PDR

URANIUM RESOURCES INC.

40-8755

Inst. Code 19170

ARTHUR L. BISHOP
Environmental Manager

October 31, 1978

RECEIVED
OCT 05 1979
U.S. Nuclear Regulatory Commission
Mail Section

Mr. Buck Steingraber, Chief
Underground Injection Unit
Texas Department of Water Resources
P.O. Box 13087 Capitol Station
Austin, Texas 78711

RE: URI LONGORIA PROJECT
AREA II

Dear Mr. Steingraber:

Persuant to instruction issued by the Texas Department of Water Resources (TDWR 0282), Uranium Resources, Inc., (URI) hereby files an application for a permit to conduct in situ uranium leaching. Such application and associated technical report are enclosed.

After review for completeness, please contact me for any additional information you may require, or for clarification of any aspect of the application.

Sincerely,

Arthur L. Bishop
Environmental Manager

ALB/tj

Encl.

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Suite 735, Promenade Bank Tower • 1600 Promenade Center • Richardson, Texas 75080 • (214) 234-5294

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TEXAS DEPARTMENT OF WATER RESOURCES

1700 North Congress
Stephen F. Austin Building
P.O. Box 13087, Capitol Station
Austin, Texas 78711

FOR DEPARTMENT USE ONLY
Application No.
County-District
Receipt Acknowledged
Adm. Review By
Administratively Complete
Copies Sent: P&WD, TDH, Dist.

APPLICATION FOR PERMIT TO CONDUCT IN SITU URANIUM MINING

1. *Applicant* URANIUM RESOURCES INC.

   Business Address Suite 735, Promenade Bank Tower, 1600 Promenade Center

   City Richardson, Texas *Zip Code* 75080

   Mine Name LONGORIA *County* DUVAL

   Mine Address (if available) P.O. Box 228 Bruni, Texas 78344

2. *List the name, title and telephone number of persons or firms authorized to act for the applicant during the processing of the permit application.*

   Mr. W. M. McKnight, Jr.
   Production Manager
   Uranium Resources Inc.
   P.O. Box 1381
   Corpus Christi, Texas 78403
   Telephone: (512)883-2569

   Mr. Arthur L. Bishop
   Environmental Manager
   Uranium Resources Inc.
   735 Promenade Bank Tower
   1600 Promenade Center
   Richardson, Texas 75080
   Telephone: (214)234-5294

3. *Type of permit: Original (x) Amendment to Permit No.*__________

4. *List any other permits, existing or pending, which pertain to pollution control activities conducted by the mine at this location.* An application for a source material license will be submitted to the Texas Dept. of Health on or about January 1, 1979.

5. *Provide a description of the mining activity to include (brief and general):*

   a. *Mining Methods,*
   b. *Leachate Control Methods,*
   c. *Leachate Processing Methods,*
   d. *Aquifer Restoration Method.*

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TDWR-0284

11. *Attached:*

	Initial
a. *Description of Mining Activities*	________
b. *Permit Area Map*	________
c. *List of Adjacent Landowners*	________
d. *Legal Description*	________
e. *Tabulation of Surveys*	________
f. *Lease List*	________
g. *Cross-sections*	________
h. *Technical Report*	________
i. *Radioactive Materials License or Letter (TDH)*	________

I, (Name) ARTHUR L. BISHOP *(Company Representative)*, *(Title)* Environmental Manager

state that I have knowledge of the facts herein set forth and that the same are true and correct to the best of my knowledge an belief. I further state that, to the best of my knowledge and belief, the project for which application is made will not in any way violate any law, rule, ordinance or decree of any duly authorized governmental entity having jurisdiction.

*Date*________________ *Signature*______________________________

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MINING ACTIVITY

Uranium Resources Inc. proposes to conduct in situ uranium leach activity within a 3.1 acre production area in southwest Duval County. Mining/benefication activity will be confined to a three step process: ore body leaching, uranium extraction, and restoration. Extraction processing is confined to a surface facility covering 2 ± acres, while leaching and restoration processes encompass a sinuous configuration of line drive injection/production wells in a 3.1 acre area (Fig. 5-1).

LEACHATE AND LEACHATE CONTROL

Leach solutions consist of formation water that is chemicalally fortified with oxidant and lixiviant chemistry of cationic and anionic composition identical to existing groundwater geochemistry. Leach solutions are pumped into a northwest - southeast trend line of 13 injection wells (Fig. 5-1). From these wells leach solutions enter 40 feet of production zone at a depth of 610 to 650 feet below surface (Fig. 5-2). After uranium oxidation and complexing, uranium enriched solutions are extracted from the production zone via a line of 12 production wells which trend subparallel to the injection well line, (Fig. 5-1). Horizontal and vertical migrations of leach solutions away from the production area/production zone are controlled by production exceeding injection. "Bleeding" of fluids from the formation creates a hydraulic sink geographically centered upon the production area, (Fig. 5-2). This sink precludes any outward fluid migration. Bleed volumes and formation responses are continuously monitored on site in order to evaluate effectiveness of system control. After pregnant solution reaches the surface, it is stripped of uranium, chemically re-fortified and re-injected.

EXTRACTION (Fig. 5-3)

Extraction of uranium from solution occurs in ion exchange columns where the complexed uranyl anion is exchanged for chloride ions on the ion exchange resin. Once all resin exchange sites are occupied with uranyl complex anions the column is taken out of service and eluted by reversing the ion exchange process. Uranium rich solutions resulting from this process are subsequently precipitated and stored prior to transport to Oklahoma for subsequent processing in the nuclear fuel cycle, (Fig. 5-3).

RESTORATION

Restoration of a depleted production zone is accomplished by displacement of contaminated formation waters with unaffected waters through continuous extraction of contaminated waters from the formation (Fig. 5-4). Waters from restoration pumping, as well as processing waste fluids and bleed stream solutions are all directed to waste retention facilities prior to disposal by deep well injection.

TABLE 6.

ADJACENT LANDOWNERS

MAP REFERENCE	OWNER
A	WAYNE MANN 11303 Dumas Houston, Texas 77034
B	VINCEY WATERMAN P.O. Box 427 Hebbronville, Texas 78361
C	ELTON SPECHT 906 W. Viggie Hebbronville, Texas 78361
D	ALFOSO VALDEZ 507 E. Santa Clara Hebbronville, Texas 78361
E	MANUEL T. LONGORIA 1408 Mier Laredo, Texas 78040
F	FERNANDO MORENO c/o Manuel T. Longoria 1408 Mier Laredo, Texas 78040

LEGAL DESCRIPTION

The Longoria Project Permit Area boundary forms a rectangle 2,130 feet long and 1,320 feet wide. Lamprecht coordinates for the corners are given below:

MAP REFERENCE	X	Y
A	1,979,741	621,627
B	1,978,595	620,972
C	1,979,652	619,123
D	1,980,798	619,778

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SURVEY TABULATION

The proposed perm t area for URI's Longoria Leach Project is contained within two mining leases under which Uranium Resources Inc. is sole lessee. These leases are recorded as:

ANGELINA B. DE LONGORIA et al (lessor)
TXM-1
Book 262, PP. 72-207
Duval County Oil and Gas Lease Records
964.3 Ac, Exp. 8-10-82.
and
FERNANDO GARCIA MORENO et al (lessor)
TXM-2
Book 262, PP. 208-232
Duval County Oil and Gas Lease Records
1348.2 Ac, Exp. 8-10-82.

Contained within these two lease areas are all, or part of the following surveys:

Survey 169, G.C. & S.F.R.R. A-862;
Survey 170, R.V. De Guerra A-1257;
Survey 171, G.C. & S.F.R.R. A-861;
Survey 172, G.C. & S.F.R.R. A-1249 and
Survey 173, F. Garza, A-860, Duval County.

The permit area lies wholly within Surveys 172 and 173 as described above.

LEASES

Leases pertinent to URI's Longoria Leach Project, Mine Area II are listed under S-8 Survey Tabulation.

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CHAPTER 1.

PERMIT AREA LOCATION

Uranium Resources Incorporated (URI) proposes to conduct in situ uranium leach operations in southwestern Duval County (Fig. 1-1). P posed permit area is located 8 airline miles northwest of Hebbronville (pop. 4079), Jim Hogg County; and 5.5 miles southeast of Bruni (pop. 375), Webb County.

At Present, there are two permitted in situ uranium leach operations within a 5 mile radius of the Longoria Leach Project permit area. Mobil Oil Corporation/Energy Minerals Division, U.S. and Canada is currently operating the O'Hern Project which is approximately 2.5 miles west northwest of the Longoria permit area. Mobil Oil Corporation has also permitted the Holiday-El Mesquite in situ Leach Project. This project is under development and is projected for a 1979-1980 operational start-up. Holiday-El Mesquite is located approximately 4 miles north of the Longoria permit area.

Within a two mile radius of the Longoria Leach Project there are no major water supply wells. However, water supply wells for Bruni and Hebbronville are completed in the same formation as the Longoria Leach Project Production zone. Number and location of these wells are detailed in Chapter 7 A.

CHAPTER 2.

PERMIT AREA TOPOGRAPHY

The Longoria Leach Project lies in an area of relatively low relief. Upland gradients average 23 feet per mile increasing to 60 feet per mile in dissected areas adjacent to major drainage ways. Stream gradients for Arroyo de los Angeles (Fig. 2-1) average 18.2 feet per mile.

No major drainageway transects the Longoria permit area. However, the drainage divide between Noriacitas Creek and Arroyo de los Angeles crosses the southern portion of mining leases held by URI (Fig. 2-1). The Longoria permit area lies wholly within the Arroyo de los Angeles drainage basin. Arroyo de los Angeles is a tributary to Mesquite Creek with the confluence located approximately 4.2 miles east northeast of the URI permit area. Mesquite Creek and Noriacitas Creek ultimately join 4 miles east southeast of Hebbronville.

CHAPTER 4.

INITIAL MINE PLAN

b. Schedule

Estimated productive life for Longoria Area II is 2.5 ... s. However, variability in permeability, and oxidation rates; underestimation of uranium reserves; and modification of production p: cedures may increase productive life by as much as 50%.

When wells cease to be productive they will be shut in and partial restoration will commence, through displacement of mine waters by inward sweeping of unaffected waters in reponse to the bleed stream. Full restoration will commence upon cessation of mining activities. Based on restoration tests by Mobil Oil Corporation on non-ammonia leach operations in the immediate area, it is estimated that full restoration can be accomplished by fluid displacement of mine waters with unaffected mine area waters. The total volume produced to accomplish this is calculated to be slightly less than five times the pore volume of the affected production zone.

The "4 a gravel" production zone for Longoria Area II has an average net permeable interval of 31 feet with an average porosity of 28%. Total affected area of Area II is calculated as 12.2 acres. Thus one pore volume is equal to 34.54 million gallons. At a restoration disposal rate of 500 gpm using reverse osmosis techniques or 240 gpm using untreated subsurface injection restoration will be accomplished in 8 to 17 months. If the entire 32.8 acre mine area is contaminated restoration could be accomp ished in 21 to 44 months. Since total area affected by mining cannot be finitely established and by regulation it cannot exceed the 32.8 acre mine area, the latter number is considered to be worse case and is the restoration time limit for the Longoria Area II.

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CHAPTER 5.

REGIONAL GEOLOGY

Duval County lies wholly within the Sand Plain subprovince of the Texas Gulf Coastal Plain. All of the county is situated on the northeast flank of the southeastern plunging synclinal Rio Grand Embayment. Surficial geology consists of either late Terliary, early Quate nary sediments deposited by the Rio Grande fluvio-deltaic system or Holocene alluvial and eolion deposits.

Topography structure and stratigraphy of Duval County are discussed in greater detail below.

TOPOGRAPHY

Topography of Duval County is typical of south Texas Gulf Coastal Plains. Relief is generally 40 feet or less and surface gradients average less than 40 feet per mile. Drainage gradients (20 feet per mile plus) are somewhat higher than normal coastal plain. The drainage within Duval County is intermittent, which results in the sediment logged streams with gradients associated with semi-arid to arid climates.

Because of this climate, extensive caliche development can be found throughout the county. Caliche forms a caprock armour which supports distinctive northeast-southwest trending escarpments found in northwest Duval County.

Duval County lies between the Nueces River and Rio Grande drainage systems. Streams trend southeast and empty directly into the Texas Gulf. This feature combined with low rainfall and high evaporation results in poorly defined drainage systems and in some cases closed drainage basins.

STRUCTURAL GEOLOGY

Formations outcropping or underlying Duval County strike approximately N 25 E, and dip to the southeast at [illegible] to 80 feet per mile (Figs. 5-1,2,3 and 4). In localized areas dips may be reversed and/or increase to 180 feet per mile because of faulting or deformation proximal to salt dome development.

The county can be typed as a broad southeastern dipping monocline broken locally by one fault zone and an area of salt dome development. The fault zone trends northeast southwest in the northwestern part of the county. Relief on the echelon down to the coast faults (Fig. 5-1) is variable, but have sufficient cloture for oil and gas entrapment. Local antithetic up to the coast faults form bounding faults for horsts and grabens in the overall fault trend.

A second structural feature is the Palangana Salt Dome which is approximately six miles north of Benevides. Around the dome, structural attitude of sedimentary sequences are altered or reversed to the regional trend (Figs. 5-2,3, and 4). On the dome, the Oakville and Catahoula units are absent, and the influence of the dome has impacted the Goliad sediments.

The Piedras Pintas Salt Dome is not as large nor does it have as much impact on local structure as the Palangana Dome. Intrusion of the Piedras Pintas Dome has altered the Oakville and Catahoula units, but has not altered Goliad sediments significantly.

STRATIGRAPHY

-Alluvium - Qal; Holocene-

Alluvial sequences in Duval County are found in and adjacent to southeastward trending intermittent streams. Spatially these deposits vary from a few tens of feet to 1.5 miles across and extend downstream from the point of integrated channel development until the channel transects strata of sufficient integrety that broad flood plain development is precluded. This point may be anywhere from 1 to 50 stream miles from the upstream origin.

Alluvial units are the youngest deposits in Duval County. Floodplain deposits are composed of dark grey to dark brown calcareous silt and clay, quartz sand, organic matter and some localized gravel units. Composition of floodplain sediments is determined by upland parent material.

-Eolian Sands - Qs; Holocene-

In the southeastern and southern part of Duval County sheet sand deposits form a thin surface mantle on underlying bedrock. Sheet sands are made up of reworked eolian deposits. The iron stained quartz sands range in thickness from one to a few tens of feet.

-Lissie Formation - Ql; Pleistocene-

The Lissie Formation corps out along the east edge of Duval County (Fig. 5-1). The Lissie unconformably overlies the Goliad Sand and is unconformably overlain by the Beaumont Formation (Pleistocene). Although a full section of Lissie is not present, formation thickness in adjacent counties average 200 feet.

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The Lissie Formation consists of interspersed meanderbelt, levee, crevasse splay, and tributary channel sequences. Depositional environment for the Lissie is lower meanderbelt/upper deltaic plain in the Rio Grande depositional system.

Sands and gravels within the Lissie are reddish orange or mottled red in oxidized outcrops and greenish blue in the subsurface. The sands are angular to subangular quartz grains, while the gravels are moderately rounded to well rounded quartz, quartzite, chert, and igneous extrusives. On outcrop, coarser clastics have moderate to extensive caliche cementation. Silts and clays in the Lissie display the same redish orange coloration on oxidized outcrop and green to bluish gray in the subsurface.

-Goliad Sand - Tg;- Pliocene-

The Goliad Sand forms a northeast to southwest outcrop belt in Duval County. This belt varies in width from less than 10 to more than 44 miles. Areal extent of the Goliad equals that of all other outcrops within the county (Fig. 5-1). Goliad sediments range in thickness from zero at the up-dip limit to 600 feet in the sub-surface.

Early depositional form of Goliad sediments was bedload. Slight upwarp in west Texas coupled with increased rainfall produced sediment choked drainageways which disgorged their loads in blanket fashion across the south Texas Coastal Plain. Basal Goliad sediments consist of bimodal sands and gravel conglomerates with poor bed form development and have little sedimentary structure. Middle and upper Goliad sediments are finer grained; have better sedimentary structure and bedform development; and have relict caliche cementation. This would indicate decreasing bedoad energy, reduced source input, and a climatic change to an arid or semi arid condition.

Basal Goliad sediments consist of sand/gravel conglomerates. The subround to subangular sands are composed of white to pink quartz and black chert. The gravels are subangular chert with some subround quartz. The gravels have pink or reddish coloration on outcrop where weathering has oxidized finely deciminated magnetite.

-Fleming Formation - Tf; Miocene-

The Fleming Formation, locally referred to as the Lagarto Clay, crops out only in northeast Duval County. Throughout the rest of the county it is onlapped by the Goliad Sand (Figs. 1,5,6, and 7). The Fleming conformably overlies the Oakville Sandstone and is unconformably overlain by the Goliad Sand. The Fleming ranges in thickness from 0 at the up-dip limit to 1000 feet + in the sub-surface around Benavides.

Depositional environment for Fleming sediments was one of regional quiescence within a coastal plain depositional frame work, much like present day gulf coast conditions. Preponderance of fine grain clastics, good bedform and sedimentary structure development; and broad thin fine grained sand filled channels all indicate a low energy fluviotile system. Primary source of clays appears to be derived from upper cretaceous calcareous marine clays. Because of low transport energy, sands probably have their origin in older tertiary sequences which crop out to the north and west.

Clays in the Fleming Formation are yellow green and grey calcareous montmorillanites. Sands found in the Fleming are well rounded fine quartz grains which are yellowish orange in outcrop and in the sub-surface. Oxidation of these sediments appears to be penecontemporaneous with deposition.

-Oakville Sandstone - To; Miocene-

The Oakville Sandstone crops out in a "v" notched trend from north central to west central Duval County (Fig. 5-1). Outcrop width varies from less than a mile to 10 miles with greatest areal extent along major streams which have eroded away the onlapping Goliad Sand. The Oakville unconformably overlies the Catahoula Tuff and is conformably overlain by the Fleming Formation. The Oakville thins at the up-dip limit and thickens to 500 to 600 feet in the sub-surface (Figs. 5,6, and 7).

Dispositon of the Oakville Sandstone represents the transition between the volcano-tectionism exemplified by the Catahoula Tuff and the relative quiessence of the Fleming. This is represented by the smaller grain size in the Oakville as compared to the Catahoula and the continuous fining upward directional sequence from the Oakville through the Fleming. The depositional environment for the Oakville can be characterized as moderate upwarp in the west producing relatively high transport energies which support bedload with broad channel sequences of moderate depth. These fining upward sequences with lower flow regime features and blanket extent represent approachment to base level without significant climate change.

Oakville sediments are medium to fine grained subangular to subrounded quartz, chert, and obsidian clastics which increase in roundness and decrease in size in vertical sequences. Bed forms are broad and sedimentary structures and are poorly developed in the basal units while upper units have well developed cross bedding, ripples, and laminae. Isolated lenticular gravel beds are found in Oakville. These gravels are medium to coarse quartz, quartzite, chert, fossil debris and some volcanics with varying degrees of roundness. On the outcrop, Oakville sediments weather to buff or yellowish orange. In the sub-surface coloration is controlled by post depositional formation geochemistry. Oxidized sediments are yellow to reddish orange, while reduced sediments are bluish to greenish gray.

-Catahoula Tuff - Tct; Miocene-

The Catahoula Tuff forms the second largest outcrop belt in the county. Extending from north central to west central Duval County, the Catahoula outcrop width varies from 4 to 10+ miles. The Catahoula unconformably overlies the Frio Clay and Jackson Group and is in turn unconformably overlain by Oakville Sandstone and where the Oakville is absent, by the onlapping Goliad Sand. Formation thicknesses vary from 0 at the up-dip limit to 875 feet proximal to outcrop, and eventually thickens to 1400 feet in the sub-surface of eastern Duval County.

There are three depositional episodes evidenced in the Catahoula. Since sediments within the Catahoula indicate semi arid to arid climates throughout, vertical differences in depositional events are a product of activity variation in the west Texas area. The thick basal Fant Tuff Member was deposited from bedload streams transporting eroded volcanic ash. Lack of significant coarse clastics and thickness of sequence indicate a period of massive ash accumulation with little suface upwarp to provide transport energy.

This sequence was broken when the Soledad Volcanic Conglomerate was deposited. Although volcanic activity did not cease, as evidenced by tuffaceous clays within the Soledad, increased clast size and broad definable channel sequences indicate greater transport energy, which is indicative of uplift in the source area. The Soledad conglomerate is characterized by sedimentary sequences deposited by sediment chocked bedload streams with high sediment enhanzed viscosities.

The upper Chusa Tuff deposition was a return to a bedload sequence of ash deposit with little or no tectonic activity supporting high transport energies.

The Fant Tuff Member is predominately composed of white to off-white massively bedded tuff and tuffaceous clays. Isolated interstratified greenish brown claystones and greenish gray to ...ish orange fine grain sands provide the only contrast to the tuff. The Soledad Volcanic Member is composed of interstratified tuffs, tuffaceous clay, friable fine sands, and conglomerates. The tuffs and tuffaceous clays are similar to those of the Fant Tuff Member. Soledad sands are fine to very fine grained quartz and chert. Larger sediments consist of angular, subangular, and subrounded rhyolite, trachyte, trachyandesite clasts which range in size from pea gravel to boulders. These are either partially or totally suspended in a fine grain matrix. The Chusa Tuff is a massive to irregular bedded sequence of light gray to pink tuff and tuffaceaus clay.

-Frio Clay - Tfc; Oligocene-

Outcrops of Frio Clay are confined to a north-south 1.5 to 4 mile wide band in northwestern Duval County (Fig. 5-1). The Frio conformably(?) overlies the Jackson Group and is unconformably overlain by the Catahoula Tuff or the onlapping Goliad Sand (Fig. 5-6). Thickness in the subsurface range from 400 in northern Duval County to 800+ feet in the southern part of the county.

Sediments in the Frio indicate fluviatile upper deltaic plain deposition with low transport energies. Sedimentation processes are similar to, if not same as those at work during Jackson deposition. Jackson and Frio sedimentary sequences differ only in the non volcanic composition of the latter.

The Fri Clay is made up of light yellowish to brownish green clays interstralified with small discontinuous sand and silty sand units. The sands are composed of fine grained noncalcareous slightly gypsiferous quartz grains.

-Jackson Group - Tj; Eocene-

The Jackson Group crops out marginally in the far northeastern part of Duval County. The Jackson Group conformably overlies the Yegua Formation and is conformably(?) overlain by the Frio Clay; where the Frio is absent the Jackson is unconformably overlain by onlapping Catahoula or Goliad. The Jackson, in the sub-surface, ranges from 360 feet near the outcrop to 1600 feet downdip.

The Jackson was deposited in a long shore destructive fluvio-deltaic barrier bar sequence. Lower Jackson is characteristically transgressive; Middle Jackson sediments are characteristic of rapid low scale shore line fluctuation; and Upper Jackson sediments represent major sea regression.

Lower and Upper Jackson sediments are composed primarilly of light brown to gray slightly calcureous clay interstralified with white to gray volcanic ash in the upper section. Jackson sands vary from light cream color to dark gray with grain size varying from medium to fine. The dominant sand mineral is quartz, but minor amounts of plagioclase can be found.

-Yegua Formation - Ty; Eocence-

The Yegua Formation does not crop out in Duval County. In the sub-surface it attains thicknesses in excess of 1500 feet. The Yegua lies unconformably on the Pico Clay and is conformably overlain by the Jackson Group.

Deposition of the Yegua in South Texas was primarilly meanderbelt and crevasse splay. Although individual sand units are not readily correlated, sand body sequences can be correlated and they indicate large point bar sand development.

The sands in the Yegua are gray, medium to fine grain, subround to subangular quartz. Bedding in the Yegua is massive with horizontal laminae and cross bedding as associated sedimentary structures.

CHAPTER 6.

REGIONAL HYDROLOGY

Since hydrologic properties are a function of geology, aquifers within Duval County will be discussed in the same sequence as utilized in Chapter 5.

-Alluvium-

Wells within the vicinity of the Longoria Project or within the county are not known to be completed in Alluvium.

-Eolian Sands-

Eolian Sands generally yield less than 50 gpm and water is of marginal quality with total dissolved solid values ranging from 1000 - 3000 mg/l up to 40,000 mg/l.

-Lissie Formation-

The Lissie Formation is not known to yield water in Duval County.

-Goliad Sand-

Because of its large areal extent and shallow depth the Goliad Sand is the principal water supply aquifer in Duval County. Well yields range from 10 to 420 gpm with some wells yielding as much as 1000 + gpm. Hydraulic gradients in the Goliad range from less than 5'/mile to 30'/mile. Although no severe localized cones of depression have developed in the Goliad aquifer, overall water levels are declining by as much as 1.4 feet per annum because of extensive area wide use. Water quality in the Goliad ranges from less than 700 mg/l TDS to 1500 mg/l TDS.

-Fleming Formation-

The Fleming Formation is not known to yield water in Duval County.

-Oakville Sandstone-

Wells completed in the Oakville yield water at a rate of less than 50 gpm to 500 gpm with a TDS quality ranging from 1000 to 1500 mg/l in Duval County. Because of limited development of the Oakville aquifer, valid regional hydraulic data is not available.

-Catahoula Tuff-

Primary yield from the Catahoula Tuff is from the Soledad Volcanic Member. Wells completed in the Catahoula yield from less than 50 gpm to 500 gpm. Hydraulic gradients range from less than 6'/mile to 50'/mile. The latter occurs where a major cone of depression has developed around two municipal water supply wells for the town of Freer. The cone is centered approximately halfway between Freer, Duval County, and Hebbronville, Jim Hogg County. Water quality in the Catahoula is highly variable with TDS values ranging from 600 mg/l to greater than 4,000 mg/l. (See Chapter 7).

-Frio Clay-

The Frio Clay is not know to yield water in Duval County.

-Jackson Group-

Sands in the Jackson generally yield less than 50 gpm with water quality ranging from 1000 to 4,000 + mg/l TDS.

CHAPTER 7.

WATER SUPPLY WELLS

a. Permit Area Vicinity Wells

Within two miles of the Longoria permit area there are 20 water supply wells. Because of age and lack of record keeping, well completion data for these wells are minimal if not nonexistent.

The following summaries provide information as to location, ownership, elevation, water level and water quality. Well numbers in the following tables are keyed to well locations found in Fig. 7 a-1. Field chemical analysis for those wells are reported in Table 7 a-2. Laboratory analytical results are contained in Appendix 7 a-1.

Of the 20 wells sampled, eighteen (90%) would be considered unacceptable for domestic use under present primary drinking water standards. Values exceeding the limits for sodium chloride and total dissolved solids are the primary cause of unacceptability. Sixty percent of all wells tested had sodium concentrations exceeding 250 mg/l. Mean sodium concentration for the permit area water supply wells is 332 mg/l with a standard deviation of 140 mg/l. Sodium concentration ranged from 127 mg/l to 673 mg/l.

Chloride concentration averaged 493 mg/l with a standard deviation of 268 mg/l. Chloride concentration ranged from 105 mg/l to 1068 mg/l. Sixty five percent of all wells analyzed exceeded acceptable concentration for chloride.

Eighty percent of all wells tested exceeded acceptable concentration for total dissolved solids. Mean concentration for the 20 wells was 1444 mg/l with a standard deviation of

546 mg/l. TDS ranged from 610 mg/l to 2,560 mg/l.

It is of interest to note that one well exceeded the acceptable level for calcium and two exceeded the acceptable level for sulfate. In addition, nitrate nitrogen concentration was also high. A summary of the nitrate values are given below:

Range NO_3-N (mg/l)	# of Wells	Concentration (mg/l)
≤ 2.0	6	0.02
		0.05
		0.06
		0.09
		0.69
		1.8
2.1 - 4.0	2	3.6
		3.7
4.1 - 6.0	7	4.3
		4.7
		4.9
		5.0
		5.0
		5.7
		6.0
6.1 - 8.0	0	
8.1 - 10.0	5	8.0
		8.8
		9.3
		10.0
		10.0
> - 10.0	0	

Overall permit area vicinity water supply well quality is considered marginal to poor. The water is primarilly Na-Cl in character with Ca and HCO_3 as secondary cation-anion chemical constituent facies (Fig. 7 a-2). The quality and character of the water indicates that the hydrochemical regime is transitional between the initial regional recharge chemistry and the deeper basin connate brines.

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All wells sampled were in use for domestic livestock, and/or irrigation purposes and the only hydrologic property URI was able to evaluate was water level. Within the permit area vicinity, the piezemetric gradient is approximately 40 feet per mile (Fig. 7 a-3). Across most of the URI lease property the gradient dips to the southeast. North of the URI leases, the gradient dip direction is to the east northeast. Although there is no significant change in gradient the axis of change is pronounced. This axis trends east across the northern portion of URI leases then turns northeast (Fig. 7 a-3).

TABLE 7 a-1.

WATER SUPPLY WELL PHYSICAL DATA

WELL NO.	OWNER	ADDRESS	ELEV.	WATER LEVEL (MSL)	USE
L-1	JOE RAMIREZ	604 N. Rigma Hebbro..ville, Texas 78361	658	@	D,L
L-2	MANUEL T. LONGORIA	1408 Mier Laredo, Texas 78040	738	671 @	L
L-3	FERNANDO MORENO c/o Manuel Longoria	1408 Mier Laredo, Texas 78040	735	646	L
L-4	WAYNE MANN	11303 Dumas Houston Texas 77034	763	696	L
-5	FERNAN' O MORENO c/o Manuel Longoria	1408 Mier Laredo, Texas 78040	699	637	L
L-6	GREENHILL CEMETARY ASSOCIATION c/o Ms. Dana Helen	P.O. Box 244 Hebbronville, Texas 78361	671	@	I
L-7	TEMPLE ROGERS	P.O. Box 1244 Robstown, Texas 78380	649	@	D,L
L-8	ALFOSO VALDEZ	507 E. Santa Clara Hebbronville, Texas 78361	678	614	D,L
L-9	ALFOSO VALDEZ	507 E. Santa Clara Hebbronville, Texas 78361	674	633	L
L-10	VINCEY WATERMAN	P.O. Box 427 Hebbronville, Texas	680	@ 598	D

WELL NO.	OWNER	ADDRESS	ELEV.	WATER LEVEL (MSL)	USE
L-11	VINCEY WATERMAN	P.O. Box 427 Hebbronville, Texas	667	598	L
L-12	FERNANDO MORENO c/o M.T. LONGORIA	1408 Mier Laredo, Texas 78040	699	634	L
L-13	M.T. LONGORIA	1408 Mier Laredo, Texas 78040	720	661	L
L-14	ELTON SPECT	906 W. Viggie Hebbronville, Texas	672	@	L
L-15	ALFREDO ALMARAZ	408 E. Harald Hebbronville, Texas	668	599	L
L-16	M.T. LONGORIA	1408 Mier Laredo, Texas 78040	721	675	L
L-17	M.T. LONGORIA	1408 Mier Laredo, Texas 78040	662	586	L
L-18	M.T. LONGORIA	1408 Mier Laredo, Texas 78040	651	@	L
L-19	DANA HELLEN	501 N. Karen Hebbronville, Texas	736	@	L
L-20	DANA HELLEN	501 N. Karen Hebbronville, Texas	657	@	L

1214 028

* Mechanically unable to obtain sample
\# Unable to obtain permission for sampling
@ Unable to obtain water level

D - Domestic
L - Livestock
I - Irrigation

TABLE 7 a-2.

WATER SUPPLY WELLS - FIELD CHEMICAL DATA

WELL NO.	TEMPERATURE (C)	CONDUCTIVITY (umhos/cm)	pH
L-1	27.50	1600	7.62
L-2	24.00	2000	7.05
L-3	27.50	2500	7.75
L-4	29.25	1500	7.6
L-5	26.00	2450	7.4
L-6	22.00	2000	7.35
L-7	27.50	3600	7.3
L-8	25.50	1300	7.6
L-9	28.25	1900	8.50
L-10	29.00	2000	7.66
L-11	26.50	2600	7.45
L-12	26.50	1600	7.5
L-13	26.00	2900	7.30
L-14	26.50	900	7.70
L-15	26.00	3000	7.50
L-16	27.55	2200	8.37
L-17	29.50	4000	8.65
L-18	25.00	4000	7.22
L-19	26.25	1600	8.12
L-20	27.50	1200	7.60

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-1 RAMIREZ
1406 8-10-78

pH -------------------- 7.37
Specific Conductance ------- 1630 µmhos/cm@25°C.
Diluted Conductance -------- 1820 µmhos/cm@25°C.

	milligrams/liter
Calcium	66
Magnesium	24
Potassium	9.5
Sodium	236
Carbonate	0
Bicarbonate	326
Sulfate	129
Chloride	263
Silica	90
Total Dissolved Solids (180°C.)	1030
Total Alkalinity as Calcium Carbonate	267
Ammonia Nitrogen	0.06
Nitrate Nitrogen	8.0
Fluoride	0.88
Molybdenum	0.01
Uranium	<0.01

					Range
Gross Alpha	nd pci/l		Ion Balance	1.021	(0.96 to 1.04)
Gross Beta	9±6 pci/l		TDS Check	1.041	(0.90 to 1.10)
Radium 226	nd pci/l		Ec Check	1.024	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4020

Respectfully submitted,

Carl F. Crownover

1214 030

TELEPHONE 884-0371

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JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

October 10, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-2 LONGORIA
0940 9-28-78

pH ———— 7.35
Specific Conductance ——— 2030 μmhos/cm@25°C.
Diluted Conductance ——— 2210 μmhos/cm@25°C.

	milligrams/liter
Calcium	122
Magnesium	36
Potassium	13
Sodium	213
Carbonate	0
Bicarbonate	244
Sulfate	146
Chloride	418
Silica	82
Total Dissolved Solids (180°C)	1210
Total Alkalinity as Calcium Carbonate	200
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	8.8
Fluoride	0.44
Molybdenum	<0.01
Uranium	0.007

Gross Alpha	8±10 pci/l	Ion Balance	0.990	(0.96 to 1.04)
Gross Beta	13±8 pci/l	TDS Check	1.042	(0.90 to 1.10)
Radium 226	1±1 pci/l	Ec Check	0.993	(0.95 to 1.05)

Lab. No. M16-4958

Respectfully submitted,

Carl Crownover

Carl F. Crownover

RECEIVED
OCT 12 1978
URANIUM

1214 031

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-3 LONGORIA (Moreno)
1611 8-10-78

pH -------------------- 7.47
Specific Conductance ------- 2760 μmhos/cm@25°C.
Diluted Conductance -------- 3170 μmhos/cm@25°C.

	milligrams/liter
Calcium	135
Magnesium	59
Potassium	15
Sodium	325
Carbonate	0
Bicarbonate	232
Sulfate	188
Chloride	640
Silica	111
Total Dissolved Solids (180°C.)	1650
Total Alkalinity as Calcium Carbonate	190
Ammonia Nitrogen	0.04
Nitrate Nitrogen	9.3
Fluoride	0.64
Molybdenum	0.01
Uranium	<0.01

					Range
Gross Alpha	nd	pci/l	Ion Balance	1.014	(0.96 to 1.04)
Gross Beta	14±10	pci/l	TDS Check	1.032	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.016	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4021

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 032

TELEPHONE 884 0371

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CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-4 ~~LONGORIA~~ Wayne Mann
1740 8-10-78

pH ---------------------- 7.19
Specific Conductance ------- 1570 µmhos/cm@25°C.
Diluted Conductance -------- 1780 µmhos/cm@25°C.

	milligrams/liter
Calcium	91
Magnesium	22
Potassium	15
Sodium	203
Carbonate	0
Bicarbonate	389
Sulfate	83
Chloride	257
Silica	104
Total Dissolved Solids (180°C.)	1020
Total Alkalinity as Calcium Carbonate	319
Ammonia Nitrogen	0.02
Nitrate Nitrogen	3.7
Fluoride	0.39
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	3±8	pci/l	Ion Balance	1.014	(0.96 to 1.04)
Gross Beta	16±7	pci/l	TDS Check	1.047	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.026	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4022

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 033

TELEPHONE 884-0371

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CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-5 LONGORIA (Moreno)
0835 8-11-78

pH ---------------------- 7.36
Specific Conductance ------- 2470 µmhos/cm@25°C.
Diluted Conductance -------- 2980 µmhos/cm@25°C.

	milligrams/liter
Calcium	203
Magnesium	46
Potassium	12
Sodium	236
Carbonate	0
Bicarbonate	237
Sulfate	154
Chloride	604
Silica	106
Total Dissolved Solids (180°C.)	1530
Total Alkalinity as Calcium Carbonate	194
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	3.6
Fluoride	0.38
Molybdenum	<0.01
Uranium	<0.01

Gross Alpha 4±13 pci/l
Gross Beta 9±9 pci/l
Radium 226 1±1 pci/l

		Range
Ion Balance	1.015	(0.96 to 1.04)
TDS Check	1.032	(0.90 to 1.10)
Ec Check	1.018	(0.95 to 1.05)

Lab. No. M16-4023

Respectfully submitted,

Carl F. Crownover

1214 034

TEL. 512-884-0371

P.O.BOX 2552 78403

JORDAN LABORATORIES INC.

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

COMPANY: URANIUM RESOURCES INC.
WELL NUMBER: GHC (4-6)
PRODUCTION AREA: LONGORIA
DATE COLLECTED: 09-28-78

MAJOR & SECONDARY CONSTITUENTS

ITEM	STORET	MG/L	EPM	CONDUCTANCE	%EPM
CALCIUM(CA)	00915	65.	3.24	168.48	16.80
MAGNESIUM(MG)	00925	22.	1.81	84.35	9.38
SODIUM(NA)	00929	318.	13.83	676.29	71.70
POTASSIUM(K)	00937	16.	.41	29.52	2.13
		TOTAL CATION	19.29		
CARBONATE(CO3)	00445	0.	0.00	0.00	0.00
BICARBONATE(HCO3)	00440	285.	4.67	203.61	23.95
SULFATE(SO4)	00945	169.	3.52	260.13	18.05
CHLORIDE(CL)	00940	401.	11.31	858.43	58.00
NITRATE(NO3-N)	71851	.06			
FLUORIDE(F)	00951	.28		TOTAL 2280.80	
SILICA(SIO2)	00955	90.			
		TOTAL ANION	19.50		
TOTAL ION		1366.			

				ACCURACY CHECK		RANGE
TDS(180 C)	70300	1270.		ION	.989	(.96 TO 1.04)
TOT ION-0.5 HCO3=		1224.		TDS	1.038	(.90 TO 1.10)
EC(25 C)	00095	2030.	UMHOS	EC	.996	(.95 TO 1.05)
EC(DIL)= 102.3 X 22.2=		2271.	UMHOS			
ALK. AS CACO3	00410	234.				
PH		7.38				

MINOR AND TRACE CONSTITUENTS

ITEM	MG/L	ITEM	MG/L	ITEM	MG/L
ARSENIC(AS)	0.025	MANGANESE(MN)	0.01	VANADIUM(V)	0.01
BARIUM(BA)	0.02	MERCURY(HG)	0.0009	ZINC(ZN)	0.080
CADMIUM(CD)	0.0008	MOLY.(MO)	0.03	BORON(B)	2.1
CHROM.(CR)	0.004	NICKEL(NI)	<0.01	AMMONIA-N	0.01
COPPER(CU)	0.013	SELENIUM(SE)	<0.001		
IRON(FE)	0.37	SILVER(AG)	<0.01		
LEAD(PB)	<0.001	URANIUM(U)	0.004		

RADIUM 226	0	+/- 1	PCI/L
GROSS ALPHA	18	+/-13	PCI/L
GROSS BETA	15	+/- 8	PCI/L

ANALYST: NIXON & ALLEN CHECKED BY: Carl Mannone

LAB.NO. M16-4957

1214 035

TELEPHONE 884-0371

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JORDAN LABORATORIES, INC
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-7 ROGERS
1200 8-11-78

pH -------------------- 7.23
Specific Conductance ------- 3670 µmhos/cm@25°C.
Diluted Conductance -------- 4600 µmhos/cm@25°C.

	milligrams/liter
Calcium	192
Magnesium	102
Potassium	29
Sodium	436
Carbonate	0
Bicarbonate	273
Sulfate	459
Chloride	826
Silica	83
Total Dissolved Solids (180°C.)	2340
Total Alkalinity as Calcium Carbonate	224
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	4.3
Fluoride	0.57
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	2±18	pci/l	Ion Balance	1.009	(0.96 to 1.04)
Gross Beta	26±15	pci/l	TDS Check	1.032	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.013	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4024

Respectfully submitted,

Carl F. Crownover

1214 036

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24 '7[illegible]

Uranium Resources, Inc.
Suite #735, Prome[illegible]ade Bank Tower
1600 Promenade Cer[illegible]er
Richardson, Texas 7508U

Report of Tests on Sample Water

Identification: L-8 VALDEZ
1404 8-11-78

pH ------------------- 7.37
Specific Conductance ------- 1280 µmhos/cm@25°C.
Diluted Conductance -------- 1390 µmhos/cm@25°C.

	milligrams/liter
Calcium	81
Magnesium	18
Potassium	6.0
Sodium	153
Carbonate	0
Bicarbonate	333
Sulfate	49
Chloride	199
Silica	87
Total Dissolved Solids (180°C.)	969
Total Alkalinity as Calcium Carbonate	273
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	0.69
Fluoride	0.66
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	1±6	pci/l	Ion Balance	1.020	(0.96 to 1.04)
Gross Beta	5±4	pci/l	TDS Check	1.045	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.026	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4025

Respectfully submitted,

Carl F. Crownover

1214 037

TELEPHONE 884-0371 P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: -9 VALDEZ
1415 8-11-78

pH -------------------- 8.10
Specific Conductance ------- 1940 µmhos/cm@25°C.
Diluted Conductance -------- 2090 µmhos/cm@25°C.

	milligrams/liter
Calcium	2.9
Magnesium	0.30
Potassium	4.7
Sodium	416
Carbonate	0
Bicarbonate	429
Sulfate	152
Chloride	291
Silica	65
Total Dissolved Solids (180°C.)	1220
Total Alkalinity as Calcium Carbonate	352
Ammonia Nitrogen	0.02
Nitrate Nitrogen	0.09
Fluoride	1.23
Molybdenum	0.03
Uranium	<0.01

					Range
Gross Alpha	1±11	pci/l	Ion Balance	0.998	(0.96 to 1.04)
Gross Beta	nd	pci/l	TDS Check	1.063	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.012	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4026

Respectfully submitted,

Carl F. Crownover

1214 038

TELEPHONE 884-0371 P. O. BOX 2552

JORDAN LABORATORIES, INC
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-10 WATERMAN
1310 8-11-78

pH ------------------- 7.24
Specific Conductance ------- 2060 μmhos/cm@25°C.
Diluted Conductance -------- 2350 μmhos/cm@25°C.

	milligrams/liter
Calcium	101
Magnesium	37
Potassium	9.6
Sodium	250
Carbonate	0
Bicarbonate	229
Sulfate	108
Chloride	460
Silica	96
Total Dissolved Solids (180°C.)	1230
Total Alkalinity as Calcium Carbonate	188
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	4.9
Fluoride	0.86
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	5±10	pci/l	Ion Balance	1.012	(0.96 to 1.04)
Gross Beta	12±8	pci/l	TDS Check	1.041	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.036	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4027

Respectfully submitted,

Carl F. Crownover

1214 039

TELEPHONE 884-0371 P. O. BOX 2552

JORDAN LABORATORIES, INC
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-11 PENA
1338 8-11-78

pH -------------------- 7.25
Specific Conductance ------- 2690 µmhos/cm@25°C.
Diluted Conductance -------- 3060 µmhos/cm@25°C.

	milligrams/liter
Calcium	130
Magnesium	30
Potassium	11
Sodium	379
Carbonate	0
Bicarbonate	290
Sulfate	186
Chloride	596
Silica	94
Total Dissolved Solids (180°C.)	1650
Total Alkalinity as Calcium Carbonate	238
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	5.7
Fluoride	0.76
Molybdenum	0.01
Uranium	<0.01

					Range
Gross Alpha	nd	pci/l	Ion Balance	1.012	(0.96 to 1.04)
Gross Beta	7±9	pci/l	TDS Check	1.046	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.004	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4028

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 040

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-12 LONGORIA (Moreno)
1625 8-11-78

pH ------------------- 7.33
Specific Conductance ------- 1740 μmhos/cm@25°C.
Diluted Conductance -------- 2020 μmhos/cm@25°C.

	milligrams/liter
Calcium	90
Magnesium	28
Potassium	9.2
Sodium	236
Carbonate	0
Bicarbonate	332
Sulfate	117
Chloride	324
Silica	110
Total Dissolved Solids (180°C.)	1140
Total Alkalinity as Calcium Carbonate	272
Ammonia Nitrogen	0.02
Nitrate Nitrogen	10
Fluoride	0.55
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	5±10	pci/l	Ion Balance	1.016	(0.96 to 1.04)
Gross Beta	5±7	pci/l	TDS Check	1.045	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.025	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4029

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 041

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-13 LONGORIA
1625 8-11-78

pH ------------------- 7.28
Specific Conductance ------- 2990 µmhos/cm@25°C.
Diluted Conductance -------- 3600 µmhos/cm@25°C.

	milligrams/liter
Calcium	150
Magnesium	56
Potassium	15
Sodium	398
Carbonate	0
Bicarbonate	284
Sulfate	244
Chloride	698
Silica	94
Total Dissolved Solids (180°C.)	1880
Total Alkalinity as Calcium Carbonate	233
Ammonia Nitrogen	0.02
Nitrate Nitrogen	5.0
Fluoride	0.59
Molybdenum	0.01
Uranium	<0.01

					Range
Gross Alpha	5±15	pci/l	Ion Balance	1.013	(0.96 to 1.04)
Gross Beta	12±11	pci/l	TDS Check	1.043	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.014	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4030

Respectfully submitted,

Carl F. Crownover

1214 042

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-14 SPECHT
0915 8-14-78

pH ------------------- 7.46
Specific Conductance ------- 919 µmhos/cm@25°C.
Diluted Conductance -------- 966 µmhos/cm@25°C.

	milligrams/liter
Calcium	44
Magnesium	13
Potassium	5.0
Sodium	127
Carbonate	0
Bicarbonate	318
Sulfate	39
Chloride	105
Silica	81
Total Dissolved Solids (180°C.)	610
Total Alkalinity as Calcium Carbonate	261
Ammonia Nitrogen	0.02
Nitrate Nitrogen	10
Fluoride	0.85
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	2±5	pci/l	Ion Balance	0.993	(0.96 to 1.04)
Gross Beta	6±4	pci/l	TDS Check	1.045	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.011	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4031

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 043

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-15 ALMARAZ
1006 8-14-78

pH ---------------------- 7.39
Specific Conductance ------- 2990 µmhos/cm@25°C.
Diluted Conductance -------- 3510 µmhos/cm@25°C.

	milligrams/liter
Calcium	135
Magnesium	44
Potassium	13
Sodium	423
Carbonate	0
Bicarbonate	318
Sulfate	232
Chloride	670
Silica	91
Total Dissolved Solids (180°C.)	1820
Total Alkalinity as Calcium Carbonate	261
Ammonia Nitrogen	0.02
Nitrate Nitrogen	6.0
Fluoride	0.64
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	5±15	pci/l	Ion Balance	1.005	(0.96 to 1.04)
Gross Beta	10±11	pci/l	TDS Check	1.025	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.014	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4032

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 044

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-16 LONGORIA
1115 8-14-78

pH -------------------- 8.09
Specific Conductance ------- 2220 μmhos/cm@25°C.
Diluted Conductance -------- 2420 μmhos/cm@25°C.

	milligrams/liter
Calcium	12
Magnesium	4.4
Potassium	8.2
Sodium	440
Carbonate	0
Bicarbonate	328
Sulfate	83
Chloride	473
Silica	17
Total Dissolved Solids (180°C.)	1270
Total Alkalinity as Calcium Carbonate	269
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	0.02
Fluoride	0.82
Molybdenum	0.03
Uranium	<0.01

						Range
Gross Alpha	4±12	pci/l	Ion Balance	0.993		(0.96 to 1.04)
Gross Beta	3±8	pci/l	TDS Check	1.057		(0.90 to 1.10)
Radium 226	1±1	pci/l	Ec Check	1.019		(0.95 to 1.05)

Lab. No. M16-4033

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

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CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-17 LONGORIA
1545 8-14-78

pH -------------------- 7.75
Specific Conductance ------- 4180 µmhos/cm@25°C.
Diluted Conductance -------- 4990 µmhos/cm@25°C.

	milligrams/liter
Calcium	111
Magnesium	64
Potassium	21
Sodium	673
Carbonate	0
Bicarbonate	365
Sulfate	282
Chloride	1024
Silica	89
Total Dissolved Solids (180°C.)	2560
Total Alkalinity as Calcium Carbonate	299
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	4.7
Fluoride	1.02
Molybdenum	0.01
Uranium	<0.01

					Range
Gross Alpha	8±19	pci/l	Ion Balance	0.997	(0.96 to 1.04)
Gross Beta	22±14	pci/l	TDS Check	1.044	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.020	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4034

Respectfully submitted,

Carl F. Crownover

1214 046

TEL. 512-884-0371 PO BOX 2552 78403

JORDAN LABORATORIES INC.
CHEMISTS & ENGINEERS
CORPUS CHRISTI, TEXAS
OCTOBER 17, 1978

URANIUM RESOURCES, INC.
1500 PROMENADE CENTE
RICHARDSON, TEXAS 75080

REPORT OF TESTS ON SAMPLES WATER

IDENTIFICATION MARKS: L-18 LONGORIA
0900 10-11-78

PH ---------------- 7.41
SPECIFIC CONDUCTANCE --------- 4300 UMHOS/CM@25 DEG.C.
DILUTED CONDUCTANCE ---------- 5030 UMHOS/CM@25 DEG.C.

	MG/L
CALCIUM	152
MAGNESIUM	88
POTASSIUM	21
SODIUM	596
CARBONATE	0
BICARBONATE	275
SULFATE	316
CHLORIDE	1068
SILICA	88
TOTAL DISSOLVED SOLIDS (180 DEG.C.)	2530
TOTAL ALKALINITY AS CALCIUM CARBONATE	225
AMMONIA NITROGEN	0.02
NITRATE NITROGEN	5.0
FLUORIDE	0.97
MOLYBDENUM	0.03
URANIUM	0.024

				RANGE
GROSS ALPHA	12 +/- 21 PCI/L	ION BALANCE	1.001	(0.96 TO 1.04)
GROSS BETA	31 +/- 13 PCI/L	TDS CHECK	1.023	(0.90 TO 1.10)
RADIUM 226	1 +/- 1 PCI/L	EC CHECK	1.004	(0.95 TO 1.05)

LAB. NO. M16-5242

RESPECTFULLY SUBMITTED.

