ATTACHMENT 2
WASTE ANALYSIS PLAN

2.1 INTRODUCTION

Generators of hazardous waste are required to obtain detailed chemical analyses of wastes they intend to treat, store, or dispose of in order to ensure proper hazardous waste management practices.

This Waste Analysis Plan describes:

(1) the physical and chemical analyses USACAMDS will perform before hazardous wastes are stored, treated, or transported off-site for further treatment and ultimate disposal,

(2) the methods to be used to collect samples,

(3) the frequency of sampling/analysis,

(4) the methods to be used to analyze the samples

(5) the procedures that will be used to ensure the validity of the analytical results, and

(6) the basis for generator knowledge

2.2 PARAMETERS AND RATIONALE

Table 2-1 presents a summary of this entire waste analysis plan. For each waste stream specified, this table presents the selected analytical parameters and corresponding analytical methods, sampling frequencies, and sampling methods. In addition the table includes either a reference to the unit that will treat each waste stream (for waste to be treated on-site) or a reference to the process generating each waste stream (for wastes to be treated and disposed of off-site).

2.2.1 Analyses for Wastes Requiring On-Site Treatment

Waste streams included in this section will be treated on-site in one or more of the three incinerators, the Brine Drying Area, or other permitted treatment units[1]. Analytical parameters were selected for each waste stream based on previous analytical results obtained for similar waste streams, the homogeneity of the waste and the ability to obtain a representative sample, and/or government manufacturing specifications (in regards to munition energetic components).

2.2.1.1 Chemical Agents GA, GB, VX, HD/H/HT

Previous analyses of chemical agents have identified agent breakdown products, organic

[1] These may include Subpart X treatment units listed in Attachment 14 and RD&D treatment units.

stabilizers, and metal constituents. An extensive database compiled from previous analyses has been used to establish expected ranges for agent purity, agent breakdown products, organic stabilizers, and metal constituents (see Appendix A).

To ensure that the chemical agents treated at USACAMDS do not contain higher concentrations of, or constituents in addition to, those previously identified, USACAMDS will analyze the chemical agent throughout each agent/munition campaign or if the waste stream is suspected to have changed.

Throughout each agent/munition campaign:

- Chemical agent will be analyzed for percent agent purity, percent agent organic impurities/breakdown products (by constituent), Toxicity Characteristic (TCLP) metals (i.e., Arsenic, Barium, Chromium, Cadmium, Lead, Mercury, Silver, and Selenium), and total metals identified in the HRA for the Deseret Chemical Depot (DCD) (i.e., Aluminum, Antimony, Beryllium, Boron, Cobalt, Copper, Manganese, Nickel, Thallium, Tin, Vanadium, and Zinc, hereafter referred to as HRA metals). Total TCLP and HRA metals will be determined.

- A representative chemical agent sample will be taken at one of the seven agent storage tanks or directly from a bulk container prior to agent incineration.

- Agent purity analyses will be performed using the SOP's listed in Table 2-2 (Row 2).

During post trial burn and long term incineration operations, one sample of chemical agent will be analyzed at least once every six months, or at the beginning of each agent/munition campaign, whichever is shorter or if the chemical agent is suspected to have changed composition outside the specified range.

For each analysis, if the result of the percent agent purity analysis is more than ten percent of the specified agent purity limit as specified for each agent/munition in Table A-2, or the agent container had previous held another agent, the Executive Secretary will be notified in writing to determine if an adjustment to incinerator feed rates and/or agent sampling frequency is required. This notification will be in writing and occur within seven days from the time when analytical results are obtained that demonstrate the agent purity to be out of range.

Appendix A of this waste analysis plan contains the following information regarding the chemical agents to be incinerated at USACAMDS:

- Table A-1: Physical Properties of Chemical Agent (as a pure substance)

- Table A-2: Chemical Agent Composition (agent percent purity ranges, by munition, and associated agent impurities)

- Table A-3: GB Agent Purity (by agent manufacturing lot #, and munition lot #)

- Table A-4: VX Agent Purity (by agent manufacturing lot #, and munition lot #)

- Table A-5: HD Agent Purity (by agent manufacturing lot #, and munition lot #)

2.2.1.2 Drained Bulk Containers & Projectiles

Drained bulk containers and projectiles will be treated in the MPF and will contain undrainable amounts of chemical agent. Previous analytical results show some of the chemical agent to contain concentrations of metals. In addition, the paints used on the containers and projectiles have metal containing pigments.

The chemical agent and item surface coatings (i.e., paint) are both organic matrices containing metal constituents. Metal constituents contained in organic matrices are referred to as non-embedded metals. Non-embedded metals may be entrained when these organic materials volatilize during incineration.

Appendix B contains the following tables regarding the metals associated with each type of chemical agent munition and bulk container to be treated at the USACAMDS:

- Table B-1: Metals in Munitions (presents by munition or bulk container, the total metal loading for non-embedded metals whose emission rates are regulated by the USACAMDS RCRA Permit)

- Table B-2: Metal in Munitions (presents by munition or bulk container, the total metal loading for non-embedded metals whose emission rates are considered in the DCD HRA)

Data included in these tables can be used to determine the quantity (and associated feed rate) of non-embedded metals fed to the incinerator.

2.2.1.3 Energetic Munition Components

All agent contaminated energetic munitions components (i.e., the fuzes, bursters, and propellants associated with M55 rockets, projectiles, mortar rounds, and M23 land mines). Will be incinerated in the DFS upon approval from the Executive Secretary These items will be designated with waste codes D003 and P999 (and other codes, as they apply). All energetic munitions components from “Leaker” munitions shall be designated as agent contaminated.

Energetic munitions components which have been removed from their associated munitions and have been determined to be non-agent contaminated by approved agent monitoring methods (i.e., less than 1.0 TWA when monitored with ACAMS), will be designated with the waste code D003 (and other codes as they apply). These munitions components may be incinerated in the DFS when it has been approved for treating this waste type. As an alternative management method, these wastes may be shipped to an off-site TSDF that is permitted for treatment or disposal of energetic wastes.

The explosives, propellants, and related compounds were manufactured and loaded according to strict government specifications and standards; therefore, sufficient information is available regarding their composition. The fill specifications will be used to determine the amount of explosive and propellant being fed to the DFS.

Appendix C contains the following tables pertaining to explosive/propellant and agent fill

weights and compositions:

- Table C-1: Energetic/Agent Nominal Weight for Chemical Agent Munitions and Bulk Containers.

- Table C-2: Munition Energetic Component Composition.

Explosive and propellant formulations are organic matrices, some of which contain regulated metal constituents. The metals contained in these formulations will potentially volatilize during incineration (i.e., the metals are non-embedded).

The quantity of each metal identified in Table C-2 has been incorporated into Tables B-1 and B-2 found in Appendix B, which present the total non-embedded metals for each munition and bulk container type to be treated at USACAMDS.

2.2.1.4 **Spent Decontamination Solution**

Each tank of spent decontamination solution (SDS) collected in TMF Tanks T-1 or T-2 will be analyzed prior to incineration. Spent decontamination solutions will be analyzed for chemical agent concentration, corrosivity (pH) and specific gravity and screened for organics (using SW 846 Method 9060, part2 - soluble volatile organic carbon). The purpose of the organic screen is to confirm that the spent decontamination solution waste stream was properly segregated from other waste streams.

If results of the organic screen show the spent decon solution to contain organics in excess of five percent (5%), the tank of spent decontamination solution will be additionally analyzed for ignitability, TCLP/HRA metals (total), and TCLP organics/ (totals).

Each agent/munitions campaign or annually, whichever is shorter, or if the waste stream has changed SDS brine will also be analyzed for TCLP metals/HRA total metals, and total organics.

If chemical agent is detected above 20 parts per billion (ppb) for GA, GB, 20 ppb for VX, and 200 ppb for H/HD/HT, and 200 ppb for L, additional decontamination solution will be added to the tank, the contents of the tank will be recirculated (i.e., mixed) and another sample will be analyzed. Once SDS has been determined to be below these agent concentration limits, it may also be transferred to storage tanks in the BDA.

2.2.1.5 **Pollution Abatement System Brines**

Pollution Abatement System (PAS) brines generated during incinerator operations are accumulated in the DFS PAS and MPF/LIC PAS retention tanks and then transferred to the Brine Drying Area (BDA) storage tanks. PAS brines stored in the BDA tanks will be treated on-site in the BDA evaporator/drum dryers. PAS brines may also be shipped off-site to a Subtitle C TSDF.

Prior to treatment, each tank of PAS brines stored in the BDA will be analyzed for chemical agent concentration, corrosivity (pH), and specific gravity.

Each agent/munitions campaign or annually, whichever is shorter, or if the waste stream has changed PAS brine will also be analyzed for TCLP metals/HRA total metals, and total organics.

Spent PAS scrubber brines will only be treated in the BDA if the agent concentration in the brines is found to be below 20 ppb for GB and VX, and 200 ppb for H/HD/HT. If the agent concentration is greater than the values previously specified, decontamination solution will be added to the scrubber brines and the agent analysis will be repeated.

2.2.1.6 Spent Activated Carbon

Activated carbon is used as a filter media in the CAMDS site ventilation filter system to prevent the release of agent vapors from toxic operations areas and laboratory hoods. It is also used (should there be an agent release) to filter any potential agent from the air entering the Personnel Support Complex (PSC) and the Site Medical Facility (SMF). Spent carbon will be managed as P999 hazardous waste. Spent carbon will be managed and stored until an appropriate method of treatment or disposal has been approved by the Executive Secretary.

2.2.1.7 Agent Contaminated Debris, Metallic

Discarded components of process equipment, discarded carbon filter trays (from which all spent carbon has been removed) associated with the site ventilation filter system, discarded chemical munition overpacks, emptied metal drums, discarded tools used inside toxic operations areas, and other contaminated metal items will be treated by incineration in the MPF to remove chemical agent surface contamination. The selection of wastes to be treated in the MPF (other than drained munitions/bulk containers) is based on the potential of the surface of the waste to have been exposed to chemical agent.

The physical state of these wastes (i.e., debris) prevents the collection of a representative sample. All wastes included in this category are described by the Utah Division of Solid and Hazardous Waste (DSHW) code P999.

Wastes included in this category will be placed onto MPF burn baskets. The CAMDS operating record will include an inventory (including description and weight) of items fed to the MPF in each burn basket to ensure compliance with USACAMDS RCRA Permit conditions.

Chemical agent contaminated metallic debris will be containerized and placed into permitted storage. As a safety precaution, these items will be stored in a ventilated area if monitoring by ACAMS indicates agent vapor concentrations above the 1.0 TWA limit.

2.2.1.8 Agent Contaminated Debris, Non-Metallic

Non-metallic agent contaminated debris will be placed into permitted storage. As a safety precaution, these items will be stored in a ventilated area if monitoring by ACAMS indicates agent vapor concentrations above the 1.0 TWA limit.

Wastes included in this category may be placed onto MPF burn baskets. For those wastes to be incinerated, the CAMDS operating record will include an inventory

(including description and weight) of items fed to the MPF in each burn basket to ensure compliance with USACAMDS RCRA Permit conditions. Examples of this waste stream include munition dunnage, wood, respirator filter canisters from which the carbon has been removed, emptied plastic containers or drums, non-metallic scrap equipment and construction materials, personnel protective clothing, and other discarded non-metallic solid materials, which may have contacted liquid or vapor chemical agent.

Because this waste stream is comprised of debris, a representative sample cannot be obtained for analysis. Therefore USACAMDS will apply knowledge of the waste or the process generating these wastes in association with USACAMDS RCRA Permit conditions established by the Executive Secretary to ensure proper management practices.

The CAMDS operating record will include an inventory (including description and estimated weight) of items fed to the MPF to ensure compliance with USACAMDS RCRA Permit conditions.

2.2.1.9 ECC Maintenance Residues

Maintenance performed on the demilitarization machines (i.e., Rocket Shear Machine, Mine Machine, and Projectile/Mortar Disassembly Machine) located in the two Explosive Containment Cubicles (ECCs) will generate waste residues. Maintenance (to include housekeeping) of the ECCs occurs on a daily basis while demil machines are in operation.

During an M55 rocket campaign, these residues will be comprised of liquid/solid chemical agent sludges, filter elements, rags contaminated with chemical agents and explosive residue, fiberglass fragments, explosive fragments, and explosive dust (resulting from the shearing of munition bursters and rocket shipping/firing tubes).

During projectile campaigns, ECC maintenance residues will be comprised of reactive (i.e., D003) dust generated from the shearing of the bursters, and cloth rags. This residue will not be contaminated with chemical agent because projectiles are not drained of their chemical agent fill in the ECCs.

During the M23 mine campaign, these residues will be comprised of liquid/solid chemical agent sludges, filter elements, rags contaminated with chemical agents and explosive residue, explosive fragments, and explosive dust (resulting from the processing of mine bursters and fuses).

ECC maintenance residues will be weighed prior to incineration to ensure the DFS agent and energetic feed rates limits are not exceeded.

2.2.1.10 Secondary Wastes to be Incinerated

Secondary wastes that are agent contaminated or that are derived from agent treatment processes will be thermally treated in the Metal Parts Furnace to destroy any residual chemical agent present. Wastes in this category either: cannot be verified to contain less than the Waste Control Limit (WCL) for agent, or have been analyzed, and found to have agent concentrations above the WCL. These wastes may include, but are not limited to,

metallic and non-metallic agent contaminated debris described in paragraphs 2.2.1.7 and 2.2.1.8, above; liquid or solid laboratory/ monitoring wastes; VX or GB agent hydrolysate wastes; and other agent contaminated items.

Prior to incineration, these wastes must be evaluated to assure compliance with feed rate limits listed in Modules V and VI of this permit. For waste matrices from which a representative sample can be collected, samples will be analyzed for HRA metals, total organics, BTU value, total halogens, and ash content. Where representative sampling is not practical (e.g. contaminated debris, solid lab wastes, etc.), waste determination will be based on documentation of waste composition and known properties of these materials. A physical description of the wastes added to each burn basket shall be included in the operating record.

2.2.2 Analyses for Wastes Requiring Off-Site Treatment & Disposal

The waste streams included in this section may be transported off-site for further treatment and ultimate disposal. The analytical parameters were selected based on process knowledge; previous analytical results obtained for these waste streams at CAMDS, and Land Disposal Restriction Notification requirements. The extraction method that will be used to determine Toxicity Characteristic parameter concentrations will be the Toxicity Characteristic Leaching Procedure (SW-846 Method 1311). Please note:

- USACAMDS is not permitted to treat TSCA regulated waste (i.e., PCB contaminated M-55 rocket firing tubes). Analysis of DFS ash waste streams for PCBs will not be required.

- Thermally treated scrap metal is defined as metal from bulk containers, projectiles, and mortar rounds, which has undergone thermal decontamination in the MPF under normal operating parameters and has no residue remaining internally or externally on the scrap metal. Treated scrap metal must be managed in accordance with paragraph 2.2.2.6. of this Attachment.

- In the state of Utah, all the wastes streams included in this section (with the exception of non-agent related maintenance wastes such as paint wastes, spent hydraulic fluid, waste oil and lubricants and thermally treated scrap metal,) will be characterized as F999 hazardous waste (Utah State Waste Code for residues from the treatment, testing, or demilitarization of chemical warfare agents as listed in R315-2-10(e)(1)). Therefore, each shipment of waste transported off-site must be accompanied by a hazardous waste manifest, and the off-site receiving facility must have an EPA Identification Number (i.e., be an approved Subtitle C Treatment Storage and Disposal Facility [TSDF]).

2.2.2.1 LIC Slag

The incineration of chemical agent and spent decontamination solutions in the Liquid Incinerator cause the generation of a "glass like" slag waste stream. Slag (in a molten state) accumulates in the secondary chamber of the LIC.

The LIC slag collection system consists of a drum collection unit and a material handling

system located below the secondary chamber slag removal port. To remove slag, incineration operations will cease, and the system will be allowed to cool down before removing the collection drum. The drum will be allowed to cool, and the slag will transferred in an approved hazardous waste container.

Each batch of LIC slag generated will be analyzed for TCLP metals.

2.2.2.2 **Treated M55 Rocket Parts/Fiberglass/Ash (DFS)**

Ash and debris, collected at the DFS Heated Discharge Conveyor (HDC) output and generated during the treatment of M55 rockets, will be analyzed for the chemical agent concentration, TCLP metals and organics. If analytical results demonstrate this waste to be Toxicity Characteristic for Organics, this waste will additionally be analyzed for dioxins/furans. The dioxin/furan analysis will occur at the same frequency as the analysis of TCLP metals and organics.

The uniformity of waste residues exiting the DFS is maintained during DFS upset conditions by a feature built into the control logic of the incinerator. The activation of DFS associated waste feed cut-offs cause the kiln to go into oscillation and the HDC to stop moving.

In the event that waste is discharged from the HDC during an upset condition, USACAMDS will document the circumstances in the operating record and analyze one sample taken from each HDC waste bin generated during the upset condition for agent concentration (if agent is included in the DFS feed stream).

2.2.2.3 **Treated Burster Casings/Fuse Bodies/Ash (DFS)**

During projectile/mortar processing, residues collected at the DFS HDC output will consist of ash, empty burster casings and fuse bodies. Projectiles/mortars, which still contain an agent heel, may also be fed to the DFS with these energetic components.

Ash and debris generated from the incineration of bursters and fuses (without residual agent feed) removed from projectiles/mortars will be analyzed for TCLP metals and organics.

Ash and debris generated from the incineration of projectiles/mortars, which contained residual agent, will be additionally analyzed for chemical agent concentration.

2.2.2.4 **Treated Mines/Fuse Bodies/Ash (DFS)**

VX mines will be punched and drained of their chemical agent fill by a mine demil machine located in the ECC #1. The drained mine body and the mine's associated energetic components will then be fed to the DFS. During the VX mine campaign, DFS HDC residues will consist of mine bodies, fuse bodies, and ash.

The ash portion of this waste stream will be analyzed for TCLP metals, organics and for chemical agent concentration.

2.2.2.5 **DFS PAS Cyclone Residues**

DFS cyclone residues will be analyzed for the parameters of chemical agent concentration, TCLP metals and organics. If analytical results demonstrate this waste to be Toxicity Characteristic for organics, this waste will additionally be analyzed for dioxins/furans. The dioxin/furan analysis will occur at the same frequency as the analysis of TCLP metals and organics.

DFS PAS cyclone residues having a chemical agent concentration below 20 parts per billion (ppb) for GA, GB, 20 ppb for VX, 200 ppb for H/HD/HT, and 1 ppm for L, will be transported to an off-site Subtitle C TSDF for further treatment and ultimate disposal.

DFS PAS cyclone residues having an agent concentration greater than 20 parts per billion (ppb) for GA, GB, 20 ppb for VX, 1 ppm for L, and 200 ppb for H/HD/HT. Will be treated on the DFS heated discharge conveyor (DFS-HDC) or placed into container storage until this waste stream is permitted for treatment in the MPF.

2.2.2.6 **Treated Bulk Containers/Projectiles/Mortar Rounds (MPF Scrap Metal)**

Each burn tray exiting the MPF undergoes an agent hazard assessment. The presence of chemical agent is determined by an Automatic Continuous Air Monitoring System (ACAMS) located in the MPF discharge canopy ventilation duct. If chemical agent is detected, the munitions/bulk containers are moved back into the MPF to undergo further thermal treatment.

The MPF is designed with a double-door airlock system at the charge end and a

ventilated canopy at the discharge end of the primary combustion chamber (PCC). These systems prevent PCC combustion gases and agent vapors from being discharged into MPF work areas or the atmosphere when burn trays are charged and discharged respectively.

