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October 27, 1982

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GROUND WATER MONITORING PROJECT  
URANIUM MILL TAILINGS IMPOUNDMENT  
MOAB, UTAH  
FOR ATLAS MINERALS

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# Dames & Moore



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October 27, 1982

Atlas Minerals  
P.O. Box 1207  
Moab, Utah 84532

Attention: Mr. Richard E. Blubaugh

Gentlemen:

Transmitted herein are 10 copies of our report entitled "Ground Water Monitoring Project, Uranium Mill Tailings Impoundment, Moab, Utah, For Atlas Minerals."

Nine monitor wells were installed during this project. Water quality data from monitor wells ATP-2-S, MW-1-R and MW-2-R indicate effects of tailings impoundment seepage and/or effects of other past site activities. Elevated sulfate and nitrate concentrations are evident in the affected area. Radionuclide levels appear to be within MPC for unrestricted areas. Based upon the overall hydraulic gradient, shallow ground water including seepage moves towards and ultimately discharges into the Colorado River. Ground water northwest of the site and southeast of the Colorado River is hydraulically upgradient from the site. Existence of the brine underneath the site precludes deep seepage movement. The major off-site impact of seepage then appears to be discharge to the Colorado River. Given the large discharge of the Colorado River and the relatively low estimated seepage rate, seepage is diluted to extremely low levels in the river. As demonstrated by the surface water monitoring data, there is negligible difference in water quality above and below the Atlas mill thus, impacts are insignificant.

We appreciate the opportunity of performing this service for you. Please call if you have any questions.

Very truly yours,

DAMES & MOORE

George C. Toland  
Partner

GCT:GWC/fl

GROUND WATER MONITORING PROJECT  
URANIUM MILL TAILINGS IMPOUNDMENT  
MOAB, UTAH  
FOR ATLAS MINERALS

INTRODUCTION

This report presents the results of the ground water monitoring project conducted for Atlas Minerals, Moab, Utah. The purposes of this work were to install ground water monitoring wells and to assess contaminant migration.

This project was conducted in two phases and is summarized herein. Appendices A and B detail the data collected during this project. Three previous letters (Dames & Moore, 1981a; 1982a; 1982b - see "References") provided preliminary findings and recommendations.

OBJECTIVES AND SCOPE

The objectives and scope of the study were outlined in our proposal dated July 30, 1981 and our letter dated April 21, 1982 giving recommendations for Phase II wells.

The overall objective of the study was to assess the site hydrogeology, controls on seepage movement, and contaminant migration. The following specific objectives were accomplished:

1. Professional supervision of the drilling and well completion operations.
2. Evaluation of available information from past and the current study to determine the characteristics and depth to bedrock across the mill property. This objective was curtailed due to the occurrence of brines in the alluvium which made further evaluation of bedrock characteristics unnecessary.
3. Evaluation of data regarding the hydrogeologic characteristics of alluvial sediments across the mill site.
4. Measurement of the location (depth) of the brine/low salinity water interface.

5. An alluvial aquifer water table map was prepared. Maps of bedrock elevations and thickness of alluvial sediment could not be prepared due to the curtailment of the bedrock study.
6. Measurement of water levels and ground water hydraulic gradients across the site and probable temporal variations.
7. Evaluation of whether the Colorado River is a recharging or discharging stream to the alluvial aquifer and how these conditions may vary with time and season.
8. Evaluation of the extent of seepage contaminant plume.
9. Assessment of the direction and potential rate of movement of present or potential seepage contaminants.
10. An overall assessment and description of the impact of the tailing impoundment on water table elevations and water quality.

The following Phase I scope of work was accomplished:

1. Recommendations on the drilling, construction and field procedures for installation of the Phase I monitor wells.
2. Inspection of the drilling and completion of the Phase I wells located between the tailings impoundment and the Colorado River.
3. Collection of lithologic samples and preparation of drilling and lithologic logs for the wells.
4. Supervision of geophysical logging and interpretation of the geophysical well logs.
5. Evaluation of lithologic samples and gravel pack; checking of screen slot sizes; and selection of screened, cased and grouted intervals.
6. Inspection of the completion operations of the wells, including grouting, surfacing casing placement, capping, and well development.
7. The pumping and sampling of water quality samples in accordance with EPA recommendations.
8. Preparation of a Phase I report.

The following work was accomplished in Phase II:

1. Preparation of written recommendations for Phase II monitor wells.
2. Field services for the Phase II work similar to that outlined above for Phase I.
3. Preparation of this summary report.



## BACKGROUND

The Atlas Minerals Uranium Mill is located on the west side of the Colorado River, about 3 miles northwest of the city of Moab, in Grand County, southeastern Utah. The plant property is bounded by the Colorado River, U.S. Highway 163, and extends across Utah Highway 279 on the west and southwest sides.

A tailings pond was built in 1956 to store mill tailings and tailings storage in the pond continues to present. The tailings impoundment area now occupies an area of 130 acres.

A number of studies have been conducted at the site. The References section of this report gives a partial listing of studies performed specifically for the Atlas site as well as other published literature.

## GENERAL GEOLOGY

The following is meant only to acquaint the reader with the general geology of the site and surrounding areas. Detailed discussion of regional and site geology are presented in the Safety Analysis Report, Atlas Minerals Division, Atlas Corporation, Moab Uranium Mill, 1975. Further discussion and details are provided in Joesting, Case, and Plouff (1966), Hunt (1956), Williams (1964), and Hemphill (1955). A bibliography of geologic and soil investigations conducted for Atlas Minerals and others is included within this report.

The site is located within the Canyonlands section of the Colorado Plateau physiographic province on the alluvium of the Colorado River. The general area is one of high relief in which outcrops of Lower Mesozoic and Upper Paleozoic rock units form near vertical cliffs with relief in excess of 2,000 feet. These cliffs result from the incision of the Colorado River into the uplifted rock units of the Colorado Plateau.

The exposed rock units range in age from Quarternary to Upper Paleozoic. The Quarternary age units are generally composed of river alluvium and flood plain sediments which have been deposited along the Colorado River, Moab Wash

and other streams as well as slope wash, talus deposits and eolian sands. The Quarternary sediments are located on an erosional surface present in the bedrock units of Lower Mesozoic and Upper Paleozoic age. No rock units of Tertiary or Cretaceous age are present in the near vicinity of the site. The Lower Mesozoic units present near the site are generally fine-grained sandstones and shales. The most notable units of this age are the sandstones of the Glen Canyon group (Navajo, Keyenta, and Wingate Formations) and the siltstones, sandstones, and shales of the Chinle and Moenkopi Formations. The Upper Paleozoic Age sediments exposed in the near vicinity of the site include the conglomerates, sandstones and shale units of the Permian Cutler and Rico Formations. These formations are underlain by Pennsylvanian limestones and evaporites of the Hermosa Formation, as well as older sediments of the Paleozoic age.

The tailings impoundment site is located upon alluvial, eolian, talus and slope wash deposits. A generalized stratigraphic column, a site geologic map and a site geologic cross-section are presented in Figures 2.4-3, 2.4-6 and 2.4-7 of the Safety Analysis Report (Dames & Moore, 1975). In the exposed bedrock located immediately north and west of the site, several geologic structures have been noted. These structures include the Moab anticline and four normal faults located on the west dipping limb of the Moab anticline (Hemphill, 1955). While no evidence of any faults can be observed within the plant site, one of the faults shown in Hemphill (1955) is inferred to be present in the bedrock beneath the site and has presumably been covered by the alluvium of the Colorado River. The origin of this anticlinal structure is inferred to result from flowage of evaporite deposits of the Paradox Member of the Hermosa Formation. The normal faulting is presumed to have occurred as the result of the collapse of the anticline caused by the partial removal of salt by continued flowage and solutioning (Joestling, et. al., 1966). The exact amount of displacement along these faults is uncertain; however, Williams (1964), shows approximately 500 feet of displacement in the westernmost of these faults.

### BEDROCK-ALLUVIUM CONTACT

The tailings disposal area overlies alluvial sediments of the Colorado and Moab Wash as well as talus and slope wash deposits along the western edge of the tailings impoundment. The depth to bedrock ranges from an elevation of less than 3,563 feet as shown by Boring ATP-1 (see Appendix A) to a maximum elevation of 3,938 feet in Boring B-4 (see Dames & Moore, 1979). Four borings are believed to have encountered bedrock. Boring data from these holes and others which did not encounter bedrock to the depths drilled suggest that the bedrock surface is generally above 3,925 feet in the western two-thirds of the tailings impoundment. In the northeastern third of the tailings impoundment, the bedrock surface is believed to be below 3,925 feet and the data from Boring ATP-1 indicates that the bedrock-alluvium contact in this area is perhaps much lower. Boring ATP-1 was drilled to a depth of 405 feet (elevation 3,563 ft) and did not encounter bedrock. The thick alluvial deposits encountered in this boring indicate significant relief in the bedrock surface. Several possible explanations for the occurrence of this relief in the bedrock surface are: 1) the existence of a deep erosional channel formed by the Colorado River or Moab Wash during earlier stages in the development of the Colorado River system, or 2) the thickening of gravel deposits over areas where the underlying salt has been removed by solutioning. Geologic data for other river systems have shown the development of deep erosional channels in the bedrock surface beneath many rivers. These erosional channels are particularly deep where the rivers have been subjected to increased discharges during the Pleistocene. The development of deep solution collapse features caused by the removal of salt by ground water has been shown to occur in the northeastern end of the Spanish Valley (Puffett, 1957). Spanish Valley is located south of the site. The occurrence of saline waters in the wells completed within borings ATP-1 and ATP-2 tend to support this explanation. However, based on the data available, no definite cause for the occurrence of this relief in the bedrock channel can be identified.

## HYDROLOGY

The principal aquifers in this region are the bedrock and alluvial aquifers.

### BEDROCK AQUIFER

The sandstone formations of the Glen Canyon Group form laterally extensive bedrock aquifers near the site. Although other formations in the vicinity contain permeable rock strata these units generally have low hydraulic conductivities and act as aquicludes or aquitards. Deeper bedrock units such as the Rico and Hermosa Formations may also be considered aquifers; however, the presence of evaporite deposits in the Hermosa renders it useless for most domestic and industrial purposes.

The sandstone formations of the Glen Canyon Group have reported well yields ranging from 0.2 to 2,500 gallons per minute; however, well yields in the range of 5 to 10 gallons per minute are more typical of these formations. The primary permeabilities of these units are low due to their fine grain-size and cementation of the inter-granular pore space. The majority of their hydraulic conductivity results from secondary permeability along fractured zones. Water qualities of these units are generally good.

Near the site only one well produces water from any of the bedrock units. This well is located approximately two miles north of the site at Arches National Park and is completed within the Navajo Formation. The locations of other bedrock wells in the vicinity of the site are inventoried in Section 2.3 of the Safety Analysis Report prepared by Dames & Moore (1975). Figure 2.3-1 of that report gives a summary of water bearing properties of aquifers in the region.

### ALLUVIAL AQUIFER

The alluvial aquifer is formed of principally alluvium and flood plain deposits of the Colorado River. Alluvial deposits from tributaries to the Colorado River also form part of the alluvial aquifer system, as do sheet wash

and talus deposits. Near the Colorado River, deposits generally above elevation 3950 feet tend to be lenticular deposits of fine-grained poorly-sorted sands and silts with some fine gravel and clays. Below this elevation, the deposits are generally clean, well-sorted river gravels and sands. With distance from the Colorado River, the coarse, clean granular deposits grade out and finer, poorly-sorted deposits indicative of deposition from Moab Wash and local areas predominate. These relationships are shown on Figure 2.3-4 of the SAR (Dames & Moore, 1975) and on the many boring logs. Hydraulic conductivities of the coarse, clean granular deposits are very high compared to other soils at the site. While no pumping tests have been conducted on these materials, hydraulic conductivities are probably in excess of 100,000 feet per year. Hydraulic conductivities of the finer, poorly-sorted materials are probably two to three orders of magnitude less.

Boring ATP-1 was drilled to 400 feet to locate the bedrock-alluvium contact (see Appendix A). The boring did not intersect the bedrock; however, it did encounter a salt water brine from approximately 85 feet to the total depth of the boring. The brine interface was found to lie at elevation 3872 feet in boring ATP-2 (see Appendix A). Due to the high permeability of the alluvium and relatively high density of the brine, it is reasonable to believe that the brine interface extends throughout the alluvium at an elevation of approximately 3,880 feet. The existence of this brine renders the entire thickness of the alluvial aquifer below the interface useless for all normal domestic and industrial purposes and severely restricts the portion of the aquifer above the interface, as any significant pumpage from this zone would accelerate the rate at which this natural brine escapes into the Colorado River.

#### WATER LEVELS AND GRADIENTS

The depth to water in the alluvium ranges from approximately 5 to 50 feet depending on the ground surface elevation and well construction. The location of the alluvial wells in which water levels have been measured and the respective water elevations on September 21 to 23, 1982, are shown on Plate 2. As



is readily observed from Plate 2, the water level elevations are variable. The cause of this variation stems from the following:

1. Variations in the well depths and water quality of the aquifer. The presence of brine in this aquifer causes the water level elevations to vary depending on the depth of the well and the density of the water.
2. Relatively rapid changes in the elevation of the surface waters of the Colorado River. That is, at the time of water level measurements the water levels are not in equilibrium with each other or with the Colorado River due to recent changes in the elevation of the river.
3. Phreatophyte discharge as it may affect water levels in shallow wells along the Colorado River.
4. Possible measurement errors.

Water level elevations shown on Plate 2 indicate that at the time of measurement, the Colorado River was losing water into the alluvium near the edge of the river. This situation probably resulted from a recent increase in the elevation of the surface waters in the Colorado River. As indicated by the data discussed below, the Colorado River generally gains rather than loses water in this reach of the river. The river controls the base elevation of the water table near the site.

An overall low gradient toward the Colorado River is indicated. Water levels in the northwestern area were two feet higher than the Colorado River and four feet higher than levels in the wells southeast of the tailings impoundment. The potentiometric surface in Moab Valley, southeast of the site and across the river, also slopes toward the Colorado River [see Figure 2.3-2 of the SAR (Dames & Moore, 1975)]. Water levels at the Arches National Park Headquarters well (the bottom of the well is 10 feet higher than water levels at the Atlas site) indicate an overall gradient toward the Colorado River on the northwest side of the Colorado River.

Past water level data (see Dames & Moore, 1982c) indicate that ground water levels generally fluctuate less than one foot over the year at locations away from the river. In wells near the Colorado River (within 500 feet),

more rapid changes have been noted; these often exceed several feet over a period of two months. This response appears directly related to river level changes, but with a smaller magnitude of change.

Water levels are also available for piezometers placed in the tailings impoundment for stability monitoring purposes. These show that water levels in and immediately below the tailings are a function of the depth of the monitoring device and existence of nearby low permeability layers. The data show a vertical hydraulic gradient of less than one.

Water level elevations measured in the four ATP-1-series wells were all within 1.1 feet of each other and indicated a slightly lower elevation with increasing depth of the wells. However, to measure the true relative potentiometric surfaces in the wells, corrections must be made for the differences in salinity of the water. Considering salinity variations, there is negligible differences in the potentiometric surface of the four wells as would be expected from the lack of confining beds. Due to differences in the density of the brine and fresh water, there is no potential for Colorado River water to move vertically downward without completely mixing with the deeper waters. Similarly, tailings pond seepage with a total dissolved solids concentration on the order of 60,000 mg/l (as reported by Atlas Minerals) would not be able to move vertically downward without mixing with and attaining the same density as the brine.

#### WATER QUALITY

Water quality data obtained during this program are given in Appendix B. Samples were collected and analyzed from each of the four wells at Site ATP-1 during Phase I. Since these all contained brine, only the shallowest, well ATP-1-S, was resampled during Phase II. Table 1 summarizes water quality data for key chemical constituents. These parameters are most useful for indicating major water types and effects of the disposal operations.

Water from deeper levels at the site are classified as brine, having total dissolved solids (TDS) concentrations exceeding 100,000 milligrams per liter (mg/l). The brine is caused by contact of ground water with evaporites of the Paradox Member of the Hermosa Formation. All four wells of the ATP-1



series contain brine. Saline water was also reported for two old wells (Wells "A" and "B") drilled to depths of 131 and 114 feet, respectively (see SAR, section 2.3). The wells were located on the west side of the tailings impoundment as shown on Plate 2. A relatively sharp interface exists between the brine and overlying waters of much lower salinity. The interface lies at a depth of 85 feet (elevation 3872) as determined from detailed sampling at site ATP-2 (see Appendix A, especially Plate A-1D). The brine has a TDS level of over 100,000 mg/l; sodium chloride is the principal constituent. Sulfate concentration is small relative to chloride. While chloride concentration is on the order of 54,000 mg/l, sulfate is 4,400 mg/l, giving a chloride to sulfate ratio of 12. Concentrations increase only slightly with depth. This data is believed representative of "background" for the brine. Waters from the three shallowest wells of the ATP-1-series (Well S, Well IS and Well ID) are quite similar and reflect an extremely small, if any, increase in salinity with depth. Well ATP-1-D is somewhat more saline than the shallower wells. Major and trace ions show a similar relationship to that of general salinity and generally show no indication of downward or vertical mixing of tailings effluent. Radium-226 shows a slightly decreasing concentration with depth. It is extremely unlikely that radium values have any relationship to seepage given the low values measured in wells ATP-2-S, MW-1-R and MW-2-R.

Water from Well ATP-3 represents background of another type; it represents water that percolates into alluvium and moves slowly down Moab Wash. As indicated by the data on Table 1, TDS is 1,386 ppm, chloride is 496 ppm, and sulfate is 223 ppm; the chloride to sulfate ratio is 2.2. Since this well is located very near Moab Wash and the effects of local recharge and direct stream infiltration, it is probably indicative of the best ground water quality on the site.

Water quality in the Colorado River, as measured at Cisco, Utah (see Table 2) is variable, but in general ranges from 400 to 1,000 mg/l TDS, depending upon discharge. Sulfate exceeds chloride by a factor of about 2.3.

Ground water samples from wells ATP-2-S, MW-1-R and MW-2-R show concentrations of sulfate which exceed all others on Table 1, including the brine.

Also, nitrate and ammonia are high compared to the others. These are indicative of seepage effects from the tailings pile and/or of past impoundment of liquids near the toe of the pile. The pH appears slightly lower in wells MW-1-R and MW-2-R than the other wells, but is still alkaline. It is not possible to determine the level of dissolved heavy metals since these analyses were not run. However, heavy metal concentrations would be expected to be relatively low due to the near-neutral pH of the ground water. Water from well ATP-2-D shows sulfate and nitrate concentrations that are somewhat higher than those for deeper brines while TDS and chloride are lower. This indicates some mixing of the brine and overlying water due to the well screen lying across the brine interface. Water from well ATP-1-S which lies entirely within the brine does not show indications of tailings pond seepage.

Table 3 gives the results of triplicate analyses for radionuclides. Radium-226 levels are all below the drinking water standard of 5 pCi/l. Agreement among the triplicate analyses for each parameter is relatively good except in a few cases. All measured radionuclides concentrations are below MPC for unrestricted areas except for two lead-210 analyses made by Eberline (analyses by Alpha Nuclear showed the concentrations to be below the MPC of 100 pCi/l). The reason for the large difference in the measured results for lead-210 (<2 vs. 260 pCi/l in well ATP-2-S; and 18 vs. 1900 pCi/l in well MW-2-R) is not clear, but is likely due to laboratory error. Future sampling and analysis will be necessary to clarify the results for lead-210.

Although uranium-natural is well below MPC, the reported concentration in  $\mu\text{g}/\text{l}$  in well MW-2-R is notably higher than in other wells. Well MW-2-R is located close to a former barium chloride treatment pond at the toe of the tailings pile. It appears that the relatively high uranium values measured in well MW-2-R are a result of seepage or spills from the old pond and entrapment in the relatively low permeability soils in which the well is completed.

#### SEEPAGE IMPACTS

Water quality data from monitor wells ATP-2-S, MW-1-R and MW-2-R indicate effects of tailings impoundment seepage and/or effects of other past site

activities such as the impoundment of liquids in the old barium treatment ponds. Based upon the overall hydraulic gradient, shallow ground water including seepage moves towards and ultimately discharges into the Colorado River. Actual discharge is probably distributed over a wide reach of the river. With the cyclic rise and fall of the river on a seasonal basis, periodic influx of surface water and flushing of ground water adjacent to the river occurs. The highest rate of ground water discharge probably occurs during low flow in the Colorado River. Estimates of seepage quantity rates and velocities are given in the SAR (sections 2.3.1.3.2 and 2.3.1.3.4). Based upon available data, we believe that better estimates cannot be made at this time. We believe that the use of a water balance provides the most reliable estimate of seepage quantities. Actual velocity of ground water movement would be highly variable depending on the permeability of the individual stratum involved. The overall velocity is quite low, ranging from a few feet per year to several tens of feet per year (see SAR, section 2.3.1.3.4).

The areal extent of seepage contamination is unclear, but appears to be closely associated with the tailings impoundment. Water in well ATP-3 appears unaffected by seepage despite its proximity to the tailings.

The only known active water well northwest of the Colorado River is the one at Arches National Park headquarters. All other wells are on Atlas Minerals property and are abandoned. Since the bottom of the Arches well is about 10 feet above the elevation of the water table at the Atlas site, pumping at Arches cannot induce ground water flow from the site. Ground water southeast of the Colorado River is hydraulically upgradient from the site. Existence of the brine underneath the site precludes deep seepage movement.

The major off-site impact of seepage then appears to be discharge to the Colorado River. Given the large discharge of the Colorado River (see Table 2) and the relatively low seepage rate (estimated at less than 0.2 cfs in the SAR), seepage would be expected to be diluted to extremely low levels. This is borne out by measurements of water quality in the Colorado River made upstream and downstream of the site as shown on Tables 4 and 5. As indicated by the data, there is negligible difference in stream quality above and below the site. Not all variations can be attributed to Atlas Minerals, of course, since a number of factors affect the river.