Carl Crownover

CARL F. CROWNOVER

1214 047

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PO BOX 2552 78403

JORDAN LABORATORIES INC.
CHEMISTS & ENGINEERS
CORPUS CHRISTI, TEXAS
OCTOBER 17, 1978

URANIUM RESOURCES, INC.
1600 PROMENADE CENTER
RICHARDSON, TEXAS 75080

REPORT OF TESTS ON SAMPLES WATER

IDENTIFICATION: L-19 LONGORIA
1045 10-11-78

PH ------------------ 7.98
SPECIFIC CONDUCTANCE -------- 1720 UMHOS/CM@25 DEG.C.
DILUTED CONDUCTANCE --------- 1860 UMHOS/CM@25 DEG.C.

	MG/L
CALCIUM	20
MAGNESIUM	3.7
POTASSIUM	10
SODIUM	335
CARBONATE	0
BICARBONATE	305
SULFATE	139
CHLORIDE	282
SILICA	19
TOTAL DISSOLVED SOLIDS (180 DEG.C.)	997
TOTAL ALKALINITY AS CALCIUM CARBONATE	250
AMMONIA NITROGEN	<0.01
NITRATE NITROGEN	1.8
FLUORIDE	0.31
MOLYBDENUM	0.03
URANIUM	0.096

				RANGE
GROSS ALPHA	45 +/- 14 PCI/L	ION BALANCE	1.018	(0.96 TO 1.04)
GROSS BETA	12 +/- 5 PCI/L	TDS CHECK	1.035	(0.90 TO 1.10)
RADIUM 226	2 +/- 1 PCI/L	EC CHECK	1.015	(0.95 TO 1.05)

LAB. NO. M16-5243

RESPECTFULLY SUBMITTED,

Carl Crownover

CARL F. CROWNOVER

1214 048

TEL. 512-884-0371 PO BOX 2552 78403

JORDAN LABORATORIES INC.
CHEMISTS & ENGINEERS
CORPUS CHRISTI, TEXAS
OCTOBER 17, 1978

URANIUM RESOURCES, INC.
1600 PROMENADE CENTER
RICHARDSON, TEXAS 75080

REPORT OF TESTS ON SAMPLES WATER

IDENTIFICATION: L-20 LONGORIA
1105 10-11-78

PH ---------------- 7.38
SPECIFIC CONDUCTANCE -------- 1580 UMHOS/CM@25 DEG.C.
DILUTED CONDUCTANCE --------- 1790 UMHOS/CM@25 DEG.C.

	MG/L
CALCIUM	80
MAGNESIUM	18
POTASSIUM	15
SODIUM	216
CARBONATE	0
BICARBONATE	279
SULFATE	154
CHLORIDE	261
SILICA	51
TOTAL DISSOLVED SOLIDS (180 DEG.C.)	955
TOTAL ALKALINITY AS CALCIUM CARBONATE	229
AMMONIA NITROGEN	<0.01
NITRATE NITROGEN	0.05
FLUORIDE	0.19
MOLYBDENUM	0.02
URANIUM	0.001

				RANGE
GROSS ALPHA	0 +/- 6 PCI/L	ION BALANCE	1.007	(0.96 TO 1.04)
GROSS BETA	19 +/- 6 PCI/L	TDS CHECK	1.022	(0.90 TO 1.10)
RADIUM 226	0 +/- 1 PCI/L	EC CHECK	1.018	(0.95 TO 1.05)

LAB. NO. M18-5244

RESPECTFULLY SUBMITTED,

Carl Crownover

CARL F. CROWNOVER

1214 049

b. Major Regional Wells

Water supply wells for the communities of Hebbronville and Bruni are the only major regional wells within 10 miles of the proposed permit area. Table 7 b-1. summarizes available information pertinent to them.

TABLE 7 b-1 MUNICIPAL WATER SUPPLY WELLS

WELL #	LOCATION	OWNER	ADDRESS	DATE DRILLED	DEPTH	PRODUCING AQUIFER	CASING	PRODUCTION RATE (GPH)	REMARKS
H-1	601 N. Cedar St. Hebbronville, Tex.	JIM HOGG Water Control & Improvement Dist. No. 2	Same as Well Location	1969	1100'	Catahoula	Steel	380	Primary water supply for H bronville
H-2	Draper Street Hebbronville, Tex.	Same as above	Same as above	1936	1380'	Catahoula	Steel	600	Standby well for H-1 Produced intermittantly
H-3	Welhelma Street	Same as above	Same as above	1942	900'	Catahoula	Steel	250	Standby well for H 1
B-1	Bruni, Texas	Bruni Water Works	*William Clayton General Del. Bruni, Tx. 78344	*	385'	Catahoula	Steel	65	Primary water supply for Bruni, Texas
B-2	Bruni, Texas	Same as above	Same as above	*	365'	Catahoula	Steel	*	Standby well for B-1

* Data not available

1214 051

CHAPTER 8.

PERMIT AREA WATER QUALITY

a. Water Quality

Water quality within the permit area is not significantly different from that of the surrounding water supply wells (Chapter 7.). As was the case in the latter, water within the permit area has NaCl as its major constituent and Ca-HCO_3 as a minor facies. Total dissolved solid concentration isopleths trend northwest - southeast and decrease in value to the northeast. At the oxidation/reduction interface there is an anomalous high, which parallels the overall trend (Fig. 8-1) The spatial relationship and distribution with respect to the geochemical roll front could be possibly explained by an alteration of formation geochemistry after initial roll front emplacement, i.e. the roll front is undergoing re-oxidation.

The quality of water is relative to its use, or potential use. Within the permit area vicinity groundwater is used for domestic, livestock and irrigation purposes. *In situ* mining and boiler feed water represent two forseeable potential uses. Water quality within the permit area is only of acceptable quality for livestock and *in situ* leach.

Water quality within the permit area exceeds drinking water standards for total dissolved solids, sodium, and chloride (See T.D.W.R. 0296, Appendix 8-1). The degree of excess varied from 50 to 200%. In addition, 52% of all wells sampled from the production zone had Ra 226 values in excess of existing drinking water standards (5 pCi/l). Ra 226 concentrations varied from 2 pCi/l to 252 pCi/l and averaged 50 pCi/l with a standard deviation of 76 pCi/l.

Irrigation water quality is determined by the sodium absorption ratio (S.A.R.) and total salt concentration. S.A.R's for permit area groundwater samples ranged from 16.2 to 22.6 for the production zone and averaged 18.8. Conductivity, as a measure of salinity, averaged 3232 in the production zone. The non-production zone had a 16.6 S.A.R. average and a 2860 micromho conductivity average. Based on criteria established by the United States Salinity Laboratory Staff, the groundwater in both zones have a very high sodium (alkali) hazard and would be considered unacceptable for irrigation waters.

Livestock watering is the only existing groundwater use for which production zone and non-production zone waters are suited.

Forseeable non-mining industrial use of groundwater from the permit area would be as boiler feed water in the petrochemical industry. Waters from the production zone exceed acceptable levels of bicarbonate (0-50 mg/l) for all boiler pressures and TDS for any boiler operating above 250 p.s.i. To use native permit area waters for boiler feed would require extensive pretreatment.

In situ leach water quality requirements are not exceeded by existing conditions. However, water quality does affect monitoring. Predetermined excursion levels control operational activity. Therefore, if those numbers are not chosen with consideration for groundwater variability, levels could be established that would be unrealistically restrictive.

Present regulatory practice for establishing upper limits is to determine the highest analytical level for a subject parameter and add to it an increment to account for laboratory error. Conceptually this means that water quality is static and the highest observed value is the highest value that will ever be encountered. Since well location and spacing is controlled by operational and/or regulatory requirements and groundwater is infinitely variable the inverse of the above is true, i.e. the highest observed value is never the highest value to be encountered.

However, statistical evaluation of groundwater can aid in the prediction of groundwater quality. If the sampling net is evenly distributed, then the analytical results of the subject population, which in this case is the groundwater quality spectrum could be used to predict groundwater variability. The mean should be the "type" for the community and the mean plus the third standard deviation should detail the upper limit under which 99.49% of the population should exist, and the skewness of this mean should indicate the degree of bias within the sampling net.

URI has used this technique to evaluate Mine Area and Production Area Wells, (Tables 8 a-1 & 2 respectively). Since the geographical confinement of these wells would bias the data, a third evaluation was made using all wells completed in the production zone, (Table 8-3). The production zone statistical evaluation yielded hypothetical type and maximum concentrations which display chemically balanced concentration

(Fig. 8 a-6 and 7). Furth· more, when the hypothetical wells were checked against conductance and TDS formulas derived independently by linear regression of well data; type and maximum wells achieved 99% accuracy. The formulas are:

$$TDS = 0.57\ (Ec) - 21.9 \qquad (1$$

$$TDS = 0.48\ [Ec(dil)] + 86.3 \qquad (2 \text{ and}$$

$$Ec = 0.84\ [Ec(dil)] + 204.5 \qquad (3$$

and have a degree of fitness of 0.994.

Based on the above, URI proposes that the hypothet. al maximum well be considered the well from which upper limits are set.

1214 056

TABLE B a-1 GROUNDWATER STATISTICAL SUMMARY - MINE AREA MONITOR WELLS

Parameter	A	G	H	Hi	Lo	Σ 1	Σ 2	Σ 3	Kurtosis	Skewness	Max. Pred.
Ca mg/l	54.5	52.5	50.0	77	25	14.1	28.1	42.2	3.01	-0.66	96.7
Mg	12.4	11.8	11.2	20	6.9	3.9	7.8	11.7	2.43	0.17	24.1
Na	566.9	564.6	562.4	647	496	53.6	107.2	160.8	1.79	0.43	727.7
K	20.2	19.6	19.0	33	12.	5.4	10.8	16.2	3.77	0.80	36.4
CO_3	0	0	0	0	0	0	-	-	-	-	0
HCO_3	239.6	238.3	237	287	203	26.1	52.2	78.4	2.02	0.33	318
SO_4	154.9	150.4	145.8	213	97	38.8	77.7	116.5	1.89	0.15	271.4
Cl	762.8	756.3	749.7	932	643	104.2	208.4	312.6	1.89	0.05	1075.4
NO_3-N	0.82	0.09	0.02	3.5	<0.01	1.23	2.47	3.7	2.80	1.12	4.52
Fl	0.56	0.56	0.56	0.64	0.48	0.06	0.12	0.17	1.65	0.14	0.73
SiO_2	36	36	36	43	28	4.2	8.5	12.7	2.52	-0.37	48.7
pH	8.16	8.16	8.16	8.30	8.05	0.08	0.16	0.24	1.83	0.13	8.4
TDS	1780.8	1769.8	1758.8	2090	1450	206.7	413.5	620.3	1.99	0.11	2401
Ec	3146.6	3127.8	3108.9	3720	2570	359.7	719.5	1079.1	2.00	0.10	4225.7
Ec Dil	3497.4	3473.0	3448.7	4192	2831	431.4	862.9	1294.3	1.95	0.13	4791.7
Alk	196.2	195.2	194.1	235	166	21.5	43.0	64.5	2.01	0.32	260.7
As	0.0180	0.0170	0.0159	0.033	0.008	0.0063	0.0127	0.0190	4.01	0.71	0.037
Ba	0.040	0.039	0.038	0.05	0.03	0.009	0.017	0.026	1.50	0.00	0.066
Cd	0.0001	0.0001	0.0001	0.0003	<0.0001	0.00008	0.00016	0.00024	4.18	1.78	0.00034
Cr	0.0017	0.0016	0.0014	0.003	<0.001	0.0008	0.0015	0.0023	1.97	0.39	0.004
Cu	0.0059	0.0058	0.0057	0.008	0.005	0.0012	0.0023	0.0035	2.33	0.89	0.0094
Fe	0.031	0.030	0.029	0.05	0.02	0.009	0.018	0.027	2.87	0.62	0.058
Pb	0.0016	0.0012	0.0010	0.006	<0.001	0.0016	0.0033	0.0049	5.56	2.04	0.0065
Mn	0.012	0.011	0.011	0.02	0.01	0.004	0.008	0.012	4.20	1.79	0.024
Hg	0.00015	0.00014	0.00013	0.0003	0.0001	0.00007	0.00013	0.00020	2.76	0.93	0.00035
Mo	0.028	0.027	0.027	0.04	0.02	0.007	0.014	0.021	2.11	0.23	0.049
Ni	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	<0.01
Se	0.0010	0.0010	0.0010	0.002	<0.001	0.0003	0.0006	0.0009	9.79	2.93	0.0019
Ag	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	0.01
U	0.0466	0.0194	0.0074	0.228	0.002	0.0627	0.1255	0.1882	7.04	2.15	0.2348
V	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	<0.01
Zn	0.0120	0.0116	0.0112	0.019	0.008	0.0032	0.0064	0.0096	2.93	0.56	0.0216
Bo	1.44	1.44	1.44	1.5	1.3	0.07	0.13	0.20	2.42	0.64	1.57
NH_4-N	0.010	0.010	0.010	0.02	<0.01	0.003	0.006	0.009	9.62	2.88	0.019
Ra 226	25.6	7.0	3.9	172	2	51.1	102.2	153.2	6.85	2.28	178.8

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. ______ Sample No. ______

Production Area No. ______

Submitted By ______ Date Collected: ______ ; By ______

Company ______ Mine ______

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
					Spec. Cond. at Well:		µmhos
1					Normal Water Level:		msl
2					Pump: Set at	msl.	gpm.
3					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.

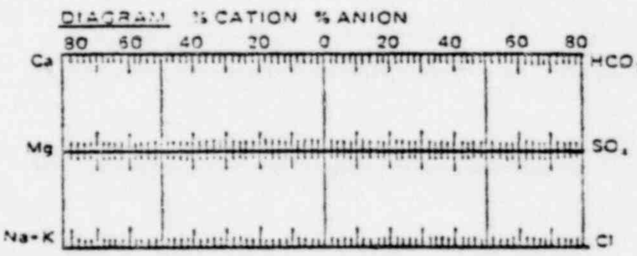
ANALYSIS: Lab Name ______ Date Received ______ Date Reported ______

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	54.5	= 20.04 x	2.72	x 52.0 =	141.42	9
B.	Magnesium (Mg)	00925	12.4	= 12.16 x	1.02	x 46.6 =	47.42	4
C.	Sodium (Na)	00929	566.9	= 22.99 x	24.66	x 48.9 =	1205.80	85
D.	Potassium (K)	00937	20.2	= 39.10 x	0.52	x 72.0 =	37.20	2
E.			Total Cation	....	28.91			
F.	Carbonate (CO_3)	00445	0.0	= 30.00 x	0.00	x 84.6 =	0.00	0.
G.	Bicarbonate (HCO_3)	00440	239.6	= 61.02 x	3.93	x 43.6 =	171.20	14
H.	Sulfate (SO_4)	00945	154.9	= 48.03 x	3.23	x 73.9 =	238.33	11
I.	Chloride (Cl)	00940	762.8	= 35.45 x	21.52	x 75.9 =	1633.19	75
J.	Nitrate (NO_3-N)	71851	0.82			Total	3474.66	*T (1) page 35
K.	Fluoride (F)	00951	0.56					
L.	Silica (SiO_2)	00955	36		28.67			
M.			Total Anion	...				
N.	Total Ion	....	1848.68					
P.	TDS (180 °C)	70300	1780.8					
Q.	TDS = N - .5G	=	1728.88					
R.	Ec (25 °C)	00095	3146.6					
S.	Ec (Dilute) = ____ x ____	=	3497.4	µmhos				
U.	Alk. as $CaCO_3$	00410	196.2	µmhos				
V.	pH	00403	8.16					

Accuracy Check

		Range
Ion (E:M)	1.01	.96 to 1.04
TDS (P:Q)	1.03	.90 to 1.10
Ec (S:T)	1.01	.95 to 1.05



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.0180	* Manganese (Mn)	0.012	* Vanadium (V)	< 0.01
* Barium (Ba)	0.040	* Mercury (Hg)	0.0015	* Zinc (Zn)	0.0120
* Cadmium (Cd)	0.0001	* Moly. (Mo)	0.028	Boron (B)	1.44
* Chrom. (Cr)	0.0017	* Nickel (Ni)	< 0.01	Ammonia-N	0.010
* Copper (Cu)	0.0059	* Selenium (Se)	0.0010	Radium 226	25.6 (pci/1)
* Iron (Fe)	0.031	* Silver (Ag)	< 0.01		
* Lead (Pb)	0.0016	* Uranium (U)	0.0466		

Analyst ______ Checked By ______

Remarks

Fig. 8 a-2 Mine Area Groundwater Quality - Mean Concentration

1214 057

Texas Department of Water Resources—Geological Services

Permit No. ____________

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. ____________ Sample No. ______

Production Area No. ____________

Submitted By ____________ Date Collected: ________ ; By ____________

Company ____________ Mine ____________

SAMPLE METHODS: Calibrate Ec Meter (1) Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
					Spec. Cond. at Well:		μmhos
1					Normal Water Level:		msl
2					Pump: Set at	msl.	gpm.
3					Bottom of: Casing	msl; screen	msl.

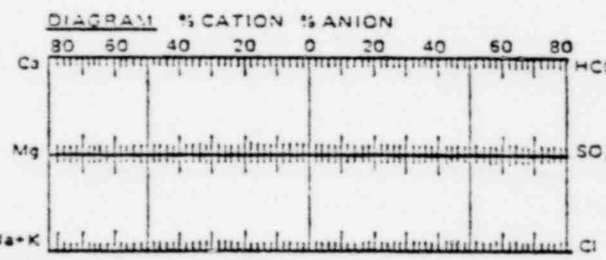
CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name ____________ Date Received ________ Date Reported ________

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	96.7	= 20.04 x	4.83	x 52.0 =	250.92	12
B.	Magnesium (Mg)	00925	24.1	= 12.16 x	1.98	x 46.6 =	92.36	5
C.	Sodium (Na)	00929	727.7	= 22.99 x	31.65	x 48.9 =	1547.83	80
D.	Potassium (K)	00937	36.4	= 39.10 x	0.93	x 72.0 =	67.03	2
E.			Total Cation	....	39.39			
F.	Carbonate (CO_3)	00445	0	= 30.00 x	0.00	x 84.6 =	0.00	0
G.	Bicarbonate (HCO_3)	00440	318	= 61.02 x	5.21	x 43.6 =	227.22	13
H.	Sulfate (SO_4)	00945	271.4	= 48.03 x	5.65	x 73.9 =	417.58	14
I.	Chloride (Cl)	00940	1075.4	= 35.45 x	30.34	x 75.9 =	2302.48	74
J.	Nitrate (NO_3-N)	71851	4.52			Total	4905.41	*T. (1) page 35
K.	Fluoride (F)	00951	0.73					
L.	Silica (SiO_2)	00955	48.7					
M.			Total Anion	...	41.20			
N.	Total Ion	....	2603.65					
P.	TDS (180 °C)	70300	2401					
Q.	TDS = N - .5G	=	244.65					
R.	Ec (25 °C)	00095	4225.7					
S.	Ec (Dilute) = ____ x ____	=	4791.7	μmhos				
U.	Alk. as $CaCO_3$	00410	260.7	μmhos				
V.	pH	00403	8.4					

Accuracy Check

		Range
Ion (E:M)	0.96	.96 to 1.04
TDS (P:Q)	0.98	.90 to 1.10
Ec (S:T)	0.98	.95 to 1.05



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.037	* Manganese (Mn)	0.024	* Vanadium (V)	< 0.01
* Barium (Ba)	0.066	* Mercury (Hg)	0.00035	* Zinc (Zn)	0.0216
* Cadmium (Cd)	0.00034	* Moly. (Mo)	0.049	Boron (B)	1.57
* Chrom. (Cr)	0.004	* Nickel (Ni)	< 0.01	Ammonia-N	0.019
* Copper (Cu)	0.0094	* Selenium (Se)	0.0019	Radium 226	178.8 (pci/1)
* Iron (Fe)	0.058	* Silver (Ag)	< 0.01		
* Lead (Pb)	0.0065	* Uranium (U)	0.2348		

Analyst ____________ Checked By ____________

Remarks

Fig.8 a-3 Mine Area Groundwater Quality - Maximum Concentrations

1211 050

TABLE 8 a-2 GROUNDWATER STATISTICS - PRODUCTION AREA

PARAMETER	A	G	H	Hi	Lo	$\Sigma 1$	$\Sigma 2$	$\Sigma 3$	Kurtosis	Skewness	Max. Pred.
Ca	51.3	51.1	50.9	58	44	5.0	9.9	14.9	2.04	-0.15	66.2
Mg	15.5	15.4	15.2	17	12	2.1	4.1	6.2	2.20	-0.88	21.7
Na	619.6	619.3	618.9	649	585	23.9	47.9	71.8	1.87	-0.07	667.5
K	18.2	18.1	18.0	21	16	1.7	3.4	5.2	2.42	0.49	23.4
CO_3	2.3	0	2.4	5	0	1.9	3.7	5.6	1.82	0.29	7.9
HCO_3	206.8	206.6	206.4	224	194	10.3	20.6	30.9	2.51	0.49	237.7
SO_4	182.5	181.7	181.0	207	161	18.4	36.8	55.2	1.58	0.16	237.7
Cl	854.5	854.1	853.8	880	902	26.8	53.7	80.5	3.71	-1.43	935.0
NO_3	0.057	0.042	0.029	0.12	0.01	0.040	0.081	0.121	2.08	0.39	0.178
Fl	0.512	0.511	0.510	0.56	.49	0.028	0.056	0.084	2.43	0.85	0.596
SiO_2	30.2	30.1	30.1	32	27	1.7	3.4	5.2	3.08	-1.05	35.4
TDS	1928.3	1927.5	1926.7	2000	1820	59.8	119.6	179.4	3.09	-0.90	2107.7
Ec	3403.3	3402.2	3401.1	3510	3250	95.0	190.0	285	2.12	-0.66	3688.3
Ec (dil)	3756.0	3754.1	3752.2	3912	3530	129.7	259.4	389.2	2.75	-0.74	4145.2
Alkas $CaCO_3$	173.5	173.4	173.3	184	163	6.8	13.7	20.5	2.68	0.00	194.0
pH	8.29	8.29	8.28	8.55	7.63	0.33	0.66	1.00	3.87	-1.59	9.29
As	0.023	0.023	0.023	0.027	0.021	0.002	0.004	0.007	3.44	1.37	0.030
Ba	0.04	0.04	0.04	0.08	0.03	0.02	0.05	0.07	1.66	0.76	0.11
Cd	0.0001	0.0001	0.0001	0.0002	<0.0001	0.0001	0.0001	0.0002	1.50	0.69	0.0003
Cr	0.002	0.002	0.002	0.003	0.001	0.001	0.002	0.002	2.11	0.23	0.004
Cu	0.006	0.006	0.006	0.008	0.005	0.001	0.003	0.004	1.88	0.65	0.010
Fe	0.04	0.03	0.02	0.08	0.01	0.03	0.05	0.08	1.94	0.48	0.12
Pb	0.003	0.002	0.001	0.012	0.001	0.004	0.009	0.013	3.94	1.66	0.016
Mn	0.02	0.02	0.01	0.03	0.01	0.01	0.01	0.02	2.04	0.63	0.04
Hg	0.0003	0.0002	0.0002	0.0006	<0.0001	0.0002	0.0004	0.0006	1.65	0.19	0.0009
Mo	0.02	0.02	0.02	0.03	0.02	0.01	0.01	0.01	1.00	0.00	0.04
Ni	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	<0.01
Se	0.002	0.001	0.001	0.005	<0.001	0.002	0.003	0.005	2.58	1.10	0.007
Ag	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	<0.01
U	0.010	0.008	0.00.	0.026	0.003	0.009	0.0017	0.0026	2.88	1.13	0.036
V	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	1.00	0.00	0.01
Zn	0.023	0.019	0.016	0.047	0.009	0.015	0.030	0.045	2.03	0.64	0.068
Bo	1.4	1.4	1.4	1.5	1.3	0.1	0.2	0.2	2.11	-0.23	1.6
NH_4 N	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	1.50	0.71	0.01
Ra 226	97	48	22	252	7	98	197	295	1.86	0.52	392

1214 059

Texas Department of Water Resources—Geological Services

Permit No. ______________________

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. ____________ Sample No. ________

Production Area No. ______________________

Submitted By ______________________________________ Date Collected: ____________ ; By ______________________

Company ______________________________________ Mine ______________________

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71, Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
					Spec. Cond. at Well:		µmhos
1					Normal Water Level:		msl
2					Pump: Set at	msl.	gpm.
3					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name ______________________________ Date Received ____________ Date Reported ____________

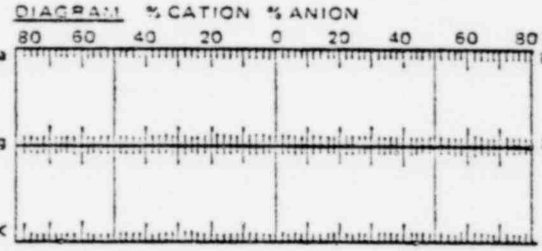
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	51.3	= 20.04 x	2.56	x 52.0 =	133.11	8
B.	Magnesium (Mg)	00925	15.5	= 12.16 x	1.27	x 46.6 =	59.40	4
C.	Sodium (Na)	00929	619.6	= 22.99 x	26.95	x 48.9 =	1317.90	86
D.	Potassium (K)	00937	18.2	= 39.10 x	0.47	x 72.0 =	33.51	1
E.			Total Cation	....	31.25			
F.	Carbonate (CO_3)	00445	2.3	= 30.00 x	0.08	x 84.6 =	6.49	0
G.	Bicarbonate (HCO_3)	00440	206.8	= 61.02 x	3.39	x 43.6 =	147.76	11
H.	Sulfate (SO_4)	00945	182.5	= 48.03 x	3.80	x 73.9 =	280.80	12
I.	Chloride (Cl)	00940	854.5	= 35.45 x	24.10	x 75.9 =	1829.52	77
J.	Nitrate (NO_3-N)	71851	0.057			Total	3808.49	= T .(1) page 35
K.	Fluoride (F)	00951	0.512					
L.	Silica (SiO_2)	00955	30.2					
M.			Total Anion	...	31.37			
N.	Total Ion	....	1981.47					
P.	TDS (180 °C)	70300	1929.3					
Q.	TDS = N - .5G	=	1878.07					
R.	Ec (25 °C)	00095	3403.3					
S.	Ec (Dilute) = ____ x ____	=	3756.0	µmhos				
U.	Alk. as $CaCO_3$	00410	173.5	µmhos				
V.	pH	00403	8.29					

Accuracy Check

		Range
Ion (E:M)	1.00	.96 to 1.04
TDS (P:Q)	1.03	.90 to 1.10
Ec (S:T)	0.99	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.023	* Manganese (Mn)	0.02	* Vanadium (V)	0.01
* Barium (Ba)	0.04	* Mercury (Hg)	0.0003	* Zinc (Zn)	0.023
* Cadmium (Cd)	0.001	* Moly. (Mo)	0.02	Boron (B)	1.4
* Chrom. (Cr)	0.002	* Nickel (Ni)	< 0.01	Ammonia-N	0.01
* Copper (Cu)	0.006	* Selenium (Se)	0.002	Radium 226	97 (pci/1)
* Iron (Fe)	0.04	* Silver (Ag)	< 0.01		
* Lead (Pb)	0.003	* Uranium (U)	0.010		

Analyst ______________________ Checked By ______________________

Remarks

Fig. 8 a-4 Production Area Groundwater Quality - Mean Concentration

1214 060

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ____________

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. ____________ Sample No. ______

Production Area No. ____________

Submitted By ____________ Date Collected: ______ ; By ____________

Company ____________ Mine ____________

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
					Spec. Cond. at Well:		μmhos
1					Normal Water Level:		msl
2					Pump: Set at	msl.	gpm.
3					Bottom of: Casing	msl; screen	msl.

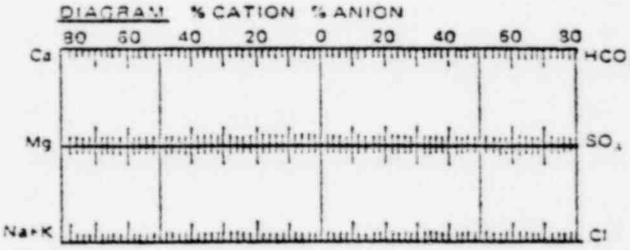
CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name ____________ Date Received ______ Date Reported ______

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	66.2	= 20.04 x	3.30	x 52.0 =	171.78	10
B.	Magnesium (Mg)	00925	21.7	= 12.16 x	1.78	x 46.6 =	83.16	5
C.	Sodium (Na)	00929	667.5	= 22.99 x	29.03	x 48.9 =	1419.78	84
D.	Potassium (K)	00937	23.4	= 39.10 x	0.60	x 72.0 =	43.09	2
E.			Total Cation	....	34.72			
F.	Carbonate (CO_3)	00445	7.9	= 30.00 x	0.26	x 84.6 =	22.28	1
G.	Bicarbonate (HCO_3)	00440	237.7	= 61.02 x	3.90	x 43.6 =	169.84	11
H.	Sulfate (SO_4)	00945	237.7	= 48.03 x	4.95	x 73.9 =	365.73	14
I.	Chloride (Cl)	00940	935.0	= 35.45 x	26.38	x 75.9 =	2001.88	74
J.	Nitrate (NO_3-N)	71851	0.178			Total	4277.53	*T (1) page 35
K.	Fluoride (F)	00951	~~0.596~~					
L.	Silica (SiO_2)	00955	35.4					
M.			Total Anion	...	35.48			
N.	Total Ion	....	2233.27					
P.	TDS (180 °C)	70300	2107.7					
Q.	TDS = N - .5G	=	2114.42					
R.	Ec (25 °C)	00095	3688.3					
S.	Ec (Dilute) = ___ x ___	=	4145.2	μmhos				
U.	Alk. as $CaCO_3$	00410	194	μmhos				
V.	pH	00403	9.29					

Accuracy Check

		Range
Ion (E:M)	0.98	.96 to 1.04
TDS (P:Q)	1.00	.90 to 1.10
Ec (S:T)	0.97	.95 to 1.05



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.30	* Manganese (Mn)	0.04	* Vanadium (V)	0.01
* Barium (Ba)	0.11	* Mercury (Hg)	0.0009	* Zinc (Zn)	0.068
* Cadmium (Cd)	0.0003	* Moly. (Mo)	0.04	Boron (B)	1.6
* Chrom. (Cr)	0.004	* Nickel (Ni)	0.01	Ammonia-N	0.01
* Copper (Cu)	0.010	* Selenium (Se)	0.007	Radium 226	392 (pci/1)
* Iron (Fe)	0.12	* Silver (Ag)	< 0.01		
* Lead (Pb)	0.016	* Uranium (U)	0.036		

Analyst ____________ Checked By ____________

Remarks

1214 061

Fig. 8 a-5 Production Area Groundwater Quality - Maximum Concentration

TDWR-0177

TABLE 8 a-3 GROUNDWATER STATISTICS - PRODUCTION ZONE

PARAMETER	A	G	H	Hi	Lo	$\Sigma 1$	$\Sigma 2$	$\Sigma 3$	Kurtosis	Skewness	Max.Pred.
Ca	53.4	52.0	50.3	77	25	11.7	23.5	35.2	3.72	-0.50	88.6
Mg	13.4	12.9	12.3	20	6.9	3.6	7.3	10.9	2.38	-0.34	24.3
Na	584.5	582.3	580.1	649	496	51.8	103.6	155.4	1.66	-0.21	739.9
K	19.6	19.1	18.7	33	12	4.6	9.1	13.7	5.36	1.23	33.3
CO_3	0.77	0	7.34	5	0	1.5	3.0	4.5	5.11	1.84	5.27
HCO_3	228.7	227.2	225.9	287	194	26.9	53.9	81.8	2.43	0.71	309.8
SO_4	164.1	160.2	155.9	213	97	35.4	70.9	106.3	2.12	-0.31	270.4
Cl	793.4	787.6	781.4	932	643	96.0	192.0	288.0	2.19	-0.60	1081.4
NO_3	0.566	0.068	0.020	3.5	0.01	1.060	2.120	3.181	4.71	1.76	3.747
Fl	0.547	0.544	0.542	0.64	0.48	0.055	0.110	0.165	2.07	0.61	0.712
SiO_2	34.3	34.0	33.7	43	27	4.6	9.3	13.9	1.99	0.24	48.2
TDS	1830.0	1820.9	1811.4	2090	1450	183.9	367.9	551.8	2.34	0.49	[illegible]81.8
Ec	3232.2	3216.7	3200.6	3720	2570	319.2	638.4	957.6	2.37	-0.51	4189.8
Ec (dil)	3583.6	3564.3	3544.3	4192	2831	375.7	751.3	1127.0	2.35	-0.41	4713.3
Alkas $CaCO_3$	188.7	187.6	186.6	235	163	20.8	41.7	62.5	2.56	0.82	251.2
pH	8.20	8.20	8.20	8.55	7.63	0.20	0.40	0.60	4.94	-0.94	8.90
As	0.020	0.019	0.018	0.033	0.008	0.006	0.011	0.017	3.70	0.10	0.037
Ba	0.04	0.04	0.04	0.08	0.03	0.01	0.03	0.04	4.01	1.32	0.08
Cd	0.0001	0.0001	0.0001	0.0003	<0.0001	0.0001	0.0001	0.0002	4.35	1.71	0.0003
Cr	0.002	0.002	0.001	0.003	<0.001	0.001	0.001	0.002	2.00	0.33	0.004
Cu	0.006	0.006	0.006	0.008	0.005	0.001	0.002	0.003	2.16	0.80	0.009
Fe	0.03	0.0[illegible]	0.03	0.08	0.01	0.02	0.03	0.05	4.62	1.24	0.08
Pb	0.002	0.001	0.001	0.012	<0.001	0.003	0.006	0.009	9.44	2.68	0.011
Mn	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.02	4.33	[illegible]	0.03
Hg	0.0002	0.0002	0.0001	0.0006	<0.0001	0.0001	0.0003	0.0004	4.32	[illegible]	0.0006
Mo	0.03	0.03	0.03	0.04	0.02	0.01	0.01	0.02	2.27	0.3[illegible]	0.05
Ni	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	<0.01
Se	0.001	0.001	0.001	0.005	<0.001	0.001	0.002	0.003	9.29	2.70	0.004
Ag	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	<0.01
U	0.034	0.014	0.007	0.228	0.002	0.054	0.107	0.161	10.60	2.77	0.195
V	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	4.20	1.79	0.01
Zn	0.016	0.014	0.012	0.047	0.008	0.010	0.020	0.030	6.75	2.10	0.046
Bo	1.4	1.4	1.4	1.5	1.3	0.1	0.1	0.2	2.25	-0.50	1.6
NH_4 N	0.01	0.01	0.01	0.01	<0.01	<0.01	0.01	0.01	14.96	3.66	0.02
Ra 226	50	13	5	252	2	76	152	227	4.00	1.50	257

1214 062

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. ______ Sample No. ______

Production Area No. ______

Submitted By ______ Date Collected: ______ ; By ______

Company ______ Mine ______

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71, Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (μmhos)			
					Spec. Cond. at Well:		μmhos
1					Normal Water Level:		msl
2					Pump: Set at	msl.	gpm.
3					Bottom of: Casing	msl; screen	msl.

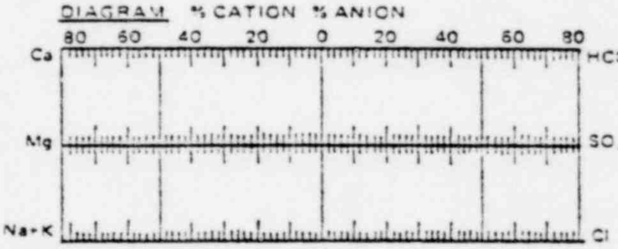
CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name ______ Date Received ______ Date Reported ______

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	53.4	= 20.04 x	2.66	x 52.0 =	138.56	9
B.	Magnesium (Mg)	00925	13.4	= 12.16 x	1.10	x 46.6 =	51.36	4
C.	Sodium (Na)	00929	584.5	= 22.99 x	25.42	x 48.9 =	1243.24	86
D.	Potassium (K)	00937	19.6	= 39.10 x	0.50	x 72.0 =	36.09	2
E.			Total Cation	....	29.68			
F.	Carbonate (CO_3)	00445	0.77	= 30.00 x	0.03	x 84.6 =	2.17	0
G.	Bicarbonate (HCO_3)	00440	228.7	= 61.02 x	3.75	x 43.6 =	163.41	13
H.	Sulfate (SO_4)	00945	164.1	= 48.03 x	3.42	x 73.9 =	252.49	12
I.	Chloride (Cl)	00940	793.4	= 35.45 x	22.38	x 75.9 =	1698.70	76
J.	Nitrate (NO_3-N)	71851	0.566			Total	3586.02	=T (1) page 35
K.	Fluoride (F)	00951	0.547					
L.	Silica (SiO_2)	00955	34.3					
M.			Total Anion	....	29.57			
N.	Total Ion	....	1893.28					
P.	TDS (180 °C)	70300	1830					
Q.	TDS = N - .56	=	1778.93					
R.	Ec (25 °C)	00095	3232.2					
S.	Ec (Dilute) = ___ x ___	=	3583.6	μmhos				
U.	Alk. as $CaCO_3$	00410	188.7	μmhos				
V.	pH	00403	8.20					

Accuracy Check

		Range
Ion (E:M)	1.00	.96 to 1.04
TDS (P:Q)	1.03	.90 to 1.10
Ec (S:T)	1.00	.95 to 1.05



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.020	* Manganese (Mn)	0.01	* Vanadium (V)	0.01
* Barium (Ba)	0.04	* Mercury (Hg)	0.0002	* Zinc (Zn)	0.016
* Cadmium (Cd)	0.0001	* Moly. (Mo)	0.03	Boron (B)	1.4
* Chrom. (Cr)	0.002	* Nickel (Ni)	< 0.01	Ammonia-N	0.01
* Copper (Cu)	0.006	* Selenium (Se)	0.001	Radium 226	50 (pci/1)
* Iron (Fe)	0.03	* Silver (Ag)	< 0.01		
* Lead (Pb)	0.002	* Uranium (U)	0.034		

Analyst ______ Checked By ______

Remarks

Fig. 8 a-6 Production Zone Groundwater Quality - Mean Concentrations

Texas Department of Water Resources—Geological Services

Permit No. ____________

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. ____________ Sample No. ________

Production Area No. ____________

Submitted By ____________ Date Collected: ________ ; By ____________

Company ____________ Mine ____________

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71, Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)	Spec. Cond. at Well:		µmhos
1					Normal Water Level:		msl
2					Pump: Set at	msl.	gpm.
3					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name ____________ Date Received ________ Date Reported ________

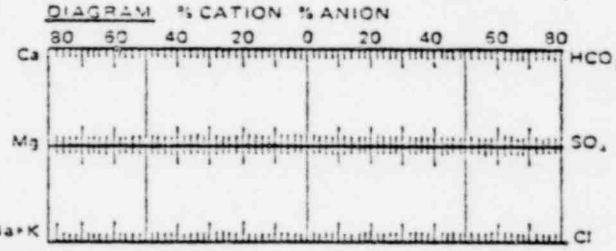
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	88.6	= 20.04 x	4.42	x 52.0 =	229.90	11
B.	Magnesium (Mg)	00925	24.3	= 12.16 x	2.00	x 46.6 =	93.12	5
C.	Sodium (Na)	00929	739.9	= 22.99 x	32.18	x 48.9 =	1573.78	82
D.	Potassium (K)	00937	33.3	= 39.10 x	0.85	x 72.0 =	61.32	2
E.			Total Cation	....	39.45			
F.	Carbonate (CO_3)	00445	5.27	= 30.00 x	0.18	x 84.6 =	14.86	0
G.	Bicarbonate (HCO_3)	00440	309.8	= 61.02 x	5.08	x 43.6 =	221.36	12
H.	Sulfate (SO_4)	00945	270.4	= 48.03 x	5.63	x 73.9 =	416.04	14
I.	Chloride (Cl)	00940	1081.4	= 35.45 x	30.50	x 75.9 =	2315.32	74
J.	Nitrate (NO_3-N)	71851	3.747			Total	4925.71	=T (1) page 35
K.	Fluoride (F)	00951	0.712					
L.	Silica (SiO_2)	00955	48.2					
M.			Total Anion	...	41.39			
N.	Total Ion	....	2605.63					
P.	TDS (180 °C)	70300	2381.8					
Q.	TDS = N - .5G	=	2450.73					
R.	Ec (25 °C)	00095	4189.8					
S.	Ec (Dilute) = ____ x ____	=	4713.3	µmhos				
U.	Alk. as $CaCO_3$	00410	251.2	µmhos				
V.	pH	00403	8.90					

Accuracy Check

		Range
Ion (E:M)	0.95	.96 to 1.04
TDS (P:Q)	0.97	.90 to 1.10
Ec (S:T)	0.96	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.037	* Manganese (Mn)	0.03	* Vanadium (V)	0.01
* Barium (Ba)	0.08	* Mercury (Hg)	0.0006	* Zinc (Zn)	0.046
* Cadmium (Cd)	0.0003	* Moly. (Mo)	0.05	Boron (B)	1.6
* Chrom. (Cr)	0.004	* Nickel (Ni)	< 0.01	Ammonia-N	0.02
* Copper (Cu)	0.009	* Selenium (Se)	0.004	Radium 226	257 (pci/l)
* Iron (Fe)	0.08	* Silver (Ag)	< 0.01		
* Lead (Pb)	0.11	* Uranium (U)	0.195		

Analyst ____________ Checked By ____________

Remarks

Fig. 8 a-7 Production Zone Groundwater Quality Maximum Concentration

TDWR-0177

TEXAS DEPARTMENT OF WATER RESOURCES

GRO WATER ANALYSIS REPORT SUMMARY - In Situ Uranium Mini.

Company: URANIUM RESOURCES

Mine Name: LONGORIA

Mine Area: APE II

Date Summarized: ______

This summary is for the: .... (check one)

Production Zone ____

Underlying Non Production Zone ____

Overlying Non Production Zone X

	PARAMETER	UNIT	REF. 7/77	PERMIT AREA Low	PERMIT AREA Average	PERMIT AREA High	MINE AREA Low	MINE AREA Average	MINE AREA High	PRODUCTION AREA Low	PRODUCTION AREA Average	PRODUCTION AREA High	WELL I.D. BY AREA * Permit	WELL I.D. BY AREA * Mine	WELL I.D. BY AREA * Product.
1	Calcium	mg/l	200							46	49.3	55		MS1	
2	Magnesium	mg/l	150							12	13.6	16		MS2	
3	Sodium	mg/l	250							490	509.3	527		MS3	
4	Potassium	mg/l	–							17	18	19			
5	Carbonate	mg/l	–							0	4.3	11			
6	Bicarbonate	mg/l	500							217	229.3	249			
7	Sulfate	mg/l	300							115	131.7	145			
8	Chloride	mg/l	300							656	695	729			
9	Fluoride	mg/l	1.8							0.47	0.50	0.56			
10	Nitrate - N	mg/l	10.0							0.85	1.45	2.10			
11	Silica	mg/l	–							33	33.7	34			
12															
13	pH	Std. unit	6-9							8.21	8.38	8.59			
14	TDS	mg/l	1000							1560	1633.3	1680			
15	Conductivity	μMHOS	–							2750	2860	2950			
16	Alkalinity	Std. Unit	–							186	195.3	204			
17															
18	Arsenic	mg/l	.05							0.014	0.018	0.020			
19	Barium	mg/l	1.0							0.04	0.06	0.07			
20	Boron	mg/l	4.0							1.4	1.4	1.4			
21	Cadmium	mg/l	.010							.0002	.0002	.0003			
22	Chromium	mg/l	0.05							.002	.002	.003			
23	Copper	mg/l	1.0							0.004	0.006	0.010			
24	Iron	mg/l	0.3							<0.01	0.05	0.14			
25	Lead	mg/l	0.05							<0.001	0.002	0.005			
26	Manganese	mg/l	0.05							<0.01	0.04	0.07			
27	Mercury	mg/l	.002							.0002	.0004	.0005			
28	Nickel	mg/l	1.0							<0.01	<0.01	<0.01			
29	Selenium	mg/l	0.01							<0.001	0.001	0.001			
30	Silver	mg/l	0.05							<0.01	<0.01	<0.01			
31	Zinc	mg/l	5.0							.004	.009	.015			
32															
33	Ammonia	mg/l	0.5							<0.01	0.01	0.02			
34	Uranium	mg/l	2.0							0.006	0.047	0.073			
35	Molybdenum	mg/l	1.0							0.02	0.03	0.04			
36	Vanadium	mg/l	5.0							<0.01	0.01	0.02			
37	Radium 226	pci/L	5.0							1	1	2			

* LIST THE IDENTIFICATION NUMBERS OF WELLS USED TO OBTAIN THE LOW, AVERAGE AND HIGH VALUES.

TDWR-0296

1214 065

TEXAS DEPARTMENT OF WATER RESOURCES

GRO[illegible] WATER ANALYSIS REPORT SUMMARY - In Situ Uranium Mi[illegible]

Company: URANIUM RESOURCES [illegible]NC.

Mine Name: LONGORIA

Mine Area: II

Date Summarized: ____

This summary is for the: .... Production Zone X
(check one) Underlying Non Production Zone ____
Overlying Non Production Zone ____

	PARAMETER	UNIT	REF. 7/77	PERMIT AREA			MINE AREA			PRODUCTION AREA			WELL I.D. BY AREA *		
				Low	Average	High	Low	Average	High	Low	Average	High	Permit	Mine	Product.
1	Calcium	mg/l	200				25	54.5	77	44	51.3	58		MW1	228
2	Magnesium	mg/l	150				6.9	12.4	20	12	15.5	17		MW2	232
3	Sodium	mg/l	250				496	566.9	647	585	619.3	649		MW3	235
4	Potassium	mg/l	–				12	20.2	33	16	18.2	21		MW4	236
5	Carbonate	mg/l	–				0	0	0	0	2.3	5		MW5	244
6	Bicarbonate	mg/l	500				203	239.6	287	194	206.8	224		MW6	247
7	Sulfate	mg/l	300				97	154.9	213	161	182.05	207		MW7	
8	Chloride	mg/l	300				643	762.8	932	802	854.5	880		MW8	
9	Fluoride	mg/l	1.8				0.48	0.56	0.64	0.49	0.512	0.56		MW9	
10	Nitrate - N	mg/l	10.0				<0.01	0.82	3.5	0.01	0.057	0.12		MW10	
11	Silica	mg/l	–				28	36	43	27	30.2	32		MW11	
12														MW12	
13	pH	Std. unit	6–9				8.05	8.16	8.30	7.63	8.29	8.55			
14	TDS	mg/l	1000				1450	1780.8	2090	1820	1928.3	2000			
15	Conductivity	µMHOS	–				2570	3146.6	3720	3250	3403.3	3510			
16	Alkalinity	Std. Unit	–				166	196.2	235	163	173.5	184			
17															
18	Arsenic	mg/l	.05				0.008	0.018	0.033	0.021	0.023	0.027			
19	Barium	mg/l	1.0				0.03	0.04	0.05	0.03	0.04	0.08			
20	Boron	mg/l	4.0				1.3	1.4	1.5	1.3	1.4	1.5			
21	Cadmium	mg/l	.010				<.0001	.0001	.0003	<.0001	.0001	.0002			
22	Chromium	mg/l	0.05				<.001	.002	.003	.001	.002	.003			
23	Copper	mg/l	1.0				.005	.006	.008	.0005	.006	.008			
24	Iron	mg/l	0.3				.02	.03	.05	0.01	0.04	0.08			
25	Lead	mg/l	0.05				<.001	0.002	0.006	<0.001	0.003	0.012			
26	Manganese	mg/l	0.05				0.01	0.01	0.02	0.01	0.02	0.03			
27	Mercury	mg/l	.002				0.0001	0.0002	0.0003	<.0001	0.0003	0.0006			
28	Nickel	mg/l	1.0				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			
29	Selenium	mg/l	0.01				<0.001	0.001	0.002	<0.001	0.002	0.005			
30	Silver	mg/l	0.05				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			
31	Zinc	mg/l	5.0				0.008	0.012	0.019	0.009	0.023	0.047			
32															
33	Ammonia	mg/l	0.5				<0.01	0.01	0.02	<0.01	0.01	0.01			
34	Uranium	mg/l	2.0				0.002	0.047	0.228	0.003	0.011	0.026			
35	Molybdenum	mg/l	1.0				0.02	0.03	0.04	0.02	0.025	0.03			
36	Vanadium	mg/l	5.0				<0.01	<0.01	<0.01	<0.01	0.01	0.01			
37	Radium 226	pci/L	5.0				2	26	172	7	97	252			

* LIST THE IDENTIFICATION NUMBERS OF WELLS USED TO OBTAIN THE LOW, AVERAGE AND HIGH VALUES.

