NRC PUBLIC DOCUMENT ROOM

Response to NRC Queries of October 28, 1976 for the Uranium Mill of Atlas Minerals Division of the Atlas Corporation at Moab, Utah

RECEIVED
DEC 15 1976
U. S. Nuclear Regulatory Commission
NMSS
Mail Section

1877

THIS DOCUMENT CONTAINS
POOR QUALITY PAGES

4C24

781C31 0062

Atlas Minerals
Division of Atlas Corporation
P.O. Box 1207 Moab, Utah 84532

December 9, 1976

Mr. Ross A. Scarano
Fuel Processing & Fabrication Branch
Division of Fuel Cycle and Material Safety
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Scarano:

NRC Ref: FCPF:RAS
40-3453
SUA-917

According to your request dated October 28, 1976, we now respond to your list of questions concerning our Environmental Report and its supplements.

Very truly yours,

William P. Badger
General Superintendent

WPB:rc:ejc

Enclosures - 15 Copies of *Response to Nuclear Regulatory Commission Questions of October 28, 1976 on Atlas Minerals Environmental Report License No. SUA-917.*

RESPONSE TO NUCLEAR REGULATORY COMMISSION QUESTIONS OF OCTOBER 28, 1976 ON ATLAS MINERALS ENVIRONMENTAL REPORT LICENSE NO. SUA-917

Atlas Minerals Division
of Atlas Corporation
Moab, Utah

December 9, 1976

TABLES

INSERTS

		ACCOMPANIES RESPONSE NO.
1.	Instructions for WS Form E-22 (Formerly WB Form 612-25) Record of Evaporation and Climatological Observations.	25
2.	Dames and Moore Computer Program EP-66.	26

FIGURES

		ACCOMPANIES RESPONSE NO.
1.	Plan showing ground water/surface water relationships to the Moab marsh sump.	2
2.	Site plan.	7
3.	Aereal photograph of site - 1950,	8
4.	Photographs showing sale efflorescence along the bank of the Colorado River upstream from the Atlas mill, near the U. S. Highway 163 bridge.	13
5.	Grazing allotments 0-10 miles.	14
6.	Appropriations of ground and surface waters near the Atlas mill.	18
7.	Photographs showing cooling towers.	23
8.	Ore truck traffic model to Atlas mill explanation.	37

RESPONSE TO NUCLEAR REGULATORY COMMISSION

QUESTIONS OF OCTOBER 28, 1976 ON ATLAS MINERALS ENVIRONMENTAL

REPORT FOR RENEWAL OF SOURCE MATERIAL LICENSE SUA-917

QUERY NO. 1

Cite the references for the scientific nomenclature of biota(Section 2.8).

RESPONSE

The principal references utilized in the preparation of Section 2.8 ecology of the ER are:

18.) Upper Colorado Region State-Federal Inter-Agency Group, 1971. Upper Colorado Region Comprehensive Framework Study, Appendix XIII.

19.) Sigler, William F., & Miller, Robert R., 1963. Fishes of Utah. Published by the Utah State Department of Fish and Game, Salt Lake City, Utah.

20.) Ellis, Max L., 1914. Fishes of Colorado, The University of Colorado Studies, Volume XI, No. 1, Published by the University of Colorado, Boulder, Colorado, March, 1914.

36.) Harrison, Bertrand F., Welsh, Stanley L., & Moore, Glenn, 1964. Plants of Arches National Monument, Brigham Young University Science Bulletin, Biological Series, Vol. V, No. 1, August, 1964.

37.) Carter, D. L., Birds of Arches National Monument, Unpublished typescript available at Arches Visitor Center, 1967.

RESPONSE TO QUERY NO. 1 (CONTINUED)

The citations for the scientific nomenclature for the biota in Section 2.8 are as follows:

SECTION	PAGE	PARA.	SPECIES	REF.	P.
2.8.1 Vegetation	2-25	1	*Atriplex canascens*	36	9
			Ephedra viridis	36	14
	2-26	1	*Yucca glauca*	a.	
			Larrea tridentata	b.	
			Coleogyne ramosissima	36	21
			Oryzopsis hymenoides	36	16
			Atriplex confertifolia	36	9
			Sarcobatus verniculatus	36	9
	2-26	2	*Juniperus osteosperma*	36	19
			Pinus edulis	36	19
			Fraxinus anomala	36	19
			Amelanchier utahensis	36	21
			Quercus gambelii	36	14
			Quercus undulata	36	14
	2-26	3	*Populus Fremontii*	36	21
			Salix spp		
			(Salix lutea)	36	21
			(Salix Amygdaloides)	36	21
			Tamarix pentandra	36	22
			Chrysothamnus nauseosus	36	10
			Typha latifolia	36	22
			Carex		
			(Carex aquatilis)	36	13
			(Carex foenea)	36	13
			(Carex garberi)	36	13
			(Carex hystricina)	36	13
			Juncus		
			(Juncus balticus)	36	17
			(Juncus longistilus)	36	17
			(Juncus saximontanus)	36	17
			Lomatium latilobum	36	22
			Atriplex garrettii	36	9
	2-27	2	*Salsola kali*	36	9
			Kochia scoparia	b.	
			Chrysothamnus nauseosus	36	10
			Salix amygdaloides	36	21
			Salix exigua	b.	
			Tamarix pentandra	36	22
			Distichlis stricta	36	15
			Scirpus acutus	c.	

RESPONSE TO QUERY NO. 1 (CONTINUED)

SECTION	PAGE	PARA.	SPECIES	REF.	P.
2.8.1 Vegetation (cont.)	2-27	2	*Juncus spp.*	36	17
			Carex spp.	36	13
			Polygonum sp.	b.	
			Populus sp. (Cottonwood)	37	1
			Eleagnus augustifolia	36	14
			Ulmus sp. (*Ulmus pumila*)	36	22
			Robinia pseudoacacia	36	18
			Potamogeton pectinatus	b.	
2.8.2 Wildlife	2-29	3	*Branta canadensis*	18	
			Anas discors	18	
			Anas carolinensis	18	
			Anas platyrhyncos	18	
			Anas strepara	18	
	2-30	1	*Aythya affinis*	18	
			Oxyura jamaicensis	18	
			Mareca americana	18	
			Aythya americana	18	
			Spatula clypeata	18	
	2-31	1	*Amphispiza bilineata*	37	5
			Eremophila alpestris	37	2
			Dendrocopos pubescens	d.	
			Myiarchus cinerascens	37	2
			Aphelocoma coerulescens	37	3
			Parus inornatus	37	3
			Viréo vicinior	37	4
			Dendroica negrescens	37	4
			Colaptes cofer	37	2
			Tachycineta thalassina	37	3
			Agelaius phoeneceus	37	5
			Pica pica	37	3
			Turdus migratorius	37	4
			Guiraca caerulea	37	5
			Troglodytes aedon	37	3
			Vermivora celata	37	4
			Wilsonia pusilla	37	4
			Piranga ludoviciana	37	5
			Icterus bullockii	37	5
	2-31	2	*Podilymbus podiceps*	e.	
			Fulica americana	e.	
			Aredea herodias	e.	
			Leucophoyx thula	e.	

RESPONSE TO QUERY NO. 1 (CONTINUED)

SECTION	PAGE	PARA.	SPECIES	REF.	P.
2.8.2 Wildlife (cont.)	2-32	1	*Telmatodytes palustris*	e.	
			Euphagus cyanocephalus	e.	
			Hesperiphona vespertina	e.	
	2-32	2	*Buteo jamaicensis*	37	1
			Falco sparverius	37	1
			Bubo virginianus	37	2
			Aquila chrysaetos	37	1
			Haliaeetus leucocephalus	37	1
			Falco mexicanus	37	1
(Fish)	2-32	3	*Gila robusta*	19	74
			Catostomus latipinnis	19	97
			Pantosteus delphinus	19	100
			Xyrauchen texanus	19	105
			Ictalurus punctatus	19	109
			Ictalurus melas	19	111
			Gila cypha	19	163
			Ptychocheilus lucius	19	164

FOOTNOTES:

a. No reference for *Yucca glauca* was recovered in this search; however, *Yucca harimanniae* was noted in Reference 36, page 18 to be widely distributed in Arches National Monument.

b. Reference was not recovered in this search.

c. On Page 2-27, Paragraph 2, *Scirpus acutus* was listed; however, this search failed to recover the source. Instead, in Reference 36, *Scirpus americanus* was listed on Page 13, and *Scirpus validus* was listed on Page 14.

d. On Page 2-31, Paragraph 1, the hairy woodpecker was erroneously listed as *Dendrocopus pubescens*. According to Reference 37, on the introductory page and on Page 2, the listing should have been *Dendrocopus villosus*.

e. The reference attributed to the Utah Division of Wildlife Resources for waterfowl on Page 2-29, Paragraph 3 was not recovered in this search; however, *Anas carolinensis* and *Anas platyrhyncos* were noted on Page 1 of Reference 37.

QUERY No. 2

Provide water quality analyses for the water from the "sump" in Moab Marsh (p.2-22).

RESPONSE

Query Nos. 2, 3 and 4 are related to the description of a "sump" located on the floodplane of the Colorado River, as presented on Page 2-22 of the Environmental Report(ER). In order to respond meaningfully, it is best to provide a discussion of the geomorphological relationships with the surface and groundwater regimes.

The geohydrologic setting and surface water hydrology are discussed in Sections 2 and 3 of the Supplement to the Environmental Report and in Section 2.3.1.1 of the Safety Analysis Report(SAR).

The geomorphology of the Colorado River was studied on aereal photographs in order to better describe the relationship of the sump to the surface and ground water regimes. The following analysis reflects the results of this study.

The meander path of the Colorado River is controlled by the change in gradient from the incised canyon east of the bridge crossing of U.S. Highway to a flatter gradient across the Moab Valley and by the constriction formed by the deeply incised "The Portal" on the western side of Moab Valley where the gradient of the river again increases and enters another deeply incised canyon. These conditions are shown on Figure 1.

RESPONSE TO QUERY NO. 2 (CONTINUED)

The Colorado River lies at the northern edge of a flood plane which has a width up to about 1¼ miles. The southern edge of the flood plane is delineated by a strand line which is visible on the photos. This strand line is shown on Figure 1. The Colorado River has meandered across this path; however, the flood plane may be roughly divided into three parts. The northwestlerly third of the flood plane is occupied by the present course of the Colorado River. The middle third is relatively high ground which has combined characteristics of a natural levee and a large bar which was formed in a deltaic manner due to the reduction in the gradient of the river's eastern entrance. The southeasterly third is relatively low ground which probably represents a relict or alternative major channel for the river. It is within this southeasterly low of the flood plane that the "sump" or marshland occurs. Examination of the photos reveals that in flood stage, the waters of the river entering the valley from the east are split into two flows. The first split follows the main northwesterly channel. As the water rises, it is diverted by a sand bar at the mouth of the river into a second split which flows almost directly to the south and enters the alternative channel along the southeasterly side of the flood plain.

The waters of the "sump", therefore, have surface communications with the waters of the river. As discussed in Section 2.3.2.2 of the SAR, "Moab Marsh is about 650 acres in size, of which an estimated 150 acres are covered by open water up to 4 feet in depth. One very small sump area in the center of the

RESPONSE TO QUERY NO. 2 (CONTINUED)

large open body of water was estimated to be 4 to 6 feet deep. ....Water depths during the spring flood period may extend to 12 feet in the lower sections of the marsh. ....."

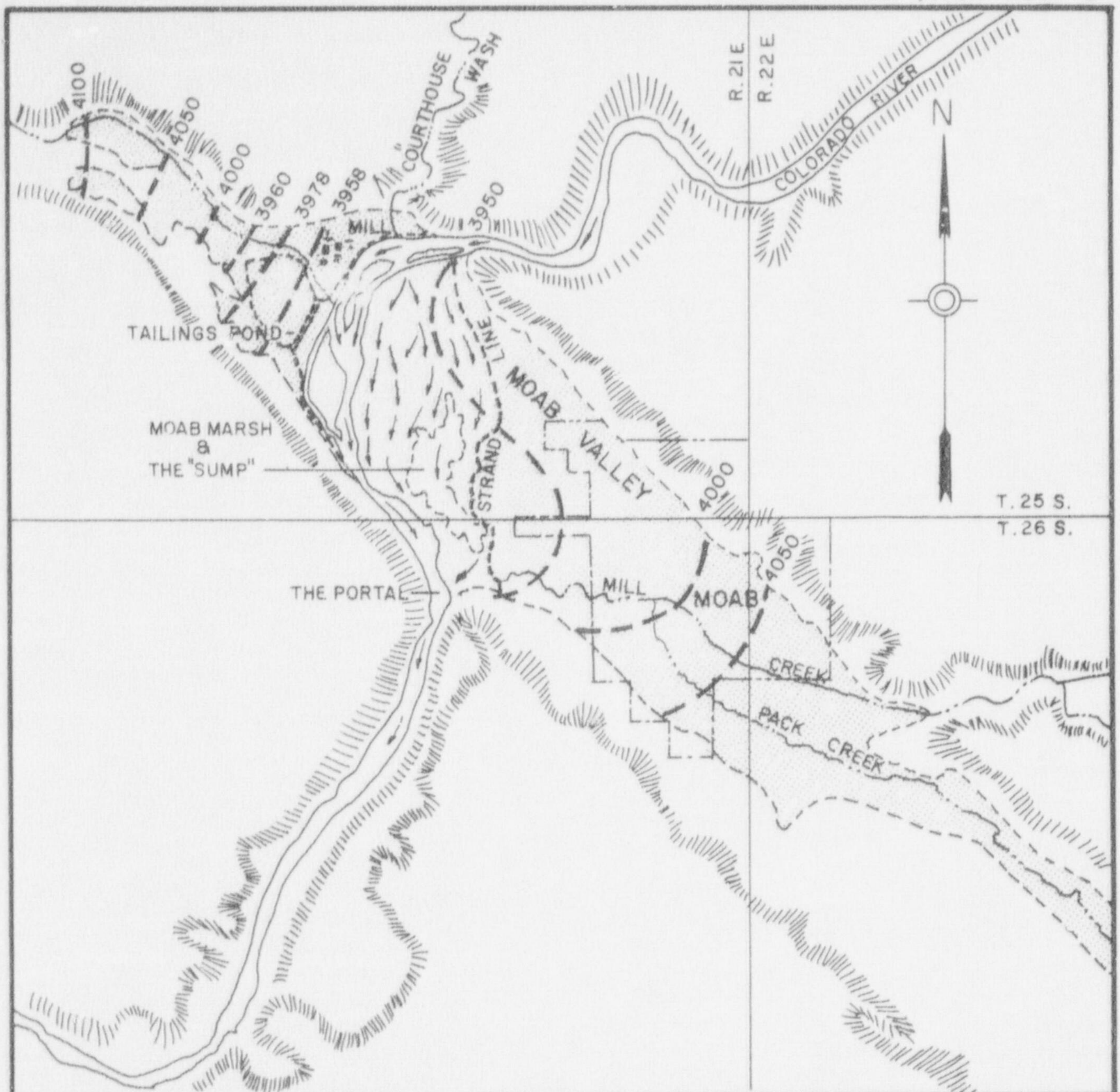
The floodplane of the Colorado River is underlain by Quaternary alluvium. This alluvium in the Moab Valley, as discussed in Paragraph 4 of Section 2.3.1.1 of the SAR, achieves a thickness of saturated deposits as great as 360 feet and averages about 70 feet. In Paragraph 4 of Section 2.1 of the Supplement to the ER, the Embar Oil Company Well No. 1 drilled through 56 feet of alluvium. Thus the "sump" may reasonably be considered to be underlain by alluvium. As a consequence, the sump is seen to have communications with the Colorado River. The surface levels of both are closely related.

On page 2.3-3 of the SAR, the last four paragraphs of Section 2.3.1.1 well describe the nature of the groundwater regime in the vicinity of the Colorado River. The surface of the Colorado River is the low point in the ground water system of the Moab Valley and may be said to be a ground water divide. The regional water table of the Moab Valley, both near Moab and near Arches National Monument, slopes toward the Colorado River with a gradient of about 100 feet per mile. Closer to the river the gradient flattens. Sumison's regional contours as shown on Figure 2.3-2 and the water table contours in the vicinity of the tailings pond as shown on Figure 2.3-3 of the SAR are superimposed upon Figure 1 accompanying this discussion.

RESPONSE TO QUERY NO. 2 (CONTINUED)

Examination of Figure 1 reveals that the principal ground water recharge of the flood plane is from the Colorado River. This is augmented from the southeast by recharge associated with the flow of Mill Creek.

Finally, in response to Query No. 1, since it is not expected that either a surface release of contaminants or seepage in the ground water regime could reach or be concentrated in the "sump" of Moab Marsh, it is not considered necessary to collect samples of water from the sump for analysis.



STREAM & RIVER ALLUVIUM

WINDBLOWN SAND COLLUVIUM & SLOPEWASH.

OLDER ROCKS UNSHADED

4000 CONTOURS ON WATER TABLE

SURFACE WATER FLOWLINES

0 1 2

SCALE 1" = 1 MILE

ATLAS MINERALS DIVISION · ATLAS CORPORATION
MOAB URANIUM MILL

FIGURE 1

PLAN SHOWING GROUND WATER/ SURFACE WATER RELATIONSHIPS TO THE MOAB MARSH SUMP.

QUERY NO. 3

What is the surface elevation of the water in the "sump" in Moab Marsh compared to the surface elevation of the Colorado River at the same time? Does the surface elevation of the "sump" fluctuate with the River elevation, or is it independent of River elevations? (p. 2-22)

RESPONSE

As discussed in the response to Query No. 2, the waters of the sump have communication with the Colorado River. The surface elevation of the waters in the sump should vary directly with that of the Colorado River. The difference in elevation of the two bodies of water should have the order of magnitude of just a few feet.

QUERY NO. 4

What is the probable ultimate source (recharge point) for the water in the "sump" in Moab Marsh, "in the summer during Utah's drier years?" (p. 2-22)

RESPONSE

As discussed in the response to Query No. 2, the recharge for the "sump" in Moab Marsh may be reasonably attributed primarily to percolation through the river alluvium from the surface flow of the Colorado River. This is augmented by percolation of ground water associated with the surface flows of Mill Creek and Pack Creek as they traverse the Spanish and Moab Vallies drainage.

QUERY NO. 5

Provide part of the text which appears to be missing from the second paragraph of Section 3.3.4.14.

RESPONSE

It is not possible at this time to determine what thoughts might have been intended in the original discussion in Section 3.3.4.14 of the ER. Nevertheless, the early discussion in this section of the ER has been superseded by discussions of fugitive dust to be found in the SAR under: Section 8.1.1.1, Ore stockpiles, and following, and more specifically under Section 8.1.1.1.6, Analysis of Ore Stockpiling Alternatives; Section 8.1.1.4, Tailings Pond. These discussions are abstracted following.

Possible principal sources for fugitive dust are the open ore stockpiles and the tailings pond.

Approximately 300,000 tons of ore are stockpiled onsite adjacent to the mill. The stockpiles are stacked to an average height of approximately 20 feet, cover an approximate area of 252,000 square feet and have a surface area of about 300,000 square feet. Analyses of alternatives for the control of fugitive dust considered: using the open stockpiles; reduction of size of the stockpiles; sprinkling of ore stockpiles; construction of a stockpile warehouse, and construction of ore bins. Considering the discussion of meteorological factors in Appendix L of the ER, and in Section 2.2 of the SAR, the wind regime may be considered to be light. The effects of wind born fugitive dust are mitigated at this mill site by the fact that except for nearby traffic on the highway, and occassional boat traffic on the Colorado River, the site is isolated and population is

RESPONSE TO QUERY NO. 5 (CONTINUED)

virtually nonexistent. As a consequence of the analysis, it was determined that the open stockpile is the preferred configuration and that during extreme meteorological conditions when significant levels of fugitive dust might be obtained, the stcokpiles will be wetted on an as-needed basis.

The tailings pond has a base area of about 115 acres and a top area of about 97-98 acres. The existing side slopes have already been covered with up to 1 foot of protective cover consisting of local shale, siltstone and sandstone. Thus these slopes already have a high level of protection against the blowing of tailings as fugitive dust. As the evaporation pond on the crest of the tailings retention system occupies an area of from 50 to 58 acres, only about 40 acres are exposed to the wind. Since these 40 acres are generally kept moist because of the continual discharge of tailings along the periphery of the pond, and since these beaches are composed of the coarser sand fractions of the tailings solids, the potential hazard from fugitive dust has largely been obviated or mitigated. As additional lifts are added to the tailings ponds, these slopes too will be covered. Ultimately, under the terms of surety being negotiated with the Utah Division of Oil, Gas, and Mining Conservation, the tailings pile will be stabilized as follows:

1. 45 acres of fines will be covered with about 4.5 feet of beach materials.
2. 97 acres of the tailings pond will be covered with surficial materials.
3. Sludge application, one-time irrigation and seeding or planting of 130 acres of pond and dike.

Upon completion of this program the long term potential for fugitive dust will have been mitigated significantly.

QUERY NO. 6

What was the impoundment rate during the past 16 years and what is it expected to be for the next 15 years? (p.3-21)

RESPONSE

As of 1973, the tailings pond was estimated to contain 7 million tons of tailings(Page 6, Appendix A, Supp. to ER). As the tailings pond was started in 1956, The average impoundment rate for the past 17 years of operation was about 412,000 tons per year.

The impoundment rate projected for 15 years of mill operation under the processing rate of 429,240 tons of ore per year is projected at between 470,000 and 518,000 tons of tailings per year or a total of from 7.0 to 7.8 million tons.

QUERY NO. 7

Show location on a map of the site where "an alternate evaporation pond" can be constructed (ER Suppl. p. 11).

RESPONSE

Should the projected alternative evaporation pond prove to be needed, it is now considered that the best available site lies north of the existing tailings pond and west of Moab Wash. The site tentatively occupies 20 acres and is now under preliminary engineering design. The projected site is shown on accompanying Figure 2.

QUERY NO. 8

Provide a detailed description of the subsurface conditions, hydrology, and ecology of the alternate evaporation pond site(s). (ER Suppl. p. 11).

