 2.9).

4. If no portion of the item can be processed (size reduction) using hand tools, then proceed to step 5. Otherwise, reduce the size of the item to meet the sample preparation requirements using hand tools. Hand tools will consist of hand shears, diagonal cutters, pliers, tubing cutters, and an air-driven metal nibbler. A hand hacksaw may be used on a limited basis, if necessary, as described in Section 2.1.1. Perform size reduction over plastic sheeting or other container to collect materials. Hand tools will be used inside a dedicated glove box when possible. If there are any materials that require processing by milling tools, then proceed to step 5. If no portion of the item requires processing by milling tools, then proceed to step 6.

5. Some metal items may require limited machining for initial breakdown. Using an acceptable milling tool (Section 2.1.1), reduce the size of those portions of the item that cannot be prepared with hand tools. Perform this size reduction over plastic sheeting or other container to collect materials. Use hand tools to further reduce the size of particles as needed (refer to step 4).

6. Consolidate materials from all containers or plastic linings, which have been used to control loss of materials, into Container B. Visually inspect the contents of Container B to identify any materials obviously not meeting the size reduction requirement (Section 2.1.1). Repeat steps 4 through 6 as necessary.

7. Sift the contents of Container B through a standard 9.5 mm or 0.375-in sieve and capture the materials in Container C. Return any materials not passing through the sieve to Container B and repeat steps 4 through 7.

8. Fill the sample container for TCLP analysis. TCLP analysis must be based on the entire scrap item to provide a representative sample (Section 2.1.5) by performing the following:

   - If the scrap item being sampled weighs less than or equal to 100 grams (bulk and fine materials combined, if applicable), then process (size reduction) a sufficient number of items (always processing the entire scrap item) to exceed the 100 grams required for TCLP analysis and place all the material directly into the TCLP sample container (Section 2.5). If there are fine materials associated with the scrap item, then refer to step 11.

- If the item being sampled weighs more than 100 grams (bulk and fine materials combined, if applicable), then completely process one item. Segregate different components (primer components, base plate, casing, etc.) of the item, if applicable. Homogenize (Section 2.4) materials accumulated from each different component separately. Fill the appropriate sample container (Section 2.5) with a minimum of 100 grams of material by placing a proportional amount of each different component into the container. Remaining material may be used to fill the container required for total SVOC and explosive analyses, step 9 and 10. If there are fine materials associated with the scrap item, then refer to step 11.

9. Fill the sample container for total SVOC analysis. A representative sample will be provided by conducting the following:

   - If the scrap item being sampled weighs less than or equal to 30 grams (bulk and fine materials combined, if applicable), then process (size reduction) a sufficient number of items (always processing the entire scrap item) to exceed the 30 grams required for total SVOC analysis and place all the material directly into the appropriate sample container (Section 2.5). If there are fine materials associated with the scrap item, then refer to step 11.

   - If the item being sampled weighs more than 30 grams (bulk and fine materials combined, if applicable), then completely process one item. Segregate different components (primer components, base plate, casing, etc.) of the item, if applicable. Homogenize (Section 2.4) materials accumulated from each different component separately. Fill the appropriate sample container (Section 2.5) with a minimum of 30 grams of material by placing a proportional amount of each different component into the container. Remaining material may be used to fill the container required for explosive analysis, step 10. If there are fine materials associated with the scrap item, then refer to step 11.

   - Fill the sample container for explosive analysis. A representative sample will be provided by conducting the following:

   - If the scrap item being sampled weighs less than or equal to 20 grams (bulk and fine materials combined, if applicable), then process (size reduction) a sufficient number of items (always processing the entire scrap item) to exceed the 20 grams required for explosive analysis and place all the material directly into the appropriate sample container (Section 2.5). If there are fine materials associated with the scrap item, then refer to step 11.

   - If the item being sampled weighs more than 20 grams (bulk and fine materials combined, if applicable), then completely process one item. Segregate different components (primer components, base plate, casing, etc.) of the item, if applicable. Homogenize (Section 2.4) materials accumulated from each different component separately. Fill the appropriate sample container (Section 2.5) with a minimum of 20 grams of material by placing a proportional amount of each different component into the container. If there are fine materials associated with the scrap item, then refer to step 11.

