11. CONCLUSIONS AND RECOMMENDATIONS

This section presents the conclusions and recommendations for the Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) conducted at the Group 3 suspected releases solid waste management units (SWMUs) at Deseret Chemical Depot (DCD). In accordance with the objectives of the governing Utah Administrative Code (UDEQ 1999), three response actions are possible for each SWMU:

- No further action
- Management activities (e.g., monitoring, deed notations, site security, and post-closure care)
- Corrective action.

The Utah Department of Environmental Quality (UDEQ) identifies a Site Management Plan (SMP) to document these response actions. Response actions for management activities and corrective action also are documented as part of the RFI/Corrective Measures Study (CMS) process. Recommendations for response actions at the Group 3 SWMUs will follow UDEQ guidance on implementation of an SMP. Following guidance presented in the Utah Administrative Code (UDEQ 1999), the need for environmental cleanup is based on calculated human health and ecological risks. The residential land use scenario must be evaluated for all investigated sites. However, current or projected future land use also may be used to make cleanup decisions. Cleanup standards may be derived for a site where a release has occurred through the development of preliminary remediation goals (PRGs). (The development of PRGs is deferred to the supporting response action documents.)

In the human health risk assessment, no further action may be proposed if the following criteria are met: residential cancer risk is less than one in a million (1×10^{-6}), the hazard index (HI) is less than 1, and blood lead levels for 95 percent of the population do not exceed the Centers for Disease Control and Prevention (CDC) guideline of 10 µg/dL. If the site does not meet the criteria to constitute no further action under the residential scenario, the site may be evaluated under actual current land use or projected future land use. If the cancer risk is less than one in ten thousand (1×10^{-4}), the HI is less than 1, and blood lead levels do not exceed the CDC guideline under current or projected future land use, an SMP can be developed. The SMP may include monitoring, site security, post-closure care, and/or procedures for corrective action. If the cancer risk is greater than 1×10^{-4}, the HI is greater than 1, and/or blood lead levels exceed the CDC guideline under current or projected future land use, corrective action must be undertaken. Table 11-1 summarizes the Utah Administrative Code (UDEQ 1999) regarding investigation response actions.

Consistent with the State guidance, chemicals of concern (COCs) were identified in the human health risk assessment if: (1) residential risks exceed a cancer risk of 1×10^{-6} and/or an HI of 1; and (2) worker (Depot and/or construction) risks exceed a cancer risk of 1×10^{-4} and/or an HI of 1. The calculated human health risks for the Group 3 SWMUs did not indicate a cancer risk greater than 1×10^{-4} or an HI greater than 1 for the current or future Depot worker or the future construction worker at any Group 3 SWMU. Cancer risks greater than 1×10^{-6} and HIs greater than 1 were calculated for future residential scenarios at most of the SWMUs. Table 11-2 summarizes the human health risk assessment results.

Table 11-1. Summary of Investigation Response Actions per Utah Administrative Code Deseret Chemical Depot, Tooele, Utah

Step	Residential Land Use		Actual or Potential Land Use		Action[a]	Reference [b]
	Cancer Risk	Hazard Index	Cancer Risk	Hazard Index		
Step 1	$<1 \times 10^{-6}$	<1	—	—	No Further Action	R315-101-6(c)(1)
Step 2	**$>1 \times 10^{-6}$**	<1	—	—	Must look at actual or potential land use	R315-101-6(c)(3)
	$<1 \times 10^{-6}$	**>1**	—	—	Must look at actual or potential land use	R315-101-6(c)(3)
	$>1 \times 10^{-6}$	**>1**	—	—	Must look at actual or potential land use	R315-101-6(c)(3)
Step 3	—	—	$<1 \times 10^{-4}$	<1	SMP may recommend either site controls or corrective action	R315-101-6(d)
	—	—	**$>1 \times 10^{-4}$**	<1	SMP recommends corrective action based on actual or potential land use	R-315-101-6(e)
	—	—	$<1 \times 10^{-4}$	**>1**	SMP recommends corrective action based on actual or potential land use	R-315-101-6(e)
	—	—	**$>1 \times 10^{-4}$**	**>1**	SMP recommends corrective action based on actual or potential land use	R-315-101-6(e)

[a] SMP – Site Management Plan

[b] Applicable rule from the Utah Administrative Code, Utah Solid and Hazardous Waste Control Board, Utah Hazardous Waste Management Rules, 1999.

Notes: For the DCD Group 3 Phase II RFI, actual or potential land use corresponds to the current Depot worker and/or the future construction worker scenarios; residential land use corresponds to a hypothetical future land use scenario.
Bolded values indicate threshold exceedances.