RESPONSE

The alternate evaporation pond will be located just to the north of the existing tailings pond. At this location, the character of the projected 20-acre site is an extension of the conditions which exist at the main tailings pond. For this reason, the discussion and documentation which pertains to the environment of the main tailings pond may also be expected to apply to the smaller, contiguous 20-acre alternate site.

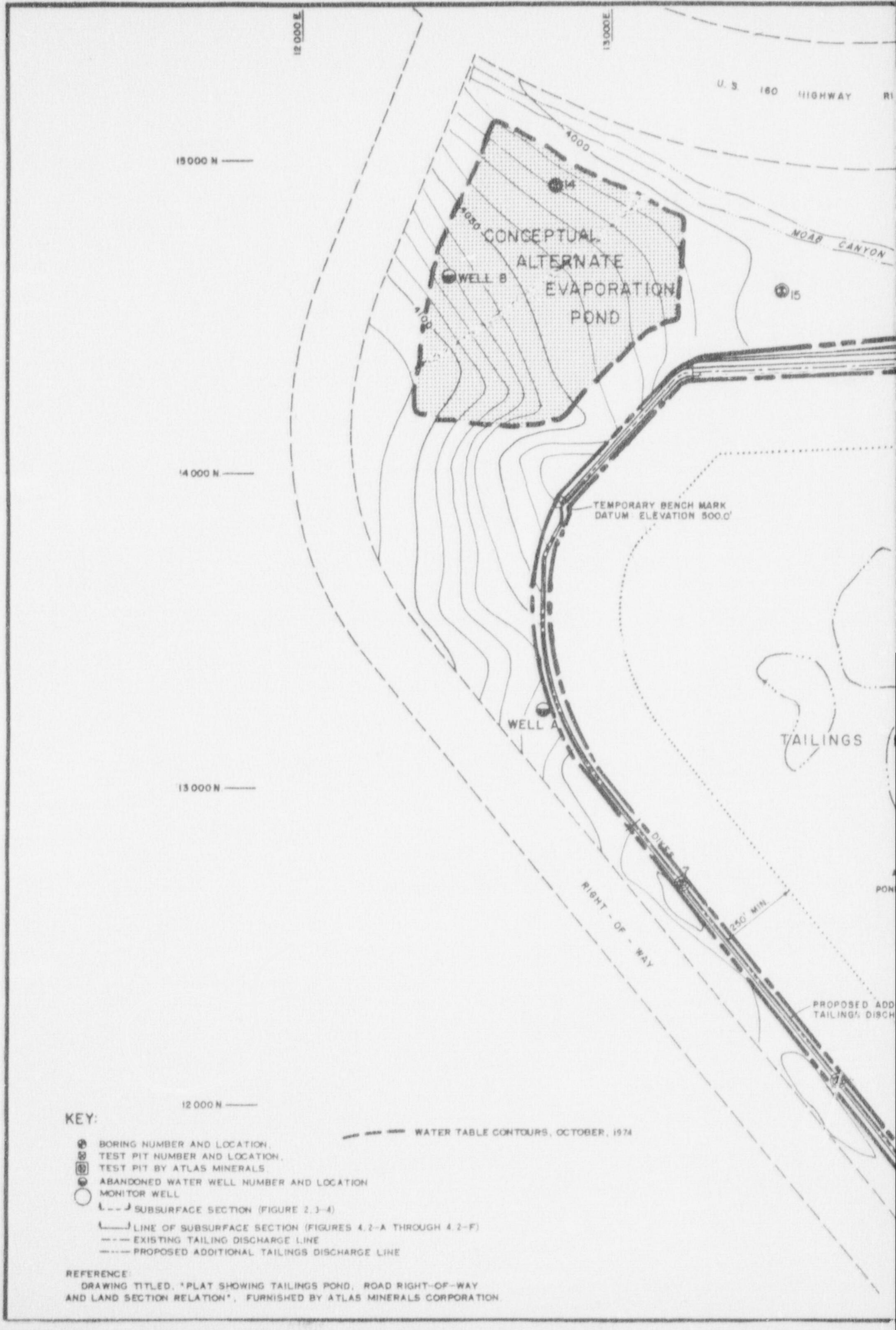
Upon inspection of Plate 2 of the Supplement to the ER, it may be seen that Borings 14 and 15, and an old water well, Well B, lie in the immediate vicinity of the alternate evaporation pond. Comparison of the logs of Borings 14 & 15, shown on Plate A-1E of the Supplement to the ER, with those of Borings 1 through 6 shown on Plates A-1A through A-1C, of the ER show the lithologic similarity of a series of reddish-brown interbedded silts and sandstones of varying grain size. These sediments which underlie the projected alternate evaporation pond belong to the same formation which underlies the main tailings pond--shown and described on Plates 3 & 4 of the Supplement to the ER as "Undifferentiated sand, residual mantle and slope wash" Ground water levels are noted in the logs of Borings 14 and 15. The water table lies at depths of 56' in Boring 14, and of 38' in Boring 15. When the collars of the two holes are adjusted for difference in elevation the water table is at about the same elevation in the two holes.

RESPONSE TO QUERY NO. 8 (CONTINUED)

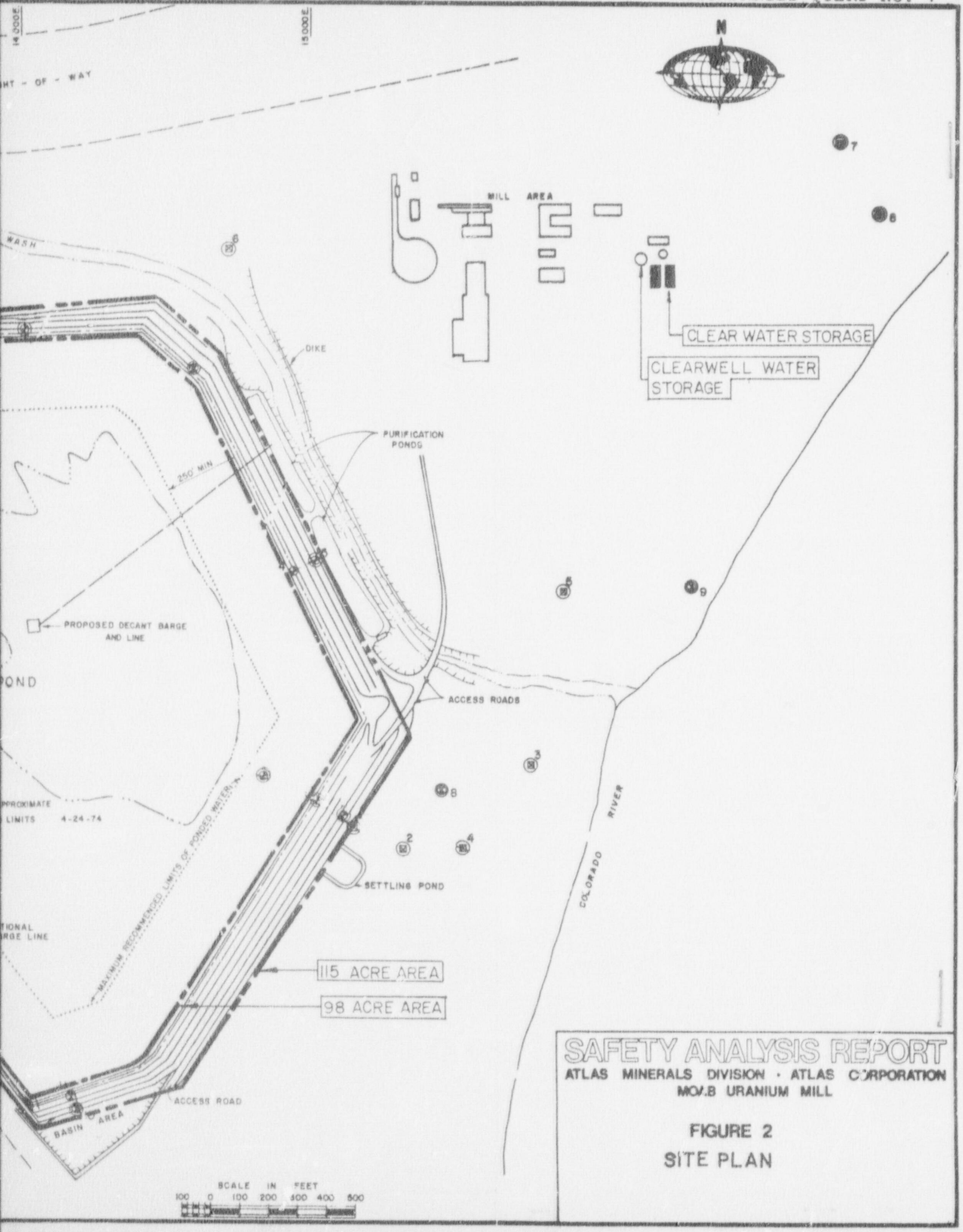
It is noteworthy that water well B, described on Plate A-15 of the Supplement to the ER, was drilled at the site before the presence of the tailing pond and that the water was "salty" and not fit for culinary purposes. This tends to indicate that the groundwaters underlying the site have a natural high salinity.

The ecology of the 20-acre site of the alternate evaporation pond is an extension of that found in the immediate vicinity of the main tailings pond, as is described in Section 2.8 of the ER. This is best documented by reproducing herein an aereal photograph which was taken on June 28, 1950 before the uranium mill was constructed on the site. This photo is shown herein as Figure 3. It is easily seen that prior to the construction of the plant- the triangle formed by U. S. Highway 163, the Colorado River, and the steep mountain scarp to the west- the land was occupied by the sparse vegetation of Southern Desert Shrub community. This community extended across the triangle without significant break. Thus, the projected alternate evaporation pond will displace habitat of the same nature as that which has already been occupied by the existing mill.

The site for the alternate evaporation pond will be well located with respect to surface hydrological conditions. It will lie high on the west sideslope of Moab Wash and will be naturally protected from flash floods.



12 000 E
13 000 E
U.S. 160 HIGHWAY RI
15000 N
14 000 N
13 000 N
12 000 N
4000
4050
4100
CONCEPTUAL ALTERNATE EVAPORATION POND
14
WELL B
15
MOAB CANYON
TEMPORARY BENCH MARK
DATUM: ELEVATION 500.0'
WELL A
TAILINGS
RIGHT - OF - WAY
250' MIN.
PONI
PROPOSED ADD
TAILINGS DISCH
KEY:
BORING NUMBER AND LOCATION.
TEST PIT NUMBER AND LOCATION.
TEST PIT BY ATLAS MINERALS
ABANDONED WATER WELL NUMBER AND LOCATION
MONITOR WELL
SUBSURFACE SECTION (FIGURE 2.3-4)
LINE OF SUBSURFACE SECTION (FIGURES 4.2-A THROUGH 4.2-F)
EXISTING TAILING DISCHARGE LINE
PROPOSED ADDITIONAL TAILINGS DISCHARGE LINE
WATER TABLE CONTOURS, OCTOBER, 1974
REFERENCE:
DRAWING TITLED, "PLAT SHOWING TAILINGS POND, ROAD RIGHT-OF-WAY AND LAND SECTION RELATION", FURNISHED BY ATLAS MINERALS CORPORATION.



SAFETY ANALYSIS REPORT
ATLAS MINERALS DIVISION · ATLAS CORPORATION
MOAB URANIUM MILL

FIGURE 2
SITE PLAN

0 1/2 1

SCALE 2 1/2" = 1 MILE

ATLAS MINERALS DIVISION · ATLAS CORPORATION
MOAB URANIUM MILL

FIGURE NO. 3

AEREAL PHOTOGRAPH OF SITE – 1950

QUERY NO. 9

Provide computation of the probable maximum flood including the probable flow patterns across Moab Marsh, and maximum flow velocity along the tailings dike. Explain why the flood mentioned in the ER (ER Supp. p. 17) is level with the toe of the embankment enclosing the tailings pond, while the same flood in the PSAR(sic) (PSAR(sic) p. 2.3-27) is 6.9 feet higher.

RESPONSE

The computation of the probable maximum flood is provided in considerable detail under the discussion of Section 2.3.2 Surface Water in the SAR and more specifically under Section 2.3.2.3 Floods, under Section 2.3.2.4.4 Runoff model of Probable Maximum Flood, and under Section 2.3.2.5 Water level determinations. The actual calculation was done using Dames & Moore Computer Program EP 66. The computer printouts resulting from this calculation are available in the project files. D&M Computer Program EP 66 is described under Query No. 26.

The average flow velocity of the Colorado River at flood stage may be estimated as follows.

At PMF the flow would be 178,300 cfs and the stage elevation 3972.6'. At a flow of 91,000 cfs, the stage elevation would be 3965.2. The width of the flood plane opposite the tailings pond and perpendicular to the flood flow direction of the stream is about 4200 feet. Therefore at flood stage elevations for a differential elevation of (3972.6-3965.2) or 7.4, the differential flow Q will be (178.300 cfs-91,000cfs) or 87.300 cfs.

QUERY NO. 9 (CONTINUED)

Thus, the differential flow of 87,300 cfs will flow through a differential cross-sectional area of (4200 ft.)(7.4 ft.) or 31,080 square feet. By dividing the flow Q by the cross-sectional area (87,300 cfs)/(31,080 ft^2) an average velocity of 2.8' per second is obtained. Due to the roughness of the river bank and the resulting laminar flow, the velocities along the tailings pond embankment would probably lie in the range of 1 to 2 feet per second.

The flood calculated in the ER Supplement is a flood having a 100-year return interval. At the time that this estimate was prepared it was considered conservative and adequate for the flood analysis. Nevertheless, Atlas' recognition of the importance of maintaining the integrity of the tailings pond lead to a new and more stringent viewpoint in the calculation of the probable maximum flood for utilization in the SAR. Thus, in the SAR calculation, the 100-year flood of the Colorado River at Cisco, Utah, was combined with a local PMF obtained by superimposing probable maximum precipitation (PMP) upon the local drainage basins--as shown on Figure 2.3-5 of the SAR. Impoundments of the Colorado River, Moab Wash and lower Moab Valley were also included in the calculation. It is therefore seen that the flood calculated for the ER is less than that calculated for the SAR and that the two are not directly comparable and the apparent 6.9' difference is not germaine.

The requested flow lines of the Colorado River during flood stage are shown on Figure 1 prepared for Query No. 2.

QUERY NO. 10

Provide calculations on the effect of snowmelt on probable maximum flood, or justify excluding snowmelt based on snowfall data in the relevant drainage basin(including the Colorado River above Cisco, Utah) (PSAR(sic) p. 2.3-22).

RESPONSE

Pursuant to discussion of the meeting of the EIS team with Atlas' representatives on November 16, 1976, it was agreed that no response was necessary for this query.

QUERY NO. 11

What treatment has been proposed if arsenic concentration in the monitor wells increases (ER Suppl. p. 30).

RESPONSE

No treatment for arsenic has yet been designated. The arsenic concentrations in the monitoring wells will continue to be scrutinized in order to perceive any significant changes such, that when dispersed into the river waters, standards will be exceeded.

Atlas is concerned with the possible future increase in arsenic levels and is examining the possibility of providing for treatment as the need might arise. Possibilities for such treatment are discussed in the article entitled, *Arsenic and the Environment*, by R. Wayne Whitacre and Carlton S. Pearse, in the Mineral Industries Bulletin, Vol. 17, No. 3, May 1974, published by the Colorado School of Mines Research Institute, Golden, Colorado. In this article, abatement methods are surveyed under the section, "Removal of Arsenic from Water", and are synopsed in their Table 24, page 18, and as reproduced on the page following.

As the state of the art is currently evolving into a feasible applied technology, it is not now possible to predict which, if any, of the currently available techniques would be applicable to the Atlas site. Should the arsenic concentrations indeed threaten to exceed standards, Atlas commits itself to provide whatever treatment is necessary to meet the applicable statutes, regulations, standards and criteria.

TABLE NO. 1

Table to accompany response to Query No. 11 of the NRC dated October 28, 1976

Methods of removing arsenic from aqueous solutions studied in recent years 1./

Year	Method	Author (s)	Country
1967	$FeSO_4$ addition + filtration	Hedlich and others	Germany(East)
1968	Addition of $FeSO_4$ & $Ca(OH)_2$ or $CaOCl_2$	Shabunin and others	USSR
1968	Addition of CaO and $FeCl_3$	Hollo and others	Hungary
1969	Addition of Cl_2 and $FeSO_4$	Kermer	Germany(East)
1970	Addition of H_3PO_4 and $Ca(OH)_2$	Nikolaev and Mazurova	USSR
1972	Addition of H_3PO_4 and $Ca(OH)_2$	Nikolaev and others	USSR
1971	Ozonation followed by coprecipitation with Fe hydoxides	Alimshanov and others	USSR
1973	Contacting with $Fe(OH)_3$ gel	Pakholkov and Ul'yanova	USSR
1972	Milk of lime treatment	Achkinadzi	USSR
1973	Addition of H_2SO_4 and CaO	Gladysheva and others	USSR
1973	Adsorption on hair or feathers	Ueda and others	Japan
1973	Contacting with disintegrated rubber waste	Albenesius and others	USA

1./ Reproduced from Table 24, Page 18, of *Arsenic and the Environment*, by R. Wayne Whiteacre and Carlton S. Pearse, in the Mineral Industries Bulletin, Volume 17, No. 3, May 1974, published by the Colorado School of Mines Research Institute, Golden, Colo.

QUERY NO. 12

The first supplement to the ER implies that the site could be reclaimed to uses "in complete harmony with its surroundings." What specific reclamation efforts are being proposed to restore natural Southern Desert Shrub at the site? (ER Suppl. p. 34(sic) and (p.2-25).

RESPONSE

The stabilization of the tailings pond and reclamation of mill site will be performed pursuant to the *Utah Mined Land Reclamation Act* (Utah Code Annotated 1953, Title 40-8-1, et. seq.) By mutual agreement with the NRC, the Division of Oil, Gas, and Mining, Department of Natural Resources, of the State of Utah assumed jurisdictional and administrative control for the performance of reclamation of the mill site and tailings pond. The reclamation plan which will be required is essentially that considered as Alternative III in the Second Supplement to the ER. The principal points of this plan consist of the following:

(1) Burial of 45 acres of fines with approximately 4.5 feet of beach materials. The final burial depth will be subject to approval by the NRC and the Division of Oil, Gas, and Mining and will be dependent upon depth measurement of soft slimes and results of tests to determine quantities of beach materials needed to provide a firm base for surface cover.

(2) Covering of 97 acres of the tailings pond with six inches of surficial material.

RESPONSE TO QUERY NO. 12 (CONTINUED)

(3) Sludge application, one time irrigation and seeding and/or planting of 130 acres of pond and dikes. During the operating lifetime of the plant a demonstration program will be conducted to develop the optimum revegetation method.

(4) Decontamination and removal of all equipment, machinery, debris and buildings.

(5) Grading and cover of mill site and foundation pads; and

(6) Fencing of the tailings pond and mill site.

-o-o-o-

Although present reclamation concepts--which were prepared with the assistance of Mr. Richard Baird of the Soil Conservation office at Monticello, Utah-- called for the utilization of grasses(a mixture of Siberian wheatgrass *Agropyron sibericum* and sand dropseed *Sporobulos ryptandrus*), the operation of a revegatation demonstration program also could well include consideration of Southern Desert Shrub types such as the four-wing saltbush *Atriplex canascens*. The ultimate reclamation will result in very sparse vegetation of a dens. y comparable to that of the surrounding environment. Upon examination of the grazing productivities listed below under Query No. 14, it becomes readily apparent that the density of vegetation is indeed low. Thus, in no case would a lush implantation blend with the local surroundings.

When considering the phrase "in complete harmony with its surroundings" as given on Page 54 of the Supplement to the ER it was intended that the term "harmony" would imply or conjure the nuance of meaning which indicates a "complementary" quality rather than the stricture that the renovation be an exact duplicate of the original

RESPONSE TO QUERY NO. 12 (CONTINUED)

site condition. Thus the use of grasses alone--or even the application of native "shale" cover as originally recommended as Alternative I in the Second Supplement to the ER--would blend or harmonize with the stark, rocky landscape which constitutes the environment surrounding the mill. The issue is basically one of aesthetics, is highly subjective, and is not susceptible to a neat resolution of contrasting or conflicting viewpoints.

QUERY NO. 13

State the probable cause of the observed surface salt deposits between the tailings embankment and the Colorado River (ER Suppl., Append. B., p. 3).

RESPONSE

The salt deposits were noted during the sampling of surface soils for use in the ion exchange studies. As a result of this NRC Query No. 13, a reconnaissance was performed of the area between the toe of the tailings pond embankment and the northwest bank of the Colorado River.

The reconnaissance revealed that there are two separate modes of salt occurrences.

The first mode of occurrence consists of surface deposits of salt immediately adjacent to the toe of the tailings pond embankment. The reconnaissance determined that this occurrence was limited to an area extending a few tens of feet from the toe. It is believed, as a result of this examination, that this mode of occurrence is attributable to surface percolation of waters down the embankment and to near-surface seepage which leached the salts from the embankment and deposited the salts close to the toe.

The second mode of occurrence consists of a horizon or layer of salt efflorescence closely related to the ambient surface of the Colorado River. This occurrence is noted along the river bank which has a steep exposure of about 4 to 5 feet in height. In this exposure there is a zone of water saturated soil rising about a foot or more above the river level. Above the saturated zone lies a more or less continuous layer of salt deposition within the

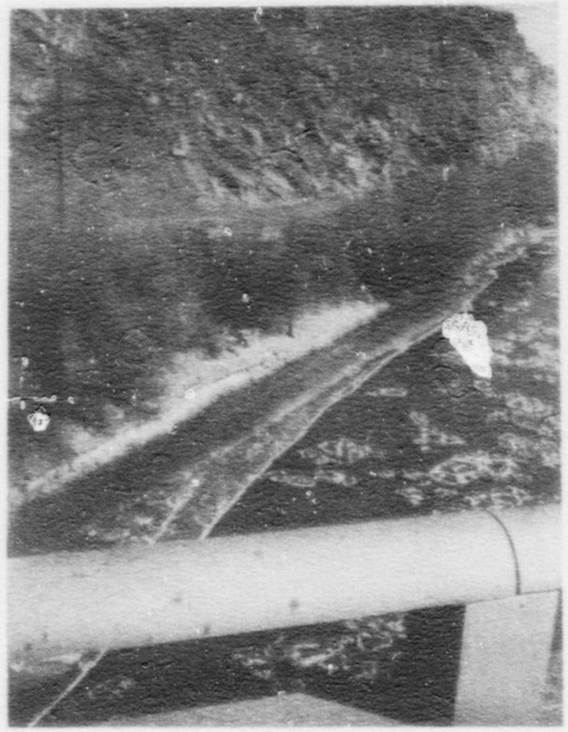
RESPONSE TO QUERY NO. 1? (CONTINUED

soil. Above the salt layer the soil it is relatively dry, or unsaturated. From these relationships, it is apparent that water was lifted above the level of the water surface (and also the ground water surface at the river's edge) by capillarity, and that the salts are precipiated through drying at the horizon where capillary forces are at balance with gravity. This capillary saline layer can be traced upstream for several miles. Thus, the second mode of occurrence could not be caused by seepage from the tailings pond.

