In Boring 400-020, TCE ranged from 17 µg/kg to 2900 µg/kg between 16 and 48 ft bgs. The maximum concentration was near the base of the UCRS. In addition to the high TCE at the base of the UCRS, a second zone of elevated TCE containing 700 µg/kg was detected at approximately 20 ft bgs in this boring.

SVOAs. No SVOAs were reported from the Sector 1 subsurface soils.

Inorganics

Five metals were detected above background concentrations in the subsurface soils collected below the C-400 Building. Antimony and thallium were detected only at concentrations below the SQL. Iron and cadmium were reported at concentrations only slightly above background levels. The most widespread inorganic substance was the common rock-forming element, sodium.

Radionuclides

Small quantities of two radionuclides were detected above screening levels from the subsurface soils of Sector 1. The soil samples contained ^{137}Cs at a maximum activity of 0.5 pCi/g and ^{237}Np at 0.3 pCi/g. These two radionuclides were reported from both Borings 400-019 and 400-020 at depths between 8 and 44 ft bgs.

4.2.2 Sector 2 [C-403 Neutralization Tank (SWMU 40)]

4.2.2.1 Site History

Location and Physical Description

The C-403 Neutralization Tank is located at the northeast corner of the C-400 Cleaning Facility. It consists of a 25-ft-square by 26-ft-deep, in-ground open-top tank constructed of concrete and lined with two layers of acid brick. Influent from C-400 Building was received from an 8-in.-diameter Duriron acid waste line. The C-403 Neutralization Tank was connected to the C-402 Lime House by a 4-in.-diameter Duriron transfer line.

Practice and Release Description

The C-403 Neutralization Tank was used for the storage and treatment (i.e., neutralization) of acidic, uranium-bearing waste solutions generated during cleaning operations in the C-400 Building. During treatment, a lime slurry was added to the wastewater from the C-402 Lime House to raise the pH and precipitate out the uranium in the form of a low-level radioactive sludge. Once the pH was raised to the proper level (10 to 12), the effluent was discharged to the C-404 Holding Pond where the sludge was allowed to settle out of the solution. In 1957, the discharge from the C-403 Neutralization Tank was routed to the North-South Diversion Ditch, where it flowed to the Little Bayou Creek. In the late 1970s, the flow from the North-South Diversion Ditch was routed into the C-616-F Full Flow Lagoon, and direct discharge to Little Bayou Creek was subsequently discontinued. Drawings for C-403 show that a 15-in. vitreous-clay pipe was installed between the C-403 Neutralization Tank and the C-410-B Neutralization Lagoon. This pipe was constructed utilizing part of an existing stormwater line. The intended purpose of this line is unknown. The C-410-B Neutralization Lagoon was used for the neutralization of hydrogen fluoride cell electrolytes.

The C-403 Neutralization Tank was not used to neutralize waste solutions from the C-400 Cleaning Facility after 1957, because treatment equipment was installed in the C-400 Building to complete the neutralization process. Although neutralization was no longer carried out at C-403, low-level, uranium-bearing wastewater continued to be discharged to C-403 until 1990. These discharges included UF_6 cylinder hydrostatic-test water, overflow and runoff from cleaning tanks, discharge from floor drains, and other unknown sources.

Location and Results of Previous Sampling

The C-403 Neutralization Tank was investigated during the Phase II SI completed in 1991 and 1992. Field activities completed during the Phase II SI included the installation of two groundwater monitoring wells (MW-177 and MW-178) south of C-403. Five composite soil samples were collected during the drilling of the borehole for MW-178 at depths ranging from 14 to 44 ft bgs. Soil samples were analyzed for TCL VOA, SVOA, pesticides/PCBs, TAL metals, cyanide, dioxins and furans, and selected radioisotopes including ^{235}U, ^{238}U, ^{99}Tc, ^{239}Pu, and ^{230}Th. No contamination was detected in any of the samples collected from MW-178. No soil samples were collected from the MW-177 borehole.

In late 1989 and early 1990, PGDP pumped the standing water from C-403. The C-403 Neutralization Tank was covered with a Hypalon plastic cover after the removal activities were completed in an unsuccessful attempt to prevent water from entering the pit. In 1993, nine water and three sediment samples were collected from the C-403 tank. These samples reported TCE concentrations between 17 and 1300 µg/L [parts per billion (ppb)]. TCE concentrations in the three sediment samples ranged from 35 to 6700 ppb. In addition to TCE, PCBs and uranium also were detected. During the WAG 6 RI field investigation, a water line located near the C-403 Tank broke, and subsurface water apparently flowed into the tank where one of the still extant fill lines enters the tank. Approximately 10 to 12 ft of water accumulated in the tank. Samples of the water from the tank were analyzed during November 1997 and found to contain as much as 21,000 ppb TCE and a gross beta activity of 43,750 pCi/L. Re-sampling in January 1998 indicated that the TCE content of the tank had dropped to 5600 ppb and that the beta activity was only 4430 pCi/L.

No spills or releases are known to have occurred within Sector 2. Previous sampling activities and process knowledge indicate that the processes described above represents potential sources for several organic, inorganic, and radiological contaminants, including TCE, uranium, ^{99}Tc, and PCBs.

4.2.2.2 Nature and Extent of Contaminants

Sampling at Sector 2 (SWMU 40) was conducted to determine whether or not releases of contaminants into the soil and groundwater had occurred and to define the extent of any identified contamination. Much of the sector is covered by man-made structures, and only limited surface soil is exposed. Shallow (15-ft) borings were drilled along utility lines to assess these corridors as potential migration pathways. At the C-403 Neutralization Tank, soil beneath influent and effluent lines was also investigated to check for the possibility of line releases. Several deep borings were drilled in proximity to the tank and near the C-400 Building to assess whether processes at either the C-403 Neutralization Tank or the C-400 Building had resulted in undiscovered releases of contaminants to the surrounding environment.

Six surface soil samples were collected from Sector 2. Three of the samples were collected due west of the C-403 Neutralization Tank (SWMU 40), and three sampling sites were located on the west and south side of the C-402 Limehouse. Thirty-three subsurface soil samples, including two duplicates, were collected from 19 locations in Sector 2 (Fig. 4.2). The samples were collected between 5 and 49 ft bgs and were analyzed for VOAs, SVOAs and metals. Twelve samples were selected for isotopic analyses. Twenty-two of the samples were screened for PCBs. The results of these analyses are summarized in Tables 4.8 through 4.11. In addition, information concerning the frequency of detection is given in Table 4.12.

Summary of Findings

Contamination related to spills and releases was identified in both the surface and subsurface soil samples within Sector 2. Three distinct areas have been defined that appear to have been impacted.

