Neil Mukherjee's office

GROUNDWATER RESOURCES CONSULTANTS, INC.

TUCSON, ARIZONA

RESULTS OF

WELL RD-63 PILOT EXTRACTION TEST

RMDF AREA

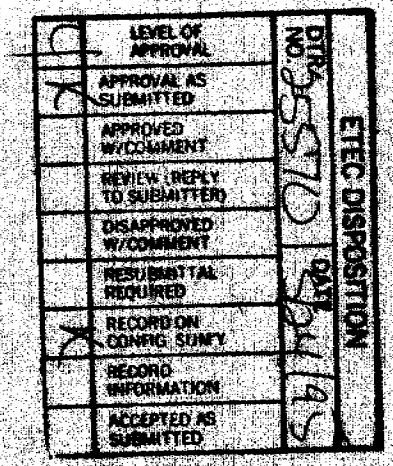
SANTA SUSANA FIELD LABORATORY

ROCKWELL INTERNATIONAL CORPORATION

ROCKETDYNE DIVISION

VENTURA COUNTY, CALIFORNIA

May 22, 1995
8640M-253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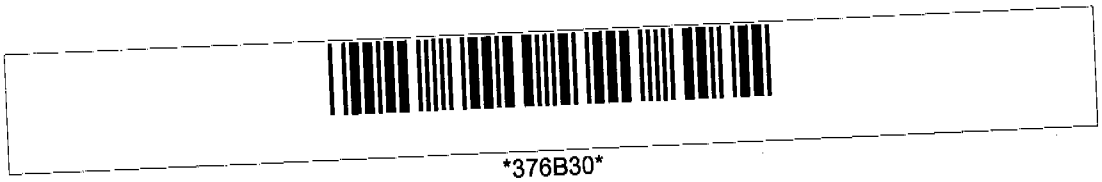

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Direct questions to ZIA Information Analysis Group at 415-288-4500.

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RE: ***RMDF Pilot Extraction Test Results - Well RD-63***

Dear Ms. Holt:

Submitted herewith is our report summarizing the three month RMDF Pilot groundwater extraction test conducted at well RD-63. Test results indicate that well RD-63 will sustain a continuous long-term pumping rate of about two gallons per minute. Significant water level declines were observed in all monitor wells located within about 600 feet of extraction well RD-63.

It is our opinion that the most economical long-term treatment method for removal of the organic compounds found in the well RD-63 discharge is granular activated carbon. Two portable 55 gallon carbon canisters, placed in series, would be quite adequate for treatment of the RD-63 discharge. The canister replacement rate would be about one per year.

If you have any questions or wish further discussion of the RD-63 test results, please contact us.

Respectfully submitted,

GROUNDWATER RESOURCES CONSULTANTS, INC.

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Project Engineer

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WELL RD-63 PILOT EXTRACTION TEST
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INTRODUCTION

This report has been prepared to summarize the results of a three month pilot groundwater extraction test conducted in the Radioactive Materials Disposal Facility (RMDF) area located in Area IV of the Rockwell International Corporation, Rocketdyne Division, Santa Susana Field Laboratory (the Facility) in Ventura County, California. The pilot test program consisted of installation of a well (Chatsworth Formation well RD-63) pumping degraded groundwater from the extraction well continuously for a period of three months, monitoring flow rate, water levels, and water quality changes at the pumped well, and monitoring water level declines at seven nearby monitor wells. Degraded groundwater pumped from the extraction well was piped to a portable Calgon carbon treatment unit for removal of organic contaminants prior to discharge to the on-site NPDES permitted storm drain system.

The pilot extraction test was conducted at the RMDF site to determine the degree of hydraulic connection between the fracture(s) penetrated by the extraction well and the nearby monitor (observation) wells, the degree of capture and containment of the degraded groundwater plume, and the amenability of the volatile organic compounds to treatment. In addition, the data necessary for the design of a full-scale long-term groundwater extraction and treatment system will be collected. Operation of a groundwater remediation system in the RMDF area is necessary to contain and remove groundwater degraded with trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), 1,1-dichloroethylene (1,1-DCE), and 1,1-dichloroethane (1,1-DCA). Concentrations of TCE at monitor wells in the RMDF area have historically been detected as high as 75 to 90 micrograms per liter (μg/l).

DESCRIPTION OF TEST AREA

WELLS AND SITE LOCATION

Well RD-63 was installed in the RMDF area at the northwest portion of the Facility in Area IV along the Rockwell property boundary for conducting the pilot extraction test (**Figure 1**). Nearby monitor wells included in the RMDF pilot extraction program include Chatsworth Formation wells RD-19, RD-27, RD-30, and Shallow Zone well RS-28, all located on-site within Area IV, and wells RD-34A, RD-34B, and RD-34C, located off-site and immediately west of the Area IV boundary (**Figures 1** and **2**).

Extraction well RD-63 and most of the nearby monitor wells are located within a canyon which drains the former RMDF area. The canyon trends east-west and drains to the west (**Figure 1**). The presence of the canyon is apparently the result of erosion along weaker-fractured rock zone(s). Although faulting has not been recognized in or along this canyon, it does appear that subsurface fracturing is more prevalent than in other areas of Area IV, based on review of video logs and well yields for other wells in Area IV.

GEOLOGIC CONDITIONS

Geologic conditions in the vicinity of the RD-63 pilot extraction well have been evaluated based on historic data compiled during the drilling of nearby wells and inspection of rock outcrops.

The Upper Cretaceous Chatsworth Formation outcrops and underlies the area of the pilot extraction test. In this area the Chatsworth Formation is composed primarily of massively bedded sandstone with minor interbeds of siltstone and claystone.

The most detailed information concerning subsurface geologic conditions in this area was developed during the drilling and video logging of deep well RD-34C. Details concerning the well RD-34C work were summarized in a previous report submitted in 1992 (GWRC, 1992). Well RD-34C is located about 130 feet west of extraction well RD-63 (**Figures 1** and **2**). Lithologic logs for wells RD-34C and RD-63 are included in **Appendix A**. A downhole video log of well RD-34C is also presented in **Appendix A**.

Unconsolidated alluvium in the form of clayey sand is present from land surface to approximately seven feet below land surface at the RD-34C site. Below the alluvium, the sandstone facies of the Chatsworth Formation is present. The top 2 to 4 feet of the Chatsworth is weathered and weakly cemented. The sandstone from eight feet to approximately 22 to 32 feet is buff colored, weakly cemented and fine grained. Below this depth the sandstone is predominately blue-grey in color, fine grained and calcareous to 450 feet, the total depth of the well. Some thin interlayers of siltstone and claystone are present.

Review of the video camera log reveals only two depth zones within the RD-34C borehole where non-sandstone layers exceeding one foot in thickness occurs. These zones are located 173.4 to 174.6 feet and 183.3 to 185.7 feet below land surface. Non-sandstone layers were comprised of fine grained layered siltstone/claystone.

Review of the RD-34C video camera log revealed the presence of approximately 104 fractures with one of these occurring above the static water level in the borehole (35 feet), and the remainder occurring below the water level. During video logging the water in the borehole was noted at 35.1 feet below land surface. Only eight of the 104 fractures recognized are bedding plane fractures (**Appendix A**). Significant fractures, those with an open space of ½-inch or more, were noted at depths of approximately 39, 50, 75, 109, 121, 147, 152, 194, 223, 282, 293, 350, and 409 feet below land surface. From 420 to 450 feet below land surface, the video log was obscured by sediment suspended in the borehole fluid.

The predominant orientation of structural fractures (non-bedding plane) at the RD-34 cluster site is north-south to north 10 degrees east and dipping east to southeast at angles ranging from 20 degrees to near-vertical. No predominant dip angle(s) were exhibited at the RD-34 site. Several near-horizontal dipping fractures were also observed. The RD-34C well site exhibited a higher fracture density than other sites in Area IV.

HISTORICAL GROUNDWATER LEVELS AND MOVEMENT

A thin zone of groundwater occurs within the alluvium and weathered upper surface of the Chatsworth Formation. Shallow Zone well RS-28 monitors groundwater conditions within the alluvium and upper weathered portion of the Chatsworth Formation. The depth to groundwater, below land surface, has generally ranged from

about 1 to 7 feet (GWRC, 1995). Groundwater occurring in the Shallow Zone is greatly affected by evapotranspiration and percolation into fractures within the Chatsworth Formation.

Groundwater was initially encountered at depths of about 20 to 50 feet during the drilling of wells RD-30, RD-34A, RD-34B, RD-34C, and RD-63. The depth to static groundwater in A-Zone type wells, RD-30 and RD-34A has ranged from near land surface to a depth of about 30 feet. Water level elevations have ranged from about 1,732 to 1,769 feet above mean sea level (MSL) (**Figure 1**).

Water level elevations for deep well RD-34C have been consistently higher than elevations at wells RD-34A and RD-34B. This suggests that a very limited potential exists for degraded groundwater occurring in the A and B-Zones to migrate below a depth of about 250 feet.

The apparent direction of lateral movement of groundwater occurring in the Chatsworth Formation in the vicinity of the RMDF is to west-northwest (**Figure 1**).

Well construction details for each of the wells is presented in **Table 1**. A summary of depth to water measurements for each of the monitor wells included in the pilot testing program is presented in **Table 2**. A summarization of water level declines is presented in **Table 3** and a water level decline contour map is presented in **Figure 2**.

WATER QUALITY CONDITIONS

Degraded groundwater is present beneath and downgradient of the RMDF (GWRC, 1995). Water quality conditions in this area have been characterized by analyses of water samples collected from wells RS-28, RD-30, and the RD-34 cluster wells.

Groundwater in the study area has been degraded by the presence of organic compounds, including TCE, cis-1,2-DCE, 1,1-DCE, and 1,1-DCA. The highest concentration of these compounds have been consistently found at well RD-34A. The range of concentrations in samples collected quarterly at well RD-34A from August 1991 to November 1994 are summarized below.

TCE	<1 to 91 µg/l
cis-1,2-DCE	<1 to 39 µg/l
1,1-DCA	<1 to 4.8 µg/l
1,1-DCE	<0.5 to 18 µg/l

Similar concentrations have been found at Shallow Zone well RS-28.

Concentrations of these organic compounds at well RD-30 have been consistently lower than at well RD-34A.

Concentrations of TCE at well RD-34B have ranged from <0.5 to 11 µg/l during quarterly sampling from August 1991 to November 1994. No degraded groundwater has been detected at well RD-34C.

The presence of degraded groundwater beneath the RMDF area and the migration of that water justified the development of a groundwater remediation scheme. The initial phase of developing a remediation plan was the performance of the three month pilot extraction test at well RD-63 (GWRC, 1993).

PILOT EXTRACTION/TREATMENT SYSTEM

This section of the report describes the extraction/treatment system, data pertaining to the three months of system operation, and observed impacts resulting from operation of the system. The sampling plan for the pilot extraction program in Area IV was outlined in GWRC report 8640M-209, dated September 9, 1993.

EXTRACTION WELL RD-63

Pilot extraction well RD-63 was completed in May 1994 to a depth of 230 feet. The well was completed in order to extract degraded groundwater found in both the A and B zones. The A-Zone at the Facility generally refers to the upper 40 to 50 feet of saturated Chatsworth Formation. In the vicinity of well RD-63, the A-Zone would extend to a depth of about 75 feet. The B-Zone at the SSFL Facility has typically referred to an intermediate depth zone generally ranging to about 200 feet below the saturation level within the Chatsworth Formation. At the RMDF test site, the B-Zone extends to a depth of about 250 feet below land surface. Previous investigations indicated that degraded groundwater extended to a depth of about 250 feet, and that the A and B zones were in direct hydraulic communication in the vicinity of the RMDF test site (GWRC, 1992).

Well RD-63 was drilled and constructed during the period of May 7 through May 10, 1994. The wellbore for RD-63 was drilled using the conventional air-rotary method, to a depth of 20 feet using a 12¾-inch tri-cone bit. Nominal 8-inch blank steel casing was then installed and neat cement placed in the well annulus from land surface to the bottom of the wellbore.

After allowing the cement to cure, the borehole was drilled to a depth of 230 feet using a 6½-inch tri-cone bit. The well was completed as an open-borehole.

Well RD-63 was completed with a one horsepower submersible pump and motor installed to a depth of about 126 feet (**Figure 3**). High and low level motor control probes were installed to depths of 60 and 125 feet. Permanent electrical power was connected at the well site, by Rockwell, in September 1994.

Groundwater pumped from well RD-63 was piped to a portable carbon treatment unit for removal of volatile organic compounds. After treatment, the groundwater was discharged to the on-site NPDES permitted drainage system.

Well RD-63 was operated continuously during the period of October 3, 1994 through January 4, 1995. Limited pumpage also occurred on September 22 and September 23, 1994 to verify the performance of the carbon canister.

CARBON TREATMENT UNIT

Degraded groundwater was piped from well RD-63 to a portable Calgon Cyclesorb™ FP-2 carbon adsorption treatment unit, located about 400 feet south of the well. The treatment unit contained 2,000 pounds of granular activated carbon with a hydraulic flow capacity up to 60 gpm. This unit was previously utilized for periodic treatment of purge water during the drilling and testing of monitor wells at the Facility. A schematic of the extraction well/treatment system is presented on **Figure 4.**

Treated water was conveyed by pipeline to an on-site NPDES permitted drainage system. The discharge point was approximately 150 feet south of the treatment unit.

OPERATION AND MONITORING

The extraction well was operated continuously during the period of October 3, 1994 through January 4, 1995. A summary of pumping water levels and flow rates and volumes for well RD-63 along with field parameters including conductivity, pH, and temperature is presented in **Table 4.** Water levels were routinely measured in the extraction well and nearby monitor wells RD-19, RD-27, RD-30, RD-34A, RD-34B, RD-34C, and RS-28. Water samples were routinely collected from the well RD-63 discharge following the scheduled sampling frequency outlined in GWRC 8640M-209, September 9, 1993. Water samples were analyzed for volatile organic compounds (**Table 5**) and periodically for common ions, trace metals, and radiological parameters (**Tables 6, 7,** and **8,** respectively). Water samples were also periodically collected from the carbon treatment unit discharge, and analyzed for the presence of volatile organic compounds.

RESULTS OF PILOT EXTRACTION PROGRAM

WELL PUMPAGE

Well discharge rates and cumulative pumpage totals for well RD-63 are summarized on **Table 4**. Initially well RD-63 was pumped at a rate of 9 gpm. However, declining water levels necessitated steady reductions in flow rate. The sustainable pumping rate for the well was finally established at about 2.1 to 2.2 gpm (on the order of 3,000 gallons per day). Total pumpage for the three month test period was 276,540 gallons. Cumulative pumpage volumes are graphically illustrated on **Figure 5**.

WATER LEVEL DECLINES

Water level declines resulting from the three month operation of the RD-63 pilot extraction well were determined by periodically measuring water levels in seven nearby monitor wells (**Figure 2** and **Table 3**). Total water level declines at each of the seven monitor wells are summarized in **Table 3**.

Water level declines ranged from 3.57 feet at distant well RD-27 to 31.49 feet at well RD-30 located about 100 feet east of extraction well RD-63. In response to the pumping of well RD-63, the proximal Shallow Zone well RS-28 became dry. Deep well RD-34C also responded to the pumping, indicating a water level decline of 8.29 feet. Wells RD-34A and RD-34B exhibited declines of 19.57 and 29.96 feet, respectively.

Although monitor well coverage was absent north and south of the extraction well, a water level decline contour map was prepared utilizing the available data (**Figure 2**). The westerly portion of the contours were projected based on the easterly shape and configuration of the contours.

Assuming the water level decline configuration shown on **Figure 2** and the static water level elevation contours presented on **Figure 1**, it is estimated that the hydraulic capture zone for well RD-63 would not extend more than about 200 to 300 feet west of the Rockwell property boundary. As indicated on **Figure 1**, the groundwater gradient west of the RMDF area becomes very steep. Water level declines resulting from

operation of well RD-63 would probably be sufficient to reverse the groundwater gradient to a distance of 200 to possibly 300 feet west of the property boundary.

WATER QUALITY - WELL DISCHARGE

Laboratory results for the analyses of volatile organic compounds in water samples collected from extraction well RD-63 are summarized in **Table 5**. TCE was the most prevalent compound detected at concentrations ranging from 5.3 to 9.4 µg/l. Cis-1,2-DCE, 1,1-DCA, and 1,1-DCE were also consistently detected but at lower concentrations.