It was observed in the field that the two modes of occurrence of efflorescence were separated by a horizontal distance of about 400 feet. No salt deposits were noted between the efflorescence along the river bank and that localized near the toe of the tailings embankment. If efflorescence from seepage were to occur, it would be found in this area, but is not.

It should be noted that the surrounding geological terrane is one wherein the sediments of the region are notably high in saline minerals. The Paradox member of the Pennsylvanian Hermosa Formation (see SAR Fig. 2.4-3) contains bedded salt deposits and many shale formations of the area have a high salt content. Large areas of the surrounding region are covered by outcrops of Mancos shale which display extensive salt efflorescence of similar occurrence to that noted on the site.

Closeup of salt efflorescence
(shovel shows scale)



Layer of efflorescence above
Colorado River water line

Photographs showing salt efflorescence along the bank of the Colorado River upstream from the Atlas mill, near the U.S. Highway 163 bridge

FIGURE NO. 4

QUERY NO. 14

Give range productivities typical of Arth's Pasture, Big Flat, Willow Spring, Kane Springs, Sand Flats and Mill Creek, Blue Hill, and the River allotment areas in AUY's (animal unit years) or AUM's (animal unit months)per acre, and indicate the effect of normal variations in annual precipitation on these figures. Include the approximate areas covered by each allotment within ten miles of the mill (PSAR(sic), Fig. 21-8(sic)).

RESPONSE

Within 10 miles of the mill, the grazing lands occur on public lands managed by the U. S. Bureau of Land Management, the National Park Service, and the Utah Department of Natural Resources. The analysis for this response indicates that approximately 159,000 acres within an area of 10 miles from the mill are utilized for grazing of cattle and sheep.

This land is poor for grazing and supports a minimal local cattle and sheep raising industry. Generally the grazing lands within ten miles of the mill are used for the winter grazing of cutter stock which has been grazed on U. S. Forest Service lands in the high country of the La Sal Mountains and elsewhere during the summer months. The winter pastures of the allotments under discussion are grazed roughly for the period November through April. The principal product is the breeding and sale of calves.

RESPONSE TO QUERY NO. 14 (CONTINUED)

Certain of the same lands are also used in rotation for the grazing of sheep. The sheep grazing allotments are grazed for an average of about a month during the period of December through May. The principal sheep allotments lie along the southwestern fringe of the area of interest (see Figure No. 5.) within the Big-Flat Ten Mile Management Plan area. On Figure Number 5, this Plan Area includes about 10,080 acres which fall within the area 10 miles from the mill. It is difficult to estimate the productivity for this area due to the fact that the AMP involves a complex formula for pasture rotation amongst both sheep and cattle. Generally it is intended that within the AMP area the land "rests" one out of three years. A small second sheep grazing allotment falls within the Monument Wash allotment. Sheep are trucked in and out and are sheared elsewhere.

Although portions of the Willow Springs, Courthouse Wash and Monument Wash allotments fall within the boundaries of Arches National Monument, these will be phased out by Act of Congress by 1982. After that time, no grazing will be permitted.

No grazing allotments have been issued within the boundaries of Deadhorse State Park; however, plans are now under way to prepare a management plan which includes use for grazing. For this analysis, the productivity of these Utah park lands is taken as nil for lack of information.

RESPONSE TO QUERY NO. 14 (CONTINUED)

The great bulk of the lands now managed for grazing by the U.S. BLM within the area of interest is now being re-evaluated. These lands are the subject of a suite brought against the U.S. BLM by the Natural Resources Defense Fund, who claim that the lands have been over-grazed in the past, and that NEPA requires the preparation of an Evironmental Impact Statement. As a result, the Moab District Office of the U.S. BLM is currently engaged in evaluating new allowable grazing allotments. The values for productivity used in this analysis were obtained from the Moab District office of the U.S. BLM and represent current transitional values. It may be expected that the values of productivity will be lowered in the near future to a more conservative level of grazing.

The accompanying table shows the productivity of grazing lands within 10 miles of the Atlas mill. This table was generated from the records of the U.S. BLM at Moab, of the National Park Service at Arches National Park, and by telecon with the Visitor's Center at Deadhorse State Park.

Productivity was estimated in the following manner. Allotment acreages and allowable grazing in terms of animal unit months were obtained from the records. A map was prepared showing the allotments within 10 miles of the mill and the acreages were measured. The unit productivity in terms of Acres per AUM were calculated from the known data. Thus for 121,985 acres having a known productivity of 5703 AUMs, the average productivity was 21.4 acres per AUM. This average was impuned to lands not having

RESPONSE TO QUERY NO. 14 (CONTINUED)

known values. Dummy or blank values were taken for built up lands at Moab, the mill site, Texasgulf Industries, and Deadhorse State Park. Thus, the average productivity for the lands within 10 miles of the mill is estimated to be 30.9 Acres per AUM for cattle.

TABLE NO. 2

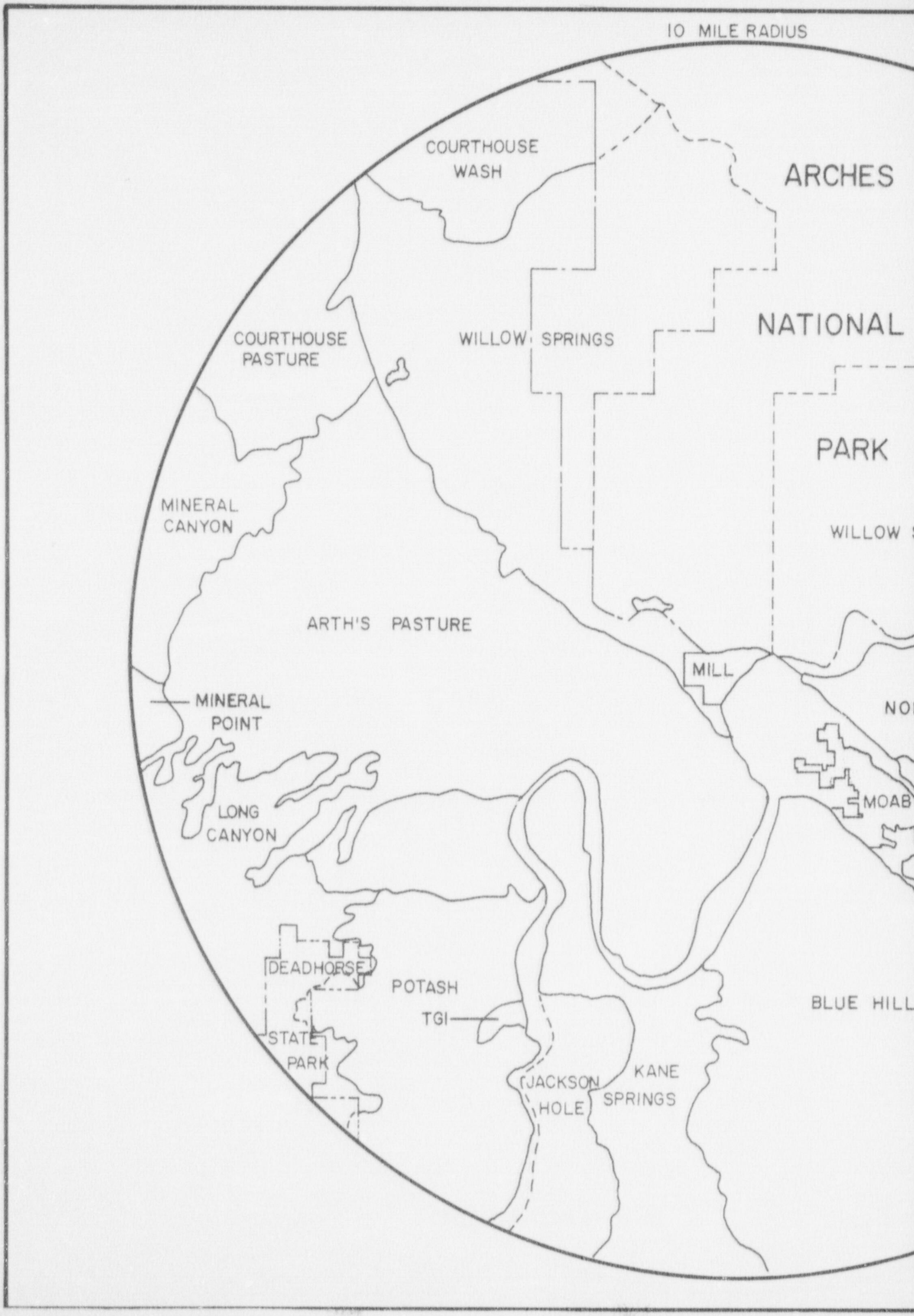
PRODUCTIVITY OF GRAZING LANDS WITHIN 10 MILES OF THE ATLAS MILL

Grazing Allotment	Acres of Total Allotment	Cattle: Animal Unit Months	Cattle: Acres Per AUM	Sheep: Animal Unit Months	Sheep: Acres Per AUM	Acres Within 10 Mi Radius of Mill	Estimated Productivity in 10-mi Radius in AUMs: Cattle	Estimated Productivity in 10-mi Radius in AUMs: Sheep
Arths Pasture	42,124	711	59.2			27,700	468	
Between the Creek	19,111	1,300	14.7			3,797	258	
Blue Hill	na	na	na			22,352	1,045i	
Courthouse Pasture	32,798	1,300	25.2			1,818	72	
Courthouse Wash (a)	na	na	na			722	34i	
Courthouse Wash (b)						3,716	174i	
Ida Gulch	na	na	na			161	8i	
Jackson Hole	na	na	na			3,610	169i	
Kane Spring	12,676	259	48.9			7,353	150	
Long Canyon (f)	5,307e	1,300	4.1	650	20.7	5,615	1,300	650
Mineral Canyon	26,240e	na	na			3,930	184i	
Mineral Point	na	1,300	g			535	25i	
Monument Wash (h)	43,785	4,923	8.9	2,364	18.5	3,610	406	195
Negro Bill	12,006	426	28.2			12,006	426	
North Sand Flats	6,531	521	12.5			6,531	522	
Potash	24,371	503	48.5			11,417	235	
South Sand Flats	16,023	823	19.3			6,604	342	
River	2,718	78	39.9			4,278	123	
Round Mountain	na	na	na			1,925	90i	
Willow (a)	18,560	832	22.3			19,652	881	
Willow (b)						11,604	520	
Subtotals						158,936	7,432	845
Acres of Blank (c)						15,846		
Net Acres Arches (d)						26,280	(915)j	
Totals						201,062	6,517	845

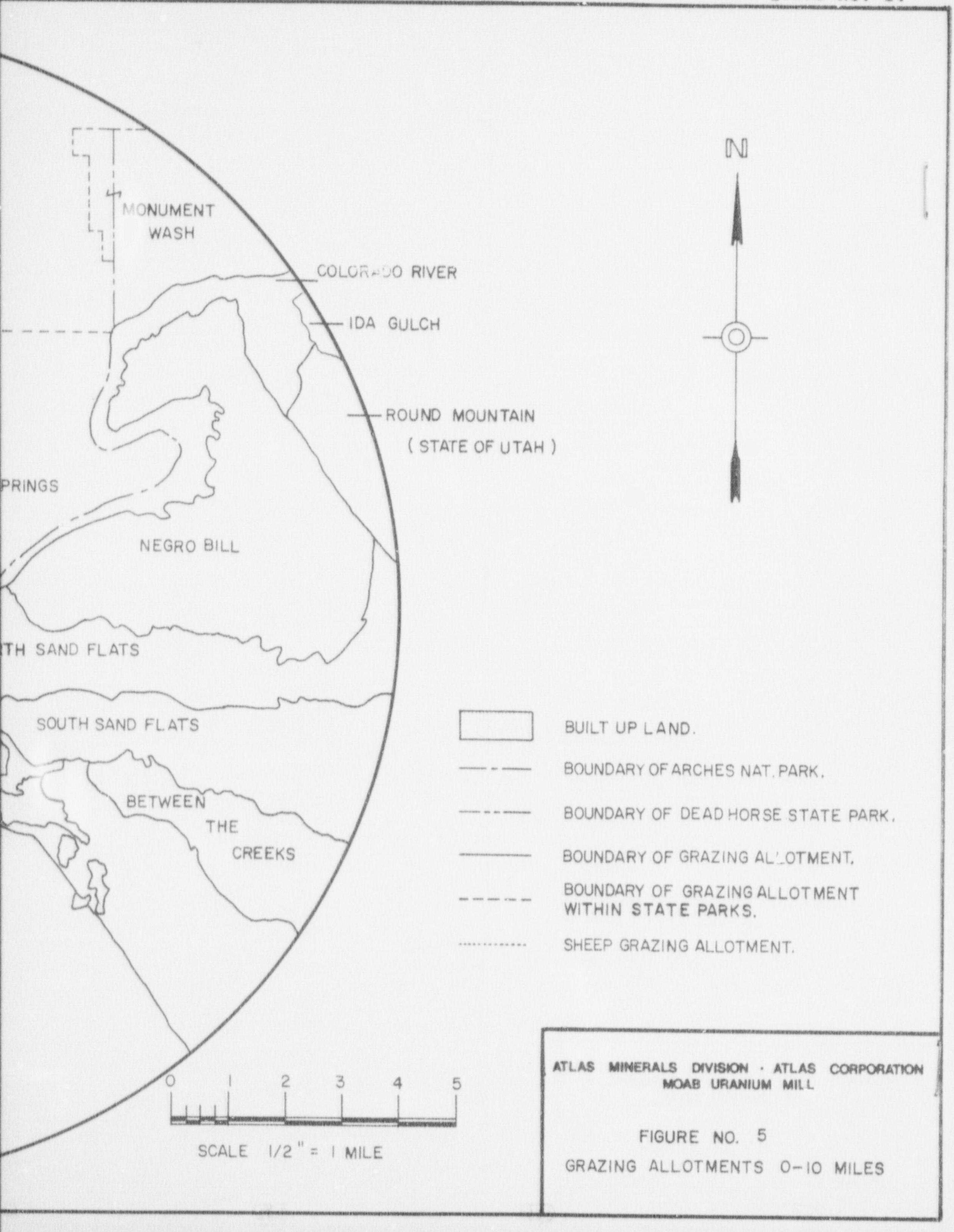
FOOTNOTES ON FOLLOWING PAGE

Footnotes for Table No. 2

a.) Acreage inside of Arches National Monument
b.) Acreage outside of Arches National Monument
c.) Acreage of Blank (for built up areas near Moab, Atlas mill site, TGI site and Deadhorse State Park
d.) Acreage in Arches National Monument not included in grazing allotments
e.) Estimated
f.) Part of new Big Flat-Ten Mile Allotment Management Plan--includes sheep AUMs for Courthouse Pasture and Mineral Canyon
g.) Part of Big Flat-Ten Mile Allotment Management Plan--average Acres/AUM used for calculation
h.) Includes minor acreage within Arches National Monument not shown
i.) Productivity estimated from known average, or 121,985 Acres/5703 AUMs = 21.4 Acres/AUM
j.) Grazing in Arches National Monument will be prohibited by Act of Congress by 1982. The grazing of 881 AUMs in the Willow Allotment and 34 AUMs for the Courthouse Wash Allowment are subtracted from the total productivity of the area of interest.



10 MILE RADIUS
COURTHOUSE WASH
ARCHES
NATIONAL
PARK
COURTHOUSE PASTURE
WILLOW SPRINGS
MINERAL CANYON
WILLOW S
ARTH'S PASTURE
MILL
MINERAL POINT
NOR
MOAB
LONG CANYON
DEADHORSE
POTASH
TGI
STATE PARK
BLUE HILL
JACKSON HOLE
KANE SPRINGS



ATLAS MINERALS DIVISION · ATLAS CORPORATION
MOAB URANIUM MILL

FIGURE NO. 5
GRAZING ALLOTMENTS 0-10 MILES

QUERY NO. 15

State normal and low flows for the downstream stations on the Colorado River, and discuss the relationship of these data to the predicted dilution of pollutants generated by the mill operations (PSAR(sic) Table 2.3-18).

RESPONSE

A discussion of dilution of pollutants is best discussed upon data available for USGS water measuring stations at Cisco, Colorado (Station No. 09180500) and near Moab, Utah (Station U-163-just upstream from the mill).

The discussion on dilution is found in the Supplement to the ER on Page 30 in Section 7.8.2. In this discussion a normal flow of 7,711 cubic feet per second was used. This was taken from Page 2-19, Section 2.6.2 of the ER which states that the average was taken from 59 years of record at Cisco for the period 1911 to 1970. Although additional data is available through the water year 1974-1975 which changes this average, the number used in the Supplement to the ER will continue to be used for consistancy of data. The change in the average is small and will not influence the calculations.

The record minimum flow was also listed on Page 2-19 of the ER as having been 558 cfs on July 21, 1934 for the same 59 year period of records. The record showing the daily discharge for the water year ending September 30, 1934, was obtained from the files of the Salt Lake City office of the Water Surveillance Branch of the USGS, and is reproduced following.

9-211 c

TABLE NO. 3

DEPARTMENT OF THE INTERIOR—GEOLOGICAL SURVEY—WATER RESOURCES BRANCH

File Number ____

Daily discharge, in second-feet, of COLORADO RIVER NEAR CISCO, UTAH, for the year ending September 30, 1924.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2490	2810	2640	2620	2270	2500	2010	6520	11600	1520	900	900
2	2540	2230	2760	2810	2090	2500	2060	6810	10900	1430	850	850
3	2450	2350	2610	2630	2040	2280	2010	7950	9690	1370	850	775
4	2230	2520	2640	2660	2060	2500	2110	8000	8500	1250	800	730
5	2440	2560	2640	2560	2150	2320	2280	7870	7660	1270	850	752
6	3320	2640	2370	2420	2250	2500	2250	7740	6810	1260	1040	704
7	4250	2690	2350	2370	2300	2270	2070	8220	6110	1260	900	744
8	3470	2620	2140	2270	2230	2500	1900	9570	5830	1200	850	760
9	3210	2370	2140	2220	2300	2300	1860	11700	5560	1170	850	900
10	3100	2520	2440	2120	2220	2230	1840	13500	5080	1110	800	1020
11	2940	2520	2400	2120	2230	2120	1880	15500	4510	1030	800	1160
12	2870	2590	2490	2110	2200	2120	2010	16700	4230	960	1040	1040
13	2730	2710	2640	2040	2140	2140	2450	16800	3990	913	895	1080
14	2830	2690	2690	2060	1960	2170	3380	16400	3760	850	1000	1150
15	2610	2570	2740	2120	2140	2110	4450	15200	3450	868	1120	1040
16	2590	2570	2990	2280	2110	2300	4450	12800	3250	769	1130	1010
17	2590	2540	2630	2230	2170	2370	4470	11500	3010	787	1200	1060
18	2590	2540	2500	2340	2340	2470	4470	11600	2920	736	1120	950
19	2490	2520	2170	2170	2370	2360	3930	11800	2740	672	1040	922
20	2450	2500	1900	2140	2260	2300	3740	11200	2670	680	1060	860
21	2440	2660	2010	2170	2230	2280	3790	11700	2420	→640	1330	860
22	2400	2490	2090	2150	2340	2190	4510	11700	2190	1140	1610	931
23	2370	2620	2200	2220	2400	2180	5140	11200	2040	1590	1250	1010
24	2520	2420	2370	2300	2450	2010	5530	10200	1900	1250	1310	1060
25	2230	2400	2450	2280	2610	2280	6030	9330	1960	990	1270	1130
26	2190	2540	2530	2320	2520	2030	6430	8840	1840	900	1120	1730
27	2140	2520	2680	2300	2390	2140	7100	8920	1900	800	970	2040
28	2140	2570	2740	2110	2340	1950	7030	8920	1840	1040	850	1730
29	2120	2450	2690	2170		2030	6740	9040	1730	1200	760	1600
30	2140	2690	2690	2230		1980	6380	9690	1650	1100	1000	[illegible]
31	[illegible]		2640	[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	
	80900*	76620*	77490*	70660*	63230*	68670*	114460*	338820*	131690*	32755*	31515*	32334*
Mean	2610	2554	2500	2279	2258	2215	3815	10930	4390	1057	1017	1078
Acre-Feet	160,500	152,000	153,700	140,200	125,400	136,200	227,000	672,200	261,200	64,970	62,510	64,170

U. S. GOVERNMENT PRINTING OFFICE 1923 6—7119

YEAR ~~or PERIOD~~ MEAN 3066

ACRE-FEET 2,220,000

RESPONSE TO QUERY NO. 15 (CONTINUED)

The daily record shows that the mean low-flow for the year 1934 was 3,066 cfs. From Table 1, on Page 10, of the Supplement to ER, the concentration of TDS in the tailings pond is 150 grams per liter. On page 20 of the Supplement to ER, the seepage loss of 77.11 gallons per minute is reported. This will be rounded to 78 gpm in this calculation.

