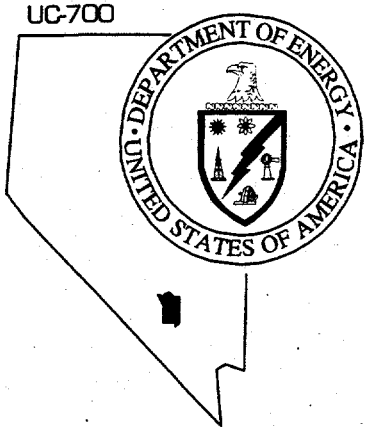
DOE/NV--460
UC-700

Nevada
Environmental
Restoration
Project



Rulison Site Groundwater Monitoring Report Third Quarter, 1996

February 1997

Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office

DOE/NV-460
UC-700

RULISON SITE
GROUNDWATER MONITORING REPORT
THIRD QUARTER, 1996

DOE Nevada Operations Office
Las Vegas, Nevada

February 1997

RULISON SITE
GROUNDWATER MONITORING REPORT
THIRD QUARTER, 1996

Approved by: Janet Appenzeller-Wing
Janet Appenzeller-Wing, Project Manager
Offsites Subproject

Date: 2/12/97

Approved by: Stephen A Mellington
Stephen A. Mellington, Project Manager
Nevada Environmental Restoration Project

Date: 2/13/97

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List of Acronyms and Abbreviations

AEC	U.S. Atomic Energy Commission
Austral	Austral Oil Company
BTEX	Benzene, toluene, ethylbenzene, and xylenes
COPC	Constituent(s) of potential concern
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
EPA ORIA RSL	U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Radiation Sciences Laboratory
ft	Foot (feet)
km	Kilometer(s)
LTGMP	Long-Term Groundwater Monitoring Plan
m	Meter(s)
mi	Mile(s)
MS/MSD	Matrix spike/matrix spike duplicate
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RPD	Relative percent difference
SGZ	Surface Ground Zero
TPH	Total petroleum hydrocarbons
TDS	Total dissolved solids
TSS	Total suspended solids
μg/L	Micrograms per liter
VOC	Volatile organic compound

1.0 Introduction

This report summarizes the results of the third quarter 1996 groundwater sampling event for the Rulison Site, which is located approximately 65 kilometers (km) (40 miles [mi]) northeast of Grand Junction, Colorado. The sampling was performed as part of a quarterly groundwater monitoring program implemented by the U.S. Department of Energy (DOE) to monitor the effectiveness of remediation of a drilling effluent pond located at the site. The effluent pond was used for the storage of drilling mud during drilling of the emplacement hole for a 1969 gas stimulation test conducted by the U.S. Atomic Energy Commission (AEC) (the predecessor agency to the DOE), and Austral Oil Company (Austral).

1.1 Site Location

The Rulison Site is located in the North ½ of the Southwest ¼ of Section 25, Township 7 South, Range 95 West of the 6th Principal Meridian, Garfield County, Colorado, approximately 19 km (12 mi) southwest of Rifle, Colorado, and approximately 65 km (40 mi) northeast of Grand Junction, Colorado (Figure 1-1). The site is situated on the north slope of Battlement Mesa on the upper reaches of Battlement Creek, at an elevation of approximately 2,500 meters (m) (8,200 feet [ft]). The valley is open to the north-northwest and is bounded on the other three sides by steep mountain slopes that rise to elevations above 2,927 m (9,600 ft).

1.2 Project Description and Background

Project Rulison, a joint AEC and Austral experiment, was conducted under the AEC's Plowshare Program to evaluate the feasibility of using a nuclear device to stimulate natural gas production in low-permeability, gas-producing geologic formations. The experiment was conducted on September 10, 1969, and consisted of detonating a 40-kiloton nuclear device at a depth of 2,568 m (8,426 ft) below ground surface. Natural gas production testing was conducted in 1970 and 1971.

The site was deactivated by the AEC and Austral in 1972 and abandoned in 1976. Cleanup associated with site abandonment consisted of removing all remaining equipment and materials, plugging the emplacement (R-E) and reentry (R-EX) wells (Figure 1-2), backfilling the mud pits adjacent to the R-EX well, removing the tritium-contaminated soils, and conducting extensive surface soil sampling and analysis to characterize the radiological condition of the site.