10. Fine materials must be managed in a way to ensure a representative aliquot of the sample is taken in the laboratory and subjected to the required testing (Section 2.1.5). Determine the ratio of fine material to bulk material from the information recorded in steps 1 and 3 in accordance with the instructions on the Sample Preparation Record (Section 2.9). Homogenize (Section 2.4) the fine materials accumulated and place the appropriate amount of fine material (based on the amount of bulk material containerized in steps 9, 10, and 11) into a separate container marked for the same analysis. Instructions must be sent with the COC/analytical request that provide the analytical laboratory with the ratio of bulk and fine materials to be maintained when preparing an aliquot of the sample for testing.
11. Label sample containers, apply sample seals, complete chain-of-custody forms, and complete required documentation as discussed in Sections 2.6, 2.7, 2.8, and 2.9 respectively.
12. Decontaminate tools and equipment as described in Section 2.10.
13. Collect excess materials in plastic bags and record the scrap type on the exterior of the bag. Seal bags and return to the installation point of contact that provided the item. Otherwise, store the accumulated bags and dispose of the materials based on the results of the analytical testing and in accordance with federal, state, and local requirements.

Figures 1 and 2 provide an example of the flow of sample preparation for a small and large scrap item, respectively

2.3 Quality Assurance/Quality Control Samples

QA Rinsate blank samples will be prepared at a rate of 1 blank per 20 samples prepared (5%). Equipment/tool rinsate blanks will be performed by collecting laboratory grade, deionized water that has been rinsed over decontaminated equipment/tool surfaces that contacted the range scrap item during sample preparation.

QC split samples will be collected at a rate of 1 split sample per 20 samples prepared (5%). Samples targeted for QC will be prepared as stated in Section 2.2, but at least 400 grams of material will be processed. The QC split sample will be performed after the material has been homogenized by filling an additional sample container for each analysis. All sample

REQUESTED ANALYSES: TCLP, TOTAL SVOCs, AND EXPLOSIVES (MINIMUM QUANTITY = 200 GRAMS)