The incremental TDS which will be added by seepage to the Colorado River may be estimated for a return of low flow conditions as follows:

$$(78 \text{ gpm})(150 \text{ gr/li})(1 \text{ min}/60 \text{ sec})(1 \text{ ft}^3/7.48 \text{ gal}) \times (28.32 \text{ l/ft}^3) = 738.29 \text{ or } 738 \text{ grams per second}$$

The tailings seepage, therefore, will add 738 grams per second of TDS to the flow of the Colorado River under mean annual low-flow conditions. This represents an added concentration of:

$$\frac{(738 \text{ gr/sec})(1/3066 \text{ ft}^3/\text{sec})}{(62.4 \text{ lb/ ft}^3)(1000 \text{ gr}/2.2 \text{ lb})} = 8.49 \times 10^{-6}$$

or 8.49 ppm

A similar calculation for an instantaneous low-flow of 558 cfs gives:

$$\frac{(738 \text{ gr/sec})(1/558 \text{ ft}^3/\text{sec})}{(62.4 \text{ lb/ft}^3)(1000 \text{ gr}/2.2 \text{ lb})} = 4.66 \times 10^{-5}$$

or 46.6 ppm

It is not reasonable to expect that the instantaneous low-flow condition will prevail at such extreme lows for long durations. Inspection of the daily record for 1934 shows that the instantaneous low-flow of record occured on July 21, after which the flow increased to above 1,000 cfs. Thus the record low occurred during 10 successive days when the flow was less than 1,000 cfs.

RESPONSE TO QUERY NO. 15 (CONTINUED)

These compare with concentrations which will be added to the Colorado River under conditions of normal or average flow:

$$\frac{(738\ \text{gr/sec})(1/7711\ \text{ft}^3/\text{sec})}{(62.4\ \text{lb/ft}^3)(1000\ \text{gr/2.2 lb})} = 3.37 \times 10^{-6}$$

or 3.37 ppm.

It is thus seen that concentrations added under mean low-flow conditions would be about 2.5 times higher than under normal flow. Under extreme instantaneous low-flow conditions, the concentrations would be about 14 times higher than under normal flow conditions; however, this would be for a short term of up to about 10 days.

When considering the addition of dissolved solids to the Colorado River from seepage under low flow conditions it should be noted that the TDS concentration rises as the flow diminishes. This is demonstrated by chemical analyses and flows from Station U-163 for the 1974-75 water year:

	Month	TDS (mg/li)	Instantaneous Discharge (cfs)
1974	Oct	1060	3240
	Nov	827	4380
	Dec	849	3940
1975	Jan	786	3600
	Feb	808	3720
	Mar	758	3820
	Apr	446	6930
	May	224	24000
	Jun	233	27000
	Jul	449	9040
	Aug	991	2970
	Sep	1070	4200

An attempt was made to acquire the water quality records for this station during the low flow period of 1934; however, they were not available in time for this analysis.

RESPONSE TO QUERY NO. 15 (CONTINUED)

A rough extrapolation from these data provide a qualitative perception that at low flow conditions of about 558 cfs, the TDS will be about 1300 ppm. Thus with the addition of 47 ppm the increase due to seepage would approximate a little less than 4% of the TDS present in the water of the Colorado River. Under mean annual low-flow conditions of 3,066 cfs, the incremental concentration of 8 49 ppm would represent an increase of about 0.8% over the estimated TDS load of about 1000 TDS already in the Colorado River at the mill site. This is only slightly more than incremental concentration which would obtain under normal flows of 7711 cfs, of about 0.75% when the river has an estimated concentration of about 450 ppm TDS.

It is seen, therefore, that the loss of dilution due to a reduction of flow which would be obtained in going from normal to low-flow conditions is approximately offset by the proportional increase of TDS acquired by the river upstream under low-flow conditions. It is only under the condition of historical instantaneous low-flow that the loss of dilution becomes notcieable, and such conditions cannot be expected to prevail over significant intervals of time.

QUERY NO. 16

Provide complete metal analysis (Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Se, V, and Zn) on water samples from observation wells between the tailings disposal area and the river.

RESPONSE

Water samples have been taken from the three monitor wells between the tailings embankment and the Colorado River. Analytical results will be forwarded as soon they are completed.

QUERY NO. 17

Provide information on the concentrations of potentially toxic metals (Al, As, Cd, Co, Cr, Fe, Hg, Mn, Mo, Ni, Pb, Se, V and Zn) in river sediments at an upstream location(i.e., within one mile of the mill in an area not receiving mill effluents) and at points adjacent to the seepage discharge and within 1/2 mile downstream of the surface effluent and seepage discharge points.

RESPONSE

As was noted in the meeting with the EIS team on November 16, 1976, no sediment samples and analyses for the heavy metal suite are available from the various Utah and Federal agencies. At the discussion it was pointed out that it would be difficult to perform meaningful sampling of the sediments in the river bed due to the shifting burden.

The character of the bedload of the Colorado River was discussed with Mr. George Birdwell, Hydrologist for the Moab District office of the Water Surveillance Branch of the USGS in a meeting in his office on November 19, 1976; with Mssrs. Leon Jensen, Hydrologist, and James Mundorff, Chief Hydrologist, both with the Water Surveillance Branch of the USGS in the Utah State office in Salt Lake City. In these discussions the following picture of the river bed was outlined.

The bed load of the Colorado River in the vicinity of the mill is determined by the nature of the geological formations which exist upstream in the Upper Colorado River basin and by the stream gradients near the plant. In the portions of steep gradient, above the bridge east of the plant, and below "The Portal", the Colorado River bed is scoured

RESPONSE TO QUERY NO. 17 (CONTINUED)

down to bedrock. In the past, attempts have been made to obtain bottom samples from these steeper reaches of the river; however, the samplers were not able to reclaim any but the most meager samples from the rocky bed. Those samples which have been retrieved lie in the size range of about 1 to 2".

In the portion of the river crossing Moab Valley, the gradients are more gentle, and the bed consists of shifting sand bars. It is assumed that this sand load through the reach of the river crossing the valley is deposited below the bridge, is slowly transported the 2½ mile distance to "The Portal", and finally is swept up by the increased velocity caused by the steepening gradient and the narrowing of the river channel. Downstream from "The Portal", it is believed that the river bottom is again scoured down to bedrock.

Where sand has been deposited in the river across the Moab Valley, it is believed that the bed consists of fairly course particles ranging from very fine to medium, and coarse grained sands. The mineralogical composition of these sands may be expected to consist predominantly of quartz grains, subordinate feldpspar, and minor amounts (probably less than 2% of the heavy mineral suite including magnetite, ilmenite, and other heavy mafic minerals. The bed may be considered to be relatively free of particles at the clay size fraction, for these probably are carried predominantly as suspended solids within the current of the river itself.

RESPONSE TO QUERY NO. 17 (CONTINUED)

Although sampling of river sediments will not be pursued for this response, water samples have been collected from points ½ mile upstream from the mill, 1¼ miles downstream from the mill, and about 13½ miles downstream from the mill which is a point about 1 mile upstream from the potash mine and mill of Texasgulf Inc. These samples were taken over a period from October 11, to November 19, 1976, and the ranges for TDS, As, Zn, Ni, Pb, and Cd are given below:

		Concentrations in ug/l except for TDS in ppm		
	Constituent	Low	Average	High
½ Mile upstream				
	TDS	835	1130	1411
	As	3.8	5.6	7.2
	Zn	2.0	18.6	61
	Ni	2	8.0	18.0
	Pb	2.8	8.3	16
	Cd		1.5(1 sample)	
1¼ Miles downstream				
	TDS	875	1141	1328
	As	5.6	6.1	6.4
	Zn	1.6	20.6	61
	Ni	1.6	8.6	21.2
	Pb	2.8	9.3	20.4
	Cd		1.4(1 sample)	
13½ Miles downstream				
	TDS	955	1121	1448
	As	5.6	6.3	6.2
	Zn	1.6	22.8	6.2
	Ni	3.2	11.0	21.2
	Pb	3.6	11.0	20.4
	Cd		1.5(1 sample)	

QUERY NO. 18

Provide the following details on surface and groundwater use in the vicinity of the site (Section 2):

a.) List water users in the vicinity of the mill to 10 miles downstream including volumes used, allocation permits, and type of use(domestic, public, industrial,irrigation) for each user;

b.) identify points of withdrawal on a map.

RESPONSE

a.) The sources of public water supply in the Moab area are listed in Table 2.3-1 of the SAR. Water wells and springs are listed in Table 2.3-2 of the SAR.

In order to assure that no new apppropriations had been made since the preparation of the ER and SAR, the office of the Utah State Engineer was visited and the records were re-examined. With the assisstance of Mr. William L. Burton and the State Engineer's staff, the index book for water appropriations was abstracted so as to examine the course of the Colorado River from 2 miles above the mill to 30 aereal miles downstream. The surface water appropriations of record were abstracted and are shown herein on the Table showing surface water appropriations in the vicinity of the Atlas Mill. The appropriations shown on this table are the only known withdrawals of surface waters from the Colorado River for the distances discussed above. Miscellaneous appropriations including springs and surface streams are shown on the Table showing miscellaneous surface water appropriations near the Atlas mill. Together,

RESPONSE TO QUERY NO. 18 (CONTINUED)

all of the above references encompass the total documentation for water sources within the immediate vicinity of the mill.

Thus in summary, there are only two known users of water withdrawn from the Colorado River for a distance of 30 miles downstream from the Atlas mill. The first user, Charles W. and Lucey A. Nelson, withdraw a maximum flow of 1.82 cfs of water from the Colorado River for stockwatering and irrigation at a point about 4 miles downstream from the Atlas mill. The second and only other user for 30 miles downstream from the Atlas mill is the potash mine and mill owned and operated by Texasgulf, Inc., who withdraw a total of 9 cfs from the surface waters of the Colorado River at a point about 14 miles downstream from the Atlas mill.

According to the public records in the State Engineer's office the distribution and use of waters by TGI is as follows:

Mine -	2800 gpm	injection underground
	200 gpm	disposal of suspended solids
	3000 gpm	- 4,032,000 gallons per day
Mill -	850.0 gpm	mill process water
	150.0 gpm	mine process water
	31.3 gpm	plant sanitary water
	0.7 gpm	plant culinary water
	10.0 gpm	lawn irrigation
	1042.0 gpm	- 1,500,400 gallons per day
Total	4,042 gpm	- 5,532,400 gallons per day

TGI has installed a water treatment plant at an approximate cost of $500,000 to process the river water before use.

RESPONSE TO QUERY NO. 18 (CONTINUED)

b.) The points of withdrawal for the users of record for appropriation of both surface water and ground water are shown on accompanying Figure 6.

TABLE NO. 4

Table showing surface water appropriations in the vicinity of the Atlas Mill

Map No.	Utah File Code No.	Document No. & date	Applicant	Point of diversion	Documented use	Flow in CFS	Miles down-stream from Atlas mill
1	5-1057	Applicat. No. 45443 7/23/75	Loyd W. Thayn DBA Ready Mix Box 569 Moab, Utah	1. 1200'S 400'W from NE corner Sec. 27, T. 25 S. R. 21 E; 2. 1700'N 1000'E from SW corner Sec. 24, T. 25 S. R. 21 E.	Sand washing	0.5	2 mi upstream
2	1-56	Applicat. No. 36566 11/20/64	G. M. McClatchey Tex's Boat Tours Moab, Utah	1300'W 1420'S of NE corner, Sec. 27, T. 25 S., R. 21 E.	Irrigation, industrial, commercial. Is installing water treatment plant.	0.5	½ mi upstream
3		Applicat. No. 30032 7/5/58	Atlas Minerals Atlas Corporation P. O. Box 1207 Moab, Utah 84532	N 3300.0 E 3090.0 from SW Corner Sec. 27 T. 25 S. R. 21 E.	Milling of uran. ores cooling, steam generation, sludge, sanitation, domestic use, fire protection & miscellaneous use	6.5	origin of mileage

TABLE NO. 4 CONTINUED

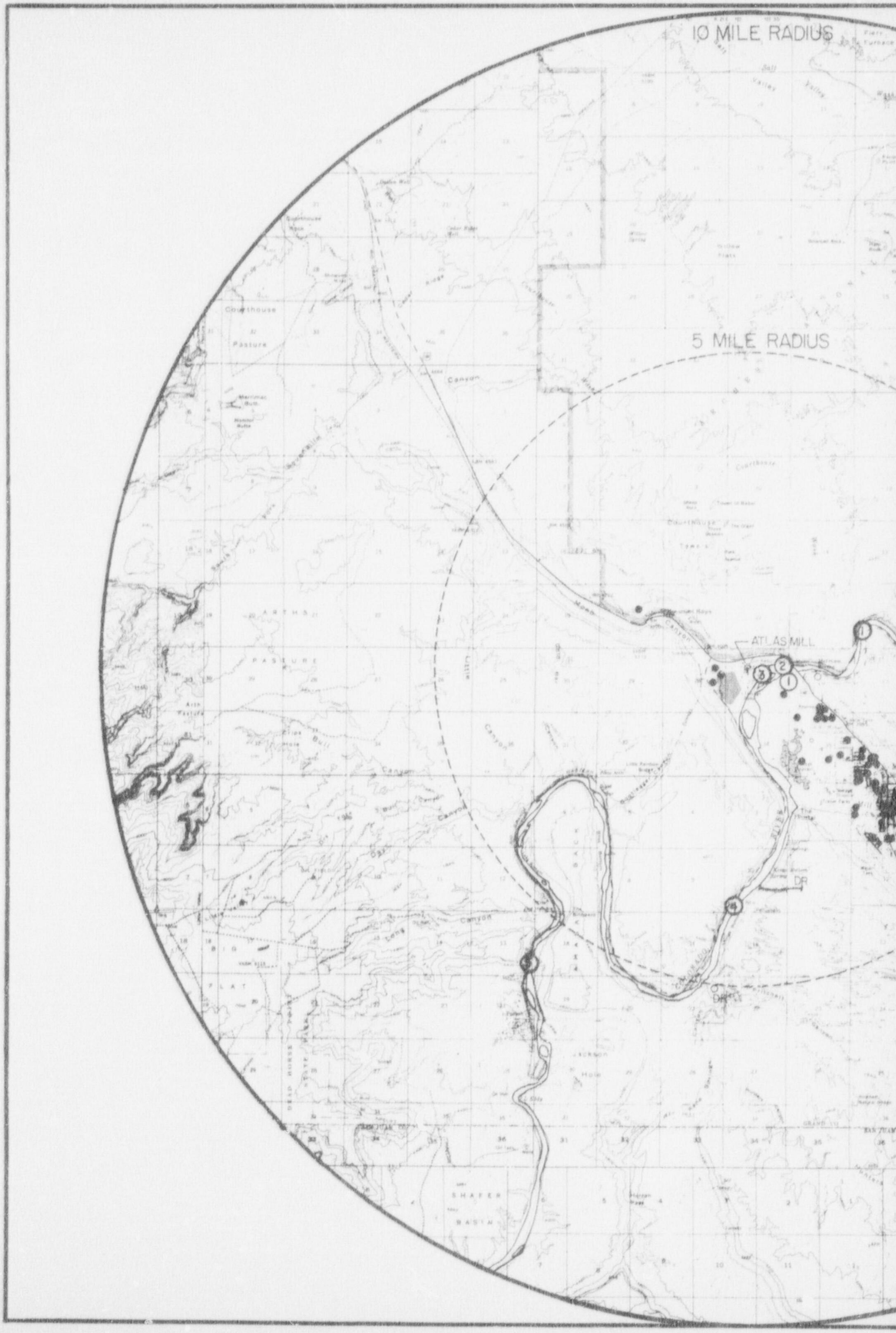
Table showing surface water appropriations in the vicinity of the Atlas Mill (Continued)

Map No.	Utah File Code No.	Document No. & date	Applicant	Point of diversion	Documented use	Flow in CFS	Miles downstream from Atlas mill
4	5-290	Certificate of Appropriation #7077 5/13/62	Chas. W. & Lucey A. Nelson P. O. Box 297 Moab, Utah 84532	N2789' E 957' from W¼ corner Sec. 15 T. 26 S. R. 21 E.	Stockwatering & irrigation	1.82	4 miles
5	1-37	Certificate of Appropriation #9161 10/15/57	Texasgulf, Inc. Moab, Utah	N1750' W 100' from NE corner Sec. 24 T. 26 S. R. 20 E.	Mining & milling of potash ores, cooling, transportation steam generation, domestic, sanitation, and irrigation(5 acres of lawn & landscaping)	3.0	14 miles
	1-43	Certific. of appropriation #9162 8/18/60	Texasgulf, Inc Moab, Utah	as above	as above	5.0	as above
	1-44	Certific. of appropriation #9160 1/23/61	Texasgulf, Inc. Moab, Utah	as above	as above	1.0	as above

TABLE NO. 4 CONTINUED

Table showing miscellaneous surface water appropriations near the Atlas Mill

Utah File Code No.	Document No. & date	Applicant	Point of diversion	Documented use	Flow in CFS	Miles down-stream from Atlas mill
5-936	Statement of water user's claim to di-ligent right Claim # 2809 Filed 7/18/73 Use prior to 1903	USBLM P. O. Box 1327 Montecello, Utah 84535	From POB of unnamed stream in NW¼SW¼, Sec. 11, T. 26 S. R. 21 E. to the con-fluence with Colorado R.	Stockwatering (100 cattle)	0.10	3½ miles
5-942	Statement of water user's claim to di-ligent right Claim # 2817 Filed 7/31/73 Use prior to 1903	USBLM P. O. Box 1327 Montecello, Utah 84535	S911' W1326' from NE corner Sec. 21 T. 26 S., R. 21 E.	Stockwatering (100 cattle)	0.0045	5½ miles
5-327	Certificate # 7697 4/6/65 unnamed spring	Ray Wagner Box 1193 Moab, Utah	S889.1' W1325.6' from NW corner Sec. 26, T. 26 S., R. 21 E.	Domestic water for one family	0.015	5 miles
5-246	Certific. of Appropria-tion 10/3/58	MoabLion's Club Moab, Utah	S889.1', E1860 from NW corner Sec. 6, T. 25 S., R. 21 E.	Culinary water from tunnel & drillhole	0.017	1 mile upstream



10 MILE RADIUS
5 MILE RADIUS
ATLAS MILL
Courthouse
Pasture
Canyon
PASTURE
Long
Canyon
BIG
FLAT
SHAFER
BASIN
DR

N

EXPLANATION

(1) SURFACE WATER APPROPRIATIONS FROM COLORADO RIVER. (SEE TABLE FOR QUERY 18.)

● WATER WELL.

○ SPRINGS.

DILIGENT RIGHT CLAIM.

—DR— (STREAM)

○ DR (SPRING)

0 1 2 3 4

SCALE 1/2" = MILE

ATLAS MINERALS DIVISION · ATLAS CORPORATION
MOAB URANIUM MILL

FIGURE NO. 6
APPROPRIATIONS OF GROUND AND SURFACE WATERS NEAR THE ATLAS MILL.

QUERY NO. 19

Show location of the clear water storage pond and clearwell storage relative to the tailings pond (add to Fig. 3.5) (p.3-19).

RESPONSE

The geographical relationship of the clear water storage pond and clearwater storage to the tailings pond are shown on Figure 2 - Site plan, which accompanies Response to Query No. 7 , herein.

QUERY NO. 20

Provide the slurry flow rate from the reactivator to the settling pond (p. 3-18).

RESPONSE

Based upon actual plant experience, the slurry flow rate for the underflow from the reactivator to the settling pond will be 3.5 gallons per minute at 3.9% solids. This will result in the settling of 24 tons of sediments. This number supersedes the "...less than 12 dry tons per month...." reported in Paragraph 5 on Page 3-24 of the ER.

QUERY NO. 21

State the uses for the two areas of impounded water, if any (p. 3-31, Fig. 3.5).

RESPONSE

The two areas of "Ponded Water" shown along the southwestern margin of the tailings pond are two natural depressions which collect precipitation and runoff in very small quantities. These ponds have no part in the plant process, or in the operation of the tailings retention system.

QUERY NO. 22

Table 3.5 states that there are 825 tons of dry filter cake per day in the tailings. Since only 750 tons of ore processed each day, explain source of the additional 75 tons of dry solids (p. 23).

RESPONSE

The additional 75 tons of equivalent dry tailings are derived within the plant process as precipitates of chemical reaction which report to the filter cakes and are backwashed and fed to the tailings effluent.

QUERY NO. 23

A cooling tower is shown in Plate 7 of the supplement. Please provide all details of the cooling tower and its use, such as heat load, cooling range, flow rate, make-up and blow-down flow rates, disposition of blowdown, etc. (Suppl., Plate 7).

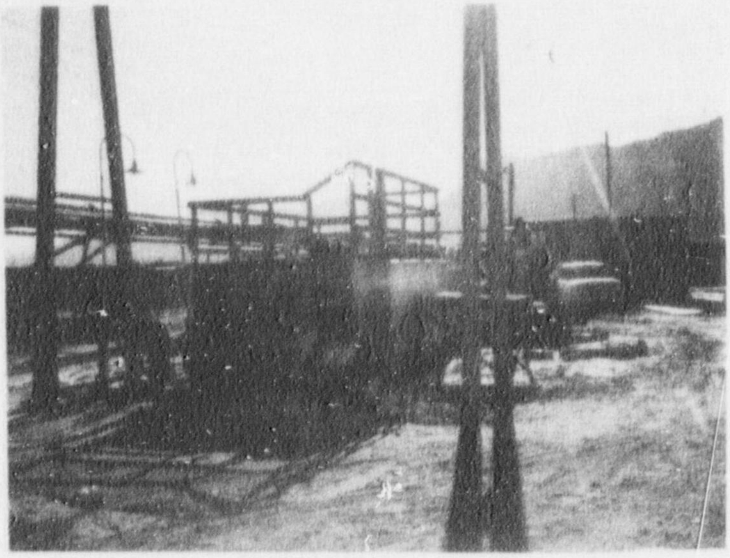
RESPONSE

The cooling tower referred to on Plate 7 of the Supplement to ER has been used in the past for cooling of compressors. This particular unit is shown in the accompanying photos in Figure 7. The tower is a Marley Model 13-101, with a cooling flow rate of 150 gpm of water which is cooled from 95° F to 75°F, for an estimated capacity of about 1.5 million BTU's per hour. The unit has exterior dimensions of 16'2" in length, 8'7" in width and 7'9" in height. This unit will be reconditioned and placed on stream as part of the current plant construction. It is estimated that when in operation, this unit will have a bleedwater rate of about 5 gallons per minute. No chemical analyses are available for this bleedstream; however, when again place in operation, this bleedstream will be recycled to the plant process water system.