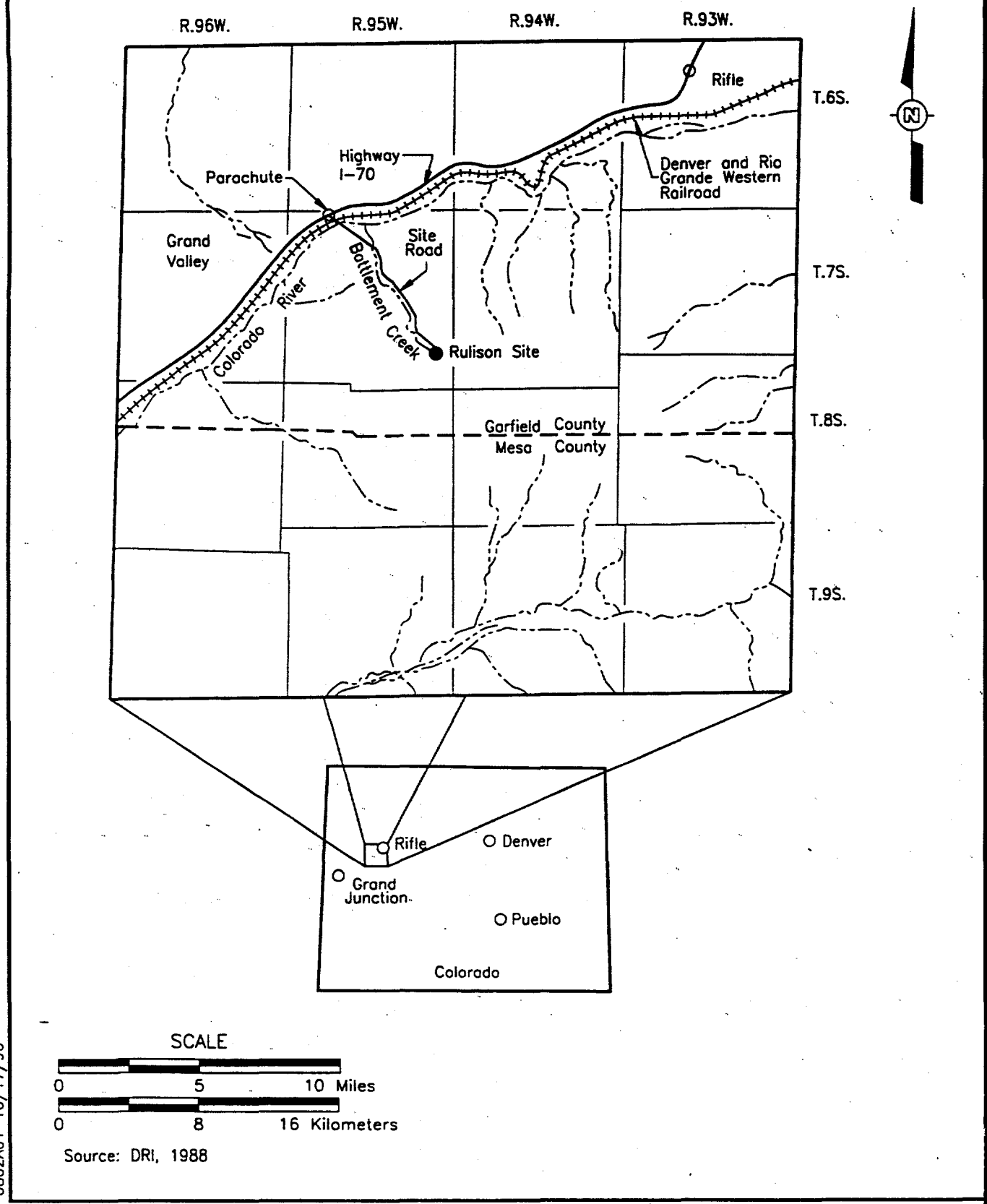

Figure 1-1
Rulison Site Location Map

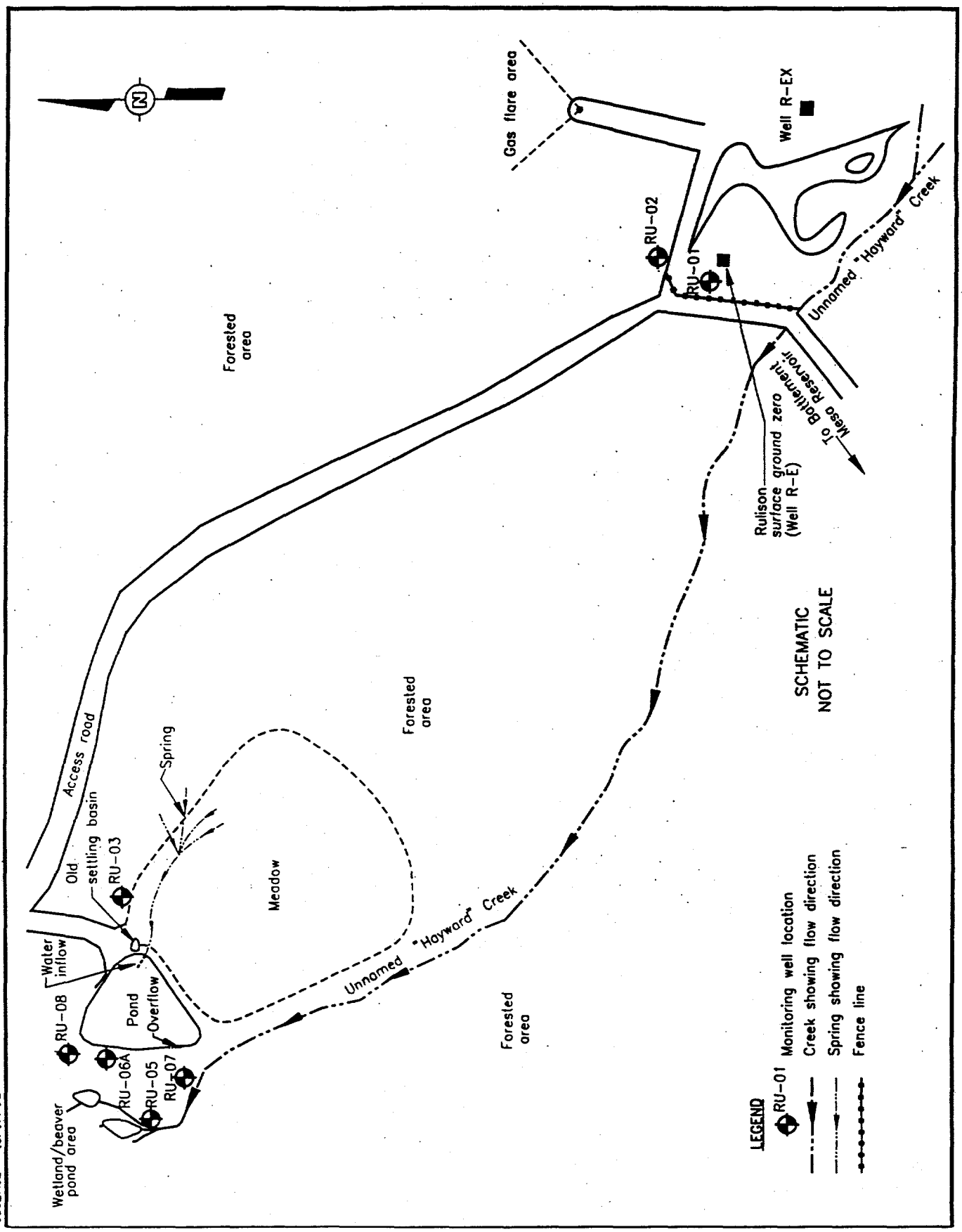

Figure 1-2
Monitoring Well Locations

Detailed descriptions of the site deactivation and abandonment activities and radiological characterizations are presented in the *Rulison Site Cleanup Report* (AEC, 1973), the *Project Rulison Well Plugging and Site Abandonment Final Report* (ERDA, 1977), and the *Rulison Radiation Contamination Clearance Report* (Eberline, 1977).

