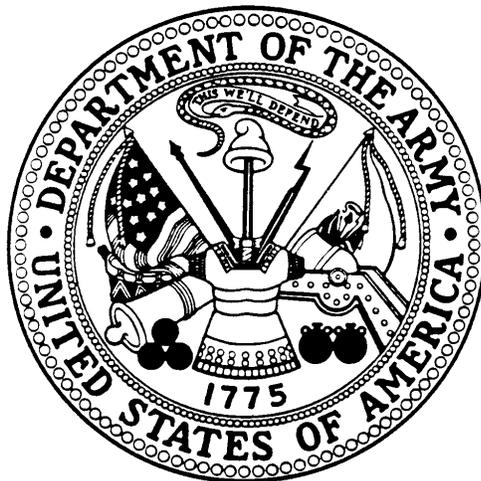


**PROPOSED MODIFICATIONS TO SUPPORT THE
DESTRUCTION OF MUSTARD AGENTS AND
MUNITIONS AT THE TOOEELE CHEMICAL AGENT
DISPOSAL FACILITY (TOCDF) IN UTAH**

ENVIRONMENTAL ASSESSMENT



May 2007

**U.S. ARMY CHEMICAL MATERIALS AGENCY
ABERDEEN PROVING GROUND, MARYLAND**

ENVIRONMENTAL ASSESSMENT

Lead Agency: Department of the Army;
U.S. Army Chemical Materials Agency (CMA)

Title of Proposed Action: Proposed Modifications to Support the Destruction of
Mustard Agents and Munitions at the Tooele Chemical
Agent Disposal Facility (TOCDF) in Utah

Affected Jurisdiction: Tooele County, Utah

PREPARED BY:



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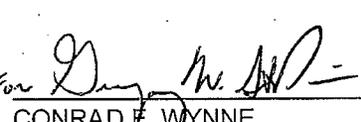
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ORGANIZATION OF THIS ENVIRONMENTAL ASSESSMENT

This Environmental Assessment (EA) evaluates the environmental effects of the Army's proposed action: installation and operation of additional equipment and systems at the Army's existing Tooele Chemical Agent Disposal Facility (TOCDF) at the Deseret Chemical Depot in Utah for the purpose of destroying the depot's inventory of mustard agents and munitions that, in some cases, contain high levels of mercury contamination and/or a large quantity of undrainable solids and sludge-like material. This EA provides information to be considered in making decisions regarding the proposed action and its alternatives.

- SECTION 1 INTRODUCTION** summarizes the purpose of and need for the proposed action and provides relevant background information about the chemical warfare agents to be destroyed.
- SECTION 2 PROPOSED ACTION AND ALTERNATIVES** describes the proposed action and the no-action alternative, as well as other alternatives to the proposed action.
- SECTION 3 THE AFFECTED ENVIRONMENT AND POTENTIAL ENVIRONMENTAL CONSEQUENCES** describes the existing environmental resources that could be affected by the proposed action, identifies potential environmental impacts of implementing the proposed action and no-action alternatives, and identifies proposed mitigation measures, as appropriate.
- SECTION 4 CONCLUSIONS** summarizes the findings about the potential environmental impacts for the proposed action and no-action alternative, and makes a recommendation to proceed with a Finding of No Significant Impact.
- SECTION 5 PERSONS CONTACTED AND CONSULTED** provides a listing of those individuals who were contacted to provide data and information for the analyses in this EA, as well as those who contributed to the preparation of this EA through their analyses and expert reviews.
- SECTION 6 REFERENCES** provides bibliographic information for cited reference materials.

ACRONYMS AND ABBREVIATIONS

$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
μm	micrometer (one millionth of a meter)
acre-ft/yr	acre-feet per year (i.e., 1 acre-ft/yr = 325,900 gallons per year)
BDS	bulk drain station
BRA	brine reduction area
CAMDS	Chemical Agent Munitions Disposal System
CFR	<i>Code of Federal Regulations</i>
CHB	container handling building
CO	carbon monoxide
COPC	chemical of potential concern
CMA	U.S. Army Chemical Materials Agency
CWC	Chemical Weapons Convention
DCD	Deseret Chemical Depot (in Utah)
DFS	deactivation furnace system
DOD	Department of Defense
dscm	dry standard cubic meter
DUN	dunnage furnace
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESQ	ecological screening quotient
FR	<i>Federal Register</i>
ft^3	cubic foot
gal	gallon
GB	a nerve agent, also called “sarin”
gpm	gallons per minute
H	mustard agent, also called “Levenstein mustard”
HCl	hydrogen chloride
HD	mustard agent, also called “distilled mustard”
HDS	hydrolysate disposal system
HEPA	high efficiency particulate air (filter)
Hg	mercury
HT	mustard agent, also called “thickened mustard”
HVAC	heating, ventilation and air-conditioning
JACADS	Johnston Atoll Chemical Agent Disposal System
kg	kilogram
lb	pound
LIC	liquid incinerator (there are two of these at the TOCDF)

m ³	cubic meter
MACT	maximum achievable control technology
MDB	munitions demilitarization building
mg	milligram (one thousandth of a gram)
mm	millimeter (one thousandth of a meter)
MPF	metal parts furnace
NaOH	sodium hydroxide
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NO ₂	nitrogen dioxide
NO _x	nitrogen oxides
PAS	pollution abatement system
Pb	lead
PFS	PAS filtration system
pH	potential of hydrogen (a measure of the acidity or alkalinity of a substance)
PM _{2.5}	particulate matter less than or equal to 2.5 micrometers in aerodynamic diameter
PM ₁₀	particulate matter less than or equal to 10 micrometers in aerodynamic diameter
PMCD	Program Manager for Chemical Demilitarization (a predecessor of the U.S. Army Chemical Materials Agency)
ppm	parts per million
PQL	practical quantification limit
PUB	process utilities building
RATA	Relative Accuracy Test Audit
RCRA	Resource Conservation and Recovery Act
RDS	rinse and drain station
RPT	rinsate pre-treatment
SIC	sulfur-impregnated carbon
SO ₂	sulfur dioxide
TC	ton container
TRI	toxics release inventory
TSDF	treatment, storage, and disposal facility
UDEQ	Utah Department of Environmental Quality
U.S.	United States
VOC	volatile organic compound
VX	a nerve agent

1. INTRODUCTION

The U.S. Army Chemical Materials Agency (CMA) is charged with safely storing and destroying the U.S. inventory of chemical warfare agents and munitions while protecting the public, the workers, and the environment. Under the terms of an international disarmament treaty, known as the Chemical Weapons Convention (CWC), the United States must destroy its entire inventory of chemical weapons by April 2012.

The CMA is presently conducting the destruction of chemical weapons at designated chemical weapons storage sites. The largest single inventory of chemical agents and munitions in the United States is stored at the Deseret Chemical Depot (DCD), near Tooele, Utah, where one of the Army's four chemical weapons incineration facilities [i.e., the Tooele Chemical Agent Disposal Facility (TOCDF)] began to destroy chemical weapons in August 1996.

The CMA's storage and inspection teams have determined that a portion of the inventory of mustard agents (i.e., the blister, or vesicant, agents H, HD, and HT) in storage at DCD may contain elevated levels of mercury and/or accumulations of solids that could complicate the ability of the TOCDF to treat the material with the existing baseline incineration technology while maintaining compliance with applicable emissions limits and regulations. This Environmental Assessment (EA) pertains to proposed modifications to the TOCDF that would allow for the timely processing and destruction of the mustard agents and munitions.

1.1 BACKGROUND

The chemical weapons inventory in storage at DCD includes the mustard-filled items listed in Table 1. (Table 1 also indicates the status of each item type, as explained later in this subsection.) The TOCDF uses a reverse-assembly, high-temperature incineration process (called the "baseline process" in this document) to destroy the chemical agents and munitions. A generalized schematic of the baseline process is shown in Figure 1. Ton containers (TCs; i.e., large cylindrical steel containers that are used to store bulk liquid agent) and munitions are normally subjected to baseline processing at the TOCDF as follows:

- Projectiles and mortar rounds may be drained of drainable agent, then disassembled into their respective components. The drained agent is fed into one of the two liquid incinerators (LICs) at the TOCDF for destruction. The munition bodies are fed to the metal parts furnace (MPF) for thermal decontamination and to destroy any residual agent remaining after the draining process.
- Agent drained from the TCs is fed into one of the two LICs. The drained TCs are fed into the MPF for thermal decontamination and to destroy any residual agent.
- Spent decontamination fluids are incinerated in the LICs.
- The atmospheric emissions from each pollution abatement system (PAS) must comply with regulatory limits.

Table 1. Inventory of munitions and bulk containers filled with mustard agent (i.e., agents H, HD, or HT) in storage at the Deseret Chemical Depot in Utah

Item Description	Number of Items	Chemical Agent Fill ^a	Total Agent (pounds)	Status (based on the results of inventory sampling)
155-mm projectiles	54,663	H	639,540	No mercury, but solids average 70%
4.2-inch mortar rounds	62,523	HT	362,630	About 17% contain a mercury residue
4.2-inch mortar rounds	885	HD	5,310	Up to 30% solids, containing mercury
Ton container ^b	6,397	HD	11,381,640	20 to 30% with mercury and/or high solids content
Ton container ^b	1	H	1,780	Solids; mercury content unknown
TOTAL	124,469		12,390,900	

^a All of these fills are blister agents (i.e., vesicants) generally known as “mustard” agents; H = leavenstein mustard agent, HD = distilled mustard agent, and HT = thickened mustard agent.

^b “Ton containers” are large cylindrical steel containers that each hold about one ton of bulk liquid mustard agent.

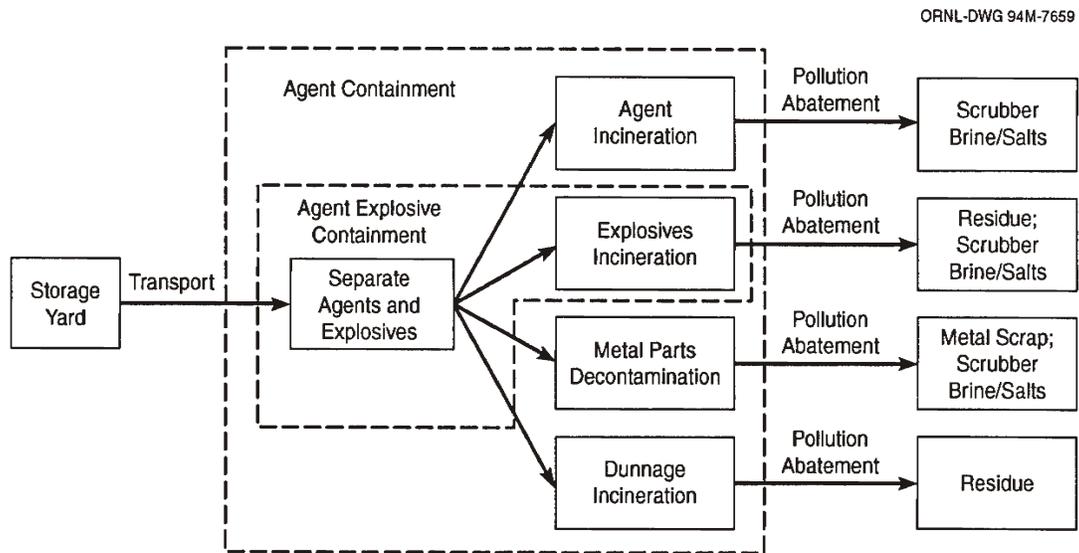


Figure 1. Schematic diagram of the baseline incineration process “as built” at the Tooele Chemical Agent Disposal Facility (TOCDF). Note: The TOCDF’s dunnage furnace was constructed, but has never been operated and has been dismantled.