The total dissolved solids concentration of well RD-63 discharge ranged from 620 to 680 mg/l (**Table 6**). Calcium and bicarbonate were the predominant ions.

No elevated trace metals were reported (**Table 7**).

No elevated radiological parameters (gross alpha and beta radioactivities and tritium) were detected in samples collected from well RD-63. These results are summarized in **Table 8**.

WATER QUALITY - TREATMENT UNIT EFFLUENT

Results of laboratory analyses of treatment unit effluent samples are summarized in **Table 5**. No volatile organic compounds were detected in the carbon canister effluent stream samples indicating adequate system operation.

CONCLUSION AND RECOMMENDATIONS

Based on data compiled during the three month pilot extraction test the following conclusions and recommendations have been prepared.

- The sustainable pumping capacity of well RD-63 is approximately 2 gpm.

- Water level declines were observed in all wells monitored during the test. Water level declines ranged from 3.57 at well RD-27, located about 400 feet east-southeast of well RD-63, to 31.49 feet at well RD-30 located 100 feet to the east.

- The magnitude of water level declines in the nearby wells suggests that long-term operation of well RD-63 could result in a capture zone extending a distance of 200 to 300 feet west of the Rockwell property line.

- Based on the response of water levels to the RD-63 pumping, it is our opinion that no additional extraction wells are necessary in the RMDF area.

- The most prevalent organic compound detected in discharge samples collected from well RD-63 was TCE at concentrations of 5.3 to 9.4 μg/l. TCE has been collected at nearby monitor wells at concentrations ranging up to 90 μg/l.

- Based on the low sustainable pumping capacity of well RD-63 and relatively low contaminant concentrations, the use of portable carbon units placed in the vicinity of the RMDF is the recommended method of long-term treatment.

- **PROPOSED CARBON TREATMENT:**

Currently available carbon adsorption canisters (55 gallon steel drum) contain about 165 pounds of granular activated carbon (GAC) and allow flow rates to 10 gpm with a 12 psi upper pressure limit.

The GAC load-rate calculated for well RD-63 (TCE @ 10 µg/l, pumping rate @ 2.5 gpm), using a contaminant breakthrough safety factor of two, would require about 0.02 pounds of GAC per thousand gallons treated, or about 27 pounds per year. Theoretically, a single 165 pound GAC adsorption canister could operate without necessity of exchange up to six years under load-rate conditions presently indicated by well RD-63.

However, at least two monitor wells in the immediate test area, RD-30 and RD-34A, have on occasion evidenced TCE concentrations in groundwater exceeding 50 µg/l. Considering this, design rationale should center on a load-rate of 50 µg/l at 2.5 gpm in the event that elevated TCE concentrations in groundwater should intercept well RD-63 over the course of long-term treatment. The 50 µg/l TCE/2.5 gpm design criteria would allow a single 165 pound adsorption canister to theoretically operate for slightly more than one year. Effluent monitoring requirements would probably include monthly sampling and analysis for VOCs using EPA method 8010.

Typically, two adsorption canisters are connected in series and sampled periodically at the connection for contaminant analysis. When canister exchange becomes necessary, the primary influent canister is removed from the process and replaced by the second canister. A fresh canister is then made available to take the place of the second canister. One canister exchanged yearly would probably be sufficient. The two canister system would be the recommended long-term system, with a canister exchange rate of one unit per year.

REFERENCES

Groundwater Resources Consultants, Inc., 1992. *Cluster Well Sites RD-33, RD-34, and RD-51, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division, Ventura County, California.* April 24, 1992.

------, 1993. *Sampling Plan for Pilot Groundwater Extraction Program, Area IV, Santa Susana Field Laboratory.* September 9, 1993.

------, 1995. *Annual Groundwater Monitoring Report, Santa Susana Field Laboratory, 1994, Rockwell International Corporation, Rocketdyne Division, Ventura County, California.* February 24, 1995.

TABLE 1

WELL CONSTRUCTION DATA

WELL I.D.	BOREHOLE DEPTH (feet)	BOREHOLE		CASING[1/]		CEMENTED INTERVAL (feet)	OPEN HOLE INTERVAL (feet)	MEASURING POINT ELEVATION (ft MSL)	DATE DRILLING COMPLETED
		Diameter (inches)	Interval (feet)	Diameter (inches)	Interval (feet)				
RS-28	19.0	8	0 - 19.0	4-1/2	0 - 19.0	0 - 9.0	14.0 - 19.0	1768.59	08-17-89
RD-19	135	12 6-1/2	0 - 30.0 30.0 - 135.0	8-5/8	0 - 30.0	0 - 30.0	30.0 - 135.0	1853.13	07-31-89
RD-27	150	12 6-1/2	0 - 30 150	8-5/8	0 - 30	0 - 30	30 - 150	1841.67	08/10/89
RD-30	75	12 6-1/2	0 - 30.0 30.0 - 75.0	8-5/8	0 - 30.0	0 - 30.0	30.0 - 75.0	1768.69	08-11-89
RD-34A	60	12-1/4 6-1/2	0 - 16.0 16.0 - 60.0	8-5/8 ---	0 - 16.0 ---	0 - 16.0	16.0 - 60.0	1761.83	07-25-91
RD-34B	240	17-1/2 11 5-1/2	0 - 30.0 30.0 - 180.0 180.0 - 240.0	12-3/4 6-5/8 ---	0 - 30.0 0 - 180.0 ---	0 - 30.0 0 - 180.0	180.0 - 240.0	1762.51	08-11-91
RD-34C	450	17-1/2 11 5-1/2	0 - 30.0 30.0 - 380.0 380.0 - 450.0	12-3/4 6-5/8 ---	0 - 30.0 0 - 380.0 ---	0 - 30.0 0 - 38.0	380.0 - 450.0	1762.60	08-10-91
RD-63	230	12-3/4 6-1/2	0 - 20 20 - 230	8-5/8	0 - 20	0 - 20	20 - 230	1764.85	05/10/94

TABLE 2

WATER LEVEL MEASUREMENTS AT MONITOR WELLS[1/]
(depth in feet)

DATE	WELL IDENTIFIER						
	RD-19	RD-27	RD-30	RD-34A	RD-34B	RD-34C	RS-28
09-21-94	77.27	49.25	11.82	34.81	43.52	3.34	12.35
09-22-94	77.26	49.81	14.55	35.73	44.46	3.35	13.43
09-23-94	77.29	49.24	18.74	38.00	46.66	3.66	16.97
10-05-94	77.98	49.50	22.85	40.72	49.47	4.40	DRY
10-14-94	78.96	49.89	23.73	43.37	51.30	5.40	DRY
10-20-94	---	---	32.31	47.45	55.90	6.20	DRY
11-01-94	[1/]81.11	[1/]50.57	24.91	44.57	54.43	6.63	DRY
11-21-94	82.77	51.67	37.67	53.92	65.37	9.15	DRY
12-06-94	84.15	52.20	38.24	54.18	66.59	9.87	DRY
12-14-94	84.84	52.51	39.55	54.02	68.21	10.10	DRY
01-04-95	86.76	52.82	43.31	54.38	73.48	11.63	DRY

[1/] Wells RD-19 and RD-27 measured on 11-02-94.

TABLE 3

WATER LEVEL DECLINE AT MONITOR WELLS

WELL IDENTIFICATION	WATER LEVEL DECLINE (feet)
RD-19	9.49
RD-27	3.57
RD-30	31.49
RD-34A	19.57
RD-34B	29.96
RD-34C	8.29
RS-28	5 (dry)

TABLE 4
WELL RD-63
PUMPING RATES AND VOLUMES

DATE	TIME	PUMPAGE FLOW DATA		PUMPING WATER LEVELS (ft)	ELECTRICAL CONDUCTIVITY (μmhos/cm)	pH	TEMPERATURE (°C)	COMMENTS
		Discharge Rate (gpm)	Total Pumpage to Date (gallons)					
09-22-94	08:50	9	---	47.33	750	7.2	19	Pump on; sampled
09-23-94	08:00 14:43	7 ---	9,550 ---	89.02	800	7.4	19	Pump off to check carbon system
10-03-94	09:20	5		---	---	---	---	Pump on
10-04-94	13:15	5.5	20,730	78.85	---	---	---	
10-05-94	14:25	5	28,630	105.84	---	---	---	
10-06-94	17:05	5	35,780	80.92	750	7.2	18.5	Sampled
10-07-94	09:22	4	39,640	114.54	---	---	---	
10-14-94	08:00	3.2	50,120	58.13	950	7.1	19	Sampled
10-20-94	15:45	2.6	74,750	82.40	---	---	---	Sampled
11-01-94	15:20	---	89,730	35.37	800	7.3	18.5	Sampled
11-02-94	07:50	2.8	93,170	65.13				Sampled
11-07-94	11:25	2.8	110,020	77.52				
11-09-94	09:45	2.2	116,205	82.13				Sampled
11-21-94	10:23	2.2	155,203	98.00	910	7.2	16.5	Sampled
12-06-94	13:30	2.2	185,440	70.20	980	7.2	20	Sampled
12-14-94	14:40	2.4	220,000	81.36	890	7.2	19	Sampled
01-04-95	11:12	2.1	276,540	120.12	800	6.8	19	Sampled

TABLE 5

RESULTS OF ANALYSES FOR VOLATILE ORGANIC COMPOUNDS
WELL RD-63 AND CARBON SYSTEM EFFLUENT

COMPOUNDS DETECTED	DATE SAMPLED									
	05-19-94 Influent	09-22-94 Effluent	10-06-94 Influent	10-06-94 Effluent	10-14-94 Influent	10-14-94 Effluent	10-20-94 Influent	10-20-94 Effluent	11-01-94 Influent	11-02-94 Effluent
1,1-DCA	ND	ND	0.74	ND	0.89	ND	0.98	ND	ND	ND
1,1-DCE	ND	ND	1.1	ND	1.7	ND	2.6	ND	ND	ND
cis-1,2-DCE	3.7	ND	2.9	ND	3.3	ND	3.6	ND	ND	ND
TCE	9.4	ND	5.3	ND	9.2	ND	8.9	ND	6.5	ND
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
All Other VOCs	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Method Laboratory	8240 SSFL	8240 SSFL	8010 SSFL	8010 SSFL	8010 BCA	8010 SSFL	8010 BCA	8010 BCA	8240 SSFL	8240 SSFL

NOTES:

Influent = Discharge from well RD-63
Effluent = Discharge from carbon treatment system
BCA = BC Analytical of Glendale, California
SSFL = SSFL Analytical Chemistry Laboratory
ND = None detected above analytical detection limit.
1,1-DCA = 1,1-dichloroethane
1,1-DCE = 1,1-dichloroethylene
cis-1,2-DCE = cis-1,2-dichloroethylene
TCE = trichloroethylene
All results are presented in micrograms per liter (µg/l).

TABLE 5
(continued)
RESULTS OF ANALYSES FOR VOLATILE ORGANIC COMPOUNDS
WELL RD-63 AND CARBON SYSTEM EFFLUENT

COMPOUNDS DETECTED	DATE SAMPLED									
	11-21-94 Influent	11-21-94 Effluent	12-06-94 Influent	12-14-94 Influent	01-04-95 Influent					
1,1-DCA	0.96	ND	0.85	0.56	0.63					
1,1-DCE	2.3	ND	2.1	1.4	2.4					
cis-1,2-DCE	3.5	ND	3.2	2.6	2.3					
TCE	9.0	ND	9.3	7.3	9.0					
Methylene Chloride	1.1	ND	ND	ND	ND					
Tetrachloroethylene	ND	ND	ND	ND	0.57					
All Other VOCs	ND	ND	ND	ND	ND					
Method Laboratory	8010 BCA	8240 SSFL	8010 BCA	8010 BCA	8010 BCA					

NOTES:
Influent = Discharge from well RD-63
Effluent = Discharge from carbon treatment system
BCA = BC Analytical of Glendale, California
SSFL = SSFL Analytical Chemistry Laboratory
ND = None detected above analytical detection limit.
1,1-DCA = 1,1-dichloroethane
1,1-DCE = 1,1-dichloroethylene
cis-1,2-DCE = cis-1,2-dichloroethylene
TCE = trichloroethylene
All results are presented in micrograms per liter (µg/l).

TABLE 6

RESULTS OF ANALYSES FOR COMMON ION CONSTITUENTS IN
GROUNDWATER SAMPLES COLLECTED FROM CHATSWORTH FORMATION WELL RD-63
(N.W., AREA IV AT RMDF, S.W. OF BUILDING 133 NEAR N.W. BOUNDARY OF THE SITE)

CONSTITUENT (milligrams per liter)	DATE SAMPLED 09-22-94	11-01-94	01-04-95
Calcium	130	130	120
Magnesium	27	26	24
Sodium	49	50	43
Potassium	3.9	4.0	3.4
Carbonate	-1	-1	-1
Bicarbonate	330	340	310
Chloride	51	50	50
Sulfate	59	140	130
Nitrate-Nitrite (NO_3)	-0.2	-0.1	-0.1
Fluoride	1.2	1.5	0.57
Boron	---	---	---
Silica	---	---	---
TDS @ 180°C (lab)	680	630	620
EC (umho/cm) (lab)	1000	1100	920
pH (lab)	7.3	7.0	6.8
Temperature, °C (field)	---	---	---
Cation/Anion Balance*	8.22	1.1	1.7
Laboratory	BCA	BCA	BCA

BCA = BC Analytical
(-) = Less than; numerical value is the Limit of Detection for that compound
(---) = Analysis not performed
(*) = Percent difference

TABLE 7

RESULTS OF ANALYSES FOR TRACE METAL CONSTITUENTS
IN GROUNDWATER SAMPLES COLLECTED FROM CHATSWORTH FORMATION WELL RD-63
(N.W., AREA IV AT RMDF, S.W. OF BUILDING 133 NEAR N.W. BOUNDARY OF THE SITE)

CONSTITUENT (milligrams per liter)	DATE SAMPLED 09-22-94	11-01-94	01-04-95
Antimony	---	---	---
Arsenic	-0.002	-0.002	-0.002
Barium	0.042	0.044	0.047
Beryllium	---	---	---
Cadmium	-0.002	-0.001	-0.001
Chromium (total)	-0.005	-0.005	-0.005
Copper	---	---	---
Iron	0.092	0.066	-0.04
Lead	0.0084	0.011	0.0045
Manganese	0.026	0.014	0.035
Mercury	-0.0002	-0.0002	-0.0002
Molybdenum	---	---	---
Nickel	---	---	---
Selenium	-0.004	0.0057	-0.004
Silver	-0.01	-0.01	---
Strontium	---	---	---
Thallium	---	---	---
Zinc	---	---	---
Laboratory	BCA	BCA	BCA

BCA = BC Analytical
(-) = Less than; numerical value is the Limit of Detection for that compound
(---) = Analysis not performed

TABLE 8

RD-63 RADIOLOGICAL RESULTS

DATE	GROSS ALPHA (pCi/l)	GROSS BETA (pCi/l)	TRITIUM (pCi/l)	MAN-MADE GAMMA-EMITTERS[1/]	SAMPLE IDENTIFICATION
05/19/94	---	---	40 ± 130	---	Influent
09/22/94	12.9 ± 5.6	10.3 ± 4.6	80 ± 150	---	Influent
10/06/94	4.7 ± 4.1	9.4 ± 4.1	60 ± 150	---	Effluent
11/09/94	14.4 ± 5.7	10.9 ± 3.8	90 ± 180	---	Influent
01/04/95	8.7 ± 5.2	7.7 ± 4.1	350 ± 210	ND	Influent

NOTE: Influent: RD-63 discharge sample
Effluent: Carbon treatment system discharge.

Results are presented in picoCuries per liter (pCi/l).

Laboratory analyses were conducted by Lockheed Analytical Services of Las Vegas, Nevada.

[1/] Man-made gamma emitters specifically included are Cobalt-57, Cobalt-60 and Cesium-137.

ND = None detected above the minimum detectable activity.

