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UMTRA PROJECT WATER SAMPLING AND ANALYSIS PLAN

SALT LAKE CITY, UTAH

June 1994

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**UMTRA PROJECT WATER SAMPLING AND ANALYSIS PLAN
SALT LAKE CITY, UTAH**

June 1994

**Prepared for
U.S. Department of Energy
UMTRA Project Office
Albuquerque, New Mexico**

**Prepared by
Jacobs Engineering Group Inc.
Albuquerque, New Mexico**

EXECUTIVE SUMMARY

Surface remedial action was completed at the Salt Lake City, Utah, Uranium Mill Tailings Remedial Action (UMTRA) Project site in the fall of 1987. Results of water sampling for the years 1992 to 1994 indicate that site-related ground water contamination occurs in the shallow unconfined aquifer (the uppermost aquifer). With respect to background ground water quality, contaminated ground water in the shallow, unconfined aquifer has elevated levels of chloride, sodium, sulfate, total dissolved solids, and uranium. No contamination associated with the former tailings pile occurs in levels exceeding background in ground water in the deeper confined aquifer. This document provides the water sampling and analysis plan for ground water monitoring at the former uranium processing site in Salt Lake City, Utah (otherwise known as the "Vitro" site, named after the Vitro Chemical Company that operated the mill). All contaminated materials removed from the processing site were relocated and stabilized in a disposal cell near Clive, Utah, some 85 miles (140 kilometers) west of the Vitro site (known as the "Clive" disposal site). No ground water monitoring is being performed at the Clive disposal site, since concurrence of the remedial action plan by the U.S. Nuclear Regulatory Commission and completion of the disposal cell occurred before the U.S. Environmental Protection Agency issued draft ground water standards in 1987 (52 FR 36000) for cleanup, stabilization, and control of residual radioactive materials at the disposal site. In addition, the likelihood of post-closure impact on the ground water is minimal to nonexistent, due to the naturally poor quality of the ground water.

There are currently no surface water quality data for the Vitro Ditch, Mill Creek, or Jordan River, and the potential impact from uranium ore processing on surface waters is unknown. Although surface water samples were collected in December 1993 from the Vitro Ditch, Mill Creek, and Jordan River at locations upstream and downstream of the site, the analytical results of the samples will not be available until after this plan has been published.

Water sampling activities planned for calendar year 1994 consist of sampling ground water from nine monitor wells to assess the migration of contamination within the shallow unconfined aquifer and sampling ground water from two existing monitor wells to assess ground water quality in the confined aquifer.

The monitor well locations provide a representative distribution of sampling points to characterize ground water quality and ground water flow conditions in the shallow unconfined aquifer. The two monitor wells sampled in the confined aquifer are sufficient to monitor ground water quality but not ground water flow conditions. The list of analytes has been modified with time and currently reflects constituents related to uranium processing activities and indicator parameters.

The nine monitor wells screened in the shallow unconfined aquifer will be sampled biannually. The two monitor wells screened in the deep confined aquifer will be sampled only annually in October, because no contamination associated with the former tailings pile occurs in levels exceeding background in ground water in this aquifer.

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LIST OF ACRONYMS

<u>Acronym</u>	<u>Definition</u>
ac	acre
AEC	Atomic Energy Commission
cm	centimeter
CVWRF	Central Valley Water Reclamation Facility
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	foot
gpm	gallon per minute
ha	hectare
km	kilometer
Lpm	liters per minute
m	meter
m ³	cubic meter
MCL	maximum concentration limit
mi	mile
mg/L	milligrams per liter
NRC	U.S. Nuclear Regulatory Commission
SOP	standard operating procedure
TAD	Technical Approach Document
TDS	total dissolved solids
UMTRA	Uranium Mill Tailings Remedial Action
WSAP	water sampling and analysis plan
yd ³	cubic yard

1.0 INTRODUCTION

1.1 PURPOSE

This water sampling and analysis plan (WSAP) provides the regulatory and technical basis for ground water sampling at the Salt Lake City, Utah, Uranium Mill Tailings Remedial Action (UMTRA) Project site. It identifies and justifies the sampling locations, analytical parameters, and sampling frequencies at the site. The ground water data are used for site characterization and risk assessment.

