State of Utah

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DIVISION OF ENVIRONMENTAL RESPONSE AND REMEDIATION

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ERRC-201-00

August 8, 2000

Luke Chavez
U.S. EPA Region VIII
999 18th Street. Suite 500
Denver, Colorado 80202-2405

Dear Mr. Chavez:

Enclosed is the Analytical Results Report for the Mount Olivet Cemetery Plume site, located in eastern Salt Lake City, Salt Lake County, Utah.

The report is a compilation of studies performed by EPA and EPA contractors, and the Utah Division of Response and Remediation documenting PCE (perchloroethylene) contamination of the shallow aquifer near the Mount Olivet Cemetery. Groundwater flow in the immediate area appears to move in a northwesternly direction, toward two University of Utah drinking water wells, located less than 2000 feet away.

An upward hydraulic gradient appears, at present, to be protective of the deeper aquifer. This deeper aquifer is the water source for the two above mentioned of University of Utah drinking water wells. However, changes in the hydraulic gradient could cause the plume to migrate to the deeper aquifer through the PCE-contaminated Mount Olivet Cemetery irrigation well, the abandoned "Fountain of Ute" University of Utah well, or the underlying geologic strata of the area. We therefore recommend that this site be evaluated further under the Superfund Program.

If you have any questions concerning this report, please contact Neil Taylor at (801) 536-4100.

Sincerely,

J. Steven Thiriot, Manager
Site Assessment Section/ CERCLA Branch
Division of Environmental Response and Remediation

BTJ/NBT/

Enclosure(s)

cc: Kevin Brown, Director, Utah Division of Drinking Water
Royal DeLegge, Director, Environmental Health, Salt Lake Valley Health Department, 788 E. Woodoak Ln., #120
Murray, Utah 84107-6379

ANALYTICAL RESULTS REPORT

MOUNT OLIVET CEMETERY PLUME

Salt Lake County, Utah
UTD981548985

Utah Department of Environmental Quality
Division of Environmental Response and Remediation
Prepared By: Neil B. Taylor

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1.0 INTRODUCTION

The **Mount Olivet Cemetery Plume** (EPA ID # UTD981548985) consists of a contaminated groundwater plume located in Salt Lake City, Salt Lake County, Utah. The site was known previously as the Utah Army National Guard Org. Maintenance Shop 5. Previously, the National Guard Maintenance Shop was thought to be a potential source for the groundwater plume, however that does not appear to be correct.

The Mount Olivet Cemetery Plume was investigated under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, and in accordance with applicable provisions of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This report summarizes the results of sampling activities and relates the sampling results to possible exposure pathways. The Utah Division of Environmental Response and Remediation (DERR) conducted this investigation during the period of 1996-1999, under agreement with the U. S. Environmental Protection Agency (EPA). This report provides results of sampling as part of a Site Inspection in accordance with EPA guidance for activities at CERCLA sites.

In 1996, four soil gas samples were collected from potential contamination sources near the plume. During the period of June 1998 to January 2000, six groundwater monitoring wells were constructed near the plume and groundwater samples analyzed for volatile organic compounds.

2.0 OBJECTIVES

The objectives of these investigations were as follows:

- Document groundwater contamination at the site
- Identify possible sources of the groundwater contamination
- Evaluate environmental targets associated with the groundwater pathway and determine if these targets are, or have the potential of, being exposed.

3.0 SITE DESCRIPTION

3.1 Site Location

Site Location and Description: The site is located in eastern Salt Lake City, south of the University of Utah Campus, in the vicinity of the Mount Olivet Cemetery in Section 4, Township 1N, Range 1E. Geographic coordinates for the site are 40° 45' 14" north latitude and 111° 50' 42" west longitude. The plume was first identified as part of routine monitoring of the Mount Olivet Cemetery's irrigation well conducted in 1990 by Salt Lake City Department of Public Utilities. A regional location map is given as Figure 1 on page 18. A site location map is given as Figure 2 on page 19.

3.2 Operational History

Samples taken from the cemetery irrigation well from 1990 to 1999 by Utah Department of Environmental Quality and the Salt Lake Department of Public Utilities yield perchloroethylene (PCE) concentrations in groundwater that exceed both state and federal regulations. The EPA Maximum Contaminant Level (MCL) for PCE in drinking water is five parts per billion (ppb)[1,2]. Since the initial report in 1990, levels of the contaminant have ranged from 11 to 184 ppb[2] in samples collected from the Mount Olivet Cemetery irrigation well.

Dimensions of the Mount Olivet Cemetery Plume site, or the extent of potential contamination, is not known. Identified potential sources are the former dry cleaning operation on the VA Medical Center campus in Building 7, former chemical storage operations at Fort Douglas Building 515, and a former Utah National Guard vehicle maintenance facility.

3.3 Previous Investigations

A Preliminary Assessment for the Utah Army National Guard Org. Maintenance Shop was conducted in 1989. This shop is located immediately to the east of the cemetery and was at one time

thought to be a potential source of the contamination found in the Mount Olivet Cemetery well. This has not proven to be correct.

On May 19 and 22, 1995, Ecology and Environment Inc., under contract to the Environmental Protection Agency, collected 15 soil-gas samples from several locations near the site. Two of the 15 soil gas samples contained organic chlorides. Sample OC-SG-06 was collected from Mount Olivet Cemetery and yielded 16 ppb of PCE. Sample NG-SG-02, was collected near one of the National Guard maintenance buildings and yielded 1 ppb of TCE.

On June 26, 1995 Ecology and Environment Inc., using the Geoprobe, collected soil gas samples at several locations near the National Guard maintenance buildings and near the Veteran's Medical Center. The initial objective of the sampling event was to obtain groundwater samples. However, a hard caliche layer prevented the Geoprobe from penetrating beyond four feet below grade. All samples were negative for organic chlorides.

Since the groundwater plume was initially identified in 1990, samples of groundwater from the Mount Olivet Cemetery irrigation well have been collected annually. The well is 470 feet deep and screened the majority of this length, through both confined and unconfined aquifers. PCE levels in samples collected from the well have ranged from 11 to 184 ppb[2].

More recent activities, conducted in the hope of identifying the contamination source, are described in section 4.0 "FIELD ACTIVITIES".

4.0 FIELD ACTIVITIES

4.1 Sample Collection

In November of 1996, soil gas samples were collected by an EPA contractor from three locations, using a Geoprobe truck-mounted system. Sample locations and sample results are given in Table 1. Concentrations are given in ppb. The field activities report for this sampling effort is included as Appendix A.

Table 1 - November 1996 Soil Gas Sample Locations and Results					
Boring No.	**Location**	**1,1-DCE**	**1,2-DCE**	**TCE**	**PCE**
O-SG-1	VA Medical Center Southeast of Building 6	ND	ND	ND	1.9
O-SG-2	Fort Douglas Center of Red Butte Gulch, southwest of Coast Guard Maintenance Shop	ND	ND	ND	ND
O-SG-3	Fort Douglas Northwest side of Red Butte Gulch, southwest of Coast Guard Maintenance Shop	ND	ND	ND	ND
O-SG-4	Fort Douglas Southwest of loading dock for Building 515 (old brig)	ND	ND	3.4	49.0

During June - August of 1998, five monitoring wells were installed east and southeast of the Mount Olivet Cemetery. The wells were located to provide information about the groundwater gradient, the groundwater flow direction, and the extent of organic chloride contamination to determine potential PCE source areas. Each well location was selected based on samples collected from previous wells and the expected groundwater flow direction. The wells were numbered sequentially based on order of installation. The wells were sampled for organic chloride and metals analysis in November of 1998. The Site Activities Report for the monitoring well construction and sampling is included as Appendix B.

Monitoring well EPA-MW-03 was abandoned in September 1999 due to planned construction in the area. A sample was collected from the well by an EPA contractor prior to abandonment and submitted to Datachem Laboratory in Salt Lake City for PCE analysis. The reported PCE concentration in the sample was 7.1 ppb.

During September of 1999, an additional monitoring well (EPA-MW-06) was installed in the southeast corner of Sunnyside Park. This well was located upgradient of wells with PCE contamination and upgradient of the sewer line that originates from the former dry cleaning facility at the VA Medical Center. On January 6, 2000 an EPA contractor collected a sample from monitoring well EPA-MW-06 for organic chloride and metals analysis. The Site Activities Report for the well construction and sampling is included as Appendix C.

During August and September 1998, five screening samples were collected of spring water emerging west to southwest of the Mount Olivet Cemetery. These samples were collected in an attempt to track the plume's western and southwestern extent, under the assumption that groundwater flow is to the west to southwest.

Table 1 on page 23 summarizes groundwater sample results.

Deviations from the Work Plan

The original work plan for placement and sampling of monitoring wells was approved by EPA in February 1996; however, subsequent events led to a substantial modification of the work plan.

Changes included the following:

- Placement and sampling of the wells was conducted by EPA contractors rather than by contractors selected by DERR. The sampling and analysis methods were, therefore, those routinely used by the contractors, which were reviewed and approved by both EPA and DERR.

- The location of the first monitoring wells placed and sampled (EPA-MW-01S and EPA-MW-01D) was modified slightly to be east of Guardsman Way. These first wells detected PCE in the shallow groundwater. The work plan incorrectly assumed this well to be upgradient of the groundwater contamination plume. The location and number of subsequent wells, therefore, was changed to locations mostly likely to provide useful information on the extent and source of the groundwater plume.

- Groundwater samples collected from monitoring wells were analyzed for both metals and volatile organic compounds to provide additional information useful in ensuring the same aquifer was being sampled in each monitoring well.

- Groundwater samples collected by DERR staff include the 1511 East 500 South Salt Lake City well and the Mount Olivet Cemetery irrigation well.

4.2 Quality Assurance/Quality Control (QA/QC)

All groundwater samples collected from existing wells by DERR personnel were handled under strict chain-of-custody, packed on ice to 4° Celsius, sealed and shipped express mail to Southwest Laboratory of Oklahoma (an EPA Contract Laboratory) , and analyzed under Routine Analytical Services (RAS) for VOA's. A carbon-filtered deionized water sample was collected and traveled with the other samples. Data validation was checked by URS Operating Services (an EPA contractor). The data was considered acceptable with qualifiers added by the reviewer.

Screening samples collected from flowing springs by DERR personnel were handled under strict chain-of-custody, packed on ice to 4° Celsius, and transported to the Utah State Health Department Laboratory and analyzed for VOA's. A deionized water sample traveled with each sample as a trip blank.

Quality control requirements for air samples are not documented; therefore, data from the November 1996 soil gas sampling event were reviewed for compliance with Method 8260 water analysis quality control criteria. Based on this review, the data were found to be acceptable for the intended purposes. More detail concerning quality control criteria for the November 1996 sampling event is contained in Appendix A.

Quality control procedures for the EPA monitoring well sampling events are described in Appendices B and C.

5.0 WASTE/SOURCE CHARACTERISTICS

PCE (also known as tetrachloroethene and tetrachloroethylene) is a synthetic, colorless, nonflammable chlorinated solvent that is commonly used for dry cleaning fabrics and for metal-

degreasing operations. Solvent soaps, printing inks, some lubricants, and silicones also may contain PCE[3]. Dimensions of the Mount Olivet Cemetery Plume site, or the extent of potential contamination, is not known. The width of the PCE plume is greater than 900 feet at well EPA-MW-01 based on the 320 ppb and 11 ppb PCE concentration in monitoring wells EPA-MW-01 and EPA-MW-03 respectively. Groundwater elevation data obtained from EPA monitoring wells reveals that groundwater in the immediate area flows in a northwestern direction. Based upon this groundwater flow and PCE concentrations, the source for contamination of the aquifer is southeast of monitoring wells EPA-MW-01S and EPA-MW-02 and northwest of monitoring well EPA-MW-06. The only identified potential source of PCE in this area is the sewer line that originates from the former dry cleaning facility at the VA Medical Center.

6.0 GROUNDWATER EXPOSURE PATHWAY

6.1 Hydrogeology

The geographic coordinates and elevation for each installed monitoring well described in Appendices B and C were surveyed by ESI engineering. UOS measured groundwater depths for each monitoring well on September 1, October 22, and November 10, 1999. Depths to the water table in this area vary from about 118 to 205 feet. Depths to groundwater in five of the six monitoring wells are given in Table 6 of Appendix B. Installation of the last monitoring well (EPA-MW-06) is described in Appendix C. Depth to groundwater in this monitoring well is 118 feet.

Ground water in the Salt Lake Valley occurs in a confined (artesian) aquifer, a deep-unconfined aquifer and a shallow-unconfined aquifer. All of the aquifers are connected hydraulically to some degree; thus, composing the groundwater reservoir in the Salt Lake Valley[3].

Based upon October 1998 groundwater elevation measurements by UOS, flow direction of the unconfined aquifer in the immediate vicinity of the site is northwest at an approximate 2% grade. This flow direction is approximately opposite of the surface topography which slopes toward the

southeast. The groundwater elevation above mean sea level of the EPA monitoring wells as measured on October 22, 1998 is given in Figure 3 on page 20

The "principal aquifer" in the valley consists of the confined and the deep-unconfined aquifers. The primary recharge areas for the principal aquifer are along the mountain fronts on the eastern and western sides of the valley. The Mount Olivet Cemetery Plume is located in a transitional area that includes both primary and secondary aquifer recharge areas. The primary recharge area includes the Wasatch Front and upper bench where confining layers are thinner than 20 feet[4]. The secondary recharge areas are characterized by a shallow unconfined aquifer and a confining aquifer separated by a confining layer. Information from EPA monitoring well EPA-MW-01D indicates the deeper aquifer displays an upward hydraulic gradient at this point. A branch of the Wasatch Fault extends approximately through the Mount Olivet Cemetery, however, it is unlikely that the fault influences shallow groundwater flow through unconsolidated materials.

6.2 Groundwater Targets

Two drinking water wells owned by the University of Utah are located approximately 2000 feet northwest of the Mount Olivet Cemetery well at 1511 East 500 South. A drinking water well owned by Salt Lake is located approximately 1000 feet to the north. Both the University of Utah wells and the Salt Lake City well are routinely sampled by the water utilities, generally annually, for VOC regulated contaminants. The most recent analytical results for the University of Utah wells (December 1999) and the Salt Lake City wells (July 1998) are non-detect for all regulated VOC's[5] Historical analyses for the University of Utah wells, dating back to 1994, are also negative for regulated VOC's. Both presently used University of Utah wells appear to be screened in the deep aquifer[6]. A well abandoned by the University of Utah is located just west of University of Utah Well No. 1. This well appears to be screened in both upper and lower aquifers[7] and has not been grouted in[8], which could permit contamination to migrate from upper to lower aquifers.

A report giving information about wells located within four miles of the site is given as Appendix D. The most recent information indicates there are 19 municipal wells located within four miles of

the site. A map showing the location of these wells in relation to sampling points described later in this report is given as Figure 4 on page 21.

6.3 Sample Locations

Locations of groundwater samples collected from EPA monitoring wells during November 1998 and January 2000 are given in Table 2. A map of the EPA monitoring well locations is given as Figure 2 of Appendix B. A detailed review of analytical results is given as Table 4 of Appendix B. General chemistry along with certain cation and anion results were used to map the hydrochemical facies of the sample. The data were also compared with sample data from the other monitoring wells on a Piper diagram (Appendix C, Figure 3). Monitoring well sample cation and anion data plotted in the same area of the Piper diagram, which indicates that the wells are screened in the same or chemically similar aquifers (except well EPA-MW-01D).

Table 2 - Mount Olivet Cemetery Plume
EPA Monitoring Well Sample Locations and Rational

Well No.	Location	Rational
EPA MW-01S	Wells EPA-MW-01S and EPA-MW-01D are nested wells with total depths of 224 and 404 feet. The wells are located in the southwestern corner of the Steiner Aquatic Center parking lot, approximately 700 feet east of the Mount Olivet well.	Determine if contamination is present in both deep and shallow aquifers
EPA-MW-01D		
EPA-MW-02	This well is located approximately 500 feet east of well EPA-MW-01 and has a screened interval of 175.5 to 205.5 feet bgs in the first aquifer encountered.	Determine eastern extent of groundwater plume
EPA-MW-03	This well is located approximately 500 feet north of EPA-MW-02, also on Salt Lake City property. The well has a screened interval of 190 to 210 feet bgs in the first aquifer encountered.	Determine northern extent of groundwater plume.
EPA-MW-04	This well is located in Sunnyside Park, about 850 feet south and 350 feet west of well EPA-MW-01. The well has a screened interval of 143 to 173 feet bgs in the first aquifer encountered.	Determine southern extent of groundwater plume
EPA-MW-05	This well is located at the VA Medical Center, approximately 1,700 feet east-northeast of well EPA-MW-01. The well was screened from 186 to 221 feet bgs in the first aquifer encountered.	Determine if contamination exists east of the VA Medical Center laundry
EPA-MW-06	This well is located in the southeast corner of Sunnyside Park, upgradient of other EPA monitoring wells in which PCE was previously detected and upgradient of the sewer line that originates from the former dry cleaning facility at the VA Medical Center.	Determine if contamination exists east of the VA Medical Center laundry sewer line

The 1511 East 500 South Salt Lake City municipal drinking water well and the Mount Olivet Cemetery irrigation well appear to be drawing water from the same shallow aquifer, based upon a review of well logs. Table 3 is a summary of the well log comparison.

Table 3

Mount Olivet Irrigation Well and 1511 East 500 South Salt Lake City Well

Well Log Comparison

Mount Olivet Irrigation Well - Grade Elevation 4630 Feet				Salt Lake City Well - Grade Elevation 4710 Feet			
Elevation	Below Grade	Formation	Comments	Elevation	Below Grade	Formation	Comments
	0-3	Soil			0-2	top soil	
	3-13	rock and boulders			2-210	clay, gravel, boulders	
	13-16	gravel					
	16-20	boulders					
	20-45	boulders and clay					
	45-52	rock and boulders					
	52-70	clay and boulders					
	70-80	boulders					
	80-85	boulders and clay					
	85-90	boulders					
4490	90-165	boulders and clay	water - 140'	4500	210-216	clay, gravel	water
4435	175-195	water gravel	water, perforated	4474	216-236	clay, gravel	
4425	195-205	boulders	perforated	4444	236-266	clay, gravel	perforated
4415	205-215	boulders and clay		4412	266-298	sand, gravel	perforated
4395	215-235	water gravel	perforated	4362	298-348	sand gravel, boulders	perforated
4350	235-280	yellow clay		4322 perforated	348-380	sand gravel, conglomerate	
	280-305	boulders, fine sand	perforated				
4320	305-310	boulders and clay	perforated				
4315	310-315	sandy rock	perforated				
4292	315-338	conglomerate	perforated	4302	380-400	conglomerate	perforated

On September 22, 1998 groundwater samples were collected from these two existing well locations. A list of samples associated with this sampling effort is given in Table 4. The municipal well was selected as a sampling point to verify contamination did not extend to this well. The analytical results and quality assurance summary is given as Appendix E. The grants of access, chain-of-custody forms, and shipping information is given as Appendix F.

Table 4 - Mount Olivet Cemetery Plume Existing Well Sample Locations and Rational		
Sample	**Sample Location**	**Rationale**
MT-01	Mt Olivet Cemetery irrigation well	Verify presence/absence of VOA's in groundwater
MT-02	1511 East 500 South Salt Lake City municipal well	Determine northern extent of groundwater plume
MT-03	Trip Blank	Quality Control

On August 5 through September 4, 1999 four springs located approximately ½ mile southwest to west of the Mount Olivet Cemetery were sampled for VOC's. The name and location of the springs are given in Table 5. Spring samples were collected in an attempt to identify the western an southwestern extent of the groundwater plume. The spring samples were collected before groundwater elevation measurements in EPA monitoring wells had revealed a northwestern groundwater flow direction. The samples were collected for screening purposes only and were submitted to the Utah State Health Department Laboratory for VOC analysis.

Table 5 - Mount Olivet Cemetery Plume Spring Water Screening Sample Locations		
Sample	Spring	Address
SP-1	Our Lady of Lourds Spring	1063 East 700 South
SP-2	Benson Spring	761 South 1100 East
SP-3	Smith Spring	1123 Alpine Place
SP-4	Bowen Spring	1220 East Yale Ave

6.4 Analytical Results

PCE was the primary VOC reported in groundwater samples. PCE concentrations ranged from non-detect at the 10 ppb reporting limit (RL) to 320 ppb. Low concentrations (<10 ppb) of TCE, chloroform, methylene chloride, and 1,2 - dichloroethene were also reported. The concentrations of these contaminants were below the 10 ppb RL and considered to be estimated values. The 6 ppb methylene chloride reported as present in the 1511 East 500 South Well sample is most likely a laboratory analysis artifact as methylene chloride was also detected in the trip blank.

Sample EPA-MW-08 was an equipment rinsate sample. The rinsate sample was collected immediately following the sample at monitoring well EPA-MW-01S which had the highest PCE concentration of the EPA monitoring wells. Chloroform and PCE were detected in the rinsate sample. These results reveal that a10-gallon purge was not sufficient to remove the residual PCE from the pump. However, other precautions were taken during the sampling event to prevent cross contamination (i.e., going from low to high concentration wells and pumping larger purge volumes. Low concentrations of chloroform (< 2 ppb) detected in spring water samples is most likely the result of chlorinated drinking water recharge of the shallow aquifer.

A map of all well sample locations and PCE analytical results is given as Figure 4 on page 21. Table 6 on page 23 gives a summary of VOC analytical results. No PCE was detected east of the VA Medical Center laundry building in which a dry cleaning operation operated historically or east of the sewer line leading from the laundry building.

6.5 Conclusions

PCE contamination appears, at this point in time to be limited to the shallow aquifer. Groundwater flow is to the northwest, in the direction of two University of Utah drinking water wells. The width of the PCE plume is greater than 900 feet at monitoring well EPA-MW-01 based on the 320 ppb and 11 ppb PCE concentration in monitoring wells EPA-MW-01 and EPA-MW-03 respectively. Based upon the northwestern groundwater flow direction and PCE concentrations, the source for contamination of the aquifer is southeast of monitoring wells EPA-

MW-01S and EPA-MW-02, west of EPA-MW-05, and northwest of EPA-MW-06. The only identified potential source of PCE in this area is the sewer line that originates from the former dry cleaning facility at the VA Medical Center. Organic chloride contamination appears to be limited, at this point in time, to the shallow aquifer.

7.0 SURFACE WATER EXPOSURE PATHWAY

7.1 Hydrologic Setting

Hydrology: Red Butte Creek is located about ½ mile south of the site. An underground, piped diversion from Red Butte Creek flows under a portion of the site and feeds the Mount Olivet Reservoir. Reservoir water is used for irrigation in the Cemetery. Occasionally, withdrawals pump the reservoir essentially dry. Reservoir overflow water enters the city storm sewer system[9]. Red Butte Creek flows downstream of the site, through Sunnyside, Miller, and Liberty Parks and then, largely underground, to the Jordan River about four miles away. Water flowing northwest of the site would enter the city storm sewer system, underground to the Jordan River. The 15 mile downstream surface water pathway is illustrated as Figure 5 on page 22.

7.2 Surface Water Targets

Surface Water Pathway Analysis: Red Butte Creek and the Mount Olivet Reservoir are not open to fishing. The Jordan River is home to various species of waterfowl and is used by some as a warm water fishery. Fish that are commonly stocked in the Jordan River are catfish, walleye, bass, and occasionally rainbow trout[10].

7.3 Surface Water Sample Locations

Sampling efforts focused on determining the extent and potential sources of groundwater contamination. No surface water samples were collected. Groundwater samples collected from monitoring wells closest to Red Butte Creek (monitoring wells EPA-MW-05 and EPA-MW-06) were non-detect for PCE. Therefore, it is unlikely that the plume extends as far east as Red

Butte Creek and is not associated with the University of Utah Building 515 chlorinated solvent plume.

8.0 SOIL EXPOSURE PATHWAY

8.1 Physical Conditions

The major soil types in the area are of the Bingham-Parley's association. This association is characterized by well-drained soils on high lake terraces and alluvial fans[11]. No evidence of hazardous waste has been found during previous site visits. The area is generally well vegetated and lawn covers a great deal of the area.

8.2 Soil Targets

Soil Exposure Pathway Analysis: Soil gas surveys have failed to locate surface soil contamination. The potential for direct contact via dermal or ingestion pathways appears low. The number of on-site residents is less than 10. Up-to-date estimates indicate that the population within ¼ mile of the site is 563 and within ½ mile of the site the population is 4892[12]. The 1990 population estimates by census tract are given as Appendix G.

Estimates of the nearby population, based on census block information, are presented in the Air Pathway section of this report. Although large numbers of people frequent the cemetery year round, the likelihood of direct exposure to PCE through soil contact is not suspected at this time due to the lack of a definable source. Therefore, no soil samples were collected. Land immediately east of the site is used for a vehicle maintenance facility for the Utah National Guard. Land farther east and south of the site is used for recreational purposes.

8.3 Soil Sample Locations

Soil gas surveys have failed to locate surface soil contamination. Therefore, no soil samples were collected.

9.0 AIR EXPOSURE PATHWAY

9.1 Meteorology

The climate in the Salt Lake Valley is characterized by hot windy summers and cold winters. Temperatures approaching 100 degrees Fahrenheit are common in the summer months, while sub-zero temperatures commonly occur during the winter. The average annual precipitation at the site generally ranges between 10 to 16 inches[13].

9.2 Air Targets

Air Exposure Pathway Analysis: A source of surface contamination has not been identified. A release of PCE to the ambient air would be anticipated when the well is pumped for irrigation. Cemetery workers have been advised to minimize irrigating lawns when visitors are close by and to minimize contact with the pumped water.

The nearest residents to the site are within 0.6 mile at the University Village. Population within four miles of the site, estimated by census block information, is 151,013 persons[14]. Appendix G lists the population estimates by census block, and by ¼ , ½ , 1, 2, 3 and 4 mile radii from the site.

9.3 Air Sample Locations

No air samples were collected due to the limited potential for exposure via the air pathway.

10.0 SUMMARY AND CONCLUSIONS

The Mount Olivet Cemetery Plume site, consists of a groundwater plume contaminated with an unknown source of PCE. Contamination of the irrigation well, located inside Mount Olivet Cemetery, was first discovered in 1990, displaying levels of PCE that exceed regulatory levels. Presently the well is still contaminated. The plume is located in a transitional area that includes both primary and secondary aquifer recharge areas. The precise dimensions of the contaminated plume are unknown; however the plume width is greater than 900 feet at well EPA-MW-01 and appears to be limited to the shallow aquifer. Groundwater flow appears to be to the northwest, in the direction of two University of Utah drinking water wells. An abandoned University of Utah well located near the other university wells appears to be screened in both upper and lower aquifers and has not been grouted in, which could permit contamination to migrate from upper to lower aquifers. Groundwater samples collected from monitoring wells closest to Red Butte Creek (EPA-MW-05 and EPA-MW-06) were non-detect for PCE. Therefore, it is unlikely that the plume extends as far east as Red Butte Creek. Based upon the northwestern groundwater flow direction and PCE concentrations, the source for contamination of the aquifer is southeast of monitoring wells EPA-MW-01S and EPA-MW-02, west of monitoring well EPA-MW-05, and northwest of EPA-MW-06. The only identified potential source of PCE in this area is the sewer line that originates from the former dry cleaning facility at the VA Medical Center.

11.0 REFERENCES

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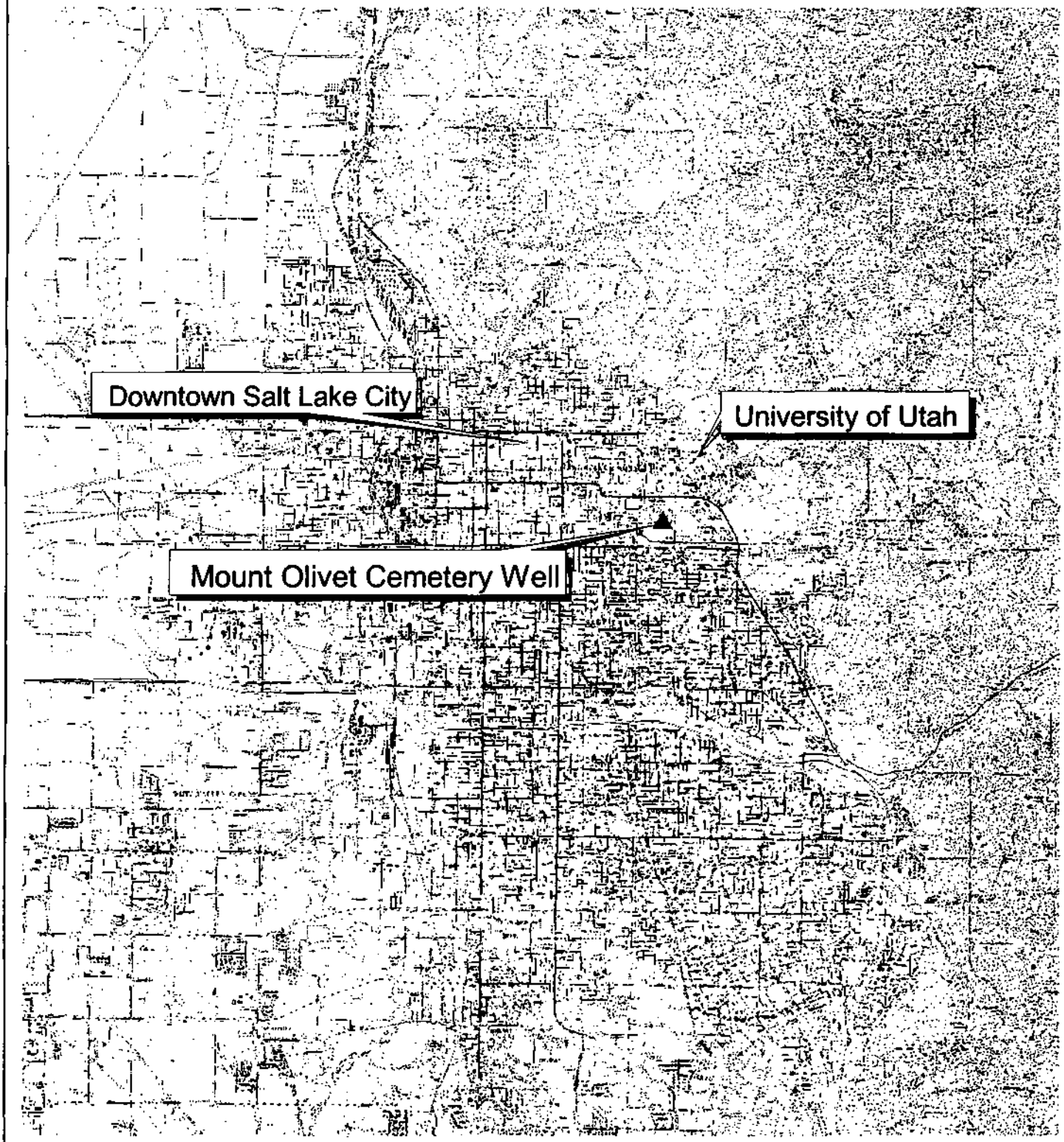

6000 0 6000 12000 Feet

N
W E
S

▲ Mount Olivet Cemetery Well

Utah Department
of Environmental Quality

Division of Environmental Response
and Remediation

Figure 1
REGIONAL LOCATION MAP
Mount Olivet Cemetery Plume - Salt Lake City
Salt Lake County, Utah
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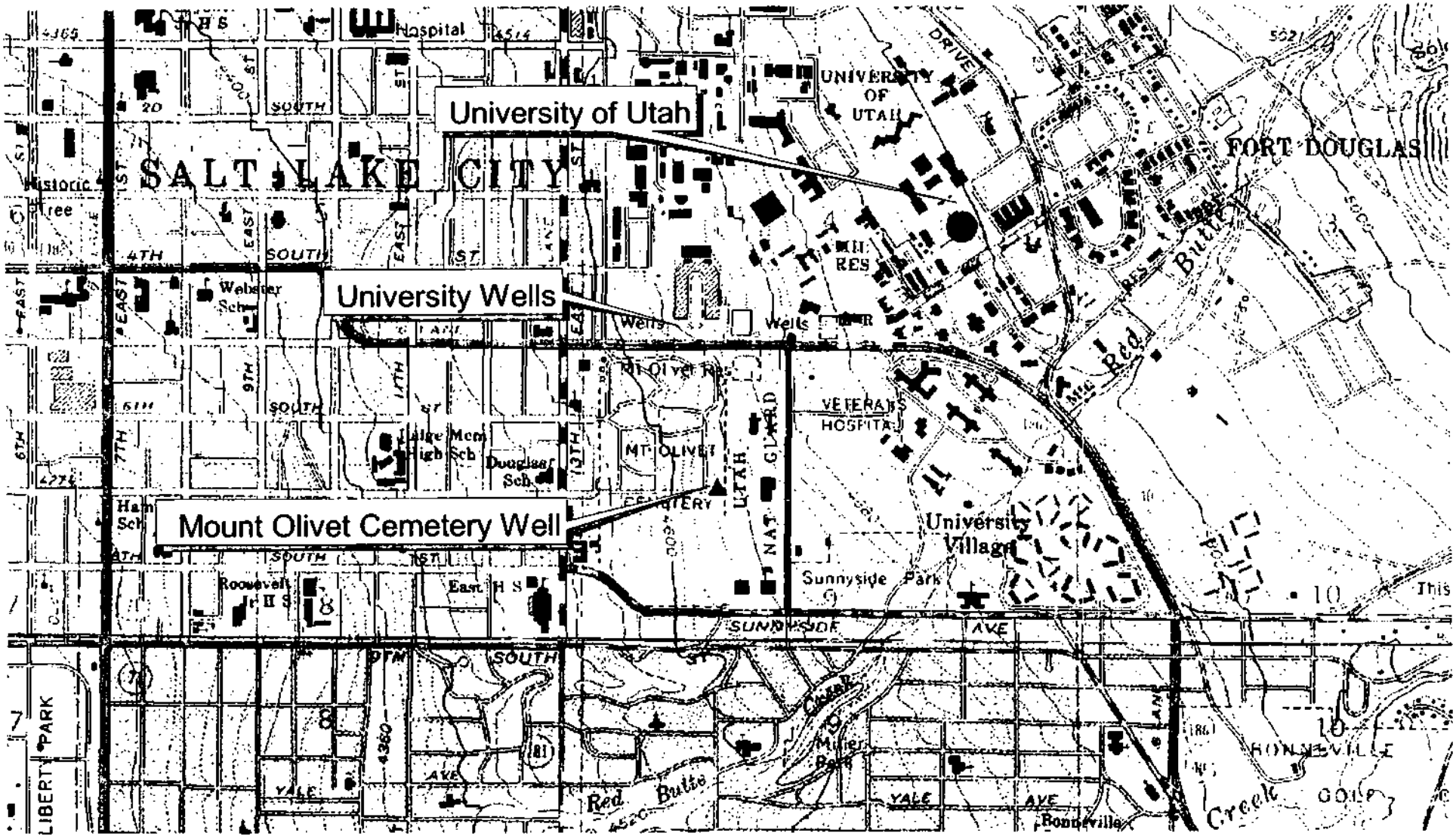
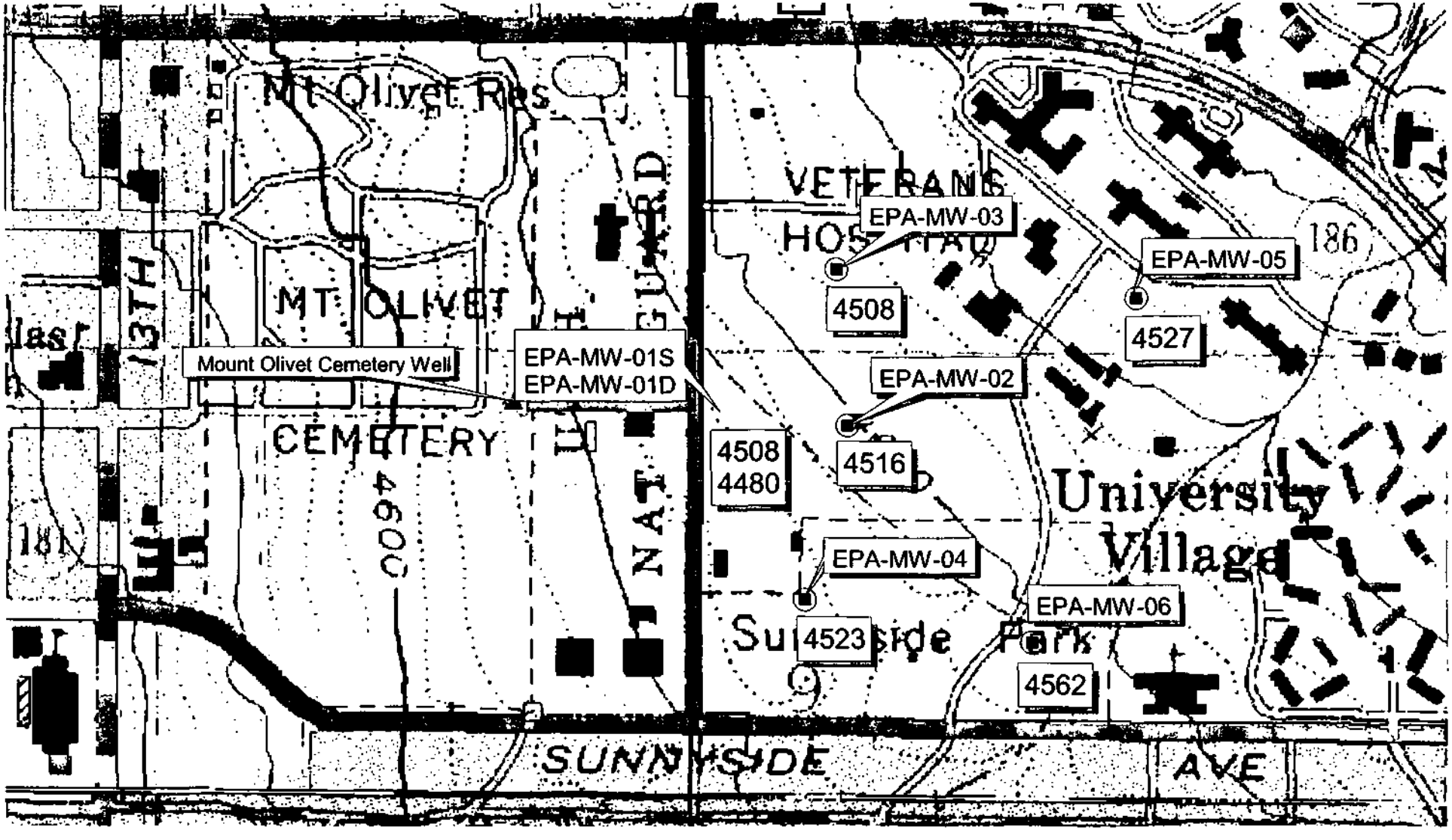


Figure 2
SITE LOCATION MAP
Mount Olivet Cemetery Plume - Salt Lake City
Salt Lake County, Utah

Utah Department of Environmental Quality

Division of Environmental Response and Remediation



0.05 0 0.05 0.1 Miles

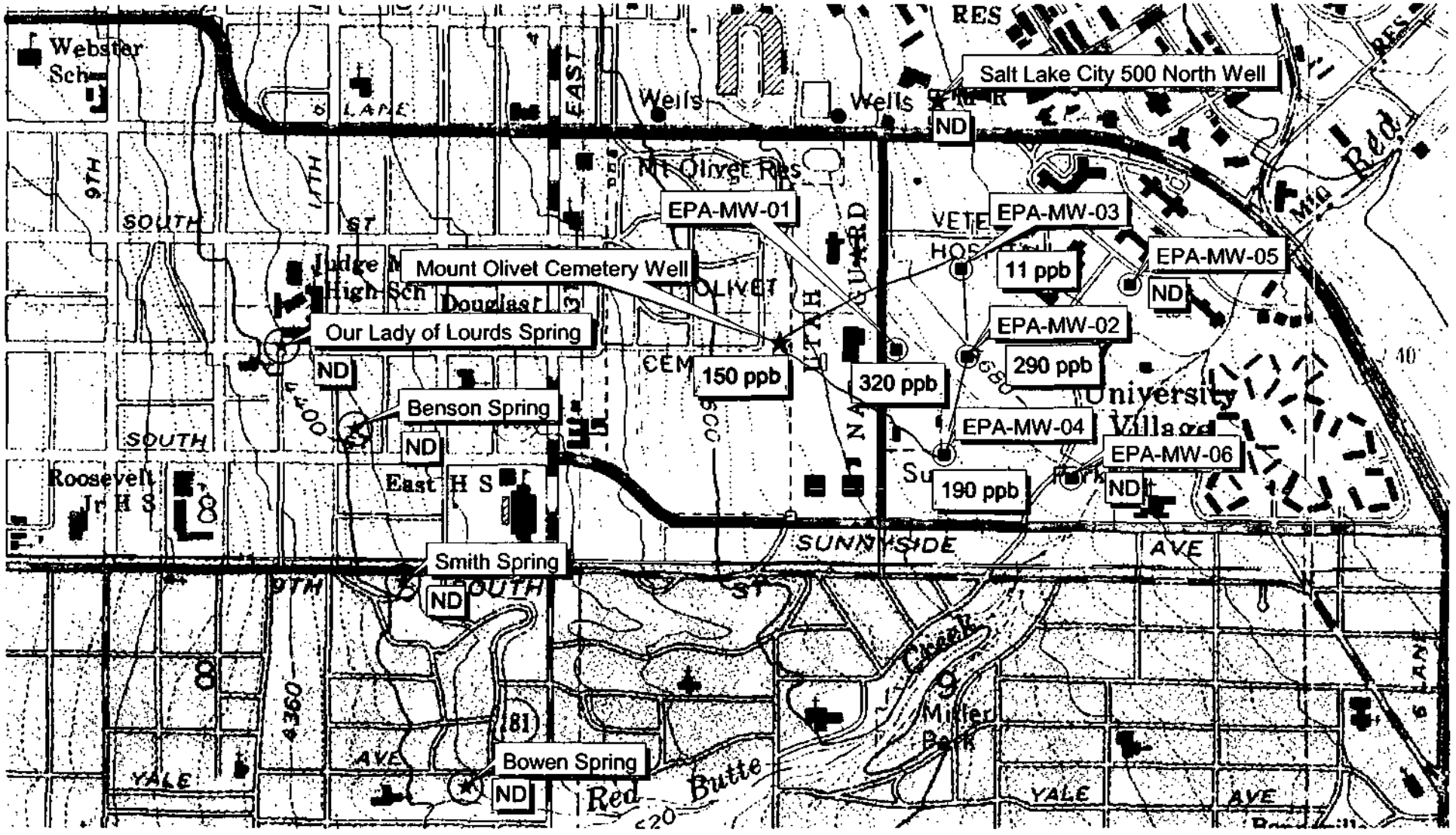
N W E S

▲ Mount Olivet Cemetery Well
◉ EPA Monitoring Wells

Figure 3
EPA Monitoring Well
Groundwater Elevations
(10/22/1998)

Utah Department
of Environmental Quality

Division of Environmental Response
and Remediation



0.1 0 0.1 0.2 0.3 0.4 Miles

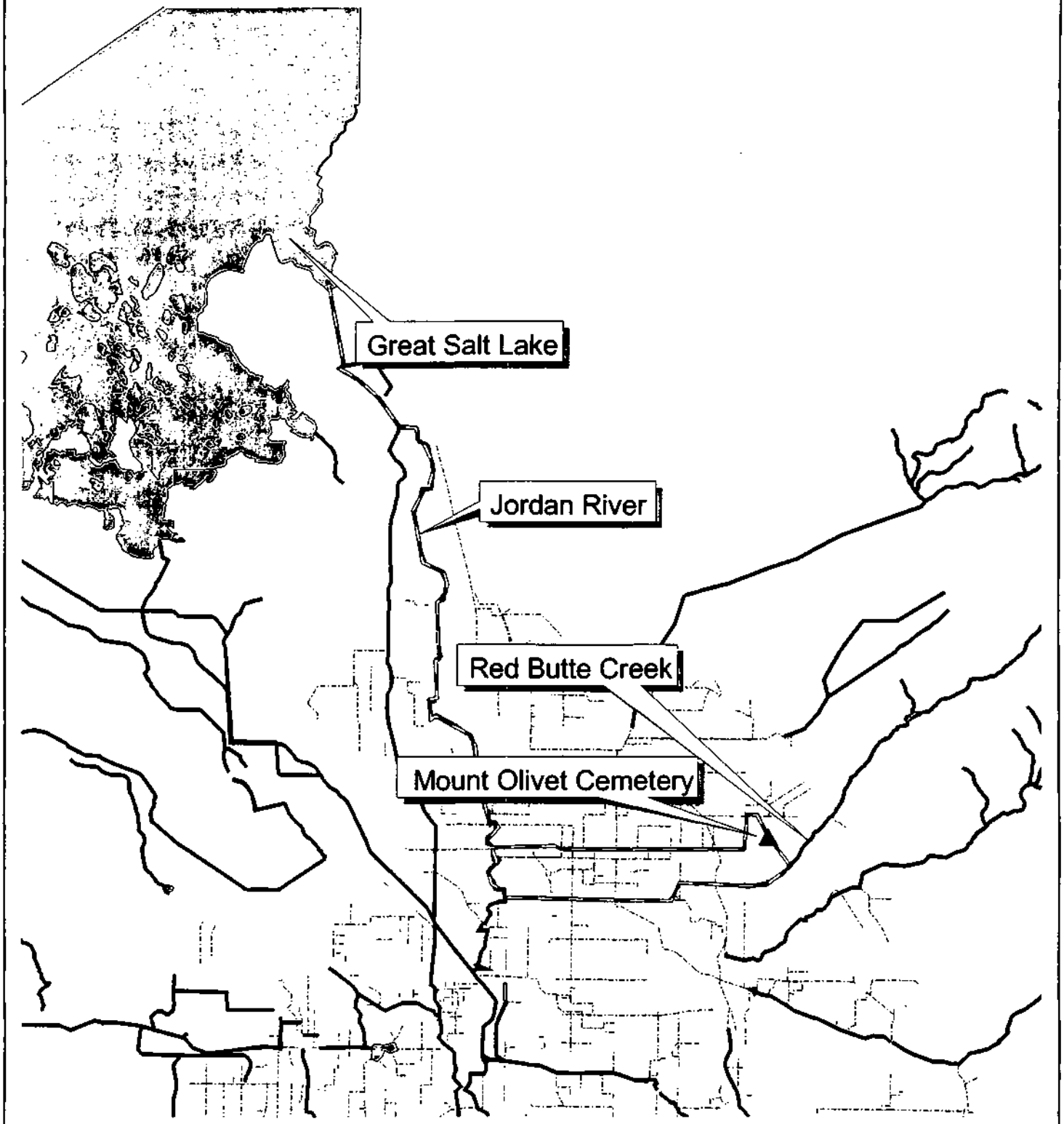
- University Wells
- Mount Olivet Cemetery Well
- EPA Monitoring Wells
- Existing Well Sample Points
- Spring Sample Locations

N W E S

Figure 4
GROUNDWATER SAMPLING LOCATIONS
AND PCE ANALYTICAL RESULTS
Mount Olivet Cemetery Plume - Salt Lake City
Salt Lake County, Utah

Utah Department of Environmental Quality

Division of Environmental Response and Remediation



2 0 2 4 Miles

N
W E
S

▲ Mount Olivet Cemetery Well
15 Mile Surface Water Pathway
Storm Sewer Line
Streams

Utah Department
of Environmental Quality

Division of Environmental Response
and Remediation

Figure 5
15 MILE SURFACE WATER PATHWAY
Mount Olivet Cemetery Plume - Salt Lake City
Salt Lake County, Utah

Table 6
VOC Analytical Results

Sample Number				MT-02		MT-01		MT-03		EPA-MW-01S		EPA-MW-01S		EPA-MW-01D		EPA-MW-02		EPA-MW-03		EPA-MW-04		EPA-MW-05		EPA-MW-07		EPA-MW-08		MT-02		SP-1		SP-2		SP-3		SP-4	
Traffic Number				HS794		HS795		HS796		HS662		HS668		HS663		HS664		HS665		HS666		HS667		HS669		HS670		HS794		Screening Samples							
Sample Location		BenchMarks		Mount Olivet Cemetery Well		1511 East 500 South Salt Lake City Well		Trip blank collected from DERR DI water unit		Stainer Center Shallow		Stainer Center Shallow (duplicate)		Stainer Center Deep		500 Ft East of Well MW 01		500 Ft North of Well MW-02		West End of Sunnyside Park		Northeast of VA Laundry Building		Trip Blank		Airsalle		East of VA Laundry Sewer Line		Our Lady of Lourds School Spring - 0.68 Miles west of site		Benson Spring - 0.58 Miles southwest of site		Smith Spring - 0.61 Miles southwest of site		Bowen Spring - 0.75 miles southwest of site	
Sample Type	EPA Reg 3**	SCDM*																																	
Analyte	µg/L	µg/L	Std	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
Chloromethane		6.6	cl	10	U	10	U	10	UJ	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	UJ	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Bromomethane		51	rd	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Vinyl Chloride		0.045	cr	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	UJ	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Chloroethane	33,000	NL	---	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Methylene Chloride		5	mcl	10	UJ	6	J	5	J	10	U	2	J	10	U	24	J	10	U	2	J	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Acetone		3,700	rd	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	50	U	10	U	10	U	10	U	11		10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Carbon Disulfide		3,700	rd	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
1,1-Dichloroethene	30	0.14	cr	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
1,1-Dichloroethane		3,700	rd	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
1, 2-Dichloroethene (total)	200	NL	---	2	J	10	U	10	U	5	J	3	J	10	U	50	U	10	U	1	J	10	U	2	J	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Chloroform		14	cl	2	J	2	J	10	U	4	J	5	J	10	U	50	U	3	J	4	J	2	J	10	U	16		2	J	1.2		0.7		0.5	U	1.8	
1,2-Dichloroethane		0.94	cr	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
2-Butanone (MEK)	NL	22,000	rd	10	U	10	U	10	UJ	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
1,1,1-Trichloroethane		200	mcl	1	J	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Carbon Tetrachloride		0.86	cl	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Bromodichloromethane		100	mcl	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dichloropropane		1.3	cr	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
cis-1, 3-Dichloropropene	1	NL	---	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Trichloroethene (TCE)	20	5	mcl	2	J	10	U	10	U	4	J	4	J	10	U	50	U	10	U	2	J	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Dibromochloromethane		1	cr	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
1,1,2-Trichloroethane		1.5	cr	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Benzene		2.9	cr	10	U	10	U	10	U	10	U	10	U	10	UJ	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
trans-1,3-Dichloropropene	1	NL	---	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	UJ	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Bromoform	500	11	cr	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
4-Methyl-2-Pentanone	NL	2,900	rd	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
2-Hexanone	NL	NL	---	10	UJ	10	UJ	10	UJ	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	U	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Tetrachloroethene (PCE)	40	1.8	cr	150		10	U	10	U	320	D	310	DJ	1	J	290		11		190		10	U	10	U	34		10	U	0.5	U	0.5	U	0.5	U	0.5	U
1,1,2,2-Tetrachloroethane		0.43	cr	10	U	10	U	10	U	10	U	10	U	10	U	50	U	10	U	10	U	10	U	10	UJ	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Toluene		1,000	mcl	10	U	10	U	10	U	10	U	10	U	10	UJ	50	U	10	U	10	U	10	U	10	UJ	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Chlorobenzene		100	mcl	10	U	10	U	10	U	10	U	10	UJ	10	UJ	50	U	10	U	10	U	10	U	10	UJ	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Ethylbenzene		700	mcl	10	U	10	U	10	U	10	U	10	UJ	10	UJ	50	U	10	U	10	U	10	U	10	UJ	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Styrene		100	mcl	10	U	10	U	10	U	10	U	10	UJ	10	UJ	50	U	10	U	10	U	10	U	10	UJ	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
Xylene (Total)		10,000	mcl	10	U	10	U	10	U	10	U	10	UJ	10	UJ	50	U	10	U	10	U	10	U	10	UJ	10	U	10	U	0.5	U	0.5	U	0.5	U	0.5	U
TENTATIVELY IDENTIFIED COMPOUND CONCENTRATIONS																																			
Cyclotrisiloxane		NL	---			6	J	5	J																										
Unknown		NL	---			5	J																												

*SCDM - Superfund Chemical Data Matrix, 6/96, (Std column = tw) - if value not listed, drinking water values (Std column = mcl/d/cl) were used
NL - A bench mark is not listed for this substance.
J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met
U - The material was analyzed for, but was not detected above the level of the associated value
UJ - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected
NJ - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration
N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
Concentrations that exceed the given threshold value are shaded.

APPENDIX A

URS OPERATING SERVICES INC.
FIELD ACTIVITIES AND ANALYTICAL RESULTS FOR
SOIL GAS SAMPLING AT THE
MOUNT OLIVET CEMETERY PLUME
SALT LAKE CITY, UTAH
DECEMBER 6, 1996

URS OPERATING SERVICES

1099 18TH STREET
SUITE 710
DENVER, COLORADO 80202-1908
TEL: (303) 291-8300
FAX: (303) 291-8296

December 6, 1996

Mr. Luke D. Chavez
Site Assessment Manager
U.S. Environmental Protection Agency
Region VIII, Mail Code 8EPR-ER
999 18th Street, Suite 500
Denver, Colorado 80202

SUBJECT: **START, EPA Region VIII, Contract No. 68-W5-0031, TDD No. 9609-0003**
Field Activities and Analytical Results for Soil Gas Sampling at the Mount Olivet Cemetery Plume, Salt Lake City, Utah, November 1996

Dear Mr. Chavez:

The attached report recounts the soil gas collection field activities and gives the results of the laboratory analyses of the four soil gas samples collected on November 9, 1996, for the Mt. Olivet Cemetery Plume site in Salt Lake City, Utah.

If you have any questions, please call me at 291-8270. Please initial both attached copies of this letter and return them to Janet Benson when you have approved this document.

Very truly yours,

URS OPERATING SERVICES, INC.

Barry Hayhurst
Environmental Scientist

cc: T. F. Staible/UOS without attachments
File/UOS

EPA ACTION BLOCK

- ☑ Approved
- ○ Approved, TDD to follow
- ○ Approved as corrected
- ○ Disapproved
- ○ Review with _____
- ○ Original to _____
- ○ Copy to _____
- ○ Reply envelope enclosed

4/13/97 L.C.
Date By

75-60903.00
\START\Mt-Olive\Trip.Rpt:bas

Field Activities and Analytical Results for Soil Gas Sampling Mount Olivet Cemetery Plume Salt Lake City, Utah November 1996

INTRODUCTION

URS Operating Services, Inc. (UOS) has been tasked, under Technical Direction Document (TDD) No. 9609-0003 and 9609-0003A, by the Region VIII office of the U.S. Environmental Protection Agency (EPA), to conduct soil gas sampling in the vicinity of the Mount Olivet Cemetery Plume in Salt Lake City, Salt Lake County, Utah (CERCLIS ID # UTD981548985) (Figure 1).

Background information for this site can be found in the Work Plan for the Army National Guard, Armory/Org. Maintenance Shop 5, Salt Lake County, Utah, prepared by Neil B. Taylor of the Utah department of Environmental Quality, Division of Environmental Response and Remediation, 1996; the Environmental Priorities Initiative Preliminary Assessment for the University of Utah, prepared by URS Consultants, 1993; and from the Analytical Results Report of the Mount Olivet Well site prepared by Ecology and Environment, Inc., Technical Assistance Team (TAT), 1995. Sampling rationale, procedures and protocols are documented in the Field Sampling Plan for the Mount Olivet Cemetery Plume, Salt Lake City, Utah, prepared by UOS in October 1996.

SOIL GAS SAMPLING ACTIVITIES

Soil gas samples were collected using the Geoprobe Model 8-M truck mounted system. The probe was driven to refusal at each location then retracted approximately six inches to allow the disposable point to disengage. A line was then run from the end of the probe to an air pump which purged the line. The purged line was then connected to a Tedlar® Bag in a vacuum chamber and the Tedlar® Bag was allowed to fill with soil gas in response to the evacuation of the vacuum chamber.

Soil gas samples were initially collected from three separate locations on October 18, 1996. Three soil gas samples were collected from east and southeast of Building 7 of the Veterans Hospital where a sewer line exited the building. One sample was taken uphill of the sewer line, one from where the sewer line exited the building, and the third from a parking area adjacent to the buried sewer line (Photo 1). The

second area sampled was southeast of the Coast Guard Building maintenance shop on the Fort Douglas Army Base. The samples were collected in a field near Red Butte Creek Gulch. Two samples were taken from this location, one from the center of the gulch (Photo 2) and one from the northeast side of the gulch. The third area sampled was also on Fort Douglas and was located just south of the loading dock for Building 515 (Photo 3).

The soil gas samples that were collected were not by START field personnel because of equipment operation problems.

A second START field crew re-sampled the locations on November 9, 1996, using the same procedures from the approved Field Sampling Plan that were used to collect the original samples. These four recollected samples were sent to Environmental Chemistry Services, Inc. of Englewood, Colorado, where they were analyzed using SW-846 Method 8260 modified for volatile organic compounds in gaseous phase. The four soil gas samples were received by the laboratory on November 11, 1996, and were analyzed on November 12, 1996.

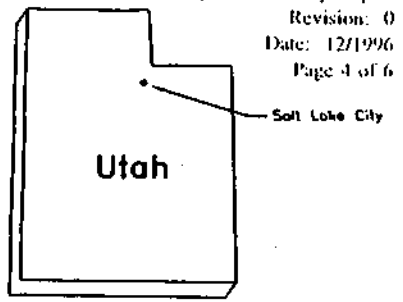
Soil gas samples were collected from the same locations on November 9, 1996, as had been collected on October 18, 1996, with the following exception. Originally three samples were collected behind the Veterans Hospital Building 7. On the re-sampling date the area where the first two soil gas samples had been collected was being paved for a parking lot and the construction area was not sampled. All final sample locations are shown in Figure 2.

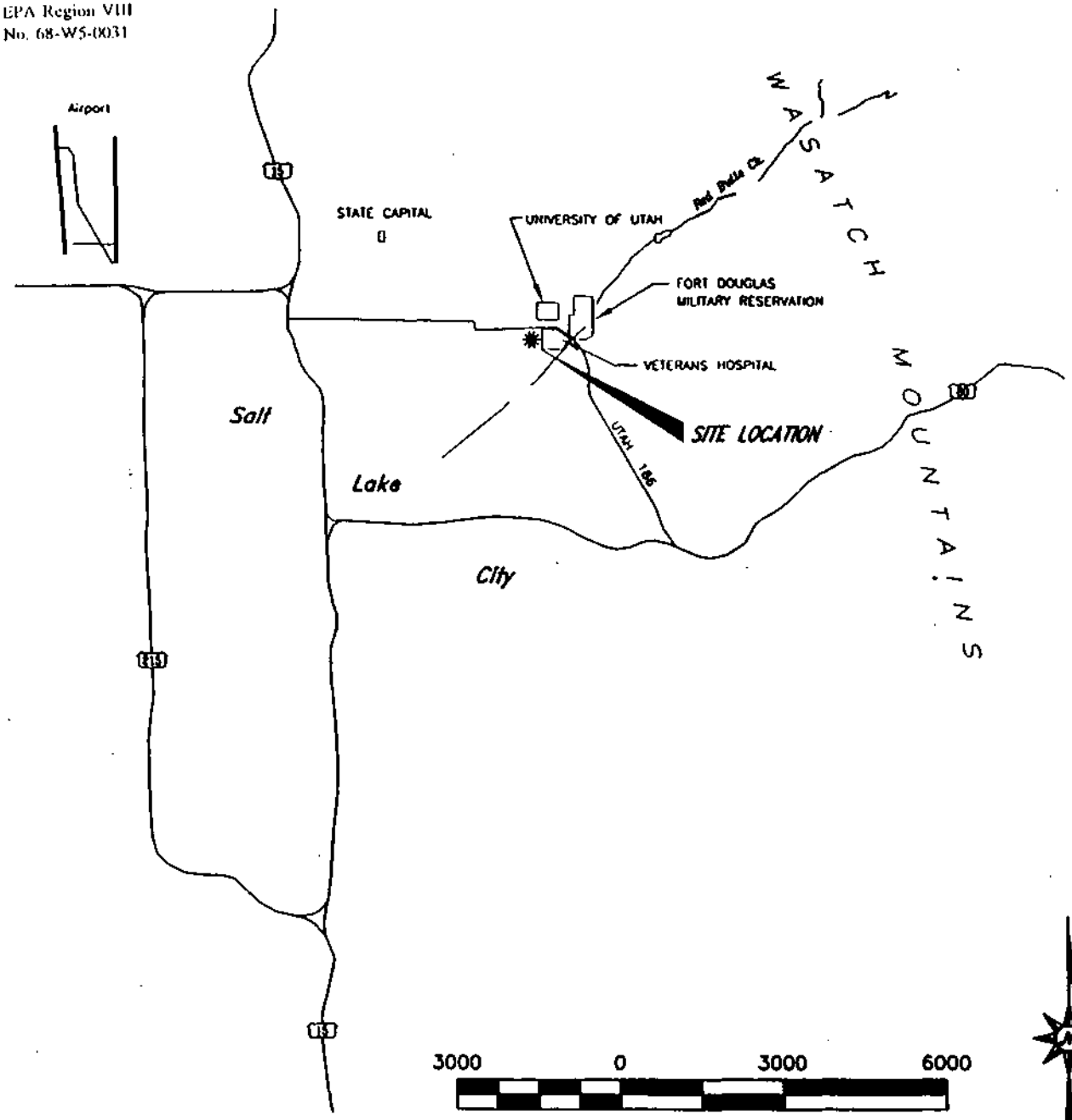
SOIL GAS SAMPLE RESULTS

The data were not validated. Quality control requirements for air samples are not documented; therefore, the data were reviewed for compliance with Method 8260 water analysis quality control criteria. The review covered holding time, instrument tune, calibration, blank contamination, system monitoring compounds and laboratory quality control samples. Based on this review, the data were found to be acceptable for the intended purposes. Minor non-compliance with method water requirements have no impact on the reported analyte concentrations.

The soil gas sample results are reported in Table 1. A detection of PCE at 1.9 ppb was recorded at O-SG-1 (The sewer line leading from the back of the VA Medical Center's Building 7. There were no detections of 1,1-DCE; +-1.2-DCE; TCE; or PCE in Samples O-SG-2 and O-SG-3 taken from Red Butte Gulch southwest of the Coast Guard Maintenance Shop. Sample station O-SG-4, from southwest of Building 515's loading dock, included detections of TCE at 3.4 ppb and PCE at 49 ppb. A copy of the complete laboratory results is included in Appendix B.

URS Operating Services, Inc.
START, EPA Region VIII
Contract No. 68-W5-0031





FIELD SAMPLING PLAN
TDD # 9609-0003

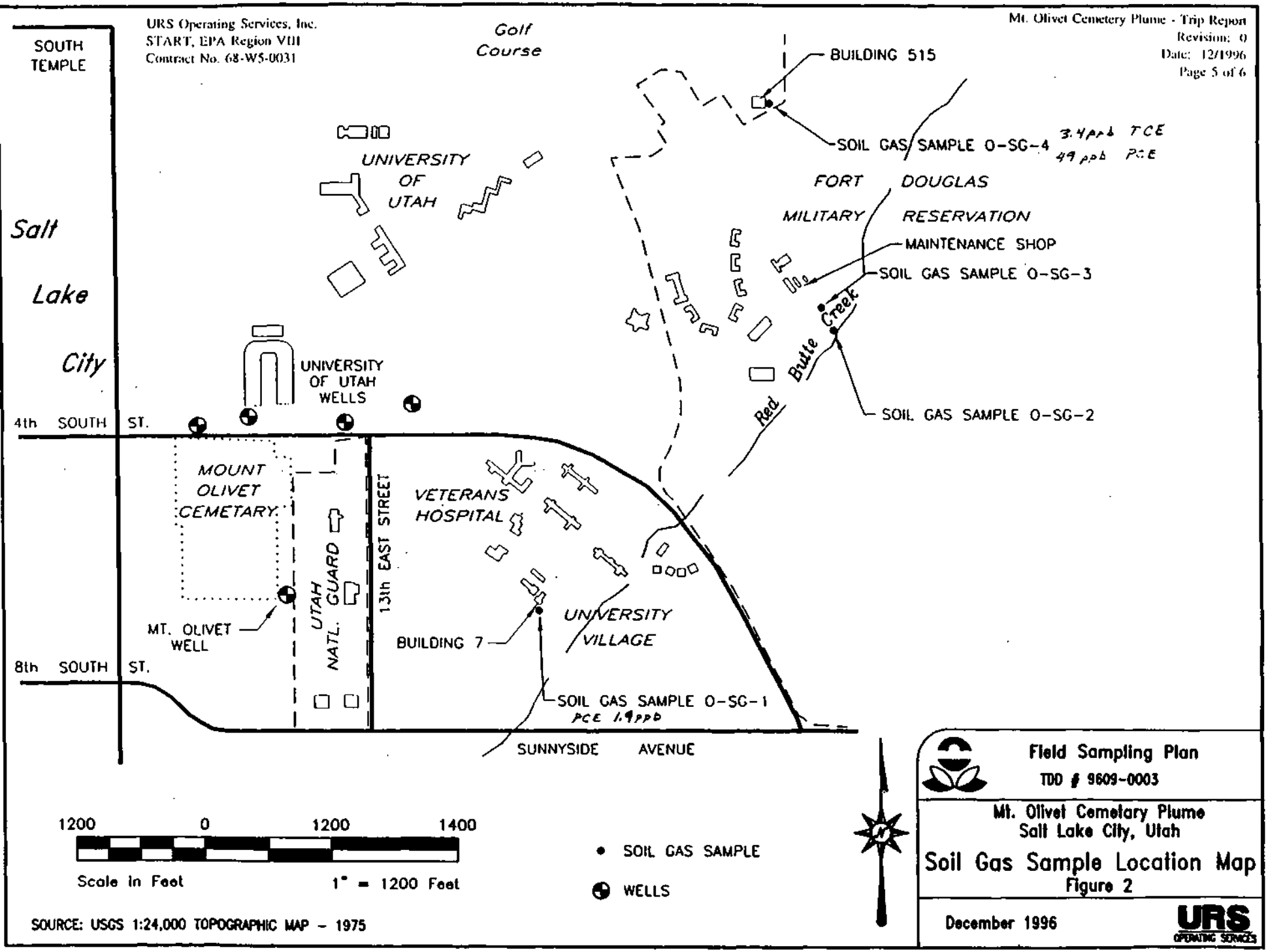
MOUNT OLIVET CEMETARY PLUME
Salt Lake City, Utah

Site Location Map
Figure 1

December 1996

URS OPERATING SERVICES

URS Operating Services, Inc.
START, EPA Region VIII
Contract No. 68-W5-0031



Field Sampling Plan
TDD # 9609-0003

Mt. Olivet Cemetary Plume
Salt Lake City, Utah

Soil Gas Sample Location Map
Figure 2

December 1996

URS OPERATING SERVICES

TABLE 1
Soil Gas Sample Results
All concentrations in ppb (µg/l)

Sample Location Detection Limit	1,1-DCE 1	+-1,2-DCE 1	TCE 1	PCE 1
O-SG-1 VA Medical Center southeast of Building 6	ND	ND	ND	1.9
O-SG-2 Fort Douglas Center of Red Butte Gulch, southwest of Coast Guard Maintenance Shop	ND	ND	ND	ND
O-SG-3 Fort Douglas Northwest side of Red Butte Gulch, southwest of Coast Guard Maintenance Shop	ND	ND	ND	ND
O-SG-4 Fort Douglas Southwest of loading dock for Building 515 (old brigg)	ND	ND	3.4	49.0

APPENDIX A

Photolog

PHOTO 1

Location of resampled station number O-SG-01. This location was resampled on November 9, 1996. Soil gas sample taken from approximately five feet below parking lot adjacent to sewer line (note manhole) running northeast to southwest. East of VA Hospital Building No. 6. John Noto (START) at geoprobe and Robert Blonquist (VA Medical Center) observing.