TDWR-0296

1214 066

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-1 Sample No. M16-4717

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9-18-78 ; By ARTHUR L. BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	31.50	8.3	3400	Spec. Cond. at Well:	3400	µmhos
2	10/19	30.00	8.25	3200	Normal Water Level:		msl
3	10/10	30.50	8.50	3200	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4°C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9-19-78 Date Reported 10-03-78

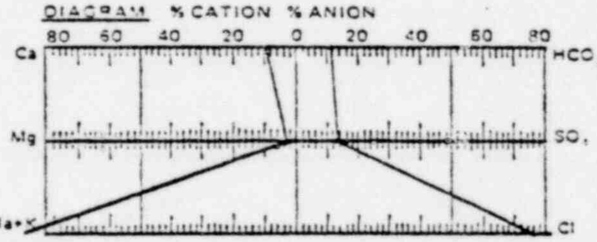
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	62	= 20.04 x	3.09	x 52.0 =	160.68	9.46
B.	Magnesium (Mg)	00925	13	= 12.16 x	1.07	x 46.6 =	49.86	3.28
C.	Sodium (Na)	0092[illegible]	643	= 22.99 x	27.97	x 48.9 =	1367.73	85.61
D.	Potassium (K)	00937	21	= 39.10 x	.54	x 72.0 =	38.88	1.65
E.			Total Cation	....	32.67			
F.	Carbonate (CO_3)	00445	0	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	226	= 61.02 x	3.70	x 43.6 =	161.32	11.41
H.	Sulfate (SO_4)	00945	201	= 48.03 x	4.18	x 73.9 =	308.90	12.89
I.	Chloride (Cl)	00940	870	= 35.45 x	24.54	x 75.9 =	1862.59	75.69
J.	Nitrate (NO_3-N)	71851	< .01			Total	3949.96	*T (1) page 35
K.	Fluoride (F)	00951	.55					
L.	Silica (SiO_2)	00955	35.					
M.			Total Anion	...	32.42			
N.	Total Ion	....	2070.					
P.	TDS (180°C)	70300	2040.					
Q.	TDS = N - .5G	=	1959.					
R.	Ec (25°C)	00095	3540.					
S.	Ec (Dilute) = ___ x ___	=	3972. µmhos					
U.	Alk. as $CaCO_3$	00410	185. µmhos					
V.	pH	00403	8.07					

Accuracy Check

		Range
Ion (E:M)	1.008	.96 to 1.04
TDS (P:Q)	1.042	.90 to 1.10
Ec (S:T)	1.006	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.020	* Manganese (Mn)	.02	* Vanadium (V)	< .01
* Barium (Ba)	0.03	* Mercury (Hg)	.0003	* Zinc (Zn)	.008
* Cadmium (Cd)	<0.0001	* Moly. (Mo)	.03	Boron (B)	1.5
* Chrom. (Cr)	0.002	* Nickel (Ni)	< .01	Ammonia-N	.01
* Copper (Cu)	0.005	* Selenium (Se)	.002	Radium 226	6 +/-2 (pci/l)
* Iron (Fe)	0.03	* Silver (Ag)	< .01		
* Lead (Pb)	< 0.001	* Uranium (U)	.010		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

TDWR 0177

1214 067

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-2 Sample No. M16-4718

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78 ; By ARTHUR BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	31.75	8.2	3100	Spec. Cond. at Well: 3100		µmhos
2	10/9	30	8.35	3000	Normal Water Level:		msl
3	10/10	30.5	8.43	2900	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.

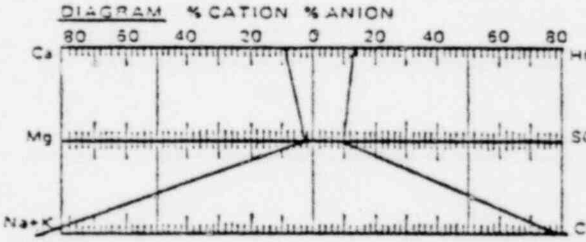
ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/19/78 Date Reported 10/03/78

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Eef (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	50.	÷ 20.04 x	2.50	x 52.0 =	130.00	8.58
B.	Magnesium (Mg)	00925	9.5	÷ 12.16 x	.78	x 46.6 =	36.35	2.68
C.	Sodium (Na)	00929	594.	÷ 22.99 x	25.40	x 48.9 =	1242.06	87.17
D.	Potassium (K)	00937	18.	÷ 39.10 x	.46	x 72.0 =	33.12	1.58
E.			Total Cation	....	29.14			
F.	Carbonate (CO_3)	00445	0.	÷ 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	234.	÷ 61.02 x	3.83	x 43.6 =	166.99	13.37
H.	Sulfate (SO_4)	00945	132.	÷ 48.03 x	2.75	x 73.9 =	203.22	9.60
I.	Chloride (Cl)	00940	782.	÷ 35.45 x	22.06	x 75.3 =	167[illegible].35	77.03
J.	Nitrate (NO_3-N)	71851	< .01			Total	3486.09	= T.(1) page 35
K.	Fluoride (F)	00951	.56					
L.	Silica (SiO_2)	00955	34.					
M.			Total Anion	...	28.64			
N.	Total	....	1844.					
P.	TDS (180 °C)	70300	1780.					
Q.	TDS = N - .5G	=	1727.					
R.	Ec (25 °C)	00095	3160.					
S.	Ec (Dilute) = ___ x ___	=	3490.	µmhos				
U.	Alk. as $CaCO_3$	00410	192.	µmhos				
V.	pH	00403	8.20					

Accuracy Check

		Range
Ion (E:M)	1.017	.96 to 1.04
TDS (P:Q)	1.031	.90 to 1.10
Ec (S:T)	1.001	.95 to 1.05



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.017	* Manganese (Mn)	.01	* Vanadium (V)	< .01
* Barium (Ba)	.05	* Mercury (Hg)	.0002	* Zinc (Zn)	.013
* Cadmium (Cd)	.0003	* Moly. (Mo)	.03	Boron (B)	1.5
* Chrom. (Cr)	.003	* Nickel (Ni)	< .01	Ammonia-N	.02
* Copper (Cu)	.007	* Selenium (Se)	< .001	Radium 226	3 +/-1 (pci/1)
* Iron (Fe)	.04	* Silver (Ag)	< .01		
* Lead (Pb)	.001	* Uranium (U)	.002		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

TDWR-0177

1214 068

Texas Department of Water Resources—Geological Services

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Permit No. ______

Well No. MW-3 Sample No. M16-4719

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78 ; By ARTHUR L. BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71: Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	30.5	8.3	13800(2760)	Spec. Cond. at Well: 2760		μmhos
2	10/9	30.5	8.35	2600	Normal Water Level:		msl
3	10/10	30.5	8.65	2600	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to < 2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/19/78 Date Reported 10/03/78

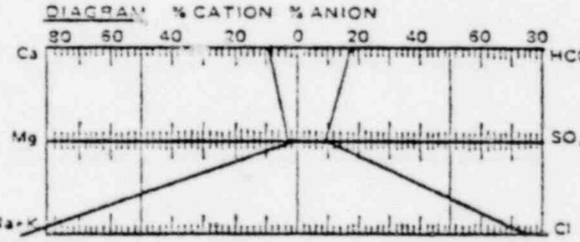
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	46.	= 20.04 x	2.30	x 52.0 =	119.60	8.84
B.	Magnesium (Mg)	00925	8.4	= 12.16 x	.69	x 46.6 =	32.15	2.65
C.	Sodium (Na)	00929	520.	= 22.99 x	22.62	x 48.9 =	1106.12	86.93
D.	Potassium (K)	00937	16.	= 39.10 x	.41	x 72.0 =	29.52	1.58
E.			Total Cation	....	26.02			
F.	Carbonate (CO_3)	00445	0.	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	265.	= 61.02 x	4.34	x 43.6 =	189.22	16.95
H.	Sulfate (SO_4)	00945	110.	= 48.03 x	2.29	x 73.9 =	169.23	8.94
I.	Chloride (Cl)	00940	673.	= 35.45 x	18.98	x 75.9 =	1440.58	74.11
J.	Nitrate (NO_3-N)	71851	< .01			Total	3086.43	= T (1) page 35
K.	Fluoride (F)	00951	.58					
L.	Silica (SiO_2)	00955	31.					
M.			Total Anion	...	25.61			
N.	Total Ion	....	1670.					
P.	TDS (180 °C)	70300	1590.					
Q.	TDS = N - .5G	=	1537.					
R.	Ec (25 °C)	00095	2850.					
S.	Ec (Dilute) = ____ x ____	=	3060.	μmhos				
U.	Alk. as $CaCO_3$	00410	217.	μmhos				
V.	pH	00403	8.20					

Accuracy Check

		Range
Ion (E:M)	1.016	.96 to 1.04
TDS (P:Q)	1.034	.90 to 1.10
Ec (S:T)	.992	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.021	* Manganese (Mn)	.01	* Vanadium (V)	< .01
* Barium (Ba)	.05	* Mercury (Hg)	.0001	* Zinc (Zn)	.015
* Cadmium (Cd)	< .0001	* Moly. (Mo)	.04	Boron (B)	1.4
* Chrom. (Cr)	.002	* Nickel (Ni)	< .01	Ammonia-N	< .01
* Copper (Cu)	.008	* Selenium (Se)	< .001	Radium 226	2 +/-1 (pci/l)
* Iron (Fe)	.03	* Silver (Ag)	< .01		
* Lead (Pb)	< .001	* Uranium (U)	.005		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

1214 069

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-4 Sample No. M16-4720

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78 ; By ARTHUR L. BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	30.8	8.45	2400	Spec. Cond. at Well: 2400		µmhos
2	10/9	30.0	8.55	2400	Normal Water Level:		msl
3	10/10	30.25	8.80	2300	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/19/78 Date Reported 10/03/78

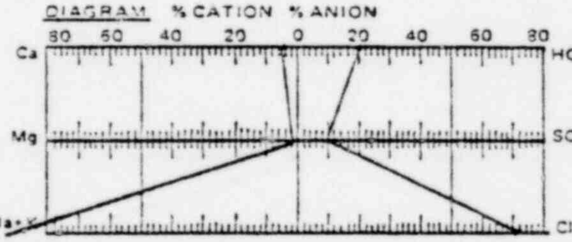
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	25.	= 20.04 x	1.25	x 52.0 =	65.00	5.27
B.	Magnesium (Mg)	00925	6.9	= 12.16 x	.57	x 46.6 =	26.56	2.41
C.	Sodium (Na)	00929	496	= 22.99 x	21.57	x 48.9 =	1054.77	91.01
D.	Potassium (K)	00937	12.	= 39.10 x	.31	x 72.0 =	22.32	1.31
E.			Total Cation	....	23.70			
F.	Carbonate (CO_3)	00445	0.	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	287.	= 61.02 x	4.70	x 43.6 =	204.92	19.97
H.	Sulfate (SO_4)	00945	97.	= 48.03 x	2.02	x 73.9 =	149.28	8.58
I.	Chloride (Cl)	00940	596.	= 35.45 x	16.81	x 75.9 =	1275.88	71.44
J.	Nitrate (NO_3-N)	71851	.01			Total	2798.73	= T (1) page 35
K.	Fluoride (F)	00951	.64					
L.	Silica (SiO_2)	00955	28.					
M.			Total Anion	...	23.53			
N.	Total Ion	....	1549.					
P.	TDS (180 °C)	70300	1450.					
Q.	TDS = N - .5G	=	1405.					
R.	Ec (25 °C)	00095	2570.					
S.	Ec (Dilute) = ___ x ___	=	2831.	µmhos				
U.	Alk. as $CaCO_3$	00410	235.	µmhos				
V.	pH	00403	8.30					

Accuracy Check

		Range
Ion (E:M)	1.007	.96 to 1.04
TDS (P:Q)	1.032	.90 to 1.10
Ec (S:T)	1.012	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.015	* Manganese (Mn)	.01	* Vanadium (V)	< .01
* Barium (Ba)	.04	* Mercury (Hg)	.0002	* Zinc (Zn)	.009
* Cadmium (Cd)	.0001	* Moly. (Mo)	.04	Boron (B)	1.4
* Chrom. (Cr)	.001	* Nickel (Ni)	< .01	Ammonia-N	< .01
* Copper (Cu)	.005	* Selenium (Se)	< .001	Radium 226	3 +/-1 (pci/l)
* Iron (Fe)	.02	* Silver (Ag)	< .01		
* Lead (Pb)	< .001	* Uranium (U)	.006		

Analyst Frank Nixon Checked By Carl Crownover

Remarks

TDWR-0177

1214 070

Texas Department of Water Resources – Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-5 Sample No. M16-4721

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78; By ARTHUR BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
					Spec. Cond. at Well: 2600		μmhos
1	9/18	30.5	8.5	2600	Normal Water Level:		msl
2	10/9	30.0	8.40	2500	Pump: Set at	msl.	gpm.
3	10/10	30.25	8.35	2500	Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/19/78 Date Reported 10/03/78

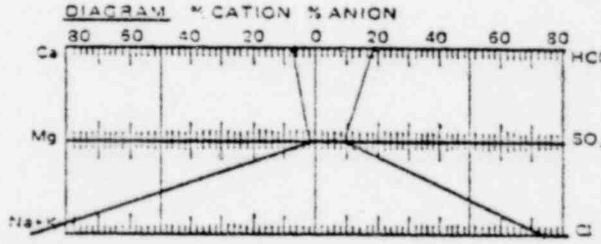
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	35.	= 20.04 x	1.75	x 52.0 =	91.00	6.88
B.	Magnesium (Mg)	00925	7.1	= 12.16 x	.58	x 46.6 =	27.03	2.28
C.	Sodium (Na)	00929	522.	= 22.99 x	22.71	x 48.9 =	1110.52	89.34
D.	Potassium (K)	0937	15.	= 39.10 x	.38	x 72.0 =	27.36	1.49
E.			Total Cation	....	25.42			
F.	Carbonate (CO_3)	00445	0.	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	272.	= 61.02 x	4.46	x 43.6 =	194.46	17.86
H.	Sulfate (SO_4)	00945	114.	= 48.03 x	2.37	x 73.9 =	175.14	9.49
I.	Chloride (Cl)	00940	643.	= 35.45 x	18.14	x 75.9 =	1376.83	72.65
J.	Nitrate (NO_3-N)	71851	< .01			Total	3002.33	= T (1) page 35
K.	Fluoride (F)	00951	.64					
L.	Silica (SiO_2)	00955	36.					
M.			Total Anion	...	24.97			
N.	Total Ion	....	1645.					
P.	TDS (180 °C)	70300	1540.					
Q.	TDS = N - .5G	=	1509.					
R.	Ec (25 °C)	00095	2720.					
S.	Ec (Dilute) = ___ x ___	=	3000.	μmhos				
U.	Alk. as $CaCO_3$	00410	223.	μmhos				
V.	pH	00403	8.23					

Accuracy Check

		Range
Ion (E:M)	1.018	.96 to 1.04
TDS (P:Q)	1.021	.90 to 1.10
Ec (S:T)	.999	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.020	* Manganese (Mn)	.01	* Vanadium (V)	< .01
* Barium (Ba)	.04	* Mercury (Hg)	.0002	* Zinc (Zn)	.012
* Cadmium (Cd)	.0001	* Moly. (Mo)	.03	Boron (B)	1.5
* Chrom. (Cr)	≤ .001	* Nickel (Ni)	< .01	Ammonia-N	< .01
* Copper (Cu)	.006	* Selenium (Se)	< .001	Radium 226	2 +/-1 (pci/1)
* Iron (Fe)	.02	* Silver (Ag)	< .01		
* Lead (Pb)	.006	* Uranium (U)	.002		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

1214 071

TDWR 0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-6 Sample No. M16-4722

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78 ; By ARTHUR BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1) Page 71, Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	31.	8.45	2800	Spec. Cond. at Well: 2800		μmhos
2	10/9	28.5	8.40	2800	Normal Water Level:		msl
3	10/10	29.50	8.92	2700	Pump: Set at	msl.	gpm.
					Bottom of Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name JORDAN LABORATORIES, INC. Date Received 9/19/78 Date Reported 10/03/78

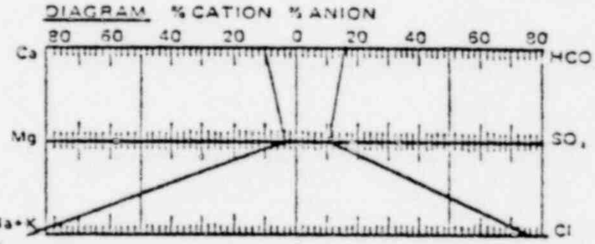
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	54.	= 20.04 x	2.69	x 52.0 =	139.88	10.08
B.	Magnesium (Mg)	00925	12.	= 12.16 x	.99	x 46.6 =	46.13	3.71
C.	Sodium (Na)	00929	519.	= 22.99 x	22.58	x 48.9 =	1104.16	84.60
D.	Potassium (K)	00937	17.	= 39.10 x	.43	x 72.0 =	30.96	1.61
E.			Total Cation	....	26.69			
F.	Carbonate (CO_3)	00445	0.	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	245.	= 61.02 x	4.02	x 43.6 =	175.27	15.11
H.	Sulfate (SO_4)	00945	143.	= 48.03 x	2.98	x 73.9 =	220.22	11.20
I.	Chloride (Cl)	00940	695.	= 35.45 x	19.61	x 75.9 =	1488.40	73.69
J.	Nitrate (NO_3-N)	71851	< .01			Total	3205.03	= T (1) page 35
K.	Fluoride (F)	00951	.64					
L.	Silica (SiO_2)	00955	34.					
M.			Total Anion	...	26.61			
N.	Total Ion	....	1720.					
P.	TDS (180 °C)	70300	1660.					
Q.	TDS = N - .5G	=	1597.					
R.	Ec (25 °C)	00095	2900.					
S.	Ec (Dilute) = ___ x ___	=	3260.	μmhos				
U.	Alk. as $CaCO_3$	00410	201.	μmhos				
V.	pH	00403	8.26					

Accuracy Check

		Range
Ion (E:M)	1.003	.96 to 1.04
TDS (P:Q)	1.039	.90 to 1.10
Ec (S:T)	1.017	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.018	* Manganese (Mn)	.01	* Vanadium (V)	< .01
* Barium (Ba)	.04	* Mercury (Hg)	.0001	* Zinc (Zn)	.014
* Cadmium (Cd)	.0003	* Moly. (Mo)	.03	Boron (B)	1.4
* Chrom. (Cr)	.001	* Nickel (Ni)	< .01	Ammonia-N	< .01
* Copper (Cu)	.006	* Selenium (Se)	< .001	Radium 226	4 +/-1 (pci/1)
* Iron (Fe)	.03	* Silver (Ag)	< .01		
* Lead (Pb)	.004	* Uranium (U)	.017		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

TDWR-0177

1214 072

Texas Department of Water Resources—Geological Services

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Permit No. ______
Well No. MW-7 Sample No. M16-4723
Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78 ; By ARTHUR BISHOP
Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1) Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	29.7	8.4	15800(3160)	Spec. Cond. at Well: 3160		µmhos
					Normal Water Level:		msl
2	10/9	29.5	8.43	3100	Pump: Set at	msl.	gpm.
3	10/10	28.50	8.63	3000	Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/19/78 Date Reported 10/3/78

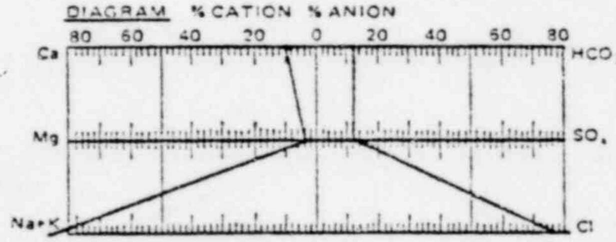
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	62.	= 20.04 x	3.09	x 52.0 =	160.68	10.41
B.	Magnesium (Mg)	00925	15.	= 12.16 x	1.23	x 46.6 =	57.32	4.15
C.	Sodium (Na)	00929	571.	= 22.99 x	24.84	x 48.9 =	1214.68	83.72
D.	Potassium (K)	00937	20.	= 39.10 x	.51	x 72.0 =	36.72	1.72
E.			Total Cation	....	29.67			
F.	Carbonate (CO_3)	00445	0.	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	215.	= 61.02 x	3.52	x 43.6 =	153.47	11.97
H.	Sulfate (SO_4)	00945	165.	= 48.03 x	3.44	x 73.9 =	254.22	11.70
I.	Chloride (Cl)	00940	796.	= 35.45 x	22.45	x 75.9 =	1703.95	76.33
J.	Nitrate (NO_3-N)	71851	.05			Total	3581.04	= T (1) page 35
K.	Fluoride (F)	00951	.61					
L.	Silica (SiO_2)	00955	37.					
M.			Total Anion	...	29.41			
N.	Total Ion	....	1882.					
P.	TDS (180 °C)	70300	1820.					
Q.	TDS = N - .5G	=	1774.					
R.	Ec (25 °C)	00095	3220.					
S.	Ec (Dilute) = ___ x ___	=	3610.	µmhos				
U.	Alk. as $CaCO_3$	00410	176.	µmhos				
V.	pH	00403	8.05					

Accuracy Check

		Range
Ion (E:M)	1.009	.96 to 1.04
TDS (P:Q)	1.026	.90 to 1.10
Ec (S:T)	1.008	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.015	* Manganese (Mn)	.01	* Vanadium (V)	< .01
* Barium (Ba)	.03	* Mercury (Hg)	.0001	* Zinc (Zn)	.009
* Cadmium (Cd)	< .0001	* Moly. (Mo)	.03	Boron (B)	1.4
* Chrom. (Cr)	.002	* Nickel (Ni)	< .01	Ammonia-N	.01
* Copper (Cu)	.005	* Selenium (Se)	.001	Radium 226 80 +/-5 (pci/1)	
* Iron (Fe)	.05	* Silver (Ag)	< .01		
* Lead (Pb)	< .001	* Uranium (U)	.228		

Analyst FRANK NIXON Checked By CARL CROWNOVER
Remarks

1214 073

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-8 Sample No. M16-4724

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78 ; By ARTHUR BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1) Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	31.0	8.3	3500	Spec. Cond. at Well:	3500	µmhos
2	10/9	28.0	8.48	3400	Normal Water Level:		msl
3	10/10	29.0	8.53	3500	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

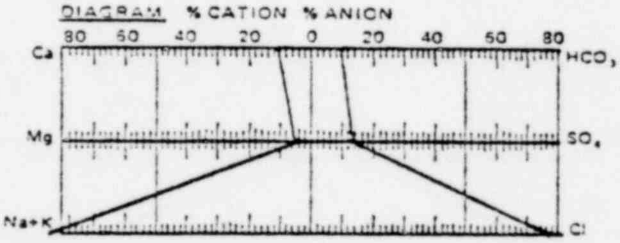
CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9-19-78 Date Reported 10-3-78

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	77.	= 20.04 x	3.84	x 52.0 =	199.68	11.22
B.	Magnesium (Mg)	00925	20.	= 12.16 x	1.64	x 46.6 =	76.42	4.79
C.	Sodium (Na)	00929	647.	= 22.99 x	28.14	x 48.9 =	1376.05	82.21
D.	Potassium (K)	00937	24.	= 39.10 x	.61	x 72.0 =	43.92	1.78
E.			Total Cation	....	34.23			
F.	Carbonate (CO_3)	00445	0.	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	214.	= 61.02 x	3.51	x 43.6 =	153.04	10.27
H.	Sulfate (SO_4)	00945	210.	= 48.03 x	4.37	x 73.9 =	322.94	12.79
I.	Chloride (Cl)	00940	932.	= 35.45 x	26.29	x 75.9 =	1995.41	76.94
J.	Nitrate (NO_3-N)	71851	1.7			Total	4167.46	*T.(1) page 35
K.	Fluoride (F)	00951	.52					
L.	Silica (SiO_2)	00955	39.					
M.			Total Anion	...	34.17			
N.	Total Ion	....	2165.					
P.	TDS (180 °C)	70300	2090.					
Q.	TDS = N - .5G	=	2058.					
R.	Ec (25 °C)	00095	3720.					
S.	Ec (Dilute) = ____ x ____	=	4192.	µmhos				
U.	Alk. as $CaCO_3$	00410	175.	µmhos				
V.	pH	00403	8.18					

Accuracy Check

		Range
Ion (E:M)	1.002	.96 to 1.04
TDS (P:Q)	1.015	.90 to 1.10
Ec (S:T)	1.006	.95 to 1.05



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.008	* Manganese (Mn)	0.02	* Vanadium (V)	< 0.01
* Barium (Ba)	0.03	* Mercury (Hg)	0.0001	* Zinc (Zn)	0.013
* Cadmium (Cd)	< 0.0001	* Moly. (Mo)	0.02	Boron (B)	1.5
* Chrom. (Cr)	0.002	* Nickel (Ni)	< 0.01	Ammonia-N	< 0.01
* Copper (Cu)	0.005	* Selenium (Se)	< 0.001	Radium 226	3 +/-1 (pci/l)
* Iron (Fe)	0.03	* Silver (Ag)	< 0.01		
* Lead (Pb)	< 0.001	* Uranium (U)	0.056		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

TDWR-0177

1214 074

Texas Department of Water Resources—Geological Services

Permit No. ____________

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-9 Sample No. M16-4725

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78 ; By ARTHUR BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71. Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	30.	8.5	3450	Spec. Cond. at Well: 3450		μmhos
2	10/9	28.5	8.45	3400	Normal Water Level:		msl
3	10/10	28.50	8.62	3400	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to < 2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9-19-78 Date Reported 10-3-78

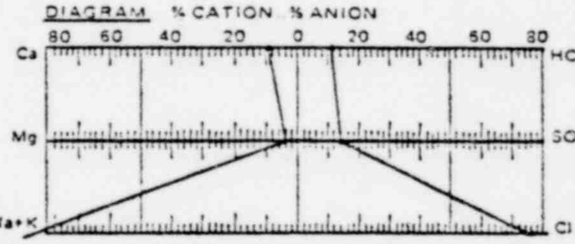
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	61.	÷ 20.04 x	3.04	x 52.0 =	158.08	9.16
B.	Magnesium (Mg)	00925	16.	÷ 12.16 x	1.32	x 46.6 =	61.51	3.98
C.	Sodium (Na)	00929	643.	÷ 22.99 x	27.97	x 48.9 =	1367.73	84.32
D.	Potassium (K)	00937	33.	÷ 39.10 x	.84	x 72.0 =	60.48	2.53
E.			Total Cation	....	33.17			
F.	Carbonate (CO_3)	00445	0.	÷ 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	216.	÷ 61.02 x	3.54	x 43.6 =	154.34	10.81
H.	Sulfate (SO_4)	00945	213.	÷ 48.03 x	4.43	x 73.9 =	327.38	13.53
I.	Chloride (Cl)	00940	878.	÷ 35.45 x	24.77	x 75.9 =	1880.04	75.66
J.	Nitrate (NO_3-N)	71851	3.5			Total	4009.57	= T .(1) page 35
K.	Fluoride (F)	00951	.48					
L.	Silica (SiO_2)	00955	43.					
M.			Total Anion	...	32.47			
N.	Total Ion	....	2107.					
P.	TDS (180 °C)	70300	2060.					
Q.	TDS = N - .5G	=	1999.					
R.	Ec (25 °C)	00095	3620.					
S.	Ec (Dilute) = ___ x ___	=	4052.	μmhos				
U.	Alk. as $CaCO_3$	00410	177.	μmhos				
V.	pH	00403	8.07					

Accuracy Check

		Range
Ion (E:M)	1.013	.96 to 1.04
TDS (P:Q)	1.031	.90 to 1.10
Ec (S:T)	1.011	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.010	* Manganese (Mn)	.01	* Vanadium (V)	< .01
* Barium (Ba)	.05	* Mercury (Hg)	.0001	* Zinc (Zn)	.008
* Cadmium (Cd)	< .0001	* Moly. (Mo)	.02	Boron (B)	1.5
* Chrom. (Cr)	.001	* Nickel (Ni)	< .01	Ammonia-N	< 0.01
* Copper (Cu)	.006	* Selenium (Se)	.001	Radium 226	11 +/-2 (pci/1)
* Iron (Fe)	.02	* Silver (Ag)	< .01		
* Lead (Pb)	< .001	* Uranium (U)	.064		

Analyst FRANK NIXON Checked By CARL CRONNOVER

Remarks

1214 075

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-10 Sample No. M16-4726

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78 ; By ARTHUR BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1) Page 71, Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	30.75	8.5	3250	Spec. Cond. at Well: 3250		µmhos
2	10/9	28.00	8.45	3100	Normal Water Level:		msl
3	10/10	28.50	8.63	3000	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4°C.

ANALYSIS: Lab Name JORDAN LABORATORIES Date Received 9/19/78 Date Reported 10/3/78

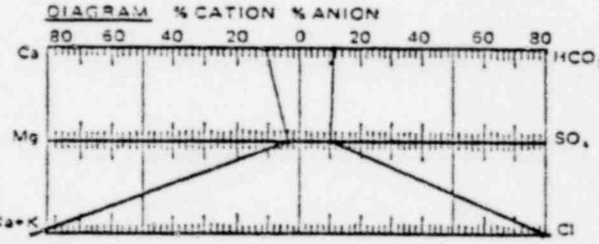
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	66.	= 20.04 x	3.29	x 52.0 =	171.08	10.87
B.	Magnesium (Mg)	00925	14.	= 12.16 x	1.15	x 46.6 =	53.59	3.80
C.	Sodium (Na)	00929	580.	= 22.99 x	25.23	x 48.9 =	1233.75	83.38
D.	Potassium (K)	00937	23.	= 39.10 x	.59	x 72.0 =	42.48	1.95
E.			Total Cation	....	30.26			
F.	Carbonate (CO_3)	00445	0.	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	203.	= 61.02 x	3.33	x 43.6 =	145.19	11.04
H.	Sulfate (SO_4)	00945	147.	= 48.03 x	3.06	x 73.9 =	226.13	10.14
I.	Chloride (Cl)	00940	843.	= 35.45 x	23.78	x 75.9 =	1804.90	78.82
J.	Nitrate (NO_3-N)	71851	.24			Total	3677.12	= T (1) page 35
K.	Fluoride (F)	00951	.51					
L.	Silica (SiO_2)	00955	39.					
M.			Total Anion	...	30.17			
N.	Total Ion	....	1916.					
P.	TDS (180°C)	70300	1860.					
Q.	TDS = N - .5G	=	1814.					
R.	Ec (25°C)	00095	3330.					
S.	Ec (Dilute) = ___ x ___	=	3732.	µmhos				
U.	Alk. as $CaCO_3$	00410	166.	µmhos				
V.	pH	00403	8.11					

Accuracy Check

		Range
Ion (E:M)	1.003	.96 to 1.04
TDS (P:Q)	1.025	.90 to 1.10
Ec (S:T)	1.015	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.033	* Manganese (Mn)	.01	* Vanadium (V)	< .01
* Barium (Ba)	.05	* Mercury (Hg)	.0001	* Zinc (Zn)	.012
* Cadmium (Cd)	< 0.0001	* Moly. (Mo)	.02	Boron (B)	1.5
* Chrom. (Cr)	0.003	* Nickel (Ni)	< .01	Ammonia-N	.01
* Copper (Cu)	0.008	* Selenium (Se)	< .001	Radium 226	172 +/- 8 (pci/l)
* Iron (Fe)	0.04	* Silver (Ag)	< .01		
* Lead (Pb)	< .001	* Uranium (U)	.059		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

1214 076

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-11 Sample No. M16-4727

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/18/78 ; By ARTHUR BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71, Pump Well Until Ec is Approx. Constant.

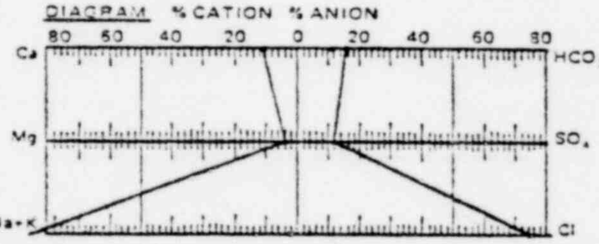
Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	31.0	8.315	3000	Spec. Cond. at Well: 3000		µmhos
2	10/9	30.0	8.38	3000	Normal Water Level:		msl
3	10/10	30.75	8.60	2900	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9-19-78 Date Reported 10-3-78

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	61.	÷ 20.04 x	3.04	x 52.0 =	158.08	10.71
B.	Magnesium (Mg)	00925	14.	÷ 12.16 x	1.15	x 46.6 =	53.59	4.05
C.	Sodium (Na)	00929	544.	÷ 22.99 x	23.66	x 48.9 =	1156.97	83.34
D.	Potassium (K)	00937	21.	÷ 39.10 x	.54	x 72.0 =	38.88	1.90
E.			Total Cation	....	28.39			
F.	Carbonate (CO_3)	00445	0.	÷ 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	249.	÷ 61.02 x	4.08	x 43.6 =	177.89	14.57
H.	Sulfate (SO_4)	00945	159.	÷ 48.03 x	3.31	x 73.9 =	244.61	11.82
I.	Chloride (Cl)	00940	731.	÷ 35.45 x	20.62	x 75.9 =	1565.06	73.62
J.	Nitrate (NO_3-N)	71851	1.7			Total	3395.08	=T (1) page 35
K.	Fluoride (F)	00951	.50					
L.	Silica (SiO_2)	00955	39.				Accuracy Check	
M.			Total Anion	...	28.01			Range
N.	Total Ion	....	1820.			Ion (E:M)	1.014	.96 to 1.04
P.	TDS (180 °C)	70300	1740.			TDS (P:Q)	1.026	.90 to 1.10
Q.	TDS = N - .5G	=	1696.			Ec (S:T)	.998	.95 to 1.05
R.	Ec (25 °C)	00095	3070.					
S.	Ec (Dilute) = ____ x ____	=	3390.	µmhos				
U.	Alk. as $CaCO_3$	00410	204.	µmhos				
V.	pH	00403	8.17					

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.022	* Manganese (Mn)	.01	* Vanadium (V)	< .01
* Barium (Ba)	.04	* Mercury (Hg)	.0002	* Zinc (Zn)	.012
* Cadmium (Cd)	< .0001	* Moly. (Mo)	.03	Boron (B)	1.3
* Chrom. (Cr)	.001	* Nickel (Ni)	< .01	Ammonia-N	.01
* Copper (Cu)	.005	* Selenium (Se)	< .001	Radium 226	2 +/-1 (pci/1)
* Iron (Fe)	.03	* Silver (Ag)	< .01		
* Lead (Pb)	.001	* Uranium (U)	.047		

Analyst NIXON, FRANK Checked By CARL CROWNOVER

Remarks

1214,077

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. MW-12 Sample No. M16-4728

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9-18-78 ; By ARTHUR L. BISHOP

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/18	31.75	8.2	3000	Spec. Cond. at Well: 3000		µmhos
2	10/9	30.00	8.10	2800	Normal Water Level:		msl
3	10/10	30.5	8.35	2800	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9-19-78 Date Reported 10-3-78

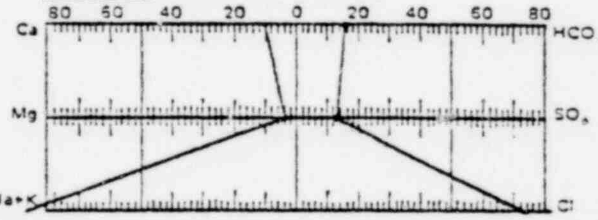
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	55.	= 20.04 x	2.74	x 52.0 =	142.48	9.92
B.	Magnesium (Mg)	00925	13.	= 12.16 x	1.07	x 46.6 =	49.86	3.87
C.	Sodium (Na)	00929	534.	= 22.99 x	23.23	x 48.9 =	1135.95	84.08
D.	Potassium (K)	00937	23.	= 39.10 x	.59	x 72.0 =	42.48	2.14
E.			Total Cation	....	27.63			
F.	Carbonate (CO_3)	00445	0.	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	249.	= 61.02 x	4.08	x 43.6 =	177.89	14.70
H.	Sulfate (SO_4)	00945	168.	= 48.03 x	3.50	x 73.9 =	258.65	12.61
I.	Chloride (Cl)	00940	715.	= 35.45 x	20.17	x 75.9 =	1530.90	72.68
J.	Nitrate (NO_3-N)	71851	2.6			Total	3338.21	=T (1) page 35
K.	Fluoride (F)	00951	.54					
L.	Silica (SiO_2)	00955	41.					
M.			Total Anion	...	27.75			
N.	Total Ion	....	1801.					
P.	TDS (180 °C)	70300	1740.					
Q.	TDS = N - .5G	=	1677.					
R.	Ec (25 °C)	00095	3060.					
S.	Ec (Dilute) = ____ x ____	=	3380.	µmhos				
U.	Alk. as $CaCO_3$	00410	204.	µmhos				
V.	pH	00403	8.10					

Accuracy Check

		Range
Ion (E:M)	.996	.96 to 1.04
TDS (P:Q)	1.038	.90 to 1.10
Ec (S:T)	1.013	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.017	* Manganese (Mn)	.02	* Vanadium (V)	< .01
* Barium (Ba)	0.03	* Mercury (Hg)	.0001	* Zinc (Zn)	.019
* Cadmium (Cd)	< 0.0001	* Moly. (Mo)	.02	Boron (B)	1.4
* Chrom. (Cr)	0.002	* Nickel (Ni)	< .01	Ammonia-N	< 0.01
* Copper (Cu)	.005	* Selenium (Se)	< .001	Radium 226	19 +/-3 (pci/1)
* Iron (Fe)	.03	* Silver (Ag)	< .01		
* Lead (Pb)	< .001	* Uranium (U)	.063		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

TDWR-0177

1214 078

Texas Department of Water Resources—Geological Services

Permit No. ____

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. M-13 Sample No. M16-4959

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/27/78 : By WILLIAM CHAPMAN

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1) Page 71, Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/28	28.60	8.50	2840	Spec. Cond. at Well: 2900		µmhos
2	10/9	28.0	8.50	2900	Normal Water Level:		msl
3	10/10	28.0	8.20	2800	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to < 2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/28/78 Date Reported 10/12/78

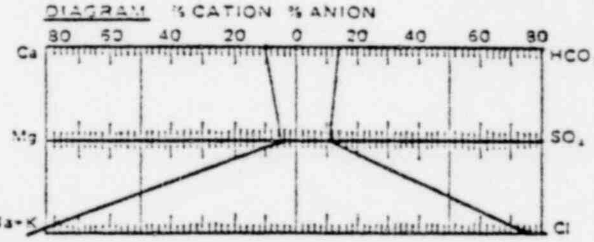
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	55.	÷ 20.04 x	2.74	x 52.0 =	142.48	9.99
B.	Magnesium (Mg)	00925	16.	÷ 12.16 x	1.32	x 46.6 =	61.51	4.81
C.	Sodium (Na)	00929	527.	÷ 22.99 x	22.92	x 48.9 =	1120.79	83.53
D.	Potassium (K)	00937	18.	÷ 39.10 x	.46	x 72.0 =	33.12	1.68
E.			Total Cation	....	27.44			
F.	Carbonate (CO_3)	00445	11.	÷ 30.00 x	.37	x 84.6 =	31.30	1.34
G.	Bicarbonate (HCO_3)	00440	217.	÷ 61.02 x	3.56	x 43.6 =	155.22	12.94
H.	Sulfate (SO_4)	00945	145.	÷ 48.03 x	3.02	x 73.9 =	223.18	10.98
I.	Chloride (Cl)	00940	729.	÷ 35.45 x	20.56	x 75.9 =	1560.50	74.74
J.	Nitrate (NO_3-N)	71851	.85			Total	3328.10 = T (1) page 35	
K.	Fluoride (F)	00951	.56					
L.	Silica (SiO_2)	00955	34.					
M.			Total Anion	....	27.51			
N.	Total Ion	....	1753.					
P.	TDS (180 °C)	70300	1680.					
Q.	TDS = N - .5G		= 1645.					
R.	Ec (25 °C)	00095	2950.					
S.	Ec (Dilute) = ____ x ____		= 3310.	µmhos				
U.	Alk. as $CaCO_3$	00410	196.	µmhos				
V.	pH	00403	8.59					

Accuracy Check

		Range
Ion (E:M)	.997	.96 to 1.04
TDS (P:Q)	1.021	.90 to 1.10
Ec (S:T)	.995	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.014	* Manganese (Mn)	0.07	* Vanadium (V)	<0.01
* Barium (Ba)	0.04	* Mercury (Hg)	0.0002	* Zinc (Zn)	0.015
* Cadmium (Cd)	0.0003	* Moly. (Mo)	0.04	Boron (B)	1.4
* Chrom. (Cr)	0.003	* Nickel (Ni)	<0.01	Ammonia-N	0.02
* Copper (Cu)	0.010	* Selenium (Se)	<0.001	Radium 226	1+/-1 (pci/1)
* Iron (Fe)	0.14	* Silver (Ag)	<0.01		
* Lead (Pb)	0.005	* Uranium (U)	0.006		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

1214 079

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. M-14 Sample No. M16-4960

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/27/78 ; By WILLIAM CHAPMAN

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/28	29.50	8.50	2820	Spec. Cond. at Well: 2820		µmhos
2	10/9	29.50	8.40	2800	Normal Water Level:		msl
3	10/10	29.50	8.10	2600	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/28/78 Date Reported 10/12/78

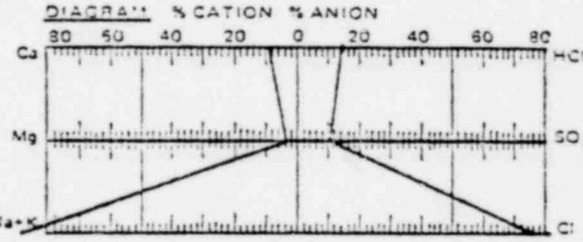
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	47.	= 20.04 x	2.35	x 52.0 =	122.20	9.02
B.	Magnesium (Mg)	00925	12.	= 12.16 x	.99	x 46.6 =	46.13	3.80
C.	Sodium (Na)	00929	00929	= 22.99 x	511.	x 48.9 =	1087.05	85.30
D.	Potassium (K)	00937	19.	= 39.10 x	.49	x 72.0 =	35.28	1.88
E.			Total Cation	....	26.06			
F.	Carbonate (CO_3)	00445	2.	= 30.00 x	.07	x 84.6 =	5.92	.27
G.	Bicarbonate (HCO_3)	00440	222.	= 61.02 x	3.64	x 43.6 =	158.70	13.86
H.	Sulfate (SO_4)	00945	135.	= 48.03 x	2.81	x 73.9 =	207.66	10.70
I.	Chloride (Cl)	00940	700.	= 35.45 x	19.75	x 75.9 =	1499.02	75.18
J.	Nitrate (NO_3-N)	71851	2.1			Total	3161.97	= T (1) page 35
K.	Fluoride (F)	00951	.47					
L.	Silica (SiO_2)	00955	33.					
M.			Total Anion	...	26.27			
N.	Total Ion	....	1684.					
P.	TDS (180 °C)	70300	1630.					
Q.	TDS = N - .5G	=	1573.					
R.	Ec (25 °C)	00095	2880.					
S.	Ec (Dilute) = ___ x ___	=	3130.	µmhos				
U.	Alk. as $CaCO_3$	00410	186.	µmhos				
V.	pH	00403	8.35					

Accuracy Check

		Range
Ion (E:M)	.992	.96 to 1.04
TDS (P:Q)	1.037	.90 to 1.10
Ec (S:T)	.990	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.019	* Manganese (Mn)	<0.01	* Vanadium (V)	0.02
* Barium (Ba)	0.06	* Mercury (Hg)	0.0004	* Zinc (Zn)	0.009
* Cadmium (Cd)	0.0002	* Moly. (Mo)	0.02	Boron (B)	1.4
* Chrom. (Cr)	0.002	* Nickel (Ni)	<0.01	Ammonia-N	<0.01
* Copper (Cu)	0.005	* Selenium (Se)	<0.001	Radium 226	2+/-1 (pci/l)
* Iron (Fe)	<0.01	* Silver (Ag)	<0.01		
* Lead (Pb)	<0.001	* Uranium (U)	0.062		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

1214 080

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. M-15 Sample No. M16-4961

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/27/78 ; By WILLIAM CHAPMAN

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71, Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/28	29.50	8.20	2700	Spec. Cond. at Well: 2700		µmhos
2	10/9	30.0	8.20	2600	Normal Water Level:		msl
3	10/10	30.0	8.20	2500	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/28/78 Date Reported 10/12/78

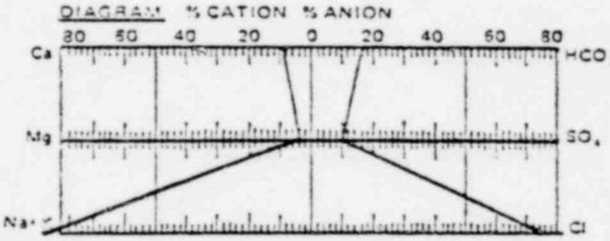
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	46.	= 20.04 x	2.30	x 52.0 =	119.60	9.16
B.	Magnesium (Mg)	00925	13.	= 12.16 x	1.07	x 46.6 =	49.86	4.26
C.	Sodium (Na)	00929	490.	= 22.99 x	21.31	x 48.9 =	1042.06	84.87
D.	Potassium (K)	00937	17.	= 39.10 x	.43	x 72.0 =	30.96	1.71
E.			Total Cation	....	25.11			
F.	Carbonate (CO_3)	00445	0	= 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	249.	= 61.02 x	4.08	x 43.6 =	177.89	16.34
H.	Sulfate (SO_4)	00945	115.	= 48.03 x	2.39	x 73.9 =	176.62	9.57
I.	Chloride (Cl)	00940	656.	= 35.45 x	18.50	x 75.9 =	1404.15	74.09
J.	Nitrate (NO_3-N)	71851	1.4			Total	3001.14	=T (1) page 35
K.	Fluoride (F)	00951	.47					
L.	Silica (SiO_2)	00955	34.					
M.			Total Anion	...	24.97			
N.	Total Ion	....	1622.					
P.	TDS (180 °C)	70300	1560.					
Q.	TDS = N - .5G	=	1497.					
R.	Ec (25 °C)	00095	2750.					
S.	Ec (Dilute) = ___ x ___	=	2960.	µmhos				
U.	Alk. as $CaCO_3$	00410	204.	µmhos				
V.	pH	00403	8.21					

Accuracy Check

		Range
Ion (E:M)	1.006	.96 to 1.04
TDS (P:Q)	1.042	.90 to 1.10
Ec (S:T)	.986	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.020	* Manganese (Mn)	0.02	* Vanadium (V)	<0.01
* Barium (Ba)	0.07	* Mercury (Hg)	0.0005	* Zinc (Zn)	0.004
* Cadmium (Cd)	0.0002	* Moly. (Mo)	0.03	Boron (B)	1.4
* Chrom. (Cr)	0.002	* Nickel (Ni)	<0.01	Ammonia-N	0.01
* Copper (Cu)	0.004	* Selenium (Se)	0.001	Radium 226	1+/-1 (pci/1)
* Iron (Fe)	<0.01	* Silver (Ag)	<0.01		
* Lead (Pb)	<0.001	* Uranium (U)	0.073		

Analyst ~~FRANK NIXON~~ Checked By CARL CROWNOVER

Remarks

1214 081

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. U-228 Sample No. M16-4962

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/27/78 ; By WILLIAM CHAPMAN

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1) Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)
1	9/28	29.50	8.50	3400
2	10/9	28.5	8.50	3400
3	10/10	28.50	8.70	3400

Spec. Cond. at Well: 3400 µmhos

Normal Water Level: ______ msl

Pump: Set at ______ msl. ______ gpm.

Bottom of: Casing ______ msl; screen ______ msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/28/78 Date Reported 10/12/78

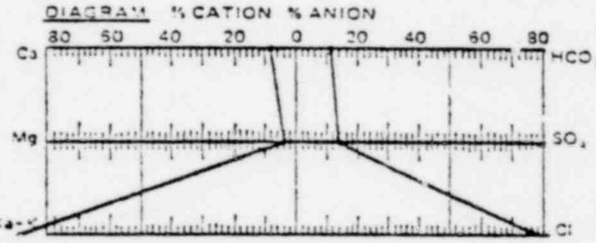
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	51.	= 20.04 x	2.54	x 52.0 =	132.08	7.84
B.	Magnesium (Mg)	00925	16.	= 12.16 x	1.32	x 46.6 =	61.51	4.07
C.	Sodium (Na)	00929	644.	= 22.99 x	28.01	x 48.9 =	1369.69	86.42
D.	Potassium (K)	00937	21.	= 39.10 x	.54	x 72.0 =	38.88	1.67
E.			Total Cation	....	32.41			
F.	Carbonate (CO_3)	00445	4	= 30.00 x	.13	x 84.6 =	11.00	.40
G.	Bicarbonate (HCO_3)	00440	207.	= 61.02 x	3.39	x 43.6 =	147.80	10.38
H.	Sulfate (SO_4)	00945	207.	= 48.03 x	4.31	x 73.9 =	318.51	13.20
I.	Chloride (Cl)	00940	880.	= 35.45 x	24.82	x [illegible] =	1883.84	76.02
J.	Nitrate (NO_3-N)	71851	.12			Total	3963.31	*T .(1) page 35
K.	Fluoride (F)	00951	.49					
L.	Silica (SiO_2)	00955	32.					
M.			Total Anion	....	32.65			
N.	Total Ion	....	2063.					
P.	TDS (180 °C)	70300	2000.					
Q.	TDS = N - .5G	=	1959.					
R.	Ec (25 °C)	00095	3510.					
S.	Ec (Dilute) = ___ x ___	=	3912.	µmhos				
U.	Alk. as $CaCO_3$	00410	176.	µmhos				
V.	pH	00403	8.46					

Accuracy Check

		Range
Ion (E:M)	.993	.96 to 1.04
TDS (P:Q)	1.021	.90 to 1.10
Ec (S:T)	.987	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.022	* Manganese (Mn)	0.0[illegible]	* Vanadium (V)	0.01
* Barium (Ba)	0.03	* Mercury (Hg)	0.0006	* Zinc (Zn)	0.011
* Cadmium (Cd)	0.0001	* Moly. (Mo)	0.02	Boron (B)	1.4
* Chrom. (Cr)	0.002	* Nickel (Ni)	<0.01	Ammonia-N	<0.01
* Copper (Cu)	0.008	* Selenium (Se)	<0.001	Radium 226	28 +/-3 (pci/1)
* Iron (Fe)	0.08	* Silver (Ag)	<0.01		
* Lead (Pb)	0.001	* Uranium (U)	0.003		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

1214 082

TDWR-1177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. U 232 II Sample No. M16-[illegible]

Production Area No. ______

Submitted By ARTHUR L. BISHOP Date Collected: 9/27/78 ; By WILLIAM CHAPMAN

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (°C)	pH	Spec. Cond. (umhos)			
1	9/28	29.90	8.40	3360	Spec. Cond. at Well: 3360		µmhos
2	10/9	30.5	8.37	3200	Normal Water Level:		msl
3	10/10	30.00	8.55	3100	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.