The MPF primary combustion chamber is divided into two combustion zones. Treatment through MPF requires that each burn tray charged remain in each zone for a preset period of time (from 40 to 80 minutes depending on the type of drained munitions or bulk containers being processed). At a preset time the burn tray in Zone 2 is advanced into the MPF discharge canopy. The burn tray in Zone 1 cannot be advanced to Zone 2 until the previous tray has been released from the discharge canopy.

While in the discharge canopy the contents of the burn tray are monitored for the presence of chemical agent using an ACAMS. The burn tray remains in the MPF discharge canopy for sufficient time for the ACAMS to complete two cycles.

If chemical agent is detected above the Surgeon General's established Time Weighted Average (TWA) for the chemical agent being processed, the burn tray in the MPF discharge canopy is move back into Zone 2 for additional processing. If no agent is detected, the burn tray exits the MPF discharge canopy by being advanced to the MPF cooling bays.

Thermally treated scrap metal will be sent off-site and will be: (1) managed as scrap metal and recycled exclusively by smelting; or (2) managed as a hazardous waste and disposed at an approved, off-site Subtitle C TSDF. For disposal, manifest requirements must be adhered to. F999 scrap metal shall be managed as described in Item (2) above.

Before shipment of thermally treated scrap metal, all loose residue in the interior and on the exterior of the scrap metal will be removed (e.g., vacuumed). The residue removed will be analyzed for chemical agent, TCLP metals and TCLP Organics. The residue shall be managed separately for the munitions metal residue and shall not be recycled. This waste stream must be shipped to an approved hazardous waste facility for disposal. A visual verification of the scrap metal for any residue in and on all scrap metal must be performed. Any scrap metal which contains residue that cannot be removed, will be considered a F999 waste and the requirements specified in 2.2.2.6 must be followed.

2.2.2.7 **MPF Treated Metallic Debris**

This waste stream is comprised of metallic debris (as listed in paragraph 2.2.1.7), which has been treated in the MPF to remove surface contamination.

Each burn basket exiting the MPF is monitored for chemical agent as described in paragraph 2.2.2.6.

The MPF treated debris waste stream will be managed separately from the thermally treated scrap metal waste stream and will not be recycled, with the exception of the following miscellaneous metal wastes. Munition overpacks, piping, conveyors, drain probes and shear blades may be thermally treated and recycled in accordance with paragraphs 2.2.2.6 and 2.2.2.7.

2.2.2.8 **MPF Treated Non-Metallic Debris (Ash)**

This waste stream is comprised of non-metallic debris (as listed in paragraph 2.2.1.8 and 2.2.1.10), which has been incinerated in the MPF in burn baskets to remove agent contamination. Ash and residue removed from the internal cavities of treated bulk containers and munition bodies is also included in this waste stream.

Each burn basket exiting the MPF is monitored for chemical agent as described in paragraphs 2.2.2.6.

MPF ash will be analyzed for agent concentration (via extraction method) and TCLP metals and organics prior to being transported to an off-site Subtitle C TSDF for further treatment and ultimate disposal. Ash pieces that do not pass through a ½ inch sieve shall be treated again in the MPF.

2.2.2.9 **MPF SDS Incineration Residue (Salts)**

This residue is generated through the incineration of SDS liquids in the MPF primary chamber. This waste stream will be managed in the same way as MPF ash (described in paragraph 2.2.2.8).

2.2.2.10 **DFS Treated Debris (Ash)**

This waste stream is comprised of debris (as listed in paragraph 2.2.1.8), which has been incinerated in the DFS to remove agent contamination.

Each container of ash accumulated from the DFS HDC is monitored for two ACAMS cycles at the TWA level for chemical agent vapor concentration prior to transfer to storage.

DFS ash will be analyzed for agent concentration (via extraction method) and TCLP metals and organics prior to being transported to an off-site Subtitle C TSDF for further treatment and ultimate disposal.

2.2.2.11 **Incinerator Refractory**

Upon change out, the discarded refractory lining of the incinerator primary and/or secondary combustion chambers will be analyzed for TCLP metals.

2.2.2.12 **PAS Residues**

PAS residues are comprised of scrubber brine precipitate and filter elements collected in the bottom of the PAS process tanks (i.e., the quench towers, packed bed scrubbers, and demister vessels), and the PAS brine filters.

The PAS residues are expected to be of a similar composition to that of the scrubber brine salts (the waste stream generated from drying the scrubber brines in the BDA evaporators and drum dryers).

The PAS residues generated by each incinerator will be analyzed for the parameters of chemical agent concentration, free liquids, and TCLP metals and organics. Residues, which contain free liquids, will also be tested for corrosivity (pH).

2.2.2.13 **PAS (scrubber) Brines**

Pollution Abatement System (PAS) brines generated during incinerator operations are accumulated in the DFS PAS and MPF/LIC PAS retention tanks and then transferred to the Brine Drying Area (BDA) storage tanks.

USACAMDS may transport brines to an off-site TSDF for further treatment and ultimate disposal.

Spent PAS scrubber brines to be transferred off-site for further treatment and disposal will be analyzed for chemical agent concentration, corrosivity (pH), specific gravity, TCLP metals and organics, total dissolved solids (TDS), and total suspended solids (TSS).

Each tank or tanker will be analyzed for agent concentration, specific gravity, and corrosivity (pH).

Spent PAS scrubber brines will only be shipped off-site for further treatment and ultimate disposal if the agent concentration in the brines is below 20 ppb for GA, GB and VX, 200 ppb for H/HD/HT, and 1 ppm for L.

2.2.2.14 **PAS Demister Packing & Packed Bed Saddles**

Discarded demister packing and packed bed scrubber saddles from each PAS will be analyzed for TCLP metals and organics.

2.2.2.15 **PAS Brine Salts**

The on-site treatment of PAS brines involves the concentration of these liquids in the BDA evaporator and further de-watering (by evaporation) of the concentrated brine in the BDA drum dryers. The output of the BDA drum dryers is referred to as PAS or scrubber brine salts.

PAS brine salts will be analyzed for free liquids and TCLP metals and organics.

2.2.2.16 **DPE Suits**

Demilitarization Protective Ensemble (DPE) suits are fully encapsulating, positive pressure supplied air PPE worn by personnel required to enter operations areas where agent liquid or vapors are known to exist. DPE suits are made of polyvinyl chloride, as opposed to the Army Level A Suits, which are made of butyl rubber. These suits may be contaminated with a varying amount of chemical agent liquid and/or vapor. Suits are decontaminated with liquid decon solutions prior to doffing. These suits may remain contaminated with varying levels of chemical agent and spent decon solution.

Discarded DPE suits will be bagged, labeled and analyzed for chemical agent to

determine if they must be placed into ventilated storage to await further on-site treatment or shipped to an off-site TSDF as a F999 hazardous waste. Chemical agent exposed DPE suits will be managed on-site in ventilated storage if analysis of an extract made from samples of the DPE suits demonstrates that agent is present in the extracts above 20 ppb for GA, GB and VX, 200 ppb for H/HD/HT, and 1 ppm for L.

DPE suit samples will be collected by cutting a piece of material from the lower mid-section of the suit most likely to become contaminated while being worn by the wearer rubbing up against agent contaminated equipment.

DPE suits will be managed off-site as an F999 listed hazardous waste if analysis of an extract made from samples of the DPE suits demonstrates that no agent is present in the extract (i.e., agent analytical results at or below 20 ppb for GA, GB and VX, 200 ppb for H/HD/HT, and 1 ppm agent L).

2.2.2.17 **Contaminated Spent Hydraulic Fluid**

Spent hydraulic fluid generated through site maintenance activities will be analyzed for TCLP metals/HRA (total), and total and TCLP organics. Spent Hydraulic fluid in the following areas will be analyzed for chemical agent concentration, TCLP metals/HRA (total), and total and TCLP organics:

1. Explosive Containment Cubicle (ECC) #1/Segregator, unpack area, and associated vestibule (building C7028)
2. Bulk Item Facility (BIF) drain area (building C7046 - Multipurpose Demilitarization Facility (MDF))
3. Multipurpose Demilitarization Machine (MDM)/Bulk Drain Station (BDS) area (building C7046)
4. Multipurpose Demilitarization Facility (MDF) conveyor gallery area and Toxic Unpack Area (building C7046)
5. Metal Parts Furnace (MPF) charge car area and output conveyor area (building C7045)
6. Deactivation Furnace System (DFS) retort room, heated discharge conveyor, discharge conveyor and cyclone room (building C7030)
7. DFS Pollution Abatement System (PAS) secondary containment area (building 7030)
8. MPF PAS secondary containment area (building 7045)
9. Material Decontamination Chamber (MDC2) area (building C7025)
10. Liquid Incinerator (LIC) agent storage, primary combustion chamber, and secondary combustion chamber areas (building C7068)
11. Explosive Containment Cubicle (ECC) #2 and Projectile/Mortar Disassembly Machine (PMD) area (building C7090 - Equipment Test Facility (ETF))
12. Residual Storage Area (RSA) (building C7046)
13. Toxic Maintenance Facility (TMF) (building C7055)
14. Brine Drying Area (BDA) secondary containment area (building C7066)
15. Munitions Holding Area (MHA) (building 7078)

Spent hydraulic fluid having agent concentrations less than 20 ppb for GA, GB and VX, 200 ppb for H/HD/HT, and 1 ppm L, will be managed at off-site Subtitle C TSDF.

Spent hydraulic fluid contaminated with chemical agent above 20 ppb for GA, GB and VX, 200 ppb for H/HD/HT, and 1 ppm agent L, will be containerized and placed into permitted storage and may be managed as described in section 2.2.1.10.

Please note: failure of a hydraulic system inside a toxic operations area may result in the generation of hydraulic fluid contaminated with chemical agent. Hydraulic fluid released from the system will be collected in a sump and transferred to TMF Tank 1 or TMF Tank 2.

2.2.2.18 **Contaminated Spent Lubricating Oil**

Spent lubricating oil generated during equipment maintenance will be analyzed for agent concentration, TCLP metals/HRA (total), and TCLP and Total organics.

Spent lubricating oil will be transported off-site for further treatment and ultimate disposal at a Subtitle C TSDF only if the agent concentration in the waste is below 20 ppb for agents GA, GB and VX, 200 ppb for agent H/HD/HT, and 1 ppm agent L.

Spent lubricating oil contaminated with chemical agent above 20 ppb for GB and VX, 200 ppb for H/HD/HT, and 1 ppm agent L, will be containerized and placed into permitted storage and may be managed as described in section 2.2.1.10..

2.2.2.19 **Liquid Laboratory Wastes**

Operation of analytical equipment within the SAF lab results in the generation of an aqueous waste stream. Past analytical results have shown this waste stream to exhibit the characteristics of ignitability and corrosivity, and contain volatile organics and metals above the regulatory limits.

Liquid lab wastes will be analyzed for the parameters of agent concentration, corrosivity (pH), ignitability, TCLP metals/HRA totals, and TCLP Organics if these wastes are to be incinerated at CAMDS. If these wastes are sent off site for disposal HRA metals will not be required.

Liquid lab wastes will be transported off-site for further treatment and ultimate disposal at a Subtitle C TSDF only if the agent concentration in the waste is below 20 ppb for agents GA, GB and VX, 200 ppb for agent H/HD/HT, and 1-ppm agent L.

If analytical results demonstrate that the agent concentration in these liquids is above the values listed in the previous paragraph, they will be placed into ventilated permitted storage and may be managed as described in section 2.2.1.10.

2.2.2.20 **Laboratory Waste, Solids (debris)**

SAF lab generated waste solids consist of discarded glassware, wipe cloths, paper, gloves, plastic, wood, pipet tips, DAAMS tubes, transfer tubes, discarded analytical equipment components and vermiculite.

Each individual item comprising this waste stream is decontaminated before it is placed into the accumulation container. Over time as the container is filled, decon solution (that

once clung to the item) collects in the bottom of the container. A sample of this residual decon solution will be taken from the bottom of each container of lab solid debris generated and analyzed for chemical agent.

Containers having analytical results demonstrating the agent concentration in the decon solution is below 20 ppb for GA, GB and VX, 200 ppb for H/HD/HT, and 1 ppm agent L, may be managed off-site as F999 listed hazardous wastes.

Containers having analytical results demonstrating the agent concentration in the decon solution is above the values listed in the previous paragraph will be containerized and placed into ventilated permitted storage and may be managed as described in section 2.2.1.10.

2.2.2.21 **Monitoring Waste Solids (debris)**

Monitoring solid debris consists of wipe cloths, personal protective equipment, discarded monitoring system components (e.g., tygon tubing, VX conversion pads, DAAMS tubes, transfer tubes, discarded analytical equipment, etc.).

This waste stream will be sampled, analyzed and managed as described in section 2.2.2.20.

2.2.2.22 **Paint Waste, Liquids**

This waste stream is generated from site maintenance painting operations where there is no potential contact with chemical agent or residues from agent treatment. Waste paint liquids are managed as a hazardous waste because they typically contain ignitable and toxic constituents. Consequently they will be tested for ignitability, TCLP metals, and TCLP Organics.

2.2.2.23 **Paint Waste, Solids**

This waste stream is also generated from site maintenance painting operations where there is no potential contact with chemical agent or residues from agent treatment. Waste paint solids will be tested for TCLP metals and TCLP Organics.

2.2.2.24 **Spent Decontamination Solution**

GB sodium hydroxide-based spent decontamination solutions, VX sodium hypochlorite-based spent decontamination solutions, or mustard (H, HD, HT) sodium hypochlorite solutions generated from chemical agent operations shall be treated/disposed exclusively at a Subtitle C permitted hazardous waste incinerator at an off-site TSDF.

Agent specific spent decontamination solutions shall remain separated. Each Tank of Spent Decontamination Solution (SDS) collected in TMF tanks T-1 or T-2 shall be analyzed for agent concentration and pH prior to transfer to storage tanks in the BDA (T13-D or T13-E). Prior to sampling the TMF or the BDA tanks, the tanks shall be mixed for a minimum of one hour. Prior to off-site shipment, each BDA tank and TMF tank of spent decontamination solution shall be sampled and analyzed for chemical agent concentration, Corrosivity (pH), HRA metals, BTU, ignitability, total halogens, total

organics and specific gravity. Each tank of VX SDS shall additionally be analyzed for the VX-related constituents EA 2192 and EA 4196 prior to off-site shipment. For decontamination solutions generated from a process where explosive contamination is possible, analysis for explosives is also required for each tank.

If the chemical agent concentration is below 20 ppb for GB or VX and 200 ppb for mustard, then the spent decontamination solution may be shipped off-site for disposal in a hazardous waste incinerator. If chemical agent is detected at or above 20 ppb for GB or VX and 200 ppb for mustard, additional decontamination solution shall be added to the TMF tanks, the contents recirculated (i.e. mixed) and another sample analyzed for agent concentration. For VX SDS only: concentration of EA-2192 must be verified less than 20 ppb and EA 4196 must be verified less than 8 ppm prior to shipment for off-site disposal.

Before transfer to tanker trucks for off-site shipment, the TMF or BDA SDS holding tanks shall be sampled for chemical agent concentration, (EA 2192 and EA 4196 for VX SDS only), pH and specific gravity. Any subsequent SDS addition will void the original sample results and shall require the above sampling analyses to be repeated and agent concentration verified less than the agent concentration limits prior to tanker transfer. In addition to the above requirements, the following restrictions shall apply to off-site shipments of SDS:

DCD/CAMDS shall impose contractual restrictions on the transporters and off-site management facilities to ensure that the spent decontamination solutions are directly fed into an incinerator from the tanker truck to prevent commingling with other waste streams managed at the facility. As an alternative to direct tanker feed, a dedicated tank at the off-site incinerator for the spent decontamination solution may be used to prevent commingling at the off-site management facility.

DCD/CAMDS shall impose contractual restrictions on the transporters and off-site management facilities to ensure that the spent decontamination solution pH is not lowered in each tanker or dedicated tank.

The off-site treatment facilities to which DCD/CAMDS may ship SDS are limited to hazardous waste incineration facilities.

The off-site transporters and management facilities shall be trained in chemical agent exposure and spill response before shipment of SDS.

2.2.3. Waste Determination for Subpart BB Requirements

In accordance with R315-8-18 [40 CFR 264.1063(d)], hazardous wastes which are contained in or contact equipment (as defined in 264.1051), will be analyzed to determine if the organic concentrations of these wastes equal or exceeds 10 percent by weight. The waste determinations must follow analytical methods listed in 264.1063(d)(1) & (2) or application for operator knowledge as described in 264.1063(d)(3). Analytical records and data supporting operator knowledge must be maintained in accordance with the applicable sections of R315-8-18 [40 CFR 264.1063(k)]. If it is determined that a waste equals or exceeds 10 percent by weight organic concentration level, the requirements of R315-8-18 [40 CFR 264.Subpart BB] will be applied to the subject equipment (ie. the

equipment requirements will be incorporated into the CAMDS Subpart BB compliance plan).

2.3 PARAMETER TEST METHODS

Table 2-2 provides a listing of the test (analytical) methods that will be used to detect and quantify the selected parameters. This information is presented in a relational format in Table 2-1 (the WAP Summary Table).

The CAMDS Site Analytical Facility (SAF) will perform the analyses related to chemical agent, total organic screening and free liquids. The above referenced analyses are incorporated into USACAMDS Laboratory Operating Procedures (included in Attachment 3 of this application).

Additionally, a laboratory certified by the State of Utah to perform the following methods which are included in the EPA document titled Test Methods for Evaluating Solid Waste (SW-846): ignitability (method 1010), corrosivity (method 9040), and free liquids (method 9095) will be used when required.

A Utah state certified laboratory will perform the analyses for TCLP Metals, Total Metals, TCLP Organics, VOCs -Total, Total Dissolved Solids (TDS) and Total Suspended Solids (TSS). When required, the selected Utah State certified laboratory will also perform the Toxic Characteristic Leaching Procedure (TCLP, Method 1311).

The Utah State certified laboratories selected will be certified by the state of Utah.

2.4 SAMPLING METHODS

See the last column in Table 2-1 (the WAP Summary Table) for the sampling methods to be used for each waste stream.

2.5 FREQUENCY OF ANALYSES

See the second to the last column of Table 2-1 (The WAP Summary Table) for the frequencies at which each waste stream will be sampled and analyzed.

2.6 ADDITIONAL REQUIREMENTS FOR WASTES GENERATED OFF-SITE

USACAMDS does not anticipate receiving wastes from sources outside Deseret Chemical Depot (DCD) on a routine basis. If such a need should arise, the generating site will be required to conduct the same analyses as described for analogous waste streams in this waste analysis plan and provide the results to USACAMDS prior to shipment of wastes.

USACAMDS may also receive wastes from other activities located within DCD. In this case, the activity, which generated the waste, will be required to perform analyses equivalent to those specified in this waste analysis plan and provide the results to USACAMDS prior to transfer of wastes.

2.7 ADDITIONAL REQUIREMENTS FOR IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTES

USACAMDS facility compliance with these regulatory requirements is outlined and documented in sections 2.2 through 2.5 of this WAP.

2.8 RECORD KEEPING REQUIREMENTS

Analytical results generated in compliance with this Waste Analysis Plan are maintained on file at the facility as part of the USACAMDS operating record.

2.9 SAMPLING AND ANALYSIS QA/QC PROCEDURES

General laboratory quality control/quality assurance procedures are in accordance with the specified analytical methods for individual parameters (see Table 2-2) as described in the EPA publication SW-846, *Test Methods for Evaluating Solid Wastes*, and in accordance with "Laboratory Support Division Monitoring Branch Quality Control Plan," Site Plan 49-03 and "Laboratory Support Division Analysis Branch Quality Control Plan," Site Plan 49-01.

Included in Attachment 3 are detailed procedures that will be used in the SAF laboratory as appropriate for specific agent analysis for which no EPA-approved methods currently exist.