PHOTO 2

Location of resampled stations O-SG-2 and O-SG-3. This location was resampled on November 9, 1996. This location is in fill material of the gulch of Red Butte Creek and is east of the Coast Guard Reserve maintenance shop. Sample O-SG-2 was taken from the center of the gulch and sample O-SG-3 was taken between O-SG-2 and the maintenance shop which is northwest of the gulch. Neil Thomas (Utah Department of Environmental Quality) in foreground observing John Noto (START) at geoprobe.

PHOTO 3

Location of resampled station No. O-SG-4. This location was resampled on November 9, 1996. This location is south of Building 515 or the old brig, loading dock. Soil gas sample taken from approximately 5 feet below ground surface.

APPENDIX B

Complete Laboratory Results

November 13, 1996

ENVIRONMENTAL CHEMISTRY SERVICES, INC.
7108 S. Alton Way, Bldg. E
Englewood, CO 80112
(303) 850-7606

TABLE 1

ECS Project #: UOS011
UOS Project #: 7560903
Method #: Mod. EPA 8260
Matrix: Air
Units: µg/L

Date Received: 11/11/96
Date Sampled: 11/9/96
Date Extracted: n/a
Date Analyzed: 11/12/96

PARAMETER	DETECTION LIMIT	LABEL # 002271 SAMPLE # O-S6-1	LABEL # 002272 SAMPLE # O-S6-2	LABEL # 002273 SAMPLE # O-S6-3	LABEL # 002274 SAMPLE # O-S6-4	BLANK
Dichlorodifluoromethane	2	ND	ND	ND	ND	ND
Chloromethane	2	ND	ND	ND	ND	ND
Bromomethane	2	ND	ND	ND	ND	ND
Vinyl chloride	2	ND	ND	ND	ND	ND
Chloroethane	2	ND	ND	ND	ND	ND
Trichlorofluoromethane	2	ND	ND	ND	ND	ND
Methylene chloride	2	ND	ND	ND	ND	ND
1,1-Dichloroethene	1	ND	ND	ND	ND	ND
1,1-Dichloroethane	1	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	1	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	1	ND	ND	ND	ND	ND
Chloroform	1	ND	ND	ND	ND	ND
Bromochloromethane	1	ND	ND	ND	ND	ND
Dibromomethane	1	ND	ND	ND	ND	ND
1,2-Dichloroethane	1	ND	ND	ND	ND	ND

*	PARAMETER	DETECTION LIMIT	LABEL # 002271 SAMPLE # O-S6-1	LABEL # 002272 SAMPLE # O-S6-2	LABEL # 002273 SAMPLE # O-S6-3	LABEL # 002274 SAMPLE # O-S6-4	BLANK
	1,1,1-Trichloroethane	1	ND	ND	ND	ND	ND
	Carbon tetrachloride	1	ND	ND	ND	ND	ND
	Bromodichloromethane	1	ND	ND	ND	ND	ND
	1,2-Dichloropropane	1	ND	ND	ND	ND	ND
	1,1-Dichloropropene	1	ND	ND	ND	ND	ND
	trans-1,3-Dichloropropene	1	ND	ND	ND	ND	ND
	2,2-Dichloropropane	1	ND	ND	ND	ND	ND
	cis-1,3-Dichloropropene	1	ND	ND	ND	ND	ND
*	Trichloroethene	1	ND	ND	ND	3.4	ND
	1,3 Dichloropropane	1	ND	ND	ND	ND	ND
	1,1,2-Trichloroethane	1	ND	ND	ND	ND	ND
	Dibromochloromethane	1	ND	ND	ND	ND	ND
	1,2-Dibromoethane	1	ND	ND	ND	ND	ND
	Bromoform	1	ND	ND	ND	ND	ND
	1,1,1,2-Tetrachloroethane	1	ND	ND	ND	ND	ND
	1,2,3-Trichloropropane	1	ND	ND	ND	ND	ND
	1,1,2,2-Tetrachloroethane	1	ND	ND	ND	ND	ND
*	Tetrachloroethene	1	1.9	ND	ND	49	ND
	Chlorobenzene	1	ND	ND	ND	ND	ND
	1,3-Dichlorobenzene	1	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	1	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	1	ND	ND	ND	ND	ND
	2-Chlorotoluene	1	ND	ND	ND	ND	ND
	4-Chlorotoluene	1	ND	ND	ND	ND	ND
	Bromobenzene	1	ND	ND	ND	ND	ND

*	PARAMETER	DETECTION LIMIT	LABEL # 002271 SAMPLE # O-S6-1	LABEL # 002272 SAMPLE # O-S6-2	LABEL # 002273 SAMPLE # O-S6-3	LABEL # 002274 SAMPLE # O-S6-4	BLANK
	Styrene	1	ND	ND	ND	ND	ND
	Benzene	1	ND	ND	ND	ND	ND
*	Toluene	1	ND	ND	1.0	ND	ND
	Ethylbenzene	1	ND	ND	ND	ND	ND
	Total xylenes	1	ND	ND	ND	ND	ND
	Isopropylbenzene	1	ND	ND	ND	ND	ND
	n-Propylbenzene	1	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	1	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	1	ND	ND	ND	ND	ND
	s-Butylbenzene	1	ND	ND	ND	ND	ND
	t-Butylbenzene	1	ND	ND	ND	ND	ND
	p-Isopropyltoluene	1	ND	ND	ND	ND	ND
	n-Butylbenzene	1	ND	ND	ND	ND	ND
	1,2-Dibromo-3-chloropropane	1	ND	ND	ND	ND	ND
	Hexachlorobutadiene	1	ND	ND	ND	ND	ND
	Naphthalene	1	ND	ND	ND	ND	ND
	1,2,4 Trichlorobenzene	1	ND	ND	ND	ND	ND
	1,2,3-Trichlorobenzene	1	ND	ND	ND	ND	ND

ND = Not detected at levels exceeding the reporting detection limit.

SURROGATE % RECOVERY

SURROGATE	SURROGATE AMOUNT	LABEL # 002271 SAMPLE # O-S6-1	LABEL #002272 SAMPLE # O-S6-2	LABEL # 002273 SAMPLE1 # O-S6-3	LABEL # 002274 SAMPLE # O-S6-4	BLANK
1,2 Dichloroethane-D4	50	95	103	99	100	102
Toluene-D8	50	83	78	81	84	76
Bromofluorobenzene	50	101	102	102	102	101

START

Superfund Technical Assessment and Response Team
- Region VIII

United States
Environmental Protection Agency

Contract No. 68-W5-0031

SITE ACTIVITIES REPORT

MT. OLIVET CEMETERY
Salt Lake City, Utah

TDD #9803-0014

MAY 20, 1999

URS
OPERATING SERVICES, INC.

In association with: Tetra Tech EM Inc.
URS Greiner Woodward Clyde
Maxim Technologies, Inc.
LT Environmental, Inc.
The Roybal Corporation

APPENDIX B

URS OPERATING SERVICES INC.

SITE ACTIVITIES REPORT

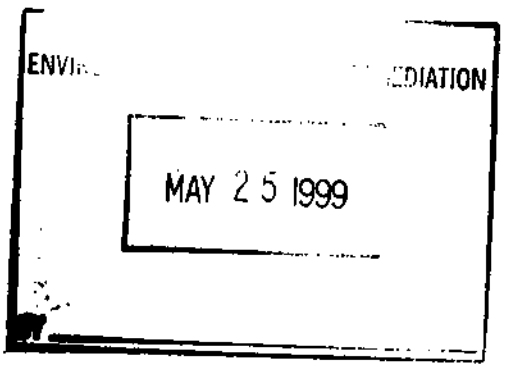
MOUNT OLIVET CEMETERY

SALT LAKE CITY, UTAH

MAY 20, 1999

SITE ACTIVITIES REPORT

MT. OLIVET CEMETERY
Salt Lake City, Salt Lake County, Utah



EPA Contract No. 68-W5-0031
TDD No. 9803-0014

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SITE ACTIVITIES REPORT
Mt. Olivet Cemetery
Salt Lake City, Utah

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1.0 INTRODUCTION

This report is submitted in accordance with certain task elements specified in Technical Direction Document (TDD) number 9803-0014 issued to the URS Operating Services, Inc. (UOS) Superfund Technical Assessment and Response Team (START) in Region VIII by the U.S. Environmental Protection Agency (EPA). START contracted for and managed the installation of six groundwater monitoring wells to investigate perchloroethylene (PCE) contamination.

2.0 BACKGROUND

The Mt. Olivet Cemetery site is located in Salt Lake City, Salt Lake County, Utah (Figure 1). The site is generally within the area bounded by 500 South and Sunnyside Avenue and approximately 1400 East and 1900 East Streets. All land in the investigated area is occupied by either municipal, federal, or state facilities. These include the Veterans Administration (VA) Hospital and campus, the City of Salt Lake Steiner Swimming Pool, Sunnyside Park, University of Utah practice fields, Utah National Guard Facilities, and the Mt. Olivet Cemetery. The known area of contamination extends from the southeast quarter of Section 4 to the northwest quarter of Section 9, T. 1 S., R. 1 E. (U.S. Geological Society (USGS) 1975).

The initial indication of aquifer contamination occurred when samples collected from an irrigation well at the Mt. Olivet Cemetery by the State of Utah Department of Environmental Quality (UDEQ) were found to be contaminated with perchloroethylene (PCE), a commonly used dry-cleaning fluid and degreaser. The well was initially sampled in October 1990 and had a reported PCE concentration of 32 parts per billion (ppb). A PCE concentration of 184 ppb was reported in a sample collected in May 1997.

Previous EPA investigations were conducted by Ecology and Environment, Inc., Region VIII Technical Assistance Team (TAT), in June 1995 (Ecology and Environment, Inc. (E&E) 1995) and by UOS Region VIII START in October and November 1996 (URS Operating Services, Inc. (UOS) 1996).

The TAT investigation included the area near the Mt. Olivet Cemetery irrigation well, the area behind the former National Guard Maintenance Facility, and the southwest part of the VA campus. The TAT collected soil gas samples using a Geoprobe® or a manually powered slide hammer. Samples were collected from depths 12 feet below ground surface (bgs) or shallower. Volatile Organic Compounds (VOC) contamination was not reported above the 10 ppb laboratory reporting limit (RL).

The UOS START investigation was conducted under TDD #9609-0003 (UOS 1996). Four soil gas sam were collected during the investigation using a Geoprobe®. At the Fort Douglas Military Reservatio sample collected adjacent to Building 515 had a PCE concentration of 49 ppb, and a trichloroethene (T concentration of 3.4 ppb. Two samples collected next to Red Butte Creek were non-detect for PCE. sample collected from the VA Medical Center near Building 7 had 1.9 ppb PCE (Appendix G).

3.0 SITE GEOLOGY

The site is approximately one mile west of the Wasatch Mountain front. The site topography slopes w southwest with a grade of approximately 4%. The site is in a transitional area that includes both primary secondary aquifer recharge areas. The primary recharge area includes the Wasatch Front and upper be where confining layers are thinner than 20 feet (USGS 1994). The secondary recharge areas characterized by a shallow unconfined aquifer and a confined aquifer separated by a confining layer. aquifers are part of a basin-fill system that is composed of sediments eroded from the adjacent moun ranges. The sediments were transported by streams and ancient Lake Bonneville toward the center of valley. Red Butte Creek is the nearest creek and is located approximately 1,200 feet to the east and so of site wells.

Basin-fill aquifers are very complex because they consist of multiple aquifers and confining layers that both laterally discontinuous and internally heterogeneous (USGS 1994). Contamination in the prim recharge areas has great potential to affect the principal aquifer because of coarse-grained sediments and h conductivity values that enable rapid movement of contaminants from the surface to the aquifer. The wells and contaminant plume lie within both the primary and the secondary recharge areas based on a US study of other wells in the area (USGS 1994).

Lake Bonneville occupied what is now the Salt Lake Valley and much of northwestern Utah in the Pleistocene epoch (<150,000 to >10,000 years before present (ybp)) with identified shorelines forr between 30,000 and 10,000 years ago (Hintze 1993). The highest recorded shoreline is at an elevatior 5,090 feet, which is above the elevation of site wells. Shoreline elevations fluctuated between below 4, feet to 5,090 feet with numerous transgressions and regressions across the current site area.

The result is a complex layering of alluvial fan and lake deposits. Gravel and sand were carried mountain streams and deposited in the valley or into the lake. Finer sediments were carried farther into

valley by the streams or in the lake to the center of the basin (USGS 1994). The coarser sediments along the mountain front compose the primary recharge areas. Lake-deposited silts and clays make up the confining layers with their maximum lateral extent defined by former shorelines.

The most recent deglaciation along the Wasatch front has been dated at approximately 8,000 years ybp, when ice receded in Little Cottonwood canyon. Red Butte Creek and Dry Creek, which bound the site to the south and north, respectively, lie in V-shaped valleys that do not appear to have contained glaciers.

The Wasatch Fault lies along the western edge of the Wasatch Mountain Range. The mountains are an upraised fault block. The fault line separates the fractured-consolidated strata of the upraised (mountain) fault block from the thick accumulations of alluvial fan and lake deposits at the base of the uplifted mountain block. The primary recharge area for the principal basin-fill aquifer is at the base of the mountains and associated fault zone.

4.0 PCE DESCRIPTION AND COMMON USES

PCE is a colorless, nonflammable chlorinated solvent commonly used in dry cleaning industry and less commonly for cold cleaning and vapor degreasing of metals. Other reported uses include a chemical intermediate in the synthesis of fluorocarbon 113, 114, 115, and 116; textile production; insulating fluid and cooling gas in electric transformers; and typewriter correction fluids. Aerosol formulations, solvent soaps, printing inks, adhesives, sealants, polishes, lubricants, silicones, and shoe polish are other products that may contain PCE (EPA 1994).

Estimated 1974 relative PCE consumption by industry was dry cleaning and textile 69%, metal cleaning 16%, Chemical intermediate 12%, and miscellaneous uses 3%.

The molecular formula of PCE is CCL_2CCL_2 . PCE is relatively volatile with a vapor pressure of 24 millimeters (mm) at 30^0 C. and has a relatively high density with a specific gravity of 1.626. The solubility of PCE in water is 1,100 milligrams per liter (mg/L) at 20^0 C.

The reduction reaction daughter product of PCE is TCE; products of TCE are Cis-Dichloroethene, Trans-dichloroethene, and 1,1-Dichloroethene (Vogel 1987).

5.0 SITE ACTIVITIES/WELL INSTALLATIONS

The activities conducted under this TDD included the installation of six (one dual nested well and fc individual) groundwater monitoring wells. The wells were installed for a groundwater contaminant plu investigation to determine a general source area, extent of the plume, and the flow direction of the shall aquifer.

The START contracted with Layne Christenson Company, a drilling contractor in Salt Lake City, Utah, install the wells. Each well was installed with an air rotary drill rig. The wells were installed during Ju July, and August, 1998. UOS START photographs of the well installations are in Appendix A. The we were all installed east of the Mt. Olivet Cemetery irrigation well. Samples were collected of the purge wa near the completion of each well development and submitted for VOC analysis. Each sample result was us to plan the next well location. The wells are numbered based on the order in which they were installe

5.1 WELL INSTALLATION

The wells were installed using air rotary type rigs with advance casing. Air rotary drilling is a "dr procedure in which a down-hole bit cuts rock and unconsolidated material that is then carried to t surface by air. An on-board air compressor is used to supply the air that travels through the dr string at high pressure and velocity. The casing consists of threaded pipe sections that travels wi the bit down the length of the borehole. Air pushes the cuttings to the surface and through a cyclo. where the velocity is decreased prior to exiting the system. The cuttings were captured in a roll-c bin at well EPA-MW-01, and in drums or a small dump truck at the other wells.

UOS START logged the borehole lithology by observing cuttings that exited the cyclone. A limit number of two-foot split-spoon samples were collected from the boreholes. The cuttings yield only approximate information about subsurface lithology. Information was limited because or small fragments of rock were carried to the surface, the air also tends to mix particles and fragmer causing information on bedding and structure to be unobtainable. This mixing renders thin laye of sand, silt, gravel, and clay indistinguishable. Lithologic logs are attached to this report Appendix B.

Thin saturated (perched) zones may also be penetrated by an air-rotary rig without being identified. This occurs because positive air pressure at the bit tends to push water out of the path of the bit. If the borehole is advanced quickly, the casing may seal off the wet zone before water is allowed to enter the borehole. The hot dry air may also dry the cuttings before they exit the cyclone. The rig was periodically idled to allow water to flow into the casing when the estimated depth of the first major aquifer was reached.

5.2 WELL LOCATIONS AND DEPTHS

The wells were located to provide information about the groundwater gradient, the groundwater flow direction, and the extent of PCE contamination to determine potential PCE source areas. Each well location was selected based on the samples collected from previous wells and the expected groundwater flow direction. The wells were numbered sequentially based on order of installation.

Well installation locations were chosen with the goal of determining potential PCE source area(s) based on the extent of the PCE plume and groundwater flow direction. Identified potential PCE sources are the former dry cleaning operation on the VA Hospital campus in Building 7, former operations at Fort Douglas, and a former Utah National Guard vehicle maintenance facility (Figure 2). Well locations and these potential source areas are illustrated on Figure 2. Lithologic logs for each well are attached in Appendix B .

All cuttings were either collected in a dump truck and transported to an on-site holding area or placed on plastic near the borehole. A sample was collected from each cuttings pile and submitted for VOC analysis. All VOCs were below the laboratory RL.

Wells EPA-MW-01S and EPA-MW-01D are nested wells with total depths of 224 and 404 feet bgs, respectively. Well drilling and installation took place June 16 through 30, 1998. The wells were nested in the same borehole. The wells are located in the southwestern corner of the Steiner Swimming Pool parking lot, approximately 700 feet east of the Mt. Olivet well (Figure 2). The screened interval of well EPA-MW-01S is 184 to 224 feet bgs. The screened interval of well EPA-MW-01D is 364 to 404 feet bgs.

Well EPA-MW-02 is located approximately 500 feet east of well EPA-MW-01. The well v completed with a screened interval of 175.5 to 205.5 feet bgs, in the first (shallowest) aquifer. T well is on Salt Lake City property just west of the VA fence line. Drilling and installation took pl July 20 through 24, 1998.

Well EPA-MW-03 was installed approximately 500 feet north of well EPA-MW-02, also on S Lake City property. The screened interval of the well is 190 to 210 feet bgs. Installation took pl July 28 through 30, 1998

Well EPA-MW-04 was installed in Sunnyside Park, approximately 850 feet south and 350 feet w of well EPA-MW-01. The borehole was completed to a depth of 173 feet bgs with a screer interval from 143 feet to 173 feet bgs. The well is screened in the first aquifer. The well v installed July 30 through August 1, 1998.

Well EPA-MW-05 was installed at the VA approximately 1,700 feet east-northeast of w EPA-MW-01. The well was screened from 186 to 221 feet bgs, in the first aquifer encountered. T well was installed August 28 through August 31, 1998.

5.3 WELL DEVELOPMENT

Layne Christenson developed the wells with a submersible pump at wells EPA-MW-01S a EPA-MW-01D. A bailer was used for developing all other wells. The goal of the well developm was to extract fine-grained particles from inside the well and the filter (sand) pack. Table 1 li water quantities extracted from each well during development. All purge water was containeri in 55-gallon drums or poly tanks. A sample was collected from each drum and tank and submit for VOC analysis. Containers that did not contain VOCs above the laboratory RL were emptied site. Other containers with VOCs were placed in a staging area near well EPA-MW-02.

5.4 GROUNDWATER SAMPLES

Groundwater samples were collected immediately after well development and submitted for V analysis to the state of Utah and/or the UOS START laboratory. The results from these ini samples were only used for planning the next well location.

UOS conducted a formal sampling event in November 1998. Groundwater samples were collected from each well and submitted for VOC, metals, pH, and analyte analysis (Table 2). The sample collection and analysis was guided by the EPA-approved Sampling Quality Assurance/Quality Control (QA/QC) Work Plan (Appendix C).

The samples were collected after three casing volumes of water had been purged from the well and/or pH, temperature, and conductivity stabilized within 10%. Final field parameters and purge volumes are shown on Table 3.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

START adhered to sample collection, packaging, and documentation procedures outlined in the Sampling Quality Assurance/Control (QA/QC) Work Plan (Appendix C).

6.1 SAMPLE COLLECTION

UOS used a non-dedicated Grunfos Rediflo® submersible pump for collecting samples from all wells except at well EPA-MW-05, which was sampled with a disposable bailer. To minimize the risk of cross-contamination, samples were collected in order from lowest to highest contaminated wells. The pump was used for both for purging and sample collection.

Samples EPA-MW-01S and EPA-MW-06 were both collected from well EPA-MW-01S. These samples were collected to evaluate the consistency of laboratory analysis and sample collection/handling. Very similar contaminant concentrations were reported for these samples (Table 4).

Sample EPA-MW-07 was a trip blank prepared with bottled distilled water. The blank was shipped with the other VOC samples. The blank was submitted for VOC analysis as an indicator of potential cross contamination of the samples during shipping and storage. Sample EPA-MW-07 results on Table 4 reveal low-level concentrations of methylene chloride, 1,2-dichloroethene, and acetone; however PCE and TCE were not reported in the sample.

Sample EPA-MW-08 was an equipment rinsate sample. The sample was distilled water run throu the pump head and line. Approximately 10 gallons of water was pumped from a bucket through t pump prior to sample collection. The rinsate sample was collected immediately following sample at well EP. W-01S, which had the highest PCE concentration of 320 µg/L D. The P concentration in the ate sample was 34 µg/L . The results reveal that the 10-gallon purge v not sufficient to remove the residual PCE from the pump. However, other precautions were tak during the sampling event to prevent cross contamination (i.e., going from low to high concentrat wells and pumping larger purge volumes).

6.2 SITE AND SAMPLE DOCUMENTATION

All samples were maintained under custody prior to and during shipment to the laboratory. A lal was attached to each sample container to indicate the sample identification, time, date, location, a analysis. This information was also placed on the chain-of-custody (COC) form that accompani the samples to the laboratory.

6.3 DATA REVIEW

Monitoring well aqueous samples were submitted for EPA Contract Laboratory Program (CL analyses. Volatile analyses for nine samples were provided by American Testing and Analyti Services (ATAS) using the EPA Statement of Work (SOW) version OLM03.2. Analysis of met and mercury was provided by Southwest Laboratory of Oklahoma using EPA SOW ILM04.0. laboratory data were validated by TechLaw, Inc., a UOS Team subcontractor, using the EPA C Functional Guidelines for Data Validation and the EPA Region VIII validation report format. T completed validation reports were reviewed and approved by the UOS Quality Assurance Offic The data are acceptable for the purpose of characterizing contamination in the samples.

Deliverables/Documentation (e.g., COC, preparation logs, analysis run logs) were reviewed completeness. Raw data were reviewed for completeness and transcription accuracy onto summ forms. Data were reviewed for holding times, tuning criteria, blank contamination, surrog recoveries, interference checks and other method requirements. Approximately 10-20% of results reported in each of the samples, calibrations, and QC analyses were recalculated and verifi

If problems were identified during the recalculation of results, all laboratory calculations were verified.

Laboratory precision (relative percent difference) was acceptable as demonstrated by the compliant matrix spike/matrix spike duplicate (for VOCs) and matrix spike/duplicate (for metals). The laboratory replicate spikes also demonstrated acceptable precision.

Laboratory accuracy (percent recovery of spike analytes) was acceptable for both the volatile organic analysis and the metals analysis.

The following problems were identified in the validation report:

6.3.1 EPA Target Analyte List Metals and Mercury

One sample (MHEC01) was received at the laboratory at a pH<2. All results for this sample were qualified as estimated.

Some of the target metals were detected in the blanks at low concentrations. Metals reported as detected in the blanks and in the samples were qualified as estimated or undetected/estimated depending on the reported concentrations in both the blank and the corresponding sample (Appendix D).

6.3.2 EPA Target Compound List VOCs

The unpreserved water samples HS663 and HS669 were not analyzed within seven days of collection as required. Aromatic compounds in these samples are qualified as undetected with an estimated detection limit. The aromatic compounds include benzene, toluene, styrene, chlorobenzene, xylenes, ethylbenzene.

Two compounds (chloromethane and vinyl chloride) did not meet continuing calibration criteria for sample HS669. These compounds were qualified as undetected with an estimated detection limit.

The tetrachlorobenzene concentration for sample HS668DL is qualified as estimated d to high surrogate recovery.

6.3.3 General Chemistry - Cations, Anions, and pH Analysis

A review of the Acculab, Inc. data was conducted by TechLaw, Inc.. The reviewer list the following comments/problems; the pH analyses were not within the 24-hour holdi time; the raw data for bicarbonate, carbonate, and hydroxide were not provided; and varic general chemistry parameters did not have associated summary forms.

7.0 GROUNDWATER SAMPLE RESULTS

7.1 VOLATILE ORGANIC ANALYSIS

Samples were submitted for VOC analysis to American Technical and Analytical Services via t Contract Laboratory Program (CLP) (Table 2).

PCE was the primary VOC reported in groundwater samples (Table 4). PCE concentrations groundwater ranged from non-detect at the 10 ppb RL to 320 ppb. Four of the five shallow aqui wells had PCE concentrations above the laboratory RL. The highest concentrations were in samp collected from wells EPA-MW-01S, EPA-MW-02, and EPA-MW-04 (Figure 2).

Low concentrations (<10 ppb) of TCE, chloroform, methylene chloride, and 1,2 - dichloroethe (DCE) were also reported in four well samples (Table 4). The concentrations of these contamina were below the 10 ppb RL and considered to be estimated values.

7.2 METALS ANALYSIS

Samples were submitted for inorganic analysis to Southwest Lab of Oklahoma via the CLP (Tal 2). The inorganic analysis data sheets with data qualifier annotations are attached in Appendix

7.3 ANION/pH ANALYSIS

A sample from each well was submitted to Acculab Inc. for analysis via methods SM2320B, 300.0, 310.1, and 150.1 for alkalinity, sulfate, chloride, bicarbonate, carbonate, hydroxide, and pH. This chemical information was acquired for general aquifer characterization and for comparison of groundwater samples from each well. These sample results are shown in Table 5, and the laboratory report is attached in Appendix E.

7.4 GROUNDWATER CHEMISTRY

All water samples are calcium bicarbonate type and very similar in chemical composition.

Chemical properties of the groundwater are illustrated graphically by plotting milliequivalent (epm) concentrations of certain cations and anions on Stiff and Piper diagrams (Appendix F). The diagrams were prepared using United Nations Ground Water for Windows software. The error balance (in percent) is the sum of the cations in epm in balance with the sum of the anions. All well locations had a relatively low error balance, indicating good quality analysis.

The primary notable difference in chemical composition is the epm value of the chloride (Cl-) anion which is about 50% less in the deeper aquifer sample (EPA-MW-01D) than in other samples.

8.0 PLUME EXTENT AND GROUNDWATER FLOW DIRECTION

UOS subcontracted ESI Engineering to survey each well coordinate and elevation. The survey measurements were used to determine precise groundwater elevations.

UOS measured groundwater depths on September 1, 1998, October 22, 1998, and November 10 and 11, 1998. Groundwater elevations are shown on Table 6. The October 1998 groundwater elevations are shown on Figure 2.

The October 1998 groundwater flow direction of the unconfined aquifer is toward the northwest at an approximate 2% grade. This flow direction is approximately opposite of the surface topography which slopes toward the southeast.

The groundwater contours (Figure 2) are based on the premise that all wells (except EPA-MW-01D) screened in the same aquifer or in hydraulically connected aquifers. Evidence that wells are in same/connected aquifer(s) includes; the uniform spacing and straightness of the contours, the similar dep of the screened intervals, and the placement of the screen in the first major saturated interval encounter The presence of PCE in wells EPA-MW-01S through EPA-MW-04 is also evidence that the wells shar common or connected aquifer. The comparable chemistry (illustrated on the Stiff and Piper diagra Appendix F) is also an indication that the screened intervals intersect a common aquifer.

The contaminant plume in the study area extends beyond the wells installed by UOS and its bounda cannot be defined. The width of the PCE plume is greater than 900 feet at well EPA-MW-01 based on 320 ppb and 11 ppb PCE concentrations in wells EPA-MW-01 and EPA-MW-03, respectively. The plu may be greater than 1,800 feet wide if it is symmetrical around well EPA-MW-01. Based on the groundw flow direction and PCE concentrations, the source for contamination of the aquifer is southeast of wells EI MW-01S and EPA-MW-02.

Salt Lake City and University of Utah municipal wells are located to the northwest and downgradient of contaminant plume. If the groundwater flow direction continues toward the northwest, the wells at r listed are 57-112 and 57-3450 (Utah Division of Water Rights identification numbers). Although these w may be at risk, additional well installations will be necessary northwest of the well EPA-MW-01 to confi the migration path of the contamination.

There are no identified potential sources upgradient of the contaminated wells, toward the southe However a thorough investigation for potential sources has not been conducted.

Although it is west of the contaminated wells and not upgradient of the highest concentrations (Figure the former dry cleaning operation in VA Building 7 is a potential source of the contamination. Buildin could be a source if PCE traveled south or southeast from Building 7 along a sewer line or other conduit pr to infiltration into the aqu · (approximately 140 to 190 feet bgs). The southwest-sloping surf topography and shallow gro dwater may have also directed PCE from Building 7 toward the southwe

To determine the source of PCE contamination, additional upgradient wells in the contaminated aquifer w be required. Once a source area is approximated, a shallow subsurface investigation of soil gas groundwater could be conducted to pinpoint the source.

9.0 SUMMARY/CONCLUSIONS

UOS START installed six groundwater monitoring wells at five locations in Salt Lake City, Utah, to investigate a report of PCE in the groundwater. The wells were installed in Sections 4 and 9 of T. 1. S. and R. 1. E. The investigation was motivated by the presence of PCE and other chlorinated hydrocarbons in an irrigation well at the Mt. Olivet Cemetery. A former dry-cleaning facility at the Veterans Hospital in Building 7 is the only identified PCE operation in the area. Other potential users of PCE include the operations at Fort Douglas (to the northeast) and the Utah National Guard vehicle maintenance facility to the west of the study area.

The wells were located to provide information about the groundwater gradient, groundwater flow direction, and the extent of PCE contamination to determine potential PCE source areas. Each well location was selected based on the samples collected from the previous wells and the expected groundwater flow direction. The wells were numbered sequentially based on order of installation.

Based on October 1998 measurements, the groundwater gradient slopes toward the northwest at an approximate 2% grade.

The contaminant plume also appears to be oriented northwest/southeast consistent with the groundwater flow direction. Wells were not installed beyond the extent of the contamination, thus the plume boundaries have not been defined. Based on the groundwater flow direction and PCE concentrations, the source of contamination is southeast of wells EPA-MW-01S and EPA-MW-02.

There are no identified potential sources toward the southeast. The former dry cleaning operation at the VA - Building 7 is east of the contaminated wells and is not upgradient of the highest concentrations, based on the October 1998 groundwater flow direction. However, Building 7 could be an indirect source if PCE followed a south or southwest-flowing sewer line of other conduit. PCE release from Building 7 may have also migrated south or southwest (in the direction of the surface topography) prior to reaching the aquifer at approximately 140 feet to 190 feet bgs.

Salt Lake City and University of Utah municipal wells are located northwest and downgradient of the contaminant plume. These at risk wells include number 57-112 and number 57-3450 (Utah Division of

Water Rights identifiers). Additional monitoring wells will be necessary to determine the course contamination northwest of wells EPA-MW-01 and EPA-MW-03.

To determine the source of [illegible] contamination, additional upgradient wells in the contaminated aquifer [illegible] be required. Once a source area is approximated, a shallow subsurface investigation of soil gas groundwater could be conducted to pinpoint the source.

10.0 LIST OF REFERENCES

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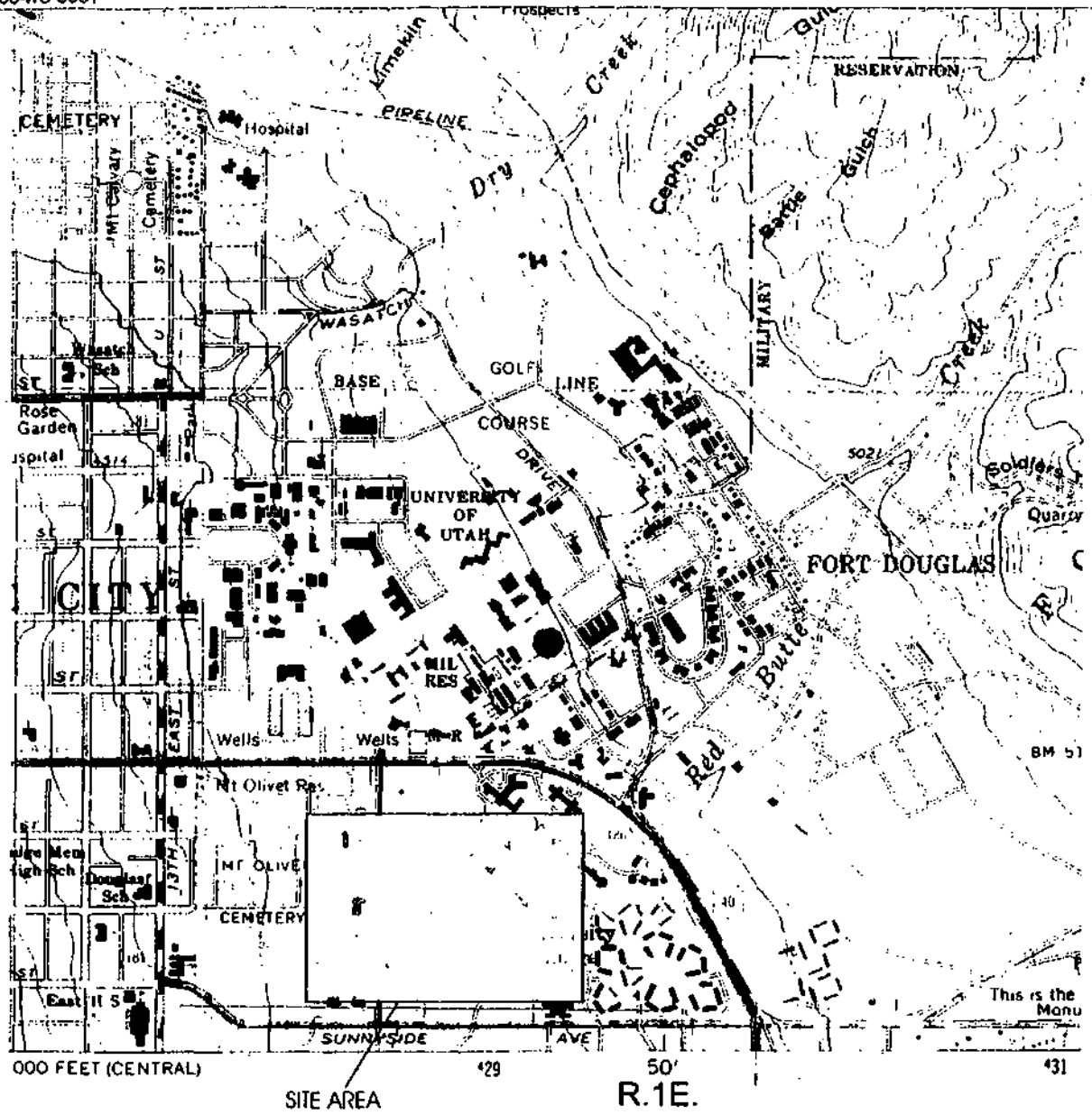

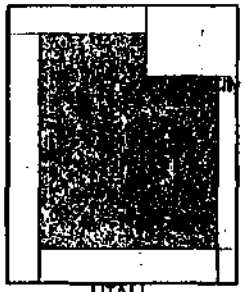

N

Sampling Activities Report
UOS Job Number 75-80314.00

MT. Olivet Cemetery Site
Salt Lake City, Utah

Site Location Map

T.D.D. 9803-0014 FIGURE 1

March 1999

URS
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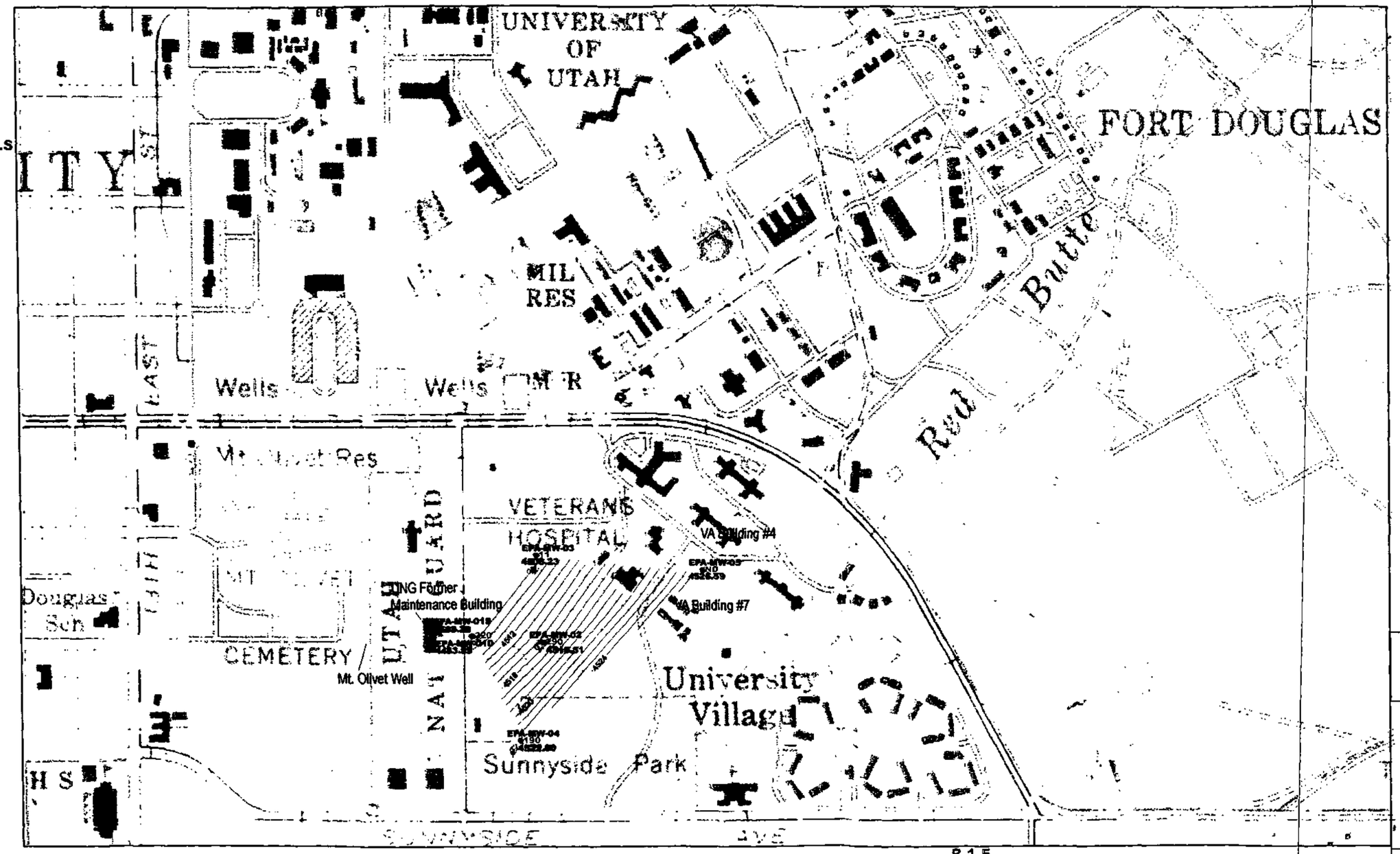
URS Operating Services, Inc.
START, EPA Region VIII
Contract No. 68-W5-0031

Mt. Olivet Cemetery - SAR



Base Map Source: U.S. Geological Survey (USGS) Fort Douglas, Utah
7.5 Minute Quadrangle Map 1975

LEGEND

Well ID
EPA-MW-04
9190
4822.80
PCE Concentration (ppb) (10/98)
Groundwater Elevation (feet) (10/98)

Groundwater Elevation Contour (feet above msl) 10/98

N

SCALE 1 inch = 750 feet

Sampling Activities Report
UOS Job Number 75-80314.00

MT. Olivet Cemetery Site
Salt Lake City, Utah

Groundwater Contours on Detailed Site Map

T.D.D. 9803-0014 FIGURE 2

March 1999

URS OPERATING SERVICES

TABLE 1
Well Development Volumes

Well ID	Volume Purged (gallons)	Method
EPA-MW-01S	50	Pump
EPA-MW-01D	700	Pump
EPA-MW-02	160	Bailer
EPA-MW-03	110	Bailer
EPA-MW-04	160	Bailer
EPA-MW-05	20	Bailer

TABLE 2
Sample Log

WELL ID	Date	Time	Method	COC or CLP Case #	Tag # or CLP sample ID#
EPA-MW-01S	11/11/98	1645	300, 310.1, 150.1, and SM2320B	4549	10601
			VOA (CLP SOW)	26631	HS662
			Metals (CLP SOW)	26631	MHEB96
EPA-MW-01D	11/10/98	1130	300, 310.1, 150.1, and SM2320B	4549	10602
			VOA (CLP SOW)	26631	HS663
			Metals (CLP SOW)	26631	MHEB97
EPA-MW-02	11/11/98	1150	300, 310.1, 150.1, and SM2320B	4549	10603
			VOA (CLP SOW)	26631	HS664
			Metals (CLP SOW)	26631	MHEB98
EPA-MW-03	11/11/98	1010	300, 310.1, 150.1, and SM2320B	4549	10604
			VOA (CLP SOW)	26631	HS665
			Metals (CLP SOW)	26631	MHEB99
EPA-MW-04	11/11/98	1320	300, 310.1, 150.1, and SM2320B	4549	10605
			VOA (CLP SOW)	26631	HS666
			Metals (CLP SOW)	26631	MHEC00
EPA-MW-05	11/11/98	1850	300, 310.1, 150.1, and SM2320B	4549	10606
			VOA (CLP SOW)	26631	HS667
			Metals (CLP SOW)	26631	MHEC01
EPA-MW-06 (collocated with EPA-MW-02)	11/11/98	1850	300, 310.1, 150.1, and SM2320B	4549	-
			VOA (CLP SOW)	26631	HS668
			Metals (CLP SOW)	26631	MHEC02
EPA-MW-07 (Trip blank)	11/11/98	1850	300, 310.1, 150.1, and SM2320B	4549	-
			VOA (CLP SOW)	26631	HS669
			Metals (CLP SOW)	26631	-
EPA-MW-08 (Rinsate blank)	11/11/98	1850	300, 310.1, 150.1, and SM2320B	4549	-
			VOA (CLP SOW)	26631	HS670
			Metals (CLP SOW)	26631	-

TABLE 3
Final Field Parameters Prior to Sample Collection

WELL ID	Volume Purged (gallons)	Temperature (°F)	pH	Conductivity (mS)
EPA-MW-01S	24	53.3	6.74	1,029
EPA-MW-01D	105	54.4	6.50	926
EPA-MW-02	55	51.4	6.52	1,088
EPA-MW-03	27	54.2	6.51	1,035
EPA-MW-04	55	53.6	6.72	1,118
EPA-MW-05	4	49.1	6.82	1,206

TABLE 4
VOC Results
Concentrations in µg/L

Well ID	EPA-MW-01S	EPA-MW-06 (EPA-MS-01S) collocated)	EPA-MW-01D	EPA-MW-02	EPA-MW-03	EPA-MW-04	EPA-MW-05	EPA-MW-07 (Trip blank)	EPA-MW-08 (Rinsate)
EPA CLP Number:	**HS662**	**HS663**	**HS664**	**HS665**	**HS666**	**HS667**	**HS668**	**HS669**	**HS670**
methylene chloride	10 U 50 U	2 J 8 DJ	1 J	24 J	10 U	2 J	10 U	4 JB 10 U	3 J 10 U
1,2 - Dichloroethene	5 J 50 U	3 J 50 U	10 U	50 U	10 U	1 J	10 U	2 J	10 U
Chloroform	4 J 50 U	5 J 50 U	10 U	50 U	3 J	4 J	2 J	10 U	16
Trichloroethene (TCE)	4 J 50 U	4 J 50 U	10 U	50 U	10 U	2 J	10 U	10 U	10 U
Perchloroethylene (PCE)	420 E 320 D	480 E 310 DJ	10 U	290	11	190	10 U	10 U	34
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	11	10 U

J The associated numerical value is an estimated quantity because quality control criteria were not met. Presence of the analyte is reliable.
U The analyte was not detected above the CRQL.
D Analyte was diluted to bring within instrument calibration range or to remove matrix interferences.
E Reported concentration is above the instrument calibration range.
B Analyte was detected in the laboratory method blank.

TABLE 5
General Chemistry Results, Methods 150.1, 300.0, 310.1, and SM2320B
Concentrations in mg/L

Well ID	EPA-MW-01S	EPA-MW-01D	EPA-MW-02	EPA-MW-03	EPA-MW-04	EPA-MW-05
Alkalinity	250	260	260	260	280	360
Bicarbonate	300	310	310	310	340	440
Carbonate	<5	<5	<5	<5	<5	<5
Chloride	150	69	160	140	170	140
Hydroxide	<5	<5	<5	<5	<5	<5
Sulfate	110	160	110	100	100	110
pH	7.4	7.3	7.4	7.4	7.3	7.3

TABLE 6
Groundwater Elevations

Well ID	Northing	Easting	TOC	Ground Elevation	DTGW 9/1/98	GW 9/1/98	DTGW 10/22/98	GW 10/22/98	DTGW 11/10/98	GW 11/10/98
EPA-01S	3274.49	6976.38	4662.18	4662.54	155.35	4506.83	153.9	4508.28	152.96	4509.22
EPA-01D	3274.17	6976.15	4662.2	4662.54	190.55	4471.65	182.2	4480	178.65	4483.55
EPA-02	3228.73	7490.2	4680.41	4678.41	NA	NA	164.9	4515.51	164.1	4516.31
EPA-03	3861.5	7444.02	4697.98	4695.54	187.6	4510.38	189.75	4508.23	188.9	4509.08
EPA-04	2513.17	7319.76	4654.15	4654.35	132.65	4521.5	131.35	4522.8	130.65	4523.5
EPA-05	3753.76	8658.65	4732.09	4732.45	207.1	4524.99	205.5	4526.59	204.71	4527.38

TOC = Top of casing (feet above mean sea level)
DTGW = Depth to groundwater (feet)
GW = Groundwater elevation (feet above mean sea level)
NA = Not available

APPENDIX A

Photolog

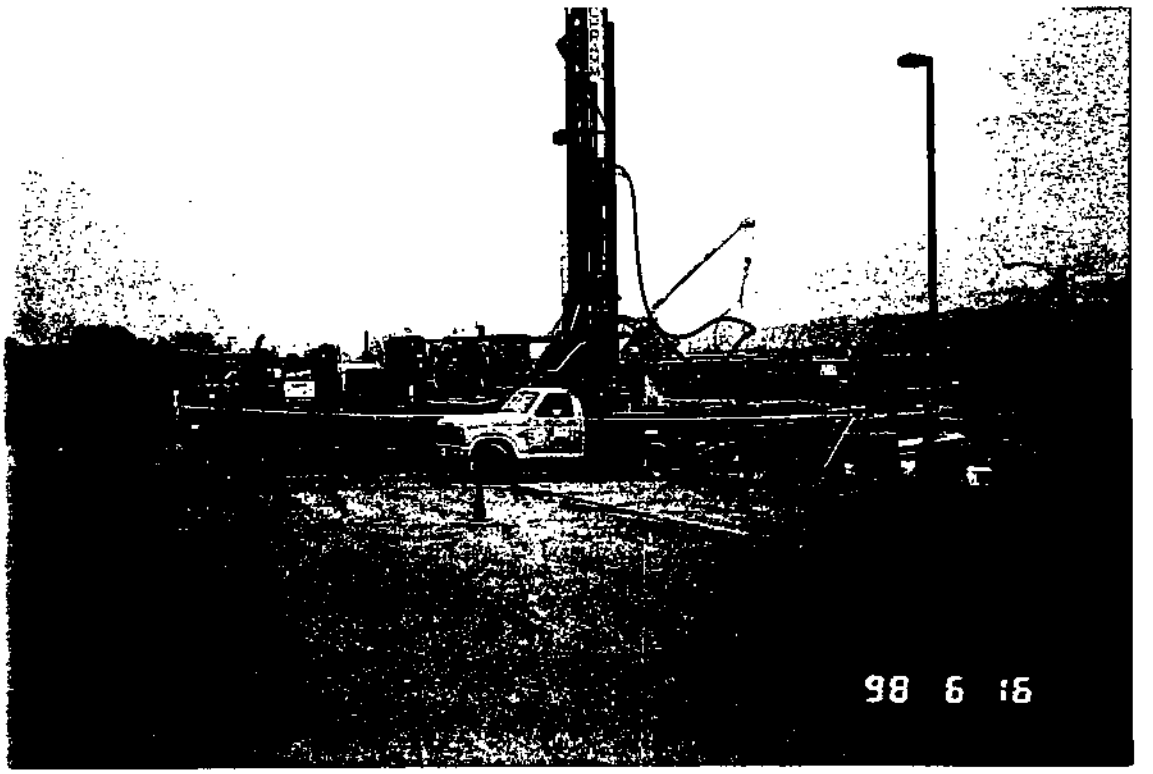


PHOTO 1-1
Well on Steiner pool lot facing southwest toward the UNG facility.
Location of well EPA-MW-01. Photo taken at 1320 hours by J. Noto/UOS.

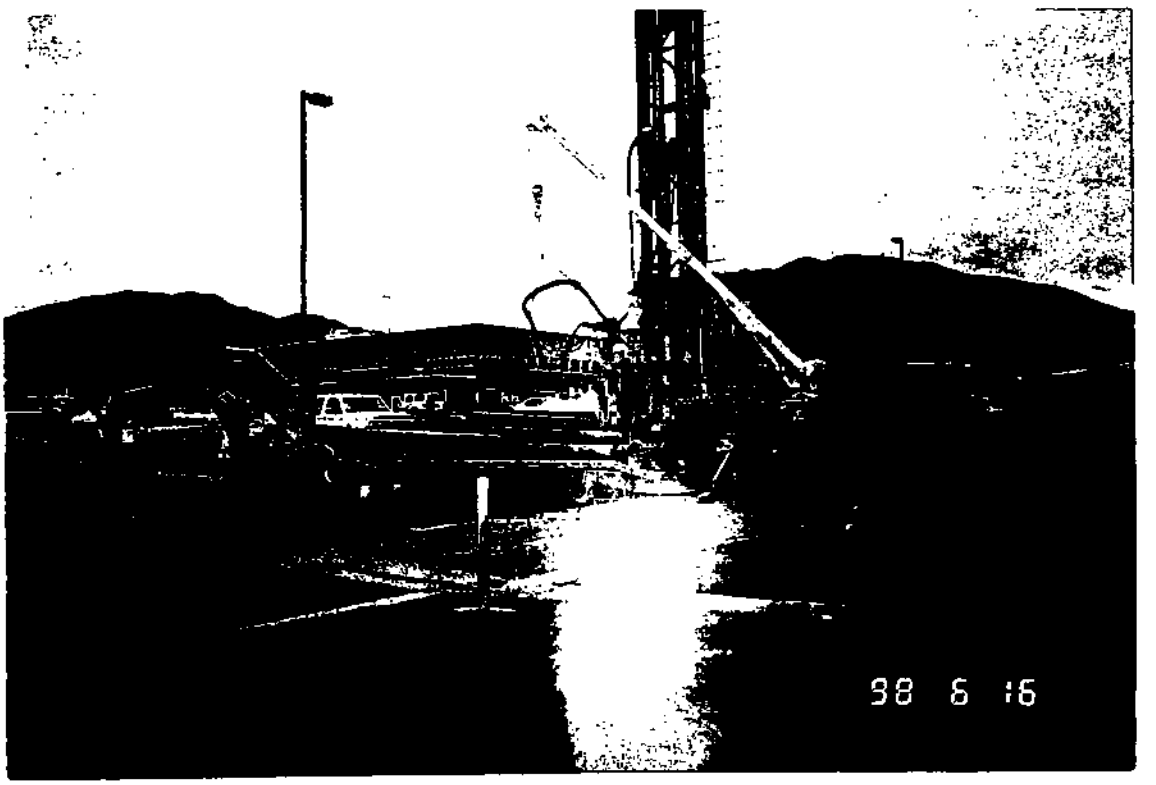


PHOTO 1-2
Rig with pool in the background. Location of EPA-MW-01. Photo taken at 1325 hours by J. Noto/UOS.

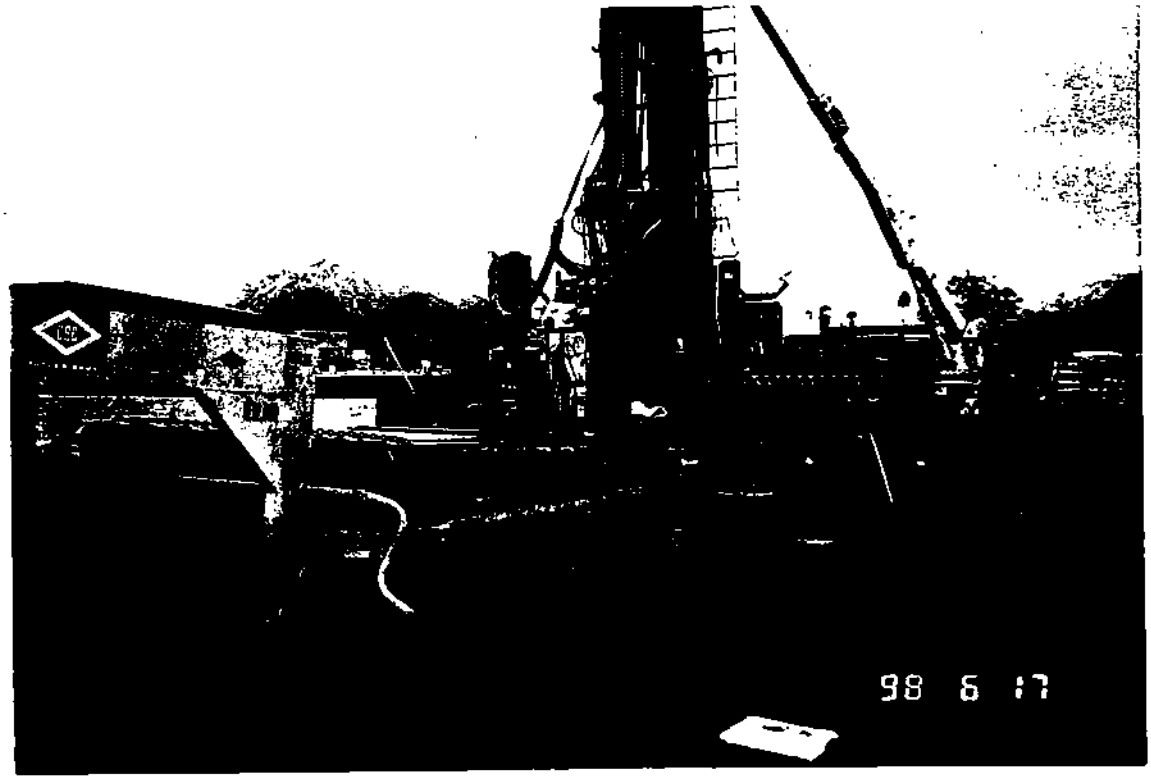


PHOTO 1-3
First hole being drilled at Steiner pool lot. Location of EPA-MW-01. Photo taken at 0945 hours by J. Noto/UOS.

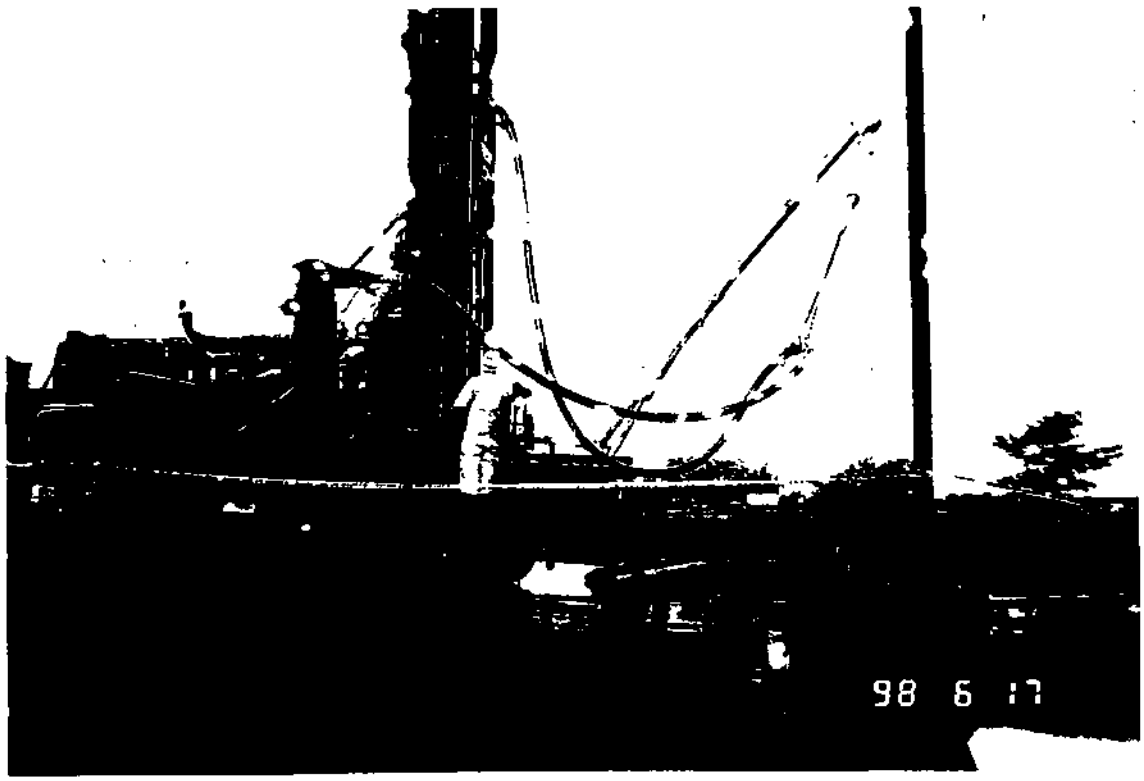


PHOTO 1-4
Drilling well EPA-MW-01 on Steiner pool lot. 130 feet below ground surface (bgs).
Photo taken toward the south by J. Noto/UOS at 0915 hours on June 18, 1998.

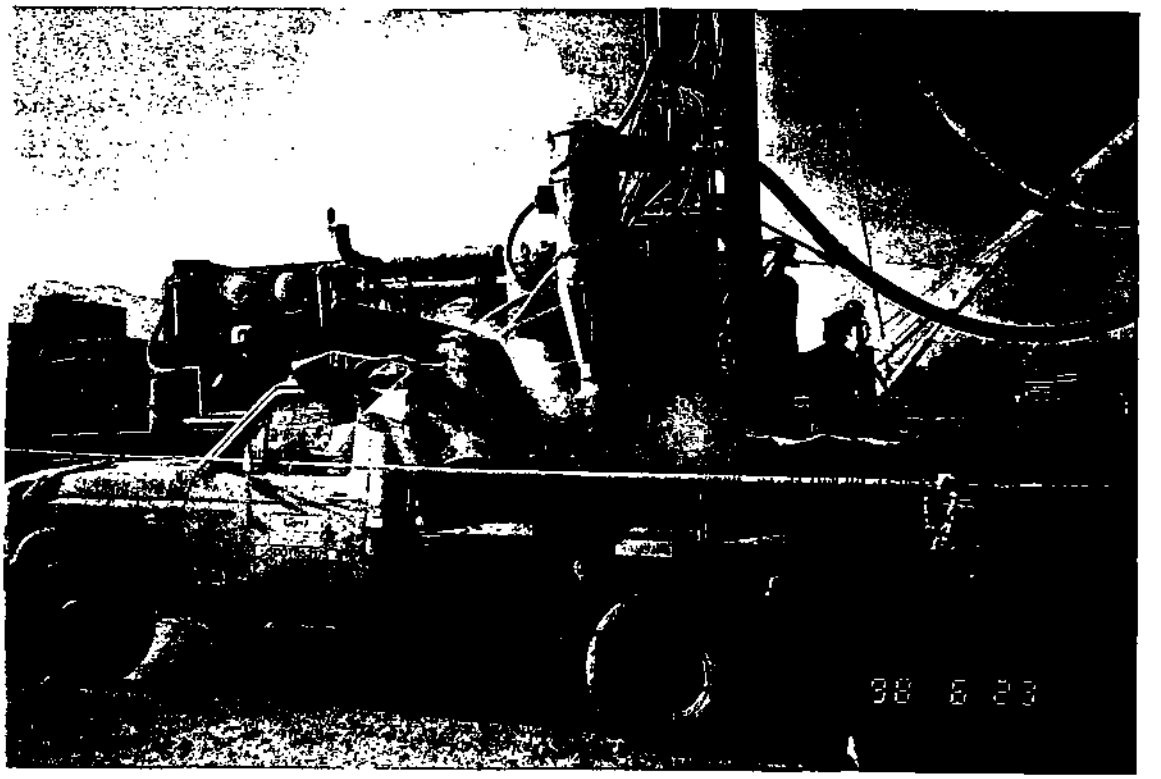


PHOTO 1-5
Picture of dust cloud discharging from chute at 210 feet bgs. Photo taken toward the southwest by B. LaRow/UOS.

PHOTO 1-6
Split spoon, showing the distinct sandy gravel and silty clay transition. Photo taken by B. LaRow/UOS.