(---) = Not analyzed

APPENDIX A

LITHOLOGIC LOG AND VIDEO CAMERA LOGS

WELLS RD-34C AND RD-63

APPENDIX A

LITHOLOGIC AND VIDEO CAMERA LOGS

WELLS RD-34C AND RD-63

TABLES

TABLE

A-1	LITHOLOGIC LOG OF MONITOR WELL RD-34C
A-2	SUMMARY OF VIDEO CAMERA LOG BOREHOLE RD-34D (WELL RD-34C)
A-3	LITHOLOGIC LOG OF EXTRACTION WELL RD-63

TABLE A-1
LITHOLOGIC LOG OF MONITOR WELL RD-34C

DEPTH INTERVAL (feet)	DESCRIPTION OF MATERIAL	
0 - 7	CLAYEY SAND	Light brown, trace gravel, fine to coarse sand, poorly sorted, subangular, loose, slight plasticity, no cementation, slightly moist, no odor.
7 - 22	SANDSTONE	Buff, some silt, very fine to fine-grained, well sorted, subrounded, compact, upper two feet weathered, weakly cemented, non-calcareous, dry, no odor. At nine feet unweathered, moderately cemented. From 18 to 19 feet some very coarse sand and very fine gravel present.
22 - 32	SANDSTONE	Blue-grey, fine to medium grained, moderately sorted, subrounded, very dense, strongly cemented, highly calcareous, dry, no odor.
32 - 60	SILTY SANDSTONE	Brown, some clay, medium grained, moderately, sorted, subrounded, compact, slight plasticity, weak to moderate cement, non-calcareous, moist, no odor. At 38 feet wet. From 45 to 55 feet interbedded dark claystone layers are present.
60 - 220	SANDSTONE	Blue-grey, some silt and clay, fine to medium grained, well sorted, subrounded, very dense, moderately cemented, calcareous, wet, no odor. From 74 to 75 feet fracture. From 77 to 79 feet some claystone interlayers. From 107 to 110 feet several fractures. From 115 to 117 some calcite. Below 120 feet slight grain size increase to medium - coarse. At 137 feet fracture. Below 140 feet some fine gravel present.

TABLE A-1 (continued)
LITHOLOGIC LOG OF MONITOR WELL RD-34C

DEPTH INTERVAL (feet)	DESCRIPTION OF MATERIAL	
60 - 220 (cont'd)	SANDSTONE	From 150 to 160 feet gravelly interbeds present. Below 182 feet cementation increases to strong. From 183 to 186 feet some grey claystone interlayers. From 200 to 205 feet some brown clayey sandstone interlayers. From 205 to 210 feet some gravel and claystone, claystone increasing with depth.
220 - 258	SANDSTONE	Grey-black, with claystone interlayers, fine grained, moderately sorted, subrounded, compact, moderate cementation, calcareous, wet, no odor. From 228 to 232 feet fractured. Below 245 feet claystone interlayers decrease.
258 - 450	SANDSTONE	Blue-grey, trace silt, occasional claystone interlayers, very fine to fine-grained, well sorted, subrounded, dense, moderate cementation, calcareous, wet, no odor. From 282 to 285 feet claystone interlayers. From 300 to 305 feet cementation is weak. From 317 to 326 feet some claystone interlayers. From 330 to 345 feet fractured, hole making more water. Below 370 feet calcareous cement decreasing. From 378 to 395 feet cementation increases to hard.

TABLE A-1 (continued)
LITHOLOGIC LOG OF MONITOR WELL RD-34C

DEPTH INTERVAL (feet)	DESCRIPTION OF MATERIAL	
258 - 450 (cont'd)	SANDSTONE	From 388 to 390 feet some brown clayey sandstone interlayers. Below 395 feet cementation decreases to moderate. From 400 to 412 feet some black claystone interlayers. Below 425 feet cementation increases to hard. From 430 to 440 feet some black claystone and brown clayey sandstone interlayers.
TOTAL DEPTH OF BOREHOLE: 450 FEET		

TABLE A-2
SUMMARY OF VIDEO CAMERA LOG BOREHOLE RD-34D (well RD-34C)

LITHOLOGY		MOISTURE		FRACTURES				
DESCRIPTION	DEPTH (ft)	DESCRIPTION	DEPTH (ft)	DEPTH (ft)	DIP ANGLE	DIP DIRECTION	OPENNESS (Inches)	TYPE
12 5/16 inches I.D. steel casing	0 - 29.7	---	---	---	---	---	---	---
Sandstone	29.7 - 54.5	Moist	29.7 - 35.1	31.3 - 32.8	75°	S80°E	1/16 - ¼	Structural
		Saturated	35.1 - T.D.	38.2 - 38.4	20°	N65°E	¼	Structural
				39.4 - 40.8	60°	N70°E	⅛ - ¾	Structural, parallel fractures
				41.4 - 42.2	50°	N75°E	⅛	Structural
				42.2 - 45.0	Fractured zone, numerous intersecting fractures			
					20°-80°	S80°E-N50°E	1/16 - ⅛	Structural
				46.2 - 47.1	75°	N80°E	1/16	Structural
				46.6 - 47.2	30°	N70°E	1/16 - ⅛	Structural
				47.1 - 47.8	70°	N80°E	1/16	Structural
				48.4 - 48.9	45°	N70°E	1/16	Structural
				49.1 - 49.5	30°	N50°E	1/16	Structural
				49.7 - 52.0	75°	S60°E	½ - 1½	Structural
				52.2 - 52.5	25°	N40°W	¼	Bedding plane
Siltstone/Claystone	53.6 - 54.5	Saturated	35.1 - T.D.	---	---	---	---	---
Sandstone	54.5 - 135.7	Saturated	35.1 - T.D.	55.9 - 56.7	50°	S35°E	1/16	Structural
				60.5 - 61.0	30°	N40°W	1/16	Bedding plane
				62.2 - 62.7	60°	N70°E	0	Structural, plugged with white vein filling
				63.2 - 63.9	50°	N80°E	1/16	Structural

TABLE A-2 (continued)
SUMMARY OF VIDEO CAMERA LOG BOREHOLE RD-34D (well RD-34C)

LITHOLOGY		MOISTURE		FRACTURES				
DESCRIPTION	DEPTH (ft)	DESCRIPTION	DEPTH (ft)	DEPTH (ft)	DIP ANGLE	DIP DIRECTION	OPENNESS (Inches)	TYPE
Sandstone (cont'd)	54.5 - 135.7	Saturated	35.1 - T.D.	68.5 - 69.0	25°	N80°E	0	Structural, plugged with white vein filling
				74.6 - 76.0	80°	S40°E	⅛ - 2	Structural
				78.4 - 78.8	30°	N40°W	1/16 - ⅛	Bedding plane, parallel fractures
				82.7 - 83.7	75°	S30°E	1/16	Structural
				95.3 - 95.8	60°	N75°E	1/16 - ⅛	Structural
				97.8 - 98.4	70°	N80°W	⅛	Structural
				98.6 - 98.9	80°	S80°E	⅛	Structural
				100.0 - 101.5	Several irregular intersecting fractures			
				106.6 - 107.1	80°	S70°E	⅛ - ¼	Structural
				108.7 - 109.3	75°	S80°E	¼ - ½	Structural
				110.0 - 112.7	Several irregular intersecting fractures			
				113.9 - 114.3	80°	S80°E	1/16	Structural
				114.9 - 117.2	65°	S50°E	0 - 1	Structural, plugged with white vein filling, parallel fractures
				121.1 - 122.3	70°	N60°E	⅛ - ½	Structural
				123.6 - 124.8	60°	S40°E	1/16	Structural
Siltstone	135.7 - 136.4	---	---	---	---	---	---	---

TABLE A-2 (continued)
SUMMARY OF VIDEO CAMERA LOG BOREHOLE RD-34D (well RD-34C)

LITHOLOGY		MOISTURE		FRACTURES				
DESCRIPTION	DEPTH (ft)	DESCRIPTION	DEPTH (ft)	DEPTH (ft)	DIP ANGLE	DIP DIRECTION	OPENNESS (Inches)	TYPE
Sandstone	136.4 - 173.4	Saturated	35.1 to T.D.	145.6 - 146.4	45°	N80°E	1/16 - ⅛	Structural, parallel fractures
				146.7 - 147.4	50°	E	¼ - ½	Structural, parallel fractures
				149.0 - 151.2	Several intersecting low angle fractures			
				151.5 - 152.0	50°	N65°E	⅛ - ½	Structural
				153.4 - 153.8	60°	S60°E	1/16	Structural
Siltstone	173.4 - 174.6	Saturated	35.1 - T.D.	---	---	---	---	---
Sandstone	174.6 - 183.3	Saturated	35.1 - T.D.	175.9 - 176.5	50°	N80°E	1/16 - ⅛	Structural
				182.4 - 182.7	40°	S60°W	1/16	Structural
Siltstone/Sandstone	183.3 - 185.7	Saturated	35.1 - T.D.	---	---	---	---	---
Sandstone	185.7 - 224.4	Saturated	35.1 - T.D.	194.1 - 196.5	80°	E	⅛ - ½	Structural
				197.5 - 199.5	Several small intersecting fractures			
				198.6 - 200.4	75°	N60°E	⅛	Structural
				203.5 - 203.9	30°	S20°W	1/16	Structural
				206.0 - 207.1	50°	N55°E	0 - ¼	Structural, plugged with white vein filling
				211.5 - 211.7	20°	S40°W	1/16 - ⅛	Structural
				213.6 - 215.3	Vertical	---	1/16	Structural
				221.1 - 221.4	40°	S60°E	1/16	Structural
				223.3 - 223.8	35°	N80°W	½ - 1½	Structural
				224.7 - 224.9	25°	N40°W	⅛	Bedding plane

NOTE: Above 235 feet, water seeping into the borehole below the temporary surface casing appears to be water introduced to stabilize the upper 40 feet of the borehole during drilling operations. This does not appear to be shallow groundwater. Shallow water was not encountered during the drilling of adjacent wells RD-51A or RD-51B. 8640M-253 GWRC

TABLE A-2 (continued)
SUMMARY OF VIDEO CAMERA LOG BOREHOLE RD-34D (well RD-34C)

LITHOLOGY		MOISTURE		FRACTURES				
DESCRIPTION	DEPTH (ft)	DESCRIPTION	DEPTH (ft)	DEPTH (ft)	DIP ANGLE	DIP DIRECTION	OPENNESS (Inches)	TYPE
Sandstone with interbedded siltstone	224.4 - 235.1	Saturated	35.1 - T.D.	224.6 - 225.9	30°	N40°W	¼	Bedding plane
				226.6 - 227.5	Washout			
				228.8 - 232.1	Intersecting fractures, broken, washout			
Sandstone	235.1 - 318.6	Saturated	35.1 - T.D.	240.4 - 240.7	30°	N30°W	¼	Bedding plane
				245.4 - 245.8	30°	N40°W	⅛ - ¼	Bedding plane
				246.6	Horizontal	---	⅛	Structural
				247.1	Horizontal	---	1/16	Structural
				263.8 - 264.7	70°	S60°E	1/16	Structural
				276.8	Horizontal	---	1/16	Structural
				280.7 - 280.9	40°	N40°E	1/16	Structural
				282.4 - 282.7	20°	S50°E	¼ - ½	Structural
				289.6 - 289.9	30°	S80°E	¼	Structural
				292.7 - 294.1	70°	S30°E	1/16 - ½	Structural, several fractures intersect
				294.3 - 295.3	60°	S50°E	⅛	Structural
				296.0 - 296.6	45°	N50°W	1/16 - ⅛	Structural
				298.1	Horizontal	---	⅛	Structural
				303.5 - 303.9	50°	S40°E	⅛	Structural
				307.8	Horizontal	---	1/16	Structural
				308.1 - 308.4	15°	S70°E	⅛	Structural

TABLE A-2 (continued)
SUMMARY OF VIDEO CAMERA LOG BOREHOLE RD-34D (well RD-34C)

LITHOLOGY		MOISTURE		FRACTURES				
DESCRIPTION	DEPTH (ft)	DESCRIPTION	DEPTH (ft)	DEPTH (ft)	DIP ANGLE	DIP DIRECTION	OPENNESS (inches)	TYPE
Sandstone (cont'd)	235.1 - 318.6	Saturated	35.1 - T.D.	312.4	Horizontal	---	½	Structural
				313.2 - 314.3	Several intersecting small fractures			
				315.3 - 315.9	45°	S80°E	⅛	Structural
Sandstone with interbedded siltstone	318.6 - 420	Saturated	35.1 - T.D.	320.7 - 321.1	25°	S70°E	¼	Structural
				325.6 - 327.2	60°	E	1/16	Structural
				328.1 - 328.7	50°	S50°E	1/16 - ⅛	Structural
				331.2 - 331.8	Several intersecting small fractures			
				333.0 - 333.6	60°	E	⅛	Structural
				334.2 - 335.2	Several intersecting small fractures			
				336.6	Horizontal	---	⅛	Structural
				339.1	Horizontal	---	1/16 - ⅛	Structural, several small fractures
				343.1 - 343.7	40°	S40°E	⅛	Structural
				344.9	Horizontal	---	1/16 - ⅛	Structural, several small fractures
				348.9 - 349.2	25°	S80°E	1/16	Structural, parallel fractures
				349.5 - 349.7	20°	E	¼ - ½	Structural
				355.1 - 355.4	30°	N80°E	⅛	Structural
				357.0 - 357.3	30°	N70°E	⅛	Structural

NOTE: Above 235 feet, water seeping into the borehole below the temporary surface casing appears to be water introduced to stabilize the upper 40 feet of the borehole during drilling operations. This does not appear to be shallow groundwater. Shallow water was not encountered during the drilling of adjacent wells RD-51A or RD-51B. 8640M-253 GWRC

TABLE A-2 (continued)
SUMMARY OF VIDEO CAMERA LOG BOREHOLE RD-34D (well RD-34C)

LITHOLOGY		MOISTURE		FRACTURES				
DESCRIPTION	DEPTH (ft)	DESCRIPTION	DEPTH (ft)	DEPTH (ft)	DIP ANGLE	DIP DIRECTION	OPENNESS (Inches)	TYPE
(Borehole fluid becoming opaque)	370 - 420	Saturated	35.1 - T.D.	372.2 - 372.4	Several small intersecting fractures			
				394.8 - 395.1	25°	N40°W	¼	Bedding plane
				396.3	Horizontal	---	⅛	Structural
				397.2 - 398.1	70°	S70°E	¼	Structural
				405.8 - 406.0	50°	S60°E	⅛	Structural
				409.2	Horizontal	---	⅛ - ½	Structural
				416.4 - 416.6	?	S60°E	⅛	Structural
Borehole fluid obscuring video, unable to log	420 - 449	Saturated	---	---	---	---	---	---

TOTAL DEPTH OF BOREHOLE: 449 FEET

TABLE A-3

LITHOLOGIC LOG OF EXTRACTION WELL RD-63

DEPTH INTERVAL (feet)		DESCRIPTION OF MATERIAL
0 - 46	SILTY SANDSTONE	Yellow brown, fine to very fine grained, trace medium grained, very weathered, clayey, poorly graded, subangular to angular and subrounded, compact, non-calcareous, moist.
		@ 3' moderate plasticity.
		@ 5' light yellow brown.
		@ 8' compact to dense, slightly moist to moist.
		@ 18.5' wet.
		@ 20' moist.
		@ 24' weakly to moderately calcareous.
		@ 25' grey and brown grey, strongly calcareous.
		@ 33' increased percentage of fines, very fine grained sand.
		@ 36' brown and grey brown, very moist.
		@ 36.5' fracture.
		@ 37' fine and medium grained, moderately graded.
		@ 42' yellow brown, moderately calcareous.
46 - 50	CLAYEY SANDSTONE	Very fine grained, increased percentage of clay fines, poorly graded, high plasticity.
		@ 48' wet.
50 - 115	SANDSTONE	Dark grey and dark yellow brown, fine grained, dense, weakly to moderately calcareous.
		@ 51' no to low plasticity.
		@ 66' yellow brown and dark grey brown.
		@ 70' dark grey, dark yellow brown, grey and yellow brown.
		@ 80' predominantly grey, some yellow brown.

