

8.0 THE DEACTIVATION FURNACE/MERCURY CONTAMINATION AREA, SWMU 17

This section discusses the results of both the previous investigations and the current RFI for SWMU 17. Previous investigation and Phase II RFI sampling results, a contamination assessment, a human health and ecological risk assessment, and conclusions and recommendations are presented for each site within the SWMU. The soil and hydrological conditions were determined based on previous investigations and the results of this investigation.

Analytical results collected during previous and Phase II investigations are summarized in figures and tables showing locations and concentrations. Complete analytical results for this Phase II investigation (including non-detects) are presented in Appendix D.

SWMU 17 has been identified as a known releases SWMU based on previous investigations of the 29 SWMUs on TEAD-S (Ebasco 1991). The contaminant releases sites within SWMU 17 are the Mercury Contamination Spill Site, the Fuel Spill Site, and the Drum Storage Site. These sites were investigated under a Phase I RI in 1988 (Weston 1991), resulting in confirmation of soil contamination at all three sites. Groundwater was not investigated at SWMU 17 since its depth is over 100 feet, and no contamination has been detected in soils below a depth of 20 feet. Figure 8-1 provides site locations for SWMU 17.

8.1 HYDROGEOLOGIC INVESTIGATION

8.1.1 Geology

Except for a thin covering of fine-grained surface soils, the sediments in the area of SWMU 17 consist primarily of mudflow deposits. These deposits are fragments of unconsolidated and poorly graded clay-silt and sand-gravel debris ranging up to small boulder size, with sands and silts being the most common size of material. The finer surficial sand-silt mixtures reach depths of approximately 5 feet in the area, and represent sheet flow or alluvial fan lobe stream processes that have channeled across the coarser mud flow debris underlying them. Along with the unconsolidated gravels found at the site, intermittent lenses of caliche (calcium carbonate) cemented conglomeratic zones were observed. Figure 8-1 provides the site locations for SWMU 17 and shows the locations of the geologic cross sections provided in Figures 8-2 and 8-3. These cross sections were developed on the basis of soil boring lithologic logs from the Phase II RFI.

8.1.2 Hydrogeology

No groundwater data were collected during this investigation for SWMU 17. Borings were drilled to a maximum depth of 20 feet bgs, none of which encountered groundwater. Based on information from previous investigations of other SWMUs near SWMU 17, the top of the

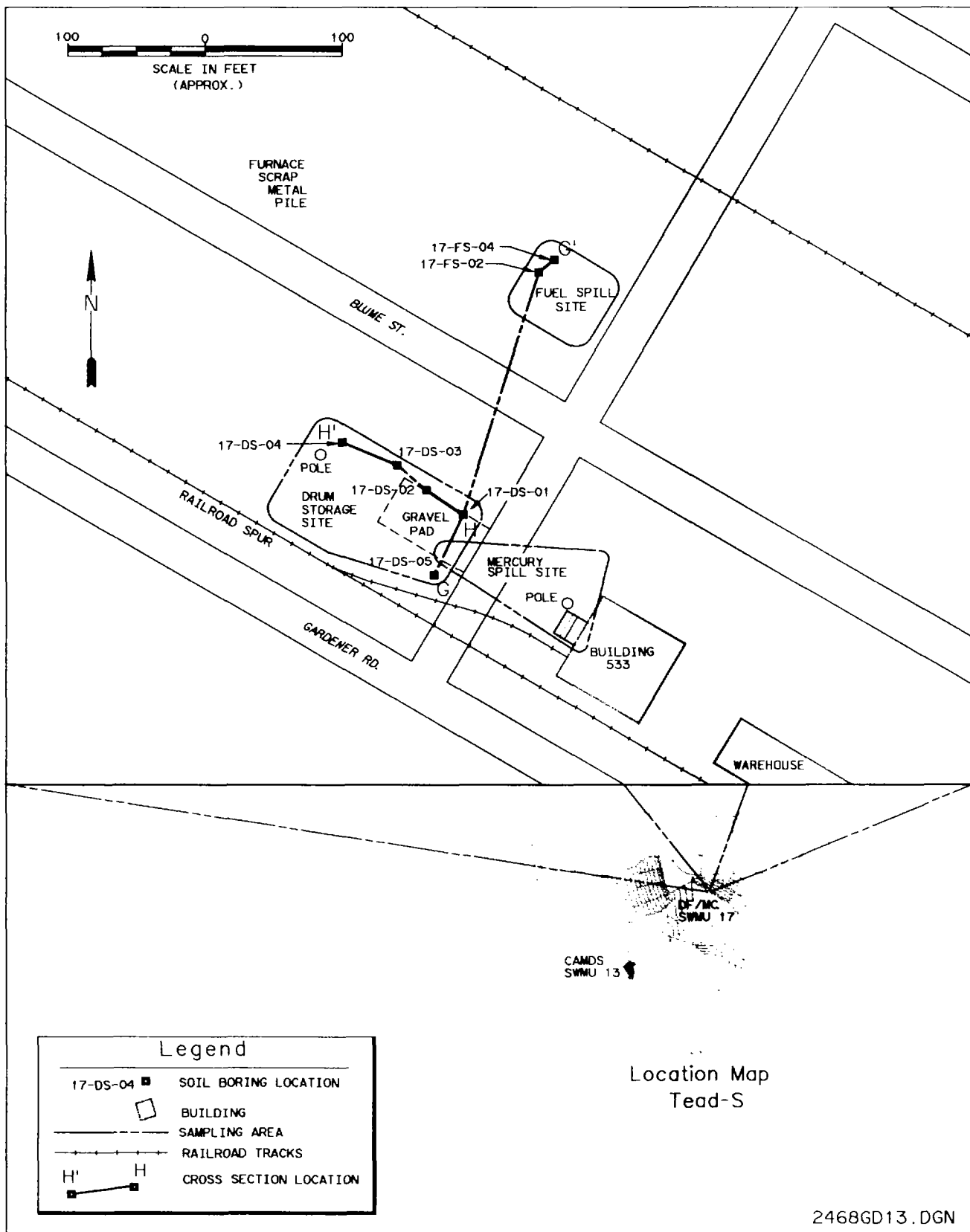


Figure 8-1. SWMU 17 Site Locations and Geologic Cross Section Support Map

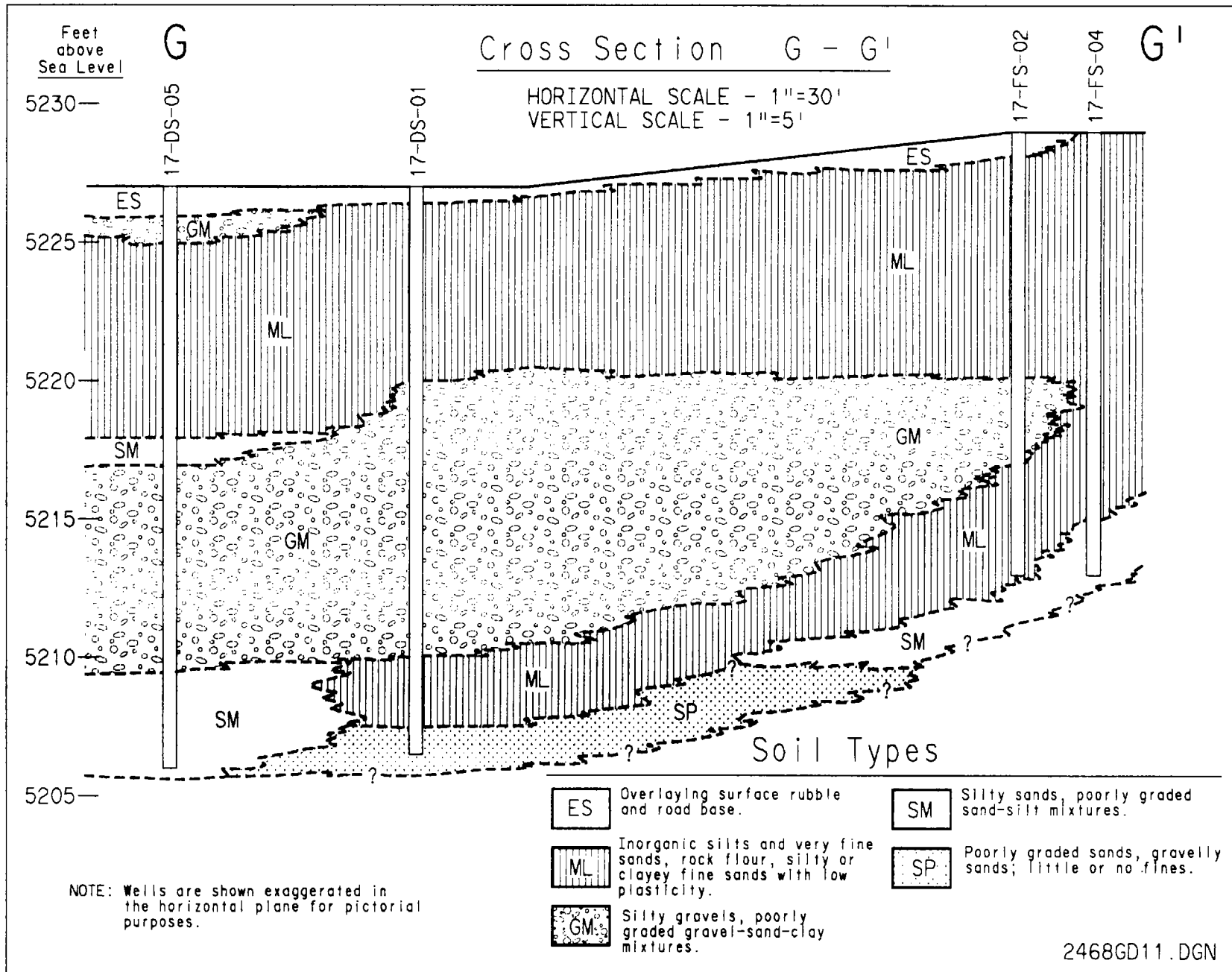


Figure 8-2. SWMU 17 Geologic Cross Section G-G'

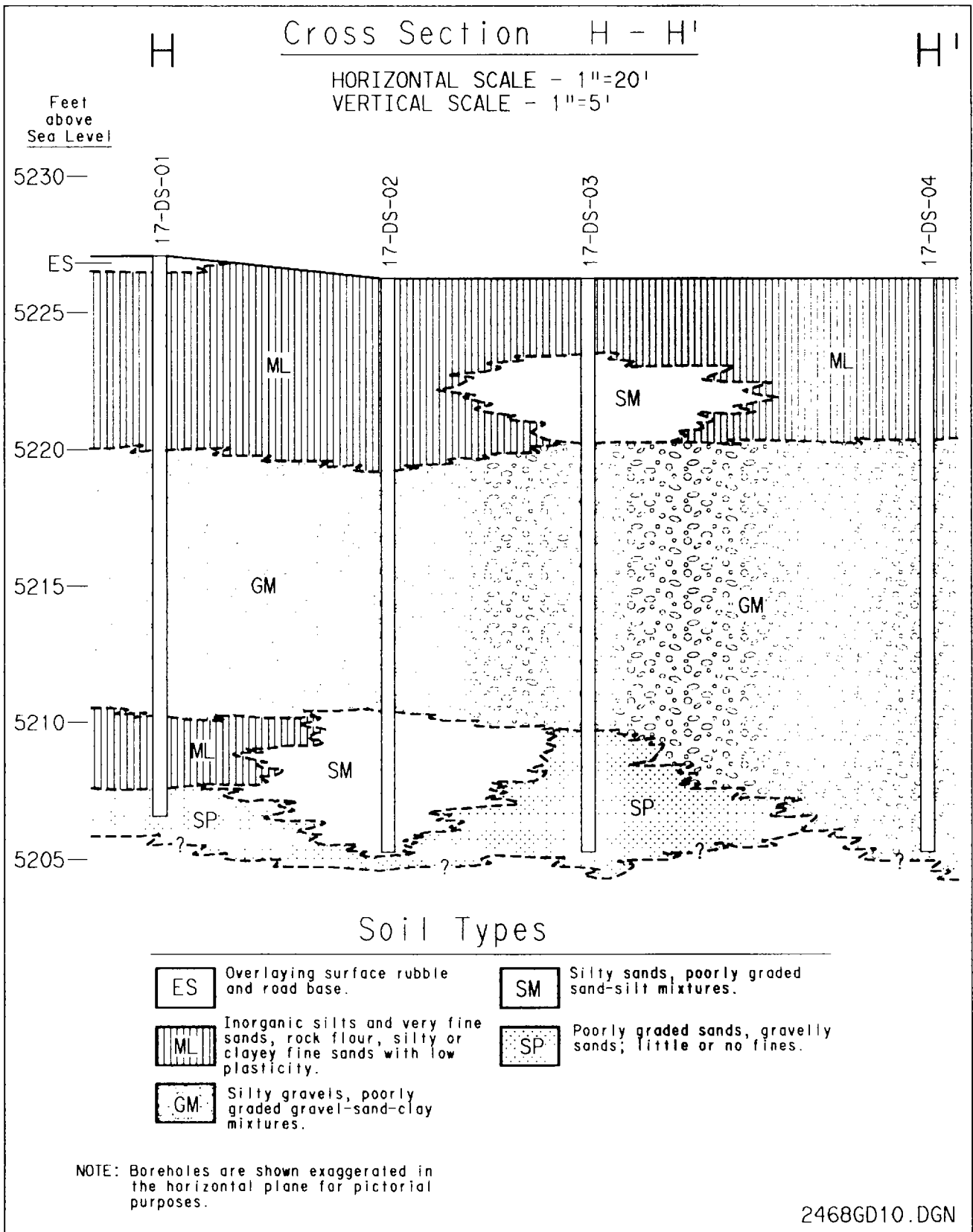


Figure 8-3. SWMU 17 Geologic Cross Section H-H'