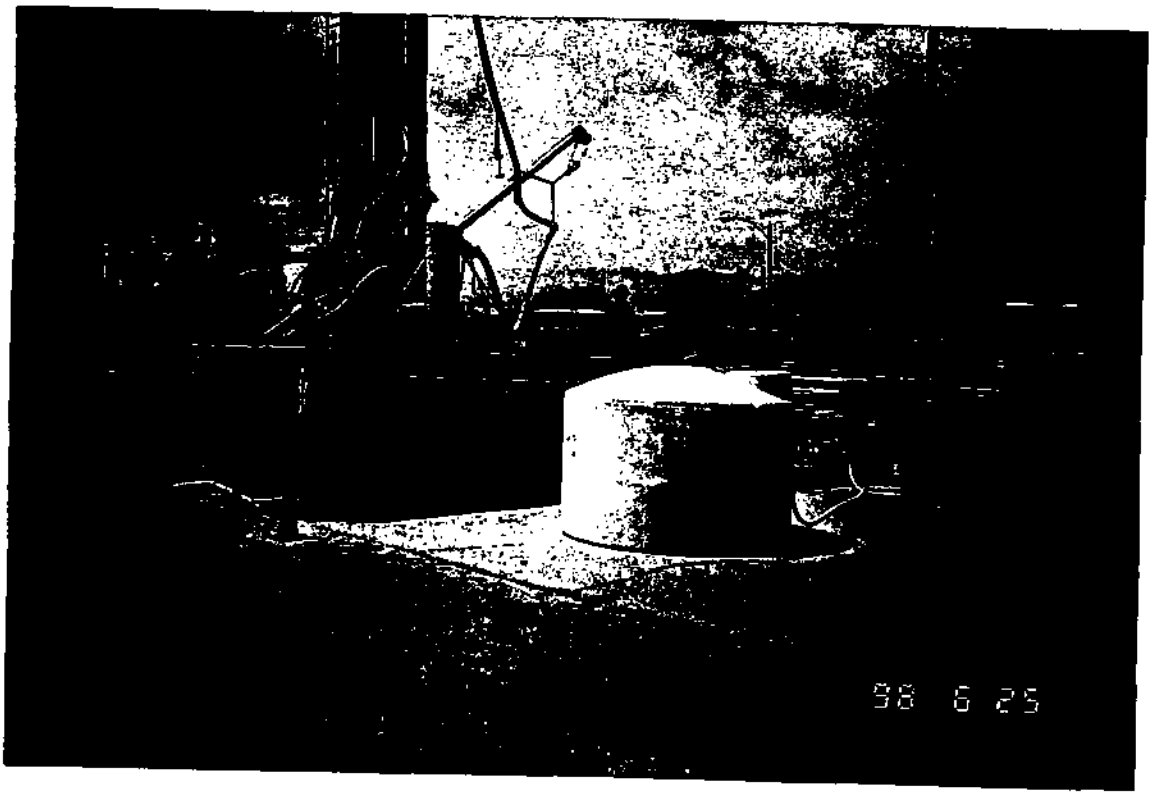


PHOTO 1-7
Roll-off bin and poly tank for collecting cuttings. Photo taken by B. LaRow/UOS.

PHOTO 1-8
Formation water in roll-off bin. Photo taken by B. LaRow/UOS.

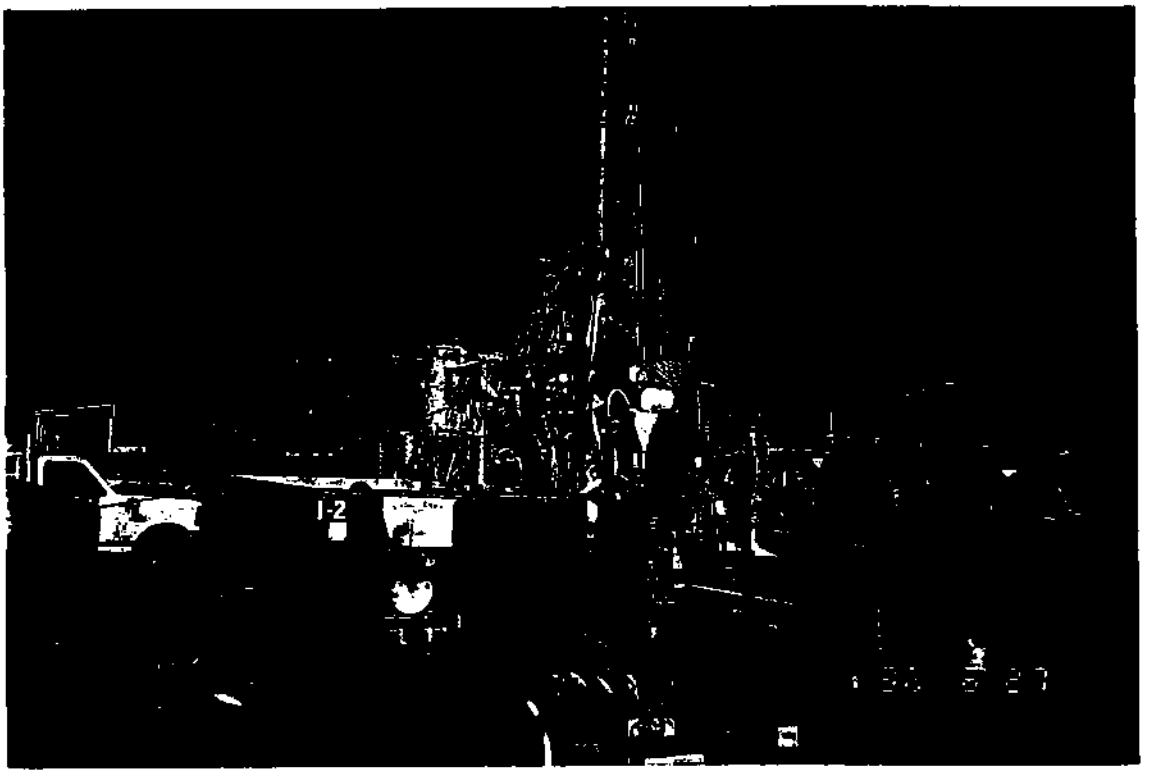


PHOTO 1-9
Installation of EPA-MW-01. Photo taken by B. LaRow/UOS.

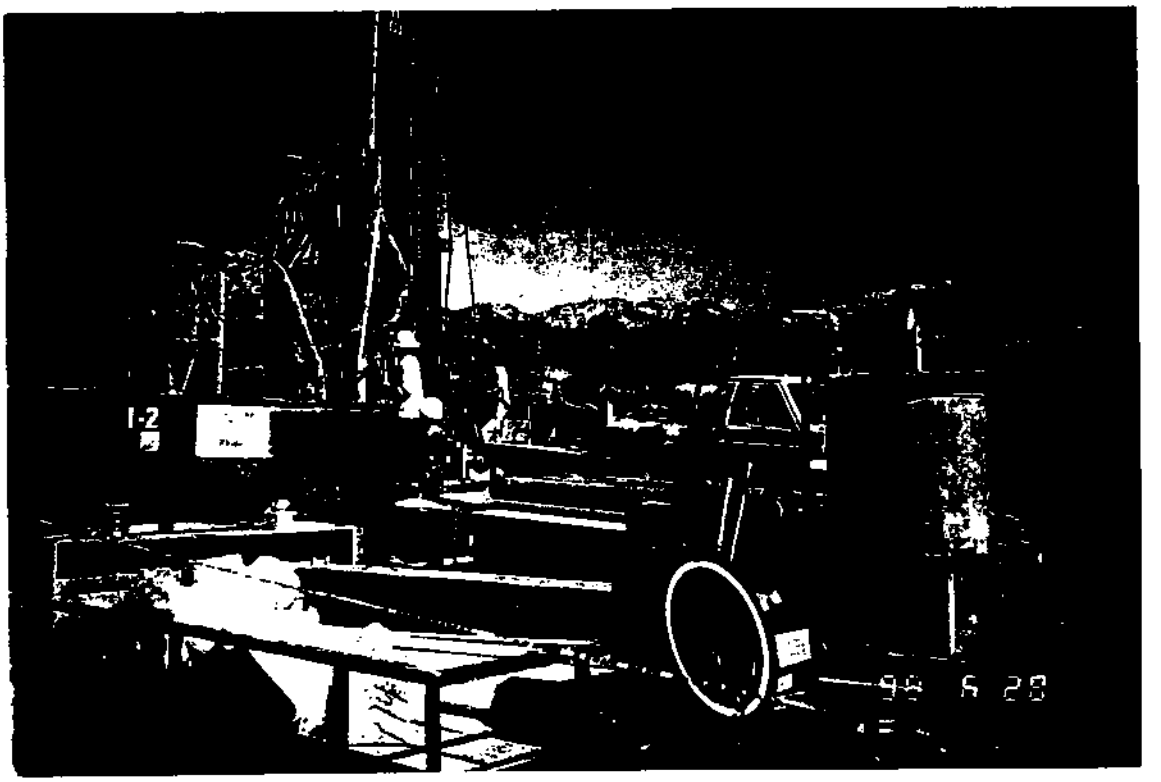


PHOTO 1-10
Bentonite slurry mixer at EPA-MW-01. Photo taken by B. LaRow/UOS.

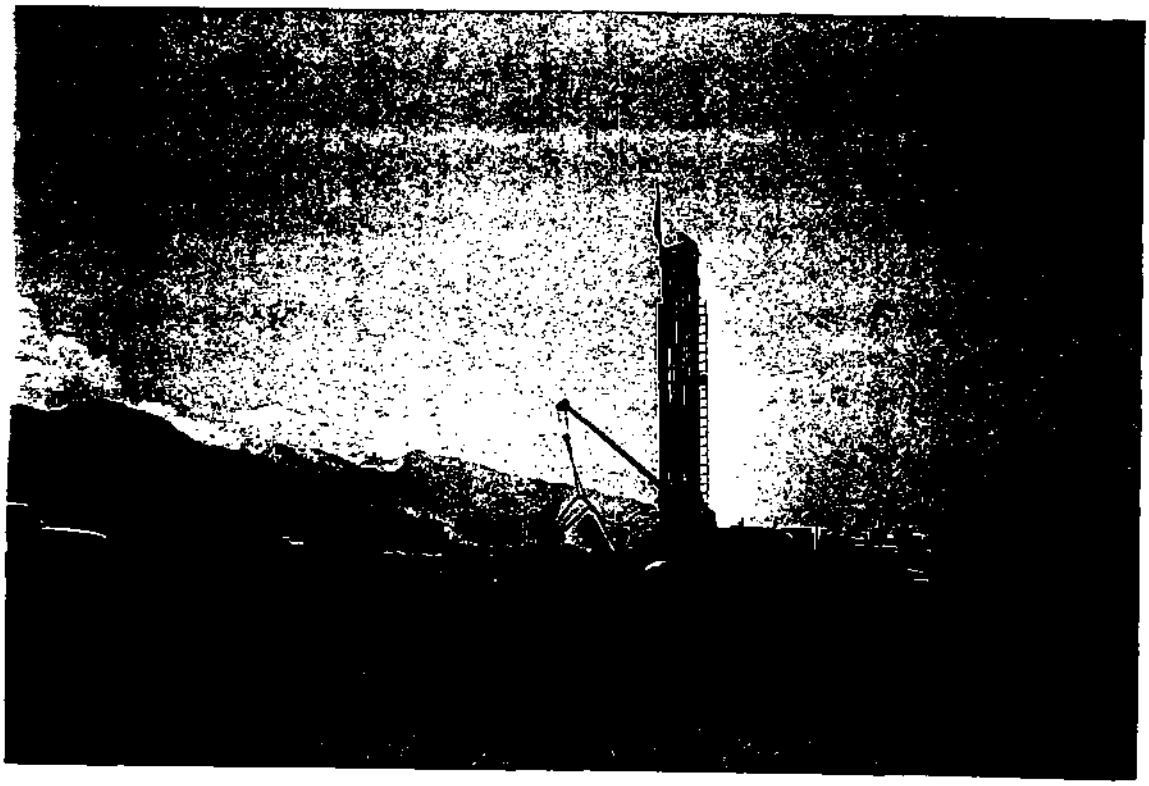


PHOTO 2-1
Rig installing EPA-MW-02. Photo taken toward the southeast by J. Noto/UOS on July 20, 1998.

PHOTO 2-2
Developing EPA-MW-02 with bailer; pool building is in the background. Photo taken by J. Noto/UOS on July 24, 1998.

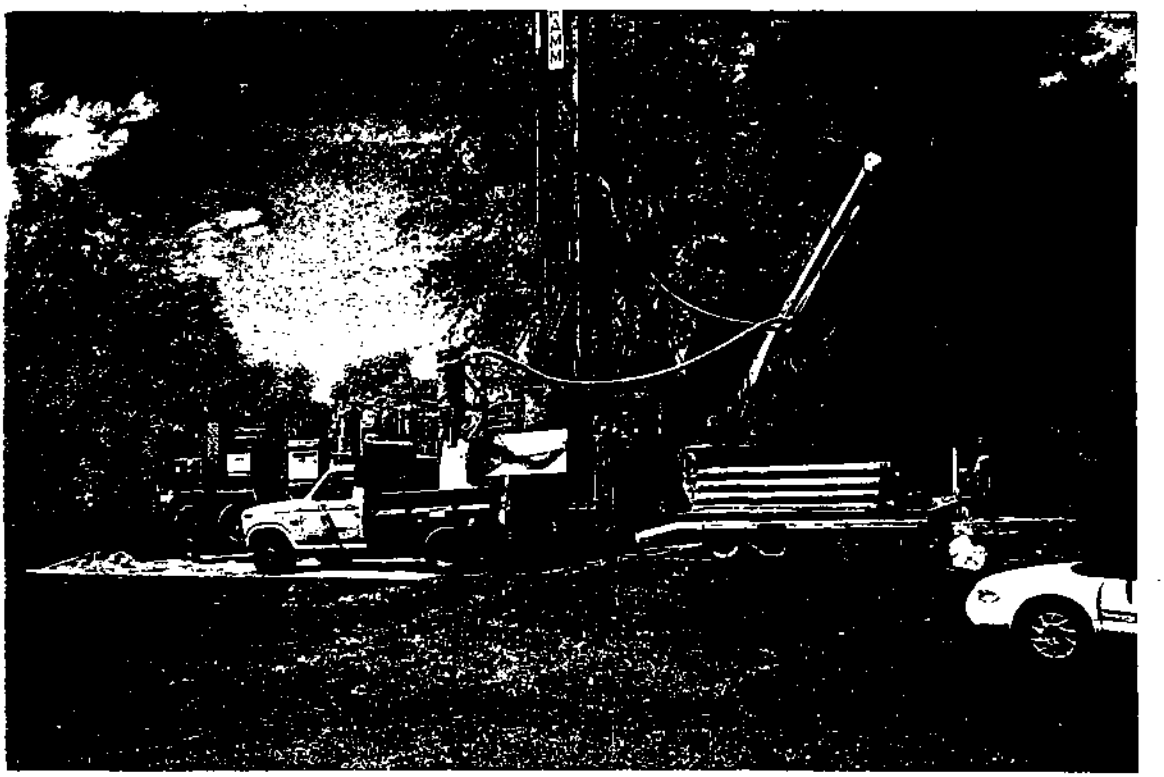


PHOTO 2-3
Installation of EPA-MW-04 at Sunnyside Park. Photo taken by Bill LaRow/UOS on July 28, 1998.

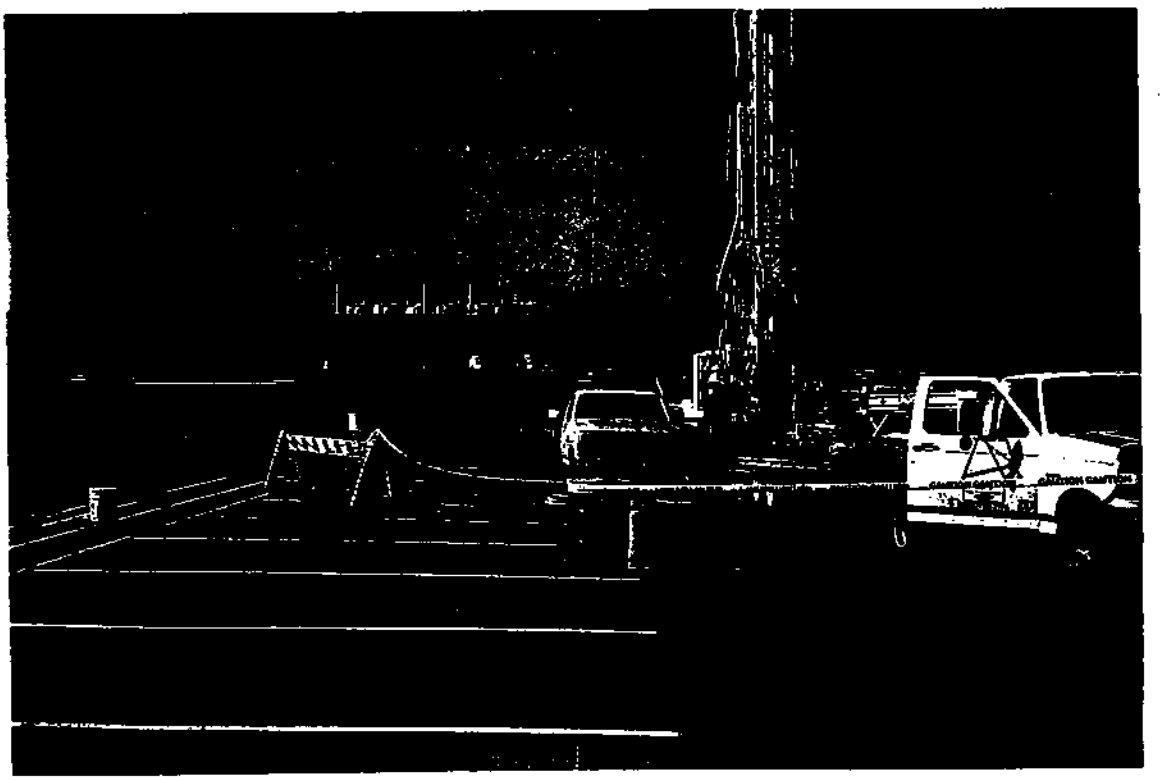


PHOTO 2-4
Installation of EPA-MW-05 at VA campus, Building 4 parking lot.
Photo taken toward the west by J. Noto/UOS on August 28, 1998.

PHOTO 2-5
Installation of EPA-MW-05. Photo taken toward the east by J. Noto/UOS on August 28, 1998.

PHOTO 2-6
Installation of EPA-MW-05. Dust from cuttings. Photo taken by J. Noto/UOS on August 30, 1998.

APPENDIX B

Lithologic Logs and Fence Diagrams

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-01	Mount Olivet 7580314.00	Salt Lake City, Utah

Boring Depth (ft) X Diameter (in):	Drilling Method:
404.0 x 10	Air Rotary w/advance casing

Well Contractor Name:	Logged by:
Layne Christenson	John Noto, Bill LaRow

Ground Surface Elevation (ASL):	Top of Casing Elevation (ASL):	Lat.	Long.	Northing	Easting
4662.54	4662.18	N 40 45'15.188"	W 111 50'41.959"	3274.49	6776.38

Date Started:	Date Completed:	Additional Comments:
6/16/98	6/30/98	TOC Elevation deep well: 4662.20

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type *	Blow count	PID / FID (ppm)
Fill; silty w/gravel	ML		0	Bentonite chips, PVC casing				
Fill; sandy w/gravel	SW		5					
Gravelly sand; reddish brown, fg-vfg sand, angular pebbles, dry	SW		10					
			15					
			20					
			25					
Sandy gravel; tan-brown	GW		30					
Gravelly sand;	SW		35					
Clay silty gravel; red/brown, 20-50% silt. Clayey silt layer 1" thick, >2" diameter., angular igneous. pebbles, dry	GC		40				41/50(3")	1.0
Sandy gravel; reddish brown, fg sand, moist	GM		45					
			50					
Clay; red, <10% gravel, highly plastic, very soft, moist	CL		55					
Gravelly sand, red, fg,	SW							
Gravelly sandy clay; red, moist	CL		60					
Clay, red, high plasticity, very soft, dry	CL							
Gravelly sand; tan-brown, fg-mg sand, rounded <1" pebbles, some silt, dry	SW		65					
			70					
			75					
Sand; red-brown, vfg, well sorted dry	SP							
Sandy gravel; red, wet at 80' bgs	GW		80				50(3")	15
Sandy clay with gravel; red, wet @ 82' - 84'	CL							
Silty sandy gravel; red, 20 - 40% gravel, <1" diameter, rounded, nonspherical pebbles,	GM		85					

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	6/30/98	10/22/98 (S)	10/22/98 (D)		
Static Water Level (from TOC)	Level:	154.6" bgs (S)	▼ 153.9	▼ 182.2		
Static Water Level (ASL)	Level:		4508.28	4479.98		

URS Operating Services

SOIL BORING LOG / MONITORING W CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-01	**Mount Olivet 7580314.00**	**Salt Lake City, Utah**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type *	Blow count	PID / FID
wet @ 95' - 98'			90 95					
Silty sandy gravel; tan-brown, dry	GM		100					
Silty sand with gravel; red, vfg sand, <10% gravel, dry	SM		105 110 115 120					
Silty sandy gravel; red, 20 - 40% gravel, dry	GM		125 130 135 140 145					
Sandy clay; red, slightly plastic, moist	CL							
Silty sandy gravel; wet @ 154 - 156'bgs	GM		150 155					
Clayey sand; red moderately plastic, soft, moist	SC		160 165					
Sandy clay with gravel; moderately plastic, soft, dry	SC		170 175 180 185 190 195 200 205	10-20 mesh sand .010 slot, 2" PVC screen				7

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	6/30/98	10/22/98 (S)	10/22/98 (D)		
Static Water Level (from TOC)	Level:	154.6" bgs (S)	▼ 153.9	▼ 182.2		
Static Water Level (ASL)	Level:		4508.28	4479.98		

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-01	**Mount Olivet 7580314.00**	**Salt Lake City, Utah**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type*	Blow count	PID / FID (ppm)
Clayey silt; brown-red, trace gravel, low plasticity, moist - wet @ 210	ML		210					
silty sand; brown-red, trace gravel	SM		215					
Sandy clay, brown-red, moist	SC		220					
Silty clay with gravel, dry	GM		225	Bentonite chips				
Silty - clayey sand; trace gravel, dry	SC		230					
			235					
			240					
Silty gravel; dry	GM		245					
			250					
			255					
Gravel; well sorted, subangular to angular, wet	GP		260					
			265					
			270					
			275					
			280					
			285					
			290					
			295					
			300					
			305					
			310					
			315					
			320					

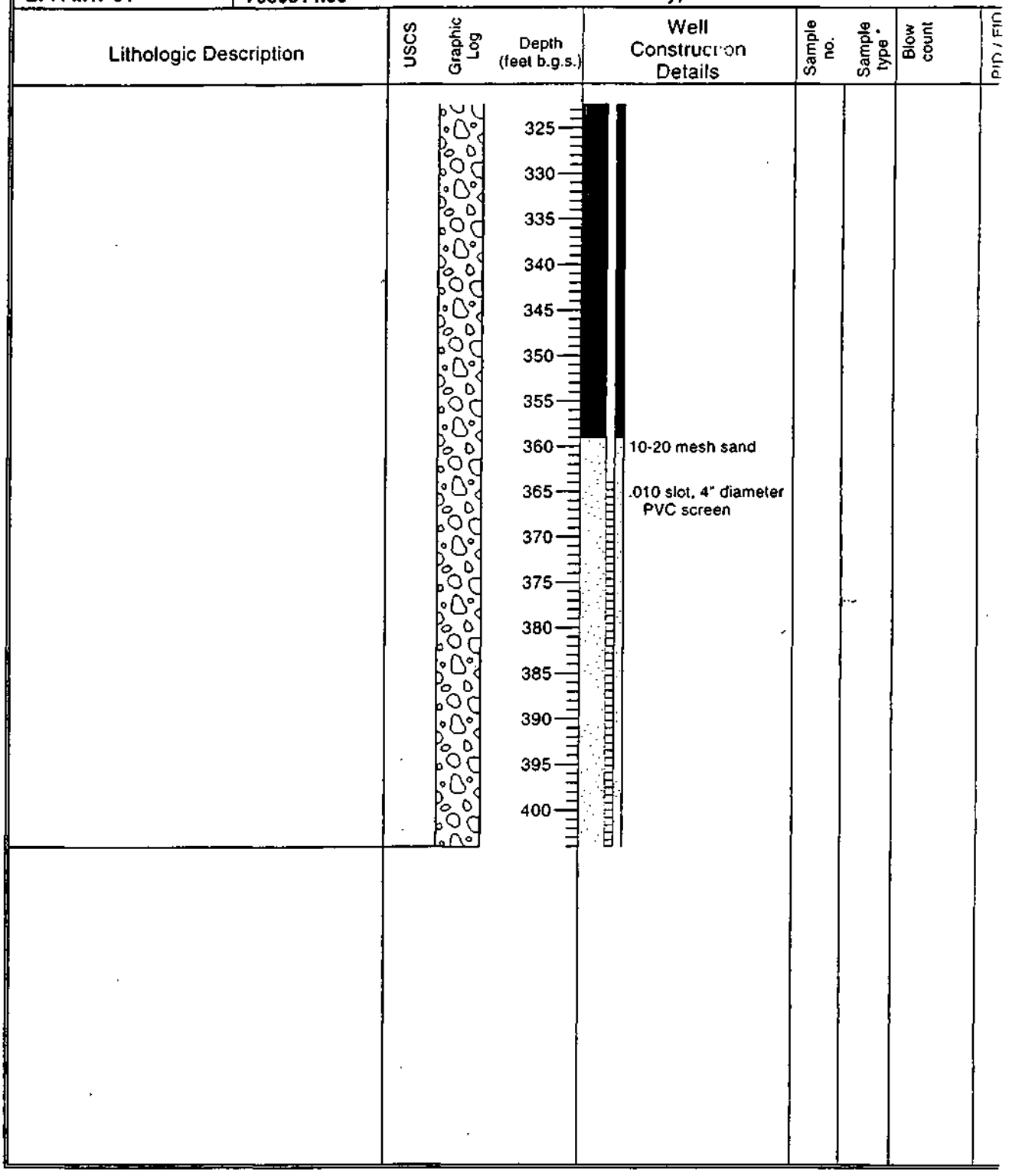
* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	6/30/98	10/22/98 (S)	10/22/98 (D)		
Static Water Level (from TOC)	Level:	154.6" bgs (S)	▼ 153.9	▼ 182.2		
Static Water Level (ASL)	Level:		4508.28	4479.98		

URS Operating Services

SOIL BORING LOG / MONITORING W CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-01	**Mount Olivet 7580314.00**	**Salt Lake City, Utah**



* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	6/30/98	10/22/98 (S)	10/22/98 (D)		
Static Water Level (from TOC)	Level:	154.6" bgs (S)	▼ 153.9	▼ 182.2		
Static Water Level (ASL)	Level:		4508.28	4479.98		

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-02	Mount Olivet 7580314.00	Salt Lake City, Utah

Boring Depth (ft) X Diameter (in):	Drilling Method:
205.5 x 8	Air Rotary w/advance casing

Well Contractor Name:	Logged by:
Layne Christenson	John Noto

Ground Surface Elevation (ASL):	Top of Casing Elevation (ASL):	Lat. / Long.	Northing / Easting
4678.41	4680.41	N 4045'14.756" / W 111 50'35.282"	3228.73 / 7490.2

Date Started:	Date Completed:	Additional Comments:
7/20/98	7/22/98	

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type*	Blow count	PID / FID (ppm)
Silty sand with gravel, grey angular to subrounded pebbles, dry	GM		0	Bentonite pellets				
			5					
			10					
			15					
Clayey Sand, reddish brown, low plasticity	SC		20					
Gravelly sand with silt; reddish brown, grey sandstone pebbles, angular-subrounded, nonspherical. dry	GM		25					
Gravelly sand with silt; reddish brown	GM		30					
			35					
Gravelly silt with sand, reddish brown, dry	GM		40					
Gravelly sand; reddish brown, fg sand, slightly cohesive when damp, dry	GM		45					
			50					
Gravelly sand; dark reddish brown, coarse grained, dry	SW		55					
			60					
Gravelly sand with silt; reddish brown, dry	GM		65					
			70					
Sand; reddish brown, medium grained, moderately sorted, slightly cohesive, with gravel, dry	SW		75					
			80					
Gravelly sand with silt; reddish brown, dry	GM		85					
			90					

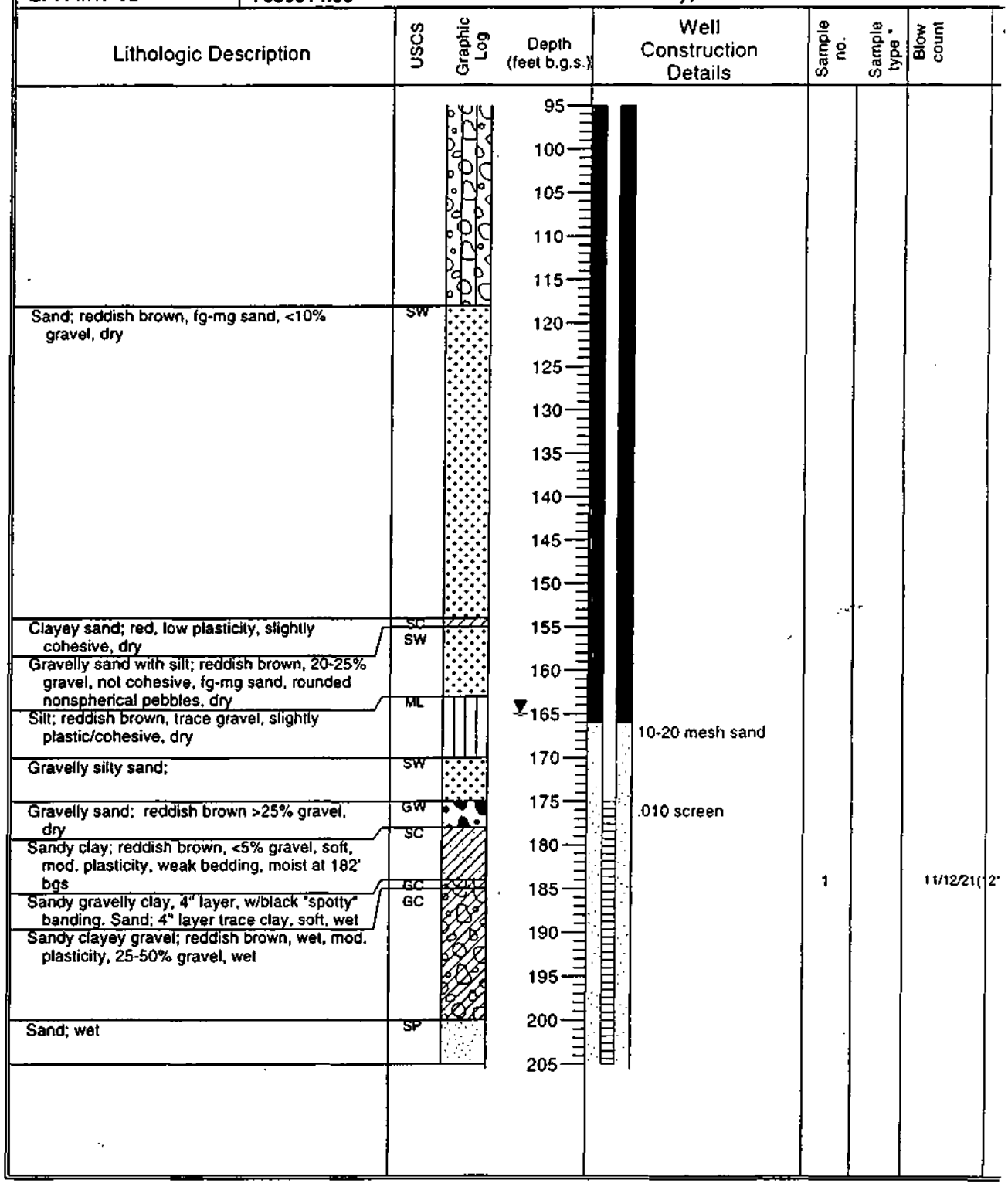
* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	7/22/98	10/22/98			
Static Water Level (from TOC)	Level:	180 bgs	▼ 164.9			
Static Water Level (ASL)	Level:		4515.51			

URS Operating Services

SOIL BORING LOG / MONITORING W CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-02	**Mount Olivet 7580314.00**	**Salt Lake City, Utah**



* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	7/22/98	10/22/98			
Static Water Level (from TOC)	Level:	180 bgs	▼ 164.9			
Static Water Level (ASL)	Level:		4515.51			

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-03	Mount Olivet 7580314.00	Salt Lake City, Utah

Boring Depth (ft) X Diameter (in): 210.0 x 8	Drilling Method: Air Rotary w/advance casing
Well Contractor Name: Layne Christenson	Logged by: Bill LaRow

Ground Surface Elevation (ASL): 4695.54	Top of Casing Elevation (ASL): 4697.98	Lat. N 40 45'21.005" Long. W 111 50'35.913"	Northing 3861.5 Easting 7444.02

Date Started:	Date Completed:	Additional Comments:
7/28/98	7/30/98	

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type*	Blow count	PID / FID (ppm)
Silty sand with gravel, brown, subrounded gravel, dry	GM		0 5 10 15 20 25 30 35 40 45 50 55 60 65	bentonite granuals, 4" PVC pipe				
Silty sand with gravel, same as above, reddish brown, coarser sand, less gravel, dry	GM		70 75					
Silty sand with gravel, as above, sand better sorted, dry	GM		80 85 90 95					

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	7/29/98	10/22/98			
Static Water Level (from TOC)	Level:	190.5 bgs	▼ 189.75			
Static Water Level (ASL)	Level:		4508.23			

URS Operating Services

SOIL BORING LOG / MONITORING W. CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-03	**Mount Olivet 7580314.00**	**Salt Lake City, Utah**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type *	Blow count	PID / FID
Silty sand with gravel, as above, more silty, less gravel, dry	SM		150					
as above, slightly moist at 155	SM		155					
Silty sand with gravel, as above, dry	GM		160					
			165					
			170					
			175					
			180	bentone seal				
Silty to clayey sand, reddish brown, low plasticity, less gravel, slightly moist	SC		185	10-20 mesh sand filter pack				
Silty sand, moist at 191 feet bgs	SM		▼190	.010 PVC screen in filter pack				
Silty sand with gravel, reddish brown, moist	SM		195					
			200					
			205					
			210					

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	7/29/98	10/22/98			
Static Water Level (from TOC)	Level:	190.5 bgs	▼ 189.75			
Static Water Level (ASL)	Level:		4508.23			

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-04	**Mount Olivet 7580314.00**	**Salt Lake City, Utah**

Boring Depth (ft) X Diameter (in):	Drilling Method:
173.0 x 8	**Air Rotary w/advance casing**

Well Contractor Name:	Logged by:
Layne Christenson	**Bill LaRow**

Ground Surface Elevation (ASL):	Top of Casing Elevation (ASL):	Lat. / Long.	Northing / Easting
4654.15	**4654.35**	N 40 45'07.680 / W 111 50'37.460"	2513.17 / 7319.76

Date Started:	Date Completed:	Additional Comments:
7/30/98	**8/1/98**	**Sunnyside park**

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type *	Blow count	PID / FID (ppm)
Silty sand with gravel; brown, dry	SM		0	Bentonite chips, 4" PVC casing				
Clayey sand/sandy clay with gravel; moderate plasticity, moist	SC		15					
Sandy clay with gravel; brown, low plasticity, dry	CL		20					
Silty sand with gravel; slightly moist	SM		85					

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	7/30/98	10/22/98			
Static Water Level (from TOC)	Level:	▽ 139	▼ 131.35			
Static Water Level (ASL)	Level:	4515.35	4523.00			

URS Operating Services

SOIL BORING LOG / MONITORING WI CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-04	Mount Olivet 7580314.00	Salt Lake City, Utah

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type *	Blow count	PID / FID
Gravel with clay; wet	GW		90, 95, 100, 105, 110, 115, 120, 125, 130 ▽, 135, 140 ▽, 145, 150, 155, 160, 165, 170	10-20 mesh sand; .010 PVC screen				

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	7/30/98	10/22/98			
Static Water Level (from TOC)	Level:	▽ 139	▽ 131.35			
Static Water Level (ASL)	Level:	4515.35	4523.00			

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-05	Mount Olivet 7580314.00	Salt Lake City, Utah

Boring Depth (ft) X Diameter (in): 221.0 x 6	Drilling Method: Air Rotary w/advance casing
Well Contractor Name: Layne Christenson	Logged by: John Noto

Ground Surface Elevation (ASL): 4732.45	Top of Casing Elevation (ASL): 4732.09	Lat. N 40 45'19.987 Long. W 111 50'20.128"	Northing 3753.76 Easting 8658.65

Date Started:	Date Completed:	Additional Comments:
8/28/98	8/31/98	VA Hospital, bldg. 4 lot

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type *	Blow count	PID / FID (ppm)
Gravelly sand; brown, fill, dry	SW		0–5	Bentonite chips, 2" PVC casing				
Gravelly sand; reddish brown, silty, dry	GM		20					
Sand,; reddish brown, fg-mg, slightly cohesive, some gravel, dry	SW		30					
Silt	ML		35					
Sand; same as above	SW							
Gravelly sand; reddish brown, subrounded to rounded nonspherical SS/quartzite pebbles, silty-sandy matrix, dry	SW		40–95					

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:		10/22/98			
Static Water Level (from TOC)	Level:		▼ 205.5			
Static Water Level (ASL)	Level:		4526.59			

URS Operating Services

SOIL BORING LOG / MONITORING W CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-05	**Mount Olivet 7580314.00**	**Salt Lake City, Utah**

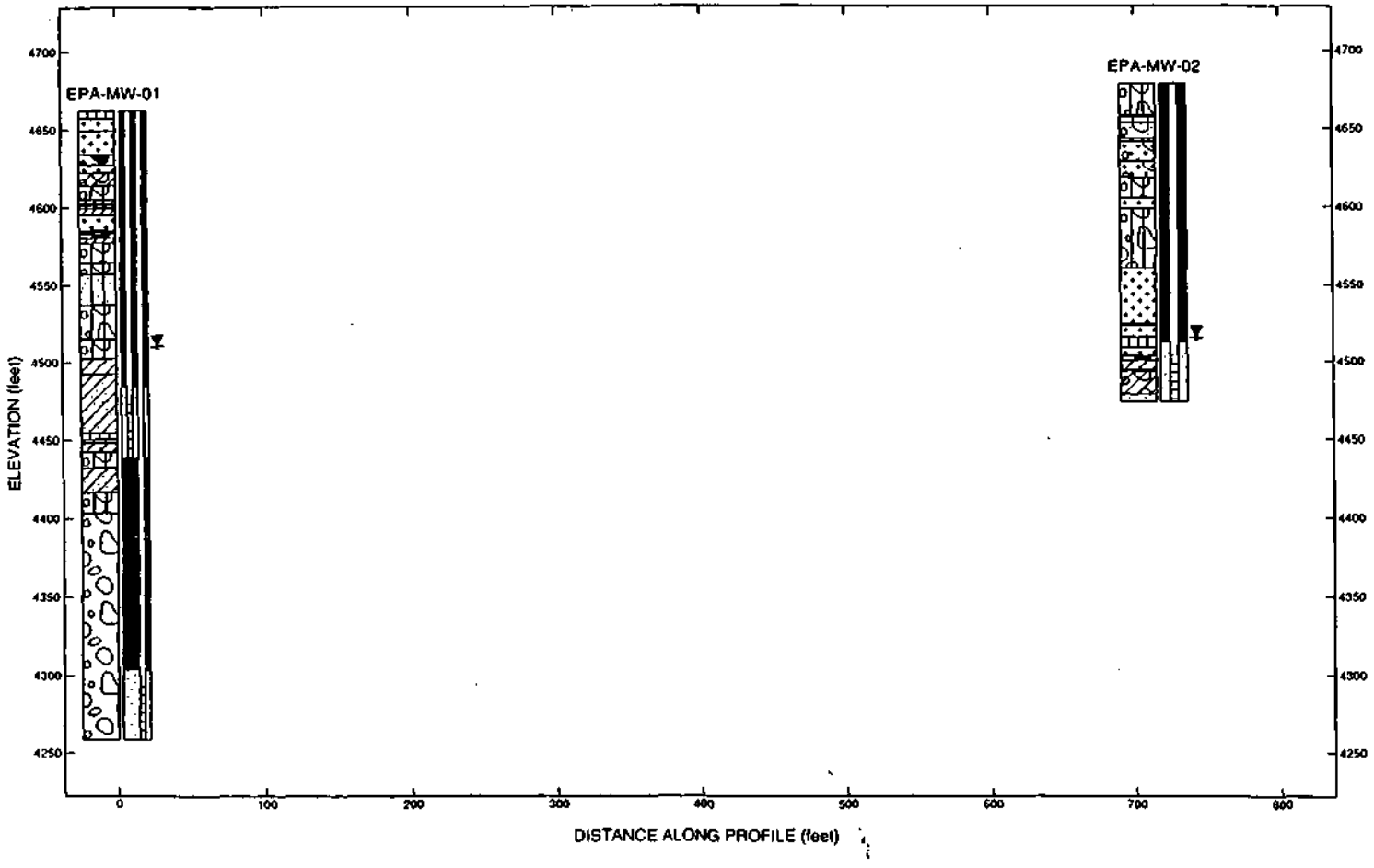
Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample no.	Sample type *	Blow count
Silty gravelly sand; reddish brown, >20% gravel, dry	GM		100				
Silt; light brown, <10% gravel	ML		105				
Gravelly sand; reddish brown, f.g.-silty, thin silt layer @ 117', dry	SW		110				
			115				
Gravelly sand/sandy gravel; tan-brown, thin silt layer @127', dry	GW		120				
			125				
			130				
			135				
Silty gravelly sand; red-brown, vfg-fg sand, <10% gravel, dry	SW		140				
same as above, higher % gravel, silty @ 146-148', dry	SW		145				
			150				
			155				
			160				
Clayey silt; brown, no sand, cohesive, moderate plasticity, gravelly @ 172' dry	CL		165				
			170				
			175				
Silty sandy gravel, reddish brown, 10-50% gravel, vfg-fg sand, trace clay, low plasticity when wetted, dry	GW		180				
same as above with < .5' layers of silt/clay (indicated by drilling speed)	GW		185	10-20 mesh sand .010 screen 2" PVC			
Sandy gravel; > 50% gravel, dry	GP		190				
			195				
Clay/silt; dry	ML		200				
Gravelly sand with clay/silt layers , very resistant @ 122.5-113.5', dry drilling, rig idled 5 minutes @ 113.5' water in hole,	SW SC		▼205				
			210				
			215				
Gravelly sand, dry	SW		220				

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:		10/22/98			
Static Water Level (from TOC)	Level:		▼ 205.5			
Static Water Level (ASL)	Level:		4526.59			

W

E

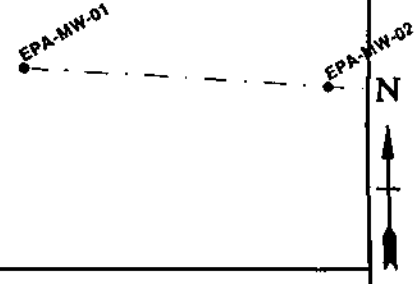


Lithology Graphics

- USCS Silt
- USCS Well-graded Sand
- USCS Well-graded Gravel
- USCS Clayey Gravel
- USCS Silty Gravel
- USCS Low Plasticity Clay
- USCS Poorly-graded Sand
- USCS Silty Sand
- USCS Clayey Sand
- USCS Poorly-graded Gravel
- USCS Poorly-graded Sandy Gravel
- USCS Well-graded Gravelly Sand

Well Graphics

- Cement grout
- Bentonite Seal
- Filter Pack
- Well Screen
- Cement Backfill
- Stuff Backfill



Site Map Scale 1 inch equals 450 feet

Explanation

EPA-MW-01 — Borehole Number

Borehole Lithology — Well Construction

▽ Water Level Reading at time of drilling.

▼ Water Level Reading after drilling.

0 123

Horizontal Scale (feet)

Vertical Exaggeration: 1x

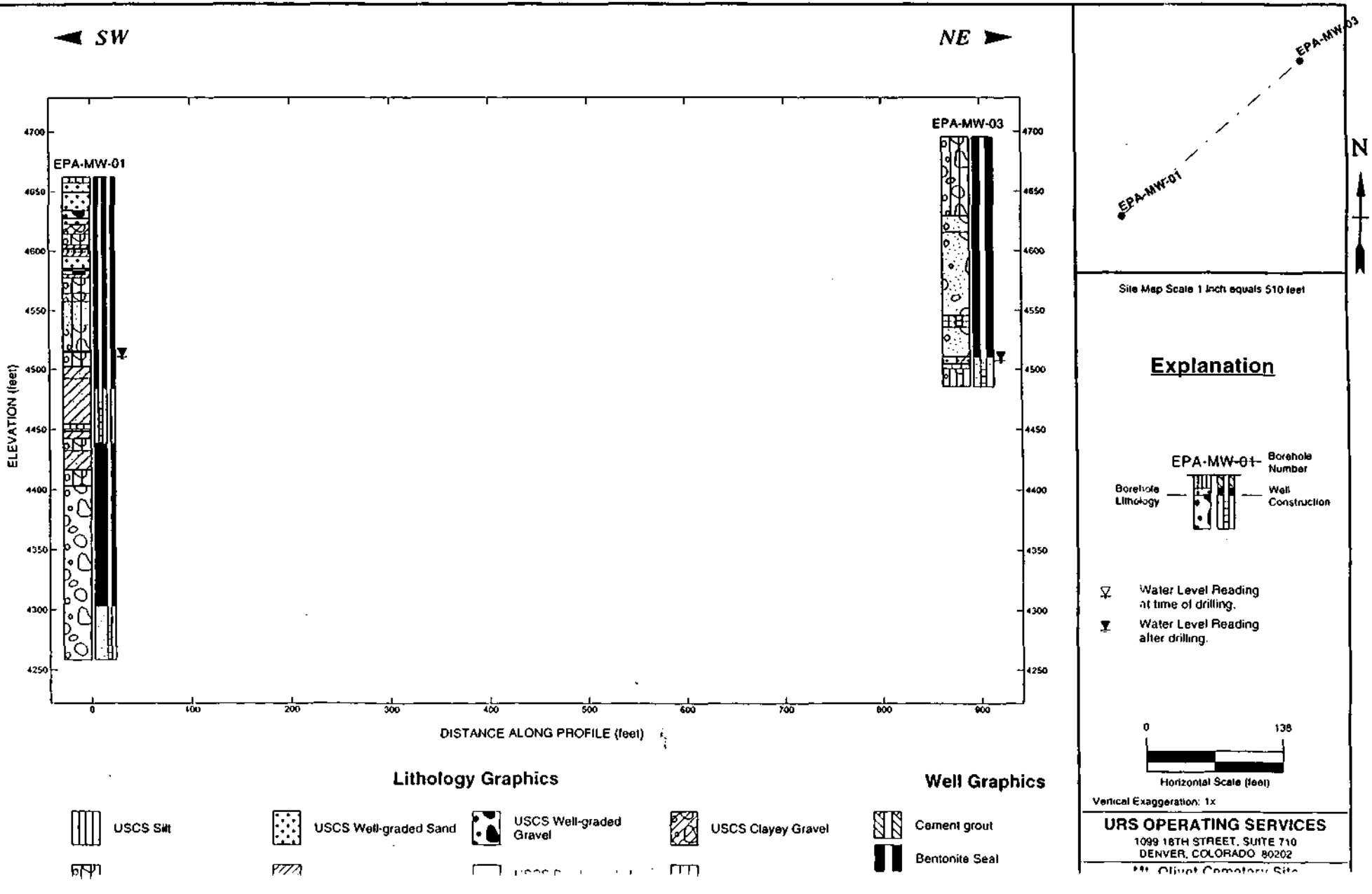
URS OPERATING SERVICES
1099 18TH STREET, SUITE 710
DENVER, COLORADO 80202

Mt. Olivet Cemetery Site
Lithologic Columns and Well Construction

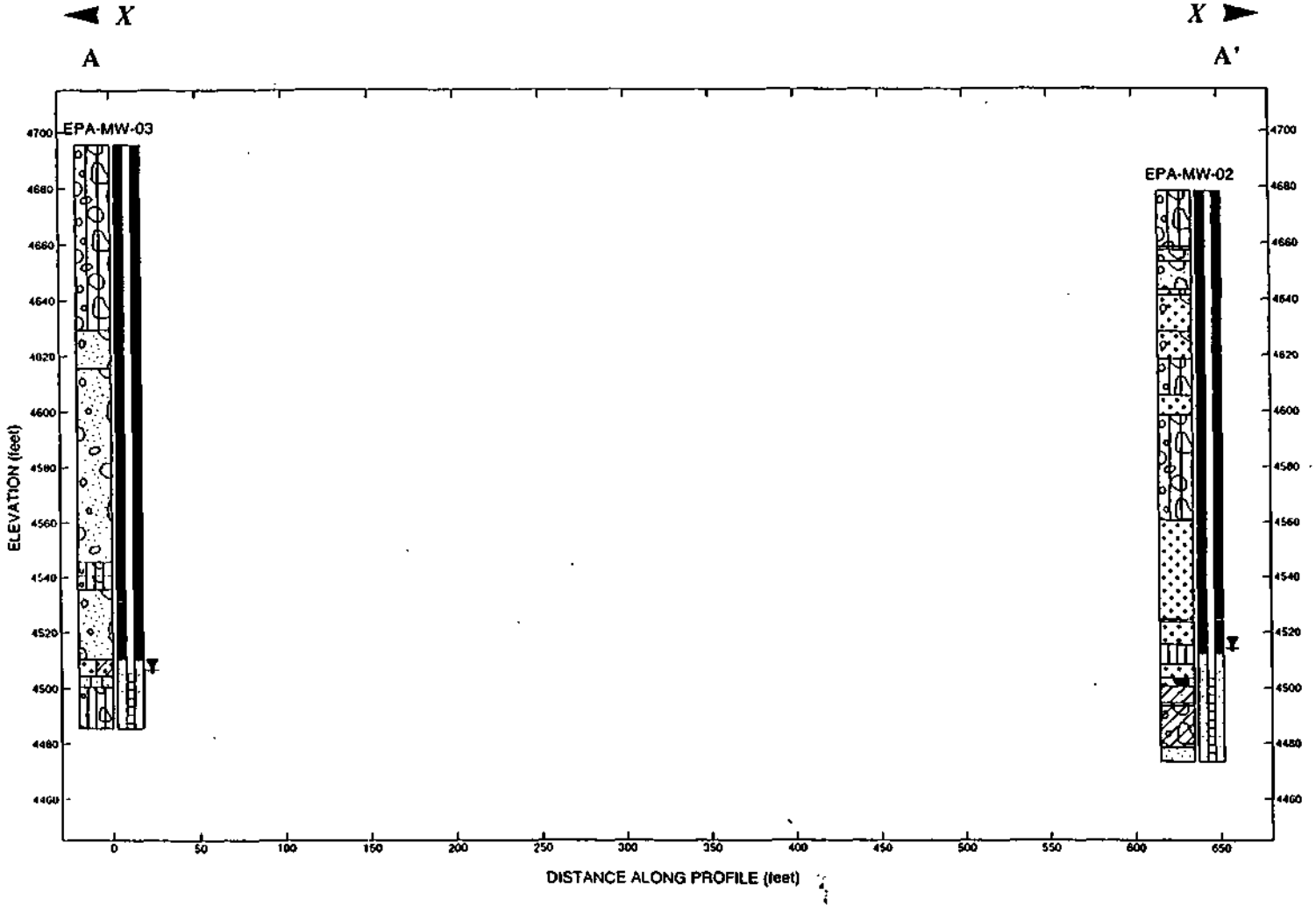
START EPA REGION VIII

JOB NUMBER	PLATE NUMBER
75803140	

MT_OLIVET01 MTOLIVET.GPJ FANWNL01.GDT 3/8/99



GPJ FANWNL01.GDT 3/8/99

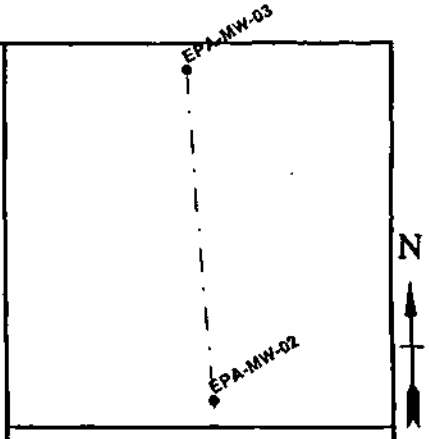


Lithology Graphics

- USCS Silty Gravel
- USCS Clayey Sand
- USCS Poorly-graded Sandy Gravel
- USCS Well-graded Gravelly Sand
- USCS Well-graded Sand
- USCS Silt
- USCS Well-graded Gravel
- USCS Clayey Gravel
- USCS Poorly-graded Sand
- USCS Poorly-graded Gravelly Sand
- USCS Gravelly Silt
- USCS Well-graded Sand with Clay
- USCS Silty Sand

Well Graphics

- Cement grout
- Bentonite Seal
- Filter Pack
- Well Screen
- Cement Backfill
- Sluff Backfill



Site Map Scale 1 inch equals 365 feet

Explanation

EPA-MW-02- Borehole Number

Borehole Lithology — Well Construction

Water Level Reading at time of drilling.

Water Level Reading after drilling.

0 100

Horizontal Scale (feet)

Vertical Exaggeration: 1.5x

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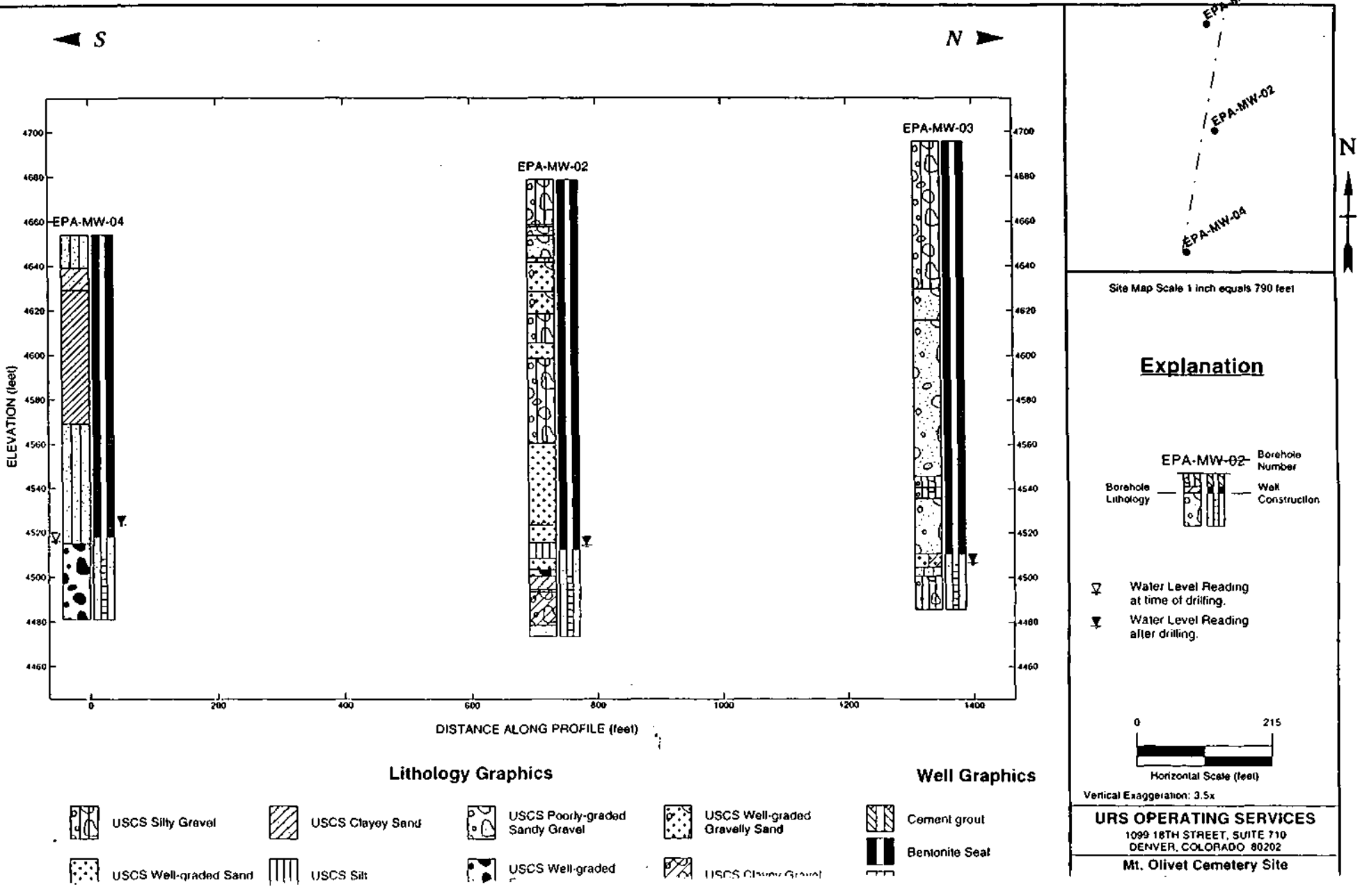
1099 18TH STREET, SUITE 710
DENVER, COLORADO 80202

Mt. Olivet Cemetery Site A-A' Lithologic Columns and Well Construction

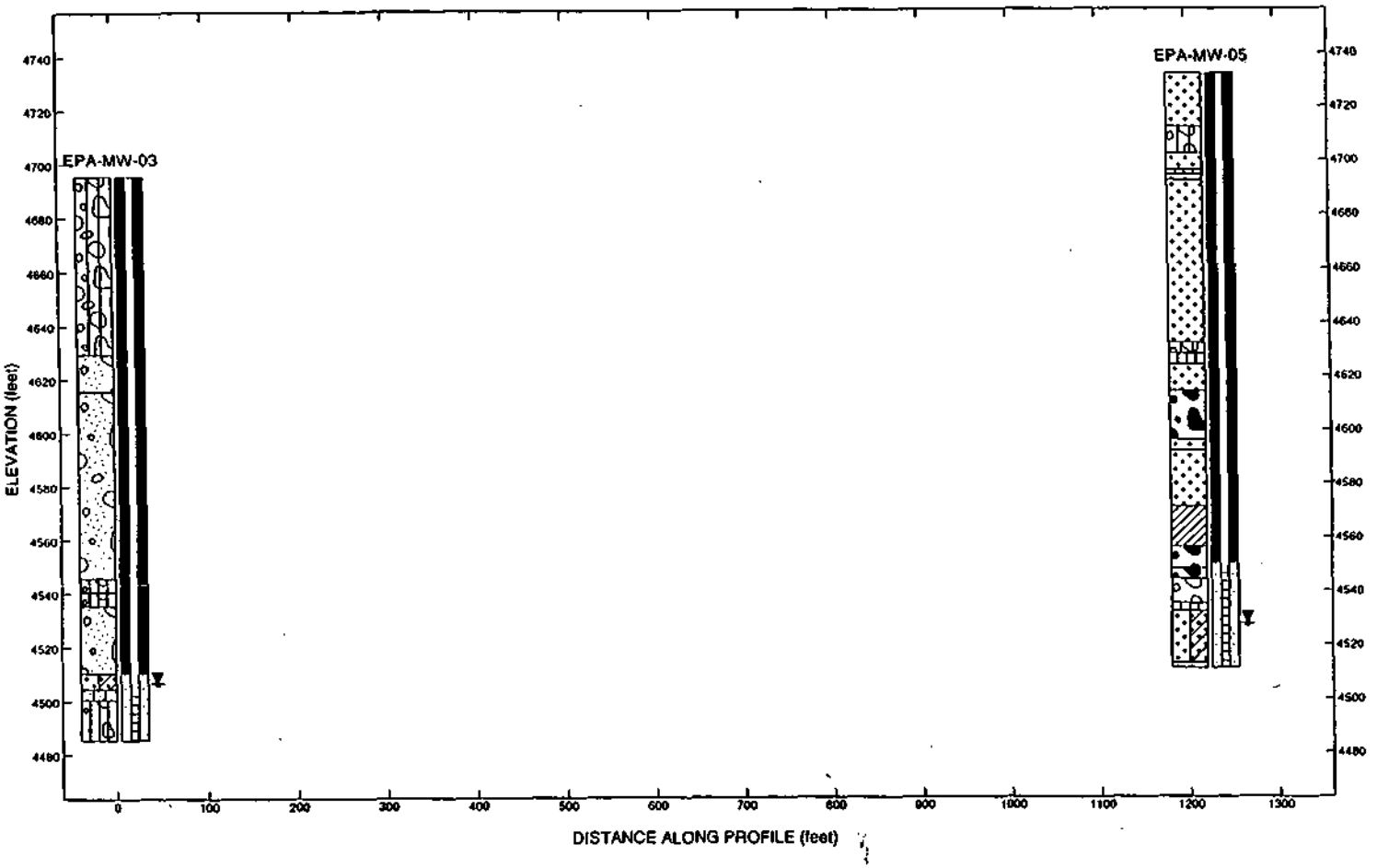
START EPA REGION VIII

JOB NUMBER	PLATE NUMBER
75803114 00	

MT_OLIVET01 MTOLIVET.GPJ FANWNL01.GDT 3/8/99



T.GPJ FANWNL01.GDT 3/8/99

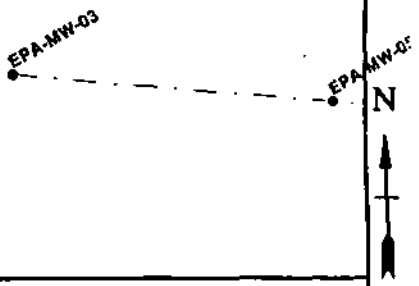


Lithology Graphics

- USCS Silty Gravel
- USCS Poorly-graded Gravelly Sand
- USCS Gravelly Silt
- USCS Well-graded Sand with Clay
- USCS Silty Sand
- USCS Well-graded Sand
- USCS Silt
- USCS Well-graded Gravel
- USCS Low Plasticity Clay
- USCS Poorly-graded Gravel

Well Graphics

- Cement grout
- Bentonite Seal
- Filter Pack
- Well Screen
- Cement Backfill
- Sluff Backfill



Site Map Scale 1 inch equals 735 feet

Explanation

EPA-MW-03 Borehole Number

Borehole Lithology — Well Construction

▽ Water Level Reading at time of drilling.

▼ Water Level Reading after drilling.

0 200

Horizontal Scale (feet)

Vertical Exaggeration: 3x

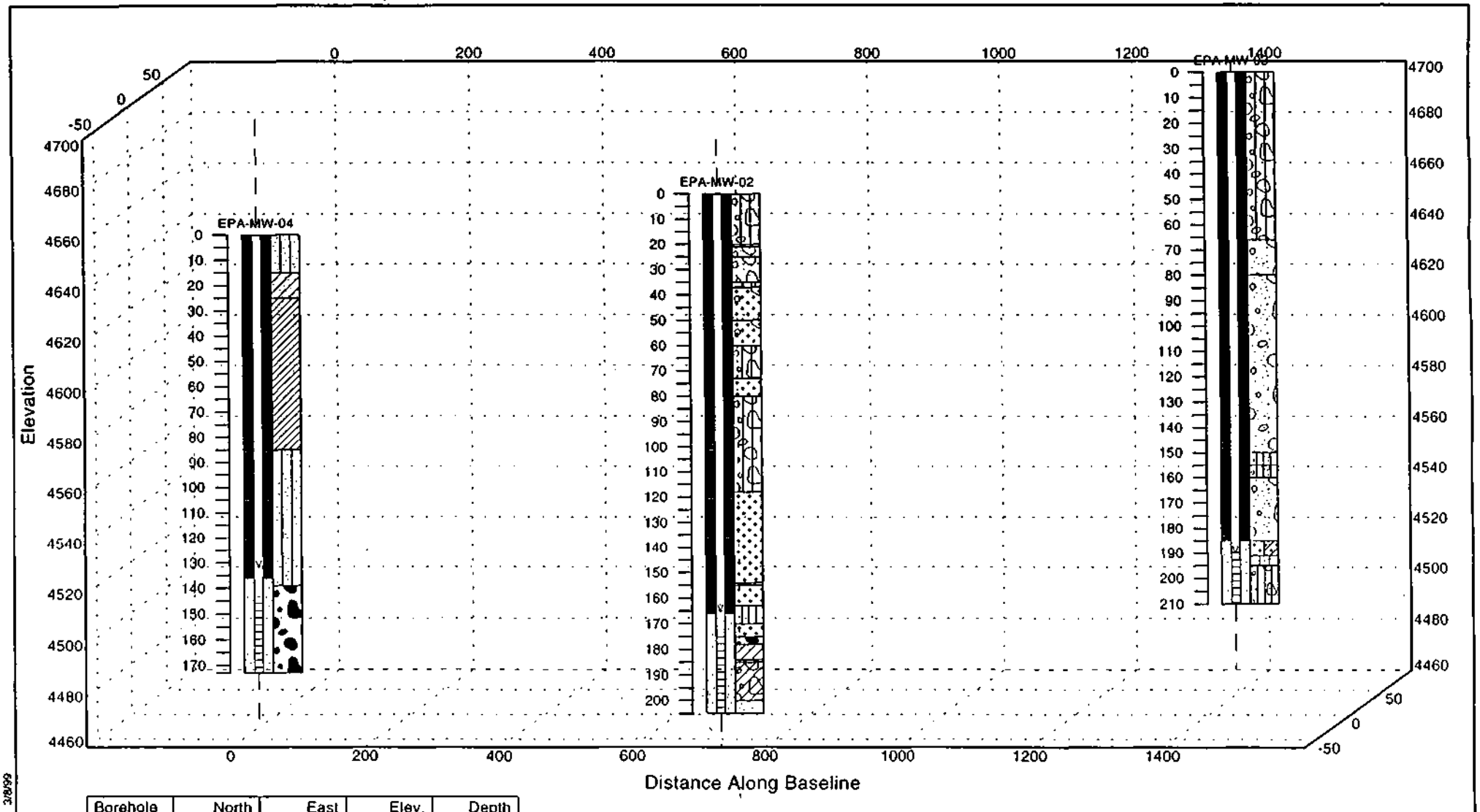
URS OPERATING SERVICES
1099 18TH STREET, SUITE 710
DENVER, COLORADO 80202

Mt. Olivet Cemetery Site
Lithologic Columns and Well Construction

START EPA REGION VIII

JOB NUMBER	PLATE NUMBER
7580314 00	

MT_OLIVET01 MTOLIVET.GPJ FANWNL01.GDT 3/8/99



Borehole	North	East	Elev.	Depth
EPA-MW-02	3229	7490	4678.4	205.5
EPA-MW-03	3862	7444	4695.5	210.0
EPA-MW-04	2513	7320	4654.2	173.0

DISTANCES:
Beginning 0
Ending 1400
VIEWING ANGLES (degrees):
Horizontal 45.0

SUBSURFACE FENCE DIAGRAM Mt. Olivet Cemetery S

GPJ FAGWGK01.GDT 3/8/99

APPENDIX C

QA/QC Work Plan

Sampling and Analysis Plan

Prepared By: John P. Noto

U.S. EPA Project Number: 9803-0014

Contractor Project Number: 75-80314.00

U.S. EPA Contract Number: 68-W5-0031 EPA Region VIII

Approvals:

[signature] 10/16/98
EPA On-Scene Coordinator Date

[signature] 10/7/98
START Deputy Team Leader Date

[signature] 10/9/98
START Project Leader Date

Note: This sampling and analysis plan was prepared by URS Operating Services, Inc. (UOS) for the U.S. Environmental Protection Agency (EPA) Region VIII Emergency Response Program (ERP) as a part of the Superfund Technical Assessment & Response Team (START) program. START is executed under Contract No. 68-W5-0031 for the EPA in Region VIII.