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Table 1

## KEY CHEMICAL CONSTITUENTS

Well	ATP-1-S	ATP-2-S	ATP-2-D	ATP-3	MW-1-R	MW-2-R	ATP-1-S	ATP-1-IS	ATP-1-ID	ATP-1-D
Screened Interval (ft)	145-155	28-38	80-90	50-60	3-13	2-10	145-155	219-229	300-310	394-396
Date Collected (Mo/Da/Yr)	6/15/82	6/15/82	6/14/82	6/15/82	6/14/82	6/15/82	1/19/82	1/20/82	1/20/82	1/19/82
pH (units)	7.1	7.7	8.0	7.8	7.2	7.0	9.1	7.9	7.9	7.6
Total Dissolved Solids	106,409	12,359	31,952	1,386	19,996	24,604	111,100	112,600	112,600	125,200
Chloride	61,984	1,347	1,234	496	2,624	2,199	51,800	54,300	54,500	55,700
Sulfate	4,656	6,664	4,582	223	8,456	10,563	4,300	4,600	4,300	4,600
Nitrate (as N)	1.2	40.5	2.1	0.15	6.6	388.	1.20	0.90	0.60	5.90
Ammonia (as N)	1.7	129.	23.6	0.31	204.	93.	3.32	3.16	3.12	3.13

Concentrations in PPM unless otherwise noted

TABLE 2

AVERAGE MONTHLY DISCHARGE AND DISSOLVED  
CHEMICAL CONSTITUENTS IN COLORADO  
RIVER NEAR CISCO, UTAH, WATER YEARS 1969-1972\*

Month	Discharge (cfs)	Sulfate (mg/l)	Chloride (mg/l)	Dissolved Solids (mg/l)	pH (units)
October	4,660	432	119	982	7.8
November	4,510	361	136	840	7.9
December	4,650	291	146	812	7.8
January	4,850	267	128	766	7.5
February	4,540	249	126	728	7.6
March	4,650	231	132	690	7.8
April	8,550	189	81	543	7.9
May	13,670	130	38	395	7.4
June	16,080	142	33	379	7.7
July	6,970	280	93	685	7.4
August	3,337	472	121	1,061	7.9
September	5,560	419	130	965	7.9

\* Source of Data: U.S. Geological Survey, 1969-1972



TABLE 3

RADIONUCLIDES - RESULTS OF TRIPLICATE ANALYSES

	<u>Lab 1</u>	<u>Lab 2</u>	<u>Lab 3</u>
<u>Well ATP-2-S</u>			
Radium-226	0.2	0.41	0.4
Thorium-230	2.2	0.77	26.
Polonium-210	0.5	*	*
Lead-210	*	<2	260.
Uranium-nat	90.	*	*
Uranium-nat (µg/l)	140.	1,475.	110.
<u>Well ATP-2-D</u>			
Radium-226	2.2	1.54	2.0
Thorium-230	1.6	0.56	1.3
Polonium-210	0.	*	*
Lead-210	*	1.0	4.0
Uranium-nat	130.	*	*
Uranium-nat (µg/l)	227.	170.	150.
<u>Well ATP-3</u>			
Radium-226	0.4	0.29	0.8
Thorium-230	2.5	0.69	0.4
Polonium-210	0.	*	*
Lead-210	*	<2	2.0
Uranium-nat	6.	*	*
Uranium-nat (µg/l)	11.	25.	17.
<u>Well MW-1-R</u>			
Radium-226	1.8	1.43	2.0
Thorium-230	2.5	0.98	0.4
Polonium-210	2.2	*	*
Lead-210	*	<2	67.
Uranium-nat	300.	*	*
Uranium-nat (µg/l)	541.	2,410.	1,600.
<u>Well MW-2-R</u>			
Radium-226	1.5	1.49	3.0
Thorium-230	3.8	9.87	160.
Polonium-210	2.3	*	*
Lead-210	*	18.	1,900.
Uranium-nat	1,500.	*	*
Uranium-nat (µg/l)	2,618.	18,992.	8,800.

Notes: \* Not analyzed

Lab 1 = Atlas Minerals Company

Lab 2 = Alpha Nuclear

Lab 3 = Eberline

All results are in picocuries per liter (pCi/l) unless noted

Samples were collected June 15 and 16, 1982



TABLE 4

RADIONUCLIDE MEASUREMENTS IN COLORADO RIVERSampling Period: October 1981

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (pCi/l)</u>				
	<u>U-Nat</u>	<u>Ra-226</u>	<u>Th-230</u>	<u>Pb-210</u>	<u>Po-210</u>
1	2.1	0.94	0.55	*	*
2	2.1	0.98	0.89	*	*
3	2.1	0.64	0.84	*	*
4	2.1	0.80	0.74	*	*
5	2.4	0.58	0.70	*	*
6	2.4	1.25	0.82	*	*

Sampling Period: November 1981

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (pCi/l)</u>				
	<u>U-Nat</u>	<u>Ra-226</u>	<u>Th-230</u>	<u>Pb-210</u>	<u>Po-210</u>
1	ND	1.1	0.96	*	*
2	ND	0.5	1.3	*	*
3	ND	0.51	0.92	*	*
4	ND	0.51	0.96	*	*
5	ND	1.0	1.3	*	*
6	ND	0.45	1.3	*	*

TABLE 4 (Continued)

Sampling Period: December 1981

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (pCi/l)</u>				
	<u>U-Nat</u>	<u>Ra-226</u>	<u>Th-230</u>	<u>Pb-210</u>	<u>Po-210</u>
1	4.0	0.80	1.4	ND	5.3
2	4.4	0.75	1.7	1.	5.7
3	5.6	0.68	0.43	ND	2.2
4	3.5	0.25	0.32	ND	3.9
5	4.0	0.46	0.32	ND	1.2
6	3.5	0.55	0.40	1.	2.9

Sampling Period: January 1982

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (pCi/l)</u>				
	<u>U-Nat</u>	<u>Ra-226</u>	<u>Th-230</u>	<u>Pb-210</u>	<u>Po-210</u>
1	ND	0.53	0.42	*	*
2	ND	0.92	0.44	*	*
3	ND	0.45	0.52	*	*
4	ND	0.61	0.44	*	*
5	ND	0.41	0.52	*	*
6	ND	0.39	0.89	*	*

TABLE 4 (Continued)

Sampling Period: February 1982

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (pCi/l)</u>				
	<u>U-Nat</u>	<u>Ra-226</u>	<u>Th-230</u>	<u>Pb-210</u>	<u>Po-210</u>
1	ND	1.1	0.79	*	*
2	ND	1.8	0.95	*	*
3	0.21	0.80	0.51	*	*
4	ND	0.67	0.52	*	*
5	ND	0.69	0.65	*	*
6	0.42	0.79	0.49	*	*

Sampling Period: March 1982

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (pCi/l)</u>				
	<u>U-Nat</u>	<u>Ra-226</u>	<u>Th-230</u>	<u>Pb-210</u>	<u>Po-210</u>
1	1.2	1.44	0.6	3.	4.
2	1.7	1.05	0.16	ND	1.25
3	0.95	0.41	0.60	ND	2.2
4	1.1	0.21	0.60	1.	1.3
5	0.95	0.78	0.79	1.	2.4
6	1.8	0.59	0.56	1.	1.1

TABLE 4 (Continued)

Sampling Period: April 1982

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (pCi/l)</u>				
	<u>U-Nat</u>	<u>Ra-226</u>	<u>Th-230</u>	<u>Pb-210</u>	<u>Po-210</u>
1	1.8	0.46	0.60	*	*
2	1.6	0.60	0.60	*	*
3	1.0	0.58	0.25	*	*
4	1.8	0.73	0.20	*	*
5	2.0	0.78	0.074	*	*
6	2.2	0.36	0.65	*	*

Sampling Period: May 1982

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (pCi/l)</u>				
	<u>U-Nat</u>	<u>Ra-226</u>	<u>Th-230</u>	<u>Pb-210</u>	<u>Po-210</u>
1	0.3	0.59	0.5	*	*
2	0.4	0.34	0.5	*	*
3	0.2	0.63	0.5	*	*
4	0.3	0.55	0.6	*	*
5	0.5	0.40	0.1	*	*
6	0.3	0.50	0.5	*	*

TABLE 4 (Continued)

Sampling Period: June 1982

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (pCi/l)</u>				
	<u>U-Nat</u>	<u>Ra-226</u>	<u>Th-230</u>	<u>Pb-210</u>	<u>Po-210</u>
1	5.	0.51	0.50	ND	0.14
2	4.	0.37	0.38	0.1	0.6
3	0.8	0.34	0.45	ND	1.1
4	20.	0.55	0.34	0.1	0.14
5	40.	0.98	0.53	0.3	0.3
6	40.	0.56	0.68	0.2	0.6

Notes:

1 Locations

- 1 = Upstream 1/2 mile from mill
- 2 = Downstream 1/4 mile from mill
- 3 = Downstream 1/2 mile from mill
- 4 = Downstream 1 mile from mill
- 5 = Downstream 5 miles from mill
- 6 = Downstream 10 miles from mill

\* = Not analyzed

ND = Not detected (see appendix B for detection limits)

Analyses by Atlas Minerals except Pb-210 analyzed by outside contractor

TABLE 5

SELECTED CHEMICAL MEASUREMENTS IN COLORADO RIVERSampling Period: December 1981

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (PPM)</u>					
	<u>pH (Units)</u>	<u>Na</u>	<u>Cl</u>	<u>SO<sub>4</sub></u>	<u>NO<sub>3</sub> (asN)</u>	<u>TDS</u>
1	8.5	114	163	343	3.5	935
2	8.5	132	159	345	4.6	874
3	8.6	135	156	352	2.7	802
4	8.5	146	159	345	2.9	899
5	8.5	134	157	336	1.5	900
6	8.4	138	157	334	3.5	865

Sampling Period: March 1982

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (PPM)</u>					
	<u>pH (Units)</u>	<u>Na</u>	<u>Cl</u>	<u>SO<sub>4</sub></u>	<u>NO<sub>3</sub> (asN)</u>	<u>TDS</u>
1	7.9	179	139	215	3.6	580
2	7.6	267	131	226	2.7	723
3	7.9	255	112	218	2.6	633
4	8.0	257	131	224	2.7	734
5	8.0	230	121	147	2.4	719
6	7.8	212	110	95	2.4	629

TABLE 5 (Continued)

Sampling Period: June 1982

<u>Location</u> <sup>1</sup>	<u>Measured Concentration (PPM)</u>					
	<u>pH (Units)</u>	<u>Na</u>	<u>Cl</u>	<u>SO<sub>4</sub></u>	<u>NO<sub>3</sub> (asN)</u>	<u>TDS</u>
1	7.8	22	149	90	0.085	283
2	8.0	28	132	97	0.010	321
3	7.9	22	134	94	0.013	265
4	8.0	21	145	90	0.090	294
5	7.9	21	134	97	0.075	285
6	8.0	37	158	94	0.15	347

Notes:

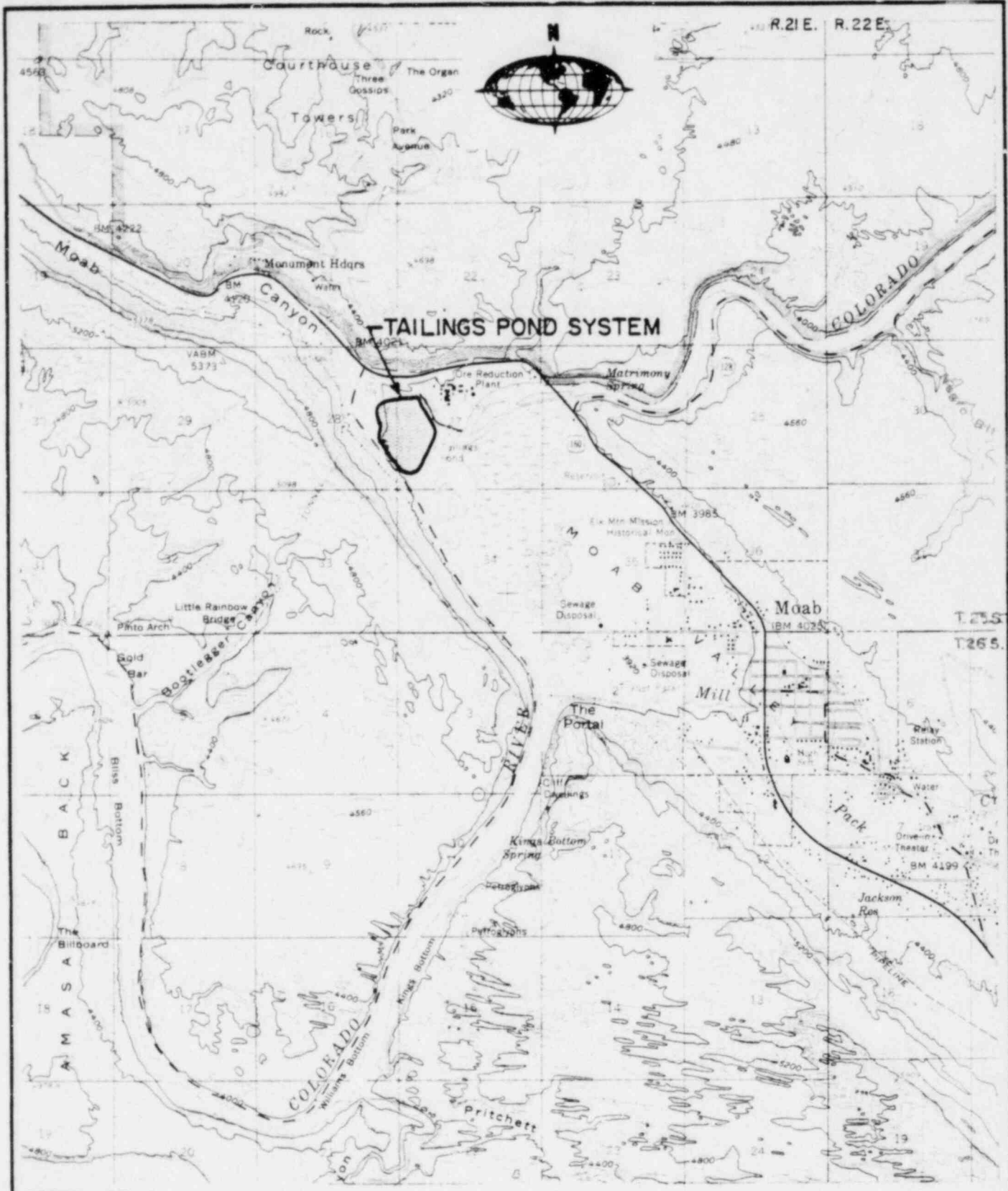
1 Locations

- 1 = Upstream 1/2 mile from mill
- 2 = Downstream 1/4 mile from mill
- 3 = Downstream 1/2 mile from mill
- 4 = Downstream 1 mile from mill
- 5 = Downstream 5 miles from mill
- 6 = Downstream 10 miles from mill

Analyses by Atlas Minerals

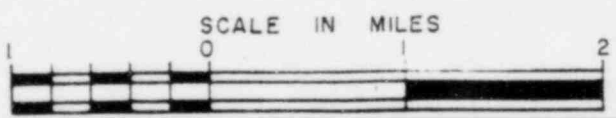


DATE 7-5-73  
CHECKED BY WIG 1-8-73  
FILE 5467-002 - ATLAS MINERALS - Moab, UT.  
BY EVIS DATE

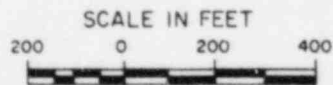
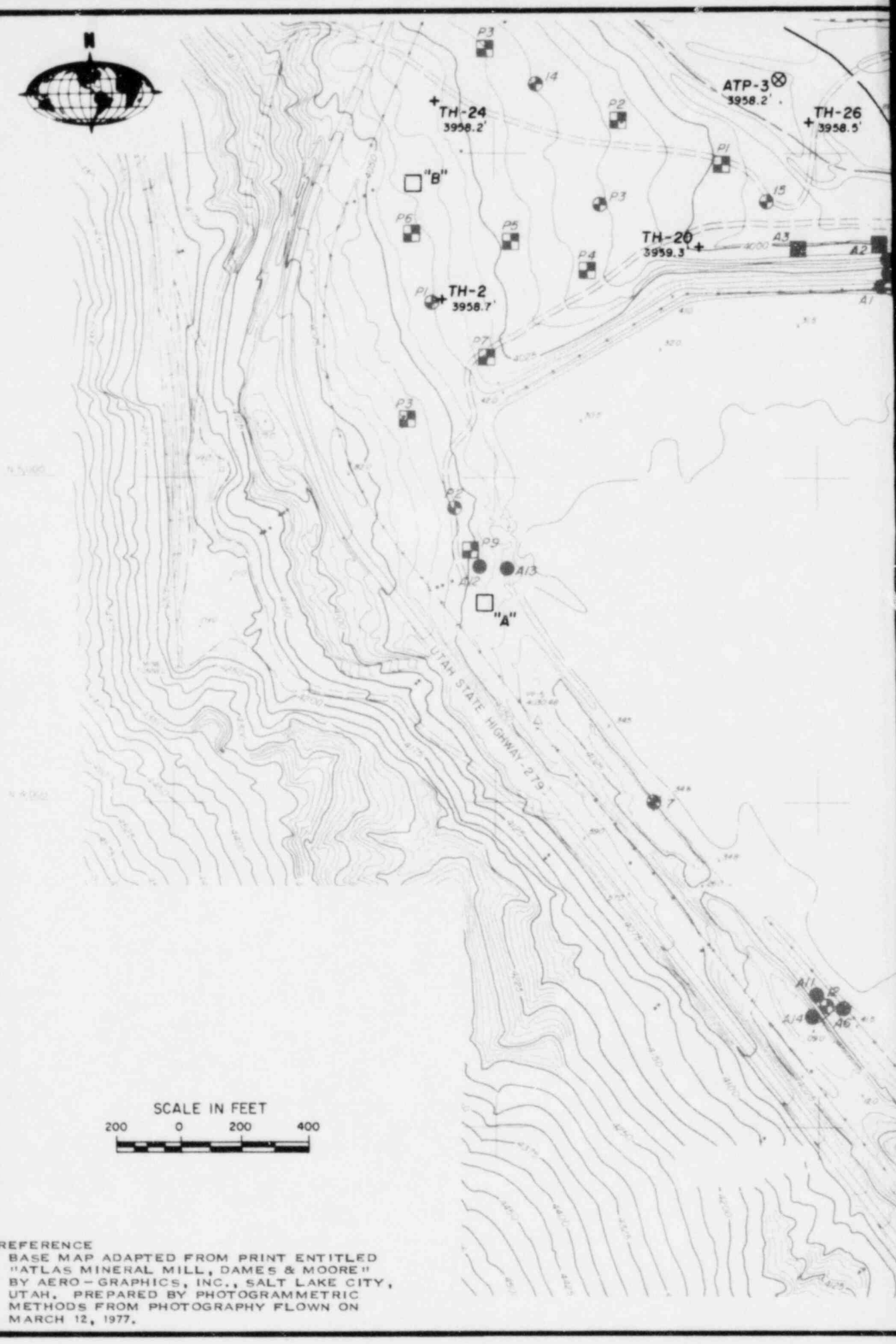


REFERENCE:  
QUADRANGLE SHEET TITLED  
"MOAB, UTAH, AND DATED 1959.

### VICINITY MAP

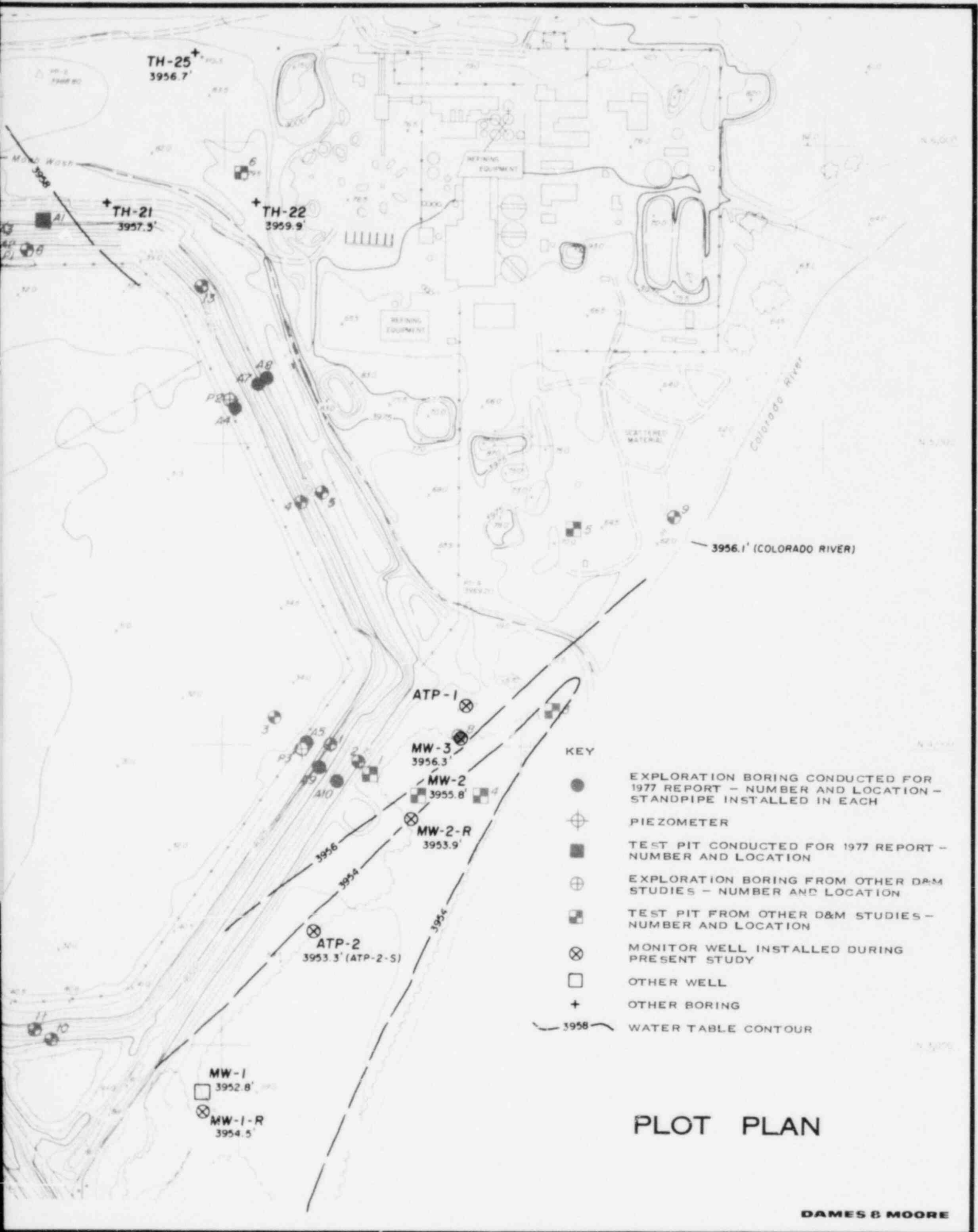


DAMES & MOORE



REFERENCE  
 BASE MAP ADAPTED FROM PRINT ENTITLED  
 "ATLAS MINERAL MILL, DAMES & MOORE"  
 BY AERO - GRAPHICS, INC., SALT LAKE CITY,  
 UTAH, PREPARED BY PHOTOGRAMMETRIC  
 METHODS FROM PHOTOGRAPHY FLOWN ON  
 MARCH 12, 1977.

DATE: 10-11-82  
 BY: SAKA  
 DETAIL: 1:25,000



# PLOT PLAN

APPENDIX A  
FIELD STUDIES

## FIELD INVESTIGATIONS

### INTRODUCTION

The field investigations were carried out in two phases during the months of December of 1981 and June of 1982, respectively. Phase I consisted of the drilling, logging, installation and ground water sampling of four monitor wells in a single borehole to a depth of 406 feet. Phase II included the installation and ground water sampling of five additional monitor wells to complete the tailings pond ground water monitoring system. The field investigations were performed under the direct supervision of experienced hydrogeologists from our staff. A summary of monitor well data is given in Table A-1 and Plates A-1A through A-1G.