The drilling effluent pond is an engineered structure located approximately 400 m (1,312 ft) north-northwest of the surface ground zero (SGZ) emplacement well (R-E) (Figure 1-2). The pond covers approximately 0.5 hectare (1.2 acre) as measured at the top of the berm; it is triangular in shape; and it is approximately 6 m (20 ft) deep from the top of the berm to the pond bottom. The drilling effluent pond was used to store nonradioactive drilling fluids generated during drilling of the device emplacement well R-E. The drilling fluids consisted of bentonite drilling mud that contained various additives, such as diesel fuel and chrome lignosulfonate, used to improve drilling characteristics. Most of the drilling wastes were removed from the pond when the site was cleaned up and decommissioned in 1976; however, some drilling fluid was left in the pond. At the request of the property owner, the pond structure was left in place following completion of site decommissioning and was subsequently converted by the property owner to a freshwater holding pond containing aquatic vegetation, amphibians, and stocked rainbow trout.

In 1994 and 1995, four pond sediment sampling events were conducted to evaluate the extent of residual contamination from drilling wastes remaining in the pond. Concentrations of diesel-range total petroleum hydrocarbons (TPH); benzene, toluene, ethylbenzene, and total xylenes (BTEX compounds); barium; chromium; and lead were found in pond sediment samples and soil samples taken from an old settling basin located adjacent to the pond. Based on the results of the 1994 and 1995 sampling events, the DOE decided to conduct a voluntary cleanup action at the pond to reduce the levels of TPH and chromium in pond sediments and soils in and adjacent to the pond. The cleanup was completed in November 1995. One upgradient monitoring well (RU-03 on Figure 1-2) and four downgradient monitoring wells (RU-05, RU-06A, RU-07, and RU-08) were installed around the pond to monitor the effectiveness of the cleanup. A detailed description of pond cleanup and well installation is presented in the *Rulison Site Corrective Action Report* (DOE, 1996a).

1.3 Summary of Site Activities

The initial third quarter 1996 groundwater sampling event was conducted on September 10, 1996, by representatives from the DOE and the U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Radiation Sciences Laboratory (EPA ORIA RSL). The analytical results for the September groundwater samples contained several anomalies that included the following:

- BTEX compounds were detected in an equipment rinsate blank at concentrations that were higher than the concentrations reported for the groundwater samples, which indicates that BTEX concentrations reported for the groundwater samples may not be representative of groundwater quality.

- The same apparent laboratory TPH contamination that was encountered during analyses of the first and second quarter 1996 samples (DOE, 1996b) was detected in samples collected in September.

- Total suspended solids (TSS) concentrations were significantly higher than TSS concentrations measured in the same wells in November 1995 (DOE, 1996a), which indicates that the sampling technique used for the September sampling event (a portable pump) may have stirred up sediments present in the bottom of the monitoring wells.

Because of the uncertainties with respect to the representativeness of the September analytical results, the DOE decided to conduct an additional sampling event to replace the September results. This second sampling event was conducted on October 8 and 9, 1996, by representatives from DOE. The weather was sunny and dry. Wells RU-05, RU-07, and RU-08 were dry, and, therefore, they were not sampled. No other unusual observations were made, and no problems were experienced during the sampling event. The remainder of this report describes the results of the October 1996 sampling event.

2.0 Sampling and Analysis Procedures

The third quarter 1996 (October) groundwater sampling event was conducted in general accordance with the *Rulison Drilling Effluent Pond Site Long-Term Groundwater Monitoring Plan* (LTGMP) (DOE, 1996c) and the *Rulison Site Quality Assurance Project Plan, Rulison Site, Colorado* (QAPP) (DOE, 1996d).

2.1 Groundwater Level Measurement

Before purging and sampling activities at each well began, the depth to groundwater and total depth of the well were measured. This information was used to calculate the appropriate purge volume and to allow evaluation of any potential changes to groundwater flow direction since the previous sampling event.

2.2 Well Purging

Monitoring wells were purged of stagnant groundwater using disposable bailers. The purge water was discharged to the ground under Colorado Wastewater Discharge Permit No. COG-310084 as approved by the Colorado Department of Public Health and Environment, Water Quality Control Division (see Appendix A).

2.3 Sample Collection and Handling

Groundwater samples were collected from wells RU-03 and RU-06A with disposable bottom-emptying bailers. For quality control (QC) purposes, one duplicate sample and one matrix spike and matrix spike duplicate sample (MS/MSD) were collected during the sampling event. In addition, a trip blank accompanied all volatile organic samples in their shipping container. Samples were containerized and preserved as specified in Table 2-1. All containers were certified clean by the laboratory and remained sealed until ready for use.

2.4 Sample Analysis

The groundwater samples from the third quarter sampling event were analyzed for the parameters listed in Table 2-1, as specified in the Rulison LTGMP (DOE, 1996c). These parameters included the constituents of potential concern (COPCs) identified for the drilling effluent pond sediments (TPH, BTEX, barium, chromium, and lead).

Table 2-1
Rulison Site Groundwater Monitoring Program
Sample Container, Preservation, and Analytical Requirements

Parameter	Analytical Method	Sample Container	Minimum Amount of Sample Required	Holding Time	Preservative[a]
BTEX	SW-846[b] 8020	Glass with Teflon™- lined cap	2 x 40 mL	14 days	pH <2 with HCl Cool to 4°C
TPH (diesel fraction)	SW-846 8015M[c]	Glass	1 liter	14 days	pH <2 with H_2SO_4 Cool to 4°C
RCRA[d] Metals	SW-846 6010/ 7470	Glass or Polyethylene	1 liter	180 days	HNO_3 to pH <2 Cool to 4°C
Total Dissolved Solids (TDS)	EPA 160.1[e]	Glass or Polyethylene	100 mL	7 days	Cool to 4°C
Total Suspended Solids (TSS)	EPA 160.2[e]	Glass or Polyethylene	100 mL	7 days	Cool to 4°C
pH	Field	Glass or Polyethylene	25 mL	Analyze Immediately	None

[a]Holding time calculated from verified time of sample collection. Holding time for mercury is 28 days.
[b]U.S. Environmental protection Agency, SW-846 *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 3rd Edition (EPA, 1990)
[c]EPA SW-846, modified according to the California State Water Resources Control Board, *Leaking Underground Fuel Tank Field Manual, Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure*, Appendix B (1989)
[d]Resource Conservation and Recovery Act
[e]U.S. Environmental Protection Agency, *Methods for Chemical Analysis of Water and Wastes*, (EPA, 1983)

mL = Milliliter
Hcl = Hydrochloric acid
H_2SO_4 = Sulfuric acid
HNO_3 = Nitric acid
°C = Degrees Celsius

3.0 Analytical Results

The analytical results for the pond cleanup COPCs (diesel-range TPH, BTEX, barium, chromium, and lead) for the drilling effluent pond monitoring wells are presented in Table 3-1. Appendix B contains the results for all analytes for the third quarter sampling event. The following sections provide a discussion of the third quarter 1996 groundwater sampling results.