All analyses performed at off-site laboratories will be conducted by laboratories that are certified by the Utah Department of Laboratory Services. These laboratories have existing quality control plans that are specific to the particular laboratory. These plans will be used and required as part of contracting for their services. The laboratories Quality Assurance Quality Control Plans will meet or exceed the requirement of the USACAMDS permit and Site Plans.

2.10 SUBPART CC SAMPLING AND ANALYSIS REQUIREMENTS

2.10.1 For the agent storage / treatment tanks (SEG-T1, SEG-T2, MDF-T3, MDF-T4, LIC-T5, ASR-T6, ASR-T7), the Toxic Maintenance Tanks (TMF-1, TMF-2), and the Brine Dryer Area Tanks (T13-A, T13-B, T13-C, T13-D, T13-E), the maximum organic vapor pressure waste determinations must be performed prior to placing hazardous waste in the tanks, if the tanks are subject to tank level 1 controls. The maximum organic vapor pressure determination must be performed by either direct measurement (Method 25E of 40 CFR 60, Append. A), or by knowledge of the waste. Existing organic vapor pressure data (knowledge of the waste) will be used for chemical agents, and will be maintained in the operating record.

2.10.2 Sampling and Analysis for determinations of “operating with no detectable organic emissions”. These determinations are required for tanks subject to Subpart CC and having a vapor headspace at a pressure equal to or above atmospheric pressure, and closed vent systems (duct work, valves, etc.) operating at atmospheric pressure or above. These determinations shall be conducted in accordance with EPA Method 21.

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	TREATMENT UNIT (S)	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.1 Wastes Requiring On-site Treatment					
1. Chemical Agent	LIC MPF DFS	• Agent % Purity	SOP's as listed in Table 2-2 (Row 2)	One sample analyzed every six months or each agent/munition campaign whichever is shorter.	Tap- agent tank systems or bulk container by Tap or modified Coliswasa
		• HRA Metals (Totals)	3010A/3050A, 6010B, 7470A, or 7000 series[4]		
		• Percent Organic Impurities/ Breakdown Products	SOP as listed in Table 2-2 (Row 3)		
2. Drained Bulk Containers/Projectiles	MPF	• Non-embedded metals (Appendix B)			
3. Energetic Munition Components	DFS	• Manufacturer Specifications (Appendix C)			
4. Spent Decon Solution (SDS) (Organic content >5%)	LIC	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each TMF tank	Tap
		• Corrosivity (pH)	9040B		
		• Specific Gravity	2710F		
		• Organic Screen	9060 (section 2) - Soluble, volatile organic carbon		
Spent Decon Solution (Organic content >5%)	LIC	• HRA Metals (Totals)	3010A, 6010B, 7470A,or 7000 series[4]	Each TMF Tank having an organic content greater than 5% by weight or annually whichever is shorter.	Tap
		• Organics[3] (Totals)	5030A, 8260B, 8270C		
		• Ignitability	1010/1020A		
5. PAS Brines	BDA	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each BDA tank	Tap
		• Corrosivity (pH)	9040B	Each agent/munition campaign or annually, whichever is shorter: One sample from first BDA tank generated for analysis	
		• Specific Gravity	2710F		
		• HRA Metals (Totals)	3010A, 6010B, 7470A, or 7000 series[4]		Tap
		• TC Organics[3]	5030A, 8260B, 8270C		
6. Spent Activated Carbon		• Agent Concentration	Approved Lab SOP (To be determined)	To be determined	Thief

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	TREATMENT UNIT (S)	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
7. Agent Contaminated Debris, Metallic	MPF	• Generator knowledge, composition of waste prevents a representative sample from being taken • Physical Description	ASTM D4979-89	Inventory for each burn basket	
8. Agent Contaminated Debris, Non-metallic	MPF DFS	• Generator knowledge, composition of waste prevents a representative sample from being taken. • Physical Description	ASTM D4979-89	Inventory for each burn basket	
9. ECC Maintenance Residues	DFS	• Generator knowledge based on government manufacturer specifications			
10. Agent Contaminated Secondary Wastes to be Incinerated	MPF	• Agent Concentration • HRA Metals (totals) • TC Organics[3] • BTU • Total Halogens • Total Volatile Solids (Ash) Or knowledge based on process of generation or known material composition and inherent properties	SOPs listed in Table 2-2 (Row 1) 3010A, 3050, 7470A, 6010B or 7000 series[4] 5030A, 8260B, 8270C ASTM D240-87 9056 or 300.0/300.1 EPA 160.4	10% of the containers from each batch[2] or one container, whichever is greater OR Inventory for each burn basket	Colowasa Tap Thief
		• Physical Description	ASTM D4979-89	Each burn basket or tray	

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	GENERATION SOURCE	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.2 Wastes Requiring Off-site Treatment					
1. LIC Slag	LIC	• TCLP Metals	1311, 7471A & 6010B/7000 series[4]	Each batch[2] of containers: One sample from each container comprising a batch composited into one sample for analysis	Hammer and Chisel or Coring Device
2. Treated M55 Rocket Parts/Ash	DFS HDC	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each month throughout M55 rocket campaign: One grab sample from each HDC waste bin generated in an operational 12 hr shift, composited into one sample for analysis.	Thief, Scoop or Coring Device
		• TCLP Metals	1311, 7471A & 6010B/7000 series[4]	Each M55 rocket campaign or annually, whichever is shorter: One grab sample from each HDC waste bin generated in an operational 12 hr shift, composited into one sample for analysis	Thief, Scoop or Coring Device
		• TCLP Organics[3]	1311, 8260B/8270C		
		• Dioxin/Furans	8290		
3. Treated Burster & Fuse Bodies/Ash	DFS HDC	• TCLP Metals	1311, 7471A & 6010B/7000 series[4]	Each agent/munition campaign or annually, whichever is shorter: One grab sample from each HDC waste bin generated in an operational 12 hr shift, composited into one sample for analysis	Thief, Scoop or Coring Device
		• TCLP Organics[3]	1311, 8260B/8270C		

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	GENERATION SOURCE	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.2 Wastes Requiring Off-site Treatment					
4. Treated VX M23 Mines: Mine Bodies/Ash	DFS HDC	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each month throughout M23 mine campaign: One grab sample from each HDC waste bin generated in an operational 12 hr shift, composited into one sample for analysis.	Thief, Scoop or Coring Device
		• TCLP Metals	1311, 7471A & 6010B/7000 series[4]	Each M23 mine campaign or semi-annually, whichever is shorter: One grab sample from each HDC waste bin generated in an operational 12 hr shift, composited into one sample for analysis	Thief, Scoop or Coring Device
		• TCLP Organics[3]	1311, 8260B/8270C		
5. DFS PAS Cyclone Residues	DFS	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Throughout each agent/munition campaign: one core sample for analysis from each container generated	Thief or Coring Device
		• TCLP Metals	1311, 7471A & 6010B/7000 series[4]	Each agent/munition campaign or semi-annually, whichever is shorter: First batch of containers, one grab sample from each container comprising a batch, composited into one sample for analysis	Thief or Coring Device
		• TCLP Organics[3]	1311, 8260B/8270C		
		• Dioxin/Furans	8290		
6. Treated Munition Casings & Bulk Containers	MPF	• Chemical Agent (vapor)	See Section 2.2.2.6	Each Burn Tray is Monitored	ACAMS

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	GENERATION SOURCE	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.2 Wastes Requiring Off-site Treatment					
7. MPF Treated Debris, Metallic (MPF Incineration residues from wastes listed in 2.2.1.7)	MPF	• Chemical Agent (vapor)	See Section 2.2.2.6	Each Burn Basket is Monitored	ACAMS
		• Generator knowledge, composition of waste prevents a representative sample from being taken			
8. MPF Treated Debris, Non-Metallic (Ash)(MPF Incineration residues from wastes listed in 2.2.1.8 and 2.2.1.10)	MPF	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each Burn Basket	Thief or Coring Device
		• TCLP Metals	1311, 7471A & 6010B/7000 series[4]	Each agent/munition campaign or semi-annually, whichever is shorter or if the waste stream is suspected to have changed: One grab sample from one container for analysis	
		• TCLP Organics[3]	1311, 8260B, 8270C		
9. MPF SDS Incineration Residues	MPF	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each Burn Tray	Thief or Coring Device
		• TCLP Metals	1311, 7471A & 6010B/7000 series[4]	Each agent/munition campaign or annually, whichever is shorter: One grab sample from one container for analysis	Thief or Coring Device
		• TCLP Organics[3]	1311, 8260B, 8270C		
10. DFS Treated Debris, Ash (DFS Incineration residues from wastes listed in 2.2.1.8)	DFS	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each HDC Ash Dumpster	Thief or Coring Device
		• TCLP Metals	1311, 7471A & 6010B/7000 series[4]	Each agent/munition campaign or semi-annually, whichever is shorter or if the waste stream is suspected to have changed: One grab sample from one container for analysis	Thief or Coring Device
		• TCLP Organics[3]	1311, 8260B, 8270C		

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	GENERATION SOURCE	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.2 Wastes Requiring Off-site Treatment					
11. Incinerator Refractory	LIC MPF DFS	• TCLP Metals	1311, 7471A & 6010B/ 7000 series[4]	Each chamber change out: One grab sample from 10% of the containers comprising a batch, composited into one sample for analysis.	Hammer and Chisel or Coring Device
12. PAS Residues	DFS PAS MPF/ LIC PAS	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	One grab sample for analysis from each accumulated container.	Trier or Coring Device
		• Free Liquids	9095	Each agent/munition campaign or annually, whichever is shorter or if the waste stream is suspected to have changed: Each PAS system, one core sample from first container generated for analysis	Trier or Coring Device
		• Corrosivity (pH) - liquids only	9040B		
		• TCLP Metals	1311, 7471A & 6010B/ 7000 series[4]		
		• TCLP Organics[3]	1311, 8260B, 8270C		
13. PAS Brines	DFS PAS MPF/ LIC PAS	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each BDA-TANK: One sample for analysis, if sample is collected from BDA-TANK	Tap
		• Corrosivity (pH)	9040B		
		• Specific Gravity	2710F		
		• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each full tanker: One sample for analysis, if sample is collected from tanker	Coliwasa or Bailer
		• Corrosivity (pH)	9040B		
		• Specific Gravity	2710F		
		• HRA Metals (totals)	3010A, 7470A, 6010B or 7000 series[4]	Each agent/munition campaign or semi-annually, whichever is shorter: One sample for analysis	Tap, Coliwasa, or Bailer depending on sample location
		• TC Organics[3]	5030A, 8260B, 8270C		
		• TDS	EPA 160.1		
		• TSS	EPA 160.2		
14. PAS Demister Packing & Scrubber Saddles	DFS PAS MPF/ LIC PAS	• TCLP Metals	1311, 7471A & 6010B/ 7000 series[4]	Each agent/munition campaign or annually,	Trier, Coring Device or Shears

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	GENERATION SOURCE	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.2 Wastes Requiring Off-site Treatment					
		• TCLP Organics[3]	1311, 8260B, 8270C	which ever is shorter: One grab sample from 10% of the drums comprising first batch generated, composited into one sample for analysis	
15. PAS Brine Salts	BDA - Dryers	• Free Liquids	9095	Every 30 hours during dryer operation	Scoop or Trier
		• TCLP Metals	1311, 7471A & 6010B/ 7000 series[4]	Each agent/munition campaign or annually, whichever is shorter: One grab sample from each container of salts generated in an 12 hr operational shift, composited into one sample for analysis	Trier or Coring Device
		• TCLP Organics[3]	1311, 8260B, 8270C		
16. DPE Suits	Agent Operations Areas	• Chemical Agent (vapor)	ACAMS/ DAAMS	Each bag of contaminated suits generated	ACAMS/ DAAMS
		• Agent Concentration	LAB SOP 32-00-01-18	For DPE suits exclusively contaminated with chemical agent vapors, one sample from 10% of the DPE suits generated	Piece cut from DPE Mid-Section of suit material
17. Spent Hydraulic Fluid	Site Maintenance	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each batch[2]	Coliwasa
		• HRA Metals (totals)	3010A, 7470A, 6010B or 7000 series[4]	Each batch generated, composited into one sample for analysis	Coliwasa
		• TC Organics[3]	5030A, 8260B, 8270C		
18. Spent Lubricating Oil	Site Maintenance	• Agent Concentration	DWS Extract (Table 2-2)	Each batch[2]	Coliwasa
		• HRA Metals (totals)	3010A, 7470A, 6010B or 7000 series[4]	Each batch generated, composited into one sample	Coliwasa

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	GENERATION SOURCE	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.2 Wastes Requiring Off-site Treatment					
		• TC Organics[3]	5030A, 8260B, 8270C	for analysis	
19. Lab Waste, Liquids	SAF	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each container: One sample for analysis	Coliwasa
		• Corrosivity (pH)	9040B		
		• Ignitability	1010/ 1020A	Each agent/munition campaign or annually, whichever is shorter: One sample from first container generated for analysis	
		• Corrosivity (pH)	9040B		
		• HRA Metals (totals)	3010A, 7470A,6010B or 7000 series[4]		
		• TC Organics[3] (totals)	5030A, 8260B, 8270B		
20. Lab Waste, Solids (debris)	SAF	• Agent Concentration	SOP's as listed in Table 2-2 (Row 1)	Each container: One sample of the decon solution collected at the bottom of the accumulation container taken for analysis	Coliwasa
21. Monitoring Waste Solids (debris)	Site Monitoring	• Agent Concentration	SOP's listed in Table 2-2 (Row 1)	Each container: One sample of the decon solution collected at the bottom of the accumulation container taken for analysis	Coliwasa
22. Paint Waste, Liquids	Site Maintenance	• Ignitability	1010/ 1020A	Annually at minimum: One sample collected for analysis brand /type of paint	Coliwasa
		• HRA Metals (totals)	3010A, 7470A, 6010B or 7000 series[4]		
		• TC Organics[3]	5030A, 8260B, 8270C		
23. Paint Waste, Solids	Site Maintenance	• TCLP Metals (totals)	1311, 3010A, 7470A, 6010B or 7000 series[4]	Annually at minimum: One sample collected for analysis	Trier, Scoop or Shears

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	GENERATION SOURCE	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.2 Wastes Requiring Off-site Treatment					
24. GB, VX or Mustard (H, HD, HT) Spent Decontamination Solutions	Off-site Hazardous Waste Incineration	● Agent Concentration ● Corrosivity (pH)	SOP's listed in Table 2-2 (Row 1) 9040B	Each TMF tank after mixing a minimum of one-hour prior to transfer to the BDA tank.	Tap
		● HRA Metals (totals) ● Ignitability ● TC Organics[3] ● Specific Gravity ● BTU ● Total Halogens ● Agent Impurities/breakdown Products[5] ● EA 2192[6] ● EA 4196[6]	3010A, 7470A, 6010B or 7000 series[4] 1010/ 1020A 5030A, 8260B, 8270C 2710F ASTM D240-87 9056 or 300.0/300.1 8260B, 8270C LAB 66-20-00-02 LAB 66-20-00-03	Each BDA Tank or TMF tank prior to shipment after mixing a minimum of one hour.	
		● Explosives	8330/8332 or LAB 66-00-02-02	Each BDA and TMF Tank when processing explosives	

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	GENERATION SOURCE	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.2 Wastes Requiring Off-site Treatment					
24a. GB or Mustard (H, HD, HT) Spent Decontamination Solutions	Off-site Hazardous Waste Incineration	● Agent Concentration ● Corrosivity (pH) ● Specific Gravity	SOP's listed in Table 2-2 (Row 1) 9040B 2710F	Each TMF or BDA tank prior to transfer to tanker trucks	Tap
2.2.3 Waste Determinations for Subpart BB					
Wastes that contact Subpart BB Equipment	CAMDS Systems	● Organic Concentrations	ASTM D 2267-88, E 169-87, E 168-88, E 260-85 SW-846 9060 or 8260 Part 60, Methods 21, 25A Operator / Process Knowledge	Based on waste stream and knowledge of process generating waste	Tap, Coliwasa Or Air Sampling Method (methods 21 & 25A)
		● Chemical Agent Concentrations	SOP's as listed in Table 2-2 (Row 1)	SOP's as listed in Table 2-2 (Row 1)	SOP's as listed in Table 2-2 (Row 1)

Table 2-1
USACAMDS WASTE ANALYSIS PLAN SUMMARY

WASTE STREAM	GENERATION SOURCE	ANALYTICAL PARAMETERS	ANALYTICAL METHODS[1]	FREQUENCY OF ANALYSIS	SAMPLING METHOD
2.2.2 Wastes Requiring Off-site Treatment					

Footnotes:

1. Analytical methods include those unique to USACAMDS operations (reference Attachment 3), EPA methods (as designated by prefix EPA) and SW-846 methods (all others). Only promulgated SW-846 methods will be used. When newly promulgated methods are approved by EPA, CAMDS will notify its laboratory of the required change and request a time frame of when the change will occur. The laboratory will have 6 months to submit documentation to CAMDS of the change or a time frame when the change will be completed. The laboratory must use the most recently promulgated method within one year of promulgation. If that is not possible, a written request for extension must be provided to DSHW for approval.

2. A batch is defined as all the drums (or containers) of waste generated from the same event, at the same location.

3. TCLP or TC organics are defined as those compounds described by 40 CFR 261.24 by the waste codes D018, D019, D021, D022, D023, D024, D025, D026, D027, D028, D029, D030, D032, D033, D034, D035, D036, D037, D038, D039, D040, D041, and D042.

4. The following SW-846 methods may be used for toxicity characteristic metals determination: 7061A, 7080A, 7130, 7190, 7420, 7741A, 7760.

5. Mustard agent impurities and breakdown products include: PCE (tetrachloroethylene), HCE (hexachloroethane), 1,1,1,2-Tetrachloroethane, 1,1,2,2-Tetrachloroethane (tetrachloroethane), Pentachloroethane, 1,2-dichloroethane, and Tentatively Identified Compounds: [1,2-bis(2-chloroethylthio)ethane, 1,4-Dithiane (Diethylene disulfide), 1,4-Thioxane (1,4-Oxathiane]6. EA 2192 and EA 4196 are analyzed for VX spent decontamination solutions.