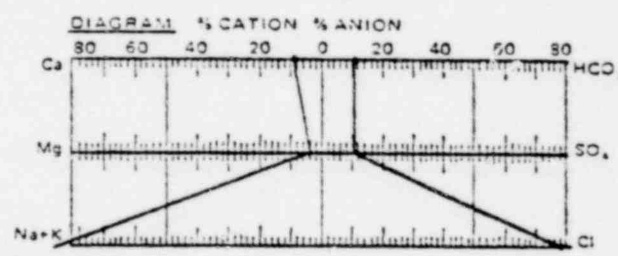
ANALYSIS: Lab Name JORDAN LABORATORIES Date Received 9/28/78 Date Reported 10/12/78

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	55.	÷ 20.04 x	2.74	x 52.0 =	142.48	8.79
B.	Magnesium (Mg)	00925	17.	÷ 12.16 x	1.40	x 46.6 =	65.24	4.49
C.	Sodium (Na)	00929	610.	÷ 22.99 x	26.53	x 48.9 =	1297.32	85.14
D.	Potassium (K)	00937	19.	÷ 39.10 x	.49	x 72.0 =	35.28	1.57
E.			Total Cation	....	31.16			
F.	Carbonate (CO_3)	00445	2.	÷ 30.00 x	.07	x 84.6 =	5.92	.22
G.	Bicarbonate (HCO_3)	00440	207.	÷ 61.02 x	3.39	x 43.6 =	147.80	10.86
H.	Sulfate (SO_4)	00945	165.	÷ 48.03 x	3.44	x 73.9 =	254.22	11.02
I.	Chloride (Cl)	00940	862.	÷ 35.45 x	24.32	x 75.9 =	1845.89	77.90
J.	Nitrate (NO_3-N)	71851	.01			Total	3794.15	= T (1) page 35
K.	Fluoride (F)	00951	.49					
L.	Silica (SiO_2)	00955	27.					
M.			Total Anion	...	31.22			
N.	Total Ion	....	1964.					
P.	TDS (180 °C)	70300	1930.					
Q.	TDS = N - .5G	=	1861.					
R.	Ec (25 °C)	00095	3330.					
S.	Ec (Dilute) = ____ x ____	=	3710.	µmhos				
U.	Alk. as $CaCO_3$	00410	174.	µmhos				
V.	pH	00403	8.35					

Accuracy Check

		Range
Ion (E:M)	.998	.96 to 1.04
TDS (P:Q)	1.037	.90 to 1.10
Ec (S:T)	.978	.95 to 1.05



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.022	* Manganese (Mn)	0.01	* Vanadium (V)	0.01
* Barium (Ba)	0.03	* Mercury (Hg)	0.0003	* Zinc (Zn)	0.009
* Cadmium (Cd)	0.0002	* Moly. (Mo)	0.02	Boron (B)	1.5
* Chrom. (Cr)	0.001	* Nickel (Ni)	<0.01	Ammonia-N	0.01
* Copper (Cu)	0.005	* Selenium (Se)	<0.001	Radium 226	7 +/- 2 (pci/l)
* Iron (Fe)	0.02	* Silver (Ag)	<0.01		
* Lead (Pb)	<0.001	* Uranium (U)	0.007		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

1214 083

TDWR 0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. U-235 Sample No. M16-4964

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/27/78 ; By WILLIAM CHAPMAN

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71, Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/28	30.60	7.60	3400	Spec. Cond. at Well: 3400		µmhos
2	10/9	30.50	7.70	3300	Normal Water Level:		msl
3	10/10	31.25	7.80	3200	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

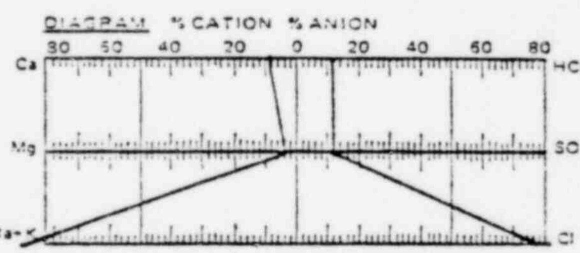
CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items., One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name JORDAN LABORATORIES Date Received 9/28/78 Date Reported 10/12/78

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	58.	÷ 20.04 x	2.89	x 52.0 =	150.28	9.26
B.	Magnesium (Mg)	00925	17.	÷ 12.16 x	1.40	x 46.6 =	65.24	4.49
C.	Sodium (Na)	00929	609.	÷ 22.99 x	26.49	x 48.9 =	1295.36	84.88
D.	Potassium (K)	00937	17.	÷ 39.10 x	.43	x 72.0 =	30.96	1.38
E.			Total Cation	....	31.21			
F.	Carbonate (CO_3)	00445	0.	÷ 30.00 x	0.00	x 84.6 =	0.00	0.00
G.	Bicarbonate (HCO_3)	00440	224.	÷ 61.02 x	3.67	x 43.6 =	160.01	11.61
H.	Sulfate (SO_4)	00945	178.	÷ 48.03 x	3.71	x 73.9 =	274.17	11.74
I.	Chloride (Cl)	00940	859.	÷ 35.45 x	24.23	x 75.9 =	1839.06	76.65
J.	Nitrate (NO_3-N)	71851	.08			Total	3815.08	=T (1) page 35
K.	Fluoride (F)	00951	.52					
L.	Silica (SiO_2)	00955	31.					
M.			Total Anion	...	31.61			
N.	Total Ion	....	1994.					
P.	TDS (180 °C)	70300	1920.					
Q.	TDS = N - .5G	=	1882.					
R.	Ec (25 °C)	00095	3440.					
S.	Ec (Dilute) = ___ x ___	=	3772.	µmhos				
U.	Alk. as $CaCO_3$	00410	184.	µmhos				
V.	pH	00403	7.63					

Accuracy Check

		Range
Ion (E:M)	.987	.96 to 1.04
TDS (P:Q)	1.020	.90 to 1.10
Ec (S:T)	.989	.95 to 1.05



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.021	* Manganese (Mn)	0.02	* Vanadium (V)	<0.01
* Barium (Ba)	0.03	* Mercury (Hg)	0.0003	* Zinc (Zn)	0.012
* Cadmium (Cd)	0.0002	* Moly. (Mo)	0.03	Boron (B)	1.5
* Chrom. (Cr)	0.002	* Nickel (Ni)	<0.01	Ammonia-N	0.01
* Copper (Cu)	0.005	* Selenium (Se)	<0.001	Radium 226	1.5 +/- .8 (pci/1)
* Iron (Fe)	0.01	* Silver (Ag)	<0.01		
* Lead (Pb)	<0.001	* Uranium (U)	0.007		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

84

TDWR-0177

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. U-236 Sample No. M16-4965

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/28/78 ; By WILLIAM CHAPMAN

Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71, Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/28	27.20	8.50	3400	Spec. Cond. at Well: 3400		µmhos
2	10/9	27.50	8.50	3300	Normal Water Level:		msl
3	10/10	28.50	8.35	3200	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items, 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name JORDAN LABORATORIES Date Received 9/28/78 Date Reported 10/12/78

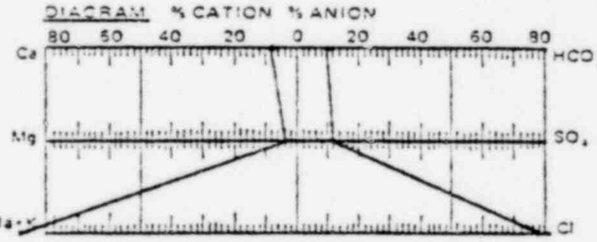
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	52.	= 20.04 x	2.59	x 52.0 =	134.68	8.25
B.	Magnesium (Mg)	00925	17.	= 12.16 x	1.40	x 46.6 =	65.24	4.46
C.	Sodium (Na)	00929	621.	= 22.99 x	27.01	x 48.9 =	1320.79	85.99
D.	Potassium (K)	00937	16.	= 39.10 x	.41	x 72.0 =	29.52	1.31
E.			Total Cation	....	31.41			
F.	Carbonate (CO_3)	00445	5.	= 30.00 x	.17	x 84.6 =	14.38	.54
G.	Bicarbonate (HCO_3)	00440	199.	= 61.02 x	3.26	x 43.6 =	142.14	10.34
H.	Sulfate (SO_4)	00945	184.	= 48.03 x	3.83	x 73.9 =	283.04	12.15
I.	Chloride (Cl)	00940	860.	= 35.45 x	24.26	x 75.9 =	1841.33	76.97
J.	Nitrate (NO_3-N)	71851	.02			Total	3831.12	*T (1) page 35
K.	Fluoride (F)	00951	.52					
L.	Silica (SiO_2)	00955	30.					
M.			Total Anion	....	31.52			
N.	Total Ion	....	1985.					
P.	TDS (180 °C)	70300	1950.					
Q.	TDS = N - .5G	=	1885.					
R.	Ec (25 °C)	00095	3440.					
S.	Ec (Dilute) = ____ x ____	=	3780.	µmhos				
U.	Alk. as $CaCO_3$	00410	171.	µmhos				
V.	pH	00403	8.55					

Accuracy Check

		Range
Ion (E:M)	.997	.96 to 1.04
TDS (P:Q)	1.034	.90 to 1.10
Ec (S:T)	.987	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	.021	* Manganese (Mn)	0.02	* Vanadium (V)	0.01
* Barium (Ba)	0.03	* Mercury (Hg)	<0.0001	* Zinc (Zn)	0.025
* Cadmium (Cd)	<0.0001	* Moly. (Mo)	0.02	Boron (B)	1.3
* Chrom. (Cr)	0.002	* Nickel (Ni)	<0.01	Ammonia-N	<0.01
* Copper (Cu)	0.006	* Selenium (Se)	0.003	Radium 226	129 +/-7 (pci/1)
* Iron (Fe)	0.02	* Silver (Ag)	<0.01		
* Lead (Pb)	0.012	* Uranium (U)	0.004		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

TDWR-0177

1214 085

Texas Department of Water Resources—Geological Services

Permit No. ______

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Well No. U-244 Sample No. M16-4966

Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/27/78 ; By WILLIAM CHAPMAN

Company URANIUM RESOURCES INC Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/28	29.20	8.60	3400	Spec. Cond. at Well: 3400		µmhos
2	10/9	28.00	8.50	3300	Normal Water Level:		msl
3	10/10	28.00	8.73	3200	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items; One quart plastic (full) for Specific Conductivity

PRESERVATION METHODS: Acidify * Item to < 2 pH (HNO_3); Cool all other items to 4 °C.

ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/28/78 Date Reported 10/12/78

MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	44.	= 20.04 x	2.20	x 52.0 =	114.40	6.90
B.	Magnesium (Mg)	00925	12.	= 12.16 x	.99	x 46.6 =	46.13	3.11
C.	Sodium (Na)	00929	649.	= 22.99 x	28.23	x 48.9 =	1380.45	88.55
D.	Potassium (K)	00937	18.	= 39.10 x	.46	x 72.0 =	33.12	1.44
E.			Total Cation	....	31.88			
F.	Carbonate (CO_3)	00445	2.	= 30.00 x	.07	x 84.6 =	5.92	.22
G.	Bicarbonate (HCO_3)	00440	194.	= 61.02 x	3.18	x 43.6 =	138.65	10.01
H.	Sulfate (SO_4)	00945	200.	= 48.03 x	4.16	x 73.9 =	307.42	13.09
I.	Chloride (Cl)	00940	864.	= 35.45 x	24.37	x 75.9 =	1849.68	76.68
J.	Nitrate (NO_3-N)	71851	.06			Total	3875.78 = T (1) page 35	
K.	Fluoride (F)	00951	.49					
L.	Silica (SiO_2)	00955	30.					
M.			Total Anion	...	31.78			
N.	Total Ion	....	2014.					
P.	TDS (180 °C)	70300	1950.					
Q.	TDS = N - .5G	=	1917.					
R.	Ec (25 °C)	00095	3450.					
S.	Ec (Dilute) = ___ x ___	=	3832.	µmhos				
U.	Alk. as $CaCO_3$	00410	163.	µmhos				
V.	pH	00403	8.39					

Accuracy Check

		Range
Ion (E:M)	1.003	.96 to 1.04
TDS (P:Q)	1.017	.90 to 1.10
Ec (S:T)	.989	.95 to 1.05

DIAGRAM % CATION % ANION

(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.023	* Manganese (Mn)	0.01	* Vanadium (V)	<0.01
* Barium (Ba)	0.07	* Mercury (Hg)	0.0005	* Zinc (Zn)	0.032
* Cadmium (Cd)	<0.0001	* Moly. (Mo)	0.03	Boron (B)	1.4
* Chrom. (Cr)	0.003	* Nickel (Ni)	<0.01	Ammonia-N	<0.01
* Copper (Cu)	0.005	* Selenium (Se)	0.005	Radium 226	252+/-10 (pci/1)
* Iron (Fe)	0.05	* Silver (Ag)	<0.01		
* Lead (Pb)	0.001	* Uranium (U)	0.025		

Analyst FRANK NIXON Checked By CARL CROWNOVER

Remarks

1214 086

Texas Department of Water Resources--Geological Services

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

Permit No. ______
Well No. U-247 Sample No. M16-4967
Production Area No. II

Submitted By ARTHUR L. BISHOP Date Collected: 9/27/78; By WILLIAM CHAPMAN
Company URANIUM RESOURCES INC. Mine LONGORIA

SAMPLE METHODS: Calibrate Ec Meter (1)Page 71; Pump Well Until Ec is Approx. Constant.

Sample	Date	Temp (C)	pH	Spec. Cond. (umhos)			
1	9/28	28.60	8.50	3200	Spec. Cond. at Well: 3200		μmhos
2	10/9	28.00	8.50	3100	Normal Water Level:		msl
3	10/10	28.00	8.03	3000	Pump: Set at	msl.	gpm.
					Bottom of: Casing	msl; screen	msl.

CONTAINER: 1 Gal. Plastic for *Items; 1 Gal. Plastic for all other items.; One quart plastic (full) for Specific Conductivity
PRESERVATION METHODS: Acidify * Item to <2 pH (HNO_3); Cool all other items to 4 °C.
ANALYSIS: Lab Name JORDAN LABORATORIES INC. Date Received 9/28/78 Date Reported 10/12/78

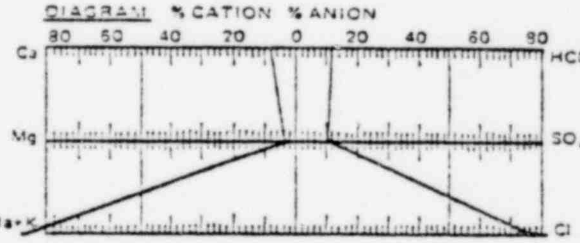
MAJOR AND SECONDARY CONSTITUENTS (Group No. 1)

	ITEM	STORET	mg/l (a)	F (b)	epm (c)	Ecf (d)	(c) x (d)	% epm
A.	Calcium (Ca)	00915	48.	= 20.04 x	2.40	x 52.0 =	124.80	8.15
B.	Magnesium (Mg)	00925	14.	= 12.16 x	1.15	x 46.6 =	53.59	3.90
C.	Sodium (Na)	00929	585.	= 22.99 x	25.45	x 48.9 =	1244.51	86.39
D.	Potassium (K)	00937	18.	= 39.10 x	.46	x 72.0 =	33.12	1.56
E.			Total Cation	....	29.46			
F.	Carbonate (CO_3)	00445	1.	= 30.00 x	.03	x 84.6 =	2.54	.10
G.	Bicarbonate (HCO_3)	00440	210.	= 61.02 x	3.44	x 43.6 =	149.98	11.68
H.	Sulfate (SO_4)	00945	161.	= 48.03 x	3.35	x 73.9 =	247.56	11.38
I.	Chloride (Cl)	00940	802.	= 35.45 x	22.62	x 75.9 =	1716.86	76.83
J.	Nitrate (NO_3-N)	71851	.05			Total	3572.96	*T (1) page 35
K.	Fluoride (F)	00951	.56					
L.	Silica (SiO_2)	00955	31.					
M.			Total Anion	...	29.44			
N.	Total Ion	....	1871.					
P.	TDS (180 °C)	70300	1820.					
Q.	TDS = N - .5G	=	1766.					
R.	Ec (25 °C)	00095	3250.					
S.	Ec (Dilute) = ___ x ___	=	3530.	μmhos				
U.	Alk. as $CaCO_3$	00410	173.	μmhos				
V.	pH	00403	8.37					

Accuracy Check

		Range
Ion (E:M)	1.001	.96 to 1.04
TDS (P:Q)	1.031	.90 to 1.10
Ec (S:T)	.988	.95 to 1.05

DIAGRAM % CATION % ANION



(1) See STD Methods - 14th Edition

MINOR AND TRACE CONSTITUENTS (Group No. 2)

ITEM	mg/l	ITEM	mg/l	ITEM	mg/l
* Arsenic (As)	0.027	* Manganese (Mn)	0.01	* Vanadium (V)	<0.01
* Barium (Ba)	0.08	* Mercury (Hg)	<0.0001	* Zinc (Zn)	0.047
* Cadmium (Cd)	<0.0001	* Moly. (Mo)	0.03	Boron (B)	1.4
* Chrom. (Cr)	0.001	* Nickel (Ni)	<0.01	Ammonia-N	<0.01
* Copper (Cu)	0.007	* Selenium (Se)	<0.001	Radium 226	13+/-2 (pci/1)
* Iron (Fe)	0.05	* Silver (Ag)	<0.01		
* Lead (Pb)	0.003	* Uranium (U)	0.014		

Analyst FRANK NIXON Checked By CARL GROWNOVER
Remarks

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TDWR-0177

8 b. Underlying Aquifer

The next aquifer below the 4/a gravel is the 4 b sand. Between the 4 a and 4 b is a maximum of 10 feet of impermeable clay. All exploration holes that penetrate this clay have been plugged with cement. Because of well completion techniques (Chapter 9.) any penetration below the well casing is filled with cement. Therefore, URI does not propose to monitor the 4 b.

CHAPTER 9.

WELL COMPLETION

All production and monitor wells are completed in the same manner. Total depth calculations for wells are made by use of existing exploration geophysical logs. All production wells are drilled to a depth of at least 8 feet below the mineralized zone in the "4 a gravel" host. All production zone monitor wells are drilled to a depth of at least 8 feet below the base of the "4 a gravel" production zone. Non-production zone monitor wells are drilled to a total depth which coincides with the top of the clay seam seperating the "3c" and 3b" sands (See Chapter 3.).

Once the well is drilled to a total depth, the bore hole is conditioned with a polymer drilling mud. At this time, well casing is made up with strap wrench tongs and placed in the hole. The Longoria in situ uranium leach project utilizes fiberglass well casing, which meets or exceeds the following specifications:

Casing Size:	4" nominal
Inside Diameter:	4.33 "
Outside Diameter:	4.83 "
Wall Thickness:	0.25 "
Weight Per Foot:	3.1 lb.
Length of Joint:	22.25 '
O.D. at Upset:	5.5 "
Thread:	Fiberglass W/"O" Ring
Operating Preassure:	1,000 psi
Ultimate Collapse:	1,100 psi
Operating Temperature:	150 degrees F. Max.
Operating Tensile Load Across Joint:	15,000 lbs.

1214 089

The first casing joint (landing joint) has a cement guide shoe bonded to the pin. The landing joint, third joint and the tenth joint up have centralizers attached as they are placed in the hole. Depth for the landing joint is five feet above total drill depth.

After the casing is landed the drilling rig is moved off location and a cementing unit is moved on. A cementing nipple is attached to the casing collar and circulation is broken with clear water; and clear water is circulated for approximately ten minutes. At this time, a cement slurry is pumped into the well casing. All cement slurries utilized on the Longoria project are made up to the following specification:

Cement Type:	Class A
Additives:	4% Bentorite Gel
Volume:	1.1 to 1.2 X Casing/hole annulus volume
Slurry Weight:	14.1 lbs/gal.
Cement Water Ratio:	7.8 gal./sk. cement

After the prescribed volume of cement slurry is pumped into the casing the cement nipple is removed, a cement wiper plug is placed in the casing, and the cementing nipple is reattached. The wiper plug is then pumped down to the bottom of the casing with clear water which displaces the cement out of the casing through the guide shoe and into the casing bore hole annulus. Once the wiper plug reaches bottom, the casing interior is pressured to 250 psi and the well is shut in until the cement has cured.

At this time, completion interval for the individual well is chosen. Completion intervals for production wells are confined to that depth interval in which there is mineralization. Production zone monitor wells are completed through the "4 a gravel". Non-production zone monitor wells have 20 feet of completion interval, the base of which is located 3 feet above the cement guide shoe. All well completions are made by water/sand perforation. This process utilizes a water sand slurry pressurized to 3000 psi injected through the casing and cement and into the formation.

After perforation the well is produced by jetting until produced waters are free of drilling sediments and have obtained attenuated pH, temperature, and conductivity levels.

Installation control is maintained through a well completion report. A copy of this form and a diagrammatic well design are attached (Figs. 9-1, 9-2).

CHAPTER 10.

HYDROLOGIC TESTING

Aquifer testing for production and monitoring purposes is carried out through all,or part of a five process step:

Well field stimulation,
pre-test well field evaluation,
well field recovery,
well field drawdown,
well field recovery and interpretation

Each process step is described below in detail.

-Well Field Development-

Prior to any aquifer testing all wells will be developed in order to achieve maximum performance. In previously utilized wells this includes, but would not be limited to, acidizing for scale removal and jet surging for removal of sediment buildup inside the casing. Recently completed wells are stimulated by air jetting to reduce or eliminate formation damage induced by drilling activity.

-Pre-Test Well Field Evaluation (New Well Fields Only)-

In order to develop adequate logistical plans for aquifer tests on new well fields, a "mini pump test" is run. Data from this test aids in selection of drawdown observation wells, assignment of monitoring equipment and scaling of pumps. In addition, this test also provides data which helps in determining if more than one test is required, or if any proximal boundaries exist. This test is normally conducted 2 or 3 days prior to the major aquifer test.

-Well Field Recovery-

All wells under URI control are shut in for at least 48 hours prior to an aquifer test. During this period continuous water level recorders would be put in place, and the degree and rate of aquifer recovery are monitored. It is during this stage all water monitoring equipment is set up. The location number and purpose of such equipment is outlined below:

Continuous Water Level Recorders

A minimum of three water level recorders are utilized. The first recorder is set on one production zone well proximal to the test pump well. The second recorder is placed on a production zone monitor well. The third recorder is set on a non-production zone monitor well. Continuous records from these wells are used not only as a record of the selected wells performance, but also as an interpretive tool for data from non-continuous recordings. If additional recorders are available they are placed symmetrically with respect to the pump well or assymetrically if a boundary condition is anticipated.

Electric Line Water Level Sonde

At least three "E-lines" are utilized in any aquifer test. Their placement will be permanent for the duration of the test. "E-lines" are only used on wells in close proximity to the aquifer test pump well where pressure response is significant in very short time spans.

Steel Lines

For all remaining water level monitoring stations, a 300 foot engineers chain are used for water level measurement by the wetted tape procedure. Wetted tape measurements involve 3 to 6 wells per steel line.

Continuous Barometric Measurement

A continuous barograph is kept during the test for interpretive purposes where barometric changes have significant influence on the test.

After aquifer recovery is indicated by the continuous water level recorders, static water levels are obtained in each observation well. This data will be used to determine groundwater gradient and direction. In turn, piezometric gradient, formation porosity and subsequent pump test data are used to determine groundwater velocity.

-Well Field Drawdown-

After static water level measurements have been obtained, the aquifer is stressed by pumping a pre-determined well for 24 hours During this time, water level in observation wells is recorded using the previously described equipment.

-Well Field Recovery-

Twenty-four hours after pumping, the test well is shut in and the aquifer allowed to recover. During this recovery period observation wells are monitored for the development of recovery curves.

-Data Interpretation-

All data derived from the aquifer test is interpreted by utilization of the Theis non-equilibrium drawdown analysis. Drawdown will be plotted semi logrithically against r^2/t. The resulting curve will be visually matched against the type curve. Once a match point is picked, u and w(u) are determined and from this transmissivity and storage coeffecients are calculated.

CHAPTER 11.

EXCURSION PREVENTION

Preventative Measures:

When production rate equals injection rate an <u>in</u> <u>s.</u> leach system is balanced. Ideally, no mine fluids would escape such a system. However, because factors such as ground water flow, differential permeabilities, meter error etc. exist, a balanced system does not provide adequate fluid control.

To preclude any vertical/horizontal mine fluid migration URI utilizes a bleed system. In simplest terms, a bleed system is one in which a flow stream is extracted from the injection lines ahead of the well head. Since production pumpage now exceeds injection a hydraulic pressure sink is created in the aquifer and is centered on the production area. Uncontaminated formation waters migrate in response to this negative pressure anomally from the surrounding permi' area to the production area. This inflow of water precludes ıtflow of mine fluids.

Monitoring of the bleed stream and its effectiveness will be made by three direct and one indirect techniques. First, at the point of bleed stream extraction the volume of extraction will be monitored by use of an in-line totalizer. The totalizer will be checked daily and the totalizer readings will be recorded and maintained on site for public inspection.

The effectiveness of the net overproduction will be monitored by direct contin cus and discontinuous measurement of aquifer depressuring. A continuous water level recorder will be placed on a production zone monitor well and on a non-production zone monitor well. Pressure reversal cn the continuous record or aquifer pressure buildup will provi ie early warning of potentially adverse fluid migration and appropriate system modification would be made through increased bleeding. Discontinuous water level measurements will be made once every two weeks on all wells without continuous water level recorders. As in the case of continuously monitored wells, any aquifer pressure buildups would be corrected by bleed stream adjustment, all water level records from continuous and discontinuous monitoring will be maintained on site subject to public inspection.

Indirect measurement of the excursion control effectiveness will be made by sampling and analyzing water from production zone and non-production zone monitor wells. Each monitor well water that is sampled will be analyzed for the conductivity, sulfate, chloride, and uranium. The reason for selection of each chemical species or quality is given below:

-Conductivity-

Specific conductance of a solution is geometrically proportional to the total dissolved solids (TDS) of that solution. During in situ leach operations, TDS concentrations within and immediately adjacent to the production field will be 3 to 4 times greater than baseline TDS concentration of the surrounding production vicinity. Therefore, any abnormal increase in specific conductance would indicate the potential that mine fluids have migrated away from the production area.

-Sulfate-

Oxidation reations in the aquifer are essential to in situ leach production. Consentrations of pyrite and marcasite are associated with oxidation/reduction uranium roll front deposits and are perferentially oxidized in in situ leach operations. Ensuing sulfate production exceeds baseline concentration by a factor of 4 to 6. Therefore, anomalaous sulfate increases in monitor well samples would indicate outward mine fluid movement.

-Chloride-

Anion exchange species for the uranyl tricarbonate complexed anion is chloride. Chloride concentration exchanged into aquifer mine fluids cause buildup of chloride in the production zone. These concentrations may exceed baseline by a factor of three. Therefore, chloride increases in monitor wells to levels well above baseline would indicate an excursion.

-Uranium-

Economic in situ leach operations require that uranium concentrations in production solutions must exceed baseline condition by at least two or more orders of magnitude. Therefore, uranium concentration significantly exceeding baseline conditions would be an excellent indicator of mine fluid excursion.

Production and non-production zone monitor wells will be sampled every two weeks coincident with discontinuous water level measurements. All samples will be analyzed and reported within 24 hours. If any one sample has a chemical level quality or species above a predetermined level, it will be assumed that an excursion has occured. These levels are:

Conductivity	4865.3	Umhos
Sulfate	296	mg/l
Chloride	1172	mg/l
Uranium	5.0	mg/l

These levels are the equal to the statistically determined maximum concentrations for the production zone aquifer plus deviation for laboratory error, (See Chapter 7). All monitor well analysis data will be kept on site for public inspection and will be reported to the State of Texas monthly on prescribed forms.

1214 098

Corrective Action Measures:

If abherrent formation pressuring occurs without attendant chemical increases in the monitor wells, corrective action will consist of greater bleed stream extraction. If one or more monitor wells have chemical levels exceeding the excursion determining threshold a second sample will be taken within 24 hours of the initial sampling. If analysis of the second sample shows that the chemical levels of the first were the result of improper sampling, faulty analysis, or similar phenomena, no further action will be taken. If the second analysis produces results substantiating the first one, the State of Texas will be so notified by telephone within one working day and by written communication within two working days of said confirmation.

Simultaneously, URI will increase the bleed extraction and will continue monitoring the affected well(s) every other day until the monitor well values of conductivity, sulfate, chloride, and uranium are within 10% of excursion threshold values.

If the affected well has not had decreases in threshold exceeding concentration of 10% in 14 calendar days, 50% in 21 calendar days, or 90% in 42 calendar days, all lixaviant injection will cease and the aquifer will be pumped until the 90% reduction is achieved. Remaining 10% reduction will be achieved no later than six months after excursion confirmation. After achievement of 90% reduction, mining activities will return to pre-excursion conditions.

An excursion corrective action report will be submitted to the State of Texas two weeks after initial excursion confirmation. The report will include measures taken in the previous two weeks and planned corrective measures to be taken in the following two weeks. Such reporting will continue until 90% reduction is achieved.

CHAPTER 12.

RESTORATION

Restoration of the production zone will be achieved by groundwater sweeping. Groundwater sweeping also referred to as pore volume flushing or pore volume displacement is an industry wide "in use" procedure which has been accepted by the states of Texas and Wyoming and by the United States Environmental Protection Agency and the Nuclear Regulatory Commission.

This procedure involves contemporaneous active and passive restoration activities. Active restoration consists of withdrawal of mine fluids by pumping. Passive restoration consists of unaffected waters migrating inward in response to pumping, thus displacing mine fluids which have not yet been extracted by pumping.

Numerous examples of the effectiveness of this procedure have been provided by in situ leach operators in south Texas. The estimated numbers of pore volumes required for total restoration have varied from 3.25 to 20 +. This high degree of variability is due to the site specific differences in cationic composition of lixiviant chemistry and clay content of the production zones. The apparent limiting dimension is in the use of ammonia. If ammonia is used, the ammonium cation exchanges for calcium in the montmorillanite clay rich formations. The reverse exchange rate of another cation for the ammonium cation is slow and requires sweeps of 10 or more pore volumes.

However, URI does not propose to use an ammonia based lixiviant and therefore the aforementioned restoration problem should not be encountered. The effectiveness of ground water sweeping for restoration in a non-ammonia leach system has been documented by Mobil Oil Corporation/Energy Minerals Division, U.S. and Canada, in their applications for the O'Hern, Holiday-El Mesquite and Piedre Lumbre-Brelum leach projects (TDWR permits numbers 01941, 02156, 02155, 02147, 02149, 02152,02148, 02151, respectively). Review of the non-ammonia restoration test yields the following conclusions about groundwater sweeping of non-ammonia leach systems:

1. The test was conducted on a production zone completed in the Catahoula Tuff.
2. Data extrapolation did not reveal any variation in effectiveness or number of pore volumes required regardless of site location or geologic interval, and
3. groundwater sweeping was effective in achieving full restoration in less than 5 pore volumes.

Therefore, it is proposed that Mobil data be considered as evidence of the ability of URI to restore the Longoria Area II mine area in 5 pore volumes or less, for the following reasons:

1. Th Longoria project is immediately adjacent to the O'Hern project where the original non-ammonia restoration test was conducted.
2. The geologic interval dedicated for production is the same as that proposed for use by other operators, and
3. URI will use a non-ammonia leach system.

Fluids produced by this restoration technique will be treated by reverse osmosis (R.O.). The reject stream will be disposed by subsurface injection. The purified stream will be spray irrigated on the permit area as part of the surface restoration program. If for any reason, the purified stream does not meet acceptable standards for surface irrigation R.O. treatment will cease and all fluids will be disposed by subsurface injection.

Restoration rate will be monitored through analysis of waters produced from the formation. A sample will be taken weekly from the composite production line and analyzed for conductivity, sulfate, chloride, and uranium. This data will be compiled monthly and reported quarterly to the Texas Department of Water Resources.

When this data indicates that restoration is at or near completion, URI will sample each original baseline well and analyze for the parameters listed in Table 12-1.

TABLE 12-1 RESTORATION PARAMETERS AND CONCENTRATIONS *

Ca (200)	CO_3 (2.27)	NO_3N (10.0)	Ec@ 25 c (3551.4)
Mg (150)	HCO_3 (500)	FL (1.8)	Ec (dilute) (3959.3)
Na (636.3)	SO_4 (300)	S_iO_2 (38.9)	Alk. as $CaCO_3$ (209.5)
K (24.2)	CI (300)	TDS @180 c (2013.9)	pH (6-9)

* All values are mg/l except Ec and Ec (dil) which are micromhos. If the 18 well mean value for each chemical parameter is equal to or below the original mean plus one standard deviation or the accepted drinking water limit, restoration is considered to be completed. These values are in paranthesis in Table 12-1.

1214 102

At such time, the state will be notified and a time selected for split sample collection for analytical verification of restoration achievement. Three sample sets will be taken at one month intervals from the original baseline wells. Providing no significant changes between the first two analyses, the third sample set will be analyzed for the minor and trace constituents originally reported. If the major and minor constituents reported for all three sample sets are within the values found in Tables 12-1 and 12-2, URI considers that restoration is complete and is under no obligation for subsurface restoration.

TABLE 12

RESTORATION PARAMETER AND CONCENTRATION, TRACE ELEMENTS *

As (0.05)	Mn (0.05)	V (5.0)
Bg (1.0)	Hg (0.002)	Zn (5.0)
Cd (0.01)	Mo (1.0)	B (4.0)
Cr (0.05)	Ni (1.0)	NH_3-N (0.5)
Cu (1.0)	Se (0.01)	Ra 226 (97)
Fe (0.3)	Ag (0.05)	
Pb (0.05)	U (2.0)	

* all values in mg/l except Ra 226 which is in pCi/l.

1214 103

CHAPTER 13.

CLOSING

All surface acerage affected by URI mining activity will be restored to a land use condition as good as, or identical with pre-mining land use. Exception to this would be any prior surface restoration agreement with the land owner and/or any restoration condition placed upon URI by the State of Texas. Basic closing procedures are outlined below.

-Well Field-

After aquifer restoration has been accomplished all lateral and master manifold pipelines will be removed from the property. Lines that are not reusable will be decontaminated and disposed of by salvage sale or destruction. Salvageable lines will be held by URI for use in other in situ leach activities. All well head equipment, i.e. valves, meters, control panels, etc. will be salvaged or destroyed in a like manner.

All production, injection, and monitor wells will be plugged and abandoned in the following manner. First, a cement plug will be placed in the well bore from total depth to a level at least 50 feet above the completion interval. Thereafter, the casing will be filled with drilling mud from the top of the bottom plug to a level 15 feet below ground. A second cement plug will be set from 15 feet to 3 feet below ground surface. The casing will then be cut at the top of the cement and the upper three feet will be pulled. The resulting hole will be backfilled with native soil. Two exceptions could possibly be made to this procedure. If the

1214 104

landowner should desire URI to leave a well or wells open, URI will do so after informing the landowner of the water quality of the well(s). In addition, URI may elect to fill the well bore up to the 3 feet level entirely with cement. Such action will be taken after informing the State of Texas of URI's intent.

-Surface Plant-

All surface structures will be removed from the property after mining activity has ceased. Tanks, lines, pumps and structural steel will be disposed of in a manner similar to that for well field equipment. Concrete pads will be decontaminated by acid scrubbing, demolished and disposed of in a licensed solid waste facility. If the surface owner should desire that URI leave any concrete slabs, URI will limit its obligation to decontamination after first notifying the State of Texas and is in receipt of approval for such action.

All fluids held in waste retention ponds will be evacuated and disposed by deep well injection. Any remaining solid waste will either be solubilized and injected as above, or drummed and shipped to a licensed L.S.A. disposal sight. Thereafter, the pond liner will be decontaminated, folded and placed in the bottom of the pond. Two feet of impermeable clay will be placed on top of the liner. Pond embankments will then be placed over the clay and graded to a crown in order that water will not be impounded on the pond site. This surface will be seeded with grass to preclude erosion.

Power poles, phone lines and other ancillary equipment will be retained at the discretion of the landowner. Office and maintenance structures will be removed and stored for further use by URI.

CHAPTER 14.

PRODUCTION FACILITIES AND PROCEDURES

a. Process Description

Uranium minerals are leached *in situ* from the host sand by a two step process of oxidation and solubilization. A lixiviant solution composed of a bicarbonate anion complexing agent and oxygen (gaseous or as peroxide) is introduced to the host sand where the following reactions occur:

$$2UO_2 + O_2 = 2UO_3 \quad (1$$

$$2UO_3 + Na_2CO_3 + 2NaHCO_3 = Na_4UO_2(CO_3) + H_2O \quad (2$$

The final uranyl tricarbonate complex is soluble and is extracted from the subsurface by pumping. Produced fluids then pass into upflow ion exchange columns (Fig. 14 a-1). Here the uranyl tricarbonate anion complex is exchanged onto positively charged resins by displacement of chloride anions through the following reaction:

$$4RCL + Na_4UO_2(CO_3)_3 = R_4UO_2(CO_3)_3 + 4NaCL \quad (3$$

The now barren leach solution passes to the barren lixiviant tanks where, if necessary, it is refortified with chemicals. Afterwards, it is pumped through one or both sand filters for removal of clastics or precipitates and reinjected (Fig. 14 a-1).

Once all ion exchange sites are filled on the resin in a particular ion exchange column, the column is taken off stream and resin therein is transferred to one of two elution columns. In the elution column the uranyl complex is stripped from the resin through reversal of formula three in two process steps.

In the first step, a fixed volume of recycle eluant is passed over the loaded resin. This portion is then transferred to the pregnant eluant tanks (Fig. 14 a-1). In the final step a fixed volume of barren eluant consisting of NaCL brine and NaOH is passed over the resin and then transferred to the recycle eluant tank. At this time, the resin is completely stripped of uranyl complex anions and is transferred back to an ion exchange column.

Uranium is precipitated from the pregnant eluant through a three step process. After pregnant eluant has transferred to the first precipitation tank, hydrochloric acid (HCL) is added until the solution's pH has been lowered to approximately 2. At this time, the solution passes to precipitation tank number two where carbonate anions are lost through venting of CO_2 to the atmosphere. Subsequently, the acidified eluant is transferred to precipitation tank number three where peroxide is added to achieve maximum oxidation of the uranium. The third and final step consists of transferring the acidified solution to precipitation tank number four where NaOH is added until the pH has been raised sufficiently to allow precipitation to begin. When the precipitation is complete the yellow cake slurry is transferred to a holding tank (Fig. 14 a-1), where it will remain until it is transported to a uranium fuel processing facility.

14 b. Plant Waste Streams

Plant waste stream sources are identified on Fig. 14 a-1. Their volume source and disposition are given in Table 14 b-1.

TABLE 14 b-1 PLANT WASTE STREAMS

	LIXIVIANT BLEED	RESIN WASH	LAB	FILTER PRESS WASH	ELUANT BLEED
Location [1]	A	B	C	D	E
Volume [2]					
Min.	1440	800	200	600	1000
Max.	7200	3000	1440	3000	2000
Disposition [3]	WP	WP	WP	WP	WP
Concentrations [4]					
Ca	650	650	500	500	500
Mg	500	500	400	400	400
Na	4500	4500	20000	40000	40000
K	250	250	20000	150	150
CO_3	200	200	100000	36000	36000
HCO_3	5000	5000	100000	36000	36000
SO_4	4000	4000	100000	2000	2000
Cl	5000	5000	100000	90000	90000
NO_3N	5.0	5.0	100000	400	400
Fl	100	100	500	50	50
TDS	12000	12000	100000	90000	90000
pH	6-10	6-10	<1-14	6-5-9-5	6-10
U	50	50	100	50	50
V	10	10	100	30	30
Mo	600	600	100	4000	4000
As	30	30	100	100	100
NH_3-N [5]	5350	5350	50000	42000	42000

NOTES:

1. See Fig. 14 a-1
2. All values in gallons per day
3. WP - waste pond
4. All values in mg/l except for pH; all or maximum except for pH where range is given.
5. Only if ammonia based lixiviant is used

14 c. Schedule for Completion

All well field, plant and process support facilities will be in place and ready for use on, or before February 1, 1979.

14 d. Injection Fluid Composition

Lixiviant concentration and composition varies through the life of any leach project. Such variability results from modification of operational techniques and differential chemical reaction rates within the host sand. Therefore, only an anticipated lixiviant composition, with ranges of concentration can be given (Table 14 d-1).

It should be noted that although ammonia values are given URI does not use an ammonium cation based system. However, if URI should elect to use ammonia the range of values in Table 14 d-1 would be applicable to the Longoria Project. Prior to use of ammonia the Texas Department of Water Resources would be notified and the restoration fluid volumes would be recalculated (Ch 14 h.).

1214 111

TABLE 14 d-1.

Lixiviant Composition and Concentration

Chemical Species	Range	
	Low *	High *
Ca	25	650
Mg	6.9	500
Na	496	4500
K	12	250
CO_3	0	200
HCO_3	194	5000
SO_4	97	4000
Cl	643	5000
NO_3-N	0.01	5.0
SiO_2	28	100
TDS	1450	12000
pH	6	10
Mo	0.02	600
U	0.002	50
NH_4-N	0.01	5350 *

* Only if ammonia leach system is used.
** All values in mg/l except for pH.

1214 112

14 e. Waste Retention

Only one waste holding pond is used at URI's Longoria Leach Project. The pond was constructed in such manner that at maximum normal operation freeboard (7') pond fluids will not be above surrounding ground level (Fig. 14 e-1). Embankments above gound level are composed of compacted sand and caliche derived from pit excavation. Thirty mil reinforced chlorinated poly ethylene overlies all water retention surfaces.

Under the pond liner is an underdrain leak detection system which is monitored from a sampling station proximal to the pond embankment (Fig. 14 e-1). This monitoring station is checked weekly for the presence of water. If water is found in the wet well, a sample will be taken and will be analyzed to determine if a leak has occurred.

If it is determined that a leak has occurred, waste waters will be evacuated from the pond and the liner failure will be located. Thereafter, the liner will be repaired, if possible. If the liner is irrepairably damaged, it will be replaced. Because of below ground waste storage under normal conditions, a leak should not effect structural competancy of the pond.

As previously mentioned maximum normal pond freeboard is seven feet. However, under emergency conditions such as extreme rainfall, the freeboard limit would be extended to a total of eight feet, which would still leave two feet of available freeboard in the pond. Pond capacities at various freeboard levels are given in Table 14 e-1.

The pond, the production area, and production facilities are enclosed by barbed wire fence. Entrance and egress through the fence is made at the plant entrance which is controlled by URI.

TABLE 14 e-1.

Freeboard Height vs. Pond Capacity

Freeboard Freeboard Height (Feet)	Pond Capacity (Gallons)	Remarks
1	55,302	
2	116,349	
3	183,380	
4	256,634	
5	336,351	
6	422,770	
7	516,130	Normal Maximum
8	616,671	Emergency Maximum
9	724,632	
10	840,253	

14 f. Runoff and Spill Control

Underlying all liquid and solid chemical use tanks on the Longoria Project is an eight inch reinforced concrete pad. Surrounding the pad perimeter is a six inch curb which will confine all chemical spills and potentially contaminated run-off (Fig. 14 a-1). Total surface area of the pad is 3,122 square feet of which 603.97 is covered by tank vessels. Total retention capacity of the pad is 9417.2 gallons and holding capacity of the sump is 2363.7 gallons. Alltogether, 11780.9 gallons can be retained within the process area.

In the eventuality that a spill escapes the pad area, it will be confined by earthen works. Subsequently, the liquid will be decontained and placed into the waste retention pond. Soil samples will then be taken to determined areal and subsurface extent of contamination. Any contaminated soil will be dryed, barreled, and shipped to a licensed L.S.A. disposal facility.

The same procedure would be followed for pipeline or well head leaks.

14 g. Maintenance Inspection

Table 14 g-1 contains the maintenance schedule for the URI Longoria Leach Project.

TABLE 14 g-1.

Maintenance Inspection Schedule

Item	Frequency			
	Daily	Weekly	Semi-Weekly	Monthly
Well Heads	X			
Pipelines		X		
IX Columns	X			
Elution Columns	X			
Chemical Makeup Tank	X			
Chemical Storage Tanks		X		
Elution & Precipitation Columns	X			
Sand Filters	X			
Monitor Wells			X	
Bleed Lines	X			
Waste Lines	X			
Sump Pump		X		
Pond Underdrain Monitor		X		
Pond Freeboard	X			
Disposal Fluid Quality				X
Fluid Disposal Volume		X		

14 - h. Fluid Waste Production and Disposal

Waste fluid disposal under normal operating conditions is accomplished by evaporation or subsurface injection. Disposal capacity for both are detailed in Table 14 h-1. Evaporation capacities were calculated using a surface area for four feet of freeboard in the waste retention pond described in Chapter 14 e, and surface evaporation rates for Duval County (Table 14 h-2). Minimum disposal capacity is 17,000 gallons per month and maximum is 66,000 gallons per month.

URI has contracted with Arnco, Inc. to dispose of fluid wastes by subsurface injection through a water flood salt water disposal unit (Appendix 14 h-1). At present, Arnco, Inc. has an available disposal rate of 57.5 gpm. Available monthly disposal capacity varies from 2,320,000 gallons per month in February to 2,568,000 gallons per month for a 31 day month (Table 14 h-1).

After *in situ* leach production of the Longoria Area II has ceased, restoration will commence. At this time, all demands from bleed, plant and lab wastes will cease. At that time, the disposal system will handle only water extracted for restoration of the host unit. The disposal rate for the restoration mode has been calculated for two restoration procedures.

The preferred precedure extracts 500 gallons per minute from the production zone. The produced fluids will be treated by reverse osmosis with a 10% rejection rate. The resulting 450 gallons per minute of treated stream will be used as spray irrigation for surface restoration. The 50 gallons per minute reject stream will be delivered to Arnco, Inc. for surface disposal. Since presently available disposal capacity is 57.5 gallons per minute, there is a 14% disposal capacity safety margin.

If for any reason osmosis cannot be used, direct subsurface injection of untreated waters will be used as the restoration procedure. Since a disposal rate limit of 51.5 gallons per minute would result in unacceptable restoration time, the disposal rate must be increased. This increase can be accomodated within the reservoir currently being used by Armco, Inc.

Armco, Inc. injects into the O'Hern Member, Cockfield Formation, Yegua Group, which has been pressure depleted through oil and gas production. Based on pre-operational formation fluid pressures, sand volume and formation porosity, it was calculated that original formation fluid volume was 3.7 billion gallons. Calculations based on present fluid levels indicate that the O'Hern Member has been depleted by 558 million gallons. This volume can therefore be replaced without exceeding pre-production pressures.

As stated previously, Armco, Inc. has an available disposal rate for 57.5 gallons per minute. With the re-opening of shut in wells it can increase the disposal rate to 249 gallons per minute. URI's disposal rate of untreated restoration fluids would be 240 gallons per minute, which yields a net disposal rate safety factor of 4%.

During the 44 months required for its restoration procedure total produced fluid volume would be 463 million gallons which is 17% less than the amount already depleted from the O'Hern Member. Therefore, regardless of restoration procedure there is sufficient capacity to handle URI projected needs.

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1979

AREA II	JAN.	FEBR.	MARCH	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
OPERATIONAL LIFE						PRODUCTION						
Normal Disposal Capacity												
Subsurface Disp.		2,320	2,568	2,485	2,568	2,485	2,568	2,568	2,485	2,568	2,485	2,568
Evaporation		18	27	32	41	48	63	66	49	39	26	18
TOTAL		2,338	2,595	2,517	2,609	2,533	2,631	2,634	2,534	2,607	2,511	2,586
Normal Require.												
Bleed		202	223	216	223	216	223	223	216	223	216	223
Restoration												
Rain Direct		10	5	11	19	17	8	15	31	15	8	8
Indirect		3	2	3	6	5	2	4	9	4	2	3
Plant Wastes		241	267	258	267	258	267	267	258	267	258	267
Lab Wastes		40	45	43	45	43	45	45	43	45	43	45
TOTAL		496	542	531	560	539	545	554	557	554	527	546
FLUID FLOW (Out - In)		1,842	2,053	1,986	2,049	1,994	2,086	2,080	1,977	2,053	1,984	2,040
Total Pond Capacity		516										
Emergency Pond Cap.		101										
Cum Pond Capacity		516	516	516	516	516	516	516	516	516	516	516
Available for Emergency		2,358										
Emergency Req.												
10 yr. 24 hr. rain (6.4")		56										
Excursion Prod. Zone		432										
Exc. Non-Prod. Zone		432										

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1980

AREA II	JAN.	FEBR.	MARCH	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
OPERATIONAL LIFE						PRODUCTION						
Normal Disposal Capacity												
Subsurface Disp.	2,568	2,320	2,568	2,485	2,568	2,485	2,568	2,568	..,485	2,568	2,485	2,568
Evaporation	17	18	27	32	41	48	63	66	49	39	26	18
TOTAL	2,585	2,338	2,595	2,517	2,609	2,533	2,631	2,634	2,534	2,607	2,511	2,586
Normal Requirements												
Bleed	223	202	223	216	223	216	223	223	216	223	216	223
Restoration												
Rain Direct	9	10	5	11	19	17	8	15	31	15	8	8
Indirect	3	3	2	3	6	5	2	4	9	4	2	3
Plant Wastes	267	241	267	258	267	258	267	267	258	267	258	267
Lab Wastes	45	40	45	43	45	43	45	45	43	45	43	45
TOTAL	547	496	542	531	560	539	545	554	551	554	527	546
FLUID FLOW (Out - In)	2,038	1,842	2,053	1,986	2,049	1,994	2,086	2,080	1,977	2,053	1,984	2,040
Total Pond Capacity	516											
Emergency Pond Cap.	101											
Cum. Pond Cap.	516											
Available for Emer.	2,554	2,358	2,569	2,502	2,565	2,510	2,602	2,596	2,493	2,569	2,500	2,556

Emergency Req.
10yr. 24hr. rain
(6.4")
Excursion Prod. Zone
Exc. Non-Prod. Zone

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.)   YEAR: 1981

AREA II	JAN.	FEBR.	MARCH	APR.	MAY	JUNE	JULY	
OPERATIONAL LIFE					PRODUCTION			
Normal Disposal Capacity								
Subsurface Disp.	2,568	2,320	2,568	2,485	2,568	2,485	2,568	
Evaporation	17	18	27	32	41	48	63	
TOTAL	2,585	2,338	2,595	2,517	2,609	2,533	2,631	
Normal Require.								
Bleed	223	202	223	216	223	216	223	
Restoration								
Rain Direct	9	10	5	11	19	17	8	
Indirect	3	3	2	3	6	5	2	
Plant Wastes	267	241	267	258	267	258	267	
Lab Wastes	45	40	45	43	45	43	45	
TOTAL	547	496	542	531	560	539	545	
FLUID FLOW (Out - In)	2,038	1,842	2,053	1,986	2,049	1,994	2,086	
Total Pond Capacity	516							
Emergency Pond Cap.	101							
Cum. Pond Capacity	516							
Available for Emer	2,554	2,358	2,569	2,502	2,565	2,510	2,602	
Emergency Req.								
10 yr. 24 hr. rain (6.4")								
Excursion Prod. Zone								
Exc. Non-Prod. Zone								

* W/O R.O. TREATMENT

1214 123

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1981

AREA II	AUG.	AUG.*	SEPT.	SEPT.*	OCT.	OCT*	NOV.	NOV.*	DEC.	DEC.*
OPERATIONAL LIFE	RESTORATION									
Normal Disposal Capacity										
Subsurface Disp.	2,568	11,129	2,485	10,770	2,568	11,129	2,485	10,770	2,568	11,129
Evaporation	66	66	49	49	39	39	26	26	18	18
TOTAL	2,634	11,195	2,534	10,819	2,607	11,168	2,511	10,796	2,586	11,147
Normal Require.										
Bleed	2,232	10,714	2,160	10,368	2,232	10,714	2,160	10,368	2,232	10,714
Restoration										
Rain Direct										
Indirect										
Plant Wastes										
Lab Wastes										
TOTAL										
FLUID FLOW (Out - In)	402	481	374	451	375	454	351	428	354	433
Total Pond Capacity										
Emergency Pond Cap.										
Cum. Pond Capacity Available for Emerge:										
Emergency Req.										
10 yr. 24 hr. rain (6.4")										
Excursion Prod. Zone										
Exc. Non-Prod. Zone										

* W/O R.O. TREATMENT

1214 124

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1982

AREA II	JAN.	JAN.	FEBR.	FEBR.	MAR.	MAR.	APR.	APR.
OPERATIONAL LIFE	RESTORATION							
Normal Disposal Capacity								
Subsurface Disp.	2,568	11,129	2,320	10,052	2,568	11,129	2,485	10,770
Evaporation	17	17	18	18	27	27	32	32
TOTAL	2,585	11,146	2,338	10,070	2,595	11,156	2,517	10,802
Normal Require.								
Bleed	2,232	10,714	2,016	9,677	2,232	10,714	2,160	10,368
Restoration								
Rain Direct								
Indirect								
Plant Wastes								
Lab Wastes								
TOTAL								
FLUID FLOW (Out - In)	353	432	322	393	363	442	357	434
Total Pond Capacity								
Emergency Pond Cap.								
Cum. Pond Capacity Available for Emerge:								
Emergency Req.								
10 yr. 24 hr. rain (6.4")								
Excursion Prod. Zone								
Exc. Non-Prod. Zone								

1214 125

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1982

AREA II	MAY	MAY *	JUNE	JUNE *	JULY	JULY *
OPERATIONAL LIFE	RESTORATION					
Normal Disposal Capacity						
Subsurface Disp.	2,568	11,129	2,485	10,770	2,568	11,129
Evaporation	41	41	48	48	63	63
TOTAL	2,609	11,170	2,533	10,818	2,631	11,192
Normal Require.						
Bleed	2,232	10,714	2,160	10,368	2,232	10,714
Restoration						
Rain Direct						
Indirect						
Plant Wastes						
Lab Wastes						
TOTAL						
FLUID FLOW (Out - In)	377	456	373	450	399	478
Total Pond Capacity						
Emergency Pond Cap.						
Cum Pond Capacity						
Available for Emergency						
Emergency Req.						
10 yr. 24 hr. rain (6.4")						
Excursion Prod. Zone						
Exc. Non-Prod. Zone						

NOTE: Same non asterisk values would repeat by month through April, 1983
Asterisk values would repeat by month through March, 1985

1214 126

TABLE 14 h-2.