### PHASE I

#### GENERAL

The drilling was done by Zimmerman Drilling, Inc. of Moab, Utah, using both a Speedstar SS-15 rotary and a Bucyrus Erie 22-W Series-Three cable-tool drilling rig. The location of the boring, approximately 250 feet southeast of the tailings impoundment is shown on Plate 2. Four monitor wells were installed in the boring and were designated ATP-1-S, ATP-1-IS, ATP-1-ID and ATP-1-D.

#### ROTARY DRILLING

Rotary-wash drilling techniques were first attempted to obtain open-hole geophysical logs of the boring. A mud pit was dug and an organic polymer drilling fluid was mixed prior to drilling. The mixing of drilling fluids and the control of mud viscosities were supervised by Nova Mud Corporation mud engineers. The Marsh Funnel Viscosity of the drilling mud was adjusted to approximately 60 seconds prior to the start of drilling and the boring was drilled to 30 feet. The Marsh Funnel Viscosity had to be increased to over

100 seconds throughout the interval 30 to 40 feet to produce a clean stable hole. Problems of hole stability increased between 40 and 60 feet. The drilling mud viscosity was then raised to 230 seconds (Marsh Funnel). The sample cuttings returned to the surface indicated that the sediments drilled were very coarse gravels. The drilling mud was of sufficient viscosity to carry the drill cuttings but could not prevent continuous caving of the boring. A gel type solution was added to the drilling mud to cause gelling within the formation in order to enhance borehole stability. This procedure failed to stabilize the boring and heavy mud losses to the formation were experienced at 60 feet. Rotary drilling methods were then discontinued.

In the opinion of the personnel from Zimmerman Drilling, Nova Mud Corporation, and Dames & Moore, the use of other drilling mud types such as bentonite would also fail to produce a clean, stable boring. It was then decided that cable-tool drilling methods were required to successfully drill the boring.

#### CABLE-TOOL DRILLING

Drilling operations using the cable-tool method were continued at the same location. A 10-3/4-inch surface casing was driven to 12 feet and bailed clean. The drive casing was 8-7/8-inch with an 8-inch drive shoe. The casing was alternately driven and bailed clean. Casing drive rates varied from approximately one foot per minute to one foot per hour. The bailing of cuttings from the boring was generally done within the casing as the hole would normally cave when the boring was advanced more than a foot beyond the bottom of the casing. The casing could still be advanced when the boring reached its total depth of 406 feet.

#### GEOLOGIC LOGGING

A complete log of the boring was maintained during drilling. The cutting samples collected during the drilling phase were analyzed and classified based on visual examination. The classification were supplemented by a subsequent inspection in our laboratory. A graphical representation of the sediments penetrated by the boring is shown on Plates A-1A through A-1C. The soil nomenclature shown on Plate A-2 has been used to describe all surface materials encountered at the site.



The boring penetrated only alluvial sediments composed primarily of gravels and coarse sands. As both rotary and cable-tool methods tended to crush the individual grains of gravel, few grains larger than two centimeters were found in the drill cuttings. However, based on observations of fractured and unfractured surfaces, the approximate grain size could be estimated. The upper 25 feet of the boring was composed of sands and gravels. Sediments within this interval were generally reddish-brown and individual gravel grains tended to be angular. The grains consisted primarily of reddish-brown sandstone and shale fragments. Below 25 feet the sediments were generally light brownish-gray. Individual gravel grains tended to be rounded to well-rounded and were composed primarily of granite, gneiss, quartzite, and limestone rock fragments. A few beds of coarse sand were also present. Differences in the granular characteristics of the subsurface materials encountered above and below 25 feet suggest that two different source areas and alluvial systems have provided sediments into this area. The upper 25 feet appear to have been the result of sediment deposition in the Moab Wash alluvial system. The sediments deeper than 25 feet appear to be related to sediment deposition along the Colorado River alluvial system.

#### GEOPHYSICAL LOGS

Three cased hole geophysical logs were run in the boring by Professional Logging Services, Inc. These logs were natural gamma, gamma-gamma density, and neutron-neutron logs. These geophysical logs are shown on Plates A-1A through A-1C.

#### NATURAL GAMMA RAY LOG

The natural gamma ray log responds to the presence of gamma ray radiation in the formation materials surrounding the borehole. In alluvial materials, such as those present at this site, the majority of the natural gamma radiation is produced by the radioactive elements commonly found in and absorbed to the clay minerals, in particular, radioactive potassium found in illitic clays. Hence, in general, the presence of clay layers are represented by high counting rates, while clean sands and gravels are generally associated with low gamma counting rates.



The natural gamma log for this well shows little, if any, significant change in the natural gamma intensity for sediments located below the water table (13 feet). This lack of change indicates that there are no clay layers of sufficient thickness to be considered a confining bed.

#### GAMMA-GAMMA DENSITY LOG

The gamma-gamma density log provides a measure of the in situ density of formational materials. In this log, gamma rays are emitted into the formation from a gamma ray source in the logging tool. The percentage of this gamma ray radiation returning from the formation to the detector is measured. In general, the percentage of radiation returned to the tool is a function of the density of formational materials, as the absorption of gamma radiation is a function of the density of formational materials. However, because the borehole is cased, the density of the casing is also interpreted by the logging tool as part of the formation. Hence, quantitative measurement of formation density cannot be made with the log.

The gamma-gamma density log obtained from this boring shows little, if any, significant change over its entire depth. This probably results from both the lack of any significant formational changes and also the attenuating effects of the steel casing.

#### NEUTRON-NEUTRON LOG

The neutron-neutron log provides a measure of the formation porosity. In this tool, epithermal neutrons are emitted from a neutron source into the formation and the number of neutrons returning from the formation to the detector, are counted. As the hydrogen atom is the principal absorber of epithermal neutrons, the number of neutrons returning is related principally to the concentration of hydrogen atoms in the formational material. For alluvial sediments such as those found in this boring, the majority of the hydrogen atoms present are located within the sediment pore water, and hence, the neutron-neutron log is an indirect measurement of the formation porosity.

The neutron-neutron log of this boring shows few significant changes, if any, in the intensity of the returned neutron as a function of depth. The changes in intensity appear to be related to changes in the sediment porosity; however, the actual change in porosity of the granular aquifer is likely only a few percent.

#### WELL COMPLETION

The 8-7/8-inch steel drive casing was perforated at four separate intervals and four monitor wells were installed opposite the perforated zones. Each well was separately sand-packed and sealed to prevent vertical migration of ground water between wells. The location and construction details for each of these wells are shown graphically on Plates A-1A through A-1C and are discussed below.

The 8-7/8-inch steel drive casing inplaced while drilling the well, was perforated at selected intervals using a mechanical knife casing perforator. Each perforation cut by the perforating knife was approximately three inches long and one-quarter inch wide. The locations of the perforations are shown graphically on the log. Four 2-inch diameter casing and screen assemblies were then sequentially set, sand-packed and grouted into place. The screen and casing used was 2-inch Schedule 40 PVC pipe. The screen was manufactured by Hydrophyllic, Inc. of Tacoma, Washington and had 0.020 inch wide saw-cut perforations. Each pipe joint was properly glued prior to installation. Glued pipe joints were given additional strength in some cases by installing two 3/16-inch stainless steel screws through the glued joint.

Each casing-screen assembly was sand-packed and grouted immediately after its installation. The sand-pack used was a Number 4-10 sand manufactured by Colorado Silica Sand, Inc., Pueblo, Colorado. The grout mixture was a neat cement grout made by mixing 5.2 gallons of water and 2 pounds of calcium chloride with each bag of Type V portland cement. The calcium chloride was added to accelerate the grout setting time. The grout was tremied into place and allowed a minimum of eight hours to set prior to the installation of the next casing-screen assembly. The locations of all casings, screens, sand-pack, grout seals and well designations are shown on Plates A-1A through A-1C.

Following the installation of all wells, each well was individually tested for the presence of a hydraulic interconnection between other casing-screen assemblies. These tests were conducted by measuring the water levels of each piezometer and then pumping one of the piezometers for approximately 30 minutes and again measuring the water levels. No significant changes in the water levels of the unpumped wells were noted while pumping any of the other wells. The pumping level in the pumped wells varied from 2 to 8 feet.

#### WATER QUALITY SAMPLING

The wells were pumped prior to sampling until it was determined that there was no longer any significant change in the specific conductivity of the ground water being pumped. The wells were pumped until three successive measurements of the specific conductivity showed no significant change. A minimum of 1,500 gallons were pumped from each well. The volumes of water pumped, specific conductivity, pH, temperature and water level measurements for each of the wells prior to sampling are given in Tables A-2A through A-2D.

Samples for parameters with short-hold times (ammonia, nitrate, nitrite, and total dissolved solids) were adequately preserved and immediately shipped by air for analysis to Ford Chemical Laboratories, Inc., Salt Lake City, Utah. Ground water samples for other parameters were split and analyzed by Hazen Research, Inc., Golden, Colorado and Atlas Minerals. Certificates of analysis are provided in Appendix B.

#### PHASE II

##### GENERAL

Five monitor wells were installed during this phase of the investigations to a maximum depth of 90 feet. The wells were completed in boreholes that required rotary and cable-tool drilling techniques. The wells were designated ATP-2-S, ATP-2-D, ATP-3, MW-1-R and MW-2-R and their locations are shown on Plate 2. The drilling was done by Zimmermen Drilling, Inc. of Moab, Utah using both a Bucyrus Erie 22-W Series-Three cable-tool and a Ingersoll Rand TH-60 drilling rigs.

### ROTARY DRILLING AND MONITOR WELL INSTALLATION-WELL ATP-3

Monitor well ATP-3 was installed in a boring drilled to 65 feet using rotary-wash drilling techniques. The boring was drilled utilizing foams and polymer additives (Schooner Chemical MF-100 and P-100) to form the drilling fluid to retrieve drill cuttings and provide borehole stability. Mud was not used to avoid mud invasion of the water-bearing formation. The bottom of the borehole was backfilled about two feet with bentonite pellets. The well consisted of 4-inch diameter Schedule 40 PVC pipe with a 10-foot section of 4-inch diameter 0.02-inch slot PVC screen installed at the bottom. The boreholes were packed with Number 4-8 sand manufactured by Colorado Silica Sand, Inc., Pueblo Colorado, to about 2 feet above the top of the screened section. The remaining annular space to the ground surface was filled with bentonite pellets and a cement grout seal. Monitor well construction characteristics are shown on Plate A-1E.

### CABLE-TOOL DRILLING AND MONITOR WELL INSTALLATION

Monitor wells ATP-2-S, ATP-2-D, MW-1-R and MW-2-R were installed in borings drilled by cable-tool drilling methods. This method allowed drilling of the boring without the use of drilling fluids or additives that could have effected the ground water chemistry at the boring. The boring at site ATP-2 was sampled for water quality during the drilling and two wells were installed in the borehole. Wells MW-R1 and MW-R2 were drilled as replacements for old wells MW-1 and MW-2.

An 8-inch surface casing was driven to 10 feet and bailed clean at the ATP-2 boring location. The drive casing was 6-inch steel with a 5-7/8-inch drive shoe. The casing was alternately driven and bailed clean. The steel casing was driven to 107 feet and left in place. Ground water samples were collected every 5-foot interval below the water table. Measurements of specific conductance and pH were made in the field. Water samples were delivered to the Atlas Minerals Mill Laboratory for analysis of sulfate and chloride concentrations. Plots of the above parameters are shown on Plate A-1D. The 6-inch steel drive casing was perforated at two separate intervals

and two monitor wells were installed opposite the perforated zones. Two 2-inch assemblies were set, sand-packed and grouted into place.

The monitor well construction characteristics for the wells are graphically shown on Plates A-1D through A-G.

#### WATER QUALITY SAMPLING

The wells were pumped prior to sampling until changes in the specific conductivity of the ground water discharge were not further observed. Tables A-3A through A-3E include data on ground water discharge, specific conductivity, pH and static water level prior to sampling for all wells installed during Phase II of this investigation.

Samples for parameters with short-hold times (ammonia, nitrate and nitrite) were adequately preserved and delivered within less than 24 hours to Ford Chemical Laboratories Inc., Salt Lake City, Utah for analysis. Ground water samples for other parameters were split and delivered to Atlas Minerals for analysis. This ground water sampling was done in addition to the water samples collected and analyzed during drilling of boring ATP-2.

TABLE A-1

SUMMARY OF MONITOR WELL CONSTRUCTION DATA

<u>Monitor Well Designation</u>	<u>Depth (Feet)</u>	<u>Screened Interval 1) (Feet)</u>	<u>Coordinates</u>		<u>Collar 2) Elevation (ft)</u>	<u>Water Level Depth (ft) 2)</u>	<u>Water Level Elevation (ft)</u>
			<u>North</u>	<u>East</u>			
ATP-1-S	155	145 - 155	4063.68	6838.71	3967.59	16.17	3951.42
ATP-1-IS	230	220 - 230			3967.44	15.32	3952.12
ATP-1-ID	320	310 - 320			3967.29	15.32	3951.97
ATP-1-D	400	390 - 400			3967.14	14.91	3951.23
ATP-2-S	38	28 - 38	3395.95	6302.47	3960.55	6.40	3954.15
ATP-2-D	90	80 - 90	3395.74	6302.49	3960.60	6.40	3954.20
ATP-3	60	50 - 60	6250.34	4868.80	3993.20	35.71	3957.49
MW-1-R	13	3 - 13	2792.02	5941.05	3959.20	4.36	3954.84
MW-2-R	10	2 - 10	3768.80	6637.79	3961.60	5.75	3955.85

Notes:

- 1) Measured from ground surface
- 2) Measured from top of casing
- 3) Water levels measured June 29, 1982



GROUND WATER QUALITY SAMPLING FORMWell No.: ATP-1-S-81Owner: Atlas MineralsDate/Time 1/19/82 / 1:00 Sampled By: Dale Edwards (Atlas Minerals)Appearance: Clear  
(clear, colored, turbid, sediment, etc.)Remarks: Well had been pumped on the previous day at 12 gpm for approximately two hours (pumped 1,500 gal).Field Measurements and Sample Collection (a)Static Water Level: 14.26 (16.86 from TOC) (in feet below land surface)Pumping Rate: 8 gpm (in gallons per minute)Duration of Pumping: from 10:30 to 1:00, Total Time = 170 (in minutes)Volume of Water Pumped Prior to Sampling<sup>(b)</sup>: 1,400 (in gallons)Method of Pumping: Centrifugal pumpElectrical Conductivity (E.C.) MeasurementsMeter No.: YSI #1Time Sampled: 10:43 pH 9.9 (E.C.) 158,000 (in micromhos/cm, corrected to 25°C)Time Sampled: 11:01 pH 9.2 (E.C.) 172,000 (in micromhos/cm, corrected to 25°C)Time Sampled: 11:05 pH 9.0 (E.C.) 158,000 (in micromhos/cm, corrected to 25°C)Time Sampled: 11:15 pH 9.1 (E.C.) 130,000 (in micromhos/cm, corrected to 25°C)Time Sampled: 12:15 pH 9.1 (E.C.) 130,000 (in micromhos/cm, corrected to 25°C)Time Sampled: 12:45 pH 9.1 (E.C.) 145,000 (in micromhos/cm, corrected to 25°C)Meter No.: Digital pH Meter #609 standardized to pH 10Temperature: 18 °C

(a) Field measurements and sample collection made in accordance with Dames &amp; Moore Technical Memorandum for the pre-operational ground water.

(b) A minimum of two (2) casing volumes of water shall be pumped from the well prior to sample collection.

TABLE A-2B  
GROUND WATER QUALITY SAMPLING FORM

Well No.: ATP-1-IS-81

Owner: Atlas Minerals

Date/Time 1/20/82 / 11:00 Sampled By: Dale Edwards (Atlas Minerals)

Appearance: Clear  
(clear, colored, turbid, sediment, etc.)

Remarks: 3,000 gallons pumped from the well on 1-19-82

Field Measurements and Sample Collection (a)

Static Water Level: 14.71 (17.46 from TOC) (in feet below land surface)

Pumping Rate: 15 (in gallons per minute)

Duration of Pumping: from 9:06 to 11:15, Total Time = 129 (in minutes)

Volume of Water Pumped Prior to Sampling (b): 1,935 (in gallons)

Method of Pumping: Centrifugal pump

Electrical Conductivity (E.C.) Measurements

Meter No.: Yellow Spring Instrument #1

Time Sampled: 9:55 pH 7.9 (E.C.) 115,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: 10:15 pH 7.9 (E.C.) 120,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: 10:25 pH 7.9 (E.C.) 125,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: 10:45 pH 7.9 (E.C.) 125,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: 11:00 pH 7.9 (E.C.) 125,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ pH \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

Meter No.: Digital pH Meter #609 standardized to pH 7

Temperature: 15 °C

(a) Field measurements and sample collection made in accordance with Dames & Moore Technical Memorandum for the pre-operational ground water.

(b) A minimum of two (2) casing volumes of water shall be pumped from the well prior to sample collection.

GROUND WATER QUALITY SAMPLING FORMWell No.: ATP-1-ID-81Owner: Atlas MineralsDate/Time 1/20/81 / 10:30 Sampled By: Dale Edwards (Atlas Minerals)Appearance: Clear  
(clear, colored, turbid, sediment, etc.)Remarks: Well had been pumped on the previous day at approximately 10 gpm for 1.5 hours  
(volume pumped was 1,500 gallons)Field Measurements and Sample Collection <sup>(a)</sup>Static Water Level: 14.65 (17.55 from TOC) (in feet below land surface)Pumping Rate: 12 (in gallons per minute)Duration of Pumping: from 8:50 to 10:31, Total Time = 101 (in minutes)Volume of Water Pumped Prior to Sampling <sup>(b)</sup>: 1,200 (in gallons)Method of Pumping: Centrifugal pumpElectrical Conductivity (E.C.) MeasurementsMeter No.: Yellow Springs Instrument #1Time Sampled: 9:45 pH 7.4 (E.C.) 135,000 (in micromhos/cm, corrected to 25°C)Time Sampled: 10:00 pH 7.7 (E.C.) 135,000 (in micromhos/cm, corrected to 25°C)Time Sampled: 10:16 pH 7.9 (E.C.) 130,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ pH \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ pH \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ pH \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

Meter No.: Digital pH Meter #609 standardized to pH 7.0Temperature: 15 °C

(a) Field measurements and sample collection made in accordance with Dames &amp; Moore Technical Memorandum for the pre-operational ground water.

(b) A minimum of two (2) casing volumes of water shall be pumped from the well prior to sample collection.

GROUND WATER QUALITY SAMPLING FORM

Well No.: ATP-1-D-81

Owner: Atlas Minerals

Date/Time 1/19/82 / 1:05 Sampled By: Dale Edwards (Atlas Minerals)

Appearance: Clear  
(clear, colored, turbid, sediment, etc.)

Remarks: 1,500 gallons pumped from the well on 1-18-82

Field Measurements and Sample Collection (a)

Static Water Level: 14.95 (18.40 from TOC) (in feet below land surface)

Pumping Rate: 2.5 gpm (in gallons per minute)

Duration of Pumping: from 10:15 to 1:05, Total Time = 110 (in minutes)

Volume of Water Pumped Prior to Sampling<sup>(b)</sup>: 425 (in gallons)

Method of Pumping: Centrifugal pump

Electrical Conductivity (E.C.) Measurements

Meter No.: YSI #1

Time Sampled:	<u>10:30</u>	pH	<u>7.6</u>	(E.C.)	<u>150,000</u>	(in micromhos/cm, corrected to 25°C)
Time Sampled:	<u>11:15</u>	pH	<u>7.6</u>	(E.C.)	<u>130,000</u>	(in micromhos/cm, corrected to 25°C)
Time Sampled:	<u>12:00</u>	pH	<u>7.6</u>	(E.C.)	<u>130,000</u>	(in micromhos/cm, corrected to 25°C)
Time Sampled:	<u>12:30</u>	pH	<u>7.6</u>	(E.C.)	<u>150,000</u>	(in micromhos/cm, corrected to 25°C)
Time Sampled:	<u>      </u>	pH	<u>      </u>	(E.C.)	<u>      </u>	(in micromhos/cm, corrected to 25°C)
Time Sampled:	<u>      </u>	pH	<u>      </u>	(E.C.)	<u>      </u>	(in micromhos/cm, corrected to 25°C)

Meter No.: Digital pH Meter #609 standardized to pH 10

Temperature: 18 °C  
Buffer solution

(a) Field measurements and sample collection made in accordance with James & Moore Technical Memorandum for the pre-operational ground water.

(b) A minimum of two (2) casing volumes of water shall be pumped from the well prior to sample collection.

TABLE A-3A

GROUND WATER QUALITY SAMPLING FORMWell No.: ATP-2-SOwner: Atlas MineralsDate/Time 6/14/82 / 15.30 Sampled By: Alberto Morilla (Dames & Moore)Appearance: Clear  
(clear, colored, turbid, sediment, etc.)

Remarks: \_\_\_\_\_

Field Measurements and Sample Collection<sup>(a)</sup>Static Water Level: 3.5 (in feet below land surface)Pumping Rate: 5 (in gallons per minute)Duration of Pumping: from 15.30 to 16.05, Total Time = 35 (in minutes)Volume of Water Pumped Prior to Sampling<sup>(b)</sup>: 175 (in gallons)Method of Pumping: Centrifugal pumpElectrical Conductivity (E.C.) Measurements

Meter No.: \_\_\_\_\_

Time Sampled: 15.35 (E.C.) 18,000 (in micromhos/cm, corrected to 25°C)Time Sampled: 15.55 (E.C.) 17,000 (in micromhos/cm, corrected to 25°C)Time Sampled: 16.05 (E.C.) 17,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

pH: 7.4 (to the nearest .1 pH unit)

Meter No.: \_\_\_\_\_

Temperature: \_\_\_\_\_ °C

(a) Field measurements and sample collection made in accordance with Dames & Moore Technical Memorandum for the pre-operational ground water.

(b) A minimum of two (2) casing volumes of water shall be pumped from the well prior to sample collection.

## TABLE A-3B

GROUND WATER QUALITY SAMPLING FORM

Well No.: ATP-2-D

Owner: Atlas Minerals

Date/Time 6/14/82 / 13.15 Sampled By: Alberto Morilla (Dames & Moore)

Appearance: Colored  
(clear, colored, turbid, sediment, etc.)