Ground water and surface water monitoring activities are based on U.S. Environmental Protection Agency (EPA) regulations in 40 CFR Part 192 (1993) and proposed EPA standards of 1987 (52 FR 36000), UMTRA Project standard operating procedures (SOP) (JEG, n.d.), the Technical Approach Document (TAD) (DOE, 1989), and the most effective technical approach for the site.

This WSAP summarizes the results of water sampling activities for the years 1992 through the first quarter of 1994 and the plan for water sampling activities for calendar year 1994.

1.2 SITE LOCATION

The Salt Lake City processing site consists of 128 acres (ac) (52 hectares [ha]) (Figure 1.1) and is located 4 miles (mi) (6 kilometers [km]) south-southwest of the center of Salt Lake City, at the northeast corner of the street intersection of 3300 South Street and 900 West Street. The Central Valley Water Reclamation Facility (CVWRF) sewage treatment plant is located on adjacent property north of the central portion of the site. The entire site is now owned by the CVWRF board.

The site is bounded on the north by the CVWRF and the channel of Mill Creek, on the east by the Denver & Rio Grande Western Railroad, on the south by 3300 South Street, and on the west by 900 West Street. A 5.4-ac (2.2-ha) industrial area occupies a 225-foot (ft) (70-meter [m])-wide strip adjacent to the west edge of the south half of the site facing 900 West Street. Another industrial facility is situated adjacent to the southeast corner of the site. The nearest residences to the Salt Lake City site are about 300 ft (90 m) away from its southwestern corner, across 3300 South Street.

1.3 SITE HISTORY

In 1941, a large smelter, known as the Calunite Smelter, Inc., was completed on 3300 South Street and 900 West Street in Salt Lake City. In 1946, the plant became known as the Vitro Chemical Company Calunite Plant. From 1941 through 1951, this smelter processed aluminum from aluminite. In May 1951, the Vitro plant began processing uranium ore under contract with the United States Atomic Energy Commission (AEC). Because the plant operator

FIGURE 1.1
LOCATION OF THE SALT LAKE CITY, UTAH, SITE

was the Vitro Chemical Company, the site is often referred to as the Vitro site rather than the Salt Lake City site.

From 1951 to 1964, the Vitro plant processed uranium ores by acid leaching. In 1965, the mill was converted to the production of vanadium. Vanadium production ceased in 1968 and the plant was dismantled in 1970.

In August 1993, a 28-ac (11-ha) golf driving range was constructed in the southeast corner of the site. This golf course requires irrigation and may impact the water table surface of the shallow unconfined aquifer and the migration of contaminants.

1.4 SITE STATUS

Remedial action at the Salt Lake City processing site occurred from 1985 to 1987. A total of 2,798,000 cubic yards (yd³) (2,139,000 cubic meters [m³]) of tailings were removed from the site and stabilized in a disposal cell located at Clive, Utah (approximately 85 mi [140 km] west of Salt Lake City). The state of Utah was the remedial action contractor. It was responsible for removing tailings and for submitting a site certification report to the U.S. Department of Energy (DOE) for U.S. Nuclear Regulatory Commission (NRC) concurrence, certifying that the surface is free of contamination. The state of Utah submitted the site certification report for NRC concurrence in December 1992.

1.5 SAMPLING PLAN

The current water sampling plan for the Salt Lake City site is to collect water samples biannually from selected DOE monitor wells. The monitor wells were relocated to provide a representative distribution of sampling points to characterize ground water quality and/or ground water flow conditions in the vicinity of the site. The list of analytes reflects constituents related to uranium processing activities. The ground water flow regime of the site is dynamic, with several anthropogenic influences controlling ground water flow and contaminant migration.

The last water quality sampling round was completed in February 1994. The next scheduled water quality sampling round will take place in October 1994 and will include 11 monitor wells. The nine monitor wells screened in the shallow unconfined aquifer will be sampled biannually. The two monitor wells screened in the deep confined aquifer will be sampled only annually in October, because no contamination associated with the former tailings pile occurs in levels exceeding background in ground water in this aquifer.