Table 11-2. Calculated Human Health RME Summary of Results
Deseret Chemical Depot, Tooele, Utah

SWMU	Medium	Current Land Use: Noncancer HI Depot Worker	Current Land Use: Cancer Risk Depot Worker	Future Land Use: Noncancer HI Resident Child	Future Land Use: Noncancer HI Resident Adult	Future Land Use: Noncancer HI Depot Worker	Future Land Use: Noncancer HI Construction Worker	Future Land Use: Cancer Risk Resident Integrated	Future Land Use: Cancer Risk Depot Worker	Future Land Use: Cancer Risk Construction Worker	Blood Lead Levels
11	Surface Soil	3E-02 B	0E+00 B	3E-01 B	4E-02 B		2E-02 B	0E+00 B		0E+00 B	
	Subsurface Soil	NA	NA	6E-06 B	2E-06 B		8E-08 B	0E+00 B		0E+00 B	
	Groundwater	NA	NA	**4E+01 E**	**2E+01 E**	same as	NA	**6E-04 E**	same as	NA	below
	Produce (Surface Soil)	NA	NA	**2E+01 E**	**7E+00 E**	current	NA	0E+00 B	current	NA	targets
	Produce (Subsurface Soil)	NA	NA	4E-05 B	1E-05 B	land use	NA	0E+00 B	land use	NA	
	Beef	NA	NA	5E-02 B	2E-02 B		NA	0E+00 B		NA	
19	Surface Soil	2E-06 B	5E-11 B	1E-05 B	3E-06 B		5E-07 B	1E-10 B		4E-12 B	
	Subsurface Soil	NA	NA	1E+00 B	3E-01 B		9E-02 B	**8E-05 E**		3E-06 B	
	Groundwater	NA	NA	**2E+00 E**	1E+00 B	same as	NA	**3E-06 E**	same as	NA	below
	Produce (Surface Soil)	NA	NA	6E-04 B	2E-04 B	current	NA	7E-09 B	current	NA	targets
	Produce (Subsurface Soil)	NA	NA	**4E+00 E**	1E+00 B	land use	NA	**4E-04 E**	land use	NA	
	Beef	NA	NA	7E-09 B	2E-09 B		NA	9E-14 B		NA	
20	Subsurface Soil	NA	NA	2E-03 B	3E-04 B	same as	1E-04 B	**2E-05 E**	same as	4E-07 B	below
	Produce (Subsurface Soil)	NA	NA	4E-01 B	1E-01 B	current land use	NA	**6E-05 E**	current land use	NA	targets
33a	Surface Soil	8E-02 B	1E-09 B	1E+00 B	1E-01 B		7E-02 B	2E-09 B		5E-11 B	
	Subsurface Soil	NA	NA	2E-01 B	2E-02 B	same as	1E-02 B	3E-08 B	same as	7E-10 B	below
	Produce (Surface Soil)	NA	NA	**5E+02 E**	**2E+02 E**	current	NA	0E+00 B	current	NA	targets
	Produce (Subsurface Soil)	NA	NA	1E+00 B	4E-01 B	land use	NA	0E+00 B	land use	NA	
	Beef	NA	NA	1E-01 B	5E-02 B		NA	0E+00 B		NA	
33b	Surface Soil	3E-01 B	4E-09 B	**4E+00 E**	4E-01 B		1E-01 B	9E-09 B		2E-10 B	
	Subsurface Soil	NA	NA	5E-01 B	7E-02 B	same as	4E-02 B	2E-09 B	same as	4E-11 B	**exceeds**
	Produce (Surface Soil)	NA	NA	**2E+01 E**	**7E+00 E**	current	NA	0E+00 B	current	NA	**target for**
	Produce (Subsurface Soil)	NA	NA	**3E+01 E**	**1E+01 E**	land use	NA	0E+00 B	land use	NA	**resident child**
	Beef	NA	NA	**3E+01 E**	**1E+01 E**		NA	0E+00 B		NA	
33c	Surface Soil	1E-02 B	2E-09 B	9E-02 B	2E-02 B		7E-03 B	4E-09 B		8E-11 B	
	Subsurface Soil	NA	NA	1E-01 B	2E-02 B	same as	1E-02 B	6E-09 B	same as	1E-10 B	**exceeds**
	Produce (Surface Soil)	NA	NA	**5E+00 E**	1E+00 B	current	NA	0E+00 B	current	NA	**target for**
	Produce (Subsurface Soil)	NA	NA	**7E+00 E**	**2E+00 E**	land use	NA	4E-08 B	land use	NA	**resident child**
	Beef	NA	NA	3E-01 B	1E-01 B		NA	0E+00 B		NA	
37 Pit	Surface Soil	4E-06 B	2E-07 B	1E-03 B	3E-04 B	2E-04 B	2E-05 B	**2E-05 E**	9E-06 B	5E-07 B	
	Subsurface Soil	NA	NA	1E+00 B	3E-01 B	NA	9E-02 B	**8E-05 E**	NA	3E-06 B	below
	Produce (Surface Soil)	NA	NA	4E-02 B	1E-02 B	NA	NA	**8E-05 E**	NA	NA	targets
	Produce (Subsurface Soil)	NA	NA	**4E+00 E**	1E+00 B	NA	NA	**4E-04 E**	NA	NA	
	Beef	NA	NA	4E-03 B	1E-03 B	NA	NA	**3E-05 E**	NA	NA	
37 Slope	Surface Soil	1E-02 B	6E-10 B	**7E+00 E**	8E-01 B	5E-01 B	5E-01 B	7E-08 B	3E-08 B	2E-09 B	
	Subsurface Soil	NA	NA	**2E+01 E**	**2E+00 E**	NA	1E+00 B	1E-08 B	NA	2E-10 B	**exceeds**
	Produce (Surface Soil)	NA	NA	**1E+02 E**	**4E+01 E**	NA	NA	**3E-06 E**	NA	NA	**target for**
	Produce (Subsurface Soil)	NA	NA	**5E+02 E**	**2E+02 E**	NA	NA	0E+00 B	NA	NA	**resident child**
	Beef	NA	NA	**9E+00 E**	**3E+00 E**	NA	NA	2E-12 B	NA	NA	