3.1 BTEX

Benzene, toluene, ethylbenzene, and total xylenes (BTEX compounds) were not detected in any of the groundwater samples from the third quarter 1996 sampling event.

3.2 Diesel-Range TPH

Diesel-range TPH was not detected in any of the groundwater samples from the third quarter 1996 sampling event.

3.3 Inorganics

The third quarter samples from both wells contained arsenic and barium. In addition, lead was detected in the sample from well RU-03 and in the duplicate sample from well RU-06A, but not in the sample from well RU-06A. Arsenic was not identified as a COPC for pond cleanup and likely is of local natural origin. Selenium was not detected in the sample from either well.

There currently are insufficient data to establish concentration trends or to determine whether barium concentrations in groundwater downgradient from the pond are significantly elevated above background. Statistical trends will be calculated as data are acquired from additional quarterly groundwater monitoring events.

3.4 Groundwater Flow

Groundwater depth and elevation data for the drilling effluent pond monitoring wells from the third quarter sampling event are presented in Table 3-2. Based on the groundwater elevation data, it appears that groundwater flow during the third quarter sampling event was generally towards the northwest. Under this flow condition, Well RU-03 is upgradient from the pond, and Well RU-06A is downgradient from the pond.

Table 3-1
Rulison Site Groundwater Analytical Results:
Third Quarter, 1996
(All results in µg/L)
(Page 1 of 2)

Well	First Quarter 1996	Second Quarter 1996	Third Quarter 1996	Fourth Quarter 1996	First Quarter 1997	Second Quarter 1997	Third Quarter 1997	Fourth Quarter 1997
	TPH - Diesel							
RU-03	100U	94U	500U					
RU-05	100UJ[1]	94U	NS					
RU-06A	100U	71R	500U					
RU-07	NS	NS	NS					
RU-08	100UJ[1]	94U	NS					
	Benzene							
RU-03	0.5U	0.5U	1U					
RU-05	0.5U	0.5U	NS					
RU-06A	0.5U	0.5U	1U					
RU-07	NS	NS	NS					
RU-08	0.5U	0.5U	NS					
	Toluene							
RU-03	0.5U	0.5U	1U					
RU-05	0.5U	0.5U	NS					
RU-06A	0.5U	0.5U	1U					
RU-07	NS	NS	NS					
RU-08	0.5U	0.5U	NS					
	Ethylbenzene							
RU-03	0.5U	0.5U	1U					
RU-05	0.5U	0.5U	NS					
RU-06A	0.5U	0.5U	1U					
RU-07	NS	NS	NS					
RU-08	0.5U	0.5U	NS					
	Xylenes (total)							
RU-03	0.5U	0.5U	1U					
RU-05	0.5U	0.5U	NS					
RU-06A	0.5U	0.5U	1U					
RU-07	NS	NS	NS					
RU-08	0.5U	0.5U	NS					

Table 3-1
Rulison Site Groundwater Analytical Results:
Third Quarter, 1996
(All results in µg/L)
(Page 2 of 2)

Well	First Quarter 1996	Second Quarter 1996	**Third Quarter 1996**	Fourth Quarter 1996	First Quarter 1997	Second Quarter 1997	Third Quarter 1997	Fourth Quarter 1997
	Barium							
RU-03	*120*	*110*	**105**					
RU-05	*360*	*120*	**NS**					
RU-06A	*120*	*120*	**119**					
RU-07	NS	*NS*	**NS**					
RU-08	*350*	*140*	**NS**					
	Chromium							
RU-03	*10U*	*10U*	**1.5U**					
RU-05	*24*	*10U*	**NS**					
RU-06A	*10U*	*10U*	**1.5U**					
RU-07	NS	NS	**NS**					
RU-08	*10U*	*10U*	**NS**					
	Lead							
RU-03	*5.6U*	*3U*	**1.5**					
RU-05	*13U*	*3U*	**NS**					
RU-06A	*3U*	*3U*	**0.8U**					
RU-07	NS	NS	**NS**					
RU-08	*12U*	*3U*	**NS**					
	Selenium							
RU-03	*16*	*14*	**2.8U**					
RU-05	*7.2*	*6*	**NS**					
RU-06A	*12*	*20*	**2.8U**					
RU-07	NS	NS	**NS**					
RU-08	*12*	*22*	**NS**					

[1] Sample analysis exceeded holding time

Values in italics are for the dissolved fraction

Values in bold are the third quarter 1996 sampling event results

NS = Well dry - no sample collected

U = Analyte not detected above the specified value

R = Quality control indicates that the data are unusable (compound may or may not be present)