Most of the mustard-filled items at DCD (particularly the TCs) have developed undrainable “heels”¹ which contain solid materials. Over 90% of the inventory of mustard agent at DCD is stored inside TCs. Sampling and evaluation of the mustard-filled TCs and munitions has indicated that a portion of the liquid mustard agent, as well as the solids in certain items, is contaminated with mercury (see the “Status” column in Table 1). The status of the specific munitions and TCs at the DCD is described in the following paragraphs.

Sampling of the 155-mm projectiles showed the presence of solids but no mercury. Analysis of 85 sampled HD-filled mortar rounds indicated no mercury in the liquid agent, but solids were present in quantities up to 30% of the munitions’ contents, with an average mercury concentration of 770 ppm. An internal residue, containing an average mercury concentration of 200 ppm, was found in 17% of the 65 sampled HT-filled mortar rounds (EG&G 2006).

Ninety-eight (98) TCs were sampled. These TCs had solid layers ranging in thickness from 1.25 to 11 inches. About two-thirds of the sampled TCs had solid heel layers with a thickness between 3.5 and 6 inches. Elevated mercury contamination was found in 18 of the sampled TCs (i.e., in about 20% of the sampled containers) (EG&G 2004). Where mercury contamination was found, the average concentration in the liquid agent was 24 mg/kg (ppm), and the average concentration in the solids was 2,500 mg/kg (ppm). There was no apparent correlation between the thickness of the solid layer and the concentration of mercury.

TOCDF baseline incineration operations are regulated by both the Resource Conservation and Recovery Act (RCRA) and the Clean Air Act (National Emission Standards for Hazardous Air Pollutants for Hazardous Waste Combustion, which are based on Maximum Achievable Control Technology, or MACT) with oversight of EPA and the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste and Division of Air Quality. The TOCDF was required to perform extensive exhaust gas sampling as part of trial burns/comprehensive performance tests to verify that emissions are in compliance with all applicable standards. In addition, the TOCDF has implemented a mercury emissions monitoring process, consistent with a method published in U.S. Environmental Protection Agency (EPA) regulations (40 CFR Part 75, Appendix K), whereby the MPF exhaust gas is being continuously sampled and analyzed for mercury concentration. This mercury monitoring method was approved by the EPA pursuant to 40 CFR Part 63 on April 27, 2006, prior to the initiation of baseline mustard TC processing (reference letter M. Hestmark to Colonel P.C. Cooper dated April 27, 2006). In order to obtain EPA’s approval, the TOCDF was required to perform a rigorous Relative Accuracy Test Audit (RATA) protocol to verify the accuracy of the monitoring method. The RATA results, documented in a report submitted to the DAQ (reference letter Colonel F. D. Pellissier to R. W. Sprott dated April 11, 2007) demonstrated a relative accuracy that meets all regulatory requirements.

¹ “Heels” are the leftover portions of the chemical agent that remains in the storage container after the draining operation is completed. Some portion of the liquid agent simply sticks to the walls of the containers and is difficult to remove. Also, mustard agents can sometimes solidify or can develop sludge-like materials that settle to the bottom of the container after long periods of storage. In either case, the “heel” represents that portion (both liquid and solid) of the contents of a container that cannot be completely drained.

The TOCDF's current mustard TC processing approach includes taking liquid agent samples from each TC prior to establishing whether they are suitable for processing using the existing baseline incineration technology. Included in the criteria for baseline processing is the requirement for the liquid agent to have mercury concentrations less than the analytical method Practical Quantification Limit (PQL), which is well under 1 ppm. Using this approach, as of April 30, 2007, the TOCDF has processed 1,111 TCs containing concentrations of mercury under 1 ppm.

The information obtained by the TOCDF on the mustard TC stockpile through liquid agent and continuous exhaust gas sampling has confirmed that the TOCDF can safely process the population of TCs that meet criteria for baseline incineration, and remain within regulatory standards for mercury emissions. As part of the "Lessons Learned" program, this information is compiled and provided to other chemical demilitarization facilities as they plan for their mustard processing campaigns. The mustard TC campaign to date indicates that the combination of elevated mercury content and undrainable solids may challenge the existing baseline incineration process in terms of throughput rates and PAS performance. The mercury content in some of the mustard agent-containing items may be too high to process in the LIC or the MPF using existing controls or without exceeding compliance limits established by regulatory authorities under the provisions of RCRA or the Clean Air Act. In addition, TCs with high solids content would require lengthy MPF processing times. As described further below, those agent-containing items which will require additional alternative processing technologies are the subject of this Environmental Assessment. Furthermore, additional permit modifications will be required under RCRA and the Clean Air Act prior to the post-baseline processing described above.

1.2 OVERVIEW OF THE PROPOSED ACTION

The CMA proposes to employ additional alternative technologies to provide greater operational flexibility at the TOCDF to augment the baseline process for destroying those mustard agents and munitions which have elevated levels of mercury contamination and/or a large solids content. Two technologies are under consideration:

- *PAS filtration system (PFS)*. To control atmospheric emissions of mercury from the TOCDF, three new PFSs would be installed on the existing PASs: one new PFS on each of the two LICs, and one new PFS on the MPF. Each new PFS would include an activated carbon filtration stage with sulfur-impregnated carbon (SIC), which would remove mercury from the stack gases. The Army evaluated various technologies for mercury removal and concluded that (a) SIC filters were the preferred technology (U.S. Army 2001) and (b) substitution of SIC for the conventional activated carbon in the current PFS designs would reduce mercury emissions by 80%. Higher removal rates would require larger SIC filters that allow longer gas residence times. A SIC filter with a 5- to 10-sec gas residence time would achieve 99.9% mercury removal. The new PFSs would be capable of reducing mercury emissions to regulatory levels.

- *Ton container washout capability.* The proposed new TC washout capability would consist of three parts:
 - (1) A *rinse and drain station (RDS)*, in which jets of hot water would be used to scour the heel from each TC after the TC has been drained of mustard agent.
 - (2) A *rinsate pre-treatment (RPT)* system, in which any residual mustard agent in the rinsate would be destroyed via a water hydrolysis reaction. The resulting liquid by-product (called “hydrolysate” in this document) would be pH adjusted to reduce its corrosive, acidic characteristics. The hydrolysate would then be filtered to remove solids.
 - (3) A *hydrolysate disposal system (HDS)*, which would be used to transport the filtered hydrolysate to one of the two LICs for destruction or transported off-site to a permitted disposal facility. The HDS would include the necessary piping and pumps for moving the hydrolysate from the RPT area into the LICs or to the existing off-site transfer station.

The proposed action would apply to those items that cannot be processed by the baseline facility. At this time, the mustard-filled items that appear suitable for baseline processing are TCs which have a low level of mercury contamination and a low solids content, as well as the 155-mm projectiles and 4.2-inch HT mortar rounds. The proposed action would be implemented via the installation of the PFS units and, if needed, the washout capability. Mercury-contaminated TCs that do not have a large solids content would not be processed using the washout capability unless it were advantageous to do so. Such TCs might be processed in the MPF. A demonstration and prove-out period would be needed to determine which TCs could be processed through the MPF (with its new PFS) and which TCs may require washout in the RDS and subsequent liquid by-product treatment in the RPT and HDS.

For the purposes of analysis of the proposed action in this EA, the new PFSs are assumed to be installed at the TOCDF and operated to destroy the entire inventory of mercury-contaminated TCs stored at the DCD, regardless of the depth of the solid layer in those TCs and regardless of any simultaneous operation of the RDS, RPT and HDS. Thus, the potential environmental impacts assessed in Chapter 3 of this EA represent an upper bound on the range of operational options available under the proposed action.

1.3 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action is to provide the TOCDF with additional alternative technologies needed for the safe and timely destruction of the DCD’s inventory of mercury-contaminated mustard agents and to dispose of the associated wastes in a safe and environmentally acceptable manner. This action is needed to meet current U.S. obligations under the CWC and Congressional directives in Public Law 99-145 for destroying the entire chemical weapons stockpile

being stored at the DCD². These destruction activities must be completed on a schedule in agreement with the deadline specified in the CWC. In addition, the completion of the proposed action would eliminate the risk to the public from continued storage of these chemical agents and munitions. Completion of stockpile destruction activities would also eliminate the need for continued surveillance and maintenance of the mustard agents and munitions currently being stored at the DCD.

The presence of unanticipated, elevated levels of mercury contamination in some mustard-filled munitions and TCs would require the baseline facility to reduce the processing rate for these items, to risk compromising permit requirements, and/or to cause potentially unacceptable human health or ecological effects due to increased mercury emissions. The addition of SIC filters (as part of the proposed new PFSs) to the baseline PASs is needed to allow the processing of mercury-contaminated items in an environmentally safe manner and in compliance with regulatory standards established under RCRA and under the Clean Air Act.

The presence of unanticipated, high solids content in some mustard-filled munitions and TCs may prevent the timely destruction of these items. The proposed TC washout capability (i.e., RDS, RPT, HDS, and ancillary equipment) is needed to allow better utilization of the existing LIC capacity and to prevent significantly extending the schedule for processing drained TCs in the MPF. The installation and operation of the TC washout equipment would allow for the appropriate tradeoff between economic and schedule considerations for the TOCDF while being protective of the environment.

1.4 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

This EA has been prepared by the U.S. Army Chemical Materials Agency to evaluate the significance of the potential environmental impacts of the proposed modifications to the TOCDF to accomplish the destruction of mustard-filled munitions and TCs with elevated levels of mercury-contamination and/or a high solids heel content. This EA has been prepared in compliance with Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (NEPA) of 1969 (see 40 CFR Parts 1500–1508) and Army Regulation 200-2 on *Environmental Analysis of Army Actions* (see 32 CFR Part 651).

The potential impacts associated with the destruction of the DCD chemical weapons stockpile (including the mustard agents) at the TOCDF have been previously reviewed in an Environmental Impact Statement (U.S. Army 1989) and in two subsequent reviews of that document (PMCD 1996; Gant and Zimmerman 1999). These three previous documents each concluded that the mustard agents and munitions could be destroyed at the TOCDF without causing significant environmental impacts; however, those conclusions were obtained without considering the recent discovery of elevated levels

² As of June 3, 2005, the TOCDF had completed the destruction of all recoverable GB and VX nerve agents and munitions stored at the DCD, and the mustard campaign is the last significant agent/munition campaign for the TOCDF. Thus, the successful completion of the proposed action described in this Environmental Assessment would result in the elimination of nearly the entire DCD inventory of chemical agents and munitions.

of mercury contamination or the high solids content in some of the mustard-filled items. This EA has been prepared to supplement the previous environmental reviews.

To avoid redundancy and to comply with the intent of the Council on Environmental Quality's guidance at 40 CFR 1500.4 on reducing paperwork, this EA relies upon the findings of the Army's previous assessments of the destruction of uncontaminated mustard agent (i.e., U.S. Army 1989; PMCD 1996; and Gant and Zimmerman 1999), rather than presenting new analyses. Where a simple comparison between the previous assessments and the proposed action is not sufficient to determine the relative magnitude or significance of the potential impacts, additional analysis is presented in Section 3 of this EA.