water-bearing unit is estimated to be approximately 100 to 200 feet bgs. Groundwater flow is speculated to be generally towards the southwest beneath the SWMU 17 area, based on the regional groundwater potentiometric surface map (see Figure 3-6).

8.2 MERCURY CONTAMINATION SPILL SITE

8.2.1 Previous Sampling and Phase II RFI Sampling Results

In 1987, TEAD personnel took three soil samples within the area of the 1986 spill to confirm the presence of mercury. Although specific results are not available, the presence of mercury was confirmed. Weston (1991) and the U.S. Army Corps of Engineers (USACE) have also conducted work at this site.

Weston, 1991. Weston performed a Phase I RI at SWMU 17 in 1988 that included 23 samples from 8 locations within the Mercury Contamination Spill Site (including 1 duplicate sample). Mercury was detected in 23 of 24 samples with a concentration range of 1.81 $\mu\text{g/g}$ in sample SSMS-12 to 8,600 $\mu\text{g/g}$ in sample SSMS-04D. Explosives were also analyzed for in all samples but results were less than the reporting value. Sampling was conducted from the surface to a depth of 2.5 feet, and the corresponding results show a significant decline in mercury contamination with depth; however, horizontal extent was not defined from the Phase I RI results. Sample locations are shown in Figure 8-4. Sample analysis results from Weston are summarized by depth in Table 8-1.

U.S. Army Corps of Engineers, 1990. In 1990, the USACE initiated remediation activities for the Mercury Contamination Spill Site. In accordance with the work plans, an area 10 by 60 feet was excavated to a depth of 3.5 feet (2,100 cubic feet). The excavated soil was disposed of off-site at the USPCI landfill in Grassy Mountain, Utah. Clean fill was placed in the excavated area following confirmation sampling on the bottom of the excavation surface and at 1 foot below the excavation surface. A clean-up standard was issued by the State of Utah, Department of Health, Division of Environmental Health (Mr. Dennis R. Downs, Exec. Sec.) to the TEAD Environmental Management Office (Mr. Tom Turner) on May 18, 1990, stating that the mercury in soil clean-up value was 5.0 mg/kg (i.e., 5.0 $\mu\text{g/g}$).

The results of the confirmation sampling, the locations of which are shown in Figure 8-4, were all below the clean-up level of 5.0 $\mu\text{g/g}$, with the highest value being 2.8 $\mu\text{g/g}$ in sample C-1. The sample results are presented in Table 8-2.

Formaldehyde was also analyzed for in the six confirmation samples but it was not detected in any of the samples. Following the analysis, TEAD requested closure of the Mercury Contamination Site and modification of the Chemical Stockpile Disposal Plant permit from the State of Utah, Department of Environmental Quality, Division of Solid and Hazardous Waste (Mr. Dennis R. Downs, Exec. Sec.). The closure approval was received September 11, 1991. As a result, no additional investigation activity was performed at the Mercury Contamination Spill Site during the Phase II RFI.

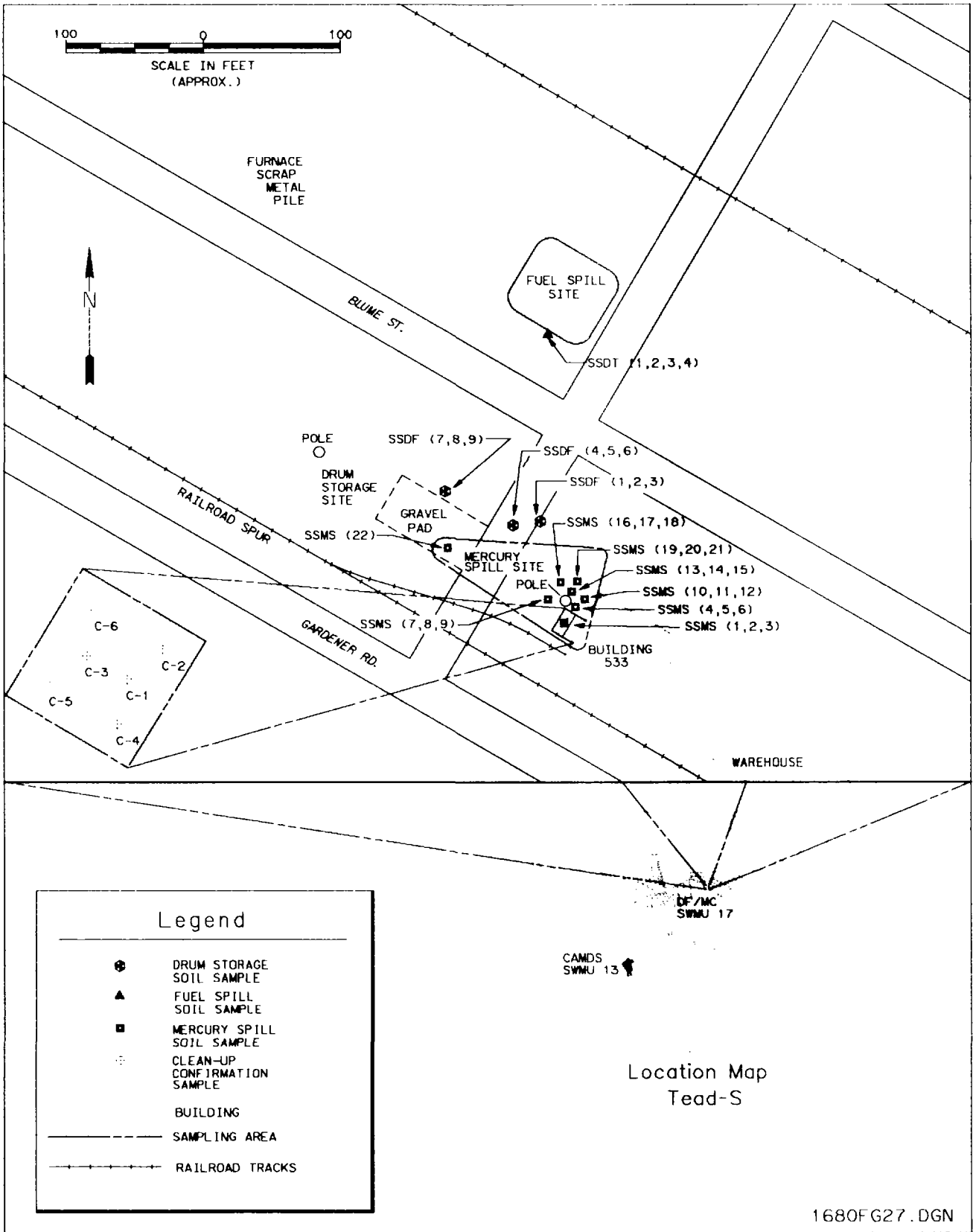


Figure 8-4. SWMU 17 Previous Investigation Sample Locations

Table 8-1. SWMU 17 Soil Sample Results for the Mercury Spill Site, RI, 1991

Sample No.	Depth (ft)	Mercury $\mu\text{g/g}$	Explosives $\mu\text{g/g}$
SSMS-01	0 - 0.5	3.1	LT
SSMS-02	0.5 - 1.5	2.6	LT
SSMS-02D	0.5 - 1.5	3.4	LT
SSMS-03	1.5 - 2.5	2.0	LT
SSMS-04	0 - 0.5	6,000	LT
SSMS-04D	0 - 0.5	8,600	LT
SSMS-05	0.5 - 1.5	350	LT
SSMS-06	1.5 - 2.5	37	LT
SSMS-07	0 - 0.5	1,600	LT
SSMS-08	0.5 - 1.5	54	LT
SSMS-09	1.5 - 2.5	5.1	LT
SSMS-10	0 - 0.5	3.42	LT
SSMS-11	0.5 - 1.5	2.26	LT
SSMS-12	1.5 - 2.5	1.81	LT
SSMS-13	0 - 0.5	4,200	LT
SSMS-14	0.5 - 1.5	150	LT
SSMS-15	1.5 - 2.5	7.1	LT
SSMS-16	0 - 0.5	180	LT
SSMS-17	0.5 - 1.5	46	LT
SSMS-18	1.5 - 2.5	9.6	LT
SSMS-19	0 - 0.5	1.9	LT
SSMS-20	0.5 - 1.5	1.36	LT
SSMS-21	1.5 - 2.5	2.76	LT
SSMS-22	0 - 0.5	LT	LT

Note.—D = Duplicate sample. LT = Less than reporting limit.

Table 8-2. SWMU 17 Mercury Confirmation Sample Results

Sample	Mercury ^(a) ($\mu\text{g/g}$)
C-1	2.8
C-2	2.1
C-3	2.0
C-4	ND ^(b)
C-5	1.0
C-6	0.3

^aMercury concentration represents an average of two sample results at each of the six sample locations.

^bNot detected.

8.2.2 Nature and Extent of Contamination

Confirmation sampling indicated that pre-existing mercury contamination at this site has been remediated to below the regulatory clean-up level of $5.0 \mu\text{g/g}$. State of Utah approval of the remediation of this area was received September 11, 1991. No Phase II RFI activities were conducted at this site. There are no COPCs at this site and, therefore, a human health risk assessment was not conducted.

8.2.3 Risk Assessment Results

8.2.3.1 Baseline Human Health Risk Assessment

Remedial action at this site effectively reduced contaminant levels to below the established clean-up levels. Therefore, this site was not evaluated in the human health risk assessment.

8.2.3.2 Ecological Risk Assessment

Remedial action at this site effectively reduced contaminant levels to below the established clean-up levels. Therefore, this site was not evaluated in the ecological assessment.

8.2.4 Conclusions and Recommendations

In 1990-91, the Mercury Contamination Spill Site was remediated to residual levels of mercury in soil that are less than $5.0 \mu\text{g/g}$. The State of Utah approved the closure at this site on September 11, 1991. As a result of these remedial activities, this site was not included in

the field investigations supporting this Phase II RFI. Additionally, a CMS is not necessary at this site, as closure was approved.

8.3 FUEL SPILL SITE

8.3.1 Previous Sampling and Phase II RFI Sampling Results

Previous investigations at the Fuel Spill Site were conducted by Weston (1991). Rust E&I also investigated this site as part of the Phase II RFI.