Table 2-2
Analytical Method Descriptions

Row	Analyte(s)	Method[1]		Description/Title
1	Chemical Agent Concentration (extraction/analysis) (1,2)	GB	LAB 32-10-04-01	DWS extraction for Agent contaminated soil or other matrices. Waste liquid or extract is analyzed by a gas chromatograph equipped with a flame ionization detector (GC-FID).
		GA	LAB 66-70-01-02	
		VX	LAB 32-20-01-01	
		HD	LAB 32-03-01-02	
		GB VX HD	LAB 32-00-01-18	DWS extraction for Agent contaminated DPE. Waste extract is analyzed by a gas chromatograph equipped with a flame ionization detector (GC-FID).
		GB VX HD	LAB 66-00-00-20	Analysis of Liquid Waste For GB, HD, and VX by Gas Chromatograph/Mass Selective Detector
		HT	LAB 66-30-00-02	Analysis of HT Hydrolysate for H and T Concentration By Gas Chromatograph/Mass Selective Detector (GC/MSD)
2	Chemical Agent Purity, % (3)	GB	LAB 66-00-00-10	Analyses of Neat Agent Samples to Determine Agent Purity .
		GA	(4)	
		VX	LAB 66-00-00-12	
		HD	LAB 66-00-00-11	
		L	LAB 66-80-99-02	Lewisite Purity Determination
3	Agent organic Impurities / breakdown products(3)	LAB 66-00-00-09		Gas Chromatography/ Mass Spectrometry with a mass selective detector.
4	Tetryl, RDX, TNT, Nitroglycerine	LAB 32-00-02-02(1)		Acetonitrile extraction followed by HPLC analysis.
5	Ignitability	SW-846 1010		Pensky-Martens Closed-Cup Method for Determining Ignitability
		SW-846 1020A		Setaflash Closed-Cup Method for Determining Ignitability
6	Toxic Metals & Organics	SW-846 1311A		Toxicity Characteristic Leaching Procedure.
7	Metals	SW-846 3010A		Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy.
8	Metals	SW-846 3050A		Acid Digestion of Sediments, Sludges, and Soils.
9	Organics	SW-846 3510B		Separatory Funnel Liquid-Liquid Extraction.
10	Organics	SW-846 3520B		Continuous Liquid-Liquid Extraction.
11	Organics	SW-846 3540B		Soxhlet Extraction
12	Organics	SW-846 3580A		Waste Dilution.
13	Organics	SW-846 5030A		Purge & Trap for Aqueous Samples
14	Organics	SW-846 5030A		Purge & Trap and Extraction for Soils and Solid Samples
15	Metals	SW-846 6010B		Inductively Coupled Plasma (ICP) - Atomic Emission Spectroscopy.
16	Arsenic	SW-846 7061A		Arsenic by Atomic Absorption (AA) – gaseous hydride
17	Barium	SW-846 7080A		Barium by Atomic Absorption (AA) -- direct aspiration
18	Cadmium	SW-846 7130		Cadmium by Atomic Absorption (AA) – direct aspiration
19	Chromium	SW-846 7190		Chromium by Atomic Absorption (AA) – direct aspiration
20	Lead	SW-846 7420		Lead by Atomic Absorption (AA) -- direct aspiration
21	Mercury	SW-846 7470A		Mercury in Liquid Waste (Manual Cold-Vapor Technique).
		SW-846 7471A		Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique)
22	Selenium	SW-846 7741A		Selenium by Atomic Absorption (AA) – gaseous hydride
23	Silver	SW-846 7760		Silver by Atomic Absorption (AA) -- direct aspiration

Table 2-2
Analytical Method Descriptions

Row	Analyte(s)	Method[1]	Description/Title
24	Volatile Organics	SW-846 8260B	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique.
25	Semi-volatile Organics	SW-846 8270C	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique.
26	Corrosivity	SW-846 9040A	pH - Electrometric Measurement.
		SW-846 9045C	pH - Soil and Non-Liquids.
27	Total Organic Carbon	SW-846 9060 (sect. 2)	Determination of Total Organic Carbon (TOC), Section 2 - Soluble, volatile organic carbon
28	Free Liquids	SW-846 9095	Paint Filter Liquids Test
29	Specific Gravity	2710F	Specific Gravity Determination from Water and Waste Water Analyses, 18th Edition
30	TDS	EPA 160.1	Total Dissolved Solids (TDS).
31	TSS	EPA 160.2	Total Suspended Solids (TSS).
32	Explosives	SW-846 8330 SW-846 8332	Nitroaromatics and Nitramines by High Performance Liquid Chromatography (HPLC) Nitroglycerine by HPLC
33	BTU	ASTM D270-87	Heat Content by Bomb Calorimeter
34	Total Halogens	SW-846 9056 or EPA 300.0/300.1	Total Halogens by Ion Chromatography
35	EA 2192	LAB 66-20-00-02	Determination of EA 2192 in PAS Brines and SDS by HPLC/MS
36	EA 4196	LAB 66-20-00-03	Determination of EA 4196 in PAS Brines and SDS by GC/MSD
37	Total Volatile Solids (Ash)	EPA 160.4	Total Volatile Solids, residue
38	Physical Description	ASTM D 4979-89	Standard Test Method for Physical Description Screening Analysis in Waste

Notes:

1. Where an EPA-approved method for analysis exists (SW-846 or equivalent), it shall be used. Methods developed by the Army will be used for those analytes, which do not have EPA methods. USACAMDS analytical methods are outlined in Attachment 3 of this Permit Application.

2. Currently developed Agent extraction procedures (SOP's) are included in Attachment 3 of this Permit.

3. Procedures (SOP's) for GB, VX and HD Agent purity analyses as well as organic impurities and breakdown products analyses at CAMDS are included in Attachment 3 of this Permit.

4. Samples of GA and GA/UCON from Ton Containers were analyzed in July 1997 for % purity, organic impurities and TCLP/HRA metals. Results of these analyses were submitted to the Utah Division of Solid and Hazardous Waste on 31 July 1997.

2.10 CHEMICAL AND PHYSICAL ANALYSES

2.10.1 COMPOSITION OF MUNITIONS AND BULK ITEMS

As a result of process testing and evaluation, U.S. Army Chemical Agent Munitions Disposal System (USACAMDS) demilitarizes a wide variety of chemical agent munitions, as well as bulk items of agent. The munitions include cartridges, projectiles, rockets, and mines containing the agents GB, VX, and mustard. The bulk items include bombs, spray tanks, and ton containers containing GB, VX, GA, mustard, and L. Tables C-1 and C-2, included in Appendix C, lists the various munitions and bulk items that are demilitarized, along with their physical dimensions, the type and weight of the agent filler, the explosive in the burster and supplemental charge and the propellant, as well as the type of fuze. Agents GA, GB, VX, and the blister agents (H, HD, HT, and L) are classified as acutely hazardous by the State of Utah.

2.10.2 CHARACTERISTICS OF PROCESS WASTES

All wastes resulting from the destruction of chemical agents, munitions, and bulk items are and will continue to be tested to ensure proper characterization according to state and federal hazardous waste management rules and Department of Army regulations. All residues generated by the demilitarization of GA, GB, VX, Mustard, and L are classified by the State of Utah as hazardous waste (State waste code: F999). CAMDS facility operations include procedures to ensure that the wastes have been properly characterized with respect to having the characteristics of a hazardous waste per 40 CFR 261.21 through 261.24.

The relevant chemical and physical characteristics of the propellants and explosives are presented in Appendix C, Table C-2. The propellants, explosives, fuzes, bursters, ignitors, squibs, detonators, and initiators are all solid materials.

2.10.3 PROCESS WASTE STREAMS

2.10.3.1 Chemical Agents

The munitions and bulk containers are each filled with the following chemical agents: GB, VX, mustard, GA, and L. When the agents are mixed with water, they form highly water-soluble byproducts and a number of highly soluble organics (in the case of VX). GA, GB, VX, L, and mustard agents are listed as acutely hazardous wastes in the State of Utah (State waste code P999). The physical properties of chemical agents are listed in Appendix A, Table A-1.

The agents do not exist in the munitions or bulk containers as pure compounds. They are stabilized (to prevent acid formation) with various compounds. Materials known to be present in the agents are listed in Table A-2 of Appendix A. Agent purity data (listed by munition number and type) for GB, VX, and HD is listed in Tables A-3, A-4, and A-5.

During the development and testing of chemical warfare agents, an extensive database was constructed to ascertain the health effects of the agents. A safe level for protected worker exposure has been established using standard protocols. In addition, the

Department of Defense (DOD) has developed standards (DOD Standard 6055.9) for the protection of unprotected workers and the general population. The U.S. Department of Health and Human Services, under the authority granted by Public Law 91-121, routinely conducts a thorough review of the demilitarization program. The results of this review were published on March 15, 1988, as "Final Recommendations for Protecting the Health and Safety Against Potential Adverse Effects of Long-Term Exposure to Low Doses of Agents: GA, GB, VX, Mustard Agent (H, HD, HT) and Lewisite."

2.10.3.2 Explosives and Propellants

The various explosives and propellants that are contained in the munitions demilitarized at the facility are identified in Table C-2. All of the explosives and propellants listed in Table C-2 are classified as reactive hazardous wastes (D003). The explosives (found in bursters and supplementary charges) include tetrytol, tetryl, Composition B, and trinitrotoluene (TNT). Tetryl is designated as a Class A explosive (as defined by 49 CFR 173.53) and Composition B contains TNT and RDX (both Class A explosives), while tetrytol contains tetryl and TNT. Small quantities of explosives are also found in the fuzes. The propellants also contain explosive constituents.

Besides these compounds and mixtures, a number of other reactive components can be found in various parts of these munitions. The M55 rocket, for example, contains small amounts of the following compounds: lead styphnate, lead azide, barium nitrate, antimony sulfide, tetracene, lead thiocyanate, potassium chlorate, charcoal, Egyptian lacquer, magnesium, potassium perchlorate, and cellulose nitrate camphor. These compounds are found in various mixtures and do not occur in pure form. The amounts of these compounds that are found in the munitions are quite small. In the M55 rocket, for example, over 99 percent of the energetic material is either Composition B (RDX/TNT) or Type M28 propellant (nitrocellulose/nitroglycerine). A listing of the reactive material contained in the munitions is found in Table C-2.

2.10.3.3 Incinerator Ash

Incinerator ash is generated by the Metal Parts Furnace (MPF) and the Deactivation Furnace System (DFS). DFS ash results from the combustion of propellants and explosives as previously discussed, as well as from the incineration of other process wastes and debris contaminated with residual agent. Ash is generated in the MPF from the incineration of liquid agent heels in drained bulk containers and munitions bodies, and other process wastes. Ash generated from the demilitarization of agents GA, GB, VX, and mustard is classified as listed hazardous wastes by the State of Utah (F999). Incinerator ash and may also contain TCLP metals, TCLP Organics, and Dioxins/furans, EPA waste codes D004-D011 and D018-D043. Both of these waste types will be analyzed for agent concentration and TCLP metals, TCLP Organics, dioxin/furans as outlined in previous sections of this Attachment. Ash, which is determined to be below the certified agent hazard level, will be shipped to an off-site TSDF for treatment/disposal. Otherwise, it will remain in storage awaiting further on-site treatment.

2.10.3.4 Cyclone Separator Residue

Cyclone separator residue will be collected in the DFS cyclone. Cyclone residue

generated from the demilitarization of agents GA, GB, VX, and mustard are classified as listed hazardous wastes by the State of Utah (F999). Incinerator residue may also contain TCLP metals, TCLP Organics, and Dioxins/furans, EPA waste codes D004-D011 and D018-D043. Both of these waste types will be analyzed for agent concentration and TCLP metals, TCLP Organics, and dioxin/furans as outlined in previous sections of this Attachment. Cyclone residue, which is determined to be below the certified agent hazard level, will be shipped to an off-site TSDF for treatment/disposal. Otherwise, it will remain in storage awaiting further on-site treatment.

2.10.3.5 **Pollution Abatement System Brine**

The Pollution Abatement System (PAS) wet scrubbers for the DFS, Liquid Incinerator (LIC), and MPF produce caustic brine. The brines contain primarily sodium salts of fluoride, chloride, sulfite, sulfate, phosphate, carbonate, and nitrate, and certain TCLP metals. Based on previous testing, the brines have a pH of 7 to 10. Scrubber brines generated by GA, GB, VX, and mustard processing are listed hazardous wastes in the State of Utah (F999). After PAS brines are verified below the certified agent hazard level, they will be treated by drying in the BDA or sent to an off-site to a Subtitle C TSDF for treatment/disposal.

2.10.3.6 **Brine Dryer Salt**

Brine dryer salts generated by GA, GB, VX, or mustard processing are classified as hazardous wastes in the State of Utah (F999) and may also contain TCLP metals, TCLP Organics, EPA waste codes D004-D011. Brine Salts will be characterized in accordance with section 2.2.1.5.

2.10.3.7 **Spent Decontamination Solutions**

Surface decontamination is accomplished with materials specifically selected to neutralize the chemical agent that is causing the contamination. For GB, a dilute solution of (18 percent) sodium hydroxide (NaOH) is used for decontamination. VX, Lewisite, GA, and mustard are decontaminated using sodium hypochlorite (NaOC1). Sodium carbonate solution (Na_2CO_3) can also be used to neutralize GB or VX agent. The process of decontamination requires that surfaces be rinsed with an excess of clear water immediately following decontamination solution application. The resulting spent decontamination solution is approximately 1.8 percent strength, is not reactive (does not evolve hazardous vapors, fumes, or gases), and is not normally corrosive (pH is normally less than 12.5). Although the latter could be affected by the duration of the rinse procedure, the normal rinse procedure calls for rinsing with an excess of water.

Decontamination of GB with sodium hydroxide (NaOH) produces sodium fluoride (NaF), water, and monosodium salt of isopropyl methyl phosphonic acid. The expected and required level of residual agent in the spent decontamination solution is less than 20 ppb of GB or GA. VX neutralized with sodium hypochlorite (NaOCl) produces sodium o-ethyl methyl phosphonate, diisopropylamine, sodium sulfate (Na_2SO_4), sodium carbonate (Na_2CO_3), sodium chloride (NaCl), and water. Sodium o-ethyl methyl phosphonate has properties similar to the monosodium salt of isopropyl methyl phosphonic acid. The expected and required level of residual agent in the spent decontamination solution is less than 20 ppb of VX. The chemical neutralization of

mustard with sodium hypochlorite (NaOC1) produces sodium sulfate (Na_2SO_4), sodium chloride (NaCl), carbon dioxide, and water. The expected and required level of residual agent in the spent decontamination solution is less than 200 ppb of mustard. The chemical neutralization of Lewisite[d] with sodium hypochlorite (NaOCl) produces sodium chloride (NaCl) and various arsenical compounds. The expected and required level of residual Lewisite in spent decontamination solutions is less than 1,000 ppb.

Although not normally used as decontamination solutions, two other decontamination solutions may be used for Mustards and VX. These are Super Tropical Bleach (STB) and HTH - high-test calcium hypochlorite (CaOCl). These are both stored dry and are mixed with water prior to use to form water-bleach slurry. These decontamination solutions may be used in the event of an agent leak or spill where the other decontamination solutions may not be readily available.

Spent decontamination solutions during GA, GB, VX, Lewisite, and mustard processing are listed hazardous wastes in the State of Utah (F999). Spent decontamination solutions will be characterized and managed in accordance with the CAMDS Waste Analysis Plan.

2.10.3.8 Laboratory Wastes

Common lab chemicals (such as: Reagents, solvents, etc.) typically make up a very small fraction of the laboratory waste (most of it is decontamination solutions). All liquid laboratory wastes containing agent (analytical standards, etc.) will be decontaminated prior to disposal at a Subtitle C TSDF. All potentially agent-contaminated solid laboratory wastes will be bagged and disposed at a Subtitle C TSDF. Laboratory waste may contain TCLP metals and TCLP Organics and volatile organic constituents (including F-listed solvents). Laboratory wastes may be disposed of at an off-site Subtitle C TSDF after they are certified below the agent hazard level. All potentially agent-contaminated laboratory wastes are listed wastes in the State of Utah (F999). These wastes will be characterized in accordance with the CAMDS Waste Analysis Plan.

2.10.4 PROCESS WASTE GENERATION AND MANAGEMENT

In addition to incineration; container storage, tank storage, and treatment of wastes in miscellaneous units occurs at the facility as follows:

- Container storage as follows: chemical agents in bulk containers, rockets, projectiles, mines and other munitions; explosives and propellants in rockets; explosives in projectiles, mines and other munitions; incinerator ash and cyclone residue; metal scrap from incineration; incinerator refractory, laboratory wastes, dryer salts, spent carbon from ventilation system filters, and other process wastes.

- Tank storage of: agent in agent tanks prior to incineration; spent decontamination solutions in the TMF or BDA tanks prior to incineration, and PAS brine storage in the BDA tanks prior to drying in the brine dryers.

- Removal of energetic material (including fuzes, bursters, boosters, and rocket motors) from chemical agent filled munitions prior to incineration.

- Removal of chemical agent fill (by draining/extraction) from munitions and bulk

containers prior to incineration.

- Evaporation (drying) of scrubber brine in the brine dryers.

- Other treatment methods which will be tested under separate RD&D permits (e.g., Lewisite Neutralization)

2.10.4.1 Containerized Wastes

The storage of chemical agents, explosives, and propellants in munitions and chemical agents in bulk containers will be considered as "containerized storage" per hazardous waste regulations. In addition, CAMDS process wastes will also be stored in containers in approved container storage areas. Process wastes stored in containers at the facility include incinerator ash, incinerator refractory, DFS cyclone residue, brine dryer salts, spent carbon from ventilation system filters, and other wastes.

Incinerator ash and refractory, and DFS cyclone residue are generated as dry solids (i.e., they do not contain any free liquids) and are placed into containers for ultimate disposal off-site at an approved hazardous waste management facility.

Liquid brine is generated from the operation of the incinerator pollution abatement systems. To reduce the volume of these wastes, brine dryers are used to evaporate the water from these brines leaving only the salts. The salts are then containerized and disposed of off-site at an approved hazardous waste management facility.

Miscellaneous waste liquids are collected in Department of Transportation (DOT) specification drums at the point of generation. These are stored in approved storage facilities located at CAMDS.

2.10.4.2 Wastes in Tanks

Wastes stored in tanks at the facility include: chemical agents drained from munitions and bulk items stored in agent tanks prior to incineration; spent decontamination solutions stored in the TMF or BDA tanks prior to incineration, and PAS brine storage in the BDA tanks prior to drying in the brine dryers. Spent decontamination solution generated during GA, GB, VX, mustard, and L processing is a listed hazardous waste in the State of Utah.

The chemical and physical analysis information for the chemical agents and spent decontamination solutions are discussed in Section 2.10.3. Physical and chemical characteristics of the scrubber brine are also discussed in this section because of its storage requirements in tanks prior to treatment in the brine dryers.

In accordance with 40 CFR 264.191, a listing the maximum anticipated specific gravity (at 20°C) of wastes to be stored in facility tanks is provided below. These were based on chemical agent characteristics; maximum estimated PAS brine composition, and previous analysis of spent decontamination solutions.

- Liquid Agent Storage Tanks - 1.27 (Mustard)
- Spent Decontamination Solution Storage Tanks (TMF) - 1.14

- PAS Brine Storage Tanks (BDA) - 1.2

USACAMDS Waste Analysis Plan
Appendix A

TABLE A-1
CHEMICAL AGENT PHYSICAL PROPERTIES

PROPERTY	GB	VX	H	HD	HT
Chemical Name	Isopropyl methyl-phosphonofluoridate (Sarin)	O-ethyl S-(2-diisopropyl-amino ethyl) methylphosphonothiolate	Same as HD with up to 25% impurities	Bis(2-chlorethyl) sulfide or 2.2'-dichlorodiethyl sulfide (sulfur mustard)	Same as HD with 40% T Bis[2(-chloroethylthio) ethyl] ether
Chemical formula	$C_4H_{10}FO_2P$	$C_{11}H_{26}NO_2PS$	$C_4H_8Cl_2S_{1.5}$	$C_4H_8Cl_2S$	$C_{5.15}H_{10.3}Cl_{2.0}O_{0.29}S_{1.29}$
Molecular weight	140.0951	267.37262	175.11016	159.07816	189.14764
Vapor specific gravity (air = 1.00)	4.86	9.2	5.4	5.4	6.92
Liquid density at 77°F (lb/ft^3)	67.965	62.93	79.49	79.49	79.49
Freezing point (°F)	-69	Below -60	41 to 57	58	32 to 34.3
Boiling Point (°F)	316	572	437	423	442
Vapor pressure at 77°F[1]mm/Hg)	2.9	0.00066	0.059	0.072	0.104
Flash Point (°F)	Does not flash	318	212	221	212
Viscosity (centistokes) at 77°F	1.28	9.96 (pure); may be substantially higher if partially decomposed	3.95	3.95	6.05
Color	Clear to straw to amber	Clear to straw	Amber-dark brown liquid		
Odor	None	None	Garlic		
Special properties	None		Permeates ordinary rubber		
Solubility properties	Miscible with water and readily soluble in all organic solvents	Best solvents are dilute mineral acids	Water (distilled), 0.092 g/100 cc at 72°F; completely soluble in acetone, CCl_4,CH_3Cl, tetrachloroethane, ethyl benzoate, ether)		
High heating value (Btu/lb at 60°F)	10073	15174	8100	8500	9,400
Physical state	Viscous liquid				

Note: Agents H, HD, and HT are at 68°F.