In addition, the State of Utah—as part of its permitting authority under RCRA—has completed two risk assessments of the atmospheric emissions from the TOCDF. One of these assessments examined the potential human health effects (UDEQ 2003), and the other examined the potential effects on ecological resources (Tetra Tech 2005). Both documents included an estimation of the mercury emissions from the TOCDF, as well as an assessment of the risks posed by those emissions. This EA relies upon the findings of the State of Utah's risk assessments.

The sampling and evaluation of TCs is currently being conducted as part of the routine surveillance and maintenance activities for the chemical agents and munitions stockpile in storage at DCD. Such activities would be required regardless of the methods or technologies used to eventually destroy the mustard agent contained in these TCs; hence, the TC sampling and evaluation activities are beyond the scope of this EA and are not discussed further in this document.

2. THE PROPOSED ACTION AND ITS ALTERNATIVES

This section describes the proposed action (i.e., modifications to the TOCDF for the purpose of destroying munitions and agents with elevated mercury content and/or excessive solids content), as well as the alternatives considered by the Army. Section 2.1 describes the proposed action, including the installation and operation of specialized equipment at the TOCDF. Section 2.1 also includes a description of the waste streams associated with the use of this equipment and provides estimates of the quantities and characteristics of the wastes that would be generated. Section 2.2 discusses the no-action alternative; that is, not installing or using modifications at the TOCDF. Section 2.3 identifies other alternatives that were considered but eliminated from detailed evaluation in this EA.

2.1 THE PROPOSED ACTION: MODIFICATIONS TO SUPPORT THE DESTRUCTION OF MUSTARD MUNITIONS AND AGENTS AT THE TOCDF

At the completion of baseline operations, several changes would be made to the TOCDF's baseline process to accommodate the elevated mercury contamination and/or high solids content of the remaining munitions and TCs. Two types of equipment would be installed: (1) To prevent excess mercury emissions during operations, exhaust gas filtration systems (i.e., the PFSs) would be installed; (2) To address the problem of excessive solids content in TCs, a TC washout capability may be added. Operations under the proposed action would begin after operational readiness of the new equipment has been demonstrated. The proposed new equipment and processes are described in the next subsection.

2.1.1 The Proposed Process and Its Associated Equipment

The MPF and each of the two LICs has an existing PAS for treating exhaust gases from the TOCDF's incinerators. These existing PAS units consists of a quench tower, a venturi scrubber, a packed bed scrubber tower, and a demister. Each PAS is designed to remove at least 99% of hydrogen chloride (HCl) and 99.8% of the particulates in the stack gases. To control mercury emissions, a new PFS would be installed on each of the three PAS units. Each new PFS would consist of a HEPA (high-efficiency particulate air) pre-filter followed by sulfur-impregnated carbon (SIC) filters followed by another HEPA filter. The HEPA filters would be designed to remove particles that might clog the SIC filters. The SIC filters would capture elemental mercury that is not captured by other types of filters. The proposed new PFSs would remove at least 90%³ of the mercury from the stack

³ The proposed new PFSs, with sulfur-impregnated carbon, might achieve mercury removal rates of significantly higher than 90%; however, for the purposes of analysis in this EA, a value of 90% is assumed.

gas stream. The TOCDF plans to process the elevated-mercury TCs and the HD 4.2-inch mortar rounds following installation of the new PFSs.

Baseline processing at the TOCDF is expected to destroy an estimated 70 to 80% of the TCs in storage at the DCD. The HD-filled TCs that remain at the end of baseline processing—including the single TC filled with agent H (see Table 1)—would be those with mustard liquid mercury concentrations at or above 1 ppm and/or with excessive solids content. The addition of the new PFSs to the two LICs will allow for the safe and efficient processing of all the mustard agent drained from TCs with elevated mercury concentrations. However, the MPF is believed to be incapable of processing some of the TCs with excessive solids content at baseline processing rates because rapid vaporization of the solids could drive the MPF beyond its designed operating conditions. To avoid overwhelming the MPF, the TCs with excessive solids content would be processed using the new washout capability, as described in the following paragraphs.

The TC washout capability would include three separate systems; (1) the RDS, (2) the RPT, and (3) the HDS; plus, ancillary piping and transfer equipment connecting these three systems and the associated waste disposal systems.

- The RDS would provide a washout capability for those TCs with a large solids content. After the mustard agent has been drained from each TC, the RDS would use hot water jets to scour the remaining contents from each TC. The RDS would consist of two remotely-controlled systems consisting of one or more high-pressure hot-water injection nozzles and an eduction tube for extracting the rinsate. The RDS would also be equipped with boroscopes for inspecting the inside of the TCs after the washout operation. Because the resulting rinsate might contain residual mustard agent, it would be sent to the RPT for further processing.
- The RPT system would use a hydrolysis⁴ process to destroy any residual mustard agent in the rinsate from the RDS. The RPT system would consist of a bulk rinsate storage tank, a reactor vessel, and associated plumbing. Rinsate would be pumped into the bulk storage tank after each RDS rinse cycle. Once a sufficient quantity of rinsate has been collected in the storage tank, the contents of the tank would be transferred into the reactor vessel where the hydrolysis reactions would occur. The resulting liquid by-product (called “hydrolysate”) would then be cooled, and sodium hydroxide (NaOH) would be added to adjust the pH to make the hydrolysate less acidic. After cooling and pH adjustment, the hydrolysate would be filtered to remove solids and would be sampled to determine the appropriate method for its eventual disposal. The solids removed in the filtration process would be expected to contain mercury, so they would be packaged for

⁴ The proposed processes would be based upon an improved version of the chemical neutralization process used by CMA to destroy the entire inventory of HD agent stored in TCs at the Aberdeen Proving Ground in Maryland (U.S. Army 1998; PMCD 2001, 2002a). Over 3 million lb of mustard agent were successfully destroyed between April 2003 and March 2005 at the Aberdeen facility (DOD 1996; CMA 2005). The principal by-products of the hydrolysis reaction (involving mustard agent and hot water or steam) are hydrochloric acid and an organic compound called thiodiglycol, which is a common ingredient in writing pen ink.

shipment to an off-site treatment, storage and disposal facility (TSDF). The filtered hydrolysate would be transferred to the HDS.

- The HDS would transfer the filtered hydrolysate from the RPT system to one of the two LICs for destruction. The HDS would consist of the necessary pumps and piping for transferring the filtered hydrolysate to the LIC, where it would be injected into the LIC secondary chamber to evaporate the water and incinerate any residual hydrocarbon compounds.

2.1.2 Proposed Site, Layout, and Installation

The new equipment that is part of this proposed action would be installed primarily within existing buildings at TOCDF, but the PFSs would be constructed east of the existing PAS building (see Figure 2).

The RDS would be built within the toxic area of the existing munitions processing bay of the munitions demilitarization building (MDB). Transfer piping would be located within the munitions processing bay, upper munitions corridor and the RPT room. The RPT would be located in the northwest corner of the MDB. The HDS would be located in the existing process utilities building (PUB). New piping and pumps would be installed to transfer rinsate and hydrolysate between the RDS, RPT and the LICs.

2.1.3 Waste Management

In addition to the wastes generated routinely by baseline operations at the TOCDF, the principal types of solid and liquid wastes to be generated under the proposed action include: (1) expended SIC and HEPA filters used in the new PFSs, (2) liquid hydrolysate from the TC washout (i.e., RDS and RPT) operation, (3) filtered solid materials removed from the liquid hydrolysate, and (4) construction wastes from the installation of the proposed new equipment. Each of these waste streams will be characterized and will be managed in accord with its hazardous characteristics. This practice is similar to what has been conducted for other TOCDF waste streams during previous baseline operations.

The principal method for controlling mercury emissions resulting from the incineration of contaminated mustard agent would be through the installation of SIC filters used in the new PFSs. Each PFS's SIC filter would be approximately 770 ft³ with a mass of about 23,000 lb. No SIC filter changes would be expected during the mustard campaign; however, at the end of TOCDF operations, approximately 69,000 lb of carbon filters would require disposal. Because these filters would be considered to have been "derived from the destruction" of mustard agent, they could not be released for disposal without confirming that they meet the criteria for off-site disposal. Because these filters would be contaminated with mercury, they may not be suitable for incineration. The SIC filters used for the LIC might be burned in the MPF provided the added mercury would not exceed regulatory requirements. After the SIC filters have been characterized and determined to meet the criteria for off-site disposal, these filters could be packaged for shipment to an off-site disposal facility.



Figure 2. Location of proposed new equipment at the Tooele Chemical Agent Disposal Facility. (The proposed new equipment is shown with dashed lines: PFS = PAS Filtration System, RDS = Rinse and Drain Station, RPT = Rinsate Pre-Treatment, and HDS = Hydrolysate Disposal System.)

The PFS units would include HEPA filters upstream and downstream of the SIC filters, as well as a pre-filter for removing large particles that might foul the HEPA filters. These filters would require disposal at scheduled intervals during the mustard campaign. In addition, each HEPA filter would be replaced annually during operations. Each HEPA filter bank would be about 48 ft³ and would weigh about 500 lb. The pre-filter banks (replaced semi-annually) would measure approximately 24 ft³ and would weigh about 48 lb. Together, the HEPA and pre-filters would amount to about 1,100 lb of waste annually.

The principal wastes of the TC washout process would be the liquid hydrolysate and the solids filtered from that hydrolysate. Approximately 500,000 gal of hydrolysate, with an organic content of about 6%, would be generated over the lifetime of the proposed action. This hydrolysate is also expected to contain mercury. The filtered liquid hydrolysate would be injected into one of the two LICs for destruction by incineration. Any mercury in the hydrolysate would thus be captured by the new PFSs. Spent decontamination solutions (i.e., liquids) are routinely injected into the LIC during baseline operations at the TOCDF, and 156,000 gal were injected in 2005. The hydrolysate to be injected into the LICs would represent a substantial increase (approximately double) over the quantities of spent decontamination solutions currently injected.

Mercury-contaminated filtration solids would be generated in the RPT. These filtration solids are expected to consist of water-insoluble salts contaminated with mercury and other metals, and organic compounds that stayed with the salts. The filtration solids would consist of water-saturated sludge material. The quantities generated will depend on how much solid heel is processed. Assuming maximum use of the proposed RDS and RPT system, 154 tons/yr of filtration solids would need to be characterized and packaged appropriately for shipment to an off-site TSDF which is permitted to manage such wastes.

Construction wastes would be generated during the installation of the proposed new equipment. Approximately 180,000 lb of wastes would be associated with the new PFS; 36,000 lb with the RPT system; and 72,000 lb with the HDS. These construction wastes would be initially placed into “roll-off” containers and then transferred to an off-site waste management vendor.

2.1.4 Resource Requirements

The use of manpower, natural gas, and electric energy during the proposed action would not be significantly different than what would be required during baseline processing. Hence, these resources are not discussed further in this EA. However, as described in the following paragraphs, increased uses of certain other resources would accompany the proposed action.

Water use at the TOCDF would increase as a result of the proposed operational modifications, as follows. Water would be used to wash out the TCs in the RDS. A triple rinse of each TC—using 80 gal per rinse—is being contemplated. Following each TC triple-rinse cycle, a 20-gal backflush of the rinsate transfer line would be performed. Assuming that up to 16 TCs could be processed each day, an estimated 4,160 gal of water would be used daily in the RDS. Additional hot water would be used in the hydrolysate reactor to destroy the mustard agent. An estimated

215 gal of water would be used daily in the hydrolysate reactor for TC processing. Therefore, the combined daily water usage for the RDS and RPT would be about 4,375 gal/day.