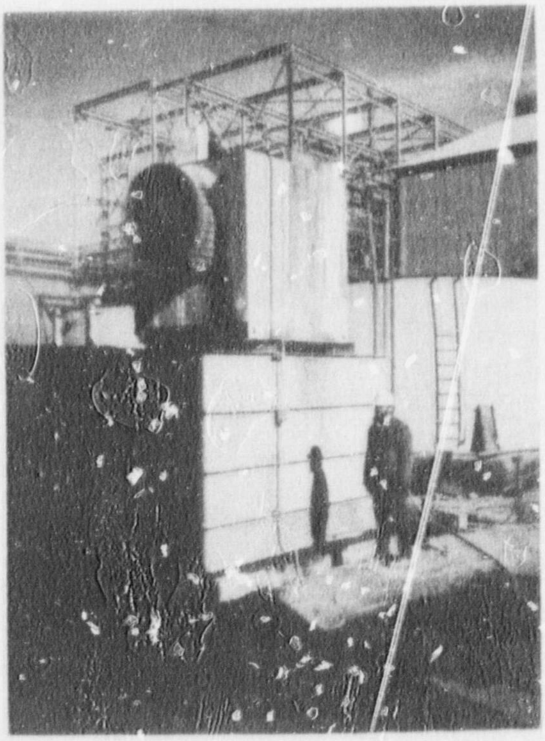
A second small cooling tower has been placed on stream for the purpose of compressor cooling. This unit, shown in the accompanying Figure 7, is a Marley Aquatower, Model No. 4535 R. It has a 5 horsepower unit which will handle a flow rate of 160 gallons per minute of water across a tempera-

RESPONSE TO QUERY NO. 23 (CONTINUED)

ture range of from 100°F. for a heat dissipation capacity of 1.6 million BTU's per hour. The bleedstream from this unit is estimated to be less than 2 gpm and is recycled to the plant process water system.



Marley Model 13-101 Cooling Tower
(not currently operational)



Marley Model No. 4535 R Cooling Tower
(onstream)

Photographs showing cooling towers

FIGURE NO. 7

QUERY NO. 24

a.) What area of Plate 2 contains 115 acres?

b.) What area of Plate 2 contains 98 acres?

c.) Describe the method by which the slurry is discharged to the tailings pond.

d.) Describe the intended use of the existing purification pond.

RESPONSE

a.) On Plate 2, the basal area of the tailings pond constitutes approximately 115 acres. This area is shown on Figure 2 which accompanies the response to Query No.7 .

b.) On plate 2, the top surface of the tailings pond constitutes approximately 98 acres. This area is shown on Figure 2 which accompanies the response to Query No. 7 .

c.) At present, the upper or flocculant pond is emptied by dragline and transported to the tailings pond by truck. Portion of the floc is pumped by pipeline to the tailings pond. The upper pond is cleaned approximately every six months. The lower or barium chloride treatment pond is also cleaned by dragline and trucked to the tailings pond. The rate of sediment accumulation in the lower pond is slow. This pond has only been cleaned out once since it was first constructed.

d. The future use of this pond is not yet clear. Despite the fact that in the new tailings retention system configuration no effluents will be released to the river, it may remain necessary to precipitate the radium-226 to prevent its loss from the system through seepage. In such case the barium chloride pond will continue to be used.

QUERY NO. 25

It is stated that evaporation is measured at a meteorological station at the mill. Explain how this is measured, including evaporation equation used, and the origin of the value of 69% for converting pan to lake evaporation (PSAR(sic) p. 2.3-10).

RESPONSE

At the weather station of the Atlas mill, daily measurements are made of maximum and minimum temperatures, dry and wet bulb temperatures by use of a sling psychrometer, precipitation by a tilting bucket gage, and wind speed by a hand held anemometer. These data are collected according the procedure contained in Instructions for WS Form E-22 (Formerly WB Form 612-25) Record of Evaporation and Climatological observations, a copy of which is reporduced following. This data is reported to the National Cimatic Center, Asheville, North Carolina.

The value of 69% for converting pan to lake evaporation was extrapolated from Plate 3, Average Annual Class A Pan Coefficient, in U. S. Weather Bureau Technical Paper No. 37, Evaporation Maps for the United States, by M. A, Kohler, T. J. Nordenson, and D. R. Baker, Washington, D. C. 1959. This value was confirmed in Estimated Return Periods for Short duration precipitation in Utah; Utah State University, Department of Soils and Biometeorology, Logan, Utah.

The value of 69% for the pan evaporation coefficient was calculated by Kohler according the Class A pan evaporation

RESPONSE TO QUERY NO. 25 (CONTINUED)

relation shown on Figure 1 of the above referenced Technical Paper No. 37. This, in turn, was based upon the lake Hefner studies.

INSTRUCTIONS FOR WS FORM E-22
(FORMERLY WB FORM 612-25)
RECORD OF EVAPORATION AND CLIMATOLOGICAL OBSERVATIONS

Taking and Recording Observations

1. Begin a new form on the first of every month. Fill in the heading and bottom of form completely. The standard time in use should be shown by the letters E, C, M, or P for the four official standards of time, Eastern, Central, Mountain, and Pacific. If your report is prepared in Daylight Saving time, the letter D should be entered just after the letters E, C, M, or P, as follows: ED, CD, MD, or PD. The following items for the last day of the preceding month will be entered in the spaces just above the line for the first of the month: dry-bulb temperature at complete observation, beginning and endings of precipitation, anemometer dial reading, gage reading at observation, and gage reading when tank filled. Entries for each day will be on the late line of the date of observation except as indicated under "Additional Data-Remarks". An additional Form E-22 will be used if more space is needed as it is not desirable in processing the forms to have entries on the reverse side. The sample form shows how entries should be made at evaporation stations with and without dry- and wet-bulb thermometers and water temperature instruments.

2. The observations will be taken at a regular hour each day. The preferred time for the complete observation is in the morning, when the rate of evaporation is low. All instruments will be read and the values recorded on the enclosed form during the complete observation. WS Form F-7 "Official Weather Observers Record" may be used to record the observations as they are taken, entering wet and dry-bulb, wind and evaopration readings under "Remarks and Notes". If this form is used, the data should be copied promptly onto Form E-22. Form F-7 may be retained by the observer. Stations equipped with a psychrometer and making a complete observation in the morning will make a supplementary observation of the dry and wet-bulb thermometers at some regular hour in the evening and record the temperature readings in the second set of dry and wet-bulb columns provided. If the complete observation is made in the evening, the supplementary reading will be made at a regular hour in the morning. Time of supplemental readings will be entered in the heading of the supplemental columns. When for some unavoidable reason, the observation is not made at the regular time, a notation will be made in the remarks column, on the correct date line showing the exact time the observation was taken. Continuity of record is very important. A member of the observer's family, or some other competent person, should, therefore, be taught to take and record observations in the event of the observer's absence or illness.

INSTRUCTIONS FOR WS FORM E-22 (CONTINUED)

3. More detailed instructions will be found in National Weather Service Observing Handbook No. 2, Chapter 5, Evaporation Station Observations and other special circulars as issued, and should be studied carefully by every observer. Instructions that follow cover the entry of data in the specific columns of the form.

4. AIR TEMPERATURE ($^{\circ}F$). - Maximum and minimum temperatures and temperature at observation will be read and entered in the proper columns to the nearest whole degree. If the temperature is below zero, place a minus sign before the readings. The maximum and minimum thermometers should agree within one degree after setting. A greater difference should be reported under "Additional Data-Remarks".

4a. Minimum Temperature. - The minimum thermometer will be read while it is in its nearly horizontal or "set" position by reading the temperature scale at the end of the small index farthest from the bulb. It will be read first so that the index in the minimum thermometer will not be jarred or disturbed in any manner before the reading is made. The minimum thermometer should be set after the maximum thermometer has been read and set (see 4b), by raising the bulb end sufficiently to allow the small index to slide to the end of the alcohol column, and then lowering the termometer to its nearly horizontal position.

4b. Maximum Temperature. - Read the top of the mercurial column, after the maximum thermometer has been lowered slowly to a vertical position, with the bulb end down. Be careful not to touch the thermometer bulb before making the reading. After reading the thermometer, it should be set by whirling it several times until the reading is approximately the same as that shown by the end of the alcohol column in the minimum thermometer. It should then be returned to its nearly horizontal position with the bulb end slightly elevated.

4c. Dry and Wet-Bulb Temperature. - Stations equipped with psychrometers will read the dry and wet-bulb temperatures to the nearest estimated tenth of a degree and enter readings in the Dry and Wet-Bulb columns.

4d. Temperature at Observation. - Stations not equipped with a psychrometer will obtain the current temperature by reading the end of the alcohol column in the minimum thermometer while in its "set" position without disturbing the instrument. The temperature at observation may also be obtained by reading the maximum thermometer after it has been whirled and while it is still in a vertical position.

4e. Dew Point . - Entries need not be made in these columns.

5. WATER TEMPERATURE (^{O}F). - If the station is equipped with a water temperature instrument where daily eye observations are required, these readings should be entered in the appropriate columns to the nearest whole degree. If equipped with an autographic water temperature instrument, the recorder chart from this instrument will be forwarded to the National Climatic Center, Asheville, North Carolina along with Form E-22 as instructed.

6. PRECIPITATION. - Times of beginning and ending will be entered on the calendar dates on which they occur and amounts will be entered on the dates of measurement, so that an amount will sometimes appear on the date line following that showing the time of beginning or ending. When precipitation occurs during the night and the exact time is not known, use the expression "DN" to denote beginning and/or ending (use "DNA" or "DNP", respectively, to denote "during night a.m., or p.m."). Make these entries on the dates of actual occurrence. The rain gage should be emptied immediately after the regular measurement has been made and recorded. Do not empty gage at times of supplementary observations.

6a. Under "24-Hr. Amounts", enter total precipitation, in inches and hundredths (rain or melted hail, ice pellets) which has accumulated during the 24 hours preceding the time of observation. Enter the amount on date of the measurement. If an amount too small to measure occurred, enter "T" for trace. Every entry of measurable precipitation must be recorded to two decimal places, being careful to enter the decimal point in its proper place. If the amount is .05 (five hundredths), it will be entered as .05, if it is .50 (50 hundredths), it will be entered as .50, and if it is over 1 inch, as 1.60, etc. If no precipitation occurred during the 24-hour observation period, a "O" (zero) should be entered so there will be no doubt as to whether any precipitation fell during the period.

6b. In freezing weather, when snow or ice pellets are likely to occur, remove the funnel and inner tube of the rain gage and leave only the large outer can exposed. Melt the catch of snow or ice pellets by adding a carefully measured amount of warm water from the tube. After the catch is melted in the can, pour the water into the tube, being careful not to spill any and measure it, then subtract the amount of warm water previously added. The resulting figures are the water equivalent of the snow or ice pellets and will be entered as the amount of precipitation. If snow, ice pellets or hail falls when the funnel and inner tube have not been removed and it is apparent that the gage has caught only a portion of the precipitation, a section of the newly fallen snow, ice pellets, or hail on the ground will be cut, by using the outer can as a biscut cutter, and this section reduced to water and measured as indicated above.

6c. Under "Snow, Ice Pellets, Hail" enter in inches and tenths the depth of new snow and ice pellets or hail that has fallen during the past 24 hours. Enter "T" for a depth too small to measure.

6d. Under "Snow, Ice Pellets, Hail, Ice on Ground" enter to the nearest inch the average depth of all snow, ice pellets, and ice (including old and new) and hail remaining on the ground (in whole inches) at time of observation in the vicinity of the station. Enter "T" for less than one-half inch. If drifting has occurred, measurements will be made at several points where there is less evidence of drifting and the average of these entered. An entry should be made each day at this space as long as snow, ice pellets, or ice remains on the ground. As soon as the covering has melted, it is not necessary to enter "O" each day, after it has once been entered.

7. WIND. - The anemometer dial reading will be entered to the nearest whole mile. Miles of movement since the preceding observation need not be entered by the observer.

8. EVAPORATION. - See Chapter 5 of National Weather Service Observing Handbook No. 2 for complete instructions on how to make evaporation readings. No entries need be made in the column headed "Amount of Evaporation".

8a. HOOK GAGE READINGS. - The gage will be read to the nearest hundredth of an inch and the reading entered in the appropriate column. Fill the pan to a level two inches below the rim and refill to that level at the time of a regular observation whenever the water has receded one inch, to a level three inches below the rim. When rains threaten to overflow the pan, remove enough water, regardless of the time of day, to lower its level to two or three inches below the rim. Read the gage immediately before and after making any change in the water level and record the readings in the "Remarks" column of the record form.

8b. POINT GAGE MEASUREMENTS. - Water will be added to, or removed from, the pan so that the tip of the point gage coincides with the water surface. When the water surface is beneath the point, measure with the measuring tube the amount of water needed to restore the water level in the pan. Enter this value preceded by a plus (+) in the column "Gage Reading, or Amount Added +". When the water surface is above the point, dip water from the pan into the measuring tube until the top of the point coincides with the water surface. Measure the water in the graduated tube and enter this reading preceded by a minus sign (-) in the column "Reading When Tank Filled, or Amount Removed-".

INSTRUCTIONS FOR WS FORM E-22 (CONTINUED)

9. ADDITIONAL DATA - REMARKS. - Special data, such as lake temperatures, additional evaporation readings, etc., should be entered in the vertical columns provided, giving the time of such readings and labeling each column accordingly (see sample). Any unusual conditions such as pan overflowing or water being lost through other means than evaporation should be recorded in these columns. Remarks may be entered either horizontally along the date line of observation or vertically in the columns (indicating dates of occurrence), depending on space needed. When the pan is cleaned, or at least once a month, remove Six's thermometer from pan and place in the instrument shelter. Allow enough time for the thermometer to dry and reach air temperature. Read the current air temperature from the minimum thermometer without resetting and the temperature from the Six's thermometer. Enter these comparative readings in the "Remarks" column. If the readings differ by 2° or more, notify the Regional Substation Management Section (RSMS) at the appropriate Weather Service Regional Headquarters. The purpose of this check is to evaluate the reliability of the water temperature observations.

10. SUMS, AVERAGES, GREATEST AND ADJUSTED TOTAL need not be entered by the observer.

11. Enter your name, station, month, and year on the bottom of the form. After the last observation of the month the forms should be rechecked for completeness, accuracy, and legibility of all entries, and should be mailed promptly to the National Climatic Center, Asheville, North Carolina. One original and one carbon copy should always be mailed, unless instructed otherwise.

QUERY NO. 26

Provide description of Dames & Moore EP 66 computer program if available (PSAR(sic) p. 2.3-25).

RESPONSE

Dames and Moore has provided the description of their computer program EP 66 which is reproduced herein on the following pages. The procedure used for the development of the PMF is also detailed in the SAR on Page 2.3-23 under Section 2.3.2.4.4 Runoff Model of Probable Maximum Flood, and also according to the equations shown in the following Section 2.3.2.5 Water Level Determinations.

DAMES & MOORE COMPUTER PROGRAM EP 66

GENERAL DESCRIPTION

This is a description of a computer program designed to calculate the water level change in a bay which is connected to the open coast through inlets. Flooding waters are also allowed to flow in either direction over the gaps between coastal bluffs depending upon whichever is higher.

The rise of the water level in a bay as a function of time is caused by inflow through inlets from the open coast due to storm surge and/or by flooding water from rivers due to river flows. The computer program is used to determine the changing water level at the site of a proposed plant. This information is then used in the design of sea walls, protective barriers, bulkheads, cooling water section and discharge pipes, and other coastal structures associated with the plant.

This computer program is written by a finite time increment method of flood routing. The basic concepts for organizing this computer program are channel flows with Manning's formula and overtopping flows through coastal gaps with broad-crested weir's formula which are shown by the following equations and are explained in Figure 1:

$$\frac{Q_\omega}{Q_1} = \left[1 - \left(\frac{H_2}{H_1}\right)^{1.5}\right]^{0.385}$$ . . . Weir Flow Formula

where $Q_1 = CAH_1^{0.5}$

A = flow cross section area above top of weir

C = discharge coefficient

H_1= upstream potential energy head above the elevation of the weir

H_2= downstream potential energy head above the elevation of the weir when water surface elevation equals or is less than the elevation of the weir, H_2 is then equal zero

$$Q_c = A^{5/3} \times \frac{1.486 \times S^{1/2}}{n \times T^{2/3}}$$ . . . Channel Flow Formula

where A = flow cross section area of the inlet

T = top width of the inlet

n = Manning's fraction coefficient

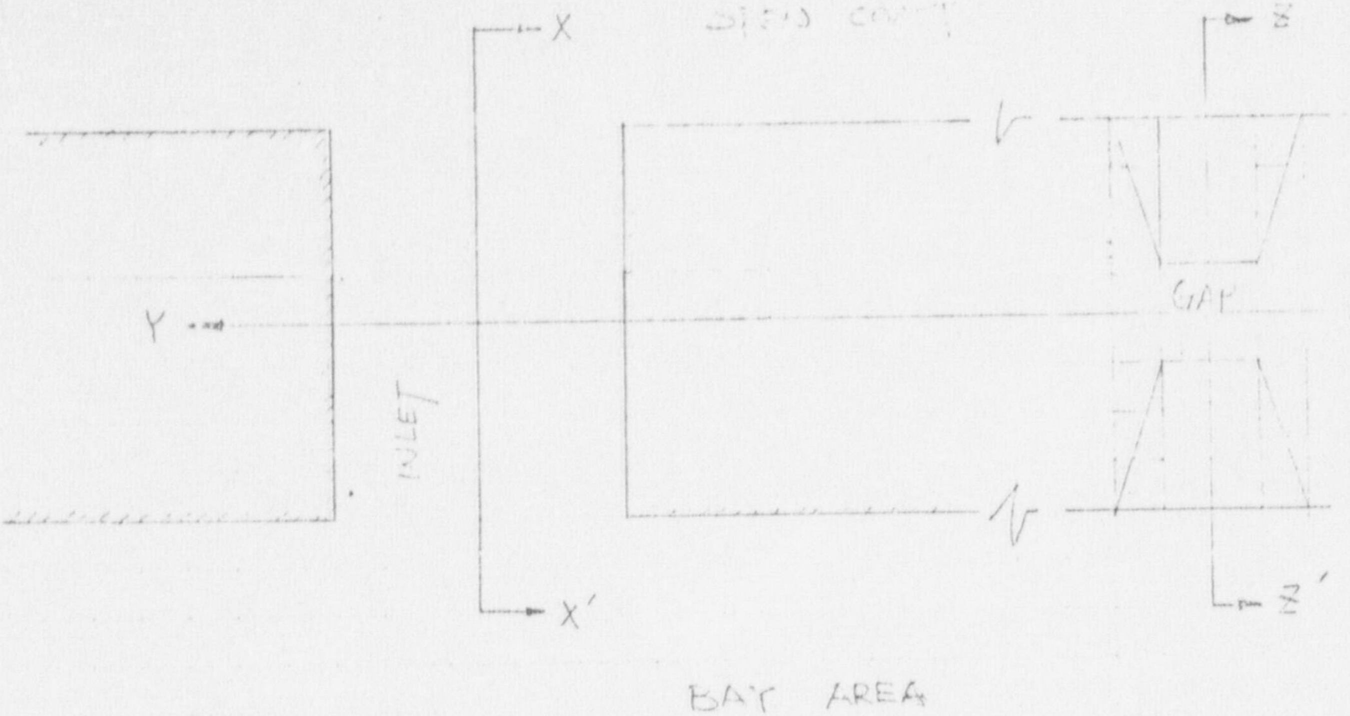
S = energy gradient between open coast and the bay, and is defined by $(H_2-H_1)/L$ where L is inlet length.

To determine the changing water level in a bay, a rating curve of the bay horizontal areas versus the elevations is prepared. The input data of river discharge hydorgraph and open coast surge height are all a function of time. The finite time increment can be changed depending upon the need and the degree of accuracy. An initial water surface elevation has to be assigned to the input data in order to determine the direction of flow at the beginning of computation.

3

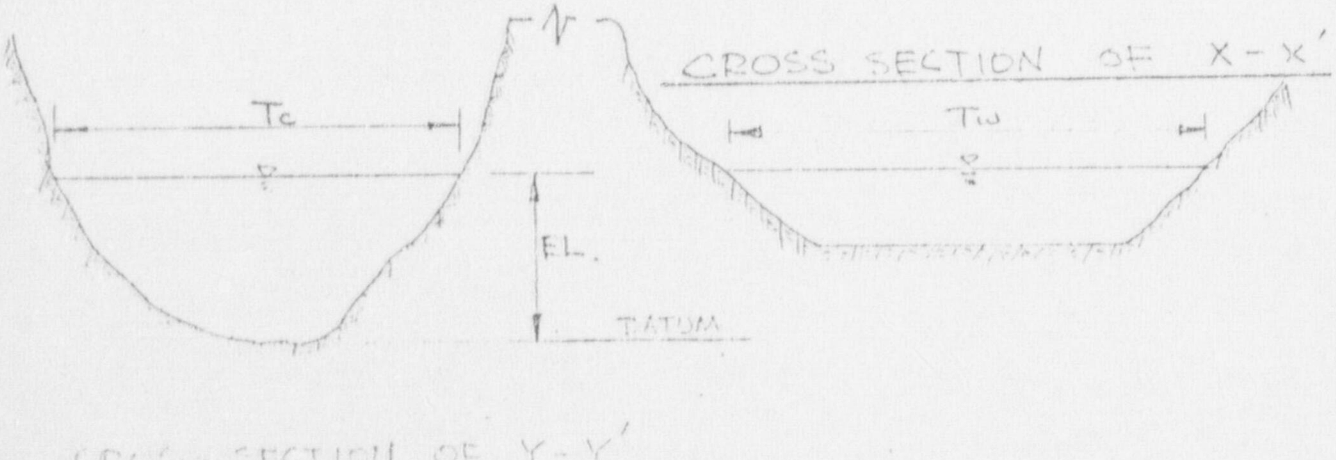
When changing the direction of flow is needed, the computer program itself is designed to detect the situation and still be able to use both formulas effectively.

The capability of this computer program can handle channel flows and weir flows simultaneously up to total amount of maximum seven combinations.