EPA Order 5360.1 "Policy and Program Requirements to Implement the Mandatory Quality Assurance Program" requires that all environmental data collection activities that are performed by or on behalf of the EPA, be supported by an approved Quality Assurance Project Plan (QAPP) prior to the start of data collection activities, except as specified by Region VIII emergency response/time-critical removal policies. A generic QAPP was prepared for the ERP in accordance with the EPA guidance document entitled, "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, Draft Interim Final EPA QA/R-5" and "Quality Assurance/Quality Control Guidance for Removal Activities" (EPA 1990). The ERP generic QAPP is supplemented by this project-specific Sampling and Analysis Plan (SAP), Standard Operating Procedures and a Site Health and Safety Plan.

A change in site conditions and/or direction from the EPA OSC may require a departure from this SAP . Departures from this SAP will be noted in the field log books and project reports.

1.0 GENERAL SITE INFORMATION

Name: Mt. Olivet Cemetery

Street Address:

City: Salt Lake City State: UT Zip Code:

County: Salt Lake

Latitude:	Longitude:	Section:	Township:	Range:
40 ° 45 ' __.__"	111 ° 51 ' __.__"	4 and 9	1 S.	1 E.

Approximate Area of Site: _____ Acres
_____ Square Feet

General Topography Slope to west

Nearest Residences are located within _____ to the _____.

2.0 OWNER/OPERATOR INFORMATION

Owner: NA	Operator: NA
Street Address:	Street Address:
City:	City:
State: Zip Code:	State: Zip Code:
Telephone:	Telephone:

Type of Ownership:

☐ Private ☐ Municipality ☐ Federal Agency
☐ County ☐ Not Specified ☐ State
☐ _____

3.0 NAME OF EPA AND/OR STATE AGENCY CONTACT:

EPA Contact Luke Chavez	State Contact Neil Taylor
Street Address: 999 18th Street #500	Street Address:
City: Denver State: CO Zip Code: 80202	City: Salt Lake City State:UT
Telephone: 303-312-6512	Telephone: 801-536-4102

Poor Quality Source Document

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To view the actual hard copy, contact the Superfund Records Center at (303) 312-6473.

4.0 GENERAL SITE CHARACTERISTICS

Years of Operation:

☐ Known x Unknown

Beginning year_____ Ending Year_____ Aband ned Since_____

Status of Site:

☐ Active x Not Specified ☐ Inactive ☐ NA (G, plume, etc.)

Predominant Land Uses Within One Mile of Site (Check all that apply):

☐	Industrial	☐	Agricultural	☐	DEI
☐	Commercial	☐	Mining	x	Other Federal Facility (VA)
☐	Residential	☐	DOD	x	cemetery, city swimming pool, par
☐	Forest/Fields	☐	DOE	☐	_____

Site Setting:

x	Urban	☐	Yes - Type_____
☐	Suburban	☐	No
☐	Rural	☐	Unknown

Previous Investigations/Assessments/Permit Violations

Distance to surface water from site: ≤1,500 ft.

☐ Water Intake(s) located within ___ miles

Distance to closest domestic or municipal well: ≤1,500 ft.

Facility Type / Site Operations (Check all that apply):

☐	Chemical Manufacturing	☐	Private Residence/Neighborhood
☐	Lumber and Wood Products	☐	Metal Forging or Stamping
☐	Drum Recycling	☐	Junk/Salvage Yard
☐	Plastic and/or Rubber Products	☐	Landfill
☐	Paints, Varnishes	☐	Metal Coating, Plating or Engraving
☐	Agricultural Chemicals	☐	Mining
☐	Petrochem Manufacturing	☐	Incinerator/Smelter
☐	Refinery	☐	Miscellaneous Chemical Products
☐	Retail Gasoline Station	☐	Industrial
☐	Battery Reclamation	☐	Treatment, Storage, or Disposal
☐	Tannery	☐	Municipal
☐	Electronic Equipment	☐	Other Manufacturing_____
☐	Fabricated Metal Products	☐	Federal Facility_____
x	Dry Cleaning	☐	_____
☐	_____	☐	_____
☐		☐	

5.0 REMEDIAL UNITS AND WASTE CHARACTERISTICS

Remedial Units: (Check all that apply)

☐	Underground Tanks	☐	Tanks and Non-Drum Containers
☐	Vats	☐	Surface Impoundment
☐	Lagoons	☐	Drums
☐	Tailings Pile	☐	Trash Pile (open dump)
☐	Landfill	☐	Buildings
☐	Chemical Waste Pile	☐	Storage Areas
☐	Process Areas	☐	Land Treatment
☐	Contaminated Soil	☐	Laboratory
☐	Railroad Tracks	☐	Roads/ Access Ways
x	Contaminated Groundwater Plume (unidentified source)	☐	Contaminated Surface Water/Sediment (unidentified source)
☐	Wetlands	☐	Injection Wells
☐	Stormwater Ponds	☐	Wastewater Ponds
☐	No Remedial Unit Identified	☐	Drainage Ditches
☐	Scrap Metal or Junk Pile	☐	_____

The following types of materials were handled at the site: (Check all that apply)

☐	Unknown	☐	Pesticides/Herbicides	x	Organics	☐	Acids
☐	Metals	☐	Bases	☐	Inorganics	☐	Solvents
☐	Explosives	☐	Municipal Waste	☐	Oily Waste		
☐	Mine Waste	☐	Radioactive Waste	☐	Construction/Demolition Waste		
☐	Laboratory/Hospital Waste			☐	Petroleum Products		
☐	Paint/Pigments			☐	_____		

Physical State of Waste as Deposited (Check all that apply):

☐ Solid ☐ Sludge ☐ Powder x Liquid ☐ Gas ☐ _____

The Contaminants of Concern are:

Contaminants	Concentration Range
Perchloroethylene (PCE)	<1.0 ppb to 500 ppb

The quantity or areal extent of contamination to be addressed is: The Groundwater plume known extent is approx. 1500 by 1000 feet

The physical/chemical threat to the population at risk is: PCE proximal to city and university wells

The following project limitations (e.g., time) have been identified: Site access restrictions

The following sampling limitations (e.g., access, potential hazards) have been identified: None

The basis for the site information is: ☐ Site maps X Geological information ☐ Disposal records ☐ Photos ☐ Historical data ☐ State investigation ☐ Federal investigation ☐ Personal interviews ☐ _____

6.0 PROJECT OBJECTIVES

6.1 Project Stage

X	Early Assessment	☐	Advanced Assessment, Phase II
☐	Advanced Assessment, Phase I	☐	Cleanup Attainment

6.2 Regulatory Objectives: Sampling for expanded site assessment (ESI)

Action levels for contaminants: EPA SDWA MCLs

The basis for this sampling effort is: Define plume and potential source areas

The work involved is as follows: Collect groundwater samples from six monitoring wells installed by UOS in 1998

The planned activities will resolve the problem as follows: Sample results will be used for ESI

The intended use and users of the data are: US EPA, and State of Utah Department of Environmental Quality

The decision makers are: U.S. EPA

6.3 Data Use Objectives: The following project objectives and data types* will be applied to this project (Choose from lists below):

	Sample Objective	Program Area: Removal		Program Area: Site Assessment	
☐	H&S assessment for worker protection	☐	S	☐	S
☐	General physical or chemical properties/sources	☐	S	☐	S
X	Delineation of plume in groundwater	☐	S	X	S
☐	Sample location selection	☐	S	☐	S
☐	Identification of hot spots	☐	S	☐	S
X	Identify sources	☐	S	X	S
☐	Extent of contamination	☐	S	☐	S
☐	Migration pathways	☐	S	☐	D
☐	Transport mechanisms	☐	S	☐	S
☐	Obtain broad screen of contaminants	☐	S	☐	S
☐	Document observed release	☐	S	☐	D
☐	Identify contaminants	☐	S	☐	S
☐	Unit/area concentrations	☐	S	☐	NA
☐	Treatment and disposal options	☐	S	☐	D
☐	Threat to humans	☐	S	☐	S/D
☐	Threat to environment	☐	S	☐	S/D
☐	Background/control	☐	S/D	☐	S/D
☐	Verification of cleanup	☐	S/D	☐	NA
☐	Ecological assessment	☐	S	☐	NA
☐	Quantity of contamination	☐	S	☐	S
☐	Compare to benchmark	☐	S	☐	S/D
☐	Emergency response	☐	S/D	☐	NA
☐	Determine presence of contamination	☐	NA	☐	S/D

* = General descriptions of the data types and specific QA/QC requirements for various common analyses are described in Appendix A.
S = Non-definitive (i.e., screening) data
S/D = Non-definitive data with 10% definitive confirmation
D = Definitive data
N/A = Not applicable

Screening Data with Definitive Confirmation: Screening data are generated by rapid, less precise methods of analysis and less rigorous sample preparation. Screening data provide analyte identification and quantification, although the quantification may be relatively imprecise. At least 10% of the screening data are confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data are not considered to be data of known quality.

Definitive Data: Definitive data are generated using rigorous analytical methods, such as approved EPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined.

7.0 Sampling Design

The following sections summarize the sampling design. Put the number for each matrix type next to each the same matrix, and use that number in the blanks associated with the analytical parameters, sampling app sampling equipment (Sections 7.2, 7.3 and 8.1).

7.1 Matrix: Air	Water	Liquid Waste	Soil/Sedime
1 Ambient air	1 Potable Water	1 Oil	1 Soil
2 Waste material	2 Surface Water	2 Drum Liquid	2 Drum Solid
3 Soil gas	3 **Groundwater**	3 Tank Liquid	3 Tank Solid
4 _____	4 _____	4 Waste Material	4 Waste Mate
5 _____	5 _____	5 _____	5 Sediment
6 _____	6 _____	6 _____	6 _____

7.2 Parameter: Air	Water	Liquid Waste	Soil/Sedimer
__ 2,4-D & 2,4,5-T	__ BNA (SVOC)	__ BNA (SVOC)	__ Ash Conten
__ Aromatic Amines	__ BOD	__ BOD	__ BNA (SVO
__ Aromatic Hydrocarbons	__ COD	__ COD	__ BTU
__ Asbestos Fibers	__ Corrosivity	__ Corrosivity	__ Creosotes
__ Bacteria	__ Creosotes	__ Creosotes	__ Cyanide
__ BP Hydrocarbons (36-126°C)	__ Cyanide	__ Cyanide	__ Dioxin/Fura
__ Cyanides	__ Dioxins/Furans	__ Dioxins/Furans	__ Haz Cat
__ Metals	__ Haz Cat	__ Haz Cat	__ Heavy Meta
__ Fibers	__ Herbicides	__ Herbicides	__ Herbicides
__ Formaldehyde	__ Ignitability	__ Ignitability	__ Ignitability
__ Fungi	3 Metals	__ Metals	__ Metals
__ Halogenated Hydrocarbons	__ Oil and Grease	__ Oil and Grease	__ Oil and Gre
__ Inorganic Acids	__ PAHs	__ PAHs	__ PAHs
__ Mercury	__ Pesticides/PCBs	__ Pesticides/PCBs	__ Pesticides/P
__ Organochlorine Pest/PCBs	__ Petroleum Hydrocarbons	__ Petroleum Hydrocarbons	__ Petroleum Hydrocarbo
__ PAHs/PNAs	__ TEPH	__ TEPH	__ TEPH
__ PCBs	__ TVPH	__ TVPH	__ TVPH
__ PM_{10}	__ Phenols	__ Phenols	__ Phenols
__ Total Nuisance Dust	__ Reactivity (CN and sulfide)	__ Reactivity (CN and sulfide)	__ Reactivity (Sulfide)
__ Vinyl Chloride	__ TOC	__ TOC	__ Sulfur
__ VOC	__ TOX	__ TOX	__ TCLP - Hg
__ _____	3 VOC	__ VOC	__ TCLP - Met Hg)
__ _____	3 Anions	__ _____	__ TCLP - Sem
__ _____	__ _____	__ _____	__ TCLP - Vol
__ _____	__ _____	__ _____	__ TOC
__ _____	__ _____	__ _____	__ Total Solids
__ _____	__ _____	__ _____	__ TOX
__ _____	__ _____	__ _____	__ VOC
__ _____	__ _____	__ _____	__ _____
__ _____	__ _____	__ _____	__ _____
__ _____	__ _____	__ _____	__ _____
__ _____	__ _____	__ _____	__ _____
__ _____	__ _____	__ _____	__ _____
__ _____	__ _____	__ _____	__ _____
__ _____	__ _____	__ _____	__ _____

7.3 Sampling Approach

Air	Water	Liquid Waste	Soil/Sediment/Solids
Sample Approach (check one)	Sample Approach (check one)	Sample Approach (check one)	Sample Approach (check one)
__ Judgmental __ Systematic Grid __ Worst Case (Air Only) __ Search (hot spots) __ Random __ Systematic Random __ One Time __ Stratified Random __ Transect __ Typical __ Composite (explain below) __ _____ __ _____ __ _____	_3 Judgmental __ Systematic Grid __ Search (hot spots) __ Random __ Systematic Random __ One Time __ Stratified Random __ Transect __ Typical __ Composite (explain below) __ _____ __ _____ __ _____ __ _____	__ Judgmental __ Systematic Grid __ Search (hot spots) __ Random __ Systematic Random __ One Time __ Stratified Random __ Transect __ Typical __ Composite (explain below) __ _____ __ _____ __ _____ __ _____	__ Judgmental __ Systematic Grid __ Search (hot spots) __ Random __ Systematic Random __ One Time __ Stratified Random __ Transect __ Typical __ Composite (explain below) __ _____ __ _____ __ _____ __ _____
Samples will be composited as follows: __	Samples will be composited as follows: __ NA	Samples will be composited as follows: __	Samples will be composited as follows: __

7.4 Justification for Sampling Frequency

X Directive of OSC
☐ _____
☐ _____
☐ _____
☐ _____

8.0 SAMPLING AND ANALYSIS

Table 1, "Environmental and Quality Control Sample Quantities for Environmental Analyses" identifies the number of field and QC samples to be collected. Include background samples and designate which samples will be used for Lab/Field QC. Include field analyses.

Complete one Table 1 for each Remedial Unit to be sampled for this project. Make extra copies of Table 1

8.1 Equipment Utilized Per Sampling Media for samples indicated in Table 1:
If more than one piece of equipment is used per matrix, put the number of the matrix type from Section 7.1 on t the item of equipment (e.g., 1 or 1, 2). Use the letter associated with each type of equipment on the line next fabrication and circle sampling equipment that is to be decontaminated (non-dedicated items). Put the letter associ equipment item for decontamination next to each applicable decontamination step (Section 8.3).

Air	Water	Liquid Waste	Soil/Sedimer

8.2 Fabrication

Air	Water	Liquid Waste	Soil/Sedimen
__ Carbon steel	__ Carbon steel	__ Carbon steel	__ Carbon steel
__ Stainless steel	__ Stainless steel	__ Stainless steel	__ Stainless steel
__ Teflon (PTFE)	__ Teflon (PTFE)	__ Teflon (PTFE)	__ Teflon (PTFE)
__ PVC	__ PVC	__ PVC	__ PVC
__ Glass	__ Glass	__ Glass	__ Glass
__ Plastic	__ Plastic	__ Plastic	__ Plastic
__ Plastic/polyethylene	b Plastic/polyethylene	__ Plastic/polyethylene	__ Plastic/polyeth
__ Carbon steel/stainless steel	__ Carbon steel/stainless steel	__ Carbon steel/stainless steel	__ Carbon steel/
__ Acetate	__ Acetate	__ Acetate	__ Acetate

8.3 Decontamination Steps (Check applicable choices for non-dedicated equipment)

Air	Water	Liquid Waste	Soil/Sediment
__ Physical removal	__ Physical removal	__ Physical removal	__ Physical remova
__ Non-phosphate detergent wash	1 Non-phosphate detergent wash	__ Non-phosphate detergent wash	__ Non-phosphate wash
__ Potable water rinse	1 Potable water rinse	__ Potable water rinse	__ Potable water ri
__ 10% nitric acid rinse	__ 10% nitric acid rinse	__ 10% nitric acid rinse	__ 10% nitric acid
__ Hexane rinse	__ Hexane rinse	__ Hexane rinse	__ Hexane rinse
__ Methylene chloride rinse	__ Methylene chloride rinse	__ Methylene chloride rinse	__ Methylene chlor
__ Pesticide grade acetone rinse	__ Pesticide grade acetone rinse	__ Pesticide grade acetone rinse	__ Pesticide grade
__ Distilled/deionized water rinse	__ Distilled/deionized water rinse	__ Distilled/deionized water rinse	__ Distilled/deioniz rinse
__ Organic free water rinse	__ Organic free water rinse	__ Organic free water rinse	__ Organic free wa
__ Air dry	__ Air dry	__ Air dry	__ Air dry
__ Cover with _____	__ Cover with _____	__ Cover with _____	__ Cover with ___

8.4 Required Support Vehicles/Facilities:

X Lift gate truck for purge water drum transport
☐ _____
☐ _____
☐ _____
☐ _____
☐ _____

8.5 Disposal of Investigation-Derived Wastes (IDW)

- ☐ No IDW will be generated.
- X IDW will be containerized and characterized for appropriate disposal.
- ☐ IDW will be placed on site in an approved location.
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

8.6 Analytical Summary

Complete Table 2. Table 2, "Environmental Sample Collection and Laboratory Analysis specifications" contains information pertinent to sampling, such as the analytical methods to be used, sample preservation method (include field filtration when necessary) to be used, container types and the quantity of sample to be collected at each sampling location, the preservation method to be used, and the sample holding times (based on the parameter being analyzed for and the matrix). For the air matrix, this table identifies the sample flow rate rather than sample containers and the volume to be collected rather than the preservative.

8.7 Performance Requirements

Complete Table 3. Table 3, "Quality Assurance Objectives for Environmental Samples" contains the required detection limits, analytical method references, the associated required data type designation, and three of the five data assessment parameters (precision, accuracy, completion). The parameters of comparability and representativeness are addressed in the project design and rationale sections of this SAP.

The EPA supports the implementation of the Data Quality Objectives (DQO) Process to ascertain the type, quality, and quantity of data necessary to address site-specific problems ("Guidance for the Data Quality Objectives Process, EPA QA/G-4," EPA 1994d). It is the responsibility of the Project Leader, in conjunction with the QAO, to implement the DQO process as part of the project planning activities. In those cases in which the DQO process is not used, it is still necessary to state the project quality objectives and measurement performance criteria in the project-specific SAP.

9.0 TECHNICAL STANDARD OPERATING PROCEDURES

START Technical Standard Operating Procedures (TSOPs) will be implemented for this project. TSOPs are applicable procedures that may be varied or changed as required, dependent upon site conditions or equipme limitations imposed by the procedure. In all instances, the procedures employed will be documented and ass with the final project deliverables.

Indicate Applicable START Technical Standard Operating Procedures (check all that apply):

x	TSOP 4.1 - General Field Operation - describes the overall field organization in support of sample c sample identification, re:· ·d keeping, field measurements, and data collection.
x	TSOP 4.2 - Sample Containers, Preservation and Maximum Holding Times - describes the methods place samples in appropriate containers to preserve specific samples, and the maximum time a samp held before it is analyzed.
x	TSOP 4.3 - Chain of Custody - outlines the documentation necessary to trace sample possession.
x	TSOP 4.4 - Sample Identification, Labeling, and Packaging - specifies the methods for sample ident and labeling. Sample packing and shipment methods are also outlined.
x	TSOP 4.5 - Sample Location Documentation - outlines the methods for documentation of all sample
x	TSOP 4.6 - Use and Maintenance of Field Log Books - outlines the proper documentation of inform field log books during data collection activities.
☐	TSOP 4.7 - Hazardous Waste Characterization - outlines the methods for characterization of unknow materials for disposal, bulking, recycling, grouping and classification purposes.
x	TSOP 4.8 - Investigation Derived Waste Management - outlines the management of wastes generate environmental field operations.
☐	TSOP 4.9 - Monitor Well Installation - describes the methods for monitoring well installation, incluc design, construction procedures, and materials.
☐	TSOP 4.10 - Monitor Well Development - describes the methods for monitoring well development, i data recording formats.
x	TSOP 4.11 - Equipment Decontamination - describes the techniques used to decontaminate equipme sample collection or data measurement.
x	TSOP 4.12 - Groundwater Sampling - establishes the methods for monitoring well purging, sample c and equipment use when sampling.
x	TSOP 4.12A - Groundwater Sampling for Low Flow Purge - describes equipment and operations for groundwater monitor wells using a pump to obtain samples with a minimum of turbidity.
x	TSOP 4.13 - Water Level Measurement - describes the methods used to record water levels at surfac locations and in groundwater monitoring wells.
☐	TSOP 4.14 - Water Sample Field Measurements - describes the measurement techniques and data requirements associated with the collection of either a groundwater or surface water sample.

- ☐ TSOP 4.15 - Flow Measurements - describes the methods for conducting flow measurements during surface water sampling.
- ☐ TSOP 4.16 - Surface and Shallow Depth Soil Sampling - establishes the methods for sample collection using a variety of sampling devices. Techniques for avoiding sample and equipment cross-contamination are also discussed.
- ☐ TSOP 4.17 - Sediment Sampling - establishes the methods for sample collection using a variety of sampling devices. Techniques for avoiding sample and equipment cross-contamination are also discussed.
- ☐ TSOP 4.18 - Surface Water Sampling - establishes the methods for sample collection and equipment use at a variety of surface water locations. Techniques for avoiding water body and sample cross-contamination are also discussed.
- ☐ TSOP 4.19 - Soil Gas Sampling - outlines the methods for decontamination and soil gas sampling for routine field operations.
- ☐ TSOP 4.20 - Drum and Container Sampling - describes methods for safe and effective sampling of drums and containers less than 120 gallons.
- ☐ TSOP 4.21 - Tank Sampling - describes the measurement techniques used in sampling aboveground storage tanks.
- ☐ TSOP 4.22 - Aquifer Slug Testing - establishes the methods and data recording formats for conducting slug tests in groundwater monitoring wells.
- ☐ TSOP 4.23 - Aquifer Pump Testing - establishes the methods and data recording formats for conducting pump tests in groundwater extraction and monitoring wells.
- ☐ TSOP 4.24 - Geological Borehole Logging - describes the information and observations to be recorded for the identification, logging, and sampling of a borehole. Sampling methods and data collection formats are also presented.
- ☐ TSOP 4.25 - Residential Dust Sampling - describes the methods for collecting composite dust samples in a residential community.
- ☐ TSOP 4.26 - Chip, Wipe and Sweep Sampling - describes the equipment and methods required for obtaining a representative chip, wipe or sweep sample to monitor potential surface contamination.
- ☐ Draft Equipment SOP 1.6 - TW Spectrace 9000 FPXRF - describes the equipment and methods required for obtaining a representative metals analyses of selected materials.

10.0 SAMPLE DOCUMENTATION, HANDLING, AND SHIPMENT

Sample documentation, handling, and shipment will be in accordance with the START generic QAPP and START TSOPs.

11.0 QUALITY ASSURANCE ASSESSMENTS

The following QA Assessments will be applied to this project:

x Independent technical review
x Technical edit
☐ Readiness review
☐ Field surveillance
☐ Field audit
☐ Management system review
☐ _____

A complete description of these reviews can be found in Section 12.0 of the ERP Generic QAPP.

12.0 DATA VALIDATION

Data will be validated as indicated: x QC review x Validation ☐ Undecided

* Data Validation is required for definitive data.

13.0 DELIVERABLES

The following deliverables will be provided: (Check all that apply)

x Trip Report: A detailed accounting of what occurred during each sampling mobilization will be prep within (two weeks) of the last day of each sampling mobilization. The Trip Report will be organize three or four major sections: Background, Observations and Activities, Conclusions and Recommen (optional), and Future Activities. Information will be provided regarding major events, dates, and p on site (including affiliations).

☐ Status Report: Prepared periodically (weekly/monthly/etc.) To provide a detailed accounting of pas future sampling activities. Information will be provided on time and date of major events and perso site (including affiliations). The status report will be organized into three major sections: Backgrour Observations and Activities, and Future Activities.

☐ Analytical Report: Documentation of lab selection, raw data, or analytical results.

☐ Data Validation Report: Review of the data generated under this plan.

☐ (Draft) Final Report: Correlates available background information with data generated under this sar event and identifies supportable conclusions and recommendations that satisfy the objectives of this sampling QA/QC plan.

The following illustrations will be provided:

- x Maps (size specifications)
- x Figures (borehole logs, cross sections)
- ☐ Drawings (scale)
- ☐ Field forms

14.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Personnel Information:

The EPA Site Assessment Manager, Luke Chavez, will provide overall direction to the START staff concerning project objectives, sampling needs, and schedule.

The START Project Leader, John Noto, is the primary point of contact with the EPA On-Scene coordinator. The Project Leader is responsible for the development and completion of the Sampling QA/QC Plan, project team organization, and supervision of all project tasks.

The START Quality Assurance Officer is responsible for ensuring field adherence to the Sampling QA/QC Plan and recording any deviations. The Analytical Services Coordinator is the primary contact with the analytical laboratory.

The following personnel will also work on this project:

Name	Responsibility
TBD	Sampling and documentation

For a detailed description of personnel responsibilities, refer to Section 2.0 of the ERP generic QAPP.

15.0 SCHEDULE OF ACTIVITIES

Proposed Schedule of Work:

Activity	Start Date	End Date
Sample wells	October 1998	

TABLE 1
Environmental and Quality Control Sample Quantities for Environmental Analyses
Remedial Unit Groundwater

Sample ID / Location	Analysis					Quality Control Samples							Total Samples
						Lab QA/QC			Field QA/QC				
	VOC	Metals	Anion			Standard Reference Samples	MS/MSD	Other	Field Replicates	Trip Blanks	Field Blank	Equipment Rinsate	
EPA-MW-01S	x	x	x				x						3
EPA-MW-01D	x	x	x										3
EPA-MW-02	x	x ms/msd	x										3
EPA-MW-03	x	x	x										3
EPA-MW-04	x	x	x										3
EPA-MW-05	x	x	x										3
EPA-MW-06 (field duplicate)	x	x	x						x				3
EPA-MW-07 (Trip blank)	x									x			1
EPA-MW-08 (rinsate)	x											x	1
Total Samples	9	7	7						1	1		1	23

TABLE 2
Environmental Sample Collection and Laboratory Analysis Specifications

Analysis	Analytical Method	Reference	Container[a]	Required Volume	Preservation[b]	Holding Time[c]
VOC	524.4	EPA	2 - 40ml glass vial	80 ml	4°C	7 days
Metals	200.7	EPA	1 liter HDPE	200 ml	pH<2 HNO3	6 months
Anions	300	EPA	250 ml HDPE	100 ml	4°C	28 days

a Container types: AGV = amber glass vial; HDPE = high-density polyethylene bottle and cap; AGB = amber glass bottle.

b Sample preservation will be performed by the sampler immediately upon sample collection. Preservatives will be added to filtered samples following filtration. Containers used for volatile organic samples will be completely filled, permitting no head space.

c Holding times begin from the time of sample collection in the field. Two holding times indicate the maximum holding time until sample extraction and the maximum holding time.

TABLE 3
Quality Assurance Objectives for Environmental Samples

Analysis (for each matrix)	Analytical Method	Data Type	Units	Detection Limits	Accuracy %	Precision ±%	Completeness %
VOCs	524.4	D	ppb	1 ppb	90	90	95
Metals	200.7	D	ppm	varies	90	90	95
Anions	300	D	ppm	varies	90	90	95

Note: The complete list of analytes determined from laboratory sample analysis is published in each reference document listed for the specified analytical method. Detection limit, accuracy, and precision values are presented in this table as ranges, but are assigned to each individual analyte as published in each reference document.

Data type refers to the following:
S = non-definitive data (i.e., screening);
S/D = non-definitive data with 10% definitive confirmation;
D = definitive data

ATTACHMENT 1
Data Types

QA/QC Levels	Non-Definitive (Screening)	Non-Definitive with 10% Definitive Confirmation (Screening with Confirmation)	Definitive
Data Uses	Data useful only for immediate situation; not defensible for decision making	Data useful for site assessment and decision making at OSC discretion	Data useful for enforcement, litigation, risk assessment, and most other uses
Typical Uses	• Exploratory data • Screening • Non-critical Decisions • Emergency situations • Waste profiling	• Site characterization • Waste characterization • Clean-up confirmation	• Enforcement • Litigation • Risk assessment
Quality Assurance Type	Data of Unknown Quality	Data of known quality (low level)	Data of known quality (high level)
Quality Assurance Elements	• Logged quality control checks • Qualified analyst	• Identification • Quantification • Confirmation of 10% of the samples by a definitive method • Error determination[1]	• Raw data • Definitive identification • Definitive quantification • Error determination
Validation	None	QC Review[2]	Yes
Quality Control Elements	• Instrument QC • Field QC • Analyst training	• Instrument QC • Field QC • Analyst training • QC within method parameters	• Instrument QC • Field QC • Analyst training • QC within method parameters • Document DLs

[1] Error determination is required for both the definitive and non-definitive portions of the data.

[2] QC review is required for all samples analyzed. Data validation is required for the confirmation data only.

ATTACHMENT 1
Data Types

QA/QC Levels	Non-Definitive (Screening)	Non-Definitive with 10% Definitive Confirmation (Screening with Confirmation)	Definitive
Sampling Plan	Optional	Mandatory	Mandatory
Typical Volatile Analyses	• Field GC	• Field GC with 10% of samples being confirmed by GC/MS with full QA/QC deliverables; duplicates and blanks.	• EPA Method 8240 or 8260; data package; replicates; blanks and spikes
		• GC method with 10% of samples being confirmed by GC/MS with full QA/QC deliverables; duplicates and blanks.	• EPA Method 8010/ 8020 with second column confirmation; data package replicate, blanks, and spikes.
Typical Non-volatile Analyses	• Immunoassay kits	• Immunoassay with 10% of samples being confirmed by GC/MS with full QA/QC deliverables; duplicates and blanks.	• EPA Method 8270; data package; replicates, blanks, and spikes.
		• GC method with 10% of samples being confirmed by GC/MS with full QA/QC deliverables; duplicates and blanks.	• EPA Method 8100/ 8120 with second column confirmation; data package; replicate, blanks, and spikes.
Typical Metal Analyses	• Field XRF	• Field XRF with 10% of samples being confirmed by ICP or AA with full QA/QC deliverables; duplicates and blanks.	• EPA Method 6010; data package; replicates, blanks, and spikes.
		• AA, ICP, IC, or wet chemistry methods with 10% of samples being confirmed by ICP or AA with full QA/QC deliverables; duplicates and blanks.	• EPA methods for AA (7000s); data pa[illegible] replicate, blanks, and spikes.

ATTACHMENT 1
Data Types (continued)

QA/QC Levels	Non-Definitive (Screening)	Non-Definitive with 10% Definitive Confirmation (Screening with Confirmation)	Definitive
Typical PCB/ Pesticide Analyses	• Immunoassay Kits	• Immunoassay kits[3] with 10% of samples being confirmed by GC/MS with full QA/QC deliverables; duplicates and blanks.	• EPA Method 8140-Pesticides; data package; replicates, blanks, and spikes.
		• GC method with 10% of samples being confirmed by GC on a second column with full QA/QC deliverables; duplicates and blanks.	• EPA Method 8080 with second column confirmation; data package; replicate, blanks, and spikes.
Typical Petroleum Hydrocarbon Analyses	• Immunoassay kits • Chem test kits (HANBY) • IR (EPA 413 and 418) methods	• Immunoassay, IR, and chemical analysis with 10% of samples being confirmed by GC/MS or EPA Method 8015 (modified) with second column confirmation with full QA/QC deliverables; duplicates and blanks.	• EPA Method 8015 (modified) with second column confirmation; data package; replicate, blanks, and spikes.
		• GC method with 10% of samples being confirmed by GC/MS or GC on two columns with full QA/QC deliverables; duplicates and blanks.	
Testing for physical parameters is not analyte specific. Therefore, by strict definition, any physical test would have to be considered non-definitive. However, the testing methods may be definitive if approved methodology is followed.			
Physical Parameters (pH, flash point, etc.)	• Field testing equipment	• Testing equipment with QC samples, duplicates, and blanks.	• Testing equipment; data package; and QC samples, duplicates, and blanks.

[3] Immunoassay kits used to generate Level I data must be capable of generating calibration, blank, duplicate, and estimation of error data.

APPENDIX D

Inorganic Analysis Data Sheets

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MHEB96

Lab Name: SOUTHWEST_LAB_OF_OKLAHOMA Contract: 68-D5-0136
Lab Code: SWOK__ Case No.: 26631 SAS No.: _____ SDG No.: MHEB96
Matrix (soil/water): WATER Lab Sample ID: 36392.01
Level (low/med): LOW__ Date Received: 11/13/98
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	12.0	U		P	UJ
7440-36-0	Antimony	3.0	U		P	
7440-38-2	Arsenic	2.0	U		P	
7440-39-3	Barium	45.6	B		P	
7440-41-7	Beryllium	1.0	U		P	
7440-43-9	Cadmium	1.0	U		P	
7440-70-2	Calcium	126000			P	
7440-47-3	Chromium	7.1	B		P	
7440-48-4	Cobalt	2.0	U		P	
7440-50-8	Copper	2.0	U		P	
7439-89-6	Iron	109			P	
7439-92-1	Lead	1.0	U		P	
7439-95-4	Magnesium	43000			P	
7439-96-5	Manganese	2.5	B		P	
7439-97-6	Mercury	0.22			CV	U
7440-02-0	Nickel	17.0	B		P	
7440-09-7	Potassium	1790	B		P	
7782-49-2	Selenium	3.0	U		P	UJ
7440-22-4	Silver	2.0	U		P	
7440-23-5	Sodium	40000			P	
7440-28-0	Thallium	3.0	B		P	U
7440-62-2	Vanadium	1.8	B		P	
7440-66-6	Zinc	2.9	B		P	

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments: RF 1/30/99

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPL

MHEB97

Lab Name: SOUTHWEST_LAB_OF_OKLAHOMA Contract: 68-D5-0136
Lab Code: SWOK__ Case No.: 26631 SAS No.: _____ SDG No.: I
Matrix (soil/water): WATER Lab Sample ID: 3639
Level (low/med): LOW__ Date Received: 11/1
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	12.0	U		P	UJ
7440-36-0	Antimony	3.0	U		P	
7440-38-2	Arsenic	2.0	U		P	
7440-39-3	Barium	23.0	B		P	
7440-41-7	Beryllium	1.0	U		P	
7440-43-9	Cadmium	1.0	U		P	
7440-70-2	Calcium	125000			P	
7440-47-3	Chromium	1.0	U		P	UJ
7440-48-4	Cobalt	2.0	U		P	
7440-50-8	Copper	2.0	U		P	
7439-89-6	Iron	12.0	U		P	
7439-92-1	Lead	1.0	U		P	
7439-95-4	Magnesium	34300			P	
7439-96-5	Manganese	3.1	B		P	
7439-97-6	Mercury	0.23			CV	U
7440-02-0	Nickel	1.0	U		P	
7440-09-7	Potassium	2050	B		P	
7782-49-2	Selenium	3.0	U		P	UJ
7440-22-4	Silver	2.0	U		P	
7440-23-5	Sodium	27500			P	
7440-28-0	Thallium	3.5	B		P	U
7440-62-2	Vanadium	1.0	U		P	
7440-66-6	Zinc	21.3			P	

Color Before: COLORLESS Clarity Before: CLEAR_ Texture:
Color After: COLORLESS Clarity After: CLEAR_ Artifacts:

Comments: RE 1/20/11

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
MHEB98

Lab Name: SOUTHWEST_LAB_OF_OKLAHOMA Contract: 68-D5-0136
Lab Code: SWOK Case No.: 26631 SAS No.: SDG No.: MHEB96
Matrix (soil/water): WATER Lab Sample ID: 36392.03
Level (low/med): LOW Date Received: 11/13/98
% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	12.0	U		P	UJ
7440-36-0	Antimony	3.0	U		P	
7440-38-2	Arsenic	2.0	U		P	
7440-39-3	Barium	53.0	B		P	
7440-41-7	Beryllium	1.0	U		P	
7440-43-9	Cadmium	1.0	U		P	
7440-70-2	Calcium	125000			P	
7440-47-3	Chromium	2.3	B		P	J
7440-48-4	Cobalt	2.0	U		P	
7440-50-8	Copper	2.0	U		P	
7439-89-6	Iron	20.8	B		P	
7439-92-1	Lead	1.0	U		P	
7439-95-4	Magnesium	43300			P	
7439-96-5	Manganese	1.0	U		P	
7439-97-6	Mercury	0.31			CV	U
7440-02-0	Nickel	4.5	B		P	
7440-09-7	Potassium	1870	B		P	
7782-49-2	Selenium	3.0	U		P	UJ
7440-22-4	Silver	2.0	U		P	
7440-23-5	Sodium	46400			P	
7440-28-0	Thallium	3.8	B		P	U
7440-62-2	Vanadium	1.7	B		P	
7440-66-6	Zinc	2.1	B		P	

Color Before: COLORLESS Clarity Before: CLEAR Texture:
Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments: TJC 1/26/11

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPL:

MHEB99

Lab Name: SOUTHWEST_LAB_OF_OKLAHOMA Contract: 68-D5-0136
Lab Code: SWOK__ Case No.: 26631 SAS No.: _____ SDG No.: I
Matrix (soil/water): WATER Lab Sample ID: 3639:
Level (low/med): LOW__ Date Received: 11/1:
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	12.0	U		P	UJ
7440-36-0	Antimony	3.0	U		P	
7440-38-2	Arsenic	2.0	U		P	
7440-39-3	Barium	49.4	B		P	
7440-41-7	Beryllium	1.0	U		P	
7440-43-9	Cadmium	1.0	U		P	
7440-70-2	Calcium	111000			P	
7440-47-3	Chromium	1.0	U		P	UJ
7440-48-4	Cobalt	2.0	U		P	
7440-50-8	Copper	2.0	U		P	
7439-89-6	Iron	12.0	U		P	
7439-92-1	Lead	1.0	U		P	
7439-95-4	Magnesium	41200			P	
7439-96-5	Manganese	1.0	U		P	
7439-97-6	Mercury	0.25			CV	U
7440-02-0	Nickel	1.2	B		P	
7440-09-7	Potassium	2100	B		P	
7782-49-2	Selenium	3.0	U		P	UJ
7440-22-4	Silver	2.0	U		P	
7440-23-5	Sodium	53700			P	
7440-28-0	Thallium	3.9	B		P	
7440-62-2	Vanadium	2.3	B		P	
7440-66-6	Zinc	2.0	U		P	

RF 1/30/19

Color Before: COLORLESS Clarity Before: CLEAR_ Texture:
Color After: COLORLESS Clarity After: CLEAR_ Artifacts:

Comments:

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MHEC00

Lab Name: SOUTHWEST_LAB_OF_OKLAHOMA Contract: 68-D5-0136
Lab Code: SWOK__ Case No.: 26631 SAS No.: _____ SDG No.: MHEB96
Matrix (soil/water): WATER Lab Sample ID: 36392.05
Level (low/med): LOW__ Date Received: 11/13/98
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	12.0	U		P	UJ
7440-36-0	Antimony	3.0	U		P	
7440-38-2	Arsenic	2.0	U		P	
7440-39-3	Barium	47.2	B		P	
7440-41-7	Beryllium	1.0	U		P	
7440-43-9	Cadmium	1.0	U		P	
7440-70-2	Calcium	116000			P	
7440-47-3	Chromium	1.0	U		P	UJ
7440-48-4	Cobalt	2.0	U		P	
7440-50-8	Copper	2.0	U		P	
7439-89-6	Iron	12.0	U		P	
7439-92-1	Lead	1.0	U		P	
7439-95-4	Magnesium	40300			P	
7439-96-5	Manganese	1.0	U		P	
7439-97-6	Mercury	0.21			CV	U
7440-02-0	Nickel	1.0	U		P	
7440-09-7	Potassium	2110	B		P	
7782-49-2	Selenium	3.0	U		P	UJ
7440-22-4	Silver	2.0	U		P	
7440-23-5	Sodium	68300			P	
7440-28-0	Thallium	3.6	B		P	
7440-62-2	Vanadium	2.2	B		P	
7440-66-6	Zinc	2.0	U		P	

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments: RF 1/30/99

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPI

MHEC01

Lab Name: SOUTHWEST_LAB_OF_OKLAHOMA Contract: 68-D5-0136
Lab Code: SWOK__ Case No.: 26631 SAS No.: _____ SDG No.:
Matrix (soil/water): WATER Lab Sample ID: 3639
Level (low/med): LOW__ Date Received: 11/1
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight) : UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1680			P
7440-36-0	Antimony	3.0	U		P
7440-38-2	Arsenic	2.0	U		P
7440-39-3	Barium	105	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	1.0	U		P
7440-70-2	Calcium	143000			P
7440-47-3	Chromium	6.4	B		P
7440-48-4	Cobalt	2.0	U		P
7440-50-8	Copper	6.7	B		P
7439-89-6	Iron	3180			P
7439-92-1	Lead	1.8	B		P
7439-95-4	Magnesium	49600			P
7439-96-5	Manganese	64.5			P
7439-97-6	Mercury	0.24			CV
7440-02-0	Nickel	6.3	B		P
7440-09-7	Potassium	3480	B		P
7782-49-2	Selenium	3.0	U		P
7440-22-4	Silver	2.0	U		P
7440-23-5	Sodium	42800			P
7440-28-0	Thallium	3.4	B		P
7440-62-2	Vanadium	4.9	B		P
7440-66-6	Zinc	19.0	B		P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture:
Color After: COLORLESS Clarity After: CLEAR_ Artifacts:

Comments:

TF 1/30/15

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
MHEC02

Lab Name: SOUTHWEST_LAB_OF_OKLAHOMA Contract: 68-D5-0136
Lab Code: SWOK Case No.: 26631 SAS No.: SDG No.: MHEB96
Matrix (soil/water): WATER Lab Sample ID: 36392.07
Level (low/med): LOW Date Received: 11/13/98
% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	12.0	U		P	UJ
7440-36-0	Antimony	3.0	U		P	
7440-38-2	Arsenic	2.0	U		P	
7440-39-3	Barium	53.5	B		P	
7440-41-7	Beryllium	1.0	U		P	
7440-43-9	Cadmium	1.0	U		P	
7440-70-2	Calcium	126000			P	
7440-47-3	Chromium	2.9	B		P	J
7440-48-4	Cobalt	2.0	U		P	
7440-50-8	Copper	2.0	U		P	
7439-89-6	Iron	13.6	B		P	
7439-92-1	Lead	1.0	U		P	
7439-95-4	Magnesium	43700			P	
7439-96-5	Manganese	1.0	U		P	
7439-97-6	Mercury	0.25			CV	UJ
7440-02-0	Nickel	4.6	B		P	
7440-09-7	Potassium	1850	B		P	
7782-49-2	Selenium	3.0	U		P	UJ
7440-22-4	Silver	2.0	U		P	
7440-23-5	Sodium	47300			P	
7440-28-0	Thallium	2.7	B		P	
7440-62-2	Vanadium	2.2	B		P	
7440-66-6	Zinc	2.0	U		P	

Color Before: COLORLESS Clarity Before: CLEAR Texture:
Color After: COLORLESS Clarity After: CLEAR Artifacts:

RE 1/30/99

Comments:

APPENDIX E

Acculab's Report of Analysis
General Chemistry

REPORT OF ANALYSIS

Ms Karen Kuoppala
URS Operating Services
1099 18th Street
Suite 710
Denver, CO 80202-1908

Lab Job Number: 026740 URS005
Date Samples Received: 11/13/98
Customer PO Number: OS-98-P-5465

ALR Designation:	98-A23251
Client Designation:	EPA-MW-01S
Sample Location:	
Location II:	
Date/Time Collected	11/11/98 16:45

General Chemistry (results in mg/L unless noted):

Alkalinity, Total (as CaCO3)	250
Bicarbonate (as HCO3-)	300
Carbonate (as CO3=)	< 5
Chloride	150
Hydroxide (as OH-)	< 5
Sulfate (as SO4)	110
pH	7.4 ▲

ALR Designation:	98-A23252
Client Designation:	EPA-MW-01D
Sample Location:	
Location II:	
Date/Time Collected	11/10/98 11:30

General Chemistry (results in mg/L unless noted):

Alkalinity, Total (as CaCO3)	260
Bicarbonate (as HCO3-)	310
Carbonate (as CO3=)	< 5
Chloride	69
Hydroxide (as OH-)	< 5
Sulfate (as SO4)	160
pH	7.3 ▲

ALR Designation:	98-A23253
Client Designation:	EPA-MW-02
Sample Location:	
Location II:	
Date/Time Collected	11/11/98 11:50

General Chemistry (results in mg/L unless noted):

Alkalinity, Total (as CaCO3)	260
Bicarbonate (as HCO3-)	310
Carbonate (as CO3=)	< 5
Chloride	160
Hydroxide (as OH-)	< 5

REPORT OF ANALYSIS

Ms Karen Kuoppala
URS Operating Services

Lab Job Number: 026740
Date Samples Received: 11

ALR Designation:	98-A23253
Client Designation:	EPA-MW-02
Sample Location:	
Location II:	
Date/Time Collected	11/11/98 11:50
Sulfate (as SO4)	110
pH	7.4 ▲

ALR Designation:	98-A23254
Client Designation:	EPA-MW-03
Sample Location:	
Location II:	
Date/Time Collected	11/11/98 10:10

General Chemistry (results in mg/L unless noted):

Alkalinity, Total (as CaCO3)	260
Bicarbonate (as HCO3-)	310
Carbonate (as CO3=)	< 5
Chloride	140
Hydroxide (as OH-)	< 5
Sulfate (as SO4)	100
pH	7.4 ▲

ALR Designation:	98-A23255
Client Designation:	EPA-MW-04
Sample Location:	
Location II:	
Date/Time Collected	11/11/98 13:20

General Chemistry (results in mg/L unless noted):

Alkalinity, Total (as CaCO3)	280
Bicarbonate (as HCO3-)	340
Carbonate (as CO3=)	< 5
Chloride	170
Hydroxide (as OH-)	< 5
Sulfate (as SO4)	100
pH	7.3 ▲

Acculabs Inc.

REPORT OF ANALYSIS

Ms Karen Kuoppala
URS Operating Services

Lab Job Number: 026740 URS005
Date Samples Received: 11/13/98

ALR Designation:	98-A23256
Client Designation:	EPA-MW-05
Sample Location:	
Location II:	
Date/Time Collected	11/11/98 18:50

General Chemistry (results in mg/L unless noted):

Alkalinity, Total (as CaCO3)	360
Bicarbonate (as HCO3-)	440
Carbonate (as CO3=)	< 5
Chloride	140
Hydroxide (as OH-)	< 5
Sulfate (as SO4)	110
pH	7.3 ▲

NOTES:

▲ Indicates that samples were received and analyzed past holding time.

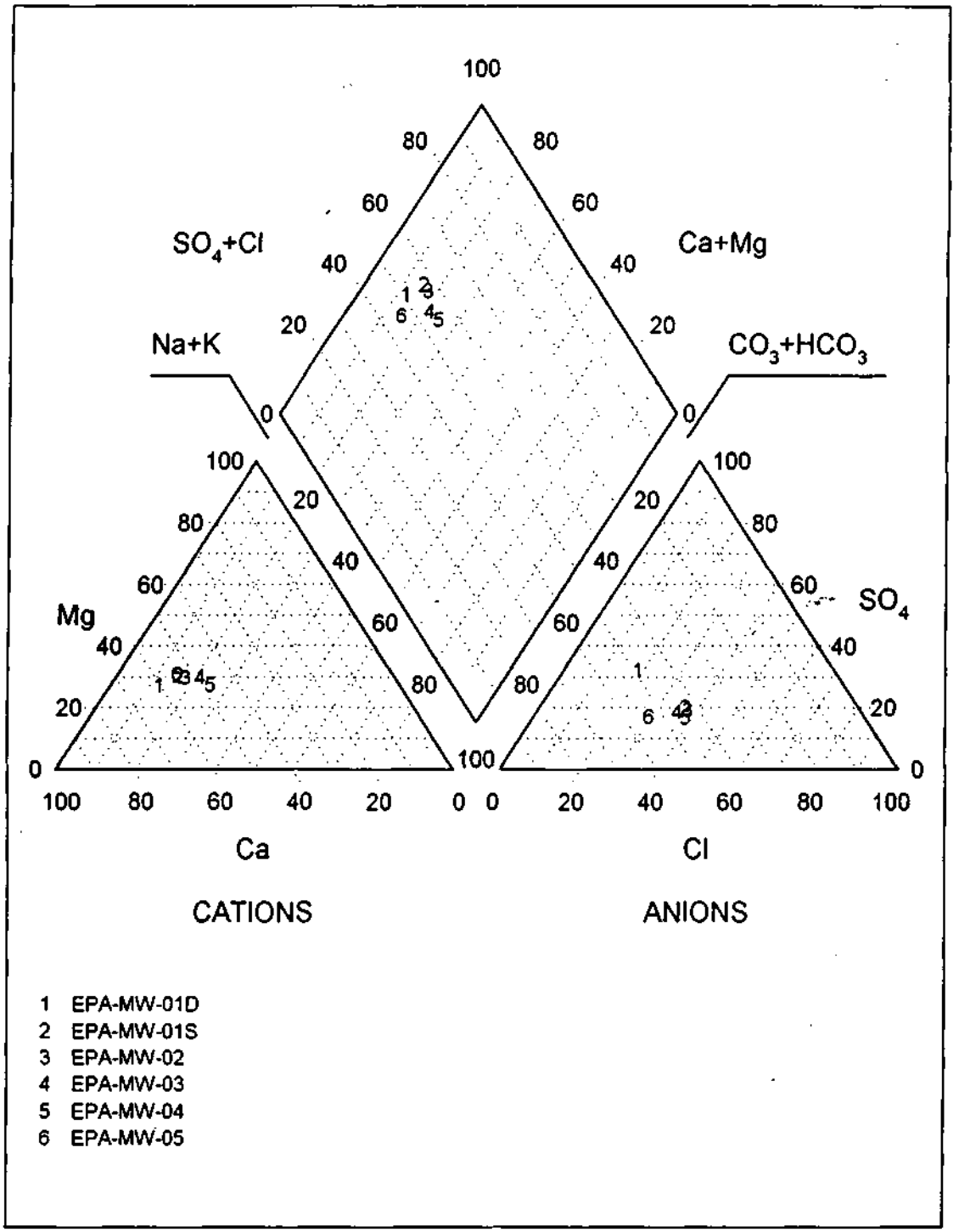
Scheduled sample disposal/return date: December 30, 1998.

Trudy L. Scott
Laboratory Manager

APPENDIX F

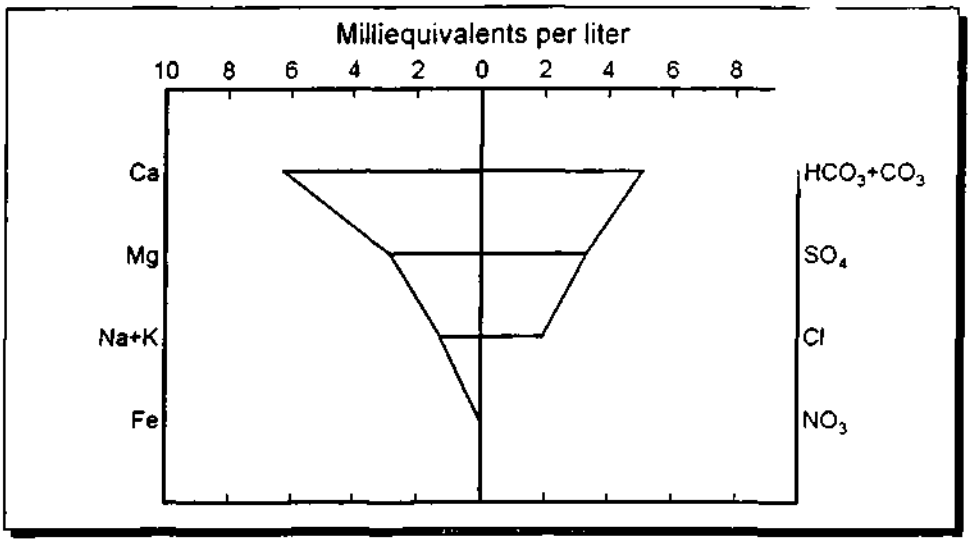
Groundwater Chemistry Stiff and Piper Diagrams

Piper Diagram .. Demo of the GWW Software



STIFF Diagram

Well Ident	Description
EPA-MW-01D	



Cations

	Ca	*Mg*	*Na*	*K*	*Fe*
Milliequivalents per liter	6.2375	2.8215	1.1962	0.05242	0.0005
Milligrams per liter	125.00	34.30	27.50	2.05	0.01

Anions

	HCO3	*CO3*	*SO4*	*Cl*	*NO3*
Milliequivalents per liter	5.08090	0.0000	3.33120	1.94649	
Milligrams per liter	310.00	0.00	160.00	69.00	

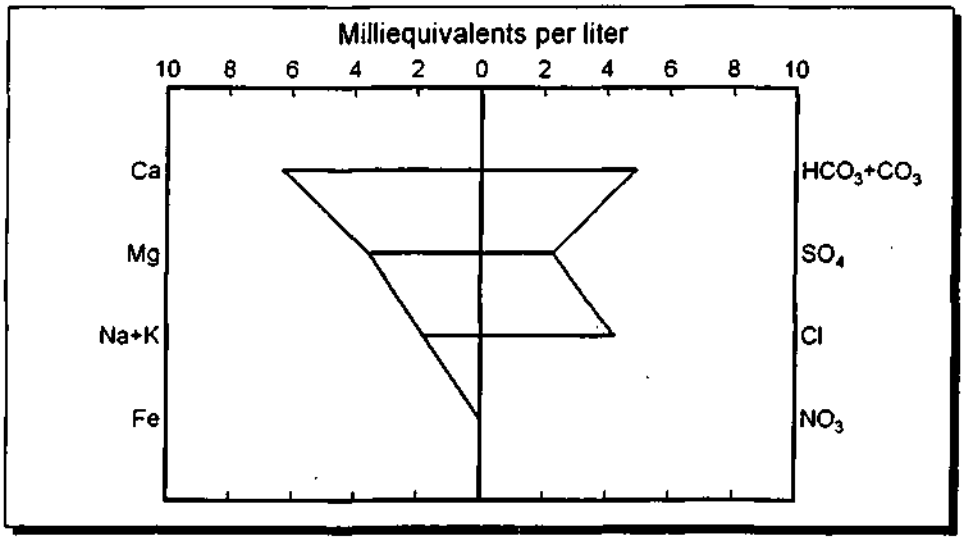
Mn	NO2	PO4	F	B	SIO2
0.0000					
TDS	Hardness	Alkalinity	Conductivity	pH	SAR
				7.30	0.5621

Water Type	Cations (epm)	Anions (epm)
Calcium Bicarbonate	10.3	10.4

Error Balance
0.24

STIFF Diagram

Well Ident	Description
EPA-MW-01S	



Cations					
	Ca	***Mg***	***Na***	***K***	***Fe***
Milliequivalents per liter	6.2874	3.5372	1.7400	0.04577	0.0059
Milligrams per liter	126.00	43.00	40.00	1.79	0.11

Anions					
	HCO3	***CO3***	***SO4***	***Cl***	***NO3***
Milliequivalents per liter	4.91700		2.29020	4.23150	
Milligrams per liter	300.00		110.00	150.00	

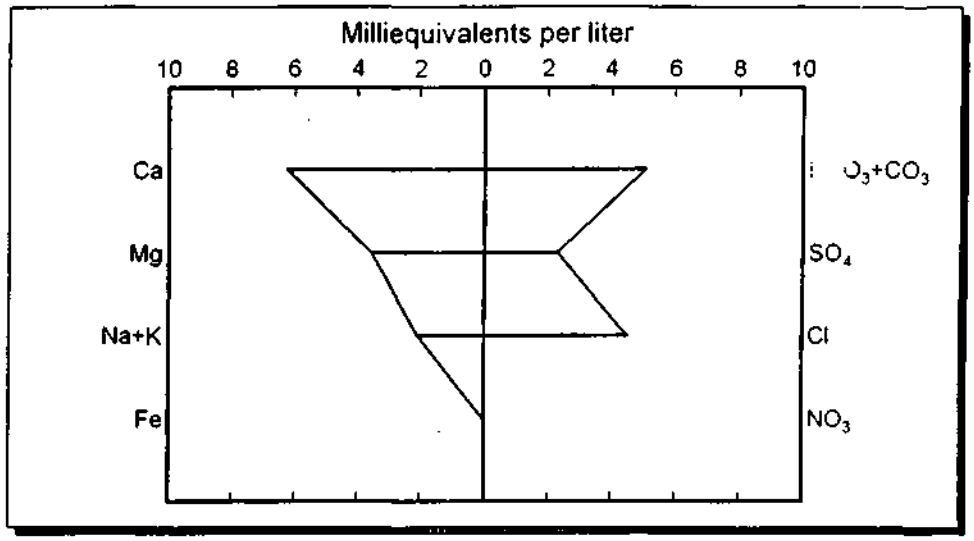
Mn	NO2	PO4	F	B	SIO2
0.0000					
TDS	Hardness	Alkalinity	Conductivity	pH	SAR
				7.40	0.7851

Water Type	Cations (epm)	Anions (epm)
Calcium Bicarbonate	11.6	11.4

Error Balance
0.77

STIFF Diagram

Well Ident	Description
EPA-MW-02	



Cations

	Ca	*Mg*	*Na*	*K*	*Fe*
Milliequivalents per liter	6.2375	3.5619	2.0184	0.04782	0.0016
Milligrams per liter	125.00	43.30	46.40	1.87	0.03

Anions

	HCO3	*CO3*	*SO4*	*Cl*	*NO3*
Milliequivalents per liter	5.08090	0.0000	2.29020	4.51360	
Milligrams per liter	310.00	0.00	110.00	160.00	

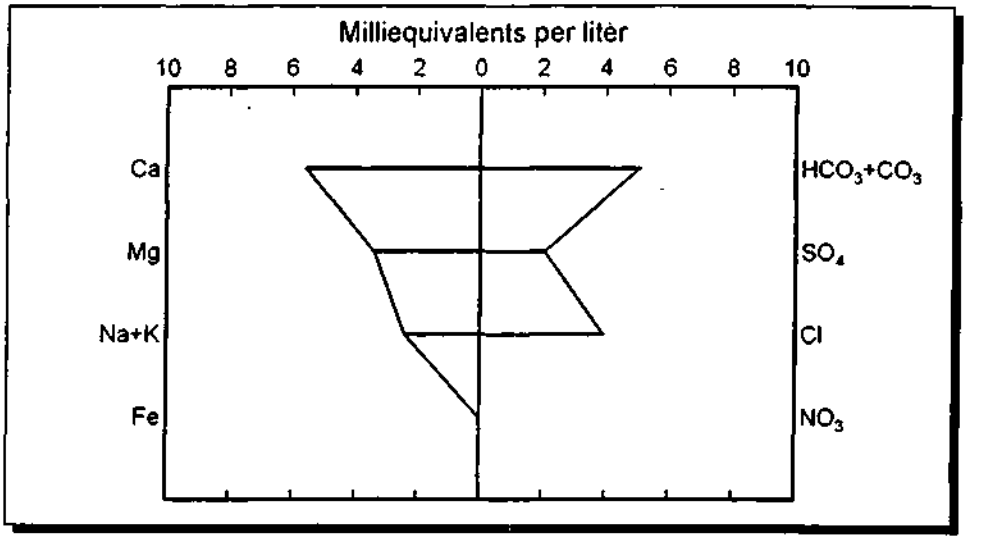
Mn	NO2	PO4	F	B	SIO2
0.0000					
TDS	Hardness	Alkalinity	Conductivity	pH	SAR
				7.40	0.9119

Water Type	Cations (epm)	Anions (epm)
Calcium Bicarbonate	11.9	11.9

Error Balance
0.07

STIFF Diagram

Well Ident	Description
EPA-MW-03	



Cations					
	Ca	***Mg***	***Na***	***K***	***Fe***
Milliequivalents per liter	5.5389	3.3891	2.3360	0.05370	0.0005
Milligrams per liter	111.00	41.20	53.70	2.10	0.01

Anions					
	HCO3	***CO3***	***SO4***	***Cl***	***NO3***
Milliequivalents per liter	5.08090	0.0000	2.08200	3.94940	
Milligrams per liter	310.00	0.00	100.00	140.00	

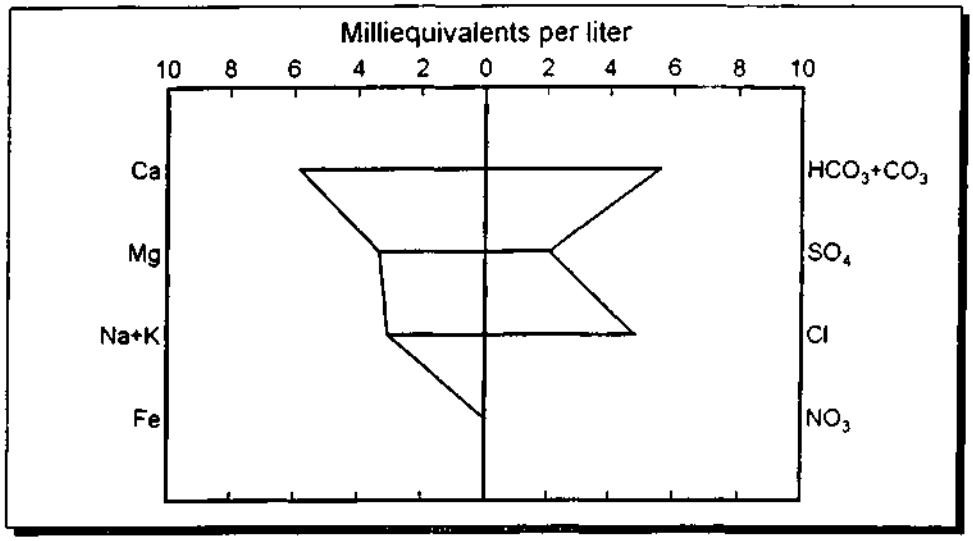
Mn	NO2	PO4	F	B	SIO2
0.0000					
TDS	Hardness	Alkalinity	Conductivity	pH	SAR
				7.40	1.1056

Water Type	***Calcium Bicarbonate***	Cations (epm)	Anions (epm)
		11.3	11.1

Error Balance
0.92

STIFF Diagram

Well Ident	Description
EPA-MW-04	



Cations					
	Ca	*Mg*	*Na*	*K*	*Fe*
Milliequivalents per liter	5.7884	3.3151	2.9710	0.05395	0.0005
Milligrams per liter	116.00	40.30	68.30	2.11	0.01

Anions					
	HCO3	*CO3*	*SO4*	*Cl*	*NO3*
Milliequivalents per liter	5.57260	0.0000	2.08200	4.79570	
Milligrams per liter	340.00	0.00	100.00	170.00	

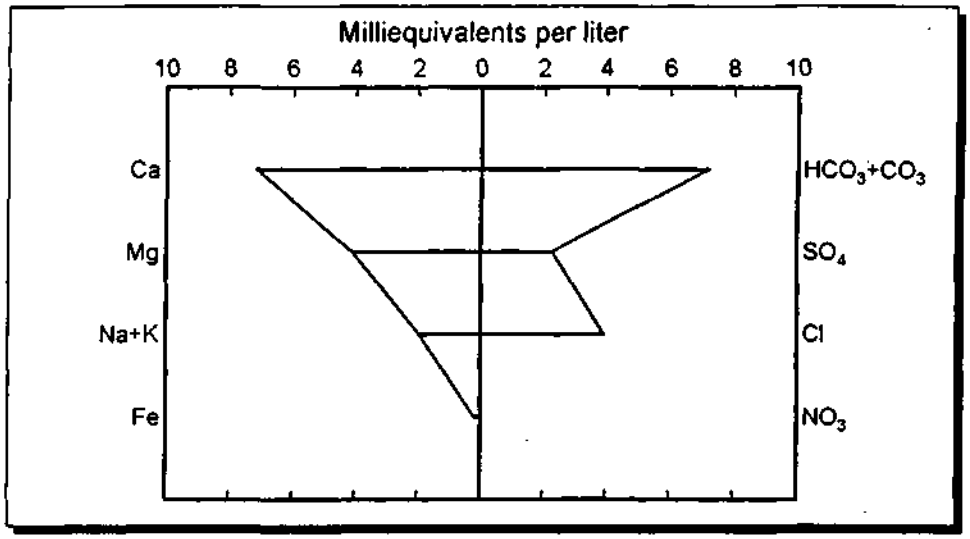
Mn	NO2	PO4	F	B	SIO2
0.0000					
TDS	Hardness	Alkalinity	Conductivity	pH	SAR
				7.30	1.3926

Water Type	Cations (epm)	Anions (epm)
Calcium Bicarbonate	12.1	12.5

Error Balance
1.31

STIFF Diagram

Well Ident	Description
EPA-MW-05	



Cations

	Ca	*Mg*	*Na*	*K*	*Fe*
Milliequivalents per liter	7.1357	4.0801	1.8618	0.08898	0.1708
Milligrams per liter	143.00	49.60	42.80	3.48	3.18

Anions

	HCO3	*CO3*	*SO4*	*Cl*	*NO3*
Milliequivalents per liter	7.21160	0.0000	2.29020	3.94940	
Milligrams per liter	440.00	0.00	110.00	140.00	

Mn	NO2	PO4	F	B	SIO2
0.0022					
TDS	Hardness	Alkalinity	Conductivity	pH	SAR
				7.30	0.7862

Water Type	Cations (epm)	Anions (epm)
Calcium Bicarbonate	13.3	13.5

Error Balance
0.42

Appendix G

UOS - Field Activities and Analytical Results for Soil Gas Sampling at the Mount Olivet Cemetery Plume, December 6, 1996

URS OPERATING SERVICES

1099 18TH STREET
SUITE 710
DENVER, COLORADO 80202-1908
TEL: (303) 291-8300
FAX: (303) 291-8296

December 6, 1996

Mr. Luke D. Chavez
Site Assessment Manager
U.S. Environmental Protection Agency
Region VIII, Mail Code 8EPR-ER
999 18th Street, Suite 500
Denver, Colorado 80202

SUBJECT: **START, EPA Region VIII, Contract No. 68-W5-0031, TDD No. 9609-0003 Field Activities and Analytical Results for Soil Gas Sampling at the Mount Olivet Cemetery Plume, Salt Lake City, Utah, November 1996**

Dear Mr. Chavez:

The attached report recounts the soil gas collection field activities and gives the results of the laboratory analyses of the four soil gas samples collected on November 9, 1996, for the Mt. Olivet Cemetery Plume site in Salt Lake City, Utah.