J = Reported value is estimated

Table 3-2
Rulison Site Groundwater Elevations:
Third Quarter, 1996

Well	First Quarter 1996	Second Quarter 1996	**Third Quarter 1996**	Fourth Quarter 1996	First Quarter 1997	Second Quarter 1997	Third Quarter 1997	Fourth Quarter 1997
	Depth to Water							
RU-03	10.56 m (34.65 ft)	6.81 m (22.33 ft)	**12.94 m (42.44 ft)**					
RU-05	2.35 m (7.71 ft)	1.96 m (6.42 ft)	**Dry**					
RU-06A	4.74 m (15.56 ft)	4.38 m (14.38 ft)	**5.55 m (18.20 ft)**					
RU-07	Dry	Dry	**Dry**					
RU-08	1.78 m (5.85 ft)	1.70 m (5.58 ft)	**Dry**					
	Groundwater Elevation							
RU-03	2444.29 m (8019.33 ft)	2448.05 m (8031.65 ft)	**2441.92 m (8011.54 ft)**					
RU-05	2433.95 m (7985.41 ft)	2434.35 m (7986.70 ft)	**< 2434.09 m (< 7985.87 ft)**					
RU-06A	2430.10 m (7972.78 ft)	2430.46 m (7973.96 ft)	**2429.30 m (7970.14 ft)**					
RU-07	< 2438.91 m (< 8001.67 ft)	< 2438.91 m (< 8001.67 ft)	**< 2438.91 m (< 8001.67 ft)**					
RU-08	2429.05 m (7969.33 ft)	2429.13 m (7969.60 ft)	**< 2429.01 m (< 7969.18 ft)**					

4.0 Quality Control Results

Field and laboratory QC sample requirements and acceptance criteria are specified in the Rulison QAPP (DOE, 1996d). The laboratory narrative for the third quarter sampling analytical results is included in Appendix B and provides a summary of the results for laboratory QC samples required under the various analytical methods used for the project. The following sections describe the results for field QC samples that are not covered by the laboratory narratives because they are not explicit requirements under the analytical methods used, but they are required for field sampling under the Rulison QAPP (DOE, 1996d).

4.1 Field Duplicate Samples

Field duplicate samples are used to monitor the variability associated with sample collection procedures and to provide estimates of the total sampling and analytical precision. A duplicate sample was collected from Well RU-06A during the sampling event. The relative percent differences (RPDs) between analytes detected in the original sample and the same analytes detected in the associated field duplicate sample were calculated and compared against the precision acceptance criteria specified in the Rulison QAPP (DOE, 1996d). The sample and sample duplicate results, calculated RPDs, and precision acceptance criteria are presented in Table 4-1.

Arsenic, barium, and lead were the only analytes detected in the RU-06A sample and/or sample duplicate. The RPD for barium (1 percent) was within the precision acceptance criterion of ± 20 percent specified in the Rulison QAPP (DOE, 1996d). The RPDs for arsenic (55 percent) and lead (≥ 40 percent) were outside of the precision acceptance criterion of ± 20 percent. Since arsenic is likely of local natural origin, its RPD may represent natural variability in groundwater quality. The relatively large RPD for lead is a result of it being detected in the duplicate sample but not in the original sample.

4.2 Equipment Rinsate Blank Samples

Equipment rinsate blanks are used to monitor potential cross-contamination associated with inadequate equipment decontamination procedures. Sampling equipment decontamination was not required during the third quarter sampling event since disposable bailers were used, so an equipment rinsate blank was not prepared.

Table 4-1
Rulison Site Groundwater Monitoring Program
Duplicate Sample Comparison:
Third Quarter, 1996
(All results in µg/L)

Analyte	Sample	Sample Duplicate	RPD[1]	RPD Acceptance Criterion
TPH	500U	500U	ND	± 40
Benzene	1U	1U	ND	± 11 to 24
Toluene	1U	1U	ND	± 11 to 24
Ethylbenzene	1U	1U	ND	± 11 to 24
Xylenes	1U	1U	ND	± 11 to 24
Arsenic	6.7	3.8	55	± 20
Barium	119	118	1	± 20
Cadmium	0.6U	0.6U	ND	± 20
Chromium	1.5U	1.5U	ND	± 20
Lead	0.8U	1.2	≥-40	± 20
Mercury	0.1U	0.1U	ND	± 20
Selenium	2.8U	2.8U	ND	± 20
Silver	1.5U	1.5U	ND	± 20

[1] Relative percent difference
U = Analyte not detected above the specified value
ND = Not determined

4.3 Trip Blank Samples

Trip blanks are used to monitor potential volatile organic compound (VOC) cross-contamination introduced into VOC sample containers through diffusion during sample shipment and storage. Trip blank samples were placed in each shipping container used for shipping BTEX samples. BTEX compounds were not detected in the trip blank from the third quarter sampling event.

5.0 Summary and Conclusions

The analytical data from the third quarter 1996 groundwater sampling event indicate that migration of contaminants from the drilling effluent pond sediments currently does not appear to be occurring. The following is a summary of the third quarter 1996 groundwater sample results:

BTEX Compounds: BTEX compounds were not detected in any of the third quarter groundwater samples.

Diesel-Range TPH: Diesel-range TPH was not detected in any of the third quarter groundwater samples.

Inorganics: Barium and lead were the only pond cleanup COPCs detected in the third quarter 1996 groundwater samples. Barium was detected in the samples collected from both monitoring wells sampled during the event, and lead was detected in the sample from the upgradient monitoring well (RU-03). As discussed in Section 3.3, there currently are insufficient data to establish concentration trends or to determine whether barium concentrations in groundwater downgradient from the drilling effluent pond are significantly elevated above background. Statistical trends will be calculated as data are acquired from additional quarterly sampling events.

6.0 References

AEC, see U.S. Atomic Energy Commission

California State Water resources Control Board. 1989. *Leaking Underground Fuel Tank Field Manual, Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure.* Sacramento, CA.

DOE, see U.S. Department of Energy.

DRI, see Desert Research Institute.

Desert Research Institute. 1988. *CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Areas.* Las Vegas, NV.

Eberline, see Eberline Instrument Corporation.

Eberline Instrument Corporation. 1977. *Rulison Radiation Contamination Clearance Report.* Santa Fe, NM.

EPA, see U.S. Environmental Protection Agency.

ERDA, see U.S. Energy Research and Development Administration.

U.S. Atomic Energy Commission, Nevada Operations Office. 1973. *Rulison Site Cleanup Report*, NVO-136. Las Vegas, NV.

U.S. Department of Energy. 1996a. *Rulison Site Corrective Action Report.* DOE/NV-453. Las Vegas, NV: IT Corporation.

U.S. Department of Energy. 1996b. *Rulison Site Groundwater Monitoring Report, First and Second Quarters, 1996.* DOE/NV-460. Las Vegas, NV: IT Corporation.