Sodium hydroxide (NaOH) would be added to the hydrolysate to raise its pH. The pH of the hydrolysate is lowered by the reaction of the chlorine in the mustard molecule with water to produce hydrochloric acid. The quantity of NaOH associated with the new hydrolysis reactions (i.e., about 20,000 gal) would approximately equal the existing quantities of NaOH that would be used in baseline incineration to adjust the pH of the solution produced in the quench vessel that is part of the existing LIC PAS. Hence, no new consumption of resources would be associated with the use of NaOH in the proposed hydrolysis steps.

2.1.5 Approvals, Permits, and Conditions

The TOCDF currently operates under the conditions imposed by a RCRA permit issued by the State of Utah. RCRA permit modifications will be required to address the installation and operation of the new technologies (i.e., the PFSs, RDS, RPT, and HDS) that are part of the proposed action. The Army would not be allowed to proceed with the proposed action without receiving approval in the form of a revised RCRA permit from the UDEQ.

The DCD has an existing, depot-wide Clean Air Act Title V operating permit (UDEQ 2005). The proposed action would be conducted in compliance with the conditions imposed by this existing Title V permit. Also, the EPA has promulgated the National Emission Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR 63.1203). This rule stipulates emissions standards based on the performance of the Maximum Achievable Control Technology (MACT). This rule and the emission standards contained therein are commonly referred to as the MACT rule and MACT standards, respectively. Under the MACT rule, mercury emissions from existing incinerators are currently limited to 130 µg/dscm [see 40 CFR 63.1203(a)(2), as cited in 70 FR 59402-59450, October 12, 2005] which would be applicable to mercury emissions from the TOCDF. Compliance monitoring of the TOCDF's exhaust gas will include sampling to determine the concentration of mercury being emitted, to ensure compliance with the MACT standard.

2.2 THE NO-ACTION ALTERNATIVE: CONTINUED STORAGE OF THE TON CONTAINERS THAT CANNOT BE PROCESSED BY BASELINE TECHNOLOGY AT THE TOCDF

Under the no-action alternative, the new technologies (i.e., the PFSs and the TC washout capability) would not be installed or operated at the TOCDF. Approximately 70 to 80% of the TCs could be destroyed in the TOCDF using the existing baseline technology. However, based upon the current characterization of the DCD stockpile, the remaining TCs may not be able to be processed under the no-action alternative in a manner that ensures compliance with the MACT emission standard for mercury. Therefore, the TOCDF would not be able to destroy this remaining portion of

the stockpile. Current estimates are that about 20 to 30% of the TCs (i.e., up to 1900 TCs containing about 3.4 million lb of mustard agent) could not be processed and thus would remain in storage.

As long as the TCs remain in storage, they would continue to be monitored for leaks and other signs of deterioration. If leaks were detected, the leaking TC would be repackaged to contain the leak. These continued surveillance, monitoring, and maintenance activities would consume financial and manpower resources for as long as the mustard-filled TCs remained in storage at DCD. Also, if the TCs remain in long-term storage, the Army would not be able to meet the U.S. obligations under the CWC and under Public Law 99-145.

2.3 ALTERNATIVES TO THE PROPOSED ACTION

This section describes alternatives to the proposed addition of new technologies (i.e., the PFSs and the TC washout capability) to the TOCDF's baseline incineration technology. Because over 90% of the inventory of mustard agent at DCD is stored in TCs, the development of alternatives to the proposed action focused primarily on the problems faced with the destruction of the mercury-contaminated agents and the solids layer inside the TCs. Three basic alternatives were identified (see EG&G 2006): (1) control the feed rates into the LICs and MPF so as to maintain compliance with regulatory emission rates and to remain within the operational control limits of the MPF, (2) add only SIC filtration to the existing PAS to remove/contain excessive mercury emissions from the TOCDF, and (3) conduct drain and washout activities for TCs which contain an elevated mercury content or a large solid content, followed by metals removal from the ensuing by-products. The strengths and weaknesses of each alternative are discussed in the following paragraphs. It should be noted that the proposed action combines the most advantageous features of these alternatives.

Reduce the Feed Rates to the LICs and the MPF. Under this alternative, the baseline TOCDF approach would be used, but in order to process the mercury-contaminated items, the feed rate of mustard agent into the LIC and the feed rate of drained TCs into the MPF would both be reduced as necessary to remain in compliance with the regulatory limit for mercury emissions. The schedule of the mustard campaign would be correspondingly lengthened to accommodate the reduction in throughput. This alternative was found to unnecessarily delay the Army's continued progress in destroying the chemical weapons stockpile and in reducing the risk presented by the aging mustard munitions and TCs in storage at the DCD. Also, while this alternative addresses the mercury problem, it does not address the high solids content known to exist in some TCs, because the MPF may not be able to process such items. That is, TCs with a large solids content could exceed the combustion capability of the MPF by consuming all of the available oxygen and creating excessive temperatures and/or gasification conditions within the combustion zone. Thus, it may not be possible to process those TCs with high solids content in the MPF. The TC washout capability (i.e., the RDS, RPT, and HDS), which is included in the proposed action, avoids the potential problem with the MPF and would provide maximum flexibility for the TOCDF to meet schedule requirements.

Install and Operate Only a PAS Carbon Filtration System (for Mercury Abatement).

Under this alternative, new PFSs would be added to the exhaust streams from the MPF and the two LICs. No further changes to the TOCDF would be made. The initial technical assessment indicated that properly designed PFSs could indeed handle the highest anticipated levels of mercury contamination in the TCs. However, for the reasons given above, it may not be possible to process TCs with high solids content in the MPF. The TC washout capability (i.e., the RDS, RPT, and HDS), which is included in the proposed action, avoids the potential problems with the MPF.

Hydrolysis with Metals Removal. Each of the 20 to 30% of the TCs with elevated mercury concentrations and/or high solids content would be drained of agent, and the agent would be destroyed in the LICs (without the addition of a PFS for mercury abatement) using reduced feed rates as necessary to control mercury emissions. Each of the drained TCs would then be put into a washout (i.e., rinse and drain) process based on the Aberdeen Chemical Agent Destruction Facility, which used hydrolysis to destroy mustard agent. Any residual mustard agent inside the drained TCs would be destroyed by this process. The hydrolysis process would be followed by an aqueous-based mercury removal step, as well as filtration to remove solid residues. The hydrolysis reaction by-product (i.e., hydrolysate)—after removal of mercury—would either be burned in the LIC as spent decontamination fluid or sent off-site for commercial disposal.

The principal advantages of this alternative are: (a) it would not require the addition of PFSs to control mercury emissions, and (b) the MPF would be able to treat all of the drained and rinsed TCs. However, this alternative was found to involve a significant reduction in the overall TC throughput rate, equating to an unacceptable extension of the mustard destruction campaign. Furthermore, a hydrolysis approach for all of the subject TCs was determined to require a lengthy procurement and installation period before the equipment would be ready to operate, thereby jeopardizing the ability of the TOCDF to meet the stockpile destruction deadlines established by the CWC and Public Law 99-145.

Employ Other Technologies to Remove Mercury from Stack Gases. The U.S. Army has examined four technologies for controlling mercury emissions from incinerators (see U.S. Army 2001): activated carbon injection, wet scrubbing of mercury, sodium sulfide injection, and adsorption onto SIC filters. Because of technical immaturity, process complexity and/or inability to meet MACT limits with elevated-mercury munitions, the report recommended against all these technologies except SIC filtration. A subsequent report (PMCD 2002b) reached substantially the same conclusion: “Fixed bed chemisorption using impregnated carbon adsorbents is the most mature and extensively demonstrated mercury control technology in industry. All technologies based on wet scrubber absorption and adsorbent injection would require major equipment upgrades to the PAS, many of which would have uncertain mercury performance.” Based on the above studies, the Army concluded that further consideration of other technologies for removal of mercury from stack gases was not warranted.

3. THE AFFECTED ENVIRONMENT AND POTENTIAL ENVIRONMENTAL CONSEQUENCES

This EA addresses proposed modifications to the existing TOCDF, a facility which has been examined in three previous environmental reviews (see Section 1.4). In comparison to the impacts previously assessed, the proposed action would create negligible or no new environmental impacts upon the following categories of environmental resources. These categories of environmental resources are not discussed further in this EA.

- **Land use.** The proposed new equipment would be installed within the footprint of the existing facilities and would therefore not affect current uses of land.
- **Air quality impacts from construction activities.** There would be no disturbance of surface soils and negligible generation of dust from construction and/or equipment-installation activities. The emissions from construction vehicles would be incidental, short-term, and small.
- **Air quality impacts during operations.** The proposed action would not result in a significant increase in the emissions of criteria pollutants (i.e., nitrogen oxides, carbon monoxide, sulfur dioxide, volatile organic compounds, particulate matter, and lead) from the TOCDF. Furthermore, even with the addition of the new equipment that is part of this proposed action, the TOCDF would still be operated in compliance with applicable air emission standards under the terms and conditions of its existing Title V Clean Air permit.
- **Surface water resources.** The nearest surface waters (i.e., the ephemeral Ophir Creek) are located more than two miles from the TOCDF (U.S. Army 1989). No surface water would be consumed, diverted or affected by the proposed action.
- **Wetlands.** The nearest wetlands (i.e., Clover Pond) are located more than two miles from the TOCDF (Tetra Tech 2005) and would not be disturbed or affected by the proposed activities.
- **Threatened and endangered species.** Bald eagles, which over-winter in the Tooele and Rush Valleys, are the only threatened or endangered species known to potentially occur within the DCD installation boundaries. Impacts from TOCDF emissions upon wildlife have been explicitly evaluated in the SLERA (Tetra Tech 2005) and were found not to be of concern; hence, potential impacts to threatened and endangered species are not discussed further in this EA.
- **Socioeconomic resources.** The existing labor force is adequate for the installation and operation of the proposed new equipment. There would be no influx of new workers, nor would the proposed action have any effects upon existing infrastructures, utilities or other socioeconomic resources in the vicinity of the DCD.
- **Cultural (i.e., archaeological and historic) resources.** Because all of the proposed activities would occur within the footprint of the existing facility, no potential exists for the proposed action to disturb or affect cultural resources.
- **Environmental justice populations.** The nearest private residence is located more than two miles from the TOCDF (U.S. Army 1989). The proposed action would not create any significant impacts to populations near the depot (see Section 4). In the absence of such impacts,

there would be no disproportionately high and adverse impacts to low-income or minority populations.

- **Safety and risks.** The hazards of installing the new equipment would be similar to those of any small-scale industrial construction project and would not be significant or unique. The hazards of the mustard agent have been well documented in the previous NEPA reviews for the TOCDF (see Section 1.4), and the Army has developed and implemented engineering barriers (such as filtered ventilation systems and protective clothing), procedures, and administrative controls to deal appropriately with these hazards.

The analysis conducted for this EA has determined that a more detailed examination of the potential environmental impacts is necessary in three additional categories: **water usage** (see Section 3.1), **waste management** (see Section 3.2), and impacts to **human health and to ecological resources** due to potential mercury emissions (see Section 3.3).