Remarks: No changes were observed in well ATP-2-5 water level during pumping of Well ATP-2-D

Field Measurements and Sample Collection<sup>(a)</sup>

Static Water Level: 3.5 (in feet below land surface)

Pumping Rate: 0.7 (in gallons per minute)

Duration of Pumping: from 13.15 to 15.20, Total Time = 130 (in minutes)

Volume of Water Pumped Prior to Sampling<sup>(b)</sup>: 91 (in gallons)

Method of Pumping: Centrifugal Pump

Electrical Conductivity (E.C.) Measurements

Meter No.: \_\_\_\_\_

Time Sampled: 13.55 (E.C.) 54,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: 14.15 (E.C.) 54,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: 14.55 (E.C.) 53,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: 15.20 (E.C.) 52,000 (in micromhos/cm, corrected to 25°C)

pH: 6.4 (to the nearest .1 pH unit)

Meter No.: \_\_\_\_\_

Temperature: \_\_\_\_\_ °C

(a) Field measurements and sample collection made in accordance with Dames & Moore Technical Memorandum for the pre-operational ground water.

(b) A minimum of two (2) casing volumes of water shall be pumped from the well prior to sample collection.





GROUND WATER QUALITY SAMPLING FORM

Well No.: MW-1-R

Owner: Atlas Minerals

Date/Time 6/14/82 / 17.00 Sampled By: Alberto Morilla (Dames & Moore)

Appearance: Sediment  
(clear, colored, turbid, sediment, etc.)

Remarks: \_\_\_\_\_

Field Measurements and Sample Collection<sup>(a)</sup>

Static Water Level: 2.36 (in feet below land surface)

Pumping Rate: 1 (in gallons per minute)

Duration of Pumping: from 17.00 to 18.40, Total Time = 100 (in minutes)

Volume of Water Pumped Prior to Sampling<sup>(b)</sup>: 100 (in gallons)

Method of Pumping: Centrifugal pump

Electrical Conductivity (E.C.) Measurements

Meter No.: \_\_\_\_\_

Time Sampled: \_\_\_\_\_ (E.C.) 26,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ (E.C.) 26,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

pH: 6.8 (to the nearest .1 pH unit)

Meter No.: \_\_\_\_\_

Temperature: \_\_\_\_\_ °C

(a) Field measurements and sample collection made in accordance with Dames & Moore Technical Memorandum for the pre-operational ground water.

(b) A minimum of two (2) casing volumes of water shall be pumped from the well prior to sample collection.

TABLE A-3E

GROUND WATER QUALITY SAMPLING FORM

Well No.: MW-2-R

Owner: Atlas Minerals

Date/Time 6/15/82 / 11.45 Sampled By: Jay (Atlas Minerals - Moab)

Appearance: Sediment  
(clear, colored, turbid, sediment, etc.)

Remarks: Very low well yield. Centrifugal pump could not be used for sampling. Specific conductance and pH measured at Atlas lab.

Field Measurements and Sample Collection <sup>(a)</sup>

Static Water Level: 3.75 (in feet below land surface)

Pumping Rate: - (in gallons per minute)

Duration of Pumping: from - to -, Total Time = - (in minutes)

Volume of Water Pumped Prior to Sampling <sup>(b)</sup>: 8 (in gallons)

Method of Pumping: Bailing vs/1" bailer

Electrical Conductivity (E.C.) Measurements

Meter No.: \_\_\_\_\_

Time Sampled: 11.45 (E.C.) 27,000 (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

Time Sampled: \_\_\_\_\_ (E.C.) \_\_\_\_\_ (in micromhos/cm, corrected to 25°C)

pH: 7.18 (to the nearest .1 pH unit)

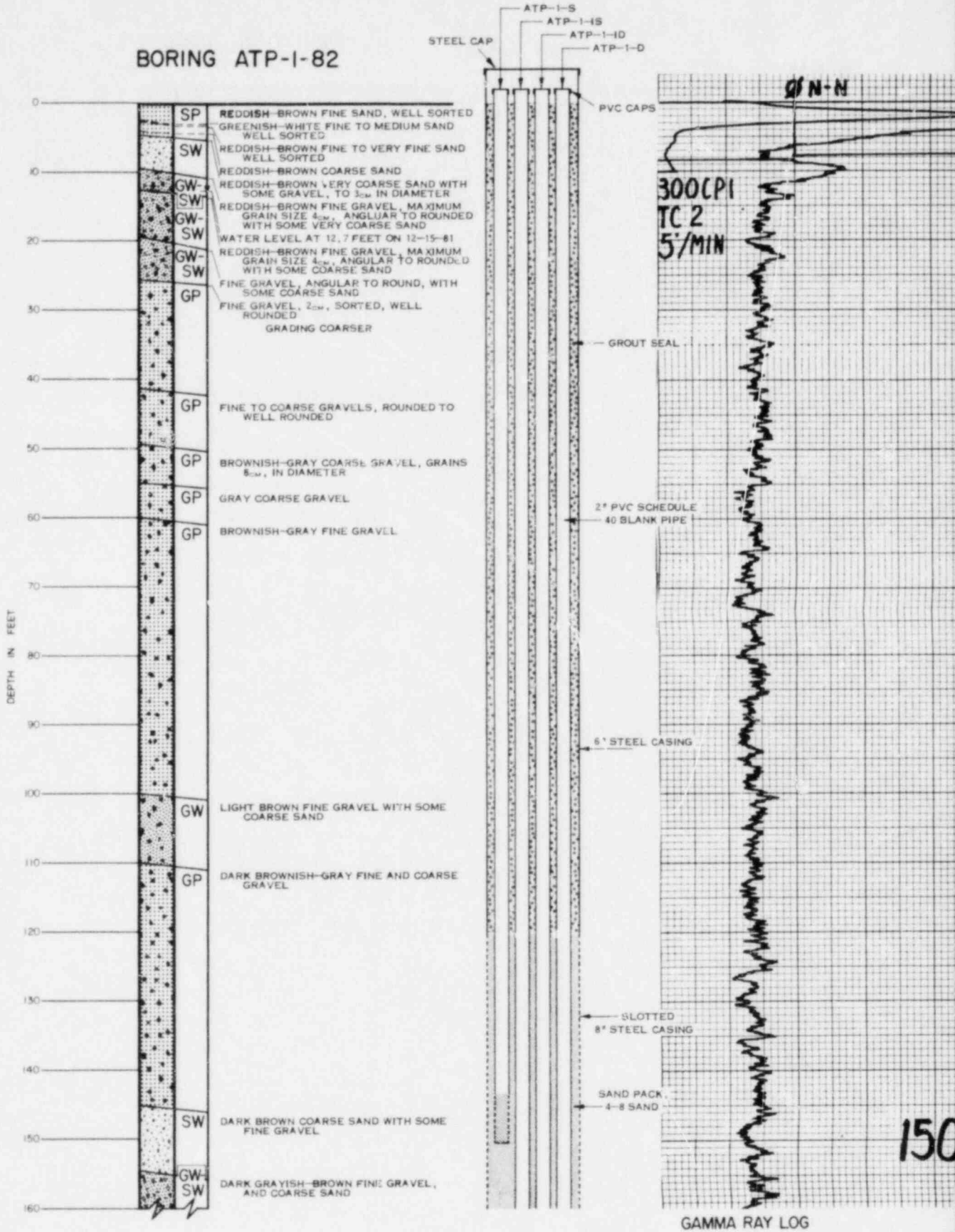
Meter No.: \_\_\_\_\_

Temperature: \_\_\_\_\_ °C

(a) Field measurements and sample collection made in accordance with Dames & Moore Technical Memorandum for the pre-operational ground water.

(b) A minimum of two (2) casing volumes of water shall be pumped from the well prior to sample collection.

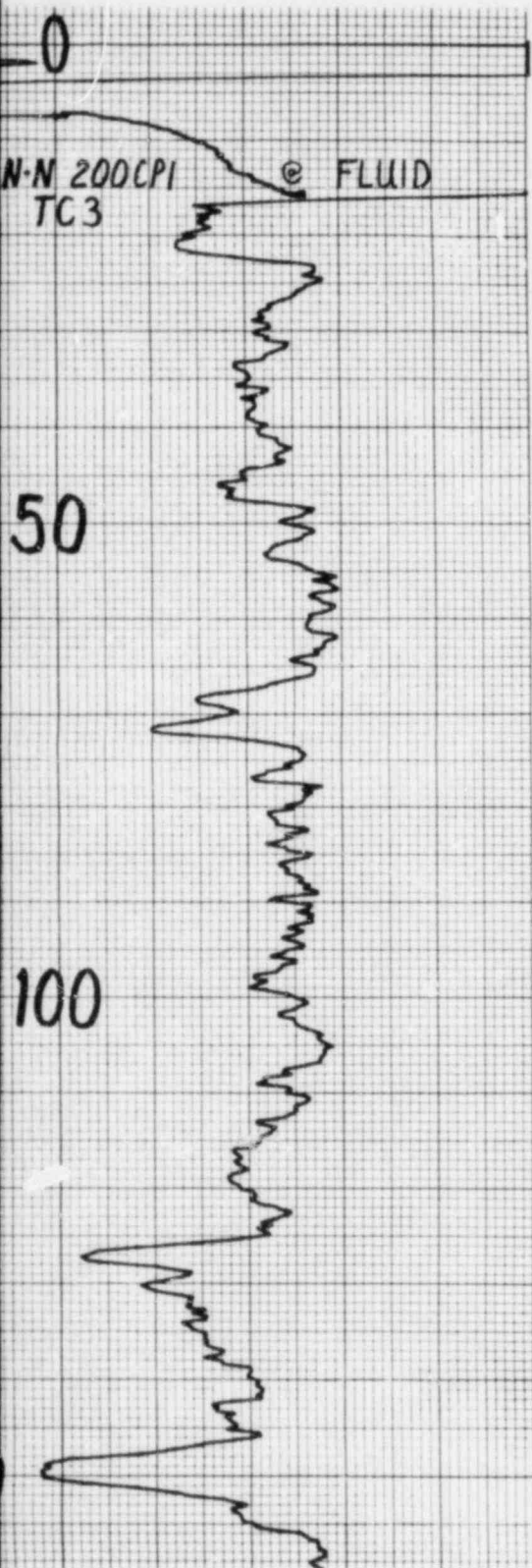
# BORING ATP-1-82



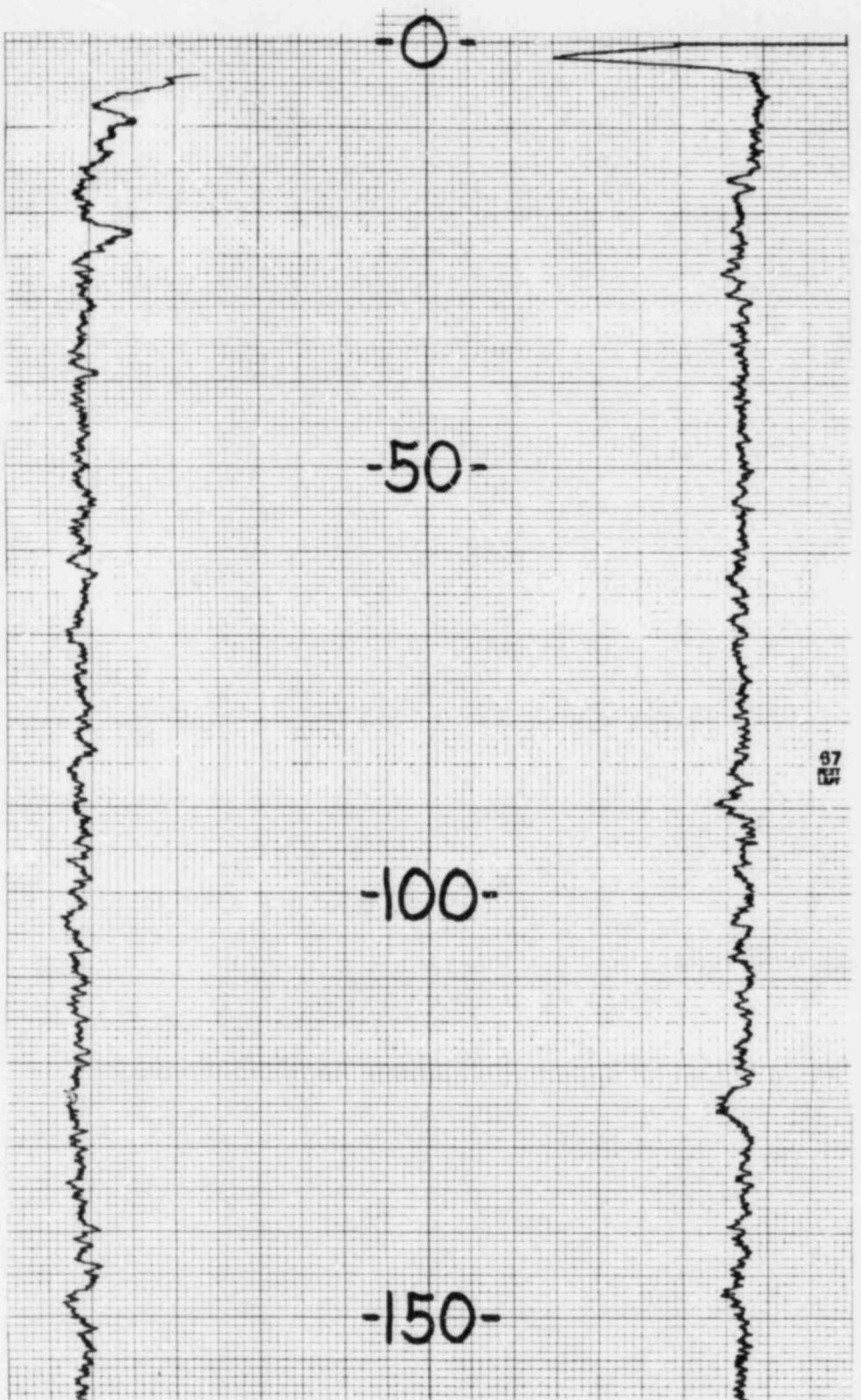
## LOG OF BORING

## WELL COMPLETION LOG

BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
 CHECKED BY: \_\_\_\_\_ DATE: \_\_\_\_\_



NEUTRON-NEUTRON LOG



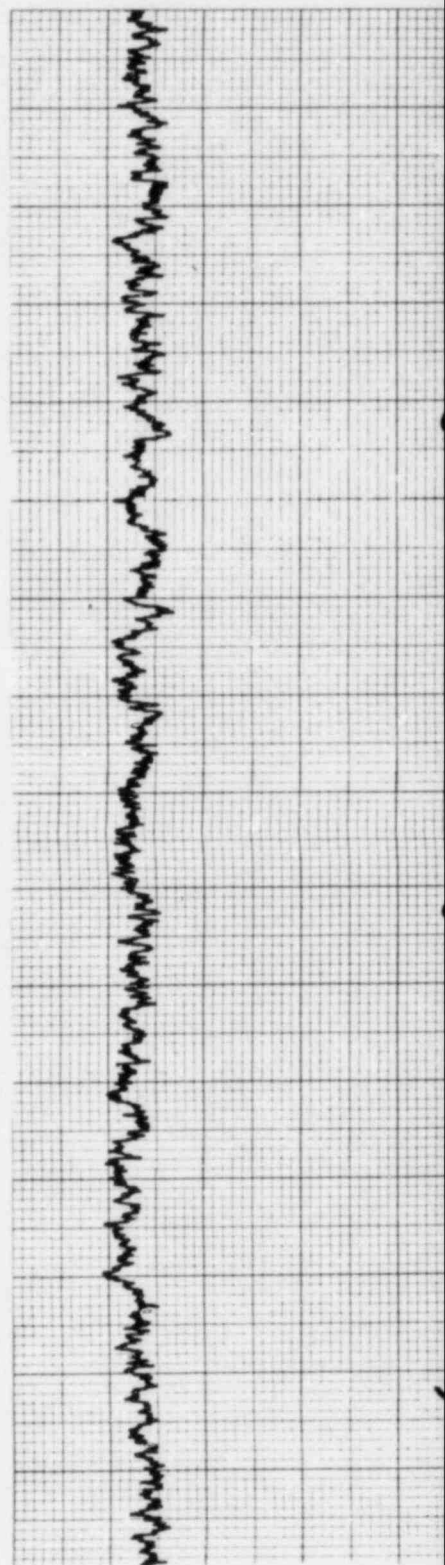
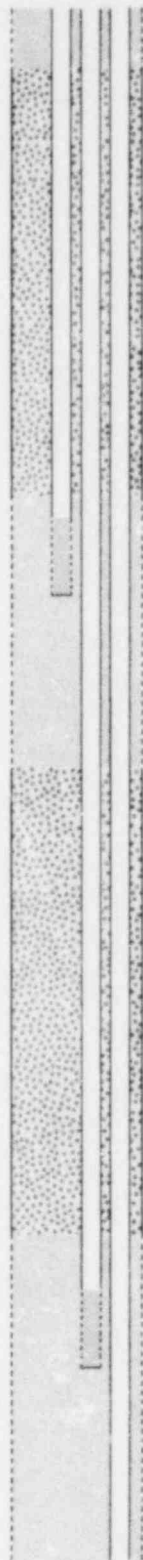
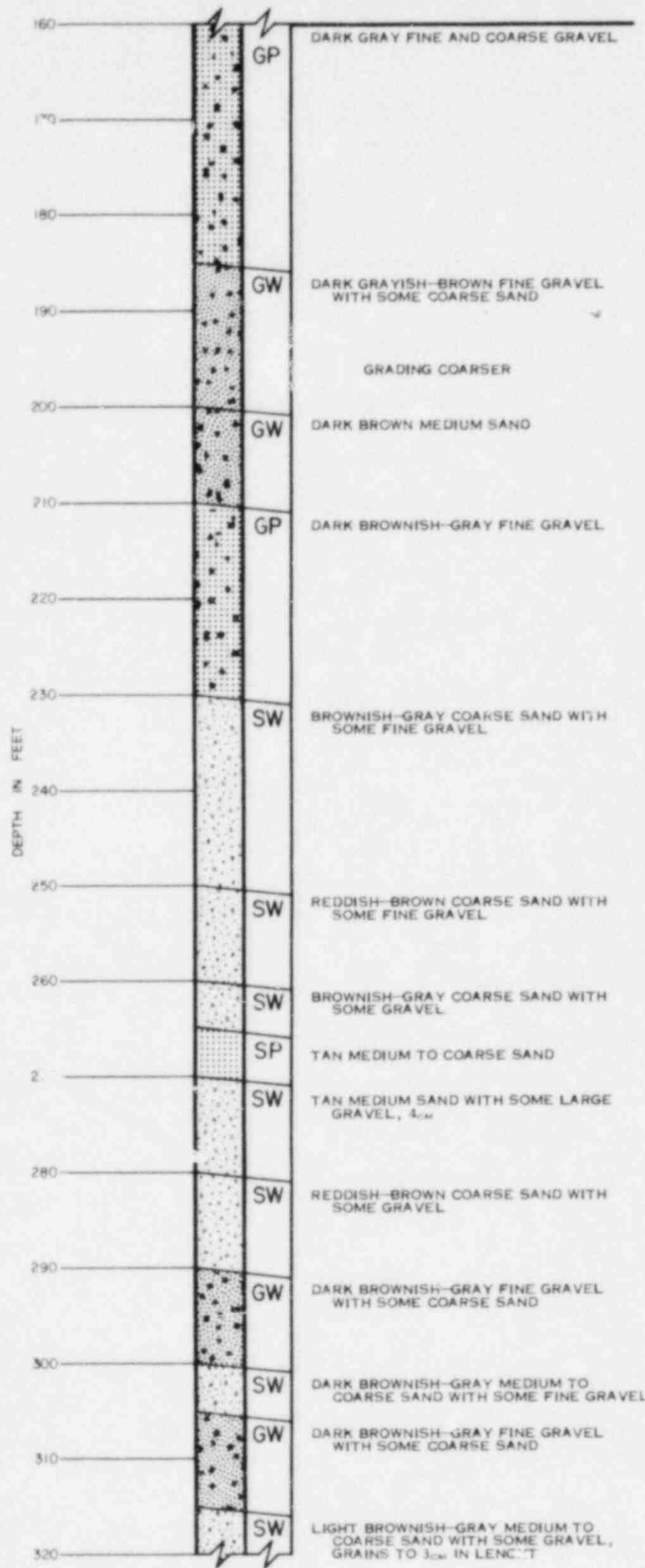
GAMMA RAY LOG

GAMMA-GAMMA DENSITY

97  
FT



BORING ATP-I-82 (CONTINUED)