Table A-2
CHEMICAL AGENT COMPOSITION [1]

AGENT	CHEMICAL CONSTITUENT	RANGE (neat agent wt. Percent)
GB	**Isopropyl methyl phosphonofluoridate**	**Ton Containers: 38.8 - 92.6** **155 mm Projectiles: 59.6 - 88.0** **105 mm Projectiles: 64.3 - 80.1** **MC1 Bomb: 76.3 - 92.5** **M55 Rockets: 77.2 to 93.1** **MK-116 Bomb: 88.8 - 92.1**
	N,N'-Diisopropylcarbodiimide	0.0 - 1.5
	Tributylamine	0.0 - 10.5
	Methylphosphonofluoridic acid	0.0 - 10.5
	Diisopropyl methylphosphonate	0.7 - 10.3
	Methylphosphonic difluoride	0.0 - 1.1
	2-Propanol	0.1 - 1.1
VX	**O-ethyl, S-2-diisopropylaminoethyl) methylphosphonthiolate**	**Ton Containers: 27.1 - 98.5** **M23 Mine: 72.4 - 90.5** **155 mm Projectiles: 72.4 - 93.8** **TMU28 (Spray Tank): 93.3 - 97.7** **Other Items: 91 - 94.8**
	P,P'-Diethyl P, P dimethyldiphosphonate	2.0 - 5.0
	2-Diisopropylaminoethanethiol	0.3 - 1.3
	bis(2-Diisopropylaminoethyl) disulfide	0.1 - 1.1
	O,O'-bis(Diisopropylaminoethyl) methylphosphonite	0.7 - 1.4
	S,S'-bis(Diisopropylaminoethyl) methyphosphonodithioate	0.2 - 3.6
	N,N'-Dicyclohexylcarbodiimide	2.2 - 3.6
	N,N'-Diisopropylcarbodiimide	1.1 - 2.5
HD [2]	**Bis (2-chloroethyl) sulfide**	**Ton Containers: 50.5 - 97.0** **Other Items: 50 - 92**
	1,2-Bis(2-chloroethylthio)ethane	4.0 - 4.7
	Bis[2-(2-chloroethylthio)ethyl]ether	5.0
	1,2,-Dichloroethane	2.4
	1-(2-Chloroethoxy)-2-(2-chloroethylthio)ethane	1.0
	2-Chloroethyl ?-chlorobutyl sulfide (mixed isomers)	2.0

Notes:
1 Data Sources: USACAMDS Records, SUPPLECAM, and Edgewood.
2 H and HT contain the same active ingredient and impurities shown for HD but in different proportions. HD contains the highest weight percent of the active ingredient bis (2-choroethyl) sulfide.

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
105mm Projectile	RM6651-312	64.30%		SUPLECAM
105mm Projectile	RM6651-310	65.80%		SUPLECAM
105mm Projectile	RM6651-309	68.50%		SUPLECAM
105mm Projectile	RM6651-310	68.50%	FE<200, CU<200, NI<200, AL<200	SUPLECAM
105mm Projectile	RM6655-309	68.50%	FE<200, CU<200, NI<200, AL=445	SUPLECAM
105mm Projectile	RM6655-309	68.50%	FE<200, CU<200, NI<200, AL=445	SUPLECAM
105mm Projectile	RM6651-313	70.10%		SUPLECAM
105mm Projectile	RM6651-236	70.20%		SUPLECAM
105mm Projectile	RM6651-236	70.20%	FE<200, CU<200, NI<200, AL<200	SUPLECAM
105mm Projectile	RM76039-323	70.20%		SUPLECAM
105mm Projectile	RM76039-409	70.60%		SUPLECAM
105mm Projectile	RM76038-425	71.20%		SUPLECAM
105mm Projectile	RM76039-376	73.30%		SUPLECAM
105mm Projectile	RM6651-316	73.60%		SUPLECAM
105mm Projectile	RM76039-389	76.20%		SUPLECAM
105mm Projectile	RM76039-335	76.80%		SUPLECAM
105mm Projectile	RM76039-333	78.30%		SUPLECAM
105mm Projectile	RM6651-234	79.40%		SUPLECAM
105mm Projectile	RM76039-390	80.10%		SUPLECAM
	MAX	80.10%		
	MIN	64.30%		
	AVG	71.81%		
	SDEV	4.39%		
Mk-116 Weteye	RMA-2-3	88.80%	FE=1.79, CU=0.17, NI=BDL, AL=22.1	SUPLECAM
Mk-116 Weteye	RMA-2-1	89.80%	FE=1.33, CU=0.20, NI=.35, AL=31.2	SUPLECAM
Mk-116 Weteye	RMA-2-2	90.30%	FE=1.55, CU=0.13, NI=BDL, AL=14.2	SUPLECAM
Mk-116 Weteye	RMA-2-4	92.10%	FE=1.64, CU=0.15, NI=BDL, AL=14.7	SUPLECAM
	MAX	92.10%		
	MIN	88.80%		
	AVG	90.25%		
	SDEV	1.20%		
155mm Projectile	RM76039-320	59.60%		SUPLECAM
155mm Projectile	RM6651-224	68.00%		SUPLECAM
155mm Projectile	RM86039-428	68.80%		SUPLECAM
155mm Projectile	RM86039-427	70.20%		SUPLECAM
155mm Projectile	RM6651-310	73.30%		SUPLECAM
155mm Projectile	RM86039-430	74.00%		SUPLECAM
155mm Projectile	RM86029-430	74.30%		SUPLECAM
155mm Projectile	RM86039-429	74.30%		SUPLECAM
155mm Projectile	RM6651-242	74.50%		CAMDS
155mm Projectile	RM5651-211	74.90%		SUPLECAM
155mm Projectile	RM86039-426	75.30%		SUPLECAM
155mm Projectile	RM86039-424	76.00%		SUPLECAM
155mm Projectile	RM86039-429	76.50%		SUPLECAM
155mm Projectile	RM6651-243	76.60%	FE=4624, CU=BDL, FI=BDL, AL=BDL	SUPLECAM
155mm Projectile	RM76039-376	76.60%		SUPLECAM
155mm Projectile	RM86038-409	78.20%		SUPLECAM
155mm Projectile	RM86039-428	78.20%		SUPLECAM
155mm Projectile	RM5651-138	78.60%	FE<200, CU<200, NI<200, AL=842	SUPLECAM
155mm Projectile	RM6651-203	79.00%		CAMDS

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
155mm Projectile	RM5651-138	79.60%		SUPLECAM
155mm Projectile	RM5651-129	79.80%		SUPLECAM
155mm Projectile	RM5651-205	80.30%		SUPLECAM
155mm Projectile	RM5651-160	81.00%		SUPLECAM
155mm Projectile	RM6651-242	81.30%	FE=3279, CU=BDL, NI=BDL, AL=BDL	SUPLECAM
155mm Projectile	RM5651-151	81.40%		SUPLECAM
155mm Projectile	RM5651-122	82.00%		SUPLECAM
155mm Projectile	RM5651-135	82.00%		SUPLECAM
155mm Projectile	RM5651-135	82.00%	FE<200, CU<200, NI<200, AL=708	SUPLECAM
155mm Projectile	RM5651-167	82.10%		SUPLECAM
155mm Projectile	RM5651-122	82.80%		SUPLECAM
155mm Projectile	RM5651-134	83.20%		SUPLECAM
155mm Projectile	RM5651-134	83.20%	FE<200, CU<200, NI<200, AL=835	SUPLECAM
155mm Projectile	RM6651-234	84.00%		SUPLECAM
155mm Projectile	RM5651-92	85.70%		SUPLECAM
155mm Projectile	RM5651-134	87.50%		CAMDS
155mm Projectile	RM5651-134	88.00%		CAMDS
	MAX	88.00%		
	MIN	59.60%		
	AVG	78.13%		
	SDEV	5.68%		
MC1 Bomb	RM5651-118	76.30%		SUPLECAM
MC1 Bomb	RM5651-118	76.30%	FE<100, CU<100, NI<100, AL=1150	SUPLECAM
MC1 Bomb	RM5651-183	78.80%		CAMDS
MC1 Bomb	RM5651-104	80.30%		CAMDS
MC1 Bomb	RM5651-110	80.30%		CAMDS
MC1 Bomb	RM5651-168	81.00%		SUPLECAM
MC1 Bomb	RM5651-60	81.30%		SUPLECAM
MC1 Bomb	RM5651-60	81.30%	FE<100, CU<100, NI<100, AL=850	SUPLECAM
MC1 Bomb	RM5651-60	81.30%	FE<100, CU<100, NI<100, AL=850	SUPLECAM
MC1 Bomb	RM5651-127	81.60%		SUPLECAM
MC1 Bomb	RM5651-127	81.60%	FE<100, CU<100, NI<100, AL=1025	SUPLECAM
MC1 Bomb	RM4651-32	81.90%		SUPLECAM
MC1 Bomb	RM5651-32	81.90%	FE<100, CU<100, NI<100, AL=1150	SUPLECAM
MC1 Bomb	RM5651-108	82.20%	FE<100, CU<100, NI<100, AL=1250	SUPLECAM
MC1 Bomb	RM5651-110	82.20%		SUPLECAM
MC1 Bomb	RM5651-183	82.70%		SUPLECAM
MC1 Bomb	RM5651-183	82.70%	FE<100, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-115	83.70%		SUPLECAM
MC1 Bomb	RM5651-115	83.70%	FE=200, CU<100, NI<100, AL=1050	SUPLECAM
MC1 Bomb	RM5651-55	83.90%		SUPLECAM
MC1 Bomb	RM5651-55	83.90%	FE<100, CU<100, NI<100, AL=1150	SUPLECAM
MC1 Bomb	RM5651-104	84.20%		SUPLECAM
MC1 Bomb	RM5651-104	84.20%	FE<100, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-126	84.30%		CAMDS
MC1 Bomb	RM5651-136	84.80%		SUPLECAM
MC1 Bomb	RM5651-136	84.80%	FE=200, CU<100, NI<100, AL=1150	SUPLECAM
MC1 Bomb	RM5651-58	84.80%		SUPLECAM
MC1 Bomb	RM5651-58	84.80%	FE=100, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-178	84.90%		CAMDS

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
MC1 Bomb	RM5651-144	85.00%		SUPLECAM
MC1 Bomb	RM5651-144	85.00%	FE=200, CU<100, NI<100, AL=1190	SUPLECAM
MC1 Bomb	RM5651-140	85.10%		SUPLECAM
MC1 Bomb	RM5651-140	85.10%	FE=150, CU<100, NI<100, AL=1050	SUPLECAM
MC1 Bomb	RM5651-125	85.50%		CAMDS
MC1 Bomb	RM5651-179	85.60%	FE<100, CU<100, NI<100, AL=950	SUPLECAM
MC1 Bomb	RM4651-52	85.70%		SUPLECAM
MC1 Bomb	RM5651-186	85.70%		SUPLECAM
MC1 Bomb	RM5651-186	85.70%	FE<100, CU<100, NI<100, AL=1050	SUPLECAM
MC1 Bomb	RM5651-52	85.70%	FE=100, CU<100, NI<100, AL-1150	SUPLECAM
MC1 Bomb	RM5651-57	85.70%		SUPLECAM
MC1 Bomb	RM5651-57	85.70%	FE<100, CU<100, NI<100, AL=1000	SUPLECAM
MC1 Bomb	RM5651-116	86.10%		SUPLECAM
MC1 Bomb	RM5651-116	86.10%	FE=100, CU<100, NI<100, AL=500	SUPLECAM
MC1 Bomb	RM5651-117	86.20%		SUPLECAM
MC1 Bomb	RM5651-133	86.20%	FE=150, CU<100, NI<100, AL=1100	SUPLECAM
MC1 Bomb	RM5651-122	86.30%		SUPLECAM
MC1 Bomb	RM5651-130	86.40%		SUPLECAM
MC1 Bomb	RM5651-130	86.40%	FE=350, CU<100, NI<100, AL=400	SUPLECAM
MC1 Bomb	RM5651-131	86.80%		SUPLECAM
MC1 Bomb	RM5651-131	86.80%	FE=100, CU<100, NI<100, Al=1050	SUPLECAM
MC1 Bomb	RM5651-108	86.90%		SUPLECAM
MC1 Bomb	RM5651-108	86.90%	FE<100, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-129	86.90%		SUPLECAM
MC1 Bomb	RM5651-129	86.90%	FE=100, CU<100, NI<100, AL=400	SUPLECAM
MC1 Bomb	RM5651-137	87.10%		SUPLECAM
MC1 Bomb	RM5651-137	87.10%	FE=100, CU<100, NI<100, AL=1100	SUPLECAM
MC1 Bomb	RM5651-175	87.10%	FE=150, CU<100, NI<100, AL=400	SUPLECAM
MC1 Bomb	RM5651-178	87.20%		SUPLECAM
MC1 Bomb	RM5651-178	87.20%	FE=100, CU<100, NI<100, AL=250	SUPLECAM
MC1 Bomb	RM5651-173	87.30%		SUPLECAM
MC1 Bomb	RM5651-173	87.30%	FE<100, CU<100, NI<100, AL=1250	SUPLECAM
MC1 Bomb	RM5651-142	87.40%		SUPLECAM
MC1 Bomb	RM5651-142	87.40%	FE<100, CU<100, NI<100, AL=1050	SUPLECAM
MC1 Bomb	RM5651-179	87.60%		SUPLECAM
MC1 Bomb	RM5651-143	87.70%		SUPLECAM
MC1 Bomb	RM5651-143	87.70%	FE=150, CU<100, NI<100, AL=350	SUPLECAM
MC1 Bomb	RM5651-134	87.90%		SUPLECAM
MC1 Bomb	RM5651-134	87.90%	FE=150, CU<100, NI<100, AL=1050	SUPLECAM
MC1 Bomb	RM5651-123	88.00%		SUPLECAM
MC1 Bomb	RM5651-124	88.00%		SUPLECAM
MC1 Bomb	RM5651-124	88.00%	FE=100, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-117	88.20%	FE=250, CU<100, NI<100, Al=300	SUPLECAM
MC1 Bomb	RM5651-119	88.20%		SUPLECAM
MC1 Bomb	RM5651-119	88.20%	FE=100, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-126	88.20%		SUPLECAM
MC1 Bomb	RM5651-126	88.20%	FE=150, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-133	88.20%		SUPLECAM
MC1 Bomb	RM5651-132	88.30%		SUPLECAM
MC1 Bomb	RM5651-132	88.30%	FE=500, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-132	88.30%	FE=500, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-172	88.40%		SUPLECAM

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
MC1 Bomb	RM5651-172	88.40%	FE<100, CU<100, NI<100, AL=1000	SUPLECAM
MC1 Bomb	RM5651-99	88.40%	FE<100, CU<100, NI <100, AL=100	SUPLECAM
MC1 Bomb	RM5651-99	88.40%		SUPLECAM
MC1 Bomb	RM5651-191	88.50%		SUPLECAM
MC1 Bomb	RM5651-191	88.50%	FE<100, CU<100, NI<100, AL=400	SUPLECAM
MC1 Bomb	RM5651-125	88.80%		SUPLECAM
MC1 Bomb	RM5651-125	88.80%	FE=350, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-139	88.80%		SUPLECAM
MC1 Bomb	RM5651-139	88.80%	FE=100, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-111	89.00%		SUPLECAM
MC1 Bomb	RM5651-111	89.00%	FE=100, CU<100, NI<100, AL=300	SUPLECAM
MC1 Bomb	RM5651-164	89.00%	FE<100, CU<100, NI<100, AL=250	SUPLECAM
MC1 Bomb	RM5651-192	89.10%		SUPLECAM
MC1 Bomb	RM5651-123	89.40%	FE<100, CU<100, NI<100, AL=1150	SUPLECAM
MC1 Bomb	RM5651-164	89.80%		SUPLECAM
MC1 Bomb	RM5651-168	91.20%	FE<100, CU<100, NI<100, AL=1000	SUPLECAM
MC1 Bomb	RM5651-114	92.00%		SUPLECAM
MC1 Bomb	RM5651-135	92.50%		SUPLECAM
	MAX	92.50%		
	MIN	76.30%		
	AVG	86.01%		
	SDEV	2.99%		
Ton Container	RM76039-384	38.80%		CAMDS
Ton Container	RM76039-384	39.30%	FE<200, CU<200, NI<200, AL=1200	SUPLECAM
Ton Container		39.70%		CAMDS
Ton Container	RM6651-239	42.40%		CAMDS
Ton Container	RM6651-273	43.90%	FE<200, CU<200, NI<200, AL=730	SUPLECAM
Ton Container	RM4651-53	46.80%		CAMDS
Ton Container	RM76039-370	46.80%		CAMDS
Ton Container	RM4651-53	47.70%		CAMDS
Ton Container	RM76039-370	48.00%		CAMDS
Ton Container	RM76039-266	50.00%		CAMDS
Ton Container	RM76039-374	51.20%		CAMDS
Ton Container	RM76039-341	56.30%		CAMDS
Ton Container	RM76039-341	57.20%	FE<200, CU<200, NI<200, AL=980	SUPLECAM
Ton Container	RM6651-272	58.20%	FE<200, CU<200, NI<200, AL=500	SUPLECAM
Ton Container	RM76039-371	58.60%		CAMDS
Ton Container	RM76039-349	58.70%	FE=212, CU<200, NI<200, AL=840	SUPLECAM
Ton Container	RM76039-370	58.90%	FE=217, CU<200, NI<200, AL=850	SUPLECAM
Ton Container	RM76039-383	59.00%	FE<200, CU<200, NI<200, AL=700	SUPLECAM
Ton Container	RM76039-385	60.00%	FE<200, CU<200, NI<200, AL=690	SUPLECAM
Ton Container	RM76039-370	60.00%		CAMDS
Ton Container	RM6651-262	61.10%		SUPLECAM
Ton Container	RM76039-329	61.40%	FE<200, CU<200, NI<200, AL=950	SUPLECAM
Ton Container	RM76038-318	61.60%	FE<200, CU<200, NI<200, AL=1830	SUPLECAM
Ton Container	RM6651-286	61.70%	FE<200, CU<200, NI<200, AL=1000	SUPLECAM
Ton Container	RM76039-371	62.00%	FE=208, CU<200, NI<200, AL=750	SUPLECAM
Ton Container	RMRM6651-225	62.20%	FE<200, CU<200, NI<200, AL=1030	SUPLECAM
Ton Container	RM76039-371	62.50%		CAMDS
Ton Container	RM6651-257	63.10%		CAMDS