A small area of surface soil between the C-402 Building and the C-400 Building was found to be impacted with moderate concentrations of several common PAH compounds. The extent of contamination appears to be confined both vertically and horizontally to the surface soil surrounding Boring 400-005. The source for the identified SVOA contaminants is unknown, but these compounds could have been derived from any number of one-time surface releases associated with the operation of an industrial facility.

A second area of contamination is associated with the floor drain collection line on the outer perimeter of the C-400 Building. Low levels of several radionuclides were detected between 15 and 40 ft bgs along this line.

A third area of contamination is associated with the C-403 Neutralization Tank and the former storm sewer. Subsurface soil collected adjacent to the tank backfill at a depth of 30 ft bgs was found to be impacted by several radionuclides. Based upon available data, the extent of contamination around the C-403 Neutralization Tank appears to be limited to the area of the tank backfill. Elevated radioactivity was also detected at a few locations along the former storm sewer utility line that connects the C-403 Neutralization Tank to the HF Lagoon. High concentrations of two metals, silver and antimony, were associated with the area of elevated radioactivity detected along this line. Both metals were used in the plating process that was performed within the C-400 Building.

Sporadic occurrences of contamination along the utility corridor suggest that leaking joints or cracks provided isolated point sources for contaminant introduction into the subsurface.

Analytical Results–Surface and Subsurface Soils

Organics

VOAs. Only small quantities of four VOAs were reported for soils from Sector 2, and these were found at concentrations below the SQL.

SVOAs. Seventeen SVOAs, most of which are PAH compounds, were reported from the six surface soil samples from Sector 2. The only samples that contained SVOAs in concentrations above the SQL (Fig. 4.3) were the sample collected at Boring 400-005 between the C-400 Building and the C-402 Limehouse and the sample from 400-008 collected south of the Limehouse. The sample from 400-005 had the maximum concentrations of all 17 detected

SVOAs, including fluoranthene at 8285 µg/kg and pyrene at 7853 µg/kg. Sample 400-008 contained only one SVOA, fluoranthene, at a concentration above the SQL. Subsurface soil samples did not contain significant quantities of SVOAs.

PCBs. Four surface soil samples and 18 subsurface soil samples collected from 11 locations within Sector 2 were analyzed for PCBs. Only PCB 1260 at 43 µg/kg in sample 400-008 was reported at a concentration above the SQL.

Inorganics

Fifteen metals were reported at concentrations that exceeded PGDP background levels; however, most were only slightly above background. Two of the metals, silver and antimony, both used in the processes performed at the C-400 Building, exceeded the PGDP background levels by approximately 2 and 22 times, respectively. The single exceedance for silver of 4.28 mg/kg was from the 10- to 14-ft-bgs sample of Boring 400-059. The same sample contained 4.7 mg/kg of antimony.

Radionuclides

Seven isotopes were detected above screening levels. The radiological constituents generally were found in two areas. One location was from samples collected at Borings 400-007 and 400-008, between the C-402 Building and the C-400 Building. At these locations, activities of less than 5 pCi/g of ^{99}Tc, ^{230}Th, ^{234}U, ^{235}U, and ^{238}U were detected in the surface soil sample and low activities (less than 2 pCi/g) of ^{230}Th and ^{241}Am were detected in the subsurface samples collected at 9 to 12.5 and 35 to 42 ft bgs, respectively.

A second area of radiological contamination was located around the C-403 Tank and along the adjacent storm sewer line. Most of the detected isotopes in this area are found below 7 ft bgs and at low levels of ^{237}Np, ^{241}Am, ^{230}Th, ^{99}Tc, ^{234}U, ^{235}U, and ^{238}U. Uranium-238 had the highest activity of any of the radionuclides at 20.2 pCi/g. The distribution of ^{238}U within Sector 2 is shown in Fig. 4.4.

No ^{238}U radionuclide activity was detected in the sample from Boring 040-005, which was collected at approximately 15 ft bgs along the storm sewer line between Borings 400-056 and 400-061, both of which contained reportable activities of ^{238}U. This observation suggests that this storm sewer line had probably leaked along pipe joints during its many years of operation.

Supplemental Sampling

During April of 1998, six borings were drilled near the C-403 Neutralization Tank. All borings were drilled into the backfill of the tank pit to determine if the elevated radiological activity and TCE that was detected in the C-403 tank may have been sourced from water contained in the backfill of the tank pit. Seven water and 28 soil samples were collected and analyzed for gross alpha/beta and TCE and TCE degradation products. Analytical data from this sampling event are contained in the Addendum to Appendix J, found at the end of the SWMU 40 data set in Appendix J (Volume 4). The maximum soil alpha activity was 62.2 pCi/g and maximum soil beta activity was 243 pCi/g from soil samples collected between 20 and 24 ft bgs immediately adjacent to the tank. TCE or TCE degradation products were not detected in the soil samples.

The maximum alpha activity for water was 4910 pCi/L and maximum beta activity was 860 pCi/L from samples collected between 10 and 30 ft bgs. Only very small concentrations of TCE, trans-1,2 DCE, and vinyl chloride were detected in the water samples.

4.2.3 Sector 3

4.2.3.1 Site History

Sector 3 consists of the east side of the C-400 Building and several buried utility lines that parallel 11th Street. It does not contain a SWMU, and no spills or releases are known to have occurred in Sector 3.

Sector 3 is a relatively flat area lying between Sector 4 (SWMU 11) to the south and Sector 2 (SWMU 40) to the north. Several small paved areas and buried utilities are present in the sector. Access to the sector is limited on the east side by the presence of an 8- to 10-ft-high security fence. Surface drainage is into storm sewer drains along 11th Street. As part of the Phase I SI (CH2M Hill 1991) and Phase II SI (CH2M Hill 1992), a deep boring was drilled in the southern part of the sector. TCE was first detected at a depth of 50 ft bgs in this boring. PAHs occurred from the surface to total depth. Radionuclides were reported only from the near-surface soils.

4.2.3.2 Nature and Extent of Contaminants

Surface and subsurface soil samples were collected throughout Sector 3 in order to assess the nature and extent of site-related contaminants. Sampling locations within Sector 3 are shown in Fig. 4.5. Three surface soil samples were analyzed for SVOAs, three for metals, and two each for radionuclides and PCBs. The subsurface samples were collected from 10 borings at depths between the surface and 50.5 ft bgs. Thirty-six samples were analyzed for VOAs, 33 for SVOAs, and 37 (including one duplicate) for radionuclides. Thirty-two soil samples (including one duplicate) were analyzed for metals, and 16 samples were analyzed for PCBs. Shallow borings to approximately 15 ft bgs were drilled adjacent to buried utilities that parallel 11th Street and adjacent to the feeder lines that connected to storm drains within the sector. Several deep borings were also drilled near the C-400 Building to assess whether any unknown releases had occurred as a result of the processes performed in the building. Analytical results for samples collected from Sector 3 are summarized in Tables 4.13 to 4.16. Additional information about the analytical results can be found in Table 4.17 (frequency of detection).