GAMMA RAY LOG

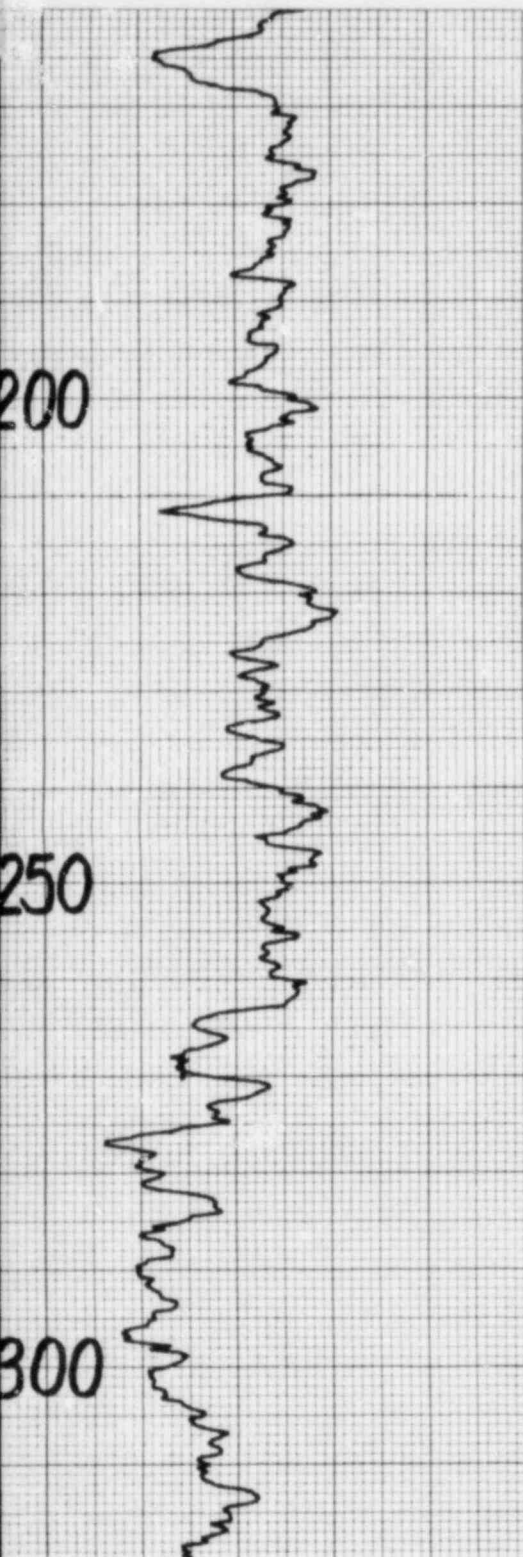
WELL COMPLETION LOG

LOG OF BORING

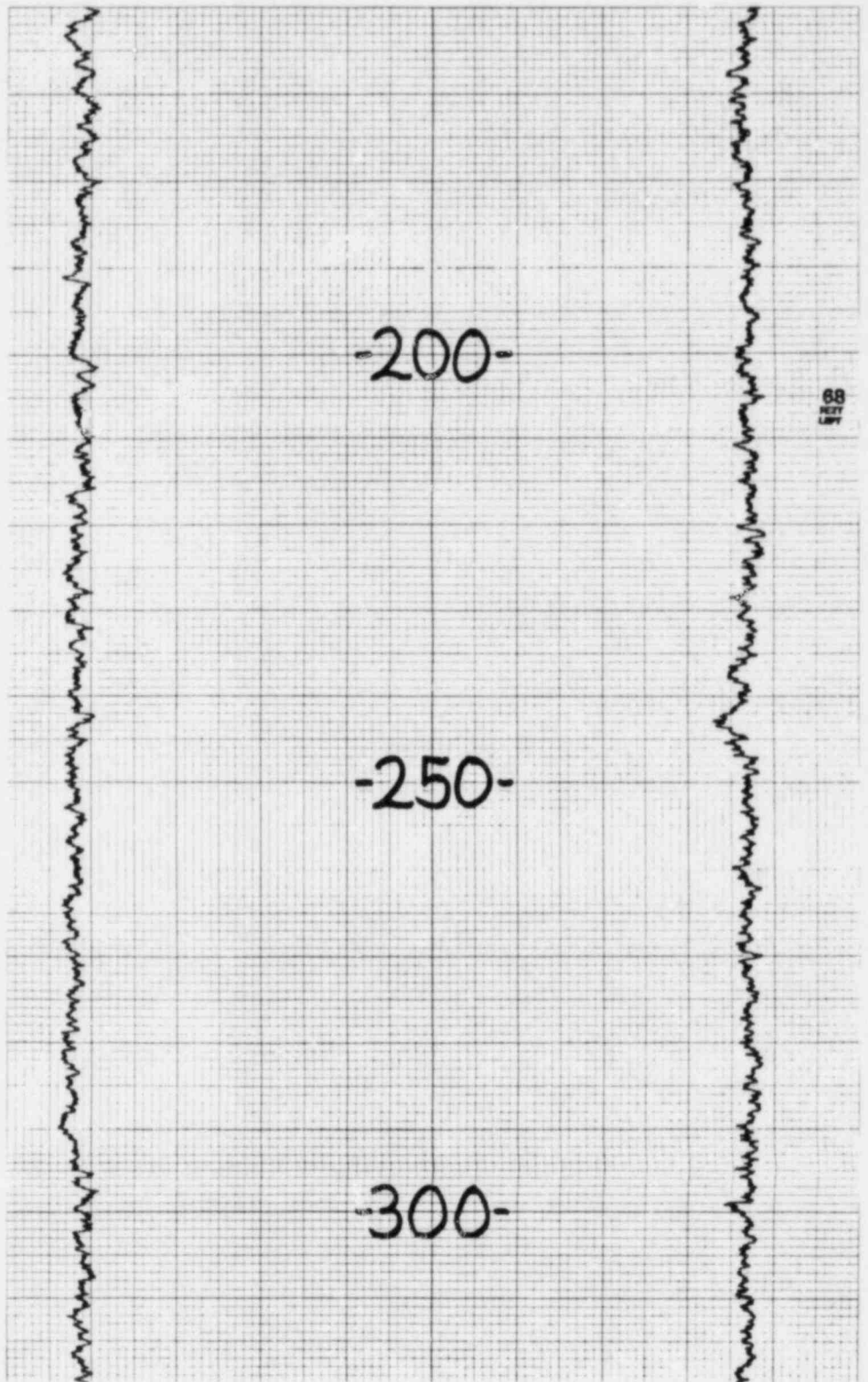
NO. 1000000  
DATE  
BY  
CHECKED BY  
PLATE

FILE 01667-080-200  
DATE 2-1-82  
CHECKED BY





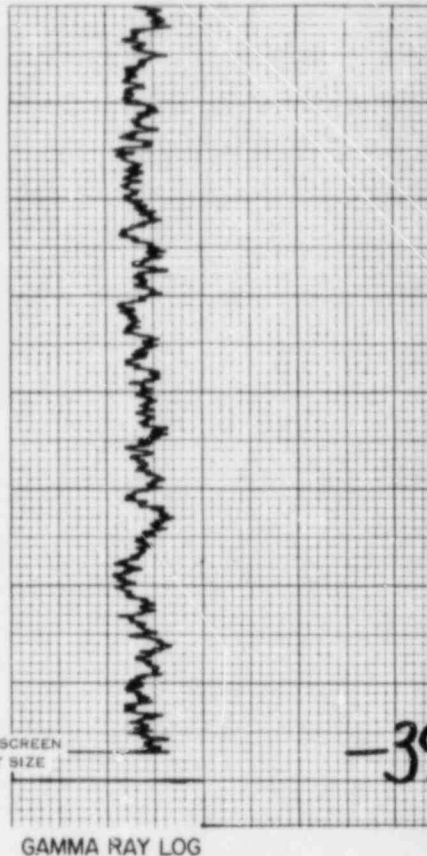
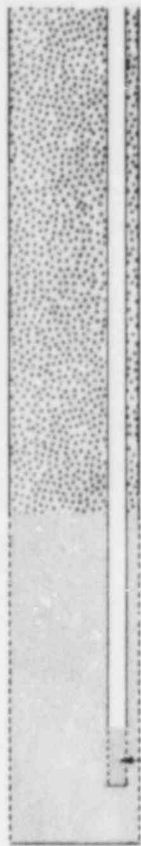
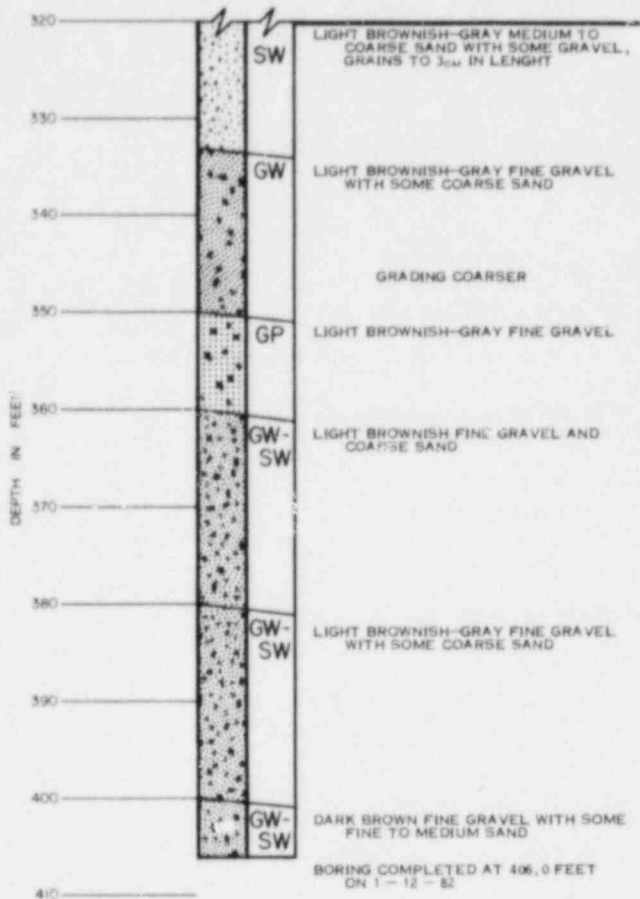
NEUTRON-NEUTRON LOG



GAMMA RAY LOG

GAMMA-GAMMA DENSITY

BORING ATP-1-82 (CONTINUED)



WELL COMPLETION LOG

LOG OF BORING

DATE: \_\_\_\_\_  
BY: \_\_\_\_\_  
CHECKED BY: \_\_\_\_\_

DATE: 5-3-82  
BY: \_\_\_\_\_  
CHECKED BY: \_\_\_\_\_

**PLS** PROFESSIONAL LOGGING SERVICE  
Clifton, Colorado 81520

HOLE NO. **ATP-1-82**

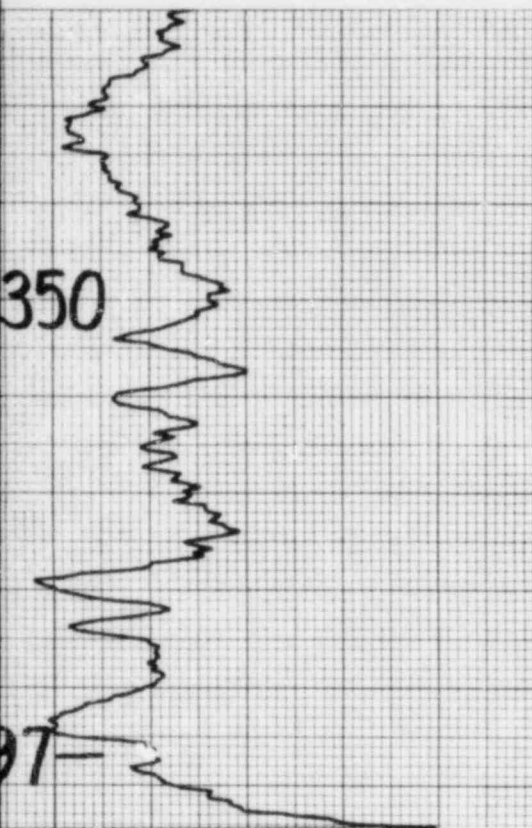
CLIENT **ATLAS MINERALS** AREA **MILL**

COUNTY **GRAND** SECTION \_\_\_\_\_ TOWNSHIP \_\_\_\_\_ STATE **UTAH** RANGE \_\_\_\_\_

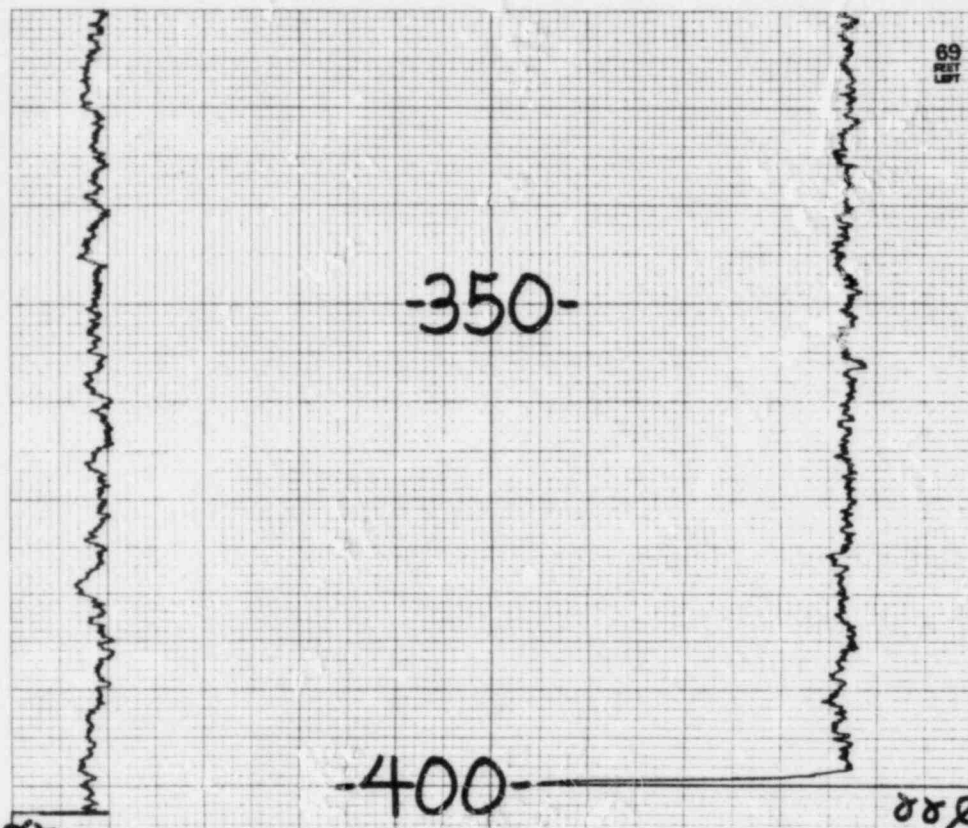
ELEVATION \_\_\_\_\_ DEPTH REFERENCE **XTAL @ GROUND LEVEL** GEOLOGIST \_\_\_\_\_

PROBE NO. 1809		INITIAL RUN		LOG RANGE
K FACTOR	DEAD TIME	T.D. DRILLED	LOG	
1.19x10 <sup>-5</sup>	6.65µsec	406	300 CPS	
WATER FACTOR	AIR FACTOR	T.D. LOGGED	TC	FROM
415	1.00	397	2	
DETECTOR TYPE AND SIZE		NATURAL GAMMA RANGE		TO
XTAL 2"x1"x1/8"		25 CPS/IN		
CALIBRATION RANGE		RATE		TOTAL
2		20'/MIN		
SOURCE		SP RANGE		TAPE
NA		NA		
SOURCE SN ACTIVITY TYPE		RES RANGE		TOTAL FEET
113 14 Am <sup>241</sup> Be		NA		
TEST PIT DATA		OTHER		416
DOE GJO		BOTTOM @ 405'		

11-30-81



NEUTRON-NEUTRON LOG



GAMMA RAY LOG

AI GM/CC  
DEN 2.7

ACRYLIC GM/CC  
DEN 1.2

MG GM/CC  
DEN 2.1

ES, INC.  
 DRILLING CONTRACTOR **ZIMMERMAN**  
 T.D. DRIFTED **NA**  
 TRUE DEPTH **25**  
 LOCATION **MOAB**  
 AZIMUTH DISTANCE  
 BIT SIZE **8 1/2 IN**  
 CASING **8" STEEL 5/16" THK**  
 CASING FACTOR **1.67**  
 BOREHOLE FLUID **H<sub>2</sub>O - BRINE**  
 FLUID LEVEL **16'**  
 VISCOSITY DENSITY  
 OPERATOR **JIM GENTRY**  
 UNIT **25**  
 LOCATION **MOAB**  
 DRIVING HOURS  
 STANDBY HOURS  
 TIME IN  
 TIME OUT  
 LOGGING HOURS  
 TOTAL HOURS  
 ROUND TRIP MILEAGE

**PLS** PROFESSIONAL LOGGING SERVICES, INC.  
 Clifton, Colorado 81201  
 HOLE NO. **ATP-1-82**  
 CLIENT **ATLAS**  
 APER **ATLAS TAILINGS POND**  
 COUNTY **GRAND**  
 SECTION TOWNSHIP STATE  
 ELEVATION DEPTH REFERENCE  
**88 XTL @ GL**  
 DATE **01-13-82**  
 GEOLOGIST **UTAH**

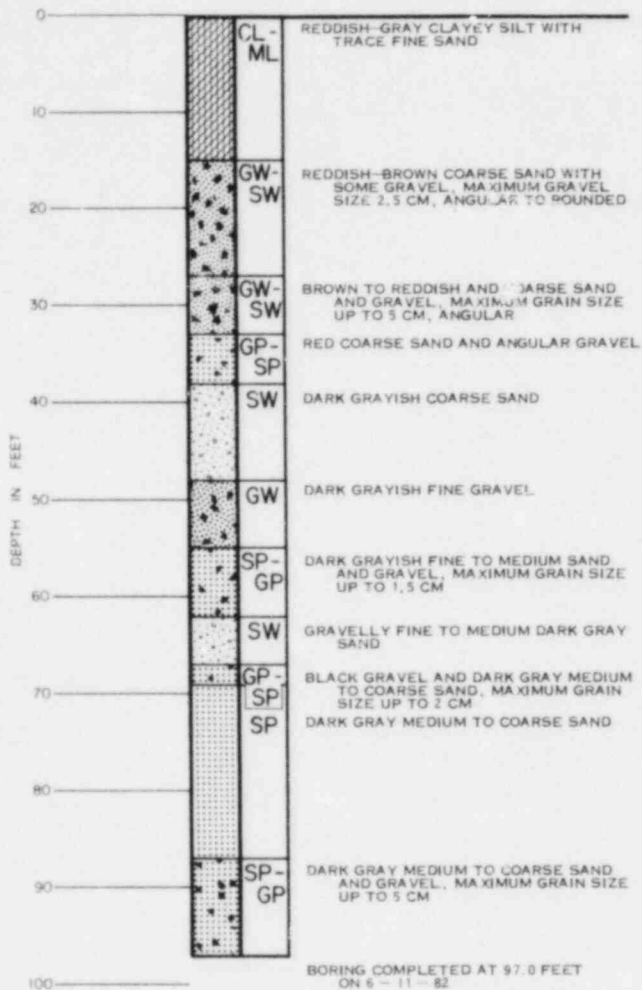
DRILLING CONTRACTOR **ZIMMERMAN**  
 T.D. DRIFTED **NA**  
 TRUE DEPTH **22**  
 LOCATION **MOAB**  
 AZIMUTH DISTANCE  
 BIT SIZE **8.5"**  
 CASING **8" STEEL 5/16"**  
 CASING FACTOR **1.67**  
 BOREHOLE FLUID **H<sub>2</sub>O - BRINE**  
 FLUID LEVEL **16'**  
 VISCOSITY DENSITY  
 OPERATOR **R. LARSON**  
 UNIT **22**  
 LOCATION **MOAB**  
 DRIVING HOURS  
 STANDBY HOURS  
 TIME IN  
 TIME OUT  
 LOGGING HOURS  
 TOTAL HOURS  
 ROUND TRIP MILEAGE

LOG	NEUTRON	LOG	NEUTRON	LOG
RANGE	RANGE	RANGE	RANGE	RANGE
100 CPS/IN	200 CPS/IN			
TC RATES	TC RATES	TC	RATE	
3	3	FROM		
5/M	5/M	TO		
		TOTAL		
404	16			
16	7			
TAPE	TAPE			

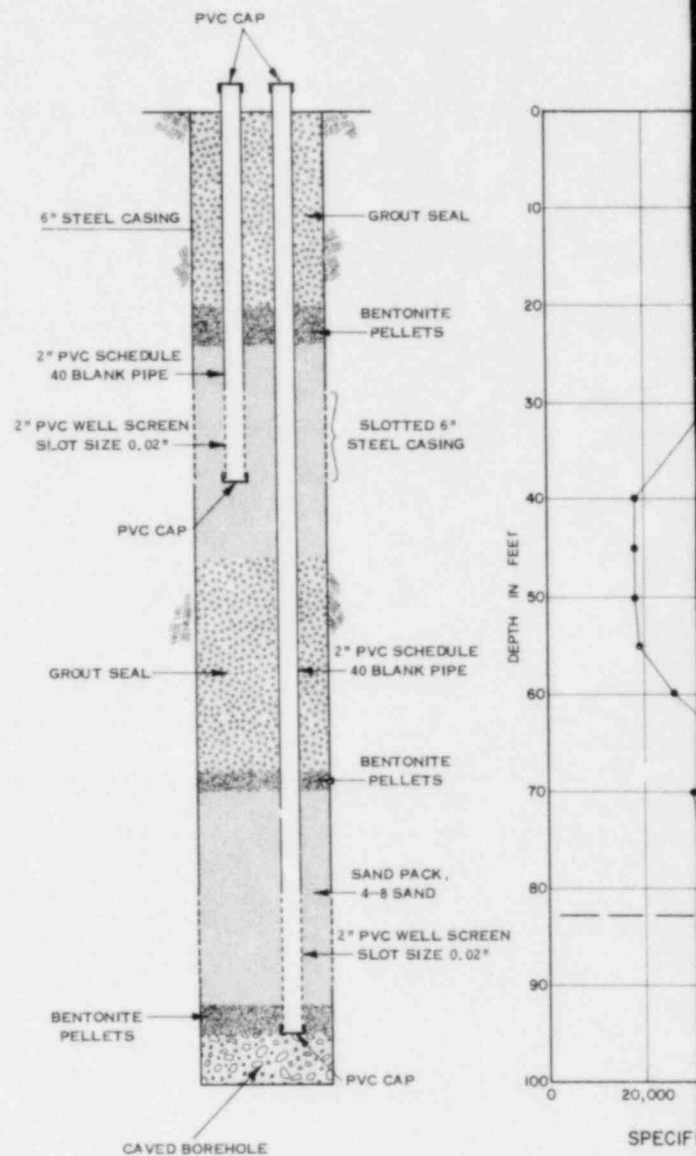
PROBE NO. **2103-2228**  
 K FACTOR **1.49 x 10<sup>-5</sup>**  
 WATER FACTOR **1.15**  
 DETECTOR TYPE AND SIZE **XTL 5 x 2 1/2**  
 CALIBRATION RANGE **200 CPS/IN**  
 SOURCE **AI MG ACRYLIC**  
 TEST PIT DATA **B319 20 MG AI**  
 DATE **11-30-81**  
 INITIAL RUN  
 T.D. DRILLED **406'**  
 T.D. LOGGED **400'**  
 NATURAL GAMMA RANGE **25 CPS/IN**  
 RANGE **2**  
 RATE **15 FPM**  
 RES RANGE **NA**  
 OTHER **NA**  
 BOTTOM OF PROBE @ 405'

LOG	DENSITY	LOG	DENSITY	LOG
RANGE	RANGE	RANGE	RANGE	RANGE
200 CPS/IN	200 CPS/IN			
TC RATES	TC RATES	TC	RATE	
2	2	FROM		
15 FPM	15 FPM	TO		
400'	400'	TOTAL		
0'	0'			
400'	400'			
01-25-04A	01-25-04A			
TAPE	TAPE			