Weston, 1991. During the Phase I RI at SWMU 17, Weston took 4 samples at 1 location (SSDT 1,2,3,4) within the 20 ft² stained area where the above-ground diesel tank was formerly located (see Figure 8-4). Sample intervals were from 0 to 1 foot, 1 to 2 feet, 2 to 3.5 feet, and 4 to 5 feet in depth. The results of the samples indicated TPHC contamination decreasing with depth from 28,000 µg/g at the 0-to-1-foot level down to 480 µg/g at the 4-to-5-foot level. The only explosive compound detection was nitrobenzene (0.86 µg/g) in the 0-to-1-foot sample.

Rust E&I, 1991. In 1991, Rust E&I performed a Phase II RFI at the Fuel Spill Site. The investigation called for 8 soil boring locations within the fuel spill area, 15 to 17 feet deep, with 5 sample intervals at 0 to 1 foot, 4 to 5 feet, 9 to 10 feet, 12 to 13 feet, and 15 to 16 feet (Figure 8-5). In all areas of SWMU 17, some deviation from the work plans was required because of the inability to drill to the required depth. Subsurface metal (e.g., nails, scrap, etc.) was encountered and, therefore, not all of the borings could be drilled to the total depth because of health and safety concerns (i.e., potential for UXO). Samples were taken from these borings at the depth intervals that could be reached. These deviations are further detailed below.

All samples at the Fuel Spill Site were analyzed for VOCs, SVOCs, and TPHCs. Samples collected at 0-to-1-foot and 4-to-5-foot intervals were also analyzed for explosives. One sample, 17-FS-01-1, was analyzed by TCLP methods for VOCs, SVOCs, and explosives. Table 8-3 summarizes the results of these analyses, and the complete analytical data for the Fuel Spill Site are presented in Appendix D.

A grid for the Fuel Spill Site soil borings was laid out in the field by Rust E&I, in consultation with the USAEC project geologist. An attempt was made to drill all specified locations. However, some holes could not be cleared below 4 feet by the ordnance locators, in which case the holes were completed at the 4-foot depth. Offset holes were not attempted. The subsurface is apparently strewn with metal. Table 8-4 outlines the changes made during the drilling of these soil borings.

Ultraviolet fluorescence tests were performed on the soil samples collected from soil borings at four depth intervals. The results from these tests (see Appendix C) were compared with the laboratory analytical results performed on the same samples. Observations with the ultraviolet

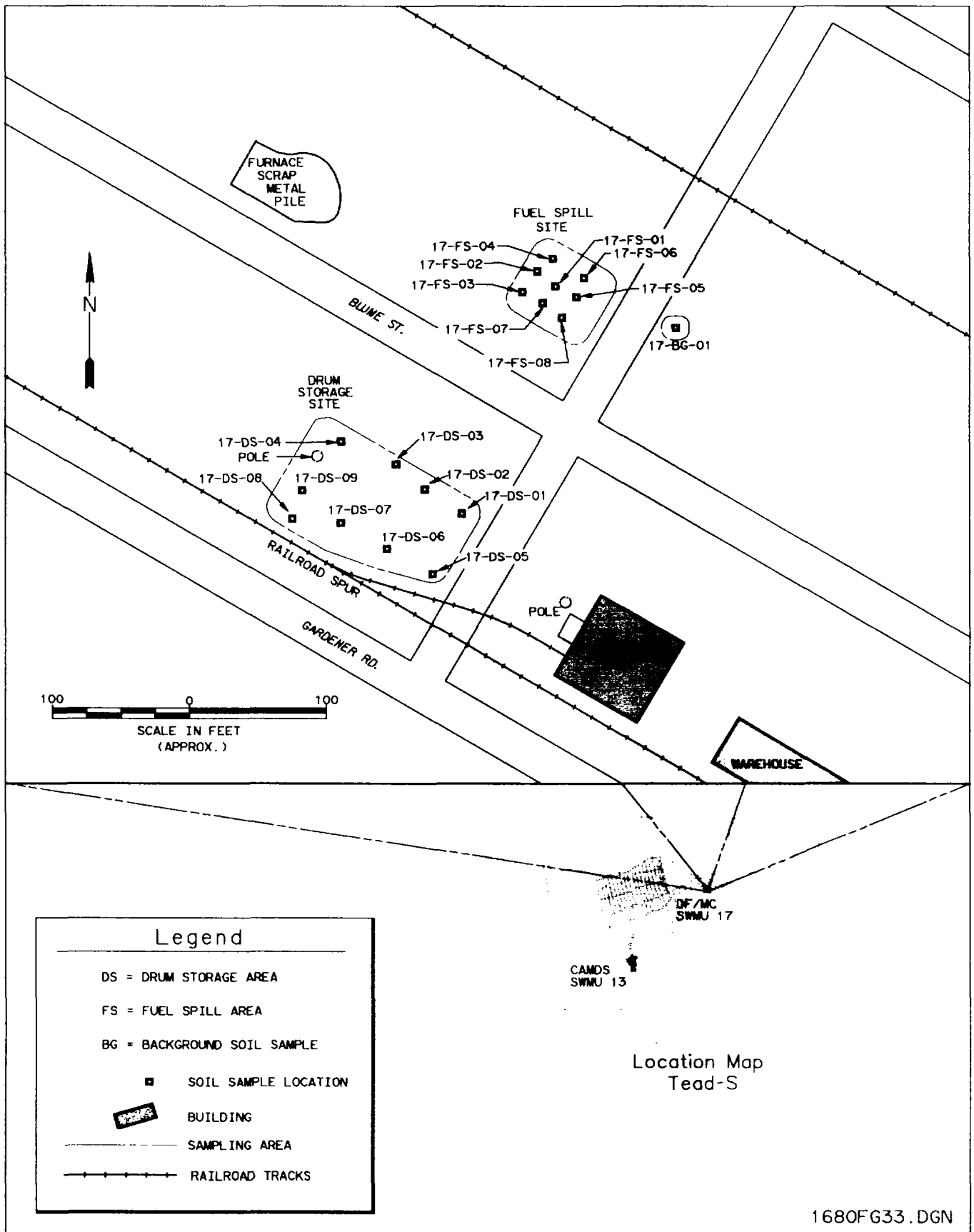


Figure 8-5. SWMU 17 Fuel Spill and Drum Storage Site Sample Locations, Phase II RFI

Table 8-3. SWMU 17 Soil Sample Results for the Fuel Spill Site, Phase II RFI

Sample ID	Depth	VOC µg/g)							SVOC µg/g)							TPHC (µg/g)	pH	TOC (µg/g)	VOC-TPHC (µg/l)		
		1,1,1,2-Tetrachloroethane	1,2-Dimethylbenzene	1,3-Dimethylbenzene	Benzene	Ethylbenzene	Methylene Chloride	Toluene	2-Methylnaphthalene	Acenaphthene	Anthracene	Bis (2-Ethylhexyl) Phthalate	Fluorene	N-Nitroso Diphenylamine	Naphthalene					Palmitic Acid	Phenanthrene
17FS-01-1	1	ND ^{a)}	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10.5	17000	4.5
17FS-03-1	1	ND	0.026	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.021	ND	ND	ND	ND	ND	ND
17FS-04-1	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.58	ND	ND	ND	ND	ND	ND	ND	ND	ND
17FS-04-5	16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.45	ND	ND	ND	ND	ND	ND	ND	ND	ND
17FS-05-5	16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
17FS-08-1	0.5	ND	ND	ND	ND	ND	DS ^{b)}	0.015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
17FS-02-1	1 ^{c)}																				
17FS-02-2	5																				
17FS-02-3	10																				
17FS-02-4	12																				
17FS-02-5	16																				
17FS-04-2	5																				
17FS-04-3	10																				
17FS-04-4	13																				
17FS-05-1	1																				
17FS-05-2	5																				
17FS-05-3	10																				
17FS-05-4	12																				
17FS-06-1	1																				
17FS-07-1	1																				

^aND=Analyte not detected at or above the CRL, SRL, or MDL.

^b.. = Analysis not performed.

^cDS=Data screened out as described in Section 6

^dThe following sample IDs, where there were no detected contaminants, are included in the remainder of this table. A comprehensive listing of all the data is presented in Appendix D.

Table 8-4. SWMU 17 Deviations of Borehole Depths, Phase II RFI

Borehole Number	Proposed Depth (ft)	Actual Depth (ft)
17FS-01	15-17	4
17FS-02	15-17	16
17FS-03	15-17	4
17FS-04	15-17	16
17FS-05	15-17	16
17FS-06	15-17	4
17FS-07	15-17	4
17FS-08	15-17	4
17DS-01	15-17	21
17DS-02	15-17	21
17DS-03	15-17	21
17DS-04	15-17	21
17DS-05	15-17	21
17DS-06	15-17	4
17DS-07	15-17	4
17DS-08	15-17	4
17DS-09	15-17	4

screen test indicated the presence of TPHCs. The corresponding laboratory analytical data showed no TPHCs to be present; thus, no correlation could be made between the two sets of data. Fluorescence testing was discontinued based on the conclusion that no correlation could be made.

The 17FS-01-1 sample was also analyzed for soil pH and TOC and yielded a soil pH value of 10.5 and a TOC value of 17,000.0 $\mu\text{g/g}$, at the 0-to-1 foot depth.

8.3.2 Nature and Extent of Contamination

TPHCs and explosives were not detected in any of the soil samples. Of the reportable values of SVOCs, bis(2-ethylhexyl)phthalate was detected in two samples (17FS-04-1 and 17FS-04-5) at the 1-foot and 15.5-foot intervals. The reportable values were 0.580 and 0.450 $\mu\text{g/g}$, respectively. This analyte is recognized as a common laboratory contaminant by the USEPA

and may not indicate contamination within the soils. The 0.5-foot interval from 17FS-03-1 contained palmitic acid at 0.210 $\mu\text{g/g}$. Both of the SVOCs are evaluated further in the risk assessment section that follows.

Two VOCs were detected at very low concentrations in the near surface samples from 17FS-03-1 and 17FS-08-1. The concentrations were 0.026 $\mu\text{g/g}$ for 1,2-dimethylbenzene (17FS-03-1) and 0.015 $\mu\text{g/g}$ for toluene (17FS-08-1). These low concentrations, in only two samples, are not considered indicative of soil contamination; however, the risk associated with these VOCs was evaluated in the risk assessment.

The results for the TCLP analysis conducted on the 0-to-1-foot sample from 17-FS-01-1 showed chloroform at 4.50 $\mu\text{g/L}$. This concentration is well below the regulatory level of 6.0 mg/L codified in 40 CFR 261.20 and, thus, this chemical was not evaluated further in the human health risk assessment.

8.3.3 Risk Assessment Results

8.3.3.1 Baseline Human Health Risk Assessment

This section presents the results of the sample data screening approach previously described in Section 6.1.1 that led to (1) the selection of the COPCs, (2) the exposure pathways that are labeled in the conceptual site model as being complete, (3) the exposure point concentrations in each respective environmental medium for those COPCs that have published health criteria, and (4) the carcinogenic and noncarcinogenic risk estimates for each receptor population under current and future land use scenarios.

This section of the report evaluates exposure to COPCs detected in site soils as well as those contaminants measured or modeled in various media from SWMU-wide or depot-wide sources. The direct soil-contact pathway (e.g., ingestion and dermal exposure) is associated with site-specific chemicals. Similarly, ingestion of homegrown produce by future on-site residents is based on those contaminants (if any) measured in surface soil within the site. Site-specific contaminants in soil (if any) are also used as model inputs to the air pathway for current off-site residents and the future on-site construction worker.

Current on-site workers and future on-site residents, however, are assumed to be potentially exposed to SWMU-wide chemicals in air (i.e., those chemicals detected in surface media at all of the sites evaluated within SWMU 17). Ingestion of beef and dairy products by future on-site residents is based on modeling contaminants detected in depot-wide surface soils; cattle are assumed to graze at contaminated sites within SWMU 13 and SWMU 17. Thus, the total cancer risk and noncarcinogenic hazards to the future on-site resident (adult and child) presented in the section below include those contributions associated with exposures to SWMU-wide contamination in air and to depot-wide chemicals in beef and milk.