SURFACE EVAPORATION RATES

DUVAL COUNTY

MONTH	RATE (inches)
January	2.7
February	2.9
March	4.3
April	5.1
May	6.4
June	7.5
July	9.9
August	10.3
September	7.7
October	6.2
November	4.1
December	2.9

Art Dunlap

May 30, 1978

Mr. Phillip R. Russell
Railroad Commission of Texas
Oil and Gas Division
P. O. Box 12967
Capitol Station
Austin, TX 78711

Re: Arnco Inc. - O'Hern Field Unit (03898)
O'Hern Field, Webb County, Texas

Dear Mr. Russell:

Under contractual arrangement with Wyoming Minerals Corp. (Bruni Project) and Mobil Oil Corp. (O'Hern Project), I have been obtaining waste water for augmentation of pressure maintenance/secondary recovery in the subject unit. This activity has received clearance by the Texas Department of Health, Texas Department of Water Resources (nee' Texas Water Quality Board) and the Railroad Commission of Texas. Because of enhanced recovery through addition of this fluid, I am considering utilization of similar fluids from additional sources.

One such source is Uranium Resources, Inc. which is currently developing a project similar to Wyoming Minerals Corp. and Mobil Oil Corp. Site location for this project is approximately two miles east of our central battery. Since Uranium Resources, Inc. has not finished their plant, the quality of water to be utilized is not known, but it is anticipated that the water will be comparable in concentration and constituency to that currently delivered by Mobil Oil Corp. Anticipated common characteristics are due to similar processes, and stratigraphic production intervals; however, prior to and during regular intervals of usage these fluid samples will be chemically and radiollogically analyzed. Uranium Resources, Inc. will hold on file for inspection all data derived from these analysis. Past experience with Mobil Oil Corp. and

RECEIVED
OCT 10 1978
URANIUM

1214 128

Wyoming Mineral Corp. indicates that use of fluids from these outside sources has helped maintain pressure and gives an additional oil kick in the water flood. No adverse reservoir responses have been noted while utilizing these fluids.

As stated in my letter of May 5, 1977 the reservoir characteristics are:

Average Depth - 2800 feet
Production Interval - 19' sand, O'Hern member Cockfield Formation
Average Porosity - 28%
Permeability Range - 10 to 1856 millidarcies (core data)
Average Permeability - 293 millidarcies

It is my opinion that this reservoir's productive life will be prolonged if this new source of fluid can be utilized. Therefore I would like to contract with Uranium Resources, Inc. to obtain this excess fluids.

I would appreciate your agencys' approval of this proposal at your earliest convenience. If I may be of further assistance please contact me at your earliest convenience.

Very truly yours,

Glen Dugger

Glen Dugger

cc: TDWR
TDH

SALT WATER DISPOSAL AGREEMENT

THIS AGREEMENT, made and entered into this 31 day of May, 1978, by and between Arnco, Inc. hereinafter called "First Party," and Uranium Resources, Inc. hereinafter called "Second Party," whether one or more:

WHEREAS, First Party owns, maintains and operates facilities for the underground disposal of salt water in the O'Hern Field in Duval County, Texas.

WHEREAS, Second Party is the owner and authorized operator of a uranium lease from which water of no potential use is being or will be produced and desires to dispose of said water into the above referred to facilities owned by First Party.

NOW, THEREFORE, in consideration of the premises, the mutual convenants and agreements hereinafter contained, it is agreed as follows:

1. First Party grants to Second Party the right and privilege of disposing of potentially non-usuable water from Second Party's lease or leases, described above, into the disposal facilities of First Part, mentioned above, subject to the terms and conditions herein contained.

2. Second Party shall deliver said potentially non-usuable

1214 130

water, at its sole risk, cost and expense to the said disposal facilities, at a point designated by First Party. Second Party agrees that said water delivered hereunder shall be clean and free of oil, basic sediment and other substance which may tend to plug or interfere with the efficient operation of the said disposal facilities, and First Party shall be sole and exclusive judge as to whether or not the said water is sufficiently free of said substances. First Party shall have the right to refuse to accept any of said water which does not meet such requirements.

3. Second Party agrees to hold First Party harmless from any and all claims, damages or liability which may arise from laying, relaying, construction, operation, maintenance and removal of pipeline or lines by Second Party, and which may arise from the delivery of potentially non-usable water by Second Party to said disposal facilities. First Party agrees to hold Second Party harmless from any claims, damages or liability which may result from said water after the same enters said disposal facilities.

4. It is agreed that First Party shall accept said water for disposal only when said disposal facilities have input capacity in excess of the disposal requirements of First Party.

5. First Party shall not be liable in damages or otherwise for delays, failures or omissions due to lack of capacity of said

disposal facilities, accidents, breakdowns, closing for repair or remedial work, labor difficulties, strikes, walkouts, fires, storms, acts of God, sabortage, interference by order of or compliance with requests of military or civil authority, whether federal, state or local, or appropriation, requisition or confiscation of any facility for the disposal of salt water hereunder.

6. Second Party shall notify First Party no later than the 15th day of the month the barrels of potentially non-usuable water delivered to the disposal facilities of the First Party during the preceding month. Volume will be determined by a metering device approved by both parties.

7. v.m.m. Second Party agrees to pay to Arnco, Inc. the sum of ~~$.09~~ .127 per barrel of Second Party potentially non-usuable water disposed of into said disposal facilities, subject to periodic adjustment based on cost of fuel gas. This adjustment shall be based on the ratio of the revised fuel cost divided by the current cost of 50¢/MCF. First Party shall render monthly invoices to Second Party for the water disposed of by Second Party into said disposal facilities. Payments shall be made within twenty (20) days from receipt of invoice and in accordance with the terms set forth in Schedule "A".

8. All the terms and provisions of this agreement are hereby

especially made subject to the conservation laws of the State of Texas; and to the valid rules and regulations of the Railroad Commission of Texas; the Texas Department of Water Resources; and the Texas Department of Health, and to all other applicable state and federal laws, rules and regulations.

9. This agreement shall be binding upon and inure to the benefit of the parties hereto, their respective heirs, devisees, executors, administrators, representatives, successors and assigns, until termination hereof by either First Party or Second Party upon ninety (90) days written notice to the other.

SCHEDULE A

INVOICE INSTRUCTIONS

A. Invoices should be rendered to Uranium Resources, Inc. in quintuplicate.

B. Original and three copies of invoices should be mailed to:

Uranium Resources, Incorporated (1)
Attention: Mickey Bottoms
Suite 735 - Promenade Bank Tower
1600 Promenade Center
Richardson, TX 75080

One copy of the invoices should be mailed to:

Uranium Resources, Inc.
Attention: W. M. McKnight, Jr.
P. O. Box 1381
Corpus Christi, TX 78403

IN WITNESS WHEREOF, this agreement is executed as of the day, month, and year first above written.

ATTEST:

____

Date signed: 11-8-78

FIRST PARTY:

ARNCO, INC.

By: [signature]

Address:
1955 Encino
Alice, Texas 78332
Attention: Glenn Dugger

ATTEST:

____

Date signed: 5-8-78

[signature]
AUDREY R. OSTERMEIER
Notary Public, Nueces County, Texas
My Commission Expires 3-8-80

SECOND PARTY:

Uranium Resources, Inc.

By: [signature]

Address:
P. O. Box 1381
Corpus Christi, TX 78403
Attention: W.M. McKnight, Jr.

1214 135

14311

Texas Department of Health

Raymond T. Moore, M.D.
Commissioner

Philip W. Mallory, M.D.
Deputy Commissioner

1100 West 49th Street
Austin, Texas 78756
458-7111

JUL 02 1979

Mr. Arthur L. Bishop
Uranium Resources Inc.
Suite 735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Dear Mr. Bishop:

We transmit herewith Radioactive Material License No. 8-2704, Am. N/A in response to your application initiated on January 30, 1979.

We request that you carefully read and note the conditions of your license and applicable sections of the Texas Regulations for Control of Radiation. You are expected to comply with the conditions of your license and the Regulations.

We call your attention specifically to Section 21.403 of the Regulations. This section sets forth requirements for telephone and telegraph notification to the Agency in the event of a radiation accident or incident. (See enclosed information sheet.)

If we may be of assistance to you in your radiation safety program, please let us know. For licensing information a member of the licensing staff should be contacted. For information concerning inspection of your facility or for the reporting of accidents or incidents, a member of the compliance staff should be contacted.

Sincerely,

Joseph E. Gorrell

Joseph E. Gorrell
Chief of Licensing and Registration
Radiation Control Branch
Division of Occupational Health
and Radiation Control

1214 136 14311

TRC FORM 41-3
(10/78)

TEXAS DEPARTMENT OF HEALTH
RADIOACTIVE MATERIAL LICENSE

Pursuant to the Texas Radiation Control Act and Texas Department of Health regulations on radiation, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess and transfer radioactive material listed below; and to use such radioactive material for the purpose(s) and at the place(s) designated below. This license is subject to all applicable rules, regulations and orders of the Texas Department of Health now or hereafter in effect and to any conditions specified below.

LICENSEE	
1. Name: Uranium Resources, Inc. ATTN: Arthur L. Bishop 2. Address: Suite 735, Promenade Bank Tower 1600 Promenade Center Richardson, Texas 75080	This license issued pursuant to and in accordance with ☐ APPLICATION ☒ LETTER ☐ Dated: 1-30-79, 3-1-79, & 5-11-79, 5-24-79 & 6-6-79. Signed By: Arthur L. Bishop 3. License Number: 8-2704 Amendment Number: N/A PREVIOUS AMENDMENTS ARE VOID 4. Expiration Date: July 31, 1982

RADIOACTIVE MATERIAL AUTHORIZED

5. Radioisotope	6. Form of Material	7. Maximum Activity*	8. Authorized Use
A. Natural Uranium and Daughter Products	A. Any	A. 350,000 pounds	A. In-situ mining, concentration into yellowcake slurry, and transfer to authorized specific licensees.
B. Ra-226	B. Filter media wastes	B. As obtained during processing	B. Storage, drumming, and transfer to authorized specific licensees.

☐ CONTINUED ON PAGE 2, IF CHECKED.

CONDITIONS

9. Radioactive material shall be mined and processed at the licensee's leach site located in Duval County, Texas approximately 5.5 miles southeast of Bruni, Texas, along State Highway 359.

10. The licensee shall comply with the provisions of Parts 11, 21, 22 and 41 of the Texas Regulations for Control of Radiation.

11. Radioactive material shall be used by, or under the supervision of, individuals designated by W. M. McKnight.

12. The individual designated to perform the functions of Radiation Safety Officer for activities covered by this license is Arthur L. Bishop.

* Ci-Curies mCi-Millicuries µCi-Microcuries CONDITIONS CONTINUED ON PAGE 2.

1214 137

TRC FORM 41-3a
(10-78)

TEXAS DEPARTMENT OF HEALTH
RADIOACTIVE MATERIAL LICENSE

Supplementary Sheet

LICENSE NUMBER	AMENDMENT NUMBER
8-2704	N/A

CONDITIONS CONTINUED:

13. At the conclusion of the leach program at each leach site, the licensee shall conduct a ground water restoration program to reduce the radioactive material concentration in the aquifer as specified in his application. Before any site is abandoned, the concentration of radioactive materials in the aquifer shall be reduced to levels as low as practical, but in no instance shall the radioactive concentration exceed those which prevailed before the leach operation began.

14. The licensee shall not discharge to the environment any radioactive material in excess of the limits specified in Appendix 21-A, Table II, Texas Regulations for Control of Radiation.

15. The licensee shall maintain for inspection by the Agency records of the water well sampling program.

16. The licensee is authorized to transfer liquid wastes to specific licensees for disposal through oil field flood injection wells in accordance with procedures contained in his application and supporting documents dated January 30, 1979.

17. Solid wastes shall be transferred to authorized specific licensees for disposal as per the licensee's application dated January 30, 1979.

18. Except as specifically provided otherwise by this license, the licensee shall possess and use the radioactive material authorized by this license in accordance with statements, representations, and procedures contained in application dated January 30, 1979, letters dated March 1, 1979, May 11, 1979, May 24, 1979, June 6, 1979 and all correspondence amending the application which results in an amendment to the license.

FOR THE TEXAS DEPARTMENT OF HEALTH

Date JUL 02 1979

Chief of Licensing/
Radiation Control Branch

1214 138

TRC Form ?-1
(77)

Texas Department of Health
1100 West 49th Street
Austin, Texas 78756

NOTICE TO EMPLOYEES

TEXAS REGULATIONS FOR CONTROL OF RADIATION

The Texas Department of Health has established standards for your protection against radiation hazards, pursuant to the Texas Radiation Control Act, Art. 4590f, Revised Civil Statutes, State of Texas.

YOUR EMPLOYER'S RESPONSIBILITY

Your employer is required to--

1. Apply these regulations to work involving sources of radiation.
2. Post or otherwise make available to you a copy of the Texas Department of Health regulations, licenses, certificates of registration, notices of violations, and operating procedures which apply to work you are engaged in, and explain their provisions to you.

YOUR RESPONSIBILITY AS A WORKER

You should familiarize yourself with those provisions of the regulations and the operating procedures which apply to the work you are engaged in. You should observe their provisions for your own protection and protection of your co-workers.

WHAT IS COVERED BY THESE REGULATIONS

1. Limits on exposure to radiation and radioactive material in restricted and unrestricted areas;
2. Measures to be taken after accidental exposure;
3. Personnel monitoring, surveys and equipment;
4. Caution signs, labels, and safety interlock equipment;
5. Exposure records and reports;
6. Options for workers regarding Agency inspections; and
7. Related matters.

REPORTS ON YOUR RADIATION EXPOSURE HISTORY

1. The regulations require that your employer give you a written report if you receive an exposure in excess of any applicable limit as set forth in the regulations or in the license. The basic limits for exposure to employees are set forth in Sections 21.101, 21.103, and 21.104 of the regulations. These sections specify limits on exposure to radiation and exposure to concentrations of radioactive material in air and water.
2. If you work where personnel monitoring is required.,
   (a) Your employer must give you a written report, upon termination of your employment, of your radiation exposures if that exposure exceeded 10% of any limit set forth in Sections 21.101, 21.103, or 21.104, and
   (b) Upon written request your employer must advise you annually of your exposure to radiation, or on termination of association, of your exposure regardless of the amount of exposure.

INSPECTIONS

All licensed or registered activities are subject to inspection by representatives of the Texas Department of Health. In addition, any worker or representative of workers who believes that there is a violation of the Texas Radiation Control Act, the regulations issued thereunder, or the terms of the employer's license or registration with regard to radiological working conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation to the Texas Department of Health. The request must set forth the specific grounds for the notice, and must be signed by the worker as the representative of the workers. During inspections, Agency inspectors may confer privately with workers, and any worker may bring to the attention of the inspectors any past or present condition which he believes contributed to or caused any violation as described above.

POSTING REQUIREMENT

Copies of this notice must be posted in a sufficient number of places in every establishment where employees are employed in activities licensed or registered, pursuant to Part 41 or Part 42 of Texas Regulations for Control of Radiation, to permit employees to observe a copy on the way to or from their place of employment.

1214 139

24 Hour
Radiological Emergency Assistance

TELEPHONE NUMBER

512 458 7460

Use for Reporting Incidents, Emergencies, and Accidents Involving Radioactive Materials, Radiation Producing Machines, or Vehicles or Packages Marked "Radioactive" or "Caution Radioactive"

NOTICE—This number shall be used for emergency assistance reporting only.

For routine business matters call 512-458-7341

TEXAS DEPARTMENT OF HEALTH
RADIATION CONTROL BRANCH
AUSTIN, TEXAS

URANIUM RESOURCES INC.

ARTHUR L. BISHOP
Environmental Manager

January 30, 1979

Texas Department of Health
Division of Occupational Health and
Radiation Control
1100 West 49th Street
Austin, Texas 78756

RE: APPLICATION FOR RADIOACTIVE
MATERIAL LICENSE
URANIUM RESOURCES INC. (URI)
LONGORIA LEACH PROJECT

Dear Sirs:

Enclosed you will find URI's application for a Radioactive Material LIcense (Form No. R-8), and supplemental information for an in situ uranium leach operation.

If you have any questions, or desire additional information, please contact me at your earliest convenience.

Sincerely,

Arthur L. Bishop

Arthur L. Bishop
Environmental Manager

ALB/tj

Encl.

CC: Mr. Henry B. Peters
Texas Department of Water Resources
Stephen F. Austin Building
1700 North Congress Ave.
P.O. Box 13087, Capitol Station
Austin, Texas 78711

1214 141

TRC FORM 41-2
(Rev. 8/77)

TEXAS DEPARTMENT OF HEALTH
APPLICATION FOR RADIOACTIVE MATERIAL LICENSE

INSTRUCTIONS—Complete all items if this is an initial application. If application is for amendment or renewal of a license, complete Items 1 through 6 and indicate only new information or requested changes in the program in Items 7 through 11. Use supplemental sheets where necessary. Item 12 must be completed on all applications. Mail two copies to: Texas Department of Health, Division of Occupational Health and Radiation Control, 1100 West 49th Street, Austin, Texas 78756. Upon approval of this application, the applicant will receive a Texas Radioactive Material License, issued in accordance with the general requirements contained in Texas Department of Health regulations on radiation and the Texas Radiation Control Act.

1. NAME AND STREET ADDRESS OF APPLICANT (Institution, firm or person)	2. LOCATION(S) AT WHICH RADIOACTIVE MATERIAL WILL BE USED.
URANIUM RESOURCES INC. Suite 735 Promenade Bank Tower 1600 Promenade Center Richardson, Texas 75080	LONGORIA URANIUM LEACH PROJECT Uranium Resources Inc. Duval County, Texas P.O. Drawer 228 Bruni, Texas 78344

3. THIS APPLICATION IS FOR: (Check One)	4. PRESENT OR PREVIOUS LICENSE NUMBERS
☒ New License ☐ Amendment to present license ☐ Renewal of present license	Not Applicable

5. INDIVIDUAL USERS AND THEIR TITLES	6. RADIATION SAFETY OFFICER
W.M. McKnight, Jr.-Production Manager K.L. Biddle - Plant Superintendent W.J. Chapman - Field Environmental & Safety Coordinator	Name: Arthur L. Bishop Environmental Manager S.735 Promenade Bank Tower 1600 Promenade Center Richardson, Tex. 75080 Telephone No.: (214) 234-5294

7. RADIOACTIVE MATERIAL DATA

(a) Element and mass number	(b) Chemical or physical form (Make and model number if sealed source)	(c) Maximum number of millicuries to be possessed	(d) Use of each form (If sealed source, also give make and model number of device in which sealed source will be used.)
U (natural)	Slurry	12,000	Benefication Product awaiting shipment to enrichment facility
U (natural)	Solution	1,000	In-Situ Mining Solutions in Leach, Elution & Precipitation Circuits
Ra226	Solution	500	Circulating Leach Solutions & Waste Retention Pond

1214 142

TABLE OF CONTENTS

IN SITU URANIUM MINING

SUPPLEMENT

ILLUSTRATIONS

1214 143

ORGANIZATIONAL STRUCTURE

URI is structured with two areas of responsibility for radiation safety and control (Fig. 1). Production personnel are responsible for implementation of all radiation safety and health programs impacting production activity. Environmental personnel are responsible for monitoring production activity for the purpose of detecting any activity which may create radiation safety/health hazards, or may cause unacceptable environmental contamination/degradation. Responsibilities for each position detailed in Fig. 1 are given below.

PRESIDENT

The President of URI has the ultimate executive authority for all URI activity: uranium exploration, uranium production, and environmental protection. All radiation safety programs are approved by him and enforcement conflicts are adjudicated through him. The President answers to the Board of Directors.

ENVIRONMENTAL MANAGER

The Environmental Manager is responsible for the development, administration and enforcement of all environmental programs to include radiation safety. As part of this responsibility, the Environmental Manager is authorized to conduct inspections and to immediately order any change necessary in order to preclude or eradicate a radiation safety hazard and/or maintain regulatory compliance. The Environmental Manager answers to the President.

FIELD ENVIRONMENTAL AND SAFETY COORDINATOR

Responsibility in this position is limited to inspection and monitoring field operations for compliance with URI and regulatory safety requirements. The Field Environmental and 1214 145

Safety Coordinator reports to the Environmental and Safety Coordinator reports to the Environmental Manager and is charged with carrying out all directives from him.

PRODUCTION MANAGER

The Production Manager is responsible for all URI uranium production activity. As such, he is responsible for implementing any safety and/or monitoring program associated with operations, e.g. personnel dosimeters, yellowcake handling procedures, etc. The Production Manager is authorized to immediately implement any action necessary to correct or prevent radiation safety hazards. The Production Manager cannot modify or eliminate any radiation safety program without prior consultation with the Environmental Manager.

ENGINEERING MANAGER

The Engineering Manager is responsible for implementation of safety programs through the application of sound engineering principles and practices to uranium production. Authority for such action comes from the Production Manager and is administered through the Plant Superintendent.

PLANT SUPERINTENDENT

The Plant Superintendent is responsible for all plant operational activity. He is authorized to carry out all directives from the Engineering Manager. In lieu of direct action by the Production or Engineering Managers, he is authorized to change any operational procedure that he deems to be unsafe. Subsequently, he must report any such change.

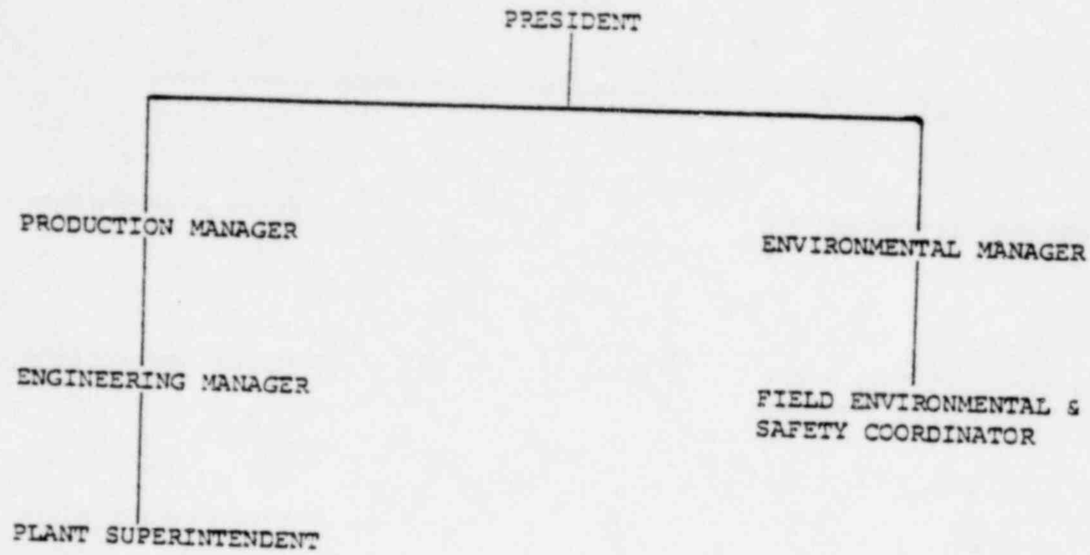


FIGURE 1 ORGANIZATIONAL CHART

QUALIFICATIONS

AND

EXPERIENCE

The following resumes detail the qualifications and experience of the personnel currently in the position detailed in Fig. 1.

RESUME

Raymond G. Larson
5811 Belt Line Avenue
Dallas, Texas 75248

A/C 214 386-7317

PERSONAL	Age: 40 Height: 5'10" Weight: 205 lbs. Marital Status: Married with one child
EDUCATION	B.S. degree-Business Administration University of North Dakota 1961
EXPERIENCE	URANIUM RESOURCES INC., Richardson, Texas Chairman of the Board President and Treasurer April 1, 1978 to present.
	R. L. BURNS URANIUM CORP., San Diego, California President 1977 thru March 31, 1978.
	R. L. BURNS CORP., San Diego, California Vice President-Finances 1971 thru March 31, 1978
	SECURITY PACIFIC NATIONAL BANK, San Bernardino, Ca. Vice President 1961 thru 1971

RESUME

ARTHUR L. BISHOP
2306 Red Oak Lane
Richardson, Texas 75081

Telephone: Home - 214-423-3100
Office - 214-234-5294

PERSONAL

Age:	30
Height:	5'10"
Weight:	180 lbs.
Marital Status:	Married, no children
Organizations:	AAPG, CCGS, NWWA

EDUCATION

B.S. Geology, Baylor University, 1976

EXPERIENCE

Uranium Resources Inc.; Richardson, Texas
Environmental Manager
May 1, 1978 to present
Responsibilities are the same as were for R.L. Burns Corporation, below.

R.L. Burns Uranium Corporation, Dallas, Texas
Environmental Manager
December 1, 1978 through April 30, 1978
Responsibile for all environmental activities. Primary duties include design and preparation of all environmental monitoring programs for uranium mining. Prepare applications for permits and licenses from and supervis compliance with all regulatory agencies. Represent company in environmental activities such as rule making processes; hearings, etc.

Texas Uranium Operation; U.S. Steel Corp.; Corpus Christi, Texas
Supervisor of Environmental Affairs
March 1, 1977 through November 30, 1977
Responsible for all environmental activities. Primary duties include development of environmental programs for largest in-situ uranium leach project in the U.S. (1.7 million lbs. U_3O_8/year. Supervised 3 professionals and field staff of 6. Established environmental programs now utilized industry wide.

Dalco - U.S. Steel, joint venture; Corpus Christi, Texa
Environmentalist
July 6, 1976 through February 28, 1977
Responsible for all environmental activities. Primary duties include development of environmental program of second permitted commercial in-situ uranium leach project in U.S. (Burns Ranch). Assumed total environmental responsibility for U.S. Steel upon U.S. Steel acquisition of Atlantic Richfield and Dalco in-situ leach properties.

<u>Heart of Texas Council of Governments; Waco, Texas</u>
<u>Director of Physical Planning</u>
August 16, 1975 through July 05, 1976
Responsible for physical planning in six country rural/urban environments. Duties included supervising 6 person professional and para-professional staff of geologists, economists and soil scientists in preparation of regional physical planning included water quality, water use, urban design and flooding.

<u>PUBLICATION:</u> <u>Flood Potentials of the Bosque Basin</u>
B.G.S. Bull. No. 33, 1977

1214 151

RESUME

William J. Chapman
P. O. Box 131
Hebbronville, Texas 78361

PERSONAL

Age: 27
Height: 6'1"
Weight: 160 lbs.
Marital Status: Married with two children

EDUCATION

B. S. degree-Secondary Education
Texas A&I University 1974

EXPERIENCE

URANIUM RESOURCES INC.
Field Environmental & Safety Coordinator
July 24, 1978 to present.
Responsibilities are the same as were for Wyoming Minerals Corp.

PREMONT INDEPENDENT SCHOOL DISTRICT
Teacher
August 1977 thru July 1978.

WYOMING MINERALS CORP.
Safety Technician
May 1974 thru August 1977.
Responsible for running drawdown tests to determine aquifer characteristics. Responsible for industrial and radiation safety for Bruni and Lamprecht in situ leach projects. Responsible for plant and leach operation water quality monitoring. Qualified First Aid Instructor. Qualified by O.S.H.A. Ionizing Radiation Safety Course (1976).

RESUME

William M. McKnight, Jr.
215 Llano
Portland, Texas 78374

Telephone: Home - 512-643-7701
Office - 512-883-2569

PERSONAL

Age: 42
Height: 5'9½"
Weight: 180
Marital Status: Married with four children.
Organizations: A.I.M.E.

EDUCATION

Graduated from Centenary College, Shreveport, Louisiana with a B.S. degree in geology in 1959. Attended Florida State University specializing in sedimentary geology and received a M.S. degree in 1961.

EXPERIENCE

Mobil Oil Corp., Shreveport, Louisiana. Exploration geologist (October 1963 through August 1965), primary responsibility - (Smackover Formation Exploration) geology delineating prospects based on mapping of porosity and structural trends for hydrocarbon traps. (Paluxy Formation) generating prospects utilizing sand, isopach trends and structural mapping North Louisiana, South Arkansas, and East Texas.

Mobil Oil Corp. (August 1965 through October 1968) Production geologist with responsibilities for 34 oil fields to generate work-overs and recompletions utilizing structure maps, sand isopachs, oil water contacts, and production data from surrounding wells, also worked closely with reservoir engineers on secondary recovery projects including recommendations for properties utilizing secondary recovery including calculations relative to response and success of secondary recovery projects including both water flooding and thermal recovery or projects either in existence or placed in operations based on recommendations.

Mobil Oil Corp. (October 1968 through January 1970) Senior Uranium Exploration Geologist, had responsibility to generate prospects and evaluate prospects being drilled in the South Texas area for Mobil Oil Corp. During this time period had up to 6 geologists reporting for guidance and supervision.

Mobil Oil Corp. (January 1970 through January 1973) Uranium operations coordinator, Denver, Colorado. Responsibility was to coordinate uranium evaluation programs for the United States for Mobil's exploration programs.

This included responsibilities for reserve calculations, evaluation, and some prospect generation. During this time period, up to 13 geologist reported to me for guidance and supervision, to accomplish my responsibilities.

Mobil Oil Corp. (January 1973 through December 1974) Had responsibility for Texas including preparation of feasibility study including reserves, plant design, and an approach for commercial production for the South Texas area.

Mobil Oil Corp. (December 1974 through May 1976) Production responsibilities relative to plant construction, design and supervision of operations relative to drilling and completing well fields and plant construction and operation for Mobil's first pilot plant.

Mobil Oil Corp. (May 1976 through January 1977) Special projects coordinator. Responsibilities included plant operation for in-situ uranium leaching, checking plant design, modifications to plant design, and supervision of all operations relative to pilot operation for uranium in-situ leaching. Plant design and scheduling including training staff-up for five planned plants in South Texas.

Mobil Oil Corp. (January 1977 through August 1977) Manager in-situ leach. Had responsibility for plant operations, production, economics, and supervision of approximately 55 people in the South Texas area. Responsibilities also included coordination for full scale production operations, including training programs, five year budget forecast, full scale economics and plant design for economics, and operation of full scale commercial operation. Approximately 55 people reported to me during this time period.

R. L. Burns (Uranium Resources, Inc.) (September 1977 through present) Production Manager. Responsibility for generating production plans for new corp., including property evaluation, property acquisitions, economics, plant designs, personnel acquisitions, and budget projections for commercial operations.

(January 1978 through present) Serving on the Boards of four seperate corporations including Drilling Corp., Uranium Corp., Mud Logging Corp., and Corp. for Antiques and Painting Acquisition.

RESUME

Harry L. Anthony IV
402 Nelda Drive
Kingsville, Texas 78363

Telephone: Home - 512-592-0666
Office - 512-883-2569

PERSONAL

Age:	31
Height:	6'4"
Weight:	190
Marital Status:	Married
Organizations:	Member AIME & ASM.

EDUCATION

B.S. Engineering Mechanics (Materials Option)
Pennsylvania State University 1965-1969

M.S. Engineering Mechanics (Materials Option)
Pennsylvania State University 1969-1970
Thesis: Recrystallization Resistance of Thoria-Dispersed Nickel

EXPERIENCE

URANIUM RESOURCES, INC.

April 1, 1978 thru Present. Engineering Manager - Plant design, engineering, and purchasing of in-situ uranium related processing equipment. Preparation of capital and operating budgets for site specific projects in Texas, New Mexico, and Montana.

Responsible for planning, organizing, controlling of the various plant disciplines, including: process control, maintenance, laboratory analysis, purchasing, employee relations and process development.

R. L. BURNS URANIUM CORP.

January 1, 1978 thru April 1, 1978. Project Manager. - Same as above.

UNION CARBIDE CORPORATION

August 1, 1977 thru January 1, 1978. Manager of Technical Development - Development of computerization of in-situ leaching, conducting on site leaching studies, responsible for plant chemistry and cost accounting.

January, 1976 thru August 1977. Plant Superintendent of an Uranium in-situ leach production facility at Benavides, Texas. Directed operations from the pilot test stage through and including full production implementation. Formulated budgets in areas of production, maintenance, laboratory and other auxiliary accounts.

1214 155

Responsible for in-situ leach development and ion exchange plant control and process development.

Developed plant safety procedures and standard operating criteria for process control. Managed 40 employees of varying disciplines.

April, 1970 thru December, 1975. Production Control Engineer at UCC Metals Division in Marietta, Ohio. Responsible for plant control and process development in areas including: solvent extraction of tantalum and columbium, electrowinning of chromium, and submerged-arc smelting of standard ferromangese during a five and one half year period.

Developed budgets pertinent to production and revised departmental safety procedures.

SPECIAL AREAS OF EXPERTISE

1. Various forms of solution filtration
2. Ion Exchange
3. Non-ferrous extractive leach techniques
4. Crystallization
5. Electrolytics

RESUME

KELLY L. BIDDLE
1000 W. Corral Street
Apt. 109
Kingsville, Texas 78363

Telephone: Home - 512-592-6936
Office - 512-883-2569

PERSONAL

Age: 32
Height:
Weight:
Marital Status: Single
Organizations: ASM, Southeast Ohio Executive Comm.,1975

EDUCATION

B.S. Met. Eng. 2.82/4.00 S.D. School of Mines 9/63-6/67
B.S. Psych. 3.89/4.00 Univ. of So. Dakota 9/71 - 6/72

EXPERIENCE

Uranium Resources Inc.; Corpus Christi, Texas
Plant Superintendent
7/1/78 to Present
Manage technical, process, and maintenance personnel of uranium solution mining plants. Responsible for administrative and technical plant controls.
Aid in design and supervision of new plant construction.

Union Carbide Corporation, Portland, Oregon
January, 1970 thru March, 1978 - Metals Division
March, 1977 thru March, 1978 - Supt. of Production
Managed production, traffic, and raw material mix departments of plant producing manganese and silicon ferroalloys in submerged electric arc furnaces. Responsible for production and technical control, operating budjets of $15,000,000 per year, material inventory balances, and planning of production, budgets, and departmental maintenance. Directed labor force including two departmental supervisors, engineer, eight shift foremen, and 60 hourly personnel.

Additional duties included procurring electrical energy auditing energy contracts, managing plant energy conservation program, and directing profit improvement research.

September, 1976 thru March, 1977
Assistant Superintendent of Production
Responsibilities and duties essentially the same as above.

January, 1974 thru September, 1976
Production Control Engineer - Marietta, Ohio
Responsible for process development and technical control pilot plant producing low carbon ferroa-loys utilizing oxygen blowing technology. Assisted in design, construction, and startup of large production facilities in Norway and Ohio including direct control of Ohio startup. Supervision

of foreman and hourly personnel during startup and initial operation of Ohio plant. Exposed to dust collection, oxygen production, high temperature refractories, and personnel training in addition to normal molten metal technology. Received $2,000 Manager's Achievement Award at conclusion of assignment.

June, 1972 thru January, 1974
Jr. Production Engineer - Marietta, Ohio
Responsible for reaction and quality control of two electric submerged arc furnaces producing manganese ferroalloys. Duties included selection of raw materials, preparation of material mix blends, control of direct material budgets, profit improvement research, and forecasting material useages, budget variances, and production tonnages.

January, 1970 thru September, 1971
Engineer
Controlled reactions and product quality control of plant producing manganese metal by electrolysis. Chemical processes used included ore crushing and sizing, leaching, oxidation, filtering, and electrowinning.

U.S. ARMY, Fort Knox, Kentucky
January, 1968 thru January, 1970
Directed field testing of experimental explosive devices for the Corp of Engineers.

Armco Steel Company, Middletown, Ohio
June, 1967 thru January, 1968
Prepared and analyzed steel samples by photo microscopy for the research group of Armco.

LEACH SITE DESCRIPTION

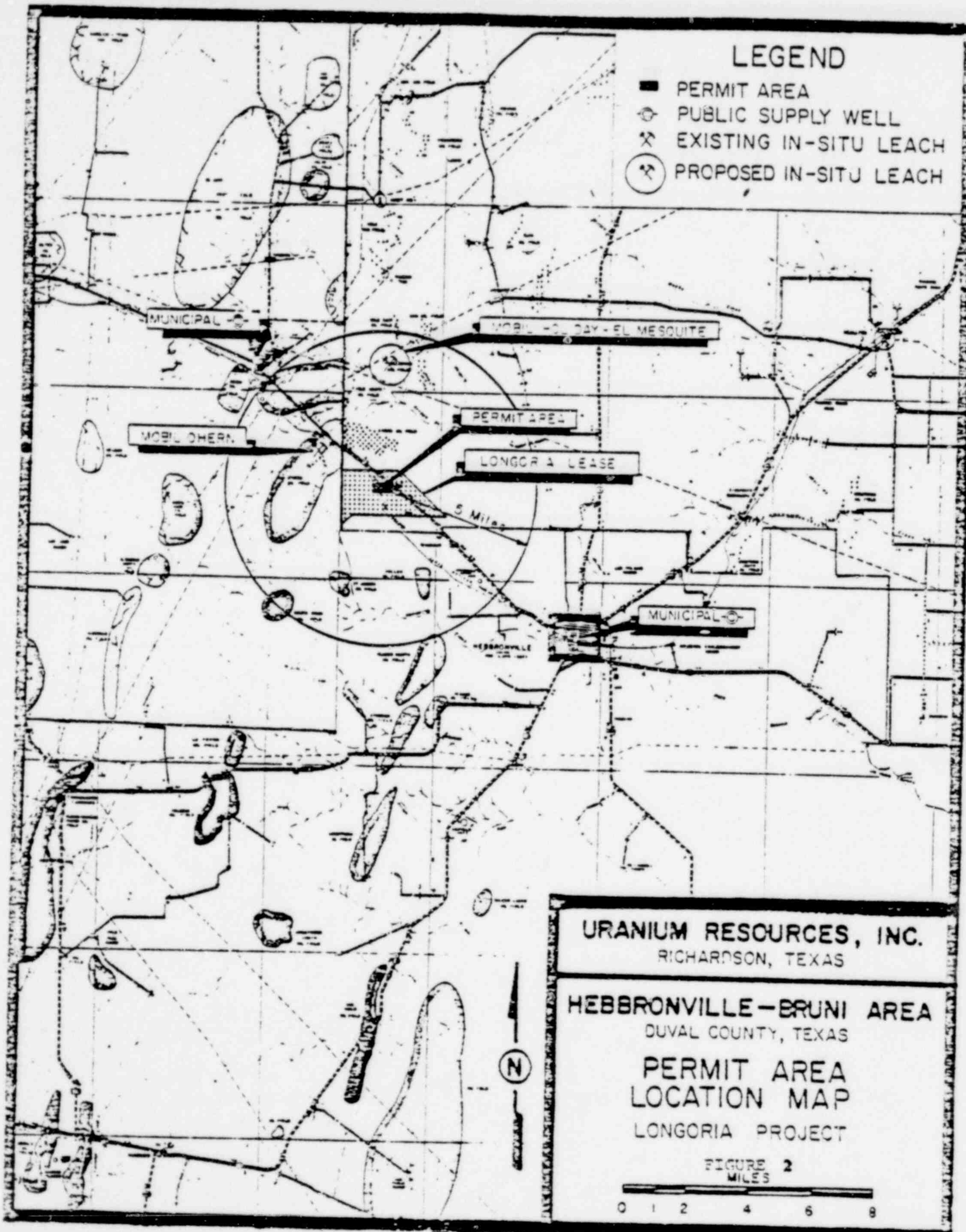
Uranium Resources Incorporated (URI) proposes to conduct *in situ* uranium leach operations in southwestern Duval County (Fig. 2). Proposed project area is located 8 airline miles northwest of Hebbronville (pop. 4079), Jim Hogg County; and 5.5 miles southeast of Bruni (pop. 375), Webb County.

At present, there are two permitted *in situ* uranium leach operations within a 5 mile radius of the Longoria Leach Project. Mobil Oil Corporation/Energy Minerals Division, U.S. and Canada is currently operating the O'Hern Project which is approximately 2.5 miles west northwest of the Longoria permit area. Mobil Oil Corporation has also permitted the Holiday-El Mesquite *in situ* Leach Project. This project is under development and is projected for a 1979-1980 operational start-up. Holiday-El Mesquite is located approximately 4 miles north of the Longoria Project.

Within a two mile radius of the Longoria Leach Project there are no major water supply wells. However, water supply wells for Bruni and Hebbronville are completed in the same formation as the Longoria Leach Project Production zone.

The Longoria Leach Project lies in an area of relatively low relief. Upland gradients average 23 feet per mile increasing to 60 feet per mile in dissected areas adjacent to major drainage ways. Stream gradients for Arroyo de los Angeles (Fig. 3), average 18.2 feet per mile.

1214 159



POOR ORIGINAL

1214 160

No major drainageway transects the Longoria permit area. However, the drainage divide between Noriacitas Creek and Arroyo de los Angeles crosses the southern portion of mining leases held by URI (Fig. 3). The Longoria permit area lies wholly within the Arroyo de los Angeles drainage basin. Arroyo de los Angeles is a tributary to Mesquite Creek with the confluence located approximately 4.2 miles east northeast of the URI project area. Mesquite Creek and Noriacitas Creek ultimately join 4 miles east southeast of Hebbronville.

Water supply for the site will be subsurface withdrawl from a non-production zone sand.

ACCESS RESTRICTIONS

Access to the URI Longoria Leach Project can only be made from S.H. 359. This access is presently controlled by a locked gate. During operations this will be controlled by a cattle guard. With the exception of exterior monitor wells the Longoria plant facility, i.e. well field buildings, pond and ion exchange unit, is surrounded by fence, (Fig. 7).

Along the fence at intervals of 200 feet, radiation warning signs will be posted. The signs will have the conventional colored radiation caution symbol as prescribed by the Texas Regulation for Control of Radiation. Beneath the symbols will be the warning "Caution, Radiation Area, Authorized Personnel Only".

Access can be gained to the plant via a gate immediately adjacent to the plant office building. Only the plant supervisor, or his designated representative has authority to allow entry to the plant by anyone other than employees.

GEOLOGY AND HYDROLOGY

Regional Geology:

The Catahoula Tuff forms the second largest outcrop belt in Duval County. Extending from north central to west central Duval County, the Catahoula outcrop width varies from 7 to 10+ miles. The Catahoula unconformably overlies the Frio Clay and Jackson Group and is in turn unconformably overlain by Oakville Sandstone and where the Oakville is absent, by the onlapping Goliad Sand. Formation thicknesses vary from 0 at the up-dip limit to 875 feet proximal to outcrop, and eventually thickens to 1400 feet in the sub-surface of eastern Duval County.

There are three depositional episodes evidenced in the Catahoula. Since sediments within the Catahoula indicate semi arid to arid climates throughout, vertical differences in depositional events are a product of activity variation in the west Texas area. The thick basal Fant Tuff Member was deposited from bedload streams transporting eroded volcanic ash. Lack of significant coarse clastics and thickness of sequence indicate a period of massive ash accumulation with little surface upwarp to provide transport energy.

This sequence was broken when the Soledad Volcanic Conglomerate was deposited. Although volcanic activity did not cease, as evidenced by tuffaceous clays within the Soledad, increased clast size and broad definable channel sequences indicate greater transport energy, which is indicative of uplift in the source area. The Soledad conglomerate is characterized by sedimentary sequences deposited by sediment chocked bedload streams with high sediment enhanced viscosities.

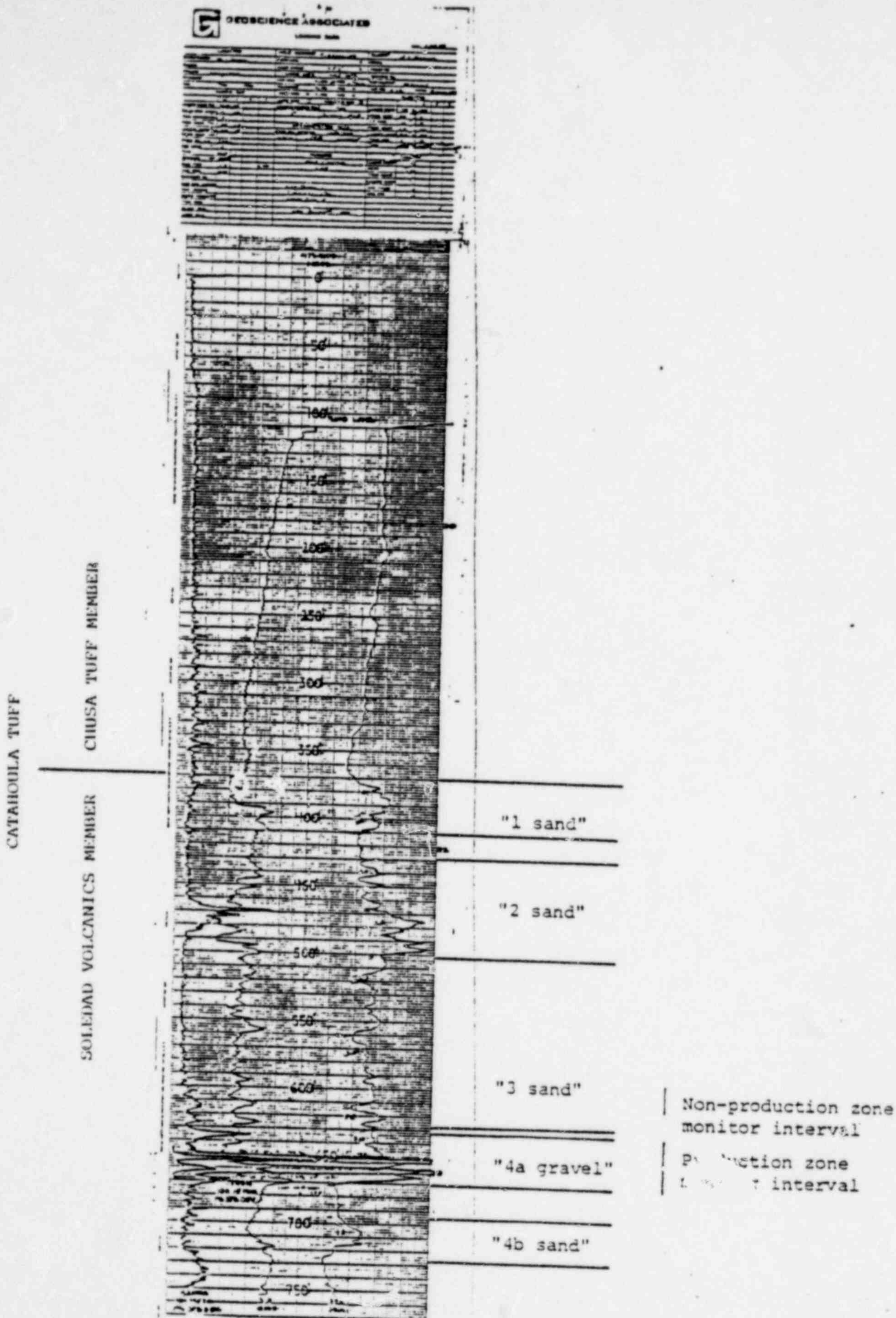
The upper Chusa Tuff deposition was a return to a bedload sequence of ash deposit with little or no tectonic activity supporting high transport energies.