3.1 WATER RESOURCES

The DCD obtains its water from two wells, with capacities of 593 gpm and 695 gpm (Earthfax Engineering 2003a, 2003b). The combined capacity of the two wells could provide about 1.85 million gal/day or 675 million gal/yr, if pumping were continuous at the rated capacity. The total amount of water actually withdrawn from these two wells in 2004 was 77.0 million gallons, and in 2005 was 78.9 million gallons [W. Lessig, Science Applications International Corporation (SAIC), Stockton, Utah, personal communication to G. Zimmerman, Oak Ridge National Laboratory, Oak Ridge, Tenn., May 24, 2006]. On an “average daily” basis, the recent historical water usage at the entire DCD has therefore been about 211,000 gal/day in 2004 and about 216,000 gal/day in 2005.

The total, average daily water usage at the TOCDF is about 100,000 gal/day; if the TOCDF operated every day of the year, the total annual water usage would be 36.5 million gallons. As discussed in Section 2.1.4, the total new water requirement for the proposed action would be about 4,375 gal/day. The total amount of groundwater used by the proposed action would therefore represent a small incremental increase (about 4%) in the average daily water usage at the TOCDF. Furthermore, the quantity of additional water required for the proposed action would be a small fraction (about 2%, using the 2004 data) of the daily water usage at the DCD. Given the relatively minor water requirements of the proposed action, any incremental impacts to the groundwater resources of the area would be negligible. Cumulative impacts to groundwater resources are addressed in the following paragraphs.

The Utah State Water Plan considers the Tooele/Rush Valley to be one of four sub-basins within the West Desert Basin for the purposes of surface-water and groundwater budgeting. The combined groundwater recharge in Tooele/Rush Valley is 89,250 acre-ft/yr (29 billion gal/year), and the net available volume is 10,000 acre-ft/yr (3.3 billion gal/year) (CMA 2003). According to records maintained since 1963, the annual amount of groundwater withdrawn from wells in the Tooele/Rush Valley has been as high as 33,000 acre-ft/yr (10.7 billion gal/yr) (in 1974), averaging

about 26,000 acre-ft/yr (8.5 billion gal/yr) (CMA 2003). As discussed in the above paragraphs, the total use of groundwater at the DCD, including the TOCDF, under the proposed action would increase from about 300,000 gal/day to about 304,375 gal/day (= 300,000 + 4,375 gal/day), which is equivalent to about 111 million gal/yr.

The available information for the Tooele Valley and the Rush Valley indicates that groundwater resources in both valleys are adequate to meet current and projected needs. The two Drinking Water Source Protection Plans (Earthfax Engineering 2003a, 2003b) prepared for the DCD's two wells show the aquifer to be classified as unprotected, but it is considered to be adequately controlled. The investigations also note that any developments up-gradient of the wells are controlled by the Tooele City Engineering Department to ensure protection of the aquifer.

The available regional and local data indicate that any effects of the operations at the TOCDF upon groundwater resources have not, and would not, extend across the region; therefore, no cumulative impacts to groundwater resources would occur. Furthermore, the mission of the TOCDF will be completed upon the destruction of the mustard agent inventory at DCD; hence, the use of groundwater at the TOCDF will diminish greatly at that time.

3.2 WASTE MANAGEMENT

The proposed action would generate solid and liquid, hazardous and nonhazardous wastes during its operational lifetime. These wastes would consist primarily of (1) expended SIC and HEPA filters used in the proposed PFSs, (2) liquid hydrolysate from the TC washout operations, (3) filtered solid materials removed from the liquid hydrolysate, and (4) construction wastes from the installation of the proposed new equipment. All wastes would be disposed of in compliance with federal, state, and local regulations. Any wastes to be shipped off-site would be packaged in accordance with applicable U.S. Department of Transportation specifications and would be transported to licensed and permitted commercial TSDFs for final treatment and disposal.

The analysis in this section is built around the latest estimates of TOCDF wastes associated with the baseline process: 36.4 tons per year of incinerator ash; 19,000 tons per year of liquid PAS brines; and 1,800 tons per year of decontaminated metal parts. Both the incinerator ash and brine are classified as hazardous wastes. The incinerator ash will be disposed of either by direct landfill or by stabilization followed by landfill—based on the characterization of the ash—in a Utah-permitted TSDF. The PAS brines will be transported to a TSDF for disposal at a permitted U.S. facility by deep-well injection, wastewater treatment, stabilization/solidification for landfill, or incineration. While decontaminated metal wastes are free of mustard agent, State of Utah regulations require that they be disposed of as hazardous waste unless specific testing is performed which may allow the material to be recycled. Decontaminated metal wastes from the TOCDF are either disposed of in a commercial hazardous waste landfill or are recycled.

Under the proposed action, the additional wastes generated during operation of the TOCDF would be almost entirely associated with the TC washout process. However, at the end of the mustard campaign, the SIC filters would need to be disposed of. At that time, a maximum of three SIC filters

with a total mass of 69,000 lb (i.e., 35 tons) and a volume of 2,400 ft³ would require disposal. This small quantity of additional waste would not be a significant increase in the amounts of waste routinely generated by the TOCDF and shipped off-site for disposal.

The new TC washout equipment (i.e., the RDS, the PRT, and the HDS) would generate an additional 154 tons/yr of mercury-contaminated filtration solids which would need to be disposed of. The removal of these solids by filtration would also result in less material being fed into the MPF with the TCs, thereby reducing the amount of incinerator ash generated. However, because no reliable estimate of the amount of reduction is available, the analysis in this EA has not taken credit for any such reduction in ash generation. The 154 tons/yr would constitute an 8.4% increase over recent solid hazardous waste generation rates and would therefore not represent a significant incremental impact.

In regard to the cumulative impacts of managing the anticipated TOCDF wastes, the following paragraphs describe the capacity of existing waste management TSDFs in the region and the extent to which anticipated increases in hazardous waste generation under the proposed action might affect the capacity of these TSDFs.

Table 2 shows the best available EPA data (EPA 2005) for the types of hazardous waste management facilities in Utah and the five surrounding states (i.e., Arizona, Colorado, Idaho, Nevada, and Wyoming) plus Texas, where brines produced by the TOCDF's PASs have previously been sent for disposal by deep-well injection. This analysis compares the anticipated annual TOCDF waste quantities with the quantities of similar wastes managed within this six-state region. For the purpose of comparison, Table 2 also shows the quantities of hazardous waste that are managed by deep-well injection in Texas.

The incremental impacts of the wastes generated by the proposed action are as follows. The proposed action would create one liquid waste (i.e., filtered hydrolysate), which would be consumed in the LICs, and several solid wastes. Incinerating the hydrolysate in the LICs would produce atmospheric emissions, solid incinerator ash, and liquid scrubber brines from the existing PAS. The remainder of the wastes from the proposed action are solid wastes, all of which would be disposed of in landfills. Table 3 shows the quantities of solid hazardous wastes generated by the TOCDF under baseline operations that are disposed of by landfill, as well as the incremental quantities of wastes that would be generated by the proposed action. Combining the wastes generated by baseline processing and the incremental quantities of waste generated by the proposed action yields about 1,991 tons per year of solid wastes to be disposed of in landfills. Table 3 shows that this quantity is only about 0.7% of the total amount of hazardous waste disposed of by regional landfills or surface impoundments⁵. Consumption of such a small fraction of regional hazardous waste landfill disposal capacity would not contribute to significant cumulative impacts on the management of hazardous wastes in the region.

⁵ The EPA's waste management source data (EPA 2005) provide only a single numerical entry for the combined categories of "landfill" and "surface impoundment." Therefore, no further breakdown is available for use in this analysis, even though some types of wastes from the TOCDF which would be appropriate for landfill disposal would not be appropriate for disposal by surface impoundment.

Table 2. RCRA hazardous waste managed in Utah and six nearby states and Texas during 2003 [numerical units are in tons]

Management method	Arizona	Colorado	Idaho	Nevada	New Mexico	Utah	Wyoming	Total^a	Texas
Aqueous inorganic treatment	99	55	0	1,725	-	5	-	1,884	422
Aqueous organic treatment	-	35	-	-	-	-	30,652	30,687	261,204
Deepwell or underground injection	-	-	-	-	697,730	-	-	697,730	5,634,130
Energy recovery	0	-	-	-	-	0	-	0	202,047
Fuel blending	2,715	23,803	-	-	-	17	-	26,535	34,397
Incineration	39	-	-	14	1	106,644	-	106,698	196,111
Land Treatment/Application/Farming	-	12,000	-	-	-	7	-	12,007	2,289
Landfill/surface impoundment ^b	-	697	128,034	34,357	1,276	107,063	-	271,427	62,536
Metals recovery	198	33	-	-	-	10	-	241	49,527
Other disposal	-	-	-	-	23,954	-	-	23,954	52
Other recovery	-	180	-	-	3	-	773	956	489,838
Other treatment	29,438	48	-	6,377	57	1,270	-	37,190	3,691,273
Sludge treatment	-	2,775	-	368	-	157	-	3,300	196
Solvents recovery	962	4,763	0	0	3	20	-	5,748	3,175
Stabilization	-	44	17	328	116	10,948	-	11,453	13,633
Total^a	33,450	40,434	128,052	43,170	723,140	226,141	31,425	1,229,812	10,640,830

^a Waste quantities may not sum to the number shown due to rounding.

^b EPA no longer distinguishes between landfill and surface impoundment in the biennial reports.

Source: *State Detail Analysis: The National Biennial RCRA Hazardous Waste Report (Based on 2003 Data)*, EPA530-R-03-008, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C., June 2005, available on-line at <http://www.epa.gov/epaoswer/hazwaste/data/br03/index.htm> (accessed September 15, 2005) (Note: The waste quantities used here are from Item 11 of each state report).

Table 3. Landfill/surface impoundment disposal of hazardous waste from TOCDF operations

Type of waste and disposal method ^b	Waste quantity (tons per year)			Wastes managed in Utah and six contiguous states ^a	
	Total amounts under mustard baseline operations	Incremental amounts under the proposed action	New total amounts (baseline plus the proposed action)	Waste quantities managed in 2003 (tons per year)	New total amounts as percentage of 2003 quantities
POTENTIAL IMPACTS OF THE PROPOSED ACTION:					
Incinerator ash	36	N/A ^c	36	271,427	0.01 %
Decontaminated metal parts	1,800	0	1,800	271,427	0.7 %
SIC and particulate filters	0	1 ^d	1 ^d	271,427	0.0002 %
RPT filtrate	0	154	154	271,427	0.06 %
<i>Subtotal</i>	<i>1,836</i>	<i>155</i>	<i>1,991</i>	<i>271,427</i>	<i>0.7 %</i>
POTENTIAL IMPACTS OF THE PROPOSED ACTION IN CONJUNCTION WITH POSSIBLE PLANS FOR PAS SCRUBBER BRINES:					
Stabilized PAS scrubber brines ^e	57,000	0	57,000	271,427	21 %
<i>Total (assuming landfill of stabilized scrubber brines)</i>	<i>58,836</i>	<i>155</i>	<i>58,991</i>	<i>271,427</i>	<i>22 %</i>

^a Utah, Idaho, Nevada, Wyoming, Colorado, New Mexico, and Arizona.

^b The EPA's waste management source data (see reference below) provide only a single numerical entry for the combined categories of "landfill" and "surface impoundment." Therefore, no further breakdown is available for use in this analysis, even though some types of wastes from the TOCDF which would be appropriate for landfill would not be appropriate for disposal by surface impoundment.