B - HI ≤ 1 or ELCR ≤ 10^{-6} for the residential scenario; HI ≤ 1 or ELCR ≤ 10^{-4} for the worker scenarios

E - HI > 1 or ELCR > 10^{-6} for the residential scenario; HI > 1 or ELCR > 10^{-4} for the worker scenarios

NA - pathway not evaluated; incomplete pathway

0E+00 - pathway evaluated; quatitative risks not calculated due to lack of EPA-approved toxicity values

The Utah Administrative Code (UDEQ 1999) also requires that an ecological risk assessment be conducted; however, no formal guidance is available that specifies remedial response actions relative to ecological risks, particularly in relation to the magnitude of hazard quotients (HQs). For the Group 3 Phase II RFI screening-level ecological risk assessment (SERA), qualitative and quantitative evaluations provided a basis for recommendations. UDEQ indicated that the SERA should determine if an imminent threat exists (i.e., acute risks to ecological receptors) when recommendations are evaluated. In the absence of an imminent threat, ecological decisions will be deferred to the installation-wide SERA to be conducted after the installation is closed and the future land use is determined (UDEQ 2000). The presence or absence of stressed plants and animals observed during the Group 3 RFI habitat check was used as the basis for determining if an imminent threat exists. In addition, as explained in Section 4, an ecological HQ above the threshold of 1, but below 10, indicates a potential risk to individual receptors rather than a risk to the receptor population as a whole. Thus, the ecological chemicals of potential concern (ecoCOPCs) with HQs above 1 but below 10 are likely not of concern at the SWMU and were not selected as ecological chemicals of concern (ecoCOCs).

The SERA conducted for the Group 3 SWMU did not include any ecological-specific sampling (e.g., tissue). Without these quantitative measurements, food chain models can be overly conservative. As such, further action relative to the SERA may not be warranted even though some ecoCOCs were identified. Table 11-3 presents all ecoCOPCs with HQs greater than 1.

Recommendations for interim remedial actions are made only if an immediate threat exists to human or ecological health or safety. Interim remedial actions may include activities such as immediate removal of the source material or interim groundwater treatment. Based on the results of the human health risk assessment and the SERA, no immediate threat was identified with the exception of the SWMU 37 slope, where there is potentially an acute risk.

A quantitative risk assessment was conducted for soils at all Group 3 SWMUs. For groundwater, a quantitative risk assessment was conducted for SWMUs where groundwater monitoring data were available (SWMUs 11 and 19). For SWMUs with no available groundwater data (SWMUs 20, 33, and 37), a chemical transport model was used to qualitatively evaluate contaminant migration to the groundwater. The results of the Phase II sampling program, baseline human health risk assessment, and SERA were used as a basis for developing recommendations for the Group 3 SWMUs. The results for each SWMU and SWMU-specific recommendation for future action are summarized below. Table 11-4 summarizes the recommendations for each SWMU.

11.1 SWMU 11 – CHEMICAL MUNITIONS STORAGE AREA

During the Phase II RFI of SWMU 11 – Chemical Munitions Storage Area, both Phase I and II sampling data were evaluated. The results indicated limited contamination of surface and subsurface soils. Metals were detected in surface and subsurface soils at concentrations less than their respective background upper tolerance limit (UTL). A limited number of volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) were inconsistently identified throughout the SWMU both areally and with depth. The majority of the VOCs and SVOCs were detected at concentrations within the same order of magnitude as the analytical detection limit. Polychlorinated biphenyls (PCBs), cyanide, and chemical agent breakdown products were not detected in any soil sample.

Table 11-3. Summary of HQs at or Above 1 for EcoCOPCs
Deseret Chemical Depot, Tooele, Utah

	Surface Soil SWMUs*			Subsurface Soil SWMUs*				
HQ	**33B**	**33C**	**37 – Slope**	**19**	**33B**	**33C**	**37 – Pit Floor**	**37 – Slope**
>100			Aluminum 470 (plants) 1,315 (rabbits)					Barium 115 (rabbits) Copper 116 (plants) Silver 293 (rabbits)
10-100	Lead 12 (plants) Mercury 94 (plants) Thallium 14 (plants)		Antimony 57 (rabbits) Barium 11 (plants) 41 (rabbits) Chromium 51 (plants) Copper 15 (plants) Lead 13 (plants) Silver 13 (plants) 92 (rabbits)		Lead 11 (plants)		Arsenic 20 (rabbits)	Antimony 36 (rabbits) Barium 31 (plants) Copper 39 (rabbits) Silver 42 (plants)
1-10	Antimony 1.5 (plants) 4.2 (rabbits) Cadmium 2.0 (plants) Copper 3.2 (plants) Silver 3.3 (plants) 2.3 (rabbits) Zinc 7.9 (plants)	Lead 4.0 (plants) Zinc 3.8 (plants)	Antimony 2.1 (plants) Cadmium 2.4 (plants) 1.7 (rabbits) Cobalt 1.1 (plants) Copper 5.2 (rabbits) Lead 1.6 (rabbits) Manganese 1.3 (plants) Nickel 2.8 (plants) Zinc 6.7 (plants)	Arsenic 2 (plants) 3.4 (rabbits) Lead 3.3 (plants)	Manganese 1.5 (plants) Silver 2.0 (plants) 1.4 (rabbits) Zinc 8.5 (plants)	Cadmium 1.26 (plants) Lead 6.45 (plants) Zinc 3.92 (plants)	Arsenic 2.1 (plants)	Antimony 1.3 (plants) Cadmium 2.4 (plants) 1.7 (rabbits) Lead 6.3 (plants) Manganese 1.8 (plants) Nickel 6.2 (plants) Zinc 6.5 (plants)

* SWMU 11 and 20 were evaluated, but did not have any HQs greater than or equal to 1. SWMU 33A was not evaluated because the samples were collected inside Building 536 where ecological exposures are not expected.