2.0 SITE CHARACTERIZATION

2.1 PHYSIOGRAPHIC SETTING

The Salt Lake City site is in the lower part of the Jordan River basin. The site is located between the Wasatch Mountains to the east and the Oquirrh Mountains to the west.

2.2 GEOLOGY

The lithology underlying the Salt Lake City site consists of a thick sequence of quaternary lacustrine-fluvial deposits with minor alluvial overburden. Unconsolidated lacustrine deposits below the site are approximately 700 ft (210 m) thick (Arnow et al., 1970). Tertiary deposits underlie the quaternary deposits to a depth of approximately 1200 ft (370 m) (Mattick, 1970). These tertiary deposits consist of semiconsolidated clay, sand, and gravel interspersed with some lava and cemented layers of sand and gravel (Arnow et al., 1970). Subsequent to the site surface remediation, the upper 4 to 13 ft (1.2 to 3.9 m) have been replaced by clean sandy gravel fill material.

Borehole samples from previous investigations indicate that shallow materials consist of unconsolidated silt, clayey-silt, silty-clay, and lenticular sands deposited in a fluvial-lacustrine environment. These sediments are complexly interbedded, and correlation between individual boreholes is sometimes difficult.

2.3 HYDROLOGY

2.3.1 Ground water

The ground water regime in the vicinity of the Salt Lake City site is generally characterized by two aquifer systems: a shallow, unconfined system and a deeper, confined system. The two aquifers are separated by interbedded layers of low-permeability clays and silts. Wells at depths from 70 to 330 ft (20 to 100 m) below the ground surface are under substantial artesian pressure, with ground water flowing from several wells. Near the site, ground water flow in both aquifers is predominantly to the west-northwest, or toward the Great Salt Lake.

Shallow unconfined aquifer

In the vicinity of the former tailings pile, the upper, unconfined aquifer is approximately 45 ft (14 m) thick. Ground water yields from the interbedded strata of this aquifer system vary depending on the lithology of the location where a well is screened. Results from recent aquifer pumping tests indicate that ground water yields can range from much less than 1 gallon per minute (gpm) (4 liters per minute [Lpm]) from the silts and clays, to long-term sustained yields of more than 4 gpm (16 Lpm) from the fine-grained sands and silty sands.

The major sources of recharge to the unconfined aquifer are infiltration of precipitation and upward leakage from the confined aquifer. Ground water in the unconfined aquifer generally discharges to surface water drainages such as the Jordan River, Mill Creek, and Great Salt Lake. However, a highway drain below the Denver & Rio Grande Western Railroad overpass of 3300 South Street locally influences ground water flow in the unconfined aquifer. The ground water entering the drain is pumped out of a sump into a culvert that discharges into the head of South Vitro Ditch. Ground water levels in the area indicate that there is a ground water divide in the southeast corner of the site.

A 28-ac (11-ha) driving range has recently been constructed in the southeast corner of the site. The irrigation of the golf course is recharging the shallow unconfined aquifer. This additional recharge may affect ground water flow and may increase the rate at which potentially contaminated ground water will migrate off the site toward the southeast.

Ground water levels in the unconfined aquifer range from 5 to 15 ft (1.5 to 4.6 m) or more below the ground surface. Topographic "lows" to the east of the site are perennial marshy areas. The ground water flow direction is primarily from southeast to northwest. A water table map of the shallow unconfined aquifer is shown in Figure 2.1.

The average linear ground water velocity in the shallow unconfined aquifer was calculated using a hydraulic conductivity of 0.46 ft/day (0.14 m/day). The hydraulic conductivity is based on a maximum transmissivity of 16 ft²/day (4.9 m²/day) derived from the aquifer pumping test divided by a saturated thickness of 35 ft (12 m), a hydraulic gradient of 0.005, and an assumed effective porosity of 0.20. Using Darcy's Law, the average linear velocity for ground water flow in the shallow unconfined aquifer is approximately 4 ft (1.3 m) per year.