# BORING ATP-2



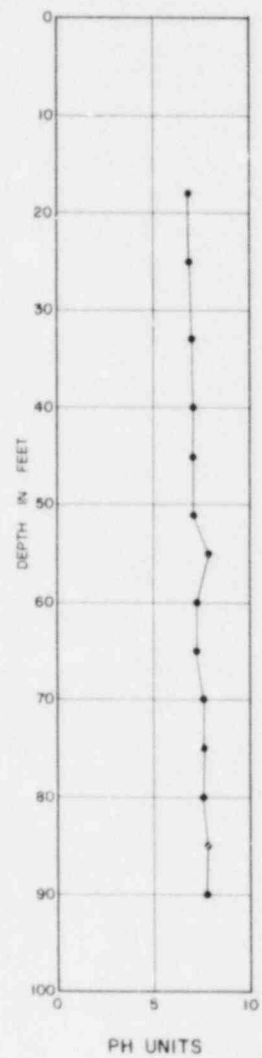
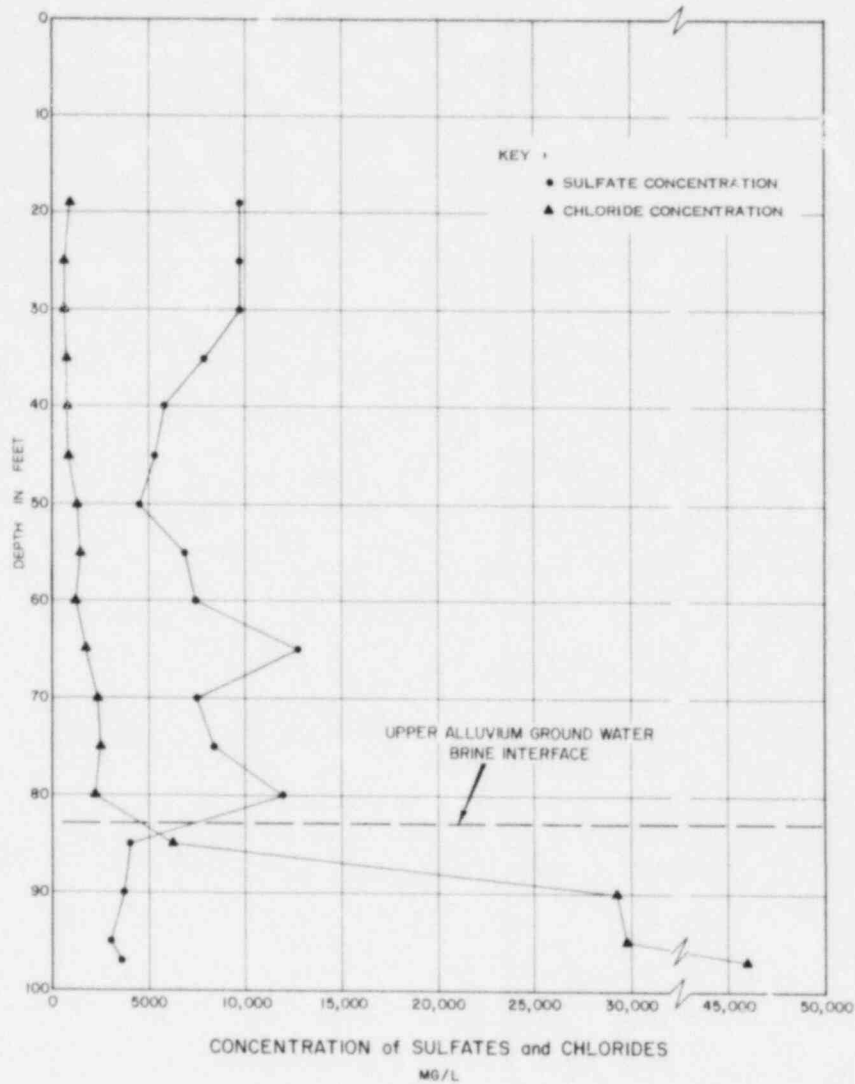
LOG OF BORING



WELL COMPLETION LOG

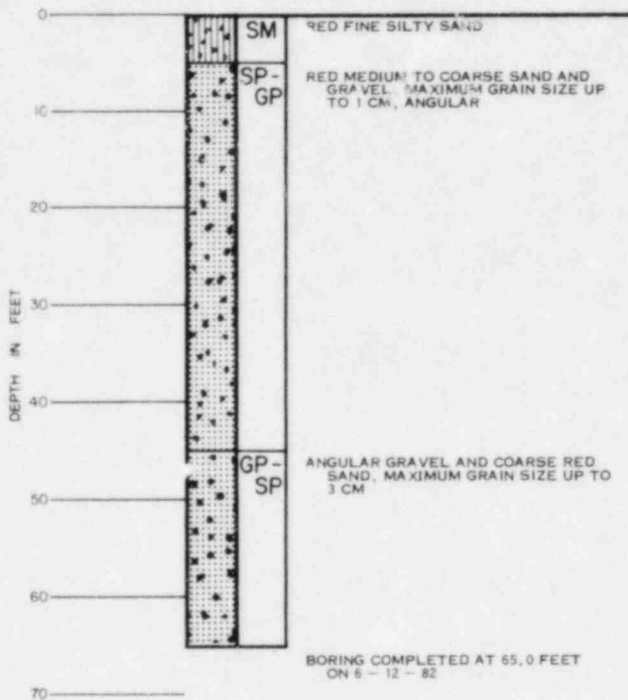
REVISIONS: DATE BY DATE BY DATE BY CHECKED BY DATE

SPECIF

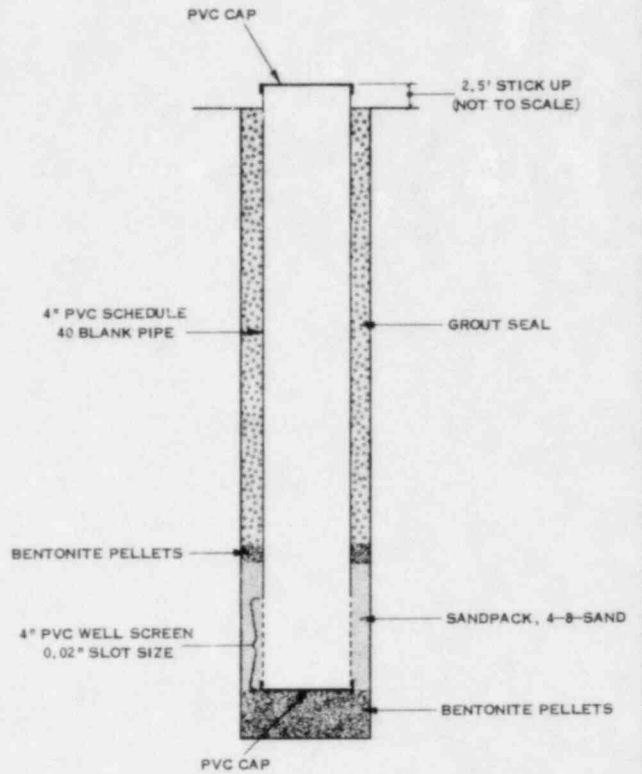




# BORING ATP-3



## LOG OF BORING



## WELL COMPLETION LOG

REVISIONS  
 BY DATE  
 BY DATE  
 PLATE OF  
 FILE  
 BY DATE  
 CHECKED BY

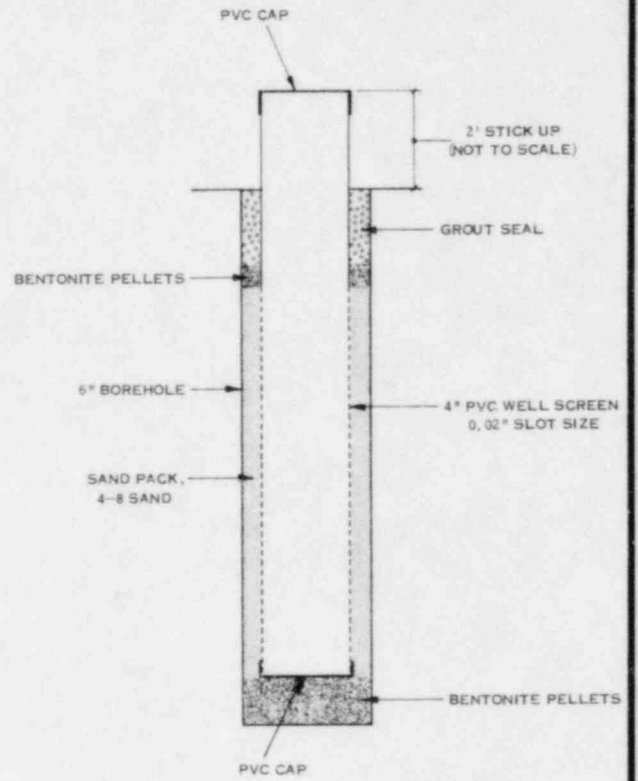
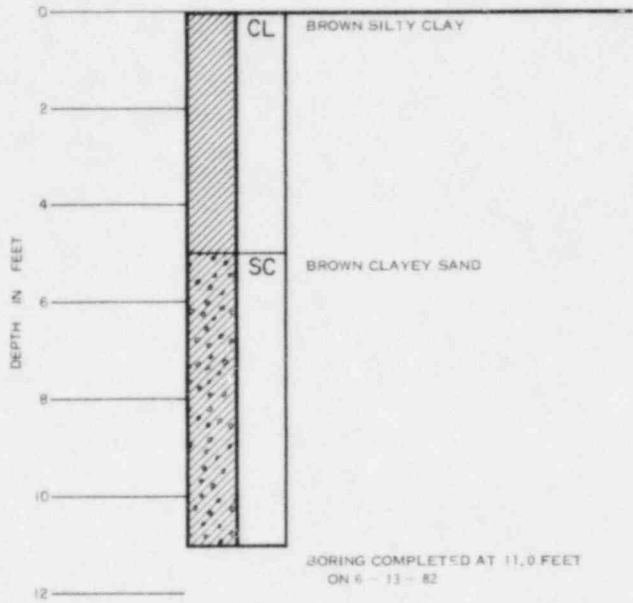




REVISED BY DATE OF

FILE BY DATE CHECKED BY DATE

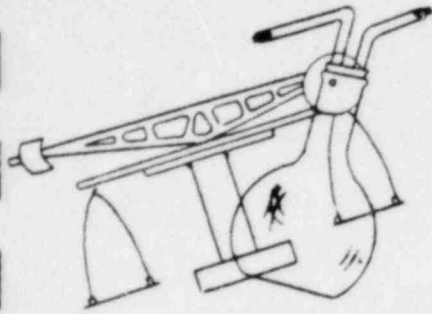
# BORING MW-2-R



## LOG OF BORING

## WELL COMPLETION LOG

APPENDIX B  
CERTIFICATES OF ANALYSIS



# Ford Chemical LABORATORY, INC.

*Bacteriological and Chemical Analysis*

40 WEST LOUISE AVENUE  
SALT LAKE CITY, UTAH 84115

PHONE 466-8761

DATE: 01/27/82

CERTIFICATE OF ANALYSIS

DAMES & MOORE, ENG.  
250 E. BROADWAY  
SALT LAKE CITY, UT  
84111

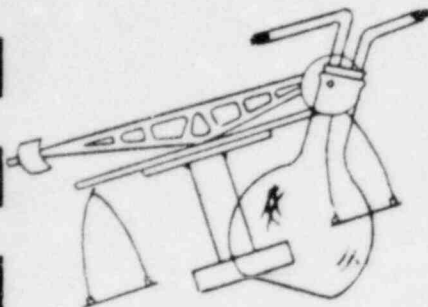
82-009050

SAMPLE: WELL WATER SAMPLES FROM ATLAS PROJECT, JOB #05467-030-06  
COLLECTED 1-19-82, RECEIVED 1-20-82 FOR ANALYSIS.  
UNDER P.O. #SL 1510.

ATP-1-D	ATP-1-S
WELL D	WELL S
13:00	13:00

	ATP-1-D	ATP-1-S
Ammonia as NH <sub>3</sub> -N mg/l	3.13	3.32
Conductivity umhos/cm	192,000	170,000
Nitrate as NO <sub>3</sub> -N mg/l	5.90	1.20
Nitrite as NO <sub>2</sub> -N mg/l	.32	.18
Total Diss. Solids Mg/l	144,500	125,380

*[Signature]*  
FORD CHEMICAL LABORATORY, INC.



# Ford Chemical

## LABORATORY, INC.

*Bacteriological and Chemical Analysis*

40 WEST LOUISE AVENUE  
SALT LAKE CITY, UTAH 84115

PHONE 466-8761

DATE: 01/26/81

CERTIFICATE OF ANALYSIS

DAMES & MOORE, ENG.  
250 E. BROADWAY  
SALT LAKE CITY, UT  
84111

82-009060

SAMPLE: WELL WATER SAMPLE FROM ATLAS PROJECT, JOB #05467-030-06  
RECEIVED 1-20-82 FOR ANALYSIS.

ATP	ATP
1-IS	1-ID
81	81

Ammonia as NH <sub>3</sub> -N mg/l	3.16	3.12
Nitrate as NO <sub>3</sub> -N mg/l	.90	.60
Nitrite as NO <sub>2</sub> -N mg/l	.12	.08
Total Diss. Solids Mg/l	125,000	127,500

*[Signature]*  
FORD CHEMICAL LABORATORY, INC.

DAMES & MOORE  
SALT LAKE CITY  
UTAH

JAN 27 '82

GET LOWE, INC.  
SUGAR CITY, UTAH  
UTAH

**HAZEN****Hazen Research, Inc.**4601 Indiana St • Golden, Colo 80401  
Tel: (303) 279-4501 • Telex: 45-860

## REPORT OF ANALYSIS

Atlas Minerals

Date February 11, 1982  
HRI Project No. 4893  
HRI Series No. 23111-2  
Date Received 1/27/82  
Customer P.O. A-10162

Element Found	ATP-1-S S
Arsenic, recoverable, mg/l	<0.001
Barium, recoverable, mg/l	1.99
Cadmium, recoverable, mg/l	0.298
Calcium, recoverable, mg/l	1570
Chromium, recoverable, mg/l	0.13
Copper, recoverable, mg/l	0.18
Iron, recoverable, mg/l	1.22
Lead, recoverable, mg/l	1.26
Magnesium, recoverable, mg/l	472
Manganese, recoverable, mg/l	0.490
Molybdenum, recoverable, mg/l	0.12
Nickel, recoverable, mg/l	3.51
Potassium, recoverable, mg/l	749
Sodium, recoverable, g/l	35.2
Vanadium, recoverable, mg/l	0.38
Zinc, recoverable, mg/l	0.21
Carbonate as CaCO <sub>3</sub> , mg/l	<5
Bicarbonate as CaCO <sub>3</sub> , mg/l	40
Chloride, g/l	59.2
Specific Conductance µmho/cm 25°C	152,600
Fluoride, mg/l	0.98
Solids, dissolved, g/l	100.3
Sulfate as SO <sub>4</sub> , mg/l	4420
Selenium, recoverable, mg/l	0.002
Uranium, recoverable, mg/l	<0.002

By: Robert Rostad  
Manager, General Analytical

mem






Hazen Research, Inc.  
4601 Indiana St • Golden, Colo 80401  
Tel: (303) 279-4501 • Telex: 45-860

REPORT OF ANALYSIS

Atlas Minerals

Date February 11, 1982  
HRI Project No. 4893  
HRI Series No. 23111-4  
Date Received 1/27/82  
Customer P.O. A-10162

Element Found	IS	ATR-1-IS
Arsenic, recoverable, mg/l	<0.001	
Barium, recoverable, mg/l	1.58	
Cadmium, recoverable, mg/l	0.311	
Calcium, recoverable, mg/l	1500	
Chromium, recoverable, mg/l	0.14	
Copper, recoverable, mg/l	0.19	
Iron, recoverable, mg/l	3.30	
Lead, recoverable, mg/l	1.32	
Magnesium, recoverable, mg/l	582	
Manganese, recoverable, mg/l	0.560	
Molybdenum, recoverable, mg/l	0.14	
Nickel, recoverable, mg/l	3.84	
Potassium, recoverable, mg/l	895	
Sodium, recoverable, g/l	37.6	
Vanadium, recoverable, mg/l	0.36	
Zinc, recoverable, mg/l	0.20	
Carbonate as CaCO <sub>3</sub> , mg/l	<5	
Bicarbonate as CaCO <sub>3</sub> , mg/l	119	
Chloride, g/l	61.6	
Specific Conductance umho/cm 25°C	160,200	
Fluoride, mg/l	1.67	
Solids, dissolved, g/l	105.1	
Sulfate as SO <sub>4</sub> , mg/l	4690	
Selenium, recoverable,	0.001	
Uranium, recoverable, mg/l	<0.002	

By:   
Robert Rostad  
Manager, General Analytical

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Hazen Research, Inc.  
4601 Indiana St • Golden, Colo 80401  
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REPORT OF ANALYSIS

Atlas Minerals

Date February 11, 1982  
HRI Project No. 4893  
HRI Series No. 23111-3  
Date Received 1/27/82  
Customer P.O. A-10162

Element Found	ID	ATP-1-ID
Arsenic, recoverable, mg/l	<0.001	
Barium, recoverable, mg/l	1.44	
Cadmium, recoverable, mg/l	0.311	
Calcium, recoverable, mg/l	1510	
Chromium, recoverable, mg/l	0.14	
Copper, recoverable, mg/l	0.20	
Iron, recoverable, mg/l	3.20	
Lead, recoverable, mg/l	1.24	
Magnesium, recoverable, mg/l	577	
Manganese, recoverable, mg/l	0.550	
Molybdenum, recoverable, mg/l	0.14	
Nickel, recoverable, mg/l	3.85	
Potassium, recoverable, mg/l	789	
Sodium, recoverable, g/l	39.1	
Vanadium, recoverable, mg/l	0.44	
Zinc, recoverable, mg/l	0.21	
Carbonate as CaCO <sub>3</sub> , mg/l	<5	
Bicarbonate as CaCO <sub>3</sub> , mg/l	98	
Chloride, g/l	62.0	
Specific Conductance, µmho/cm 25°C	161,200	
Fluoride, mg/l	1.37	
Solids, dissolved, g/l	106.3	
Sulfate as SO <sub>4</sub> , mg/l	4600	
Selenium, recoverable, mg/l	0.002	
Uranium, recoverable, mg/l	<0.002	

By: Robert Rostad  
Robert Rostad  
Manager, General Analytical

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**HAZEN****Hazen Research, Inc.**4601 Indiana St. • Golden, Colo. 80401  
Tel (303) 279-4501 • Telex 45-860

## REPORT OF ANALYSIS

Atlas Minerals

Date February 11, 1982  
HRI Project No. 4893  
HRI Series No. 23111-1  
Date Received 1/27/82  
Customer P.O. A-10162

Element Found	ATP-1-D D
Arsenic, recoverable, mg/l	<0.001
Barium, recoverable, mg/l	1.61
Cadmium, recoverable, mg/l	0.334
Calcium, recoverable, mg/l	1550
Chromium, recoverable, mg/l	0.14
Copper, recoverable, mg/l	0.21
Iron, recoverable, mg/l	9.48
Lead, recoverable, mg/l	1.34
Magnesium, recoverable, mg/l	604
Manganese, recoverable, mg/l	0.475
Molybdenum, recoverable, mg/l	0.27
Nickel, recoverable, mg/l	4.10
Potassium, recoverable, mg/l	891
Sodium, recoverable, g/l	39.6
Vanadium, recoverable, mg/l	0.18
Zinc, recoverable, mg/l	0.34
Carbonate as CaCO <sub>3</sub> , mg/l	<5
Bicarbonate as CaCO <sub>3</sub> , mg/l	107
Chloride, g/l	62.4
Specific Conductance, umho/cm 25°C	166,600
Fluoride, mg/l	2.02
Solids, dissolved, g/l	110.3
Sulfate as SO <sub>4</sub> , mg/l	4720
Selenium, recoverable, mg/l	<0.001
Uranium, recoverable, mg/l	<0.002

By: Robert Rostad  
Manager, General Analytical

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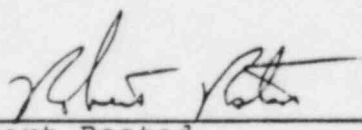
Hazen Research, Inc.  
4601 Indiana St. • Golden, Colo 80401  
Tel (303) 279-4501 • Telex 45-860

REPORT OF ANALYSIS

Atlas Minerals

Date February 11, 1982  
HRI Project No. 4893  
HRI Series No. 23111  
Date Received 1/27/82  
Customer P.O. A-10162

Analysis No.	Sample Designation	pCi/l Po <sup>210</sup>	recoverable ± Precision*
23111-1	ATP-1- D	0.9	± 2.4
-2	S	0.4	± 2.2
-3	ID	1.7	± 2.7
-4	IS	0.0	± 1.9

By:   
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Manager, General Analytical

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\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.



Hazen Research, Inc.  
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REPORT OF ANALYSIS

Atlas Minerals  
North Highway 163 Mill Site  
Moab, Utah 84532

Date February 11, 1982  
HRI Project No. 4893  
HRI Series No. 23111  
Date Received 1/27/82  
Customer P.O. A-10162

Analysis No.	Sample Designation	pCi/l recoverable Ra <sup>226</sup> ± Precision*
23111-1	ATP-1 - D	3.4 ± 2.2
-2	S	6.8 ± 2.5
-3	ID	5.6 ± 2.7
-4	IS	3.9 ± 1.9

By: Robert Rostad  
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\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.

NOTE: Lead 210 results to follow.



Hazen Research, Inc.  
4601 Indiana St • Golden, Colo 80401  
Tel (303) 279-4501 • Telex 45-860

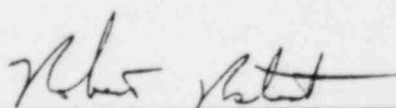
REPORT OF ANALYSIS

Atlas Minerals

Date February 11, 1982  
HRI Project No. 4893  
HRI Series No. 23111  
Date Received 1/27/82  
Customer P.O. A-10162

Analysis No.	Sample Designation	pCi/l Th <sup>230</sup>	recoverable ± Precision*
	ATP-1-		
23111-1	D	0	± 16
-2	S	0	± 20
-3	ID	0	± 16
-4	IS	0	± 20

By:

  
Robert Rostad  
Manager, General Analytical

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\*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.