Table 11-4. Group 3 Phase II RFI Recommendations
Deseret Chemical Depot, Tooele, Utah

Group 3 SWMU	Phase II Recommendations
SWMU 11 – Chemical Munitions Storage Area	• No additional sampling. • No imminent ecological threat. • SMP controlling residential and agricultural activities and exposure and use of the surficial aquifer.
SWMU 19 – Building 533 Foundation (Empty Drum Storage Area)	• No additional sampling. • No imminent ecological threat. • SMP controlling residential and agricultural activities and exposure and use of the surficial aquifer. SMP to address the removal of the former septic tank.
SWMU 20 – Building 521 (Crating Facility)	• No additional sampling. • No imminent ecological threat. • SMP controlling residential and agricultural activities. SMP to address the removal of the former septic line.
SWMU 33 – Building 536 (CAMDS Salt Storage)	
SWMU 33A – Inside Building 536	• No additional sampling. • No imminent ecological threat. • SMP to evaluate corrective action for removal of agent breakdown contaminated soils. SMP to control and divert stormwater runoff and snow melt.
SWMU 33B – Outside Building 536	• No additional sampling. • No imminent ecological threat. • SMP controlling residential and agricultural activities. SMP to evaluate corrective action for removal of mercury-contaminated soils.
SWMU 33C – Drainage Swale	• No additional sampling. • No imminent ecological threat. • SMP controlling residential and agricultural activities. SMP to evaluate corrective action for removal of construction debris.
SWMU 37 – Slag Piles and Bomb Fragments	
SWMU 37 – Pit Floor	• No additional sampling. • No imminent ecological threat. • SMP controlling residential and agricultural activities.
SWMU 37 – Slope	• No additional sampling. • Potential imminent ecological threat; ecoCOCs should be evaluated further as part of the installation-wide ecological risk assessment. • SMP controlling residential and agricultural activities. SMP to evaluate the need for corrective action of the thermate bomb disposal trenches.

Note: No plans have been made to change the current activities at the site. The concerns at each SWMU should be addressed in the context of the established future land use when control of the area is relinquished by DCD.

Phase I and II groundwater data indicate that attenuation of metals concentrations is occurring. Explosive compounds, VOCs, and SVOCs were detected inconsistently at low concentrations generally of the same order of magnitude as the analytical detection limit. PCBs, cyanide, and chemical agent breakdown products were not detected in any groundwater sample. There is no apparent or consistent source for the chemicals detected in the soil and groundwater.

A human health risk assessment was conducted for soil and groundwater at SWMU 11. All HIs for the soil exposure pathways for residents were below the State of Utah's criterion. However, for the resident ingesting produce grown in surface soil, noncancer HIs for the child and adult were above the State of Utah's criterion. Manganese was identified as a COC for the produce ingestion pathway. For both the Depot worker and construction worker scenarios (current and future), all calculated noncancer HIs are below the criteria established by the State of Utah. Cancer risks were not quantified for the soil or food chain pathways because none of the associated COPCs has U.S. Environmental Protection Agency (EPA)-approved toxicity values for carcinogenic effects. Table 6-9 lists the SWMU-specific soil COPCs.

For the future residential scenario, groundwater ingestion HIs, groundwater ingestion cancer risks, and groundwater dermal contact cancer risks were above the State of Utah's criteria for residential land use. The COCs in groundwater are antimony, arsenic, iron, and thallium. The COPCs in groundwater are listed in Table 6-10.

No stressed plants or animals were observed during the qualitative habitat surveys. Thus, no imminent threat to ecological receptors appears to exist. The SERA did not identify HQs exceeding the threshold of 1 for any of the selected receptors (i.e., terrestrial plants, black-tailed jackrabbits, and golden eagles) for the ecoCOPCs at SWMU 11. Based on the available Phase I and II information, no unacceptable ecological risks appear to be associated with surface and subsurface soil exposures at SWMU 11. Therefore, no ecoCOCs have been identified at SWMU 11.

At SWMU 11, because the nature and extent of potential contamination has been defined, no additional sampling is recommended. No imminent ecological risks have been identified. Residential risks exceed the criteria established by the State of Utah; however, risks for the current and projected future land use (represented by the Depot and construction worker scenarios) are below the State criteria. An SMP is recommended that outlines procedures for controlling residential and agricultural activities conducted in the site area and for controlling the exposure and use of the surficial aquifer. SWMU 11 is currently an active, operating chemical munitions storage facility and no plans have been made to change the current operations at the site. The concerns at SWMU 11 should be addressed in the context of the established future land use when control of the area is relinquished by DCD.