Confined aquifer

The confined aquifer begins 70 ft (20 m) below the ground surface and contains ground water under substantial artesian pressure. The hydraulic head levels range from approximately 8 ft (2.5 m) above the ground surface for the well screened at 70 ft (20 m), to 15 ft (4.5 m) above ground surface for the wells screened at a depth of approximately 130 ft (40 m). Near the Jordan River, this confined (artesian) aquifer system extends to depths of 500 to 800 ft (150 to 240 m) below the ground surface (Hely et al., 1971).

The major source of recharge to the confined aquifer is infiltration of precipitation and snowmelt along the flanks of the Wasatch and Oquirrh Mountains. Beneath the site, the ground water in this aquifer flows toward the west-northwest. Natural discharge is upward to the unconfined aquifer system. The absence of any prominent aquitard stratum on the west side of the site (boreholes O15 and 134) indicates the potential for upward leakage of ground water from the lower system and mixing with ground water in the shallow

FIGURE 2.1
WATER TABLE SURFACE OF THE UNCONFINED AQUIFER
SALT LAKE CITY, UTAH, SITE

system in this area. Artificial discharge includes pumpage of wells completed in the confined aquifer system.

No potentiometric contour map of the deeper confined aquifer was constructed because on-site data of ground water elevations were lacking.

2.3.2 Surface water

Three surface water bodies are near the Salt Lake City site. The Jordan River is about 1500 ft (460 m) west of the site and flows north to the Great Salt Lake. Mill Creek, a perennial stream, flows along the north edge of the site. This creek empties directly into the Jordan River. One flowing drainage is on the Salt Lake City site (see Figure 2.2). The South Vitro Ditch flows from south to north and joins Mill Creek just north of the site. The site does not contribute runoff to the South Vitro Ditch except in severe rains; the ditch is primarily fed by ground water.

2.4 GROUND WATER QUALITY

2.4.1 Background ground water quality

Shallow unconfined aquifer

Background ground water quality in the shallow, unconfined aquifer was established using monitor wells SLC-01-0006 and SLC-01-0007 (Figure 2.2). These monitor wells are upgradient and crossgradient from the site. Background ground water quality in the shallow, unconfined aquifer is characterized by chloride concentrations ranging from 59 to 318 milligrams per liter (mg/L); sodium concentrations ranging from 129 to 243 mg/L; total dissolved solids (TDS) concentrations ranging from approximately 535 to 1290 mg/L; and sulfate concentrations ranging from <1 to 137 mg/L. Concentrations of arsenic exceed the proposed EPA maximum concentration limit (MCL) in some samples collected from background monitor wells but not in samples collected from downgradient wells. Background ground water quality for the unconfined aquifer is summarized in Table 2.1.

On-site monitor wells SLC-01-0130, SLC-01-0132, and SLC-01-0133 exhibit ground water that is generally of better quality than ground water sampled from background monitor wells SLC-01-0006 and SLC-01-0007. The three on-site wells were not used to help characterize background ground water quality because they are located downgradient of some of the former tailings piles and could be affected by residual ground water contamination that may have remained after surface remediation. Ground water quality for these three wells is summarized in Table 2.1.

The shallow unconfined aquifer is a source of water for small-scale irrigation but is seldom used for drinking water because its yield is low and it is readily contaminated by surface conditions (Seiler and Waddell, 1984).