TABLE A-3
(continued)
LITHOLOGIC LOG OF EXTRACTION WELL RD-63

DEPTH INTERVAL (feet)		DESCRIPTION OF MATERIAL
50 - 115 (cont'd)	SANDSTONE	@ 85' strongly calcareous.
		@ 90' grey.
		@ 100' grey and yellow brown, weakly to strongly calcareous.
		@ 103' grey.
		From 108 to 109.5' very dense, strongly calcareous.
		@ 109.5' some medium and coarse grained sand, moderately to well graded, dense, moderately calcareous.
115 - 140	SILTY SANDSTONE	Fine grained, some medium grained, very micaceous, clayey, poorly to moderately graded, high plasticity, weakly to moderately calcareous.
		@ 120' strongly calcareous.
		@ 121' possible fracture, poorly graded.
		From 126.5 to 127' harder.
		@ 127' softer, low to moderate plasticity.
		@ 130' weakly to moderately calcareous.
140 - 141.5	SILTSTONE/ CLAYSTONE	Black, non-calcareous.
141.5 - 181	SILTY SANDSTONE	Light grey to grey.
		@ 151.5' possible small fracture.
		@ 175' fine to medium grained, moderately calcareous.
181 - 188.5	SILTSTONE/ CLAYSTONE	Black, some fractures, compact to dense, non-calcareous.
188.5 - 190	SILTY SANDSTONE	Dense.
190 - 191	SILTSTONE/ CLAYSTONE	Black, compact to dense.

TABLE A-3
(continued)
LITHOLOGIC LOG OF EXTRACTION WELL RD-63

DEPTH INTERVAL (feet)		DESCRIPTION OF MATERIAL
191 - 230	SILTY SANDSTONE	Grey, fine grained, dense, moderately to strongly calcareous. @ 219' strongly calcareous. @ 225' moderately to strongly calcareous. @ 227.5' fracture.

TOTAL DEPTH OF BOREHOLE: 230 FEET

APPENDIX B

LABORATORY REPORTS

Lockheed Analytical Services

GROUNDWATER RESOURCES CONSULTANTS, INC.

SAMPLE ANALYSIS SUMMARY PACKAGE

FOR

RADIOCHEMISTRY

JOB NAME: L1974

QUOTATION NUMBER: Q323540

DOCUMENT FILE NUMBER: 0520445

Lockheed
Environmental Systems & Technologies Co.

Lockheed Analytical Services
975 Kelly Johnson Drive
Las Vegas, Nevada 89119-3705

Phone: (800) 361-0220
Fax: (702) 361-6434

June 3, 1994

Mr. Shel Clark
GROUNDWATER RESOURCES CONSULTANTS, INC.
1735 E. Fort Lowell Rd., Suite 4
Tucson, AZ 85719

RE: Job Name: L1974
Quotation No.: Q323540
Document File No.: 0520445

The attached data package contains the results of analyses on samples that were submitted to Lockheed Analytical Services on May 20, 1994. All samples were received intact.

SUMMARY ANALYSIS STATEMENT:

Tritium

The tritium analysis was performed using LAL-91-SOP-0066. No problems were encountered during analysis. All QC criteria were met.

If you have any questions concerning the analysis or the data please do not hesitate to contact Chet Frank, (702) 361-3955.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

for Chet Frank,
Client Services Representative

CF/ymj

cc: Client Services
Doc/frument Control Department

Lockheed Analytical Services

DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES

[Revised 08/28/92]

For Use on the Analytical Data Reporting Forms	
B	Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL) and/or minimum detectable activity (MDA).
C	Presence of high TDS in sample required reduction of sample size which increased the MDA.
D	Constituent detected in the diluted sample.
E	Constituent concentration exceeded the calibration or attenuation curve range.
F	***For Alpha Spectrometry Only***-- FWHM exceeded acceptance limits.
H	Sample analysis performed outside of method-specified maximum holding time requirement.
Y	Chemical yield exceeded acceptance limits.
For Use on the QC Data Reporting Forms	
*	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
a[1]	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
b[1]	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

[1] Used as foot note designations on the QC summary form.

RAD DATA REPORT (ra01)

Groundwater Resources Cons. Inc. * Tuscn

Rad analysis on groundwater (Project GRCI-GROUNDWATER)

Client Sample ID: RMDF PILOT EXT. RD-63 LAL Sample ID: L1974-1

Date Collected: 19-MAY-94 Date Received: 20-MAY-94

Matrix: Water Login Number: L1974

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
H-3	27-MAY-94	TRITIUM(H3) LAL-0066_8578	40	130	230		pCi/L

SSFL ANALYTICAL CHEMISTRY, EPA #CA183

Rockwell International, Rocketdyne Div.
(818) 586-5827 D/392 SS21

REVISED

RECEIVED JUN 15 1994

Log Number 94050858

TO: Rocketdyne Environmental Protection
Requester: Norma Fujikawa D/543-000 T486 392-5316
cc:P. Blandino D/543-T486, N. Mukherjee D/543 T486

REPORT DATE: 06/07/94
DATE OF ANALYSIS: 05/23/94

SAMPLE INFORMATION FOR 94050858

Sample Descrption: Groundwater, RD-63
Requested Analysis: VOA, 8240
Sampler: GRB Sampler ID#: RD-63
Received: 05/20/94
Sampled: 05/19/94

ANALYTE per SW-846, #8240	RESULT, ug/L
Date Extracted	5/23/94
1,1,1-Trichloroethane (TCA)	<1
1,1,2,2-Tetrachloroethane	<1
1,1,2-Trichloroethane	<1
1,1-Dichloroethane	<1
1,1-Dichloroethylene	<1
1,2-Dichlorobenzene	<1
1,2-Dichloroethane	<1
1,2-Dichloroethylene (cis)	3.7
1,2-Dichloroethylene (trans)	<1
1,2-Dichloropropane	<1
1,3-Dichlorobenzene	<1
1,3-Dichloropropene (cis)	<1
1,3-Dichloropropene (trans)	<1
1,4-Dichlorobenzene	<1
2-Butanone	<5
2-Hexanone	<5
4-Methyl-2-Pentanone	<5
Acetone	<20
Benzene	<1
Bromodichloromethane	<1
Bromoform	<1
Bromomethane	<2
Carbon Disulfide	<2
Carbon Tetrachloride	<1
Chloroethane	<2
Chloroform	<1
Chloromethane	<2
Dibromochloromethane	<1
Dichlorodifluoromethane	<5
Ethylbenzene	<1
Freon 113	<2
Methylene Chloride	<2
Monochlorobenzene	<1
Styrene	<2
Tetrachloroethylene	<1
Toluene	<1
Trichloroethylene (TCE)	9.4
Trichlorofluoromethane	<1
Vinyl Chloride	<2
Xylenes (Total)	<2

COMMENTS:

APPROVED: Beverly L Hurst
Rocketdyne SSFL Analytical Chemistry

SIGNED: Paul Dryden
Rocketdyne SSFL Analytical Chemistry

SSFL ANALYTICAL CHEMISTRY, EPA #CA183

Rockwell International, Rocketdyne Div.
(818) 586-5827 D/392 SS21

Log Number
94090241

TO: Rocketdyne Environmental Protection
Requester: Alan Nelson D/543-000 T486 392-5329

Report Date: 09/27/94
Date of Analysis: 09/27/94

SAMPLE INFORMATION FOR 94090241

Sample Descrption: Groundwater, RD-63 Effluent
Requested Analysis: VOA
Sampler: Rick Banaga Sampler ID#: 1782

Received: 09/23/94
Sampled: 09/~~23~~/94

ANALYTE per SW-846, #8240	RESULT, ug/L
Date Extracted	9/27/94
1,1,1-Trichloroethane (TCA)	<1
1,1,2,2-Tetrachloroethane	<1
1,1,2-Trichloroethane	<1
1,1-Dichloroethane	<1
1,1-Dichloroethylene	<1
1,2-Dichlorobenzene	<1
1,2-Dichloroethane	<1
1,2-Dichloroethylene (cis)	<1
1,2-Dichloroethylene (trans)	<1
1,2-Dichloropropane	<1
1,3-Dichlorobenzene	<1
1,3-Dichloropropene (cis)	<1
1,3-Dichloropropene (trans)	<1
1,4-Dichlorobenzene	<1
2-Butanone	<5
2-Hexanone	<5
4-Methyl-2-Pentanone	<5
Acetone	<20
Benzene	<1
Bromodichloromethane	<1
Bromoform	<1
Bromomethane	<2
Carbon Disulfide	<2
Carbon Tetrachloride	<1
Chloroethane	<2
Chloroform	<1
Chloromethane	<2
Dibromochloromethane	<1
Dichlorodifluoromethane	<5
Ethylbenzene	<1
Freon 113	<5
Methylene Chloride	<2
Monochlorobenzene	<1
Styrene	<2
Tetrachloroethylene	<1
Toluene	<1
Trichloroethylene (TCE)	<1
Trichlorofluoromethane	<1
Vinyl Chloride	<2
Xylenes (Total)	<2

COMMENTS:

APPROVED: Beverly K Hart
Rocketdyne SSFL Analytical Chemistry

SIGNED: Donna Douglas
Rocketdyne SSFL Analytical Chemistry

B C Analytical

801 Western Avenue
Glendale, CA 91201
818/247-5737
Fax: 818/247-9797

ANALYTICAL REPORT

LOG NO: G94-09-310

Received: 23 SEP 94

Mailed: OCT 12 1994

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT.EXTRACTION

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
09-310-1	RD-63	22 SEP 94

PARAMETER	09-310-1
Digestion (3010), Date	09/28/94
Furnace Digestion (3020), Date	09/29/94
Ion Balance, Percent	8.22
Nitrate+Nitrite	
Nitrate+Nitrite (as NO3), mg/L	<0.2
Nitrate+Nitrite (as N), mg/L	<0.05
Conductivity (120.1), umhos/cm	1000
Fluoride, mg/L	1.2
Sulfate, mg/L	59
pH (150.1/9040), Units	7.3
Dissolved Solids (160.1), mg/L	680
Alkalinity (310.1)	
Carbonate Alk (as CaCO3), mg/L	<1
Bicarbonate Alk (as CaCO3), mg/L	330
Hydroxide Alk (as CaCO3), mg/L	<1
Total Alkalinity (as CaCO3), mg/L	330
Chloride (325.3), mg/L	51
Arsenic (7060/206.2), mg/L	<0.002
Barium (6010/200.7), mg/L	0.042
Cadmium (7131/213.2), mg/L	<0.002
Calcium (6010/200.7), mg/L	130
Chromium (7191/218.2), mg/L	<0.005
Iron (6010/200.7), mg/L	0.092
Lead (7421/239.2), mg/L	0.0084
Magnesium (6010/200.7), mg/L	27
Manganese (6010/200.7), mg/L	0.026
Mercury (7470/245.1), mg/L	<0.0002
Potassium (6010/200.7), mg/L	3.9

BCA

B C Analytical

801 Western Avenue
Glendale, CA 91201
818/247-5737
Fax: 818/247-9797

LOG NO: G94-09-310

Received: 23 SEP 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT.EXTRACTION

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
09-310-1	RD-63	22 SEP 94

PARAMETER	09-310-1
Selenium (7740/270.2), mg/L	<0.004
Silver (6010/200.7), mg/L	<0.01
Sodium (6010/200.7), mg/L	49

B C Analytical

801 Western Avenue
Glendale, CA 91201
818/247-5737
Fax: 818/247-9797

LOG NO: G94-09-310

Received: 23 SEP 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT.EXTRACTION

REPORT OF ANALYTICAL RESULTS

Log Number : 94-09-310-1
Sample Description: RD-63

General Mineral Analysis
Sampled Date 22 SEP 94

Anions	mg/L	meq/L
Nitrate+Nitrite (as NO3)	<0.2	<0.0032
Chloride (325.3)	51	1.4
Sulfate	59	1.2
Bicarbonate (as HCO3)	400	6.6
Carbonate (as CO3)	<0.6	<0.02
Hydroxide (as OH)	<0.34	<0.02
Total Millequivalents per Liter		9.2

Cations	mg/L	meq/L
Magnesium (6010/200.7)	27	2.2
Sodium (6010/200.7)	49	2.1
Potassium (6010/200.7)	3.9	0.1
Calcium (6010/200.7)	130	6.5
Total Millequivalents per Liter		10.9

Determination	mg/L
Hydroxide Alk (as CaCO3)	<1
Carbonate Alk (as CaCO3)	<1
Bicarbonate Alk (as CaCO3	330
Ca Hardness (as CaCO3)	320
Mg Hardness (as CaCO3)	110
Total Hardness	430
Iron (6010/200.7)	0.092
Manganese (6010/200.7)	0.026
Dissolved Solids (160.1)	680
Sp. Conductance, umhos/cm	1000
pH (150.1/9040), units	7.3
Ion balance in percent	8.22

* Conforms to Title 22, California Administrative Code

BCA

Lockheed Analytical Services

GROUNDWATER RESOURCES CONSULTANTS, INC.

ANALYTICAL DATA REPORT

FOR

RADIOCHEMISTRY

LOG-IN NUMBER: L2995

QUOTATION NUMBER: Q323540

DOCUMENT FILE NUMBER: 0923445

COPY

Lockheed
Environmental Systems & Technologies Co.

Lockheed Analytical Services
975 Kelly Johnson Drive
Las Vegas, Nevada 89119-3705

Phone: (702) 361-0220
Phone: (800) 582-7605
Fax: (702) 361-8146

October 17, 1994

Mr. Shel Clark
GROUNDWATER RESOURCES CONSULTANTS, INC.
6200 East 14th Street, Suite A200
Tucson, AZ 85711

RE: Log-in No: L2995
Quotation No: Q323540
Document File No: 0923445

The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 23 September 1994.

The temperature of the cooler upon receipt was 10°C. Sample containers received were not accompanied by chain-of-custody documentation. (See attached Sample Receiving Checklist). Sample containers were received intact. Samples were received in time to meet the analytical holding time requirements. All discrepancies identified upon receipt of the samples have been forwarded to the client and are documented in the enclosed chain-of-custody records.

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Chet Frank at (702) 361-3955, ext. 272.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

Chet A. Frank

Chet Frank
Client Services Representative

CF/yj
cc: Client Services
Document Control

CASE NARRATIVE
RADIOCHEMICAL ANALYSES

The routine calibration and quality control analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, and duplicate samples.

Holding Time Requirements

All holding time requirements were met.

Analytical Method

Gross Alpha Beta

The gross alpha beta analysis was performed using LAL-91-SOP-0060. No problems were encountered during analysis. All QC criteria were met. A sample from another client was used for the sample duplicate analysis.

Tritium

The tritium analysis was performed using LAL-91-SOP-0066. No problems were encountered during analysis. All QC criteria were met. A sample from another client was used for the sample duplicate analysis.

Yvonne M. Jacoby
Prepared By

October 17, 1994
Date

Lockheed Analytical Services
DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES
[Revised 08/28/92]

For Use on the Analytical Data Reporting Forms	
B	Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL) and/or minimum detectable activity (MDA).
C	Presence of high TDS in sample required reduction of sample size which increased the MDA.
D	Constituent detected in the diluted sample.
E	Constituent concentration exceeded the calibration or attenuation curve range.
F	*For Alpha Spectrometry Only*-- FWHM exceeded acceptance limits.
H	Sample analysis performed outside of method-specified maximum holding time requirement.
Y	Chemical yield exceeded acceptance limits.
For Use on the QC Data Reporting Forms	
*	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
a[1]	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
b[1]	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

[1] Used as foot note designations on the QC summary form.

RAD DATA REPORT (ra01)

Groundwater Resources Cons. Inc. * Tuscn

Rad analysis on groundwater (Project GRCI-GROUNDWATER)

Client Sample ID: RD-63 LAL Sample ID: L2995-1

Date Collected: 22-SEP-94 Date Received: 23-SEP-94

Matrix: Filt H2O Login Number: L2995

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Gross Alpha	07-OCT-94	GR ALP/BETA LAL-0060_14100	12.9	5.6	5.8	C	pCi/L
Gross Beta	07-OCT-94	GR ALP/BETA LAL-0060_14100	10.3	4.6	6.9	C	pCi/L

RAD DATA REPORT (ra01)

Groundwater Resources Cons. Inc. * Tuscn

Rad analysis on groundwater (Project GRCI-GROUNDWATER)

Client Sample ID: RD-63 LAL Sample ID: L2995-2

Date Collected: 22-SEP-94 Date Received: 23-SEP-94

Matrix: Water Login Number: L2995

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
H-3	13-OCT-94	TRITIUM(H3) LAL-0066_14144	80	150	260		pCi/L

Lockheed Analytical Services

GROUNDWATER RESOURCES CONSULTANTS, INC.