^c Not available. The anticipated quantities of ash to be generated by the proposed action would be less than the quantities that would be generated if the new washout equipment were not installed and operated; hence, the incremental amount in the table would be a negative number, if it could be quantified.

^d At the end of the mustard campaign, approximately 35 tons of charcoal filters would be disposed of.

^e Stabilization of the 19,000 tons of PAS scrubber brines is assumed to increase the mass by a factor of three.

Source: State-specific data taken from *State Detail Analysis; The National Biennial RCRA Hazardous Waste Report (Based on 2003 Data)*,

EPA-530-R-03-008, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C., June 2005; available on-line at <http://www.epa.gov/epaoswer/hazwaste/data/br03/index.htm> (accessed September 15, 2005).

Because the quantity of PAS scrubber brines to be generated during the proposed action is not substantially different from that associated with baseline processing, no significant incremental impacts would be associated with the management of these wastes. Nevertheless, the cumulative impacts of the wastes to be generated by the proposed action can only be determined by considering the disposal of other wastes generated by the TOCDF baseline process. For reasons that are unrelated to this proposed action, the TOCDF staff is reconsidering the current disposal method for PAS scrubber brines. The disposal options being considered are continued deep-well injection, as well as wastewater treatment, stabilization followed by landfill disposal, and incineration. If the TOCDF were to choose the “stabilization followed by landfill” option, the combination of the incremental wastes from the proposed action and the stabilized scrubber brines has the potential to contribute to cumulative impacts on the management of hazardous wastes by landfill disposal in the region. Stabilization could increase the mass of the brine by a factor of approximately three⁶. If “stabilization followed by landfill” were to be selected for the PAS scrubber brines, Table 3 shows that these wastes from the TOCDF could increase hazardous waste landfill disposal in the region by about 22%. Existing commercial hazardous waste management facilities might be able to expand their operations to accommodate these larger quantities of waste from the TOCDF. As the TOCDF staff considers whether to move forward with the option of stabilization of PAS scrubber brines, discussions with the potential waste disposal facilities will be conducted to ensure the availability of suitable waste management and disposal capacity for these types of wastes.

3.3 HUMAN HEALTH AND ECOLOGICAL RESOURCES

Section 3.3.1 summarizes the findings from a human health risk assessment (HHRA) prepared in compliance with the licensing conditions of the Resource Conservation and Recovery Act (RCRA) for the TOCDF. The HHRA also included a screening-level ecological risk assessment (SLERA) whose results are summarized in Section 3.3.2. The implications of the proposed action on the findings of the HHRA and the SLERA are discussed in Section 3.3.3.

3.3.1 The Human Health Risk Assessment for the TOCDF

The HHRA for the TOCDF was prepared by the State of Utah as an update to the original 1996 HHRA (see A.T. Kearney 1996) using actual stack emissions data collected at the facility.

⁶ The factor of three is based on the assumption that the most likely method of stabilizing the brine, which is primarily water, would be to combine it with portland cement or some similar grouting material. Concrete is formed when portland cement is hydrated by addition of water. While structural concrete includes sand, gravel and portland cement, as well as water, it is assumed here that the liquid scrubber brine would be combined with portland cement alone to minimize the mass and volume of the stabilized waste. Portland cement and water are combined in a 2:1 ratio to achieve complete hydration for making concrete (see *The Chemistry of Cement*, <http://www.uvi.edu/Physics/SCI3xxWeb/Structure/ChemOfCement.html>, accessed February 27, 2006). This same ratio of 2:1 is used here for stabilization; hence, the mass of the stabilized brine would be approximately three times that of the original liquid brine.

The process began with the development of a *Health Risk Assessment Protocol* (Tetra Tech 2001), which included a public review and comment period and which was intended to establish all of the methods and parameters to be used in the updated HHRA. The final HHRA was completed in the fall of 2003 (UDEQ 2003).

The objectives of the 2003 HHRA were to calculate the cumulative risks (cancer effects) and hazards (non-cancer effects) for each exposure scenario specific to each source at the DCD—including both the TOCDF and the nearby Chemical Agent Munitions Disposal System (CAMDS)—and specific to each chemical warfare agent destruction campaign. The 2003 HHRA evaluated six emission sources at the TOCDF and four sources at CAMDS. The sources evaluated for the TOCDF included those from the two LICs, the deactivation furnace, the MPF, the heating ventilation and air-conditioning system, and the brine reduction area. For the TOCDF's sources, actual trial burn emission rate data (e.g., GB trial burn data) were used when available; otherwise, values were extrapolated from data available from the Army's Johnston Atoll facility (i.e., JACADS) and CAMDS.

Potential adverse health effects were evaluated separately and cumulatively for each source and for each agent to provide a basis for evaluating the protectiveness of the operating conditions in the RCRA hazardous waste permits. The health risks were first evaluated with very conservative assumptions to enable the analysts to eliminate many ultra-low risk scenario/chemical combinations. The scenarios remaining were then examined more closely to reduce the uncertainty in the estimates.

A total of 393 Chemicals of Potential Concern (COPCs) were identified for evaluation in the HHRA. The 2003 HHRA used a multi-pathway (e.g., inhalation, food consumption, water consumption) assessment to evaluate the COPCs with exposure scenarios for (1) a subsistence rancher adult and child, (2) a resident adult and child, (3) an on-site worker, (4) a water skier adult and child for the SunTen lake, (5) a recreationist adult and child at Rush Lake, and (6) a fisher adult and child for Rainbow Reservoir.

The findings of the 2003 HHRA stated that, with the exception of five chemicals (as identified below), the potential exposures to emissions from the TOCDF and CAMDS are considered safe and need no additional investigation or evaluation. The five chemicals of concern included (1) ethyl methanesulfonate, (2) di-n-octylphthalate (DNOP), (3 & 4) two polyaromatic hydrocarbons, namely dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene, and (5) mercury. Of these five chemicals, only DNOP and mercury have been detected in stack emissions at the TOCDF, CAMDS, or JACADS. The DNOP was detected in a single test at CAMDS. The majority of risk from DNOP in the HHRA was attributable to the consumption of contaminated homegrown foods; however, the Centers for Disease Control and Prevention reports that DNOP is not expected to be a concern in terrestrial food pathways because it is metabolized (ATSDR 1997).

Based on the lack of detection of the other problematic COPCs in stack emissions, and on the overestimation of exposure inherent in the EPA's risk assessment methodologies, only mercury was identified as warranting additional evaluation in the HHRA. The majority of risk from mercury in the 2003 HHRA is attributable to the consumption of fish contaminated with methyl mercury. Upon further evaluation, the HHRA concluded that mercury emissions from the TOCDF are considered safe because (1) the risk assessment methodology overestimates the risks from mercury

emissions, (2) hypothetically exposed individuals were assumed to eat fish taken from Rush Lake and Rainbow Reservoir for 30 years; however, Rush Lake does not support a fishery and Rainbow Reservoir is not always open, and (3) mercury levels in soil and fish have been periodically monitored during the environmental update studies over the course of the TOCDF operations, and will continue to be monitored to confirm that mercury is not being released from stack emissions at unsafe levels.

3.3.2 The Screening-Level Ecological Risk Assessment for the TOCDF

In 2005, a SLERA (Tetra Tech 2005) was completed as a follow-on to the HHRA (see Section 3.3.1). The 2005 SLERA is an update of the previous ecological risk assessment (A.T. Kearney, Inc. 1996) prepared as part of the 1996 HHRA when the TOCDF was preparing to begin the destruction of chemical weapons.

The objective of the 2005 SLERA was to determine, for each emissions source at TOCDF and CAMDS, cumulative (across agent campaigns) hazards for COPCs based on ecological screening quotients (ESQ) for ecological receptors (communities and guilds) in the assessment region. The same six emission sources for the TOCDF and CAMDS as were used in the HHRA were used in the SLERA. The list of COPCs was based on the set of COPCs used in the HHRA.

Three types of ecosystems were included in the 2005 SLERA: (1) the dominant sage grass and salt shrub habitat (i.e., shrub-scrub habitat) found on the valley floor near the DCD, (2) the sage brush and grassy mountainous benchland (i.e., montane) areas east and west of the DCD at elevations over 5,400 feet above mean sea level, and (3) four freshwater areas: Rush Lake, Clover Pond, Atherly Reservoir, and Rainbow Reservoir.

The 2005 SLERA evaluated receptor interactions (e.g., predator-prey) to build food webs that are used to estimate indirect exposure to a COPC by a receptor. Plants and animals were categorized according to their habitats and feeding niches, following the example food webs presented in EPA (1999b). Each food web contained four trophic levels, each with its own appropriate feeding guilds and assessment endpoint/receptors (for example, ranging from algae to fish to birds to mammals).

In the 2005 SLERA, risk is characterized by calculating numerical ESQs and then describing the main exposure pathways for any receptors with an ESQ value above the target value (i.e., above a numerical ESQ value of 1.0). ESQ values exceeding the target level were noted for receptors in the shrub-scrub habitat, in Clover Pond, and in Rush Lake; these risks are presented and discussed below. ESQ values for receptors in the montane habitat, Atherly Reservoir, and Rainbow Reservoir were all less than 1.0, and are not discussed further in this summary.

For the shrub-scrub habitat, source-specific methyl mercury ESQs exceeding the target level were calculated for omnivorous birds assuming that terrestrial invertebrates compose 100% of their diet. The ESQ values decreased to less than 1.0 when it was assumed that the omnivorous bird diet was 50% invertebrates and 50% plant matter. The ESQ values decreased to 0.01 when it was assumed that the diet was entirely plant matter. The differences in the magnitudes of the ESQs are a function of

the propensity for mercury to accumulate, in terrestrial ecosystems, in animal matter rather than in plant matter.

For the endpoint receptors in Clover Pond, the 2005 SLERA found that the methyl mercury ESQs for omnivorous aquatic birds (modeled as the mallard), carnivorous birds (modeled as the red-tailed hawk and the golden eagle), and fish-eating birds (modeled as the blue heron and the osprey) exceeded an ESQ of 1.0. Exposure through algae ingestion was responsible for the magnitude of the omnivorous aquatic bird ESQs. The omnivorous aquatic bird “equal-diet” ESQs, which are based on the ingestion of equal parts algae, benthic invertebrates, and rooted aquatic plants, were about one-third of the algae ESQs. The difference between the ESQs indicates that mercury dissolved in surface water, rather than that deposited in sediment, and its subsequent bioconcentration by algae, is the primary biotic transport pathway of concern for aquatic birds. The source-specific ESQ values for carnivorous birds and fish-eating birds are based on the ingestion of carnivorous fish. The concentration of methyl mercury in carnivorous fish depends on the concentration in surface water and its bioaccumulation by fish. These results also point to the relative importance of surface water-based exposure pathways for birds.

Evaluation of the air dispersion modeling information indicates that soil COPC concentrations decrease as a function of distance from any particular source at the TOCDF and CAMDS. To characterize methyl mercury risks as a function of distance from TOCDF and CAMDS, the 2005 SLERA created ESQ isopleths utilizing air concentrations and depositions modeled for each receptor node. These isopleths indicate that methyl mercury in soil is, as expected, greatest near the facilities and the concentration declines with increasing distance from the facilities. The isopleths indicate that mercury in stack gases emitted from the TOCDF deposits relatively close to the source, while mercury in stack gases from CAMDS is dispersed more widely. The differences between the ESQ patterns are believed to stem from different source characteristics—mainly building downwash and, to a lesser extent, stack gas exit velocities. Emission rates and other source characteristics are similar.