The Fant Tuff Member is predominately composed of white to off-white massively bedded tuff and tuffaceous clays. Isolated interstratified greenish brown claystones and greenish gray to reddish orange fine grain sands provide the only contrast to the tuff. The Soledad Volcanic Member is composed of interstratified tuffs, tuffaceous clay, friable fine sands, and conglomerates. The tuffs and tuffaceous clays are similar to those of the Fant Tuff Member. Soledad sands are fine to very fine grained quartz and chert. Larger sediments consist of angular, subangular, and subrounded rhyolite, trachyte, trachyandesite clasts which range in size from pea gravel to boulders. These are either partially or totally suspended in a fine grain matrix. The Chusa Tuff is a massive to irregular bedded sequence of light gray to pink tuff and tuffaceaus clay.

Primary yield from the Catahoula Tuff is from the Soledad Volcanic Member. Wells completed in the Catahoula yield from less than 40 gpm to 500 gpm. Hydraulic gradients range from less than 6'/mile to 50'/mile. The latter occurs where a major cone of depression has developed around two municipal water supply wells for the town of Freer. The cone is centered approximately halfway between Freer, Duval County, and Hebbronville, Jim Hogg County. Water quality in the Catahoula is highly variable with TDS values ranging from 600 mg/l to greater than 4,000 mg/l.

Local Geology:

The Catahoula Tuff in the Longoria Project area is little different from that described on the regional level. The ore zone is located in the "4 a" unit of the Soledad Volcanic Member, (Fig. 4). Beneath the "4 a" is an aquiclude composed of tuffaceous montmorillonite clay, which will preclude any downward migration of production fluids. Above the "4 a" are the " 1, 2, and 3 " sands. These sands are predominantly grained quartz with disseminated silt and clay. The top of the "1" sand is the upper surface of the Soledad Volcanic.



1214 165

FIGURE 4 LONGORIA TYPE LOG

The overlying Chusa Tuff Member of the Catahoula consists of a thick sequence of impermeable montorillonite tuffaceous clay (Fig. 4). Above the Chusa Tuff is a zone of caliche which extends upward to the land surface. This caliche is covered by eolian sand deposits.

The piezometric surface of the completion interval averages 74.88 feet below ground surface (648.6' m.s.l.). Well yield from the "4 a" production zone averages 3700 gallons/day/foot.

WASTE DISPOSAL

The majority of the waste generated at the URI Longoria Leach Project will be aqueous. The following discussion of waste retention; runoff and spill control; and fluid waste production and disposal details the handling and disposition procedures to be utilized by URI.

WASTE RETENTION

Only one waste holding pond is used at URI's Longoria Leach Project. The pond was constructed in such manner that at maximum normal operation gauge height (7') pond fluids will not be above surrounding ground level (Fig. 5). Embankments above gound level are composed of compacted sand and caliche derived from pit excavation. Thirty mil reinforced chlorinated poly ethylene overlies all water retention surfaces.

Under the pond liner is an underdrain leak detection system which is monitored from a sampling station proximal to the pond embankment (Fig. 5). This monitoring station is checked weekly for the presence of water. If water is found in the wet well, a sample will be taken and will be analyzed to determine if a leak has occurred.

If it is determined that a leak has occurred, waste waters will be evacuated from the pond and the liner failure will be located. Thereafter, the liner will be repaired, if possible. If the liner is irrepairably damaged, it will be replaced. Because of below ground waste storage under normal conditions, a leak should not effect structural competancy of the pond.

TABLE 1

FLUID LEVEL vs. POND CAPACITY

FLUID DEPTH (Feet)	POND CAPACITY (Gallons)	REMARKS
1	55,302	
2	116,349	
3	183,380	
4	256,634	
5	336,351	
6	422,770	
7	516,130	Normal Maximum
8	616,671	Emergency Maximum
9	724,632	
10	[illegible]53	

As previously mentioned, maximum normal waste water depth is seven feet. However, under emergency conditions such as extreme rainfall, the depth would be extended to a total of eight feet, which would still leave two feet of available freeboard in the pond. Pond capacities at various freeboard levels are given in Table 1.

RUNOFF AND SPILL CONTROL

Underlying all liquid and solid chemical use tanks on the Longoria Project is an eight inch reinforced concrete pad. Surrounding the pad perimeter is a six inch curb which will confine all chemical spills and potentially contaminated runoff (Fig. 6). Total surface area of the pad is 3,122 square feet of which 603.97 is covered by tank vessels. Total retention capacity of the pad is 9417.2 gallons and holding capacity of the sump is 2363.7 gallons. Alltogether, 11780.9 gallons can be retained within the process area.

In the eventuality that a spill escapes the pad area, it will be confined by earthen works. Subsequently, the liquid will be evacuated and placed into the waste retention pond. Soil samples will then be taken to determined areal and subsurface extent of contamination. Any contaminated soil will be dryed, barreled, and shipped to a licensed L.S.A. disposal facility.

The same procedure would be followed for pipeline or well head leaks.

FLUID WASTE PRODUCTION AND DISPOSAL

Waste fluid disposal under normal operating conditions is accomplished by evaporation or subsurface injection. Disposal capacity for both are detailed in Table 2. Evaporation capacities were calculated using a surface area for four feet of fluid level in the waste retention pond described, and surface evaporation rates for Duval County (Table 3). Minimum disposal capacity is 17,000 gallons per month and maximum is 66,000 gallons per month.

URI has contracted with Arnco, Inc. to dispose of fluid wastes by subsurface injection through a water flood salt water disposal unit (Appendix 1). At present, Arnco, Inc. has an available disposal rate of 57.5 gpm. Available monthly disposal capacity varies from 2,320,000 gallons per month in February to 2,568,000 gallons per month for a 31 day month, (Table 2).

After in situ leach production of the Longoria Project has ceased, restoration will commence. At this time, all demands from bleed, plant and lab wastes will cease. At that time, the disposal system will handle only water extracted for restoration of the host unit. The disposal rate for the restoration mode has been calculated for two restoration procedures.

The preferred procedure extracts 500 gallons per minute from the production zone. The produced fluids will be treated by reverse osmosis with a 10% rejection rate. The resulting 450 gallons per minute of treated stream will be used as spray irrigation for surface restoration. The 50 gallons per minute reject stream will be delivered to Arnco, Inc. for surface disposal. Since presently available disposal capacity is 57.5 gallons per minute, there is a 14% disposal capacity safety margin.

TABLE 2

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1979

AREA II	JAN.	FEBR.	MARCH	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
OPERATIONAL LIFE						PRODUCTION						
Normal Disposal Capacity												
Subsurface Disp.		2,320	2,568	2,485	2,568	2,485	2,568	2,568	2,485	2,568	2,485	2,568
Evaporation		18	27	32	41	48	63	66	49	39	26	18
TOTAL		2,338	2,595	2,517	2,609	2,533	2,631	2,634	2,534	2,607	2,511	2,586
Normal Require.												
Bleed		202	223	216	223	216	223	223	216	223	216	223
Restoration												
Rain Direct		10	5	11	19	17	8	15	31	15	8	8
Indirect		3	2	3	6	5	2	4	9	4	2	3
Plant Wastes		241	267	258	267	258	267	267	258	267	258	267
Lab Wastes		40	45	43	45	43	45	45	43	45	43	45
TOTAL		496	542	531	560	539	545	554	557	554	527	546
FLUID FLOW (Out - In)		1,842	2,053	1,986	2,049	1,994	2,086	2,080	1,977	2,053	1,984	2,040
Total Pond Capacity		516										
Emergency Pond Cap.		101										
Cum Pond Capacity		516	516	516	516	516	516	516	516	516	516	516
Available for Emergency		2,358										
Emergency Req.												
10 yr. 24 hr. rain (6.4")		56										
Excursion Prod. Zone		432										
Exc. Non-Prod. Zone		432										

1214 171

TABLE 2 Continued

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1980

AREA II	JAN.	FEBR.	MARCH	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
OPERATIONAL LIFE	PRODUCTION											
Normal Disposal Capacity												
Subsurface Disp.	2,568	2,320	2,568	2,485	2,568	2,485	2,568	2,568	2,485	2,568	2,485	2,568
Evaporation	17	18	27	32	41	48	63	66	49	39	26	18
TOTAL	2,585	2,338	2,595	2,517	2,609	2,533	2,631	2,634	2,534	2,607	2,511	2,586
Normal Requirements												
Bleed	223	202	223	216	223	216	223	223	216	223	216	223
Restoration												
Rain Direct	9	10	5	11	19	17	8	15	31	15	8	8
Indirect	3	3	2	3	6	5	2	4	9	4	2	3
Plant Wastes	267	241	267	258	267	258	267	267	258	267	258	267
Lab Wastes	45	40	45	43	45	43	45	45	43	45	43	45
TOTAL	547	496	542	531	560	539	545	554	551	554	527	546
FLUID FLOW (Out - In)	2,038	1,842	2,053	1,986	2,049	1,994	2,086	2,080	1,977	2,053	1,984	2,040
Total Pond Capacity	516											
Emergency Pond Cap.	101											
Cum. Pond Cap.	516											
Available for Emer.	2,554	2,358	2,569	2,502	2,565	2,510	2,602	2,596	2,493	2,569	2,500	2,556

Emergency Req.
10yr. 24hr. rain
(6.4")
Excursion Prod. Zone
Exc. Non-Prod. Zone

1214 172

TABLE 2 Continued

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1981

AREA II	JAN.	FEBR.	MARCH	APR.	MAY	JUNE	JULY
OPERATIONAL LIFE					PRODUCTION		
Normal Disposal Capacity							
Subsurface Disp.	2,568	2,320	2,568	2,485	2,568	2,485	2,568
Evaporation	17	18	27	32	41	48	63
TOTAL	2,585	2,338	2,595	2,517	2,609	2,533	2,631
Normal Require.							
Bleed	223	202	223	216	223	216	223
Restoration							
Rain Direct	9	10	5	11	19	17	8
Indirect	3	3	2	3	6	5	2
Plant Wastes	267	241	267	258	267	258	267
Lab Wastes	45	40	45	43	45	43	45
TOTAL	547	496	542	531	560	539	545
FLUID FLOW (Out - In)	2,038	1,842	2,053	1,986	2,049	1,994	2,086
Total Pond Capacity	516						
Emergency Pond Cap.	101						
Cum. Pond Capacity	516						
Available for Emer	2,554	2,358	2,569	2,502	2,565	2,510	2,602
Emergency Req.							
10 yr. 24 hr. rain (6.4")							
Excursion Prod. Zone							
Exc. Non-Prod. Zone							

* W/O R.O. TREATMENT

1214 173

TABLE 2 Continued

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1981

AREA II	AUG.	AUG.*	SEPT.	SEPT.*	OCT.	OCT.*	NOV.	NOV.*	DEC.	DEC.*
OPERATIONAL LIFE	RESTORATION									
Normal Disposal Capacity										
Subsurface Disp.	2,568	11,129	2,485	10,770	2,568	11,129	2,485	10,770	2,568	11,129
Evaporation	66	66	49	49	39	39	26	26	18	18
TOTAL	2,634	11,195	2,534	10,819	2,607	11,168	2,511	10,796	2,586	11,147
Normal Require.										
Bleed	2,232	10,714	2,160	10,368	2,232	10,714	2,160	10,368	2,232	10,714
Restoration										
Rain Direct										
Indirect										
Plant Wastes										
Lab Wastes										
TOTAL										
FLUID FLOW (Out - In)	402	481	374	451	375	454	351	428	354	433
Total Pond Capacity										
Emergency Pond Cap.										
Cum. Pond Capacity Available for Emerge:										
Emergency Req.										
10 yr. 24 hr. rain (6.4")										
Excursion Prod. Zone										
Exc. Non-Prod. Zone										

* W/O R.O. TREATMENT

1214 174

TABLE 2 Continued

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.) YEAR: 1982

AREA II	JAN.	JAN.	FEBR.	FEBR.	MAR.	MAR.	APR.	APR.
OPERATIONAL LIFE	RESTORATION							
Normal Disposal Capacity								
Subsurface Disp.	2,568	11,129	2,320	10,052	2,568	11,129	2,485	10,770
Evaporation	17	17	18	18	27	27	32	32
TOTAL	2,585	11,146	2,338	10,070	2,595	11,156	2,517	10,802
Normal Require.								
Bleed	2,232	10,714	2,016	9,677	2,232	10,714	2,160	10,368
Restoration								
Rain Direct								
Indirect								
Plant Wastes								
Lab Wastes								
TOTAL								
FLUID FLOW (Out - In)	353	432	322	393	363	442	357	434
Total Pond Capacity								
Emergency Pond Cap.								
Cum. Pond Capacity Available for Emerge:								
Emergency Req.								
10 yr. 24 hr. rain (6.4")								
Excursion Prod. Zone								
Exc. Non-Prod. Zone								

1214 175

TABLE 2 Continued

FLUID HANDLING CAPACITY VS REQUIREMENTS (1000 gal.)   YEAR: 1982

AREA II	MAY	MAY *	JUNE	JUNE *	JULY	JULY *
OPERATIONAL LIFE			RESTORATION			
Normal Disposal Capacity						
Subsurface Disp.	2,568	11,129	2,485	10,770	2,568	11,129
Evaporation	41	41	48	48	63	63
TOTAL	2,609	11,170	2,533	10,818	2,631	11,192
Normal Require.						
Bleed	2,232	10,714	2,160	10,368	2,232	10,714
Restoration						
Rain Direct						
Indirect						
Plant Wastes						
Lab Wastes						
TOTAL						
FLUID FLOW (Out - In)	377	456	373	450	399	478
Total Pond Capacity						
Emergency Pond Cap.						
Cum Pond Capacity						
Available for Emergency						
Emergency Req.						
10 yr. 24 hr. rain (.4")						
Excursion Prod. Zone						
Exc. Non-Prod. Zone						

NOTE: Same non asterisk values would repeat by month through April, 1983
Asterisk values would repeat by month through March, 1985

1214 176

TABLE 3

SURFACE EVAPORATION RATES

DUVAL COUNTY

MONTH	RATE (inches)
January	2.7
February	2.9
March	4.3
April	5.1
May	6.4
June	7.5
July	9.9
August	10.3
September	7.7
October	6.2
November	4.1
December	2.9

If for any reason osmosis cannot be used, direct subsurface injection of untreated waters will be used as the restoration procedure. Since a disposal rate limit of 51.5 gallons per minute would result in unacceptable restoration time, the disposal rate must be increased. This increase can be accomodated within the reservoir currently being used by Arnco, Inc.

Arnco, Inc. injects into the O'Hern Member, Cockfield Formation, Yegua Group, which has been pressure depleted through oil and gas production. Based on pre-operational formation fluid pressures, sand volume and formation porosity, it was calculated that original formation fluid volume was 3.7 billion gallons. Calculations based on present fluid levels indicate that the O'Hern Member has been depleted by 558 million gallons. This volume can therefore be replaced without exceeding pre-production pressures.

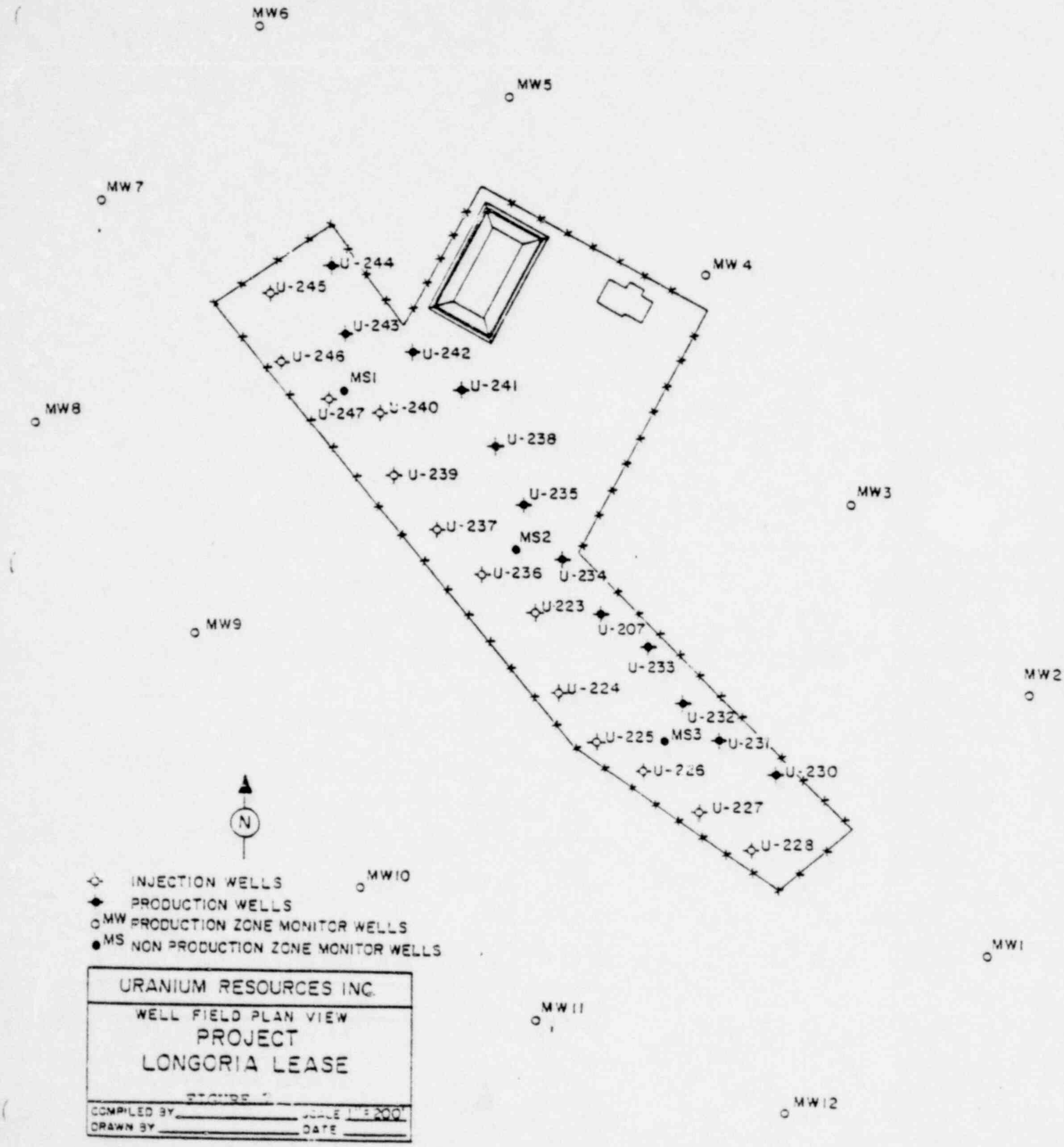
As stated previously, Arnco, Inc. has an available disposal rate for 57.5 gallons per minute. With the re-opening of shut-in wells it can increase the disposal rate to 249 gallons per minute. URI's disposal rate of untreated restoration fluids would be 240 gallons per minute, which yields a net disposal rate safety factor of 4%.

During the 44 months required for its restoration procedure total produced fluid volume would be 463 million gallons which is 17% less than the amount already depleted from the O'Hern Member. Therefore, regardless of restoration procedure there is sufficient capacity to handle URI projected needs.

PLANT OPERATIONS

Figures 6 and 7 detail respectively the physical arrangements of the Longoria plant and well field. The two sand filters (Fig. 6) are closed vessels and are the only potential place for radon accumulation.

The two sand filters are also the anticipated points in the process system where Ra 226 will accumulate. The reason for this is the pressure drop across the sand filters causes decreased CO_2 partial pressure. This will in turn lead to coprecipitation of Ca and Ra 226 as carbonate salts.


MW6
MW5
MW7
MW4
MW8
MW3
MW9
MW2
MW10
MW1
MW11
MW12
U-244
U-245
U-243
U-246
U-242
MS1
U-241
U-247
U-240
U-238
U-239
U-235
U-237
MS2
U-236
U-234
U-223
U-207
U-233
U-224
U-232
U-225
MS3
U-231
U-226
U-230
U-227
U-228
N
INJECTION WELLS
PRODUCTION WELLS
MW PRODUCTION ZONE MONITOR WELLS
MS NON PRODUCTION ZONE MONITOR WELLS
URANIUM RESOURCES INC.
WELL FIELD PLAN VIEW
PROJECT
LONGORIA LEASE
COMPILED BY
SCALE 1"=200'
DRAWN BY
DATE

1214 180

REGIONAL WATER WELLS

Within two miles of the Longoria Project there are 20 water supply wells. Because of age and lack of record keeping, well completion data for these wells are minimal, if not non-existent.

The following summaries provide information as to location, ownership, elevation, water level and water quality, (Table 4.). Well numbers in the following tables are keyed to well locations found in Fig. 3. Field chemical analysis for those wells are reported in Table 5. Laboratory analytical results are contained in Appendix 2.

Of the 20 wells sampled, eighteen (90%) would be considered unacceptable for domestic use under present primary drinking water standards. Values exceeding the limits for sodium chloride and total dissolved solids are the primary cause of unacceptability. Sixty percent of all wells tested had sodium concentrations exceeding 250 mg/l. Mean sodium concentration for the permit area water supply wells is 332 mg/l with a standard deviation of 140 mg/l. Sodium concentration ranged from 127 mg/l to 673 mg/l.

Chloride concentration averaged 493 mg/l with a standard deviation of 268 mg/l. Chloride concentration ranged from 105 mg/l to 1068 mg/l. Sixty five percent of all wells analyzed exceeded acceptable concentration for chloride.

Eighty percent of all wells tested exceeded acceptable concentration for total dissolved solids. Mean concentration for the 20 wells was 1444 mg/l with a standard deviation of 546 mg/l. TDS ranged from 610 mg/l to 2,560 mg/l.

It is of interest to note that one well exceeded the acceptable level for calcium and two exceeded the acceptable level for sulfate. In addition, nitrate nitrogen concentration was also high. A summary of the nitrate values are given below:

RANGE NO_3-N (mg/l)	# OF WELLS	CONCENTRATION (mg/l)
-2.0	6	0.02
		0.05
		0.06
		0.09
		0.69
		1.8
2.1 - 4.0	2	3.6
		3.7
4.1 - 6.0	7	4.3
		4.7
		4.9
		5.0
		5.0
		5.7
		6.0
6.1 - 8.0	0	
8.1 - 10.0	5	8.0
		8.8
		9.3
		10.0
		10.0
- 10.0	0	

Overall permit area vicinity water supply well quality is considered marginal to poor. The water is primarilly Na-Cl in character with Ca and HCO_3 as secondary cation-anion chemical constituent facies. The quality and character of the water indicates that the hydrochemical regime is transitional between the initial regional recharge chemistry and the deeper basin connate brines.

Initiating with plant start-up, domestic supply wells L-1, L-7, L-8 and L-10 will be sampled once per calendar quarter and analyzed for total dissolved solids, Ra226, Gross Alpha and Gross Beta. Wells L-2, L-3, L-4, L-5, L-12 and L-13 will be sampled on the same schedule and analyzed for the same parameters. All analytical results will be kept on file in URI's Richardson, Corpus, and Longoria site offices.

The remaining ten wells will be sampled in such number that all will be sampled at least once every two years. Such samples will be analyzed for the same parameters as the domestic supply and six closest wells to the project.

TABLE 4

WATER SUPPLY WELL PHYSICAL DATA

WELL NO.	OWNER	ADDRESS	ELEV.	WATER LEVEL (MSL)	USE
L-1	JOE RAMIREZ	604 N. Rigma Hebbronville, Texas 78361	658	@	D,L
L-2	MANUEL T. LONGORIA	1408 Mier Laredo, Texas 78040	738	671 @	L
L-3	FERNANDO MORENO c/o Manuel Longoria	1408 Mier Laredo, Texas 78040	735	646	L
L-4	WAYNE MANN	11303 Dumas Houston Texas 77034	763	696	L
L-5	FERNANDO MORENO c/o Manuel Longoria	1408 Mier Laredo, Texas 78040	699	637	L
L-6	GREENHILL CEMETARY ASSOCIATION c/o Ms. Dana Helen	P.O. Box 244 Hebbronville, Texas 78361	671	@	I
L-7	TEMPLE ROGERS	P.O. Box 1244 Robstown, Texas 78380	649	@	D,L
L-8	ALFOSO VALDEZ	507 E. Santa Clara Hebbronville, Texas 78361	678	614	D,L
L-9	ALFOSO VALDEZ	507 E. Santa Clara Hebbronville, Texas 78361	674	633	L
L-10	VINCEY WATERMAN	P.O. Box 427 Hebbronville, Texas	680	@ 598	D

1214 184

WELL NO.	OWNER	ADDRESS	ELEV.	WATER LEVEL (MSL)	USE
L-11	VINCEY WATERMAN	P.O. Box 427 Hebbronville, Texas	667	598	L
L-12	FERNANDO MORENO c/o M.T. LONGORIA	1408 Mier Laredo, Texas 78040	699	634	L
L-13	M.T. LONGORIA	1408 Mier Laredo, Texas 78040	720	661	L
L-14	ELTON SPECT	906 W. Viggie Hebbronville, Texas	672	@	L
L-15	ALFREDO ALMARAZ	408 E. Harald Hebbronville, Texas	668	599	L
L-16	M.T. LONGORIA	1408 Mier Laredo, Texas 78040	721	675	L
L-17	M.T. LONGORIA	1408 Mier Laredo, Texas 78040	662	586	L
L-18	M.T. LONGORIA	1408 Mier Laredo, Texas 78040	651	@	L
L-19	DANA HELLEN	501 N. Karen Hebbronville, Texas	736	@	L
L-20	DANA HELLEN	501 N. Karen Hebbronville, Texas	657	@	L

* Mechanically unable to obtain sample
# Unable to obtain permission for sampling
@ Unable to obtain water level

D - Domestic
L - Livestock
I - Irrigation

TABLE 5

WATER SUPPLY WELLS - FIELD CHEMICAL DATA

WELL NO.	TEMPERATURE (C)	CONDUCTIVITY (umhos/cm)	pH
L-1	27.50	1600	7.62
L-2	24.00	2000	7.05
L-3	27.50	2500	7.75
L-4	29.250	1500	7.6
L-5	26.00	2450	7.4
L-6	22.00	2000	7.35
L-7	27.50	3600	7.3
L-8	25.50	1300	7.6
L-9	28.25	1900	8.50
L-10	29.00	2000	7.66
L-11	26.50	2600	7.45
L-12	26.50	1600	7.5
L-13	26.00	2900	7.30
L-14	26.50	900	7.70
L-15	26.00	3000	7.50
L-16	27.55	2200	8.37
L-17	29.50	4000	8.65
L-18	25.00	4000	7.22
L-19	26.25	1600	8.12
L-20	27.50	1200	7.60

RESTORATION

Restoration of the production zone will be achieved by groundwater sweeping. Groundwater sweeping also referred to as pore volume flushing or pore volume displacement is an industry wide "in use" procedure which has been accepted by the states of Texas and Wyoming and by the United States Environmental Protection Agency and the Nuclear Regulatory Commission.

This procedure involves contemporaneous active and passive restoration activities. Active restoration consists of withdrawal of mine fluids by pumping. Passive restoration consists of unaffected waters migrating inward in response to pumping, thus displacing mine fluids which have not yet been extracted by pumping.

Numerous examples of the effectiveness of this procedure have been provided by in situ leach operations in south Texas. The estimated numbers of pore volumes required for total restoration have varied from 3.25 to 20+. This high degree of variability is due to the site specific differences in cationic composition of lixiviant chemistry and clay content of the production zones. The apparent limiting dimension is in the use of ammonia. If ammonia is used, the ammonium cation exchanges for calcium in the montmorillonite clay rich formations. The reverse exchange rate of another cation for the ammonium cation is slow and requires sweeps of 10 or more pore volumes.

However, URI does not propose to use an ammonia based lixiviant and therefore the aforementioned restoration problem should not be encountered. The effectiveness of ground water sweeping for restoration in a non-ammonia leach system has been documented by Mobil Oil Corporation/Energy Minerals Division, U.S. and Canada, in their applications for the O'Hern, Holiday-El Mesquite and Piedre Lumbre-Brelum leach projects (TDWR permit

1214 187

numbers 01941, 02156, 02155, 02147, 02149, 02152, 02148, C2151, respectively). Review of the non-ammonia restoration test yields the following conclusions about groundwater sweeping of non-ammonia leach systems:

1. The test was conducted on a production zone completed in the Catahoula Tuff.
2. Data extrapolation did not reveal any variation in the effectiveness or number of pore volumes required regardless of site location or geologic interval, and
3. groundwater sweeping was effective in achieving full restoration in less than 5 pore volumes.

Therefore, it is proposed that Mobil data be considered as evidence of the ability of URI to restore the Longoria Area II mine area in 5 pore volumes or less, for the following reasons:

1. The Longoria project is immediately adjacent to the O'Hern project where the original non-ammonia restoration test was conducted.
2. The geologic interval dedicated for production is the same as that proposed for use by other operators, and
3. URI will use a non-ammonia leach system.

Fluids produced by this restoration technique will be treated by reverse osmosis (R.O.). The reject stream will be disposed by subsurface injection. The purified stream will be spray irrigated on the permit area as part of the surface restoration program. If for any reason, the purified stream does not meet acceptable standards for surface irrigation R.O. treatment will cease and all fluids will be disposed by sub-surface injection.

Restoration rate will be monitored through analysis of waters produced from the formation. A sample will be taken weekly from the composite production line and analyzed for conductivity, sulfate, chloride, and uranium. This data will be compiled monthly and reported quarterly to the Texas Department of Water Resources.

When this data indicates that restoration is at, or near completion, URI will sample each original baseline well and analyze for the parameters listed in Table 6.

TABLE 6 RESTORATION PARAMETERS AND CONCENTRATIONS *

Ca (200)	CO_3(2.27)	NO_3N (10.0)	Ec@ 25c (3551.4)
Mg (150)	HCO_3 (500)	FL (1.8)	Ec (dilute)(3959.3)
Na (636.3)	SO_4 (300)	S_iO_2 (38.9)	Alk. as $CaCO_3$ (209.5)
K (24.2)	CI (300)	TDS @180 c (2013.9)	pH (6-9)

* All values are mg/l except Ec and Ec (dil.) which are micromhos.

If the 18 well mean value for each chemical parameter is equal to, or below the original mean plus one standard deviation, or the accepted drinking water limit, restoration is considered to be completed. These values are in paranthesis in Table 6.

At such time, the state will be notified and a time selected for split sample collection for analytical verification of restoration achievement. Three sample sets will be taken at one month intervals from the original baseline wells. Providing no significant changes between the first two analyses, the third sample set will be analyzed for the minor and trace constituents originally reported. If the major and minor constituents reported for all three sample sets are within the values found in Tables 6 and 7, URI considers that restoration is complete and is under no obligation for subsurface restoration.

TABLE 7

RESTORATION PARAMETER AND CONCENTRATION, TRACE ELEMENTS *

As (0.05)	Mn (0.05)	V (5.0)
Bg (1.0)	Hg (0.002)	Zn (5.0)
Cd (0.01)	Mo (1.0)	B (4.0)
Cr (0.05)	Ni (1.0)	NH_3-N (0.5)
Cu (1.0)	Se (0.01)	Ra 226 (97)
Fe (0.3)	Ag (0.05)	
Pb (0.05)	U (2.0)	

* all values in mg/l except Ra 226 which is in pCi/l.

YELLOWCAKE STORAGE AND TRANSPORTATION

Yellowcake slurry (50% solids) will be the ultimate product of the Longoria Leach Project. The slurry will be stored in the yellowcake slurry tank (Fig. 6). All exterior surfaces of this tank will be washed daily to preclude buildup of dessicated product.

The slurry will be transported in a slurry tank trailer. The tank vessel will be manufactured from stainless steel. The tank/trailer unit is designed to meet or exceed U.S. Department of Transportation specifications for MC 312 tanker.

URI is negotiating with Kerr-McGee to accept slurry at their Gore, Oklahoma conversion facility. If an accident should occur enroute to Oklahoma, the Spill Contingency Plan enclosed as Appendix 3 would be followed.

EXCURSION PREVENTION

Preventative Measures:

When production rate equals injection rate an *in situ* leach system is balanced. Ideally, no mine fluids would escape such a system. However, because factors such as ground water flow, differential permeabilities, meter error, etc. exist, a balanced system does not provide adequate fluid control.

To preclude any vertical/horizontal mine fluid migration URI utilizes a bleed system. In simplest terms, a bleed system is one in which a flow stream is extracted from the injection lines ahead of the well head. Since production pumpage now exceeds injection a hydraulic pressure sink is created in the aquifer and is centered on the production area. Uncontaminated formation waters migrate in response to this negative pressure anomally from the surrounding permit area to the production area. This inflow of water precludes outflow of mine fluids.

Monitoring of the bleed stream and its effectiveness will be made by three direct and one indirect techniques. First, at the point of bleed stream extraction the volume of extraction will be monitored by use of an in-line totalizer. The totalizer will be checked daily and the totalizer readings will be recorded and maintained on site for public inspection.

The effectiveness of the net overproduction will be monitored by direct continuous and discontinuous measurement of aquifer depressuring. A continuous water level recorder will be placed on a production zone monitor well and on a non-production zone monitor well. Pressure reversal on the continuous record, or aquifer pressure buildup will provide early warning of potentially adverse fluid migration and appropriate system modification would be made through increased bleeding. Discontinuous water level measurements will be made once every two weeks on all wells without continuous water level recorders. As in the case of continuously monitored wells, any aquifer pressure buildups would be corrected by bleed stream adjustment, all water level records from continuous and discontinuous monitoring will be maintained on site subject to public inspection.

Indirect measurement of the excurion control effectiveness will be made by sampling and analyzing water from production zone and non-production zone monitor wells (Fig. 7), monitor well water that is sampled will be analyzed for the conductivity, sulfate, chloride, and uranium. The reason for selection of each chemical species or quality is given below:

-Conductivity-

Specific conductance of a solution is geometrically proportional to the total dissolved solids (TDS) of that solution. During in situ leach operations, TDS concentrations within and immediately adjacent to the production field will be 3 to 4 times greater than baseline TDS concentration of the surrounding production vicinity. Therefore, any abnormal increase in specific conductance would indicate the potential that mine fluids have migrated away from the production area.

-Sulfate-

Oxidation reactions in the aquifer are essential to in situ leach production. Concentrations of pyrite and marasite are associated with oxidation/reduction uranium roll front deposits and are perferentially oxidized in in situ leach operations. Ensuing sulfate production exceeds baseline concentration by a factor of 4 to 6. Therefore, anomaleous sulfate increases in monitor well samples would indicate outward mine fluid movement.

-Chloride-

Anion exchange species for the uranyl tricarbonate complexed anion is chloride. Chloride concentration exhanged into aquifer mine fluids cause buildup of chloride in the production zone. These concentrations may exceed baseline by a factor of three Therefore, chloride increases in monitor wells to levels well above baseline would indicate an excursion.

-Uranium-

Economic <u>in situ</u> leach operations require that uranium concentrations in production solutions must exceed baseline condition by at least two or more orders of magnitude. Therefore, uranium concentration significantly exceeding baseline conditions would be an excellent indicator of mine fluid excursion.

Production and non-production zone monitor wells will be sampled every two weeks coincident with discontinuous water level measurements. All samples will be analyzed and reported within 24 hours. If any one sample has a chemical level quality or species above a predetermined level, it will be assumed that an excursion has occurred. These levels are:

Conductivity	4885.3	Umhos
Sulfate	296	mg/l
Chloride	1172	mg/l
Uranium	5.0	mg/l

These levels are the equal to the statistically determined maximum concentrations for the production zone aquifer plus deviation for laboratory error. All monitor well analysis data will be kept on site for public inspection and will be reported to the State of Texas monthly on prescribed forms.

Corrective Action Measures:

If abherrent formation pressuring occurs without attendant chemical increases in the monitor wells, corrective action will consist of greater bleed stream extraction. If one or more monitor wells have chemical levels exceeding the excursion determining threshold a second sample will be taken within 24 hours of the initial sampling. If analysis of the second sample shows that the chemical levels of the first were the result of improper sampling, faulty analysis, or similar phenomena, no further action will be taken. If the second analysis produces results substantiating the first one, the State of Texas will be so notified by telephone within one working day and by written communication within two working days of said confirmation.

Simultaneously, URI will increase the bleed extraction and will continue monitoring the affected well (s) every other day until the monitor well values of conductivity, sulfate, chloride, and uranium are within 10% of excursion threshold values.

If the affected well has not had decreases in threshold exceeding concentration of 10% in 14 calendar days, 50% in 21 calendar days, or 90% in 42 calendar days, all lixiviant injection will cease and the aquifer will be pumped until the 90% reduction is achieved. Remaining 10% reduction will be achieved no later than six months after excursion confirmation. After achievement of 90% reduction, mining activities will return to pre-excursion conditions.

An excursion corrective action report will be submitted to the State of Texas two weeks after initial excursion confirmation. The report will include measures taken in the previous two weeks and planned corrective measures to be taken in the following two weeks. Such reporting will continue until 90% reduction is achieved.

DRYER OPERATIONS

URI will not operate any dryer facility at the Longoria Project.

1214 196

WATER SUPPLY

Operations:

All plant requirements for water will be supplied from subsurface sources. A well will be drilled and completed into the "2" sand of the Soledad Volcanics (Fig. 4) for this purpose. Drinking water for plant personnel will be supplied by URI from commercial sources.

Regional:

Although regional subsurface water supplies are of marginal quality (see Regional Water Wells), the Soledad Volcanics constitute the only fresh water aquifer within the immediate area. The Longoria Leach Project will not affect the potability of this aquifer. However, restoration will reduce the amount of water available by the amount described under Restoration and detailed under Fluid Waste Production and Disposal.

RADIATION SURVEYS AND PERSONNEL MONITORING

Each work station at the URI Longoria Project will be monitored weekly for gamma radiation. Similarly all vessels containing radioactive material will be monitored for gamma emmissions. The monitoring will be done with a gamma survey meter. All data obtained from such surveys will be recorded and kept on file in the plant office.

If the survey indicates that an employee might receive a dose above the maximum permissible the Plant Superintendent will be notified. The Plant Superintendent and the Environmental Manager will then develop a safe working procedure which will reduce the employees time in such an area. The time reduction will at least insure that the worker will not receive a dose greater than 25% of maximum permissible for an eight-hour working day.

If the sand filters (Fig. 6) must be opened, they will be vented to the atmosphere for at least four hours. Thereafter no employee will be allowed to work inside until the working level is equal to 0.5. Plant personnel will be monitored for exposure via personnel dosimeter and bioassay. The URI employees will wear thermal luminescent detectors (TLD) while on duty and/or within the restricted area. The results of the TLD analysis will be kept on file at the plant and will be open for inspection by the public or employees at any time.

To check for potential uranium ingestion URI will require each plant employee to submit a monthly urine sample to be analyzed for uranium.

If either personnel dosimeter and/or bioassay indicates dosage to radionuclides in excess of 0.1 rems per month, the employee will be removed from exposure related activity for one month. In the interim the employees work activity will be investigated in order to discern the exposure source. Subsequently, working procedures will be modified to preclude a recurrence.

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-1 RAMIREZ
1406 8-10-78

pH -------------------- 7.37
Specific Conductance ------- 1630 µmhos/cm@25°C.
Diluted Conductance -------- 1820 µmhos/cm@25°C.

	milligrams/liter
Calcium	66
Magnesium	24
Potassium	9.5
Sodium	236
Carbonate	0
Bicarbonate	32[illegible]
Sulfate	12[illegible]
Chloride	263
Silica	90
Total Dissolved Solids (180°C.)	1030
Total Alkalinity as Calcium Carbonate	267
Ammonia Nitrogen	0.06
Nitrate Nitrogen	8.0
Fluoride	0.88
Molybdenum	0.01
Uranium	<0.01

					Range
Gross Alpha	nd	pci/l	Ion Balance	1.021	(0.96 to 1.04)
Gross Beta	9±6	pci/l	TDS Check	1.041	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.024	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4020

Respectfully submitted,

Carl F. Crownover

1214 199

TELEPHONE 884-0371

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JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

October 10, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-2 LONGORIA
0940 9-28-78

C O P Y

pH ———————— 7.35
Specific Conductance ——— 2030 µmhos/cm@25°C.
Diluted Conductance ——— 2210 µmhos/cm@25°C.

	milligrams/liter
Calcium	
Magnesium	122
Potassium	36
Sodium	13
Carbonate	213
Bicarbonate	0
Sulfate	244
Chloride	1[illegible]6
Silica	418
Total Dissolved Solids (180°C)	82
Total Alkalinity as Calcium Carbonate	1210
Ammonia Nitrogen	200
Nitrate Nitrogen	<0.01
Fluoride	8.8
Molybdenum	0.44
Uranium	<0.01
	0.007

Gross Alpha 8±10 pci/l
Gross Beta 13±8 pci/l
Radium 226 1±1 pci/l

Ion Balance 0.990 (0.96 to 1.04)
TDS Check 1.042 (0.90 to 1.10)
Ec Check 0.993 (0.95 to 1.05)

Lab. No. M16-4958

Respectfully submitted,

Carl F. Crownover

1214 200

TELEPHONE 884 0371

P O BOX 2552

JORDAN LABORATORIES, INC
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-3 LONGORIA
1611 8-10-78

pH ---------- 7.47
Specific Conductance ------ 2760 μmhos/cm@25°C.
Diluted Conductance ------ 3170 μmhos/cm@25°C.

	milligrams/liter
Calcium	135
Magnesium	59
Potassium	15
Sodium	325
Carbonate	0
Bicarbonate	232
Sulfate	188
Chloride	640
Silica	111
Total Dissolved Solids (180°C.)	1650
Total Alkalinity as Calcium Carbonate	190
Ammonia Nitrogen	0.04
Nitrate Nitrogen	9.3
Fluoride	0.64
Molybdenum	0.01
Uranium	<0.01

Gross Alpha nd pci/l
Gross Beta 14±10 pci/l
Radium 226 nd pci/l

		Range
Ion Balance	1.014	(0.96 to 1.04)
TDS Check	1.032	(0.90 to 1.10)
Ec Check	1.016	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4021

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 201

TELEPHONE 884-[illegible]

P. O. BOX [illegible]

JORDAN LABORATORIES, INC
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 7840[illegible]

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-4 LONGORIA
1740 8-10-78

pH -------------------- 7.19
Specific Conductance ------- 1570 µmhos/cm@25°C.
Diluted Conductance -------- 1780 µmhos/cm@25°C.

	milligrams/liter
Calcium	
Magnesium	91
Potassium	22
Sodium	15
Carbonate	203
Bicarbonate	0
Sulfate	389
Chloride	83
Silica	257
Total Dissolved Solids (180°C.)	104
Total Alkalinity as Calcium Carbonate	1020
Ammonia Nitrogen	319
Nitrate Nitrogen	0.02
Fluoride	3.7
Molybdenum	0.39
Uranium	<0.01
	<0.01

					Range
Gross Alpha	3±8 pci/l		Ion Balance	1.014	(0.96 to 1.04)
Gross Beta	16±7 pci/l		TDS Check	1.047	(0.90 to 1.10)
Radium 226	nd pci/l		Ec Check	1.026	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4022

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 202

TELEPHONE 884-0371

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CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-5 LONGORIA
0835 8-11-78

pH ---------------------- 7.36
Specific Conductance ------- 2470 µmhos/cm@25°C.
Diluted Conductance -------- 2980 µmhos/cm@25°C.

	milligrams/liter
Calcium	
Magnesium	203
Potassium	46
Sodium	12
Carbonate	236
Bicarbonate	0
Sulfate	237
Chloride	154
Silica	604
Total Dissolved Solids (180°C.)	106
Total Alkalinity as Calcium Carbonate	1530
Ammonia Nitrogen	194
Nitrate Nitrogen	<0.01
Fluoride	3.6
Molybdenum	0.38
Uranium	<0.01
	<0.01

Gross Alpha 4±13 pci/l
Gross Beta 9±9 pci/l
Radium 226 1±1 pci/l

		Range
Ion Balance	1.015	(0.96 to 1.04)
TDS Check	1.032	(0.90 to 1.10)
Ec Check	1.018	(0.95 to 1.05)

Lab. No. M16-4023

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 203

TEL. 512-884-0371

P.O.BOX 2552 78-

JORDAN LABORATORIES INC.

GROUND WATER ANALYSIS REPORT-IN SITU MINING-URANIUM

COMPANY: URANIUM RESOURCES INC.
WELL NUMBER: GHC
PRODUCTION AREA: LONGORIA
DATE COLLECTED: 09-28-78

MAJOR & SECONDARY CONSTITUENTS

ITEM	STORET	MG/L	EPM	CONDUCTANCE	%EPM
CALCIUM(CA)	00915	65.	3.24	168.48	16.80
MAGNESIUM(MG)	00925	22.	1.81	84.35	9.33
SODIUM(NA)	00929	318.	13.83	676.29	71.70
POTASSIUM(K)	00937	16.	.41	29.52	2.13
		TOTAL CATION	19.29		
CARBONATE(CO3)	00445	0.	0.00	0.00	0.00
BICARBONATE(HCO3)	00440	285.	4.67	203.61	23.95
SULFATE(SO4)	00945	169.	3.52	260.13	18.05
CHLORIDE(CL)	00940	401.	11.31	858.43	58.00
NITRATE(NO3-N)	71851	.06			
FLUORIDE(F)	00951	.28			
SILICA(SIO2)	00955	90.		TOTAL 2280.80	
		TOTAL ANION	19.50		
TOTAL ION		1366.			

	STORET		
TDS(180 C)	70300	1270.	
TOT ION-0.5 HCO3=		1224.	
EC(25 C)	00095	2030.	UMHOS
EC(DIL)= 102.3 X 22.2=		2271.	UMHOS
ALK. AS CACO3	00410	234.	
PH		7.30	

ACCURACY CHECK

		RANGE
ION	.989	(.96 TO 1.04)
TDS	1.038	(.90 TO 1.10)
EC	.996	(.95 TO 1.05)

MINOR AND TRACE CONSTITUENTS

ITEM	MG/L	ITEM	MG/L	ITEM	MG/L
ARSENIC(AS)	0.025	MANGANESE(MN)	0.01	VANADIUM(V)	0.01
BARIUM(BA)	0.02	MERCURY(HG)	0.0002	ZINC(ZN)	0.080
CADMIUM(CD)	0.0008	MOLY.(MO)	0.03	BORON(B)	2.1
CHROM.(CR)	0.004	NICKEL(NI)	<0.01	AMMONIA-N	0.01
COPPER(CU)	0.013	SELENIUM(SE)	<0.001		
IRON(FE)	0.37	SILVER(AG)	<0.01		
LEAD(PB)	<0.001	URANIUM(U)	0.004		

RADIUM 226	0	+/- 1	PCI/L
GROSS ALPHA	18	+/-13	PCI/L
GROSS BETA	15	+/- 8	PCI/L

ANALYST: NIXON & ALLEN CHECKED BY: ____________

LAB.NO. M16-4957

POOR ORIGINAL

1214 204

P. O. BOX 2552

August 24, 1978

Uranium Resourc , Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification. L-7 ROGERS
1200 8-11-78

pH ---------- 7.23
Specific conductance ---------- 3670 µmhos/cm@25°C.
Diluted ---------- 4600 µmhos/cm@25°C.