Table 8-5. SWMU 17 Summary of Concentrations of Chemicals of Potential Concern in Surface Soil at the Fuel Spill Site, Phase II RFI

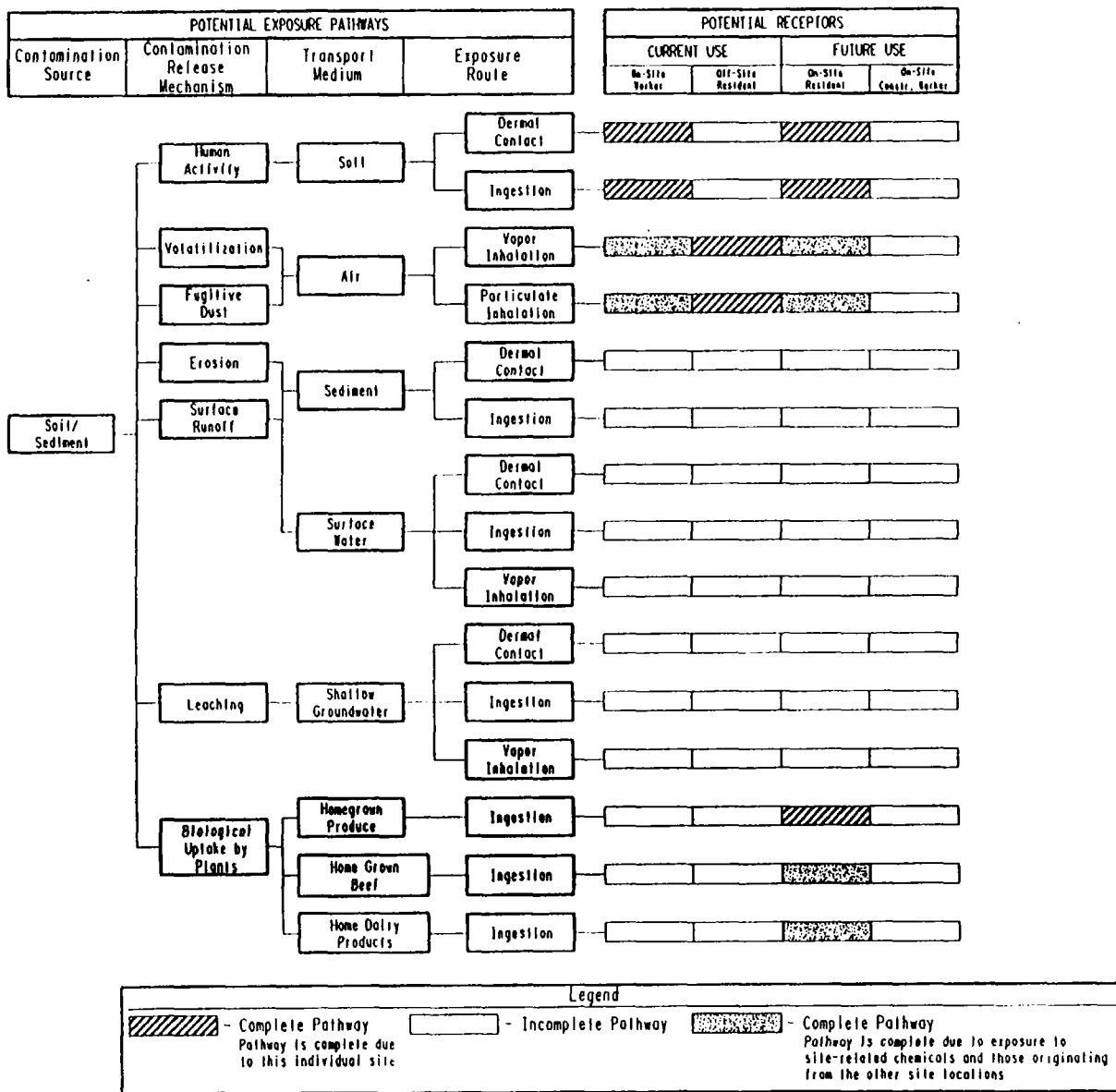
Chemical	Background Concentration (mg/kg)	Frequency of Detection	Range of Detects (mg/kg)	Arithmetic Mean Concentration (mg/kg)	95% UCL (mg/kg)
<i>Surface Soil</i>					
Bis(2-ethylhexyl)phthalate	NA	1/7	0.58	0.25	0.36
1,2-Dimethylbenzene	NA	1/8	0.0258	0.009	0.014
Toluene	NA	1/3	0.015	0.008	0.018

Notes.—NA denotes Not Applicable. Palmitic acid was detected in the surface soil but was not evaluated further since it lacks USEPA Health Criteria. Bold type designates the exposure point concentration selected for these media.

8.3.3.1.1 Chemicals of Potential Concern. The COPCs in the surface soil (0 to 1.0 foot) at this site include bis(2-ethylhexyl)phthalate, palmitic acid, 1,2-dimethylbenzene, and toluene. Palmitic acid lacks USEPA Health Criteria and, thus, it was not evaluated further. Palmitic acid is a skin irritant and a questionable carcinogen. However, since it was detected in only one sample as a TIC, it is unlikely to be of concern at this site. The soil concentrations of these chemicals are summarized in Table 8-5 above.

8.3.3.1.2 Complete Exposure Pathways. The pathways assumed complete at this location are shown on the conceptual site model in Figure 8-6. Exposure by current on-site workers and potential future on-site residents from ingestion of and dermal contact with COPCs measured in surface soil was evaluated. This site does not contain site-related chemicals in subsurface soil (1.0 to 10.0 feet) and, thus, exposure by the future construction worker was not evaluated. Exposure from inhalation of VOC and fugitive dust emissions by current on-site workers, off-site residents, and potential future on-site residents was evaluated. Chemicals measured in surface soil were assumed to be available for plant uptake. Therefore, exposure by potential future on-site residents from consumption of homegrown produce including vegetables grown at this site was evaluated. These residents were also evaluated for exposure to depot-wide chemicals in beef and milk.

8.3.3.1.3 Exposure Point Concentrations. Exposures from all complete pathways by all the identified receptors were estimated based on the exposure point concentrations in Table 8-6. These values are based on soil chemical concentrations measured in surface soil within this site. In addition, it should be noted that the approach of evaluating exposures from inhalation of average chemical concentrations over SWMU 17 by the on-site worker during daily visits to this site included chemicals that were not found in the surface soil at this location but instead originated from the other Phase II RFI site (i.e., the Drum Storage Site) within this SWMU. Similarly, exposure by potential future on-site residents from ingestion of chemicals in beef and milk derived as area averages using data collected from SWMUs 13 and 17 was also



17 ES 2468001 DGH
RF 2468004 DGH

Figure 8-6. SWMU 17 Potential Human Exposure Pathway Conceptual Model for the Fuel Spill Site, Phase II RFI

Table 8-6. SWMU 17 Exposure Point Concentrations for the Chemicals of Potential Concern at the Fuel Spill Site, Phase II RFI

Receptor	Chemical	EXPOSURE POINT CONCENTRATIONS								
		Air ^(a) (mg/m ³)	Soil (mg/kg)	Milk ^(b) (mg/L)	Beef ^(b) (mg/g)	Potato ^c (mg/g)	Tomato (mg/g)	Carrot (mg/g)	Lettuce (mg/g)	Beans (mg/g)
On-Site Worker	Arsenic	9.29E-08	---	---	---	---	---	---	---	---
	Chromium	6.26E-08	---	---	---	---	---	---	---	---
	Copper	2.38E-07	---	---	---	---	---	---	---	---
	Lead	5.60E-07	---	---	---	---	---	---	---	---
	Zinc	2.25E-07	---	---	---	---	---	---	---	---
	Bis(2-ethylhexyl)phthalate	1.80E-10	0.36	---	---	---	---	---	---	---
	1,2-Dimethylbenzene	1.15E-10	0.014	---	---	---	---	---	---	---
	Toluene	2.55E-10	0.015	---	---	---	---	---	---	---
Off-Site Resident	Bis(2-ethylhexyl)phthalate	1.33E-13	---	---	---	---	---	---	---	---
	1,2-Dimethylbenzene	8.50E-14	---	---	---	---	---	---	---	---
	Toluene	1.85E-13	---	---	---	---	---	---	---	---
Future On-Site Resident	Arsenic	7.43E-07(1.49E-06)	---	9.8E-08	1.63E-09	---	---	---	---	---
	Beryllium	---	---	9.32E-11	3.99E-11	---	---	---	---	---
	Chromium	5.00E-07(1.0E-06)	---	7.65E-08	4.0E-09	---	---	---	---	---
	Copper	1.91E-06(3.81E-06)	---	4.41E-05	1.13E-07	---	---	---	---	---
	Lead	4.48E-06(8.96E-06)	---	1.55E-07	8.16E-11	---	---	---	---	---
	Mercury	---	---	1.03E-09	1.26E-11	---	---	---	---	---
	Nickel	---	---	8.52E-08	7.29E-09	---	---	---	---	---
	Nitrate	---	---	NA	NA	---	---	---	---	---

Table 8-6. SWMU 17 Exposure Point Concentrations for the Chemicals of Potential Concern at the Fuel Spill Site, Phase II RFI (continued)

Receptor	Chemical	EXPOSURE POINT CONCENTRATIONS								
		Air ^(a) (mg/m ³)	Soil (mg/kg)	Milk ^(b) (mg/L)	Beef ^(b) (mg/g)	Potato ^c (mg/g)	Tomato (mg/g)	Carrot (mg/g)	Lettuce (mg/g)	Beans (mg/g)
Future On-Site Resident (cont.)	Uranium	---	ND	2.00E-09	7.71E-12	---	---	---	---	---
	Zinc	1.80E-06(3.6E-06)	ND	4.63E-03	1.78E-05	---	---	---	---	---
	Bis(2-ethylhexyl)phthalate	2.16E-09(4.68E-09)	0.36	1.24E-09	1.51E-12	6.5E-06	9.4E-07	6.5E-06	7.9E-07	4.4E-06
	1,2-Dimethylbenzene	1.35E-09 (2.95E-09)	0.014	3.49E-12	4.25E-15	3.0E-06	5.1E-07	3.0E-06	4.3E-07	2.4E-06
	4-Methylphenol	---	ND	4.07E-10	4.96E-13	---	---	---	---	---
	Methyl isobutyl ketone	---	ND	6.5E-12	7.92E-15	---	---	---	---	---
	Toluene	3.05E-09(6.50E-09)	0.015	2.48E-12	3.02E-15	2.3E-06	9.2E-07	2.3E-06	7.7E-07	4.3E-06

Notes.—NA denotes Not Available. ND denotes chemical was not detected in site soil. "---" indicates not applicable.

^aAir chemical concentrations represent average or maximum values over SWMU 17. Value in parenthesis represents that for child.

^bMilk and beef concentrations were derived to evaluate exposure to potential future on-site residents. These concentration estimates represent average values based on data collected at SWMUs 13 and 17.

^cVegetable chemical concentrations are based on corresponding soil concentrations.

evaluated. Therefore, Table 8-6 also includes chemicals that contribute to overall exposure, but were not detected within the Fuel Spill Site soils.

8.3.3.1.4 Risk Estimates. The receptor populations evaluated at this site include the current on-site worker, off-site resident (adult and child), and the potential future on-site resident (adult and child). Cancer risks and noncarcinogenic hazards to these receptor populations were estimated based on exposure to chemicals in surface soil and air, and in homegrown products for the on-site resident. The results of this evaluation under current and future land use are presented below. These results are also summarized for each exposure pathway in Tables 8-7 and 8-8. Actual risk calculations are presented in Appendix H. Tables 8-7 and 8-8 show in bold font those risks and hazards which are site specific (i.e., related to chemicals detected specifically in this site's soil).

Current Land Use

Cancer risk to the current on-site worker from exposure to chemicals in air and surface soil was estimated to be $1.44\text{E-}07$, and the noncarcinogenic hazard to this receptor was estimated to be $5.92\text{E-}03$. Contribution from this location to the total cancer risks to the off-site adult and child residents could not be estimated because of the lack of USEPA Health Criteria for chemicals associated with the complete exposure pathways. Noncarcinogenic hazards to the current off-site adult and child residents were $4.06\text{E-}12$ and $1.42\text{E-}11$, respectively.