U.S. Department of Energy. 1996c. *Rulison Drilling Effluent Pond Site Long-Term Groundwater Monitoring Plan.* DOE/NV-441. Las Vegas, NV: IT Corporation.

U.S. Department of Energy. 1996d. *Rulison Site Quality Assurance Project Plan, Rulison Site, Colorado.* DOE/NV-440. Las Vegas, NV: IT Corporation.

U.S. Energy Research and Development Administration, Nevada Operations Office. 1977. *Project Rulison Well Plugging and Site Abandonment Final Report*, NVO-187. Las Vegas, NV.

U.S. Environmental Protection Agency. 1983. *Methods for Chemical Analysis of Water and Wastes*. EPA-600/4-79-020. Cincinnati, OH.

U.S. Environmental Protection Agency. 1990. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, 3rd Edition. Washington, DC: Office of Solid Waste and Emergency Response.

U.S. Environmental Protection Agency. 1994. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. EPA 540/R-94/013. Washington, DC: Office of Solid Waste and Emergency Response.

Appendix A

Purge Water Discharge Permit

STATE OF COLORADO

Roy Romer, Governor
Patti Shwayder, Acting Executive Director
Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80222-1530
Phone (303) 692-2000

Laboratory Building
4210 E. 11th Avenue
Denver, Colorado 80220-3716
(303) 691-4700

Colorado Department
of Public Health
and Environment

March 19, 1996

Mr. Kevin D. Leary
DOE

Subject: Reply to request for addition of source to permit COG-310084.

Dear Mr. Leary:

The Division has received and reviewed your fax of 3/19/96. Since the wells described in your fax are in such close proximity to the pond that the permit was designed to provide dewatering conditions for, the Division
will allow the wells to be dewatered using the same discharge point as described in the permit. Please follow the same conditions and monitoring schedule as described in the permit. The Division realizes that due to the small amount of water in question, the water might not be of sufficient flow to reach the discharge point. Any future purgings of the water from these wells are covered by this letter and the permit noted above as long as the permit remains active and conditions, monitoring schedule and reporting procedure are followed.

Please feel free to call me at (303)+692-3593 with questions or comments.

Sincerely,

Tom Boyce
Environmental Protection Specialist
Permits and Enforcement
WATER QUALITY CONTROL DIVISION

cc.file

Appendix B

Third Quarter 1996 Analytical Results

Sample Number-Sample Location Crosswalk

Sample Number	Sample Location
RUGW0005	Well RU-03
RUGW0006	Well RU-06A
RUGW0007	Well RU-06A Duplicate

Quanterra Environmental Services

Quanterra Incorporated
13715 Rider Trail North
Earth City, Missouri 63045

314 298-8566 Telephone
314 298-8757 Fax

CERTIFICATE OF ANALYSIS

IT Las Vegas
4330 South Valley View
Suite 114
Las Vegas, NV 89103-4047

October 19, 1996

Attention: Mr. Kurt Schmidt

IT Las Vegas Project Number	: Rulison
Quanterra, St. Louis Project Number	: 317.43
SDG Number	: 12453
Date Received	: October 10, 1996
Number of Samples	: Nine (9)
Sample type	: Water

INTRODUCTION

The following samples from the Nevada Test Site were received at Quanterra, St. Louis for Metals, Gamma, Rad-Screen, Tritium, Total Petroleum Hydrocarbon (Diesel and Gasoline), Radium 226, Strontium 89/90, Total Dissolved Solids, Tritium, Total Suspended Solids, BTEX and Gross Alpha/Beta. Enclosed is the full data package. The radiochemistry will be transmitted at a later date when those items get completed neater the due date.

Reviewed and Approved

Allen M. Field
Quanterra Project Manager

The samples were labeled as follows:

CLIENT ID	LAB ID	Matrix
RUGW007	12453-001	Water
RUGW006	12453-002	Water
RUGW005	12453-003,DUP,MS,MSD	Water
RUGW001	12453-004	Water
RUGW002	12453-005	Water
RUGW003	12453-006	Water
RUGW009	12453-007	Water
RUGW004	12453-009	Water
RUSP0008	12453-010	Water

ANALYTICAL RESULTS/METHODOLOGY

The analytical results are presented in the enclosed Certificate of Analysis and EDD Disk. This report includes information on client identification numbers, lab identification numbers, preparation date, analysis date, results, units, and results for quality control samples.

The following table is a list of the analyses requested and the methods used for the above samples:

Analysis	Method
Metals	EPA method 7470/6010
Gamma Scan	EPA 901.1
Tritium	EPA 906.0
TPH (Diesel)	EPA 8015
Gross Alpha/Beta	EPA 900.0
BTEX	EPA 8020
Radium	EPA 903.1
Strontium 89/90	Std. Method 7500-Sr
Total Dissolved Solids	EPA method 160.1
Total Suspended Solids	EPA method 160.2

QUALITY CONTROL

Method blanks and laboratory control samples were analyzed with the samples listed above for each parameter. A laboratory duplicate, matrix spike and matrix spike duplicate was performed on sample RUGW005.

NONCONFORMANCE

There were no nonconformances associated with the analysis of these samples.

COMMENTS

Login 12453 was received at a temperature of 3/2/2/2°C. Sample RUGW0010 was not received on COC 486075.

Analytical Notes

Metals

The nitric acid preserved samples were filtered and matrix matched with HCl to our normal ICAP standards matrix and analyzed without digestion. In addition a matrix spike was prepared by spiking a second aliquot of sample after filtration

Total recoverable metals were digested by SW846 method 3005A and analyzed by SW846 method 6010A. The matrix spike recovery for iron in the total recoverable metals analysis was 30% and below the 80-120% criteria. In accordance with our SOW the associated iron data was flagged with an "N".

QUALIFIERS/DEFINITIONS

*	Values outside of QC limits
B	Results were between the PQL and the IDL.
U	Results are less than the IDL
J	An estimated value.
ND	Parameter was analyzed for but not detected.
UG/L	Micrograms per Liter.
MG/L	Milligrams per Liter.
pCi/L	Picocurries per liter.
NA	Not applicable.