LEGEND

- 133 ● NUMBER AND LOCATION OF WELL SCREENED IN THE SHALLOW UNCONFINED AQUIFER
- 003 ● NUMBER AND LOCATION OF WELL SCREENED IN THE DEEP CONFINED AQUIFER
- 186 ▲ SURFACE WATER SAMPLING POINT NUMBER AND LOCATION

FIGURE 2.2
LOCATION OF MONITOR WELLS AND SURFACE WATER SAMPLING POINTS
AT THE SALT LAKE CITY, UTAH, SITE

Table 2.1 Summary of ground water quality of the unconfined aquifer at the Salt Lake City site (mg/L)

Constituent	Average background ^a	Average contaminated ^b	Average on-site uncontaminated ^c	
Major ions				
Ammonium	9.8	10.5	13.2	
Calcium	431.6	159.4	25.35	
Chloride	188.5	695	16.4	
Iron	0.18	2.39	0.66	
Magnesium	47.6	367.7	37.2	
Manganese	0.24	0.27	0.059	
pH	7.98	7.3	7.6	
Potassium	37.8	85.0	27.05	
Sodium	187.9	601.4	39.9	
Sulfate	69.7	1228	1.25 ^d	
TDS	915	3652	350	
Constituent	MCL	Average background	Average downgradient	Average on-site uncontaminated
EPA inorganics with MCLs				
Arsenic	0.05	0.049	0.036 ^d	0.054
Barium	1.0	0.116	0.027 ^d	0.20
Cadmium	0.01	<0.0005	0.0006 ^d	<0.001
Chromium	0.05	<0.01	<0.01	<0.01
Lead	0.05	<0.003	<0.003	<0.003
Mercury	0.002	<0.0002	<0.0002	<0.0002
Molybdenum	0.1	<0.01	0.068	<0.01
Net gross alpha (pCi/L)	15.0	3.6	5.17	0.5
Nitrate (as NO ₃)	44	2.68	1.0 ^d	<1.0
Radium-226 and -228 (pCi/L)	5.0	0.50	1.9	1.3
Selenium	0.01	<0.005	0.006 ^d	<0.005
Silver	0.05	<0.01	0.01 ^d	0.011
Uranium ^e	0.044	0.0022	0.04	0.001

^aBackground ground water quality was determined using monitor wells SLC-01-0006 and -0007.

^bContaminated ground water quality was determined using monitor wells SLC-01-0008, -0131, -0134, and -0135.

^cOn-site uncontaminated ground water quality was determined using monitor wells SLC-01-0130, -0132, and -0133.

^dThe constituent concentration distribution was nonparametric and an average could not be determined; therefore, the median value was used instead.

^e0.044 mg/L is the mass equivalent to the 30 pCi/L MCL for uranium.

Confined aquifer

Background ground water quality in the confined aquifer is characterized by TDS values of approximately 300 mg/L and a sulfate content of approximately 20 mg/L. The confined aquifer is an important source of domestic, agricultural, and industrial water supply in the Salt Lake Valley. No constituent exceeded the proposed EPA MCL for ground water.

2.4.2 Magnitude of site-related ground water contamination

Shallow, unconfined aquifer

Ground water samples collected from monitor wells SLC-01-0131, -0134, and -0135 were used to characterize on-site contaminated ground water quality. Ground water samples collected from monitor wells SLC-01-0008, -0011, and -0109 were used to characterize ground water quality just west and northwest (downgradient) of the site boundary (monitor wells SLC-01-0011 and -0109 have recently been destroyed). Residual ground water contamination from the former tailings piles still exists in the unconfined aquifer, both on the site and downgradient from the site. Concentrations of chloride, sodium, sulfate, TDS, and uranium in downgradient ground water are generally elevated by one to two orders of magnitude as compared to concentrations in background ground water. Concentrations of molybdenum, selenium, and uranium exceeded the proposed EPA MCL in some downgradient monitor wells. Table 2.1 compares the average background ground water concentrations with the average contaminated ground water concentrations for selected constituents.

The concentration distribution for sulfate, which typifies the concentration distribution patterns of other major ions (calcium, chloride, magnesium, sodium, and TDS) found at elevated concentrations, is shown in Figure 2.3. A sulfate plume exists, with the highest concentrations occurring nearly in the center of the site at monitor well SLC-01-0135 and extending off the site to the west-northwest. The concentration distribution for sulfate in ground water in the shallow unconfined aquifer is typical of the distribution of concentrations for major ions, molybdenum, and uranium. The concentration distribution for sulfate also indicates that contaminated ground water has migrated from the site to the west and northwest in the vicinity of monitor wells SLC-01-0011, -0109, and -0008 and the southeast toward monitor well SLC-01-0131. Since 1983, when monitoring began, ground water on the site and in nearby off-site areas in the unconfined aquifer has shown elevated concentrations of chloride, sodium, sulfate, TDS, and uranium. Ground water quality data collected from 1992 through the first quarter of 1994 confirm the presence of contamination shown by historical data.