ANALYTICAL DATA REPORT

FOR

RADIOCHEMISTRY

LOG-IN NUMBER: L3102

QUOTATION NUMBER: Q323540

DOCUMENT FILE NUMBER: 1007445

Lockheed
Environmental Systems & Technologies Co.

Lockheed Analytical Services
975 Kelly Johnson Drive
Las Vegas, Nevada 89119-3705

Phone: (702) 361-0220
Phone: (800) 582-7605
Fax: (702) 361-8146

November 7, 1994

Mr. Shel Clark
GROUNDWATER RESOURCES CONSULTANTS, INC.
6200 East 14th Street, Suite A200
Tucson, AZ 85711

RE: Log-in No: L3102
Quotation No: Q323540
Document File No: 1007445

The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 7 October 1994.

The temperature of the cooler upon receipt was 10°C. (See attached Sample Receiving Checklist). Sample containers received agree with the chain-of-custody documentation. Sample containers were received intact. Samples were received in time to meet the analytical holding time requirements. All discrepancies identified upon receipt of the samples have been forwarded to the client and are documented in the enclosed chain-of-custody records.

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Chet Frank at (702) 361-3955, ext. 272.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

Chet A. Frank

Chet Frank
Client Services Representative

CF/yj
cc: Client Services
Document Control

CASE NARRATIVE
RADIOCHEMICAL ANALYSES

The routine calibration and quality control analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, and duplicate samples.

Holding Time Requirements

All holding time requirements were met.

Analytical Method

Gamma Spectrum Analysis

The gamma spectrum analysis was performed using LAL-91-SOP-0063. No problems were encountered during analysis. All QC criteria were met. A sample from another client was used for the sample duplicate analysis.

Gross Alpha Beta

The gross alpha beta analysis was performed using LAL-91-SOP-0060. No problems were encountered during analysis. All QC criteria were met. A sample from another client was used for the sample duplicate analysis.

Tritium

The tritium analysis was performed using LAL-91-SOP-0066. No problems were encountered during analysis. All QC criteria were met. A sample from another client was used for the sample duplicate analysis.

Yvonne M. Jacoby
Prepared By

November 4, 1994
Date

Lockheed Analytical Services
DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES
[Revised 08/28/92]

For Use on the Analytical Data Reporting Forms	
B	Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL) and/or minimum detectable activity (MDA).
C	Presence of high TDS in sample required reduction of sample size which increased the MDA.
D	Constituent detected in the diluted sample.
E	Constituent concentration exceeded the calibration or attenuation curve range.
F	*For Alpha Spectrometry Only*-- FWHM exceeded acceptance limits.
H	Sample analysis performed outside of method-specified maximum holding time requirement.
Y	Chemical yield exceeded acceptance limits.
For Use on the QC Data Reporting Forms	
*	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
a[1]	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
b[1]	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

[1] Used as foot note designations on the QC summary form.

RAD DATA REPORT (ra01)

Groundwater Resources Cons. Inc. * Tuscn

Rad analysis on groundwater (Project GRCI-GROUNDWATER)

Client Sample ID: RD-63EFF
LAL Sample ID: L3102-4

Date Collected: 06-OCT-94
Date Received: 07-OCT-94

Matrix: Filt H20
Login Number: L3102

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Gross Alpha	31-OCT-94	GR ALP/BETA LAL-0060_14605	4.7	4.1	6.0	C	pCi/L
Gross Beta	31-OCT-94	GR ALP/BETA LAL-0060_14605	9.4	4.1	6.1	C	pCi/L

RAD DATA REPORT (ra01)

Groundwater Resources Cons. Inc. * Tuscn

Rad analysis on groundwater (Project GRCI-GROUNDWATER)

Client Sample ID: RD-63EFF
LAL Sample ID: L3102-5

Date Collected: 06-OCT-94
Date Received: 07-OCT-94

Matrix: Water
Login Number: L3102

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
H-3	18-OCT-94	TRITIUM(H3) LAL-0066_14567	60	150	270		pCi/L

SSFL ANALYTICAL CHEMISTRY, EPA #CA183

Rockwell International, Rocketdyne Div.
(818) 586-5827 D/392 SS21

Log Number
94100061

TO: Rocketdyne Environmental Protection
Requester: Neil Mukherjee D/543-000 T486 382-6188
cc: P. Blandino D/543-T486

Report Date: 11/08/94
Date of Analysis: 10/20/94

SAMPLE INFORMATION FOR 94100061

Sample Description: Water, RD-63
Requested Analysis: 8010
Sampler: Chuck Dickens, GWRC Sampler ID#: RD-63

Received: 10/07/94
Sampled: 10/06/94

ANALYTE per 8010A, SW-846	RESULT, ug/l
Date Extracted	10/20/94
1,1,1,2-Tetrachloroethane	<0.1
1,1,1-Trichloroethane (TCA)	<0.1
1,1,2,2-Tetrachloroethane	<0.1
1,1,2-Trichloroethane	<0.1
1,1-Dichloroethane	0.74
1,1-Dichloroethene	1.1
1,2,3-Trichloropropane	<0.1
1,2-Dichlorobenzene	<0.1
1,2-Dichloroethane	<0.1
1,2-Dichloroethene (cis)	2.9
1,2-Dichloroethene (trans)	<0.1
1,2-Dichloropropane	<0.1
1,3-Dichlorobenzene	<0.1
1,3-Dichloropropene (cis)	<0.1
1,3-Dichloropropene (trans)	<0.1
1,4-Dichlorobenzene	<0.1
2-Chloroethylvinyl Ether	<0.1
Bromobenzene	<0.1
Bromodichloromethane	<0.1
Bromoform	<0.1
Bromomethane	<0.1
Carbon Tetrachloride	<0.1
Chlorobenzene	<0.1
Chloroethane	<0.1
Chloroform	<0.1
Chloromethane	<0.1
Dibromochloromethane	<0.1
Dibromomethane	<0.1
Dichlorodifluoromethane	<0.3
Methylene Chloride	<0.2
Tetrachloroethene	<0.1
Trichloroethene (TCE)	5.3
Trichlorofluoromethane	<0.1
Vinyl Chloride	<0.2

COMMENTS: These results are for indication purposes only.

APPROVED: Beverly K Hurst
Rocketdyne SSFL Analytical Chemistry

SIGNED: R Mata
Rocketdyne SSFL Analytical Chemistry

SSFL ANALYTICAL CHEMISTRY, EPA #CA183

Rockwell International, Rocketdyne Div.
(818) 586-5827 D/392 SS21

Log Number
94100062

TO: Rocketdyne Environmental Protection
Requester: Neil Mukherjee D/543-000 T486 382-6188
cc: P. Blandino D/543-T486

Report Date: 11/08/94
Date of Analysis: 10/20/94

SAMPLE INFORMATION FOR 94100062

Sample Descrption: Water, Rd-63 Effluent
Requested Analysis: 8010
Sampler: Chuck Dickens, GWRC Sampler ID#: RD-63 Eff

Received: 10/07/94
Sampled: 10/06/94

ANALYTE per 8010A, SW-846	RESULT, ug/l
Date Extracted	10/20/94
1,1,1,2-Tetrachloroethane	<0.1
1,1,1-Trichloroethane (TCA)	<0.1
1,1,2,2-Tetrachloroethane	<0.1
1,1,2-Trichloroethane	<0.1
1,1-Dichloroethane	<0.1
1,1-Dichloroethene	<0.1
1,2,3-Trichloropropane	<0.1
1,2-Dichlorobenzene	<0.1
1,2-Dichloroethane	<0.1
1,2-Dichloroethene (cis)	<0.1
1,2-Dichloroethene (trans)	<0.1
1,2-Dichloropropane	<0.1
1,3-Dichlorobenzene	<0.1
1,3-Dichloropropene (cis)	<0.1
1,3-Dichloropropene (trans)	<0.1
1,4-Dichlorobenzene	<0.1
2-Chloroethylvinyl Ether	<0.1
Bromobenzene	<0.1
Bromodichloromethane	<0.1
Bromoform	<0.1
Bromomethane	<0.1
Carbon Tetrachloride	<0.1
Chlorobenzene	<0.1
Chloroethane	<0.1
Chloroform	<0.1
Chloromethane	<0.1
Dibromochloromethane	<0.1
Dibromomethane	<0.1
Dichlorodifluoromethane	<0.3
Methylene Chloride	<0.2
Tetrachloroethene	<0.1
Trichloroethene (TCE)	<0.1
Trichlorofluoromethane	<0.1
Vinyl Chloride	<0.2

COMMENTS: These results are for indication purposes only.

APPROVED: Beverly K. Hurts
Rocketdyne SSFL Analytical Chemistry

SIGNED: R. Maita
Rocketdyne SSFL Analytical Chemistry

B C Analytical

ANALYTICAL REPORT

801 Western Avenue
Glendale, CA 91201
818/247-5737
Fax: 818/247-9797

LOG NO: G94-10-226

Received: 14 OCT 94
Mailed : 28 OCT 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
10-226-1	RD-63	14 OCT 94

PARAMETER	10-226-1
Halocarbons/EPA 8010	
Date Analyzed	10/25/94
Date Confirmed	10/25/94
Dilution Factor, Times	1
1,1,1-Trichloroethane, ug/L	<0.5
1,1,2,2-Tetrachloroethane, ug/L	<0.5
1,1,2-Trichloroethane, ug/L	<0.5
1,1-Dichloroethane, ug/L	0.89
1,1-Dichloroethene, ug/L	1.7
1,2-Dichloroethane, ug/L	<0.5
1,2-Dichlorobenzene, ug/L	<0.5
1,2-Dichloropropane, ug/L	<0.5
1,3-Dichlorobenzene, ug/L	<0.5
1,4-Dichlorobenzene, ug/L	<0.5
2-Chloroethylvinylether, ug/L	<0.5
Bromodichloromethane, ug/L	<0.5
Bromomethane, ug/L	<0.5
Bromoform, ug/L	<0.5
Chlorobenzene, ug/L	<0.5
Carbon Tetrachloride, ug/L	<0.5
Chloroethane, ug/L	<0.5
Chloroform, ug/L	<0.5
Chloromethane, ug/L	<0.5
Dibromochloromethane, ug/L	<0.5
Dichlorodifluoromethane, ug/L	<0.5
Freon 113, ug/L	<0.5
Methylene chloride, ug/L	<0.5
Trichloroethene, ug/L	9.2

BCA

B C Analytical

801 Western Avenue
Glendale, CA 91201
818/247-5737
Fax: 818/247-9797

LOG NO: G94-10-226

Received: 14 OCT 94
Mailed : 28 OCT 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
10-226-1	RD-63	14 OCT 94

PARAMETER	10-226-1
Trichlorofluoromethane, ug/L	<0.5
Tetrachloroethene, ug/L	<0.5
Vinyl chloride, ug/L	<0.5
cis-1,2-Dichloroethene, ug/L	3.3
cis-1,3-Dichloropropene, ug/L	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5

Mark A. Valentini, PhD, Laboratory Director

BCA

SSFL ANALYTICAL CHEMISTRY, EPA #CA183

Rockwell International, Rocketdyne Div.
(818) 586-5827 D/392 SS21

Log Number
94100188

TO: Rocketdyne Environmental Protection
Requester: Neil Mukherjee D/S43-000 T486 382-6188
cc: P. Blandino D/S43-T486

Report Date: 11/09/94
Date of Analysis: 10/26/94

SAMPLE INFORMATION FOR 94100188

Sample Descrption: Groundwater, RD-63 Effluent
Requested Analysis: 8010
Sampler: R. Pierce of GRC Sampler ID#: RD-63 Effluent

Received: 10/14/94
Sampled: 10/14/94

ANALYTE per 8010A, SW-846	RESULT, ug/L
1,1,1,2-Tetrachloroethane	<0.1
1,1,1-Trichloroethane (TCA)	<0.1
1,1,2,2-Tetrachloroethane	<0.1
1,1,2-Trichloroethane	<0.1
1,1-Dichloroethane	<0.1
1,1-Dichloroethene	<0.1
1,2,3-Trichloropropane	<0.1
1,2-Dichlorobenzene	<0.1
1,2-Dichloroethane	<0.1
1,2-Dichloroethene (cis)	<0.1
1,2-Dichloroethene (trans)	<0.1
1,2-Dichloropropane	<0.1
1,3-Dichlorobenzene	<0.1
1,3-Dichloropropene (cis)	<0.1
1,3-Dichloropropene (trans)	<0.1
1,4-Dichlorobenzene	<0.1
2-Chloroethylvinyl Ether	<0.1
Bromobenzene	<0.1
Bromodichloromethane	<0.1
Bromoform	<0.1
Bromomethane	<0.1
Carbon Tetrachloride	<0.1
Chlorobenzene	<0.1
Chloroethane	<0.1
Chloroform	<0.1
Chloromethane	<0.1
Dibromochloromethane	<0.1
Dibromomethane	<0.1
Dichlorodifluoromethane	<0.3
Methylene Chloride	<0.4
Tetrachloroethene	<0.1
Trichloroethene (TCE)	<0.1
Trichlorofluoromethane	<0.1
Vinyl Chloride	<0.2

COMMENTS: These results are for indication purposes only.

APPROVED: Beverly K. Hurst
Rocketdyne SSFL Analytical Chemistry

SIGNED: R. Maita
Rocketdyne SSFL Analytical Chemistry

B C Analytical

801 Western Avenue
Glendale, CA 91201
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Fax: 818/247-9797

ANALYTICAL REPORT

LOG NO: G94-10-373

Received: 24 OCT 94

Mailed: NOV - 4 1994

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640NWC

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
10-373-1	Well RD-63	20 OCT 94
10-373-2	Carbon Effluent RD-63	20 OCT 94

PARAMETER	10-373-1	10-373-2			
Halocarbons/EPA 8010					
Date Analyzed	10/31/94	10/29/94			
Date Confirmed	10/31/94	10/29/94			
Dilution Factor, Times	1	1			
1,1,1-Trichloroethane, ug/L	<0.5	<0.5			
1,1,2,2-Tetrachloroethane, ug/L	<0.5	<0.5			
1,1,2-Trichloroethane, ug/L	<0.5	<0.5			
1,1-Dichloroethane, ug/L	0.98	<0.5			
1,1-Dichloroethene, ug/L	2.6	<0.5			
1,2-Dichloroethane, ug/L	<0.5	<0.5			
1,2-Dichlorobenzene, ug/L	<0.5	<0.5			
1,2-Dichloropropane, ug/L	<0.5	<0.5			
1,3-Dichlorobenzene, ug/L	<0.5	<0.5			
1,4-Dichlorobenzene, ug/L	<0.5	<0.5			
2-Chloroethylvinylether, ug/L	<0.5	<0.5			
Bromodichloromethane, ug/L	<0.5	<0.5			
Bromomethane, ug/L	<0.5	<0.5			
Bromoform, ug/L	<0.5	<0.5			
Chlorobenzene, ug/L	<0.5	<0.5			
Carbon Tetrachloride, ug/L	<0.5	<0.5			
Chloroethane, ug/L	<0.5	<0.5			
Chloroform, ug/L	<0.5	<0.5			
Chloromethane, ug/L	<0.5	<0.5			
Dibromochloromethane, ug/L	<0.5	<0.5			
Dichlorodifluoromethane, ug/L	<0.5	<0.5			
Freon 113, ug/L	<0.5	<0.5			
Methylene chloride, ug/L	<0.5	<0.5			

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B C Analytical

801 Western Avenue
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Fax: 818/247-9797

LOG NO: G94-10-373

Received: 24 OCT 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640NWC

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
10-373-1	Well RD-63	20 OCT 94
10-373-2	Carbon Effluent RD-63	20 OCT 94

PARAMETER	10-373-1	10-373-2
Trichloroethene, ug/L	8.9	<0.5
Trichlorofluoromethane, ug/L	<0.5	<0.5
Tetrachloroethene, ug/L	<0.5	<0.5
Vinyl chloride, ug/L	<0.5	<0.5
cis-1,2-Dichloroethene, ug/L	3.6	<0.5
cis-1,3-Dichloropropene, ug/L	<0.5	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5	<0.5