Summary of Findings

Several small areas were identified in Sector 3 where the soil has been impacted due to localized spills or releases. The most significant area of contamination occurs in the surface and subsurface of Boring 400-011, which was drilled adjacent to the C-400 Building beside the exterior floor drain collection line. In this boring, TCE was found at elevated levels from near the surface to the total depth of 41 ft. The high TCE concentrations found at this location appear to be associated with a point source release near the C-400 Building. Elevated concentrations of arsenic, SVOAs, and PCBs were found in the surface and shallow subsurface soils at this location. TCE-impacted soil was found at depth in Boring 011-001 and may be contiguous with soil where elevated TCE was found in 400-011. A second release of contaminates at the surface is indicated by surface soil containing PCBs and radionuclides at 400-046. This area of elevated

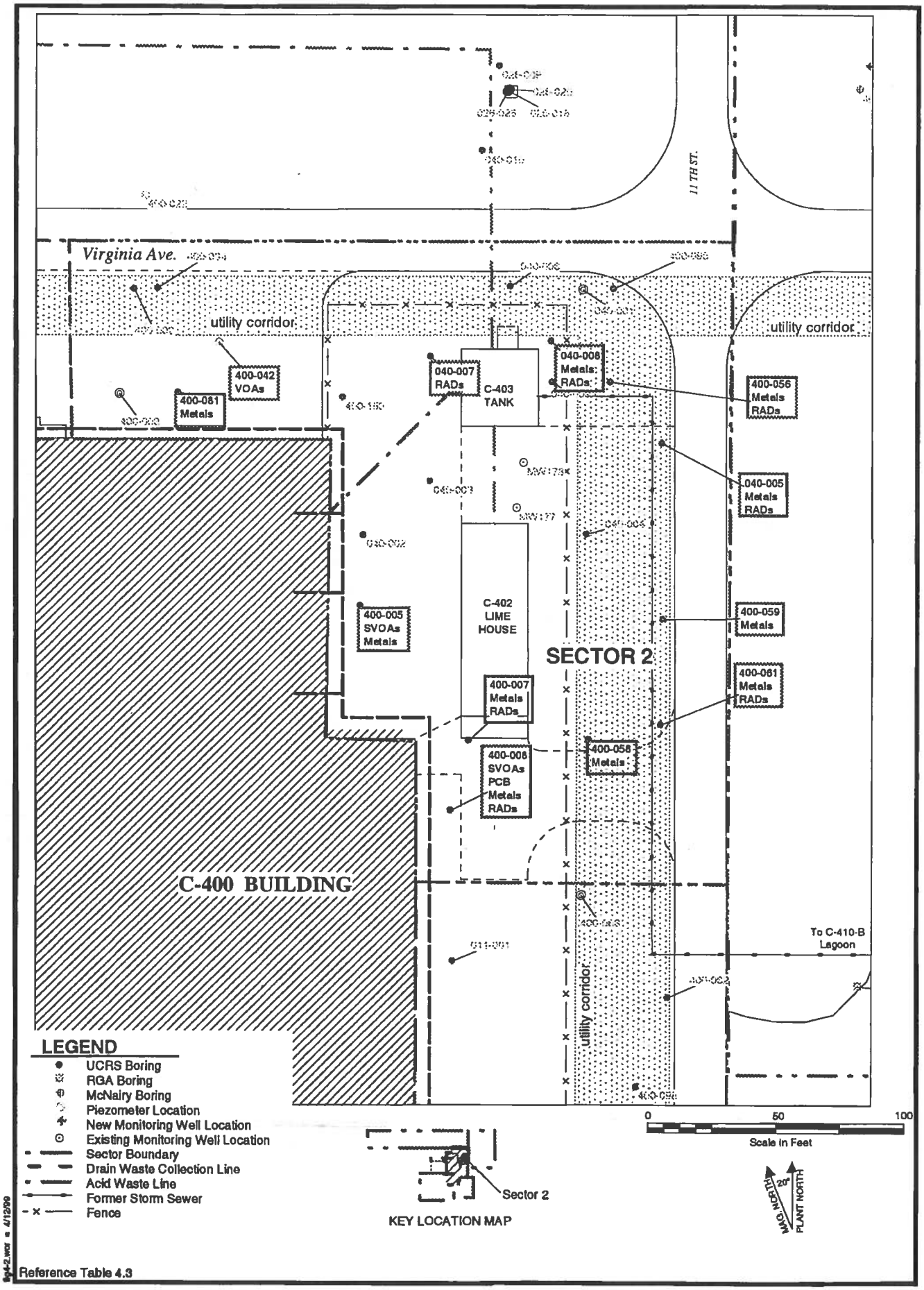

Fig. 4.2. Sector 2 site map showing contaminant groups detected in UCRS soil above SQL at each sampling location.