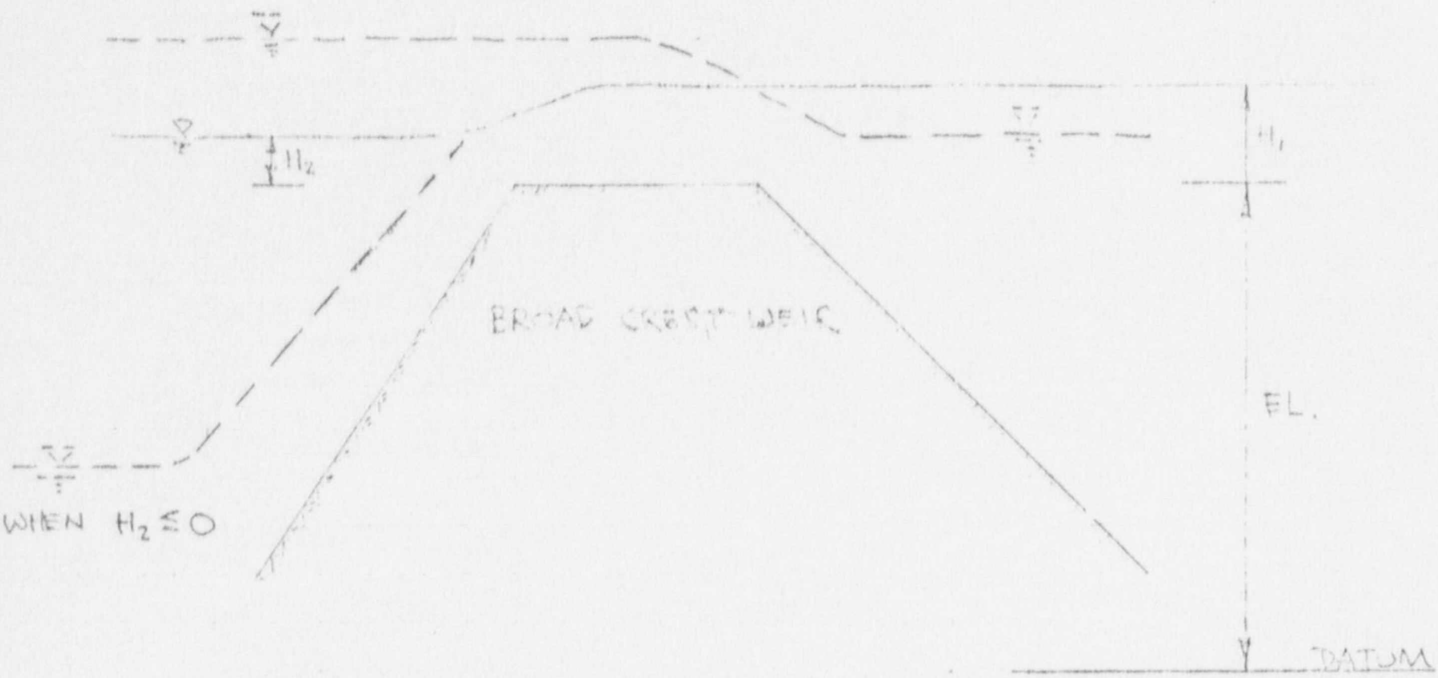


PLAN VIEW OF INLET AND GAPS BETW... COASTAL

CROSS SECTION OF X-X'



CROSS SECTION OF Y-Y'



CROSS-SECTION OF Z-Z'

Figure 1: Explanations of Inlet and Gaps Between Coastal Bluffs

BAY WATER LEVELS DUE TO FLOOD AND HURRICANE EVENTS

Maximum water level at a coastal project site due to combined events of river flooding and/or storm surge is needed to design sea walls, bulkheads, protective barriers and other coastal structures. The rise of water level in a bay as a function of time is caused by flow through inlets and gaps due to storm surge and/or by flooding water from river discharging into the bay. The computer program is designed to calculate the water level changes, due to hydrologic events, in a bay connected to the open coast through inlets and gaps. Water is allowed to flow from bay to sea or sea to bay through the inlets and gaps in the sea-wall or coastal bluffs depending on the differential head between the bay and the sea.

The computer program uses a finite time increment method of flood routing through bay area. Results are also double checked by using modified Puls method of flood routing. Flows through inlets are computed by using Manning's formula. Overtopping flows, Q, through coastal gaps are computed by broad-crested weir formula given in King's handbook (PP. 5-19) as:

$$\frac{Q}{Q_1} = \left(1 - (H_2/H_1)^{1.5}\right)^{0.385} \qquad (1)$$

in which $Q_1 = CA\sqrt{H_1}$

where H_1 = upstream head above weir crest.

H_2 = downstream head above weir crest. $H_2 < H_1$

A = flow area above weir crest

C = discharge coefficient

The energy gradient used in the Manning's formula is computed by:

$$Se = (H_1 - H_2) / L \qquad (2)$$

where L is the inlet length. Determination of L is not very accurate and therefore, judgment should be used. The best suggested value of L seems to be the length of the channel plus two times the width of the channel. Also, the average distance between the centroid of the horizontal bay area and the sea-wall may be used as inlet length.

The area-capacity curve of the bay used in the computation is prepared internally by the program from area-elevation data read by the program. The finite time increment may be changed by specifying DTN in the program. In some problems a smaller time increment may be essential for an accurate solution.

ASSUMPTIONS AND LIMITATIONS

It is assumed that the hurricane surge has no effect on river flood in this program. The bay program is based on equation of continuity only and should be used where approximate value of water elevation is needed. Another program (EP72) for flood routing based on implicit finite different solution of equations of continuity and momentum is available. The bay program has been used on Puerto Rico job. The methodology used in this program has been discussed with AEC. AEC had no criticism or comment during presentation of the method used in the bay program.

BASIC DATA NEEDED

Following data are needed to use Bay program:

(1) Bay area-elevation curve.

(2) Geometry of the inlets and gaps.

(3) Flood and hurricane hydrographs.

(4) Initial Bay elevation, inlet length, Manning's roughness coefficient and time increment, t.

OUTPUT

The program gives time history of the water levels (hydrograph) in the Bay. Also the flow in and out of the bay through all inlets and gaps are printed.

DESCRIPTION OF INPUT VARIABLES

Variable Name	Explanation
	FORMAT CARD
FMT	FMT is the variable format (Cols. 1-24), enclosed within parentheses, in which all data are to be read.
	PARAMETER CARD
FNC	Total number of channel flow areas in the sea-wall. FNC may be between zero and 20.
FNW	Total number of Weir flow areas in the sea-wall. FNW should be between 1 and 20.
FCC	Total number of points on the Elevation vs. Area curve for the Bay. FCC $<$ 100.
FNQ	Total number of points on the hydrographs. FNQ $<$ 500. Both flood and hurricane hydrographs must have the same number of points.
BAY(1)	Initial Bay elevation in ft. above M.S.L. before start of the flood event.
DT	Constant time interval, Δt, in hours for both flood and hurricane hydrographs.
ELB	Inlet length in ft. Average distance between the centroid of the horizontal bay area and the sea-wall may be used as inlet length. This is used in estimating the energy gradient.
EN	Manning's roughness coefficient for the channel flow areas.
DTN	New smaller value of Δt used in computation. DTN $<$ DT
	BAY AREA-ELEVATION CARD
ELV(I),AR(I)	FCC pairs of bay elevation above M.S.L., ELV(I), and the horizontal area of the bay, AR(I), in acres are needed.
	CHANNEL GEOMETRY CARD
	These cards have data to define geometry of the channel flow areas.

Variable Name	Explanation
ELC(I), TC(I)	Each channel flow area is defined by twelve (12) pairs of values of elevation, ELC(I), and top width, TC(I), in ft. This is read only if FNC > 0.

WEIR GEOMETRY CARD

ELW(I), TW(I)	Weir geometry is also defined by twelve pairs of values of elevation, ELW(I), and top width, TW(I), in ft.

TITLE CARD

TTL(I)	One card title of computation or any pertinent information (Col. 1-76).

FLOOD HYDROGRAPH CARD

Q(I)	NQ values of flood hydrograph discharge.

HURRICANE HYDROGRAPH CARD

SEA(I)	NQ values of hurricane hydrograph discharge. Flood hydrograph (Q) and hurricane hydrograph (SEA) have to be determined using standard methods and procedures. Title card, Q and SEA may be repeated for many different events or combination of events.

QUERY NO. 27

Provide basis for the emission rate of kerosene and organic solvents from the uranium and vanadium solvent extractions (S-X) and stripping units at 180 lbs. per day (p. 3-35).

RESPONSE

In a telecon with Stearns Rogers on December 8, 1976, it was learned that the original calculations have been found in the files at Denver. Full calculations were not passed over the telephone; however, the notes revealed that the calculation was based upon a formula found on Page 525 of a reference by Bird, Steward and Lightfoot. Using this formula, a temperature of 100° F, an emission surface area of 5,000 square feet, and a vapor pressure of 10 mm of Hg, an emission rate was calculated of 1.95×10^{-7} gram/cm^2/sec. For the 5,000 square of surface area, a daily loss was calculated of 173 pounds per day.

Copies of this original calculation are being forwarded to Atlas. Upon examination of these materials, a revised response will be prepared detailing the full formula and calculation, and a revised response will be submitted.

QUERY NO. 28

In Table 3.10, give chemical compositions and particle size distribution of the airborne particulates emitted to characterize emissions in a manner similar to Tables 3.8 and 3.9 (p. 3-36).

RESPONSE

Such data are not now available and could not be collected within the time frame of NRC's required response. Nevertheless the character of these emissions are discussed in a qualitative manner below.

The character of the particulates which are trapped in the dust collectors is based upon the mineralogical compositions of the ores which are crushed. These ores are basically the occurrence of the commercial minerals containing uranium, vanadium, and copper. The ores treated by the Atlas mills are essentially sandstones of the Brushy Basin and Salt Wash members of the Upper Jurassic Morrison Formation; of the Upper Triassic Shinarump Formation;of the Moss Back Member of the Upper Triassic Chinle Formation; and of the De Chelly member of the Permian Cutler Fm.

These sandstones--from the standpoint of milling characteristics--are broken down into high lime ores which are processed by alkaine leaching, and the other ores which are low in lime and are processed in the acid circuits. The principal gangue minerals are quartz and feldspar in all ores and calcium carbonate in the form of calcite in the high lime ores. Minor petrological constituents may be expected to include small amounts

RESPONSE TO QUERY NO. 28

of alumina contained in clay fractions and the suite of heavy mafic minerals which would include magnetite, ilmenite, iron-magnesium silicates, and related heavy minerals which may be expected to contain rare earth and heavy metals in trace amounts.

The mineralogy and petrology of these uranium ores are discussed in considerable detail in Mineralogy and Oxidation of the Colorado Plateau Uranium ores, by Alice D. Weeks, in Geological Professional Paper 300, Contributions to the Geology of Uranium and Thorium by the U. S. Geological Survey and Atomic Energy Commission for the United Nations International Conference on Peaceful Uses of Atomic Energy, Geneva Switzerland 1955. Items of interest from this work are noted below.

1.) (p 188) "The primary vanadium-uranium ores are characterized by their black color and the presence of low-valent uranium and vanadium oxides and copper, iron, lead, and zinc sulfides arsenides and selenides."

2.) (p 189 - under discussion of non-vanadiferous ores) "In the primary ores uranium is contained chiefly in uraninite..." "Two generations of pyrite have also been established in these primary ores, with the pyrite in uraninite showing rims of unidentified nickel and cobalt minerals...." "Copper sulfides, including chalcopyrite, bornite, chalcocite and covellite, are dominant in some mines; and lead, zinc, and iron sulfides are dominant in others."

It is thus seen that dusts from the ore crushing section can contain trace amounts of a wide variety of elements, and that these trace elements would vary greatly from day to day, depenpend upon which ores were processed.

RESPONSE TO QUERY NO. 28 (CONTINUED)

The character of the road dust is dependent upon the mineralogical composition of the local soils. These soils will consist of a full range of particle sizes ranging from coarse to medium sized grains of quartz, feldspar, through fine grained particles of the same minerals, and down to the silt to clay size particles mainly composed of varieties of clay and some organics derived from vegetation. These soils, due to their derivitive nearby formations, also will contain a higher than normal accessary contain of iron oxide.

The characteristics of particulates originating in product packaging and drying areas, and from the vanadium furnace will be dependent upon the contents of the uranium and vanadium products themselves. The copper precipitates are formed in a liquid phase and will not be expected to report to particulates in the atmosphere. Thus, particulates originating in these areas are well characterized by analyses of the product. The following analyses are those obtained from operating experience at the Atlas mill.

Typical analyses of uranium product(yellowcake)

U_3O_8	-	95.22 %	Ca	-	.05 %
V_2O_5	-	0.3	Na	-	.25
PO_4		.03	B	-	.001
Cl^-	-	.01	K	-	.02
F	-	.01	SiO_2	-	.9
Mo	-	.02	Ti	-	.01
SO_4	-	.7	Mg	-	.01
Fe	-	.08	Zn	-	.1
As	-	.01	CO_3	-	.02

RESPONSE TO QUERY NO. 28 (CONTINUED)

Typical analyses of vanadium product

V_2O_5	-	98.5 %
Na_2O	-	.5
Fe	-	.35
SiO_2	-	.6
As	-	.02
PO_4	-	.01
Mo	-	.01

-o-o-o-

The character of the airborne particulates which originate within the tailings retention system will derive from the combination of characteristics of the original gangue minerals, the chemical residues created within the plant process, the unrecovered trace values of the original ore minerals, and the trace elements contained within the original ores, reagents, and process water. The chemical analysis of the process residues are embodied in Table 3.6 on Page 3-28 of the ER. It is estimated that approximately 80% of the solids in the tailings pile will be comprised by the unreacted gangue minerals to include principally SiO_2 as quartz, and feldspars as a variety of calcium-magnesium-alumino-silicates. The remaining solids will be salts of residues of a complex variety of calcium, magnesium, potassium, and sodium carbonates, sulfates, and chlorides. When considering the airborne particulates which originate in the tailings pile, it must be remembered that all of the side slopes are covered with a protective layer of native stone, that the beaches are kept wet by pond management, and that the central pond area is covered with liquid effluents--all of which factors keep fugitive dust at low levels.

RESPONSE TO QUERY NO. 28 (CONTINUED)

The character of emissions to be expected from the ore stockpiles is directly related to the mineralogical and petrological contents of the ores as discussed under the dust collectors, above. Fugitive dust from the ore stockpiles is reduced during exceptionally dry periods by means of stockpile wetting.

QUERY NO. 29

Provide information on cooling tower blowdown in terms of chemical analysis and discharge rates; explain the ultimate disposal of the blowdown.

RESPONSE

As discussed in the response to Query No. 23, above, of two cooling towers on site, only one is now onstream. It is estimated that the unit not now in operation has a bleedwater rate of about 5 gallons per minute, whereas the unit in operation is estimated to have a bleedwater rate of about 2 gallons per minute.

No chemical analyses of the bleedwater are available. Since this water is recycled to the process water system, it will not be released to the ambiant environment, and therefore, no significant impacts are expected to attend such low bleed rates.

QUERY NO. 30

Give the efficiency of the dust suppression spray system in the crushing building (p. 3-51).

RESPONSE

The ore dust emission control is discussed in the SAR under Section 3.1.2 on Page 3.1-2, and in Section 4.1.1 on page 4.1-1.

These discussions describe that water spraying is performed intermittantly based upon the experience of the Crusher Foreman. Dusting characteristics of the various ores processed in the plant differ as a function of grain size and moisture. For example, Chinle ores tend to be fine grained as opposed to the coarser grained ores from the Morrison Formation. In general ores having more than 4% moisture do not have an associated dusting problem. Thus, when the ores have a moisture content of approximately 4% the sprays are used to suppress dust.

In actual practice the efficiency of the dust collectors also reflects the efficiency of the dust spray system. Thus the spray system contributes to the 99% efficiency listed for the two crusher dust collectors listed in the table on Page 4.1-1 of the SAR. Since the dust spray system has been considered an element in the overall system, records have not been kept which would enable an analysis of a separate efficiency rating for the sprays alone.

QUERY NO. 31

Explain how the barium precipitate (with Ra-226 absorbed) will be transferred to the tailings pond with the other solid residues (p.3-25).

RESPONSE

The barium treatment ponds consist of an upper pond where floculants are added in order to reduce the contents of suspended solids. The lower, or southern, pond is the point at which barium chloride is added to the decant from the floculant pond and where the barium sulphate is precipitated.

Both ponds are cleaned by dragline and the residues are trucked for emplacement in the tailings pond. The residue accumulates in the upper, or northern, floculant pond at a relatively fast rate, and requires cleaning about once every 6 months. The precipitation rate within the barium chloride treatment pond is relatively slow, such that since its construction in 1956, it has been cleaned only once.

QUERY NO. 32

Provide data on past chemical analyses of actual liquid samples from the tailings pond (p.3-28).

RESPONSE

Complete chemical analyses for the 6 month period from April through September were performed on samples from the effluent stream from the tailings pond below the barium chloride precipitation pond by the Utah Division of Health, Bureau of Water Quality. These results are reproduced on the following page. It must be noted that these analyses reflect the historical record of plant operations which include processing by the old resin-in-pulp (RIP) circuits, and that consequently, these analyses will not be representative of the contained pond waters under a zero discharge configuration.

TABLE NO. 5

Table of chemical analyses of samples of the effluent from the tailings pond*

Parameter measured	unit	4/30	5/31	6/30	7/31	8/31	9/30	Average
Ammonia as N	mg/l	490.0	390.0	560.0	360.0	41.0	440.0	380.0
Arsenic	ug/l	10.9	15.0	16.0	5.8	0.4	2.5	8.4
Barium	ug/l	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boron	ug/l	350.0	280.0	290.0	360.0	270.0	320.0	371.0
Cadmium	ug/l	35.0	40.0	50.0	0.0	40.0	70.0	39.0
Calcium	mg/l	550.	488.	504.	520.	488.	464.	502.
Chromium hex as Cr	ug/l	68.0	23.0	0.1	60.0	63.0	0.0	36.5
Copper	ug/l	55.0	50.0	30.0	30.0	25.0	40.0	38.0
Iron	ug/l	45.0	45.0	30.0	30.0	35.0	30.0	36.0
Lead	ug/l	180.0	200.0	100.0	70.0	120.0	80.0	125.0
Magnesium	mg/l	176.	151.	238.	243.	282.	292.	230.
Manganese	ug/l	13,900.	6,000.	7,300.	6,700.	10,000.	10,500.	9,067.
Mercury, total	ug/l	0	0	0	0	0	0	0
Nickel	ug/l	170.0	100.0	120.0	0.0	130.0	160.0	113.0
Potassium	mg/l	88.	91.	95.	92.	100.	95.	93.
Selenium	ug/l	25.0	40.0	47.0	50.0	30.0	6.0	33.0
Silver	ug/l	40.0	20.0	10.0	15.0	15.0	20.0	20.0
Sodium	mg/l	1,990.	2,000.	234.	2,050.	1,900	2,150.	1.721.
Zinc	ug/l	290.0	290.0	200.0	180.0	150.0	360.0	230.0
Total Cations	mg/l	2,817.	2,730	3,177.	2,905.	2,760.	2,900.	2,402.

(TABLE CONTINUED ON NEXT PAGE.)

*Analyses by the Utah State Division of Health, Bureau of Water Quality, From Standard Form, Chemical, RAdillogical & Pesticides Analysis.

TABLE NO. 5 CONTINUED

Table of chemical analyses of samples of the effluent stream from the tailings pond*

Parameter measured	unit	1976 4/30	5/31	6/30	7/31	8/31	9/30	Average
(CONTINUED FROM PREVIOUS PAGE)								
Bicarbonate	mg/l	139.	56.	80.	30.	46.	96.	75.
Carbon dioxide	mg/l	70	90.	128.	49.	47.	31.	69.
Carbonate	mg/l	0	0	0	0	0	0	0
Chloride	mg/l	850.	800.	975.	1,050.	863.	950.	915.
CO_3 solids	mg/l	68.	27.	40.	15.	23.	47.	37.
Fluoride	mg/l	0.30	0.54	0.92	1.20	0.62	0.37	0.67
Hydroxide	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrate as N	mg/l	11.00	1.15	37.00	4.50	14.00	13.50	13.50
Nitrite as N	mg/l	21.50	4.35	26.50	37.00	16.00	3.50	23.40
Phosphorous, orth(P)	mg/l	0.03	0.08	0.40	0.27	0.05	0.02	0.14
Silica, diss. (SiO_2)	mg/l	10.0	9.0	5.0	10.0	9.0	10.0	8.9
Sulphate	mg/l	6,725.	7,050.	8,000.	6,050.	6,450	6,575.	6,808
Total anions	mg/l	7,653.	7,890.	9,200.	7125.	7,435.	7,633.	7,823.
GRAND TOTAL	mg/l	10,460.	10,620.	12,380.	10,030.	10,200.	10,540.	10,705.
pH		6.5	5.9	6.0	6.0	6.2	6.7	6.8
TDS	mg/l	9,812.	9,140.	11,500.	10,700.	10,020.	9,920.	10,182.
Surfactant as MBA	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total alk. as $CaCO_3$	mg/l	114.	45.	66.	25.	38.	79.	61.
Total Hrd. as $CaCO_3$	mg/l	2,100.	18,400.	22,400.	12,300.	2,380.	23,600.	13,530
Iron, total	mg/l	4.0	3.93	10.0	6.3	10.0	26.0	10.0
Turbidity as JTU		23.0	25.0	75.0	79.0	82.0	185.0	78.0
Specific conductity @ 25° C	mhos/c	13,660	11,730	13,680	13,440	12,480	12,840	12,972

QUERY NO. 33

What is the current number of employees at the mill and the approximate payroll?

RESPONSE

As of October 15, 1976, the payroll of the Atlas mill was as follows:

	Number of Personnel
Exempt salaried	31
Non-exempt salaried	16
Hourly	114
Total	161

The payroll for the month was approximately $160,000.

The general socioeconomic character of the employees was obtained by an anonymous sampling of every fourth employee, or in other words a random 25% sampling. The results of this sampling are shown in the following table.

RESPONSE TO QUERY NO. 33 (CONTINUED)

Table summarizing socioeconomic character of employees at Atlas mill based upon a random sampling of 25 percent.