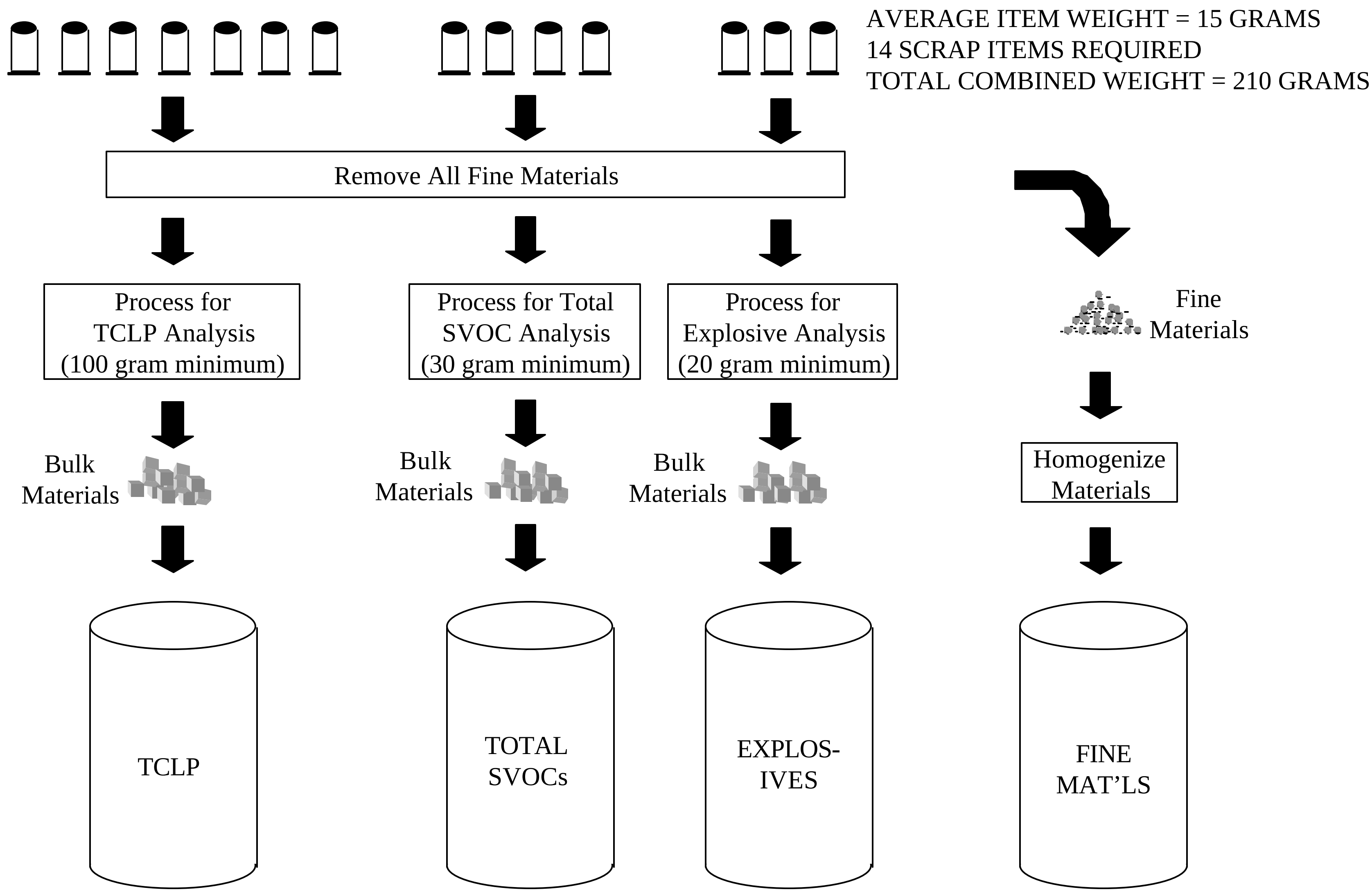

Figure 1. Sample Preparation Example Number 1: Small Scrap Item with Fine Material

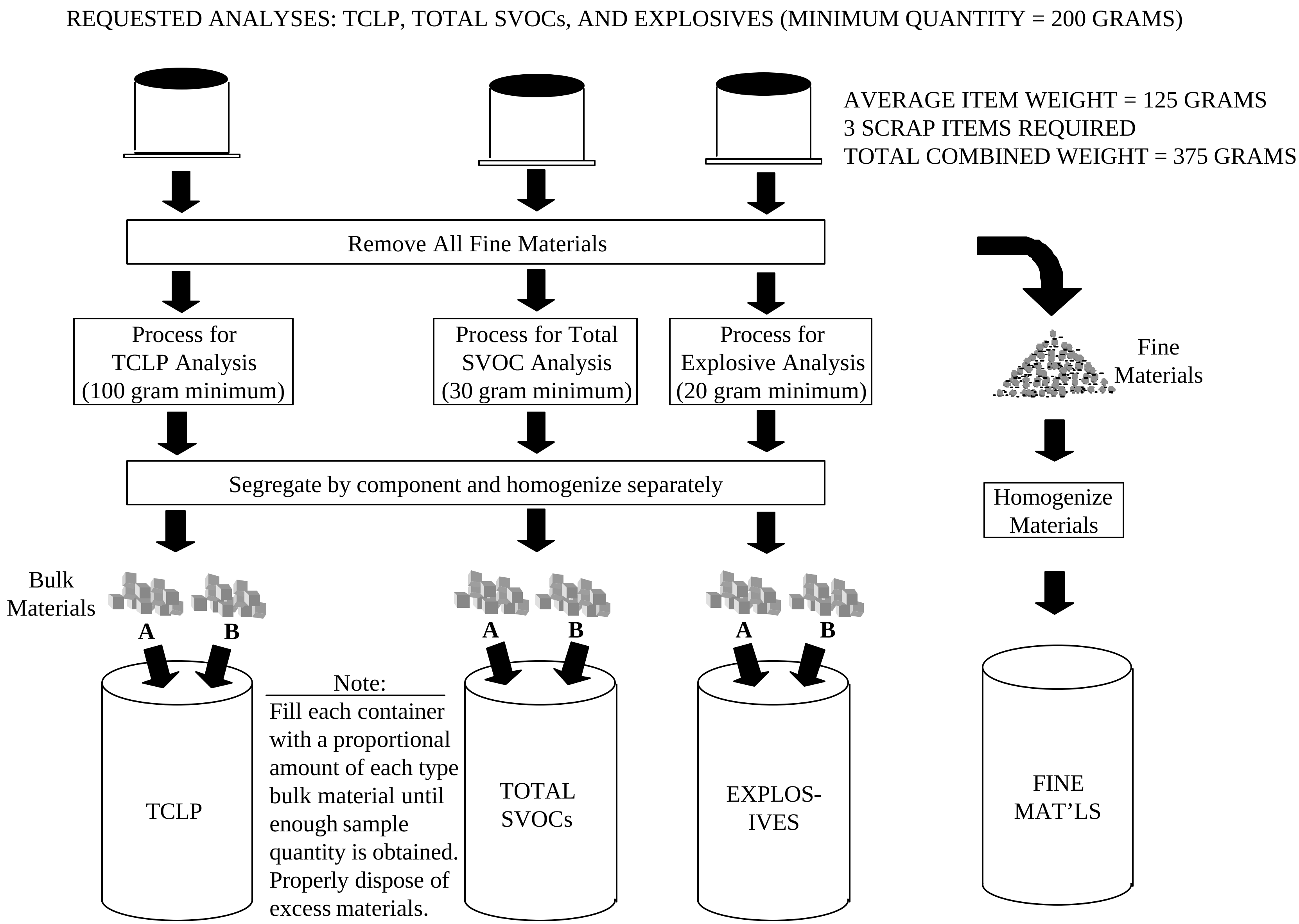

Figure 2. Sample Preparation Example Number 2: Large Scrap Item with Fine Material

containers will be filled simultaneously. Analysis of the split samples will be reviewed to assess the representativeness of the samples submitted to the laboratory.