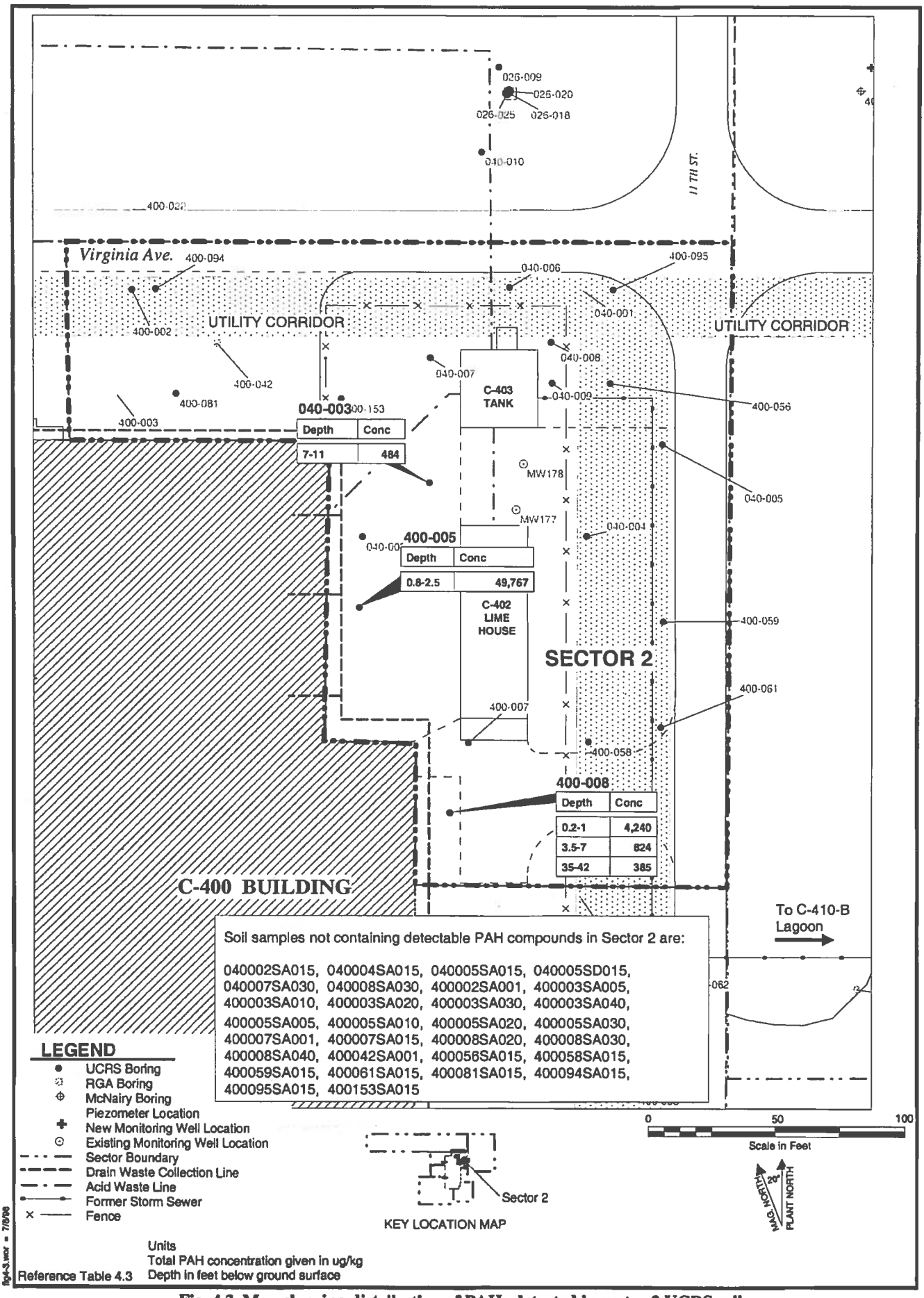

Fig. 4.3. Map showing distribution of PAHs detected in sector 2 UCRS soil.

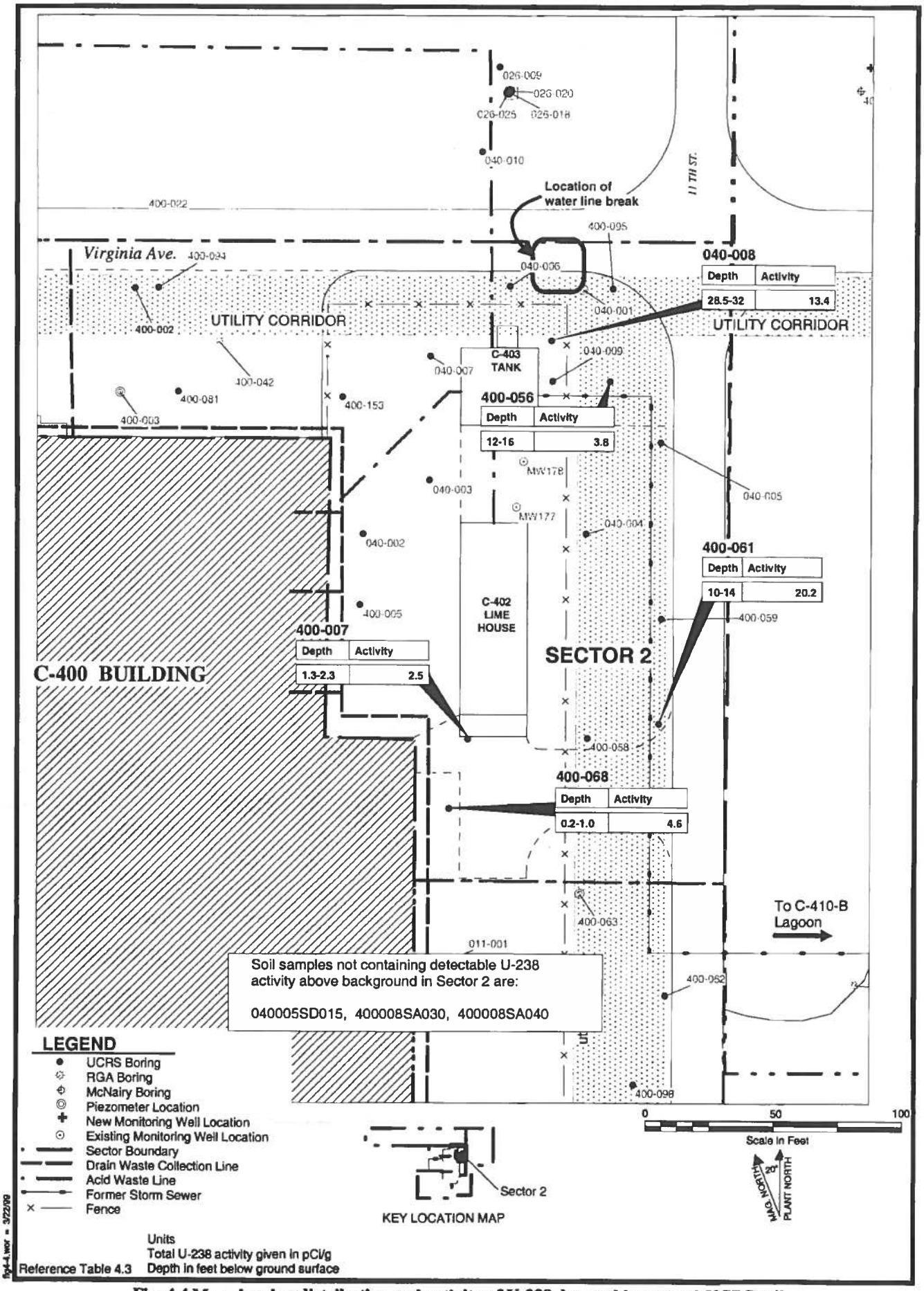

Fig. 4.4 Map showing distribution and activity of U-238 detected in sector 2 UCRS soil.

Table 4.8. VOA compounds detected in Sector 2
UCRS soil

Sample Type	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results ug/kg	Lab Qualifier	Validation Qualifier	Data Assessment
		Top	Bottom					
Soil	040003SA015	7	11	Toluene	2.3	J	?	
	040005SA015	7	11	Toluene	1.6	J	?	
		7	11	Vinyl acetate	1.3	J	?	BH-SS
	040005SD015	7	11	Toluene	1.8	J	?	
		7	11	Vinyl acetate	28	J	?	BH-SS
	400005SA030	30	33	2-Butanone	6	J	?	
		30	33	Vinyl acetate	1.3	J	?	BH-SS
	400007SA015	9	12.5	Toluene	1.5	J	=	
	400008SA040	35	42	Toluene	1.4	J	=	
	400008SD040	35	42	Toluene	1.5	J	=	
	400081SA015	6	10	Trichloroethene	2.2	J	?	