11.2 SWMU 19 – BUILDING 533 FOUNDATION (EMPTY DRUM STORAGE AREA)

The Phase II RFI at SWMU 19 – Building 533 Foundation (Empty Drum Storage Area) evaluated both Phase I and II sampling data. The results of the Phase II soil organic vapor (SOV) and soil sampling investigation activities confirmed the Phase I study, identifying a limited number of randomly distributed VOCs and SVOCs in the surface soils. The VOCs and SVOCs were confined to the area between former Building 533 and Building 536. A single PCB

(Aroclor-1260) was identified in the Building 533 sump (Phase I) and in the septic tank (Phase II); a single SVOC COC (bis[2-ethylhexyl]phthalate [B2EHP]) was identified in the groundwater. PCB Aroclor-1260 was detected in only 1 of the 16 soil samples collected at SWMU 19. B2EHP was reported inconsistently between groundwater sampling rounds and detected at the same magnitude as the analytical detection limit. There is no apparent or consistent source at SWMU 19 for the chemicals detected in the soil or groundwater.

A human health risk assessment was conducted for soil and groundwater at SWMU 19. For the residential land use scenario, noncancer HIs and cancer risks were at or exceeded the State of Utah targets due to subsurface soil and groundwater exposures. Arsenic was identified as a COC in subsurface soil and B2EHP was identified as a COC in groundwater. For the residents ingesting produce, the noncancer HI for the child and cancer risk were above the State of Utah's criterion due to produce grown in subsurface soil. Arsenic was identified as a COC in produce. For both the Depot worker and construction worker scenarios (current and future), all calculated noncancer HIs and cancer risks were below the associated criteria established by the State of Utah.

No stressed plants or animals were observed during the qualitative habitat surveys. Thus, no imminent threat to ecological receptors appears to exist. The results of the SERA identified no ecoCOPCs in the surface soil at SWMU 19. Thus, there are no unacceptable surface soil ecological risks or ecoCOCs. EcoCOPCs in subsurface soil with HQs above the threshold of 1 but below 10 occurred for terrestrial plants and rabbits (Table 11-3).

At SWMU 19, because the nature and extent of potential contamination has been defined, no additional sampling is recommended. No imminent ecological risks have been identified. Residential risks exceed the criteria established by the State of Utah; however, risks for the current and projected future land use (represented by the Depot and construction worker scenarios) are below the State criteria. An SMP is recommended that outlines procedures for controlling residential and agricultural activities conducted in the site area and for controlling the exposure and use of the surficial aquifer. In addition, it is recommended that the SMP address the removal of the former septic tank associated with SWMU 19. No plans have been made to change the current activities at the site. The concerns at SWMU 19 should be addressed in the context of the established future land use when control of the area is relinquished by DCD.

11.3 SWMU 20 – BUILDING 521 (CRATING FACILITY)

During the Phase II RFI of SWMU 20 – Building 521 (Crating Facility), both Phase I and II sampling data were evaluated. Organic compounds were not detected in any sample collected during the 1994-95 Phase II sampling event. VOCs were not detected during the 2000 Phase II sampling event. SVOCs, however, were detected immediately below the septic pipe during the 2000 Phase II sampling. With the exception of the sample collected from the end of the discharge pipe, all SVOCs were within an order of magnitude of the analytical detection limit. The SVOCs detected at SWMU 20 were confined to the area immediately below the perforated septic discharge pipe. No vertical migration of contaminants was observed and no contamination was observed beyond the end of the discharge pipe. DCD demolished Building 520 in 1999 and removed the associated septic tank in April 1999, thus effectively removing the potential contaminant sources.

The results of the chemical transport model in the variably saturated DCD soil indicate that benzo(a)pyrene, the chemical selected for modeling at SWMU 20, in the shallow soil may degrade to below the detection limit (0.17 µg/g) after 7 years. Benzo(a)pyrene also would not reach the water table (approximately 117 feet below land surface [BLS]) in detectable concentrations over 35 years under the conditions of the model. Chemical concentrations at the last modeled compartment (20 feet BLS) are below detection limits throughout the model period (35 years).

A human health risk assessment was conducted for subsurface soil at SWMU 20. For the residential land use scenario, the combined cancer risk exceeded the target of 1×10^{-6} due to ingestion and dermal contact with subsurface soil. Benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were identified as COCs in subsurface soil. For the residents ingesting produce, the combined cancer risk was above the State of Utah criterion also due to exposure to polycyclic aromatic hydrocarbons (PAHs) in the subsurface soil. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene in tuberous vegetables were identified as COCs. For the future construction worker scenario, the combined noncancer HI and cancer risk were below the associated criteria established by the State of Utah. Risks for the Depot worker were not calculated. The Depot worker is assumed to be exposed only to surface soils, which were not investigated at SWMU 20.

No stressed plants or animals were observed during the qualitative habitat surveys. Thus, no imminent threat to ecological receptors appears to exist. The SERA did not identify HQs exceeding the threshold of 1 for any of the receptors (i.e., terrestrial plants, black-tailed jackrabbits, and golden eagles) for the ecoCOPCs at SWMU 20 subsurface soil (Table 11-3). Therefore, no ecoCOCs have been identified at SWMU 20. Based on the available Phase I and II information, no unacceptable ecological risks appear to be associated with subsurface soil exposures at SWMU 20.