Mark A. Valentini, PhD, Laboratory Director

BCA

SSFL ANALYTICAL CHEMISTRY, EPA #CA183

Rockwell International, Rocketdyne Div.
(818) 586-5827 D/392 SS21

Log Number
94110043

Rocketdyne Environmental Protection
Requester: Neil Mukherjee D/543-000 T486 382-6188
cc: P. Blandino D/543-T486

Report Date: 11/07/94
Date of Analysis: 11/04/94

SAMPLE INFORMATION FOR 94110043

Sample Descrption: Water, Area IV 8640 Extraction Test, RD-63
Requested Analysis: 8240
Sampler: C. Dickens, GWRC Sampler ID#: RD-63

Received: 11/02/94
Sampled: 11/01/94

ANALYTE per SW-846, #8240	RESULT, ug/L
Date Extracted	11/04/94
1,1,1-Trichloroethane (TCA)	<1
1,1,2,2-Tetrachloroethane	<1
1,1,2-Trichloroethane	<1
1,1-Dichloroethane	<1
1,1-Dichloroethylene	<1
1,2-Dichlorobenzene	<1
1,2-Dichloroethane	<1
1,2-Dichloroethylene (cis)	<1
1,2-Dichloroethylene (trans)	<1
1,2-Dichloropropane	<1
1,3-Dichlorobenzene	<1
1,3-Dichloropropene (cis)	<1
1,3-Dichloropropene (trans)	<1
1,4-Dichlorobenzene	<1
2-Butanone	<5
2-Hexanone	<5
4-Methyl-2-Pentanone	<5
Acetone	<20
Benzene	<1
Bromodichloromethane	<1
Bromoform	<1
Bromomethane	<2
Carbon Disulfide	<2
Carbon Tetrachloride	<1
Chloroethane	<2
Chloroform	<1
Chloromethane	<2
Dibromochloromethane	<1
Dichlorodifluoromethane	<5
Ethylbenzene	<1
Freon 113	<5
Methylene Chloride	<2
Monochlorobenzene	<1
Styrene	<2
Tetrachloroethylene	<1
Toluene	<1
Trichloroethylene (TCE)	6.5
Trichlorofluoromethane	<1
Vinyl Chloride	<2
Xylenes (Total)	<2

COMMENTS:

APPROVED: Beverly K. Hurt
Rocketdyne SSFL Analytical Chemistry

SIGNED: Donna Douglas
Rocketdyne SSFL Analytical Chemistry

B C Analytical

801 Western Avenue
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RECEIVED NOV 2 1 1994

ANALYTICAL REPORT

LOG NO: G94-11-077

Received: 04 NOV 94

Mailed: NOV 17 1994

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
11-077-1	RD-63	01 NOV 94

PARAMETER	11-077-1				
Digestion (3010), Date	11/11/94				
Furnace Digestion (3020), Date	11/11/94				
Ion Balance, Percent	1.1				
Nitrate+Nitrite					
Nitrate+Nitrite (as NO3), mg/L	<0.1				
Nitrate+Nitrite (as N), mg/L	<0.02				
Conductivity (120.1), umhos/cm	1100				
Fluoride, mg/L	1.5				
Sulfate, mg/L	140				
pH (150.1/9040), Units	7.0				
Dissolved Solids (160.1), mg/L	630				
Alkalinity (310.1)					
Carbonate Alk (as CaCO3), mg/L	<1				
Bicarbonate Alk (as CaCO3), mg/L	340				
Hydroxide Alk (as CaCO3), mg/L	<1				
Total Alkalinity (as CaCO3), mg/L	340				
Chloride (325.3), mg/L	50				
Arsenic (7060/206.2), mg/L	<0.002				
Barium (6010/200.7), mg/L	0.044				
Cadmium (7131/213.2), mg/L	<0.001				
Calcium (6010/200.7), mg/L	130				
Chromium (7191/218.2), mg/L	<0.005				
Iron (6010/200.7), mg/L	0.066				
Lead (7421/239.2), mg/L	0.011				
Magnesium (6010/200.7), mg/L	26				
Manganese (6010/200.7), mg/L	0.014				
Mercury (7470/245.1), mg/L	<0.0002				
Potassium (6010/200.7), mg/L	4.0				

BCA

B C Analytical

801 Western Avenue
Glendale, CA 91201
818/247-5737
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LOG NO: G94-11-077

Received: 04 NOV 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
11-077-1	RD-63	01 NOV 94

PARAMETER	11-077-1
Selenium (7740/270.2), mg/L	0.0057
Silver (6010/200.7), mg/L	<0.01
Sodium (6010/200.7), mg/L	50

Mark A. Valentini, PhD, Laboratory Director

BCA

B C Analytical

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LOG NO: G94-11-077

Received: 04 NOV 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

Log Number : 94-11-077-1
Sample Description: RD-63

General Mineral Analysis
Sampled Date 01 NOV 94

Anions	mg/L	meq/L
Nitrate+Nitrite (as NO3)	<0.1	<0.0016
Chloride (325.3)	50	1.4
Sulfate	140	2.9
Bicarbonate (as HCO3)	410	6.8
Carbonate (as CO3)	<0.6	<0.02
Hydroxide (as OH)	<0.34	<0.02
Total Millequivalents per Liter		11.1

Cations	mg/L	meq/L
Magnesium (6010/200.7)	26	2.1
Sodium (6010/200.7)	50	2.2
Potassium (6010/200.7)	4.0	0.1
Calcium (6010/200.7)	130	6.5
Total Millequivalents per Liter		10.9

Determination	mg/L
Hydroxide Alk (as CaCO3)	<1
Carbonate Alk (as CaCO3)	<1
Bicarbonate Alk (as CaCO3	340
Ca Hardness (as CaCO3)	320
Mg Hardness (as CaCO3)	110
Total Hardness	430
Iron (6010/200.7)	0.066
Manganese (6010/200.7)	0.014
Dissolved Solids (160.1)	630
Sp. Conductance, umhos/cm	1100
pH (150.1/9040), units	7.0
Ion balance in percent	1.09

* Conforms to Title 22, California Administrative Code

BCA

SSFL ANALYTICAL CHEMISTRY, EPA #CA183

Rockwell International, Rocketdyne Div.
(818) 586-5827 D/392 SS21

Log Number
94110044

Rocketdyne Environmental Protection
Requester: Neil Mukherjee D/543-000 T486 382-6188
cc: P. Blandino D/543-T486

Report Date: 11/07/94
Date of Analysis: 11/04/94

SAMPLE INFORMATION FOR 94110044

Sample Descrption: Water, Area IV 8640 Extraction Test, RD-63 Effluent
Requested Analysis: 8240
Sampler: C. Dickens, GWRC Sampler ID#: RD-63 Eff

Received: 11/02/94
Sampled: 11/02/94

ANALYTE per SW-846, #8240	RESULT, ug/L
Date Extracted	11/04/94
1,1,1-Trichloroethane (TCA)	<1
1,1,2,2-Tetrachloroethane	<1
1,1,2-Trichloroethane	<1
1,1-Dichloroethane	<1
1,1-Dichloroethylene	<1
1,2-Dichlorobenzene	<1
1,2-Dichloroethane	<1
1,2-Dichloroethylene (cis)	<1
1,2-Dichloroethylene (trans)	<1
1,2-Dichloropropane	<1
1,3-Dichlorobenzene	<1
1,3-Dichloropropene (cis)	<1
1,3-Dichloropropene (trans)	<1
1,4-Dichlorobenzene	<1
2-Butanone	<5
2-Hexanone	<5
4-Methyl-2-Pentanone	<5
Acetone	<20
Benzene	<1
Bromodichloromethane	<1
Bromoform	<1
Bromomethane	<2
Carbon Disulfide	<2
Carbon Tetrachloride	<1
Chloroethane	<2
Chloroform	<1
Chloromethane	<2
Dibromochloromethane	<1
Dichlorodifluoromethane	<5
Ethylbenzene	<1
Freon 113	<5
Methylene Chloride	<2
Monochlorobenzene	<1
Styrene	<2
Tetrachloroethylene	<1
Toluene	<1
Trichloroethylene (TCE)	<1
Trichlorofluoromethane	<1
Vinyl Chloride	<2
Xylenes (Total)	<2

COMMENTS:

APPROVED: Beverly K Hurt
Rocketdyne SSFL Analytical Chemistry

SIGNED: Vonnie Douglas
Rocketdyne SSFL Analytical Chemistry

COPY - original filed with Nov quarterly data

RAD DATA REPORT (ra01)

Groundwater Resources Cons. Inc. * Tuscn

Rad analysis on groundwater (Project GRCI-GROUNDWATER)

Client Sample ID: RD-63
LAL Sample ID: L3299-4

Date Collected: 09-NOV-94
Date Received: 10-NOV-94

Matrix: Water
Login Number: L3299

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Gross Alpha	05-DEC-94	GR ALP/BETA LAL-0060_15843	14.4	5.7	5.5	C	pCi/L
Gross Beta	05-DEC-94	GR ALP/BETA LAL-0060_15843	10.9	3.8	5.3	C	pCi/L

RAD DATA REPORT (ra01)

Groundwater Resources Cons. Inc. * Tucson

Rad analysis on groundwater (Project GRCI-GROUNDWATER)

Client Sample ID: RD-63 LAL Sample ID: L3299-5

Date Collected: 09-NOV-94 Date Received: 10-NOV-94

Matrix: Water Login Number: L3299

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
H-3	07-DEC-94	TRITIUM(H3) LAL-0066_15902	90	180	230		pCi/L

B C Analytical

801 Western Avenue
Glendale, CA 91201
818/247-5737
Fax: 818/247-9797

RECEIVED DEC 1 5 1994

ANALYTICAL REPORT

LOG NO: G94-11-431

Received: 22 NOV 94

Mailed: DEC 1 4 1994

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
11-431-1	RD-63	21 NOV 94

PARAMETER	11-431-1
Halocarbons/EPA 8010	
Date Analyzed	11/28/94
Date Confirmed	11/28/94
Dilution Factor, Times	1
1,1,1-Trichloroethane, ug/L	<0.5
1,1,2,2-Tetrachloroethane, ug/L	<0.5
1,1,2-Trichloroethane, ug/L	<0.5
1,1-Dichloroethane, ug/L	0.96
1,1-Dichloroethene, ug/L	2.3
1,2-Dichloroethane, ug/L	<0.5
1,2-Dichlorobenzene, ug/L	<0.5
1,2-Dichloropropane, ug/L	<0.5
1,3-Dichlorobenzene, ug/L	<0.5
1,4-Dichlorobenzene, ug/L	<0.5
2-Chloroethylvinylether, ug/L	<0.5
Bromodichloromethane, ug/L	<0.5
Bromomethane, ug/L	<0.5
Bromoform, ug/L	<0.5
Chlorobenzene, ug/L	<0.5
Carbon Tetrachloride, ug/L	<0.5
Chloroethane, ug/L	<0.5
Chloroform, ug/L	<0.5
Chloromethane, ug/L	<0.5
Dibromochloromethane, ug/L	<0.5
Dichlorodifluoromethane, ug/L	<0.5
Freon 113, ug/L	<0.5
Methylene chloride, ug/L	1.1
Trichloroethene, ug/L	9.0

BCA

B C Analytical

801 Western Avenue
Glendale, CA 91201
818/247-5737
Fax: 818/247-9797

LOG NO: G94-11-431

Received: 22 NOV 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
11-431-1	RD-63	21 NOV 94

PARAMETER	11-431-1
Trichlorofluoromethane, ug/L	<0.5
Tetrachloroethene, ug/L	<0.5
Vinyl chloride, ug/L	<0.5
cis-1,2-Dichloroethene, ug/L	3.5
cis-1,3-Dichloropropene, ug/L	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5

BCA

SSFL ANALYTICAL CHEMISTRY, EPA #CA183

Rockwell International, Rocketdyne Div.
(818) 586-5827 D/392 SS21

Log Number
94110333

TO: Rocketdyne Environmental Protection
Requester: Neil Mukherjee D/543-000 T486 382-6188
cc: P. Blandino D/543-T486

Report Date: 11/23/94
Date of Analysis: 11/22/94

SAMPLE INFORMATION FOR 94110333

Sample Descrption: Groundwater, RD-63 Effluent
Requested Analysis: 8240
Sampler: REP of GRC Sampler ID#: RD-63

Received: 11/21/94
Sampled: 11/21/94

ANALYTE per SW-846, #8240	RESULT, ug/L
Date Extracted	11/22/94
1,1,1-Trichloroethane (TCA)	<1
1,1,2,2-Tetrachloroethane	<1
1,1,2-Trichloroethane	<1
1,1-Dichloroethane	<1
1,1-Dichloroethylene	<1
1,2-Dichlorobenzene	<1
1,2-Dichloroethane	<1
1,2-Dichloroethylene (cis)	<1
1,2-Dichloroethylene (trans)	<1
1,2-Dichloropropane	<1
1,3-Dichlorobenzene	<1
1,3-Dichloropropene (cis)	<1
1,3-Dichloropropene (trans)	<1
1,4-Dichlorobenzene	<1
2-Butanone	<5
2-Hexanone	<5
4-Methyl-2-Pentanone	<5
Acetone	<20
Benzene	<1
Bromodichloromethane	<1
Bromoform	<1
Bromomethane	<2
Carbon Disulfide	<2
Carbon Tetrachloride	<1
Chloroethane	<2
Chloroform	<1
Chloromethane	<2
Dibromochloromethane	<1
Dichlorodifluoromethane	<5
Ethylbenzene	<1
Freon 113	<5
Methylene Chloride	<2
Monochlorobenzene	<1
Styrene	<2
Tetrachloroethylene	<1
Toluene	<1
Trichloroethylene (TCE)	<1
Trichlorofluoromethane	<1
Vinyl Chloride	<2
Xylenes (Total)	<2

COMMENTS:

APPROVED: Beverly K Hunt
Rocketdyne SSFL Analytical Chemistry

SIGNED:
Rocketdyne SSFL Analytical Chemistry

B C Analytical

801 Western Avenue
Glendale, CA 91201
818/247-5737
Fax: 818/247-9797

ANALYTICAL REPORT

LOG NO: G94-12-096

Received: 07 DEC 94
Mailed : 20 DEC 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
12-096-1	RD-23	06 DEC 94
12-096-2	RD-63 Inf	06 DEC 94

PARAMETER	12-096-1	12-096-2
Halocarbons/EPA 8010		
Date Analyzed	12/15/94	12/16/94
Date Confirmed	12/15/94	12/16/94
Dilution Factor, Times	1	1
1,1,1-Trichloroethane, ug/L	<0.5	<0.5
1,1,2,2-Tetrachloroethane, ug/L	<0.5	<0.5
1,1,2-Trichloroethane, ug/L	<0.5	<0.5
1,1-Dichloroethane, ug/L	<0.5	0.85
1,1-Dichloroethene, ug/L	0.76	2.1
1,2-Dichloroethane, ug/L	2.4	<0.5
1,2-Dichlorobenzene, ug/L	<0.5	<0.5
1,2-Dichloropropane, ug/L	<0.5	<0.5
1,3-Dichlorobenzene, ug/L	<0.5	<0.5
1,4-Dichlorobenzene, ug/L	<0.5	<0.5
2-Chloroethylvinylether, ug/L	<0.5	<0.5
Bromodichloromethane, ug/L	<0.5	<0.5
Bromomethane, ug/L	<0.5	<0.5
Bromoform, ug/L	<0.5	<0.5
Chlorobenzene, ug/L	<0.5	<0.5
Carbon Tetrachloride, ug/L	<0.5	<0.5
Chloroethane, ug/L	<0.5	<0.5
Chloroform, ug/L	<0.5	<0.5
Chloromethane, ug/L	<0.5	<0.5
Dibromochloromethane, ug/L	<0.5	<0.5
Dichlorodifluoromethane, ug/L	<0.5	<0.5
Freon 113, ug/L	<0.5	<0.5
Methylene chloride, ug/L	<0.5	<0.5

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LOG NO: G94-12-096

Received: 07 DEC 94
Mailed : 20 DEC 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
12-096-1	RD-23	06 DEC 94
12-096-2	RD-63 Inf	06 DEC 94