Note: Soil boring samples not containing any detectable VOA compounds in Sector 2 are:

040002SA015, 040004SA015, 040006SA015, 040007SA030, 040008SA030, 400003SA005, 400003SA010, 400003SA020, 400003SA030, 400003SA040, 400005SA005, 400005SA010, 400005SA020, 400005SA040, 400008SA005, 400008SA010, 400008SA020, 400008SA030, 400056SA015, 400058SA015, 400059SA015, 400061SA015, 400094SA015, 400095SA015, 400153SA015

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Table 4.9. SVOA and PCB compounds detected in Sector 2 UCRS soil

Sample Type	Analytical Group	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results ug/kg	Lab Qualifier	Validation Qualifier	Data Assessment
			Top	Bottom					
Soil	SVOA	040003SA015	7	11	N-Nitroso-di-n-propylamin	484	JB	?	
		040006SA015	8.5	12.5	2,6-Dinitrotoluene	432	J	?	
		400003SA001	1	1.5	2,6-Dinitrotoluene	347	J	?	
		400005SA001	0.8	2.5	2,6-Dinitrotoluene	374	J	?	
			0.8	2.5	Acenaphthene	1220		?	
			0.8	2.5	Anthracene	1893		?	
			0.8	2.5	Benz(a)anthracene	4133		?	
			0.8	2.5	Benzo(a)pyrene	3362		?	
			0.8	2.5	Benzo(b)fluoranthene	3424		?	
			0.8	2.5	Benzo(ghi)perylene	1867		?	
			0.8	2.5	Benzo(k)fluoranthene	1982		?	
			0.8	2.5	Chrysene	3968		?	
			0.8	2.5	Dibenz(a,h)anthracene	412	J	?	
			0.8	2.5	Dibenzofuran	576	J	?	
			0.8	2.5	Fluoranthene	8285		?	
			0.8	2.5	Fluorene	925		?	
			0.8	2.5	Indeno(1,2,3-cd)pyrene	1891		?	
			0.8	2.5	Naphthalene	503	J	?	
			0.8	2.5	Phenanthrene	7473		?	
			0.8	2.5	Pyrene	7853		?	
		400005SA040	39	42	2,6-Dinitrotoluene	345	J	?	

Table 4.9. SVOA and PCB compounds detected in Sector 2 UCRS soil

Sample Type	Analytical Group	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results ug/kg	Lab Qualifier	Validation Qualifier	Data Assessment
			Top	Bottom					
Soil	SVOA	400008SA001	0.2	1	Acenaphthene	40	J	?	
			0.2	1	Anthracene	80	J	?	
			0.2	1	Benz(a)anthracene	350	J	?	
			0.2	1	Benzo(a)pyrene	300	J	?	
			0.2	1	Benzo(b)fluoranthene	430	J	?	
			0.2	1	Benzo(ghi)perylene	170	J	?	
			0.2	1	Benzo(k)fluoranthene	280	J	?	
			0.2	1	Chrysene	400	J	?	
			0.2	1	Fluoranthene	860		?	
			0.2	1	Indeno(1,2,3-cd)pyrene	180	J	?	
			0.2	1	Phenanthrene	470	J	?	
			0.2	1	Pyrene	680	J	?	
		400008SA005	3.5	7	Fluoranthene	80	J	?	
			3.5	7	N-Nitroso-di-n-propylamin	634	J	?	
			3.5	7	Phenanthrene	50	J	?	
			3.5	7	Pyrene	60	J	?	
		400008SA010	10.5	14	2,6-Dinitrotoluene	416	J	?	
		400008SD040	35	42	N-Nitroso-di-n-propylamin	385	J	?	
	PPCB	400003SA001	1	1.5	PCB-1254	5.2	J	?	
		400008SA001	0.2	1	PCB-1260	43		?	

Table 4.9. SVOA and PCB compounds detected in Sector 2 UCRS soil

Sample Type	Analytical Group	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results ug/kg	Lab Qualifier	Validation Qualifier	Data Assessment
			Top	Bottom					

Note: Soil boring samples not containing any detectable SVOA compounds in Sector 2 are:

040002SA015, 040004SA015, 040005SA015, 040005SD015, 040007SA030, 040008SA030, 400002SA001, 400003SA005, 400003SA010, 400003SA020, 400003SA030, 400003SA040, 400005SA005, 400005SA010, 400005SA020, 400005SA030, 400007SA001, 400007SA015, 400008SA020, 400008SA030, 400008SA040, 400042SA001, 400056SA015, 400058SA015, 400059SA015, 400061SA015, 400081SA015, 400094SA015, 400095SA015, 400153SA015

Soil boring samples not containing any detectable PCB compounds in Sector 2 are:

040003SA015, 040005SA015, 040005SD015, 040006SA015, 040007SA030, 040008SA030, 400002SA001, 400003SA005, 400003SA010, 400007SA001, 400007SA015, 400008SA005, 400008SA010, 400008SA020, 400008SA030, 400008SA040, 400008SD040, 400056SA015, 400081SA015, 400095SA015

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Table 4.10. Metals detected in Sector 2
UCRS soil

Sample Type	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results mg/kg	Lab Qualifier	Validation Qualifier	Data Assessment	Background mg/kg
		Top	Bottom						
Soil	040002SA015	11	15	Sodium	382		?		340
		11	15	Thallium	0.7	B	?		0.34
	040003SA015	7	11	Magnesium	2150		?		2100
		7	11	Nickel	24.9		?		22
		7	11	Sodium	409		?		340
	040005SA015	7	11	Sodium	389		?		340
	040005SD015	7	11	Aluminum	12400		?		12000
		7	11	Antimony	0.7	B	?		0.21
		7	11	Sodium	408		?		340
	040006SA015	8.5	12.5	Sodium	359		?		340
	040008SA030	28.5	32	Aluminum	12600		=		12000
		28.5	32	Antimony	1.2	B	=		0.21
		28.5	32	Thallium	0.6	B	=		0.34
	400002SA001	0.8	2.7	Antimony	1.2	B	?		0.21
		0.8	2.7	Cadmium	0.26	B	?		0.21
		0.8	2.7	Cobalt	15.4		?		14
		0.8	2.7	Nickel	21.9		?		21
		0.8	2.7	Sodium	1670		?		320
	400003SA001	1	1.5	Antimony	3.4	B	?		0.21
		1	1.5	Cadmium	0.33	B	?		0.21
		1	1.5	Calcium	318000		?		200000