At SWMU 20, because the nature and extent of potential contamination has been defined, no additional sampling is recommended. The building has been razed and the associated septic tank has been removed. No imminent ecological risks have been identified. Residential risks exceed the criteria established by the State of Utah, however, risks for the current and projected future land use (represented by the Depot and construction worker scenarios) are below the State criteria. An SMP is recommended that outlines procedures for controlling residential and agricultural activities conducted in the site area. In addition, it is recommended that the SMP address the removal of the former septic line at SWMU 20. No plans have been made to change the current activities at the site. The concerns at SWMU 20 should be addressed in the context of the established future land use when control of the area is relinquished by DCD.

11.4 SWMU 33 – BUILDING 536 (CAMDS SALT STORAGE)

During the Phase II RFI of SWMU 33 – Building 536 (Chemical Agent Munitions Disposal System [CAMDS] Salt Storage), both Phase I and II sampling data were evaluated. The Phase II results confirmed the presence of inorganic, organic, and agent breakdown products.

Inside Building 536 (SWMU 33A)—A random and limited presence of inorganics and agent breakdown products were detected within Building 536 (SWMU 33A). A limited number

of inorganic COPCs exceeding their respective UTL were identified. The magnitude of the concentration of each inorganic COPC was the same in the surface as in the subsurface soil. Chemical agent breakdown products were distributed inconsistently throughout the inside of the building with no single identifiable source area. The maximum concentrations for all breakdown products were detected in the surface soils. The higher concentrations of agent breakdown products were detected in the center of the building, along the walls (in areas of anticipated drum storage), and near the building doors. The limited horizontal and vertical extent of the agent breakdown products support the historical reports that limited, random spills, attributable to the type of drums in which the "dried organic salts" were stored (i.e., cardboard), are the source of the contamination.

The results of the chemical transport model in the variably saturated DCD soil indicate that concentrations of the agent breakdown product isopropyl methyl phosphonate (IMPA), the site chemical selected for modeling, would be below the detection limit (0.5 μg/g) at the last modeled compartment (20 feet BLS), and are below detection limits throughout the model period (35 years).

A human health risk assessment was conducted for surface and subsurface soil at SWMU 33A. For the residential land use scenario, all soil pathway and beef ingestion noncancer HIs and cancer risks were below the State criteria. However, for the resident ingesting produce grown in surface soil, noncancer HIs for the child and adult were above the State criterion. Cadmium, IMPA, and methylphosphonic acid (MPA) were identified as COCs for the produce ingestion pathways. For the current Depot worker and future construction worker, all noncancer HIs and cancer risks were below the criteria established by the State of Utah. Cancer risks could not be quantified for most surface soil and produce pathways because none of the COPCs for these pathways has an oral slope factor for carcinogenic effects. (Table 9-10 presents the COPCs inside Building 536.)

A SERA was not conducted for SWMU 33A because the associated area is located within Building 536. As a result, few, if any, wildlife exposures would be expected. In the absence of exposure, no ecological risks are associated with SWMU 33A.

For SWMU 33A, because the nature and extent of potential contamination has been defined, no additional sampling is recommended. Residential risks exceed the criteria established by the State of Utah; however, risks for the current and projected future land use (represented by the Depot and construction worker scenarios) are below the State criteria. An SMP is recommended that considers two alternatives based on the intended use of Building 536. If and when the current use of Building 536 is altered (i.e., discontinued storage of hazardous materials), the agent breakdown contaminated soil should be evaluated for corrective action. If the operations of the building are planned to remain unchanged, the SMP should establish procedures to control and divert stormwater runoff and snow melt (i.e., inhibit water from entering the building and fostering downward migration of the agent breakdown products), to mitigate future releases, and to continue controlling access into Building 536.

Outside Building 536 (SWMU 33B)—Phase II investigation activities outside Building 536 (SWMU 33B) focused on defining the extent of mercury detected during the 1994-95 Phase II activities. The mercury concentrations exceeding its UTL are predominantly

confined to the surface soils, with only one subsurface sample (5 feet BLS) exceeding the mercury UTL. The locations of sample points exceeding the respective mercury UTL generally are found within 50 feet of Building 536, south of Blume Street. The vertical and horizontal extent of mercury has been defined; however, no apparent or consistent source area has been identified.

The results of the chemical transport model in the variably saturated DCD soil indicate that mercury concentrations in the shallow soil will not degrade substantially over time and will not migrate to the water table (approximately 117 feet BLS) under the variably saturated soil conditions at the site. The model shows that chemical concentrations at the last modeled compartment (20 feet BLS) would be below the detection limit throughout the model period (35 years), indicating the lack of vertical movement.

A human health risk assessment was conducted for surface and subsurface soil at SWMU 33B. Under residential land use, soil ingestion, produce ingestion, and beef ingestion HIs exceeded the State criterion of 1. Thallium (not detected at concentrations exceeding its UTL) and lead (detected at concentrations exceeding its UTL in 3 of 10 samples) were identified as COCs in soil. Cadmium, copper, manganese, and mercury were identified as COCs for the produce ingestion pathways. For ingestion of beef, mercury and thallium were identified as COCs. For the Depot worker and construction worker, all noncancer HIs and cancer risks were below the criteria established by the State of Utah. Cancer risks outside Building 536 could not be quantified for most surface soil and produce pathways because none of the COPCs for these pathways has an oral slope factor for carcinogenic effects. (Table 9-11 presents the COPCs outside Building 536.)