Future Land Use

Total cancer risks to the potential future on-site adult and child from exposure to chemicals associated with this site soil and vegetables, from exposure to SWMU-wide chemicals in air, and from exposure to depot-wide chemicals in beef and milk were estimated to be $3.68\text{E-}06$ and $5.06\text{E-}06$, respectively. Total noncarcinogenic hazards to these receptors were estimated to be $1.23\text{E-}01$ and $8.58\text{E-}01$, respectively.

8.3.3.1.5 Conclusions. The results of the human health risk assessment under the current land use exposure scenario at this site indicate that the estimated cancer risk to the on-site worker of $1.44\text{E-}07$ is below the $1\text{E-}06$ State of Utah recommended threshold limit of allowable risk. Noncarcinogenic hazards to all receptors associated with this site under current land use conditions were found to be well below the State of Utah recommended value of 1.

The results of the human health risk assessment under future land use conditions indicate that the estimated total cancer risks to the potential future on-site adult and child resident of $3.68\text{E-}06$ and $5.06\text{E-}06$, respectively, exceed the recommended threshold limit of allowable risk. Total noncarcinogenic hazards to the potential future on-site adult and child resident of 0.12 and 0.86, respectively, were found to be below the State of Utah recommended value of 1.

Inhalation of chromium and arsenic dispersed from surface soils at Drum Storage Site is responsible for all of the total air pathway risks to the future on-site resident.

Table 8-7. SWMU 17 Summary of Carcinogenic Risks for the Fuel Spill Site, Phase II RFI

Potential Exposure Pathways					
Environmental Medium	Potential Exposure Route	Current Use		Future Use	
		On-Site Worker ^(a)	Off-Site Resident Adult (Child)	Construction Worker	On-Site Resident Adult (Child) ^(b)
Soil	Dermal Contact	NE	NA	NA	NE
	Ingestion	4.40-E-10	NA	NA	2.69E-09(5.52E-09)
Air	Vapor Inhalation	NE	NE	NA	NE
	Particulate Inhalation	1.44E-07	NE	NA	3.57E-06 ^(c) (5.00E-06) ^(c)
Homegrown Produce	Ingestion	NA	NA	NA	1.04E-07(5.44E-08)
Homegrown Beef	Ingestion	NA	NA	NA	1.35E-09(5.55E-10)
Homegrown Dairy Products	Ingestion	NA	NA	NA	5.73E-10(6.54E-10)
Total Cancer Risk		1.44E-07	NE	NA	3.68E-06(5.06E-06)

Notes.—NA denotes not applicable. NE denotes not evaluated due to lack of USEPA Health Criteria for site-related chemicals within this pathway. Bold type designates site-specific risks (i.e., those potential risks that are attributed to chemicals detected at this site).

^aExposure to workers was evaluated based on the time spent at each site during assumed daily visits to each site within SWMU 17. Exposure to airborne chemicals was evaluated based on chemicals measured in surface soil within this SWMU. The concentrations used for this medium represent SWMU-wide values. Therefore, even if site-specific contamination is absent from surficial soil, exposure from inhalation of particulates and vapors from other sites was assumed to occur.

^bBeef and milk chemical concentrations represent depot-wide values for TEAD-S. Therefore, the future resident at each site may be exposed to site-specific chemicals and also to those associated with other site locations within SWMU 13 and 17.

^cInhalation of chromium and arsenic dispersed from surface soils at the Drum Storage Site is responsible for all of the total air pathway risks.

Table 8-8. SWMU 17 Summary of Noncarcinogenic Hazards for the Fuel Spill Site, Phase II RFI

Potential Exposure Pathways					
Environmental Medium	Potential Exposure Route	Current Use		Future Use	
		On-Site Worker ^(a)	Off-Site Resident Adult (Child)	Construction Worker	On-Site Resident Adult (Child) ^(b)
Soil	Dermal Contact	1.53E-08	NA	NA	5.16E-08(3.05E-05)
	Ingestion	4.42E-06	NA	NA	2.48E-05(2.30E-04)
Air	Vapor Inhalation	2.36E-10	4.42E-13(1.52E-12)	NA	7.29E-09(5.44E-08)
	Particulate Inhalation	5.92E-03	3.62E-12(1.27E-11)	NA	1.22E-01(8.56E-01)
Homegrown Produce	Ingestion	NA	NA	NA	8.86E-04(7.01E-04)
Homegrown Beef	Ingestion	NA	NA	NA	8.30E-05(1.70E-04)
Homegrown Dairy Products	Ingestion	NA	NA	NA	1.57E-04(8.97E-04)
Total Hazard		5.92E-03	4.06E-12(1.42E-11)	NA	1.23E-01(8.58E-01)

Notes.—NA denotes not applicable. **Bold type designates site-specific hazards** (i.e., those potential hazards that are attributed to chemicals detected at this site).

^aExposure to workers was evaluated based on the time spent at each site during assumed daily visits to each site within SWMU 17. Exposure to airborne chemicals was evaluated based on chemicals measured in surface soil within this SWMU. The concentrations used for this medium represent SWMU-wide values. Therefore, even if site-specific contamination is absent from surficial soil, exposure from inhalation of particulates and vapors from other sites was assumed to occur.

^bBeef and milk chemical concentrations represent depot-wide values for TEAD-S. Therefore, the future resident at each site may be exposed to site-specific chemicals and also to those associated with other site locations within SWMU 13 and 17.

In summary, there are no significant risks/hazards which can be attributed to chemicals detected specifically in media at this site. The potentially significant risks/hazards associated with future on-site residents (via the air pathway as summarized above) are related to chemicals detected at the Drum Storage Site.

8.3.3.2 Ecological Risk Assessment

8.3.3.2.1 Site Characterization. The ecological assessment for the Fuel Spill Site included a survey of vegetation and wildlife, and a qualitative habitat evaluation. This assessment did not include collection of either vegetation or wildlife samples for analysis. Human activity at this site is frequent. The potential wildlife inhabitants include small and large mammals, reptiles, birds, and several of the raptor species. There is no indication that this area is a critical habitat for any endangered or threatened species. Species of vegetation and wildlife that have been observed in the vicinity of the Fuel Spill Site are presented in Table 8-9.

No evidence of surface water was observed during the field investigation. It is unlikely that significant surface water ever accumulates on this site as the result of storm episodes or snow melt.

8.3.3.2.2 Chemicals of Potential Concern. The potential ecological COPCs in Fuel Spill Site surface soil include Bis(2-ethylhexyl)phthalate, palmitic acid, chloroform, 1,2-dimethylbenzene, and toluene. Palmitic acid was not evaluated because of the lack of ecological risk data.

8.3.3.2.3 Results of Risk Characterization. Table 8-10 presents HQs calculated for the Fuel Spill Site. All HQs, except for possible inhalation of volatile organics by the deer mouse, are less than the target endpoint of 1. The indicated deer mouse HQ of approximately 6 for inhalation of chloroform is based upon a single TCLP analysis. A very conservative method was used to derive inhalation concentrations as discussed in Section 6.2.5.3.5. Further, the half-life of chloroform in soil is 180 days (Howard 1991) so that existing concentrations of this volatile organic are likely much less than that measured in 1991. The calculated HQs are thus highly conservative.

8.3.3.2.4 Conclusions. Results indicate that no adverse impacts to the key receptor populations or to the habitat should occur at the Fuel Spill Site.

8.3.4 Conclusions and Recommendations

COPCs associated with the Fuel Spill Site are VOCs and SVOCs. The soil borings drilled during the 1991 field effort identified very low concentrations of VOCs and SVOCs in the near surface soils.

Table 8-9. SWMU 17 Vegetation and Wildlife Inventory at the Fuel Spill Site,
Phase II RFI

Scientific Name	Common Name
VEGETATION SPECIES	
<i>Bromus tectorum</i>	Cheatgrass
<i>Atriplex confertifolia</i>	Shadscale
<i>Chrysothamnus nauseosus</i>	Tall rabbitbrush
<i>Artemisia tridentata</i>	Big sagebrush
<i>Grindelia aquarrosa</i>	Gumweed
<i>Sitanion hystrix</i>	Bottlebrush squirreltail grass
WILDLIFE SPECIES	
<i>Bubo virginianus</i>	Great horned owl
<i>Odocoileus hemionus</i>	Mule deer
<i>Antilocapra americana</i>	Pronghorn antelope
<i>Leupus californicus</i>	Black-tailed jackrabbit
<i>Pituophis melanoleucus</i>	Bullsnake
<i>Peromyscus maniculatus</i>	Deer mouse

Table 8-10. Hazard Quotients for Fuel Spill Site

Analyte Name	Soil EPC (mg/kg)	Water EPC (mg/L)	Air EPC (mg/m ³)	ABS	American Robin			Golden Eagle			Deer Mouse			Mule Deer			Total										
					Soil Ingestion	Dermal Contact with Soil	Dietary Ingestion	Water Ingestion	Total	Soil Ingestion	Dermal Contact with Soil	Dietary Ingestion	Water Ingestion	Total	Soil Ingestion	Dermal Contact with Soil		Dietary Ingestion	Water Ingestion	Total							
1,2-DMB	0.026		3.00	0.100	ND	ND	ND	ND	ND	0	ND	ND	ND	NA	2E-06	1E-08	ND	NA	2E-01	2E-01	1E-10	6E-13	ND	NA	1E-10		
B2HEP	0.390		ND	0.100	0.01	3E-06	ND	ND	ND	8E-03	3E-08	1E-10	ND	NA	5E-05	4E-07	ND	NA	ND	ND	0	ND	2E-11	ND	NA	4E-09	4E-09
C16A	0.210		ND	0.100	ND	ND	ND	NA	NA	0	ND	ND	ND	NA	ND	ND	ND	NA	ND	ND	0	ND	ND	ND	NA	ND	0
CHCL3	0.005		0.81	0.100	ND	ND	ND	NA	NA	0	ND	ND	ND	NA	4E-03	3E-07	ND	NA	6E+00	6E+00	0	ND	1E-11	ND	NA	3E-09	3E-09
MECORH5	0.015		2.67	0.100	ND	ND	ND	NA	NA	0	ND	ND	ND	NA	7E-06	5E-08	ND	NA	1E+00	1E+00	0	ND	3E-12	ND	NA	5E-10	5E-10
										HTotal	8E-03			HTotal	3E-08				HTotal	7E-00					HTotal	7E-09	

Note.—NA indicates pathway incomplete. ND indicates parameters unavailable.

The human health risk assessment evaluated both the current and future use exposure scenarios at the site. Results of the human health risk assessment under the current land use exposure scenario indicate that carcinogenic risk did not exceed the State of Utah criteria for any receptors. Noncarcinogenic hazards to all receptors under the current use conditions were also found to be below State of Utah criteria. Results of the human health risk assessment under future use conditions indicated that carcinogenic risk to the potential future on-site resident (adult and child) exceed the recommended threshold limit for allowable risk, but these risks are due primarily to surface soil contaminants at the Drum Storage Site dispersed into ambient air at the Fuel Spill Site. Total noncarcinogenic hazards were found to be below the State of Utah criteria.

As stated above, it should be noted that the unacceptable level of cancer risk to the future residents is due solely to exposure of SWMU-wide airborne contaminants since the air pathway was evaluated comprehensively. In so doing, these receptors were assumed to also be exposed to site-related chemicals originating from other site locations (i.e., the Drum Storage Site) within SWMU 17. Therefore, recommendations for this site will be based on cancer risk and hazard associated with exposure to chemicals measured at the Fuel Spill Site. The results of the ecological assessment indicate that no adverse impacts to key receptor species should occur.

All available data were used to determine whether past operations at the Fuel Spill Site have created an environment that could result in any adverse effects to human health or to the local ecology. Based on the results of the risk assessment and ecological assessment, the criterion in item (c)(1) of R315-101-6 can be met and, therefore, a no further action option may be pursued.

8.4 DRUM STORAGE SITE

8.4.1 Previous Sampling and Phase II RFI Sampling Results

Previous investigations at the Drum Storage Site were conducted by Weston (1991). Rust E&I also investigated this site as part of this Phase II RFI.