MONITOR WELL REPORTS

Quarter

ATP-1-S

Well # Well S

Date and time sample was collected January 20, 1982

Location of sample \_\_\_\_\_

Sampling method used (bailed or pumped) Pumped

The amount of water to be removed prior to sampling \_\_\_\_\_

<u>Radionuclide</u>	<u>M.P.C.</u>	<u>Concentration uci/ml</u>	<u>Error Estimate</u>
Gross Beta-Gamma		<u>Nil x 10<sup>-6</sup> uci/ml</u>	<u>±0</u>
U-Nat	<u>3 x 10<sup>-5</sup> uci/ml</u>	<u>Nil x 10<sup>-5</sup> uci/ml</u>	<u>±0</u>
Ra <sup>226</sup>	<u>3 x 10<sup>-8</sup> uci/ml</u>	<u>.026 x 10<sup>-8</sup> uci/ml</u>	<u>±.06</u>
Th <sup>230</sup>	<u>2 x 10<sup>-6</sup> uci/ml</u>	<u>0 x 10<sup>-6</sup> uci/ml</u>	<u>±0</u>
Pb <sup>210</sup>	<u>1 x 10<sup>-7</sup> uci/ml</u>	_____	_____
Po <sup>210</sup>	<u>7 x 10<sup>-7</sup> uci/ml</u>	<u>0.0 Pci/ml</u>	<u>±.0009</u>

<u>Common Ions and Trace Metals</u>	<u>Concentration</u>	<u>Error Estimate</u>
K <sup>+</sup>	<u>1580 PPM</u>	<u>±0</u>
Na <sup>+</sup>	<u>25000 PPM</u>	<u>±0</u>
Cl <sup>-</sup>	<u>44,485 PPM</u>	<u>±481</u>
SO <sup>=</sup>	<u>4150 PPM</u>	<u>±200</u>
NO <sup>4-</sup>	<u>.011 G/L</u>	<u>±.009</u>
Fe <sup>3</sup>	<u>1.2 PPM</u>	<u>±0</u>
Mn	<u>.15 PPM</u>	<u>±0</u>
As	<u>&lt;.01 PPM</u>	<u>±0</u>
Se	<u>&lt;.1 PPM</u>	<u>±0</u>
TDS	<u>107,638</u>	<u>±4236</u>
Conductivity	<u>143,600</u>	<u>umhos</u>
Ph	<u>9.0</u>	_____
Cu	<u>.193 PPM</u>	<u>±.02</u>

MONITOR WELL REPORTS

Quarter

ATP-1-IS

Well # Well S1

Date and time sample was collected January 20, 1982

Location of sample \_\_\_\_\_

Sampling method used (bailed or pumped) Pumped

The amount of water to be removed prior to sampling \_\_\_\_\_

<u>Radionuclide</u>	<u>M.P.C.</u>	<u>Concentration uci/ml</u>	<u>Error Estimate</u>
Gross Beta-Gamma		<u>Nil x 10<sup>-6</sup> uci/ml</u>	<u>±0</u>
U-Nat	<u>3 x 10<sup>-5</sup> uci/ml</u>	<u>Nil x 10<sup>-5</sup> uci/ml</u>	<u>±0</u>
Ra <sup>226</sup>	<u>3 x 10<sup>-8</sup> uci/ml</u>	<u>.019 x 10<sup>-8</sup> uci/ml</u>	<u>±035</u>
Th <sup>230</sup>	<u>2 x 10<sup>-6</sup> uci/ml</u>	<u>0 x 10<sup>-6</sup> uci/ml</u>	<u>±0</u>
Pb <sup>210</sup>	<u>1 x 10<sup>-7</sup> uci/ml</u>		
Po <sup>210</sup>	<u>7 x 10<sup>-7</sup> uci/ml</u>	<u>.00015 Pci/ml</u>	<u>±.0004</u>

<u>Common Ions and Trace Metals</u>	<u>Concentration</u>	<u>Error Estimate</u>
K <sup>+</sup>	<u>1615 PPM</u>	<u>±45</u>
Na <sup>+</sup>	<u>27,500 PPM</u>	<u>±4492</u>
Cl <sup>-</sup>	<u>46,985 PPM</u>	<u>±319</u>
SO <sup>=</sup>	<u>4174 PPM</u>	<u>±314</u>
NO <sup>4-</sup>	<u>.015 g/L</u>	<u>±.0046</u>
Fe <sup>3</sup>	<u>2.5 PPM</u>	<u>±.44</u>
Mn	<u>.22 PPM</u>	<u>±.04</u>
As	<u>&lt;.01 PPM</u>	<u>±0</u>
Se	<u>&lt;.01 PPM</u>	<u>±0</u>
TDS	<u>107,859</u>	<u>±2412</u>
Conductivity	<u>121,250</u>	<u>umhos</u>
Ph	<u>7.9</u>	
Cu	<u>.213 PPM</u>	<u>±.02</u>

MONITOR WELL REPORTS

Quarter

Well # Well D1 ATP-1-1D

Date and time sample was collected January 20, 1982

Location of sample \_\_\_\_\_

Sampling method used (bailed or pumped) \_\_\_\_\_

The amount of water to be removed prior to sampling \_\_\_\_\_

<u>Radionuclide</u>	<u>M.P.C.</u>	<u>Concentration uci/ml</u>	<u>Error Estimate</u>
Gross Beta-Gamma		<u>1.13 x 10<sup>-6</sup> uci/ml</u>	<u>±.17</u>
U-Nat	<u>3 x 10<sup>-5</sup> uci/ml</u>	<u>Nil x 10<sup>-5</sup> uci/ml</u>	<u>█</u>
Ra <sup>226</sup>	<u>3 x 10<sup>-8</sup> uci/ml</u>	<u>.036 x 10<sup>-8</sup> uci/ml</u>	<u>±.058</u>
Th <sup>230</sup>	<u>2 x 10<sup>-6</sup> uci/ml</u>	<u>0 x 10<sup>-6</sup> uci/ml</u>	<u>±0</u>
Pb <sup>210</sup>	<u>1 x 10<sup>-7</sup> uci/ml</u>	<u>.</u>	<u>_____</u>
Po <sup>210</sup>	<u>7 x 10<sup>-7</sup> uci/ml</u>	<u>.0.0 Pci/ml</u>	<u>±0</u>

Common Ions and Trace Metals

<u>Common Ions and Trace Metals</u>	<u>Concentration</u>	<u>Error Estimate</u>
K <sup>+</sup>	<u>1450 PPM</u>	<u>±90</u>
Na <sup>+</sup>	<u>25,000 PPM</u>	<u>±0</u>
Cl <sup>-</sup>	<u>47,017 PPM</u>	<u>±1182</u>
SO <sup>=</sup>	<u>3986 PPM</u>	<u>±136</u>
NO <sup>4-</sup>	<u>.010 g/l</u>	<u>±0</u>
Fe <sup>3</sup>	<u>3.0 PPM</u>	<u>±.45</u>
Mn	<u>.17 PPM</u>	<u>±0</u>
As	<u>&lt;.01 PPM</u>	<u>±0</u>
Se	<u>&lt;.01 PPM</u>	<u>±0</u>
TDS	<u>103,982 PPM</u>	<u>±10,927</u>
Conductivity	<u>120,000</u>	<u>umhos</u>
Ph	<u>7.9</u>	<u>_____</u>
Cu	<u>.205 PPM</u>	<u>±0</u>

MONITOR WELL REPORTS

Quarter \_\_\_\_\_

Well # Well D ATP-1-D

Date and time sample was collected January 20, 1982

Location of sample \_\_\_\_\_

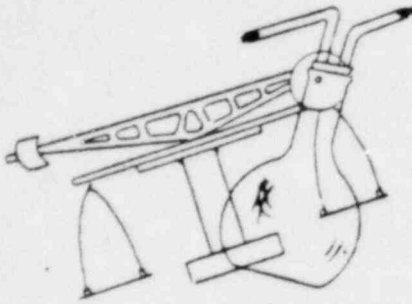
Sampling method used (bailed or pumped) Pumped

The amount of water to be removed prior to sampling \_\_\_\_\_

<u>Radionuclide</u>	<u>M.P.C.</u>	<u>Concentration uci/ml</u>	<u>Error Estimate</u>
Gross Beta-Gamma		$Nil \times 10^{-5}$ uci/ml	$\pm 0$
U-Nat	$3 \times 10^{-5}$ uci/ml	$Nil \times 10^{-5}$ uci/ml	$\pm 0$
Ra <sup>226</sup>	$3 \times 10^{-8}$ uci/ml	$.034 \times 10^{-8}$ uci/ml	$\pm .14$
Th <sup>230</sup>	$2 \times 10^{-6}$ uci/ml	$0 \times 10^{-6}$ uci/ml	$\pm 0$
Pb <sup>210</sup>	$1 \times 10^{-7}$ uci/ml		
Po <sup>210</sup>	$7 \times 10^{-7}$ uci/ml	0.0 Pci/ml	$\pm .0009$

Common Ions and Trace Metals

	<u>Concentration</u>	<u>Error Estimate</u>
K <sup>+</sup>	1555 PPM	$\pm 90$
Na <sup>+</sup>	28,500 PPM	$\pm 4492$
Cl <sup>-</sup>	48,974 PPM	$\pm 988$
SO <sup>=</sup>	4441 PPM	$\pm 263$
NO <sup>4-</sup>	.0145 g/L	$\pm 0$
Fe <sup>3</sup>	9.6 PPM	$\pm .9$
Mn	.16 PPM	$\pm .04$
As	.01 PPM	$\pm 0$
Se	<.1 PPM	$\pm 0$
TDS	120,671 PPM	$\pm 7333$
Conductivity	150,400	umhos
Ph	7.6	
Cu	.22 PPM	$\pm 0$



# Ford Chemical LABORATORY, INC.

*Bacteriological and Chemical Analysis*

40 WEST LOUISE AVENUE  
SALT LAKE CITY, UTAH 84115  
PHONE 466-8761

DATE: 08/18/82

CERTIFICATE OF ANALYSIS

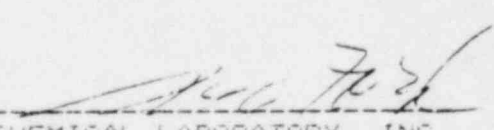
DAMES & MOORE, ENG.  
250 E. BROADWAY  
SALT LAKE CITY, UT  
84111

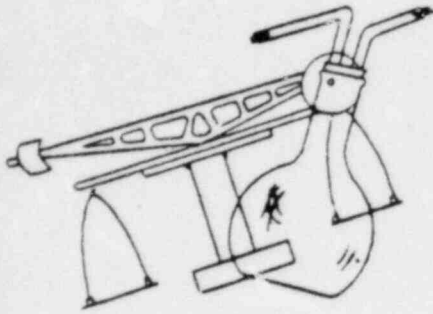
82-004608

SAMPLE: WATER SAMPLE FROM ATLAS MINERALS RECEIVED 8-17-82 FOR  
ANALYSIS UNDER P.O. SL-1773.

MW-1R  
8-16-82  
11 A.M.

=====  
Ammonia as NH<sub>3</sub>-N mg/l                      203.65  
Nitrate as NO<sub>3</sub>-N mg/l                        6.60  
Nitrite as NO<sub>2</sub>-N mg/l                        2.48

  
-----  
FORD CHEMICAL LABORATORY, INC.



# Ford Chemical

## LABORATORY, INC.

*Bacteriological and Chemical Analysis*

40 WEST LOUISE AVENUE  
SALT LAKE CITY, UTAH 84115

PHONE 466-8761

DATE: 06/23/82

CERTIFICATE OF ANALYSIS

DAMES & MOORE, ENG.  
250 E. BROADWAY  
SALT LAKE CITY, UT  
84111

82-003595

SAMPLE: WATER SAMPLES COLLECTED 6-15-82 RECEIVED 6-16-82 FOR  
ANALYSIS UNDER P.O. SL-1773, TEMPERATURE 5 DEGREES C.

MW-2-R      ATP-S-1      ATP-2-D      ATP-2-S      ATP-3

	MW-2-R	ATP-S-1	ATP-2-D	ATP-2-S	ATP-3
Ammonia as NH3-N mg/l	93.10	1.73	23.60	129.20	.31
Nitrate as NO3-N mg/l	388.00	1.20	7.10	40.50	.15
Nitrite as NO2-N mg/l	.01	<.01	.04	.01	.01

*[Signature]*  
FORD CHEMICAL LABORATORY, INC.

DAMES & MOORE  
SALT LAKE CITY  
RECEIVED  
JUN 24 '82

GCT	GWC	PTG
WJG	VRH	LAE
LTM	SV	HP
ADP	SKV	DR
PFO	LA	DR
RJ	GT	SH
CHR	TV	IFZ
EP	ARB	

FILE  
VIDEO RECEIPT



## ATLAS MINERALS

## MOAB MILL

## REGULATORY AFFAIRS DEPARTMENT

## MONITOR WELL REPORTS

2nd Quarter 1982

Well # ATP, S-1  
 Date and Time Sample was Collected 6-15-82  
 Location of Sample South East of tails pond  
 Sampling Method Used (~~Barrel~~ - Pumped) pumped  
 The Amount of Water to be Removed Prior to Sampling \_\_\_\_\_  
 Name of Sampler Dames & Moore

Radionuclide	M.P.C.	Date of Analysis	Concentration uci/ml	Error Estimate	L.L.D.	Name of Assayer
Gross Beta-Gamma		6/16	$0 \times 10^{-6}$	+ 0		JJ
U-Nat	$3 \times 10^{-5}$ uci/ml	6/24	.000003 $\times 10^{-5}$	+ .0000009	$8 \times 10^{-10}$ uci/ml	VH
Ra-226	$3 \times 10^{-8}$ uci/ml	7/27	$0 \times 10^{-6}$	+ 0	$4.9 \times 10^{-10}$ uci/ml	JJ
Th-230	$2 \times 10^{-6}$ uci/ml	7/16	.0013 $\times 10^{-6}$	+ .0002	$4.9 \times 10^{-10}$ uci/ml	JJ
Pb-210	$1 \times 10^{-7}$ uci/ml				$3.7 \times 10^{-9}$ uci/ml	
Po-210	$7 \times 10^{-7}$ uci/ml	7/22	0	+ 0	$2.0 \times 10^{-9}$ uci/ml	JJ

## Common Ion and Trace Metals

	Date of Analysis	Concentration	Error Estimate	L.L.D.	Name of Assayer
K+	7/5	1,045 PPM	+44	.001 PPM	J. Johnson
Na+	7/5	31,400 PPM	+ 898	.001 PPM	J. Johnson
Cl-	6/20	61,984 PPM	+1604	.40 PPM	J. Johnson
SO <sub>4</sub>	6/20	4,656 PPM	+ 19	.21 PPM	J. Johnson
NO <sub>3</sub>	6/15	.25 PPM	+ 0	.01 PPM	J. Johnson
Fe	7/20	.42 PPM	+ 0	.001 PPM	D. Edwards
Mn	7/20	.40 PPM	+ 0	.01 PPM	D. Edwards
As	7/20	<.1 PPM	+ 0	.10 PPM	D. Edwards
Se	7/20	<.5 PPM	+ 0	.50 PPM	D. Edwards
Cu	7/20	.01 PPM	+ 0	.01 PPM	D. Edwards
TDS	6/15	106,409 PPM	+ 1756	1.0 PPM	J. Johnson
PH	6/15	7.10		.10 Units	J. Johnson
Conductivity	6/15	200,000 umhos		10 umhos	J. Johnson

## ATLAS MINERALS

## MOAB HILL

## REGULATORY AFFAIRS DEPARTMENT

## MONITOR WELL REPORTS

2nd Quarter 1982

Well # ATP - 2-S  
 Date and Time Sample Was Collected 6-15-82  
 Location of Sample South of Tails Pond  
 Sampling Method Used (Bailed - Pumped) pumped  
 The Amount of Water to be Removed Prior to Sampling \_\_\_\_\_  
 Name of Sampler Dames & Moore

Radionuclide	M.P.C.	Date of Analysis	Concentration uci/ml	Error Estimate	L.L.D.	Name of Assayer
Gross Beta-Gamma		<u>6/16</u>	<u>.11 x 10<sup>-6</sup></u>	<u>+.04</u>		<u>JJ</u>
U-Nat	<u>3x10<sup>-5</sup> uci/ml</u>	<u>6/24</u>	<u>.0009 x 10<sup>-5</sup></u>	<u>+.0001</u>	<u>8x10<sup>-10</sup> uci/ml</u>	<u>VH</u>
Ra-226	<u>3x10<sup>-8</sup> uci/ml</u>	<u>7/27</u>	<u>.02x10<sup>-8</sup></u>	<u>+ 0</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Th-230	<u>2x10<sup>-6</sup> uci/ml</u>	<u>7/16</u>	<u>.0022x10<sup>-6</sup></u>	<u>+.0004</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Pb-210	<u>1x10<sup>-7</sup> uci/ml</u>				<u>3.7x10<sup>-9</sup> uci/ml</u>	
Po-210	<u>7x10<sup>-7</sup> uci/ml</u>	<u>7/23</u>	<u>.005x10<sup>-7</sup></u>	<u>+.0004</u>	<u>2.0x10<sup>-9</sup> uci/ml</u>	<u>JJ</u>

## Common Ion and Trace Metals

	Date of Analysis	Concentration	Error Estimate	L.L.D.	Name of Assayer
K+	<u>7/5</u>	<u>120 PPM</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Na+	<u>7/5</u>	<u>695 PPM</u>	<u>+ 44</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Cl-	<u>6/20</u>	<u>1,347 PPM</u>	<u>+ 0</u>	<u>.40 PPM</u>	<u>J. Johnson</u>
SO <sub>4</sub>	<u>6/20</u>	<u>6,664 PPM</u>	<u>+ 44</u>	<u>.21 PPM</u>	<u>J. Johnson</u>
NO <sub>3</sub>	<u>6/15</u>	<u>17.4 PPM</u>	<u>+ 5</u>	<u>.01 PPM</u>	<u>J. Johnson</u>
Fe	<u>7/20</u>	<u>.72 PPM</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>D. Edwards</u>
Mn	<u>7/20</u>	<u>1.9 PPM</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
As	<u>7/20</u>	<u>&lt;.1 PPM</u>	<u>+ 0</u>	<u>.10 PPM</u>	<u>D. Edwards</u>
Se	<u>7/20</u>	<u>&lt;.5 PPM</u>	<u>+ 0</u>	<u>.50 PPM</u>	<u>D. Edwards</u>
Cu	<u>7/20</u>	<u>.015 PPM</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
TDS	<u>6/15</u>	<u>12,359 PPM</u>	<u>+ 235</u>	<u>1.0 PPM</u>	<u>J. Johnson</u>
PH	<u>6/15</u>	<u>7.7</u>		<u>.10 Units</u>	<u>J. Johnson</u>
Conductivity	<u>6/15</u>	<u>18,000 umhos</u>		<u>10 umhos</u>	<u>J. Johnson</u>

## ATLAS MINERALS

## MOAB MILL

## REGULATORY AFFAIRS DEPARTMENT

## MONITOR WELL REPORTS

2nd Quarter 1982

Well # ATR 2-DDate and Time Sample Was Collected 6-15-82Location of Sample South of tails pondSampling Method Used (Bailed - Pumped) pumped

The Amount of Water to be Removed Prior to Sampling \_\_\_\_\_

Name of Sampler Dames & Moore

Radionuclide	M.P.C.	Date of Analysis	Concentration uci/ml	Error Estimate	L.L.D.	Name of Assayer
Gross Beta-Gamma		<u>6/16</u>	<u>0x10<sup>-6</sup></u>	<u>+ 0</u>		<u>JJ</u>
U-238	<u>3x10<sup>-5</sup> uci/ml</u>	<u>6/24</u>	<u>.0013 x10<sup>-5</sup></u>	<u>+.0001</u>	<u>8x10<sup>-10</sup> uci/ml</u>	<u>VH</u>
Ra-226	<u>3x10<sup>-8</sup> uci/ml</u>	<u>7/28</u>	<u>.22x10<sup>-8</sup></u>	<u>+.04</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Th-230	<u>2x10<sup>-6</sup> uci/ml</u>	<u>7/16</u>	<u>.0016x10<sup>-6</sup></u>	<u>+.001</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Pb-210	<u>1x10<sup>-7</sup> uci/ml</u>				<u>3.7x10<sup>-9</sup> uci/ml</u>	
Po-210	<u>7x10<sup>-7</sup> uci/ml</u>	<u>7/27</u>	<u>0</u>	<u>0</u>	<u>2.0x10<sup>-9</sup> uci/ml</u>	<u>JJ</u>

## Common Ion and Trace Metals

	Date of Analysis	Concentration	Error Estimate	L.L.D.	Name of Assayer
K+	<u>7/5</u>	<u>340 PPM</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Na+	<u>7/5</u>	<u>7,500 PPM</u>	<u>+0</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Cl-	<u>6/20</u>	<u>17,234 PPM</u>	<u>+0</u>	<u>.40 PPM</u>	<u>J. Johnson</u>
SO <sub>4</sub>	<u>6/20</u>	<u>4,582 PPM</u>	<u>+ 13</u>	<u>.21 PPM</u>	<u>J. Johnson</u>
NO <sub>3</sub>	<u>6/15</u>	<u>2.4 PPM</u>	<u>+5</u>	<u>.01 PPM</u>	<u>J. Johnson</u>
Fe	<u>7/20</u>	<u>6.7 PPM</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>D. Edwards</u>
Mn	<u>7/20</u>	<u>1.1 PPM</u>	<u>+0</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
As	<u>7/20</u>	<u>&lt; 1 PPM</u>	<u>+ 0</u>	<u>.10 PPM</u>	<u>D. Edwards</u>
Se	<u>7/20</u>	<u>&lt; 5 PPM</u>	<u>+ 0</u>	<u>.50 PPM</u>	<u>D. Edwards</u>
Cu	<u>7/20</u>	<u>.08 PPM</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
TDS	<u>6/15</u>	<u>31,952 PPM</u>	<u>+ 377</u>	<u>1.0 PPM</u>	<u>J. Johnson</u>
PH	<u>6/15</u>	<u>8.0</u>		<u>.10 Units</u>	<u>J. Johnson</u>
Conductivity	<u>6/15</u>	<u>36,000 umhos</u>		<u>10 umhos</u>	<u>J. Johnson</u>

ATLAS MINERALS

MOAB MILL

REGULATORY AFFAIRS DEPARTMENT

MONITOR WELL REPORTS

2nd Quarter 1982

Well # \_\_\_\_\_ Atp #3  
 Date and Time Sample Was Collected 6-15-82  
 Location of Sample North of tails pond  
 Sampling Method Used (Drilled - Pumped) pumped  
 The Amount of Water to be Removed Prior to Sampling \_\_\_\_\_  
 Name of Sampler Dames & Moore

<u>Radionuclide</u>	<u>M.P.C.</u>	<u>Date of Analysis</u>	<u>Concentration uci/ml</u>	<u>Error Estimate</u>	<u>L.L.D.</u>	<u>Name of Assayer</u>
Gross Beta-Gamma		<u>6/16</u>	<u>0x10<sup>-6</sup></u>	<u>+ 0</u>		<u>JJ</u>
U-Nat	<u>3x10<sup>-5</sup> uci/ml</u>	<u>6/24</u>	<u>.00006x10<sup>-5</sup></u>	<u>+ .000007</u>	<u>8x10<sup>-10</sup> uci/ml</u>	<u>VH</u>
Ra-226	<u>3x10<sup>-8</sup> uci/ml</u>	<u>7/28</u>	<u>.04x10<sup>-8</sup></u>	<u>+ 0</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Th-230	<u>2x10<sup>-6</sup> uci/ml</u>	<u>7/16</u>	<u>.0025x10<sup>-6</sup></u>	<u>+ .001</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Pb-210	<u>1x10<sup>-7</sup> uci/ml</u>				<u>3.7x10<sup>-9</sup> uci/ml</u>	
Po-210	<u>7x10<sup>-7</sup> uci/ml</u>	<u>7/28</u>	<u>0</u>	<u>+ 0</u>	<u>2.0x10<sup>-9</sup> uci/ml</u>	<u>JJ</u>

Common Ion and Trace Metals

	<u>Date of Analysis</u>	<u>Concentration</u>	<u>Error Estimate</u>	<u>L.L.D.</u>	<u>Name of Assayer</u>
K+	<u>7/5</u>	<u>31 mg/L</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Na+	<u>7/5</u>	<u>390 mg/L</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Cl-	<u>6/20</u>	<u>496 mg/L</u>	<u>+ 0</u>	<u>.40 PPM</u>	<u>J. Johnson</u>
SO <sub>4</sub>	<u>6/20</u>	<u>223 MG/L</u>	<u>+ 19</u>	<u>.21 PPM</u>	<u>J. Johnson</u>
NO <sub>3</sub>	<u>6/15</u>	<u>&lt;.01 mg/L</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>J. Johnson</u>
Fe	<u>7/20</u>	<u>.05 mg/L</u>	<u>+ .02</u>	<u>.001 PPM</u>	<u>D. Edwards</u>
Mn	<u>7/20</u>	<u>.21 mg/L</u>	<u>+ .06</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
As	<u>7/20</u>	<u>&lt;.1 mg/L</u>	<u>+ 0</u>	<u>.10 PPM</u>	<u>D. Edwards</u>
Se	<u>7/20</u>	<u>&lt;.5 mg/L</u>	<u>+ 0</u>	<u>.50 PPM</u>	<u>D. Edwards</u>
Cu	<u>7/20</u>	<u>.05 mg/L</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
TDS	<u>6/15</u>	<u>1,386 mg/L</u>	<u>+269</u>	<u>1.0 PPM</u>	<u>J. Johnson</u>
PH	<u>6/15</u>	<u>7.76</u>		<u>.10 Unit</u>	<u>J. Johnson</u>
Conductivity	<u>6/15</u>	<u>2,400 umhos</u>		<u>10 umhos</u>	<u>J. Johnson</u>