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
Ton Container	RM76039-264	63.70%		CAMDS
Ton Container	RM76039-342	64.00%	FE=300, CU<200, NI<200, AL=950	SUPLECAM
Ton Container	RM76039-342	64.60%		CAMDS
Ton Container	RM6651-265	64.70%		CAMDS
Ton Container	RM6651-257	65.60%	FE<200, CU<200, NI<200, AL=800	SUPLECAM
Ton Container	RM6651-284	66.40%	FE=217, CU<200, NI<200, AL=1010	SUPLECAM
Ton Container	RM76039-374	66.70%		CAMDS
Ton Container	RM76039-341	66.80%		CAMDS
Ton Container	RM76039-264	67.00%		CAMDS
Ton Container	RM76039-367	67.90%	FE<200, CU<200, NI<200, AL=1020	SUPLECAM
Ton Container	RM76039-324	68.60%	FE=625, CU<200, NI<200, AL=1010	SUPLECAM
Ton Container	RM76039-342	68.60%		CAMDS
Ton Container	RM6651-265	68.70%	FE=212, CU<200, NI<200, AL=1020	SUPLECAM
Ton Container	RM76039-329	68.70%		CAMDS
Ton Container	RM76039-423	69.00%		CAMDS
Ton Container	RM76039-343	69.30%	FE=570, CU<200, NI<200, AL=860	SUPLECAM
Ton Container	RM6651-276	69.40%	FE<200, CU<200, NI<200, AL=500	SUPLECAM
Ton Container	RM76039-289	69.40%		CAMDS
Ton Container	RM6651-257	69.50%		CAMDS
Ton Container	RM76039-324	69.50%		CAMDS
Ton Container	RM86025-20	69.60%		CAMDS
Ton Container	RM76039-323	69.90%		CAMDS
Ton Container	RM76039-341	70.00%		CAMDS
Ton Container	RM76039-336	70.10%	FE<200, CU<200, NI<200, AL=70.1	SUPLECAM
Ton Container	RM76039-412	70.20%		CAMDS
Ton Container	RM6651-257	70.40%		CAMDS
Ton Container	RM6651-277	70.80%	FE<200, CU<200, NI<200, AL=760	SUPLECAM
Ton Container	RM76039-336	70.80%		CAMDS
Ton Container	RM76039-358	71.00%	FE=1350, CU<200, NI<200, AL=700	SUPLECAM
Ton Container	RM76039-264	71.00%		CAMDS
Ton Container	RM76039-374	71.00%		CAMDS
Ton Container	RM76039-346	71.10%	FE<200, CU<200, NI<200, AL=970	SUPLECAM
Ton Container	RM76039-321	71.40%		CAMDS
Ton Container	RM76039-289	71.50%	FE<200, CU<200, NI<200, AL=910	SUPLECAM
Ton Container	RM76039-321	71.50%	FE<200, CU<200, NI<200, AL=950	SUPLECAM
Ton Container	RM6651-287	71.60%	FE<207, CU<200, NI<200, AL=1070	SUPLECAM
Ton Container	RM6651-265	71.80%		CAMDS
Ton Container	RM76039-343	71.80%		CAMDS
Ton Container	RM6651-271	72.10%	FE<200, CU<200, NI<200, AL=770	SUPLECAM
Ton Container	RM76039-382	72.10%	FE=600, CU<200, NI<200, AL=590	SUPLECAM
Ton Container	RM76039-331	72.20%	FE<200, CU<200, NI<200, AL=850	SUPLECAM
Ton Container	RM76039-345	72.40%	FE<200, CU<200, NI<200, AL=980	SUPLECAM
Ton Container	RM5651-287	72.50%		CAMDS
Ton Container		72.60%		CAMDS
Ton Container	RM76039-323	72.70%		SUPLECAM
Ton Container	RM6651-257	72.70%		CAMDS
Ton Container	RM76039-345	72.70%		CAMDS
Ton Container	RM76039-388	72.80%	FE<200, CU<200, NI<200, AL=1010	SUPLECAM
Ton Container	RM76039-368	72.90%	FE<200, CU<200, NI<200, AL=700	SUPLECAM
Ton Container	RM6651-299	73.00%	FE<200, CU<200, NI<200, AL=990	SUPLECAM
Ton Container	RM76039-346	73.10%		CAMDS
Ton Container	RM76039-336	73.30%		CAMDS

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
Ton Container	RM76039-327	73.40%	FE<200, CU<200, NI<200, AL=830	SUPLECAM
Ton Container	RM76039-363	73.40%	FE=360, CU<200, NI<200, AL=1070	SUPLECAM
Ton Container	RM5651-287	73.40%		CAMDS
Ton Container	RM6651-278	73.60%	FE=215, CU<200, NI<200, AL=950	SUPLECAM
Ton Container	RM76039-342	73.60%		CAMDS
Ton Container	RM6651-268	73.90%	FE=360, CU<200, NI<200, AL=1930	SUPLECAM
Ton Container	RM6651-233	73.90%	FE<200, CU<200, NI<200, Al=910	SUPLECAM
Ton Container	RM6651-265	73.90%		CAMDS
Ton Container	RM86039-418	74.00%		CAMDS
Ton Container	RM76039-324	74.10%		CAMDS
Ton Container	RM76039-352	74.20%	FE=352, CU<200, NI<200, AL=1000	SUPLECAM
Ton Container	RM76039-356	74.20%	FE=307, CU<200, NI<200, AL=840	SUPLECAM
Ton Container	RM76039-343	74.20%		CAMDS
Ton Container	RM5651-62	74.30%	FE<200, CU<200, NI<200, AL=280	SUPLECAM
Ton Container	RM6651-278	74.30%		CAMDS
Ton Container	RM6651-242	74.50%		CAMDS
Ton Container	RM6651-299	74.50%		CAMDS
Ton Container	RM76039-392	74.60%	FE<200, CU<200, NI<200, AL=1020	SUPLECAM
Ton Container	RM86039-418	74.60%		CAMDS
Ton Container	RM6651-299	74.70%		CAMDS
Ton Container	RM76039-412	74.80%		CAMDS
Ton Container	RM6651-270	75.00%	FE<200, CU<200, NI<200, AL=1860	SUPLECAM
Ton Container	RM5651-92	75.00%		CAMDS
Ton Container	RM6651-278	75.00%		CAMDS
Ton Container	RM76039-346	75.00%		CAMDS
Ton Container	RM6651-274	75.20%	FE=253, CU<200, NI<200, AL=820	SUPLECAM
Ton Container	RM6651-265	75.30%		CAMDS
Ton Container	RM76039-289	75.30%		CAMDS
Ton Container	RM76039-387	75.40%	FE<200, CU<200, NI<200, AL=780	SUPLECAM
Ton Container	RM6651-240	75.70%	FE<200, CU<200, NI<200, AL=1030	SUPLECAM
Ton Container	RM76039-373	75.70%	FE=425, CU<200, NI<200, AL=900	SUPLECAM
Ton Container	RM76039-289	75.80%		CAMDS
Ton Container	RM5651-367	75.90%		CAMDS
Ton Container	RM76039-328	76.00%	FE<200, CU<200, NI<200, AL=560	SUPLECAM
Ton Container	RM76039-289	76.00%		CAMDS
Ton Container	RM76039-321	76.00%		CAMDS
Ton Container	RM76039-345	76.10%		CAMDS
Ton Container	RM86039-414	76.10%		CAMDS
Ton Container	RM76039-393	76.20%	FE<200, CU<200, NI<200, AL=640	SUPLECAM
Ton Container	RM4651-53	76.20%	FE<200, CU<200, NI<200, AL=1030	SUPLECAM
Ton Container	RM6651-229	76.20%	FE<200, CU<200, NI<200, AL=1330	SUPLECAM
Ton Container	RM76039-381	76.30%	FE=300, CU<200, NI<200, AL=1020	SUPLECAM
Ton Container	RM76039-381	76.30%		CAMDS
Ton Container	RM86039-414	76.40%		CAMDS
Ton Container	RM76039-350	76.50%	FE=555, CU<200, NI<200, AL=1030	SUPLECAM
Ton Container	RM6651-231	76.50%	FE<200, CU<200, NI<200, AL=880	SUPLECAM
Ton Container	RM76036-374	76.50%		CAMDS
Ton Container	RM76039-323	76.50%		CAMDS
Ton Container	RM76039-416	76.60%		CAMDS
Ton Container	RM6651-295	76.70%	FE=207, CU<200, NI<200, AL=1120	SUPLECAM
Ton Container	RM76039-360	76.70%	FE=800, CU<200, NI<200, AL=1060	SUPLECAM
Ton Container	RM4651-53	76.80%		CAMDS

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
Ton Container	RM76039-364	76.90%	FE=360, CU<200, NI<200, AL=1060	SUPLECAM
Ton Container	RM76039-354	77.00%	FE=567, CU<200, NI<200, AL=860	SUPLECAM
Ton Container	RM6651-242	77.00%		CAMDS
Ton Container	RM6651-242	77.00%		CAMDS
Ton Container	RM76039-323	77.00%		CAMDS
Ton Container	RM76039-323	77.10%		CAMDS
Ton Container	RM76039-366	77.30%	FE<200, CU<200, NI<200, AL=1030	SUPLECAM
Ton Container	RM76039-323	77.50%		CAMDS
Ton Container	RM76039-321	77.60%		CAMDS
Ton Container	RM76039-374	77.70%	FE<200, CU<200, NI<200, AL=590	SUPLECAM
Ton Container	RM6651-262	77.70%		CAMDS
Ton Container	RM86039-418	77.70%		CAMDS
Ton Container	RM76039-336	77.80%		CAMDS
Ton Container	RM86025-20	78.00%		CAMDS
Ton Container	RM6651-239	78.10%		CAMDS
Ton Container	RM76039-416	78.10%		CAMDS
Ton Container	RM6651-262	78.30%		CAMDS
Ton Container	RM76039-323	78.30%		CAMDS
Ton Container	RM76039-371	78.40%		CAMDS
Ton Container	RM76039-365	78.60%	FE=440, CU<200, NI<200, AL=940	SUPLECAM
Ton Container	RM5651-183	78.80%		CAMDS
Ton Container	RM5651-73	78.80%	FE<200, CU<200, NI<200, AL=2020	SUPLECAM
Ton Container	RM76039-323	78.80%		CAMDS
Ton Container	RM76039-369	79.00%	FE<200, CU<200, NI<200, AL=1050	SUPLECAM
Ton Container	RM6651-203	79.00%		CAMDS
Ton Container	RM6651-297	79.10%	FE<200, CU<200, NI<200, AL=1000	SUPLECAM
Ton Container		79.10%		CAMDS
Ton Container	RM76039-369	79.20%		CAMDS
Ton Container	RM76039-345	79.30%		CAMDS
Ton Container	RM76039-323	79.40%		CAMDS
Ton Container	RM76039-369	79.40%		CAMDS
Ton Container	RM86039-414	79.40%		CAMDS
Ton Container	RM76039-329	79.50%		CAMDS
Ton Container	RM76039-323	79.60%		CAMDS
Ton Container	RM76039-381	79.60%		CAMDS
Ton Container	RM6651-239	79.70%	FE<200, CU<200, NI<200, AL=1080	SUPLECAM
Ton Container	RM6651-279	79.70%	FE<200, CU<200, NI<200, AL=780	SUPLECAM
Ton Container	RM76039-323	79.70%		CAMDS
Ton Container	RM76039-370	79.80%		CAMDS
Ton Container	RM6651-299	80.00%		CAMDS
Ton Container	RM76039-355	80.30%	FE<200, CU<200, NI<200, AL=560	SUPLECAM
Ton Container	RM5651-104	80.30%		CAMDS
Ton Container	RM5651-110	80.30%		CAMDS
Ton Container	RM5651-144	80.30%		CAMDS
Ton Container	RM76039-280	80.30%		CAMDS
Ton Container	RM76039-323	80.30%		CAMDS
Ton Container	RM6651-293	80.40%	FE<200, CU<200, NI<200, AL=970	SUPLECAM
Ton Container	RM76039-323	80.40%		CAMDS
Ton Container	RM6651-228	80.50%	FE<200, CU<200, NI<200, AL=1000	SUPLECAM
Ton Container	RM6651-262	80.50%		CAMDS
Ton Container	RM76039-412	80.50%		CAMDS
Ton Container	RM76039-280	80.70%	FE<200, CU<200, NI<200, AL-1769	SUPLECAM

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
Ton Container	RM86039-423	80.70%		CAMDS
Ton Container	RM76039-332	80.80%	FE<200, CU<200, NI<200, AL=550	SUPLECAM
Ton Container	RM76039-324	80.80%		CAMDS
Ton Container	RM76039-362	80.90%	FE=567, CU<200, NI<200, AL=1980	SUPLECAM
Ton Container	RM6651-262	81.00%		CAMDS
Ton Container	RM6651-262	81.00%		CAMDS
Ton Container	RM76039-369	81.00%		CAMDS
Ton Container	RM76039-280	81.10%		CAMDS
Ton Container	RM6651-314	81.20%	FE<200, CU<200, NI<200, AL=1760	SUPLECAM
Ton Container	RM76039-379	81.20%	FE<200, CU<200, NI<200, AL=950	SUPLECAM
Ton Container	RM76039-386	81.20%	FE<200, CU<200, NI<200, AL=810	SUPLECAM
Ton Container	RM76039-372	81.30%	FE=300, CU<200, NI<200, AL=920	SUPLECAM
Ton Container	RM76039-280	81.40%		CAMDS
Ton Container	RM6651-266	81.50%	FE=233, CU<200, NI<200, AL=1000	SUPLECAM
Ton Container	RM76039-280	81.60%		CAMDS
Ton Container	RM5651-142	81.70%		CAMDS
Ton Container	RM6651-262	81.70%		CAMDS
Ton Container	RM6651-262	81.80%		CAMDS
Ton Container	RM5651-109	81.90%		CAMDS
Ton Container	RM6651-262	82.00%		CAMDS
Ton Container	RM76039-280	82.10%		CAMDS
Ton Container	RM6651-262	82.20%		CAMDS
Ton Container	RM6651-262	82.20%		CAMDS
Ton Container	RM76039-337	82.30%	FE=500, CU<200, NI<200, AL=900	SUPLECAM
Ton Container	RM5651-137	82.40%		CAMDS
Ton Container	RM6651-239	82.50%		CAMDS
Ton Container	RM86039-423	82.50%		CAMDS
Ton Container	RM76036-374	82.70%		CAMDS
Ton Container	RM5651-169	82.80%	FE<200, CU<200, NI<200, AL=1160	SUPLECAM
Ton Container	RM76036-374	82.80%		CAMDS
Ton Container	RM76039-280	82.80%		CAMDS
Ton Container	RM76036-374	82.90%		CAMDS
Ton Container	RM5651-107	83.00%		CAMDS
Ton Container	RM86039-423	83.10%		CAMDS
Ton Container	RM6651-262	83.20%		CAMDS
Ton Container	RM86039-423	83.20%		CAMDS
Ton Container	RM6651-262	83.30%		CAMDS
Ton Container	RM6651-260	83.40%	FE<200, CU<200, NI<200, AL=930	SUPLECAM
Ton Container	RM5651-367	83.60%		CAMDS
Ton Container	RM5651-123	83.70%		CAMDS
Ton Container	RM86039-423	84.00%		CAMDS
Ton Container	RM86039-423	84.00%		CAMDS
Ton Container	RM76039-374	84.10%		CAMDS
Ton Container	RM5651-168	84.20%		CAMDS
Ton Container	RM5651-126	84.30%		CAMDS
Ton Container	RM76039-374	84.30%		CAMDS
Ton Container	RM6651-239	84.40%		CAMDS
Ton Container	RM76039-390	84.50%	FE<200, CU<200, NI<200, AL=1230	SUPLECAM
Ton Container	RM76036-374	84.50%		CAMDS
Ton Container	RM5651-132	84.60%		CAMDS
Ton Container	RM76039-374	84.60%		CAMDS
Ton Container	RM86039-423	84.60%		CAMDS

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
Ton Container	RM76039-374	84.70%		CAMDS
Ton Container	RM86039-423	84.70%		CAMDS
Ton Container	RM76039-378	84.80%	FE<200, CU<200, NI<200, AL=1000	SUPLECAM
Ton Container	RM5651-178	84.90%		CAMDS
Ton Container	RM76039-371	85.00%		CAMDS
Ton Container	RM86039-423	85.10%		CAMDS
Ton Container	RM86039-423	85.30%		CAMDS
Ton Container	RM5651-390	85.40%		CAMDS
Ton Container	RM76039-370	85.40%		CAMDS
Ton Container	RM5651-125	85.50%		CAMDS
Ton Container	RM4651-52	85.60%		CAMDS
Ton Container	RM6651-261	85.70%	FE=310, CU<200, NI<200, AL=2220	SUPLECAM
Ton Container	RM86039-423	85.70%		CAMDS
Ton Container	RM86039-423	85.70%		CAMDS
Ton Container	RM5651-115	85.80%		CAMDS
Ton Container	RM86039-423	85.90%		CAMDS
Ton Container	RM5651-124	86.00%		CAMDS
Ton Container	RM76039-374	86.00%		CAMDS
Ton Container	RM76039-390	86.30%		CAMDS
Ton Container	RM76036-374	86.40%		CAMDS
Ton Container	RM5651-109	86.60%		CAMDS
Ton Container	RM6651-262	86.90%		CAMDS
Ton Container	RM5651-134	87.40%		CAMDS
Ton Container	RM5651-167	87.60%		CAMDS
Ton Container	RM76039-380	87.90%	FE<200, CU<200, NI<200, AL=1100	SUPLECAM
Ton Container	RM5651-167	87.90%		CAMDS
Ton Container	RM5651-134	88.00%		CAMDS
Ton Container	RM76039-266	88.10%		CAMDS
Ton Container	RM76039-323	88.40%		CAMDS
Ton Container	RM5651-116	88.70%		CAMDS
Ton Container	RM5651-174	89.10%	FE<200, CU<200, NI<200, AL=970	SUPLECAM
Ton Container	RM6651-225	92.60%		SUPLECAM
	MAX	92.60%		
	MIN	38.80%		
	AVG	75.51%		
	SDEV	9.43%		
M55 Rocket	1034-46-1282	77.20%		CRDEC
M55 Rocket		80.30%		CAMDS
M55 Rocket	1034-55-1255	81.70%		CRDEC
M55 Rocket		81.70%		CAMDS
M55 Rocket	1034-46-1282	81.90%		CRDEC
M55 Rocket	1034-55-1255	82.40%		CRDEC
M55 Rocket		82.40%		CAMDS
M55 Rocket	1034-55-1255	82.50%		CRDEC
M55 Rocket	1033-52-1053	82.70%		CRDEC
M55 Rocket	1034-55-1255	83.40%		CRDEC
M55 Rocket	1034-55-1255	83.80%		CRDEC
M55 Rocket		84.20%		CAMDS
M55 Rocket		84.50%		CAMDS

TABLE A-3
GB AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
M55 Rocket		85.60%		CAMDS
M55 Rocket		85.80%		CAMDS
M55 Rocket		86.00%		CAMDS
M55 Rocket		88.70%		CAMDS
M55 Rocket	1033-62-1094	92.30%		CRDEC
M55 Rocket	RM5651-59	93.10%		CRDEC
	MAX	93.10%		
	MIN	77.20%		
	AVG	84.22%		
	SDEV	3.75%		

TABLE A-4
VX AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
TMU28/B	NY1-767-A44	93.30%	FE<100, AL<100, CU<100, NI<100	SUPLECAM
TMU28/B	NY1-767-A45	94.70%	FE<100, AL<100, CU<100, NI<100	SUPLECAM
TMU28/B	NY1-767-A40	95.30%	FE<100, AL<100, CU<100, NI<100	SUPLECAM
TMU28/B	NY1-767-A41	97.00%	FE<100, AL<100, CU<100, NI<100	SUPLECAM
TMU28/B	NY1-767-A42	97.70%	FE<100, AL<100, CU<100, NI<100	SUPLECAM
	MAX	97.70%		
	MIN	93.30%		
	AVG	95.60%		
	SDEV	1.58%		
Ton Container	NY1-767-A35	27.10%		CAMDS
Ton Container	NY1-767-A35	27.10%		CAMDS
Ton Container	NY1-767-A26	37.60%		CAMDS
Ton Container	NY1-767-A45	47.60%		CAMDS
Ton Container	NY1-767-A45	47.60%		CAMDS
Ton Container	NY1-767-A35	54.40%		CAMDS
Ton Container	NY1-767-A35	54.40%		CAMDS
Ton Container	NY1-767-A35	75.20%		CAMDS
Ton Container	NY1-767-A35	75.20%		CAMDS
Ton Container	NY1-767-A32	78.60%		CAMDS
Ton Container	NY1-767-A32	78.60%		CAMDS
Ton Container	NY1-767-A35	80.20%		CAMDS
Ton Container	NY1-767-A35	80.20%		CAMDS
Ton Container	NY1-767-A35	82.00%		CAMDS
Ton Container	NY1-767-A35	82.90%		CAMDS
Ton Container	NY1-767-A32	85.30%		CAMDS
Ton Container	NY1-767-A33	85.50%		SUPLECAM
Ton Container	NY1-767-A35	85.80%		SUPLECAM
Ton Container	NY1-767-A35	86.90%		CAMDS
Ton Container	NY1-767-A35	86.90%		CAMDS
Ton Container	NY1-767-A35	86.90%		CRDEC
Ton Container	U-4308CTFN	86.90%		CAMDS
Ton Container	U-4308CTFN	87.50%		CAMDS