Weston, 1991. The RI investigation included sampling three locations at three sample intervals of 0 to 0.5 foot, 0.5 to 1.5 feet, and 1.5 to 2.5 feet. These locations (shown in Figure 8-4 as SSDF 1 through 9) covered the former drum storage area and stained areas on the adjacent road. In the Phase II RFI Work Plans, these areas were placed in one group called the Drum Storage Site, and results of previous sampling are summarized under this one area. The results of the RI sample analyses are presented in Table 8-11.

The chemical analyses of soil samples from the stained areas on the road indicated trace levels of SVOCs in all of the soil samples collected; however, no priority pollutant SVOCs were detected. No explosives or VOCs were detected at concentrations above their respective certified reporting limits.

Table 8-11 SWMU 17 Soil Samples for the Drum Storage Site, RI, 1991

Analyte	SSDF-01	SSDF-02	SSDF-03	SSDF-04	SSDF-04 ^(a)	SSDF-05	SSDF-06	SSDF-07	SSDF-08	SSDF-09
	(Concentrations in $\mu\text{g/g}$)									
Volatile Organics	ND ^(b)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semi-Volatiles	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzenedi-carboxylic acid ester derivative	ND	ND	1.45 (1) ^(c)	ND	ND	ND	ND	ND	ND	ND
Hydrocarbons	ND	ND	ND	ND	ND	ND	ND	1.22 (1)	1.16 (1)	ND
Methylketone	ND	ND	ND	ND	ND	1.05	ND	ND	ND	ND
Unknown Semi-VOCs	2.0 (3)	1.59 (13)	18.7 (14)	1.55 (22)	1.23 (1)	2.7 (7)	17.3 (1)	16.3 (1)	22.1 (1)	19.5 (3)

^(a)Duplicate analysis.

^(b)Not detected.

^(c)Number of unknown or tentatively identified compounds (TICs). If more than one occurrence, the value represents the highest detection.

Source: Modified from Weston (1991)

Rust E&I, 1991. Rust E&I also investigated this area of SWMU 17 as part of the approved work plans, which called for 12 sample locations, bored to 20 feet with sample intervals at 0 to 1 foot, 4 to 5 feet, 9 to 10 feet, 12 to 13 feet, and 19 to 20 feet. As indicated previously, borings were completed at only nine sample locations shown in Figure 8-5 (see page 8-10) as 17DS-01 through 17DS-09. In addition, there were approximately 5 feet of fill materials on top of the Drum Storage Site. Rust E&I ascertained that this material was clean fill material obtained from another area of TEAD-S. Without large earth-moving equipment to move this material, it was not possible to start boring at the original surface; therefore, the borings were all started at the surface of the fill.

All samples were analyzed for VOCs, SVOCs, explosives, and metals, and one sample (17DS-02-2) was analyzed for pH and total organic carbon. Table 8-12 presents the results of these analyses. A full set of analytical data for the Drum Storage Site is in Appendix D.

The following metals were detected in concentrations above background: arsenic was detected in 2 soil borings at the 0.5-foot interval at concentrations of 38.8 and 61.9 $\mu\text{g/g}$; chromium was detected in 4 soil borings at depths of 0.5 feet to 5.0 feet, ranging from 34.7 to 52.0 $\mu\text{g/g}$; copper was detected in 12 soil borings at the 0.5-to-5-foot level at concentrations ranging from 26.0 to 230 $\mu\text{g/g}$; lead was detected in 8 soil borings at the 0.5-to-5.0-foot level at concentrations ranging from 72.0 to 690 $\mu\text{g/g}$; and zinc was detected in 5 soil borings at the 0.5-to-5-foot level at concentrations ranging from 120 to 230 $\mu\text{g/g}$.

VOCs were detected in six soil borings at concentrations above the CRL at depths greater than or equal to 5 feet. Soil sample 17DS-02-2 was also analyzed for pH and yielded a value of 8.41.

8.4.2 Nature and Extent of Contamination

The presence of arsenic near the surface is at concentrations slightly higher than background. Chromium detections are also slightly higher than background and are found in the surface and shallow subsurface soils. The copper, lead, and zinc detections are present in the upper 5 feet of this area at levels higher than their respective background values. The source of these metals appears to be the fill material used at this site. There were no metals detected above background below the 5-foot depth. Because the metal detections occurred in the fill material that was deposited over existing soils present during drum storage activities, these detections are not considered to be a result of contamination from the storage of drums or other practices at the site. However, these metals were evaluated further in the risk assessment section that follows.

Detected VOCs were all at concentrations less than 0.05 $\mu\text{g/g}$. These low concentrations were only found at depths of 5 feet or more. Any associated risk from these VOCs were evaluated in the risk assessment.

Table 8-12. SWMU 17 Soil Sample Results for the Drum Storage Site, Phase II RFI

Sample ID	Depth	VOC (µg/g)						Metals (µg/g)					pH	TOC (µg/g)
		1,1,1-Trichloroethane	1,2-Dimethylbenzene	1,3-Dimethylbenzene	Benzene	Monochlorobenzene	Toluene	Arsenic (Bkgd - 16.4) ^(a)	Chromium (Bkgd - 23.5)	Copper (Bkgd - 18.1)	Lead (Bkgd - 69.8)	Zinc (Bkgd - 62.9)		
17DS-01-1	0.5	ND	ND	ND	ND	ND	ND	38.8	47.4	32	ND ^(b)	150	--	--
17DS-01-2	5	ND	ND	ND	ND	ND	ND	ND	34.7	DS ^(c)	ND	ND	--	--
17DS-01-3	10	ND	ND	ND	ND	ND	0.037	ND	ND	ND	ND	ND	--	--
17DS-01-5	20	ND	0.03	ND	ND	ND	0.04	ND	ND	ND	ND	ND	--	--
17DS-02-1	0.5	--	--	--	--	--	--	61.9	39.1	160	430	ND	--	--
17DS-02-2	5	ND	ND	ND	ND	0.041	ND	ND	ND	32	ND	140	8.41	13,000
17DS-02-3	10	0.04	0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--
17DS-02-5	20	ND	0.027	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--
17DS-03-1	1	--	--	--	--	--	--	ND	ND	150	300	ND	--	--
17DS-03-2	5	ND	DS	0.027	0.045	ND	ND	ND	ND	63	72	230	--	--
17DS-04-1	--	--	--	--	--	--	--	ND	ND	100	170	ND	--	--
17DS-04-2	5	ND	ND	ND	ND	ND	ND	ND	ND	26	ND	120	--	--
17DS-05-1	2	--	--	--	--	--	--	ND	ND	230	690	ND	--	--
17DS-05-4	15	0.034	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	--
17DS-06-1	2	--	--	--	--	--	--	ND	52	140	320	ND	--	--
17DS-07-1	2	--	--	--	--	--	--	ND	ND	46	ND	200	--	--
17DS-08-1	--	--	--	--	--	--	--	ND	ND	110	210	ND	--	--
17DS-09-1	2	--	--	--	--	--	--	ND	ND	85	130	ND	--	--

^(a)(Bkgd)=Background value for specific analyte.

^(b)-- = Analysis not performed.

^(c)ND=Analyte not detected at or above the CRL, SRL, or MDL.

^(d)DS=Data screened out as described in Section 6.

8.4.3 Risk Assessment Results

8.4.3.1 Baseline Human Health Risk Assessment

This section presents the results of the sample data screening approach previously described in Section 6.1.1 that led to (1) the selection of the COPCs, (2) the exposure pathways that are labeled in the conceptual site model as being complete, (3) the exposure point concentrations in each respective environmental medium for those COPCs that have published health criteria, and (4) the carcinogenic and noncarcinogenic risk estimates for each receptor population under current and future land use scenarios.

This section of the report evaluates exposure to COPCs detected in site soils as well as those contaminants measured or modeled in various media from SWMU-wide or depot-wide sources. The direct soil-contact pathway (e.g., ingestion and dermal exposure) is associated with site-specific chemicals. Similarly, ingestion of homegrown produce by future on-site residents is based on those contaminants (if any) measured in surface soil within the site. Site-specific contaminants in soil are also used as model inputs to the air pathway for current off-site residents and the future on-site construction worker.

Current on-site workers and future on-site residents, however, are assumed to be potentially exposed to SWMU-wide chemicals in air (i.e., those chemicals detected in surface media at all of the sites evaluated within SWMU 17). Ingestion of beef and dairy products by future on-site residents is based on modeling contaminants detected in depot-wide surface soils; cattle are assumed to graze at contaminated sites within SWMU 13 and SWMU 17. Thus, the total cancer risk and noncarcinogenic hazards to the future on-site resident (adult and child) presented in the section below include those contributions associated with exposures to SWMU-wide contamination in air and to depot-wide chemicals in beef and milk.

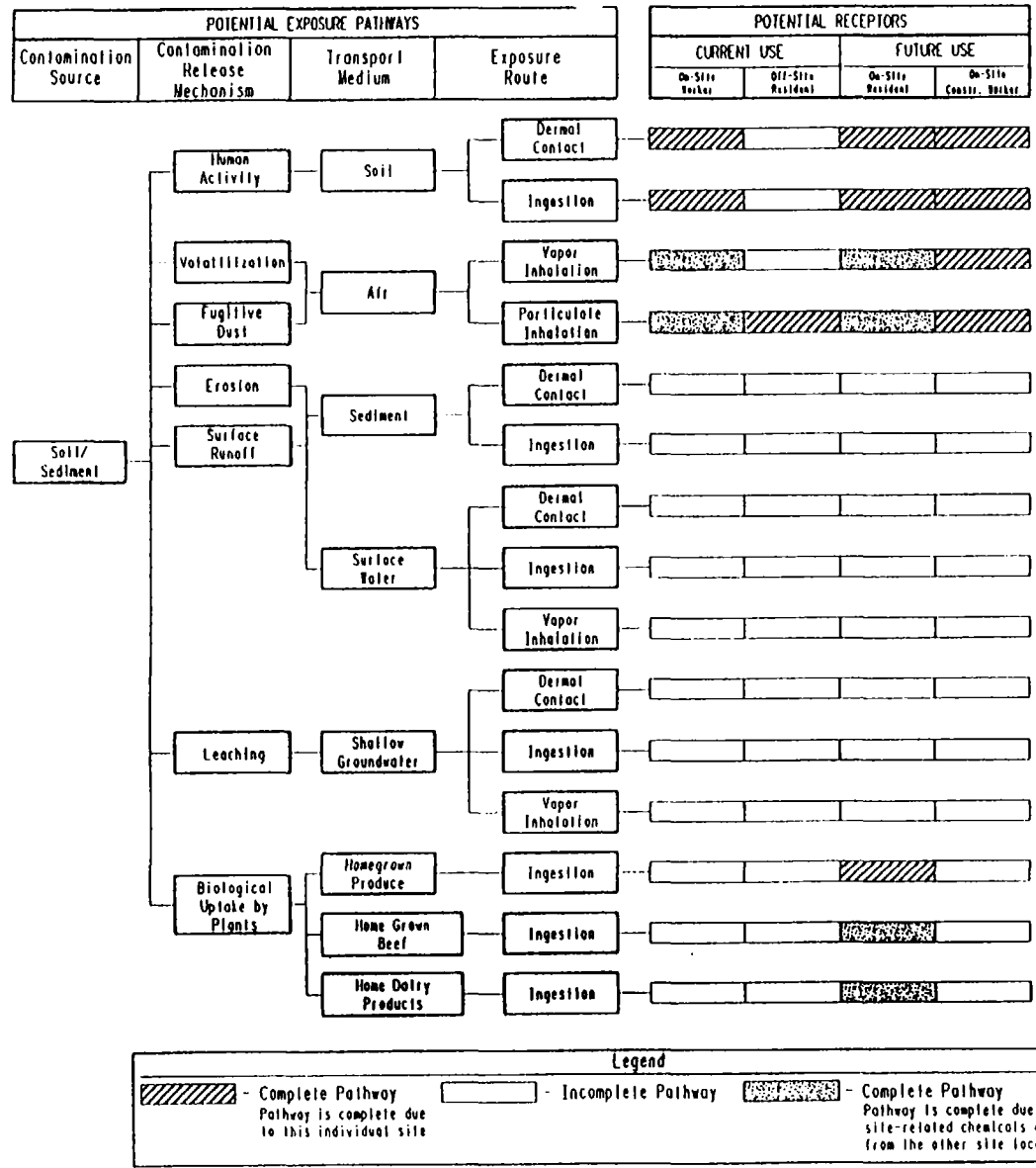
8.4.3.1.1 Chemicals of Potential Concern. The soil data for this site were grouped by depth and evaluated in the human health risk assessment accordingly. The COPCs measured in the surface and subsurface soil are summarized in Table 8-13.