2.4 Sample Homogenization

Applying proper homogenization techniques will help ensure that conditions are being accurately represented. Homogenization will be accomplished by mixing the entire contents of the sample thoroughly with a plastic or Teflon spatula/spoon. Adequate mixing is achieved by stirring the material in a circular manner and occasionally turning the material over. The extent of the mixing required will depend on the nature of the sample and will be done to achieve a consistent appearance prior to filling sample containers. In addition to the size reduction required for TCLP analysis (less than 1 cm in narrowest dimension), particles greater than 0.5 inch in their broadest dimension will be further reduced, if necessary, to provide materials of consistent size. Once mixing is completed, the sample will be divided in half within the mixing container and sample containers will be filled simultaneously by scooping sample material alternatively from each half.

2.5 Sample and Shipping Containers

Table 2 lists the sample containers and minimum sample amounts required to conduct the analyses for this effort.

Table 2

Sample Containers and Minimum Sample Amounts

Analysis	Routine Container		Minimum Weight Required (grams)[a]	Recommended Weight (grams)[a]
	Solid	Aqueous		
TCLP	250 ml glass	Total metals – 250 ml plastic w/ nitric	100	100+
Total SVOCs	250 ml glass	2 - 1 L amber glass	30	30-60[b]
Explosives	125 ml glass	2 – 1 L glass	20	20-40[b]

[a]Solid samples.
[b]Additional sample material will allow the analytical laboratory to reanalyze the sample, if needed.

Standard food/beverage coolers designated solely for sample shipment shall be used for shipping the samples prepared for this effort. A copy of the COC record, shipping waybill, and "inert certification" shall be included in each shipping container. The contents of the shipping container should be specified as "environmental samples".

2.6 Sample Labeling

Samples will be labeled at the time sample containers are filled. The label will contain the following information:

- Sample identifier,
- Requested analysis
- Date and time of collection, and
- Sampler initials.

This information will be written on a label affixed to the container. Sample label information should be completed using indelible ink.

2.7 Sample Seals

Sample seals are used to preserve the integrity of the sample from the time it is collected until it is opened in the analytical laboratory. Gummed paper or plastic is used as official sample seals. These seals will be applied to the outside of shipping packages.

2.8 Sample COC and Analytical Request

All samples submitted to the analytical laboratory will be documented on a standard COC form. If samples are hand delivered to the laboratory, the sampler, the courier (if other than the sampler), and the receiver will sign the form. If samples are shipped via an overnight express service, the number of the waybill will be substituted for the receiver signature. The laboratory receiving clerk must still sign the COC to acknowledge receipt at the laboratory.

The COC/analytical request will include the following minimum information:

- Place of collection (sample identification),
- Data and time of collection,
- Sample type (grab or composite),
- Sample description,
- Requested analyses,
- Number of containers,
- Signatures of personnel involved in the chain of possession,
- Inclusive dates of possession, and
- Instructions or reference to an attachment that provides additional instructions to the analytical laboratory regarding non-routine activities.

2.9 Sample Preparation Documentation

Attachment A contains a Sample Preparation Record that will be used to record the sample preparation information.

2.10 Equipment/Tools Decontamination

Equipment and tools that are reused during sample preparation will be decontaminated as follows:

1. Wipe the equipment with a laboratory grade wipe that has been saturated with a 2% nitric acid solution.
2. Rinse thoroughly with distilled water.
3. Rinse with laboratory grade isopropanol.
4. Rinse thoroughly with laboratory grade organic-free water.
5. Dry the equipment with laboratory grade disposable wipes.

Unless the equipment is going to be used immediately, it should be stored in a clean place (on plastic sheeting).

Attachment E-2

SAMPLE PREPARATION RECORD

SAMPLE PREPARATION RECORD

The following information shall be recorded for each sample prepared for analysis.