Confined aquifer

No radioactive constituents and metals that would be associated with the tailings pile were found in levels above background in ground water in the confined aquifer.

NOTE: WELLS SAMPLED OCTOBER 1993.
 * MONITOR WELLS 011 AND 109 WERE
 LAST SAMPLED ON 10/7/92 BEFORE BEING DESTROYED.

FIGURE 2.3
CONCENTRATION DISTRIBUTIONS OF SULFATE IN THE UNCONFINED AQUIFER
SALT LAKE CITY, UTAH, SITE

The good quality of ground water in the confined aquifer, relative to the shallow unconfined aquifer, is maintained by the upward vertical hydraulic gradient between the two aquifers, which prevents downward migration of site-related contamination from the unconfined aquifer. The potential for contamination of the confined aquifer exists if the hydraulic head in the confined aquifer declines so that the direction of flow between the two aquifers reverses. It is conceivable that localized migration of ground water from the shallow, unconfined aquifer into the confined aquifer could occur in the area of the cone of depression caused by large-scale pumping from wells developed in the confined aquifer.

The nearest operating municipal water supply well is located approximately 1200 ft (370 m) northeast of the site by the intersection of Mill Creek and the Denver & Rio Grande Western Railroad main line. The city of South Salt Lake owns a 10-inch (25-centimeter [cm]) diameter well located on-site approximately 450 ft (140 m) southwest of monitor well SLC-01-0130. The well is currently nonoperational, but the city is attempting to develop the well as a municipal water supply.

3.0 DATA COLLECTION OBJECTIVES

3.1 DATA QUALITY OBJECTIVES

Data quality objectives define the manner in which samples are collected, handled, and analyzed. The objectives include 1) defining analytical support levels, 2) following standard procedures for water sampling, preservation, transport, and various other field procedures, 3) performing activities in accordance with quality assurance and quality control protocols, and 4) providing analytical data validation. Data quality objectives to be followed during data collection and evaluation activities are stated in the WSAP guidance document (DOE, 1993) and applicable SOPs (JEG, n.d.).

3.2 REGULATORY REQUIREMENTS

The regulatory requirements for ground water and surface water sampling at the Salt Lake City site are specified in 40 CFR Part 192 (1993) and in state of Utah regulations.

3.3 COMPLIANCE MONITORING

Currently, no compliance monitoring is required at the Salt Lake City processing site.

3.4 SITE CHARACTERIZATION

Characterization of contaminant migration in the shallow, unconfined aquifer will be an ongoing activity. Monitor wells SLC-01-0008, -0131, -0134, and -0136 will monitor the downgradient migration of the contaminant plume. Monitor well SLC-01-0135 will be replaced with monitor well SLC-01-0136, which is 10 ft (3 m) away. Monitor well SLC-01-0136 is a 2-inch (5-cm) diameter well; it will require one-ninth the purge volume and less time to sample than monitor well SLC-01-0135, which is a 6-inch (15-cm) diameter well. Both wells are screened at the same depth, and ground water collected from both wells is similar in quality. Monitor wells SLC-01-0130, -0132, and -0133 are currently not affected by residual ground water contamination and will provide information of any potential contamination migration that could occur. Wells SLC-01-0006 and -0007 will monitor background ground water quality. Wells SLC-01-0002 and -0003 will monitor ground water quality in the confined aquifer.

3.5 RISK ASSESSMENT

Ground water and surface water samples were collected in October and December 1993 for risk assessment. The results from the sampling will be used to determine contaminant plume locations, constituent concentrations, and water quality and quantity at potential receptor points. A list of potential

contaminants of concern will be compiled to assess human health or environmental risks at the Salt Lake City site. This information will be presented in the Salt Lake City baseline risk assessment, which will be completed by the end of the 1994 fiscal year. No sampling for risk assessment purposes will be conducted in 1994.