Uncertainties associated with the risk estimates include those for the three main parts of the risk assessment: (1) estimates of emission rates, (2) exposure assessment, and (3) toxicity assessment. Emissions of mercury in stack gases from some sources resulted in ESQ values for receptors in the shrub-scrub and aquatic environments that exceed the target level of 1.0; however, the 2005 SLERA states that the weighted-average mercury emission rates used in the analysis overestimate actual mercury emissions, thus indicating the elevated ESQs for methyl mercury overestimate potential ecological risks.

The fate and transport of methyl mercury was evaluated using EPA-recommended procedures (EPA 1999b). The risk assessment evaluates potential exposures to mercuric chloride and methyl mercury but the analyses of stack emissions is limited to total mercury. In accordance with the EPA procedures, the defined percentages of the mercury released from the stack were modeled as elemental mercury and mercuric chloride. Once the mercury leaves the stack, the fate and transport of these two types of mercury are modeled separately with a portion converting via biological processes to a third type: methyl mercury. Methyl mercury is the most toxic form of the three types of mercury, and the resulting exposures have a considerable amount of uncertainty. According to the

2005 SLERA, environmental monitoring data suggests that the modeling methods overestimate the amount of mercury deposited in the environment around the DCD; that is, no mercury has been detected in fish sampled from Rainbow Reservoir, and recent soil sampling results show no accumulation of mercury (Tetra Tech 2005; CMA 2003).

Also, elevated methyl mercury ESQs for omnivorous birds foraging on aquatic plants and benthic invertebrates in Clover Pond, west of the DCD, do not accurately represent the potential risks to these populations because Clover Pond periodically dries down, severely reducing available forage. The inherent assumption of continuous foraging activity, therefore, overestimates the potential risks to omnivorous birds in Clover Pond.

As a result of the multiple uncertainties associated with many components of the 2005 SLERA—including emission rates, exposure and toxicity assumptions, and fate and transport parameters for methyl mercury—the SLERA concludes that it potentially overestimates risks to ecological receptors in the assessment area. Based on the potential significant overestimation of risk results indicated by the uncertainty analysis in the 2005 SLERA, the Utah Division of Solid and Hazardous Waste has concluded that potential ecological impacts from mercury emissions of the TOCDF are negligible (Tetra Tech 2005); therefore, no additional risk characterization was deemed to be necessary for baseline operation of the TOCDF.

3.3.3 Impacts of the Proposed Action upon Human Health and Ecological Resources

The new PFSs are expected to control emissions of mercury from the TOCDF. Nevertheless, for the purpose of analysis in this document, a bounding calculation is used to illustrate the effects of the proposed action on human health and ecological resources. The following calculation and analysis is therefore largely theoretical and not directly applicable to the way the proposed action would actually be implemented. The calculation merely serves to establish an upper bound on the magnitude and extent of the potential environmental impacts, and thereby to demonstrate that such impacts would not be significant.

Table 4 shows the quantity of mercury emitted to the environment as assumed in the HHRA and SLERA (see also Table 4-22 in UDEQ 2003). That is, the emission of approximately 1,000 lb of mercury over the lifetime of the TOCDF (including the mercury emissions from CAMDS) would result in the types of non-significant impacts to human health as described in Section 3.3.1 and to ecological resources as described in Section 3.3.2. This quantity therefore establishes the “threshold” at which any additional mercury introduced in the environment around the TOCDF would warrant further, detailed evaluation. This threshold value of 1,000 lb is used in the following bounding analysis.

The estimates of mercury emissions in the HHRA were developed as the sum of four parts: emissions from the TOCDF during the GB, VX, and mustard campaigns and emissions from CAMDS. According to measurements made by the Army, the estimated amount of mercury actually emitted during the campaign at the TOCDF to destroy agent GB was 128 lb (EG&G 2002). Similarly,

the conservative estimate⁷ made under EPA's toxics release inventory (TRI) program for the amount of mercury emitted to the atmosphere during the VX campaign was 49.74 lb (E. Lowes, EG&G Defense Materials, Stockton, Utah, personal communication to G. Zimmerman, Oak Ridge National Laboratory, Oak Ridge, Tenn., May 11, 2006). The HHRA and SLERA assume that the mercury emissions from CAMDS would be 90.6 lb (see Table 4). Using the 1,000-lb ceiling value for total mercury emissions (as discussed above for the HHRA and SLERA), the amount of mercury emitted during the forthcoming mustard agent campaign could be as large as 731 lb (= 1,000 – 128 – 49.74 – 90.6), according to the assumptions in the HHRA and SLERA, before the threshold value of concern would be exceeded.

Section A.3 of Appendix A presents an upper-bound estimate of the total quantity of mercury contained in the inventory of mustard agent stored at the DCD. For the purposes of analysis in this EA, that upper-bound quantity is estimated to be about 2,410 lb, which is a value well in excess of the threshold value established in the HHRA and SLERA. However, if a 90%⁸ mercury removal efficiency is assumed for the new PFSs, the amount of mercury emitted from the TOCDF stacks during the mustard agent campaign would be calculated as 241 lb. This latter value is well below the value of 731 lb for mercury that could be emitted from the TOCDF during the mustard campaign without concern (see the preceding paragraph). Thus, the emissions from the TOCDF with the addition of the new PFSs would not be expected to exceed the quantities of mercury already accounted for in the 2003 HHRA and in the 2005 SLERA; hence, no significant impacts to either human health or ecological resources as a result of mercury emissions to the atmosphere would be expected during the proposed action.

Implications of Compliance with MACT Limits. With regard to the consequences of operating the incinerators at MACT emissions levels (see Section 2.1.5), a study was conducted by Bittner (2005) to compare the TOCDF emission rates used in the HHRA and SLERA with MACT emission rates for mercury. The study obtained revised hazard quotients (or indices) by adjusting the hazard quotients presented in the HHRA and SLERA. The study revealed that operating the incinerators at the MACT emissions limits would produce smaller hazard quotients for mercury for some of the incinerator/scenario combinations (e.g., for the MPF and the Rush Lake recreationist) and larger hazard quotients for other incinerator/scenario combinations (e.g., for the LICs and the Rush Lake recreationist). Nevertheless, the above analysis indicates that the proposed new PFSs would reduce the amounts of mercury emitted from the TOCDF to levels below those used as the basis for the conclusion in the HHRA and SLERA that no significant impacts would occur.

⁷ A more realistic estimate, based upon actual agent VX sample analysis, indicated that only 1.35 lb of mercury was fed into the LICs with the agent VX. During that same campaign, an additional 1.53 lb of mercury (for a total of 2.88 lb) was also fed into the TOCDF in the form of mercury-contaminated materials from the previously completed GB campaign (E. Lowes, EG&G Defense Materials, Stockton, Utah, personal communication to G. Zimmerman, Oak Ridge National Laboratory, Oak Ridge, Tenn., May 11, 2006).

⁸ The proposed new PFSs, with sulfur-impregnated carbon, might achieve mercury removal rates of significantly higher than 90%; however, for the purposes of analysis in this EA, a value of 90% is assumed.

Table 4. Hypothetical mercury emissions from the Deseret Chemical Depot (in Utah) as calculated from the Human Health Risk Assessment (HHRA) and the Screening-Level Ecological Risk Assessment (SLERA) for the TOCDF.

		Mercury Emissions			
	Agent Destruction Campaign	IRAP-h Emission Rate ^a (g/s)	Data Source in Final HHRA or SLERA	Campaign Duration (years)	Total Mercury (lb)
<i>TOCDF Sources:</i>					
LIC1	GB	7.90E-04	HHRA Table A-1	7.67	421.3
	VX	1.39E-06	HHRA Table A-3	2.47	0.2
	HD	2.63E-05	HHRA Table A-5	2.86	5.2
				Subtotal for LIC1	426.7
LIC2	GB	7.90E-04	HHRA Table A-2	7.67	421.3
	VX	1.39E-06	HHRA Table A-4	2.47	0.2
	HD	2.63E-05	HHRA Table A-6	2.86	5.2
				Subtotal for LIC2	426.7
MPF	GB	8.95E-06	HHRA Table A-7	7.67	4.8
	VX	1.48E-06	HHRA Table A-8	2.47	0.3
	HD	5.38E-05	HHRA Table A-9	2.86	10.7
				Subtotal for MPF	15.7
DFS	GB	9.80E-06	HHRA Table A-10	7.67	5.2
	VX	3.42E-09	HHRA Table A-11	2.47	0.001
	HD	1.15E-05	HHRA Table A-12	2.86	2.3
				Subtotal for DFS	7.5
BRA		3.60E-05	HHRA Table C-1 and SLERA Table B-7	13.0	32.5
Subtotals for the TOCDF:					
GB					852.5
VX					0.7
HD					23.4
BRA					32.5
All Campaigns					909.2

Table 4. (continued)

<i>CAMDS Sources:</i>						
MPF	GB	6.61E-07	Table B-1	10.0	0.5	
	VX	0.00E+00	Table B-2	10.0	0.0	
	HD	2.99E-05	Table B-3	10.0	20.8	
				Subtotal for MPF	21.2	
DFS	GB	2.08E-05	Table B-4	10.0	14.5	
	VX	2.08E-05	Table B-5	10.0	14.5	
	HD-1	5.81E-05	Table B-6a	10.0	40.4	
	HD-2	4.38E-05	Table B-6b	10.0	30.5	
				Subtotal for DFS	69.3	
				Subtotals for CAMDS:		
				GB	14.9	
				VX	14.5	
				HD	61.2	
				All Agents	90.6	
GRAND TOTAL (Both Facilities with the BRA):						999.8

Acronyms: BRA = brine reduction area (which is no longer in operation at the TOCDF); DFS = deactivation furnace system; GB = nerve agent GB (sarin); HD = sulfur mustard agent; HHRA = human health risk assessment (see UDEQ 2003 in the list of references in Section 6); LIC1 and LIC2 = the two liquid agent incinerators at the TOCDF; MPF = metal parts furnace; SLERA = screening-level ecological risk assessment (see Tetra Tech 2005 in the list of references in Section 6); VX = nerve agent VX.

^a The HHRA and the SLERA used the Industrial Risk Assessment Program–Health (IRAP-h) computer code to generate numerical risk values. The values in the table above are listed in the respective HHRA and SLERA documents as the numerical inputs to the IRAP-h calculations.

3.4 IMPACTS OF THE NO-ACTION ALTERNATIVE

Under the no-action alternative (see Section 2.2), the proposed alternative technologies (i.e., the PFSs and the TC washout capability) would not be constructed at the TOCDF. At the end of baseline operations, the TOCDF would be shutdown, and all of the mustard-filled munitions—as well as the TCs with elevated mercury content and/or excessive solids content—would remain in storage. This alternative would prevent the Army from complying with CWC obligations to destroy the entire stockpile and would also require continued monitoring and surveillance of stored chemical agents and

munitions for the indefinite future. The risks of accidental releases of mustard agent during storage activities would continue until such time as the agents and munitions were eventually destroyed.

Under the no-action alternative, there would be no changes in land use and no potential for disturbance of cultural (i.e., historic and archaeological) resources. Nor would there be any adverse effects from modifications to or disturbances of existing terrestrial and/or aquatic communities, wetlands, or threatened and endangered species habit areas. Impacts to such resources would therefore be negligible. There would be no new water consumption requirements for the no-action alternative; hence, there would be no effects on water resources. No additional workers would be required under the no-action alternative, and no socioeconomic impacts would be anticipated. No disproportionate impacts to minority or low-income populations would be expected during baseline operations of the TOCDF.