Table 4.10. Metals detected in Sector 2
UCRS soil

Sample Type	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results mg/kg	Lab Qualifier	Validation Qualifier	Data Assessment	Background mg/kg
		Top	Bottom						
Soil	400003SA001	1	1.5	Magnesium	8040		?		7700
		1	1.5	Sodium	352		?		320
		1	1.5	Thallium	2.3		?		0.21
	400003SA010	6	12	Barium	181		?		170
		6	12	Magnesium	2270		?		2100
		6	12	Sodium	398		?		340
	400003SA020	20	24	Sodium	379		?		340
	400005SA005	3.5	7	Aluminum	13700		?		12000
		3.5	7	Antimony	0.9	B	?		0.21
	400005SA010	10.5	14	Aluminum	12900		?		12000
		10.5	14	Sodium	451		?		340
	400005SA040	39	42	Vanadium	47		?		37
	400007SA001	1.3	2.3	Aluminum	13800		=		13000
		1.3	2.3	Antimony	1.6	B	=		0.21
		1.3	2.3	Chromium	22.9		=		16
		1.3	2.3	Thallium	0.9	B	=		0.21
	400008SA001	0.2	1	Chromium	19.3		?		16
		0.2	1	Zinc	70.2		?		65
	400008SA005	3.5	7	Aluminum	13800		?		12000
		3.5	7	Arsenic	9.2		?		7.9
		3.5	7	Beryllium	0.7		?		0.69

Table 4.10. Metals detected in Sector 2
UCRS soil

Sample Type	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results mg/kg	Lab Qualifier	Validation Qualifier	Data Assessment	Background mg/kg
		Top	Bottom						
Soil	400008SA005	3.5	7	Sodium	386		?		340
	400008SA020	21	24.5	Antimony	0.8	B	?		0.21
		21	24.5	Beryllium	0.79		?		0.69
		21	24.5	Chromium	54.3		?		43
		21	24.5	Vanadium	53.3		?		37
	400008SA030	31.5	35	Thallium	0.8	B	=		0.34
	400008SA040	35	42	Antimony	5.5	B	=		0.21
		35	42	Beryllium	0.9		=		0.69
		35	42	Thallium	0.6	B	=		0.34
		35	42	Vanadium	38.6		=		37
	400008SD040	35	42	Aluminum	12900		=		12000
		35	42	Beryllium	0.7		=		0.69
		35	42	Thallium	0.8	B	=		0.34
	400042SA001	1.2	1.7	Antimony	1.2	B	?		0.21
		1.2	1.7	Cadmium	0.49	B	?		0.21
		1.2	1.7	Calcium	340000		?		200000
		1.2	1.7	Sodium	665		?		320
	400056SA015	12	16	Aluminum	17100		=		12000
		12	16	Antimony	1.9	B	=		0.21
		12	16	Arsenic	8.83		=		7.9
		12	16	Magnesium	2350		=		2100

Table 4.10. Metals detected in Sector 2
UCRS soil

Sample Type	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results mg/kg	Lab Qualifier	Validation Qualifier	Data Assessment	Background mg/kg
		Top	Bottom						
Soil	400056SA015	12	16	Potassium	1080		=		950
		12	16	Sodium	619		=		340
	400058SA015	10	14	Aluminum	13500		?		12000
		10	14	Sodium	451		?		340
	400059SA015	10	14	Aluminum	12600		?		12000
		10	14	Antimony	4.7		?		0.21
		10	14	Beryllium	0.79		?		0.69
		10	14	Silver	4.28		?		2.7
		10	14	Sodium	341		?		340
		10	14	Thallium	0.8	B	?		0.34
		10	14	Vanadium	37.7		?		37
	400061SA015	10	14	Aluminum	14900		?		12000
	400081SA015	6	10	Aluminum	15300		?		12000
		6	10	Barium	179		?		170
		6	10	Beryllium	0.81		?		0.69
		6	10	Cobalt	16.8		?		13
		6	10	Magnesium	2490		?		2100
		6	10	Manganese	842		?		820
		6	10	Sodium	410		?		340

Table 4.10. Metals detected in Sector 2
UCRS soil

Sample Type	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results mg/kg	Lab Qualifier	Validation Qualifier	Data Assessment	Background mg/kg
		Top	Bottom						

Note: Soil boring samples not containing any detectable metals at concentrations above background in Sector 2 are:

040004SA015, 040007SA030, 400003SA005, 400003SA030, 400003SA040, 400005SA001, 400005SA020, 400005SA030, 400007SA015, 400008SA010, 400094SA015, 400095SA015, 400153SA015

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Table 4.11. Radioactive isotopes detected in Sector 2 UCRS soil

Sample Type	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results pCi/g	Lab Qualifier	Validation Qualifier	Data Assessment	Background pCi/g
		Top	Bottom						
Soil	040005SA015	7	11	Neptunium-237	0.3		?		0
	040007SA030	30.5	33.5	Americium-241	0.2		?		0
	040008SA030	28.5	32	Uranium-234	13		=		2.4
		28.5	32	Uranium-235	0.6		=		0.14
		28.5	32	Uranium-238	13.4		=		1.2
	400007SA001	1.3	2.3	Uranium-238	2.5		=		1.2
	400007SA015	9	12.5	Thorium-230	1.5		=		1.4
	400008SA001	0.2	1	Technetium-99	3.6		?		2.5
		0.2	1	Thorium-230	1.8		?		1.5
		0.2	1	Uranium-234	3.4		?		2.5
		0.2	1	Uranium-235	0.2		?		0.14
		0.2	1	Uranium-238	4.6		?		1.2
	400008SD040	35	42	Americium-241	0.8		=		0
		35	42	Thorium-230	1.6		=		1.4
	400056SA015	12	16	Technetium-99	4		=		2.8
		12	16	Thorium-230	1.9		=		1.4
		12	16	Uranium-234	3.5		=		2.4
		12	16	Uranium-235	0.2		=		0.14
		12	16	Uranium-238	3.8		=		1.2
	400061SA015	10	14	Uranium-234	20.1		?		2.4
		10	14	Uranium-235	0.7		?		0.14

Table 4.11. Radioactive isotopes detected in Sector 2
UCRS soil

Sample Type	Sample ID	Sample Interval (ft bgs)		Analytical Compound	Results pCi/g	Lab Qualifier	Validation Qualifier	Data Assessment	Background pCi/g
		Top	Bottom						
Soil	400061SA015	10	14	Uranium-238	20.2		?		1.2

Note: Soil boring samples not containing any detectable radioactive isotopes at concentrations above background in Sector 2 are: 040005SD015, 400008SA030, 400008SA040

Table 4.12. Frequency of detection of organic compounds, metals, and radioactive isotopes in Sector 2 UCRS soil