4.0 WATER SAMPLING PLAN

4.1 SAMPLING LOCATIONS

The ground water monitoring network at the Salt Lake City processing site will consist of nine wells screened in the shallow, unconfined aquifer and two wells screened in the confined aquifer (Figure 2.2). The network of monitor wells for the shallow, unconfined and the confined aquifers is listed in Table 4.1.

Table 4.1 Ground water monitoring network, Salt Lake City, Utah, site

Well number	Aquifer screened	Total depth ft (m)	Screened interval (depth below surface) ft (m)
SLC-01-0002	Confined	133 (41)	119-129 (36-39)
SLC-01-0003	Confined	124 (38)	110-120 (34-37)
SLC-01-0006	Unconfined	32 (10)	26-28 (8-8.5)
SLC-01-0007	Unconfined	32 (10)	26-28 (8-8.5)
SLC-01-0008	Unconfined	33 (10)	19-21 (5.8-6.4)
SLC-01-0130	Unconfined	44 (13)	32-42 (10-13)
SLC-01-0131	Unconfined	47 (14)	35-45 (11-14)
SLC-01-0132	Unconfined	48 (15)	36-46 (11-14)
SLC-01-0133	Unconfined	47 (14)	35-45 (11-14)
SLC-01-0134	Unconfined	44 (13)	32-42 (10-13)
SLC-01-0136	Unconfined	45 (14)	33-43 (10-13)

Surface water samples were collected in December 1993 along the Vitro Ditch, Mill Creek, and Jordan River at locations upstream and downstream of the site (Figure 2.2). The analytical results of the samples will not be available until after this WSAP has been published. One additional surface water sampling round will be conducted in 1994.

4.2 CONSTITUENT SELECTION

The ground water monitoring program includes collecting and analyzing ground water samples from the monitor wells listed in Table 4.1. Ground water samples were initially evaluated for hazardous constituents generally expected to be in or derived from the residual radioactive material related to the uranium processing activities. The list of constituents analyzed has been modified during

subsequent sampling events, based on the historical data base, to focus on hazardous constituents related to uranium processing activities at this site. Based on existing ground water quality data, the list of constituents to be analyzed are those presented in Table 2.1. Compliance with ground water regulations, and protection of human health and the environment are based on assessment of trends observed in ground water quality data in relation to background levels and site-specific conditions.

4.3 SAMPLING FREQUENCY

Ground water monitoring in the shallow unconfined aquifer will be performed biannually at the Salt Lake City site. This sampling frequency will allow for evaluation of trends in ground water flow conditions and ground water quality and will also provide additional information and continuity of the data base. This will be useful during the ground water remediation phase of the UMTRA Project. Ground water in the deeper confined aquifer has not been affected by contamination from the tailings piles and will be sampled annually. Water level measurements in all wells will be taken during each sampling event.

4.4 DATA INTERPRETATION

Water sampling data collected during 1994 will be analyzed and evaluated according to prescribed UMTRA Project procedures and compared with the existing data base. Trend analyses will be performed to detect any variations in ground water flow conditions and ground water quality. Variations will be evaluated and modifications to the sampling plan will be noted, justified, and implemented as appropriate.

4.5 ANOMALOUS DATA EVALUATION

In the event that results from the water sampling are beyond the range of expected values, the suspect data will be evaluated to determine the cause of the deviation. If the deviation cannot be related to an error in collection or analysis of the sample, or to processes reasonably expected to occur in the hydrogeologic environment, then the location will be resampled during the next scheduled sampling round, or sooner if dictated by an urgent need related to potential impact to human health and the environment. Detailed procedures for evaluation of anomalous data are included in the WSAP guidance document (DOE, 1993).

5.0 LIST OF CONTRIBUTORS

The following individuals contributed to the preparation of this document.

Name	Contribution
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L. Connolly	Technical editing

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CODE OF FEDERAL REGULATIONS

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