If you have any questions, please call me at 291-8270. Please initial both attached copies of this letter and return them to Janet Benson when you have approved this document.

Very truly yours,

URS OPERATING SERVICES, INC.

Barry Hayhurst
Environmental Scientist

cc: T. F. Staible/UOS without attachments
File/UOS

EPA ACTION BLOCK

- O Approved
- O Approved, TDD to follow
- O Approved as corrected
- O Disapproved
- O Review with _____
- O Original to _____
- O Copy to _____
- O Reply envelope enclosed

_____ _____
Date By

75-60903.00
\START\Mt-Olive\Trip.Rpt:bas

Field Activities and Analytical Results for Soil Gas Sampling Mount Olivet Cemetery Plume Salt Lake City, Utah November 1996

INTRODUCTION

URS Operating Services, Inc. (UOS) has been tasked, under Technical Direction Document (TDD) 9609-0003 and 9609-0003A, by the Region VIII office of the U.S. Environmental Protection Ag (EPA), to conduct soil gas sampling in the vicinity of the Mount Olivet Cemetery Plume in Salt City, Salt Lake County, Utah (CERCLIS ID # UTD981548985) (Figure 1).

Background information for this site can be found in the Work Plan for the Army National G Armory/Org. Maintenance Shop 5, Salt Lake County, Utah, prepared by Neil B. Taylor of the department of Environmental Quality, Division of Environmental Response and Remediation, 1996 Environmental Priorities Initiative Preliminary Assessment for the University of Utah, prepared by Consultants, 1993; and from the Analytical Results Report of the Mount Olivet Well site prepare Ecology and Environment, Inc., Technical Assistance Team (TAT), 1995. Sampling rationale, proce and protocols are documented in the Field Sampling Plan for the Mount Olivet Cemetery Plume, Salt City, Utah, prepared by UOS in October 1996.

SOIL GAS SAMPLING ACTIVITIES

Soil gas samples were collected using the Geoprobe Model 8-M truck mounted system. The probe driven to refusal at each location then retracted approximately six inches to allow the disposable poi disengage. A line was then run from the end of the probe to an air pump which purged the line. purged line was then connected to a Tedlar® Bag in a vacuum chamber and the Tedlar® Bag was allo to fill with soil gas in response to the evacuation of the vacuum chamber.

Soil gas samples were initially collected from three separate locations on October 18, 1996. Three gas samples were collected from east and southeast of Building 7 of the Veterans Hospital where a s line exited the building. One sample was taken uphill of the sewer line, one from where the sewer exited the building, and the third from a parking area adjacent to the buried sewer line (Photo 1).

second area sampled was southeast of the Coast Guard Building maintenance shop on the Fort Douglas Army Base. The samples were collected in a field near Red Butte Creek Gulch. Two samples were taken from this location, one from the center of the gulch (Photo 2) and one from the northeast side of the gulch. The third area sampled was also on Fort Douglas and was located just south of the loading dock for Building 515 (Photo 3).

The soil gas samples that were collected were not by START field personnel because of equipment operation problems.

A second START field crew re-sampled the locations on November 9, 1996, using the same procedures from the approved Field Sampling Plan that were used to collect the original samples. These four recollected samples were sent to Environmental Chemistry Services, Inc. of Englewood, Colorado, where they were analyzed using SW-846 Method 8260 modified for volatile organic compounds in gaseous phase. The four soil gas samples were received by the laboratory on November 11, 1996, and were analyzed on November 12, 1996.

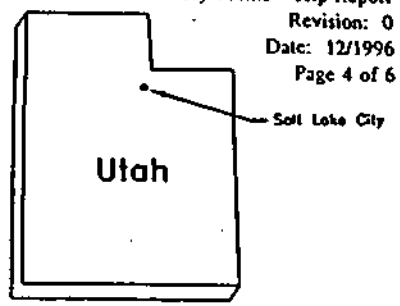
Soil gas samples were collected from the same locations on November 9, 1996, as had been collected on October 18, 1996, with the following exception. Originally three samples were collected behind the Veterans Hospital Building 7. On the re-sampling date the area where the first two soil gas samples had been collected was being paved for a parking lot and the construction area was not sampled. All final sample locations are shown in Figure 2.

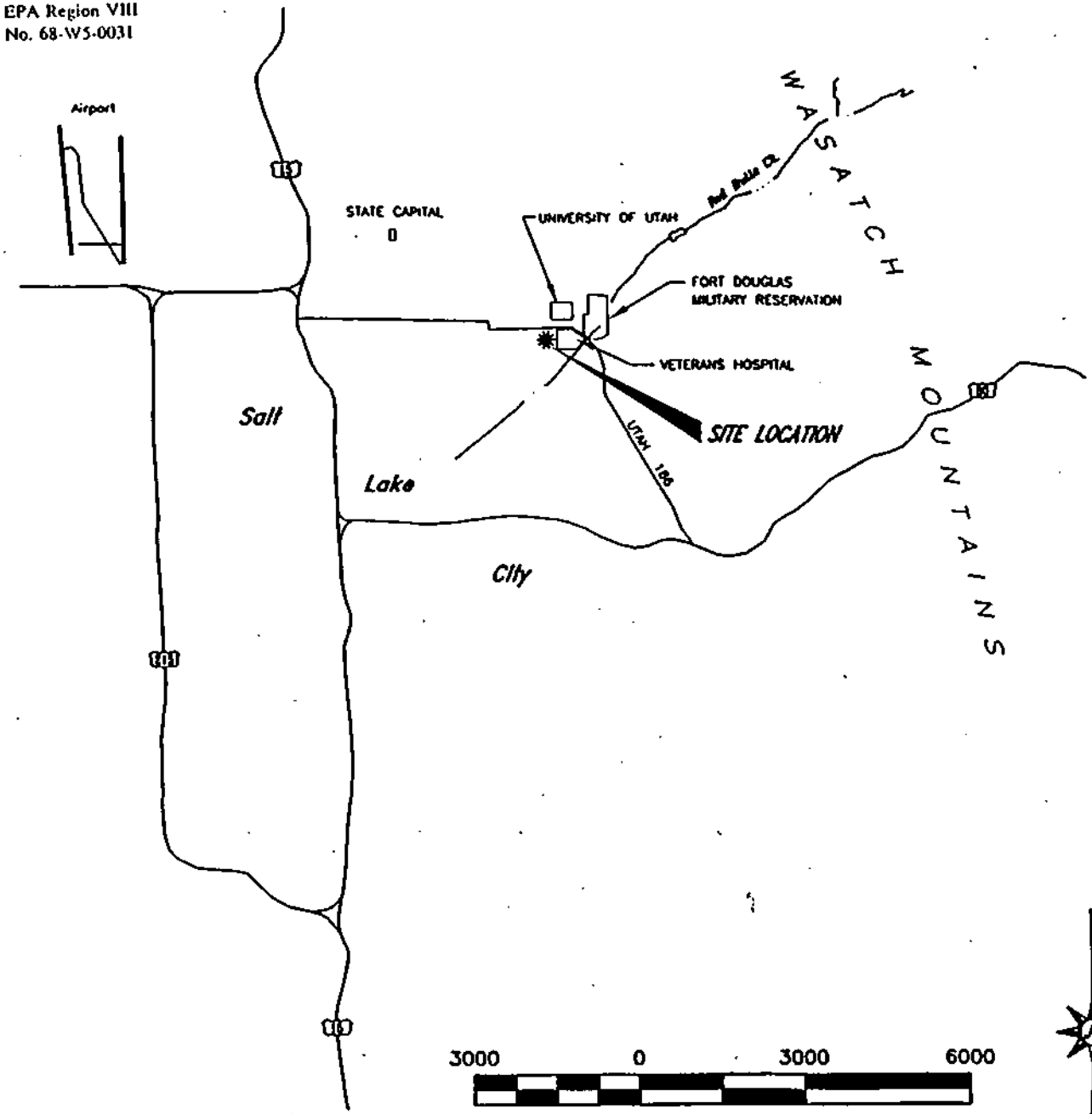
SOIL GAS SAMPLE RESULTS

The data were not validated. Quality control requirements for air samples are not documented; therefore, the data were reviewed for compliance with Method 8260 water analysis quality control criteria. The review covered holding time, instrument tune, calibration, blank contamination, system monitoring compounds and laboratory quality control samples. Based on this review, the data were found to be acceptable for the intended purposes. Minor non-compliance with method water requirements have no impact on the reported analyte concentrations.

The soil gas sample results are reported in Table 1. A detection of PCE at 1.9 ppb was recorded at O-SG-1 (The sewer line leading from the back of the VA Medical Center's Building 7. There were no detections of 1,1-DCE; +-1,2-DCE; TCE; or PCE in Samples O-SG-2 and O-SG-3 taken from Red Butte Gulch southwest of the Coast Guard Maintenance Shop. Sample station O-SG-4, from southwest of Building 515's loading dock, included detections of TCE at 3.4 ppb and PCE at 49 ppb. A copy of the complete laboratory results is included in Appendix B.

URS Operating Services, Inc.
START, EPA Region VIII
Contract No. 68-W5-0031





FIELD SAMPLING PLAN
TDD # 9609-0003

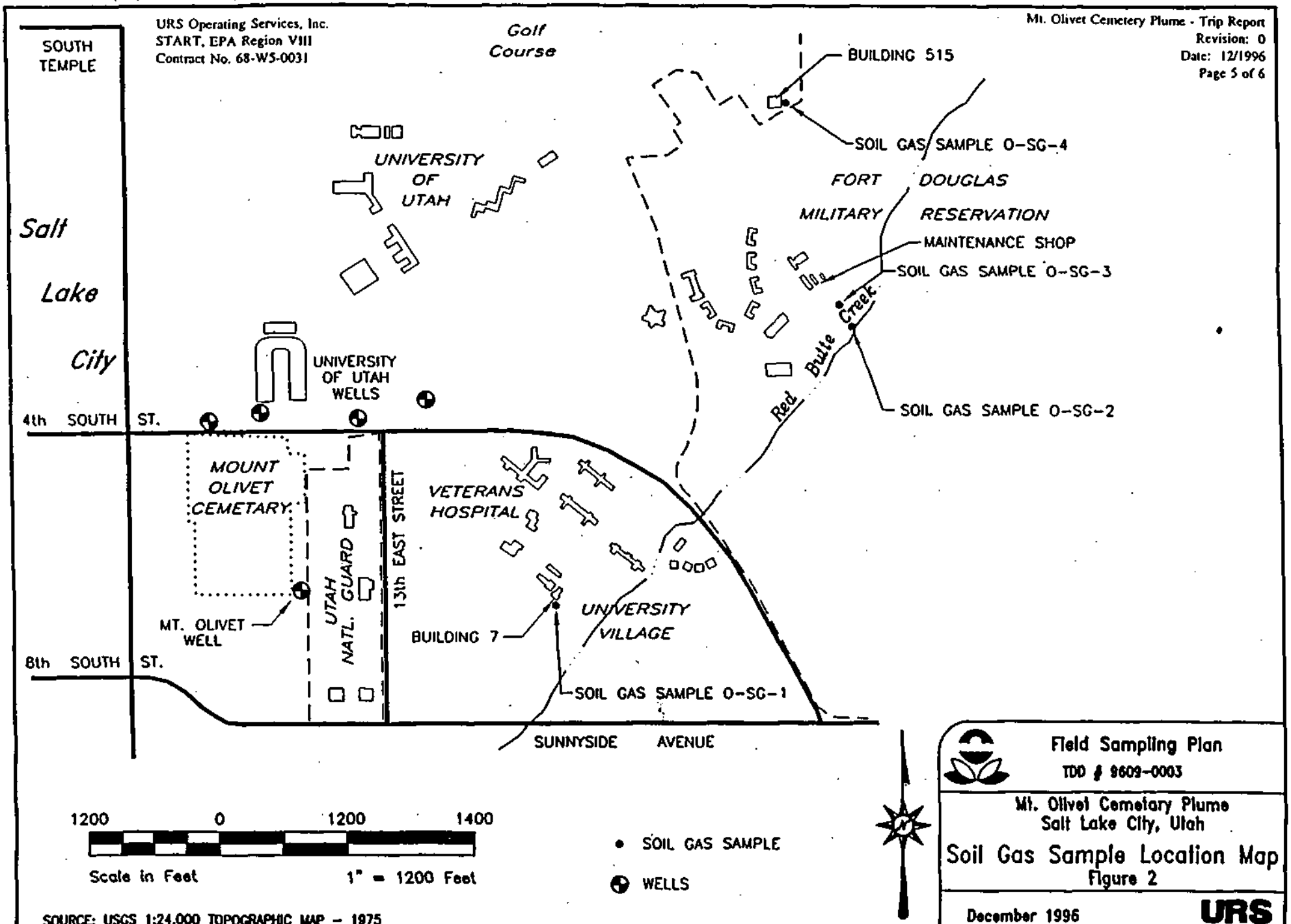
MOUNT OLIVET CEMETARY PLUME
Salt Lake City, Utah

Site Location Map
Figure 1

December 1996

URS OPERATING SERVICES

URS Operating Services, Inc.
START, EPA Region VIII
Contract No. 68-W5-0031



Field Sampling Plan
TDD # 9609-0003

Mt. Olivet Cemetary Plume
Salt Lake City, Utah

Soil Gas Sample Location Map
Figure 2

December 1996

URS OPERATING SERVICES

TABLE 1
Soil Gas Sample Results
All concentrations in ppb (µg/l)

Sample Location Detection Limit	1,1-DCE 1	+-1,2-DCE 1	TCE 1	PCE 1
O-SG-1 VA Medical Center southeast of Building 6	ND	ND	ND	1.9
O-SG-2 Fort Douglas Center of Red Butte Gulch, southwest of Coast Guard Maintenance Shop	ND	ND	ND	ND
O-SG-3 Fort Douglas Northwest side of Red Butte Gulch, southwest of Coast Guard Maintenance Shop	ND	ND	ND	ND
O-SG-4 Fort Douglas Southwest of loading dock for Building 515 (old brigg)	ND	ND	3.4	49.0

APPENDIX B

Complete Laboratory Results

November 13, 1996

ENVIRONMENTAL CHEMISTRY SERVICES, INC.
7108 S. Alton Way, Bldg. E
Englewood, CO 80112
(303) 850-7606

TABLE 1

ECS Project #:	UOS011	Date Received:	11/11/96
UOS Project #:	7560903	Date Sampled:	11/9/96
Method #:	Mod. EPA 8260	Date Extracted:	n/a
Matrix:	Air	Date Analyzed:	11/12/96
Units:	µg/L		

*	PARAMETER	DETECTION LIMIT	LABEL # 002271 SAMPLE # O-S6-1	LABEL # 002272 SAMPLE # O-S6-2	LABEL # 002273 SAMPLE # O-S6-3	LABEL # 002274 SAMPLE # O-S6-4	BLANK
	Dichlorodifluoromethane	2	ND	ND	ND	ND	ND
	Chloromethane	2	ND	ND	ND	ND	ND
	Bromomethane	2	ND	ND	ND	ND	ND
	Vinyl chloride	2	ND	ND	ND	ND	ND
	Chloroethane	2	ND	ND	ND	ND	ND
	Trichlorofluoromethane	2	ND	ND	ND	ND	ND
	Methylene chloride	2	ND	ND	ND	ND	ND
	1,1-Dichloroethene	1	ND	ND	ND	ND	ND
	1,1-Dichloroethane	1	ND	ND	ND	ND	ND
	cis-1,2-Dichloroethene	1	ND	ND	ND	ND	ND
	trans-1,2-Dichloroethene	1	ND	ND	ND	ND	ND
	Chloroform	1	ND	ND	ND	ND	ND
	Bromochloromethane	1	ND	ND	ND	ND	ND
	Dibromomethane	1	ND	ND	ND	ND	ND
	1,2-Dichloroethane	1	ND	ND	ND	ND	ND

*	PARAMETER	DETECTION LIMIT	LABEL # 002271 SAMPLE # O-S6-1	LABEL # 002272 SAMPLE # O-S6-2	LABEL # 002273 SAMPLE # O-S6-3	LABEL # 002274 SAMPLE # O-S6-4	BLANK
	1,1,1-Trichloroethane	1	ND	ND	ND	ND	ND
	Carbon tetrachloride	1	ND	ND	ND	ND	ND
	Bromodichloromethane	1	ND	ND	ND	ND	ND
	1,2-Dichloropropane	1	ND	ND	ND	ND	ND
	1,1-Dichloropropene	1	ND	ND	ND	ND	ND
	trans-1,3-Dichloropropene	1	ND	ND	ND	ND	ND
	2,2-Dichloropropane	1	ND	ND	ND	ND	ND
	cis-1,3-Dichloropropene	1	ND	ND	ND	ND	ND
*	Trichloroethene	1	ND	ND	ND	3.4	ND
	1,3-Dichloropropane	1	ND	ND	ND	ND	ND
	1,1,2-Trichloroethane	1	ND	ND	ND	ND	ND
	Dibromochloromethane	1	ND	ND	ND	ND	ND
	1,2-Dibromoethane	1	ND	ND	ND	ND	ND
	Bromoform	1	ND	ND	ND	ND	ND
	1,1,1,2-Tetrachloroethane	1	ND	ND	ND	ND	ND
	1,2,3-Trichloropropane	1	ND	ND	ND	ND	ND
	1,1,2,2-Tetrachloroethane	1	ND	ND	ND	ND	ND
*	Tetrachloroethene	1	1.9	ND	ND	49	ND
	Chlorobenzene	1	ND	ND	ND	ND	ND
	1,3-Dichlorobenzene	1	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	1	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	1	ND	ND	ND	ND	ND
	2-Chlorotoluene	1	ND	ND	ND	ND	ND
	4-Chlorotoluene	1	ND	ND	ND	ND	ND
	Bromobenzene	1	ND	ND	ND	ND	ND

*	PARAMETER	DETECTION LIMIT	LABEL # 002271 SAMPLE # O-S6-1	LABEL # 002272 SAMPLE # O-S6-2	LABEL # 002273 SAMPLE # O-S6-3	LABEL # 002274 SAMPLE # O-S6-4	BLANK
	Styrene	1	ND	ND	ND	ND	ND
	Benzene	1	ND	ND	ND	ND	ND
*	Toluene	1	ND	ND	1.0	ND	ND
	Ethylbenzene	1	ND	ND	ND	ND	ND
	Total xylenes	1	ND	ND	ND	ND	ND
	Isopropylbenzene	1	ND	ND	ND	ND	ND
	n-Propylbenzene	1	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	1	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	1	ND	ND	ND	ND	ND
	s-Butylbenzene	1	ND	ND	ND	ND	ND
	t-Butylbenzene	1	ND	ND	ND	ND	ND
	p-Isopropyltoluene	1	ND	ND	ND	ND	ND
	n-Butylbenzene	1	ND	ND	ND	ND	ND
	1,2-Dibromo-3-chloropropane	1	ND	ND	ND	ND	ND
	Hexachlorobutadiene	1	ND	ND	ND	ND	ND
	Naphthalene	1	ND	ND	ND	ND	ND
	1,2,4-Trichlorobenzene	1	ND	ND	ND	ND	ND
	1,2,3-Trichlorobenzene	1	ND	ND	ND	ND	ND

ND = Not detected at levels exceeding the reporting detection limit.

APPENDIX C

URS OPERATING SERVICES INC.
FIELD INVESTIGATION REPORT SUPPLEMENT TO THE
SITE ACTIVITIES REPORT
MOUNT OLIVET CEMETERY
SALT LAKE CITY, UTAH
MARCH 14, 2000

Luke

START

Superfund Technical Assessment and Response Team - Region VIII

United States
Environmental Protection Agency

Contract No. 68-W5-0031

SUPPLEMENT TO THE SITE ACTIVITIES REPORT

MT. OLIVET CEMETERY
Salt Lake City, Utah

TDD #9803-0014

MARCH 14, 2000

URS OPERATING SERVICES, INC.

In association with:
Tetra Tech EM Inc.
URS Greiner Woodward Clyde
Maxim Technologies, Inc.
LT Environmental, Inc.
The Roybal Corporation

482154

URS OPERATING SERVICES

1099 18TH STREET
SUITE 710
DENVER, COLORADO 80202-1908
TEL: (303) 296-3523
FAX: (303) 291-8296

March 14, 2000

Mr. Luke D. Chavez
Site Assessment Manager
U.S. Environmental Protection Agency
Region VIII, Mail Code: 8EPR-ER
999 18th Street, Suite 500
Denver, Colorado 80202-2405

SUBJECT: START, EPA Region VIII, Contract No. 68-W5-0031, TDD No. 9803-0014
Supplement to the Site Activities Report - Mt. Olivet Cemetery, Salt Lake City, Utah

Dear Luke:

Attached are two copies of the draft Supplement to the Site Activities Report for the Mt. Olivet Cemetery at Salt Lake City, Utah. Additional site activities included contracting for and managing the extension of background monitoring well EPA-MW-02 and the abandonment of monitoring well EPA-MW-03. This document is submitted for your review and comments.

If you have any questions, please call me at 303-291-8313.

Very truly yours,

URS OPERATING SERVICES, INC.

John P. Noto
Geologist

cc: T. F. Staible/UOS
File/UOS

75-80314.00
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SUPPLEMENT TO THE SITE ACTIVITIES REPORT

MT. OLIVET CEMETERY
Salt Lake City, Salt Lake County, Utah

EPA Contract No. 68-W5-0031
TDD No. 9803-0014

Prepared By:
John Noto
Geologist

URS Operating Services, Inc.
1099 18th Street, Suite 710
Denver, CO 80202-1908

Approved: _____ Date: 3/20/00
Luke Chavez, Site Assessment Manager, EPA, Region VIII

Approved: _____ Date: _____
T. F. Staible, START Team Leader, UOS

Approved: _____ Date: _____
John P. Noto, Geologist, UOS

DISTRIBUTION LIST

U.S. ENVIRONMENTAL PROTECTION AGENCY

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STATE OF UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY

Neil Taylor (3 copies)

URS OPERATING SERVICES, INC.

John P. Noto	Geologist, START, EPA Region VIII
File (2 copies)	START, EPA Region VIII

SUPPLEMENT TO THE SITE ACTIVITIES REPORT

MT. OLIVET CEMETERY
Salt Lake City, Utah

TABLE OF CONTENTS

1.0 INTRODUCTION

This Report is submitted in accordance with certain task elements specified in Technical Direction Document (TDD) number 9803-0014 issued to the URS Operating Services, Inc. (UOS) Superfund Technical Assessment and Response Team (START) in Region VIII by the U.S. Environmental Protection Agency (EPA). This report is a supplement to the Site Activities Report for the Mt. Olivet Cemetery (URS Operating Services, Inc. (UOS) 1999a). START contracted for and managed the installation of an additional background well at the Mt. Olivet site (Figure 1). Construction of an ice rink necessitated that well EPA-MW-03 be abandoned and well EPA-MW-02 be extended.

2.0 WELL ABANDONMENT AND EXTENSION

Due to the planned construction work in the area, well EPA-MW-03 was abandoned by the Layne Christenson Company on September 21, 1999, per State of Utah regulations. A sample was collected from the well prior to abandonment and submitted to Datachem Laboratory in Salt Lake City, Utah, for perchloroethylene (PCE). The reported PCE concentration in the sample was 7.1 micrograms per liter ($\mu g/L$).

The planned construction work also necessitated that well EPA-MW-02 be extended in height. The well was extended with a welded-on section of steel protector casing and a PVC blank casing extension.

3.0 WELL INSTALLATION AND SAMPLING

The START contracted with Layne Christenson Company, a drilling contractor in Salt Lake City, Utah, to install the well, EPA-MW-06. The well was installed with an advance casing hammer/percussion rig in September 1999. Photographs of the well installation are included in Appendix A. The lithologic log for the well is attached in Appendix B.

Well EPA-MW-06 was installed in the southeast corner of Sunnyside Park, in the northeast quarter of Section 9, T. 1 N., R. 1 E. (Figure 2). Well EPA-MW-06 was located upgradient of wells with PCE contamination. The well was placed upgradient of the PCE contamination identified in other wells and upgradient of the sewer line that originates from the former dry cleaning facility at the Veterans Administration (VA) Hospital.

All cuttings and formation water were collected in drums. The cuttings were screened with a photoionization detector (PID). Because the PID readings on the cuttings were not elevated, the cuttings were discarded near well EPA-MW-02. Two samples, SB-06-A and SB-06-B, were collected from the cuttings that originated near the vadose zone. The samples were submitted for volatile organic compound (VOC) analysis via the START Gas Chromatograph/Mass Spectrometer (GC/MS). All VOCs were below the laboratory reporting limit (RL).

Sample EPA-MW-06A was collected of the formation water during drilling at approximately 126 feet below ground surface (bgs). The sample was submitted for VOC analysis via the START GC/MS. All VOCs were below the laboratory RL.

Well EPA-MW-06 was installed to a depth of approximately 134 feet bgs, approximately 20 feet into the first aquifer, which was encountered at about 114 feet bgs. The well casing and screen were four-inch inside diameter (i.d.) Schedule 40 PVC. The well was screened at approximately 134 feet to 104 feet bgs (Appendix B).

Layne Christenson developed the well with a stainless steel bailer on September 23, 1999. Approximately 75 gallons of water (5.6 casing volumes) were bailed. A water sample was collected of the final development water and submitted for PCE analysis. The sample was collected to determine if the purge water required formal disposal. The sample was analyzed for PCE using the UOS START GC/MS. There was no PCE reported in the sample above the reporting limit.

On January 6, 2000, START collected sample EPA-MW-06 from well EPA-MW-06 with a Geotech bladder pump. Approximately three well volumes (20 gallons) were purged prior to sample collection. Water parameters were measured with a pH, temperature, conductivity meter at 10-gallon, 15-gallon, and 20-gallon purge volumes. The respective water parameters all measured within 10 percent on all three readings. The samples were submitted for volatile organic analysis to Sentinel Laboratory in Huntsville, Alabama; for metals analysis to Mitkem Corporation in Warwick, Rhode Island; and for general chemistry (anions, alkalinity, and pH) analysis to Accu-Labs in Golden, Colorado. START adhered to sample collection, packaging and documentation procedures outlined in the Sampling Quality Assurance/Control (QA/QC) Work Plan (UOS 1999b). A summary of the samples collected is presented in Table 1.

4.0 DATA VALIDATION AND INTERPRETATION

One aqueous monitoring well sample, EPA-MW-06, was submitted for EPA Contract Laboratory Program (CLP) analysis. Volatile organic analysis of the monitoring well sample was provided by Mitkem Corporation using the EPA Statement of Work (SOW). Metals and mercury analysis of the monitoring well sample was provided by Sentinel, Inc. using EPA SOW. All laboratory data were validated by Tech Law, Inc., a UOS Team subcontractor, using the EPA CLP Functional Guidelines for Data Validation and the EPA Region VIII validation report format (U.S. Environmental Protection Agency (EPA) 1994). The data validation report is attached as Appendix D.

The data are acceptable for the purpose of characterizing contamination in the samples.

The following problems were identified:

- VOC:

  Acetone was estimated (J) because the continuing calibration was outside of validation criteria. This was possibly due to background levels within the laboratory.

  Chloroform was also estimated (J) because it was below the contract required detection limit.

- Metals:

  Positive and negative blank contamination was detected in chromium, copper, lead, thallium, and vanadium. Associated samples were qualified estimated (J) and undetected estimated (UJ).

  Antimony and selenium and low matrix spike recoveries of 61.6% and 63.2% were qualified estimated (J) and undetected estimated (UJ). This was possibly due to sample preparation and procedures.

  Serial dilution results for barium and potassium exceeded validation criteria by 6% and 1%, respectively. This possibly indicates matrix interference. All associated samples were qualified estimated (J) and undetected estimated (UJ).

5.0 SAMPLE RESULTS EPA-MW-06

All laboratory data sheets are attached in Appendix C. There were no VOCs reported above the laboratory reporting limit in sample EPA-MW-06. There were no elevated concentrations of metallic ions of concern.

The general chemistry along with certain cation and anion results were used to map the hydrochemical facies of the sample. The data were also compared with sample data from the other wells on a Piper diagram (Figure 3). All well sample data plotted in the same area of the diagram, indicating wells are screened in the same or chemically similar aquifers (except well EPA-MW-01D).

Water levels were measured in the six existing wells on September 21, 1999, prior to the installation of well EPA-MW-06 (Table 2). An approximate water elevation of EPA-MW-06 was calculated from the October 14, 1999, measurement and the top-of-casing (TOC) estimated elevation. These recent water table measurements are consistent with previous measurements listed in the UOS Site Activities Report (SAR) (UOS 1999a). The estimated groundwater elevation at EPA-MW-06 is also consistent with the northwestern sloping water table of the first unconfined aquifer.

6.0 SUMMARY AND CONCLUSIONS

.UOS START managed the installation of a monitoring well at the Mt. Olivet Cemetery site in September 1999. The well installation was required to provide a sampling location upgradient of the existing wells with PCE contamination. START sampled the well in January 2000.

Due to the construction of a building and parking lot, well EPA-MW-03 was abandoned and well EPA-MW-02 was extended. Well EPA-MW-03 was sampled prior to abandonment; the PCE concentration in the well was 7.1 μg/l.

START collected samples from the well and submitted them for metals, VOC, anions, alkalinity, and pH analysis to Mitkem, Sentinel, and Accu-labs laboratories, respectively. The samples were forwarded through the CLP. There were no VOCs reported above the laboratory reporting limits.

The hydrochemical facies of water collected from well EPA-MW-06 is similar to that of the other wells installed in the study area. The groundwater chemistry combined with other information such as water table contours and observations made during the well installations indicate the wells are screened in a common aquifer (except well EPA-MW-01D).

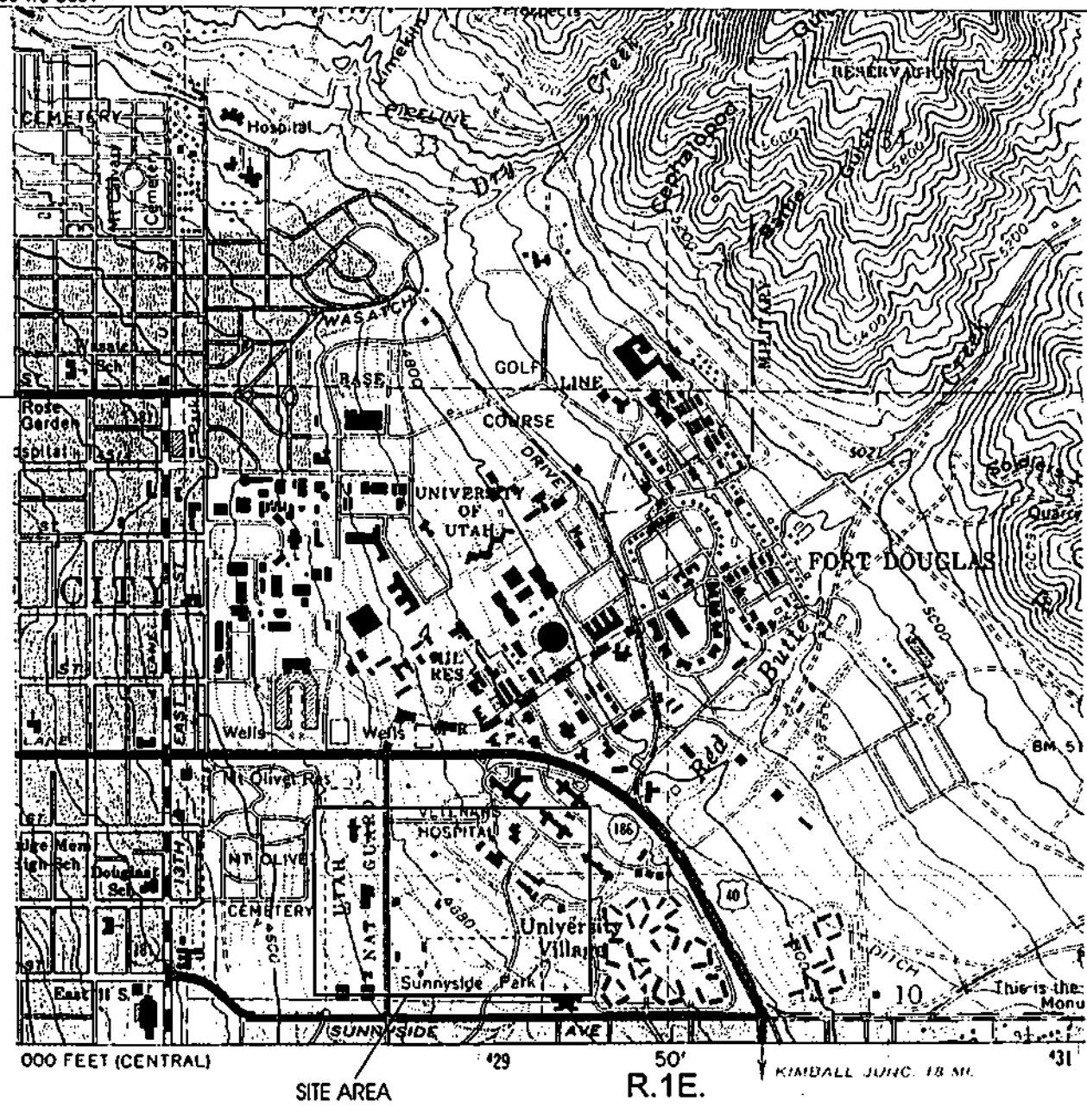
The water table information and laboratory results indicate that well EPA-MW-06 is a background well relative to the PCE source area and the PCE contaminant plume. The specific location of the PCE release, however, is still not defined. The only identified potential source of PCE that is both downgradient of the background wells and upgradient of the contaminant plume is the former VA dry cleaning facility.

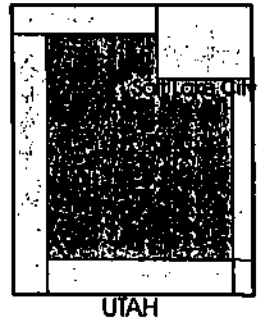
7.0 LIST OF REFERENCES

U.S. Environmental Protection Agency (EPA). 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review." Publication 9240.1-05, PB94-963501 EPA540/R-94/012. February 1994. Office of Emergency and Remedial Response, Washington, D.C.

URS Operating Services, Inc. (UOS). 1999a. "Site Activities Report, Mt. Olivet Well Site," Salt Lake City, Utah. May 1999.

URS Operating Services, Inc. (UOS). 1999b. "Sampling and Analysis Plan, Mt. Olivet Well Site," Salt Lake City, Utah. October 1998.





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Supplement to
Sampling Activities Report
UOS Job Number 75-80314.00

MT. Olivet Cemetery Site
Salt Lake City, Utah

Site Location Map

T.D.D. 9803-0014 FIGURE 1

March 2000

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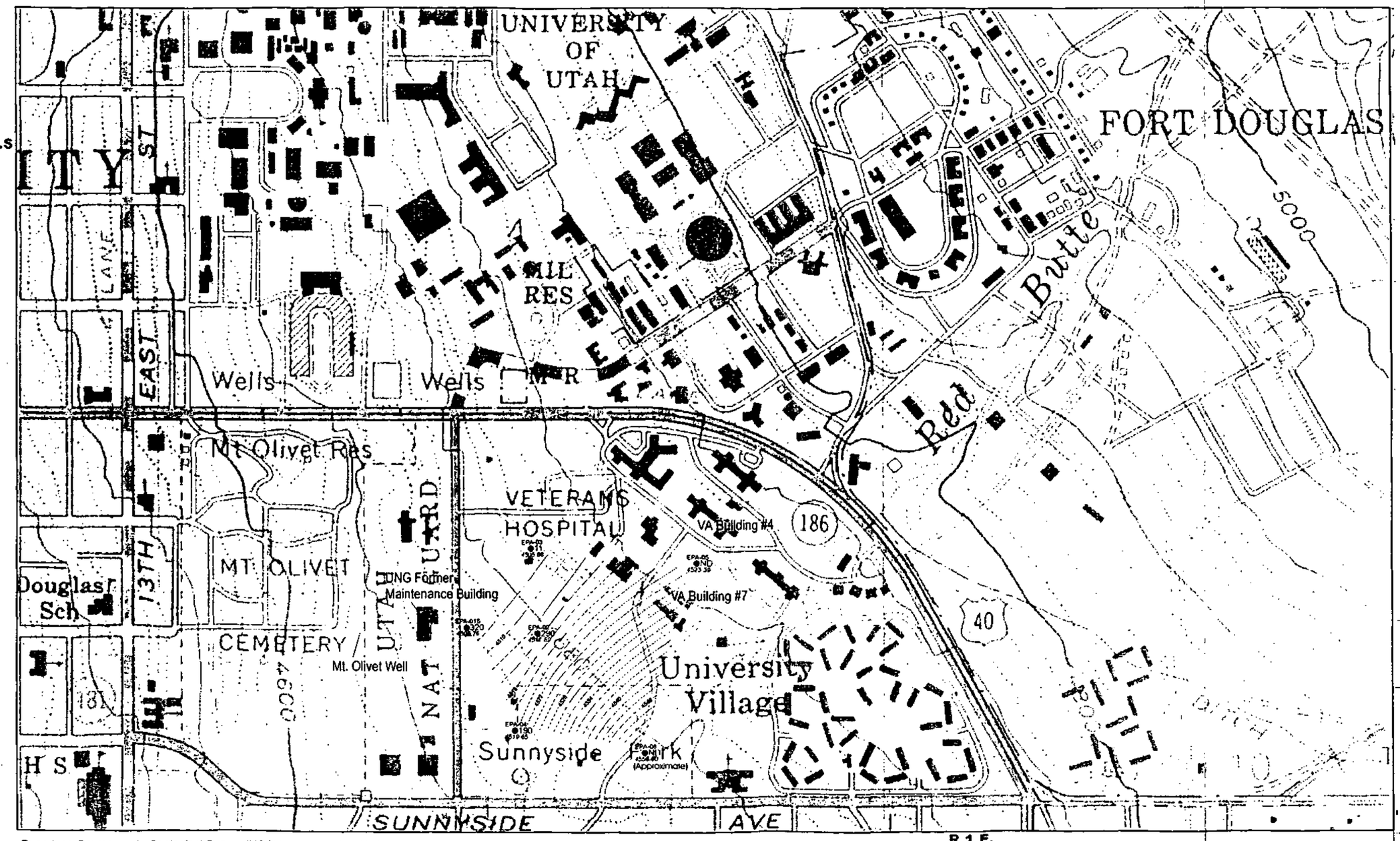
URS Operating Services, Inc.
START, EPA Region VIII
Contract No. 68-W5-0031

Mt. Olivet Cemetery - SAR



Base Map Source: U.S. Geological Survey (USGS) Fort Douglas, Utah
7.5 Minute Quadrangle Map 1975

LEGEND

- Well ID
- EPA-MW-04 / 1140 / 4522.80 — PCE Concentration (ppb) (wells sampled 10/98, EPA-MW-06 sampled 1/20
- Groundwater Elevation (feet) (9/99)
- Groundwater Elevation Contour (feet above msl) 9/99

Note: The location and elevation of EPA-MW-06 are approximate.

N

SCALE 1 inch = 750 feet

Supplement to Sampling Activities Repo
UOS Job Number 75-80314.0

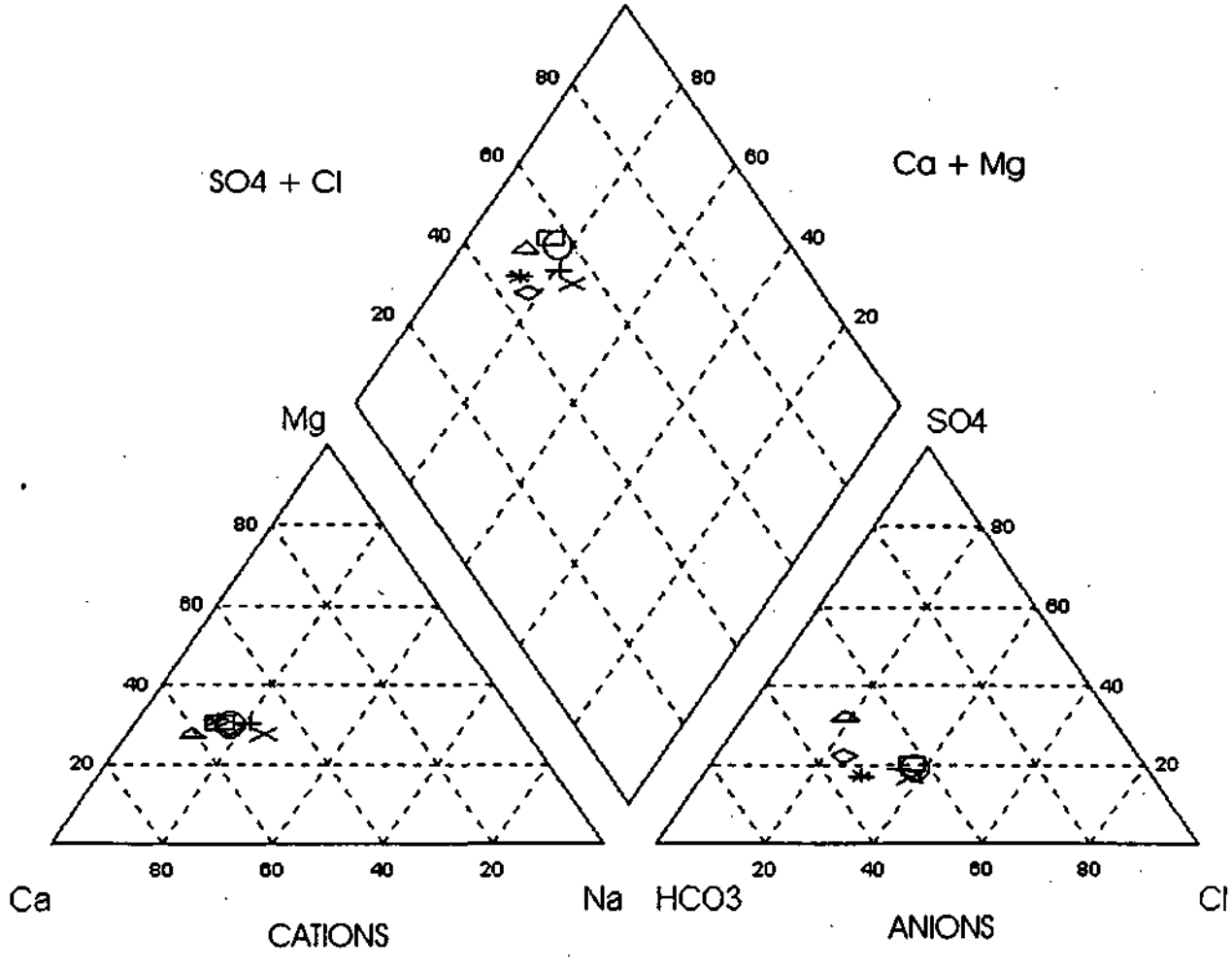
MT. Olivet Cemetery Site
Salt Lake City, Utah

Groundwater Contours on Detailed Site Map

T.D.D. 9803-0014 FIGURE 2

March 2000

URS OPERATING SERVICE



Legend:

- EPA-MW-01S
- EPA-MW-02
- EPA-MW-03
- EPA-MW-04
- EPA-MW-05
- EPA-MW-06
- EPA-MW-01D

Supplement to
Sampling Activities Report
UOS Job Number 75-80314.00

MT. Olivet Cemetery Site
Salt Lake City, Utah

PIPER DIAGRAM

T.D.D. 9803-0014 FIGURE 3

March 2000

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TABLE 1
Sample Log

Sample ID	COC# or CLP Case#	Matrix	Date	Laboratory	Analysis
EPA-MW-03	DN5005	Aqueous	9/20/99	Data Chem	PCE
EPA-MW-06A	DN5004	Aqueous	9/22/99	UOS START	VOCs
SB-06-A	DN5004	Soil	9/22/99	UOS START	VOCs
SB-06-B	DN5004	Soil	9/22/99	UOS START	VOCs
EPA-MW-06	8-24705 27716	Aqueous	1/6/00	Accu-Labs (CLP) Mitkem (CLP) Sentinel (CLP)	Anions, Alkalinity, pH Volatile Organics Inorganics

TABLE 2
Groundwater Elevations

Well ID	Date	Depth to Groundwater (feet)	TOC Elevation (feet amsl)	Groundwater Elevation (feet amsl)
EPA-MW-01D	09/21/99	193.78	4662.2	4468.42
EPA-MW-01S	09/21/99	156.43	4662.18	4505.75
EPA-MW-02	09/21/99	167.52	4680.41	4512.89
EPA-MW-03	09/21/99	192.1	4697.98	4505.88
EPA-MW-04	09/21/99	139.25	4654.15	4514.9
EPA-MW-05	09/21/99	208.7	4732.09	4523.39
EPA-MW-06*	10/04/99	118.21	4680	4561.79

* EPA-MW-06 TOC and groundwater elevations are estimated.
amsl Above mean sea level.

APPENDIX A

Photolog

PHOTO 1
Preparing pump and equipment to collect sample EPA-MW-06.

PHOTO 2
Well EPA-MW-06.

PHOTO 3
Photo taken toward the south of Well EPA-MW-06.

APPENDIX B

Lithologic Well Log

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-06	Mount Olivet 7580314.00	Salt Lake City, Utah

Boring Depth (ft) X Diameter (in): 134.0 x 8	Drilling Method: Hammer Rig w/advance casing
Well Contractor Name: Layne Christenson	Logged by: Mike Carmien

Ground Surface Elevation (ASL):	Top of Casing Elevation (ASL):	Lat. SE Corner of Sunnyside Park Dr Long.	Northing Easting
Date Started: 9/22/99	Date Completed: 9/23/99	Additional Comments: Sunnyside Park north of tennis court	

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type*	Sample Recovery	Blow count	PID / FID (ppm)
Silty clay; tan-brown, plastic, 10% cobbles	CL		0	4" Sch. 40 PVC blank, bentonite pellet seal				
Silty gravel; Red, low plasticity, no clay, dry, PID=background	GM		5 10 15 20 25 30 35 40					
Gravelly sand; reddish, silty, medium grained sand, 10% gravel	SM		45 50 55					
Silty clay; reddish-pink, plastic, moist	CL		60					

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	9/23/99	1/6/00			
Static Water Level (from TOC)	Level:	▽ 118.21	▽ 121			
Static Water Level (ASL)	Level:					

URS Operating Services

SOIL BORING LOG / MONITORING WELL CONSTRUCTION DIAGRAM

Boring / Well Number:	TDD Name/Project Number:	Site Location:
EPA-MW-06	Mount Olivet 7580314.00	Salt Lake City, Utah

Lithologic Description	USCS	Graphic Log	Depth (feet b.g.s.)	Well Construction Details	Sample Type *	Sample Recovery	Blow count	PID / FID (ppm)
Gravelly silt; red, 30% gravel, dry	GM		65, 70, 75, 80, 85, 90					
Silty sand; red	SM		95	10-20 mesh silica sand				
Sandy gravel; red, dry	GW		100, 105	4" Sch. 40 slotted screen in 10-20 mesh sand				
Silty sand; red, dry	SM		110					
Silty sand; red, wet (water table @ 115 bgs)	SM		115, ▽ 120					
Gravel/silt/clay; very resistant, slow drilling, well cemented, qtz, rhyolite, amphiboles, and feldspars	GM		125, 130					

* SS (split spoon) HSA (hollow stem auger) MC (Geoprobe macrocore) CT (cuttings)

Observations	Date:	9/23/99	1/6/00			
Static Water Level (from TOC)	Level:	▽ 118.21	▽ 121			
Static Water Level (ASL)	Level:					

APPENDIX C

Laboratory Data Sheets

ACCULABS, INC.

REPORT OF ANALYSIS

Mr Jim Gindelberger
US EPA Region 8 (8ES-MEB)
999 18th Street Suite 500
Denver, CO 80202-2466

Lab Job Number: 035791 EPA002
Date Samples Received: 01/07/00
Customer PO Number: 9X0017NASA

Acculabs Designation:	00-A340
Client Designation:	WELL #6
Sample Location:	
Location II:	
Date/Time Collected	01/06/00 16:15

General Chemistry (results in mg/L unless noted):

Alkalinity, Total (as CaCO3)	260
Bicarbonate (as HCO3-)	310
Carbonate (as CO3=)	< 5
Chloride	78
Hydroxide (as OH-)	< 5
Sulfate (as SO4)	100
pH	8.0

NOTES:

Scheduled sample disposal/return date: July 23, 2000.

Trudy L. Scott
Laboratory Manager

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

SOW No.: ILM04.0

EPA Sample No.	Lab Sample ID.
MHEP01	28628S
MHEP01D	28628S2
MHEP01S	28628DS

Were ICP interelement corrections applied?	Yes/No	YES
Were ICP background corrections applied?	Yes/No	YES
If yes-were raw data generated before application of background corrections?	Yes/No	NO

Comments: Ba and K are estimated due to possible matrix interference. The cooler temperature measured 0.5°C.

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: [signature] Name: BAKiswe

Date: 1/13/00 Title: QA Officer

EPA SAMPLE NO.

INORGANIC ANALYSIS DATA SHEET

MHEP01

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

Matrix (soil/water): WATER Lab Sample ID: 28628S

Level (low/med): LOW Date Received: 01/07/2000

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.9	U		P
7440-36-0	Antimony	2.1	U	N	P
7440-38-2	Arsenic	2.2	U		P
7440-39-3	Barium	56.1	B	E	P
7440-41-7	Beryllium	0.10	U		P
7440-43-9	Cadmium	0.30	U		P
7440-70-2	Calcium	107000			P
7440-47-3	Chromium	0.70	B		P
7440-48-4	Cobalt	0.60	U		P
7440-50-8	Copper	1.6	B		P
7439-89-6	Iron	18.6	U		P
7439-92-1	Lead	1.7	B		P
7439-95-4	Magnesium	35500			P
7439-96-5	Manganese	2.4	U		P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	1.3	U		P
7440-09-7	Potassium	2000	B	E	P
7782-49-2	Selenium	2.3	B	N	P
7440-22-4	Silver	0.40	U		P
7440-23-5	Sodium	40400			P
7440-28-0	Thallium	3.5	B		P
7440-62-2	Vanadium	2.8	B		P
7440-66-6	Zinc	12.9	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

SDG Narrative

Mitkem Corporation submits the enclosed data package in response to USEPA Case # 27716 and SDG# HW935. Analyses were performed for one aqueous sample that was received on January 7, 2000. The analyses were performed under USEPA Contract # 68-W-99-076.

The following samples are submitted in this data package:

Client ID	Lab ID	Analysis	Aqueous VOA pH
HW935	70027001	V	<2
HW935MS	70027002	V	<2
HW935MSD	70027003	V	<2

V = Volatiles

The analyses were performed using USEPA CLP Multi-Media, Multi-Concentration (OLM04.2) protocols. The analyses were performed with strict adherence to the SOW with the following exceptions and observations:

1. Overall Observation:

Where needed, manual integrations were performed to improve data quality. The corrections were reviewed and associated hardcopies generated and reported as required.

2. Volatile Analysis:

Trap used for instrument V6: OI Analytical #10 trap containing 8 cm each of Tenax, silica gel and carbon molecular sieve

GC column used: 30 m x 0.25 mm id (1.4 um film thickness) DB-624 capillary column.

Matrix spike and matrix spike duplicate were performed on HW935. Spike recoveries and replicate RPDs were within QC limits except for benzene in which the RPD was not within the QC limit.

No other unusual observation was made for the analysis.

All of the submittals to the region are originals other than log book pages and copies of tunes and standard files which are shared by many other cases. For these, the original copies are archived in the laboratory.

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the laboratory manager or his designee, as verified by the following signature.

Agnes Ng
CLP Project Manager
1/20/00

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HW935

Lab Name: MITKEM CORPORATION Contract: 68W99076

Lab Code: MITKEM Case No.: 27716 SAS No.: SDG No.: HW935

Matrix: (soil/water) WATER Lab Sample ID: 70027001

Sample wt/vol: 5.000 (g/mL) ML Lab File ID: V6A0591

Level: (low/med) LOW Date Received: 01/07/00

% Moisture: not dec. Date Analyzed: 01/13/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	10	U
74-87-3	Chloromethane	10	U
75-01-4	Vinyl Chloride	10	U
74-83-9	Bromomethane	10	U
75-00-3	Chloroethane	10	U
75-69-4	Trichlorofluoromethane	10	U
75-35-4	1,1-Dichloroethene	10	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
79-20-9	Methyl Acetate	10	U
75-09-2	Methylene Chloride	10	U
156-60-5	trans-1,2-Dichloroethene	10	U
1634-04-4	Methyl tert-Butyl Ether	10	U
75-34-3	1,1-Dichloroethane	10	U
156-59-2	cis-1,2-Dichloroethene	10	U
78-93-3	2-Butanone	10	U
67-66-3	Chloroform	2	J
71-55-6	1,1,1-Trichloroethane	10	U
110-82-7	Cyclohexane	10	U
56-23-5	Carbon Tetrachloride	10	U
71-43-2	Benzene	10	U
107-06-2	1,2-Dichloroethane	10	U

1B

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HW935

Lab Name: MITKEM CORPORATION Contract: 68W99076

Lab Code: MITKEM Case No.: 27716 SAS No.: _____ SDG No.: HW935

Matrix: (soil/water) WATER Lab Sample ID: 70027001

Sample wt/vol: 5.000 (g/mL) ML Lab File ID: V6A0591

Level: (low/med) LOW Date Received: 01/07/00

% Moisture: not dec. _____ Date Analyzed: 01/13/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
79-01-6	Trichloroethene	10	U
108-87-2	Methylcyclohexane	10	U
78-87-5	1,2-Dichloropropane	10	U
75-27-4	Bromodichloromethane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
108-88-3	Toluene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
79-00-5	1,1,2-Trichloroethane	10	U
127-18-4	Tetrachloroethene	10	U
591-78-6	2-Hexanone	10	U
124-48-1	Dibromochloromethane	10	U
106-93-4	1,2-Dibromoethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
1330-20-7	Xylene (Total)	10	U
100-42-5	Styrene	10	U
75-25-2	Bromoform	10	U
98-82-8	Isopropylbenzene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
96-12-8	1,2-Dibromo-3-chloropropane	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U

1F

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HW935

Lab Name: MITKEM CORPORATION Contract: 68W99076

Lab Code: MITKEM Case No.: 27716 SAS No.: _____ SDG No.: HW935

Matrix: (soil/water) WATER Lab Sample ID: 70027001

Sample wt/vol: 5.000 (g/mL) ML Lab File ID: V6A0591

Level: (low/med) LOW Date Received: 01/07/00

% Moisture: not dec. _____ Date Analyzed: 01/13/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

Number TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
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APPENDIX D

CLP Data Validation Report

300 UNION BOULEVARD, SUITE 600, LAKEWOOD, CO 80228
PHONE: (303) 763-7188
FAX: (303) 763-4896

TECHLAW INC.

February 2, 2000

Ms. Lori Raschke
URS Operating Services
1099 18th Street, Suite 710
Denver, CO 80202

RE: Transmittal of Data Validation Reports
Mt. Olivet Cemetery
TDD No. 75-80314
SDG Nos. HW935 and MHEP01

Dear Ms. Raschke:

Please find the enclosed data validation report for TDD No. 75-80314 for the Mt.Olivet Cemetery project. These reports are for the validation of CLP volatile and metal analyses.

If you have any questions regarding the enclosed reports, please contact me at (303) 763-7188.

Yours sincerely,
TECHLAW, INC.

Lisa Burnley
Associate Consultant

enclosure
IF: Q252-371

REGION VIII
DATA VALIDATION REPORT
ORGANICS - VOA

Case No. / TDD No.	Site Name		Operable Unit
27716 / 75-80314	Mt. Olivet Cemetery		
RPM/OSC Name			
Luke Chavez			
Contractor Laboratory	**Contract No.**	**SDG No.**	**Laboratory DPO/Region**
Mitkem Corporation	68-W-99-076	HW935	

Review Assigned Date January 31, 2000 Data Validator Bill Fear
Review Completion Date February 2, 2000 Report Reviewer Amy Ballow

Sample ID	Station Location	Matrix	Analysis
HW935	EPA-MW-06	Water	CLP - Volatile Analyses

DATA QUALITY STATEMENT

( ) Data are ACCEPTABLE according to EPA Functional Guidelines with no qualifiers (flags) added by the reviewer.
( ) Data are UNACCEPTABLE according to EPA Functional Guidelines.
(X) Data are acceptable with QUALIFICATIONS noted in review.

Telephone/Communication Logs Enclosed? Yes _____ No ___X_____

TPO Attention Required? Yes _____ No ___X___ If yes, list the items that require attention:

ORGANIC DATA VALIDATION REPORT

REVIEW NARRATIVE SUMMARY

This data package was reviewed according to the EPA document "USEPA Contract Laboratory Program National Functional Guidelines For Organic Data Review," February 1994.

Raw data were reviewed for completeness and transcription accuracy onto the summary forms. Approximately 10-20% of the results reported in each of the samples, calibrations, and QC analyses were recalculated and verified. If problems were identified during the recalculation of results, a more thorough calculation check was performed.

Case No. 27716, SDG No. HW935 consisted of one water sample for CLP volatile organic analyses.

The laboratory performed the required library search on all non-target sample components.

The following tables lists data qualifiers added to the data. (Please see Data Qualifier Definitions, attached to the end of this report.)

Sample Number	Semivolatile Compound	Qualifier	Reason For Qualification	Review Section
HW935	Acetone	UJ	Continuing calibration %D > 25%	4

Method Number OLM04.0
Revision OLM04.2

Organic Data Completeness Checklist
VOA

Quality Control Summary Package
- P Surrogate Recovery Summary
- P MS/MSD Summary
- P Method Blank Summary
- P GC/MS Tuning and Mass Calibration

Sample Data Package
- P Holding Times (CLASS Sample Traffic Reports/UOS Chain-of-Custody)
- P Organic Analysis Data Sheets
- P Reconstructed Ion Chromatogram(s) (RIC)
- P Quantitation Reports
- P Mass Spectral Data
- P Mass Spectral Library Search for TICs

Standards Data Package
- NR Current List of Laboratory/Instrument Detection Limits
- P Initial Calibration Data for each instrument
- P Continuing Calibration Data for each instrument
- P Internal Standard Area Summary
- P VOA Standards RICs
- P VOA Standards Quantitation Reports

Raw QC Package
- P BFB mass spectra and mass listings

Reagent Blank Data
- P Organic Analysis Data Sheets
- P RIC or Total Ion Chromatogram
- P Quantitation Reports
- P Mass Spectral Data
- P Library Search for TICs

Matrix Spike/Matrix Spike Duplicate Data
- P Organic Analysis Data Sheets
- P RIC
- P Quantitation Reports
- NA Mass Spectral Data
- NA Library search for TICs

KEY:
- P = Provided in original data package
- R = Provided as resubmission
- NP = Not provided in original data package or as resubmission
- NR = Not required
- NA = Not applicable to this data package or analysis

1. **DELIVERABLES**

All deliverables were present as specified in the subcontract.

VOA: Yes_X_ No___

Comments: None.

2. **HOLDING TIMES AND PRESERVATION CRITERIA**

All method holding times were met.

VOA: Yes_X_ No___

Comments: The water sample was analyzed within ten days from sample receipt at the laboratory. Chain-of-custody, summary forms, and raw data were evaluated.

All technical holding times and preservation criteria were met.

VOA: Yes_X_ No___

Comments: The preserved water sample was analyzed within 14 days from sample collection. Chain-of-custody records, summary forms, and raw data were evaluated. No shipping or receiving problems were noted.

3. **BFB PERFORMANCE RESULTS**

The bromofluorobenzene (BFB) performance results were within the specified control limits. All appropriate BFB results were included.

VOA: Yes_X_ No___

Comments: BFB instrument performance checks were run for each 12 hours of analysis. Ion abundance criteria were met and were verified from raw data.

4. **INSTRUMENT CALIBRATIONS: INITIAL AND CONTINUING STANDARDS**

Initial instrument calibrations were performed according to method requirements and met the specified control limits listed in the Functional Guidelines.

VOA: Yes_X_ No___

Comments: Initial calibration standards containing both volatile target compounds and surrogate compounds were analyzed at the required frequency. Initial calibration relative response factors (RRFs) for all target volatile compounds and surrogate

compounds were greater than or equal to 0.05. The percent standard deviations (%RSDs) were less than or equal to 30% for all compounds. Summary forms and raw data were evaluated.

Continuing instrument calibrations were performed according to method requirements and met specified control limits listed in the Functional Guidelines.

VOA: Yes___ No_X_

Comments: Continuing calibration standards containing both target compounds and surrogate compounds were analyzed at the beginning of each 12-hour analysis period. Continuing calibration RRFs for all target volatile compounds and system monitoring compounds were greater than or equal to 0.05. Summary forms and raw data were evaluated.

The following table lists the percent differences (%Ds) for compounds that were greater than 25% in the continuing calibration and the qualifiers added to the data:

Compound	%D	Associated Samples	Qualifiers
Acetone	27.7	HW935	UJ

5. SURROGATE COMPOUND RECOVERY

Surrogate compound recovery analysis was performed according to method requirements and results met specified control limits.

VOA: Yes_X_ No___

Comments: Surrogate compounds were added to all samples and blanks. The surrogate percent recoveries (%Rs) were all within the QC limits. Summary forms and raw data were evaluated.

6. MATRIX SPIKE/MATRIX SPIKE DUPLICATE

Matrix Spike/Matrix Spike Duplicate (MS/MSD) analyses were performed according to method requirements and results met recommended recovery and precision limits.

VOA: Yes___ No_X_

Comments: MS/MSD analyses were performed on samples HW935. The percent recoveries for the MS/MSD analyses were within QC limits. The relative percent difference (RPD) for benzene at 12% exceeded the QC limit of 11%. No action is required as sample results are not qualified using only MS/MSD data. Summary forms and raw data were evaluated.

7. INTERNAL STANDARD AREA

Internal standard area analysis was performed according to method requirements and results met specified control limits.

VOA: Yes_X_ No___

Comments: Internal standard area counts did not vary by more than a factor of two from the associated 12-hour calibration standard. The internal standard retention times did not vary more than ± 30 seconds from the retention time of the associated 12-hour calibration standards. Summary forms and raw data were evaluated.

8. LABORATORY BLANK ANALYSIS RESULTS

The laboratory blank analysis was performed according to method requirements and results met specified limits.

VOA: Yes_X_ No___

Comments: A method blank analysis was performed after the calibration standards and once for every 12-hour time period beginning with a BFB analysis. Contamination was not detected in the volatile blanks or in the holding blank. Summary forms and raw data were evaluated.

Tentatively identified compounds (TICs) were not found in the method or holding blanks.

9. SAMPLE RESULTS

The sample results were reviewed and all compound identifications were acceptable and met contract requirements.

VOA: Yes_X_ No___

Comments: Sample relative retention times (RRTs) were within ± 0.06 RRT units of the standard RRT. Ions present in the standard mass spectrum at a relative intensity greater than 10% were present in the sample spectrum. Relative intensities of ions agreed within ± 20% between standard and sample spectra.

No TICs were found in the sample.

10. Additional Comments or Problems/Resolutions Not Addressed Above

VOA: Yes___ No_X_

Comments: None.

ORGANIC DATA QUALITY ASSURANCE REVIEW

Region VIII

DATA QUALIFIER DEFINITIONS

For the purpose of Data Validation, the following code letters and associated definitions are provided for use by the data validator to summarize the data quality.

GENERAL QUALIFIERS for use with both INORGANIC and ORGANIC DATA

R - Reported value is "rejected." Resampling or reanalysis may be necessary to verify the presence or absence of the compound.

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.

U J - The reported quantitation limit is estimated because Quality Control criteria were not met. Element or compound was not detected.