## ATLAS MINERALS

## MOAB MILL

## REGULATORY AFFAIRS DEPARTMENT

## MONITOR WELL REPORTS

2nd Quarter 1982

Well # 1-R

Date and Time Sample Was Collected 6-15-82Location of Sample South West of tail's pondSampling Method Used (Bailed - Pumped) pumped

The Amount of Water to be Removed Prior to Sampling \_\_\_\_\_

Name of Sampler Dames & Moore

Radionuclide	M.P.C.	Date of Analysis	Concentration uci/ml	Error Estimate	L.L.D.	Name of Assayer
Gross Beta-Gamma		6/16	<u>.16</u> x 10 <sup>-6</sup>	+ 0		JJ
U-Nat	3x10 <sup>-5</sup> uci/ml	6/24	<u>.003</u> x 10 <sup>-5</sup>	+ .0001	8x10 <sup>-10</sup> uci/ml	VH
Ra-226	3x10 <sup>-8</sup> uci/ml	7/22	<u>.18</u> x 10 <sup>-8</sup>	+ .08	4.9x10 <sup>-10</sup> uci/ml	JJ
Th-230	2x10 <sup>-6</sup> uci/ml	7/14	<u>.0025</u> x 10 <sup>-6</sup>	+ .001	4.9x10 <sup>-10</sup> uci/ml	JJ
Pb-210	1x10 <sup>-7</sup> uci/ml				3.7x10 <sup>-9</sup> uci/ml	
Po-210	7x10 <sup>-7</sup> uci/ml	7/20	<u>.022</u> x 10 <sup>-7</sup>	+ .0004	2.0x10 <sup>-9</sup> uci/ml	JJ

## Common Ion and Trace Metals

	Date of Analysis	Concentration	Error Estimate	L.L.D.	Name of Assayer
K+	7/5	120 PPM	+ 0	.001 PPM	J. Johnson
Na+	7/5	1,900 PPM	+ 0	.001 PPM	J. Johnson
Cl-	6/20	2,624 PPM	+ 0	.40 PPM	J. Johnson
SO <sub>4</sub>	6/20	8,456 PPM	+ 223	.21 PPM	J. Johnson
NO <sub>3</sub>	6/15	98.2 PPM	+ 6	.01 PPM	J. Johnson
Fe	7/20	4.2 PPM	+ 0	.001 PPM	D. Edwards
Mn	7/20	.67 PPM	+ 0	.01 PPM	D. Edwards
As	7/20	<.1 PPM	+ 0	.10 PPM	D. Edwards
Se	7/20	<.5 PPM	+ 0	.50 PPM	D. Edwards
Cu	7/20	.07 PPM	+ .01	.01 PPM	D. Edwards
TDS	6/15	19,966 PPM	+ 1024	1.0 PPM	J. Johnson
PH	6/15	7.18		.10 Units	J. Johnson
Conductivity	6/15	20,500 umhos		10 umhos	J. Johnson

## ATLAS MINERALS

## MOAB MILL

## REGULATORY AFFAIRS DEPARTMENT

## MONITOR WELL REPORTS

2nd Quarter 1982

MW-2-R

Well # 2-R  
 Date and Time Sample Was Collected 6-16-82  
 Location of Sample South of Tails Pond  
 Sampling Method Used (Bailed - Pumped) Bailed  
 The Amount of Water to be Removed Prior to Sampling 6 Gal  
 Name of Sampler Jay Johnson

Radionuclide	M.P.C.	Date of Analysis	Concentration uci/ml	Error Estimate	L.L.D.	Name of Assayer
Gross Beta-Gamma		6/16	<u>2.4</u> $\times 10^{-6}$	<u>+.17</u>		JJ
U-238	$3 \times 10^{-5}$ uci/ml	6/24	<u>.015</u> $\times 10^{-5}$	<u>+.0005</u>	$8 \times 10^{-10}$ uci/ml	VH
Ra-226	$3 \times 10^{-8}$ uci/ml	7/28	<u>.15</u> $\times 10^{-8}$	<u>+ 0</u>	$4.9 \times 10^{-10}$ uci/ml	JJ
Th-230	$2 \times 10^{-6}$ uci/ml	7/15	<u>.0038</u> $\times 10^{-6}$	<u>+.001</u>	$4.9 \times 10^{-10}$ uci/ml	JJ
Pb-210	$1 \times 10^{-7}$ uci/ml				$3.7 \times 10^{-9}$ uci/ml	
Po-210	$7 \times 10^{-7}$ uci/ml	7/21	<u>.023</u> $\times 10^{-7}$	<u>+.0004</u>	$2.0 \times 10^{-9}$ uci/ml	JJ

## Common Ion and Trace Metals

	Date of Analysis	Concentration	Error Estimate	L.L.D.	Name of Assayer
K+	7/5	120 PPM	+ 0	.001 PPM	J. Johnson
Na+	7/5	2,600 PPM	+ 0	.001 PPM	J. Johnson
Cl-	6/20	2,199 PPM	+ 0	.40 PPM	J. Johnson
SO <sub>4</sub>	6/20	10,563 PPM	+528	.21 PPM	J. Johnson
NO <sub>3</sub>	6/16	127 PPM	+5	.01 PPM	J. Johnson
Fe	7/20	1.6 PPM	+ 0	.001 PPM	D. Edwards
Mn	7/20	1.1 PPM	+ 0	.01 PPM	D. Edwards
As	7/20	<.1 PPM	+ 0	.10 PPM	D. Edwards
Se	7/20	<.5 PPM	+ 0	.50 PPM	D. Edwards
Cu	7/20	.50 PPM	+ 0	.01 PPM	D. Edwards
TDS	6/16	24,604 PPM	+ 1313	1.0 PPM	J. Johnson
PH	6/16	7.04		.10 Units	J. Johnson
Conductivity	6/16	26,000 umhos		10 umhos	J. Johnson

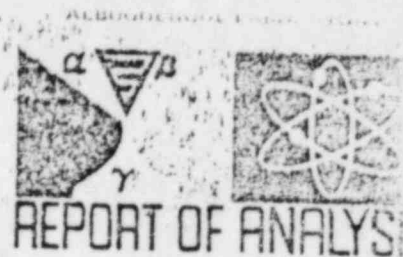


5 water samples for analysis fo Ra226, 1h230, Pb210, U(nat)

<u>SAMPLE I.D.</u>	<u>ANALYSIS</u>	<u>pCi/l</u>	<u>µg/l</u>
MW-1-R	Ra226	1.43 ± 0.44	
	Th230	0.98 ± 0.40	
	Pb210	0 ± 3	
	U(nat)		2,410
MW-2-R	Ra226	1.49 ± 0.38	
	Th230	9.87 ± 0.52	
	Pb210	78 ± 4	
	U(nat)		18,992
ATP-2 D	Ra226	1.54 ± 0.35	
	Th230	0.56 ± 0.22	
	Pb210	1 ± 3	
	U(nat)		170
ATP-2 S	Ra226	0.41 ± 0.25	
	1h230	0.77 ± 0.30	
	Pb210	0 ± 4	
	U(nat)		1,475
Background b-1b-82 ATP-3	Ra226	0.29 ± 0.23	
	Th230	0.63 ± 0.11	
	Pb210	0 ± 3	
	U(nat)		25

Approved by:

*Michael J. Bawghan* Date 8/20/82



CUSTOMER: Atlas Minerals  
 ATTENTION: Division of Atlas Corp.  
 ADDRESS: Box 1297  
 CITY: Molair, Utah 84532  
 S.O. NO.: 7727 (E-030)

Radiochemical analyses of water samples.

A-7904 REL#11  
 CUSTOMER ORDER NUMBER: [blank] SAMPLES RECEIVED: 6/30/82

Customer Identification	Date Collected	Type of Analysis	ug/l	pCi/l	Total Vol. (ml)
MSI-1-R		* Total Uranium	1500		3250
		Th-230		0.4±0.3	
		Ra-226		2±1	
		Pb-210		67±9	
MSI-3-R		* Total Uranium	8800		3500
		Th-230		160±10	
		Ra-226		3±1	
		Pb-210		1900±200	
ATP-2-D		* Total Uranium	150		90
		Th-230		1.3±1.1	
		Ra-226		2±1	
		Pb-210		4±2	
ATP-2-S		* Total Uranium	1100		3500
		Th-230		26±7	
		Ra-226		0.4±0.1	
		Pb-210		260±30	
Back Ground ATP-3	6/15/82	* Total Uranium	17		3400
		Th-230		0.4±0.4	
		Ra-226		0.8±0.2	
		Pb-210		2±2	

\* By Fluorometric method.

REPORTED VIA TELEPHONE  
 REPORTED VIA TWX

PAGE 1 OF 1 PAGE

Eberline



APPROVED BY: *Chandrasekaran*  
 CHANDRASEKARAN, E.S., MANAGER

10/1/82  
 DATE

ATLAS MINERALS

MOAB MILL

REGULATORY AFFAIRS DEPARTMENT

MONITOR WELL REPORTS

2nd Quarter 1982

Well # 1  
 Date and Time Sample Was Collected 6-15-82  
 Location of Sample South West tails pond  
 Sampling Method Used (Bailed - Pumped) Pumped  
 The Amount of Water to be Removed Prior to Sampling \_\_\_\_\_  
 Name of Sampler Dames & Moore

<u>Radionuclide</u>	<u>M.P.C.</u>	<u>Date of Analysis</u>	<u>Concentration uci/ml</u>	<u>Error Estimate</u>	<u>L.L.D.</u>	<u>Name Assay</u>
Gross Beta-Gamma		<u>6/16</u>	<u>.10x10<sup>-6</sup></u>	<u>+.03</u>		<u>JJ</u>
U-238	<u>3x10<sup>-5</sup> uci/ml</u>	<u>6/24</u>	<u>.003x10<sup>-5</sup></u>	<u>+.0007</u>	<u>8x10<sup>-10</sup> uci/ml</u>	<u>VH</u>
Ra-226	<u>3x10<sup>-8</sup> uci/ml</u>	<u>7/22</u>	<u>.40x10<sup>-8</sup></u>	<u>+ 0</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Th-230	<u>2x10<sup>-6</sup> uci/ml</u>	<u>7/14</u>	<u>.0016x10<sup>-6</sup></u>	<u>+.0008</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Pb-210	<u>1x10<sup>-7</sup> uci/ml</u>				<u>3.7x10<sup>-9</sup> uci/ml</u>	
Po-210	<u>7x10<sup>-7</sup> uci/ml</u>	<u>7/20</u>	<u>.035x10<sup>-7</sup></u>	<u>+.0022</u>	<u>2.0x10<sup>-9</sup> uci/ml</u>	<u>JJ</u>

Common Ion and Trace Metals

	<u>Date of Analysis</u>	<u>Concentration</u>	<u>Error Estimate</u>	<u>L.L.D.</u>	<u>Name of Assayer</u>
K+	<u>7/5</u>	<u>140PPM</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Na+	<u>7/5</u>	<u>2,100 PPM</u>	<u>+ 40</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Cl-	<u>6/20</u>	<u>3,440 PPM</u>	<u>+ 152</u>	<u>.40 PPM</u>	<u>J. Johnson</u>
SO <sub>4</sub>	<u>6/20</u>	<u>10,171 PPM</u>	<u>+ 108</u>	<u>.21 PPM</u>	<u>J. Johnson</u>
NO <sub>3</sub>	<u>6/15</u>	<u>187 PPM</u>	<u>+ 5</u>	<u>.01 PPM</u>	<u>J. Johnson</u>
Fe	<u>7/20</u>	<u>.11 PPM</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>D. Edwards</u>
Mn	<u>7/20</u>	<u>.42 PPM</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
As	<u>7/20</u>	<u>&lt;1 PPM</u>	<u>+ 0</u>	<u>.10 PPM</u>	<u>D. Edwards</u>
Se	<u>7/20</u>	<u>&lt;.5 PPM</u>	<u>+ 0</u>	<u>.50 PPM</u>	<u>D. Edwards</u>
Cu	<u>7/20</u>	<u>.08 PPM</u>	<u>+ .02</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
TDS	<u>6/15</u>	<u>24,906 PPM</u>	<u>+ 615</u>	<u>1.0 PPM</u>	<u>J. Johnson</u>
PH	<u>6/15</u>	<u>7.15</u>		<u>.10 Units</u>	<u>J. Johnson</u>
Conductivity	<u>6/15</u>	<u>25,500 UMHOS</u>		<u>10 umhos</u>	<u>J. Johnson</u>

ATLAS MINERALS

MOAB MILL

REGULATORY AFFAIRS DEPARTMENT

MONITOR WELL REPORTS

2nd Quarter 1982

Well # 2  
 Date and Time Sample Was Collected 6-16-82  
 Location of Sample South of Tails Pond  
 Sampling Method Used (Bailed - Pumped) Bailed  
 The Amount of Water to be Removed Prior to Sampling 6 gal  
 Name of Sampler J. Johnson

<u>Radionuclide</u>	<u>M.P.C.</u>	<u>Date of Analysis</u>	<u>Concentration uci/ml</u>	<u>Error Estimate</u>	<u>L.L.D.</u>	<u>Name of Assayer</u>
Gross Beta-Gamma		<u>6/16</u>	<u>2.09x10<sup>-6</sup></u>	<u>+ 0</u>		<u>JJ</u>
U-238	<u>3x10<sup>-5</sup> uci/ml</u>	<u>6/24</u>	<u>.013x10<sup>-5</sup></u>	<u>+ .008</u>	<u>8x10<sup>-10</sup> uci/ml</u>	<u>VH</u>
Ra-226	<u>3x10<sup>-8</sup> uci/ml</u>	<u>7/22</u>	<u>.048x10<sup>-8</sup></u>	<u>+ 0</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Th-230	<u>2x10<sup>-6</sup> uci/ml</u>	<u>7/15</u>	<u>.0030x10<sup>-6</sup></u>	<u>+ .001</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Pb-210	<u>1x10<sup>-7</sup> uci/ml</u>				<u>3.7x10<sup>-9</sup> uci/ml</u>	
Po-210	<u>7x10<sup>-7</sup> uci/ml</u>	<u>7/21</u>	<u>.021x10<sup>-7</sup></u>	<u>+ .0013</u>	<u>2.0x10<sup>-9</sup> uci/ml</u>	<u>JJ</u>

Common Ion and Trace Metals

	<u>Date of Analysis</u>	<u>Concentration</u>	<u>Error Estimate</u>	<u>L.L.D.</u>	<u>Name of Assayer</u>
K+	<u>7/5</u>	<u>130 PPM</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Na+	<u>7/5</u>	<u>1,300 PPM</u>	<u>+ .04</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Cl-	<u>6/20</u>	<u>1,347 PPM</u>	<u>+ 0</u>	<u>.40 PPM</u>	<u>J. Johnson</u>
SO <sub>4</sub>	<u>6/20</u>	<u>11,389 PPM</u>	<u>+ 381</u>	<u>.21 PPM</u>	<u>J. Johnson</u>
NO <sub>3</sub>	<u>6/16</u>	<u>170 PPM</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>J. Johnson</u>
Fe	<u>7/20</u>	<u>.10 PPM</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>D. Edwards</u>
Mn	<u>7/20</u>	<u>1.28 PPM</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
As	<u>7/20</u>	<u>&lt;.1 PPM</u>	<u>+ 0</u>	<u>.10 PPM</u>	<u>D. Edwards</u>
Se	<u>7/20</u>	<u>&lt;.5 PPM</u>	<u>+ 0</u>	<u>.50 PPM</u>	<u>D. Edwards</u>
Cu	<u>7/20</u>	<u>.07 PPM</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
TDS	<u>6/16</u>	<u>27,218 PPM</u>	<u>+ .002</u>	<u>1.0 PPM</u>	<u>J. Johnson</u>
PH	<u>6/16</u>	<u>7.04</u>		<u>.10 Units</u>	<u>J. Johnson</u>
Conductivity	<u>6/16</u>	<u>30,000 umhos</u>		<u>10 umhos</u>	<u>J. Johnson</u>

## ATLAS MINERALS

## MOAB MILL

## REGULATORY AFFAIRS DEPARTMENT

## MONITOR WELL REPORTS

2nd Quarter 1982

Well # 3

Date and Time Sample Was Collected 6-17-82

Location of Sample South East of Tails Pond

Sampling Method Used (Bailed - Pumped) Bailed

The Amount of Water to be Removed Prior to Sampling 16 gal

Name of Sampler J Johnson

Radionuclide	M.P.C.	Date of Analysis	Concentration uci/ml	Error Estimate	L.L.D.	Name of Assayer
Gross Beta-Gamma		6/18	$.084 \times 10^{-6}$	+ .03		JJ
U-238	$3 \times 10^{-5}$ uci/ml	6/24	$.005 \times 10^{-5}$	+0	$8 \times 10^{-10}$ uci/ml	VH
Ra-226	$3 \times 10^{-8}$ uci/ml	7/27	$.09 \times 10^{-8}$	+ .02	$4.9 \times 10^{-10}$ uci/ml	JJ
Th-230	$2 \times 10^{-6}$ uci/ml	7/16	$.0009 \times 10^{-6}$	+ .0008	$4.9 \times 10^{-10}$ uci/ml	JJ
Pb-210	$1 \times 10^{-7}$ uci/ml				$3.7 \times 10^{-9}$ uci/ml	
Po-210	$7 \times 10^{-7}$ uci/ml	7/22	$.005 \times 10^{-7}$	+0	$2.0 \times 10^{-9}$ uci/ml	JJ

## Common Ion and Trace Metals

	Date of Analysis	Concentration	Error Estimate	L.L.D.	Name of Assayer
K+	7/5	200 PPM	+ 0	.001 PPM	J. Johnson
Na+	7/5	1800 PPM	+0	.001 PPM	J. Johnson
Cl-	6/20	3,534	+ 99	.40 PPM	J. Johnson
SO <sub>4</sub>	6/20	8,331	+381	.21 PPM	J. Johnson
NO <sub>3</sub>	6/18	15.3 PPM	+ .8	.01 PPM	J. Johnson
Fe	7/20	.11 PPM	+ 0	.001 PPM	D. Edwards
Mn	7/20	.45 PPM	+ 0	.01 PPM	D. Edwards
As	7/20	<.1 PPM	+ 0	.10 PPM	D. Edwards
Se	7/10	<.5 PPM	+ 0	.50 PPM	D. Edwards
Cu	7/20	.03 PPM	+ .02	.01 PPM	D. Edwards
TDS	6/18	17,482 PPM	+ 2041	1.0 PPM	J. Johnson
PH	6/17	7.26		.10 Units	J. Johnson
Conductivity	6/17	19,000 umhos		10 umhos	J. Johnson

ATLAS MINERALS

MOAB MILL

REGULATORY AFFAIRS DEPARTMENT

MONITOR WELL REPORTS

2nd quarter 1982

Well # Arches  
 Date and Time Sample Was Collected 6-17-82  
 Location of Sample Arches Headquarters  
 Sampling Method Used (Carried - Pumped) pumped  
 The Amount of Water to be Removed Prior to Sampling Cont. Flow  
 Name of Sampler J. Johnson

Radionuclide	M.P.C.	Date of Analysis	Concentration uci/ml	Error Estimate	L.L.D.	Name of Assayer
Gross Beta-Gamma		<u>6/18</u>	<u>0x10<sup>-6</sup></u>	<u>+ 0</u>		<u>JJ</u>
U-235	<u>3x10<sup>-5</sup> uci/ml</u>	<u>6/24</u>	<u>.00005x10<sup>-5</sup></u>	<u>+ .000015</u>	<u>8x10<sup>-10</sup> uci/ml</u>	<u>VH</u>
Ra-226	<u>3x10<sup>-8</sup> uci/ml</u>	<u>7/28</u>	<u>.018x10<sup>-8</sup></u>	<u>+ .006</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Th-230	<u>2x10<sup>-6</sup> uci/ml</u>	<u>7/16</u>	<u>.0013x10<sup>-6</sup></u>	<u>+ .001</u>	<u>4.9x10<sup>-10</sup> uci/ml</u>	<u>JJ</u>
Pb-210	<u>1x10<sup>-7</sup> uci/ml</u>				<u>3.7x10<sup>-9</sup> uci/ml</u>	
Po-210	<u>7x10<sup>-7</sup> uci/ml</u>	<u>7/28</u>	<u>0</u>	<u>+ 0</u>	<u>2.0x10<sup>-9</sup> uci/ml</u>	<u>JJ</u>

Common Ion and Trace Metals

	Date of Analysis	Concentration	Error Estimate	L.L.D.	Name of Assayer
K+	<u>7/5</u>	<u>9 mg/l</u>	<u>+ .004</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Na+	<u>7/5</u>	<u>40 mg/l</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>J. Johnson</u>
Cl-	<u>6/20</u>	<u>57 mg/l</u>	<u>+ 0</u>	<u>.40 PPM</u>	<u>J. Johnson</u>
SO <sub>4</sub>	<u>6/20</u>	<u>201 mg/l</u>	<u>+ 0</u>	<u>.21 PPM</u>	<u>J. Johnson</u>
NO <sub>3</sub>	<u>6/18</u>	<u>.65 mg/l</u>	<u>+ 0</u>	<u>.01 PPM</u>	<u>J. Johnson</u>
Fe	<u>7/20</u>	<u>.05 mg/l</u>	<u>+ 0</u>	<u>.001 PPM</u>	<u>D. Edwards</u>
Mn	<u>7/20</u>	<u>.004 mg/l</u>	<u>+ .01</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
As	<u>7/20</u>	<u>.1 mg/l</u>	<u>+ 0</u>	<u>.10 PPM</u>	<u>D. Edwards</u>
Se	<u>7/20</u>	<u>.5 mg/l</u>	<u>+ 0</u>	<u>.50 PPM</u>	<u>D. Edwards</u>
Cu	<u>7/20</u>	<u>.01 mg/l</u>	<u>+ .006</u>	<u>.01 PPM</u>	<u>D. Edwards</u>
TDS	<u>7/18</u>	<u>421 PPM</u>	<u>+ 21</u>	<u>1.0 PPM</u>	<u>J. Johnson</u>
PH	<u>6/17</u>	<u>7.70</u>		<u>.10 Units</u>	<u>J. Johnson</u>
Conductivity	<u>6/17</u>	<u>800 umhos</u>		<u>10 umhos</u>	<u>J. Johnson</u>