8.4.3.1.2 Complete Exposure Pathways. The pathways that are assumed complete at this site are shown on the conceptual site model in Figure 8-7. Exposure to current on-site workers and potential future on-site residents from ingestion of and dermal contact with COPCs measured in surface soil was evaluated. Exposure to future construction workers from ingestion of and dermal contact with site-related chemicals in subsurface soil was evaluated. Exposure to SWMU-wide chemicals from inhalation of fugitive dust and VOC emissions by current on-site workers, future construction workers, and potential future on-site residents was evaluated. Off-site residents were assumed to be exposed to fugitive dust generated and dispersed from Drum Storage Site surface soils. Inhalation of dust and VOC emissions from subsurface soil by the future on-site construction worker was also evaluated. Chemicals measured in surface soil (0 to 1.0 foot) were assumed to be available for plant uptake.

Table 8-13. SWMU 17 Summary of Concentrations of Chemicals of Potential Concern in Surface and Subsurface Soil at the Drum Storage Site, Phase II RFI

Chemical	Background Concentration (mg/kg)	Frequency of Detection	Range of Detects (mg/kg)	Arithmetic Mean Concentration (mg/kg)	95% UCL (mg/kg)
<i>Surface Soil</i>					
Arsenic	16.4	2/2	38.8- 61.9	50.4	123.3
Chromium	23.5	2/5	39.1-47.4	29.0	41.7
Copper	18.1	5/5	32.0-160.0	110.4	158.8
Lead	69.8	4/5	170.0-430.0	222.5	373.5
Zinc	62.9	1/1	150.0	NA	NA
<i>Subsurface Soil</i>					
Chromium	23.5	2/12	34.7-52.0	23.5	28.7
Copper	18.1	8/12	10.2-230.0	56.0	91.1
Lead	69.8	4/12	72.0-690.0	117.1	220.9
Zinc	62.9	4/9	120.0-230.0	98.9	146.4
Benzene	NA	1/8	0.0445	0.014	0.023
1,2-Dimethylbenzene	NA	2/8	0.025-0.203	0.04	0.08
1,3-Dimethylbenzene	NA	1/8	0.0268	0.012	0.016
Monochlorobenzene	NA	1/8	0.041	0.016	0.023
Toluene	NA	1/8	0.0366	0.015	0.021
1,1,1-Trichloroethane	NA	1/8	0.0487	0.011	0.021

Notes.—NA denotes Not Applicable. Bold type designates the exposure point concentration selected for these media.



17 DS 2468 005 001
REF 2458 004 001

Figure 8-7. SWMU 17 Potential Human Exposure Pathway Conceptual Model for the Drum Storage Site, Phase II RFI

Therefore, exposure by potential future on-site residents from consumption of vegetables grown at this site was evaluated. These residents were also evaluated for exposure to base-wide chemicals in beef and milk.

8.4.3.1.3 Exposure Point Concentrations. Exposures from all complete pathways by all the identified receptors shown in Figure 8-8 were estimated based on the exposure point concentrations in Table 8-14. These values are based on soil chemical concentrations measured in surface and subsurface soil within this site. In addition, it should be noted that the approach of evaluating exposures from inhalation of average chemical concentrations over SWMU 17 by the on-site worker during daily visits to this site included chemicals that were not found at this location but instead originated from the other Phase II RFI site (Fuel Spill Site) at this SWMU. Similarly, exposure by potential future on-site residents from ingestion of chemicals in beef and milk, derived as area averages over TEAD-S using soil data collected from SWMUs 13 and 17, was also evaluated. Therefore, Table 8-14 also includes chemicals that contribute to overall exposure but were not actually measured within the Drum Storage Site soils.

8.4.3.1.4 Risk Estimates. The receptor populations evaluated at this site include the current on-site worker, off-site resident (adult and child), future construction worker, and the potential future on-site resident (adult and child). Cancer risks and noncarcinogenic hazards to these receptor populations were estimated based on exposure to chemicals in surface soil, subsurface soil (construction worker), and air, and in homegrown products for the on-site resident. The results of this evaluation under current and future land use are presented below. These results are also summarized for each exposure pathway in Tables 8-15 and 8-16. Risk calculations are presented in Appendix H. Tables 8-15 and 8-16 show in bold font those risks and hazards which are site specific (i.e., related to chemicals detected specifically in this site's soil).

Current Land Use

Cancer risk to the current on-site worker from exposure to site-related chemicals in air and surface soil was estimated to be 8.86E-06, and the noncarcinogenic hazard to this receptor was estimated to be 2.92E-01. Ingestion of arsenic in site soil is responsible for all of the cancer risk. The contribution to cancer risk from this location to the off-site adult was 3.27E-10, and the noncarcinogenic hazard was 1.12E-05. Cancer risk to the off-site child resident was 2.29E-11, and the noncarcinogenic hazard was 3.93E-05.

Future Land Use

Total cancer risk to the construction worker was estimated to be 4.93E-08, and the noncarcinogenic hazard, 3.10E-01. Total cancer risk to the future on-site adult and child from exposure to chemicals in air, in site soil, and in vegetables, beef, and milk were estimated to be 2.55E-04 and 2.08E-04, respectively. Total noncarcinogenic hazard to these receptors was estimated to be 8.72E+00 and 2.97E+01, respectively.

Table 8-14. SWMU 17 Exposure Point Concentrations for the Chemicals of Potential Concern at the Drum Storage Site, Phase II RFI

Receptor	Chemical	EXPOSURE POINT CONCENTRATIONS								
		Air ^(a) (mg/m ³)	Soil (mg/kg)	Milk ^(b) (mg/L)	Beef ^(b) (mg/g)	Potato ^(c) (mg/g)	Tomato (mg/g)	Carrot (mg/g)	Lettuce (mg/g)	Beans (mg/g)
On-Site Worker	Arsenic	9.29E-08	61.9	---	---	---	---	---	---	---
	Chromium	6.26E-08	41.7	---	---	---	---	---	---	---
	Copper	2.38E-07	158.8	---	---	---	---	---	---	---
	Lead	5.60E-07	373.5	---	---	---	---	---	---	---
	Zinc	2.25E-07	150	---	---	---	---	---	---	---
	Bis(2-ethylhexyl) phthalate	1.80E-10	ND	---	---	---	---	---	---	---
	1,2 Dimethyl Benzene	1.15E-10	ND	---	---	---	---	---	---	---
	Toluene	2.55E-10	ND	---	---	---	---	---	---	---
Off-Site Resident	Arsenic	6.81E-11	---	---	---	---	---	---	---	---
	Chromium	4.59E-11	---	---	---	---	---	---	---	---
	Copper	1.75E-10	---	---	---	---	---	---	---	---
	Lead	4.11E-10	---	---	---	---	---	---	---	---
	Zinc	1.65E-10	---	---	---	---	---	---	---	---
Future On-Site Resident	Arsenic	7.43E-07(1.49E-06)	61.9	9.80E-08	1.63E-09	9.3E-05	2.2E-05	4.5E-05	1.2E-04	1.0E-04
	Beryllium	---	< Bkgd	9.3E-11	3.99E-11	---	---	---	---	---
	Chromium	5.0E-07(1.00E-06)	41.7	7.7E-08	4.00E-09	4.7E-05	1.1E-05	2.3E-05	1.6E-05	5.3E-05
	Copper	1.91E-06(3.81E-06)	158.8	7.65E-08	0.00e+00	9.9E-03	2.4E-03	4.8E-03	3.2E-03	1.1E-02
	Lead	4.48E-06(8.96E-06)	373.5	1.55E-07	8.16E-11	3.0E-04	2.0E-04	1.4E-04	1.1E-04	9.4E-04
	Mercury	---	ND	1.0E-09	1.26E-11	---	---	---	---	---
	Nickel	---	ND	8.5E-08	7.29E-09	---	---	---	---	---

Table 8-14. SWMU 17 Exposure Point Concentrations for the Chemicals of Potential Concern at the Drum Storage Site, Phase II RFI (continued)

Receptor	Chemical	EXPOSURE POINT CONCENTRATIONS								
		Air ^(a) (mg/m ³)	Soil (mg/kg)	Milk ^(b) (mg/L)	Beef ^(b) (mg/g)	Potato ^(c) (mg/g)	Tomato (mg/g)	Carrot (mg/g)	Lettuce (mg/g)	Beans (mg/g)
Future On-Site Resident (cont.)	Nitrate	—	ND	NA	NA	—	---	---	---	---
	Uranium	—	ND	2.0E-09	7.71E-12	—	---	---	---	---
	Zinc	1.80E-06 (3.60E-06)	150.0	4.63E-03	1.78E-05	2.20E-02	8.1E-03	1.1E-02	1.1E-02	3.8E-02
	Bis(2-ethylhexyl) phthalate	2.16E-09(4.68E-08)	ND	1.2E-09	1.51E-12	—	---	---	---	---
	1,2-Dimethylbenzene	1.35E-09(2.95E-09)	ND	3.49E-12	4.25E-15	—	---	---	---	---
	4-Methylphenol	—	ND	4.07E-10	4.96E-13	—	---	---	---	---
	Methyl isobutyl ketone	---	ND	6.5E-12	7.92E-15	—	---	---	---	---
	Toluene	3.05E-09(6.50E-09)	ND	2.48E-12	3.02E-15	—	---	---	---	---
Future Construction Worker	Chromium	5.74E-07	28.7	—	---	---	---	---	---	---
	Copper	1.82E-06	91.1	---	---	---	---	---	---	---
	Lead	4.42E-06	220.9	---	---	---	---	---	---	---
	Zinc	2.93E-06	146.4	---	---	---	---	---	---	---
	Benzene	9.50E-08	0.023	---	---	---	---	---	---	---
	1,2-Dimethylbenzene	8.90E-08	0.08	---	---	---	---	---	---	---
	1,3-Dimethylbenzene	1.70E-08	0.016	---	---	---	---	---	---	---
	Monochlorobenzene	3.10E-08	0.023	---	---	---	---	---	---	---
	Toluene	4.90E-08	0.021	---	---	---	---	---	---	---
1,1,1-Trichloroethane	9.30E-08	0.021	---	---	---	---	---	---	---	

Notes.—NA denotes Not Available. ND denotes chemical was not detected in site soil. "—" denotes Not Applicable.

^aAir chemical concentrations represent average values for on-site worker and maximum values for future on-site resident over SWMU 17. Value in parenthesis represents that for child.

^bMilk and beef concentrations were derived to evaluate exposure to potential future on-site residents. These concentration estimates represent average values over all of TEAD-S.

^cVegetable chemical concentrations are based on corresponding soil concentration.

Table 8-15. SWMU 17 Summary of Carcinogenic Risks for the Drum Storage Site, Phase II RFI

Potential Exposure Pathways		Potential Receptors			
Environmental Medium	Potential Exposure Route	Current Use		Future Use	
		On-Site Worker ^(a)	Off-Site Resident Adult (Child)	Construction Worker	On-Site Resident Adult (Child) ^(b)
Soil	Dermal Contact	6.20E-07	NA	2.57E-12	2.50E-06(1.35E-06)
	Ingestion	8.10E-06 ^(c)	NA	2.69E-11	5.45E-05 ^(c) (1.02E-04) ^(c)
Air	Vapor Inhalation	NE	NA	5.78E-12	NE
	Particulate Inhalation	1.44E-07	3.27E-10(2.29E-10)	4.93E-08	3.57E-06 ^(d) (5.00E-06) ^(d)
Homegrown Produce	Ingestion	NA	NA	NA	1.94E-04 ^(e) (9.96E-05) ^(e)
Homegrown Beef	Ingestion	NA	NA	NA	1.35E-09(5.55E-10)
Homegrown Dairy Products	Ingestion	NA	NA	NA	5.73E-10(6.54E-10)
Total Cancer Risk		8.86E-06	3.27E-10(2.29E-10)	4.93E-08	2.55E-04(2.08E-04)

Notes.—NA denotes not applicable. NE denotes not evaluated due to lack of USEPA Health Criteria for site-related chemicals within this pathway. Bold type designates site-specific risks (i.e., those potential risks that are attributed to chemicals detected at this site).