Place of Residence Moab	County*	Age	Sex	Marital status	No. of Children	Job function
X		34	M	m	2	Management
	X	45	M	m	9	Operator
X		56	M	s	0	Maintenance
X		19	M	m	1	Operator
X		28	F	m	2	Laboratory
X		21	M	s	0	Operator
	X	36	M	m	0	Laborer
	X	28	M	s	0	Operator
	X	30	M	m	3	Laboratory
X		52	M	m	2	Management
X		41	M	m	3	Maintenance
X		40	M	m	2	Mangement
X		49	F	m	3	Laboratory
X		22	M	m	0	Crusher
X		28	M	m	1	Operations
X		27	F	d	0	Laboratory
X		25	M	m	2	Maintenance
X		25	M	s	0	Operator
X		21	M	s	0	Laborer
X		20	M	m	0	Operator
X		29	F	m	2	Laboratory
	X	56	M	m	2	Shifter
X		19	M	m	1	Laborer
X		23	F	d	1	Scales
	X	58	M	m	2	Crusher
X		45	F	m	2	Clerical
X		63	M	m	0	Operator
X		24	M	m	0	Operator
X		21	M	m	0	Maintenance
X		39	M	m	2	Maintenance

(CONTINUED ON NEXT PAGE)

RESPONSE TO QUERY NO. 33 (CONTINUED)

Table summerizing socioeconomic character of employees at Atlas mill based upon a random sampling of 25 percent.

(CONTINUED FROM PREVIOUS PAGE)

Place of Residence						
Moab	County*	Age	Sex	Marital status	No. of Children	Job function
	X	41	M	m	7	Management
X		28	M	m	0	Maintenance
X		39	M	m	4	Laboratory
X		46	M	m	1	Office
X		49	M	m	3	Crusher
X		27	M	m	1	Office
X		31	F	m	2	Office
X		19	M	m	0	Operator
X		40	M	m	1	Maintenance
X		44	M	m	6	Management
	X	59	M	m	1	Maintenance

*Residents of the county live almost totally in Spanish Valley

Abbreviations used in table

M - male
F - female
m - married
s - single
d - divorced

QUERY NO. 34

Provide report(s), if any, on archeological surveys for the mill property (Section 2).

RESPONSE

The EIS team has contacted the Utah State Archeologist and has determined that no reports of archeological significance are known to exist for the Atlas mill site.

QUERY NO. 35

Describe ambulance and/or emergency services available for use at the Mill (Section 2).

RESPONSE

The principal medical facility in the Moab area is the Allen Memorial Hospital. This facility is described in the SAR under Section 2.1.2.2.2 Health Facilities.

On November 18, 1976, Mr. Kay Hawks, Administrator for the Allen Memorial Hospital was interviewed to determine if there was any change in the status of the hospital since the SAR was prepared. Mr. Hawks confirmed that the SAR section was accurate as of that date.

Mr. Hawks went on to describe the ambulance facilities.

The hospital utilizes the services of two ambulances which are owned and operated by the Grand County Ambulance Association. This Association is a non-profit organization which was established by the citizens of Moab to provide ambulance service to the community. The drivers are all volunteers and have received training at the Moab Area Vocational Center in order to be certified as Emergency Medical Technicians (EMTs). A group of 20 of these volunteers recently were so certified and are available on a three-shift basis, 7 EMTs per shift. These drivers, when on call, are in direct communication with the hospital by call "bleepers" on each person. Mr. Hawks estimates that an ambulance would reach the Atlas mill within 7 minutes of receipt of an emergency call.

QUERY NO. 36

Provide infromation on the ownership of the mill site(i.e., federally leased, privately owned, etc.) (Section 2).

RESPONSE

As shown on Figure 2.1-3 in the SAR, and as discussed in Section 2.1.1.1 of the SAR, Atlas Minerals Division of Atlas Corporation is the owner of the lands shown to lie within the dashed line marked "Property Boundary". This property consists of approximately 400 acres.

Atlas Minerals enjoys the exclusive right, as owner of these lands, to control all access to and activities upon these lands--with the exception of several rights-of-way which cross the Atlas property.

These easements are: 1.) a railroad R.O.W. and tunnel to the Denver and Rio Grande Western Railroad for a spur which serves both the Atlas mill and the potash mine and mill of Texasgulf, Inc., 7 miles to the southwest; 2.) a R.O.W. for a high voltage transmission line of the Utah Power & Light Company; 3.) a pipeline R.O.W. following U. S. Highway 163 of the El Paso Natural Gas Company; and 4.) a R.O.W in the eastern portion of the mill site which serves as an access road to Tex's Tour Center.

Recently, a five-strand barbed wire fence was constructed around the perimeter of the restricted area in order to deny tresspass.

QUERY NO. 37

Provide a list of the mines with location that are currently supplying or are expected to supply the uranium ore to the mill (Section 3).

RESPONSE

At the meeting with the EIS team on November 16, 1976, it was mutually agreed that the need for such a list lay in the need to develop a truck traffic model. During the life of the mill, ore will be trucked from a continually changing mix of mines. Some mines now in production will be depleted and new reserves will be discovered in others. For this reason, it was suggested and mutually agreed upon that Atlas would develop a suitable model for the truck transport of ore. The reasoning and development of the model is presented below and is illustrated on Figure No. 8, following.

Truck ore receipts at the mill for the month of November, 1976, were considered to be representative or typical of future receipts. The mine manager identified ore shipments from 40 mines in 17 separate mining districts. A tabulation was made of receipts corresponding to the districts. These data were recast into the model in the following manner. A working map was prepared which compiled the outlines of the districts. Centroids of these districts were located and were projected along a normal line to the nearest paved Utah or Federal highway. This projection established the average entrance point or node into the highway model.

RESPONSE TO QUERY NO. 37 (CONTINUED)

The total shipment from the district was assumed to enter the highway model at this node. On the accompanying Figure 8, these nodes are represented by black dots and are labeled with capital letters B, C, D, and so forth. The nodes A, D, G, and O were located at major highway junctions for convenience in calculating the model. Mileages between nodes were read, or measured, from current highway maps of Utah and Colorado prepared by the H. M. Gousha Co., San Jose, California, as prepared for and distributed by the Chevron Oil Company. Seasonal variations in shipments were adjusted to provide the final model with annual average values. The aggregate monthly tonnage shipped from each district was divided by 27 tons per truckload--the legal maximum on Utah highways--to determine the number of trucks from the district during the month. The number of truck trips between each two nodes was determined and aggregated on a monthly basis. This was multiplied by two to provide for round trips, and was then divided by 30 days/month to provide the trips per day. These trips per day are the values shown on Figure 8.

It is concluded from this analysis that an average of 45 truck deliveries, (12+78)/2, of ore will be made to the mill each day. Of this number, 12 truck trips may be expected to enter from the north along U. S. Highway 163, and 78 truck trips from the mining districts to the south. It is calculated that these 80 trips will travel an average aggregate of about 130,000 miles per month or 4,467 miles per day. About 83% of the mileage will come from districts to the south and about 17% from districts to the north.

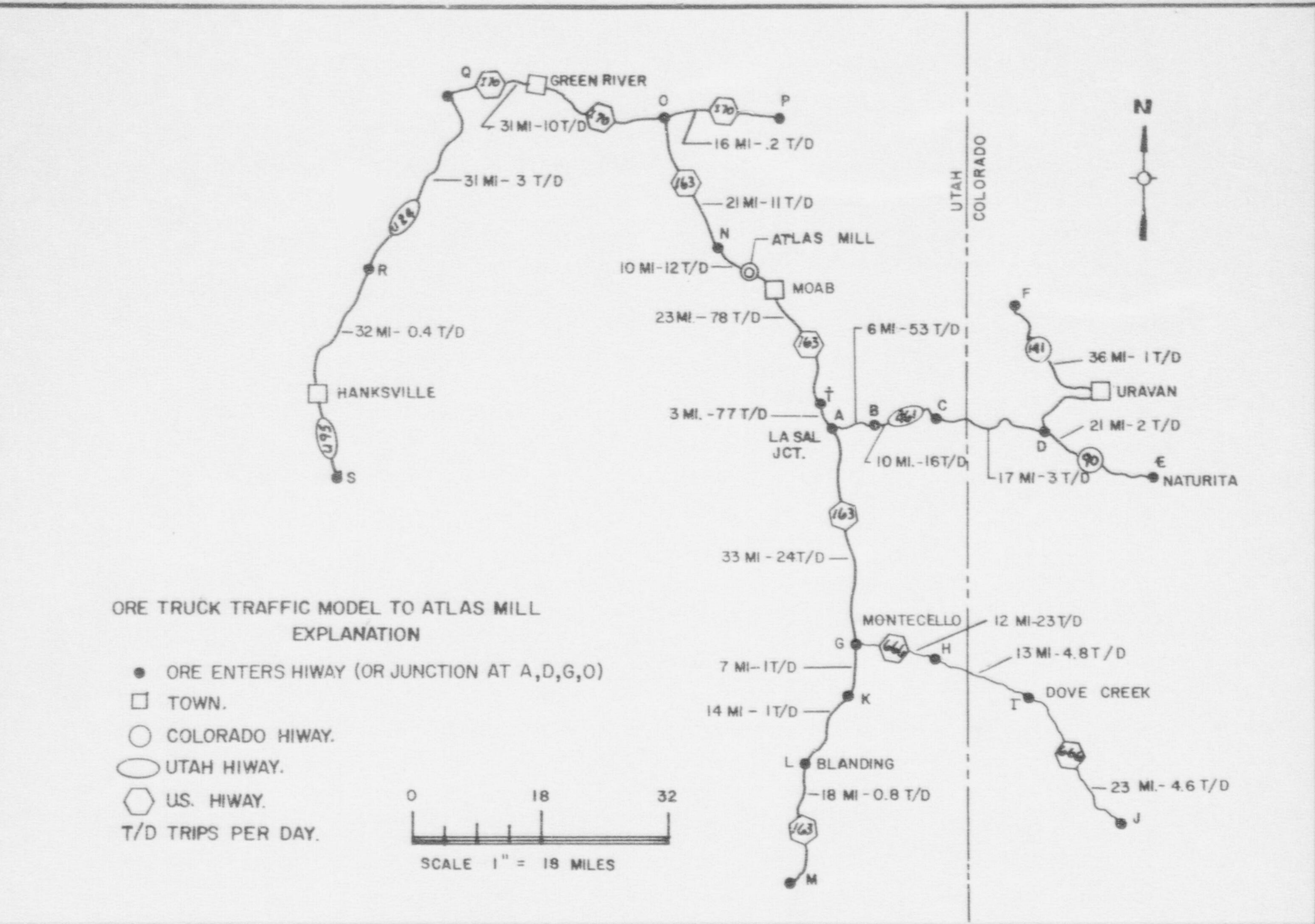


FIGURE NO. 8

ACCOMPANIES QUERY NO. 37

QUERY NO. 38

Provide the following information (Section 3):

a.) average number of trucks per day that carry ore to the mill.

b.) average number of trucks per day that bring material other than ore to the mill.

c.) truck accident rate for a. and b. above.

d.) modes of transportation used by employees (i.e., individual cars, car pools, etc.).

e.) number of cars traveling daily on Highway 160 near the mill.

f.) additional vehicle movements expected on and off the site daily during construction for equipment, material and workers.

g.) truck hauls to the siding per week when the uranium concentrate is shipped by rail.

h.) expected traffic increase to the mill due to the proposed expansion.

RESPONSE

a.) As developed in the truck traffic model in the response to Query No. 37, an average of 45 trucks will enter the mill each day to deliver ore.

b.) According to records of the Purchasing Agent at the Atlas mill, an average of 69 trucks per month bring material other than ore to the mill.

c.) The truck accident rate may be estimated upon the experience of Mr. Vian Johnston, the Moab Manager of the ore trucking firm of McFarland and Hullinger. In an interview on December 3, 1976, Mr. Johnston stated that over the past year, his trucks have carried ore for an aggregate distance estimated at about 3,830,000 truck miles. During this period, the following 5 accidents occurred.

RESPONSE TO QUERY NO. 38 (CONTINUED)

c.) (continued)

1.) 1 truck hit an Atlas 4-wheel drive field vehicle with about $3000 damage. No personal injury was sustained.

2.) 1 truck ran into an embankment to avoid collision with a vehicle approaching in the wrong lane.

3.) A mountain dirt road collapsed under a truck. The truck was saved.

4.) A truck hit a cow.

5.) A truck hit a horse.

Shipments of other materials received by the mill are carried by a large number of commerical carriers. It was not possible to survey this group to determine an accident rate.

d.) On December 2, 1976, at 2:45 PM, typical car conditions were measured with a car count in the parking lot at the Atlas mill. There were a total of 85 personal vehicles and one motorcycle. It was determined that there were present in the plant at that time 101 Atlas employees and 66 employees of the construction contractor--the MAACO Corporation. Based upon this observation there were an average of 2 people per car. Since a considerable number of employees are known to travel alone, it must be inferred that a significant number of employees travel in car pools.

e.) The average daily traffic count for U. S. HIghway 163 is taken near the intersection with Utah Highway 279 which lies about 12 miles nortwest of the mill. This survey point is close enough to the mill to be considered representative of the traffic passing in front of the mill. The ADT reported for 1975 is 1540 vehicles per day. Of these,

RESPONSE TO QUERY NO. 38 (CONTINUED)

e.) (continued) approximately 20% are trucks having more than 6 wheels.

f.) On the average, construction work has required deliveries of about one semi-trailer load per month and one small truck load (pick-up)of materials and suppiies each week. Most large items of equipment have already been delivered to the site.

g.) Yellowcake is shipped at the average rate of once per month. One railroad car is loaded by 4 truck round trips to the railroad siding, which is less than 1 mile distant from the main gate of the plant.

The vanadium product is shipped either by railroad or by truck the full distance to the ultimate destination. If the shipment for a given month is by railroad, it requires 3 railroad cars or less for the shipment, and about 10 truck round trips from the plant to fill the railcar.
If the shipment is by truck the full distance, the shipment will require the use of 10 one-way truck trips by a commercial carrier.

The copper concentrate is shipped at an average rate of once per month and requires only one truck trip to export the shipment from the region.

h.) Present levels of traffic at and near the plant include traffic attributable to construction activity. The change of shift of the construction workers is the most noticeable construction traffic, but does not appear to be deleteriously significant.

QUERY NO. 39

Provide up-to-date cost estimates (Section 8.1)

RESPONSE

By November, 1976, a total of approximately $7.3 million have been spent on plant construction. Upon completion of this construction it is projected that an additional $2 million will have been spent.

The operational costs presented in the Benefit-cost estimate of Section 8 of the Third Supplement to the ER may be considered applicable after an escalation factor for inflation to the present time has been applied.

QUERY NO. 40

Is the town of Moab eligible for federal or state funds becasue of the mill? (i.e. 701 HUD funds)(Section 8).

RESPONSE

During their visit to Moab, members of the EIS team interviewed Mr. Ken McDougald, Mayor of Moab, and determined that Moab was not eligible for such funds.

QUERY NO. 41

Provide the following information (Section 2):

a) the fire and police services available for use at the mill;

b) available housing within the area; including rentals, trailers, and homes.

RESPONSE

a) In an interview on November 17, 1976 with Mr. Troy Black, Fire Chief of the Moab Volunteer Fire Department, the capabilities of this volunteer group were described.

At this time, the group comprises about 37 volunteers. The group is organized as follows:

Hose company - 7 firemen

Hose company - 7 firemen

Engine Company - 9 firemen

Safety Company - 8 firemen

The fire department owns and operates the following equipment:

3 - Pumper trucks, w/ 750 gallon tanks, 1200' of 2½" hose and 400' of 1½" hose.

1 - Water tank truck (capacity was not specified)

1 - Equipment truck, having electrical generating equipment for emergency power.

1 - Mini-pumper truck

The volunteer personnel take fire fighting instruction at their own expense. The group has weekly training, and all have completed courses in advanced first aid. Of these volunteers, 21 were reported to have been certified as EMTs.

RESPONSE TO QUERY NO. 41 (CONTINUED)

a) (continued)

All of the volunteers are in communications with the dispatcher by call "bleeper". Chief Black states that upon receipt of an emergency call, only 3 minutes will be required for all of the units to be manned and ready to leave the fire station. In the case of a response to a call from the Atlas mill, an additional 5 to 6 minutes of driving time would be required before the units were to reach the mill.

The City of Moab employs a total of 6 full time policemen. The County of Grand employs 3 full time peace officers. Mr. Mel Dalton, Chief of Police for the City of Moab, was contacted by members of the EIS team and no further inquiry was pursued for this response.

b) Members of the EIS team conducted interviews in Moab to determine the adequacy of housing. Therefore, no inquiries were made for this response. In general, however, housing in the recent past has been in short supply, with rental units at a premium demand. In the past year, new housing starts have served to alleviate the shortage, and the supply is roughly in balance with demand.

After the fire in the solvent extraction section in 1968 (See SAR Section 7.1.2), an extensive fire protection system was installed in the plant. This is discussed in the SAR under Section 3.4 Fire Protection, and the solvent extraction section fire protection line is shown on Figure 3.4-1.

QUERY NO. 42

Provide figures for property taxes paid by the mill during the last 5 years. How was the property tax allocated? (Section 8).

RESPONSE

Atlas paid property taxes over the last 6 years on the basis of the fiscal year July 1 through June 30 as follows:

Fiscal Year Ending June 30,	Property Tax Paid
1971	$109,044.99
1972	97,339.25
1973	98,196.80
1974	84,406.09
1975	126,396.85

Atlas has just been advised that taxes for 1976 year will be $214,531.99. According to the December 2, 1976 issue of the Moab Times-Independent, County Treasurer Donna Loveridge said that the 4 highest property taxes paid in Grand County for 1976 are:

1. Atlas Minerals - $214,531.99

2. D. & R. G. W. Railroad - $210,630.50

3.) Texasgulf, Inc. - $84,216.20.

4.) Continental Telephone Co. - $54,812.22

Thus, Atlas Minerals is the largest payer of property taxes in Grand County.

Taxes are allocated as shown on the accompanying Budget for 1977 for Grand County.

BUDGET FOR GRAND COUNTY
GOVERNMENTAL UNIT

1977
YEAR

TABLE NO. 6.

1976 OPERATING BUDGET

Account No.	Source of Revenue	Prior Years Actual Revenue 19__	19__	1975	Current Year Estimates	Ensuing Year Approved Budget Appropriation
	3100 – TAXES					
3110	General property tax - current			314,037	355,504	355,504
3120	Delinquent prior year's taxes			9,671	10,000	10,000
3130	General sales & use taxes			40,416	53,643	50,000
3140	Franchise taxes					
3150	Transient room tax			19,490	21,183	35,000
3190	Penalties & interest on taxes			180	100	100
	3200 – LICENSES & PERMITS					
3210	Business licenses & permits			1,939	1,798	1,700
3220	Non business licenses & permits					
3221	Buildings, structures and equipment					
3222	Marriage licenses			730	405	400
3223	Motor vehicle operation					
3224	Cemetery – burial permits					
3225	Animal licenses			18	-0-	-0-
	3300 – INTERGOVERNMENTAL OTHER			12,388	19,200	-0-
3310	Federal grants					
3311	General government					43,000
3312	Public safety					
3313	Highways & streets					
3314	Health					
3317	Cultural – recreation					
	Federal Mineral Lease			39,793	39,676	35,000
	Forest Reserve			1,012	1,753	1,500
3320	Federal shared revenue			79,841	100,835	113,800
3330	Federal payments in lieu of taxes					

GRAND COUNTY
GOVERNMENTAL UNIT

1977
YEAR

OPERATING BUDGET

Account No.	Source of Revenue	Prior Years Actual Revenue 19__	19__	19 75	Current Year Estimates	Ensuing Year Approved Budget Appropriation
3340	State grants			17,362	13,461	10,000
3350	State shared revenue					
3356	Class " " road fund allotment			106,161	107,868	107,800
3357	Collector road fund allotment			49,847	52,311	52,000
3358	State liquor fund allotment			5,186	3,457	3,500
3370	Grants from local units			2,784	4,897	4,000
	3400 – CHARGES FOR SERVICES					
3410	General Government					
3411	Court costs, fees & charges			2,189	1,530	1,000
3412	Recording legal documents			21,346	30,026	25,000
3413	Zoning & subdivision fees					
3415	Sale of maps & publications					
3416	Auditor's fees					
3417	Surveyor's fees					
3418	Treasurer's fees					
3420	Public safety					
3421	Law enforcement services			892	1,263	1,000
3422	Special protective services			9,359	9,194	9,000
3423	Corrective fees (jail)			465	1,156	600
3430	Streets and public improvements			-0-	112,296	-0-
3431	Street, sidewalk & curb repair					
3432	Parking meter revenue					
3433	Street lighting charges					

GRAND COUNTY
GOVERNMENTAL UNIT

1977
YEAR

OPERATING BUDGET

Account No.	Source of Revenue	Prior Years Actual Revenue 19__	19 [illegible]	19 75	Current Year Estimates	Ensuing Year Approved Budget Appropriation
3440	Sanitation					
3441	Sewer charges					
3442	Street sanitation charges					
3443	Refuse collection charges					
3444	Sale of waste & sludge					
3445	Weed removal & cleaning charges					
3450	Health			20	-0-	-0-
3470	Parks & public property					
3480	Cemeteries					
3490	Miscellaneous)THER			12,689	13,825	12,000
	Assessing & Collecting			22,796	19,330	20,000
	Juror & Witness			326	2,426	500
	3500 – FINES & FORFEITURES					
3510	Fines City & Precinct			76,874	59,360	60,000
	Juvenile			3,998	4,370	3,000
3520	Forfeitures					
	3600 – MISCELLANEOUS REVENUE Other			412	610	-0-
3610	Interest			30,310	22,636	25,000
	"B" Road & Collector Road			18,773	13,201	7,200
3620	Parks & concessions			10,574	8,596	8,000

GRAND COUNTY
GOVERNMENTAL UNIT

1977
YEAR

OPERATING BUDGET

Account No.	Source of Revenue	Prior Years Actual Revenue 19__	19__	19 75	Current Year Estimates	Ensuing Year Approved Budget Appropriation
3640	Sale of fixed assets - compensation			168	50	-0-
3650	Sale of materials & supplies					
	3800 – CONTRIBUTION AND TRANSFERS					
3810	Contributions from other gov. units					
3820	Contributions from other funds					
3830	Contributions from private sources					
3840	Recurring transfers from other funds					
3850	Contribution class "B" road surplus			4,061	-0-	6,000
3860	Contribution collector road surplus			-0-	64,393	229,150
3870	Contributions general fund surplus			-0-	-0-	21,641
	TOTAL REVENUE			916,107	1,150,353	1,252,395