TABLE A-4
VX AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
Ton Container	NY1-767-A33	87.60%		CAMDS
Ton Container	NY1-767-A33	87.60%		CAMDS
Ton Container	NY1-767-A26	88.10%		SUPLECAM
Ton Container	NY1-767-A40	88.10%		CAMDS
Ton Container	NY1-767-A32	88.50%		CAMDS
Ton Container	NY1-767-A32	88.50%		CAMDS
Ton Container	NY1-767-A28	88.60%		SUPLECAM
Ton Container	NY1-767-A40	89.00%		CAMDS
Ton Container	NY1-767-A35	89.40%		CAMDS
Ton Container	NY1-767-A35	89.40%		CAMDS
Ton Container	NY1-767-A35	89.60%		CAMDS
Ton Container	NY1-767-A35	89.60%		CAMDS
Ton Container	NY1-767-A29	89.80%		SUPLECAM
Ton Container	NY1-767-A33	89.80%		CRDEC
Ton Container	U-8132CTFN	89.80%		CAMDS
Ton Container	NY1-767-A28	89.90%		CRDEC
Ton Container	NY1-767-A29	90.10%		CRDEC
Ton Container	NY1-767-A35	90.30%		CAMDS
Ton Container	NY1-767-A35	90.30%		CAMDS
Ton Container	NY1-767-A26	90.40%		CRDEC
Ton Container	NY1-767-A35	90.50%		CAMDS
Ton Container	NY1-767-A35	90.50%		CAMDS
Ton Container	NY1-767-A32	90.80%		CRDEC
Ton Container	NY1-767-A32	91.00%		SUPLECAM
Ton Container	NY1-767-A45	91.00%		CAMDS
Ton Container	NY1-767-A35	91.40%		CAMDS
Ton Container	NY1-767-A35	91.40%		CAMDS
Ton Container	U-4308CTFN	92.30%		CAMDS
Ton Container	U-8132CTFN	92.60%		CAMDS
Ton Container	NY1-767-A35	93.00%		CAMDS
Ton Container	NY1-767-A35	93.00%		CAMDS
Ton Container	U-4308CTFN	93.20%		CAMDS
Ton Container	NY1-767-A35	93.50%		CAMDS
Ton Container	NY1-767-A35	93.50%		CAMDS
Ton Container	NY1-767-A35	93.70%		CAMDS
Ton Container	NY1-767-A35	93.70%		CAMDS
Ton Container	NY1-767-32	94.50%		CAMDS
Ton Container	NY1-767-A32	94.50%		CAMDS
Ton Container	NY1-767-A35	94.70%		CAMDS
Ton Container	NY1-767-A35	94.70%		CAMDS
Ton Container	NY1-767-A35	94.90%		CAMDS
Ton Container	NY1-767-A35	94.90%		CAMDS
Ton Container	NY1-767-A35	96.70%		CAMDS
Ton Container	NY1-767-A35	96.70%		CAMDS
Ton Container	U-8132CTFN	98.50%		CAMDS
	MAX	98.50%		
	MIN	27.10%		
	AVG	84.41%		
	SDEV	15.43%		
M23 Mine	NY1-767-A34	72.40%		SUPLECAM

TABLE A-4
VX AGENT PURITY

Munition	Agent Lot	Purity	Metals	Source
M23 Mine	NY1-767-A34	75.60%	FE=29.4, AL=54.6, CU=19.8, NI=159	SUPLECAM
M23 Mine	NY1-767-A34	75.80%	FE=43.7, AL=39.2, CU=25.2, NI=98.3	SUPLECAM
M23 Mine	NY1-767-A34	78.40%	FE=31.9, AL=63.8, CU=9.7, NI=0.6	SUPLECAM
M23 Mine	NY1-767-A34	79.90%		SUPLECAM
M23 Mine	NY1-767-A34	80.80%	FE=33.7, AL=32.4, CU=23.0, NI=224.3	SUPLECAM
M23 Mine	NY1-767-A34	81.50%	FE=56.3, AL=65.7, CU=23.5, NI=178.3	SUPLECAM
M23 Mine	NY1-767-A34	81.70%	FE=32.8, AL=116.2, CU=17.3, NI=161.9	SUPLECAM
M23 Mine	NY1-767-A34	82.30%	FE=29.3, AL=81.7, CU=13.8, NI=143.3	SUPLECAM
M23 Mine	NY1-767-A34	82.60%	FE=24.9, AL=89.0, CU=22.4, NI=486.7	SUPLECAM
M23 Mine	NY1-767-A34	84.70%	FE=21.9, AL=42.9, CU=10.1, NI=296.0	SUPLECAM
M23 Mine	NY1-767-A34	85.10%	FE NR, AL=62.7, CU=12.5, NI=315.7	SUPLECAM
M23 Mine	NY1-767-A34	85.10%	FE=31.9, AL=76.6, CU=11.8, NI=177.0	SUPLECAM
M23 Mine	NY1-767-A36	87.40%		SUPLECAM
M23 Mine	NY1-767-A22	88.30%	FE<200, AL<200, CU<200, NI<200	SUPLECAM
M23 Mine	NY1-767-A45	89.10%	FE<200, AL<200, CU<200. NI<200	SUPLECAM
M23 Mine	NY1-767-A34	89.70%	FE=61.4, AL=12.6, CU BDL, NI BDL	SUPLECAM
M23 Mine	NY1-767-A38	90.50%	FE<200, AL<200, CU<200, NI<200	SUPLECAM
	MAX	90.50%		
	MIN	72.40%		
	AVG	82.83%		
	SDEV	5.03%		
Proj 155	NY1-767-A27	72.40%		SUPLECAM
Proj 155	NY1-767-A45	83.30%	FE<200, AL<200, CU<200, NI<200	SUPLECAM
Proj 155	NY1-767-A29	83.70%		SUPLECAM
Proj 155	NY1-767-A26	84.40%		SUPLECAM
Proj 155	NY1-767-A25	85.00%		SUPLECAM
Proj 155	NY1-767-A23	86.10%	FE<200, AL<200, FE<200, AL<200, CU<200, NI<200	SUPLECAM
Proj 155	NY1-767-A40	86.10%		SUPLECAM
Proj 155	NY1-767-A44	86.10%	FE<200, AL<200, CU<200, NI<200	SUPLECAM
Proj 155	NY1-767-A32	86.40%		SUPLECAM
Proj 155	NY1-767-A41	89.80%	FE<200, AL<200, CU<200, NI<200	SUPLECAM
Proj 155	NY1-767-A42	92.20%	FE<200, AL<200, CU<200, NI<200	SUPLECAM
Proj 155	NY1-767-A43	93.80%	FE<200, AL<200, CU<200, NI<200	SUPLECAM
	MAX	93.80%		
	MIN	72.40%		
	AVG	85.78%		
	SDEV	5.12%		

TABLE A-5
HD AGENT PURITY

Munition	Agent Lot	Purity	Metal	Source
Projectile 105	RM-5721-2	83.6%	FE=1920, CU=235, NI=BDL	SUPLECAM
Projectile 105	RM-5721-3	88.8%	FE=6184, CU=14.1, NI=BDL	SUPLECAM
Projectile 105	RM-5721-1	89.4%	FE=4538, CU=11.7, NI=3.54	SUPLECAM
	MAX	89.4%		
	MIN	83.6%		
	AVG	87.3%		
	SDEV	2.6%		
Ton Container	RM-113-188	50.5%	FE=2106	TEAD
Ton Container	RM-113-305	62.5%	FE=1946	TEAD
Ton Container	RM-113-369	64.4%	FE=1923	TEAD
Ton Container	RM-113-223	67.1%	FE=2702	TEAD
Ton Container	RM-113-174	67.3%		CAMDS
Ton Container	RM-113-174	67.3%		CAMDS
Ton Container	RM-113-193	69.8%	FE=2093	TEAD
Ton Container	RM-113-64	71.8%	FE=2494	TEAD
Ton Container	RM-113-341	71.8%	FE=1986	TEAD
Ton Container	RM-113-331	73.9%	FE=2372	TEAD
Ton Container	RM-113-180	74.3%	FE=1988	TEAD
Ton Container	RM-113-350	74.5%	FE=2140	TEAD
Ton Container	RM-113-47	75.3%	FE=2262.31	TEAD
Ton Container	RM-113-137	76.6%	FE=2814	TEAD
Ton Container	RM-113-205	77.2%	FE=2137	TEAD
Ton Container	RM-113-174	77.6%		CAMDS
Ton Container	RM-113-325	78.1%	FE=1729	TEAD
Ton Container	RM-113-174	78.5%		CAMDS
Ton Container	RM-113-174	78.5%		CAMDS
Ton Container	RM-113-255	78.6%	FE=2010	TEAD
Ton Container	RM-113-298	78.6%	FE=3511	TEAD
Ton Container	RM-113-151	79.5%	FE=2068	TEAD
Ton Container	RM-113-174	80.2%		CAMDS
Ton Container	RM-113-348	81.4%	FE=1952	TEAD
Ton Container	RM-113-240	81.7%	FE=2174	TEAD
Ton Container	RM-113-249	83.3%	FE=2125	TEAD
Ton Container	RM-113-216	83.5%	FE=2522	TEAD
Ton Container	RM-113-358	84.4%	FE=2304	TEAD
Ton Container	RM-113-152	84.5%	FE=2193	TEAD
Ton Container	RM-113-178	84.8%	FE=2429	TEAD
Ton Container	RM-113-306	84.8%	FE=1916	TEAD
Ton Container	RM-113-189	84.9%	FE=1836	TEAD
Ton Container	RM-113-99	85.0%	FE=1945	TEAD
Ton Container	RM-113-195	85.8%	FE=2807	TEAD
Ton Container	RM-113-247	85.8%	FE=2035	TEAD
Ton Container	RM-113-202	85.9%	FE=2134	TEAD
Ton Container	RM-113-46	87.2%	FE=2631.64	TEAD
Ton Container	RM-113-359	87.2%	FE=2629	TEAD
Ton Container	RM-113-134	87.5%	FE=2228	TEAD
Ton Container	RM-113-353	88.0%	FE=1899	TEAD
Ton Container	RM-113-144	88.4%	FE=2700	TEAD
Ton Container	RM-113-199	89.1%	FE=2091	TEAD

TABLE A-5
HD AGENT PURITY

Munition	Agent Lot	Purity	Metal	Source
Ton Container	RM-113-340	89.3%	FE=2785	TEAD
Ton Container	U-4244CTFN	97.0%		CAMDS
	MAX	97.0%		
	MIN	50.5%		
	AVG	79.2%		
	SDEV	8.65%		

TABLE B-1
Metals in Munitions (Metals with Feed Rate Limitations)

Metals (lb)	Sb	As	Ba	Be	Cd	Cr	Pb	Hg	Ag	Tl
4.2" Cartridge (M2), Agent HT, Surface Area = 1.88 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0.00044	0.04676	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.01824	0	0.0094	0.00526	0.0329	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.01824**	**0**	**0.0094**	**0.00526**	**0.0329**	**0**	**0**	**0**
4.2" Cartridge (M2A1), Agent HD, Surface Area = 1.88 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0.00044	0.04676	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.01824	0	0.0094	0.00526	0.0329	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.01824**	**0**	**0.0094**	**0.00526**	**0.0329**	**0**	**0**	**0**

1. The metals within the munitions metal are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.
2. No distinction between different chromium valences (e.g., identification of hexavalent chrome) can be made from the available information.

155 MM Projectile (M104 and M110), Agent H, Surface Area = 2.9 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0	0.21698	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic (burster)	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.02813	0	0.0145	0.00812	0.05075	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.02813**	**0**	**0.0145**	**0.00812**	**0.05075**	**0**	**0**	**0**
155 MM Projectile (M121/A1 And M122), Agent GB, Surface Area = 2.9 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0	3.6	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.02813	0	0.0145	0.00812	0.05075	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.02813**	**0**	**0.0145**	**0.00812**	**0.05075**	**0**	**0**	**0**
155 MM Projectile (M121/A1), Agent VX, Surface Area = 2.9 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0	3.6	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.02813	0	0.0145	0.00812	0.05075	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.02813**	**0**	**0.0145**	**0.00812**	**0.05075**	**0**	**0**	**0**

1. The metals within the munitions metal are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.
2. No distinction between different chromium valences (e.g., identification of hexavalent chrome) can be made from the available information.

TABLE B-1
Metals in Munitions (Metals with Feed Rate Limitations)

Metals (lb)	Sb	As	Ba	Be	Cd	Cr	Pb	Hg	Ag	Tl
Ton Containers, Agent HD, Surface Area = 65.75 sq. ft.										
Metals in Fusible Plugs	0	0	0	0	0	0	1.684	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.63778	0	0.32875	0.1841	1.15062	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.63778**	**0**	**0.32875**	**0.1841**	**2.83462**	**0**	**0**	**0**
Ton Containers, Agent GB, Surface Area = 65.75 sq. ft.										
Metals in Fusible Plugs	0	0	0	0	0	0	1.684	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.63778	0	0.32875	0.1841	1.15062	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.63778**	**0**	**0.32875**	**0.1841**	**2.83462**	**0**	**0**	**0**
Ton Containers, Agent VX, Surface Area = 65.75 sq. ft.										
Metals in Fusible Plugs	0	0	0	0	0	0	1.684	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.63778	0	0.32875	0.1841	1.15062	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.63778**	**0**	**0.32875**	**0.1841**	**2.83462**	**0**	**0**	**0**

1. The ton containers are constructed of carbon steel. Any metals associated with the steel are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.
2. The fusible plugs associated with the ton containers melt at 108 °C. Therefore the associated metals are assumed to be non-embedded and are included in the above totals.
3. No distinction between different chromium valences (e.g., identification of hexavalent chrome) can be made from the available information.
4. Weight and composition of brass valve associated with ton containers is unknown and therefore is not included in the above values (embedded and would not affect totals).

105 MM Cartridge (M360), Agent GB, Surface Area = 2.8 sq. ft.										
Metals in Munition Metal including fuze (embedded)	0	0	0	0	0.00044	1.21681	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic (burster)	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.02721	0	0.01402	0.00785	0.04908	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.02721**	**0**	**0.01402**	**0.00785**	**0.04908**	**0**	**0**	**0**
105 MM Projectile (M360), Agent GB, Surface Area = 2.8 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0	1.2148	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.02721	0	0.01402	0.00785	0.04908	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.02721**	**0**	**0.01402**	**0.00785**	**0.04908**	**0**	**0**	**0**

TABLE B-1
Metals in Munitions (Metals with Feed Rate Limitations)

Metals (lb)	Sb	As	Ba	Be	Cd	Cr	Pb	Hg	Ag	Tl
1. The Metals Within the Munitions Metal Are Considered to Be Fixed (Embedded, Inert) and Will Not Vaporize and Are Therefore Not Included in the above Totals. 2. No distinction between different chromium valences (e.g., identification of hexavalent chrome) can be made from the available information. 3. The primer, propelling charge, and cartridge case associated with the 105 MM Cartridge are not processed at the TOCDF and are therefore not included in the above totals.										
115 MM Rocket (M55), Agent GB, Surface Area = 7.93 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0.000439	0.00201	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0.000005	0	0.000005	0	0	0	0.1032	0	0	0
Metals in Paint	0	0	0.07692	0	0.03965	0.02220	0.1388	0	0	0
TOTAL (lb, non-embedded)	**0.000005**	**0**	**0.076925**	**0**	**0.03965**	**0.02220**	**0.2420**	**0**	**0**	**0**
115 MM Rocket Warhead (M56), Agent GB, Surface Area = 2.6 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0.000439	0.00201	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0.000005	0	0.000005	0	0	0	0.00021	0	0	0
Metals in Paint	0	0	0.02564	0	0.01322	0.00740	0.04626	0	0	0
TOTAL (lb, non-embedded)	**0.000005**	**0**	**0.025645**	**0**	**0.01322**	**0.00740**	**0.04647**	**0**	**0**	**0**
1. The metals within the munitions metal are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals. 2. One third of the M55 Rocket surface area is assumed to be associated with the warhead for the calculation of the warhead surface area. 3. No distinction between different chromium valences (e.g., identification of hexavalent chrome) can be made from the available information. 4. The rocket warhead is constructed of an aluminum casing (95% Al, 5% Cu). The casing is assumed to weigh 10.8 lbs for the above calculations.										
115 MM Rocket (M55), Agent VX, Surface Area = 7.93 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0.000439	0.00201	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0.000005	0	0.000005	0	0	0	0.1032	0	0	0
Metals in Paint	0	0	0.07692	0	0.03965	0.02220	0.1388	0	0	0
TOTAL (lb, non-embedded)	**0.000005**	**0**	**0.076926**	**0**	**0.03965**	**0.02220**	**0.2420**	**0**	**0**	**0**
115 MM Rocket Warhead (M56), Agent VX, Surface Area = 2.6 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0.000439	0.00201	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0.000005	0	0.000005	0	0	0	0.00021	0	0	0
Metals in Paint	0	0	0.02564	0	0.01322	0.00740	0.04626	0	0	0
TOTAL (lb, non-embedded)	**0.000005**	**0**	**0.02564**	**0**	**0.01322**	**0.00740**	**0.04647**	**0**	**0**	**0**

TABLE B-1
Metals in Munitions (Metals with Feed Rate Limitations)

Metals (lb)	Sb	As	Ba	Be	Cd	Cr	Pb	Hg	Ag	Tl
1. The metals within the munitions metal are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals. 2. One third of the M55 Rocket surface area is assumed to be associated with the warhead for the calculation of the warhead surface area. 3. No distinction between different chromium valences (e.g., identification of hexavalent chrome) can be made from the available information. 4. The rocket warhead is constructed of an aluminum casing (95% Al, 5% Cu). The casing is assumed to weigh 10.8 lbs for the above calculations.										
Weteye Bomb (MK-116), Agent GB, Surface Area = 28.4 sq. ft.										
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.27553	0	0.14203	0.07953	0.49709	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.27553**	**0**	**0.14203**	**0.07953**	**0.49709**	**0**	**0**	**0**
750 lb Bomb (MC-1), Agent GB, Surface Area = 17.5 sq. ft.										
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.16930	0	0.08727	0.04887	0.30543	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.16930**	**0**	**0.08727**	**0.04887**	**0.30543**	**0**	**0**	**0**
8" Projectile (M426), Agent VX, Surface Area = 6.1 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	0	0	7.26	0	0	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.05942	0	0.03063	0.01715	0.10721	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.05942**	**0**	**0.03063**	**0.01715**	**0.10721**	**0**	**0**	**0**
1. The metals within the munitions metal are unknown, not estimated, and considered to be embedded and are not included in the above totals. 2. No distinction between different chromium valences (e.g., identification of hexavalent chrome) can be made from the available information.										
Mine (M23), Agent VX, Surface Area = 3.5 sq. ft.										
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0.00003	0	0	0	0	0	0.00044	0	0	0
Metals in Paint	0	0	0.03357	0	0.01730	0.00969	0.06056	0	0	0
TOTAL (lb, non-embedded)	**0.00003**	**0**	**0.03357**	**0**	**0.01730**	**0.00969**	**0.06100**	**0**	**0**	**0**
Spray Tank (TMU-28), Agent VX, Surface Area = 91.1 sq. ft.										
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0	0.88325	0	0.45529	0.25496	1.59350	0	0	0
TOTAL (lb, non-embedded)	**0**	**0**	**0.88325**	**0**	**0.45529**	**0.25496**	**1.59350**	**0**	**0**	**0**
1. The metals within the mine and spray tank metal are unknown, not estimated, and considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals. 2. No distinction between different chromium valences (e.g., identification of hexavalent chrome) can be made from the available information.										