	Milligrams/Liter
Calcium	19
Magnesium	[illegible]
Potassium	[illegible]
Sodium	29
Carbonate	[illegible]
Bicarbonate	[illegible]
Sulfate	2
Chloride	[illegible]
Silica	[illegible]
Total Dissolved Solids (180°C.)	234[illegible]
Total Alkalinity as Calcium Carbonate	[illegible]
Ammonia Nitrogen	[illegible]
Nitrate	<0.[illegible]
Fluoride	[illegible]
[illegible]	0.[illegible]
[illegible]	<0.[illegible]
[illegible]	[illegible].0

Gross Alpha	[illegible] pci/l	Ion Balance	1.009	
Gross Beta	26[illegible] pci/l	TDS Check	1.022	
Radium	nd pci/l	Ec Check	[illegible].013	

nd = none detected

Lab. No. [illegible]-40[illegible]

Respectfully submitted,

Carl F. Crownover

1214 205

POOR ORIGINAL

TELEPHONE 884 0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-8 VALDEZ
1404 8-11-78

pH -------------------- 7.37
Specific Conductance ------- 1280 μmhos/cm@25°C.
Diluted Conductance -------- 1390 μmhos/cm@25°C.

	milligrams/liter
Calcium	
Magnesium	81
Potassium	18
Sodium	6.0
Carbonate	153
Bicarbonate	0
Sulfate	333
Chloride	49
Silica	199
Total Dissolved Solids (180°C.)	87
Total Alkalinity as Calcium Carbonate	969
Ammonia Nitrogen	273
Nitrate Nitrogen	<0.01
Fluoride	0.69
Molybdenum	0.66
Uranium	<0.01
	<0.01

Gross Alpha 1±6 pci/l
Gross Beta 5±4 pci/l
Radium 226 nd pci/l

		Range
Ion Balance	1.020	(0.96 to 1.04)
TDS Check	1.045	(0.90 to 1.10)
Ec Check	1.026	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4025

Respectfully submitted,

Carl F. Crownover

1214 206

TELEPHONE 884-0371

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JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-9 VALDEZ
1415 8-11-78

pH ---------------------- 8.10
Specific Conductance ------- 1940 µmhos/cm@25°C.
Diluted Conductance -------- 2090 µmhos/cm@25°C.

	milligrams/liter
Calcium	2.9
Magnesium	0.30
Potassium	4.7
Sodium	416
Carbonate	0
Bicarbonate	429
Sulfate	152
Chloride	291
Silica	65
Total Dissolved Solids (180°C.)	1220
Total Alkalinity as Calcium Carbonate	35[illegible]
Ammonia Nitrogen	0.02
Nitrate Nitrogen	0.09
Fluoride	1.23
Molybdenum	0.03
Uranium	<0.01

					Range
Gross Alpha	1±11 pci/l		Ion Balance	0.998	(0.96 to 1.04)
Gross Beta	nd pci/l		TDS Check	1.063	(0.90 to 1.10)
Radium 226	nd pci/l		Ec Check	1.012	(0.95 to 1.05)

nd = none detected

Lab. No.M16-4026

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 207

TELEPHONE 884 0371

P. O. BOX 2352

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-10 WATERMAN
1310 8-11-78

pH -------------------- 7.24
Specific Conductance ------- 2060 µmhos/cm@25°C.
Diluted Conductance -------- 2350 µmhos/cm@25°C.

	milligrams/liter
Calcium	101
Magnesium	37
Potassium	9.6
Sodium	250
Carbonate	0
Bicarbonate	229
Sulfate	108
Chloride	460
Silica	96
Total Dissolved Solids (180°C.)	1230
Total Alkalinity as Calcium Carbonate	188
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	4.9
Fluoride	0.86
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	5±10	pci/l	Ion Balance	1.012	(0.96 to 1.04)
Gross Beta	12±8	pci/l	TDS Check	1.041	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.036	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4027

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

TELEPHONE 884 037·

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-11 PENA
1338 8-11-78

pH -------------------- 7.25
Specific Conductance ------- 2690 µmhos/cm@25°C.
Diluted Conductance -------- 3060 µmhos/cm@25°C.

	milligrams/liter
Calcium	130
Magnesium	30
Potassium	11
Sodium	379
Carbonate	0
Bicarbonate	290
Sulfate	186
Chloride	596
Silica	94
Total Dissolved Solids (180°C.)	1650
Total Alkalinity as Calcium Carbonate	238
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	5.7
Fluoride	0.76
Molybdenum	0.01
Uranium	<0.01

					Range
Gross Alpha	nd	pci/l	Ion Balance	1.012	(0.96 to 1.04)
Gross Beta	7±9	pci/l	TDS Check	1.046	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.004	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4028

Respectfully submitted,

Carl Crownover

Carl F. Crownover

TELEPHONE 884 0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-12 LONGORIA
1625 8-11-78

pH ---------------------- 7.33
Specific Conductance ------- 1740 µmhos/cm@25°C.
Diluted Conductance -------- 2020 µmhos/cm@25°C.

	milligrams/liter
Calcium	90
Magnesium	28
Potassium	9.2
Sodium	236
Carbonate	0
Bicarbonate	332
Sulfate	117
Chloride	324
Silica	110
Total Dissolved Solids (180°C.)	1140
Total Alkalinity as Calcium Carbonate	272
Ammonia Nitrogen	0.02
Nitrate Nitrogen	10
Fluoride	0.55
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	5±10 pci/l		Ion Balance	1.016	(0.96 to 1.04)
Gross Beta	5±7 pci/l		TDS Check	1.045	(0.90 to 1.10)
Radium 226	nd pci/l		Ec Check	1.025	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4029

Respectfully submitted,

Carl F. Crownover

1214 210

TELEPHONE 884 0371

P O BOX 2552

JORDAN LABORATORIES, INC
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-13 LONGORIA
1625 8-11-78

pH ---------------------- 7.28
Specific Conductance ------- 2990 µmhos/cm@25°C.
Diluted Conductance -------- 3600 µmhos/cm@25°C.

	milligrams/liter
Calcium	150
Magnesium	56
Potassium	15
Sodium	398
Carbonate	0
Bicarbonate	284
Sulfate	244
Chloride	698
Silica	94
Total Dissolved Solids (180°C.)	1880
Total Alkalinity as Calcium Carbonate	233
Ammonia Nitrogen	0.02
Nitrate Nitrogen	5.0
Fluoride	0.59
Molybdenum	0.01
Uranium	<0.01

					Range
Gross Alpha	5±15	pci/l	Ion Balance	1.013	(0.96 to 1.04)
Gross Beta	12±11	pci/l	TDS Check	1.043	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.014	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4030

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 211

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-14 SPECHT
0915 8-14-78

pH ---------------------- 7.46
Specific Conductance ------- 919 μmhos/cm@25°C.
Diluted Conductance -------- 966 μmhos/cm@25°C.

	milligrams/liter
Calcium	44
Magnesium	13
Potassium	5.0
Sodium	127
Carbonate	0
Bicarbonate	318
Sulfate	39
Chloride	105
Silica	81
Total Dissolved Solids (180°C.)	610
Total Alkalinity as Calcium Carbonate	261
Ammonia Nitrogen	0.02
Nitrate Nitrogen	10
Fluoride	0.85
Molybdenum	<0.01
Uranium	<0.01

Gross Alpha 2±5 pci/l
Gross Beta 6±4 pci/l
Radium 226 nd pci/l

		Range
Ion Balance	0.993	(0.96 to 1.04)
TDS Check	1.045	(0.90 to 1.10)
Ec Check	1.011	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4031

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 212

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-15 ALMARAZ
1006 8-14-78

pH ---------------------- 7.39
Specific Conductance ------- 2990 µmhos/cm@25°C.
Diluted Conductance -------- 3510 µmhos/cm@25°C.

	milligrams/liter
Calcium	135
Magnesium	44
Potassium	13
Sodium	423
Carbonate	0
Bicarbonate	318
Sulfate	232
Chloride	670
Silica	92
Total Dissolved Solids (180°C.)	1820
Total Alkalinity as Calcium Carbonate	261
Ammonia Nitrogen	0.02
Nitrate Nitrogen	6.0
Fluoride	0.64
Molybdenum	<0.01
Uranium	<0.01

					Range
Gross Alpha	5±15	pci/l	Ion Balance	1.005	(0.95 to 1.04)
Gross Beta	10±11	pci/l	TDS Check	1.025	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.[illegible]14	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4032

Respectfully submitted,

Carl Crownover

Carl F. Crownover

1214 213

TELEPHONE 884-0371

P. O. BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-16 LONGORIA
1115 8-14-78

pH -------------------- 8.09
Specific Conductance ------- 2220 µmhos/cm@25°C.
Diluted Conductance -------- 2420 µmhos/cm@25°C.

	milligrams/liter
Calcium	12
Magnesium	4.4
Potassium	8.2
Sodium	440
Carbonate	0
Bicarbonate	328
Sulfate	83
Chloride	473
Silica	17
Total Dissolved Solids (180°C.)	1270
Total Alkalinity as Calcium Carbonate	269
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	0.02
Fluoride	0.82
Molybdenum	0.03
Uranium	<0.01

					Range
Gross Alpha	4±12	pci/1	Ion Balance	0.993	(0.96 to 1.04)
Gross Beta	3±8	pci/1	TDS Check	1.057	(0.90 to 1.10)
Radium 226	1±1	pci/1	Ec Check	1.019	(0.95 to 1.05)

Lab. No. M16-4033

Respectfully submitted,

Carl F. Crownover

Carl F. Crownover

1214 214

TELEPHONE 884-0371

P O BOX 2552

JORDAN LABORATORIES, INC.
CHEMISTS AND ENGINEERS
CORPUS CHRISTI, TEXAS 78403

August 24, 1978

Uranium Resources, Inc.
Suite #735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Report of Tests on Sample Water

Identification: L-17 LONGORIA
1545 8-14-78

pH -------------------- 7.75
Specific Conductance ------- 4180 µmhos/cm@25°C.
Diluted Conductance -------- 4990 µmhos/cm@25°C.

	milligrams/liter
Calcium	111
Magnesium	64
Potassium	21
Sodium	673
Carbonate	0
Bicarbonate	365
Sulfate	282
Chloride	1024
Silica	89
Total Dissolved Solids (180°C.)	2560
Total Alkalinity as Calcium Carbonate	299
Ammonia Nitrogen	<0.01
Nitrate Nitrogen	4.7
Fluoride	1.02
Molybdenum	0.01
Uranium	<0.01

					Range
Gross Alpha	8±19	pci/l	Ion Balance	0.997	(0.96 to 1.04)
Gross Beta	22±14	pci/l	TDS Check	1.044	(0.90 to 1.10)
Radium 226	nd	pci/l	Ec Check	1.020	(0.95 to 1.05)

nd = none detected

Lab. No. M16-4034

Respectfully submitted,

Carl F. Crownover

1214 215

JORDAN LABORATORIES, INC.
CHEMISTS [illegible]
CORPUS CHRISTI, [illegible]
OCTOBER [illegible] 1978

[illegible]
[illegible]
[illegible] 78[illegible]

[illegible] SAMPLES WATER

IDENTIFICATION MARKS: L-18 LONGORIA
0900 10-11-78

PH ------------------ 7.41
SPECIFIC CONDUCTANCE ---------- 4300 UMHOS/CM@25 DEG.C.
[illegible] CONDUCTANCE ---------- 5030 UMHOS/CM@25 DEG.C.

	MG/L
CALCIUM	152
MAGNESIUM	88
POTASSIUM	21
SODIUM	596
CARBONATE	0
BICARBONATE	275
SULFATE	316
CHLORIDE	1068
SILICA	88
TOTAL DISSOLVED SOLIDS (180 DEG.C.)	2530
TOTAL ALKALINITY AS CALCIUM CARBONATE	225
AMMONIA NITROGEN	0.02
NITRATE NITROGEN	5.0
FLUORIDE	0.9[illegible]
MOLYBDENUM	0.0[illegible]
URANIUM	0.024

			RANGE
GROSS ALPHA	12 +/- 21 PCI/L	ION BALANCE 1.001	(0.96 TO 1.04)
GROSS BETA	31 +/- 13 PCI/L	TDS CHECK 1.023	(0.90 TO 1.10)
RADIUM 226	1 +/- 1 PCI/L	EC CHECK 1.004	(0.95 TO 1.05)

LAB NO. M18-5241

RESPECTFULLY SUBMITTED,

CARL [illegible] [illegible]

POOR ORIGINAL

1214 216

TEL. 512-884 [illegible]   PO BOX 2552 78403

JORDAN LABORATORIES INC.
CHEMISTS & ENGINEERS
CORPUS CHRISTI, TEXAS
OCTOBER [illegible] 1978

[illegible] IA
[illegible]
[illegible] TEXAS 78[illegible]

REPORT [illegible] ON SAMPLES WATER

[illegible] IDENTIFICATION: L-19 LONGORIA
1045 10-11-78

PH ------------------ 7.98
SPECIFIC CONDUCTANCE -------- 1720 UMHOS/CM@25 DEG.C.
DILUTED CONDUCTANCE --------- 1860 UMHOS/CM@25 DEG.C.

	MG/L
CALCIUM	20
MAGNESIUM	3.7
POTASSIUM	10
SODIUM	335
CARBONATE	0
BICARBONATE	305
SULFATE	139
CHLORIDE	282
SILICA	19
TOTAL DISSOLVED SOLIDS (180 DEG.C.)	[illegible]7
TOTAL ALKALINITY AS CALCIUM CARBONATE	[illegible]0
AMMONIA NITROGEN	<0.01
NITRATE NITROGEN	1.8
FLUORIDE	0.31
MOLYBDENUM	0.02
URANIUM	0.096

				RANGE
GROSS ALPHA 45 +/- 14 PCI/L	ION BALANCE	1.018	(0.98 TO 1.04)
GROSS BETA 12 +/- 5 PCI/L	TDS CHECK	1.035	(0.90 TO 1.10)
RADIUM 226 [illegible] +/- 1 PCI/L	EC CHECK	1.015	(0.95 TO 1.05)

LAB NO. 316-5243

POOR ORIGINAL

RESPECTFULLY SUBMITTED,

CARL F. CROWNOVER

1214 217

TEL. 512-[illegible]

PO BOX 2552 78403

JORDAN LABORATORIES INC.
CHEMISTS & ENGINEERS
CORPUS CHRISTI, TX
OCTOBER 1[illegible], 1978

[illegible]
[illegible]
TEXAS [illegible]

[illegible] SAMPLES WATER

IDENTIFICATION: L-20 LONGORIA
1105 10-11-78

PH ---------------- 7.38
SPECIFIC CONDUCTANCE -------- 1580 UMHOS/CM@25 DEG.C.
DILUTED CONDUCTANCE --------- 1790 UMHOS/CM@25 DEG.C.

	MG/L
CALCIUM	80
MAGNESIUM	18
POTASSIUM	13
SODIUM	216
CARBONATE	0
BICARBONATE	279
SULFATE	154
CHLORIDE	261
SILICA	51
TOTAL DISSOLVED SOLIDS (180 DEG.C.)	955
TOTAL ALKALINITY AS CALCIUM CARBONATE	229
AMMONIA NITROGEN	<0.01
NITRATE NITROGEN	0.05
[illegible]	0.19
MOLYBDENUM	0.02
URANIUM	0.001

			RANGE
GROSS ALPHA 0 +/- 6 PCI/L	ION BALANCE	1.007	(0.96 TO 1.04)
GROSS BETA 19 +/- 6 PCI/L	TDS CHECK	1.022	(0.90 TO 1.10)
RADIUM 226 0 +/- 1 PCI/L	EC CHECK	[illegible].916	(0.95 TO 1.05)

LAB. NO. 616-3244

POOR ORIGINAL

RESPECTFULLY SUBMITTED,

CARL [illegible]. CROWNOVER

1214 218

CONTINGENCY PLAN

CONTINGENCY PLAN FOR URANIUM
TRANSPORTATION ACCIDENTS

PURPOSE

This manual identifies the procedures to be followed in the event of a highway transportation accident of uranium concentrate (yellowcake slurry). There are three major protions to the emergency response plan: immediate containment, accurate and proper notification, and a conceptualized clean-up procedure with preplanned dedicated personnel and equipment.

SHIPMENTS

To minimize the severity of an accident, the following safety measure has been incorporated into the shipping of uranium concentrate (yellowcake);

1. The driver will be fully briefed on the nature of his load and the necessary safety precautions. The special instructions for accidents will be verbally presented to him, and he will also carry written instructions with him accompanying the shipping papers. Additionally, a simple one page response letter will accompany the shipping papers detailing the nature of the problem. The letter will be used by persons encountering the accident if the driver is unable to explain the nature of the material and the preliminary containment procedures. An example of the emergency response letter and the driver's manual accompanies this manual.

INITIAL CONTAINMENT

The basic philosophy in spill containment is to prevent the spread of the material and to notify Uranium Resources Inc. (URI) personnel and civil authorities.

A. Containment

Each transporter is equipped with the proper shipping papers, response letter of identification and notification, driver's contingency manual, and the following equipment in a weatherproof box:

1214 220

1. Polyethylene sheeting (2,000 square feet)
2. Shovels (2, short handle)
3. Disposable coveralls (3 pairs)
4. Rubber boots (3 pairs, mixed sizes)
5. Rubber gloves (4 pairs)
6. Fiber tape (2 rolls)
7. Pocket knives (3)
8. Reflective warning signs and polyethylene guard rope
9. Respirators (3)

The divers or civil authorities immediately on the scene should cover any spilled material with the sheeting. Sufficient protective clothing is available for the work. The equipment and clothing should be wrapped in plastic after it is used (for future decontamination). The site must be secured from unauthorized personnel and all civil authorities must be notified and briefed on the situation. The initial notification and precautions are enumerated in the response letter and the driver's manual.

The following are procedures for containment:

1. Slurry Tank - not leaking
   a. Rope off area and restrain people from tampering with any material. Request the police for assistance in keeping people about 20-25 feet from the accident.
   b. Assure everyone professional assistance and equipment is on the way, and there is no danger with a sealed tank.

2. Slurry Tank - leaking
   a. Rope off area and caution everyone to stay away from the material. Use the police for assistance.
   b. Assure the police that there is no radiation danger, but potential dusts from the material is poisonous and should not be inhaled.
   c. Request to the civil authorities that the traffic be routed in such a fashion as to prevent tracking.

d. If possible, prevent the material from running into streets, gutters, sewers, etc. A simple method is utilizing dirt ditches or dikes.

e. Minimize dispersion and wear your supplied respirators.

3. Fire involved with accident

a. If necessary, isolate area from entry by using civil authorities.

b. The material will not explode; but, if possible, keep the fire away.

c. If the tank is ruptured, use respirators to preclude material inhalation.

B. Initial Notification

Initial notification will be from the driver or the civil authorities who find the response letter and the driver's manual. The people to be notified (by collect calls(are as follows:

William McKnight	Corpus Christi (Portland)	512/883-2569 Off. 512/643-7701 Home
A.L. Bishop	Richardson	214/234-5294 Off. 214/423-3100 Home
Kelly Biddle	Hebbronville	512/747-5388 Off. 512/527-4746 Home

As soon as one of these individuals is notified, a company notification system and civil regulatory/authority system will be initiated.

COMPANY NOTIFICATION

The company notification system is designed as a triple communication system consisting of management, clean-up team, and civil/regulatory notification. There is duplication of notification in key areas to insure that notification has been given. The basic system is as follows:

A	B	C
PRODUCTION MANAGER	ENVIRONMENTAL MANAGER	PLANT SUPERINTENDENT
will notify all:	will notify all:	will notify all:
ENVIRONMENTAL MANAGER	PRODUCTION MANAGER	PRODUCTION MANAGER
PLANT SUPERINTENDENT	PLANT SUPERINTENDENT	ENVIRONMENTAL MANAGER
DPS	DPS	CLEAN-UP TEAM LEADER
CLEAN-UP TEAM LEADER	CLEAN-UP TEAM ASSIT. LDR.	CLEAN-UP TEAM
CLEAN-UP TEAM	CLEAN-UP TEAM	HOSPITAL
TDH (State Regulatory)	TDH (State Regulatory)	
HOSPITAL		

A. Production Manager Notifications

Environmental Manager	Arthur L. Bishop	214/234-5294 Off. 214/423-3100 Home
Plant Superintendent	Kelly Biddle	512/747-5388 Off. 512/527-4746 Home
DPS -	Robert Lansford Larry Skiles Non Duty Hours	512/452-0331 ext.295 512/452-0331 ext.295 512/452-0331

(If not Texas, see civil/regulatory list for State Police)

Clean-up Team Leader
(notifys clean-up crew)

Hospital (if necessary)

1214 223

B. Environmental Manager Notifications

Production Manager	William McKnight	512/883-2569 Off. 512/643-7701 Home
Plant Superintendent	Kelly B:ddle	512/747-5388 Off. 512/527-4746 Home.

DSP -	Robert Lansford	512/452-0331 ext.295
	Larry Skiles	512/452-0331 ext.295
	Non Duty Hours	512/452-0331

(If not Texas, see civil/regulatory list for State Police)

Clean-up Team Assistant Leader
(notifys clean-up team)
State Regulatory Agencys (See List)

C. Plant Superintendent Notifications

Production Manager	William McKnight	512/883-2569 Off. 512/643-7701 Home
Environmental Manager	Arthur L. Bishop	214/234-5294 Off. 214/423-3100 Home

Clean-up Team Leader
(notifys clean-up team)
Hospital (if necessary)

State Regulatory Agencies

1. OKLAHOMA

Oklahoma State Health Department	(405) 271-5600
Department of Pollution Control	(405) 271-5204
Department of Public Safety -	(405) 424-4011
Occupational and Radiological Health	(405) 271-5221

2. TEXAS

Texas Department of Health Resources	(512) 458-7460
Department of Public Safety -	(512) 452-0331, ext.295
Robert Lansford	(512) 452-0331, ext.295
Larry Skiles	(512) 452-0331, ext.295
Non Duty Hours	(512) 452-0331
Texas Department of Water Resources	(512) 475-2786

Contract Lab
Jordan Labs, Corpus Christi (512) 884-0371

Hospital

1214 224

CLEAN-UP TEAM EQUIPMENT

In order to handle effectively a uranium concentrate spill, the following equipment will be assembled and stored in transportable containers (by aircraft) for use by the clean-up team:

1. Coveralls- disposable (15 pair per size - medium large)
2. Gloves - rubber - long cuff (15 pairs)
3. Rubber boots - 15 pairs (3 size 9, 7-size 1', 5-size 12)
4. Shovels - (3-std. long handle, 3 - scoop blade)
5. Plastic sheeting - 12 mil, 3200 square feet
6. Solvent glue for sheeting (3 cans/jars)
7. Hard hats (10)
8. Brooms (2) industrial floor
9. 55 gallon drum liners (50 bags)
10. Portable water sprayer (misting down powder)
11. Sample bottles (24)
12. Urine bottles (24)
13. Rope - 1 1/2 inch - 1000 feet
14. Warning signs - radioactive materials
15. Fiber tape - 6 rolls
16. Sump pump - 110 volt
17. Garden hose - 50 feet
18. Highway flashers

Slurry Spill Box

1. Respiratiors - 100 dust disposable

Additional Equipment

1. Calibrated beta, gamma, alpha survey meter
2. Hydrochloric acid, 55 gallon drum with dispensing pump
3. Product storage drums(25), 55 gallon with lids and bolts
4. Tools
5. Onan generator with fuel
6. Portable flood lights
7. Vacuum cleaner
8. Air compressor
9. Front end loader/back hoe
10. Radiotelephone, if possible
11. Camera with flash
12. Ore transport

CLEAN-UP PROCEDURE

1. Set-up

   a. Arrive at site, access situation, and assign team members to (1) collect/procure additional site specific equipment; (2) notify management of situation; and, (3) brief civil authorities on procedures.

b. Issue protective clothing and secure site from unauthorized entry.

c. Cover all spilled materials with plastic.

d. Set-up command post.

2. Protective Berming (See illustration below)

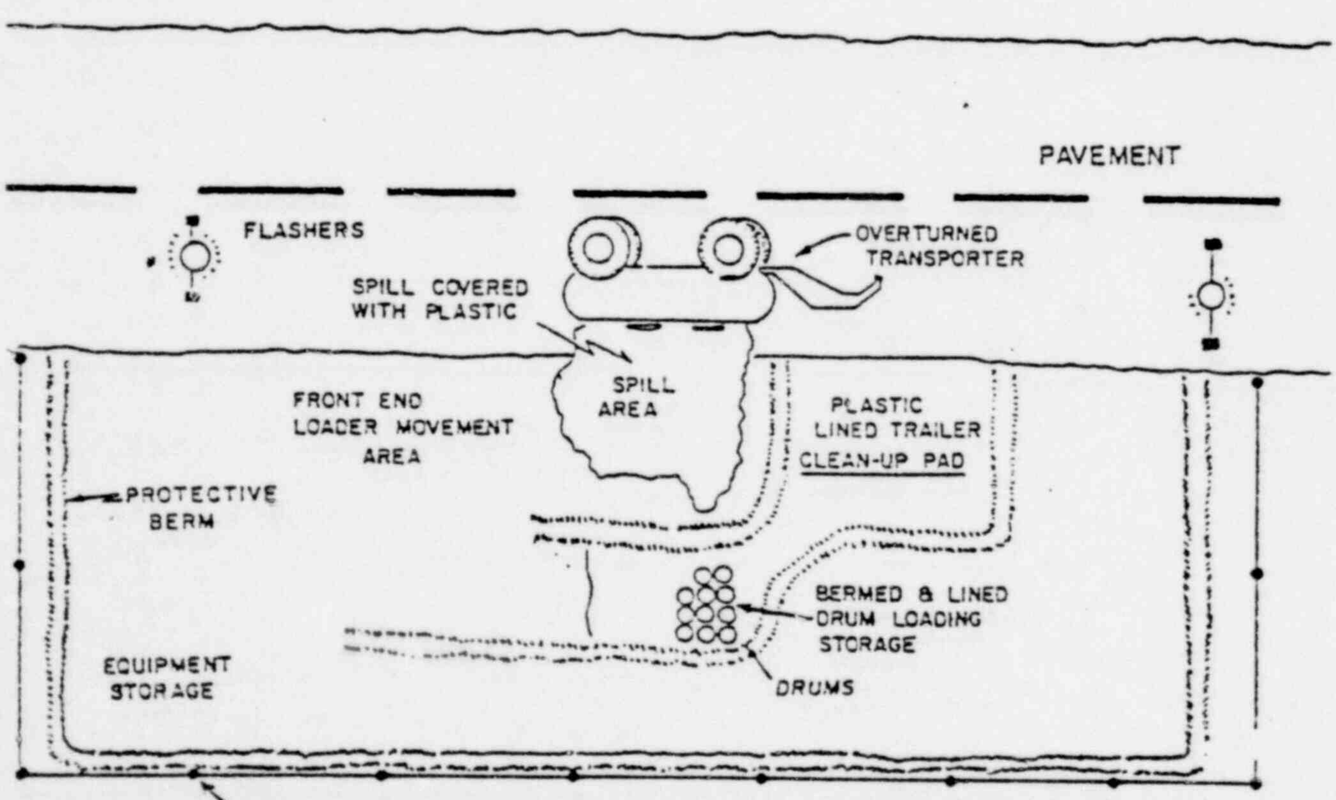
a. Construct a protective berm completely around the whole area including the working or clean-up area.

b. If possible, construct a berm around the spilled material.

c. Construct a lined diked area for drum reloading and contaminated equipment.

d. If possible, construct a lined area for trailer decontamination.

CONCEPTUALIZED CLEAN-UP SITE



PLAN VIEW — CLEAN UP FACILITIES

— NOT TO SCALE —

3. Clean-up

Clean-up should proceed with the clean-up of the trailer, cleaning and removal of the product and finally the spill site.

a. Trailer Clean-up

1. Remove spilled material by shovels and vacuum cleaner into lined 55 gallon drum and move to pad.

2. Right trailer, if possible, and move off road surface to diked clean-up area.

3. Clean exterior and interior and remove to nearest fully controlled site (plant) for final decontamination.

4. Test for contamination.

b. Pavement Clean-up

1. If spill material has contacted the pavement, clean-up of this surface should be conducted next.

2. Using scoop shovels, load lined barrels. If possible, lay down plastic to minimize spreading of the material.

3. Construct a two foot (2) wide plastic lined trench along the pavement edge.

4. Rinse the surface with an acid solution, and direct the solution to the lined ditch for pick up by the sump pump.

5. Continue until all signs of the material are removed.

6. Neutralize surface with water and collect final run-off for lab verification of clean-up.

c. Road Shoulder (Soil) Clean-up

1. Using shovels or loader, remove product to drum loading area and load into lined drums or ore hauling transport.

2. Remove six inches of top soil and place in drums in area of direct spill.

3. After trailer is removed and road is cleaned, begin to decontaminate plastic.

4. Place plastic in drums.

5. Place obviously contaminated soils in drums.

6. Remove trailer and remove its berm.

7. Remove spill berm.

8. Remove majority of drums.

9. Begin final removal of all topsoil in affected area.

10. Conduct soil sampling in a grid fashion.

d. Final Clean-up

1. Do not remove outer protective berm.

2. Review grid soil samples with regulatory agencies and get final clean-up approval.

3. Consult with highway department on reseeding program.

4. Remove protective berm after written verification from regulatory agencies.

5. Reseed area.

PERSONNEL PROTECTION

1. Identify everyone by name and address who came in contact with the material.

2. Secure urine analysis from these individuals.

3. Report analysis to these individuals and explain the results.

RESPONSE LETTER

TO WHOM IT MAY CONCERN:

This vehicle is transporting uranium yellowcake, a refined ore. The material is poisonous and should not be inhaled or injested. It is not a radiation hazard or an explosive. You should try to keep the material off your clothing and try not to track it about. The following steps will minimize spreading of the material.

1. Notify the Department of Public Safety or County Sheriff and request his assistance in guarding the site.

2. Find the plastic sheeting in the vehicle and cover all spilled materials. Any tools used in this effort that contact the material should be left on the sheeting.

3. The following people have the responsiblity for handling the problem. CALL COLLECT as soon as possible. The civil authorities may assist you in this notification.

William McKnight	Corpus Christi	512/883-2569 Off. 512/643-7701 Home
Arthur L. Bishop	Richardson	214/234-5294 Off. 214/423-3100 Home
Kelly Biddle	Hebbronville	512/747-5388 Off. 512/527-4746 Home

4. Instruct one of the above on the situation. Please give him your name and address. These people are trained in handling this problem.

5. Request assistance in preventing people from handling the material or removing it until Uranium Resources Inc. personnel are present.

6. Give this letter and all other shipping papers and the driver's spill instructions manual to civil authorities.

URANIUM SPILL REPORTING FORM

1. Name of person reporting incident ____________________
   ____________________Telephone # ____________
   Date ____________________Time ____________________

2. Location of accident ____________miles________(Direction) on Highway
   __________from____________________City____________State____________

3. Was personnel injured ________yes________no ____________Killed________

4. Name of driver ____________________

5. Bill lading number and destination ____________________

6. Describe preliminary precautions taken ____________________
   ____
   ____

7. Describe any spillage or leakage ____________________
   ____
   ____

8. Name of law officers or civil authorities on scene ____________________
   ____
   ____

9. Is vehicle road worthy ____________________
   ____

10. Where can a person having direct facts of the accident be contacted ____
    ____
    ____

11. Remarks ____________________
    ____
    ____
    ____
    ____
    ____

1214 231

DRIVER'S MANUAL

INSTRUCTIONS TO DRIVER

The material you are transporting is uranium concentrate and the product

1. Is not a radiation hazard in exposures of less than a few days;
2. Is poisonous and should not be breathed, swallowed, or put in the mouth;
3. Should be kept to a small area and off clothing or body; and,
4. Is not explosive.

IN CASE OF AN ACCIDENT

1. Cover any spilled material with the plastic sheeting provided in the transporter utilizing equipment supplied in emergency equipment bos. The box contains the following equipment:

   a. Polyethylene sheeting (2,000 square feet)
   b. Shovels (2, short handle)
   c. Disposable coverals (3 pair)
   d. Rubber boots (3 pair, mixed sizes)
   e. Rubber gloves (4 pairs)
   f. Respirators (3, use only for dry product spills)
   g. Fiber tape (2 rolls)
   h. Pocket knives (3)
   i. Warning signs and guard rope (1/2 inch polyethylene)

After equipment is used, place under sheeting for later decontamination and prevention of theft.

2. Notify the civil authorities of the nature of the problem by:

   a. Giving them the accompanying letter;
   b. Telling them the nature of the problem; and,
   c. Requesting their help in securing the site from interference of bystanders and notifying the Uranium Resources Inc. people listed below as soon as possible. Call collect and tell the operator that this is an emergency call. Call until one of the following individuals is notified:

William McKnight	Corpus Christi	512/883-2569 Off. 512/643-7701 Home.
Arthur L. Bishop	Richardson	214/234-5294 Off. 214/423-3100 Home
Kelly Biddle	Hebbronville	512/747-5388 Off. 512/527-4746 Home

3. Initial containment prior to arrival of Uranium Resources clean-up team on site.

   a. <u>Containers not leaking</u>

      1. Rope off area and restrain people from tampering with any material. Request the police for assistance in keeping people about 20-25 feet from the accident.

      2. Assure everyone professional assistance and equipment is on the way, and there is no danger with closed uncontaminated containers.

   b. <u>Tank leaking</u>

      1, Rope off area and caution everyone to stay away from the material. Use the police for assistance.

      2. Assure the police that there is no radiation danger, but dusts from the material is poisonous and should not be inhaled.

      3. Request to the civil authorities that the traffic be routed in such a fashion as to prevent tracking.

      4. If possible, prevent the material from running into streets, gutters, sewers, etc. A simple method is utilizing dirt ditches or dikes.

      5. Minimize dispersion and wear your supplied respirators.

   c. <u>Fire involved with accident</u>

      1. If necessary, isolate area from entry by using civil authorities.

      2. The material will not explode; but,if possible, keep the fire away.

      3. If the tank is ruptured, use respirators to preclude material inhalation.

INSTRUCTIONS TO CIVIL AUTHORITIES

Uranium Resources has a fully trained and equipped Clean-up Team for this type of hazardous material. A notification system has been developed, and the following State Agencies have the responsibility for handling this problem. Uranium Resources will notify the responsible State Agencies. You may wish to call the Highway Patrol for assistance.

1. OKLAHOMA

Oklahoma State Health Department -	405/271-5600
Department of Pollution Control	405/271-5204
Department of Public Safety	405/424-4011
Occupational & Radiological Health	405/271-5221

2. TEXAS

Texas Department of Health Resources	512/458-7460
Department of Public Safety	512/452-0331,ext.295
Robert Lansford	512/452-0331,ext.295
Larry Skiles	512/452-0331,ext.295
Non Duty Hours	512/452-0331
Texas Department of Water Resources	512/475-2786 512/475-2651

1214 235

TRCB EA-2

ENVIRONMENTAL ASSESSMENT

related to the

URANIUM RESOURCES INCORPORATED

LONGORIA LEACH PROJECT

Duval County, Texas

Radiation Control Branch
Division of Occupational Health
and Radiation Control

Texas Department of Health

June 5, 1979

1214 236

I. Introduction

An application for a radioactive material license was filed January 30, 1979, by Uranium Resources Incorporated, Suite 735, Promenade Bank Tower, 1600 Promenade Center, Richardson, Texas 75080. The applicant is seeking licensure to leach in place (<u>in situ</u>) a permeable uranium ore deposit located within the Soledad Volcanic Member of the Catahoula Tuff. This Soledad Volcanic ore body lies about 600 feet below the surface of a proposed 3.1 acre production area of a 32.8 acre mine area within a 64.5 acre permit area (Figure 1). The permit area is located in Duval County along State Highway 359, about eight miles northwest of Hebbronville (population 4079), Jim Hogg County, and 5.5 miles southeast of Bruni (population 375), Webb County, Texas (Figure 2). An operating permit from the Texas Department of Water Resources for <u>in situ</u> leaching has been obtained. The Texas Air Control Board has exempted this facility from the requirement to obtain a construction permit.

To obtain the uranium from the ore body, an alkaline carbonate solution (the lixiviant) mixed with either hydrogen peroxide or oxygen will be filtered and pumped into the ore zone to leach the uranium <u>in situ</u> from its surroundings and pumped back to the surface. This will be accomplished by a system of 12 production wells with 13 associated offset injection wells in a staggered line-drive pattern. The injection wells introduce the leach solution and oxidant into the ore body, where the oxidant and carbonate ions react with the existent insoluble uranium to form water-soluble uranyl carbonate complexes. The solution flows toward the low pressure areas created by the production wells and the uranium-rich production liquid is pumped to the surface to the processing plant located on the north side of the permit area (Figure 1).

At the plant, the uranium-bearing solution (pregnant lixiviant) is passed through a series of three ion exchange columns. Ion exchange resins selectively strip the uranium from the solution. The stripped solution (barren lixiviant) then flows to the barren lixiviant surge tank. A slip stream from the surge tank discharge flows to a liquid waste circuit for eventual disposal into an injection well. The portion of the effluent disposed of is called the bleed stream. The other effluent is returned to the leach circuit, where it is refortified by the addition of sodium hydroxide, filtered, refortified with carbon dioxide and reinjected to start the cycle again.

The purpose of the bleed stream, mentioned above, is to minimize any possible migration of leach solution from the underground mine area. By continuously pumping more fluid from the production wells than is being replaced through the injection wells, a hydraulic sink, or low pressure area, is created which causes an inflow of native ground water into the pattern, effectively confining the leach solution.

The uranium bearing resins are periodically removed from a saturated exchange column and loaded into one of two elution columns. Barren resin from the other elution column is transferred to the empty exchange column.

The uranium complex is removed from the resin in the elution column by passing sodium chloride brine solutions through the column driving off the uranyl tri-carbonate anions and loading chloride anions in their place. The resin is thereby regenerated as the uranium complex is removed.

The uranium bearing solution from the elution column is pumped to precipitation tanks, where hydrochloric acid is added to lower the pH. Carbon dioxide gas is driven off through this reaction. The acidified solution then passes into another precipitation tank, where additions of hydrogen peroxide are made. The slurry then flows into a final tank, where its pH is adjusted to neutral by the addition of sodium hydroxide causing the uranium oxide to precipitate out as a slurry. Subsequent processing of the slurry consists of filtration and washing to remove impurities.

Process contaminants that cannot be removed by washing, such as molybdenum, are not expected to be encountered in significant quantities in this leach project based on the history of nearby leases. However, the applicant has contingency plans for the installation of a molybdenum removal circuit should it prove necessary.

The finished slurry (called yellowcake slurry) which contains about 50% solids, is shipped directly to the Kerr-McGee Sequoya facility in Oklahoma. The shipments will be made by tanker truck with the yellowcake slurry loaded into two ¼" thick walled stainless steel tanks of 2100 gallons capacity each. Because of process space limitations at Kerr-McGee's location each tank will only be 2/3 full to allow for acid solubilization upon delivery at the Sequoya facility. The tanker design is approved by the U.S. Department of Transportation. The applicant has also submitted a plan to deal with transportation accidents.

The Longoria Leach Project plant has been specifically designed for the collection and containment of all process solutions that could be released from the systems. All process and storage areas are to be paved and framed or diked with concrete curbs six (6) inches high. Sump fluids are pumped to the appropriate system tanks by a sump pump automatically actuated by a level control system.

The applicant has provided and will maintain a hose capable of reaching any location in the plant area to facilitate the washing down of areas should overflows or spills occur. All holding and process tanks will be equipped with high-level alarms to control overflow, and all process piping will be located above ground to permit frequent visual inspections by plant personnel.

All process liquid wastes will be collected in a waste pond (Figure 1) for transfer by truck to an injection well(s) offsite. This well(s) is used to repressurize an oil field pursuant to secondary recovery of petroleum in a nearby oil lease (O'Hern Field, Webb County). The central pumping battery is operated by Arnco, Incorporated and is approximately 2 miles west of the Longoria Leach Project. Arnco, Incorporated's activities in this regard will be subject to licensure by the Texas Department of Health and permit approval by the Texas Railroad Commission prior to receipt of any waste material. Enough capacity in the oil field is available to accomodate all of Uranium Resources Incorporated's liquid waste from production and restoration of the Longoria Leach Project. During restoration, the flow is expected to rise from the 50 gallon per minute production maximum to around 250 gallons per minute. This increase will necessitate contract trucking delivery or construction of a pipeline to the injection battery. The 500,000 gallon capacity of the waste pond will serve as a buffer for these operations.

Radioactive solid wastes from the process streams and backflushing of sand filters will be deposited by sedimentation in the waste pond. The waste pond will be for temporary storage only and the solid wastes will be removed when restoration ceases and drummed for shipment by truck to a licensed radioactive waste disposal site in accordance with U.S. Department of Transportation regulations.

The waste pond is ten feet deep with the bottom at 7 feet below ground level. The normal maximum liquid level will be seven feet (516,000 gallons). An emergency level of eight feet (617,000 gallons) will leave two feet of freeboard and 220,000 gallons of capacity in reserve. The three foot berm will divert rainfall runoff away from the waste pond. To prevent leakage, a 30 mil polyvinyl chloride (PVC) liner will be used. A leak detection system will be established. A barbed wire fence will enclose the pond, processing facilities, and production area.

Possible leakage of solution from the ore zone will be monitored by a system of monitor wells in the mine area (Figure 1). These wells will be no closer than 100 feet to the permit boundary. Additional wells will be located in the aquifers above the mined zone. Two wells will be monitored continuously, the rest semi-monthly. The Texas Department of Water Resources has determined that the integrity of the aquaclude below the production zone is such that no monitors at this level are necessary.

The applicant has indicated that mined aquifer restoration will commence after the initial mining zone is depleted of recoverable uranium. The methodology for restoration will be to pump water from the mined area to the waste pond where the solution will be transferred by contract trucking service or pipeline to the injection well(s) for repressurization. Because no ammonia is used in the lixiviant, the applicant anticipates that restoration will be completed with a treatment of fluid volume not greater than 5 pore volumes of the affected area. This estimate is based on the experience of others using non-ammonia lixiviants in the Catahoula Tuff which indicates little variation from site to site or location within the geologic interval. The final limits of restoration are stated in the Texas Department of Water Resources permit, but in no case shall the water be inconsistent with current uses for the water.

Upon completion of operations and before the termination of licensure, the applicant will remove all surface structures and seal off all wells in accordance with existing or future regulations. All structures and equipment will be either shipped for burial to a licensed radioactive waste disposal site or decontaminated to less than limits set by the Texas Department of Health. The solid contents of the waste pond shall be removed for disposal at a licensed radioactive waste disposal site. All surface areas shall be restored to the same uses as existed before mining operations or as otherwise accepted by the landowners.

II. Summary of Environmental Impacts

A. The Longoria Leach Project lies on the upper part of the Texas Gulf Coastal Plain. Early exploration by western Europeans found the area to be a grassland savannah dissected by brush choked arroyoes and occassional upland mottes of mesquite. Subsequent agrarian practice of overgrazing has led to a mixed brush community whose canopy cover is characterized by mesquite.

The site locality can be characterized as a mixed brush community. Predominant grasses within the site include buffelgrass, hybrid bluestem, and Texas grama. Weeds found within the site area include snakecotton, milkpea, and bull nettle. The dominant cacti species found in and around the site are eastern and Texas prickly pear. Honey mesquite and huisache are the dominant woody plants found in and around the plant site. For a more complete list of flora which can be encountered refer to Table 1.

TABLE 1 COMMON VASCULAR PLANTS OF SOUTHWEST DUVAL COUNTY

Clapweed	Crameria	Rattlesnakeweed
Hybrid Bluestem	Guajillo	Texas Persimmon
King Ranch Bluestem	Huisache	Prairie Gentian
Silver Bluestem	Catclaw	Showy-milkweed
Texas Grama	Huisachello	Bindweed
Rescuegrass	Loco Weed	Morning Glory
Buffelgrass	Dwarfdalea	Gromwell
Hooded Windmillgrass	Milkpea	Desert Lantana
Lovegrass	Texas Bluebonnet	Dakota Vervain
Browntop Panic Grass	Honey Mesquite	Beaked Vervain
Knotroot Bristlegrass	Snout Bean	Basil Beebalm
Johnsongrass	Cranesbill	Skullcap
Spiderwart	Goathead	American Nightshade
Wild Onion	Bull Nettle	Buffalo Bur
Yucca	Vara Blanca	Anizo
Spanish Dagger	Soapberry	Lazy Daisy
Century Plant	Brasil	Straggler Daisy
Texas Tuberose	Lotebush	Bull Thistle
Granjeno	Poppy Mallow	Texas Thistle
Pigweed	Axocatzin	Horseweed
Snake-cotton	Horse Crippler	Firewheel
Angel Trumpets	Hedgehog Cactus	Common Sunflower
Anemone	Eastern Prickly Pear	Camphorweed
Plains Larkspur	Texas Prickly Pear	Mexican Hat
Agarita	Gaura	Texas Groundsel
Red Poppy	Wavy-leaved Gaura	

This area has no known unique vegetation characteristics; therefore, it is not anticipated that temporary disruption afforded by the 4½ year productive life of the mine will cause any long lasting ecological impacts. The applicant will restore the land consistent with its prior condition, using grass types acceptable to the land owner.

Southwest Duval County represents the climatological transition from the temperate/tropical climes of the southern portion of the Texas Gulf Coast to the semi-arid/arid climes of West Texas. Coupled with the man-induced changes in the plant community, this geographic/climatologic regime supports a highly divergent faunal community. Common soil and litter invertebrates found within the area are rove beetles, mites, ants, and ground beetles. Frit flies and leafhoppers can also be found within the area.

Common amphibians to be found in the area include the Texas toad, Gulf Coast toad, and Great Plains narrow-mouthed toad. Reptiles to be found in and around the Longoria Leach Project include the Texas tortoise, Texas horned lizard, Texas spotted whiptail, bullsnake, and western diamond-back rattlesnake.

Birds common in the region include mockingbirds, red-winged blackbirds, mourning doves, cactus wrens, bobwhites, golden fronted woodpeckers, cardinals, brown-headed cowbirds, barn swallows, and cliff swallows and wild turkeys.

B. The mammalian population roughly corresponds to habitat requirements furnished by the vegetation assemblages. Common mammals living in the area are the cotton rat, gray wood rat, Mexican ground squirrel, raccoon, coyote, bobcat, eastern cottontailed rabbit, collared peccary and white-tailed deer. The limited area of the site and the relatively large degree to which the land has been disturbed by grazing tends to indicate that only the insectivores the rodents and the hares and rabbits listed above are likely to be present in significant numbers. The larger species are more apt to be transients, if present at all. Therefore, it may be logically concluded that a temporary disruption of such a small area will not significantly affect the mammalian population of the region. The fenced perimeter will not impede the passage of transient animals.

C. Ground water will be drawn from the ore body and, at the maximum injection rate projected for disposal by the applicant, it is anticipated that a maximum 384 acre feet per year of water could be removed permanently from the aquifer, for a total of approximately 36 million gallons during the life of the project. Texas Department of Water Resources Report 181, Groundwater Resources of Duval County, indicated that in 1974, approximately 6 million gallons of water per day was available for development without depletion of the supplies located in the Catahoula Tuff, the formation of interest. The impact, therefore, of withdrawing 0.4% of the available water resources by this operation is considered acceptable. Also, it should be borne in mind that the water quality in the permit area vicinity is considered marginal to poor because of dissolved solids. The quality and character of the water indicate that the Catahoula Tuff aquifers are transitional between the initial regional recharge chemistry and the deeper basin connate brines, restricting use to irrigation and domestic livestock watering.

D. All process system liquid wastes, including potentially contaminated laundry wash and laboratory wastes, will be disposed of off-site by injection well as mentioned previously. No process liquid wastes are to be released to the surrounding environment unless approved by the Texas Department of Health and the Texas Department of Water Resources. Sanitary system wastes will go in a septic system permitted by local authorities.

E. Trace chemical releases to the air are to be expected; however, no adverse effects on total air quality are expected. Dusting and diesel emissions can be expected during construction and drilling. These will be of a temporary nature and much less than similar emissions from open pit mines. Radon 222 releases are expected to be within the limits prescribed by the Texas Regulations for Control of Radiation Appendix 21-A, Table II; however, these releases will be monitored by the applicant and the Texas Department of Health to insure compliance. As there is no yellowcake dryer operation, releases of uranium to the environment should be negligible.

F. Three roadways will be affected. The delivery by truck of the waste water to Arnco, Inc., will be made over URI's plant access road, 1.8 miles of Texas State Highway 359, and Arnco, Inc.'s access road. The two companies will maintain their respective access roads, and no impact on public resources will result. There will be an increase in wear on Highway 359, resulting either in increased maintenance or decrease in expected life of the roadway. However, revenues accrued to the state and county through taxation of the project are expected to more than offset the extra maintenance required, in view of the limited area involved.

G. Because of the small number of employees needed for the project, it is not expected to have any significant socioeconomic effect on the local area. All types of technical expertise needed are already available in the labor pool of the area, due to the presently existing uranium operations.

III. Principle Alternatives Considered

A. Currently there are three recognized methods of uranium mining: open pit, underground, and <u>in situ</u> mining. These were considered and the conclusion reached that the only economically viable method, at this time, of mining this small ore body is the <u>in situ</u> leach process. Factors considered were environmental and economic in nature.

1. Environmentally the advantages are:

   a. minimal and temporary surface disturbance,

   b. small volume of solid waste generated and no mill tailings,

   c. less air pollution compared with conventional uranium mining and milling using open pits and crushing methods,

   d. minimal, if any, surface subsidence from <u>in situ</u> leaching,

   e. possible restoration of the mine site to an "unrestricted use" status within a relatively short time after completion of mining operations,

   f. smaller radioactive material releases than in conventional mining and milling process, especially the release of radon-222, and

   g. lack of the need for long term maintenance and monitoring of buried tailings, since no tailings are produced.

2. Economic advantages are:

   a. ability to mine lower grades and smaller bodies of ore,

   b. minimal capital investment,

   c. less risk to personnel than from ore trucks and open pit mining,

   d. short lead time before yellowcake production, and

   e. lower manpower requirements.

B. An alkaline leach solution was chosen because past experiences of the uranium industry in like formations in Texas have shown that acidic solutions interact with the clays in the formation, causing swelling which blocks the leach flow process.

C. On-site burial of solid radioactive waste was considered; however, this is not encouraged by the Texas Department of Health, so commercial disposal will be used.

D. Liquid waste disposal alternatives:

1. Evaporation ponds would entail the construction of large ponds and the concentration of radium-226 bearing solids, which in themselves

would have to be disposed of. This would environmentally affect the surface much more than injection wells.

2. Total cleanup and reuse of all waters would make the process economically infeasible at this time.

3. Injection has been an acceptable form of secondary recovery of oil and gas for many years in Texas and is permitted under strict regulation by the Texas Railroad Commission.

E. Denial of licensure at this time would preclude the only economical means of mining this ore body, thus denying the nation the amount of energy available in the ore body.

IV. Limitations of Licensure

From analyses and evaluation of the data submitted by the applicant, the Agency proposes that the applicant be licensed to conduct solution mining within the following limitations:

A. Solution mining will be confined to the area permitted by the Texas Department of Water Resources. Any modifications to said permit must be approved by the Texas Department of Water Resources and the Texas Department of Health.

B. The applicant must obtain all permits and licenses required by State and local authorities before commencing operations.

C. The aquifer of concern must be restored to conditions stated in the application to the Texas Department of Water Resources. In no case shall the aquifer be restored to conditions of lesser use than existed bef mining operations.

D. No liquid waste from the plant process will be discharged to the environment without the prior approval of the Texas Department of Health and the Texas Department of Water Resources.

E. The mining operation shall be monitored in accordance with procedures contained in the applications to the Texas Department of Water Resources and the Texas Department of Health.

F. Liquid wastes shall be disposed of in injection wells and all radioactive solid waste shall be disposed of at licensed radioactive waste disposal sites.

G. The liquid waste pond shall be lined with a 30 mil PVC liner and a leak detection system shall be installed.

H. Water wells within a two mile radius of the mine site shall be sampled in accordance with procedures contained in the applications to the Texas Department of Water Resources and the Texas Department of Health.

I. The applicant shall have a plan to cope with transportation accidents.

J. Upon completion of mining, the permit area shall be restored to conditions consistent with its original use, subject to lease agreements.

V. Agency Staff Position

A. Concerning the requirements of the Uranium Mill Tailings Radiation Control Act of 1978 (PL 95-604), the Agency, based upon currently accepted standards and definitions, has determined that since no tailings are produced, no long-term maintenance or monitoring will be required after restoration. Therefore, transfer to the State of the title to the land involved and a long-term maintenance and monitoring fund is not required. Furthermore, the Agency has reviewed the applicant's financial statement and, based upon its merits, has determined that adequate financial arrangements exist for the decontamination, decommissioning and reclamation of sites, structures and equipment.

B. In situ solution mining, though relatively new and experimental in most areas of the United States, has been in use in Texas since 1974. Texas, because of its vast experience in drilling and oil and gas technology, has helped to set national standards in all aspects of in situ mining applications. Now that known reserves of oil and gas are diminishing, the energy companies have been looking for alternative sources of energy such as uranium.

Texas is blessed with a large reserve of known uranium deposits, and a great potential for future discoveries; however, these deposits are of a low grade and the amount of ore available at specific sites is relatively small. The need for energy, availability of existing technology, geological peculiarities, growing environmental awareness, and innovative regulatory policies have led to the creation of a new mining industry whose applications are being accepted by both Federal and State governments. Not only has a new industry been developed, but one that is, in many respects, more economical, safe, and environmentally sound than open pit or underground mining of the same scale. However, this industry is not without restrictions upon its application. In some instances, the geology will not accomodate solution mining. It is the responsibility of the State's regulatory agencies to carefully review all aspects of each specific application to ensure that all safety requirements are met before facilities are constructed of operations begun. Future surveillance of these activities must be maintained to ensure compliance with all applicable requirements and regulations. In conclusion, after careful review of all documents, statements, and literature submitted, the Agency recommends that licensure be granted subject to the conditions specified in Section IV.