^aExposure to workers was evaluated based on the time spent at each site during assumed daily visits to each site within SWMU 17. Exposure to airborne chemicals was evaluated based on chemicals measured in surface soil within this SWMU. The concentrations used for this medium represent SWMU-wide values. Therefore, even if site-specific contamination is absent from surficial soil, exposure from inhalation of particulates and vapors from other sites was assumed to occur.

^bBeef and milk chemical concentrations represent depot-wide values for TEAD-S. Therefore, the future resident at each site may be exposed to site-specific chemicals and also to those associated with other site locations within SWMU 13 and 17.

^cIngestion of arsenic detected in this site's soil is responsible for all of the risks.

^dInhalation of chromium and arsenic dispersed from surface soils at this site is responsible for all of the total air pathway risk.

Table 8-16. SWMU 17 Summary of Noncarcinogenic Hazards for the Drum Storage Site, Phase II RFI

Potential Exposure Pathways		Potential Receptors			
Environmental Medium	Potential Exposure Route	Current Use		Future Use	
		On-Site Worker ^(a)	Off-Site Resident Adult (Child)	Construction Worker	On-Site Resident Adult (Child) ^(b)
Soil	Dermal Contact	2.02E-02	NA	2.78E-03	6.81E-02(1.83E-01)
	Ingestion	2.66E-01	NA	2.92E-01	1.49E+00 ^(c) (1.38E+01) ^(e)
Air	Vapor Inhalation	2.36E-10	NA	2.05E-07	7.29E-09(5.44E-08)
	Particulate Inhalation	5.92E-04	1.12E-05(3.93E-05)	1.56E-02	1.22E-01(8.56E-01)
Homegrown Produce	Ingestion	NA	NA	NA	5.47E+00 ^(d) (1.49E+01) ^(d)
Homegrown Beef	Ingestion	NA	NA	NA	8.30E-05(1.70E-04)
Homegrown Dairy Products	Ingestion	NA	NA	NA	1.57E-04(8.97E-04)
Total Hazard		2.92E-01	1.12E-05(3.93E-05)	3.10E-01	8.72E+00(2.97E+01)

Notes.—NA denotes not applicable. Bold type designates site-specific hazards (i.e., those potential hazards that are attributed to chemicals detected at this site).

^aExposure to workers was evaluated based on the time spent at each site during assumed daily visits to each site within SWMU 17. Exposure to airborne chemicals was evaluated based on chemicals measured in surface soil within this SWMU. The concentrations used for this medium represent SWMU-wide values. Therefore, even if site-specific contamination is absent from surficial soil, exposure from inhalation of particulates and vapors from other sites was assumed to occur.

^bBeef and milk chemical concentrations represent depot-wide values for TEAD-S. Therefore, the future resident at each site may be exposed to site-specific chemicals and also to those associated with other site locations within SWMU 13 and 17.

^cIngestion of lead and arsenic detected in this site's soil is responsible for at least 90% of the hazards.

^dIngestion of lead, arsenic, and copper detected in this site's soil is responsible for at least 90% of the hazard.

8.4.3.1.5 Conclusions. The results of the human health risk assessment under the current land use exposure scenario at this site indicate that the estimated cancer risk to the on-site worker of $8.86E-06$ exceeds the $1E-06$ State of Utah recommended threshold limit of allowable risk. The contribution of the total cancer risks to the off-site resident (adult and child) from this location are well below this limit. Noncarcinogenic hazards to all receptors associated with this release unit under current land use conditions were found to be well below the State of Utah recommended value of 1.

The results of the human health risk assessment under future land use conditions indicate that the estimated total cancer risks to the potential future on-site adult and child resident of $2.55E-04$ and $2.08E-04$, respectively, exceed the State of Utah recommended threshold limit of allowable risk. Total cancer risk to the future construction worker was found to be well below this limit. Total noncarcinogenic hazards to the potential future on-site adult and child resident of 8.72 and 29.7, respectively, were found to be well above the State of Utah recommended value of 1. Total noncarcinogenic hazard to a future construction worker was found to be below 1.

Ingestion of arsenic in this site's surface soil is responsible for all of the potential cancer risks associated with the soil pathway for the current on-site worker and the future on-site residents, and with the consumption of homegrown produce for these residents. Ingestion of lead and arsenic detected in this site's surface soil is also responsible for at least 90 percent of the potential noncancer hazards associated with direct soil contact by the future on-site residents. Ingestions of lead, arsenic, and copper detected in this site's soils is responsible for at least 90 percent of the noncarcinogenic hazards associated with consumption of homegrown produce by the residents (adults and children). Inhalation of chromium and arsenic dispersed from surface soils at the Drum Storage Site is responsible for all of the total air pathway risks to the future on-site residents.

8.4.3.2 Ecological Risk Assessment

8.4.3.2.1 Site Characterization. The ecological assessment for the Drum Storage Site included a survey of vegetation and wildlife, and a qualitative habitat evaluation. This assessment did not include collection of either vegetation or wildlife samples for analysis. Human activity at this site is frequent. The potential wildlife inhabitants include small and large mammals, reptiles, and birds. There is no indication that this area is a critical habitat for any endangered or threatened species. Species of vegetation and wildlife that have been observed in the vicinity of the Fuel Spill Site are presented in Table 8-17.

No evidence of surface water was observed during the field investigation. It is unlikely that significant surface water ever accumulates on this site as the result of storm episodes or snow melt.

8.4.3.2.2 Chemicals of Potential Concern. The potential ecological COPCs at the Drum Storage Site include arsenic, chromium, copper, lead, and zinc in surface soil.

Table 8-17. SWMU 17 Vegetation and Wildlife Inventory at the Drum Storage Site, Phase II RFI

Scientific Name	Common Name
VEGETATION SPECIES	
<i>Gramus tectorum</i>	Cheatgrass
<i>Atriplex confertifolia</i>	Shadscale
<i>Chrysothamnus nauseosus</i>	Tall rabbitbrush
<i>Artemesia tridentata</i>	Big sagebrush
<i>Grindelia squarrosa</i>	Gumweed
<i>Sitanion hystrix</i>	Bottlebrush squirreltail grass
WILDLIFE SPECIES	
<i>Bubo virginianus</i>	Great horned owl
<i>Odocoileus hemionus</i>	Mule deer
<i>Antilocapra americana</i>	Pronghorn antelope
<i>Leupus californicus</i>	Black-tailed jackrabbit
<i>Pituophis melanoleucas</i>	Bullsnake
<i>Peromyscus maniculatus</i>	Deer mouse

8.4.3.2.3 Results of Risk Characterization. Table 8-18 presents potential HQs calculated for the Drum Storage Site. Total HIs for the golden eagle and the mule deer are negligible. Total HIs for the American robin and the deer mouse exceed the target endpoint of 1 due to potential ingestion of metals in soil and bioaccumulated plants and invertebrates. It is likely that the concentrations of the metals at the site are within the natural variation of TEAD-S background concentrations especially since the site surface soils are imported from another TEAD-S area.

8.4.3.2.4 Conclusions. Results indicate that no adverse impacts to ecological receptors should occur because of site-specific contaminant concentrations at the Drum Storage Site.

8.4.4 Conclusions and Recommendations

COPCs associated with the Drum Storage Site are metals and VOCs. Prior to the Phase II RFI, approximately 4 to 5 feet of soil fill was placed on this site. As a result, sample analyses conducted during the Phase II RFI detected metals in the upper 5 feet at higher than background levels but consistent with TEAD-S natural occurrences. Trace amounts (up to 0.049 $\mu\text{g/g}$) of VOCs were detected at depths greater than 5 feet (see Section 8.4.2).

The human health risk assessment evaluated both the current and future land use exposure scenarios at the site. Results of the human health risk assessment under the current land use exposure scenario indicate that carcinogenic risk did not exceed the State of Utah criteria for off-site residents but did exceed this limit for the on-site worker (due primarily to arsenic detected in the site's soil). Noncarcinogenic hazards to all receptors under the current use conditions were also found to be below State of Utah criteria. Results of the human health risk assessment under future use conditions indicated that carcinogenic risk to the potential future on-site resident (adult and child) exceeded the State of Utah recommended threshold limit for allowable risk. Total carcinogenic risk to the future on-site construction worker was found to be below State of Utah criteria. Total noncarcinogenic hazards were found to exceed State of Utah criteria for the future on-site resident but to be below State of Utah criteria for the future on-site construction worker.

The ecological assessment indicated that hazards calculated for ecological receptors are approximately the same as those due to natural background conditions and that no adverse impacts are likely due to site-specific contamination.

All available data were used to determine whether past operations at the Drum Storage Site have created an environment that could result in any adverse effects to human health or to the local ecology. Results from the human health and ecological risk assessments indicate that adverse impacts to the future on-site resident at the site may occur although it is not expected that this site will become available for residential use in the future.

Table 8-18. Hazard Quotients for Drum Storage Site

Analyte Name	Soil EPC (mg/kg)	Water EPC (mg/L)	Air EPC (mg/m ³)	ABS	American Robin					Golden Eagle					Deer Mouse					Mule Deer					
					Soil Ingestion	Dermal Contact with Soil	Dietary Ingestion	Water Ingestion	Total	Soil Ingestion	Dermal Contact with Soil	Dietary Ingestion	Water Ingestion	Total	Soil Ingestion	Dermal Contact with Soil	Dietary Ingestion	Water Ingestion	Inhalation	Total	Soil Ingestion	Dermal Contact with Soil	Dietary Ingestion	Water Ingestion	Total
AS	61.9		ND	0.010	1.E+00	3.E-05	6.E-01	NA	2.E+00	5.E-06	2.E-09	3.E-06	NA	3.E-06	6.E-01	4.E-04	1.E+00	NA	ND	2.E+00	4.E-05	2.E-08	8.E-05	NA	1.E-04
CR	41.7		ND	0.010	1.E+01	4.E-04	ND	NA	1.E+01	4.E-05	1.E-08	ND	NA	4.E-05	7.E-02	3.E-05	ND	NA	ND	7.E-02	3.E-06	2.E-09	ND	NA	3.E-06
CU	158.8		ND	0.010	9.E-01	3.E-05	2.E+00	NA	3.E+00	4.E-06	1.E-09	3.E-05	NA	3.E-05	8.E-02	6.E-05	9.E-01	NA	ND	1.E+00	6.E-06	3.E-09	5.E-05	NA	6.E-05
PB	373.5		ND	0.010	8.E+00	3.E-04	2.E+00	NA	1.E+01	3.E-05	8.E-09	5.E-04	NA	5.E-04	7.E-01	5.E-04	9.E-01	NA	ND	2.E+00	4.E-05	2.E-08	8.E-05	NA	1.E-04
ZN	1500		ND	0.010	2.E+00	6.E-05	1.E+01	NA	1.E+01	7.E-06	2.E-09	9.E-05	NA	9.E-05	2.E-02	1.E-05	4.E-01	NA	ND	4.E-01	1.E-06	7.E-10	2.E-05	NA	2.E-05
							HI Total		4.E+01			HI Total		6.E-04			HI Total		5.E+00				HI Total		3.E-04

Note.—NA indicates pathway incomplete. ND indicates parameters unavailable.

The results of the risk assessment under both land use exposure scenarios indicate that the levels of cancer risk and hazard (residential scenario only) to the current on-site worker and future resident are above State of Utah criteria due primarily to site-specific chemicals detected in soil. These risk/hazard levels are within the conditions defined in item (d) of R315-101-6. This is because the risk under current land use would be less than $1E-04$ but greater than $1E-06$ under on-site residential land use. Therefore, the Drum Storage Site should be carried through the CMS. However, it is not necessary that corrective actions for this site be included in the CMS but instead, appropriate management activities such as monitoring, deed notations, site security, or post-closure care should be included.