N J - Estimated value of a tentatively identified compound. (Identified with a CAS number.) ORGANICS analysis only.

U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HW935

Lab Name: MITKEM CORPORATION Contract: 68W99076

Lab Code: MITKEM Case No.: 27716 SAS No.: _____ SDG No.: HW935

Matrix: (soil/water) WATER Lab Sample ID: 70027001

Sample wt/vol: 5.000 (g/mL) ML Lab File ID: V6A0591

Level: (low/med) LOW Date Received: 01/07/00

% Moisture: not dec. _____ Date Analyzed: 01/13/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-71-8	Dichlorodifluoromethane	10	U
74-87-3	Chloromethane	10	U
75-01-4	Vinyl Chloride	10	U
74-83-9	Bromomethane	10	U
75-00-3	Chloroethane	10	U
75-69-4	Trichlorofluoromethane	10	U
75-35-4	1,1-Dichloroethene	10	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
79-20-9	Methyl Acetate	10	U
75-09-2	Methylene Chloride	10	U
156-60-5	trans-1,2-Dichloroethene	10	U
1634-04-4	Methyl tert-Butyl Ether	10	U
75-34-3	1,1-Dichloroethane	10	U
156-59-2	cis-1,2-Dichloroethene	10	U
78-93-3	2-Butanone	10	U
67-66-3	Chloroform	2	J
71-55-6	1,1,1-Trichloroethane	10	U
110-82-7	Cyclohexane	10	U
56-23-5	Carbon Tetrachloride	10	U
71-43-2	Benzene	10	U
107-06-2	1,2-Dichloroethane	10	U

RF 1/21/00

1B

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HW935

Lab Name: MITKEM CORPORATION Contract: 68W99076

Lab Code: MITKEM Case No.: 27716 SAS No.: _____ SDG No.: HW935

Matrix: (soil/water) WATER Lab Sample ID: 70027001

Sample wt/vol: 5.000 (g/mL) ML Lab File ID: V6A0591

Level: (low/med) LOW Date Received: 01/07/00

% Moisture: not dec. _____ Date Analyzed: 01/13/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
79-01-6	Trichloroethene	10	U
108-87-2	Methylcyclohexane	10	U
78-87-5	1,2-Dichloropropane	10	U
75-27-4	Bromodichloromethane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
108-88-3	Toluene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
79-00-5	1,1,2-Trichloroethane	10	U
127-18-4	Tetrachloroethene	10	U
591-78-6	2-Hexanone	10	U
124-48-1	Dibromochloromethane	10	U
106-93-4	1,2-Dibromoethane	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
1330-20-7	Xylene (Total)	10	U
100-42-5	Styrene	10	U
75-25-2	Bromoform	10	U
98-82-8	Isopropylbenzene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
96-12-8	1,2-Dibromo-3-chloropropane	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U

RE 1/31/00

1F

EPA SAMPLE NO.

HW935

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Lab Name: MITKEM CORPORATION Contract: 68W99076

Lab Code: MITKEM Case No.: 27716 SAS No.: _____ SDG No.: HW935

Matrix: (soil/water) WATER Lab Sample ID: 70027001

Sample wt/vol: 5.000 (g/mL) ML Lab File ID: V6A0591

Level: (low/med) LOW Date Received: 01/07/00

% Moisture: not dec. _____ Date Analyzed: 01/13/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL)

Number TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) ug/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

HOLDING TIMES

Method #: VOA aromatic

Client & Batch #: URS-HW935 27716

Validator/Date: Bill Fear

Reviewer/Date: Amy Baum 02-01-00

Include samples, dilutions & reanalyses

#	SAMPLE NUMBER (per COC)	(If Applicable) COC # = Form I Y/N	SAMPLE PRE-SERVED Y/N	TEMP. 4°C (±2°C) Y/N	CONC. LEVEL/ MATRIX	DATE COLLECTED	Extractables DATE EXTRACTED	DATE ANALYZED	Extractables EXT. DATE - COLL. DATE	ANAL. DATE - EXT. DATE	ANAL. DATE - COLL. DATE	Action Taken VOA Aromatic J(+) UJ (U)	J ALL	J (+) R (U)	COMMENTS (ANY PROBLEMS ESP. WITH SHIPPING, RECEIPT & SAMPLING CONDITION)
1	HW935		y	7°C	W	1-6-00 ✓	—	1-13-00	—	—	7 ✓	None w/in 14 days			EPA-method ✓ rec'd 1/9/00 UTSR
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															

For all worksheets: (1) If a particular category is "Not Applicable," denote with N/A (2) Calculation checks performed by validators.

TUNING

Include samples, dilutions, reanalyses, calibrations & cal checks

TUNING COMPOUND	DATE & TIME TUNED	INSTRUMENT ID	ABUND. CRIT. MET Y/N	SAMPLE WITHIN 12 HR. TIME FRAME Y/N	FORM 5 #'S EQUAL RAW DATA Y/N	CALC. OK	HEADER INFO OK Y/N	ACTION/COMMENTS
TUNE 1:	DATE: 1-11-00 TIME: 1256	V6	Y	Y	✓	✓	—	None ✓
Associated samples: ICAL								
TUNE 2:	DATE: 1-12-00 TIME: 2301	V6	Y	Y	✓	✓	—	
Associated samples: All								
TUNE 3:	DATE: TIME:							
Associated samples:								
TUNE 4:	DATE: TIME:							
Associated samples:								
TUNE 5:	DATE: TIME:							
Associated samples:								
TUNE 6:	DATE: TIME:							
Associated samples:								

INITIAL CALIBRATION

Include samples, dilutions, reanalyses, spikes & blanks

INITIAL CALIBRATION	DATE CALIBRATED	INSTRU-MENT ID	AVG RRF ≥ 0.05 Y/N	RSD ≤ 30 % Y/N	1ST ORD. CORR. COEF. r or r^2 ≥ 0.99 Y/N	2ND ORD. VALUES TRACE-ABLE Y/N	CALCULATIONS CHECKS: 1 RRF PER I-CAL STND.	CALCULATIONS CHECKS: MIN 1 AVG. RRF & %RSD	CALCULATIONS CHECKS: MIN. 1 CORR. COEF-FICIENT	COMMENTS & COMPOUNDS FAILING CRITERIA (Note if compounds are SPCC or CCC)
I-CAL 1:	1-11-00	V6	1) Y	2) Y	3)	4)	✓	✓		none
Associated samples: All										
I-CAL 2:			5)	6)	7)	8)				
Associated samples:										
I-CAL 3:			9)	10)	11)	12)				
Associated samples:										
I-CAL 4:			13)	14)	15)	16)				
Associated samples:										
I-CAL 5:			17)	18)	19)	20)				
Associated samples:										
I-CAL 6:			21)	22)	23)	24)				
Associated samples:										

CONTINUING CALIBRATION

Include samples, dilutions, reanalyses, spikes & blanks

CONTINUING CALIBRATION	DATE & TIME CALIBRATED	ASSOC. I-CAL DATE	DAILY RRF ≥ 0.05 Y/N	%D ≤ 25 % Y/N	CALCULATIONS CHECKS: MIN. 1 DAILY RRF	CALCULATIONS CHECKS: MIN. 1 %D	COMPOUNDS FAILING CRITERIA (Note if compounds are SPCC or CCC)
C-CAL 1:	1/12/00 (2328)	1/11/00	1) Y	2) NO	✓	✓	Acetone 27.7 – UJ ✓
Associated samples:	All						
C-CAL 2:			3)	4)			
Associated samples:							
C-CAL 3:			5)	6)			
Associated samples:							
C-CAL 4:			7)	8)			
Associated samples:							
C-CAL 5:			9)	10)			
Associated samples:							
C-CAL 6:			11)	12)			
Associated samples:							

BLANKS

Include method, trip, equipment & field blanks

BLANK NUMBER & TYPE (Method, Trip, Equipment, Field)	EXTRACTABLES DATE EXTRACTED	DATE ANALYZED	CORRECT MATRIX & LEVEL Y/N	FREQ-UENCY MET Y/N	ENTER BLANK CONTAMINANTS FOLLOWED BY CONCENTRATION	COMMENTS
BLK #/TYPE (meth) VBLK63	/	1/17/00 0021	Y	Y	no hits	none /
Associated samples: All						
BLK #/TYPE storage VHBLK67	/	1/17/00	Y	Y	no hits	
Associated samples: All						
BLK #/TYPE						
Associated samples:						
BLK #/TYPE						
Associated samples:						
BLK #/TYPE						
Associated samples:						
BLK #/TYPE						
Associated samples:						

SURROGATES & INTERNAL STANDARDS

Include samples, dilutions, reanalyses, spikes & blanks which do not meet criteria.

#	SAMPLE NUMBER (Include sample number if limits not met)	SURROGATES: RECOVERIES WITHIN LIMITS FORM II Y/N	SURROGATES: IF NOT, RE-EXT./ RE-ANAL Y/N	SURROGATES: RE-EXT/ RE-ANAL WITHIN LIMITS Y/N	INTERNAL STDS.: AREAS WITHIN LIMITS MET Y/N	INTERNAL STDS.: R.T.S. WITHIN LIMITS Y/N	SURR & IS: CALC. OK	SURROGATES OUTSIDE QC LIMITS*	INTERNAL STANDARDS OUTSIDE QC LIMITS*	ACTIONS/COMMENTS
1	All	y	—	—	y	y	OK	None out	None out	None
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
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19										
20										
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23										
24										
25										

*Indicate whether surrogate recovery (or internal standard area) was above or below QC limits. Use for extremely low surrogate recoveries (<10%) or internal standard areas (<2x the lower limit)

SPIKES ,LFBs, & LCSs

Include matrix spikes & laboratory fortified blanks which do not met spiking criteria

TYPE OF SPIKE (Circle One) & ID NUMBER	DATE & TIME ANALYZED	FREQUENCY CRITERIA MET Y/N	SPIKED AT CORRECT LEVEL Y/N	CALC. & TRANS. OK Y/N	LIST SPIKING COMPOUNDS OUTSIDE PERCENT RECOVERY CRITERIA (Followed by percent recovery)	LIST MS/MSD SPIKING COMPOUNDS OUTSIDE RPD CRITERIA (Followed by RPD)	ACTIONS/COMMENTS
LFB / MS / MSD / LCS # Hw 9975 ✓	1/13/00	✓	✓	✓	none o-t	Benzene 12 -11 ✓	
Associated samples: All							
LFB / MS / MSD / LCS #							
Associated samples:							
LFB / MS / MSD / LCS #							
Associated samples:							
LFB / MS / MSD / LCS #							
Associated samples:							
LFB / MS / MSD / LCS #							
Associated samples:							
LFB / MS / MSD / LCS #							
Associated samples:							

COMPOUND IDENTIFICATION, QUANTITATION & MDLS

Include samples, dilutions, reanalyses & blanks

#	SAMPLE NUMBER (Include if problems exist)	ID CRITERIA		COMMENTS & COMPOUNDS FAILING ID CRITERIA	SPECTRA PRESENT (TCL & TIC) Y/N	CALC. CHECKS		TRANS-CRIPTION ERRORS Y/N	ACTIONS/COMMENTS
		RRT (0.06) MET Y/N	MASS SPECTRAL MET Y/N			MDLS CORRECT Y/N	CHECK 1-3 HIT(S) PER SAMPLE		
1	Blanks	—	—	none	—	✓	✓	—	
2	435	✓	✓		✓	✓	—	—	None
3									
4									
5									
6									
7									
8									
9									
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25									

For all worksheets: (1) If a particular category is "Not Applicable," denote with N/A (2) Calculation checks performed by validators.

SYSTEM PERFORMANCE, DATA COMPLETENESS & ADDITIONAL QC

Include samples for which problems exist.

SYSTEM PERFORMANCE			DATA COMPLETENESS	
#	SAMPLE NUMBER	*IDENTIFY FACTORS THAT INDICATE SYSTEM* PERFORMANCE PROBLEMS (e.g. Baseline Shifts, Large Air Peaks, I.S. Area Changes, etc.)	SAMPLE NUMBER	OTHER MISSING DATA (including Mass Spectra)

Include field duplicates.

ADDITIONAL, QC		
FIELD DUPLICATE SAMPLE NUMBERS	LIST COMPOUNDS WITH RPDs OUTSIDE RPD CRITERIA (followed by RPD)	ACTION/COMMENTS
	N/A	

REGION VIII
DATA VALIDATION REPORT
INORGANIC

Case No. / TDD No.	Site Name		Operable Unit
27716 / 75-80314	Mt. Olivet Cemetery		
RPM/OSC Name			
Luke Chavez			
Contractor Laboratory	Contract No.	SDG No.	Laboratory DPO/Region
Sentinel, Inc.	68-D5-0169	MHEP01	

Review Assigned Date January 31, 2000 Data Validator Bill Fear
Review Completion Date February 2, 2000 Report Reviewer Amy Ballow

Sample ID	Sample Location	Matrix	Analysis
MHEP01	EPA-MW-06	Water	CLP - Metals and Mercury

DATA QUALITY STATEMENT

( ) Data are ACCEPTABLE according to EPA Functional guidelines with no qualifiers (flags) added by the reviewer.
( ) Data are UNACCEPTABLE according to EPA Functional Guidelines.
(X) Data are acceptable with QUALIFICATIONS noted in review.

Telephone/Communication Logs Enclosed? Yes _____ No ___X___

TPO Attention Required? Yes _____ No ___X___ If yes, list the items that require attention:

INORGANIC DATA VALIDATION REPORT

REVIEW NARRATIVE SUMMARY

This data package was reviewed according to "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," February 1994.

Raw data were reviewed for completeness and transcription accuracy onto the summary forms. Approximately 10-20% of the results reported in each of the samples, calibrations, and QC analyses were recalculated and verified. If problems were identified during the recalculation of results, a more thorough calculation check was performed.

The data package, Case No. 27716, SDG No. MHEP01, consisted of one water sample for CLP metals and mercury.

The following table lists the data qualifiers added to the sample analyses. Please see Data Qualifier Definitions, attached to the end of this report.

Sample ID	Elements	Qualifiers	Reason for Qualification	Review Section
MHEP01	Chromium Copper Lead Vanadium	U	Blank contamination	VII
	Thallium	J	Negative blank contamination	
	Antimony Selenium	J/UJ	Matrix spike recoveries less than QC limits	IX
	Barium Potassium	J	Serial dilution %D greater than 10% and original sample value at least 50*IDL	XV

Method/SOW Number ILM04.0
Revision 0.0

Inorganic Deliverables Completeness Checklist

P Inorganic Cover Page
P Inorganic Analysis Data Sheets (Form I)
P Initial Calibration and Calibration Verification Results (Form II)
P Continuing Calibration Verification Results (Form II)
P CRDL Standard for ICP and AA (Form II, Part 2)
P Blank Analysis Results (Form III)
P ICP Interference Check Sample Results (Form IV)
P Spiked Sample Results (Form V)
P Post-digest Spiked Sample Analysis (Form V, Part 2)
P Duplicate Sample Results (Form VI)
P Instrument Detection Limits (Form VII) or (Form X - Quarterly)
P Laboratory Control Sample results (Form VII)
NA Standard Addition Results (Form VIII)
P ICP Serial Dilution Results (Form IX)
NA Holding Times Summary Sheet (Form X)
P ICP Interelement Correction Factors (Form XII - Quarterly, or Form XI - Annually)
P ICP Linear Ranges (Form XII (XII) - Quarterly)
P Raw Data

P Samples	P Calibration Standards	P Blanks	P Spikes
P Duplicates	P ICP QC (ICS and Serial Dilution	P LCS	
NA Furnace AA	P Mercury Analysis	NA Cyanide Analysis	

NA Percent Solids Calculations - (Solids Only)
P Sample Prep/Digestion Logs (Form XIII)
P Analysis Run Log (Form XIV)
P Chain-of-Custody
P Sample Description
NP Case Narrative
P Method References

KEY:
P = Provided in original data package, as required by the SOW
R = Provided as Resubmission
NP = Not provided in original data package or as resubmission
NR = Not required under the SOW
NA = Not applicable to this data package or analysis

I. DELIVERABLES

All deliverables were present as specified in the Statement of Work.

Yes_X_ No___

Comments: None.

II. HOLDING TIMES AND PRESERVATION CRITERIA

All method holding times were met.

Yes_X_ No___

Comments: None.

All technical holding times and preservation criteria were met.

Yes_X_ No___

Comments: The sample was properly preserved and analyzed within required holding times. No shipping or receiving problems were noted.

III. INSTRUMENT CALIBRATIONS: STANDARDS AND BLANKS

Initial instrument calibrations were performed according to SOW requirements.

Yes_X_ No___

Comments: None.

The instruments were calibrated daily and each time an analysis run was performed.

Yes_X_ No___

Comments: None.

The instruments were calibrated using one blank and the appropriate number of standards.

Yes_X_ No___

Comments: None.

IV. FORM 1 - SAMPLE ANALYSIS RESULTS

Sample analyses were entered correctly on Form Is.

Yes_X_ No___

Comments: None.

V. FORM 2A - INITIAL AND CONTINUING CALIBRATION VERIFICATION

The initial and continuing calibration verification standards (ICV and CCV, respectively) met SOW requirements.

Yes_X_ No___

Comments: The calibration correlation coefficient for mercury was greater than 0.995.

The calibration verification results were within 90-110% recovery for metals, 85-115% for cyanide, and 80-120% for mercury.

Yes_X_ No___

Comments: None.

The continuing calibration standards were run at 10% frequency.

Yes_X_ No___

Comments: None.

VI. FORM 2B - CRDL STANDARD FOR ICP AND AA

ICP Analysis: Standards (CRI) at two times the CRDL or the IDL (whichever were greater) were analyzed at the beginning and the end of each sample run, or at a minimum of twice per eight hours, whichever was more frequent.

Yes_X_ No___

Comments: None.

GFAA Analysis: Standards (CRA) at two times CRDL were analyzed at the beginning of each sample run.

Yes___ No___ NA_X_

Comments: None.

The CRI and/or the CRA were analyzed after the ICV.

Yes_X_ No___

Comments: None.

VII. FORM 3 - BLANKS

The initial and continuing calibration blanks (ICB and CCB, respectively) met SOW requirements.

Yes_X_ No___

Comments: None.

The continuing calibration blanks were run at 10% frequency.

Yes_X_ No___

Comments: Continuing calibration blanks were run every 10 samples.

A laboratory/preparation blank was run at the frequency of one per twenty samples, or per sample delivery group (whichever is more frequent), and for each matrix analyzed.

Yes_X_ No___

Comments: None.

All analyzed blanks were free of contamination.

Yes___ No_X_

Comments: The following table lists the blanks with contamination, elements present, affected samples, and data qualifiers:

Blank Contaminants

Blank ID	Date	Contaminant	Concentration Found in Blank (ug/L)	IDL (ug/L)	Associated Samples	Concentration Found in Sample (ug/L)	Qualifier/ Adjustment
ICB	01/12/00	Chromium	0.5	0.3	MHEP01	0.70	U
		Lead	1.3	1.1		1.7	
		Vanadium	0.7	0.5		2.8	
CCB1		Copper	0.7	0.5		1.6	
CCB2		Thallium	-2.2	2.1		3.5	J

VIII. FORM 4 - ICP INTERFERENCE CHECK SAMPLE

The ICP interference check sample (ICS) was run twice per eight hour shift and/or at the beginning and end of each sample set analysis sequence (whichever is more frequent).

Yes_X_ No___

Comments: None.

Percent recovery of the analytes in solution ICSAB were within the range of 80-120%.

Yes_X_ No___

Comments: None.

Sample results for aluminum, calcium, iron, and magnesium were less than the ICSA values.

Yes_X_ No___

Comments: None.

IX. FORM 5A - MATRIX SPIKE SAMPLE ANALYSIS

A matrix spike sample was analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes_X_ No___

Comments: None.

The percent recoveries (%R) were calculated correctly.

$$\%\ Recovery = \frac{(SSR - SR)}{SA} \times 100$$

SSR = spiked sample result
SR = sample result
SA = spike added

Yes_X_ No___

Comments: None.

Spike recoveries were within the range of 75-125% (an exception is granted where the sample concentration is four times the spike concentration).

Yes___ No_X_

Comments: The following table lists the spike recoveries outside control limits, matrix, samples affected, and data qualifiers:

Element	Spike Recovery	Matrix	Samples Affected	Qualifiers
Antimony	61.6%	Water	MHEP01	UJ
Selenium	63.2%			J

X. FORM 5B - POST DIGEST SPIKE RECOVERY

A post-digest spike was performed for those elements that did not meet the specified criteria (i.e., Pre-digestion/pre-distillation spike recovery falls outside of control limits and sample result is less than four times the spike amount added, exception: Ag, Hg).

Yes_X_ No___ Not Required___

Comments: Post digestion spike recoveries for the antimony and selenium were within QC limits. Post digestion spike results do not affect sample qualification.

XI. FORM 6 - DUPLICATE SAMPLE ANALYSIS

Duplicate sample analysis was performed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes_X_ No___

Comments: None.

The RPDs were calculated correctly.

$$RPD = \frac{(S - D)}{(S + D)/2} \times 100$$

S = sample
D = duplicate

Yes X No___

Comments: None.

For sample concentrations greater than five times the CRDL, RPDs were within ±20% (limits of ±35% apply for soil/sediments/tailings samples).

Yes X No___ NA___

Comments: None.

For sample concentrations less than five times the CRDL, duplicate analysis results were within the control window of ± CRDL (two times CRDL for soils).

Yes X No___

Comments: None.

XII. GFAA QC

Duplicate injections were performed on all GFAA samples and the RSD was within ± 20%.

Yes___ No___ NA X

Comments: GFAA analyses were not performed on these samples.

Analytical spikes were performed on all GFAA samples and the percent recovery was 85 - 115%.

Yes___ No___ NA X

Comments: GFAA analyses were not performed on these samples.

MSAs were analyzed when required and the correlation coefficient was > 0.995.

Yes___ No___ NA_X_

Comments: None.

XIII. FORM 7 - LABORATORY CONTROL SAMPLE

The laboratory control sample (LCS) was prepared and analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes_X_ No___

Comments: None.

All results were within control limits.

Yes_X_ No___

Comments: All LCS recoveries were within the control limits of 80-120%.

XIV. FORM 8 - STANDARD ADDITION RESULTS

Results from graphite furnace standard additions were entered on Form VIII as directed in the SOW.

Yes___ No___ NA_X_

Comments: None.

XV. FORM 9 - ICP QC

A serial dilution was performed for ICP analysis with every twenty or fewer samples of a similar matrix, or one per sample delivery group, whichever is more frequent.

Yes_X_ No___

Comments: None.

The serial dilution was without interference problems as defined by the SOW.

Yes___ No_X_

Comments: The following serial dilution %Ds were greater than 10% and the original sample results were at least 50* the IDLs:

Element	% Difference	Samples Affected	Qualifiers
Barium	15.9%	MHEP01	J
Potassium	11.4%		

XVI. FORM 10 - QUARTERLY INSTRUMENT DETECTION LIMITS (IDL)

IDLs were provided for all elements on the target analyte list.

Yes_X_ No___

Comments: None.

Reported IDLs met SOW requirements.

Yes_X_ No___

Comments: None.

XVII. FORM 11 - INTERELEMENT CORRECTION FACTORS FOR ICP

Interelement corrections for ICP were reported.

Yes_X_ No___

Comments: None.

XVIII. FORM 12 - ICP LINEAR RANGES

ICP linear ranges were reported.

Yes_X_ No___

Comments: None.

XIX. LINEAR RANGE VERIFICATION ANALYSIS

Linear Range Verification Analysis (LRA) was performed and results were within control limits of ± 5% of the true value.

Yes___ No___ NA_X_

Comments: None.

XX. FORM 13 - PREPARATION LOG

Information on the preparation of samples for analysis was reported on Form XIII.

Yes_X_ No___

Comments: None.

XXI. FORM 14 - ANALYSIS RUN LOG

A Form XIV with the required information was filled out for each analysis run in the data package.

Yes_X_ No___

Comments: None.

XXII. Additional Comments or Problems/Resolutions Not Addressed Above

Yes___ No_X_

Comments: None.

INORGANIC DATA QUALITY ASSURANCE REVIEW

Region VIII

DATA QUALIFIER DEFINITIONS

For the purpose of Data Validation, the following code letters and associated definitions are provided for use by the data validator to summarize the data quality. Use of additional qualifiers should be carefully considered. Definitions for all qualifiers used should be provided with each report.

GENERAL QUALIFIERS for use with both INORGANIC and ORGANIC DATA

R - Reported value is "rejected." Resampling or reanalysis may be necessary to verify the presence or absence of the compound.

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.

U J - The reported quantitation limit is estimated because Quality Control criteria were not met. Element or compound was not detected.

N J - Estimated value of a tentatively identified compound. (Identified with a CAS number.) ORGANICS analysis only.

U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

ACRONYMS

AA	Atomic Absorption
Ag	Silver
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CRA	CRDL standard required for AA
CRDL	Contract Required Detection Limit
CRI	CRDL standard required for ICP
CV	Cold Vapor
EPA	U.S. Environmental Protection Agency
GFAA	Graphite Furnace Atomic Absorption
Hg	Mercury
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
ICSA	Interference Check Sample (Solution A)
ICSAB	Interference Check Sample (Solution AB)
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
LRA	Linear Range Verification Analysis
MSA	Method of Standard Additions
PDS	Post Digestion Spike
QC	Quality Control
RPD	Relative Percent Difference
RPM	Regional Project Manager
RSD	Percent Relative Standard Deviation
SA	Spike Added
SAS	Special Analytical Services
SDG	Sample Delivery Group
SOW	Statement of Work
SR	Sample Result
SSR	Spiked Sample Result
TPO	Technical Project Officer

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

MHEP01

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

Matrix (soil/water): WATER Lab Sample ID: 28628S

Level (low/med): LOW Date Received: 01/07/2000

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.9	U		P
7440-36-0	Antimony	2.1	U	N	P
7440-38-2	Arsenic	2.2	U		P
7440-39-3	Barium	56.1	B	E	P
7440-41-7	Beryllium	0.10	U		P
7440-43-9	Cadmium	0.30	U		P
7440-70-2	Calcium	107000			P
7440-47-3	Chromium	0.70	B		P
7440-48-4	Cobalt	0.60	U		P
7440-50-8	Copper	1.6	B		P
7439-89-6	Iron	18.6	U		P
7439-92-1	Lead	1.7	B		P
7439-95-4	Magnesium	35500			P
7439-96-5	Manganese	2.4	U		P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	1.3	U		P
7440-09-7	Potassium	2000	B	E	P
7782-49-2	Selenium	2.3	B	N	P
7440-22-4	Silver	0.40	U		P
7440-23-5	Sodium	40400			P
7440-28-0	Thallium	3.5	B		P
7440-62-2	Vanadium	2.8	B		P
7440-66-6	Zinc	12.9	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

RF 1/26/00

I. INORGANIC ANALYSIS WORKSHEET – HOLDING TIMES

TDD# 75-8031 4

BATCH: MHEP01 27716

List all analytes which do not meet holding time criteria

Sample ID	Matrix	List Pre-servative (A, B, C)	Date Collected	*Metals Analysis Date/s	*Hg CVAA Analysis Date	*CN Analysis Date	Analysis Date/s	No. of Days Past Holding Time	Action
MHEP01	W	A	1-6-00	1-12-00	1-10-00	—	—	-0-	None

COMMENTS Collection date from sample Tag not on COC

Actions:

1. If holding times are exceeded, all sample results are estimated (J)/(UJ).
2. If holding times are grossly exceeded (>=2*holding time), detected results are estimated (J), and non-detected results are rejected (R).

Validated by: Bill F— Date: 1/28/00

Review By: Amy Ballow Date: 02·01·00

Preservatives:

A. Preserved w/HNO3 and cooled to 4°C
B. Cooled to 4°C
C. No Preservative

ANALYTE	HOLDING TIME	PRESERVATIVE AQUEOUS	SOIL
Metals	180 days	pH < 2 w/HNO3, 4 Deg. C	4 Deg. C
Mercury	28 days	pH < 2 w/HNO3, 4 Deg. C	4 Deg. C
Cyanide	14 days	pH > 12 w/NaOH, 4 Deg. C	4 Deg. C

Holding Time = Analysis Date - Collection Date

*VERIFY ANALYSIS DATES ON REPORT MATCH RAW DATA.

TECHLAW

IIA. INORGANIC ANALYSIS WORKSHEET – ICP CALIBRATIONS

BATCH: MHE901

List all ICP analytes that did not meet the percent recovery criteria for initial calibration verification (ICV) and continuing calibration verification (CCV).

Analyte	ICV CCV	TRUE	Found	% R	Action	Samples Affected
						~~All within limits~~
Mg	CCV3	12500	13711	110.3%	none	less than bracket ✓

CCV run after CRI, every 10 samples and at end of sequences? (CLP only) (Yes) No

Was a CRDL check sample (CRI) analyzed at the beginning and at the end of each sample run (CLP only)? (Yes) No

COMMENTS

Actions:

ICV/CCV Actions:

	PERCENT RECOVERY				
	<75%	75-89%	90-110%	111-125%	>125%
Detected results	R	J	V	J	R
Non-detected Results	R	UJ	V	V	V

1. If the instrument was not calibrated daily and each time the instrument was set up, qualify the data as rejected (R).

IIB. INORGANIC ANALYSIS WORKSHEET -- AA CALIBRATIONS

BATCH:_____

List all AA analytes that did not meet the percent recovery criteria for initial calibration verification (ICV) and continuing calibration verification (CCV).

Analyte	ICV CCV	TRUE	Found	% R	Action	Samples Affected

1. Were the correct number of standards and blanks used to calibrate the instrument? Yes No

2. Is the initial calibration correlation coefficient > 0.995? Yes No

If no, list affected analytes and samples:

3. Was a CRDL check sample (CRA) analyzed at the beginning of each sample run? (CLP only) Yes No

4. CCV run after CRA, every ten samples and at end of sequence? Yes No

COMMENTS

Actions:

ICV/CCV Actions:

	PERCENT RECOVERY				
	<75%	75-89%	90-110%	111-125%	>125%
Detected results	R	J	V	J	R
Non-detected Results	R	UJ	V	V	V

1. If three standards and a blank were not used for initial calibration, or the instrument was not calibrated daily and each time the instrument was set up, qualify the data as rejected (R).
2. If the initial calibration correlation coefficient was less than 0.995, qualify sample results as estimated (J)/(UJ).

TECHLAW

IIC. INORGANIC ANALYSIS WORKSHEET – Hg CALIBRATIONS

BATCH: MHE201

List all mercury results that did not meet the percent recovery criteria for the ICV and/or CCV standard.

ICV CCV	TRUE	Found	% R	Action	Samples Affected
					All within limits ✓

1. Were the correct number of standards and blanks used to calibrate the instrument? (Yes) No
2. Is the initial calibration correlation coefficient > 0.995? (Yes) No 0.99984
   If no, list affected analytes and samples:
3. Was a CRDL check sample (CRA) analyzed at the beginning of each sample run? (CLP only) (Yes) No
4. CCV run after CRA, every ten samples and at end of sequence? (Yes) No

COMMENTS

Actions:

	PERCENT RECOVERY				
	<65%	65-79%	80-120%	121-135%	>135%
Detected results	R	J	V	J	R
Non-detected Results	R	UJ	V	V	V

1. If four standards and a blank were not used for initial calibration, or the instrument was not calibrated daily and each time the instrument was set up, qualify the data as rejected (R).
2. If the initial calibration correlation coefficient was less than 0.995, qualify sample results as estimated (J)/(UJ).

TECHLAW

IID. INORGANIC ANALYSIS WORKSHEET -- CN CALIBRATIONS

BATCH:________________

List all cyanide results that did not meet the percent recovery criteria for the ICV and/or CCV standard.

ICV CCV	TRUE	Found	% R	Action	Samples Affected
					NA

1. Were the correct number of standards and blanks used to calibrate the instrument? Yes No
2. Is the initial calibrations correlation coefficient > 0.995? Yes No
   If no, list affected analytes and samples:
3. Was the mid-range calibration standard or an ICV distilled? Yes No
   If no, list affected samples:

COMMENTS

Actions:

	PERCENT RECOVERY				
	<70%	70-84%	85-115%	116-130%	>130%
Detected results	R	J	V	J	R
Non-detected Results	R	UJ	V	V	V

1. If three standards and a blank were not used for initial calibration, or the instrument was not calibrated daily and each time the instrument was set up, qualify the data as rejected (R).
2. If the initial calibration correlation coefficient was less than 0.995, qualify sample results as estimated (J)/(UJ).
3. If a mid-range standard (or ICV) was not distilled, qualify sample results as estimated (J)/(UJ).

TECHLAW

III. INORGANIC ANALYSIS WORKSHEET – BLANKS

MATRIX: Water BATCH: MHE01

List the highest positive AND negative blank result >=|DL| below. Use one worksheet for soil matrix and another for water matrix.

Analyte	ICB CCB PB/MB	IDL	Blank Conc.	5 * Bl. Conc.	Action	Samples Affected
Al	CCB1				—	no hit in sample
Sb	ICB		4.8			no hit sample
Ba	ICB		1.3	6.5	—	> 5x
Be	various				—	no hit in sample
Ca			1.2		—	no hit
Cr	ICB	0.3	0.5	2.5	(U)	MHE01 (0.20)
Co	various				—	no hit
Cu	CCB1	0.5	0.7	3.5	(U)	MHE01 (1.6)
Fe	various				—	no hit
Pb	ICB	1.1	1.3	6.5	(U)	MHE01 (1.2)
Mg	ICB		547	273	—	> 5x
K	ICB		26.8	134	—	> 5x
Ag	various				—	no hit
Na	CCB	155.1	776	3868	—	> 5x
Tl	CCB2	21	-2.2	-11	(U)	MHE01 (3.5)
Ni	CCB	—	does not bracket		—	
V	ICB	0.5	0.7	3.5	(U)	EP01 (2.8)

NOTE: Verify that the absolute value of any analyte concentration in the PB or MB is < CRDL *

Verify

One prep blank per matrix	use CCB1 & 2
One prep blank per batch	
ICB analyzed immediately after ICV	
CCB analyzed after each CCV.	
Field/equipment/rinsate blanks analyzed? If so, include above if applicable to project.	
COMMENTS	

Actions:

1. If |Blank| < IDL, no action is taken.
2. If Blank > = IDL, then all sample results > = IDL and < 5*Blank are non-detected (U).
3. If Blank = < -IDL, all sample results > = IDL and < 5* |Blank| are estimated (J).
4. If Blank = < -IDL then all non-detected results are estimated (UJ).

* If blank concentration > CRDL, all detected sample results < 5 *Blanks are rejected (R).

* If blank concentration > CRDL, all detected sample results > 5 *Blanks and < 10* Blank are estimated (J).

IVA. INORGANIC ANALYSIS WORKSHEET – ICP INTERFERENCE CHECK SAMPLE

BATCH: MHEP01

NOTE: The sample results can be accepted without qualification, if the sample concentrations of Al, Ca, Fe and Mg are less than or equal to the concentration found in the ICSA solution.

Examine the sample results in ug/L and list any Al, Ca, Fe or Mg results that are greater than the ICSA values.

Sample ID	Analyte	Sample Result	ICS Value	Comments
				none
				< ICSA

List any analytes in the ICS AB solution that did not meet the criteria of 80-120% R.

Analyte	% R	Action	Samples Affected
			w/in 80-120%

CLP Protocol Only

Were Interference Check Samples run at the beginning and end of each sample analysis run, or a minimum of twice per 8-hour shift (whichever is more frequent)? Yes No

COMMENTS

Actions:

PERCENT RECOVERY

	<50%	50-79%	80-120%	>120%
Detected results	R	J	V	J
Non-detected results	R	UJ	V	V

IVB. INORGANIC ANALYSIS WORKSHEET – ICP INTERFERENCE CHECK SAMPLE

BATCH: MHEP01

Note: For the CLP protocol only, report the concentration of any analytes detected in the ICSA solution > |IDL | that should not be present (apply only to samples with elements identified at concentrations above the ICSA on the previous page).

Analyte	ICSA Result	Action	Sample/ Result	Sample/ Result	Sample/ Result	Sample/ Result	Sample/ Result	Sample/ Result
N/A								

Actions:

If the ICSA value > the positive IDL:

1. For non-detected results, no action is taken.
2. Estimate (J) all detected results < = 5*ICSA.

If the ICSA value < -IDL:

1. Estimate (J) detected results < = 5* |ICSA|.
2. Estimate (UJ) non-detected results.

V. INORGANIC ANALYSIS WORKSHEET – PRE-DIGESTION MATRIX SPIKE

MATRIX: H_2O BATCH: MHE01

List all parameters that do not meet the percent recovery criteria. Note: The pre-digestion spike recovery criteria are not evaluated for Ca, Mg, K, Na, Al and Fe for soil samples, and Ca, Mg, K and Na for water samples.

If the sample result exceeds the spike added by a factor of 4 or more, no action is taken.

Sample ID	Analyte	Spiked Sample Result	Sample Results	Spike Added	% R	Action	Samples Affected
01	Sb.	308.2	—	500	61.6% ✓	UJ	01
	Se	8.6	2.28	10.0	63.2% ✓	J	01

1. Was a pre-digestion matrix spike prepared at the required frequency of once every 20 samples, or every SDG (whichever is more frequent)? (Yes) No

2. Was a post-digestion matrix spike analyzed for all ICP elements, except Silver, that did not meet the pre-digestion matrix spike recovery criteria? (Yes) No NA both within limits ✓

3. Was a matrix spike prepared for each different sample matrix? Yes No

COMMENTS H_2O

1. If any analyte does not meet the % R criteria, qualify all associated samples using the following criteria:

Actions:

PERCENT RECOVERY

	< 30%	30-74%	75-125%	> 125%
Detected results	J	J	V	J
Non-detected Results	R	UJ	V	V

Note

If analyte concentrations in the sample is greater than 4 times the amount spiked, then limits do not apply.

TECHLAW

VI. INORGANIC ANALYSIS WORKSHEET – LABORATORY DUPLICATES

MATRIX: H2O BATCH: MHEP01

List all parameters that do not meet RPD or CRDL criteria.

Sample ID	Analyte	Sample Result	Dup. Results	RPD	Difference[3]	Action	Samples Affected
		All criteria were met ✓					

COMMENTS

Actions:

1. AQUEOUS
If both sample values > 5*CRDL, estimate (J/UJ) all sample results of the same matrix if the RPD is > 20%.
If either sample value < 5*CRDL, and the difference between the duplicate and the original is > CRDL, estimate (J)/(UJ) all sample results of the same

2. SOLID
If both sample value > 5*CRDL, estimate (J/UJ) all sample results of the same matrix if the RPD is > 35%.
If either sample value < 5*CRDL, and the difference between the duplicate and the original is > 2*CRDL, estimate (J)/(UJ) all sample results of the

Difference = |Sample result - Duplicate sample result|
Include outliers for field duplicates (if applicable)
Note
A duplicate sample must be prepared for each sample matrix analyzed or per batch, whichever is more frequent.

VII. INORGANIC ANALYSIS WORKSHEET – LABORATORY CONTROL SAMPLES

MATRIX: H_2O BATCH: MHE301

List all parameters that do not meet the percent recovery criteria.

LCS ID	Analyte	True Value	Found Value	% R	Action	Samples Affected
						All w/in 60-20%.

Note:

LCS with the same matrix as samples must be prepared for each SDG.

COMMENTS

Actions:

Exception: Antimony and silver have no control limits. An aqueous LCS is not required for CN and mercury.

	PERCENT RECOVERY			
1. AQUEOUS	<50%	50-79%	80-120%	>120%
Detected results	R	J	V	J
Non-detected results	R	UJ	V	V

2. SOLID LCS

Recoveries stipulated by EMSL

	BELOW CONTROL LIMITS	WITHIN CONTROL LIMITS	ABOVE CONTROL LIMITS
Detected results	J	V	J
Non-detected results	UJ	V	V

VIIIA. INORGANIC ANALYSIS WORKSHEET – ANALYTICAL SPIKE ANALYSIS

BATCH:________________

List all samples whose analytical spike recovery did not meet the 85-115% recovery criteria.

Analyte	Sample ID	Sample Result	Spiked Sample Result	True Spike Value	% R	Action	Comment
							NA

1. Spike Recovery for CLP Protocol: One point analytical spikes were performed for all GFAA samples? Yes No
2. Spike Recovery for SW-846: One analytical spike was analyzed per batch or matrix, whichever is more frequent? Yes No

COMMENTS

If the sample result is <50% of the spike result, or the sample result is >50% of the spike result* and the percent recovery is <40% or between 80-115%, the following apply.

Actions:	10%	10-84%	85-115%	>115%
	PERCENT RECOVERY			
Detected results	J	J	V	J
Non-detected results	R	UJ	V	V

*Spike result = [spiked sample result - sample result]

VIIIB. INORGANIC ANALYSIS WORKSHEET – FURNACE AA ANALYSIS

BATCH:_____

If the sample result is > = 50% of the spike result and the percent recovery was between 40-84% or > 115%, then MSA must be performed.

List all samples for which an MSA analysis was required but not performed, or MSA results were outside control limits.

Analyte	Sample ID	1st Corr. Coeff.	2nd Corr. Coeff.	Action	Comments

Actions:

1. Estimate (J/UJ) if an MSA was required and not performed.
2. If the correlation coefficient was <0.995, the MSA should be performed a second time. If a reanalysis was not performed, or the reanalysis correlation coefficient was <0.995, or result from the highest correlation coefficient was not reported, then estimate (J/UJ) all sample results.

List all sample > CRDL whose duplicate injections did not agree within 20% RSD or CV, or samples in which duplicate injections were not performed.

Analyte	Sample ID	Sample Result	Duplicate Result	% RSD or CV	CRDL	Action	Comment

*Spike result = |spiked sample result - sample result|

Actions:

1. Estimate (J) detected results greater than the CRDL if duplicate injections are outside 20% RSD.
2. Estimate (J) all sample results if duplicate injections were not performed.

NOTE: Three separate spiked sample concentration levels, in addition to the unspiked sample must be analyzed for each MSA.

IX. INORGANIC ANALYSIS WORKSHEET – ICP SERIAL DILUTION ANALYSIS

MATRIX: Water BATCH: MHE201

Serial dilution criteria only applies if the original sample result is at least 50* IDL and %D > 10%.

Analyte	IDL	50*IDL	Sample Results	Serial Dilution Result	% D	Action	Samples Affected
Ba	0.8	40	56.1	65.0	15.9	J	01 ✓
K	32	160	2007	2233	11.4	J	01 ✓

INDUCTIVELY COUPLED PLASMA SERIAL DILUTION ANALYSIS:

Serial dilutions were performed for each matrix and results of the diluted sample analysis agreed within ten percent of the original undiluted analysis. Yes No

Serial dilutions were not performed for the following:

COMMENTS CA 2592×50 129600
Cu 0.5×50 – ICP [illegible] [illegible] < 50 RD ok [illegible]
Pb 1.1 – JS

Actions:

Estimate (J) detected results if %D is > 10%.

NOTES

If results from diluted samples are higher than concentrated sample, matrix interference should be suspected and sample results may be biased low.

X. METAL ANALYSIS WORKSHEET – SAMPLE RESULT VERIFICATION

BATCH: MHEAV

1. Describe any raw data anomalies (i.e., baseline shifts, negative absorbances, transcription or calculation errors, legibility, etc.

none

2. List results that fall outside the linear range of the ICP instrument or the calibrated range of the AA or Cyanide instrument, and were not reanalyzed.

no dilutions required

3. Were ICP linear ranges obtained within 3 months of, and preceding, the sample analyses?	(Yes)	No	NA
4. Were ICP interelement corrections obtained within 12 months of, and preceding, the sample analyses?	(Yes)	No	NA
5. Were instrument detection limits present, found to be less than or equal to the CRDL, and obtained within 3 months of, and preceding, the sample analyses?	(Yes)	No	NA
6. Were all sample results reported down to the IDL if running CLP protocol?	(Yes)	No	NA
7. Were all sample results reported down to MDL if running SW-846 methods?	Yes	No	NA
8. Were sample weights, volumes, percent solids, and dilutions used correctly when reporting the results?	(Yes)	No	

COMMENTS None.

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10
INSTRUMENT DETECTION LIMITS (QUARTERLY)

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

ICP ID Number: P4 Date: 10/15/1999

Flame AA ID Number:

Furnace AA ID Number:

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Aluminum	308.20		200	34.9	P
Antimony	206.80		60	2.1	P
Arsenic	189.00		10	2.2	P
Barium	493.40		200	0.8	P
Beryllium	313.00		5	0.1	P
Cadmium	226.50		5	0.3	P
Calcium	317.90		5000	2592.0	P
Chromium	267.70		10	0.3	P
Cobalt	228.60		50	0.6	P
Copper	324.70		25	0.5	P
Iron	271.40		100	18.6	P
Lead	220.30		3	1.1	P
Magnesium	279.00		5000	38.8	P
Manganese	257.60		15	2.4	P
Mercury			0.2		NR
Nickel	231.60		40	1.3	P
Potassium	766.40		5000	3.2	P
Selenium	196.00		5	1.8	P
Silver	328.00		10	0.4	P
Sodium	330.20		5000	155.1	P
Thallium	190.80		10	2.1	P
Vanadium	292.40		50	0.5	P
Zinc	206.20		20	12.9	P
Cyanide			10		NR

Comments:
P4: THERMO JARRELL ASH

U.S. EPA - CLP

10

INSTRUMENT DETECTION LIMITS (QUARTERLY)

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

ICP ID Number: Date: 10/15/1999

Flame AA ID Number: C5

Furnace AA ID Number:

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Aluminum			200		NR
Antimony			60		NR
Arsenic			10		NR
Barium			200		NR
Beryllium			5		NR
Cadmium			5		NR
Calcium			5000		NR
Chromium			10		NR
Cobalt			50		NR
Copper			25		NR
Iron			100		NR
Lead			3		NR
Magnesium			5000		NR
Manganese			15		NR
Mercury	253.60		0.2	0.1	CV
Nickel			40		NR
Potassium			5000		NR
Selenium			5		NR
Silver			10		NR
Sodium			5000		NR
Thallium			10		NR
Vanadium			50		NR
Zinc			20		NR
Cyanide			10		NR

Comments:

C5: CETAC M6000

U.S. EPA - CLP

11A
ICP INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

ICP ID Number: P4 Date: 08/26/1999

Analyte	Wave-length (nm)	Interelement Correction Factors for: Al	Ca	Fe	Mg	Co
Aluminum	308.20	0.0000000	0.0000000	0.0000000	0.0000000	-0.0177100
Antimony	206.80	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Arsenic	189.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Barium	493.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Beryllium	313.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cadmium	226.50	0.0000250	0.0000000	0.0001200	0.0000000	0.0000000
Calcium	317.90	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Chromium	267.70	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cobalt	228.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Copper	324.70	0.0000000	0.0000000	0.0000000	0.0000000	-0.0003560
Iron	271.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0797000
Lead	220.30	0.0004200	0.0000000	0.0000800	0.0000000	0.0001490
Magnesium	279.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Manganese	257.60	-0.0000150	0.0000000	0.0000000	0.0000180	0.0000000
Mercury						
Nickel	231.60	0.0000000	0.0000000	0.0000000	0.0000000	-0.0002400
Potassium	766.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Selenium	196.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0002000
Silver	328.00	0.0000000	0.0000000	-0.0003400	0.0000000	0.0000000
Sodium	330.20	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Thallium	190.80	0.0000000	0.0000000	-0.0000500	0.0000000	0.0032000
Vanadium	292.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Zinc	206.20	0.0000000	0.0000000	0.0000000	0.0000320	0.0000000

Comments:
P4: THERMO JARRELL ASH

U.S. EPA - CLP

11B
ICP INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

ICP ID Number: P4 Date: 08/26/1999

Analyte	Wave-length (nm)	Interelement Correction Factors for: Cr	Cu	Mn	Mo	Ni
Aluminum	308.20	0.0000000	0.0000000	0.0000000	0.0100000	0.0000000
Antimony	206.80	0.0056000	0.0000000	0.0000000	0.0000000	0.0000000
Arsenic	189.00	0.0020000	0.0000000	0.0000000	-0.0015000	0.0000000
Barium	493.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Beryllium	313.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Cadmium	226.50	0.0000000	0.0000000	0.0000000	0.0000000	0.0000650
Calcium	317.90	0.0000000	0.0000000	0.0000000	0.0300000	0.0000000
Chromium	267.70	0.0000000	0.0007700	0.0000000	0.0000000	0.0000000
Cobalt	228.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0001100
Copper	324.70	0.0000000	0.0000000	0.0000000	0.0010000	0.0000000
Iron	271.40	0.0016100	0.0000000	0.0000000	0.0000000	0.0000000
Lead	220.30	0.0000000	0.0000000	0.0000430	-0.0002000	0.0002950
Magnesium	279.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Manganese	257.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Mercury						
Nickel	231.60	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Potassium	766.40	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Selenium	196.00	0.0000000	0.0000000	0.0003300	0.0000000	0.0000000
Silver	328.00	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Sodium	330.20	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Thallium	190.80	0.0002400	0.0000000	0.0000000	0.0000000	0.0000000
Vanadium	292.40	-0.0012000	0.0000000	0.0000000	-0.0020000	0.0000000
Zinc	206.20	0.0083700	0.0000000	0.0000000	0.0009000	0.0000000

Comments:
P4: THERMO JARRELL ASH

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11B
ICP INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

ICP ID Number: P4 Date: 08/26/1999

Analyte	Wavelength (nm)	Interelement Correction Factors for: Ti	V	Zn	—	—
Aluminum	308.20	0.0000000	0.0043000	0.0000000		
Antimony	206.80	0.0000000	0.0000980	0.0000000		
Arsenic	189.00	0.0000000	0.0000000	0.0000000		
Barium	493.40	0.0000000	0.0000000	0.0000000		
Beryllium	313.00	-0.0014000	0.0012300	0.0000000		
Cadmium	226.50	0.0000000	0.0000000	0.0000000		
Calcium	317.90	0.0000000	0.0000000	0.0000000		
Chromium	267.70	0.0000000	0.0002200	0.0000000		
Cobalt	228.60	0.0018000	0.0000000	0.0000000		
Copper	324.70	0.0000000	0.0000000	0.0000000		
Iron	271.40	0.0000000	0.0069200	0.0000000		
Lead	220.30	0.0000000	0.0000000	0.0000000		
Magnesium	279.00	0.0000000	0.0000000	0.0000000		
Manganese	257.60	0.0000000	0.0000000	0.0000000		
Mercury						
Nickel	231.60	0.0000000	0.0000000	0.0000000		
Potassium	766.40	0.0000000	0.0000000	0.0000000		
Selenium	196.00	0.0000000	0.0002000	0.0000000		
Silver	328.00	0.0000000	0.0000000	0.0000000		
Sodium	330.20	0.0000000	0.0150000	0.0500000		
Thallium	190.80	-0.0015000	0.0000000	0.0000000		
Vanadium	292.40	0.0000000	0.0000000	0.0000000		
Zinc	206.20	0.0000000	0.0000000	0.0000000		

Comments:
P4: THERMO JARRELL ASH

U.S. EPA - CLP

12

ICP LINEAR RANGES (QUARTERLY)

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

ICP ID Number: P4 Date: 10/15/1999

Analyte	Integ. Time (Sec.)	Concentration (ug/L)	M
Aluminum	15.00	900000.0	P
Antimony	15.00	25000.0	P
Arsenic	15.00	25000.0	P
Barium	15.00	10000.0	P
Beryllium	15.00	5000.0	P
Cadmium	15.00	25000.0	P
Calcium	15.00	1130000.0	P
Chromium	15.00	100000.0	P
Cobalt	15.00	100000.0	P
Copper	15.00	100000.0	P
Iron	15.00	1000000.0	P
Lead	15.00	50000.0	P
Magnesium	15.00	1000000.0	P
Manganese	15.00	100000.0	P
Mercury			NR
Nickel	15.00	50000.0	P
Potassium	15.00	400000.0	P
Selenium	15.00	25000.0	P
Silver	15.00	1250.0	P
Sodium	15.00	1000000.0	P
Thallium	15.00	50000.0	P
Vanadium	15.00	100000.0	P
Zinc	15.00	100000.0	P

Comments:

P4: THERMO JARRELL ASH

U.S. EPA - CLP

13
PREPARATION LOG

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

Method: P

EPA Sample No.	Preparation Date	Weight (gram)	Volume (mL)
LCSW	01/10/2000		100
MHEP01	01/10/2000		100
MHEP01D	01/10/2000		100
MHEP01S	01/10/2000		100
PBW	01/10/2000		100

U.S. EPA - CLP

13
PREPARATION LOG

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

Method: CV

EPA Sample No.	Preparation Date	Weight (gram)	Volume (mL)
MHEP01	01/10/2000		100
MHEP01D	01/10/2000		100
MHEP01S	01/10/2000		100
PBW	01/10/2000		100

U.S. EPA - CLP

14
ANALYSIS RUN LOG

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

Instrument ID Number: P4 Method: P

Start date: 01/12/2000 End date: 01/12/2000

EPA Sample No.	D/F	Time	% R	Analytes																										
				AL	SB	AS	BA	BE	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	K	SE	AG	NA	TL	V	ZN	CN
S0	1.00	0451		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
S	1.00	0456		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
ICV	1.00	0501		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
ICB	1.00	0506		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CRI	1.00	0511			X	X		X	X		X	X	X		X		X		X		X	X		X	X	X	
ICSA	1.00	0515		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
ICSAB	1.00	0520		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
CCV	1.00	0525		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
CCB	1.00	0530		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
PBW	1.00	0535		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
LCSW	1.00	0540		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
MHEP01L	5.00	0544		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
MHEP01	1.00	0549		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
MHEP01D	1.00	0554		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
MHEP01S	1.00	0559		X	X	X	X	X	X		X	X	X	X	X		X		X		X	X		X	X	X	
MHEP01A	1.00	0604			X																X						
ZZZZZZ	1.00	0609																									
ZZZZZZ	10.00	0613																									
CCV	1.00	0618		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
CCB	1.00	0623		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
ZZZZZZ	10.00	0628																									
ZZZZZZ	10.00	0633																									
ZZZZZZ	10.00	0637																									
ZZZZZZ	10.00	0642																									
ZZZZZZ	10.00	0647																									
CRI	1.00	0652			X	X		X	X		X	X	X		X		X		X		X	X		X	X	X	
ICSA	1.00	0657		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
ICSAB	1.00	0702		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
CCV	1.00	0706		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	
CCB	1.00	0711		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	

U.S. EPA - CLP

14
ANALYSIS RUN LOG

Lab Name: SENTINEL INC. Contract: 68-D5-0169

Lab Code: SENTIN Case No.: 27716 SAS No.: SDG No.: MHEP01

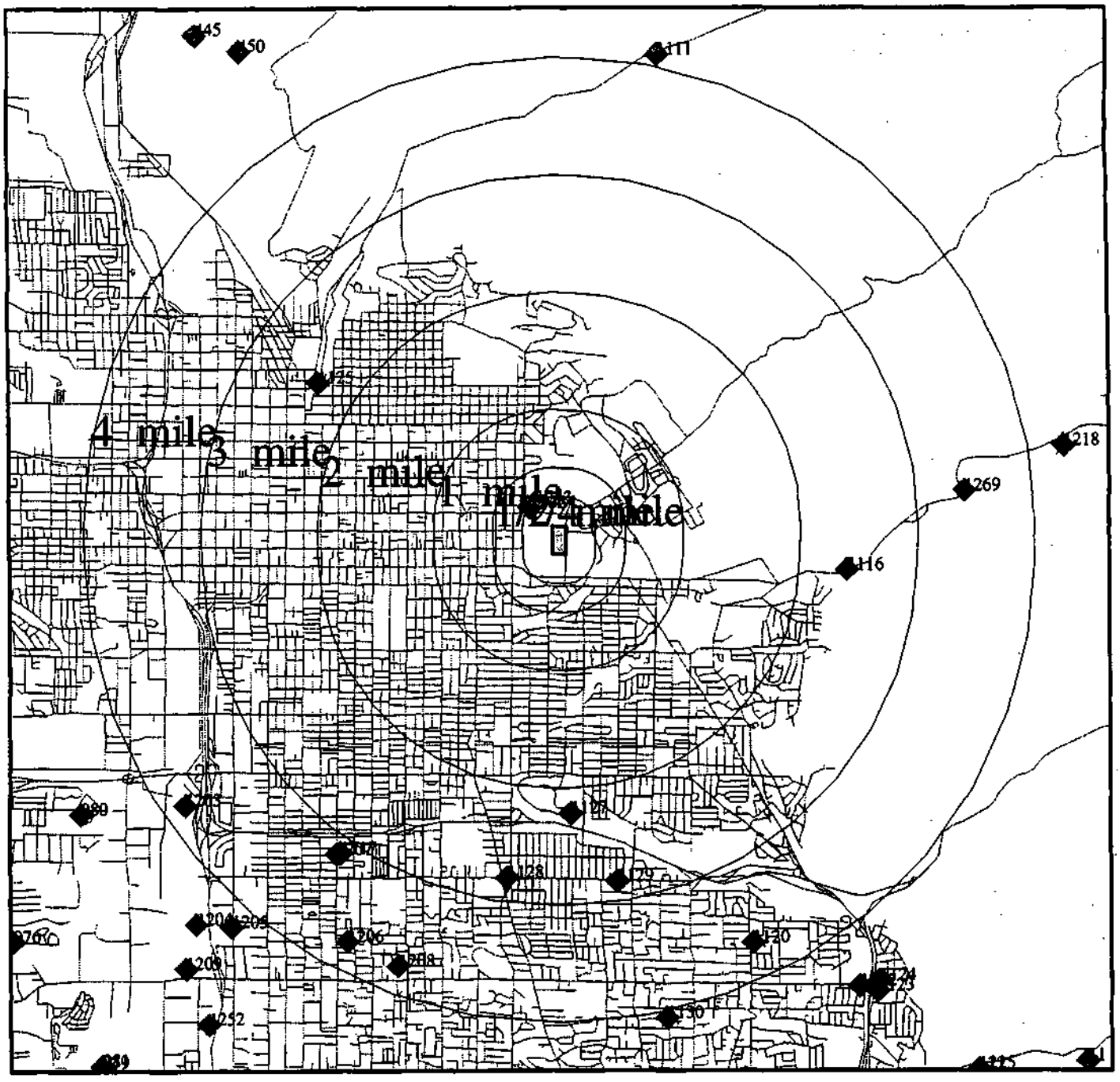
Instrument ID Number: C5 Method: CV

Start date: 01/10/2000 End date: 01/10/2000

EPA Sample No.	D/F	Time	% R	Analytes																							
				AL	SB	AS	BA	BE	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	K	SE	AG	NA	TL	V	ZN	CN
S0	1.00	1339																X									
S0.2	1.00	1340																X									
S0.5	1.00	1341																X									
S1.0	1.00	1343																X									
S2.0	1.00	1344																X									
S5.0	1.00	1346																X									
S10.0	1.00	1347																X									
ICV	1.00	1426																X									
ICB	1.00	1428																X									
CRA	1.00	1429																X									
CCV	1.00	1430																X									
CCB	1.00	1432																X									
PBW	1.00	1433																X									
MHEP01	1.00	1434																X									
MHEP01D	1.00	1436																X									
MHEP01S	1.00	1437																X									
CCV	1.00	1439																X									
CCB	1.00	1440																X									

APPENDIX D

MUNICIPAL DRINKING WATER SOURCES WITHIN FOUR MILES

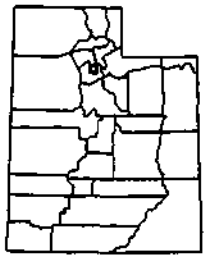


Mount Olivet Cemetery Plume
Drinking Water Wells Within Four Miles

Scale
1" = 1.29 Miles

Legend

- Site
- Concentric bands
- Road Centerlines
- Drinking Water Sources



UDEQ
Division of Environmental
Response and Remediation

file: uangwell created by: eqerr on 09/21/95

DRINKING WATER WELL REPORT
Date: October 03, 1995 8:25 PM

Distance to Site:	2.4 miles
HDDWS-ID:	1116
SYSTEM-NUM:	18026
SYSTEM-NAME:	SALT LAKE CITY WATER SYS.
LOCATION:	SALT LAKE CITY
ADDRESS:	1530 S W TEMPLE
SYSTEM-OWNER:	SALT LAKE CITY
USER-POPUL:	285258
RES-CONNECT:	78806
TOTAL-CONNECT:	83000
SOURCE-NUM:	08
SOURCE-TYPE:	SPRING
SOURCE-NAME:	EMIGRATION TUNL
WELL-DEPTH:	
WELL-DIAMETER:	0
FIRM-SUPPLY:	1480
LATITUDE:	404505.5
LONGITUDE:	1114755.0
BEGIN-PERIOD-OPE:	04/01
END-PERIOD-OPER:	11/31
VOC:	11/17/93

Distance to Site:	3.12 miles
HDDWS-ID:	1117
SYSTEM-NUM:	18026
SYSTEM-NAME:	SALT LAKE CITY WATER SYS.
LOCATION:	SALT LAKE CITY
ADDRESS:	1530 S W TEMPLE
SYSTEM-OWNER:	SALT LAKE CITY
USER-POPUL:	285258
RES-CONNECT:	78806
TOTAL-CONNECT:	83000
SOURCE-NUM:	09
SOURCE-TYPE:	WELL
SOURCE-NAME:	ART. BAS. 3RD E
WELL-DEPTH:	
WELL-DIAMETER:	0
FIRM-SUPPLY:	5475
LATITUDE:	404257.5
LONGITUDE:	1115250.5
BEGIN-PERIOD-OPE:	04/01
END-PERIOD-OPER:	11/31
VOC:	08/30/93

Distance to Site:	3.67 miles
HDDWS-ID:	1120
SYSTEM-NUM:	18026
SYSTEM-NAME:	SALT LAKE CITY WATER SYS.
LOCATION:	SALT LAKE CITY
ADDRESS:	1530 S W TEMPLE
SYSTEM-OWNER:	SALT LAKE CITY
USER-POPUL:	285258
RES-CONNECT:	78806
TOTAL-CONNECT:	83000
SOURCE-NUM:	12
SOURCE-TYPE:	WELL
SOURCE-NAME:	ABANDONED

WELL-DEPTH:
WELL-DIAMETER: 16
FIRM-SUPPLY: 0
LATITUDE: 404219.0
LONGITUDE: 1114849.0
BEGIN-PERIOD-OPE: /
END-PERIOD-OPER: /
VOC: / /

Distance to Site: 2.34 miles
HDDWS-ID: 1125
SYSTEM-NUM: 18026
SYSTEM-NAME: SALT LAKE CITY WATER SYS.
LOCATION: SALT LAKE CITY
ADDRESS: 1530 S W TEMPLE
SYSTEM-OWNER: SALT LAKE CITY
USER-POPUL: 285258
RES-CONNECT: 78806
TOTAL-CONNECT: 83000
SOURCE-NUM: 17
SOURCE-TYPE: WELL
SOURCE-NAME: 202 CANYON RD.
WELL-DEPTH:
WELL-DIAMETER: 20
FIRM-SUPPLY: 3472
LATITUDE: 404627.0
LONGITUDE: 1115306.0
BEGIN-PERIOD-OPE: 04/01
END-PERIOD-OPER: 11/31
VOC: 07/21/89

Distance to Site: 0.24 miles
HDDWS-ID: 1126
SYSTEM-NUM: 18026
SYSTEM-NAME: SALT LAKE CITY WATER SYS.
LOCATION: SALT LAKE CITY
ADDRESS: 1530 S W TEMPLE
SYSTEM-OWNER: SALT LAKE CITY
USER-POPUL: 285258
RES-CONNECT: 78806
TOTAL-CONNECT: 83000
SOURCE-NUM: 18
SOURCE-TYPE: WELL
SOURCE-NAME: 1511 E. 500 S.
WELL-DEPTH: D
WELL-DIAMETER: 20
FIRM-SUPPLY: 1944
LATITUDE: 404532.0
LONGITUDE: 1115101.0
BEGIN-PERIOD-OPE: 04/01
END-PERIOD-OPER: 11/31
VOC: 08/30/93

Distance to Site: 2.21 miles
HDDWS-ID: 1127
SYSTEM-NUM: 18026
SYSTEM-NAME: SALT LAKE CITY WATER SYS.
LOCATION: SALT LAKE CITY
ADDRESS: 1530 S W TEMPLE
SYSTEM-OWNER: SALT LAKE CITY

USER-POPUL:	285258
RES-CONNECT:	78806
TOTAL-CONNECT:	83000
SOURCE-NUM:	19
SOURCE-TYPE:	WELL
SOURCE-NAME:	SUGARHOUSE PARK
WELL-DEPTH:	D
WELL-DIAMETER:	20
FIRM-SUPPLY:	3889
LATITUDE:	404316.0
LONGITUDE:	1115036.0
BEGIN-PERIOD-OPE:	04/01
END-PERIOD-OPER:	11/31
VOC:	08/30/93

Distance to Site:	2.79 miles
HDDWS-ID:	1128
SYSTEM-NUM:	18026
SYSTEM-NAME:	SALT LAKE CITY WATER SYS.
LOCATION:	SALT LAKE CITY
ADDRESS:	1530 S W TEMPLE
SYSTEM-OWNER:	SALT LAKE CITY
USER-POPUL:	285258
RES-CONNECT:	78806
TOTAL-CONNECT:	83000
SOURCE-NUM:	20
SOURCE-TYPE:	WELL
SOURCE-NAME:	1297 E. 2700 S.
WELL-DEPTH:	D
WELL-DIAMETER:	20
FIRM-SUPPLY:	2700
LATITUDE:	404247.0
LONGITUDE:	1115113.0
BEGIN-PERIOD-OPE:	04/01
END-PERIOD-OPER:	11/31
VOC:	08/30/93

Distance to Site:	2.82 miles
HDDWS-ID:	1129
SYSTEM-NUM:	18026
SYSTEM-NAME:	SALT LAKE CITY WATER SYS.
LOCATION:	SALT LAKE CITY
ADDRESS:	1530 S W TEMPLE
SYSTEM-OWNER:	SALT LAKE CITY
USER-POPUL:	285258
RES-CONNECT:	78806
TOTAL-CONNECT:	83000
SOURCE-NUM:	21
SOURCE-TYPE:	WELL
SOURCE-NAME:	1905 E. 2700 S.
WELL-DEPTH:	D
WELL-DIAMETER:	20
FIRM-SUPPLY:	2835
LATITUDE:	404246.0
LONGITUDE:	1115009.0
BEGIN-PERIOD-OPE:	04/01
END-PERIOD-OPER:	11/31
VOC:	08/30/93

Distance to Site:	3.8 miles

HDDWS-ID: 1203
SYSTEM-NUM: 18032
SYSTEM-NAME: SOUTH SALT LAKE CITY
LOCATION: SOUTH SALT LAKE
ADDRESS: 220 E MORRIS AVE
SYSTEM-OWNER: CITY OF SOUTH SALT LAKE
USER-POPUL: 11500
RES-CONNECT: 2752
TOTAL-CONNECT: 3010
SOURCE-NUM: 02
SOURCE-TYPE: WELL
SOURCE-NAME: BOLINDER NO 2
WELL-DEPTH: D
WELL-DIAMETER: 16
FIRM-SUPPLY: 300
LATITUDE: 404318.0
LONGITUDE: 1115422.0
BEGIN-PERIOD-OPE: 01/01
END-PERIOD-OPER: 12/31
VOC: 08/25/92

Distance to Site: 3.74 miles
HDDWS-ID: 1206
SYSTEM-NUM: 18032
SYSTEM-NAME: SOUTH SALT LAKE CITY
LOCATION: SOUTH SALT LAKE
ADDRESS: 220 E MORRIS AVE
SYSTEM-OWNER: CITY OF SOUTH SALT LAKE
USER-POPUL: 11500
RES-CONNECT: 2752
TOTAL-CONNECT: 3010
SOURCE-NUM: 05
SOURCE-TYPE: WELL
SOURCE-NAME: 400 E 3000 S
WELL-DEPTH: D
WELL-DIAMETER: 16
FIRM-SUPPLY: 425
LATITUDE: 404218.0
LONGITUDE: 1115246.0
BEGIN-PERIOD-OPE: /
END-PERIOD-OPER: /
VOC: 03/23/93

Distance to Site: 3.15 miles
HDDWS-ID: 1207
SYSTEM-NUM: 18032
SYSTEM-NAME: SOUTH SALT LAKE CITY
LOCATION: SOUTH SALT LAKE
ADDRESS: 220 E MORRIS AVE
SYSTEM-OWNER: CITY OF SOUTH SALT LAKE
USER-POPUL: 11500
RES-CONNECT: 2752
TOTAL-CONNECT: 3010
SOURCE-NUM: 06
SOURCE-TYPE: WELL
SOURCE-NAME: 2501 S. 300 E.
WELL-DEPTH: D
WELL-DIAMETER: 16
FIRM-SUPPLY: 350
LATITUDE: 404257.0

LONGITUDE: 1115253.0
BEGIN-PERIOD-OPE: /
END-PERIOD-OPER: /
VOC: 05/18/90

Distance to Site: 3.75 miles
HDDWS-ID: 1208
SYSTEM-NUM: 18032
SYSTEM-NAME: SOUTH SALT LAKE CITY
LOCATION: SOUTH SALT LAKE
ADDRESS: 220 E MORRIS AVE
SYSTEM-OWNER: CITY OF SOUTH SALT LAKE
USER-POPUL: 11500
RES-CONNECT: 2752
TOTAL-CONNECT: 3010
SOURCE-NUM: 07
SOURCE-TYPE: WELL
SOURCE-NAME: 700 E 3190 S
WELL-DEPTH: D
WELL-DIAMETER: 16
FIRM-SUPPLY: 700
LATITUDE: 404207.0
LONGITUDE: 1115216.0
BEGIN-PERIOD-OPE: /
END-PERIOD-OPER: /
VOC: 03/23/93

Distance to Site: 0.24 miles
HDDWS-ID: 1242
SYSTEM-NUM: 18057
SYSTEM-NAME: UNIVERSITY OF UTAH
LOCATION: SALT LAKE CITY
ADDRESS: BLDG 50 RM 222
SYSTEM-OWNER: UNIVERSITY OF UTAH
USER-POPUL: 18000
RES-CONNECT: 1000
TOTAL-CONNECT: 1125
SOURCE-NUM: 02
SOURCE-TYPE: WELL
SOURCE-NAME: WELL NO. 1
WELL-DEPTH: D
WELL-DIAMETER: 20
FIRM-SUPPLY: 975
LATITUDE: 404532.0
LONGITUDE: 1115101.0
BEGIN-PERIOD-OPE: 06/01
END-PERIOD-OPER: 11/31
VOC: 02/03/88

Distance to Site: 0.24 miles
HDDWS-ID: 1243
SYSTEM-NUM: 18057
SYSTEM-NAME: UNIVERSITY OF UTAH
LOCATION: SALT LAKE CITY
ADDRESS: BLDG 50 RM 222
SYSTEM-OWNER: UNIVERSITY OF UTAH
USER-POPUL: 18000
RES-CONNECT: 1000
TOTAL-CONNECT: 1125
SOURCE-NUM: 03

SOURCE-TYPE:	WELL
SOURCE-NAME:	WELL NO. 2
WELL-DEPTH:	D
WELL-DIAMETER:	16
FIRM-SUPPLY:	1100
LATITUDE:	404534.0
LONGITUDE:	1115058.0
BEGIN-PERIOD-OPE:	06/01
END-PERIOD-OPER:	11/31
VOC:	02/03/88
Distance to Site:	3.41 miles
HDDWS-ID:	1269
SYSTEM-NUM:	18113
SYSTEM-NAME:	RUTH'S DINER
LOCATION:	EMIGRATION CANYON
ADDRESS:	2100 EMIGRATION CYN
SYSTEM-OWNER:	CURTIS OBERHANSLEY
USER-POPUL:	40
RES-CONNECT:	0
TOTAL-CONNECT:	1
SOURCE-NUM:	01
SOURCE-TYPE:	WELL
SOURCE-NAME:	RUTH'S WELL
WELL-DEPTH:	S
WELL-DIAMETER:	6
FIRM-SUPPLY:	60
LATITUDE:	404541.2
LONGITUDE:	1114646.8
BEGIN-PERIOD-OPE:	/
END-PERIOD-OPER:	/
VOC:	/ /

APPENDIX E

ANALYTICAL RESULTS AND QUALITY ASSURANCE INFORMATION

TRANSMITTAL LETTER — URS OPERATING SERVICES

1099 18TH STREET
SUITE 710
DENVER, COLORADO 80202-1907
TEL: (303) 291-8300

Date: 2/3/99

To: Steven Thiriot
UDEQ - DERR

Attention:

Proj. Name: Vernal Area TCE / Mt Olivet UOS # 75-90102 / 90103

Please find enclosed ✓, or under separate cover _____, the following items prepared by AR and sent via Fed Ex

Copies	Item No.	Description	Status
1	1	Data Validation Rpt Case 26586 SDGs HS814	
1	2	" " Case 26509 SDGs HS794	

DERR
ENVIRONMENTAL RESPONSE & REMEDIATION
ENTERED
BY

Remarks:

Very truly yours,

URS OPERATING SERVICES, INC.