No additional solid or liquid wastes—beyond those currently generated during baseline operations—would be produced under the no-action alternative. Thus, there would be no need for additional treatment or disposal of any new wastes. The only wastes generated under the no-action alternative would be those associated with continued monitoring and storage of the TCs and munitions that could not be processed by the baseline TOCDF.

4. CONCLUSIONS

The information and analyses presented in this EA indicate that the proposed action of installing three new PAS filtration systems (i.e., PFSs; with sulfur-impregnated carbon filters) at the TOCDF and operating these new PFSs during the campaign to destroy mercury-contaminated mustard agents and munitions would have no significant environmental impacts. In addition, the option of installing and operating new washout equipment [including the proposed rinse and drain station (RDS), the rinsate pre-treatment (RPT) system, and the hydrolysate disposal system (HDS)] for ton containers with high solids content would likewise have no significant environmental impacts.

Installation and operation of the PFSs would ensure the emissions from the TOCDF would be in compliance with applicable regulatory limits. The emissions from the TOCDF with the PFSs in operation would not result in significant impacts to human health or to ecological resources. Consumption of additional resources, such as water, to support the proposed action would involve incremental quantities that are mere fractions of the TOCDF's baseline consumption requirements. The additional waste streams to be created by the proposed action are likewise only small, incremental amounts of the wastes normally generated by baseline operation of the TOCDF.

An evaluation of the no-action alternative (i.e., continued storage of the munitions and ton containers that cannot be processed in the baseline TOCDF without installing the aforementioned new equipment) indicates that no significant impacts would occur; however, the no-action alternative could jeopardize the United States' ability to comply with deadlines established under the CWC. Furthermore, choosing the no-action alternative would require the continued commitment of resources for stockpile monitoring, surveillance, and maintenance for as long as the mustard agents and munitions remained in storage.

Based on the above considerations and the lack of significant adverse environmental effects, it is concluded that the most desirable course of action is to proceed with the installation and operation of PFSs to control mercury emissions from the TOCDF and to continue with plans for the installation and possible operation of washout equipment to handle those ton containers with a high solids content that cannot be officially managed by the MPF.

This proposed action would create no significant impacts. A finding indicating this conclusion will be prepared and published for public comment.

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APPENDIX A

ESTIMATES OF THE QUANTITIES OF MERCURY IN MUSTARD AGENT STORED AT THE DESERET CHEMICAL DEPOT

Evaluation of the inventory of mustard-filled munitions and containers in storage at the Deseret Chemical Depot (DCD) has revealed the presence of unexpected concentrations of mercury. The mercury is believed to have been inadvertently introduced as a contaminant when the munitions and containers were originally filled with mustard agent (i.e., agent H, HD or HT). Sampling and evaluation (see EG&G 2002, 2004, 2006a, 2006b) has produced data that can be used to quantify the amount of mercury in the mustard agent. This appendix provides an overall estimate of the mercury contained inside the 4.2-inch mortar rounds, the 155-mm projectiles, and the ton containers (TCs), as well as the total of mercury in the inventory of mustard agent currently in storage at the DCD.

A.1 RESULTS OF PREVIOUS SAMPLING

4.2-inch HT mortar rounds. Sampling and evaluation of the 4.2-inch mortar rounds filled with agent HT found no mercury in the liquid agent, but mercury was found in a residue inside the rounds (EG&G 2006a). Approximately 17% of the rounds were found to have a residue containing 200 ppm of mercury. This film accounted for 2% of the fill weight. There are 181.5 tons of agent HT inside these types of munitions (DOD 1996). Therefore, the total quantity of mercury contained inside the 4.2-inch HT mortar rounds is about 0.3 lb ($= 181.5 \text{ tons} \times 2,000 \text{ lb/ton} \times 17\% \times 2\% \times 200 \text{ parts} \div 1,000,000 \text{ parts}$).

4.2-inch HD mortar rounds. The sampling and evaluation of the 4.2-inch mortar rounds filled with agent HD revealed that the munitions had up to 30% heel (i.e., undrainable solids or sludge-like materials which have accumulated over time) with an average of 770 ppm of mercury in the heel (EG&G 2006a). There are 2.9 tons of agent HD inside these types of munitions (DOD 1996). Therefore, the total quantity of mercury contained inside the 4.2-inch HD mortar rounds is about 1.3 lb ($= 2.9 \text{ tons} \times 2,000 \text{ lb/ton} \times 30\% \times 770 \text{ parts} \div 1,000,000 \text{ parts}$).

155-mm projectiles. None of the sampled 155-mm projectiles were found to contain mercury; hence, there is no mercury associated with these types of munitions.

Ton Containers. As part of an effort to characterize the ton containers (TCs) filled with mustard agent in storage at the Deseret Chemical Depot, the Army evaluated a selected number of

those containers. Of the 98 TCs sampled, 18 TCs (i.e., about 18%) were found to contain mercury in the liquid mustard agent and in the undrainable solid layer (which is also called the “heel”)⁹. The data obtained from the sampling (see EG&G 2002, 2004) have been used in this appendix for the purpose of estimating the quantity of mercury in the entire inventory of 6,397 TCs.

The method used to estimate mercury quantities was based on the physical size of the individual TCs and the fact that the sampling results provide the mercury concentrations in the liquid agent and in the solid layer. Each cylindrical TC has a length of 85.1 inches and an outside diameter of 30.1 inches. The wall thickness is 0.75 inch; hence, the inside diameter of the cylinder is 28.6 inches. Using these dimensions, the internal volume of the TC can be calculated. The depth of the solids layer can be used to obtain the volume of the heel. The volume of liquid mustard agent was assumed to be the internal volume of the TC that was not otherwise associated with the solid layer. Each TC was assumed to initially be filled with 1,780 lb of mustard agent (DOD 1996).

Table A.1 shows the concentrations of mercury obtained during sampling, as well as the measured depth of the solid layer. The table also shows the fraction of the total volume in each TC that is associated with the liquid and with the solid layer. The measured mercury concentration is then applied to these volumes (and to the 1,780 lb capacity of the TC) to obtain an estimate of the quantity of mercury in each of the sampled TCs. Table A.1 shows that the average amount of mercury in the 18 contaminated TCs is 0.724 lb.

A.2 LATEST SAMPLING RESULTS FOR TON CONTAINERS

Through the week ending October 1, 2006, on-going sampling of mustard agent inside TCs at the DCD has produced information for 682 sampled TCs. Of these TCs, 174 contained high levels of mercury; i.e., mercury concentrations in excess of 1 ppm (EG&G 2006b). This represents about 26% of the TCs sampled. Because the current sampling is being conducted as a screening exercise to categorize the TCs as either containing “low mercury” or “high mercury,” no further concentration data are available from this most recent sampling.

Using the average amount of mercury (0.724 lb) observed in the previously sampled, contaminated TCs (see Section A.1), the total quantity of mercury inside the TCs at the DCD can be estimated. If 26% of the TCs contain mercury contamination, then the total amount of mercury inside the entire inventory of 6,397 TCs in storage at the DCD can be computed to be 1,204 lb ($= 0.724 \text{ lb/TC} \times 0.26 \times 6,397 \text{ TCs}$).

⁹ Although samples were initially taken from a region conceptually called the “non-cohesive layer,” this layer was subsequently determined to be merely the interface between the liquid and solid phases within the TC, and did not represent a separate and distinct phase.

Table A.1. Estimated quantity of mercury inside ton containers in storage at the Deseret Chemical Depot in Utah

Sampled TC Number	Mercury Concentration (mg/kg) ^(a)		Depth of Solid Layer ^(b) (inches)	Volume Fraction of Sampled TC		Mercury (lbs) in Fraction ^(c) of TC Containing:		Total Mercury in each TC (lb)
	Liquid	Solid		Liquid	Solid	Liquid	Solid	
D42249	23.5	1,680	5.25	0.87	0.13	0.037	0.377	0.41
D46537	41.1	2,440	4.5	0.90	0.10	0.066	0.438	0.50
D48309	17.8	10,300	11.75	0.61	0.39	0.019	7.097	7.12
D46491	26.3	2,140	3.75	0.92	0.08	0.043	0.295	0.34
D41559	46.8	2,010	3	0.94	0.06	0.079	0.200	0.28
D50034	57.2	2,000	3.25	0.94	0.06	0.095	0.223	0.32
D49168	5.2	442	4	0.92	0.08	0.008	0.067	0.08
D46992	1.47	694	5.5	0.87	0.13	0.002	0.166	0.17
D47708	1.62	95	4.5	0.90	0.10	0.003	0.017	0.02
D48273	27.4	5,590	3.25	0.94	0.06	0.046	0.625	0.67
D51059	5.75	996	3.75	0.92	0.08	0.009	0.137	0.15
D45179	17.1	1,600	6	0.85	0.15	0.026	0.434	0.46
D44007	16.3	1,740	5.5	0.87	0.13	0.025	0.417	0.44
D48980	65	1,960	4	0.92	0.08	0.106	0.296	0.40
D49972	6.96	2,200	4.5 ^(d)	0.90	0.10	0.011	0.395	0.41
D41787	55.8	3,020	3 ^(d)	0.94	0.06	0.094	0.300	0.39
D50997	3.02	185	3 ^(d)	0.94	0.06	0.005	0.018	0.02
D44485	4.06	4,780	4.5 ^(d)	0.90	0.10	0.006	0.858	0.86
Mean value	23.5	2,437	4.6	0.89	0.11	0.038	0.687	0.724

^(a) Numerical concentrations were obtained from Table 3-21 in *Mustard Characterization Project Report for Deseret Chemical Depot Mustard Ton Containers*, Rev. 0, EG&G Defense Materials, Inc., Stockton, Utah, January 14, 2004. Note that, although samples were initially taken from a region conceptually called the “non-cohesive layer,” this layer was subsequently determined to be merely the interface between the liquid and solid phases within the TC, and did not represent a separate and distinct phase.

^(b) The depth of the solid layer was obtained from data presented in Table 6-2 in *Mustard Sampling and Analysis Project; Quality Assurance Project Plan for Deseret Chemical Depot Mustard Ton Containers*, Rev. 1, EG&G Defense Materials, Inc., Stockton, Utah, December 9, 2002.

^(c) The calculation of mass assumes that one entire ton container (TC) originally held 1,780 lb of mustard agent.

^(d) No depth data are available for this sampled TC; the tabulated value was obtained from other TCs sampled from the same “lot number.”

A.3 ESTIMATED TOTAL QUANTITY OF MERCURY IN THE INVENTORY OF CHEMICAL AGENT

The total quantity of mercury in the inventory of mustard agent in storage at the DCD can be computed as the sum of the mercury in the 4.2-inch mortar rounds (both for agents HT and HD), the 155-mm projectiles, and the TCs. The sum of the numbers presented in the above subsections is 1,205.6 lb (= 0.3 + 1.3 + 0 + 1,204 lb). The uncertainty in this numerical value is unknown; hence, for the purposes of the “upper bound” analysis in this EA, an error factor of 2 was applied to the numerical result. The overall, estimated quantity of mercury in the entire inventory of mustard agent in storage at the DCD—for use in the environmental impact analyses contained in this EA—is therefore assumed to be about 2,410 lb (= 2 × 1,205.6 lb).

A.4 REFERENCES FOR APPENDIX A

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