- Date: ___________ Personnel: ____
- Project Team Sample ID: ___________ COC#: ___________
- Requested Analyses (check one):

Analyses	Minimum Sample Quantity
TCLP metals, SVOCs, and Explosives	200 Grams
TCLP metals and SVOCs	160 Grams
TCLP metals including mercury and SVOCs	160 Grams
Add matrix spike and matrix spike duplicate	Triple the applicable quantity above
Other:	Specify:

- Sample Preparation:

Field ID	Lab ID	Item Weight	Field ID	Lab ID	Item Weight

Calculate the following:
A = Total combined weight of items: ______ grams Exceeds min. quantity (Y/N): __
B = Ave. total weight of item = A/No. of items = _____ grams

- Fines accumulated (Y/N): _____ If Yes, calculate the following:
  C = Total weight of fines: _____ grams
  D = Ave. weight of fines per item = C/no. of items = _____ grams
  E = Ave weight of bulk component per item = B – D = _____ grams
  Percent Bulk Material = E/B x 100% = _____

- Sample preparation tools used: ____
  ____
- Highest temperature recorded (optional): ___________
- QA/QC: Matrix Spike (Y/N): _____ Field Sample ID#: ___________
  Matrix Spike Duplicate (Y/N): _____ Field Sample ID#: ___________
- Other Notes: ____
  ____

Appendix E-3

RANGE SCRAP ANALYTICAL PROCEDURES

1.0 CHARACTERIZATION SCHEME

A minimum of three samples will be prepared for analysis from each of the waste streams. Range scrap items will be collected from Army installation ASPs, DRMO, range maintenance scrap yards, and/or directly from the range as close to the time of usage as possible (within five days, if practical). All analysis will be based on the entire (bulk) scrap item. Range scrap items will be prepared (size reduction) to meet the size requirements of the analytical procedures, as necessary. This material will be homogenized for each sample and submitted for analysis. Table 1 summarizes the analytical requirements for this effort. If review of the analytical data indicates that additional analysis is required to meet project DQOs, additional range scrap items will be prepared and submitted for analysis, as required.

Table 1
General Sampling and Analysis Requirements for Each Waste Stream/Group

Number of Samples	Leach Method	Prep Method	Analytical Method[a]	Hold Time Extraction/ Analysis	Suspect Contaminants
3	SW-1311 (TCLP)	SW-3005A	SW-6010B (Metals)	14 days/6 month	Arsenic, barium, cadmium, chromium, lead, selenium, silver
3	NA	SW-3520C	SW-8270C (SVOCs)	14/40 days	All SVOCs specified for analytical method
3 (optional)	SW-1311 (TCLP)	SW-3520C	SW-8270C (SVOCs)	14/40 days	For any SVOCs that exceed the maximum theoretical leaching limit in the total analysis above
3 (optional)	SW-1311 (TCLP)	SW-3020A	SW-7470A (Mercury)	14/28 days	Mercury
3 (optional)	NA	NA	EPA 8330 (Nitro-aromatics)[b]	14/40 days	Nitroaromatics and nitrate esters

[a] The required reporting limits are based on the Method of Detection Limits stipulated in 40 CFR 136 or the Practical Quantitative Limits stipulated in SW846 unless otherwise indicated.
[b]Method 8330 will be modified or an equivalent method proposed to also include nitrate esters (PETN and nitroglycerin).

2.0 SAMPLE ANALYSIS

2.1 Analytical Methods/Procedures

The subcontract laboratory used for this study shall be certified by the U.S. Army Corps of Engineers Missouri River District for the applicable methods. The analytical procedures for this project are specified as a sample matrix in Table 1. Chemical analyses will be performed in accordance with the following guidelines:

- SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, EPA Office of Solid Waste and Emergency Response, November 1986 and
- EPA, *Method for Chemical Analysis of Water and Wastes*, EPA/600/4-79-020, March 1993.

As stated earlier, Modified Method 8330 will be used for the analysis of nitroglycerin and PETN. The difference between the two methods (8330 and Modified 8330) is the addition of a salting out procedure used for 8330. This procedure allows for lower (i.e., more sensitive) detection limits of the analytes.

Analytical data report packages will be provided at an EPA “Level III” format or U.S. Army Corps of Engineers standard data reporting format as described below:

> A standard reporting format will be used to report all data along with the supporting QC information. The standard data reporting format will include, at a minimum, a general discussion, analytical data for field samples and QC samples, calibration information, laboratory performance and matrix-specific information, and any other information that is pertinent to the project samples. Electronic format will be provided in Microsoft Excel.

Attachment A provides an example specification for analytical services, which may be used in procuring a laboratory for analysis of range scrap items.