October 19, 1996
IT Las Vegas Project Number : Project Shoal
Quanterra, St. Louis Project Number : 317.55

%REC	: Percent Recovery.
DUP	: Duplicate.
QCBLK	: Laboratory Method Blank.
QCLCS	: Laboratory Control Sample.
Qual.	: Qualifier.
LCL	: Lower Control Limits.
UCL	: Upper Control Limits.
PQL	: Practical Quantitation Limit.
MDA	: Minimum Detectable Activity.

IT-Las Vegas
4330 S. Valley View Boulevard
Suite 114
Las Vegas, NV 89103

Project: 317.43

Category: TPH
Method: EPA 8015
Matrix: Water

Sample Date : 10/08/96
Receipt Date : 10/10/96
Report Date : 10/18/96

Client ID: RUGW0005

Quanterra ID : 12453-003

Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dilution
Diesel	68334-30-5	QCBLK116937-1	10/15/96	10/18/96	0.50	mg/L	U	0.50	1
C-40	14762-74-4	QCBLK116937-1	10/15/96	10/18/96	65	%REC			1

IT-Las Vegas
4330 S. Valley View Boulevard
Suite 114
Las Vegas, NV 89103

Project: 317.43

Category: TPH
Method: EPA 8015
Matrix: Water

Sample Date : 10/09/96
Receipt Date : 10/10/96
Report Date : 10/18/96

Client ID: RUGW0006

Quanterra ID : 12453-002

Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dilution
Diesel	68334-30-5	QCBLK116937-1	10/15/96	10/18/96	0.50	mg/L	U	0.50	1
C-40	14762-74-4	QCBLK116937-1	10/15/96	10/18/96	76	%REC			1

IT-Las Vegas
4330 S. Valley View Boulevard
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Project: 317.43

Category: TPH
Method: EPA 8015
Matrix: Water

Sample Date : 10/09/96
Receipt Date : 10/10/96
Report Date : 10/18/96

Client ID: RUGW0007

Quanterra ID : 12453-001

Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dilution
Diesel	68334-30-5	QCBLK116937-1	10/15/96	10/18/96	0.50	mg/L	U	0.50	1
C-40	14762-74-4	QCBLK116937-1	10/15/96	10/18/96	84	%REC			1

IT-Las Vegas
4330 S. Valley View Boulevard
Suite 114
Las Vegas, NV 89103

Project: 317.43

Category: BTEX
Method: EPA 8020
Matrix: Water

Sample Date : 10/08/96
Receipt Date : 10/10/96
Report Date : 11/13/96

Client ID: RUGW0005

Quanterra ID : 12453-003

Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dilution
Benzene	71-43-2	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
Toluene	108-88-3	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
EthylBenzene	100-41-4	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
m-,p-Xylene	136777-61-2	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
o-Xylene	95-47-6	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
Bromofluorobenzene (SURR)	460-00-4	QCBLK117481-1	10/17/96	10/17/96	100	%REC			1

IT-Las Vegas
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Project: 317.43

Category: BTEX
Method: EPA 8020
Matrix: Water

Sample Date : 10/09/96
Receipt Date : 10/10/96
Report Date : 11/13/96

Client ID: RUGW0006

Quanterra ID : 12453-002

Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dilution
Benzene	71-43-2	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
Toluene	108-88-3	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
EthylBenzene	100-41-4	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
m-,p-Xylene	136777-61-2	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
o-Xylene	95-47-6	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
Bromofluorobenzene (SURR)	460-00-4	QCBLK117481-1	10/17/96	10/17/96	104	%REC			1

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Project: 317.43

Category: BTEX
Method: EPA 8020
Matrix: Water

Sample Date : 10/09/96
Receipt Date : 10/10/96
Report Date : 11/13/96

Client ID: RUGW0007

Quanterra ID : 12453-001

Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dilution
Benzene	71-43-2	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
Toluene	108-88-3	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
EthylBenzene	100-41-4	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
m-,p-Xylene	136777-61-2	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
o-Xylene	95-47-6	QCBLK117481-1	10/17/96	10/17/96	1.0	ug/L	U	1.0	1
Bromofluorobenzene (SURR)	460-00-4	QCBLK117481-1	10/17/96	10/17/96	110	%REC			1

IT-Las Vegas
4330 S. Valley View Boulevard
Suite 114
Las Vegas, NV 89103

Project: 317.43

Category: ICAP Metals
Method: EPA 6010
Matrix: Water

Sample Date : 10/08/96
Receipt Date : 10/10/96
Report Date : 10/19/96

Client ID: RUGW0005

Quanterra ID : 12453-003

Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dilution
Arsenic	7440-38-2	QCBLK116737-1	10/12/96	10/12/96	3.2	ug/L	B	10.0	1
Barium	7440-39-3	QCBLK116737-1	10/12/96	10/12/96	105	ug/L	B	200	1
Cadmium	7440-43-9	QCBLK116737-1	10/12/96	10/12/96	0.60	ug/L	U	5.0	1
Chromium	7440-47-3	QCBLK116737-1	10/12/96	10/12/96	1.5	ug/L	U	10.0	1
Lead	7439-92-1	QCBLK116737-1	10/12/96	10/12/96	1.5	ug/L	B	3.0	1
Selenium	7782-49-2	QCBLK116737-1	10/12/96	10/12/96	2.8	ug/L	U	5.0	1
Silver	7440-22-4	QCBLK116737-1	10/12/96	10/12/96	1.5	ug/L	U	10.0	1

IT-Las Vegas
4330 S. Valley View Boulevard
Suite 114
Las Vegas, NV 89103

Project: 317.43

Category: ICAP Metals
Method: EPA 6010
Matrix: Water

Sample Date : 10/09/96
Receipt Date : 10/10/96
Report Date : 10/19/96

Client ID: RUGW0006

Quanterra ID : 12453-002

Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dilution
Arsenic	7440-38-2	QCBLK116737-1	10/12/96	10/12/96	6.7	ug/L	B	10.0	1
Barium	7440-39-3	QCBLK116737-1	10/12/96	10/12/96	119	ug/L	B	200	1
Cadmium	7440-43-9	QCBLK116737-1	10/12/96	10/12/96	0.60	ug/L	U	5.0	1
Chromium	7440-47-3	QCBLK116737-1	10/12/96	10/12/96	1.5	ug/L	U	10.0	1
Lead	7439-92-1	QCBLK116737-1	10/12/96	10/12/96	0.80	ug/L	U	3.0	1
Selenium	7782-49-2	QCBLK116737-1	10/12/96	10/12/96	2.8	ug/L	U	5.0	1
Silver	7440-22-4	QCBLK116737-1	10/12/96	10/12/96	1.5	ug/L	U	10.0	1