No stressed plants or animals were observed during the qualitative habitat surveys. Thus, no imminent threat to ecological receptors appears to exist. The SERA identified eight inorganic ecoCOPCs in surface soil and four inorganic ecoCOPCs in subsurface soil with HQs above the threshold of 1 (Table 11-3). In the surface soil, three of these contaminants (lead, mercury, and thallium) have HQs greater than 10 for terrestrial plants. Lead in subsurface soil also had an HQ greater than 10 for terrestrial plants. An HQ above the threshold of 1, but below 10, indicates a potential risk to individuals rather than a risk to the population as a whole. Thus, a few of the ecoCOPCs may be a concern at SWMU 33B. Assuming an HQ of 10 as being the more realistic assessment endpoint for plant and rabbit populations, the ecoCOCs at SWMU 33B include lead (surface and subsurface soil), mercury (surface soil), and thallium (surface soil).

For SWMU 33B, because the nature and extent of potential contamination has been defined, no additional sampling is recommended. No imminent ecological risks have been identified. Residential risks exceed the criteria established by the State of Utah; however, risks for the current and projected future land use (represented by the Depot and construction worker scenarios) are below the State criteria. An SMP is recommended that outlines procedures for controlling residential and agricultural activities conducted in the site area. In addition, the SMP should address the need for corrective action of the mercury-contaminated soils. The ecoCOCs should be evaluated further as part of the installation-wide ecological risk assessment to be conducted after the future land use of the installation is determined.

Drainage Swale (SWMU 33C)—A limited number of inorganic chemicals above background UTLs and organic compounds (VOCs and SVOCs) were detected at SWMU 33C. Concentrations of both were relatively low with inorganic concentrations the same order of magnitude as their respective UTL, and organic concentrations the same order of magnitude as the analytical detection limit. No persistent source of organic contamination was detected, as confirmed by the nondetect results during the SOV survey and the limited organic compounds detected in the soils.

A human health risk assessment was conducted for surface and subsurface soil at SWMU 33C. Under residential land use, all soil pathway and beef ingestion HIs and cancer risks were below State criteria. However, lead was identified as a COC in subsurface soil due to blood lead levels exceeding the CDC target for the resident child. For the resident ingesting produce, noncancer HIs for the child and adult were above the State criterion. Cadmium and copper were identified as COCs in produce. For the Depot worker and construction worker, all noncancer HIs and cancer risks were below the State criteria. Cancer risks for some exposure pathways in the drainage swale could not be quantified because none of the COPCs for these pathways has a slope factor for carcinogenic effects. (Table 9-12 presents the COPCs for the drainage swale.)

No stressed plants or animals were observed during the qualitative habitat surveys. Thus, no imminent threat to ecological receptors appears to exist. The SERA identified two inorganic ecoCOPCs in surface soil and three inorganic ecoCOPCs in subsurface soil with HQs above the threshold of 1 (Table 11-3). No ecoCOPCs with HQs greater than 10 were identified in either surface or subsurface soil. Thus, no ecoCOCs are associated with SWMU 33C.

For SWMU 33C, because the nature and extent of potential contamination has been defined, no additional sampling is recommended. No imminent ecological threats have been identified. Residential risks exceed the criteria established by the State of Utah; however, risks for the current and projected future land use (represented by the Depot and construction worker scenarios) are below the State criteria. An SMP is recommended that outlines procedures for controlling residential and agricultural activities conducted in the site area. The SMP also could address the need for corrective action (e.g., removal of the construction debris from the swale). No plans have been made to change the current activities at the site. The concerns at SWMU 33C should be addressed in the context of the established future land use when control of the area is relinquished by DCD.

11.5 SWMU 37 – SLAG PILES AND BOMB FRAGMENTS

The Phase II RFI of SWMU 37 – Slag Piles and Bomb Fragments evaluated both Phase I and II sampling data.

SWMU 37 Pit Floor—The results of the Phase II investigation confirmed the Phase I results that inorganics and SVOCs are distributed inconsistently throughout the site area. SVOCs were detected at only one location in the pit floor surface soils during the Phase II investigation. No inorganic COPCs were identified for the pit floor surface soils. Inorganics in the subsurface soils were not detected at concentrations greater than one order of magnitude above the analytical detection limit. Cyanide, PCBs, and explosives were not detected in any of

the pit floor surface or subsurface samples. No apparent trend was identified for the inconsistently detected chemicals that are limited in their areal and vertical distribution. The site is presently inactive, and no plans have been made for conducting future activities in this area. In addition, the ash/slag piles have been removed from the site.

A human health risk assessment was conducted for surface and subsurface soil at SWMU 37. For the residential scenario, all soil pathway HIs were below the State criterion for residential land use. However, soil ingestion and dermal contact cancer risks were above the State criterion for the resident. In addition, produce ingestion HIs for the resident child, produce ingestion cancer risks, and beef ingestion cancer risks exceeded the State criteria due to PAHs. In soil, arsenic, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were identified as COCs. In produce, arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene were identified as COCs. In beef, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene were identified as COCs. For the Depot worker and construction worker, all noncancer HIs and cancer risks were below the criteria established by the State of Utah.