PARAMETER	12-096-1	12-096-2
Trichloroethene, ug/L	97	9.3
Trichlorofluoromethane, ug/L	<0.5	<0.5
Tetrachloroethene, ug/L	<0.5	<0.5
Vinyl chloride, ug/L	<0.5	<0.5
cis-1,2-Dichloroethene, ug/L	7.4	3.2
cis-1,3-Dichloropropene, ug/L	<0.5	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5	<0.5

Mark A. Valentini, PhD, Laboratory Director

BCA

B C Analytical

801 Western Avenue
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LOG NO: G94-12-268

Received: 15 DEC 94

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
12-268-2	RD-63 Inf.	14 DEC 94

PARAMETER	12-268-2
Halocarbons/EPA 8010	
Date Analyzed	12/22/94
Date Confirmed	12/22/94
Dilution Factor, Times	1
1,1,1-Trichloroethane, ug/L	<0.5
1,1,2,2-Tetrachloroethane, ug/L	<0.5
1,1,2-Trichloroethane, ug/L	<0.5
1,1-Dichloroethane, ug/L	0.56
1,1-Dichloroethene, ug/L	1.4
1,2-Dichloroethane, ug/L	<0.5
1,2-Dichlorobenzene, ug/L	<0.5
1,2-Dichloropropane, ug/L	<0.5
1,3-Dichlorobenzene, ug/L	<0.5
1,4-Dichlorobenzene, ug/L	<0.5
2-Chloroethylvinylether, ug/L	<0.5
Bromodichloromethane, ug/L	<0.5
Bromomethane, ug/L	<0.5
Bromoform, ug/L	<0.5
Chlorobenzene, ug/L	<0.5
Carbon Tetrachloride, ug/L	<0.5
Chloroethane, ug/L	<0.5
Chloroform, ug/L	<0.5
Chloromethane, ug/L	<0.5
Dibromochloromethane, ug/L	<0.5
Dichlorodifluoromethane, ug/L	<0.5
Freon 113, ug/L	<0.5
Methylene chloride, ug/L	<0.5

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LOG NO: G94-12-268

Received: 15 DEC 94

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Groundwater Resources Consult.
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Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
12-268-2	RD-63 Inf.	14 DEC 94

PARAMETER	12-268-2
Trichloroethene, ug/L	7.3
Trichlorofluoromethane, ug/L	<0.5
Tetrachloroethene, ug/L	<0.5
Vinyl chloride, ug/L	<0.5
cis-1,2-Dichloroethene, ug/L	2.6
cis-1,3-Dichloropropene, ug/L	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5

Mark A. Valentini, PhD, Laboratory Director

BCA

Lockheed Analytical Services

GROUNDWATER RESOURCES CONSULTANTS, INC.

ANALYTICAL DATA REPORT

FOR

RADIOCHEMISTRY

LOG-IN NUMBER: L3583

QUOTATION NUMBER: Q323540

DOCUMENT FILE NUMBER: 0105445

Lockheed
Environmental Systems

Lockheed Analytical Services
975 Kelly Johnson Drive
Las Vegas, Nevada 89119-3705

Phone: (702) 361-0220
Phone: (800) 582-7605
Fax: (702) 361-8146

January 23, 1995

Mr. Shel Clark
GROUNDWATER RESOURCES CONSULTANTS, INC.
6200 East 14th Street, Suite A200
Tucson, AZ 85711

RE: Log-in No: L3583
Quotation No: Q323540
Document File No: 0105445

The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 5 January 1995.

The temperature of the cooler upon receipt was 12°C. Sample containers received agree with the chain-of-custody documentation. Sample containers were received intact. Samples were received in time to meet the analytical holding time requirements. All discrepancies identified upon receipt of the samples have been forwarded to the client and are documented in the enclosed chain-of-custody records.

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Chet Frank at (702) 361-3955, ext. 272.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

Chet A. Frank

Chet Frank
Client Services Representative

CF/ymj
cc: Client Services
Document Control

CASE NARRATIVE
RADIOCHEMICAL ANALYSES

The routine calibration and quality control analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, and duplicate samples.

Holding Time Requirements

All holding time requirements were met.

Analytical Method

Gamma Spectrum analysis

The Gamma Spectrum analysis was analyzed using LAL-91-SOP-0064. Bi-214 and Pb-214 were above the MDA; however, this does not seem to effect the sample results. The QC for the analytical batch was shared with another batch (17776), and a sample from another client was used for the sample duplicate analysis. All other QC criteria were met.

Gross Alpha Beta

The gross alpha beta analysis was performed using LAL-91-SOP-0060. No problems were encountered during analysis. A sample from another client was used for the sample duplicate analysis. All QC criteria were met.

Tritium

The tritium analysis was performed using LAL-91-SOP-0066. No problems were encountered during analysis. A sample from another client was used for the sample duplicate analysis. All QC criteria were met.

Yvonne M. Jacoby
Prepared By

January 23, 1995
Date

Lockheed Analytical Services
DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES
[Revised 08/28/92]

For Use on the Analytical Data Reporting Forms	
B	Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL) and/or minimum detectable activity (MDA).
C	Presence of high TDS in sample required reduction of sample size which increased the MDA.
D	Constituent detected in the diluted sample.
E	Constituent concentration exceeded the calibration or attenuation curve range.
F	***For Alpha Spectrometry Only***-- FWHM exceeded acceptance limits.
H	Sample analysis performed outside of method-specified maximum holding time requirement.
Y	Chemical yield exceeded acceptance limits.
For Use on the QC Data Reporting Forms	
*	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
a[1]	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
b[1]	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

[1] Used as foot note designations on the QC summary form.

RAD DATA REPORT (ra01)

Groundwater Resources Cons. Inc. * Tuscn

Rad analysis on groundwater (Project GRCI-GROUNDWATER)

Client Sample ID: RD-63 LAL Sample ID: L3583-1

Date Collected: 04-JAN-95 Date Received: 05-JAN-95

Matrix: Water Login Number: L3583

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
Gross Alpha	13-JAN-95	GR ALP/BETA LAL-0060_17783	8.7	5.2	6.2	C	pCi/L
Gross Beta	13-JAN-95	GR ALP/BETA LAL-0060_17783	7.7	4.1	6.2	C	pCi/L

RAD DATA REPORT (ra01)

Groundwater Resources Cons. Inc. * Tuscn

Rad analysis on groundwater (Project GRCI-GROUNDWATER)

Client Sample ID: RD-63
LAL Sample ID: L3583-3

Date Collected: 04-JAN-95
Date Received: 05-JAN-95

Matrix: Water
Login Number: L3583

Constituent	Analyzed	Batch	Activity	Error	MDA	DataQual	Units
H-3	12-JAN-95	TRITIUM(H3) LAL-0066_17781	350	210	250		pCi/L

B C Analytical

801 Western Avenue
Glendale, CA 91201
818/247-5737
Fax: 818/247-9797

ANALYTICAL REPORT

RECEIVED JAN 2 3 1995

LOG NO: G95-01-064

Received: 04 JAN 95

Mailed: JAN 20 1995

Mr. Chuck Dickens
Groundwater Resources Consult.
6200 East 14th Street, Suite A200
Tucson, Arizona 85711-4029

Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
01-064-1	RD-63	04 JAN 95

PARAMETER	01-064-1				
Digestion (3010), Date	01/11/95				
Furnace Digestion (3020), Date	01/06/95				
Ion Balance, Percent	1.7				
Nitrate+Nitrite					
Nitrate+Nitrite (as NO3), mg/L	<0.1				
Nitrate+Nitrite (as N), mg/L	<0.02				
Conductivity (120.1), umhos/cm	920				
Fluoride, mg/L	0.57				
Sulfate, mg/L	130				
pH (150.1/9040), Units	6.8				
Dissolved Solids (160.1), mg/L	620				
Alkalinity (310.1)					
Carbonate Alk (as CaCO3), mg/L	<1				
Bicarbonate Alk (as CaCO3), mg/L	310				
Hydroxide Alk (as CaCO3), mg/L	<1				
Total Alkalinity (as CaCO3), mg/L	310				
Chloride (325.3), mg/L	50				
Arsenic (7060/206.2), mg/L	<0.002				
Barium (6010/200.7), mg/L	0.047				
Cadmium (7131/213.2), mg/L	<0.001				
Calcium (6010/200.7), mg/L	120				
Chromium (7191/218.2), mg/L	<0.005				
Iron (6010/200.7), mg/L	<0.04				
Lead (7421/239.2), mg/L	0.0045				
Magnesium (6010/200.7), mg/L	24				
Manganese (6010/200.7), mg/L	0.035				
Mercury (7470/245.1), mg/L	<0.0002				
Potassium (6010/200.7), mg/L	3.4				

BCA

B C Analytical

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LOG NO: G95-01-064

Received: 04 JAN 95

Mr. Chuck Dickens
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Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
01-064-1	RD-63	04 JAN 95

PARAMETER	01-064-1
Selenium (7740/270.2), mg/L	<0.004
Sodium (6010/200.7), mg/L	43

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REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
01-064-1	RD-63	04 JAN 95

PARAMETER	01-064-1
Halocarbons/EPA 8010	
Date Analyzed	01/12/95
Date Confirmed	01/12/95
Dilution Factor, Times	1
1,1,1-Trichloroethane, ug/L	<0.5
1,1,2,2-Tetrachloroethane, ug/L	<0.5
1,1,2-Trichloroethane, ug/L	<0.5
1,1-Dichloroethane, ug/L	0.63
1,1-Dichloroethene, ug/L	2.4
1,2-Dichloroethane, ug/L	<0.5
1,2-Dichlorobenzene, ug/L	<0.5
1,2-Dichloropropane, ug/L	<0.5
1,3-Dichlorobenzene, ug/L	<0.5
1,4-Dichlorobenzene, ug/L	<0.5
2-Chloroethylvinylether, ug/L	<0.5
Bromodichloromethane, ug/L	<0.5
Bromomethane, ug/L	<0.5
Bromoform, ug/L	<0.5
Chlorobenzene, ug/L	<0.5
Carbon Tetrachloride, ug/L	<0.5
Chloroethane, ug/L	<0.5
Chloroform, ug/L	<0.5
Chloromethane, ug/L	<0.5
Dibromochloromethane, ug/L	<0.5
Dichlorodifluoromethane, ug/L	<0.5
Freon 113, ug/L	<0.5
Methylene chloride, ug/L	<0.5

BCA

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LOG NO: G95-01-064

Received: 04 JAN 95

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Tucson, Arizona 85711-4029

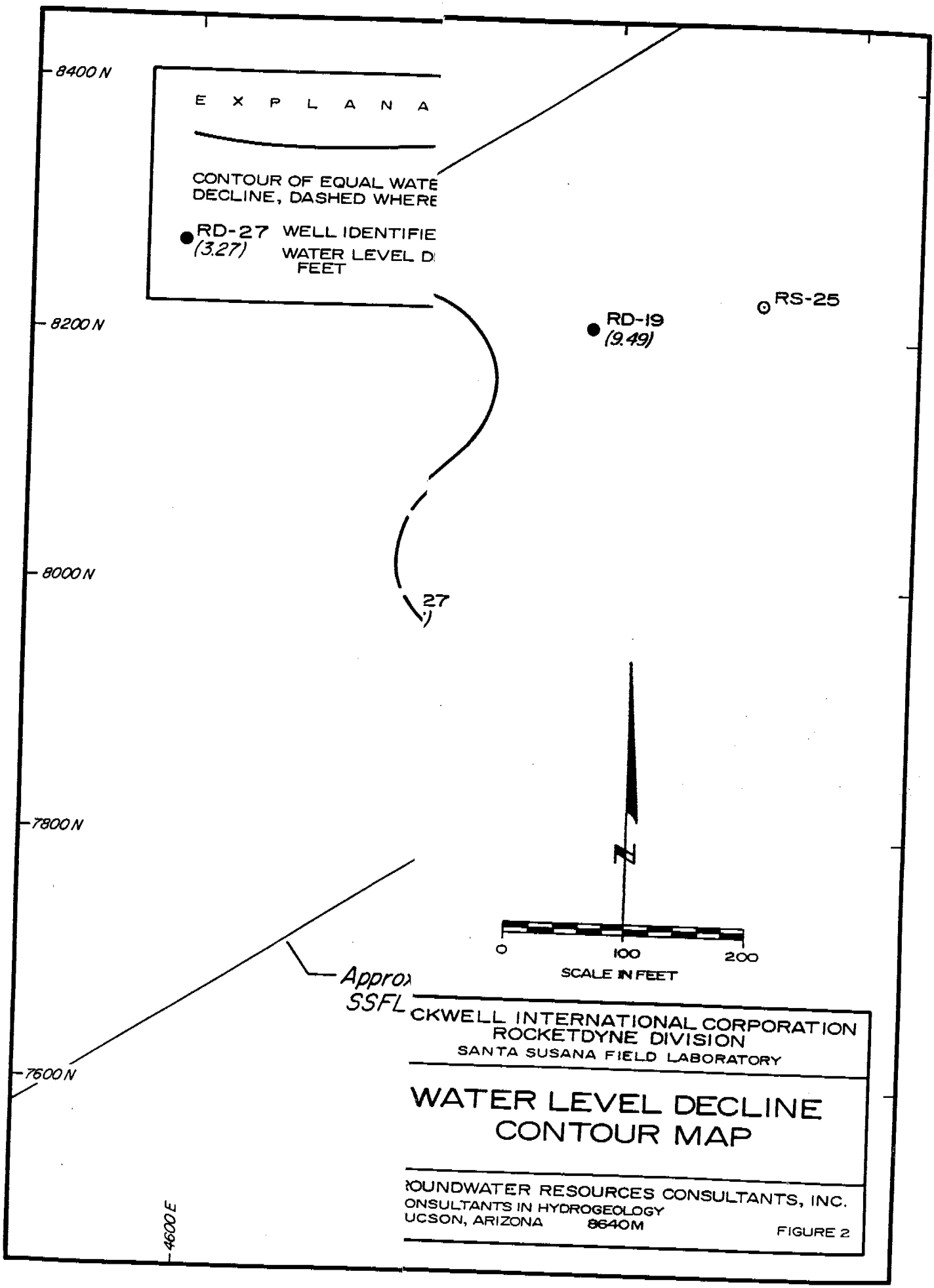
Project: 8640.DOE.PILOT

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
01-064-1	RD-63	04 JAN 95

PARAMETER	01-064-1
Trichloroethene, ug/L	9.0
Trichlorofluoromethane, ug/L	<0.5
Tetrachloroethene, ug/L	0.57
Vinyl chloride, ug/L	<0.5
cis-1,2-Dichloroethene, ug/L	2.3
cis-1,3-Dichloropropene, ug/L	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5