GRAND COUNTY
GOVERNMENTAL UNIT

1977
YEAR

OPERATING BUDGET

Account No.	Function & Department	Prior Years Actual Expenditures 19__	19__	19 75	Current Year Estimates	Ensuing Year Approved Budget Appropriation
4110	Legislative					
4111	Board of commissioners			14,496	14,936	16,300
4112	Legislative committees					
4113	Ordinances and proceedings					
4120	Judicial					
4121	District court			2,367	8,368	10,000
4122	City & precinct courts			21,926	15,616	20,000
4123	Juvenile court			290	1,589	1,500
4124	Detention home					
4125	Sanity hearings					
4126	Public defender – Legal Aid			5,912	11,694	16,000
4127	Grand jury					
4128	Law library					
4130	Central staff agencies					
4131	Executive					
4132	Boards & commissions					
4133	Central purchasing					
4134	Budgeting					
4136	Data processing					
4137	Microfilming					
4140	Administration agencies					
4141	Auditor					
4142	Clerk			20,722	22,718	25,500
4143	Treasurer			13,557	14,502	16,800
4144	Recorder			24,396	23,085	31,600
4145	Attorney			21,780	24,662	27,700
4146	Assessor			27,524	21,744	24,000
4147	Surveyor					

GRAND COUNTY
GOVERNMENTAL UNIT

1977
YEAR

OPERATING BUDGET

Account No.	Function & Department	Prior Years Actual Expenditures 19__	19__	19 75	Current Year Estimates	Ensuing Year Approved Budget Appropriation
4150	Non departmental			14,091	14,829	19,100
	Audit			3,350	3,900	4,200
4160	General government buildings			43,365	33,235	30,300
4170	Elections			28	6,976	-0-
4180	Planning & zoning			728	6,000	1,000
4190	Education & community prom.					
	4200 PUBLIC SAFETY			29,402	7,553	-0-
4210	Law enforcement			71,531	84,680	96,000
4220	Fire department			1,569	2,200	21,600
4230	Corrections					
4240	Protective inspection					
	Building Inspection			3,874	3,110	3,800
4250	Other protective service					
4252	Agricultural					
4253	Animal control					
4254	Flood center					
4255	Civil defense			5,400	6,425	2,000

GRAND COUNTY
GOVERNMENTAL UNIT

1977
YEAR

OPERATING BUDGET

Account No.	Function & Department	Prior Years Actual Expenditures 19__	19__	19 75	Current Year Estimates	Ensuing Year Approved Budget Appropriation
	4300 PUBLIC HEALTH					
4310	Health department			22,206	22,044	24,000
4320	Other health					
4360	Infirmaries					
	Senior Citizens			1,627	9,200	11,000
	4400 STREET & PUBLIC IMP.					
4410	Streets & highways			189,630	152,769	273,345
	Class "B" Road			110,943	98,000	115,000
	Collector Road			6,479	241,000	287,150
4420	Sanitation					
4430	Sewage collection & disposal					
4440	Shop & garage					
	4500 PARKS, RECREATION & PUBLIC PROP.					
4510	Parks			13,801	12,198	14,450
	Moab Museum			5,729	5,842	6,800
4560	Recreation & culture					
4580	Libraries					
	Airport			18,386	28,691	6,500

GRAND COUNTY
GOVERNMENTAL UNIT

1977
YEAR

OPERATING BUDGET

Account No.	Function & Department	Prior Years Actual Expenditures 19__	19__	19 75	Current Year Estimates	Ensuing Year Approved Budget Appropriation
4590	Cemetaries					
	4600 CONSERVATION & ECON. DEV.					
4610	Agricultural & ext. serv.			3,5[illegible]5	3,708	6,2[illegible]
4620	Exhibits			13,124	11,700	4,000
4650	Economic development			15,491	4,000	-0-
	4800 INTERGOVERNMENTAL EXP.					
4810	Recurring transfers to other funds					
4820	Contributions to other gov. units				72,530	3,000
4830	Contributions to other funds					
	Contributions to Hospital			88,000	75,721	77,000
	Contributions to Travel Council			19,490	21,183	35,000
	Contributions to Other Agencies			4,017	2,400	2,000
	4900 MISCELLANEOUS					
4960	Non classifiable					
	Other			4,411	5,24[illegible]	5,000
	Equipment			279	8,500	14,500
	Contribution to "B" Ro[illegible] Surplus			-0-	11,069	-0-
	Contribution to Collector Road Surplus			61,420	-0-	-0-
	Contribution to General Fund Surplus			11,251	36,832	-0-
	Fund Balance					
	Excess or revenue over expenditures					
	TOTAL EXPENDITURES			916,107	1,150,353	1,252,395

QUERY NO. 43

How much does the mill currently spend on county sales tax and what are the projections for the future? (Section 8)

RESPONSE

In the calendar year 1975, the Atlas mill paid $47,771.52 in state and local sales taxes. In the fiscal year ending June 30, 1976, $116,288.44 was paid. From January 1, 1976, through October 31, 1976, $122,388.42 has been paid in sales taxes.

Atlas projects that it will continue to pay sales taxes at the current level for the foreseeable future; however, this should be adjusted upward to account for future expectable inflation.

The State of Utah levies a 4-3/4% tax on retail sales. The City of Moab or the County of Grand imposes another 3/4%. The total sales tax, therefore, is 5-1/2%. The following taxes were collected during the last 5 quarters for which totals are available.

Year	Quarter	Grand County	Moab
1975	2nd	$10,273	$30,999
	3rd	12,371	46,705
	4th	13,320	46,369
1976	1st	13,831	45,255
	2nd	15,585	52,719

From these data, the total sales for which taxes are collected may be computed.

QUERY NO. 44

Provide latest annual report(s) for the mill operations if available(Section 8).

RESPONSE

During the meeting on November 16, 1976, a copy of the 1976 Atlas Corporate report was presented to the EIS team.

QUERY NO. 45

What is the unit in Table 2.1 (Supplement 3)?

RESPONSE

The data in Table 2.1 were intended to characterize the activity of samples of tailings material; however, results of ion exchange studies were instead reported. None of these data were used in the calculation of radon releases and should not be considered in any future analysis. The units in question are those of the cation exchange coefficient (CEC) in terms of milliliters of solution per gram of soil.

QUERY NO. 46

Provide complete data for Table 2.1. Describe the sampling procedure and number of samples for each site and techniques for analysis (Supplement 3).

RESPONSE

As discussed in the response to Query No. 45, Table 2.1 was erroneously given and should not be considered in future analyses.

Nevertheless, the soil sampling program is reported in Section 5.5.5.1.1 of the SAR as follows:

"Soil samples from three locations at the plant boundary will be taken annually to determine buildup of uranium dust deposits. The samples, consisting of 500 grams of topsoil to a 1-inch depth, will be analyzed for natural uranium, Ra-226, Th-230, and Rn-222. The soil sample locations are shown on Figure 5.5-2."

Analyses of these samples are performed in the laboratory of the mill, where they are digested by hydrofluoric acid, nitric acid, perchloric acid, hydrochloric acid, and sulphuric acid, and are analyzed by standard fluorimetric methods.

QUERY NO. 47

Explain the change in the yearly average of discharged radium after 1968 Table 2.2 (Supplement 3).

RESPONSE

It is believed that the reduction in the annual average discharge of radium, as shown in Table 2.2, is attributable to the treatment of lower grade ores and to closer surveillance of the barium chloride treatment ponds and stricter management procedures.

QUERY NO. 48

Quantify and provide data to show the validity of the statement, "Since thorium and radium are in secular equilibrium in the ore..." on Pages 2-3 (Supplement. 3). Provide a radioactive analysis of typical ores utilized give U-238, Th-230, Ra-226, Pb-210 (Ci/g of ore). Describe the technique and calibrations for the analysis.

RESPONSE

Thorium-230 and radium-226 are assumed to be in equilibrium with uranium in the ore. This has not been varified by radio-chemical analysis. A sample of the ore has been sent to Eberline for determination of relative concentrations of U-234, U-238, Th-230, Ra-226, and Pb-210.

The procedures used by Eberline are similar to those developed by Claude Sill (ERDA, Idaho) for this purpose. Calibrations are made using solution standards (for example Radium-226 standard from MBS) and are verified using a pitchblende sample for which the uranium is known to be in equilibrium with the radium-226 and other decay products of uranium.

When the analytical results are received, a revised response will be sent to the NRC and the EIS team.

QUERY NO. 49

Describe in detail and provide data to justify paragraph 2 (page 2-3) and paragraph 1 (page 2-4) (Supplement 3).

RESPONSE

Paragraph 2, Page 2-3, Supplement 3 to the ER

The cementation by gypsum of soils underlying tailings containing high concentrations of sulphates has been demonstrated at the phosphate fertilizer plant owned and operated by the J. R. Simplot Company near Pocatello, Idaho. At this operation, phosphate ores are acidulated by sulphuric acid. The resulting effluents to the tailings pond contain high concentrations of the sulfate ion and the various cations--principally Ca^{++}.

In 1975, the J. R. Simplot Company had occassion to do earthwork at the berm of one of its oldest tailings ponds. A bulldozer operator noted and reported to his superiors that he was having great difficulty penetrating the original soils underlying the tailings materials he had just cut through. An examination was made in the field and it was discovered that the orginal soils had been impregnated, cemented, and sealed by the tailings pond seepage. The firm of Dames & Moore was called upon to investigate the phenomenon. In November of 1975, Dames & Moore conducted 5 laboratory permeability tests utilizing native silt loess soils and water from the gypsum tailings slurry and performed thin-section studies under the polarizing microscope.

RESPONSE TO QUERY NO. 49 (CONTINUED)

Soil samples were cut from the site at 5 locations, of which two were subjected to permeability testing using tapwater for 6 days, followed by 14 days of testing using water from the plant tailings effluent. Three samples were tested for 15 days using only the effluent. The first two samples had permeabilities of 65 and 140 feet per year. Within only 5 hours after introducing the effluent the respective permeabilities had been reduced to 20 and 9 feet per year. In less than one week these permeabilities had been reduced to less than one foot per year. At the end of 14 days, both of these samples had permeabilities measured at 0.85 feet per year.

The initial permeabilities of the other three samples were 45, 85, and 250 feet per year. Within 24 hours, these had been reduced to 3, 10, and 4 feet per year, respectively. After the end of the 15 day test period, the final permeabilities of the three samples ranged from 1.2 to 1.5 feet per year.

The results of the thin section work failed to identify the nature of the cementing material. The fact that cementation had filled the available pores and had effectively reduced permeability well was well demostrated by this work.

It may be reasonably expected that since both the Simplot and Atlas tailings piles are saturated with mill effluents high in the sulphate ion, that sealing similar to that observed at the Simplot operation has already occurred under the Atlas tailings pond.

RESPONSE TO QUERY NO. 49 (CONTINUED)

Paragraph 1, Page 2-4, Supplement 3 to the ER

Several assumptions had to be made to estimate radon emanation from the tailings pile when it will no longer be active. Radium-226 was assumed to be in equilibrium with uranium in the ore and the average ore grade was assumed to be 0.25% U_3O_8. All of the radium-226 was assumed to end up in the tailings. Radon diffusivity from the pile was assumed to be 1.13×10^{-5} cm^2/sec. No effort has been made to measure radon diffusivity by the "barrel" method as the pile is very nonhomogeneous and is not now representative of the final dry pile. Any effort to measure a radon emanation rate from the existing pond/pile would require a large number of tests because of the non-homogeneous nature of this active tailings pond. Even so, such measurements may not provide a better diffusivity coefficient for the tailings pile after the liquids evaporate. Instead of a research program to try to confirm individual parameters used in the calculations, the applicant has measured radon concentrations in the atmosphere near the site perimeter. The results of this one-time sampling are shown in the report of analysis, following.

CUSTOMER ATLAS MINERALS CORPORATION
ATTENTION Mr. Gary Boyer
ADDRESS P. O. Box 1207
CITY Moab, Utah 84532
S.O. NO. 5247

TABLE NO. 7

REPORT OF ANALYSIS

TYPE OF ANALYSIS DETERMINATION of RADON-222 in AIR SAMPLES

CUSTOMER ORDER NUMBER A-42969

SAMPLES RECEIVED 10-12-76

Sample Identification	Sample Number	Time Collected	Date Collected	pCi/l*
S.E. Corner Tailings Pond	108	0900	10-11-76	12.3 ± 0.3
Midway East Side Tailings Pond	109	0905	10-11-76	3.37 ± 0.17
N.E. Corner Tailings Pond	110	0912	10-11-76	9.02 ± 0.28
Midway North Side Tailings Pond	111	0920	10-11-76	2.08 ± 0.15
N.W. Corner Tailings Pond	112	0925	10-11-76	0.40 ± 0.13

*Corrected for decay to time and date of collection.

☐ REPORTED VIA TELEPHONE

☐ REPORTED VIA TWX

EBERLINE INSTRUMENT CORPORATION
P.O. BOX 3874 ALBUQUERQUE, NEW MEXICO 87110
PHONE (505) 345 3461 TWX: 910 985 0678

APPROVED BY Kathy Burnham, Environmental Reports, Albuquerque Laboratory

DATE 10-21-76

QUERY NO. 50

Justify Section 2.3.2 on Page 2-4 (Supplement. 3).

RESPONSE

Sections 2.3.1, 2.3.2, and 2.3.3 on Page 2-4 of the Third Supplement contain some errors and inconsistancies; however, these values were not used in the calculation of radon release in Section 2.3.4 and should not be cited in the final EIS.

QUERY NO. 51

Provide a complete citation for Foundation Engineering by Peck, Hansen and Thorburn.

RESPONSE

The proper citation should have been:

Peck, Ralph B., Hansen, Walter E., and Thornburn, Thomas H., Foundation Engineering, Second Edition, John Wiley & Sons, Inc., New York, 1953.

The value of .5 as used for the voids in tailings was taken as being equivalent to those with the value reported in Table 1.4 on page 13.

QUERY NO. 52

Justify (data and references) the third sentence on page 3-1 (Supplement 3).

RESPONSE

The sentence:

> "As presented in the Safety Analysis Report the frequency of occurrence for wind velocities in excess of eleven mph is less than 22 percent."

was based upon the value taken from Table 2.2-4 Wind Frequency Distribution, Pasquill Class E, under that portion of the table under Frequency in Percent, and under the column headed 11 mph. This was considered as being the worst case condition for releases at the stack heights existing at the mill.

QUERY NO. 53

Describe the techniques presently used for airborne monitoring, calibration and provide data, Page 6-1 and 6-2 (Supplement 3).

RESPONSE

The current program of airborne monitoring is described in several sections of the SAR. These include:

Section 4.1.16 - Airborne Emissions

Section 5.5.2 - Airborne Radiation

Section 5.5.5.1.3 - Aerosol Samples

These sections provide considerable data on the airborne sampling programs.

As mentioned in the response to Query No. 49, a one-time sampling and analysis for radon in the ambient atmosphere was made at 5 sample locations surrounding the tailings pond. The analytical results were reproduced under that response. When the tailings pile is stabilized, a monitoring program will be inaugurated, according to surety arrangements with the Utah Division of Oil, Gas and Mining. (Also see response to Query No. 12, herein).

QUERY NO. 54

Provide analysis of typical uranium concentrates and activity of U-238, Thorium-230, Radium-226, and Pb-210 per gram of yellowcake.

RESPONSE

The requested information on radionuclides in yellowcake is not available; however, samples of airborne particulates have been taken from the yellowcake drying and packaging exhaust stacks and these have been analyzed for natural uranium, thorium alpha emitters, and radium-226.

The average offsite concentration north of the mill has been calculated using the average annual Chi/Q from Table 2.2-22 of the SAR for the NNE Sector and a distance of 244 meters. At that location, an average of 5.5×10^{-13} uci/ml is attributable to the emission from the product drying and packaging stacks. This is 10% of the maximum permissable concentration (MPC), offsite, for uranium (natural).

The same calculation for thorium alpha emitters and radon-226 indicates much lower concentrations attributable to product drying. The offsite concentration for thorium-230 is 0.06% of the offsite MPC, and the 0.005% of the offsite MPC for radium-226.

These data indicate that uranium (natural) is the dominate radionuclide in terms of radiation and that thorium-230 and radium-226 from this source does not contribute significantly to offsite concentrations.

The accompanying table provides the data and calculations supporting this analysis.

TABLE NO. 8

Table showing concentrations of Uranium(nat), Th-230, & Ra-226 from the yellowcake drying section and calculation of offsite concentrations.

	Activity in exhaust X 10^{-11} uci/ml					
	(A) Dust collecter			(B) Scrubber		
Month	U-nat	Th-230	Ra-226	U-nat	Th-230	Ra-226
Jan	117	-	-	938	-	-
Feb	402	0.52	0.13	19,743	0.16	nil
Mar	207	nil	nil	1,342	0.30	nil
Apr	32	0.34	0.20	41	0.13	0.07
May	1,450	0.50	0.04	4,036	0.92	0.09
Jun	7,945	0.39	0.12	1,300	0.10	0.13
Jul	8,816	0.40	0.13	73	0.11	0.08
Aug	80	0.60	0.09	91	0.56	0.16
Sep	1,933	0.60	0.21	8,635	0.11	0.14

	Activity in exhaust* X 10^{-6} uci/sec					
	(D) Dust collecter			(S) Scrubber		
Month	U-nat	Th-230	Ra-226	U-nat	Th-230	Ra-226
Jan	193	--	-	6,566	-	-
Feb	663	0.9	0.21	138,201	1.1	nil
Mar	342	nil	nil	9,394	2.1	nil
Apr	53	0.6	0.33	287	0.9	0.49
May	2,393	0.8	0.07	28,252	6.4	0.63
Jun	3,109	0.6	0.20	9,100	0.7	0.91
Jul	14,546	0.7	0.21	511	0.8	0.56
Aug	132	1.0	0.15	637	3.9	1.12
Sep	3,189	1.0	0.35	60,445	0.8	0.98

Month	Fraction of time operated (F)	Effective total emission rate** 10^{-6} uci/sec U-nat	Th-230	Ra-226
Jan	0.23	1,555	-	-
Feb	0.32	44,436	3.9	0.07
Mar	0.34	3,310	0.7	nil
Apr	0.31	105	0.5	0.25
May	0.24	7,355	1.7	0.17
Jun	0.25	2,275	0.3	0.28
Jul	0.22	3,313	0.3	0.17
Aug	0.37	285	1.8	0.47
Sep	0.26	16,544	0.5	0.35
Average release rates(pci/ml)		8,798	0.8	0.22

(Calculation continued on following page)

TABLE NO. 8 CONTINUED

Table showing concentrations of Uranium(nat), Th-230, & Ra-226 from the yellowcake drying section and calculation of offsite concentrations (continued)

Average offsite concentrations in NNE Sector, Distance 244 meters (based upon an average annual Chi/Q of 6.3×10^{-5} sec/m^3, as shown in the SAR on Table 2.2-22) are:

Isotope	Average offsite concentration in uci/ml	Offsite MPC in uci/ml	Fraction of offsite MPC
Uranium(nat)	5.5×10^{-13}	5×10^{-12}	0.10
Thorium-230	5.0×10^{-17}	8×10^{-14}	0.0006
Radium-226	1.4×10^{-17}	3×10^{-12}	0.00005

Footnotes:

* Calculated as follows:
D = A(stack flow rate of 1.65×10^5 ml/sec)
S = B(stack flow rate of 7.00×10^5 ml/sec)

** Calculated as follows:
Effective total emission rate = (D + S)(F)

*** Calculated as follows:
Average offsite concentration = (Average release rate in uci/sec)(Chi/Q)($10^{-6}m^3$/ml)

QUERY NO. 55

Describe in detail ore crushing and grinding operation. What is the work load (number of hours/day and the number of days/year) for this operation? What monitoring techniques are presently used to estimate the ore dust release?

RESPONSE

Details of ore crushing and grinding are discussed in the SAR under several sections which include: Section 3.1.1 Ore receiving, crushing, and sampling, and Section 3.1.3.1 Grinding. Monitoring techniques used to estimate ore dust release are described in Section 3.1.2 Ore dust emission control. Stack sampling procedures are discussed in Table 4.1-4 (Revision 1, August 15, 1975). And, other sampling procedures which are used to estimate the effects of dust releases are discussed in Section 5.5.2.1 Sampling for natural uranium in airborne dust, and in Section 5.5.2.2 Breathing zone dust sampling.

The ore crushing and grinding sections are recognized as being areas of breathing hazard; consequently, the provision for the use of respirators is specifically defined in a series of references within the SAR. Notice should be paid to Paragraph 3--and following--on Page 5.5-4, Revision 1, August 15, 1975, and to the related Table 5.5-5, Annex A, Revision 1, August 15, 1975.

The crusher is operated 8 hours a day, 365 days a year, except for short periods for required maintenance and repairs.

RESPONSE TO QUERY NO. 55 (CONTINUED)

Three new, larger bag type dust collectors have just been installed in the crushing and sampling area, the vanadium section, the uranium packaging area; and a new and larger wet scrubber is being installed over the yellowcake hearth (dryer). As soon as the total new systems are completed, samples will be taken and efficiencies will be measured.

Detailed drawings of the new dust collection installation are on file with the NRC at its Bethesda office.

QUERY NO. 56

Provide a complete copy of all monitoring data obtained since the start of operation, and describe techniques and changes in techniques and calibrations.

RESPONSE

Since the amount of monitoring data accumulated since start of operations of the mill in 1956 is voluminous, it was suggested to the EIS team that the Argonne reviewer examine the records at the mill in Moab and personally select the data which he requires for his analysis. This suggestion was accepted by the team.

QUERY NO. 57

Provide a record of exposure data to mill operators and the techniques for exposure determination.

RESPONSE

It was suggested at the same November 16, 1976 meeting with the EIS team, that the reviewer mentioned in the response to Query No. 56, also examine the records at the mill and select those which he requires for his analysis. This recommendation was also accepted by the team.