2.2 Laboratory DQO Goals

DQOs define data quality requirements in order to obtain sufficient data of known defensible quality. These objectives are established based on the intended use of the data being generated and are represented by a set of parameters consisting of PARCC and sensitivity requirements, which establish the standard criteria for reviewing project data results.

QC procedures are operations employed during chemical analysis in order to support and document the attainment of established QA objectives. The laboratory used to analyze the data is responsible for meeting the QA objectives by maintaining the PARCC and sensitivity requirements, as specified in Table 2. The laboratories that have been selected to provide analytical support for this project are EPA-certified laboratories that operate under approved QA plans.

Table 2
Acceptance Criteria

	Solid Criteria
Precision (% RPD)	
Method 6010	0-30
Method 7470	0-30
Method 8270	0-50
Method 8330	0-30
Accuracy (% Recovery)	
Method 6010	70-130
Method 7470	70-130
Method 8270	10-200
Method 8330	40-140
Completeness (%)	
All Methods	100

2.2.1 Precision

Precision is the agreement among the results from a set of duplicate analyses, regardless of the true value. Precision may be affected by the natural variation of the matrix or contamination within that matrix, as well as by errors made in the field and/or laboratory handling procedures. In order to assess this parameter, matrix spike/matrix spike duplicate samples will be analyzed. Two representative aliquots of the same sample matrix will be subjected to identical analytical procedures in order to assess the procedural precision of the method through the calculation of relative percent difference (RPD). This value will be used to ensure precision objectives have been met. Method-specific RPD limits will be provided in the laboratory-specific reports of results. The number of matrix spike and matrix spike duplicate samples will be determined in accordance with the specified methods.

2.2.2 Accuracy

Accuracy is defined as the closeness of agreement between the measured value and the true value and is calculated as percent recovery. Sources of error include the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques. Analytical accuracy will be assessed by measuring the percent recovery of known concentrations of target analytes spiked into a field sample (matrix spikes). Method-specific percent recovery limits will be provided in the laboratory-specific reports of results.

2.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population of samples or an environmental condition. Employing appropriate sampling strategies as described in Section 3.2 will ensure representativeness. In the laboratory, representativeness may be enhanced by making certain that all subsamples taken from a given sample are representative of the entire sample. Representativeness will be assessed by the use of duplicate field and laboratory samples.

For the laboratory (matrix) duplicates, two representative aliquots of the same sample matrix will be subjected to identical analytical procedures. The RPD between the two sample results will be calculated.

2.2.4 Comparability

Comparability is the confidence with which one data set can be compared to another. Sample data will be comparable with other measurement data for similar samples and sample conditions. This goal will be achieved by using standard methods for sample collection, sample analysis, data review, reporting data in standard units, and using standard and comprehensive reporting formats. Complete field documentation using a standardized data collection format also supports the assessment of comparability.

2.2.5 Completeness

Completeness is the percentage of measurements made that are judged to be valid measurements compared to the total number of measurements planned. Any critical samples will be identified to ensure that valid data are obtained in order to obtain the requisite type, quantity, and quality of data necessary to complete the project. The number of samples needed to meet project DQOs is discussed in Section 2 of this document.

2.3 Sample Custody and Holding Times

Requirements for sample custody and documentation during the fieldwork are discussed in work plans and/or procedures provided to sampling personnel. Custody requirements also apply to the receiving laboratory. Laboratory personnel will indicate transfer of custody by signing the COC record upon receiving the shipment of samples. Table 3 lists the holding time requirements for the analyses.

Table 3

Holding Times for Chemical Analyses on Solid Samples

Media	Parameter	Extraction	Analysis
Solid	Explosives	14 days	40 days
	Nitroglycerine and PETN	14 days	40 days
	Metals	Not applicable	180 days
	TCLP	14 days	Refer to Chemical Analysis
	Semivolatiles	14 days	40 days

2.4 Internal QC Checks

Internal QC checks are used to determine whether analytical operations are in control, as well as determining the affect the sample matrix may have on data being generated. These two aspects are described as batch QC and matrix-specific QC procedures, respectively. The type and frequency of specific QC samples performed by the laboratory will be in accordance with the specified analytical methods. Acceptance criteria and target ranges for the laboratory QC samples are presented within the analytical methods and summarized in Table 2. Data that vary from these target ranges will result in the implementation of appropriate corrective measures. Full documentation of all actions taken will be recorded within a case narrative.

2.4.1 Batch QC

Typical batch QC for analyses to be performed for this project is described below.