Lou Kaschke

Copy to: Luke Chavez

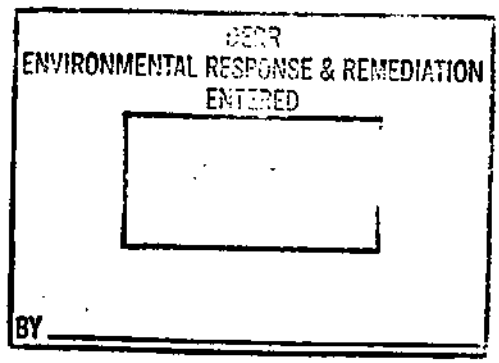
Status
A = No Exception Taken
B = Make Corrections Noted
C = Revise and Resubmit
D = Submit Specified Items
E = For Construction
F = For Your Review and Comment
(G) = For Your Files
H = For Your Approval
O = _____

REGION VIII
SUMMARY OF DATA QUALITY ASSURANCE REVIEW
ORGANICS - VOA

Case No. / TDD No.	Site Name		Operable Unit
26509 / 75-90103	Mt. Olivet Plume		
RPM/OSC Name			
Luke Chavez			
Contractor Laboratory	**Contract No.**	**SDG No.**	**Laboratory DPO/Region**
Southwest Laboratory of Oklahoma	68-D5-0026	HS794	

Review Assigned Date January 11, 1999
Review Completion Date February 2, 1999
Data Validator Bill Fear
Report Reviewer Lisa Burnley

Sample ID	Station Location	Matrix	Analysis
HS794	MT-01	Water	CLP - Volatile analyses
HS795	MT-02		
HS796	MT-03		



DATA QUALITY STATEMENT

( ) Data are ACCEPTABLE according to EPA Functional Guidelines with no qualifiers (flags) added by the reviewer.
( ) Data are UNACCEPTABLE according to EPA Functional Guidelines.
(X) Data are acceptable with QUALIFICATIONS noted in review.

Telephone/Communication Logs Enclosed? Yes _____ No __X____

TPO Attention Required? Yes _____ No _X___ If yes, list the items that require attention:

ORGANIC DATA QUALITY ASSURANCE REVIEW

REVIEW NARRATIVE SUMMARY

This data package was reviewed according to the EPA document "USEPA Contract Laboratory Program National Functional Guidelines For Organic Data Review," February 1994.

Raw data were reviewed for completeness and transcription accuracy onto the summary forms. Approximately 10-20% of the results reported in each of the samples, calibrations, and QC analyses were recalculated and verified. If problems were identified during the recalculation of results, all laboratory calculations were verified.

Case No. 26509, SDG No. HS794, consisted of 3 water samples for CLP volatile analyses.

The laboratory performed the required library search on all non-target sample components. TICs detected in the samples and associated blanks were qualified rejected (R).

The following tables lists data qualifiers added to the data. (Please see Data Qualifier Definitions, attached to the end of this report.)

Sample Number	Volatile Compound	Qualifier	Reason For Qualification	Review Section
HS794, HS795, HS796	Acetone	J/UJ	Initial calibration %RSD exceeded 30%	4
	Methylene chloride Acetone 4-Methyl-2-pentanone 2-Hexanone		Continuing calibration %D > 25%	

Method Number OLM03.0
Revision OLM03.2

Organic Data Completeness Checklist
VOA

Quality Control Summary Package
- P Surrogate Recovery Summary
- P MS/MSD Summary
- P Method Blank Summary
- P GC/MS Tuning and Mass Calibration

Sample Data Package
- P Holding Times (CLASS Sample Traffic Reports/UOS Chain-of-Custody)
- P Organic Analysis Data Sheets
- P Reconstructed Ion Chromatogram(s) (RIC)
- P Quantitation Reports
- P Mass Spectral Data
- P Mass Spectral Library Search for TICs

Standards Data Package
- NR Current List of Laboratory/Instrument Detection Limits
- P Initial Calibration Data for each instrument
- P Continuing Calibration Data for each instrument
- P Internal Standard Area Summary
- P VOA Standards RICs
- P VOA Standards Quantitation Reports

Raw QC Package
- P BFB mass spectra and mass listings

Reagent Blank Data
- P Organic Analysis Data Sheets
- P RIC or Total Ion Chromatogram
- P Quantitation Reports
- P Mass Spectral Data
- P Library Search for TICs

Matrix Spike/Matrix Spike Duplicate Data
- P Organic Analysis Data Sheets
- P RIC
- P Quantitation Reports
- NA Mass Spectral Data
- NA Library search for TICs

KEY:
- P = Provided in original data package
- R = Provided as resubmission
- NP = Not provided in original data package or as resubmission
- NR = Not required
- NA = Not applicable to this data package or analysis

1. DELIVERABLES

All deliverables were present as specified in the subcontract.

VOA: Yes_X_ No___

Comments: None.

2. HOLDING TIMES AND PRESERVATION CRITERIA

All method holding times were met.

VOA: Yes_X_ No___

Comments: The sample analyses were within ten days from the validated time of receipt. Chain-of-custody, summary forms, and raw data were evaluated.

All technical holding times and preservation criteria were met.

VOA: Yes___ No_X_

Comments: The preserved water samples were analyzed within the recommended 14 days from sample collection. The samples were received by the laboratory at a temperature of 6.5° C which is just above the 6.0° C requirement. No qualification was taken. Chain-of-custody, summary forms, and raw data were evaluated.

3. BFB PERFORMANCE RESULTS

The bromofluorobenzene (BFB) performance results were within the specified control limits. All appropriate BFB results were included.

VOA: Yes_X_ No___

Comments: BFB instrument performance checks were run for each 12 hours of analysis. Ion abundance criteria were met and were verified from raw data.

4. INSTRUMENT CALIBRATIONS: INITIAL AND CONTINUING STANDARDS

Initial instrument calibrations were performed according to method requirements and met the specified control limits listed in the Functional Guidelines.

VOA: Yes___ No_X_

Comments: Initial calibration standard relative response factors (RRFs) for all volatile compounds and system monitoring compounds were greater than or equal to 0.05. Summary forms and raw data were evaluated.

The following table lists the percent relative standard deviation (%RSD) that was greater than 30% in the initial calibration and qualifiers added to the data:

Compound	%RSD	Associated Samples	Qualifiers
Acetone	30.9	All samples	UJ

Continuing instrument calibrations were performed according to method requirements and met specified control limits listed in the Functional Guidelines.

VOA: Yes___ No_X_

Comments: Continuing calibration standards containing both target compounds and system monitoring compounds were analyzed at the beginning of each 12-hour analysis period. The continuing calibration RRFs for all volatile compounds and system monitoring compounds were greater than or equal to 0.05. Summary forms and raw data were evaluated.

The following table lists the percent differences (%Ds) in the continuing calibration that were greater than 25% and qualifiers added to the data:

Compound	%D	Associated Samples	Qualifiers
Methylene chloride	30.4	All samples	J/UJ
Acetone	42.6		
4-Methyl-2-pentanone	36.7		
2-Hexanone	27.2		

5. SURROGATE COMPOUND RECOVERY

Surrogate compound recovery analysis was performed according to method requirements and results met specified control limits.

VOA: Yes_X_ No___

Comments: System monitoring compounds were added to all samples and blanks. System monitoring compound recoveries were verified from raw data and were within QC limits. Summary forms and raw data were evaluated.

6. MATRIX SPIKE/MATRIX SPIKE DUPLICATE

Matrix Spike/Matrix Spike Duplicate (MS/MSD) analyses were performed according to method requirements and results met recommended recovery and precision limits.

VOA: Yes___ No_X_

Comments: MS/MSD analyses were performed for every 20 samples of similar matrix in this SDG. The percent recoveries were within QC criteria. Summary forms and raw data were evaluated. No action is taken on MS/MSD results alone.

The following table lists MS/MSD results that were outside criteria:

Sample	Compound	Percent Recovery		RPD	Control Limits		Qualifiers
		MS	MSD		% R	RPD	
HS794	Benzene	--	--	15	--	11	None

7. INTERNAL STANDARD AREA

Internal standard area analysis was performed according to method requirements and results met specified control limits.

VOA: Yes_X_ No___

Comments: Internal standard area counts did not vary by more than a factor of two from the associated 12-hour calibration standard. The internal standard retention times did not vary more than ± 30 seconds from the retention time of the associated 12-hour calibration standards. Summary forms and raw data were evaluated.

8. LABORATORY BLANK ANALYSIS RESULTS

The laboratory blank analysis was performed according to method requirements and results met specified limits.

VOA: Yes___ No_X_

Comments: A method blank analysis was performed after the calibration standards and once for every 12-hour time period beginning with a BFB analysis. Summary forms and raw data were evaluated.

No target compounds were detected in the volatile method blanks or the storage blank.

Tentatively identified compounds (TICs) that were found in both the samples and associated blanks were qualified as rejected (R). The following table lists blank TIC results, associated samples, and qualifiers added to the data.

Blank ID	Analysis	TIC Retention Time	Associated Samples	Qualifiers
VBLK1	09/29/98	12.6	HS795, HS796	R

9. SAMPLE RESULTS

The sample results were reviewed and all compound identifications were acceptable and met contract requirements.

VOA: Yes_X_ No___

Comments: Sample relative retention times (RRTs) were within ± 0.06 RRT units of the standard RRT. Ions present in the standard mass spectrum at a relative intensity greater than 10% were present in the sample spectrum. Relative intensities of ions agreed within ± 20% between standard and sample spectra. TICs were qualitatively assessed by a mass spectral library search and all TICs identified with a CAS number were qualified as "NJ" by the laboratory.

Sample HS795 reported two TICs (cyclotetrasiloxane and an unknown) and sample HS796 reported one TIC (cyclotetrasiloxane) that appear to be column bleed.

10. Additional Comments or Problems/Resolutions Not Addressed Above

VOA: Yes___ No_X_

Comments: None.

ORGANIC DATA QUALITY ASSURANCE REVIEW

Region VIII

DATA QUALIFIER DEFINITIONS

For the purpose of Data Validation, the following code letters and associated definitions are provided for use by the data validator to summarize the data quality.

GENERAL QUALIFIERS for use with both INORGANIC and ORGANIC DATA

R - Reported value is "rejected." Resampling or reanalysis may be necessary to verify the presence or absence of the compound.

J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.

U J - The reported quantitation limit is estimated because Quality Control criteria were not met. Element or compound was not detected.

N J - Estimated value of a tentatively identified compound. (Identified with a CAS number.) ORGANICS analysis only.

U - The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS794

Lab Name: SWL-TULSA Contract: 68-D5-0026

Lab Code: SWOK Case No.: 26509 SAS No.: SDG No.: HS794

Matrix: (soil/water) WATER Lab Sample ID: 35676.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L33665.D

Level: (low/med) LOW Date Received: 09/24/98

% Moisture: not dec. _____ Date Analyzed: 09/29/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
74-87-3	Chloromethane	10	U	
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl Chloride	10	U	
75-00-3	Chloroethane	10	U	
75-09-2	Methylene Chloride	10	U	U#=UJ
67-64-1	Acetone	10	U	
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	10	U	
75-34-3	1,1-Dichloroethane	10	U	
540-59-0	1,2-Dichloroethene (total)	2	J	
67-66-3	Chloroform	2	J	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	1	J	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	2	J	
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	10	U	
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-Pentanone	10	U	UJ
591-78-6	2-Hexanone	10	U	UJ
127-18-4	Tetrachloroethene	150		
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-88-3	Toluene	10	U	
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethylbenzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Xylene (Total)	10	U	

RF .129/129

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS794

Lab Name: SWL-TULSA Contract: 68-D5-0026

Lab Code: SWOK Case No.: 26509 SAS No.: SDG No.: HS794

Matrix: (soil/water) WATER Lab Sample ID: 35676.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L33665.D

Level: (low/med) LOW Date Received: 09/24/98

% Moisture: not dec. _____ Date Analyzed: 09/29/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0 CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
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28.					
29.					
30.					

R- 11/29/99

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
HS795

Lab Name: SWL-TULSA Contract: 68-DS-0026

Lab Code: SWOK Case No.: 26509 SAS No.: SDG No.: HS794

Matrix: (soil/water) WATER Lab Sample ID: 35676.02

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L33666.D

Level: (low/med) LOW Date Received: 09/24/98

% Moisture: not dec. _____ Date Analyzed: 09/29/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
74-87-3	Chloromethane	10	U	
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl Chloride	10	U	
75-00-3	Chloroethane	10	U	
75-09-2	Methylene Chloride	6	J	J
67-64-1	Acetone	10	U	UJ
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	10	U	
75-34-3	1,1-Dichloroethane	10	U	
540-59-0	1,2-Dichloroethene (total)	10	U	
67-66-3	Chloroform	2	J	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	10	U	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	10	U	
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	10	U	
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-Pentanone	10	U	UJ
591-78-6	2-Hexanone	10	U	UJ
127-18-4	Tetrachloroethene	10	U	
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-88-3	Toluene	10	U	
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethylbenzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Xylene (Total)	10	U	

RF 1/29/99

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS795

Lab Name: SWL-TULSA Contract: 68-D5-0026

Lab Code: SWOK Case No.: 26509 SAS No.: SDG No.: HS794

Matrix: (soil/water) WATER Lab Sample ID: 35676.02

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L33666.D

Level: (low/med) LOW Date Received: 09/24/98

% Moisture: not dec. _____ Date Analyzed: 09/29/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Cyclotrisiloxane	12.350	6	J
2.		UNKNOWN	12.638	9	JB
3.		UNKNOWN	16.959	5	J
4.					
5.					
6.					
7.					
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29.					
30.					

R

AF 1/29/99

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
HS796

Lab Name: SWL-TULSA Contract: 68-D5-0026

Lab Code: SWOK Case No.: 26509 SAS No.: SDG No.: HS794

Matrix: (soil/water) WATER Lab Sample ID: 35676.03

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L33667.D

Level: (low/med) LOW Date Received: 09/24/98

% Moisture: not dec. _____ Date Analyzed: 09/29/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
74-87-3	Chloromethane	10	U	
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl Chloride	10	U	
75-00-3	Chloroethane	10	U	
75-09-2	Methylene Chloride	5	J	EJ
67-64-1	Acetone	10	U	EJ
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	10	U	
75-34-3	1,1-Dichloroethane	10	U	
540-59-0	1,2-Dichloroethene (total)	10	U	
67-66-3	Chloroform	10	U	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	10	U	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	10	U	
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	10	U	
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-Pentanone	10	U	UJ
591-78-6	2-Hexanone	10	U	UJ
127-18-4	Tetrachloroethene	10	U	
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-88-3	Toluene	10	U	
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethylbenzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Xylene (Total)	10	U	

Rc 1/25/99

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS796

Lab Name: SWL-TULSA Contract: 68-D5-0026

Lab Code: SWOK Case No.: 26509 SAS No.: SDG No.: HS794

Matrix: (soil/water) WATER Lab Sample ID: 35676.03

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L33667.D

Level: (low/med) LOW Date Received: 09/24/98

% Moisture: not dec. _____ Date Analyzed: 09/29/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 2

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		Cyclotrisiloxane	12.339	5	J
2.		UNKNOWN	12.598	8	JB
3.					
4.					
5.					
6.					
7.					
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28.					
29.					
30.					

RF 1/27/99

HOLDING TIMES

Method #: VOA-CLP
Client & Batch #: MES- HS794

Validation /Date: Bill F
Review/Date: [illegible]

Include samples, dilutions & reanalyses

#	SAMPLE NUMBER (per COC)	(If Applicable) COC # = Form I Y/N	SAMPLE PRE-SERVED Y/N	TEMP. 4°C (±2°C) Y/N	CONC. LEVEL/ MATRIX	DATE COLLECTED	Extractables ~~DATE EXTRACTED~~ Rec'd DATE	DATE ANALYZED	Extractables EXT. DATE - COLL. DATE	ANAL. DATE - EXT. DATE	ANAL. DATE - COLL. DATE	Action Taken VOA Aromatic J(+) UJ (U)	J ALL	J (+) R (U)	COMMENTS (ANY PROBLEMS ESP. WITH SHIPPING, RECEIPT & SAMPLING CONDITION)
1	HS794	y	y	6.5°C	W	9/22/98	9/24/98	9/29/98			7				
2	5	↓	↓	↓	↓	↓	↓	↓			↓				
3	6	↓	↓	↓	↓	↓	↓	↓			↓				
4															Temp just above 6°C
5											w/in 14				
6															
7															
8															
9															
10															
11															
12															
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24															
25															

For all worksheets: (1) If a particular category is "Not Applicable," denote with N/A (2) Calculation checks performed by validators.

AS794

TUNING

Include samples, dilutions, reanalyses, calibrations & cal checks

TUNING COMPOUND	DATE & TIME TUNED	INSTRUMENT ID	ABUND. CRIT. MET Y/N	SAMPLE WITHIN 12 HR. TIME FRAME Y/N	FORM 5 #'S EQUAL RAW DATA Y/N	CALC. OK	HEADER INFO OK Y/N	ACTION/COMMENTS
TUNE 1:	DATE: 8-10-98 ✓ TIME: 0427	L	y	y	y	y	✓	None ✓
Associated samples:	ICAL ✓							
TUNE 2:	DATE: 9-29-98 ✓ TIME: 1032	L	y	y	y	y	✓	
Associated samples:	All ✓							
TUNE 3:	DATE: TIME:							
Associated samples:								
TUNE 4:	DATE: TIME:							
Associated samples:								
TUNE 5:	DATE: TIME:							
Associated samples:								
TUNE 6:	DATE: TIME:							
Associated samples:								

INITIAL CALIBRATION

AS794

Include samples, dilutions, reanalyses, spikes & blanks

INITIAL CALIBRATION	DATE CALIBRATED	INSTRU-MENT ID	AVG RRF ≥ 0.05 Y/N	RSD ≤ 30% Y/N	1ST ORD. CORR. COEF. (r) or r² ≥ 0.99 Y/N	2ND ORD. VALUES TRACE-ABLE Y/N	CALCULATIONS CHECKS: 1 RRF PER I-CAL STD.	CALCULATIONS CHECKS: MIN 1 AVG. RRF & %RSD	CALCULATIONS CHECKS: MIN. 1 CORR. COEF-FICIENT	COMMENTS & COMPOUNDS FAILING CRITERIA (Note if compounds are SPCC or CCC)
I-CAL 1:	8-10-94	L	1) Y	2) NO	3)	4)	✓	✓	✓	2). Acetone -30.9 ✓
Associated samples: ALL										
I-CAL 2:			5)	6)	7)	8)				
Associated samples:										
I-CAL 3:			9)	10)	11)	12)				
Associated samples:										
I-CAL 4:			13)	14)	15)	16)				
Associated samples:										
I-CAL 5:			17)	18)	19)	20)				
Associated samples:										
I-CAL 6:			21)	22)	23)	24)				
Associated samples:										

GC/MS WORKSHEETS

TechLaw

HS714

CONTINUING CALIBRATION

Include samples, dilutions, reanalyses, spikes & blanks

CONTINUING CALIBRATION	DATE & TIME CALIBRATED	ASSOC. I-CAL DATE	DAILY RRF ≥ 0.05 Y/N	%D ≤ 25% Y/N	CALCULATIONS CHECKS MIN. 1 DAILY RRF	CALCULATIONS CHECKS MIN. 1 %D	COMPOUNDS FAILING CRITERIA (Note if compounds are SPCC or CCC)
C-CAL 1:	9/29/98 1042	8/10/98	1) Y	2) NO	✓	✓	MECL - 30.4 ✓ Acetone 42.6 ✓ 4-methyl-2- 36.7 ✓ 2-Hex 22.2 ✓
Associated samples:	All						
C-CAL 2:			3)	4)			
Associated samples:							
C-CAL 3:			5)	6)			
Associated samples:							
C-CAL 4:			7)	8)			
Associated samples:							
C-CAL 5:			9)	10)			
Associated samples:							
C-CAL 6:			11)	12)			
Associated samples:							

BLANKS

HS794

Include method, trip, equipment & field blanks

BLANK NUMBER & TYPE (Method, Trip, Equipment, Field)	EXTRACTABLES DATE EXTRACTED	DATE ANALYZED	CORRECT MATRIX & LEVEL Y/N	FREQUENCY MET Y/N	ENTER BLANK CONTAMINANTS FOLLOWED BY CONCENTRATION	COMMENTS
BLK #/TYPE Method VBLK1 ✓	—	9/29 1143	y	y	no ~~hits~~ target hits ✓	
Associated samples: All ✓					1 unk TIC at 12.59 ✓ 13 ppb	(77 ppb) in 795 796 R
BLK #/TYPE Holding VHBLK1 ✓	—	9/21	—	—	Same TIC 12.655 no targets ✓	
Associated samples: All ✓						
BLK #/TYPE						
Associated samples:						
BLK #/TYPE						
Associated samples:						
BLK #/TYPE						
Associated samples:						
BLK #/TYPE						
Associated samples:						

GC/MS WORKSHEETS

TechLaw
AS7A4

SURROGATES & INTERNAL STANDARDS

Include samples, dilutions, reanalyses, spikes & blanks which do not met criteria.

QLI #	SAMPLE NUMBER (Include sample *number if limits* not met)	SURROGATES: RECOVERIES WITHIN LIMITS FORM II Y/N	SURROGATES: IF NOT, RE-EXT./ RE-ANAL Y/N	SURROGATES: RE-EXT/ RE-ANAL WITHIN LIMITS Y/N	INTERNAL STDS.: AREAS WITHIN LIMITS MET Y/N	INTERNAL STDS.: R.T.S. WITHIN LIMITS Y/N	SURR & IS: CALC. OK	SURROGATES OUTSIDE QC LIMITS*	INTERNAL STANDARDS OUTSIDE QC LIMITS*	ACTIONS/COMMENTS
1	~~A0~~ A4	y	—	-	y	y	OK	none	No—	None
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
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18										
19										
20										
21										
22										
23										
24										
25										

*Indicate whether surrogate recovery (or internal standard area) was above↑ or below↓QC limits. Use↓↓ for extremely low surrogate recoveries (<10%) or internal standard areas (<2x the lower limit)

GC/MS WORKSHEETS

TechLaw

SPIKES ,LFBs, & LCSs

H5794

Include matrix spikes & laboratory fortified blanks which do not met spiking criteria

TYPE OF SPIKE (Circle One) & ID NUMBER	DATE & TIME ANALYZED	FREQUENCY CRITERIA MET Y/N	SPIKED AT CORRECT LEVEL Y/N	CALC. & TRANS. OK Y/N	LIST SPIKING COMPOUNDS OUTSIDE PERCENT RECOVERY CRITERIA (Followed by percent recovery)	LIST MS/MSD SPIKING COMPOUNDS OUTSIDE RPD CRITERIA (Followed by RPD)	ACTIONS/COMMENTS
LFB / ~~MS / MSD /~~ LCS # H5794		y	y	OK	none	Benzene 15% (limit 11) ✓	NO ACTION
Associated samples: All							
LFB / MS / MSD / LCS #							
Associated samples:							
LFB / MS / MSD / LCS #							
Associated samples:							
LFB / MS / MSD / LCS #					794 - 12 DCE total 2 c/3 2 1,1,1 TCA 1		
Associated samples:							
LFB / MS / MSD / LCS #					PCE MEK	140 17 - not on spike	
Associated samples:							
LFB / MS / MSD / LCS #							
Associated samples:							

GC/MS WORKSHEETS

TechLaw

COMPOUND IDENTIFICATION, QUANTITATION & MDLS

AS794

Include samples, dilutions, reanalyses & blanks

QLI #	SAMPLE NUMBER (Include if problems exist)	ID CRITERIA		COMMENTS & COMPOUNDS FAILING ID CRITERIA	SPECTRA PRESENT (TCL & TIC) Y/N	CALC. CHECKS		TRANS-CRIPTION ERRORS Y/N	ACTIONS/COMMENTS
		RRT (0.06) MET Y/N	MASS SPECTRAL MET Y/N			MDLS CORRECT Y/N	CHECK 1-3 HIT(S) PER SAMPLE		
1	794	✓	✓	None	✓	✓	✓		
2	795	✓	✓		✓	✓	✓		3 TICs 1 B
3	796	✓	✓		✓	—	—		2 TICs 1 B
4									
5									
6									
7									
8									
9									CB → TICs
10									
11									
12									
13									
14									
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25									

For all worksheets: (1) If a particular category is "Not Applicable," denote with N/A (2) Calculation checks performed by validators.

SYSTEM PERFORMANCE, DATA COMPLETENESS & ADDITIONAL QC

AS794

Include samples for which problems exist.

SYSTEM PERFORMANCE			DATA COMPLETENESS	
QLI #	SAMPLE NUMBER	IDENTIFY FACTORS THAT INDICATE SYSTEM PERFORMANCE PROBLEMS (e.g. Baseline Shifts, Large Air Peaks, I.S. Area Changes, etc.)	SAMPLE NUMBER	OTHER MISSING DATA (including Mass Spectra)

Include field duplicates.

ADDITIONAL QC		
FIELD DUPLICATE SAMPLE NUMBERS	LIST COMPOUNDS WITH RPDs OUTSIDE RPD CRITERIA (followed by RPD)	ACTION/COMMENTS

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS662

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7613.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. ________ Date Analyzed: 11/18/98

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: ______ (uL) Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
74-87-3	Chloromethane	10	U	
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl Chloride	10	U	
75-00-3	Chloroethane	10	U	
75-09-2	Methylene Chloride	10	U	
67-64-1	Acetone	10	U	
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	10	U	
75-34-3	1,1-Dichloroethane	10	U	
540-59-0	1,2-Dichloroethene (total)	5	J	
67-66-3	Chloroform	4	J	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	10	U	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	4	J	
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	10	U	
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-Pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	420	E	320 D
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-88-3	Toluene	10	U	
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethylbenzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Xylene (Total)	10	U	

Report PCE from the 5 times diluted analysis
TE 1/29/99

FORM I VOA OLM3.0

~~AHHA2A~~
000020

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS662

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7613.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
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RF 1/29/99

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS662DL

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7626.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	50	U
74-83-9	Bromomethane	50	U
75-01-4	Vinyl Chloride	50	U
75-00-3	Chloroethane	50	U
75-09-2	Methylene Chloride	50	U
67-64-1	Acetone	50	U
75-15-0	Carbon Disulfide	50	U
75-35-4	1,1-Dichloroethene	50	U
75-34-3	1,1-Dichloroethane	50	U
540-59-0	1,2-Dichloroethene (total)	50	U
67-66-3	Chloroform	50	U
107-06-2	1,2-Dichloroethane	50	U
78-93-3	2-Butanone	50	U
71-55-6	1,1,1-Trichloroethane	50	U
56-23-5	Carbon Tetrachloride	50	U
75-27-4	Bromodichloromethane	50	U
78-87-5	1,2-Dichloropropane	50	U
10061-01-5	cis-1,3-Dichloropropene	50	U
79-01-6	Trichloroethene	50	U
124-48-1	Dibromochloromethane	50	U
79-00-5	1,1,2-Trichloroethane	50	U
71-43-2	Benzene	50	U
10061-02-6	trans-1,3-Dichloropropene	50	U
75-25-2	Bromoform	50	U
108-10-1	4-Methyl-2-Pentanone	50	U
591-78-6	2-Hexanone	50	U
127-18-4	Tetrachloroethene	320	D
79-34-5	1,1,2,2-Tetrachloroethane	50	U
108-88-3	Toluene	50	U
108-90-7	Chlorobenzene	50	U
100-41-4	Ethylbenzene	50	U
100-42-5	Styrene	50	U
1330-20-7	Xylene (Total)	50	U

Report only PCE from this analysis

DF 1/29/99

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS662DL

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7626.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
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Report only PCE from this analysis BF 11/20/98

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS663

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.02

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7615.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
74-87-3	Chloromethane	10	U	
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl Chloride	10	U	
75-00-3	Chloroethane	10	U	
75-09-2	Methylene Chloride	1	J	10 u
67-64-1	Acetone	10	U	
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	10	U	
75-34-3	1,1-Dichloroethane	10	U	
540-59-0	1,2-Dichloroethene (total)	10	U	
67-66-3	Chloroform	10	U	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	10	U	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	10	U	
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	10	U	5 u
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-Pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	1	J	
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-88-3	Toluene	10	U	5 u
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethylbenzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Xylene (Total)	10	U	

TK 12/29/98

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS663

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.02

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7615.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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12/1/99

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1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS664

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.03

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7627.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	50	U
74-83-9	Bromomethane	50	U
75-01-4	Vinyl Chloride	50	U
75-00-3	Chloroethane	50	U
75-09-2	Methylene Chloride	24	J
67-64-1	Acetone	50	U
75-15-0	Carbon Disulfide	50	U
75-35-4	1,1-Dichloroethene	50	U
75-34-3	1,1-Dichloroethane	50	U
540-59-0	1,2-Dichloroethene (total)	50	U
67-66-3	Chloroform	50	U
107-06-2	1,2-Dichloroethane	50	U
78-93-3	2-Butanone	50	U
71-55-6	1,1,1-Trichloroethane	50	U
56-23-5	Carbon Tetrachloride	50	U
75-27-4	Bromodichloromethane	50	U
78-87-5	1,2-Dichloropropane	50	U
10061-01-5	cis-1,3-Dichloropropene	50	U
79-01-6	Trichloroethene	50	U
124-48-1	Dibromochloromethane	50	U
79-00-5	1,1,2-Trichloroethane	50	U
71-43-2	Benzene	50	U
10061-02-6	trans-1,3-Dichloropropene	50	U
75-25-2	Bromoform	50	U
108-10-1	4-Methyl-2-Pentanone	50	U
591-78-6	2-Hexanone	50	U
127-18-4	Tetrachloroethene	290	
79-34-5	1,1,2,2-Tetrachloroethane	50	U
108-88-3	Toluene	50	U
108-90-7	Chlorobenzene	50	U
100-41-4	Ethylbenzene	50	U
100-42-5	Styrene	50	U
1330-20-7	Xylene (Total)	50	U

50 u

BF 12/29/98

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS664

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.03

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7627.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS665

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.06

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7618.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	3	J
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	11	
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (Total)	10	U

RF 1/29/99

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS665

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.06

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7618.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS666

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.07

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7619.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. ________ Date Analyzed: 11/18/98

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: ________ (uL) Soil Aliquot Volume: ______ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
74-87-3	Chloromethane	10	U	
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl Chloride	10	U	
75-00-3	Chloroethane	10	U	
75-09-2	Methylene Chloride	2	J	10 U
67-64-1	Acetone	10	U	
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	10	U	
75-34-3	1,1-Dichloroethane	10	U	
540-59-0	1,2-Dichloroethene (total)	1	J	
67-66-3	Chloroform	4	J	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	10	U	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	2	J	
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	10	U	
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-Pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	190		
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-88-3	Toluene	10	U	
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethylbenzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Xylene (Total)	10	U	

RF 1/20/99

~~A11102C~~
000058
SAB 121598

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS666

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.07

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7619.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
6.					
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8.					
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10.					
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TF 1/29/99

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000059

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS667

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.08

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7620.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total	10	U
67-66-3	Chloroform	2	J
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (Total)	10	U

PK 12/29/99

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS667

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.08

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7620.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	104-76-7	1-Hexanol, 2-ethyl-	17.716	17	NJ
2.					
3.					
4.					
5.					
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11/19/98

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS668

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.09

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7621.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
74-87-3	Chloromethane	10	U	
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl Chloride	10	U	
75-00-3	Chloroethane	10	U	
75-09-2	Methylene Chloride	2	J	10 U
67-64-1	Acetone	10	U	
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	10	U	
75-34-3	1,1-Dichloroethane	10	U	
540-59-0	1,2-Dichloroethene (total)	3	J	
67-66-3	Chloroform	5	J	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	10	U	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	4	J	
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	10	U	
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-Pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	480	E	310 D
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-88-3	Toluene	10	U	
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethylbenzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Xylene (Total)	10	U	

Report PCE from 5 times dilution

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS668

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.09

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7621.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 2

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	75-37-6	Ethane, 1,1-difluoro-	2.441	21	NJ
2.	110-54-3	Hexane	7.606	5	NJ
3.					
4.					
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1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS668DL

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.09

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7694.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/21/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
74-87-3	Chloromethane	50	U	
74-83-9	Bromomethane	50	U	
75-01-4	Vinyl Chloride	50	U	
75-00-3	Chloroethane	50	U	
75-09-2	Methylene Chloride	8	JD	
67-64-1	Acetone	50	U	
75-15-0	Carbon Disulfide	50	U	
75-35-4	1,1-Dichloroethene	50	U	
75-34-3	1,1-Dichloroethane	50	U	
540-59-0	1,2-Dichloroethene (total)	50	U	
67-66-3	Chloroform	50	U	
107-06-2	1,2-Dichloroethane	50	U	
78-93-3	2-Butanone	50	U	
71-55-6	1,1,1-Trichloroethane	50	U	
56-23-5	Carbon Tetrachloride	50	U	
75-27-4	Bromodichloromethane	50	U	
78-87-5	1,2-Dichloropropane	50	U	
10061-01-5	cis-1,3-Dichloropropene	50	U	
79-01-6	Trichloroethene	50	U	
124-48-1	Dibromochloromethane	50	U	
79-00-5	1,1,2-Trichloroethane	50	U	
71-43-2	Benzene	50	U	
10061-02-6	trans-1,3-Dichloropropene	50	U	
75-25-2	Bromoform	50	U	
108-10-1	4-Methyl-2-Pentanone	50	U	
591-78-6	2-Hexanone	50	U	
127-18-4	Tetrachloroethene	310	D	J
79-34-5	1,1,2,2-Tetrachloroethane	50	U	
108-88-3	Toluene	50	U	
108-90-7	Chlorobenzene	50	U	
100-41-4	Ethylbenzene	50	U	
100-42-5	Styrene	50	U	
1330-20-7	Xylene (Total)	50	U	

Report only PCE from this analysis

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS668DL

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.09

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7694.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/21/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
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30.					

TF 1/26/99

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

HS669

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.10

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7679.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/21/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
74-87-3	Chloromethane	10	U	UJ
74-83-9	Bromomethane	10	U	
75-01-4	Vinyl Chloride	10	U	UJ
75-00-3	Chloroethane	10	U	
75-09-2	Methylene Chloride	4	JB	104
67-64-1	Acetone	11		
75-15-0	Carbon Disulfide	10	U	
75-35-4	1,1-Dichloroethene	10	U	
75-34-3	1,1-Dichloroethane	10	U	
540-59-0	1,2-Dichloroethene (total)	10	U	
67-66-3	Chloroform	2	J	
107-06-2	1,2-Dichloroethane	10	U	
78-93-3	2-Butanone	10	U	
71-55-6	1,1,1-Trichloroethane	10	U	
56-23-5	Carbon Tetrachloride	10	U	
75-27-4	Bromodichloromethane	10	U	
78-87-5	1,2-Dichloropropane	10	U	
10061-01-5	cis-1,3-Dichloropropene	10	U	
79-01-6	Trichloroethene	10	U	
124-48-1	Dibromochloromethane	10	U	
79-00-5	1,1,2-Trichloroethane	10	U	
71-43-2	Benzene	10	U	UJ
10061-02-6	trans-1,3-Dichloropropene	10	U	
75-25-2	Bromoform	10	U	
108-10-1	4-Methyl-2-Pentanone	10	U	
591-78-6	2-Hexanone	10	U	
127-18-4	Tetrachloroethene	10	U	
79-34-5	1,1,2,2-Tetrachloroethane	10	U	
108-88-3	Toluene	10	U	UJ
108-90-7	Chlorobenzene	10	U	
100-41-4	Ethylbenzene	10	U	
100-42-5	Styrene	10	U	
1330-20-7	Xylene (Total)	10	U	

RF 1/29/99

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS669

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26531 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.10

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7679.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. ________ Date Analyzed: 11/21/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 0

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
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FORM I VOA-TIC TK 1/21/99 OLM3.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
HS670

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.11

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7623.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	3	J
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	16	
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	34	
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (Total)	10	U

10 U

DF 1/29/11

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

HS670

Lab Name: ATAS, INC. Contract: 68-D5-0018

Lab Code: ATAS Case No.: 26631 SAS No.: SDG No.: HS662

Matrix: (soil/water) WATER Lab Sample ID: 24509.11

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: C7623.D

Level: (low/med) LOW Date Received: 11/13/98

% Moisture: not dec. _____ Date Analyzed: 11/18/98

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	75-37-6	Ethane, 1,1-difluoro-	2.435	12	NJ
2.					
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4.					
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Cost Code: 360

EPA METHOD 524.2 GC/MS
Purgeables

Lab # 9807807

Send Report To:
UDEQ - DERR - UST
ATTN:
168 N 1950 W BLDG #2
SALT LAKE CITY UT 84116

Utah Division of Laboratory Services
46 North Medical Drive
Salt Lake City, UT 84113

Date/Time Collected: 09/04/98 14:40 Sample Matrix: Water
Collected By: NEIL TAYLOR Sampling Site:
Description of Sampling Point: OUR LADY OF LORDS SPRING

Analyst: R.L Date Received: 09/04/98 Date Analyzed: 09/11/98

Regulated	MRL	Results ug/L	List 1	MRL	Results ug/L
Benzene	0.5	U	Chloroform	0.5	1.2
Carbon Tetrachloride	0.5	U	Bromodichloromethane	0.5	U
1,2-Dichloroethane	0.5	U	Chlorodibromomethane	0.5	U
1,1-Dichloroethylene	0.5	U	Bromoform	0.5	U
Para-Dichlorobenzene	0.5	U	m-Dichlorobenzene	0.5	U
1,1,1-Trichloroethane	0.5	U	1,1-Dichloropropene	0.5	U
Trichloroethylene	0.5	U	1,1-Dichloroethane	0.5	U
Vinyl Chloride	0.5	U	1,1,2,2-Tetrachloroethane	0.5	U
o-Dichlorobenzene	0.5	U	1,3-Dichloropropane	0.5	U
cis 1,2-Dichloroethylene	0.5	U	Chloromethane	0.5	U
trans 1,2-Dichloroethylene	0.5	U	Bromomethane	0.5	U
1,2-Dichloropropane	0.5	U	1,2,3-Trichloropropane	0.5	U
Ethylbenzene	0.5	U	1,1,1,2-Tetrachloroethane	0.5	U
Monochlorobenzene	0.5	U	Chloroethane	0.5	U
Styrene	0.5	U	2,2-Dichloropropane	0.5	U
Tetrachloroethylene	0.5	U	o-Chlorotoluene	0.5	U
Toluene	0.5	U	p-Chlorotoluene	0.5	U
Xylenes (total)	0.5	U	Bromobenzene	0.5	U
Dichloromethane	0.5	U	cis-1,3-Dichloropropene	0.5	U
1,2,4-Trichlorobenzene	0.5	U	trans-1,3-Dichloropropene	0.5	U
1,1,2-Trichloroethane	0.5	U	Dibromomethane	0.5	U
Ethylene Dibromide	0.5	U			
1,2-dibromo-3-chloropropane	0.5	U			

List 3	MDL	Results ug/L		MDL	Results ug/L
1,2,4-Trimethylbenzene	0.5	U	p-Isopropyltoluene	0.5	U
1,2,3-Trichlorobenzene	0.5	U	Isopropylbenzene	0.5	U
n-Propylbenzene	0.5	U	Tert-butylbenzene	0.5	U
n-Butylbenzene	0.5	U	Sec-bytylbenzene	0.5	U
Napthalene	0.5	U	Fluorotrichloromethane	0.5	U
Hexachlorobutadiene	0.5	U	Dichlorodifluoromethane	0.5	U
1,3,5-Trimethylbenzene	0.5	U	Bromochloromethane	0.5	U

U- Analyzed for but not detected

18

Analysis Certified By: Date: 9/16

Cost Code: 367 | EPA METHOD 524.2 GC/MS Purgeables | Lab # 9806662

Send Report To:
DIV.EMERGENCY RESPONSE & REMED
ATTN:
168 NORTH 1950 WEST
SALT LAKE CITY UT 84114

Utah Division of Laboratory Services
46 North Medical Drive
Salt Lake City, UT 84113

Date/Time Collected: 08/07/98 09:15 Sample Matrix: Water
Collected By: NEIL TAYLOR Sampling Site:
Description of Sampling Point: BENSON SPRING

Analyst: RL Date Received: 08/07/98 Date Analyzed: 8/11/98

Regulated	MRL	Results ug/L	List 1	MRL	Results ug/L
Benzene	0.5	U	Chloroform	0.5	0.7
Carbon Tetrachloride	0.5	U	Bromodichloromethane	0.5	U
1,2-Dichloroethane	0.5	U	Chlorodibromomethane	0.5	U
1,1-Dichloroethylene	0.5	U	Bromoform	0.5	U
Para-Dichlorobenzene	0.5	U	m-Dichlorobenzene	0.5	U
1,1,1-Trichloroethane	0.5	U	1,1-Dichloropropene	0.5	U
Trichloroethylene	0.5	U	1,1-Dichloroethane	0.5	U
Vinyl Chloride	0.5	U	1,1,2,2-Tetrachloroethane	0.5	U
o-Dichlorobenzene	0.5	U	1,3-Dichloropropane	0.5	U
cis 1,2-Dichloroethylene	0.5	U	Chloromethane	0.5	U
trans 1,2-Dichloroethylene	0.5	U	Bromomethane	0.5	U
1,2-Dichloropropane	0.5	U	1,2,3-Trichloropropane	0.5	U
Ethylbenzene	0.5	U	1,1,1,2-Tetrachloroethane	0.5	U
Monochlorobenzene	0.5	U	Chloroethane	0.5	U
Styrene	0.5	U	2,2-Dichloropropane	0.5	U
Tetrachloroethylene	0.5	U	o-Chlorotoluene	0.5	U
Toluene	0.5	U	p-Chlorotoluene	0.5	U
Xylenes (total)	0.5	U	Bromobenzene	0.5	U
Dichloromethane	0.5	U	cis-1,3-Dichloropropene	0.5	U
1,2,4-Trichlorobenzene	0.5	U	trans-1,3-Dichloropropene	0.5	U
1,1,2-Trichloroethane	0.5	U	Dibromomethane	0.5	U
Ethylene Dibromide	0.5	U			
1,2-dibromo-3-chloropropane	0.5	U			

List 3	MDL	Results ug/L		MDL	Results ug/L
1,2,4-Trimethylbenzene	0.5	U	p-Isopropyltoluene	0.5	U
1,2,3-Trichlorobenzene	0.5	U	Isopropylbenzene	0.5	U
n-Propylbenzene	0.5	U	Tert-butylbenzene	0.5	U
n-Butylbenzene	0.5	U	Sec-bytylbenzene	0.5	U
Napthalene	0.5	U	Fluorotrichloromethane	0.5	U
Hexachlorobutadiene	0.5	U	Dichlorodifluoromethane	0.5	U
1,3,5-Trimethylbenzene	0.5	U	Bromochloromethane	0.5	U

U- Analyzed for but not detected

*Data could be suspect. LFB failed. Recovery for some compounds > 120%

Analysis Certified By: /2 Date: 8/12

Cost Code: 360

EPA METHOD 524.2 GC/MS
Purgeables

Lab # 9806484

Send Report To:
UDEQ - DERR - UST
ATTN:
168 N 1950 W BLDG #2
SALT LAKE CITY UT 84116

Utah Division of Laboratory Services
46 North Medical Drive
Salt Lake City, UT 84113

Date/Time Collected: 08/03/98 12:45
Collected By: M TAYLOR
Sample Matrix: Water
Sampling Site:
Description of Sampling Point: CHAPMAN WELL

Analyst: R.L Date Received: 08/03/98 Date Analyzed: 08/04/98

Regulated	MRL	Results ug/L	List 1	MRL	Results ug/L
Benzene	0.5	U	Chloroform	0.5	U
Carbon Tetrachloride	0.5	U	Bromodichloromethane	0.5	U
1,2-Dichloroethane	0.5	U	Chlorodibromomethane	0.5	U
1,1-Dichloroethylene	0.5	U	Bromoform	0.5	U
Para-Dichlorobenzene	0.5	U	m-Dichlorobenzene	0.5	U
1,1,1-Trichloroethane	0.5	U	1,1-Dichloropropene	0.5	U
Trichloroethylene	0.5	U	1,1-Dichloroethane	0.5	U
Vinyl Chloride	0.5	U	1,1,2,2-Tetrachloroethane	0.5	U
o-Dichlorobenzene	0.5	U	1,3-Dichloropropane	0.5	U
cis 1,2-Dichloroethylene	0.5	U	Chloromethane	0.5	U
trans 1,2-Dichloroethylene	0.5	U	Bromomethane	0.5	U
1,2-Dichloropropane	0.5	U	1,2,3-Trichloropropane	0.5	U
Ethylbenzene	0.5	U	1,1,1,2-Tetrachloroethane	0.5	U
Monochlorobenzene	0.5	U	Chloroethane	0.5	U
Styrene	0.5	U	2,2-Dichloropropane	0.5	U
Tetrachloroethylene	0.5	U	o-Chlorotoluene	0.5	U
Toluene	0.5	U	p-Chlorotoluene	0.5	U
Xylenes (total)	0.5	U	Bromobenzene	0.5	U
Dichloromethane	0.5	U	cis-1,3-Dichloropropene	0.5	U
1,2,4-Trichlorobenzene	0.5	U	trans-1,3-Dichloropropene	0.5	U
1,1,2-Trichloroethane	0.5	U	Dibromomethane	0.5	U
Ethylene Dibromide	0.5	U			
1,2-dibromo-3-chloropropane	0.5	U			

List 3	MDL	Results ug/L		MDL	Results ug/L
1,2,4-Trimethylbenzene	0.5	U	p-Isopropyltoluene	0.5	U
1,2,3-Trichlorobenzene	0.5	U	Isopropylbenzene	0.5	U
n-Propylbenzene	0.5	U	Tert-butylbenzene	0.5	U
n-Butylbenzene	0.5	U	Sec-bytylbenzene	0.5	U
Napthalene	0.5	U	Fluorotrichloromethane	0.5	U
Hexachlorobutadiene	0.5	U	Dichlorodifluoromethane	0.5	U
1,3,5-Trimethylbenzene	0.5	U	Bromochloromethane	0.5	U

U- Analyzed for but not detected

- 7 -

Analysis Certified By: Date: 8/5

Cost Code: 360

EPA METHOD 524.2 GC/MS
Purgeables

Lab # 9806567

Send Report To:
UDEQ - DERR - UST
ATTN:
168 N 1950 W BLDG #2
SALT LAKE CITY UT 84116

Utah Division of Laboratory Services
46 North Medical Drive
Salt Lake City, UT 84113

Date/Time Collected: 08/05/98 10:00 Sample Matrix: Water
Collected By: NEIL TAYLOR Sampling Site:
Description of Sampling Point: SMITH SPRING

Analyst: RL Date Received: 08/05/98 Date Analyzed: 8/11/98

Regulated	MRL	Results ug/L	List 1	MRL	Results ug/L
Benzene	0.5	U	Chloroform	0.5	U
Carbon Tetrachloride	0.5	U	Bromodichloromethane	0.5	U
1,2-Dichloroethane	0.5	U	Chlorodibromomethane	0.5	U
1,1-Dichloroethylene	0.5	U	Bromoform	0.5	U
Para-Dichlorobenzene	0.5	U	m-Dichlorobenzene	0.5	U
1,1,1-Trichloroethane	0.5	U	1,1-Dichloropropene	0.5	U
Trichloroethylene	0.5	U	1,1-Dichloroethane	0.5	U
Vinyl Chloride	0.5	U	1,1,2,2-Tetrachloroethane	0.5	U
o-Dichlorobenzene	0.5	U	1,3-Dichloropropane	0.5	U
cis 1,2-Dichloroethylene	0.5	U	Chloromethane	0.5	U
trans 1,2-Dichloroethylene	0.5	U	Bromomethane	0.5	U
1,2-Dichloropropane	0.5	U	1,2,3-Trichloropropane	0.5	U
Ethylbenzene	0.5	U	1,1,1,2-Tetrachloroethane	0.5	U
Monochlorobenzene	0.5	U	Chloroethane	0.5	U
Styrene	0.5	U	2,2-Dichloropropane	0.5	U
Tetrachloroethylene	0.5	U	o-Chlorotoluene	0.5	U
Toluene	0.5	U	p-Chlorotoluene	0.5	U
Xylenes (total)	0.5	U	Bromobenzene	0.5	U
Dichloromethane	0.5	U	cis-1,3-Dichloropropene	0.5	U
1,2,4-Trichlorobenzene	0.5	U	trans-1,3-Dichloropropene	0.5	U
1,1,2-Trichloroethane	0.5	U	Dibromomethane	0.5	U
Ethylene Dibromide	0.5	U			
1,2-dibromo-3-chloropropane	0.5	U			

List 3	MDL	Results ug/L		MDL	Results ug/L
1,2,4-Trimethylbenzene	0.5	U	p-Isopropyltoluene	0.5	U
1,2,3-Trichlorobenzene	0.5	U	Isopropylbenzene	0.5	U
n-Propylbenzene	0.5	U	Tert-butylbenzene	0.5	U
n-Butylbenzene	0.5	U	Sec-bytylbenzene	0.5	U
Napthalene	0.5	U	Fluorotrichloromethane	0.5	U
Hexachlorobutadiene	0.5	U	Dichlorodifluoromethane	0.5	U
1,3,5-Trimethylbenzene	0.5	U	Bromochloromethane	0.5	U

U- Analyzed for but not detected

*Data could be suspect. LFB failed. Recovery for some compounds > 120%

Analysis Certified By: [signature] Date: 8/31

Cost Code: 360

EPA METHOD 524.2 GC/MS
Purgeables

Lab # 9806568

Send Report To:
UDEQ - DERR - UST
ATTN:
168 N 1950 W BLDG #2
SALT LAKE CITY UT 84116

Utah Division of Laboratory Services
46 North Medical Drive
Salt Lake City, UT 84113

Date/Time Collected: 08/05/98 11:00 Sample Matrix: Water
Collected By: NEIL TAYLOR Sampling Site:
Description of Sampling Point: BOWEN SPRING

Analyst: R.L Date Received: 08/05/98 Date Analyzed: 8/11/98

Regulated	MRL	Results ug/L	List 1	MRL	Results ug/L
Benzene	0.5	U	Chloroform	0.5	1.8
Carbon Tetrachloride	0.5	U	Bromodichloromethane	0.5	U
1,2-Dichloroethane	0.5	U	Chlorodibromomethane	0.5	U
1,1-Dichloroethylene	0.5	U	Bromoform	0.5	U
Para-Dichlorobenzene	0.5	U	m-Dichlorobenzene	0.5	U
1,1,1-Trichloroethane	0.5	U	1,1-Dichloropropene	0.5	U
Trichloroethylene	0.5	U	1,1-Dichloroethane	0.5	U
Vinyl Chloride	0.5	U	1,1,2,2-Tetrachloroethane	0.5	U
o-Dichlorobenzene	0.5	U	1,3-Dichloropropane	0.5	U
cis 1,2-Dichloroethylene	0.5	U	Chloromethane	0.5	U
trans 1,2-Dichloroethylene	0.5	U	Bromomethane	0.5	U
1,2-Dichloropropane	0.5	U	1,2,3-Trichloropropane	0.5	U
Ethylbenzene	0.5	U	1,1,1,2-Tetrachloroethane	0.5	U
Monochlorobenzene	0.5	U	Chloroethane	0.5	U
Styrene	0.5	U	2,2-Dichloropropane	0.5	U
Tetrachloroethylene	0.5	U	o-Chlorotoluene	0.5	U
Toluene	0.5	U	p-Chlorotoluene	0.5	U
Xylenes (total)	0.5	U	Bromobenzene	0.5	U
Dichloromethane	0.5	U	cis-1,3-Dichloropropene	0.5	U
1,2,4-Trichlorobenzene	0.5	U	trans-1,3-Dichloropropene	0.5	U
1,1,2-Trichloroethane	0.5	U	Dibromomethane	0.5	U
Ethylene Dibromide	0.5	U			
1,2-dibromo-3-chloropropane	0.5	U			

List 3	MDL	Results ug/L		MDL	Results ug/L
1,2,4-Trimethylbenzene	0.5	U	p-Isopropyltoluene	0.5	U
1,2,3-Trichlorobenzene	0.5	U	Isopropylbenzene	0.5	U
n-Propylbenzene	0.5	U	Tert-butylbenzene	0.5	U
n-Butylbenzene	0.5	U	Sec-bytylbenzene	0.5	U
Napthalene	0.5	U	Fluorotrichloromethane	0.5	U
Hexachlorobutadiene	0.5	U	Dichlorodifluoromethane	0.5	U
1,3,5-Trimethylbenzene	0.5	U	Bromochloromethane	0.5	U

U- Analyzed for but not detected

*Data could be suspect. LFB failed. Recovery for some compounds > 120%

Analysis Certified By: Date: 8/11

APPENDIX F

GRANT OF ACCESS, CHAIN OF CUSTODY, AND SHIPPING INFORMATION

DEPARTMENT OF VETERANS AFFAIRS
Medical Center
500 Foothill Blvd.
Salt Lake City UT 84148

In Reply Refer To: 660/00QH

.October 8, 1996

Mr. Neil Taylor
Environmental Scientist, Site Assessment Section
Division of Environmental Response and Remediation
168 North, 1950 West, Salt Lake City, UT 84114

Dear Mr. Taylor:

Thank you for your letter of October 3, 1996. Enclosed is the Consent for Access To Property as you have requested. The date of October 18, 1996 is acceptable to conduct the sampling. Please contact me when you arrive on-site. I can be reached at extension 4533 or VA pager 1338.

Sincerely,

Robert P. Blonquist

ROBERT P. BLONQUIST
Industrial Hygienist

Enclosure

cc: District Counsel (02)

Utah Department of Environmental Quality
Division of Environmental Response and Remediation
CERCLA Branch

CONSENT FOR ACCESS TO PROPERTY

Name, Title, Mailing Address:

Robert Blonquist
Veteran's Medical Center
500 Foothill Drive
Salt Lake City, Utah 84

Property Location:

This property is located at 500 Foothill Drive, Salt Lake City, Utah. Building Seven is located on the southeastern section of the facility.

I am an owner of record, title holder or authorized agent for the record owner, of the property described above, after receiving reasonable advanced notice, I hereby give my consent and grant access for ingress and egress to the Property to officers, employees, and authorized representatives of the Utah Division of Environmental Response and Remediation (UDERR) and the U.S. Environmental Protection Agency (USEPA) for the following purposes:

- *Collecting subsurface soil samples east and south of Building Seven.*
- Other such actions related to the taking of the above samples as may be necessary.

I have been informed and understand that these actions by UDERR are undertaken pursuant to the authorities provided in the Utah Environmental Quality Regulations of the Utah Code Ann.: Sections 19-1-101 et seq. (General Provisions), and Sections 19-6-301 et seq. (Hazardous Substances Mitigation Act), and the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA), 42 U.S.C.A. 9601.

This consent and grant for access is given voluntarily with knowledge of my right to refuse access. I further acknowledge that no other promises, representations or claims of any kind, either written or oral, have been made by UDERR to induce my consent.

( ) I wish to obtain splits of all samples collected on the above property and a receipt describing each sample taken. I understand that I must provide the necessary sample containers to obtain these splits. The responsibility of choosing an analytical laboratory and the cost of analysis of the splits is solely mine.

(✓) I waive my right to obtain split samples.

(Signature) Robert L. Blodgett (Date) 10/28/94

VETERANS ADMINISTRATION

PERMIT FOR USE OF REAL PROPERTY BY FEDERAL AGENCY

1. PERMIT NO.

Permission, revocable at the will of the Veterans Administration, is hereby granted the permittee hereinafter named to use the property described below for the purpose designated. Subject to the conditions, special and general, herein prescribed.

2. NAME OF PERMITTEE AGENCY	3A. NAME AND ADDRESS OF LOCAL PERMITTEE REPRESENTATIVE	3B. TELEPHONE NO.
Utah Div. of Environmental Response and Remediation and/or the U.S. E.P.A.	Neil B. Taylor Utah Div. of Environmental Response and Remediation	536-4102

4. NAME AND ADDRESS OF INSTALLATION	5. MAXIMUM PERIOD COVERED	
	From (Month, day, year)	To (Month, day, year)
Department of Veteran Affairs Medical Center, 500 Foothill Blvd., Salt Lake City, UT 84148	8/~~21~~27/98	8/~~23~~31/98

6A. DESCRIPTION OF PROPERTY AFFECTED	6B. EXHIBIT(S) ATTACHED
Parking Lot #4, VA Medical Center	Site Map attached

7. PURPOSE OF PERMIT

To allow the E.P.A. to drill a single monitoring well (water) to determine the presence of a contaminant (Perchlorethylene) in the aquifer.

By the acceptance of this permit, the permittee agrees to abide by and be bound by the following conditions:

8. SPECIAL CONDITIONS

a. The time of the drilling operations shall be between the hours of 7:00 A.M. and 5:00 P.M. 8/~~21~~27/98 through 8/~~23~~31/98.

b. Drilling operations to be concluded within the maximum period covered unless an extension of time agreement between both parties is entered into.

c. Sample splits will be provided to the VA by the permittee in containers provided by the E.P.A.

d. Permittee shall provide the VA with copies of any and all reports and/or analytical data from the findings.

e. Capping of the well will be the responsibility of the permittee; will be performed within the maximum time allowed and will be done so to the satisfaction of the VA.

f. The POC for the VA is Robert P. Blonquist, Safety & Occupational Health Specialist, and may be reached at 582-1565.

g. Permittee's access to the well outside the period covered here will be permitted only upon notice and approval of the VA.

h. Permittee shall give the VA 24-hour notice of additional water sampling, as required.