No stressed plants or animals were observed during the qualitative habitat surveys. Thus, an imminent threat to ecological receptors does not appear to exist. No HQs are over the threshold of 1 for any of the receptors (i.e., terrestrial plants, black-tailed jackrabbits, and golden eagles) for the ecoCOPCs unacceptable in the SWMU 37 pit floor surface soil (Table 11-3). Based on the available information, no ecological risks appear to be associated with pit floor surface soil exposures. EcoCOPCs in subsurface soil with HQs above the threshold of 1 occurred for arsenic (2.1 for terrestrial plants and 20 for black-tailed jackrabbits). An HQ above the threshold of 1, but below 10, indicates a potential risk to individuals rather than a risk to the population as a whole. Thus, arsenic is likely not of concern to plants, but may be of concern to black-tailed jackrabbits. Assuming an HQ of 10 as being the correct adjusted assessment endpoint for plant populations, arsenic in subsurface soil is the only ecoCOC at the pit floor. As previously indicated, no formal guidance is available that specifies remedial response actions relative to ecological risks. Given the depth at which some of the subsurface soil samples were collected, exposures to contaminants are expected to be less than occurred in the food chain model. Thus, no further ecological evaluation of the SWMU 37 pit floor is warranted.

At the SWMU 37 pit floor, because the nature and extent of potential contamination has been identified, no additional sampling is recommended. No imminent ecological risks have been identified. Residential risks exceed the criteria established by the State of Utah; however, risks for the current and projected future land use (represented by the Depot and construction worker scenarios) are below the State criteria. An SMP is recommended that outlines procedures for controlling residential and agricultural activities conducted in the site area. No plans have been made to change the current activities at the site. The concerns at the SWMU 37 pit floor should be addressed in the context of the established future land use when control of the area is relinquished by DCD.

SWMU 37 Slope—The northern slope of SWMU 37 was used as a disposal and detonation area for thermate bombs. Exploratory test pits indicated two separate areas of underground metal debris and bomb fragments. The eastern disposal area covers an area of approximately 12,800 square feet with an approximate subsurface volume of metal debris of 3,000 cubic yards.

The western disposal area covers an area of approximately 700 square feet with an approximate subsurface volume of metal debris of 90 cubic yards. Inorganic COPCs are distributed randomly throughout the sampled area on the northern slope, with the higher concentrations detected in the area of the identified thermate bomb fragment disposal trenches. Magnesium, the element of concern on the slope during Phase II because it is the major component of the bomb housing, exceeded its UTL primarily at 5 to 6.5 feet BLS. This sample depth is immediately below the bottom of the disposal trench. Only 2 of the 11 samples collected below this depth exceeded the magnesium UTL. The elevated magnesium appears to be confined to the area of metal debris. 2,4,6-Trinitrotoluene (TNT) was detected in only 1 of 11 surface samples and was not detected in subsurface samples.

A human health risk assessment was conducted for surface and subsurface soil at SWMU 37. For the residential scenario, noncancer HIs from exposure to soil exceeded the State criterion for both the child and adult. Barium, copper, iron, and lead were identified as soil COCs. For the food chain pathways, produce and beef ingestion HIs and produce ingestion cancer risks exceeded State criteria. Barium, cadmium, copper, iron, manganese, and TNT were identified as COCs in produce and copper and iron were identified as COCs in beef. For the Depot worker and construction worker, all noncancer HIs and cancer risks were below the criteria established by the State of Utah.

The lack of vegetation on the slope in conjunction with dead plants suggests an imminent threat to ecological receptors at the SWMU 37 slope could exist. However, the stressed area covers only approximately ¼ acre of the total 14 acres of SWMU 37. Because the stressed area is small relative to the total size of SWMU 37, it is unlikely that there would be an adverse effect to populations of ecological receptors. At the SWMU 37 slope, 12 inorganic ecoCOPCs were identified in surface soil and 9 inorganic ecoCOPCs in subsurface soil with HQs above the threshold of 1 (Table 11-3). In the surface soil, six of these metals (aluminum, barium, chromium, copper, lead, and silver) have HQs greater than 10 for terrestrial plants (ranging from 11 to 470). Surface soil HQs for aluminum, antimony, barium, and silver also exceeded 10 for jackrabbits (ranging from 41 to 1,315). In the subsurface soil, three of these metals (barium, copper, and silver) have HQs greater than 10 for terrestrial plants (ranging from 31 to 116). HQs for antimony, barium, copper, and silver in subsurface soil also exceeded 10 for jackrabbits (ranging from 36 to 293). An HQ above the threshold of 1, but below 10, indicates a potential risk to individuals rather than a risk to the population as a whole. Thus, the ecoCOPCs with HQs above 1 but below 10 are likely not of concern at the SWMU 37 slope. Assuming an HQ of 10 as being the more realistic assessment endpoint for plant and rabbit populations, the ecoCOCs at the SWMU 37 slope include aluminum, antimony, barium, chromium, copper, lead, and silver.

At the SWMU 37 slope, because the nature and extent of the potential contamination has been defined, no additional sampling is recommended. The extent of the metal debris has been delineated. A potential imminent threat to ecological receptors has been identified. Residential risks exceed the criteria established by the State of Utah; however, risks for the current and projected future land use (represented by the Depot and construction worker scenarios) are below the State criteria. An SMP is recommended that outlines procedures for controlling residential and agricultural activities conducted in the site area. The SMP also should evaluate the need for corrective action of the disposal trenches. The ecoCOCs should be evaluated further as part of the installation-wide ecological risk assessment to be conducted after the future land use of the

installation is determined. No plans have been made to change the current activities at the site. The concerns at the SWMU 37 slope should be addressed in the context of the established future land use when control of the area is relinquished by DCD.