Method Blanks. Method blanks are analyzed to assess the level of background interference or contamination that exists in the analytical system and that might lead to the reporting of elevated concentration levels or false positive data. At least one method blank will be prepared and analyzed with every batch of samples processed. The concentration of all target analytes in the blank will be below the MDL or 5% of the measured concentration in the sample. If the blank does not meet acceptance criteria, the source of contamination will be investigated and appropriate corrective action will be taken and documented. Corrective actions may include reanalysis of the blank and/or re-preparation and reanalysis of the blank and all associated samples at the laboratory’s cost. Sample results will not be corrected for blank contamination.

Laboratory Control Samples. Laboratory performance QC will be based on the use of standard control matrices that are prepared independently from the standard solutions used in establishing the calibration curve, to calculate precision and accuracy data. These QC data will be compared on a per-batch basis, to the control limits of the methods, to verify compliance. This data, along with method blank data, will be used to assess laboratory performance.

Other QC Samples. In order to maintain the quality of the data and laboratory performance, the laboratory will implement the QC requirements and standards described in the reference methods that is uses. These method-specific QC requirements include the following:

- Initial Calibration (metals and SVOCs);
- Initial Calibration Verification (metals);
- Initial Calibration Blank and Continuing Calibration Blank (metals);
- Continuing Calibration Verification (metals, explosives, and SVOCs);
- Interference Check Sample (metals);

- Tune (SVOCs);
- Linear Range Analysis (metals);
- Method Blank (metals, explosives, and SVOCs);
- Serial Dilution (metals);
- Laboratory Control Sample (metals, explosives, and SVOCs);
- Surrogate Spike (SVOCs); and
- Matrix spikes (metals, explosives, and SVOCs).

2.4.2 Matrix-Specific QC

Matrix-specific QC will be based on the use of an actual environmental sample for precision and accuracy determinations and will rely on the analysis of matrix duplicates, surrogate compounds, matrix spikes, and matrix spike duplicates. The required frequency of these sample types is established within each specific analytical method. Results of these samples will be used to assess the affect of sample matrix conditions on analytical data.

Attachment E-3

EXAMPLE SPECIFICATIONS FOR ANALYTICAL SERVICES

Example Specifications for Analytical Services

QA/QC Element	Project Minimum Acceptable Level
1. Sample Custody	A record of COC must be discernible for "individual sample containers" while they are in the possession of the laboratory. A copy of the original complete COC record must be provided with the results for each sample as part of the hardcopy deliverable.
2. Sample Receipt	The laboratory must be able to receive and store sample shipments (including weekends and holidays) without compromising the integrity of the samples. The laboratory must note on the COC form when samples are received.
3. Holding Times	Where holding times have been specified in the published method (e.g., 40 CFR 136, SW-846), the laboratory is expected to meet those holding times without exception. Evidence of hold time compliance must be reported with the results for each sample. The laboratory should maintain a real-time system for determining percent compliance.
4. Published Method Compliance	Where published methods for analysis exist, those methods will be followed (in most cases, the latest version of the method) without exception unless exceptions are requested by THE PROJECT TEAM or our client. All exceptions must be agreed to in writing and before award is made.
5. Standard Traceability	A clear record must exist for each result to show what material was used as the reference standard. All dilutions and preparations of standard materials must be documented in a permanent record. Each standard preparation must be uniquely identified such that no two preparations could be confused in the evidentiary files.
6. Reporting of Analytical Measurement Results	Results for analytical measurements will be reported in a consistent, standardized format. The laboratory must be able to report with each constituent measurement result with the minimum detection and corresponding reporting limit determined, adjusted for sample specific preparation activities. All reported measurements must be obtained from a system operated in a state of "statistical control," as evidenced by batch QC measurements which fall within the laboratory's Standard Operating Procedures (SOPs), and associated QA manuals. If the batch QC indicates that the system is not in control, corrections must be made, and samples reanalyzed. If it is not possible to reanalyze samples using an in-control system, the sample result may be flagged with a qualifier. No sample results may be reported from an out of control system without incurring penalties as described in Item 13. If the batch QC measurements and sample reanalysis indicate that the system is in control and that the sample matrix is the cause of QC measurements falling outside of specifications, the data may be flagged without penalty and will not be counted against the completeness objective, as would out-of-control system results described above.
7. QC Data Reporting	Results for QC measurements relevant to each analytical measurement must be maintained in a consistent, standardized format. For each QC measurement, the theoretical value, the quality objective and the calculated error (in terms of the quality objective for the measurement) must be maintained in a permanent record. The same information reported for samples must also be reported for analytical QC samples. It must be clear from the QC data report that the correct QC measurements have been made for the method employed and what the outcome was. Relevant QC measurement data (e.g., method blank, laboratory control sample, calibration standards) must be maintained in a consistent, standardized format and reported with the results for each sample in a manner that allows determination that the required frequency of analytical QC samples were analyzed with each "batch" of samples.