Analytical Group	Analytical Compound	No. of Detects	No. of Analyses	Maximum Result	Minimum Result	Average Result	Units
VOA	Toluene	6	20	2.30	1.40	1.68	ug/kg
	Vinyl acetate	3	20	28.00	1.30	10.20	ug/kg
	2-Butanone	1	20	6.00	6.00	6.00	ug/kg
	Trichloroethene	1	34	2.20	2.20	2.20	ug/kg
SVOA	2,6-Dinitrotoluene	5	39	432.00	345.00	382.80	ug/kg
	Fluoranthene	3	39	8285.00	80.00	3075.00	ug/kg
	N-Nitroso-di-n-propylamine	3	39	634.00	385.00	501.00	ug/kg
	Phenanthrene	3	39	7473.00	50.00	2664.33	ug/kg
	Pyrene	3	39	7853.00	60.00	2864.33	ug/kg
	Acenaphthene	2	39	1220.00	40.00	630.00	ug/kg
	Anthracene	2	39	1893.00	80.00	986.50	ug/kg
	Benz(a)anthracene	2	39	4133.00	350.00	2241.50	ug/kg
	Benzo(a)pyrene	2	39	3362.00	300.00	1831.00	ug/kg
	Benzo(b)fluoranthene	2	39	3424.00	430.00	1927.00	ug/kg
	Benzo(ghi)perylene	2	39	1867.00	170.00	1018.50	ug/kg
	Benzo(k)fluoranthene	2	39	1982.00	280.00	1131.00	ug/kg
	Chrysene	2	39	3968.00	400.00	2184.00	ug/kg
	Indeno(1,2,3-cd)pyrene	2	39	1891.00	180.00	1035.50	ug/kg
	Dibenz(a,h)anthracene	1	39	412.00	412.00	412.00	ug/kg
	Dibenzofuran	1	39	576.00	576.00	576.00	ug/kg
	Fluorene	1	39	925.00	925.00	925.00	ug/kg
	Naphthalene	1	39	503.00	503.00	503.00	ug/kg
PCB	PCB-1254	1	22	5.20	5.20	5.20	ug/kg
	PCB-1260	1	22	43.00	43.00	43.00	ug/kg
Metals	Sodium	16	39	1670.00	341.00	504.31	mg/kg
	Aluminum	12	39	17100.00	12400.00	13791.67	mg/kg
	Antimony	11	39	5.50	0.70	2.10	mg/kg
	Thallium	8	39	2.30	0.60	0.94	mg/kg
	Beryllium	6	39	0.90	0.70	0.78	mg/kg
	Magnesium	5	39	8040.00	2150.00	3460.00	mg/kg
	Vanadium	4	39	53.30	37.70	44.15	mg/kg
	Cadmium	3	39	0.49	0.26	0.36	mg/kg

Table 4.12. Frequency of detection of organic compounds, metals, and radioactive isotopes in Sector 2 UCRS soil

Analytical Group	Analytical Compound	No. of Detects	No. of Analyses	Maximum Result	Minimum Result	Average Result	Units
Metals	Chromium	3	39	54.30	19.30	32.17	mg/kg
	Arsenic	2	39	9.20	8.83	9.02	mg/kg
	Barium	2	39	181.00	179.00	180.00	mg/kg
	Calcium	2	39	340000.00	318000.00	329000.00	mg/kg
	Cobalt	2	39	16.80	15.40	16.10	mg/kg
	Nickel	2	39	24.90	21.90	23.40	mg/kg
	Manganese	1	39	842.00	842.00	842.00	mg/kg
	Potassium	1	39	1080.00	1080.00	1080.00	mg/kg
	Silver	1	39	4.28	4.28	4.28	mg/kg
	Zinc	1	39	70.20	70.20	70.20	mg/kg
Radioactive isotopes	Uranium-238	5	12	20.20	2.50	8.90	pCi/g
	Thorium-230	4	12	1.90	1.50	1.70	pCi/g
	Uranium-234	4	12	20.10	3.40	10.00	pCi/g
	Uranium-235	4	12	0.70	0.20	0.43	pCi/g
	Americium-241	2	12	0.80	0.20	0.50	pCi/g
	Technetium-99	2	12	4.00	3.60	3.80	pCi/g
	Neptunium-237	1	12	0.30	0.30	0.30	pCi/g

Table 5.11. Sector 2 source terms

Contaminant	Level	X-Axis (ft)	Y-Axis (ft)	Z-Axis (ft)	Notes
			SURFACE SOIL		
Phenanthrene	470 µg/kg	230	210	1	Modeled over entire sector.
Uranium-238	4.6 pCi/g				
			SUBSURFACE SOIL		
2,6-Dinitrotoluene	432 µg/kg	182	180	49	Maximum detect of 5 detects (in Borings 400-003, 400-005, 400-006, and 400-008). This contaminant could not be modeled because it was absent from the MEPAS database.
Chromium	54.3 mg/kg	101	41	49	Maximum detect. Area around Boring 400-008.
Dibenzofuran	576µg/kg	51	76	2	From 0-2 ft. This contaminant could not be modeled because it was absent from the MEPAS database.
N-Nitroso-di-n-propylamine	634 µg/kg	80	170	46	Maximum detect of 3 detects (in Borings 040-003 and 400-008).
Phenanthrene	487µg/kg	101	117	6	Average of 2 detects +1/2 of 62 non-detects. Detected in borings in southwestern portion of sector (400-005 and 400-008) in soil samples from 1-7 ft bgs.
Thallium	2.3 mg/kg	58	53	2	Maximum detect (Boring 400-003). Detected in 0-2 ft sample.
Uranium-234	20.1 pCi/g	53	129	38	Maximum detects.
Uranium-235	0.7 pCi/g				Detected in SWMU 40 area (Borings 40-005, 40-007, 40-008) and in southeastern portion of sector (Borings 400-058 and 400-061).
Uranium-238	20.2 pCi/g	210	230	49	Maximum detect.
			Modeled over entire sector		

Notes:

The following detects were excluded from consideration in the subsurface in Sector 2 because they only slightly exceeded the background levels:

- Chromium – detected concentration of 39 mg/kg in Boring 040-002 at 11-15 ft bgs just exceeds background of 38 mg/kg.
- Thallium – detected concentration of 0.9 mg/kg in Boring 400-007 at 1-2 ft bgs just exceeds background of 0.7 mg/kg.
- Thallium – detected concentration of 0.8 mg/kg in Boring 400-008 at 32-42 ft bgs just exceeds background of 0.7 mg/kg
- Thallium – detected concentration of 0.8 mg/kg in Boring 400-059 at 10-14 ft bgs just exceeds background of 0.7 mg/kg.

In addition, ^{237}Np was excluded from consideration because it had only one detect in 11 samples (0.3 pCi/g in Boring 040-005 at 7-11 ft bgs). There was a non-detect at 0.1 pCi/g in the same boring.

X-axis is east-west; Y-axis is north-south; Z-axis is vertical (thickness).