TABLE B-2
Metals in Munitions (Other Metals of Interest)

Metals (lb)	Se	Ni	V	Al	B	Co	Cu	Mn	Sn	Zn
4.2" Cartridge (M2), Agent HT, Surface Area = 1.88 sq. ft.										
Metals in Munition Metal (embedded)	0	0.0895	0	0	0	0	0	0.1253	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.0094	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.0094**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
4.2" Cartridge (M2A1), Agent HD, Surface Area = 1.88 sq. ft.										
Metals in Munition Metal (embedded)	0	0.0895	0	0	0	0	0	0.1253	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.0094	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.0094**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1. The metals within the munitions metal are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.										
155 MM Projectile (M104 and M110), Agent H, Surface Area = 2.9 sq. ft.										
Metals in Munition Metal (embedded)	0	0.43395	0	0	0	0	0	0.60753	0	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Energetic (burster)	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.0145	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.0145**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
155 MM Projectile (M121/A1 And M122), Agent GB, Surface Area = 2.9 sq. ft.										
Metals in Munition Metal (embedded)	0	0.45	0	0	0	0	0.45	0.495	0	0
Metals in Agent	0	0.00016	0	0.013	0	0	0.00003	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.0145	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.01466**	**0**	**0.013**	**0**	**0**	**0.00003**	**0**	**0**	**0**
155 MM Projectile (M121/A1), Agent VX, Surface Area = 2.9 sq. ft.										
Metals in Munition Metal (embedded)	0	0.45	0	0	0	0	0.45	0.495	0	0
Metals in Agent	0	0.00016	0	0.00063	0	0	0.00003	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.0145	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.01466**	**0**	**0.00063**	**0**	**0**	**0.00003**	**0**	**0**	**0**
1. The metals within the munitions metal are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.										

TABLE B-2
Metals in Munitions (Other Metals of Interest)

Metals (lb)	Se	Ni	V	Al	B	Co	Cu	Mn	Sn	Zn
Ton Containers, Agent HD, Surface Area = 65.75 sq. ft.										
Metals in Fusible Plugs	0	0	0	0	0	0	0	0	0.632	0
Metals in Agent	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.32875	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.32875**	**0**	**0**	**0**	**0**	**0**	**0**	**0.632**	**0**
Ton Containers, Agent GB, Surface Area = 65.75 sq. ft.										
Metals in Fusible Plugs	0	0	0	0	0	0	0	0	0.632	0
Metals in Agent	0	0.0375	0	3.0	0	0	0.006	0	0	0
Metals in Paint	0	0.32875	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.36625**	**0**	**3.0**	**0**	**0**	**0.006**	**0**	**0.632**	**0**
Ton Containers, Agent VX, Surface Area = 65.75 sq. ft.										
Metals in Fusible Plugs	0	0	0	0	0	0	0	0	0.632	0
Metals in Agent	0	0.04	0	0.15	0	0	0.0064	0	0	0
Metals in Paint	0	0.32875	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.36875**	**0**	**0.15**	**0**	**0**	**0.0064**	**0**	**0.632**	**0**

1. The ton containers are constructed of carbon steel. Any metals associated with the steel are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.
2. The fusible plugs associated with the ton containers melt at 108 oC. Therefore the associated metals are assumed to be non-embedded and are included in the above totals.
3. Weight and composition of brass valve associated with ton containers is unknown and therefore is not included in the above values (embedded and would not affect totals).

105 MM Cartridge (M360), Agent GB, Surface Area = 2.8 sq. ft.										
Metals in Munition Metal including fuze (embedded)	0	0.15185	0	0	0	0	0.15185	0.16703	0	0
Metals in Agent	0	0.00004	0	0.00326	0	0	0.000006	0	0	0
Metals in Energetic (burster)	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.01402	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.01406**	**0**	**0.00326**	**0**	**0**	**0.000006**	**0**	**0**	**0**
105 MM Projectile (M360), Agent GB, Surface Area = 2.8 sq. ft.										
Metals in Munition Metal (embedded)	0	0.15185	0	0	0	0	0.15185	0.16703	0	0
Metals in Agent	0	0.00004	0	0.00326	0	0	0.000006	0	0	0
Metals in Paint	0	0.01402	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.01406**	**0**	**0.00326**	**0**	**0**	**0.000006**	**0**	**0**	**0**

1. The metals within the munitions metal are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.
2. The primer, propelling charge, and cartridge case associated with the 105 MM Cartridge are not processed at the TOCDF and are therefore not included in the above totals.

115 MM Rocket (M55), Agent GB, Surface Area = 7.93 sq. ft.

TABLE B-2
Metals in Munitions (Other Metals of Interest)

Metals (lb)	Se	Ni	V	Al	B	Co	Cu	Mn	Sn	Zn
Metals in Munition Metal (embedded)	0	0	0	10.26	0	0	0.54	0	0	0
Metals in Agent	0	0.00027	0	0.0214	0	0	0.00004	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.03965	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.03992**	**0**	**0.0214**	**0**	**0**	**0.00004**	**0**	**0**	**0**
115 MM Rocket Warhead (M56), Agent GB, Surface Area = 2.6 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	10.26	0	0	0.54	0	0	0
Metals in Agent	0	0.00027	0	0.0214	0	0	0.00004	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.01322	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.01349**	**0**	**0.0214**	**0**	**0**	**0.00004**	**0**	**0**	**0**

1. The metals within the munitions metal are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.
2. One third of the M55 Rocket surface area is assumed to be associated with the warhead for the calculation of the warhead surface area.3. The rocket warhead is constructed of an aluminum casing (95% Al, 5% Cu). The casing is assumed to weigh 10.8 lbs for the above calculations.

115 MM Rocket (M55), Agent VX, Surface Area = 7.93 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	10.26	0	0	0.54	0	0	0
Metals in Agent	0	0.00025	0	0.001	0	0	0.00004	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.03965	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.0399**	**0**	**0.001**	**0**	**0**	**0.00004**	**0**	**0**	**0**
115 MM Rocket Warhead (M56), Agent VX, Surface Area = 2.6 sq. ft.										
Metals in Munition Metal (embedded)	0	0	0	10.26	0	0	0.54	0	0	0
Metals in Agent	0	0.00025	0	0.001	0	0	0.00004	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.01322	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.01347**	**0**	**0.001**	**0**	**0**	**0.00004**	**0**	**0**	**0**

1. The metals within the munitions metal are considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.
2. One third of the M55 Rocket surface area is assumed to be associated with the warhead for the calculation of the warhead surface area.3. The rocket warhead is constructed of an aluminum casing (95% Al, 5% Cu). The casing is assumed to weigh 10.8 lbs for the above calculations.

Weteye Bomb (MK-116), Agent GB, Surface Area = 28.4 sq. ft.										
Metals in Agent	0	0.00868	0	0.694	0	0	0.00139	0	0	0
Metals in Paint	0	0.14203	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.15071**	**0**	**0.694**	**0**	**0**	**0.00139**	**0**	**0**	**0**
750 lb Bomb (MC-1), Agent GB, Surface Area = 17.5 sq. ft.										
Metals in Agent	0	0.0055	0	0.44	0	0	0.00088	0	0	0

TABLE B-2
Metals in Munitions (Other Metals of Interest)

Metals (lb)	Se	Ni	V	Al	B	Co	Cu	Mn	Sn	Zn
Metals in Paint	0	0.08727	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.09277**	**0**	**0.44**	**0**	**0**	**0.00088**	**0**	**0**	**0**
1. The metals within the munitions metal are unknown, not estimated, and considered to be embedded and are not included in the above totals.										
8" Projectile (M426), Agent VX, Surface Area = 6.1 sq. ft.										
Metals in Munition Metal (embedded)	0	0.9075	0	0	0	0	0.9075	0.9983	0	0
Metals in Agent	0	0.00036	0	0.00145	0	0	0.00006	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.03063	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.03099**	**0**	**0.00145**	**0**	**0**	**0.00006**	**0**	**0**	**0**
Mine (M23), Agent VX, Surface Area = 3.5 sq. ft.										
Metals in Agent	0	0.00026	0	0.00105	0	0	0.00004	0	0	0
Metals in Energetic	0	0	0	0	0	0	0	0	0	0
Metals in Paint	0	0.01730	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.01756**	**0**	**0.00105**	**0**	**0**	**0.00004**	**0**	**0**	**0**
Spray Tank (TMU-28), Agent VX, Surface Area = 91.1 sq. ft.										
Metals in Agent	0	0.03390	0	0.1356	0	0	0.00542	0	0	0
Metals in Paint	0	0.45529	0	0	0	0	0	0	0	0
TOTAL (lb, non-embedded)	**0**	**0.48919**	**0**	**0.1356**	**0**	**0**	**0.00542**	**0**	**0**	**0**
1 The metals within the mine and spray tank metal are unknown, not estimated, and considered to be fixed (embedded, inert) and will not vaporize and are therefore not included in the above totals.										

USACAMDS Waste Analysis Plan
Appendix C

TABLE C-1
Energetic / Agent Nominal Weight for Chemical Agent Munitions and Bulk Containers

Munition	Model	Dimensions		Total Mass (Lb)	Agent		Burster			Propellant		Fuze Model	Other Energetic Components
		Diameter	Length (In)		Fill	Mass (Lb)	Model	Explosive	Mass (Lb)	Model	Mass (Lb)		
105-mm Cartridge	M360	105 mm	31.1	43.86	GB	1.63	M40	Tetrytol	1.12	M67	2.83	M509	M28B2 Primer
				43.86	GB	1.63	M40A	Comp B	1.12	M67	2.83	M557	M28B2 Primer
				N/A	GB	1.63	--	--	--	--	--	--	--
105-mm Projectile	M360	105 mm	31.1	N/A	GB	1.63	--	--	--	--	--	--	--
4.2-inch Mortar	M2	4.2 in	21.0	24.67	HD	6.0	M14	Tetryl	0.14	M6	0.6	M8	M28B2 Primer
		4.2 in	21.0	24.67	HT	5.8	M14	Tetryl	0.14	M6	0.4	M8	M2 Primer
155-mm Projectile	M104	155 mm	26.9	98.9	H	11.7	M6	Tetrytol	0.41	--	--	--	--
	M110	155 mm	26.9	98.9	H	11.7	M6	Tetrytol	0.41	--	--	--	--
	M121	155 mm	26.9	98.9	GB	6.0	M71	Comp B	2.45	--	--	--	TNT (0.3 lb)
	M121A1	155 mm	26.9	98.9	VX	6.0	M71	Comp B	2.45	--	--	--	TNT (0.3 lb)
	M121A1	155 mm	26.9	98.9	GB	6.0	M71	Comp B	2.45	--	--	--	TNT (0.3 lb)
	M122	155 mm	26.9	98.9	GB	6.5	M37	Tetrytol	2.45	--	--	--	--
8-inch Projectile	M426	8 in	35.1	203	VX	14.5	M83	Comp B	7.0	--	--	--	--
		8 in	35.1	203	GB	14.5	M83	Comp B	7.0	--	--	--	--
		8 in	35.1	203	GB	14.5	--	--	7.0	--	--	--	--
Land Mine	M23	13.5 in	5	23	VX	10.5	M38	Comp B	0.8	--	--	M603	--
Rocket	M55	115 mm	78.0	57	GB	10.7	M34	Comp B	3.2	M28	19.3	M417	M62 Primer
		115 mm	78.0	57	GB	10.7	M36	Comp B	3.2	M28	19.3	M417	M62 Primer
		115 mm	78.0	56	VX	10.2	M34	Comp B	3.2	M67	19.3	M417	M62 Primer
		115 mm	78.0	56	VX	10.2	M36	Comp B	3.2	M67	19.3	M417	M62 Primer
525-lb Weteye Bomb	MK-116-0	14.0 in	86	525	GB	347	--	--	--	--	--	--	--
750-lb Bomb	MC-1	16.0 in	50.0	725	GB	220	--	--	--	--	--	--	--

TABLE C-1
Energetic / Agent Nominal Weight for Chemical Agent Munitions and Bulk Containers

Munition	Model	Dimensions		Total Mass (Lb)	Agent		Burster			Propellant		Fuze Model	Other Energetic Components
		Diameter	Length (In)		Fill	Mass (Lb)	Model	Explosive	Mass (Lb)	Model	Mass (Lb)		
Spray Tank	TMU-28/B	22.5 in	185	1,935	VX	1,356	--	--	--	--	--	--	--
Bulk Containers	Agent GA	31.1 in	85.1	N/A†	GA	N/A†	--	--	--	--	--	--	--
	Agent GB	31.1 in	85 1	2,900	GB	1,500	--	--	--	--	--	--	--
	Agent H	31.1 in	85.1	3,100	H	1,700	--	--	--	--	--	--	--
	Agent HT	31.1 in	85.1	3,100	HT	1,700	--	--	--	--	--	--	--
	Agent HD	31.1 in	85.1	3,100	HD	1,700	--	--	--	--	--	--	--
	Agent L	31.1 in	85.1	3,100	L	1,700	--	--	--	--	--	--	--
	Agent VX	31.1 in	85.1	3,000	VX	1,600	--	--	--	--	--	--	--

NOTES: H, HD, HT are Mustard Agents.
NA = Information not available.
"--" = Indicates that Information does not apply to this munition.
Some types of munitions are not configured with fuzes and bursters while in storage.
Bulk containers: Ton Containers and Spray Tanks do not contain energetic components.
† = Agent fill weight and total weight for GA ton containers will be similar to those for a GB filled ton container.

Comp B = 60% RDX, 39% TNT, 1% presensitizer (wax)
Tetrytol = 70% Tetryl, 30% TNT
RDX = Cyclotrimethylenetrinitramine; $N(NO_2)CH_2N(NO_2)CH_2N(NO)_2CH_2$
TNT = 2,4,6-trinitrotoluene; $CH_3C_6H_2(NO_2)_3$
Tetryl = 2,4,6-trinitrophenylmethylnitramine; $(NO_2)_3C_6H_2N(N)_2)CH_3$

References:
1. Department of the Army Technical Manual on *Military Explosives*, TM 9-1300-214, Change 3, September 1988.
2. AMC Pamphlet (AMCP 706-177) "Engineering Design Handbook Explosive Series, Properties of Explosives of Military Interest."
3. Final Demilitarization Plan for Operation of USACAMDS at Tooele Army Depot, Utah, and June 1983.
4. Data and diagrams for each munition type are also contained in Attachment 21 of this Permit Application.

TABLE C-2
COMPOSITION OF REACTIVE MATERIAL IN MUNITIONS

MUNITION	COMPONENT			WEIGHT	COMPOSITION
M55 Rocket	1.	Fuze, M417			
		a.	Booster	1.12 grains	RDX[a]
		b.	Pellet Booster	183.5 grains	RDX[a]
		c.	Rotor, Lead	2.77 grains	RDX[a]
	2.	Detonator, M63			
		a.	Upper Charge Primer Mix	0.31 grains	Overall Mixture: 40% Lead Styphnate 20% Lead Azide 20% Barium Nitrate 15% Antimony Sulfide 5% Tetracene
		b.	Intermediate Charge	2.0 grains	Lead Azide
		c.	Lower Charge	0.99 grains	RDX[a]
	3.	Squib, M2			
		a.	Flash Charge	1.0 grains each(2 required)	Overall Mixture: 32% Lead Thiocyanate 40% Potassium Chlorate 18% Charcoal 10% Egyptian Lacquer
		b.	Booster Igniter	46.2 grains each(2 required)	Overall Mixture: 49% Magnesium 49% Potassium Perchlorate 2% Cellulose Nitrate-Camphor
	4.	Igniter Rocket Motor, M62		385 grains	Overall Mixture: 49% Magnesium 49% Potassium Perchlorate 2% Cellulose Nitrate-Camphor
	5.	Propellant Grain, M28		134,750 grains	Overall Mixture: 60.0% Nitrocellulose 23.8% Nitroglycerin 9.9% Triacetin 2.6% Diethylphthalate 2.0% Lead Stearate 1.7% 2-Nitrodiphenylamine
	6.	Rocket Burster, M34		22,400 grains	Comp B[b]
	7.	Rocket Burster, M36		22,400 grains	Comp B[b]
	8.	Rocket Motor Pellet		3.1 grains	Overall Mixture: 49% Magnesium 49% Potassium Perchlorate 2% Cellulose Nitrate-Camphor
M23 Land Mine	1.	Fuze, M603			
		a.	Detonator, M45		
			(1)	1.9 grains	Overall Mixture: 53% Potassium Chlorate 25% Lead Sulfocyanate 17% Antimony Sulfide 5% Lead Azide
			(2)	4.2 grains	Lead Azide
			(3)	1.9 grains	RDX[a]
		b.	Booster, M120	172.5 grains	RDX[a]
	2.	Burster, M38		5709.8 grains	Comp B[b]
				308.6 grains	Tetryl[d]
	3.	Initiator, M48		848.8 grains	Comp B[b]

TABLE C-2
COMPOSITION OF REACTIVE MATERIAL IN MUNITIONS

MUNITION	COMPONENT				WEIGHT	COMPOSITION
M360	1.	Fuze, M508A1				
		a.	Booster		230 milligrams	Lead Azide
					244 milligrams	Tetryl Lead
		b.	Booster Pellet		22 grams	Tetryl[d]
	2.	Detonator, M18				
		a.	Upper Charge		65 milligrams	Overall Mixture: 33.5% Potassium Chlorate 32.2% Antimony Sulfide 28.3% Lead Azide 5.0% Carborundum
		b.	Intermediate Charge		191 milligrams	Lead Azide
		c.	Lower Charge		80 milligrams	Tetryl[d]
M2A1(4.2-inch mortar)	1.	Fuze, M8				
		a.	Booster Charge		65.2 grams	Tetryl[d]
	2.	Detonator, M18				
		a.	Upper Charge		50 milligrams	Overall Mixture: 33.5% Potassium Chlorate 32.2% Antimony Sulfide 28.3% Lead Azide 5.0% Carborundum
		b.	Intermediate Charge		157 milligrams	Lead Azide
		c.	Lower Charge		70 milligrams	Tetryl[d]
M60	1.	Fuze, M51A5				
		a.	Booster, M121A4		230 milligrams	Lead Azide
					244 milligrams	Tetryl Lead
		b.	Booster Charge		22 grams	Tetryl[d]
	2.	Detonator, M24				
		a.	Upper Charge		68 milligrams	Overall Mixture: 33.5% Potassium Chlorate 32.2% Antimony Sulfide 28.3% Lead Azide 5.0% Carborundum
		b.	Lower Charge		185 milligrams	Tetryl[d]
		c.	Plunger, M1			
			(1)	Primer, M54	11 milligrams	Overall Mixture: 53% Potassium Chloride 25% Lead Sulfocyanate 17% Antimony Sulfide 5% TNT[c]
			(2)	Black Powder	19 milligrams	Black Powder
			(3)	Relay	100 milligrams	Lead Azide

[a] RDX = cyclotrimethylenetrinitramine; $N(NO_2)CH_2N(NO_2)CH_2N(NO)_2CH_2)$
[b] Comp B = 60% RDX, 39% TNT, 1% presensitizer (wax)
[c] TNT = 2,4,6-trinitrotoluene; $CH_3C_cH_2(NO_2)_3$
[d] Tetryl = 2,4,6-trinitrophenylmethylnitramine; $(NO_2)_3C_6H_2N(N)_2)CH_3$

References:
1. Department of the Army Technical Manual on *Military Explosives*, TM 9-1300-214, Change 3, September 1988.
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