QA/QC Element	Project Minimum Acceptable Level
8. Electronic Transfer of Data	The laboratory must have the ability to transfer information for Items 3, 6, and 7 in predefined, consistent, standardized data files or equivalent as agreed to by THE PROJECT TEAM and the laboratory subcontractor. Each data file must contain the exact information as the corresponding hard copy record except for the COC form(s) and case narrative. The structure of these files must be held constant for the duration of this subcontract unless a change is requested by THE PROJECT TEAM.
9. Turn Around Time (TAT)	The laboratory will complete all analyses and be able to report measurement data (as per Items 1, 3, 4, 6, 7, and 8) in electronic format within the following required TAT **(14 days)** to ensure reporting requirements are met. The hardcopy report for the submitted data may be received by THE PROJECT TEAM up to 5 working days after the electronic data is submitted.
10. Disposal	Samples must be kept in laboratory storage for at least 2 months. Once the sample disposal is approved by THE PROJECT TEAM, the laboratory will incur all costs associated with disposal of samples. The laboratory is responsible for the transportation of all associated laboratory waste products to an approved waste disposal facility in accordance with U.S. Department of Transportation, U.S. Environmental Protection Agency, U.S. NRC, federal, and state regulations. THE PROJECT TEAM retains the right to audit the laboratory for evidence of proper disposal.
11. Recordkeeping	The laboratory will maintain a recordkeeping system that can reproduce an "evidentiary file" adequate for use in legal defense of analytical measurements. This should include but is not limited to evidence of COC, sample preparation, instruments, preservation, standard traceability, calibration, the actual measurement, and all other QC measurements. Additional records such as instrument run logs, maintenance logs, personal (analyst) logs and analysis related correspondence may be necessary to defend some types of measurement data.
12. Archiving	The laboratory is required to maintain in a retrievable medium all information relevant to the analysis of THE PROJECT TEAM samples for a period of at least 10 years from the date of sample receipt. Transfer of raw data to THE PROJECT TEAM custody may be required in the event the data must be maintained for a longer period of time.
13. Penalties	Non-Defensible Sample Analysis Results. In cases where the results reported by the laboratory are found to be non-defensible due to laboratory handling of the sample or related laboratory measurement information, or due to missing or inadequate documentation such that results cannot be reproduced or recalculated from the raw data and laboratory records, those findings will result in nonpayment for all associated samples. If non-defensible results are determined to be "critical" to meeting the objectives of THE PROJECT TEAM, the laboratory will be required to pay THE PROJECT TEAM costs directly related to resampling including, for example, labor, materials, and shipment expenses. THE PROJECT TEAM will minimize the costs of resampling by combining these efforts with other field activities. Non-compliant Sample Analytical Results. THE PROJECT TEAM shall have three months from receipt of analytical data (including associated QA/QC information) to identify sample results which are non-compliant with system control requirements. Should the non-compliant sample results be "critical" to meeting the objectives of THE PROJECT TEAM, resampling and reanalysis will be required at the laboratory's expense.

QA/QC Element	Project Minimum Acceptable Level
	<u>Corrective Action TAT Non-compliance</u>. In cases where the results reported by the laboratory are found to be indefensible, unusable, or both, based on initial review of hard copy reports by THE PROJECT TEAM QC staff, a rejection of the data package will occur. The unacceptable data package will be returned to the subcontractor, with written comments on the hard copy report explaining reasons for rejection (i.e., incorrect calculations, incorrect reporting limits, insufficient batch QC, etc.). Once notification of data package rejection is given, THE PROJECT TEAM will expect corrective actions be taken to deliver a defensible written response or error-free reissuance of the hard copy report within (14) calendar days. If final resolution of identified problems takes more than (14) calendar days, payment to subcontractor will be discounted according to the following schedule: **DAYS LATE — PERCENT OF COMPENSATION WITHHELD** **1 - 7 — 20%** **8 - 14 — 40%** **> 14 — 100%** **The (14) day corrective action TAT schedule begins on the initial date of problem notification.**
14. Price	The cost of analytical services shall not be escalated during the period that this subcontract is in effect. The laboratory QC samples should be included in cost per THE PROJECT TEAM field sample. Any anticipated annual cost escalation factors shall be indicated in the response to this SOW
15. Laboratory Certifications/ License	The laboratory will maintain all certifications required to comply with the objectives of THE PROJECT TEAM for given sets of samples. For this program, MRD certification and approval is required.