Table 5.12. Contaminant inventory for Sector 2

Source	Site Contaminant	Contaminant Concentration/Activity mg/kg	g/g	pCi/g	WS-Length ft	WS-Width ft	z Thickness ft	Volume ft^3	Volume cm^3	Bulk Density g/cm^3	Inventory g	Inventory Ci
Surface	Phenanthrene	0.47	5E-07		210	230	1	4.83E+04	1367703855	1.6	1028.513299	
	Uranium-238			4.6	210	230	1	4.83E+04	1367703855	1.6		1.01E-02
Subsurface	2-6 Dinitrotoluene	0.432	4E-07		180	182	49	1.61E+06	45455340294	1.86	36524.27503	
	Chromium	54.3	5E-05		41	101	49	2.03E+05	5745743717	1.86	580308.6239	
	Dibenzofuran	576	0.0006		76	51	2	7.75E+03	219512221.2	1.86	235176.6133	
	N-Nitroso-di-n-propylamine	0.634	6E-07		170	80	46	6.26E+05	17715021360	1.86	20890.26179	
	Phenanthrene	0.487	5E-07		117	101	6	7.09E+04	2007721299	1.86	1818.634107	
	Thallium	2.3	2E-06		53	58	2	6.15E+03	174091993.8	1.6	640.6585372	
	Uranium-234			20.1	53	129	38	2.60E+05	7356887531	1.86		2.75E-01
	Uranium-235			0.7	53	129	38	2.60E+05	7356887531	1.86		9.58E-03
	Uranium-238			20.2	210	230	49	2.37E+06	67017488895	1.86		2.52E+00

Note:
MEPAS uses WS-Length to denote length of source in direction of groundwater flow and WS-Width to denote width in direction perpendicular to groundwater flow.

Table 5.13. MEPAS results for Sector 2

Constituent	Plant Fence Max Conc. (mg/L)(pCi/L)	Plant Fence Time (yr)	Property Boundary Max Conc. (mg/L)(pCi/L)	Property Boundary Time (yr)
Source: Surface				
^{238}U	7.22E-08	5,160	4.51E-08	5,950
^{234}Th	7.22E-08	5,160	4.51E-08	5,950
^{234}U	1.05E-09	5,160	7.55E-10	5,950
^{230}Th	2.41E-11	5,160	2.00E-11	5,950
^{226}Ra	1.12E-11	5,160	1.01E-11	5,950
^{222}Rn	1.12E-11	5,160	1.01E-11	5,950
^{210}Pb	1.12E-11	5,160	9.93E-12	6,180
^{210}Bi	1.12E-11	5,160	9.93E-12	6,180
^{210}Po	1.12E-11	5,160	9.92E-12	6,180
Phenanthrene	4.68E-06	7,560	3.00E-06	7,980
Source: Subsurface				
Chromium[1]	2.56E-53	10,000	0.00E+00	NA
N-Nitroso-di-propylamine	2.17E-02	24	1.37E-02	27
Phenanthrene	8.62E-06	7,810	5.41E-06	8,450
Thallium	8.45E-04	31	4.94E-04	37
^{238}U	6.62E-06	7,380	4.28E-06	8,050
^{234}Th	6.62E-06	7,380	4.28E-06	8,050
^{234}U	1.45E-07	7,870	1.03E-07	8,750
^{230}Th	5.17E-09	8,110	4.02E-09	8,980
^{226}Ra	3.05E-09	8,110	2.49E-09	8,980
^{222}Rn	3.05E-09	8,110	2.49E-09	8,980
^{210}Pb	3.02E-09	8,110	2.47E-09	8,980
^{210}Bi	3.02E-09	8,110	2.47E-09	8,980
^{210}Po	3.02E-09	8,110	2.47E-09	8,980
^{234}U	9.61E-07	6,460	6.08E-07	7,580
^{230}Th	5.93E-08	7,130	4.15E-08	7,820
^{226}Ra	4.13E-08	7,130	3.02E-08	8,050
^{235}U	3.41E-08	6,640	2.16E-08	7,580
^{231}Th	3.41E-08	6,640	2.16E-08	7,580
^{231}Pa	4.67E-09	7,130	3.26E-09	7,810
^{227}Ac	4.65E-09	7,130	3.25E-09	7,810
^{227}Th	4.65E-09	7,130	3.25E-09	7,810
^{223}Ra	4.65E-09	7,130	3.25E-09	7,810

[1]Did not reach maximum during model runs

Notes:

Bold type denote constituents which were run from screening.

Italic type denotes daughter products resulting from constituents listed in bold

Table 6.4. Summary of human health risk characterization for Sector 2 without lead as a COPC

Receptor	Total ELCR[a]	ELCR COCs	% Total ELCR	ELCR POCs	% Total ELCR	Total HI[a]	Systemic Toxicity COCs	% Total HI	Systemic Toxicity POCs	% Total HI
Current industrial worker at current concentrations	1.7×10^{-5}	PAHs	88	Dermal contact with soil	86	0.4	NE	NE	NE	NE
		Uranium-238	9	External exposure	10					
Future industrial worker at current concentrations	1.7×10^{-5}	PAHs	88	Dermal contact with soil	86	0.4	NE	NE	NE	NE
		Uranium-238	9	External exposure	10					
Future child rural resident at current concentrations	NA	NA	NA	NA	NA	10.6	Chromium	55	Ingestion of soil	1
							Uranium	40	Dermal contact with soil	23
							Zinc	4	Consumption of vegetables	76
Future adult rural resident at current concentrations	8.1×10^{-4}	PAHs	84	Ingestion of soil	<1	3.0	Chromium	51	Dermal contact with soil	16
		PCBs	5	Dermal contact with soil	5		Uranium	44	Consumption of vegetables	84
		Uranium-235	<1	External exposure	93		Zinc	5		
		Uranium-238	11							
Future child recreational user at current concentrations	NA	NA	NA	NA	NA	<0.1	NE	NE	NE	NE
Future teen recreational user at current concentrations	NA	NA	NA	NA	NA	<0.1	NE	NE	NE	NE
Future adult recreational user at current concentrations	4.7×10^{-7}	NE	NE	NE	NE	<0.1	NE	NE	NE	NE
Future excavation worker at current concentrations	1.6×10^{-4}	Arsenic	6	Ingestion of soil	17	1.2	Aluminum	10	Ingestion of soil	11
		Beryllium	44	Dermal contact with soil	81		Antimony	20	Dermal contact with soil	88
		PAHs	35	External exposure	2		Chromium	14		
		N-nitroso-di-n-propylamine	10				Manganese	16		
		Uranium-234	<1				Vanadium	28		
		Uranium-238	3							

[a]Total ELCR and total HI columns reflect values from Tables 1.68 to 1.77 of Appendix A in Volume 3 without lead included. Also, values in this table do not include contributions from water ingestion or use because groundwater was evaluated on an area basis. For risks due to water use, see Table 6.2.

Notes:

NA = ELCR not applicable to child and teen cohorts. Values for adult include exposure as child and teen.

NE = Land use scenario not of concern.