IT-Las Vegas
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Project: 317.43

Category: ICAP Metals
Method: EPA 6010
Matrix: Water

Sample Date : 10/09/96
Receipt Date : 10/10/96
Report Date : 10/19/96

Client ID: RUGW0007

Quanterra ID : 12453-001

Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dilution
Arsenic	7440-38-2	QCBLK116737-1	10/12/96	10/12/96	3.8	ug/L	B	10.0	1
Barium	7440-39-3	QCBLK116737-1	10/12/96	10/12/96	118	ug/L	B	200	1
Cadmium	7440-43-9	QCBLK116737-1	10/12/96	10/12/96	0.60	ug/L	U	5.0	1
Chromium	7440-47-3	QCBLK116737-1	10/12/96	10/12/96	1.5	ug/L	U	10.0	1
Lead	7439-92-1	QCBLK116737-1	10/12/96	10/12/96	1.2	ug/L	B	3.0	1
Selenium	7782-49-2	QCBLK116737-1	10/12/96	10/12/96	2.8	ug/L	U	5.0	1
Silver	7440-22-4	QCBLK116737-1	10/12/96	10/12/96	1.5	ug/L	U	10.0	1

IT-Las Vegas
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Project: 317.43

Category: MERCURY
Method: EPA 7470
Matrix: Water

Sample Date : 10/09/96
Receipt Date : 10/10/96
Report Date : 10/17/96

Client ID	Quanterra ID	Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dil.
RUGW0007	12453-001	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	0.10	ug/L	U	0.20	1
RUGW0006	12453-002	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	0.10	ug/L	U	0.20	1
RUGW0005	12453-003	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	0.10	ug/L	U	0.20	1
RUGW0005DUP	12453-003DUP	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	0.10	ug/L	U	0.20	1
RUGW0005MS	12453-003MS	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	82	%REC			1
RUGW0001	12453-004	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	0.10	ug/L	U	0.20	1
RUGW0002	12453-005	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	0.10	ug/L	U	0.20	1
RUGW0003	12453-006	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	0.10	ug/L	U	0.20	1
QCLCS116739-1	QCLCS116739-1	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	97	%REC			1
QCBLK116739-1	QCBLK116739-1	Mercury	7439-97-6	QCBLK116739-1	10/12/96	10/12/96	-0.13	ug/L	B	0.20	1

IT-Las Vegas
4330 S. Valley View Boulevard
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Project: 317.43

Category: TSS
Method: EPA 160.2
Matrix: Water

Sample Date : 10/09/96
Receipt Date : 10/10/96
Report Date : 10/17/96

Client ID	Quanterra ID	Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dil.
RUGW0007	12453-001	Total Suspended	C-009	QCBLK116636-1	10/11/96	10/11/96	11.0	mg/L		1.00	1
RUGW0006	12453-002	Total Suspended	C-009	QCBLK116636-1	10/11/96	10/11/96	8.0	mg/L		1.00	1
RUGW0005	12453-003	Total Suspended	C-009	QCBLK116636-1	10/11/96	10/11/96	62.0	mg/L		1.00	1
RUGW0005	12453-003DUP	Total Suspended	C-009	QCBLK116636-1	10/11/96	10/11/96	67.0	mg/L		1.00	1
RUGW0001	12453-004	Total Suspended	C-009	QCBLK116636-1	10/11/96	10/11/96	1.00	mg/L	U	1.00	1
RUGW0002	12453-005	Total Suspended	C-009	QCBLK116636-1	10/11/96	10/11/96	14.0	mg/L		1.00	1
RUGW0003	12453-006	Total Suspended	C-009	QCBLK116636-1	10/11/96	10/11/96	12.0	mg/L		1.00	1
QCBLK116636-1	QCBLK116636-1	Total Suspended	C-009	QCBLK116636-1	10/11/96	10/11/96	1.00	mg/L	U	1.00	1
QCLCS116636-1	QCLCS116636-1	Total Suspended	C-009	QCBLK116636-1	10/11/96	10/11/96	94	%REC			1

IT-Las Vegas
4330 S. Valley View Boulevard
Suite 114
Las Vegas, NV 89103

Project: 317.43

Category: TDS
Method: EPA 160.1
Matrix: Water

Sample Date : 10/09/96
Receipt Date : 10/10/96
Report Date : 10/17/96

Client ID	Quanterra ID	Analyte	CAS Number	Blank Sample Name	Prep. Date	Analyses Date	Result	Unit	Qual.	Detection Limit	Dil.
RUGW0007	12453-001	Total Dissolved	C-010	QCBLK116635-1	10/11/96	10/11/96	433	mg/L		5.00	1
RUGW0006	12453-002	Total Dissolved	C-010	QCBLK116635-1	10/11/96	10/11/96	445	mg/L		5.00	1
RUGW0005	12453-003	Total Dissolved	C-010	QCBLK116635-1	10/11/96	10/11/96	458	mg/L		5.00	1
RUGW0005	12453-003DUP	Total Dissolved	C-010	QCBLK116635-1	10/11/96	10/11/96	442	mg/L		5.00	1
RUGW0001	12453-004	Total Dissolved	C-010	QCBLK116635-1	10/11/96	10/11/96	453	mg/L		5.00	1
RUGW0002	12453-005	Total Dissolved	C-010	QCBLK116635-1	10/11/96	10/11/96	463	mg/L		5.00	1
RUGW0003	12453-006	Total Dissolved	C-010	QCBLK116635-1	10/11/96	10/11/96	452	mg/L		5.00	1
QCBLK116635-1	QCBLK116635-1	Total Dissolved	C-010	QCBLK116635-1	10/11/96	10/11/96	5.00	mg/L	U	5.00	1
QCLCS116635-1	QCLCS116635-1	Total Dissolved	C-010	QCBLK116635-1	10/11/96	10/11/96	105	%REC			1

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