BCA



ROCKWELL INTERNATIONAL CORPORATION
ROCKETDYNE DIVISION
SANTA SUSANA FIELD LABORATORY

WATER LEVEL DECLINE CONTOUR MAP

GROUNDWATER RESOURCES CONSULTANTS, INC.
CONSULTANTS IN HYDROGEOLOGY
TUCSON, ARIZONA 8640M

FIGURE 2

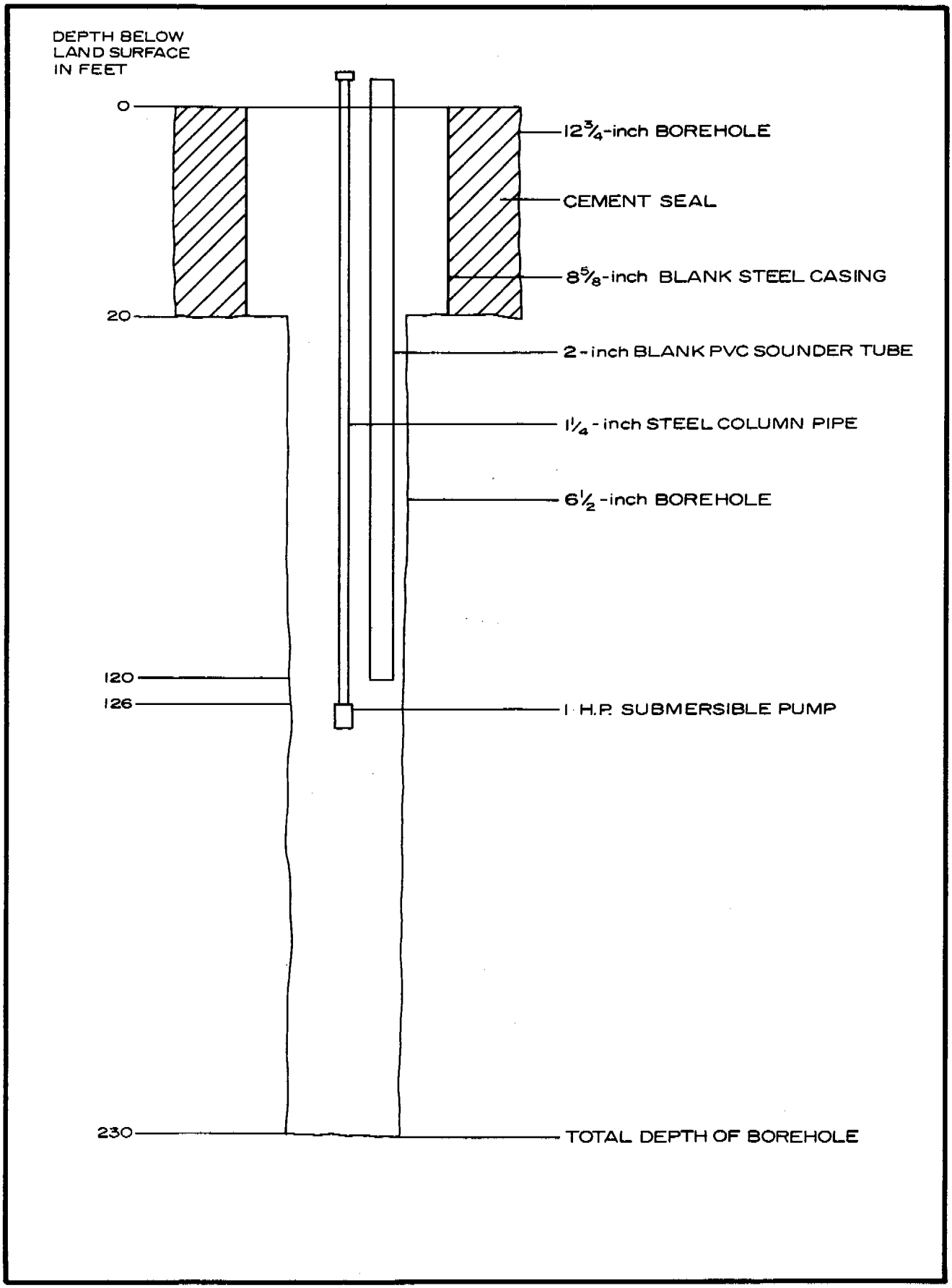


FIGURE 3
SCHEMATIC DIAGRAM OF MONITOR WELL RD-63

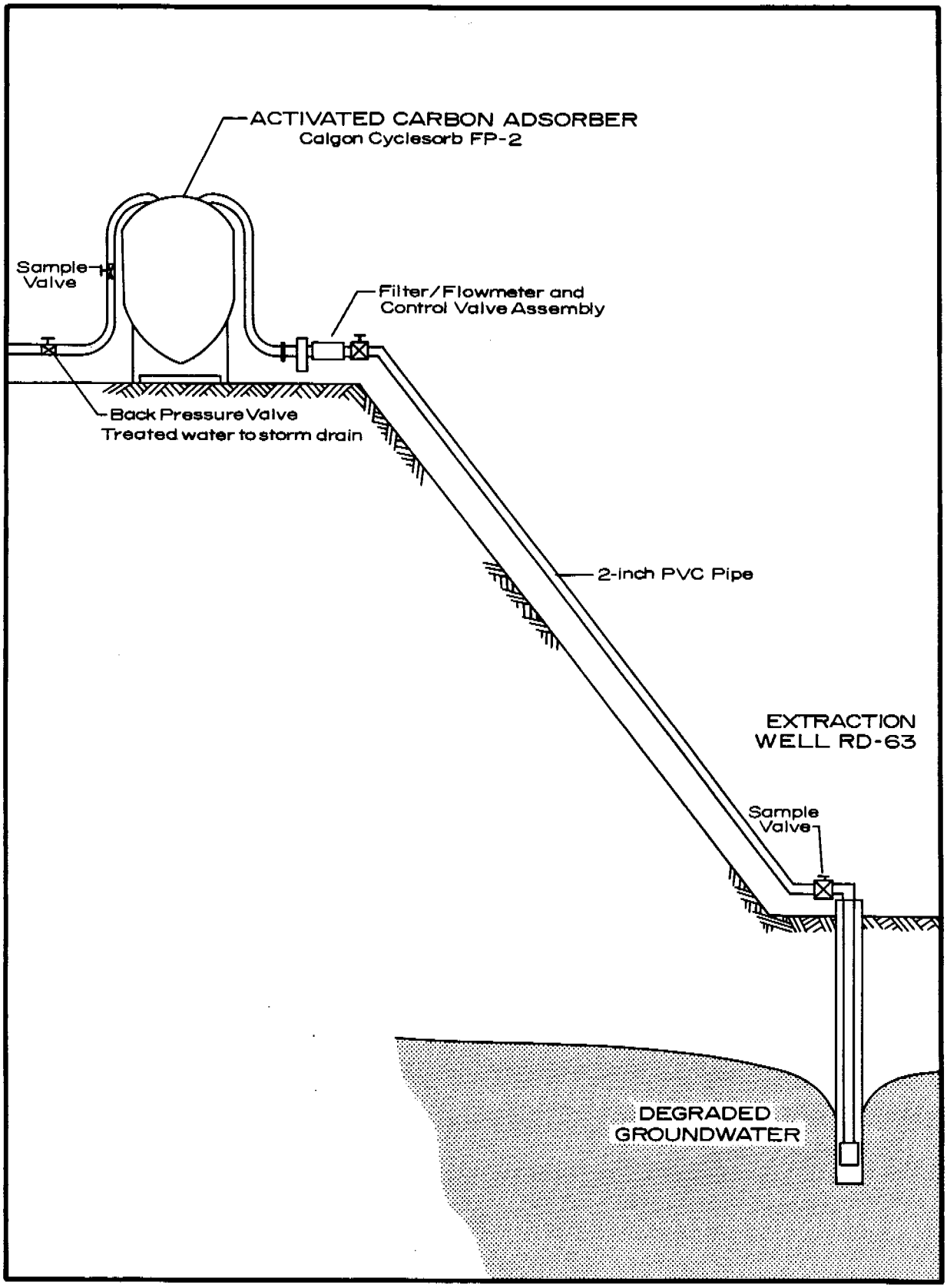


FIGURE 4
SCHEMATIC OF SYSTEM COMPONENTS

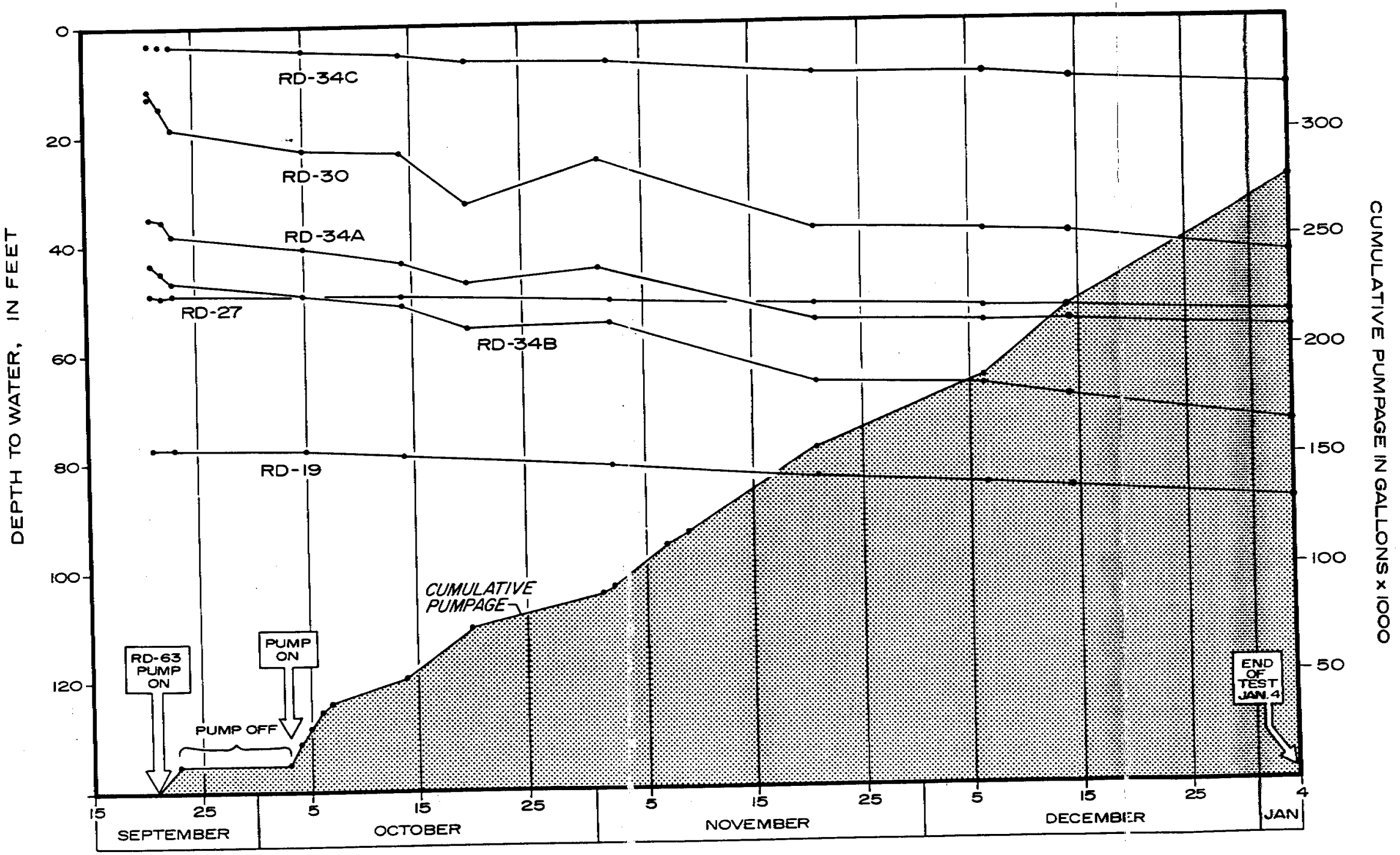
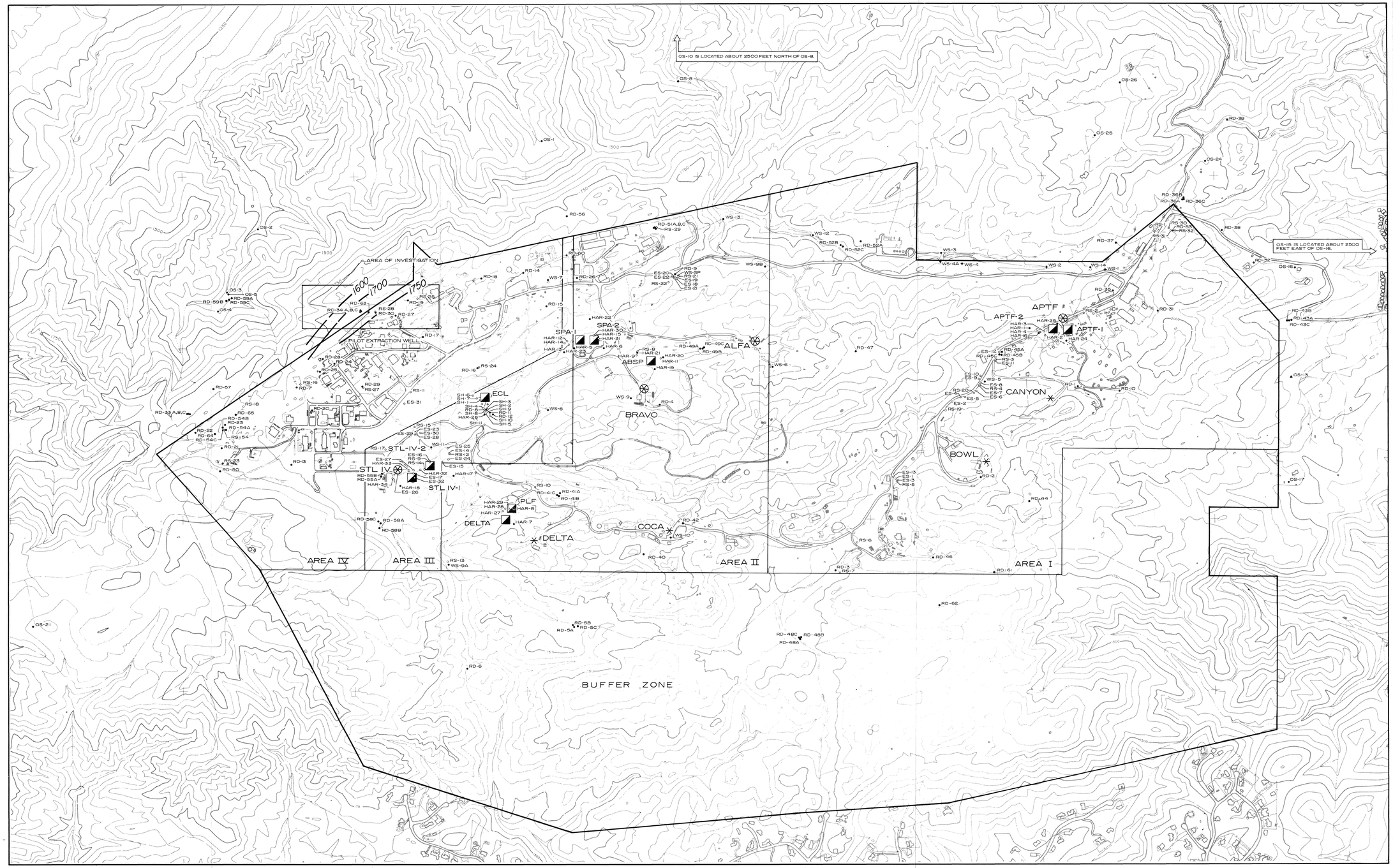


FIGURE 5
CUMULATIVE PUMPAGE AND WATER LEVEL CHANGES



EXPLANATION

- CHATSWORTH FORMATION WELL
- SHALLOW ZONE WELL
- SPRING
- ABANDONED WELL
- ACTIVE TEST STAND
- FORMER OR INACTIVE TEST STAND
- RCRA IMPOUNDMENT
- 1750 — CONTOUR OF EQUAL WATER LEVEL ELEVATION, FEET ABOVE MEAN SEA LEVEL (NOVEMBER 1994)

FEET
0 500 1000

Results of Well RD-63 Pilot Extraction Test, RMDF Area

ROCKWELL INTERNATIONAL CORPORATION
ROCKETDYNE DIVISION
SANTA SUSANA FIELD LABORATORY

AREA OF INVESTIGATION RMDF PILOT EXTRACTION TEST

GROUNDWATER RESOURCES CONSULTANTS, INC.
CONSULTANTS IN HYDROGEOLOGY
TUCSON, ARIZONA 8640M-253 FIGURE 1

8400 N

8200 N

8000 N

7800 N

7600 N

4600 E

4800 E

5000 E

5200 E

5400 E

5600 E

EXPLANATION

CONTOUR OF EQUAL WATER LEVEL DECLINE, DASHED WHERE PROJECTED

RD-27 WELL IDENTIFIER
(3.27) WATER LEVEL DECLINE IN FEET

Extraction Well

RD-34B (29.96)

RD-34A (19.57)

RD-34C (8.29)

RD-63

RS-28

RD-30 (31.49)

RD-19 (9.49)

RS-25

RD-27 (3.27)

30

10

Approximate Location of SSFL Facility Boundary

N

0 100 200

SCALE IN FEET

ROCKWELL INTERNATIONAL CORPORATION
ROCKETDYNE DIVISION
SANTA SUSANA FIELD LABORATORY

WATER LEVEL DECLINE CONTOUR MAP

GROUNDWATER RESOURCES CONSULTANTS, INC.
CONSULTANTS IN HYDROGEOLOGY
TUCSON, ARIZONA 8640M

FIGURE 2