SPECIAL CONDITIONS (Continued)

GENERAL CONDITIONS

a. The use and occupancy of the property shall be without cost or expense to the Veterans Administration, and under the general supervision of the Medical Center Director or his authorized representative, and subject to such rules and regulations as he may prescribe from time to time.

b. The permittee shall at its own expense and without cost or expense to the Veterans Administration, maintain and keep the property in good repair and condition.

c. The use to be made of the property shall be limited to that specified in this permit.

d. The permittee shall pay the cost, as determined by the Medical Center Director or his authorized representative, of producing and/or supplying any utilities and other services furnished by the Veterans Administration for use of the permittee. At signing, no cost to the permittee is oweing.

e. No additions to or alterations of the property shall be made without the prior consent of the Medical Center Director. or its authorized representative.

f. On or before the date of expiration or termination of this permit, the permittee shall vacate the premises, remove its property therefrom and restore the premises to a condition satisfactory to the Veterans Administration. If, however, this permit is revoked, the permittee shall vacate the premises, remove its property therefrom and restore the premises as aforesaid within such time as the Veterans Administration may designate.

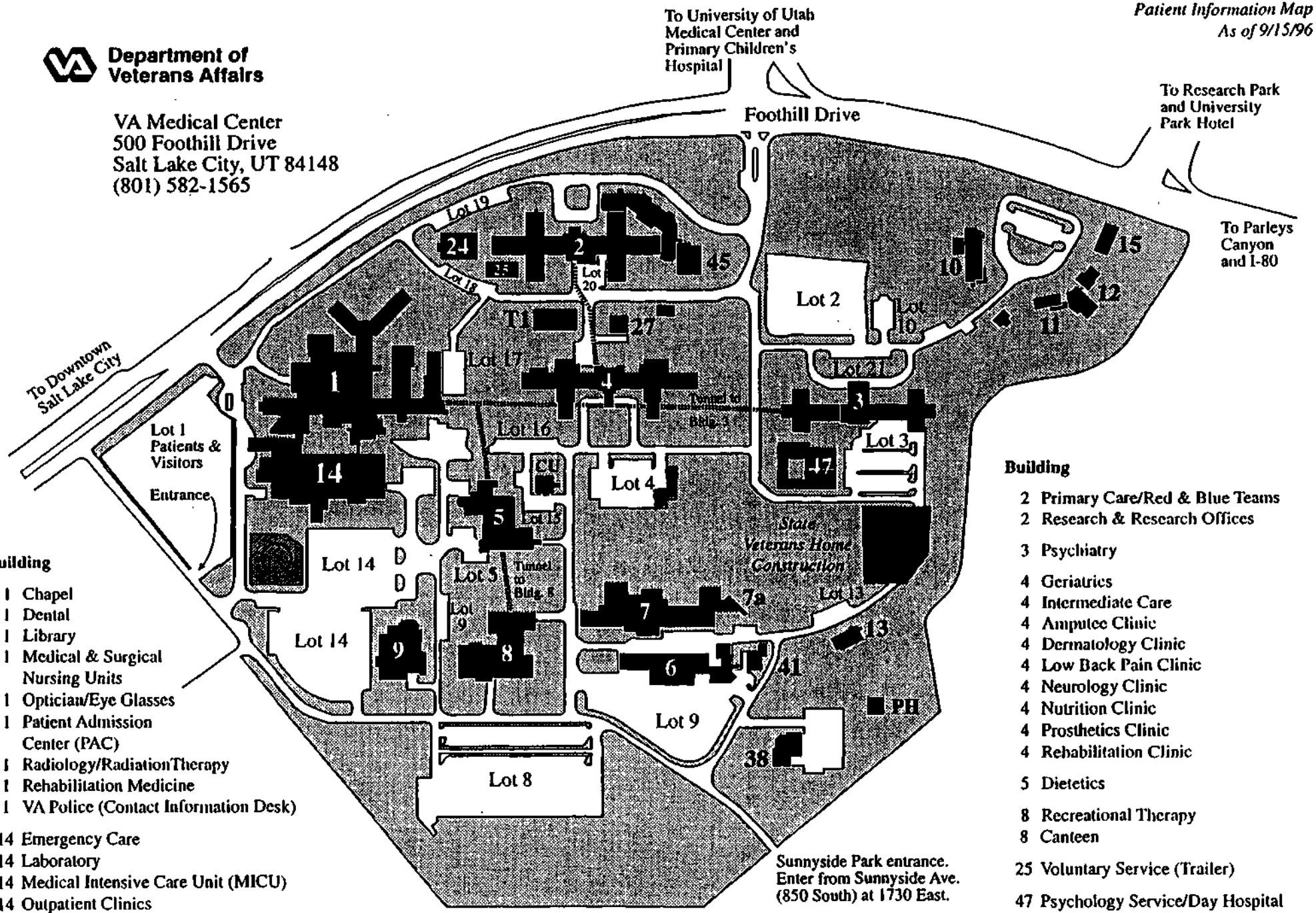
VETERANS ADMINISTRATION PERMITTOR	PERMITTEE
DATE OF PERMIT (Month, day, year) August 10, 1998	DATE ACCEPTED (Month, day, year) 08/14/98
SIGNATURE OF PERMITTOR James R. Hyde	SIGNATURE OF PERMITTEE Neil Taylor
TITLE Medical Center Director	TITLE Environmental Scientist

NEIL TAYLOR

Patient Information Map
As of 9/15/96

Department of Veterans Affairs

VA Medical Center
500 Foothill Drive
Salt Lake City, UT 84148
(801) 582-1565



Building

- 1 Chapel
- 1 Dental
- 1 Library
- 1 Medical & Surgical Nursing Units
- 1 Optician/Eye Glasses
- 1 Patient Admission Center (PAC)
- 1 Radiology/RadiationTherapy
- 1 Rehabilitation Medicine
- 1 VA Police (Contact Information Desk)
- 14 Emergency Care
- 14 Laboratory
- 14 Medical Intensive Care Unit (MICU)
- 14 Outpatient Clinics
- 14 Surgery
- 14 Surgical Intensive Care Unit (SICU)

Building

- 2 Primary Care/Red & Blue Teams
- 2 Research & Research Offices
- 3 Psychiatry
- 4 Geriatrics
- 4 Intermediate Care
- 4 Amputee Clinic
- 4 Dermatology Clinic
- 4 Low Back Pain Clinic
- 4 Neurology Clinic
- 4 Nutrition Clinic
- 4 Prosthetics Clinic
- 4 Rehabilitation Clinic
- 5 Dietetics
- 8 Recreational Therapy
- 8 Canteen
- 25 Voluntary Service (Trailer)
- 47 Psychology Service/Day Hospital
- 47 Outpatient Substance Abuse Clinic (OSAC)

FABIAN & CLENDENIN

A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW

TWELFTH FLOOR
215 SOUTH STATE STREET
P.O. BOX 510210
SALT LAKE CITY, UTAH 84151-0210
TELEPHONE (801) 531-8900
FACSIMILE (801) 596-2814

GEORGE D. MELLING, JR.
WARREN PATTEN
M. BYRON FISHER
STANFORD B. OWEN
PETER W. BILLINGS, JR.
THOMAS CHRISTENSEN, JR.
JAY B. BELL
DANIEL W. ANDERSON
GARY E. JUBBER
ROSEMARY J. BELESS
W. CULLEN BATTLE
KEVIN N. ANDERSON†
NORMAN J. YOUNKER
MICHELE MITCHELL†
JOHN E. S. ROBSON†
DOUGLAS B. CANNON*
DOUGLAS J. PAYNE
ROBERT PALMER REES
DIANE H. BANKS
P. BRUCE BADGER
JOHN (JACK) D. RAY
CRAIG T. JACOBSEN
DOUGLAS R. BREWER
JULIE PEASLEE
ROBERT A. GARDA
E. BLAINE RAWSON
JOHN D. DUNN
ROSS I. ROMERO

† ALSO IN NEVADA
* ALSO IN IDAHO

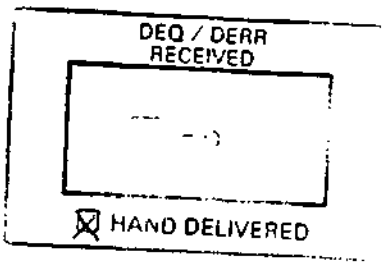
OF COUNSEL
RALPH H. MILLER
DAVID J. LYON
ROBERT S. McCONNELL

NEVADA OFFICE
3811 WEST CHARLESTON BLVD., SUITE 208
LAS VEGAS, NEVADA 89102-1846
TELEPHONE (702) 367-4545
FACSIMILE (702) 367-1227

October 3, 1997

HAND DELIVERED

Neil B. Taylor, Environmental Scientist
Division of Environmental
Response and Remediation
Utah Department of Environmental Quality
168 North 1950 West
Salt Lake City, Utah 84114



Re: Proposed Sampling of Water Well at Mount Olivet Cemetery Site

Dear Mr. Taylor:

Pursuant to your request for access for an EPA contractor to sample the water well at Mount Olivet Cemetery on a date between October 13, 1997 to November 13, 1997, we are enclosing a Consent for Access to Property which will be signed by Mount Olivet Cemetery Association for that purpose.

As stated in our letter of November 6, 1995, to Luke D. Chavez and Steve Hawthorn, it is important that Daniel ValDez, the sexton of Mount Olivet Cemetery, receive adequate notice of EPA's date of sampling because he must coordinate funerals being held at the cemetery in order to avoid a conflict with EPA's proposed time of testing the well. Also, he must have a copy of EPA's plan for testing the well because the well is normally shut down after October 15, 1997, and he must continue to provide electric power to the well and know what pumping requirements will be required under EPA's sampling plan. You will note that the enclosed Consent for Access is nearly identical to the last consent used for this project.

Mount Olivet looks forward to working with DERR and EPA in order to find the answers to questions concerning any contamination, or potential contamination, of the well located on Mount Olivet's property.

Mount Olivet is willing to allow access to DERR and EPA pursuant to the terms of the enclosed Consent for Access to Property. Please advise me of your concurrence in this

LAW OFFICES OF
FABIAN & CLENDENIN
A PROFESSIONAL CORPORATION

matter so that I can have an original executed Consent for Access to Property hand delivered to you as soon as possible.

Thank you for your attention to this matter.

Very truly yours,

Rosemary J. Beless

Rosemary J. Beless
Attorney for Mount Olivet Cemetery Association

cc: Daniel A. ValDez, Sexton
RJB:aw

CONSENT FOR ACCESS TO PROPERTY

Mount Olivet Cemetery Association ("Mount Olivet"), owner of the real property at the address of 1342 East 500 South, Salt Lake City, Utah 84102 (the "Site"), agrees, subject to the understandings provided herein, to allow the officers, employees, authorized representatives, and consultants of the Utah Division of Environmental Response and Remediation ("DERR") and the United States Environmental Protection Agency ("EPA"), (collectively the "Governmental Representatives") to enter upon the Site, after meeting with Mount Olivet personnel, on a date between October 13, 1997 and November 13, 1997, after giving Daniel ValDez, Sexton of Mount Olivet, at least twenty-four (24) business hours (8:00 a.m. - 5:00 p.m. Monday through Friday) notice by telephone of the specific date and time of the investigation, solely for the purpose of taking groundwater samples from Mount Olivet's water well.

Mount Olivet will be provided with splits of each sample taken, will be given a receipt describing each sample taken, and will be promptly furnished with a copy of the results of any analysis made of samples taken. Mount Olivet will provide the necessary sample containers to obtain these splits and will be responsible for the cost of analysis of the split samples.

It is understood that the Government Representatives shall notify Mount Olivet in writing of the names, titles, and employers of the individuals who will be entering onto the Site prior to their entry.

It is understood that the Government Representatives shall promptly provide Mount Olivet with copies of any and all photographs taken of the Site and of any final reports made or data collected from the above-described activities. It is further understood that the Government Representatives shall provide Mount Olivet with a sampling and analysis plan, including specific procedures for testing the well, for the above-referenced sampling activities at least twenty-four (24) business hours prior to their entry upon the Site. This sampling and analysis plan will provide Mount Olivet with the information necessary to operate its well appropriately for the sampling activity.

It is understood that prior to the Government Representatives' completion of activities at the Site, the Government Representatives will remove from the Site all discarded materials, rubbish, protective clothing and unused chemicals and sampling devices which they brought on the Site during their sampling activities.

Mount Olivet understands that the above-described activities by the Government Representatives are undertaken pursuant to their response and enforcement responsibilities pursuant to the Utah Environmental Quality Code at Utah Code Ann. § 19-1-101 *et seq.* (General Provisions) and § 19-6-301 *et seq.* (Hazardous Substances Mitigation Act), and/or the Comprehensive Environmental Response, Compensation and Liability Act, (CERCLA) 42 U.S.C.A. § 9601. By granting access to the Government Representatives, Mount Olivet makes no admission of liability or responsibility for any contamination which may be found on the Site. As of this date, Mount Olivet, in giving this voluntary consent, is not responding to any threats, nor is it relying upon any additional promises, representations or claims, either oral or written, made by any Government Representative, other than the understandings specified in this Consent for Access to Property.

MOUNT OLIVET CEMETERY ASSOCIATION

By: _____

Its: _____

_____

Date

FABIAN & CLENDENIN

A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW

TWELFTH FLOOR
215 SOUTH STATE STREET
P.O. BOX 510210
SALT LAKE CITY, UTAH 84151-0210
TELEPHONE (801) 531-8900
FACSIMILE (801) 596-2814

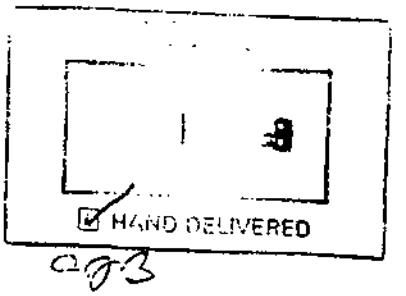
GEORGE D. MELLING, JR.
WARREN PATTEN
M. BYRON FISHER
STANFORD B. OWEN
PETER W. BILLINGS, JR.
THOMAS CHRISTENSEN, JR.
JAY B. BELL
DANIEL W. ANDERSON
GARY E. JUBBER
ROSEMARY J. BELESS
W. CULLEN BATTLE
KEVIN N. ANDERSON†
NORMAN J. YOUNKER
MICHELE MITCHELL†
JOHN E. S. ROBSON†
DOUGLAS B. CANNON*
DOUGLAS J. PAYNE
ROBERT PALMER REES
DIANE H. BANKS
P. BRUCE BADGER
JOHN (JACK) D. RAY
DOUGLAS R. BREWER
JULIE PEASLEE
ROBERT A. GARDA
JOHN D. DUNN
ROSS I. ROMERO
SCOTT M. PETERSEN

† ALSO IN NEVADA
* ALSO IN IDAHO

OF COUNSEL
RALPH H. MILLER
DAVID J. LYON
ROBERT S. McCONNELL
CRAIG T. JACOBSEN

NEVADA OFFICE
3811 WEST CHARLESTON BLVD., SUITE 208
LAS VEGAS, NEVADA 89102-1846
TELEPHONE (702) 367-4545
FACSIMILE (702) 367-1227

June 10, 1998



HAND DELIVERED

Neil B. Taylor, Environmental Scientist
Division of Environmental Response and Remediation
Utah Department of Environmental Quality
168 North 1950 West
Salt Lake City, Utah 84114

Re: Proposed Sampling of Water Well at Mount Olivet Cemetery Site

Dear Mr. Taylor:

Pursuant to your request for access for an EPA contractor to sample the water well at Mount Olivet Cemetery on a date between June 15, 1998 to July 25, 1998, we are enclosing a Consent for Access to Property which will be signed by Mount Olivet Cemetery Association for that purpose.

As stated in our letter of November 6, 1995, to Luke D. Chavez and Steve Hawthorn, it is important that Daniel ValDez, the sexton of Mount Olivet Cemetery, receive adequate notice of EPA's date of sampling because he must coordinate funerals being held at the cemetery in order to avoid a conflict with EPA's proposed time of testing the well. Also, he must have a copy of EPA's plan for testing the well so that he can provide electric power to the well and know what pumping requirements will be required under EPA's sampling plan. You will note that the enclosed Consent for Access is nearly identical to the last consent used for this project.

Mount Olivet looks forward to working with DERR and EPA in order to find the answers to questions concerning any contamination, or potential contamination, of the well located on Mount Olivet's property.

LAW OFFICES OF
FABIAN & CLENDENIN
A PROFESSIONAL CORPORATION

Mount Olivet is willing to allow access to DERR and EPA pursuant to the terms of the enclosed Consent for Access to Property. Please advise me of your concurrence in this matter so that I can have an original executed Consent for Access to Property hand delivered to you as soon as possible.

Thank you for your attention to this matter.

Very truly yours,

Rosemary J. Beless

Rosemary J. Beless
Attorney for Mount Olivet Cemetery Association

RJB/cam
cc: Daniel A. ValDez, Sexton

CONSENT FOR ACCESS TO PROPERTY

Mount Olivet Cemetery Association ("Mount Olivet"), owner of the real property at the address of 1342 East 500 South, Salt Lake City, Utah 84102 (the "Site"), agrees, subject to the understandings provided herein, to allow the officers, employees, authorized representatives, and consultants of the Utah Division of Environmental Response and Remediation ("DERR") and the United States Environmental Protection Agency ("EPA"), (collectively the "Governmental Representatives") to enter upon the Site, after meeting with Mount Olivet personnel, on a date from June 15, 1998 to and including July 25, 1998, after giving Daniel ValDez, Sexton of Mount Olivet, at least twenty-four (24) business hours (8:00 a.m. - 5:00 p.m. Monday through Friday) notice by telephone of the specific date and time of the investigation, solely for the purpose of taking groundwater samples from Mount Olivet's water well.

Mount Olivet will be provided with splits of each sample taken, will be given a receipt describing each sample taken, and will be promptly furnished with a copy of the results of any analysis made of samples taken. Mount Olivet will provide the necessary sample containers to obtain these splits and will be responsible for the cost of analysis of the split samples.

It is understood that the Government Representatives shall notify Mount Olivet in writing of the names, titles, and employers of the individuals who will be entering onto the Site prior to their entry.

It is understood that the Government Representatives shall promptly provide Mount Olivet with copies of any and all photographs taken of the Site and of any final reports made or data collected from the above-described activities. It is further understood that the Government Representatives shall provide Mount Olivet with a sampling and analysis plan, including specific procedures for testing the well, for the above-referenced sampling activities at least twenty-four (24) business hours prior to their entry upon the Site. This sampling and analysis plan will provide Mount Olivet with the information necessary to operate its well appropriately for the sampling activity.

It is understood that prior to the Government Representatives' completion of activities at the Site, the Government Representatives will remove from the Site all discarded materials, rubbish, protective clothing and unused chemicals and sampling devices which they brought on the Site during their sampling activities.

Mount Olivet understands that the above-described activities by the Government Representatives are undertaken pursuant to their response and enforcement responsibilities pursuant to the Utah Environmental Quality Code at Utah Code Ann. § 19-1-101 *et seq.* (General Provisions) and § 19-6-301 *et seq.* (Hazardous Substances Mitigation Act), and/or the Comprehensive Environmental Response, Compensation and Liability Act, (CERCLA) 42 U.S.C.A. § 9601. By granting access to the Government Representatives, Mount Olivet makes no admission of liability or responsibility for any contamination which may be found on the Site. As of this date, Mount Olivet, in giving this voluntary consent, is not responding to any threats, nor is it relying upon any additional promises, representations or claims, either oral or written, made by any Government Representative, other than the understandings specified in this Consent for Access to Property.

MOUNT OLIVET CEMETERY ASSOCIATION

By: _____

Its: _____

_____
Date

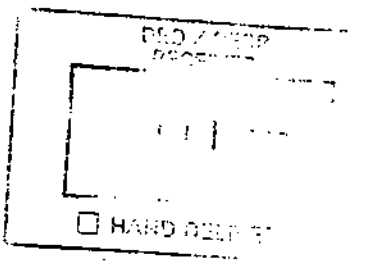
119183

RICHARD GRAHAM
PUBLIC SERVICES DIRECTOR

SALT LAKE CITY CORPORATION

DEPARTMENT OF PUBLIC SERVICES

DEEDEE CORRADINI
MAYOR



June 10, 1998

State of Utah
DEQ/DERR
Attn: Neal Taylor
168 North 1950 West
Salt Lake City, UT 84114-4840

Re: Grant of Access to Steiner Aquatic Center on Guardsman Way

The State of Utah is hereby granted the authority to construct a monitoring well as described in items 1 and 2 of the attached "Grant of Access to Property" agreement. Item 3, "any other such actions related to the above activities on the Property as may be necessary," is granted only on a "by case" basis. Each case must be approved in advance.

Salt Lake City reserves the right to monitor and observe the work and requires the restoration of the property to its original state upon completion of the work.

For access to the lot, please contact Amy Quinn at Steiner Aquatic Center, 583-9713.

Sincerely,

Debbie Booth
Environmental Analyst

Attachments: 1

Cc: Sherianne Cotterell, Director of Youth and Family Services Division
Amy Quinn, Steiner Aquatic Center

451 SOUTH STATE STREET, ROOM 148, SALT LAKE CITY, UTAH 84111
TELEPHONE: 801-535-7916 FAX 801-535-7789

GRANT OF ACCESS TO PROPERTY

Debbie Booth, is the owner ("Owner") of record, title holder or authorized agent for certain real property located at the Steiner Aquatic Center, 645 South Guardsman Way, Salt Lake City, Utah. These locations are referred to as the "Property".

The Owner hereby grants to the officers, employees, authorized representatives, and consultants of the Utah Division of Environmental Response and Remediation (DERR) and/or United States Environmental Protection Agency (EPA) access, including ingress and egress, to the Property for the following purposes:

1. construction of a monitoring well in the southwest portion of the aquatic center parking lot.

2. the taking of soil, boring; and/or groundwater samples,

3. Any other such actions related to the above activities on the Property as may be necessary.

The tasks described above may be altered if conditions change or if the DERR or EPA obtains additional information requiring further investigation. The DERR or EPA will notify the Owner in writing of any new planned tasks.

It is anticipated that the work described herein will be performed between 15 June 1998 and 25 July 1998. If it becomes necessary to perform the work at other times, the DERR or EPA will notify the Owner by telephone at least 24 hours before it intends to enter the Property.

I have been informed and understand that these actions by the EPA and EPA are undertaken pursuant to the authorities provided in the Utah Environmental Quality Code of Utah Code Ann. Sections 19-1-101 et seq., (General Provisions), Sections 19-6-301 et seq. (Hazardous Substances Mitigation Act), and/or the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA), 42 U.S.C. A. 9601.

By granting access to the DERR or EPA, the Owner makes no admission of liability or responsibility for any contamination which may be found on the property. This grant of access is given voluntarily with knowledge of my right to refuse access. I further acknowledge that no other promises, representations or claims of any kind, either written or oral have been made by the Grantee to induce my consent.

By accepting this grant the DERR and EPA shall, as far as permitted by state or federal law, indemnify and hold Owner and its officers, agents, and employees harmless from claims, loss, damage, injury, or liability (hereafter "Liability") resulting from the conduct of DERR or EPA's operations or from use of the property by contractors, officers, agents or employees, including reasonable attorney's fees, but excluding any liability resulting from acts or omissions of Owner, its contractors, officers, agents, or employees. Nothing herein shall be construed as a waiver of any of the rights or defenses under the Utah Governmental Immunity Act (Utah Code Annotated 1953, Section 63-30-1, et seq) or the coverage of defenses provided therein.

[ ] I wish to obtain splits of all samples collected on the Property and a receipt describing each sample taken. I understand that I must provide the necessary sample containers to obtain these splits. The responsibility of choosing an analytical laboratory and the cost of analysis of the splits is solely mine.

[X] I waive my right to obtain split samples.

Owner's Signature: [signature] 6/10/98
Date

Title: Environmental Analyst

GRANT OF ACCESS TO PROPERTY

John Benson, is the owner ("Owner") of record, title holder or authorized agent for the record owner of certain real property located at 761 South 1100 East in Salt Lake City, Utah. The property is hereafter referred to as the "Property".

The Owner hereby grants to the officers, employees, authorized representatives, and consultants of the Utah Division of Environmental Response and Remediation (DERR) access, including ingress and egress, to the Property for the taking of spring or well water samples,

It is anticipated that the work described herein will be performed on August 5, 1998. If it becomes necessary to perform the work at other times, the Grantee will notify the Owner by telephone at least 24 hours before it intends to enter the Property.

I have been informed and understand that these actions by the Grantee are undertaken pursuant to the authorities provided in the Utah Environmental Quality Code of Utah Code Ann. Sections 19-1-101 et seq., (General Provisions), Sections 19-6-301 et seq. (Hazardous Substances Mitigation Act), and/or the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA), 42 U.S.C. A. 9601.

By granting access to the Grantee, the Owner makes no admission of liability or responsibility for any contamination which may be found on the property. This grant of access is given voluntarily with knowledge of right to refuse access. I further acknowledge that no other promises, representations or claims of any kind, either written or oral have been made by the Grantee to induce my consent.

[ ] I wish to obtain splits of all samples collected on the Property and a receipt describing each sample taken. I understand that I must provide the necessary sample containers to obtain these splits. The responsibility of choosing an analytical laboratory and the cost of analysis of the splits is solely mine.

[✓] I waive my right to obtain split samples.

Owner's Signature: _____ 8/7/98
Date

Title: _____

GRANT OF ACCESS TO PROPERTY

Edward Campos is the owner ("~~Owner~~") of record, ~~title holder~~ or authorized agent for the record owner of certain real property located at OUR LADY OF LOURDES SCHOOL in Salt Lake City, Utah. The property is hereafter referred to as the "Property".

The Owner hereby grants to the officers, employees, authorized representatives, and consultants of the Utah Division of Environmental Response and Remediation (DERR) access, including ingress and egress, to the Property for the taking of a spring water sample.

It is anticipated that the work described herein will be performed on September 4, 1998. If it becomes necessary to perform the work at other times, the Grantee will notify the Owner by telephone at least 24 hours before it intends to enter the Property.

I have been informed and understand that these actions by the Grantee are undertaken pursuant to the authorities provided in the Utah Environmental Quality Code of Utah Code Ann. Sections 19-1-101 et seq., (General Provisions), Sections 19-6-301 et seq. (Hazardous Substances Mitigation Act), and/or the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA), 42 U.S.C. A. 9601.

By granting access to the Grantee, the Owner makes no admission of liability or responsibility for any contamination which may be found on the property. This grant of access is given voluntarily with knowledge of right to refuse access. I further acknowledge that no other promises, representations or claims of any kind, either written or oral have been made by the Grantee to induce my consent.

[X] I wish to obtain splits of all samples collected on the Property and a receipt describing each sample taken. I understand that I must provide the necessary sample containers to obtain these splits. The responsibility of choosing an analytical laboratory and the cost of analysis of the splits is solely mine.

[ ] I waive my right to obtain split samples.

Owner's Signature: Edward Campos

Title: PRINCIPAL Date 9/4/98

GRANT OF ACCESS TO PROPERTY

Stephen Chapman, is the owner ("Owner") of record, title holder or authorized agent for the record owner of certain real property located at 1457 South 900 East in Salt Lake City, Utah. The property is hereafter referred to as the "Property".

The Owner hereby grants to the officers, employees, authorized representatives, and consultants of the Utah Division of Environmental Response and Remediation (DERR) access, including ingress and egress, to the Property for the taking of spring or well water samples,

It is anticipated that the work described herein will be performed on August 3, 1998. If it becomes necessary to perform the work at other times, the Grantee will notify the Owner by telephone at least 24 hours before it intends to enter the Property.

I have been informed and understand that these actions by the Grantee are undertaken pursuant to the authorities provided in the Utah Environmental Quality Code of Utah Code Ann. Sections 19-1-101 et seq., (General Provisions), Sections 19-6-301 et seq. (Hazardous Substances Mitigation Act), and/or the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA), 42 U.S.C. A. 9601.

By granting access to the Grantee, the Owner makes no admission of liability or responsibility for any contamination which may be found on the property. This grant of access is given voluntarily with knowledge of right to refuse access. I further acknowledge that no other promises, representations or claims of any kind, either written or oral have been made by the Grantee to induce my consent.

[ ] I wish to obtain splits of all samples collected on the Property and a receipt describing each sample taken. I understand that I must provide the necessary sample containers to obtain these splits. The responsibility of choosing an analytical laboratory and the cost of analysis of the splits is solely mine.

[ ] I waive my right to obtain split samples.

Owner's Signature: Beverly P. Chapman 8/3/98
Date

Title: _____

GRANT OF ACCESS TO PROPERTY

Clark or Julie Smith, are the owner ("Owner") of record, title holder or authorized agent for the record owner of certain real property located at 1123 Alpine Place in Salt Lake City, Utah. The property is hereafter referred to as the "Property".

The Owner hereby grants to the officers, employees, authorized representatives, and consultants of the Utah Division of Environmental Response and Remediation (DERR) access, including ingress and egress, to the Property for the taking of spring or well water samples,

It is anticipated that the work described herein will be performed on August 5, 1998. If it becomes necessary to perform the work at other times, the Grantee will notify the Owner by telephone at least 24 hours before it intends to enter the Property.

I have been informed and understand that these actions by the Grantee are undertaken pursuant to the authorities provided in the Utah Environmental Quality Code of Utah Code Ann. Sections 19-1-101 et seq., (General Provisions), Sections 19-6-301 et seq. (Hazardous Substances Mitigation Act), and/or the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA), 42 U.S.C. A. 9601.

By granting access to the Grantee, the Owner makes no admission of liability or responsibility for any contamination which may be found on the property. This grant of access is given voluntarily with knowledge of right to refuse access. I further acknowledge that no other promises, representations or claims of any kind, either written or oral have been made by the Grantee to induce my consent.

[ ] I wish to obtain splits of all samples collected on the Property and a receipt describing each sample taken. I understand that I must provide the necessary sample containers to obtain these splits. The responsibility of choosing an analytical laboratory and the cost of analysis of the splits is solely mine.

[✓] I waive my right to obtain split samples.

Owner's Signature: Julie A Smith 8-5-98

Date

Title: _____

CSF CHAIN OF CUSTODY FORM
U.S. Environmental Protection Agency - Region 8
Environmental Services Division, Multi-Media Branch
Analytical Operations Section

Audit Number: 08-08-99 Case Number: 26509

Date CSF Received: 10/8/98 Site Name: Mt. Olivet Plume

Auditor: Carol Beard Lab Name: SWOK

Date of Audit: 11/16/98 SDG Number: HS 794

Date of Transfer: 1/5/99 Comments:

Transfer to: Luke Chavez

Affiliation: EPA

Transfer from (AOS): RSCC

CSF Relinquished By:

Print Name	Date	Signature
Carol Beard	1/5/99	Carol Beard

CSF Received By:

Print Name	Date	Signature
Karen Kuppala	1/5/99	Karen Kuppala

CSF Relinquished By:

Print Name	Date	Signature
Karen Kuppala		Karen Kuppala

CSF Received By:

Print Name	Date	Signature
Lora Burley	1/7/99	

CSF Relinquished By:

Print Name	Date	Signature

CSF Received By:

Print Name	Date	Signature

EPA — Organic Traffic Report & Chain of Custody Record

United States Environmental Protection Agency
Contract Laboratory Program

(For Organic CLP Analysis)

Case No. 26509

1. Project Code	Account Code	2. Region No.	Sampling Co.	4. Date Shipped	Carrier
		8	UDEQ	9/23/98	Fed Ex

Regional Information

Sampler (Name): Neil Taylor

Airbill Number: 216556 2070

Non-Superfund Program

Sampler Signature: N. Taylor

5. Ship To: Southwest Labs of Oklahoma, 1700 West Albany, Suite C, Broken Arrow OK 74012

Site Name: Mt. Olivet Plume

3. Purpose* — Lead: [ ] SF [ ] PRP [X] ST [ ] FED; Early Action: [ ] CLEM [ ] PA [ ] REM [ ] RI [ ] SI [X] ESI; Long-Term Action: [ ] FS [ ] RD [ ] RA [ ] O&M [ ] NPLD

City, State: Salt Lake City, Utah

Site Spill ID

ATTN: Harry Borg

6. Matrix (Enter in Column A)
1. Surface Water
2. Ground Water
3. Leachate
4. Field QC
5. Soil/Sediment
6. Oil (High only)
7. Waste (High only)
8. Other (Specify in Column A)

7. Preservative (Enter in Column D)
1. HCl
2. HNO3
3. NaHSO4
4. H2SO4
5. Ice only
6. Other (Specify in Column D)
N. Not preserved

CLP Sample Numbers (from labels)	A Matrix (from Box 6) Other:	B Conc.: Low Med High	C Sample Type: Comp. Grab	D Preservative (from Box 7) Other:	E RAS Analysis VOA	BNA	Pest/PCB	High only ARO/TOX	F Regional Specific Tracking Number or Tag Numbers	G Station Location Identifier	H Mo/Day/Year/Time Sample Collection	I Corresponding CLP Inorganic Sample No.	J Sampler Initials	K Field QC Qualifier (B = Blank, S = Spike, D = Duplicate, R = Rinsate, PE = Perform. Eval, — = Not a QC Sample)
HS795	2	L	G	1	X				8-164299	MT-01	9/22/98 0911		NJT	
HS794	2	L	G	1	X				8-164295	MT-02	9/22/98 1045		NJT	
HS796	2	L	G	1	X				8-164297	MT-05	9/22/98 1441		NJT	B

Shipment for Case Complete? (Y/N)

Page 1 of 1

Sample(s) to be Used for Laboratory QC

Additional Sampler Signatures

Chain of Custody Seal Number(s)

CHAIN OF CUSTODY RECORD

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
N Taylor	9/23 10:00				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks Is custody seal intact? Y/N/none	

A21-012-15 REV

DISTRIBUTION: Blue - Region Copy; White - Lab Copy for Return to Region; Pink - CLASS Copy; Yellow - Lab Copy for Return to CLASS

EPA Form 9110-2

SEE REVERSE FOR ADDITIONAL STANDARD INSTRUCTIONS
*SEE REVERSE FOR PURPOSE CODE DEFINITIONS

FedEx. USA Airbill Tracking Number 2165562070

Sender's Copy

23 100 44102398 6270M

1 From (please print)

Date 9/23/98 Sender's FedEx Account Number 1828-8775-7

Sender's Name Neil Taylor Phone (801) 536-4102

Dept./Floor/Suite/Room

Company DEPT OF ENVIRONMENTAL QUALITY

Address 168 N 1950 WEST

City SALT LAKE CITY State UT Zip 84116

2 Your Internal Billing Reference Information (Optional) (First 24 characters will appear on invoice)

3 To (please print)

Recipient's Name Southwest Labs of Oklahoma Phone (918) 251-0545

Dept./Floor/Suite/Room

Company

Address 1700 West Albany Suite C Attn: Harry Berg
(To "HOLD" at FedEx location, print FedEx address here) (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes)

City Broken Arrow State OK Zip 74012

For HOLD at FedEx Location check here
☐ Hold Weekday (Not available with FedEx First Overnight)
☐ Hold Saturday (Not available at all locations) (Not available with FedEx First Overnight or FedEx Standard Overnight)

For Saturday Delivery check here
☐ (Extra Charge. Not available to all locations) (Not available with FedEx First Overnight or FedEx Standard Overnight)

4a Express Package Service *Packages under 150 lbs.* Delivery commitment may be later in some areas.
☒ FedEx Priority Overnight (Next business morning)
☐ FedEx Standard Overnight (Next business afternoon)
☐ FedEx 2Day* (Second business day)
☐ FedEx First Overnight (Earliest next business morning delivery to select locations)
*FedEx Letter Rate not available. Minimum charge: One pound FedEx 2Day rate

4b Express Freight Service *Packages over 150 lbs.* Delivery commitment may be later in some areas.
☐ FedEx Overnight Freight (Next business day service for any distance)
☐ FedEx 2Day Freight (Second business day service for any distance)
☐ FedEx Express Saver Freight (Up to 3 business day service based upon distance)
(Call for delivery schedule. See back for detailed descriptions of freight products.)

5 Packaging ☐ FedEx Letter ☐ FedEx Pak ☐ FedEx Box ☐ FedEx Tube ☐ Other Pkg.
Declared value limit $500

6 Special Handling
Does this shipment contain dangerous goods? ☐ Yes (As per attached Shipper's Declaration) ☐ Yes (Shipper's Declaration not required)
☐ Dry Ice — Dry Ice, 9, UN 1845 ___ x ___ kg 904 (Dangerous Goods Shipper's Declaration not required)
CA ☐ Cargo Aircraft Only

7 Payment
Bill to: ☐ Sender (Account no. in section 1 will be billed) ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check
(Enter FedEx account no. or Credit Card no. below)

FedEx Account No.

Credit Card No. Exp. Date

Total Packages	Total Weight	Total Declared Value*	Total Charges
1	10	$ 500 .00	$

*When declaring a value higher than $100 per shipment, you pay an additional charge. See SERVICE CONDITIONS, DECLARED VALUE AND LIMIT OF LIABILITY section for further information.

8 Release Signature

Your signature authorizes Federal Express to deliver this shipment without obtaining a signature and agrees to indemnify and hold harmless Federal Express from any resulting claims.

272

Service Conditions, Declared Value, and Limit of Liability – By using this Airbill, you agree to the service conditions in our current Service Guide or U.S. Government Service Guide. Both are available on request. SEE BACK OF SENDER'S COPY OF THIS AIRBILL FOR INFORMATION AND ADDITIONAL TERMS. We will not be responsible for any claim in excess of $100 per package whether the result of loss, damage, or delay, non-delivery, misdelivery, or misinformation, unless you declare a higher value, pay an additional charge, and document your actual loss in a timely manner. Your right to recover from us for any loss includes intrinsic value of the package, loss of sales, interest, profit, attorney's fees, costs, and other forms of damage, whether direct, incidental, consequential, or special, and is limited to the greater of $100 or the declared value but cannot exceed actual documented loss. The maximum declared value for any FedEx Letter and FedEx Pak is $500. Federal Express may, upon your request, and with some limitations, refund all transportation charges paid. See the FedEx Service Guide for further details.

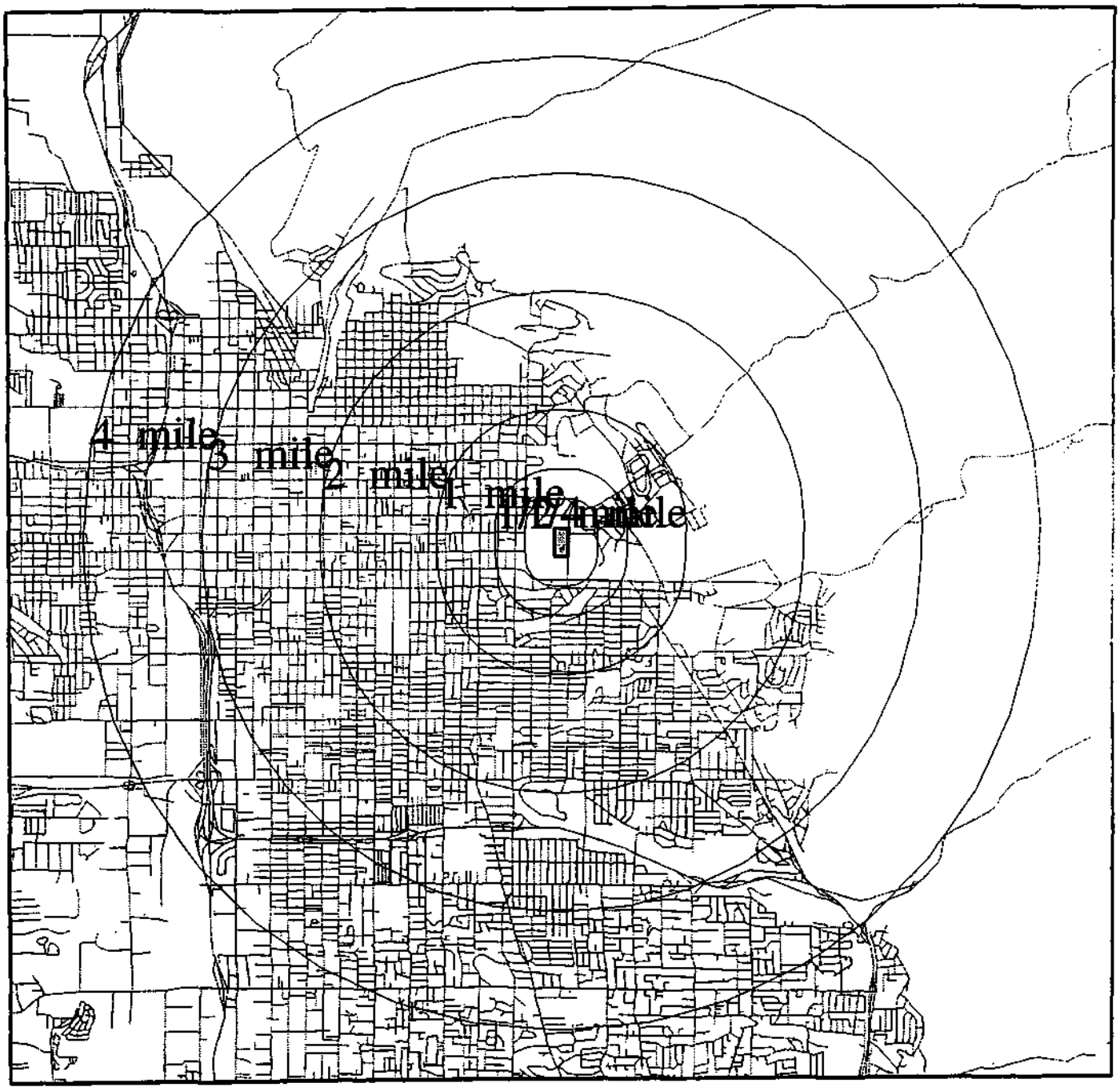
Questions?
Call 1·800·Go·FedEx (1-800-463-3339)

The World On Time

Rev. Date 6/95 PART #132795 ©1994-95 FedEx PRINTED IN U.S.A.

APPENDIX G

FOUR MILE POPULATION RADIUS



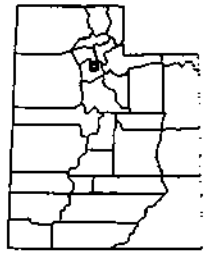
Mount Olivet Cemetery Plume
Population By Census Tract

N

Scale
1" = 1.29 Miles

Legend

- Site
- Concentric bands
- Road Centerlines
- County boundaries



UDEQ
Division of Environmental
Response and Remediation

file: uangpop created by: eqem on 12/11/95

Population by Concetric Bands
Calculated from Census Blocks
Site Theme: cercla
Site Name: uang
Created By: eqerr
Created On: 09/21/95

Total 1/4 mile	191.000000
Total 1/2 mile	4,129.000000
Total 1 mile	20,603.000000
Total 2 mile	69,031.000000
Total 3 mile	113,870.000000
Total 4 mile	151,013.000000

APPENDIX H

SITE INSPECTION DATA SUMMARY

SITE INSPECTION DATA SUMMARY

Site Name: Mount Olivet Cemetery Plume EPA Region: 8 Date: 05/12/2000

State Office or Contractor Name and Address: Utah Division of Environmental Response and Remediation

GENERAL SITE INFORMATION

1. **CERCLIS ID Number:** UTD981548985

   Address: 1342 East 500 South (approximate) City: Salt Lake City

   County: Salt Lake State: UT Zip Code: 84102 Cong. Dist.: 2

2. **Owner Name:** No Owner Identified (groundwater plume)

   Owner Address: _____ City: _____ State: ___

   Operator Name: _____

   Operator Address: _____ City: _____ State: __

3. **Type of Ownership** (check all that apply):

   X Private ___ Municipal ___ County ___ State

   ___ Federal/Agency Name: _____ ___ Other: _____

   References: _____

4. **Approximate size of Property:** 90 acres. References: _____

5. **Latitude:** 40 45 14

   Longitude: 111 50 42 References: _____

6. **Status:** ___ Active X Inactive ___ Unknown References: _____

7. **Years of Operation:** From: _____ To: _____ References: _____

8. **Previous Investigations:**

TYPE	AGENCY/STATE/CONTRACTOR	DATE	
Work Plan	Utah DEQ	1996	References: 1
Soil Gas	EPA	1995	References: 2
			References:
			References:
			References:
			References:
			References:
			References:
			References:

WASTE SOURCE INFORMATION

1. **Waste source types** (check all that apply):

___ Constituent ___ Wastestream (type): _____

___ Landfill ___ Tanks or non-drum containers (type): _____

___ Drums ___ Pile (type): _____

___ Contaminated Soil ___ Surface Impoundment (buried)

___ Land Treatment ___ Surface Impoundment (backfilled)

_X_ Other: PCE groundwater plume

References: _____

2. **Types of wastes** (check all that apply):

_X_ Organic Chemicals ___ Inorganic Chemicals ___ Municipal Wastes

___ Pesticides/Herbicides ___ Metals ___ Solvents

___ Radionuclides ___ Other: _____

References: _____

3. Summarize history of waste disposal operations:

Samples taken from the cemetery irrigation well from 1990 to 1999 by Utah Department of Environmental Quality and the Salt Lake Department of Public Utilities yield perchloroethylene (PCE) concentrations that exceed both state and federal regulations. The Maximum Contaminant Levels (MCLs) for PCE, recommended by the EPA, should not exceed five parts per billion (ppb) in drinking water. Since the initial report in 1990, levels of the contaminant have ranged from 11 to 184 ppb in samples collected from the Mt. Olivet Cemetery irrigation well.

Identified potential organic chloride sources are the former dry cleaning operation on the VA Hospital campus in Building 7, former chemical storage operations at Fort Douglas Building 515, and a former Utah National Guard vehicle maintenance facility.

References: 1

4. **Source characterization** (Attach pages to show quantity and calculations):

Source 1 name: PCE groundwater plume Source Type: groundwater

Describe Source: Groundwater plume

Ground water migration containment: None

Surface water migration containment: NA

Air migration (gas and migration) containment: None

Physical State of Wastes:

___ Solid _X_ Liquid ___ Sludge/Slurry ___ Gas ___ Unknown

Constituent Quantity of Hazardous Substances: Unknown (specify units).

Wastestream Quantity Containing Hazardous Substances: _____ (specify units).

Volume of Source (yd^3): _____ Area of Source (ft^2): unknown

Hazardous substances associated with source 1:

PCE _____ _____ _____ _____ _____ _____

References: 2

Source 2 name: _____ Source Type: _____

Describe Source: _____

Ground water migration containment: _____

Surface water migration containment: _____

Air migration (gas and migration) containment: _____

Physical State of Wastes:

___ Solid ___ Liquid ___ Sludge/Slurry ___ Gas ___ Unknown

Constituent Quantity of Hazardous Substances: _____ (specify units).

Wastestream Quantity Containing Hazardous Substances: _____ (specify units).

Volume of Source (yd^3): _____ Area of Source (ft^2): 20,000

Hazardous substances associated with source 2:

_____ _____

5. Description of removal or remedial activities:

If Removal has occurred, identify the removal authority and describe the activities. Specify the date(s) of the removal.

References: _____

GROUND WATER INFORMATION

1. Ground water drinking water use within 4 miles of site sources:

___ Municipal ___ Private X Both ___ No Drinking Water Use

References: 3,4

2. Is ground water contaminated?

X Yes ___ No ___ Uncertain but likely ___ Uncertain but not likely

___ Additional sampling required

Is analytical evidence available? X Yes ___ No

References: 1

3. Is ground water contamination attributable to the site?

_X_ Yes ___ No ___ Additional sampling required

Groundwater at the site is contaminated, but the source of the contamination has not been identified

References:_____

4. Are drinking water wells contaminated?

___ Yes _X_ No ___ Uncertain but likely ___ Uncertain but not likely

___ Additional sampling required

Is analytical evidence available? _X_ Yes ___ No References: 5

5. Net precipitation (HRS Section 3.1.2.2): 2 inches.

6. County average number of persons per residence:

3.2 people. References: 6,7

7. Discuss general stratigraphy underlying the site. Attach sketch of stratigraphic column.

Quaternary lake sediments and alluvial floodplain deposits underlie the These consist of fine sandy loams and clays of sedimentary and igneous origins deposited as lake sediments which underlie the more course grained stream sediments of sands, silts and gravel. The clay layers near the site are likely not thick enough or probably not large enough in areal extent to act as true aquicludes in the local hydrologic system.

Reference: 8, 9

8. Using Table GW-1, summarize geology underlying the site (starting with formation #1 closest to ground surface). Indicate if formation is interconnected with overlying formation.

TABLE GW-1: SITE GEOLOGY

NAME OF FORMATION	INTER-CONNECT? (yes/no)	TYPE OF MATERIAL	AVERAGE THICKNESS (feet)	HYDRAULIC CONDUCTIVITY (cm/sec)	USED FOR DRINKING WATER?
Sand/Silty Clay	yes		160	unk	Yes
Clayey Sand	unk		100	unk	No
Gravel	unk		200	unk	Yes

References: 10

9. Does a karst aquifer underlie any site source?

___ Yes _X_ No References: 10

10. Depth to top of aquifer: 118 feet

Elevation: 4561 feet References: 10

11. In the table below, enter the number of people obtaining drinking water from wells located within 4 miles of the site. For each aquifer, attach population calculation sheets. Key aquifer to formations listed in Table GW-1.

POPULATION SERVED BY WELLS WITHIN DISTANCE CATEGORIES BY AQUIFER

DISTANCE OF WELL(S) FROM SITE SOURCES	AQUIFER A: INCLUDES FORMATIONS 1-2	AQUIFER B: INCLUDES FORMATIONS 3	AQUIFER C: INCLUDES FORMATIONS
¼ mile or less	0	11,265	
>¼ to ½ mile	0	0	
>½ to 1 mile	0	0	
>1 to 2 miles	0	0	
>2 to 3 miles	0	11,327	
>3 to 4 miles	0	11,232	

References: 11

12. Is ground water from multiple wells blended prior to distribution?

_X_ Yes ___ No References: 11

13. Is ground water blended with surface water?

_X_ Yes ___ No References: 11

Briefly Describe:

Population Calculation Sheet 2 indicates the percentage of contribution and potentially affected population. Groundwater is blended with surface water from a variety of surface water treatment plants.

14. Distance from any incompletely contained source available to ground water to nearest drinking water well (HRS Section 3.3.1):

0.24 Mile References: 3

15. Briefly describe standby drinking water wells within 4 miles of sources at the site:

All municipal wells listed are actively used, but some during summer only.

References: 7

16. Ground water resources within 4 miles of site sources (HRS Section 3.3.3):

___ Irrigation (5-acre minimum) of commercial food or commercial forage crops.

___ Commercial livestock watering.

___ Ingredient in commercial food preparation.

___ Supply for commercial aquaculture.

___ Supply for major or designated water recreation area, excluding drinking water use.

___ Water usable for drinking water but no drinking water wells are within 4 miles.

X None of the above.

References:

17. Wellhead protection area (WHPA) within 4 miles of site sources (HRS Section 3.3.4):

___ Source with non-zero containment factor value lies within or above the WHPA.

X Observed ground water contamination attributable to site source(s) lies within the WHPA.

___ WHPA lies within 4 miles of site sources.

___ None

References: 7

Additional ground water pathway description:

References:

SURFACE WATER INFORMATION

COMPLETE A COPY OF THIS SECTION OF THE DATA SUMMARY FOR EACH WATERSHED

1. **Describe the surface water migration path from site sources to at least 15 miles downstream.** Attach a sketch of the surface water migration route.

   Surface water may follow Red Butte Creek to the city storm sewer system, or enter the storm sewer directly. Storm sewers lead to the Jordan River which leads to the Great Salt Lake.

   References: 8

2. **Is Surface Water Contaminated?**

   ___ Yes ___ No ___ Uncertain but likely _X_ Uncertain but not likely

   ___ Additional sampling is required

   Is analytical evidence available? ___ Yes _X_ No References: _____

3. **Is surface water contamination attributable to the site?**

   ___ Yes _X_ No ___ Additional sampling required References: _____

4. **Floodplain category in which site sources are located** (check all that apply):

   ___1-year ___10-year___100-year ___500-year _X_None References: 13

5. **Describe flood containment for each source** (HRS Section 4.1.2.1.2.2):

   Source #1 NA Flood Containment _____

   Source #2_____ Flood Containment _____

   References: _____

6. **Shortest overland distance to surface water from any source** (HRS Section 4.1.2.1.2.1.3):

   1200 feet References: 10

7. **Size of drainage area** (HRS Section 4.4.3):

   NA acres References: 1

8. **Describe the predominant soil group within the drainage area** (HRS Section 4.1.2.1.2.1.2):

   NA

   References: 1

9. **2-year 24-hour Rainfall** (HRS Section 4.1.2.1.2.1.2):

   2.41 inches References: 6

10. **Elevation of the bottom of nearest surface water body:**

    4670 feet above sea level References: 14

11. Elevation of top of uppermost aquifer:

4508 feet above sea level References: 10

12. Predominant type of water body between probable point of entry to surface water and nearest drinking water intake:

X River ___ Lake References: 14

13. Identify all drinking water intakes, fisheries, and sensitive environments within 15 miles downstream.

TARGET NAME/TYPE	WATER BODY TYPE	DISTANCE FROM PPE	FLOW (CFS)	TARGET CHARACTERISTICS*	TARGET SAMPLED ?
Jordan River	River	4.6 Miles	400-600	Fishery (production unknown)	No

* If target is a drinking water intake, provide number of people served by intake. If target is a fishery, provide species and annual production of human food chain organisms (pounds per year). If target is a wetland, specify wetland frontage (in miles). Attach calculation pages.

References: 15

14. Is surface water drinking water blended prior to distribution?

X Yes ___ No References: 3

15. Describe any standby drinking water intakes within 15 miles downstream:

None

References: 3

16. Surface water resources within 15 miles downstream (HRS Section 4.1.2.3.3):

___ Irrigation (5 acres minimum) of commercial food or commercial forage crops

___ Commercial livestock watering

___ Ingredient in commercial food preparation

X Major or designated water recreation area, excluding drinking water use

___ Water designated by the state for drinking water use but is not currently used

X Water usable for drinking water but no drinking water intakes within 15 miles downstream

___ None of the above

References: 15

SOIL EVALUATION

1. **Is surficial or soil contamination present at the site?**

___ Yes ___ No ___ Uncertain but likely _X_ Uncertain but not likely

___ Additional sampling required

Is analytical evidence available? ___ Yes _X_ No References:_____

2. **Is surficial or soil contamination attributable to the site?**

___ Yes _X_ No ___ Additional Sampling Required

3. **Is surficial contamination on the property and within 200 feet of a residence, school, daycare center, or workplace?**

___ Yes ___ No ___ Uncertain but likely _X_ Uncertain but not likely

___ Additional sampling required

Is analytical evidence available? ___ Yes _X_ No References:_____

4. **Total area of surficial contamination** (HRS Section 5.2.1.2):

__NA__ Acres References:_____

5. **Attractiveness/accessibility of the areas of observed contamination** (HRS Section 5.2.1.1). Check all that apply:

___ Designated recreational area

___ Used regularly, or accessible and unique recreational area

___ Moderately accessible with some use

___ Slightly accessible with some use

___ Accessible with no use

___ Inaccessible with some use

___ Inaccessible with no use References:_____

6. **Population within 1-mile travel distance from site.**

DISTANCE FROM SITE SOURCES	POPULATION
0.25	191
0.50	4129
1.00	20603

References: 7

AIR INFORMATION

1. **Is air contamination present at the site?**

___ Yes ___ No ___ Uncertain but likely _X_ Uncertain but not likely

___ Additional sampling required

Is analytical evidence available? ___ Yes _X_ No References:_____

2. **Is air contamination attributable to the site?**

___ Yes _X_ No ___ Additional sampling required

3. **Are populations, sensitive environments, or wetlands exposed to airborne hazardous substances released from the site?**

___ Yes ___ No ___ Uncertain but likely _X_ Uncertain but not likely

___ Additional sampling required

Is analytical evidence available? ___ Yes _X_ No References: _____

4. **Evidence of biogas release from any of the following source types at the site**

___ Below-ground containers or tanks ___ Landfill

___ Buried surface impoundment References: _____

5. **Particulate migration potential factor value:** _17_ (HRS Figure 6-2)

6. **Particulate mobility factor value:** _.002_ (HRS Figure 6-3)

7. **Distance from any incompletely contained source to nearest residence or regularly occupied area:**

_NA_ miles References:_____

8. **Population within 4 miles of site sources.**

DISTANCE FROM SITE SOURCES	POPULATION
0.25	191
0.50	3938
1.00	16665
2.00	52366
3.00	61504
4.00	89509

References: 7

9. Resources within ½ mile of site sources (HRS Section 6.3.3):

___ Commercial agriculture

___ Commercial silviculture

_X_ Major or designated recreation area

___ None of the above

References: 14

10. Sensitive environments and wetlands within 4 miles of the site:

NAME/DESCRIPTION/ LOCATION OF SENSITIVE ENVIRONMENT OR WETLAND	DISTANCE FROM SITE (MILES)	TYPE OF SENSITIVE ENVIRONMENT	WETLAND SIZE (ACRES)
None			

References: _____

LIST OF REFERENCES

1. Work Plan, Army National Guard Armory/ORG. Maintenance Shop 5. Division of Environmental Response and Remediation. February 2, 1996.

2. Ecology and Environment. Analytical Results Report. Soil Gas Sampling. Mount Olivet Cemetery, Salt Lake City, Utah, June 2, 1995

3. Utah Division of Drinking Water. October, 1996. Municipal well location printout.

4. Utah Department of Natural Resources Points of Diversion Database.

5. Personal Conversation. Florence Reynolds. Salt Lake City Public Utilities. June 8, 2000

6. Stevens, Dale J., R. Clayton Brough, Rodney D. Griffen, and Arlo E. Richardson. 1983. Utah Weather Guide.

7. Personal Conversation. James Staples. University of Utah. June 15, 2000

8. Salt Lake Department of Public Works. Flood Control Division.

9. Utah Geological and Mineral Survey. Geological Map of the Central Wasatch Front, Utah 1993.

10. Lambert, Patrick. U.S. Geological and Mineral Survey. Personal Communication. September 29, 1995.

11. URS Operating Services. Site Activities Report. Mt. Olivet Cemetery Salt Lake City, Utah. May 20, 1999.

12. Utah Division of Drinking Water Database.

13. Personal Conversation. Nancy Barr. Utah Division of Comprehensive Emergency Management. June 15, 2000.

14. U.S.G.S. Topography Maps - Fort Douglas.

15. Personal Conversation. Dave Darbey. Utah Division of Wildlife Resources. January 1995.

16. Utah Division of Wildlife Resources. April, 1995. Telephone conversation regarding sensitive environments.

Population Calculation Sheet 1
Municipal Drinking Water Source Population Estimates
Mt. Olivet Park Plume - By Distance From The Site and Aquifer

Well No.	Drinking Water System	# of G.W. Withdrawals in System	% That G.W. Contributes to System	Population Served by System	Population Affected by Well	Distance From Site (mi.)	Aquifer	Distance Population Totals
1126	Salt Lake City	27	20	305835	2,265	0.24		
1243	University of Utah	2	50	18000	4,500	0.24		
1242	University of Utah	2	50	18000	4,500	0.24	B	11,265
1116	Salt Lake City	27	20	305835	2,265	2.40		
1125	Salt Lake City	27	20	305835	2,265	2.34		
1128	Salt Lake City	27	20	305835	2,265	2.79		
1129	Salt Lake City	27	20	305835	2,265	2.82	B	9,062
1117	Salt Lake City	27	20	305835	2,265	3.12		
1207	Salt Lake City	27	20	305835	2,265	3.15		
1206	South Salt Lake	7	90	11500	1,479	3.74		
1208	South Salt Lake	7	90	11500	1,479	3.75	B	7,488

Municipal Drinking Water Source Population Estimates

Mount Olivet Cemetery Plume - By Distance From The Park

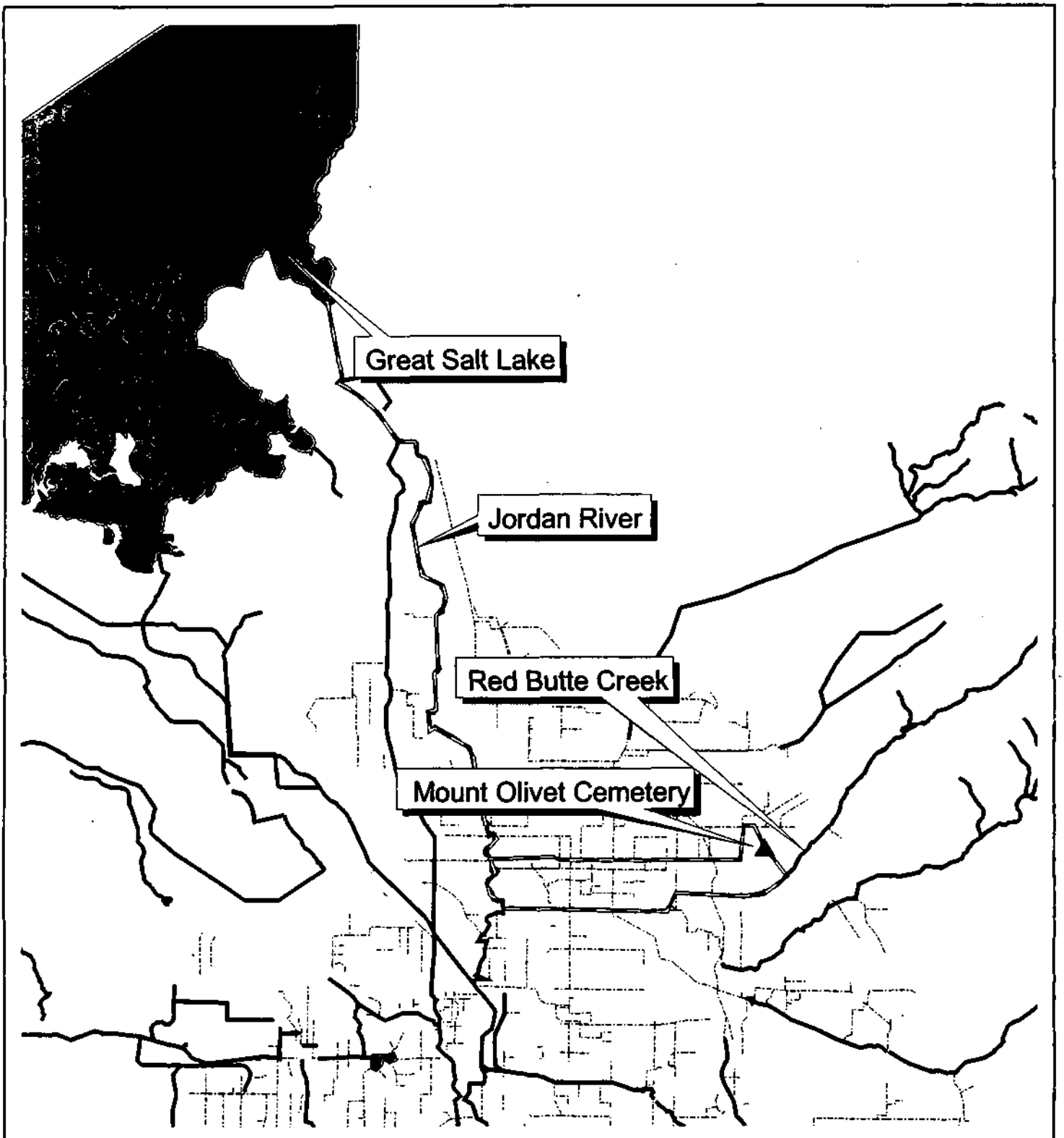
Well No.	Drinking Water System	# of G.W. Withdrawals in System	% That G.W. Contributes to System	Population Served by System	Population Affected by Well	Distance From Site (mi.)	Distance Population Totals
1129	Salt Lake City	27	20	285258	2113	0.69	
1129	Salt Lake City	27	20	285258	2113	0.77	4226
1130	Salt Lake City	27	20	285258	2113	1.93	
1208	South Salt Lake City	7	90	11500	1479	1.96	
1117	Salt Lake City	27	20	285258	2113	1.99	5705
1207	South Salt Lake City	7	90	11500	1479	2.03	
1206	South Salt Lake City	7	90	11500	1479	2.19	
1126	Salt Lake City	27	20	285258	2113	2.63	
1242	University of Utah	2	50	18000	4500	2.63	
994	Holiday Water	6	80	15000	2000	2.65	
1243	University of Utah	2	50	18000	4500	2.66	
1124	Salt Lake City	27	20	285258	2113	2.98	18183
1123	Salt Lake City	27	20	285258	2113	3.01	
1205	South Salt Lake City	7	90	11500	1479	3.05	
1118	Salt Lake City	27	20	285258	2113	3.14	
1116	Salt Lake City	27	20	285258	2113	3.14	
992	Holiday Water	6	80	15000	2000	3.21	
1203	South Salt Lake City	7	90	11500	1479	3.29	
1121	Salt Lake City	27	20	285258	2113	3.3	
993	Holiday Water	6	80	15000	2000	3.3	
1204	South Salt Lake City	7	90	11500	1479	3.33	
1122	Salt Lake City	27	20	285258	2113	3.34	
1252	Daily Foods	1	80	25	20	3.58	
996	Holiday Water	6	80	15000	2000	3.86	
1132	Salt Lake City	27	20	285258	2113	3.86	
995	Holiday Water	6	80	15000	2000	3.88	
1224	Boundary Spring	1	100	120	120	3.92	
1152	SL County Water	18	17	400000	3778	3.95	29032

Population Served, by Distance Category

0-½ mile---------- 0 >2 - 3 miles---18,183

>½ - 1 mile-------- 4226 >3 - 4 miles----29,032

>1 - 2 miles--------5705



2 0 2 4 Miles

N
W E
S

▲ Mount Olivet Cemetery Well
15 Mile Surface Water Pathway
Storm Sewer Line
Streams

Utah Department
of Environmental Quality

Division of Environmental Response
and Remediation

15 MILE SURFACE WATER PATHWAY
Mount Olivet Cemetery Plume - Salt Lake City
Salt Lake County, Utah