REFERENCES:

1. Uranium Resources Incorporated license application to the Texas Department of Health with associated documents and amendments, dated January 30, 1979.

2. Uranium Resources Incorporated permit application to the Texas Department of Water Resources, dated October 31, 1978.

3. Ground Water Resources of Duval County, Report 181, Texas Department of Water Resources.

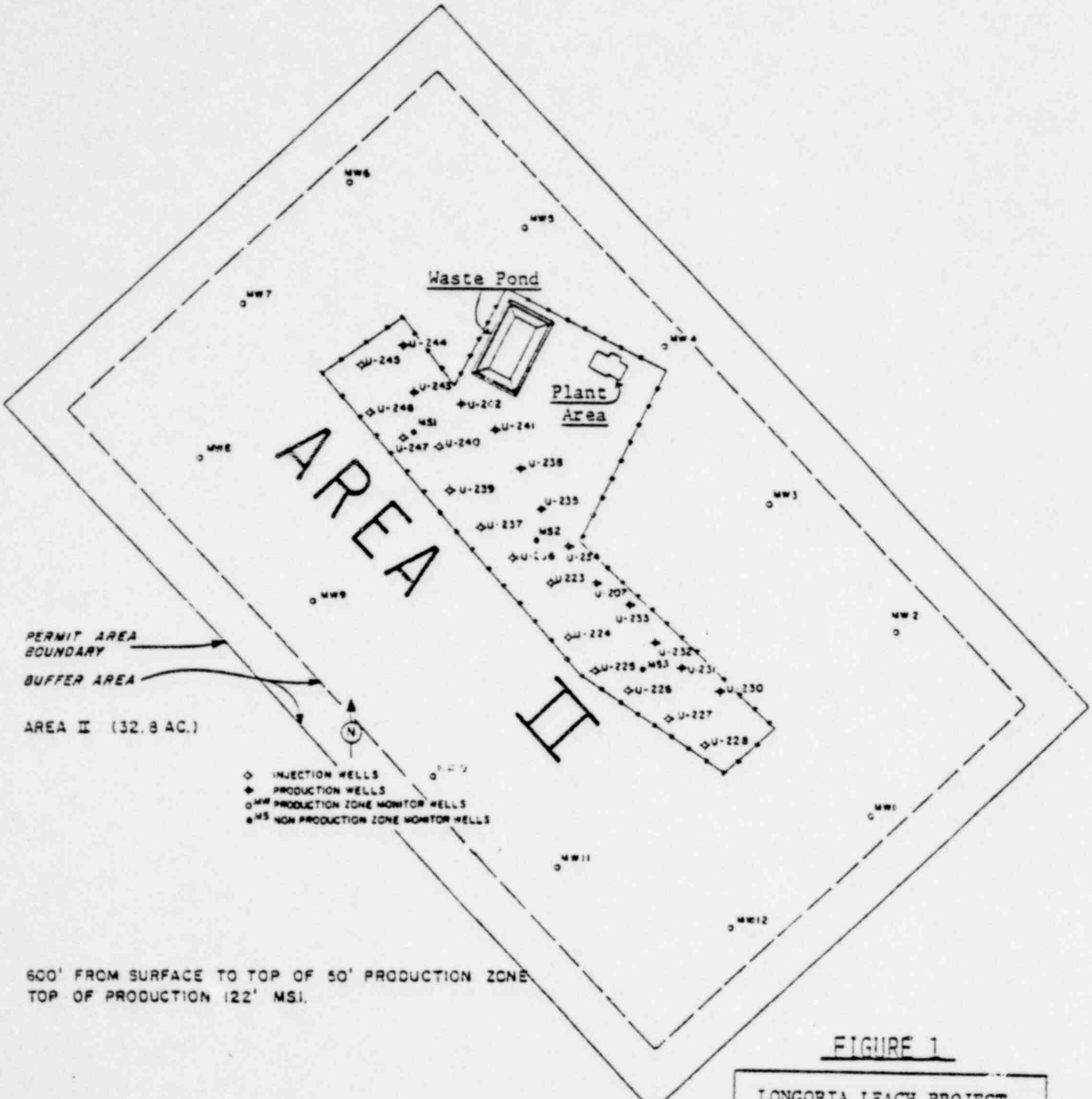
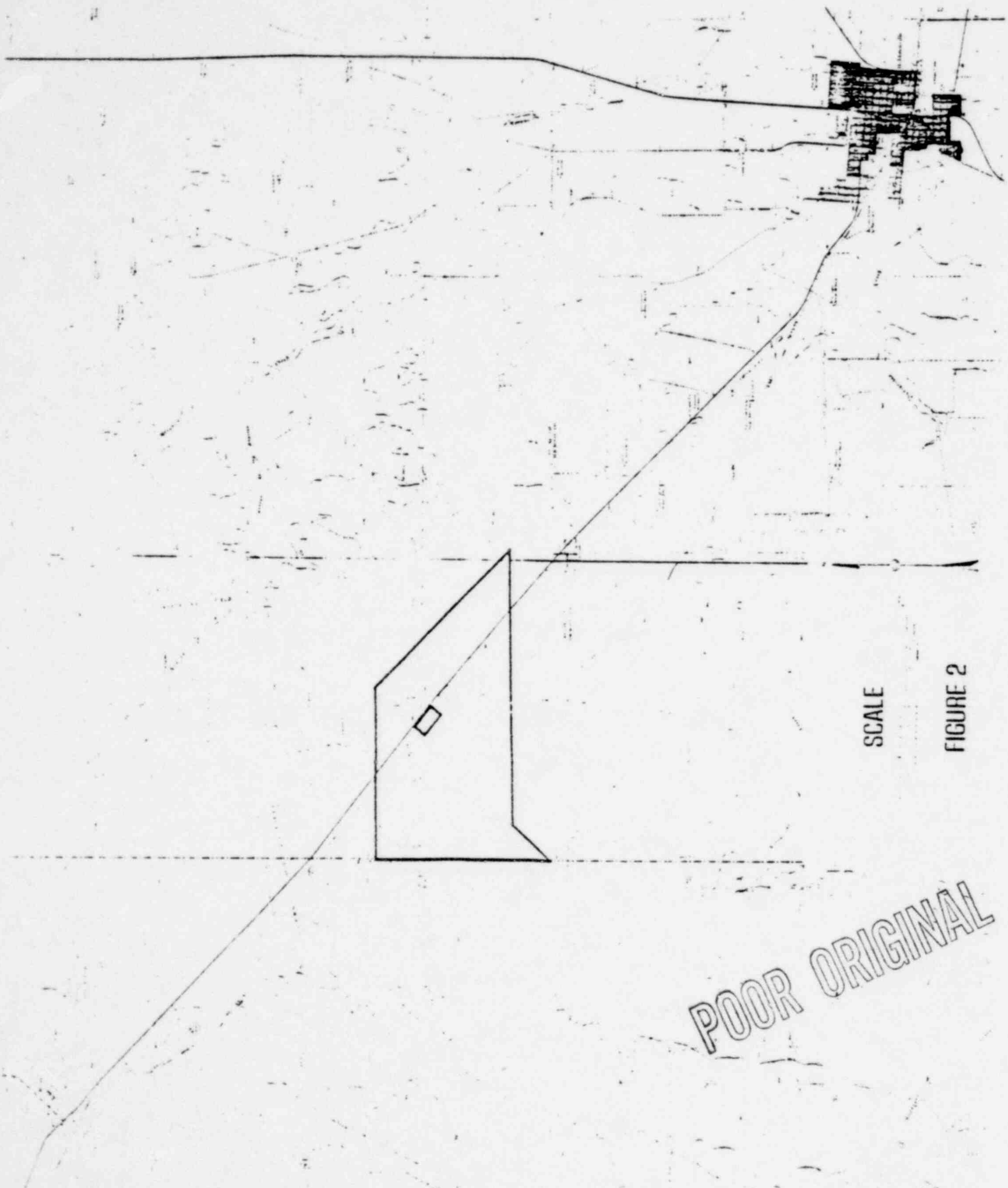


FIGURE 1

LONGORIA LEACH PROJECT

0 100' 300' 500'

SCALE



SCALE

FIGURE 2

URANIUM RESOURCES INC.

ARTHUR L. BISHOP
Environmental Manager

June 6, 1979

Mr. Jon R. Sharp
Supervisor of Medical Licensing
Radiation Control Branch
Division of Occupational Health and
Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, Texas 78756

RE: RADIOACTIVE MATERIAL LICENSE LONGORIA IN SITU LEACH PROJECT URANIUM RESOURCES INC.

Dear Mr. Sharp:

Per your request for certain documentation and clarification of proposed operating procedures under the referenced subject, I am enclosing URI's response to your questions of May 30.

If you need any additional information, please contact me at your earliest convenience.

Sincerely,

Arthur L. Bishop

Arthur L. Bishop
Environmental Manager

ALB/tj

Encl.

1214 248

Suite 735, Promenade Bank Tower • 1600 Promenade Center • Richardson, Texas 75080 • (214) 234-5234

TDH REQUEST:

1.a) What is the usable capacity of the slurry truck for uranium slurry? For liquid wastes?

URI RESPONSE:

The slurry trailer contains two DOT MC-312 specification tanks which have a combined capacity of 4200 gallons. Each will be filled with 1260 gallons of yellowcake slurry for shipment. The remaining capacity is held for processing action at the Kerr-McGee facility in Oklahoma.

For transferring fluids to Arnco Inc., the total 4200 gallon capacity would be utilized.

TDH REQUEST:

1.b) What schedule of filling and transfer will be used during the producti n phase for wastes and for slurry? How will the pond be used in this schedule?

URI RESPONSE:

During normal operations the anticipated shipment schedule for shipment of yellowcake slurry will be once every fourteen weeks. At that time, the slurry trailer will not be available for liquid transfer for 6 days. During that period, all fluids will be directed to the retention pond. Upon the trailer return it will make two trips per day to Arnco, Inc. for a period of twelve to fourteen days. Thereafter, one trip per day should be adequate to handle fluid production.

TDH REQUEST:

1.c) What other transfer resources are expected to be available for the production phase?

URI RESPONSE:

URI is in the process of purchasing a 5000 gallon trailer which will be dedicated to fluid handling only. In addition, URI will have a 1000 gallon nurse trailer which can be utilized in fluid handling when not in service as an ancillary vehicle for well conditioning.

1214 249

Long term URI has contracted for two additional slurry trailers which could also be utilized for fluid handling. After the first year of plant production URI will have 18,600 gallon/service trip capacity (3 slurry trailers, 1 fluid trailer and 1 nurse trailer).

TDH REQUEST:

1.d) During restoration when flow is expected to increase by a factor of five, how will the transfer of liquid wastes be accomplished?

URI RESPONSE:

URI has entered into negotiations for obtaining pipeline easements in order to handle the increased fluid demands. However, if such negotiations not be successful, URI will obtain the additional six trailers (5,000 gallons each) needed to fulfill the demand.

In addition, if the reverse osmosis treatment proves successful and necessary regulatory clearances are obtained, the fluid handling demand will be obviated.

TDH REQUEST:

1.e) What will the procedure for monitoring the waste radiologically?

URI RESPONSE:

The fluids will be sampled daily and blended to form a weekly composite. This composite will then be analyzed for Ra 226, gross alpha and gross beta. The analytical result will be kept on file at the plant and at the URI office in Richardson, Texas. If the radiometric concentration in the fluids exceed that of native groundwater, URI will use secondary treatment (e.g. R.O., barium chloride, etc.) to achieve those levels prior to fluid shipment.

TDH REQUEST:

1.f) In the event that solid wastes sufficiently contaminate liquid wastes to that the latter could not be transferred to Arnco per agreement, what contingency plans are available?

URI RESPONSE:

If particulates preclude shipment, URI will install a polishing filter (5 micron) to keep the transferred liquid free of insolubles.

1214 250

TDH REQUEST:

2.a) Are the sand filters expected to collect the bulk of the solid waste? Are there any other significant collection points?

URI RESPONSE:

The design purpose of the sand filters is to collect any insoluble particulates or process related precipitates. The collection point is at the top of the sand bed inside the filter.

TDH REQUEST:

2.b) How will the sand filter solid waste be dealt with? If by backflushing, why will the material not prove to be a problem with respect to contamination of pond liquid waste or reduction of pond capacity?

URI RESPONSE:

When a pressure drop across the sand filter indicates a solids buildup within the unit, the filter will be backwashed. Based on previous operating experience, it is not anticipated that produced solids will reduce the pond capacity by more than 5%. Solids within the pond will be filtered out of any fluids being shipped to Arnco, Inc.

TDH REQUEST:

2.c) If backflushing of the sand filters is unsuccessful, what contingency plans are available?

URI RESPONSE:

If the sand media is no longer effective, the sand will be removed and new sand put in its place. Prior to removal, the containment tank will be force vented with compressed air for at least 4 hours, in order to purge the radon from the interior. No worker will be placed into the interior until radon levels are below existing regulatory standards. The old filter media will either be decontaminated, or it will be dried, packaged, and shipped to an L.S.A. disposal site.

TDH REQUEST:

3) Are sufficient hoses and sumps available on the equipment pad to effect the removal of any spills or contamination?

URI RESPONSE:

The concrete pad on which the leach plant is located is graded to the centrally located sump. URI already has on site two taps and sufficient hose which allows URI personnel the capability of reaching all parts of the pad and equipment.

1214 252

TDH REQUEST:

4) Why is no bleed stream or molybdenum removal equipment contemplated for the slurry processing loop? What levels of molybdenum are expected to result in the liquid waste?

URI RESPONSE:

URI personnel through previous operating experience in the same geologic and geographic environments as the Longoria, do not anticipate molybdenum levels to exceed 5 mg/l in the composite production stream. At this level, the cost and operating expense of a molybdenum removal circuit is greater than the product penalty. Therefore, URI does not anticipate using such a circuit. It is not anticipated that molybdenum concentration will exceed 15 mg/l in the liquid waste.

TDH REQUEST:

5) Will Arnco, Inc. have the acquifer capacity to handle wastes from URI if they are also disposing wastes from the Mobil Oil project?

URI RESPONSE:

As soon as Mobil's Holiday-El Mesquite project disposal well is put on line (mid July, 79), Mobil will be no longer using Arnco, Inc.

1214 254

TDH REQUEST:

6a) Describe the proximity of any office or other facility where personnel will be present during a 40 hour work week, to the equipment pad and/or Radon release points.

URI RESPONSE:

Anticipated release points for radon are the ion exchange columns, the barren lixiviant tank and the sand filters (when vented). The laboratory trailer is approximately 40 yards to the southwest and the office trailer is 50 yards to the southeast of these points.

TDH REQUEST:

6b) Describe the average meterology at the site with respect to wind direction and speed.

URI RESPONSE:

The prevailing wind is from the southeast averaging 11 mph with gusts up to 38 mph. The percentages of wind dominance is as follows:

DIRECTION OF WIND (from)	%	WORK AREA AFFECTED
N	14	
NE	8	Lab Trailer
E	13	
SE	46	
S	15	
SW	<.5	
W	1.5	
NW	2.5	Office Trailer

1214 255

TDH REQUEST:

6c) Describe the average annual activity of Radon released from mining activities. Please use conservative assumptions if data are not available for this estimation. Please submit copies of previous <u>in situ</u> analyses for Radon should your response be based substantially on such studies.

URI RESPONSE:

The anticipated annual activity of total radon to be released is 77.4 curies. This is based on a Nuclear Regulatory Commission estimate in NUREG-0481. A copy of page 4-16 of this document is enclosed.

(c) waste ponds. To reduce atmospheric releases within the uranium recovery process area, process components will be enclosed or vented where practicable. Ventilation and emission controls will be maintained at levels necessary to ensure safe working conditions and insignificant environmental impacts. In the plant building, there will be two principal atmospheric emission sources: the calcium removal unit (tanks) and the product drying and packaging unit.

According to the applicant, the drying and packaging unit atmospheric release will consist of (1) by-products of combustion (1,000,000-Btu/hr product drying unit), (2) volatilized solution residuals (about 0.75 to 1.25 lb of barren eluant per pound of ammonium diuranate feed), and (3) U_3O_8 fines generated during product drying. The off-gases from the dryer will be scrubbed by a high-intensity Venturi scrubber (99.5 to 99.9% efficient) to reduce U_3O_8 losses to less than 1000 lb/year.

The storage ponds will also be a source of atmospheric ammonia, carbon dioxide, radon, and ammonium chloride emissions. The magnitude and composition of atmospheric emissions will be determined by the equilibria established between the prevailing evaporation rate, the feed rate, and the composition of solutions being impounded. Particulate emissions from impoundment areas will be minimized by a liquid seal over pond contents. The maintenance of a liquid seal on impoundments will be a license condition.

Radioactive atmospheric releases will originate in the ammonium diuranate drying unit, the calcium control unit, and the waste storage ponds. Releases of 1000 lb of U_3O_8 per year from dryer losses would correspond to a release of approximately 0.15 Ci of uranium-238 per year. A like amount of radioactivity release would be expected from the other natural uranium isotopes. Radium-226 mobilized during in situ leaching will coprecipitate with the calcite in the calcium control unit and will be deposited in the calcite storage pond. The staff estimates that about 1.4 Ci of radon-222 per year could be released from the calcite storage pond and calcium control unit as a result of decay of radium-226. Radon-222 mobilized from the ore zone during solution mining would be vented at the well field surge tanks. The staff estimates that approximately 76 Ci of radon-222 per year would be released from these tanks.

Table 4.5 contains a summary of the estimated emissions from each of the indicated sources. The cited estimates are based on the applicant's source composition and ambient temperature data and an assumed mean evaporation rate of 42 in./year.

Table 4.5. Estimated atmospheric emissions

Source	Emission rate[a] (thousands of pounds per year)				Radioactive releases[b] (Ci/year)	
	NH_3	CO_2	NH_4Cl	H_2O	U-238	Rn-222
Uranium recovery process facility (excluding the calcium control unit and waste storage ponds)	6–9	1500–2000	30–54		0.151	
Calcium control unit (basis: 1,000 ft² of exposed solution surface containing 0.75 g NH_4, 1.5 g total CO_3, and 0.75 g Cl per liter)	2–4	6–9	0.05–0.09	390–470		0.04
Calcite storage pond (basis: complete evaporation of 2.04 gpm of supernate containing 0.75 g NH_4, 1.5 g total CO_3, and 0.75 g Cl per liter)	2.5–3.5	9–10	9.5–10.5	~8000		1.36
Liquid waste storage ponds (basis: 1 acre of exposed solution surface containing about 7.0 g NH_4, 1.0 g total CO_3, and 16 g Cl per liter)	9–11	7–8	27–31	~9300		
Well field surge tanks						76

[a] Based on data supplied by applicant. Net evaporation rate of 42 in./year used in estimating releases.
[b] Staff estimates.

REFERENCES FOR SECTION 4

1. Wyoming Mineral Corporation, Application for In Situ Permit to Mine for the Irigaray Site, April 12, 1978.

2. W. C. Larson, "Nomograph for In-Situ Uranium Leaching," *Eng. Min. J.*, September 1977, p. 159.

Texas Department of Health

Raymond T. Moore, M.D.
Commissioner

Philip W. Mallory, M.D.
Deputy Commissioner

1100 West 49th Street
Austin, Texas 78756
458-7111

May 30, 1979

Mr. Arthur Bishop
Environmental Manager
Uranium Resources, Inc.
Suite 735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Dear Mr. Bishop:

To document your plans and the clarifications received in various telephone conversations in recent days, we submit the following questions for your consideration and reply:

1. Please describe the methods for handling and transfering liquid waste to Arnco for deep well disposal. In particular;

   a) What is the useable capacity of the slurry truck for uranium slurry? For liquid wastes?

   b) What schedule of filling and transfer will be used during the production phase for wastes and for slurry? How will the pond be used in this schedule?

   c) What other transfer resources are expected to be available for the production phase (other trucks, pipelines, contract hauling?)

   d) During restoration, when flow is expected to increase by a factor of five, how will the transfer of liquid wastes be accomplished (describe as before).

   e) What will be the procedures for monitoring the waste radiologically?

   f) In the event that solid wastes sufficiently contaminate liquid wastes so that the latter could not be transferred to Arnco per agreement, what contingency plans are available?

2. Please describe how production waste solids are handled. In particular;

   a) Are the sand filters expected to collect the bulk of the solid waste? Are

1214 258

there any other significant collection points?

b) How will the sand filter solid waste be dealt with? If by backflushing, why will the material not prove to be a problem with respect to contamination of pond liquid waste or reduction of pond capacity?

c) If backflushing of the sand filters is unsuccessful, what contingency plans are available?

3. Are sufficient hoses and sumps available on the equipment pad to effect the removal of any spills or contamination?

4. Why is no bleed stream or molybdenum removal equipment contemplated for the slurry processing loop? What levels of molybdenum are expected to result in the liquid waste?

5. Will Arnco have the a fer capacity to handle wastes from URI if they are also disposing of wastes from the Mobil Oil project?

6. Please describe the expected Radon release points and the expected concentrations in restricted and unrestricted areas. In particular;

a) Describe the proximity of any office or other facility where personnel will be present during a 40 hour work week, to the equipment pad and/or Radon release points.

b) Describe the average meterology at the site with respect to wind direction and speed.

c) Describe the average annual activity of Radon released from mining activities. Please use conservative assumptions if data are not available for this estimation. Please submit copies of previous <u>in situ</u> analyses for Radon should your response be based substantially on such studies.

If any clarification of the above is needed, please do not hesitate to contact me.

Sincerely,

Jon R. Sharp
Supervisor of Medical Licensing
Radiation Control Branch
Division of Occupational Health
and Radiation Control

13166, Austin, Texas 78711. The phone numbers are (800) 252-9642 (toll-free) or (512) 475-6335 (direct).

Issued in Austin, Texas, on May 22, 1979.

Doc. No. 793171 Tom A. Laramey, Jr.
General Counsel
Texas Department of Community Affairs

Filed: May 23, 1979, 3:38 p.m.
For further information, please call (512) 475-6335.

Texas Department of Health

Uranium Resources Incorporated Hebbronville Solution Mining Project

Availability of Environmental Assessment and Opportunity for Public Hearing

Notice is hereby given that an environmental assessment prepared by the Radiation Control Branch related to the Uranium Resources Incorporated Hebbronville Solution Mining Project in Duval County is available upon request by writing to the Radiation Control Branch, Texas Department of Health, 1100 West 49th Street, Austin, Texas 78756. This environmental assessment, prepared in accordance with the Uranium Mill Tailings Radiation Control Act of 1978 (Public Law 95-604), is an evaluation of the environmental impacts associated with the operation of this proposed uranium production facility.

Comments regarding the environmental assessment and requests for a public hearing will be accepted by the Radiation Control Branch until June 30, 1979. If no comments or requests for a hearing are received by that date, the Radiation Control Branch, Texas Department of Health, will issue a radioactive material license for the construction and operation of the proposed uranium processing facility.

Issued in Austin, Texas, on May 31, 1979.

Doc. No. 793324 Dan LaFleur
Attorney
Texas Department of Health

Filed: May 31, 1979, 11:02 a.m.
For further information, please call (512) 458-7341.

Texas Health Facilities Commission

Correction of Error

Emergency Rule 315.20.03.080 of the Texas Health Facilities Commission published in the May 29, 1979, issue of the *Texas Register* (4 TexReg 1938) contained an error. The first sentence of Rule .080, Motion to Reschedule a Certificate of Need Hearing, should read as follows: "The chairman may, upon written motion, reschedule a hearing on a certificate of need application to a date *46 or more* [later than 100] days after the original *date of hearing*."

Notice of Applications

Notice is given by the Texas Health Facilities Commission of applications (including a general project description) for declaratory rulings, exemption certificates, or administrative orders accepted May 15-21, 1979.

Should any person wish to become a formal party to any application for a declaratory ruling, exemption certificate, or administrative order, that person must file a notice of intent to become a party to the application with the chairman of the commission within 12 days after the enclosed listing is published. The first day for calculating this 12-day period is the first calendar day following the dating of this publishing. The 12th day will expire at 5 p.m. on the 12th consecutive day after said publishing if the 12th day is a working day. If the 12th day is a Saturday, Sunday, or state holiday, the last day shall be extended to 5 p.m. of the next day that is not a Saturday, Sunday, or state holiday. When notice of intent to become a party is mailed to the chairman of the commission, P.O. Box 15023, Austin, Texas 78761, it must be postmarked no later than the day prior to the last day allowed for filing notice of intent to contest.

The contents and form of a request to become a party to an application for a declaratory ruling, exemption certificate, or administrative order must meet the minimum criteria set out in Rule 315.20.01.050. Failure of a party to supply the minimum necessary information in the correct form by the 12th day will result in a defective request to become a party and such application will be considered uncontested.

The fact that an application is uncontested will not mean that it will be approved. The application will be approved only if the commission determines that it qualifies under the criteria of Sections 3.02 or 3.03 of Article 4418(h), Vernon's Annotated Civil Statutes, and Rules 315.17.04.010-.070, 315.17.05.010-.030, 315.18.04.010-.040, and 315.18.05.010-.030

In the following notice, the applicant is listed first, the file number second, and the relief sought and description third. EC indicates exemption certificate, DR indicates declaratory ruling, and AO indicates administrative order.

Good Shepherd Hospital, Longview
AH79-0517-015
EC—Addition of two hemodialysis stations to an existing six-station dialysis facility and conversion of the systems to a multipatient central proportioning and delivery system of dialysate

Visiting Nurse Association of Dallas, Dallas
AS79-0521-031
EC—Lease 2,200 square foot building at 5925 Maple Avenue, Suite 110, in order to relocate the Purchasing and Personnel Departments from their 900 square foot administrative offices at 4606 Greenville Avenue in Dallas.

Family and Individual Services Association of Tarrant County, Fort Worth
AS79-0209-003
EC—Relocation of the agency from 212 Burnet to 716 West Magnolia in Fort Worth

University of Texas System Cancer Center—M. D. Anderson Hospital and Tumor Institute, Houston
AH79-0518-009
EC—Replacement of laboratory data management system, a six-month old Geometric Data Corp. Hematrak 240 with 360 model, due to considerable down time of the 240, at no cost to

POOR ORIGINAL

1214 260

LAW OFFICES

McGINNIS, LOCHRIDGE & KILGORE

FIFTH FLOOR, TEXAS STATE BANK BUILDING
900 CONGRESS AVENUE
AUSTIN, TEXAS 78701
TELEPHONE (512) 476-6982

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B. D. ST. CLAIR
DENNY O. INGRAM
SHANNON H. RATLIFF
C. MORRIS DAVIS
J. GAYLORD ARMSTRONG
JOHN W. STAYTON, JR.
WILLIAM H. BINGHAM
ROBERT WILSON
DAVID W. NELSON
DAVID L. ORR

JAMES W. HACKNEY
P. MICHAEL HEBERT
WILLIAM H. DANIEL
EARNEST C. CASSTEVENS
PAMELA M. GIBLIN
DEAN M. KILGORE
DUANE F. EMMERT
BROOK BENNETT BROWN
THOMAS D. BARTON
MARC O. KNISELY
PATTON G. LOCHRIDGE
S. JACK BALAGIA, JR.
RICK HARRISON
LOUIS FRANK OLIVER
CAREY M. BRENNAN, (ADM. ARK.)
JERRY A. BELL, JR.

May 24, 1979

Mr. John Sharp
Texas Health Department
1100 West 49th Street
Austin, Texas 78756

Re: Radioactive Material License
Longoria Insitu Leach Mining Project
Uranium Resources, Inc.

Dear Mr. Sharp:

Pursuant to your conversation of May 22, 1979, with Mr. Art Bishop of Uranium Resources I am providing information on two of the matters you raised during that conversation. I understand that these matters came up as you were developing the Environmental Assessment for the project referenced above.

Your first request was for an estimate of the impact on local roadways from vehicular transportation of fluids from the URI project to Arnco, Inc. Three roads will be impacted: URI's plant access road, Texas State Highway 359, and Arnco, Inc.'s access road. The two companies will maintain their respective access roads, and therefore there will be no impact on public resources as a result of travel over those ways. There will be some slight increase in wear on Highway 359. The increase in wear will result either in increased maintenance expense or a slight decrease in expected life of the roadway. However, any increase in expense associated with extra maintenance or a shorter life will be offset through tax revenues generated from the activities at the project.

The second request you made was for an estimate of the impact of removal of ground water during operation and restoration. The Company anticipates that approximately 35.85 million gallons of water will be removed during the 4.25 year period of life of the project. A Texas Department of Water Resources report, originally published by the Texas Water Development Board in 1974 as Report 181-Groundwater Resources of Duval County, indicated that approximately 6 million gallons of water per day were available for development

1214 261

without depletion of the supplies located in the Catahoula Tuff, which is the formation of consequence in this situation. Therefore, the anticipated impact on the total quantity of water available from the formation by this particular operation would be less than 0.3% of what is estimated as available for use without depletion, which is negligible.

In addition to these two comments, I have also now obtained a copy of a letter from the Texas Air Control Board which makes reference to a different in-situ mining project of Uranium Resources, Inc. The Benavides project, described in the Texas Air Control Board letter in Webb County, is much larger than the Longoria Project. As you can see from the enclosed copy, the Air Control Board determined, in response to a permit application, that a construction permit for the larger facility would not be required.

Should you have need for any further information, or have any further questions, please contact me or Mr. Bishop directly.

Sincerely,

Robert Wilson

RW:ck

Enclosure

cc: Mr. Art Bishop w/enclosure

MAY 22 1979

Mr. Arthur L. Bishop
Environmental Manager
URANIUM RESOURCES, INCORPORATED
735 Promenade Bank Tower
Richardson, Texas 75080

Re: Permit Exemption
Permit Application No. C-7554
In Situ Uranium Leach Mine
Bruni, Webb County

Dear Mr. Bishop:

This letter is a response to your permit app..cation, Form PI-1 for the proposed construction of facilities to recover uranium from the ground by the in situ leaching method at your Benavides Project site near Bruni.

After evaluation of the information which you have furnished, we have determined that your proposed construction is exempt from the permit procedures because it is considered to be an insignificant source of air pollution if constructed and operated as described in your application. You are reminded that regardless of whether a construction permit is required, this facility must be in compliance with all Rules and Regulations of the Texas Air Control Board at all times.

Thank you for providing the information necessary for our evaluation of your proposal. If you have further questions concerning this exemption, please contact Mr. Fred Mulloy of our Permits Section.

Sincerely,
ORIGINAL SIGNED BY
ALEX D. OPIELA, JR.

Bill Stewart, P.E.
Executive Director

cc: Mr. Robert J. Guzman, Regional Supervisor, Harlingen
BCC: FMulloy, Board, File

1214 263

URANIUM RESOURCES INC.

ARTHUR L. BISHOP
Environmental Manager

May 11, 1979

Mr. William E. Hellums
Supervisor of Industrial Licensing
Radiation Control Branch
Division of Occupational Health
and Radiation Control
Texas Department of Health
1100 West 49th Street
Austin, Texas 78756

Re: Application for Radioactive Materials License
Longoria Leach Project

Dear Mr. Hellums:

Pursuant to your request of 7 May, Uranium Resources Inc. is providing as enclosures, the information requested under items 1, 2, 7, 9, and 10. The remaining information will be supplied by our representative Mr. Wilson of McGinnis Lochridge and Kilgore.

Thank you for your assistance in this matter.

Sincerely,

URANIUM RESOURCES INC.

Arthur L. Bishop

Arthur L. Bishop
Environmental Manager

ALB/jp
Encls.
cc: Bob Wilson

1214 264

ITEM 1, TDH Request: A description of flora and fauna located in the area that will be affected by the mining activities.

URI Response:

The Longoria Leach Project lies on the upper part of the Texas Gulf Coastal Plain. Early exploration by western Europeans found the area to be a grassland savannah dissected by brush choked arroyoes and occassional upland mottes of mesquite. Subsequent agrarian practice of overgrazing has led to a mixed brush community whose canopy cover is characterized by mesquite.

The site locality can be characterized as a mixed brush community. Predominant grasses within the site include Buffelgrass, Hybrid Bluestem, and Texas Grama. Weeds found within the site area include Snakecotton, Milkpea, and Bull Nettle. The dominant cacti species found in and around the site are Eastern and Texas Prickly Pear. Honey Mesquite and Huisache are the dominant woody plants found in and around the plant site. For a more complete list of flora which can be encountered refer to Table 1-1.

Southwest Duval County represents the climatological transition from the temperate/tropical climes of the southern portion of the Texas Gulf Coast to the semi-arid/arid climes of West Texas. Coupled with the man induced changes in the plant community, this geographic/climatologic regime supports a highly divergent faunal community. Common soil and litter invertebrates found within the area are rove beetles, mites, ants, and ground beetles. Frit flies and leafhoppers can also be found within the area.

Common amphibians to be found in the area include the Texas Toad, Gulf Coast Toad, and Great Plains Narrow-mouthed Toad. Reptiles to be found in and around the Longoria Leach Project include the Texas Tortoise, Texas Horned Lizard, Texas Spotted Whiptail, Bullsnake, and Western Diamond-back Rattlesnake.

Birds common in the region include mockingbird, red-winged blackbirds, mourning doves, cactus wrens, bobwhite, golden fronted woodpeckers, cardinals, brown-headed cowbirds, barn swallows, and cliff swallows and wild turkey.

Common mammalians found within the area of interest include cotton rat, Mexican ground squirrel, gray wood rat, white-tailed deer, collared peccary, cottontailed rabbits, coyote, raccoon, and bobcat.

TABLE [illegible] ANTS OF SOUTHWEST DUVAL COUNTY

Clapweed	Crameria	Rattlesnakeweed
Hybrid [illegible]	Guajillo	Texas Persimmon
Ki[illegible]	Huisache	Prairie Gentian
Silver [illegible]	Catclaw	Showy-milkweed
Texas [illegible]	Huisachello	Bindweed
Rescue[illegible]	Loco Weed	Morning Glory
Buffelgrass	Dwarfdalea	Gromwell
Hooded [illegible]	Milkpea	Desert Lantana
Lovegrass	Texas Bluebonnet	Dakota Vervain
Browntop [illegible]	Honey Mesquite	Beaked Vervain
Knotroot [illegible]	Snout Bean	Basil Beebalm
Johnsongrass	Cranesbill	Skullcap
Spiderwort	Goathead	American Nightshade
Wild Onion	Bull Nettle	Buffalo Bur
Yucca	Vara Blanca	Anizo
Spanish Dagger	Soapberry	Lazy Daisy
Century Plant	Brasil	Straggler Daisy
Texas Tuberose	Lotebush	Bull Thistle
Granjeno	Poppy Mallow	Texas Thistle
Pigweed	Axocatzin	Horseweed
Snake-cotton	Horse Crippler	Firewheel
Angel Trumpets	Hedgehog Cactus	Common Sunflower
Anemone	Eastern Prickly Pear	Camphoweed
Plains Larkspur	Texas Prickly Pear	Mexican Hat
Agarita	Gaura	Texas Groundsel
Red Poppy	Wavy-leaved Gaura	

ITEM 2, TDH Request: Land Usage Pattern in the Area of Concern and Adjacent Areas

URI Response: Previous land use of the URI Longoria Leach Project was rangeland pasture. Similarly except for existing uranium leach sites, all lands within 5 miles of the leach project are currently used as pasture land for cattle. Certain oil and gas fields are also to be found in the immediate area, however; that activity does not interfere with grazing activity.

For an understanding of the spatial relationships for each land use, refer to the attached figure.

1214 267

ITEM 7, TDH Request: Meteorlogical Data From the Area For the Last Year

URI Response: The Longoria Leach Project lies 8 miles northwest of Hebbronville, Jim Hogg County, Texas. The weather station at Hebbronville is located at 27°18' north latitude and 98°40' west longitude. Elevation of the station is 559' above mean sea level. The attached tables contain the recorded data from the Hebbronville station for the year 1978.

TABLE 7-1 MONTHLY SUMMARIZED HEBBRONVILLE STATION DATA - January-December 1978

	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Temperature												
Avg. Max.	50.4	63.1	81.0	87.3	94.3	95.9	100.5	97.4	89.4	83.3	75.8	68.9
Avg. Min.	37.5	39.3	50.1	63.0	70.3	71.5	73.6	72.4	70.9	58.8	56.8	45.0
Avg.	49.0	51.2	65.6	75.2	82.3	83.7	87.1	84.9	80.2	71.1	66.3	57.0
Highest	83	85	9[illegible]	99	102	101	104	103	98	90	88	91
Date	7	26	1	19	18	26	18	29	5	14	12	21
Lowest	25	31	31	50	57	66	71	67	63	48	40	18
Date	20	22	5	12	4	8	31	21	30	19	9	10
Degree Days	491	391	83	12	0	0	0	0	0	3	92	6
Precipitation												
Total	0.80	0.52	0.00	1.26	2.90	2.48	0.00	2.06	5.82	1.44	0.67	3.0[illegible]
Greatest Day	0.18	0.25	0.00	0.92	1.40	1.52	0.00	1.47	1.77	0.62	0.26	2.6[illegible]
Date	2	7	0	12	21	7	0	1	24	28	28	27

1214 269

TABLE 7-2 DAILY TEMPERATURES AND PRECIPITATION, HEBBRONVILLE, TEXAS, 1978

DAY	January			February			March		
	Max Temp	Min Temp	Precip	Max Temp	Min Temp	Precip	Max Temp	Min Temp	Precip
1	73	58		42	38	0.07	94	58	
2	61	31	0.18	49	40	0.03	73	56	
3	38	31	0.05	46	38	0.02	84	49	
4	52	37		55	38		57	31	
5	69	47		60	35		57	31	
6	77	47		63	34		75	40	
7	83	49		68	36	0.26	87	56	
8	82	44		59	35	0.02	82	48	
9	71	30		43	35		69	36	
10	59	32		55	31		77	41	
11	64	39	0.05	56	33		89	52	
12	64	38	0.02	73	44		89	50	
13	69	40		81	41		80	55	
14	62	31		75	40		86	50	
15	67	36		61	40	0.08	89	52	
16	77	42		59	40	0.02	85	49	
17	82	33		57	41	0.02	73	43	
18	53	34	0.05	68	31		77	42	
19	45	35	0.08	54	33		80	48	
20	50	25		57	34		83	54	
21	40	26		69	33		86	58	
22	40	31	0.02	59	31		90	62	
23	46	36	T	68	35		84	68	
24	47	40		73	39		87	68	
25	54	44	0.10	78	52		83	52	
26	63	35		85	56		75	52	
27	64	36		78	58		82	44	
28	77	38		77	60		85	47	
29	47	40	0.04				86	55	
30	44	40	0.12				80	54	
31	51	40	0.09				85	52	

1214 270

TABLE 7-2 (cont'd)

DAY	April			May			June		
	Max Temp	Min Temp	Precip	Max Temp	Min Temp	Precip	Max Temp	Min Temp	Precip
1	86	55		96	71		96	73	
2	90	84		102	72		92	75	
3	90	65		91	57	0.82	99	73	0.54
4	91	68		82	57		90	71	
5	92	68		94	62		91	71	
6	90	67		90	70		94	73	
7	92	68		98	73		98	66	1.52
8	89	71		95	70		85	66	0.35
9	83	71		95	72		93	71	
10	88	68	0.05	94	72		92	69	
11	80	55		85	73		93	72	
12	65	50	0.92	93	71		95	75	
13	69	51	0.27	101	73		97	71	
14	82	53		88	61		95	70	
15	87	60		94	64		94	69	
16	90	66		98	71		97	69	
17	91	69		102	75		97	71	
18	96	69		102	75		97	71	
19	99	64		99	77		96	70	
20	89	64		95	74		95	69	
21	75	54		94	71	1.40	97	70	
22	85	63	0.02	86	68	0.68	97	70	
23	89	69		90	71		98	71	
24	98	60		93	73		100	73	
25	98	64		95	74		101	75	
26	89	57		95	75		101	76	
27	84	56		95	73		100	77	
28	88	61		96	72		100	77	
29	89	68		95	71		99	72	
30	85	71		95	71		96	71	0.07
31				95	70				

1214 271

TABLE 7-2 (Cont'd)

DAY	July Max Temp	July Min Temp	July Precip	August Max Temp	August Min Temp	August Precip	September Max Temp	September Min Temp	September Precip
1	100	73		86	73	1.47	87	72	0.13
2	101	75		92	74	0.23	95	68	
3	101	75		95	74		96	71	
4	101	75		97	70		97	72	
5	102	75		97	73		98	70	
6	101	75		97	71		92	72	
7	101	76		96	73		83	70	0.58
8	101	75		95	71	0.07	87	71	0.58
9	102	71		93	71		90	73	0.29
10	101	72		97	72		90	74	0.32
11	101	74		97	73		89	73	0.30
12	102	74		100	75		81	71	0.06
13	102	[illegible]		99	76		94	76	
14	102	73		101	77		93	78	
15	101	72		100	74		94	76	
16	102	73		101	74		94	74	
17	104	76		101	73		94	75	
18	104	72		102	75		94	73	
19	102	75		103	74		94	74	
20	102	73		101	72		94	74	
21	98	71		100	67	0.09	95	72	
22	102	72		95	70		94	71	
23	101	73		97	69		86	70	0.94
24	95	72		98	71		78	70	1.77
25	97	71		97	72		86	67	0.55
26	97	72		97	72		86	65	
27	100	74		99	72		86	65	
28	98	76		100	72		75	64	0.30
29	100	76		103	73		75	64	
30	101	75		92	71	0.24	85	63	
31	93	71		92	72				

1214 272

TABLE 7-2 (Cont'd)

DAY	October Max Temp	October Min Temp	October Precip	November Max Temp	November Min Temp	November Precip	December Max Temp	December Min Temp	December Precip
1	67	64		82	61		83	46	
2	88	66		84	62		81	49	
3	89	67		84	59		89	67	
4	90	69		85	62		87	44	
5	87	68		84	66		70	41	
6	90	68		83	57		78	50	
7	79	59	0.14	81	50		81	51	
8	74	61		68	41		60	40	
9	75	62		73	40		42	27	
10	84	58		79	45		49	18	
11	83	60		87	58		52	27	
12	89	69		88	70		55	46	0.28
13	89	60		85	66		60	47	
14	90	60		85	66		54	46	
15	77	48		87	71		54	45	
16	81	52		83	54	0.05	70	46	
17	85	52		56	52		77	47	
18	84	52		67	53		57	49	
19	83	48		66	59	0.20	65	50	
20	83	49		69	52	0.07	81	64	
21	87	50		56	52	0.04	91	54	
22	85	52		62	55		68	34	
23	88	60		70	56		72	36	
24	83	63		78	64		80	50	
25	82	51		78	69	0.05	78	32	
26	87	62		80	70		74	36	
27	79	59	0.58	81	58		59	40	2.60
28	73	57	0.62	65	45	0.26	57	46	0.02
29	70	57	0.10	53	45		67	53	
30	80	54		76	45		68	56	0.02
31	83	57					76	58	0.05

1214 273

ITEM 9, TDH Request: Information on the Reverse Osmosis Unit

URI Response: At this time Uranium Resources Inc. would like to clarify the use of the reverse osmosis unit. First, there exists sufficient available disposal capacity to handle URI requirements without use of an R.O. unit (URI application, January 30, 1979, pp. 23-34). Second, if an R.O. unit is to be used it will be tested to determine its true efficiency. At that time the field tested data will be provided to the Texas Department of Health and the Texas Department of Water Resources. URI will not use or dispose of R.O. treated waters in any manner other than in production without first receiving approval from the two aforementioned agencies.

ITEM 10, TDH Request: A Financial Statement of Uranium Resources Inc. indicating assets available for surety for the performance of reclamation, decontamination and decommissioning the facilities.

URI Response: The financial statement for Uranium Resources Inc. as of December 31, 1978 is attached hereto.

Texas Department of Health

Raymond T. Moore, M.D.
Commissioner

Philip W. Mallory, M.D.
Deputy Commissioner

1100 West 49th Street
Austin, Texas 78756
458-7111

May 7, 1979

Mr. Arthur Bishop
Environmental Manager
Uranium Resources, Inc.
Suite 735, Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Dear Mr. Bishop:

Sorry for the delays in reviewing the information you sent us in March; however, as you know, things have been in a rather confused state. As we have almost completed our first environmental assessment I feel I have matters a little more under control and so, if you will bear with us, we may continue the licensing review process.

With the above in mind, we shall need the following additional information:

1. A description of flora and fauna located in the area that will be affected by the mining activities.

2. Land usage patterns in the area of concern and adjacent areas.

3. A copy of the construction permit issued by the Air Control Board.

4. The status of your permit application with the Texas Department of Water Resources.

5. One copy of all information submitted for the Texas Department of Water Resources.

6. Do you have any monitor wells located beneath the aquiclude below the ore zone? (If so, please indicate how many and which ones they are.)

7. Meteorlogical data from the area for the last year.

8. Cross section of the stratigraphy of the geological formations of the permit area.

1214 276

Mr. Arthur Bishop
May 7, 1979
Page Two

9. Information on the reverse osmosis unit. (This should include the amount diverted to it, the amount that is returned for use and the amount to be disposed of by injection or other means).

10. A financial statement of Uranium Resources, Inc., indicating assets available for surety for the performance of reclamation, decontamination and decommissioning the facilities.

Upon receipt of the above requested information, we will continue to review your application and issue your license as soon as possible.

Sincerely,

Wm E Hellums JES
William E. Hellums
Supervisor of Industrial Licensing
Radiation Control Branch
Division of Occupational Health
and Radiation Control

RECEIVED
MAY 10 1979
URANIUM

1214 277

CUSTOMER Uranium Resources
ADDRESS
CITY Corpus Christi, TX
ATTENTION Art Bishop
INVOICE NO. 903035

REPORT OF ANALYSIS

SAMPLES RECEIVED 2/20/79 | CUSTOMER ORDER NUMBER

TYPE OF ANALYSIS Soil Analysis -

Sample Identification	Date Collected		Analysis	pCi/g (dry)
S5-0.0	2/11/79		Radium-226	1.7±0.2
			Lead-210	0.6±0.1
			Polonium-210	0.5±0.1
		Gamma Spec:	Lead-214	0.3±0.1
			Bismuth-214	0.3±0.1
URI-S7-0.0 Longoria	2/11/79		Lead-210	0.2±0.1
			Polonium-210	0.2±0.1
		Gamma Spec:	Lead-214	0.5±0.1
			Bismuth-214	0.3±0.1
URI-S?.05 Longoria	2/11/79		Lead-210	0.3±0.1
			Polonium-210	0.2±0.1
		Gamma Spec:	Lead-214	< 0.1
			Bismuth-214	< 0.1

RECEIVED MAR 1 2 1979 URANIUM

APPROVED BY
Bud Summers, Environmental Sciences Manager
3/7/79

CEP
Controls for Environmental Pollution, Inc.
P.O. Box 5351 • 1925 Rosina • Santa Fe, New Mexico 87502
Telephone 505/982-9841

1214 278

URANIUM RESOURCES INC.

ARTHUR L. BISHOP
Environmental Manager

March 1, 1978

Mr. William T. Hellums
Supervisor of Industrial Licensing
Radiation Control Branch
Division of Occupational Health
and Radiation Control
Texas Department of Health
'100 W. 49th Street
.ustin, Texas 78756

Re: Application For Radioactive Material License
Longoria In Situ Leach Project
Uranium Resources Inc. (URI)

Dear Mr. Hellums:

Pursuant to your letter of February 15, 1979, URI is enclosing the information requested. If you desire additional information please contact me at your earliest convenience.

Sincerely,

URANIUM RESOURCES INC.

Arthur L. Bishop

Arthur L. Bishop
Environmental Manager

ALB/jp
Encl.
cc: Robert Wilson

Suite 735, Promenade Bank Tower • 1600 Promenade Center • Richardson, Texas 75080 • (214) 234-6294

T.D.H. REQUEST:

1. A brief description of the leach loop. Where and what chemicals are added and stripped from the cycle and reasoning for such.

URI RESPONSE:

In situ leaching of uranium from well field to marketable product can be divided into three distinct chemical processes: leaching/ion exchange, elution, and precipitation. Each process step is discussed below:

LEACHING/ION EXCHANGE

Since the leach circuit or "loop" is a continuous cycle there is no ideal starting point. It is easiest to start with the Barren Lixiviant Tank (See Fig. 6, URI Radioactive Material License Application). At this point, NaOH is added for pH control purposes. Barren lixiviant is pumped across one, or both sand filters in order to remove insolubles.

After the lixiviant is filtered, but prior to injection, the lixiviant is fortified with CO_2 to a level which will allow full complexing of solubilized uranium. The lixiviant now passes into the well field via a manifold distributor. At the well bore formation interface, an oxidant is introduced to the lixiviant stream. Thereafter, the lixiviant passes into the mineralized production interval.

When oxidant contacts uranium ore, the following reaction takes place:

$$2\ UO_2 + O_2 = 2\ UO_3 \qquad (1$$

$$2\ UO_3 + Na_2CO_3 + 2\ NaHCO_3 = Na_4UO_2(CO_3)_3 + H_2O \qquad (2$$

An additional reaction also takes place in the formation:

$$15\ O_2 + 30\ H_2O + 4\ FeS_2 = 4\ Fe(OH)_3 + 8H_2SO_4 + 16\ H_2O \quad (3$$

It is this reaction which mandates the use of NaOH for pH adjustment. Uranyl tri-carbonate anion $(UO_2(CO_3)_3^{=})$ is soluble in water and is subsequently extracted from the formation via pumping.

At the surface, pregnant lixiviant passes into the ion exchange columns. Inside each column are ion exchange beads (represented by "R", below) which strip the uranyl tri-carbonate anion from the pregnant lixiviant through the following reaction:

$$4\ RCl + Na_4UO_2\ (CO_3)_3 = R_4UO_2\ (CO_3)_3 + 4\ NaCl \qquad (4$$

Once the solution passes through all three of the ion exchange columns, it enters the barren lixiviant tank, thus completing the leach circuit.

ELUTION

When all exchange sites within a given column are loaded with uranyl tri-carbonate anions, the ion exchange column is taken out of service. The resin contained therein is transferred to one of two elution columns. Barren resin from the remaining elution column is transferred into the previously vacated ion exchange column.

In the elution column, uranium is stripped from the resin through the reverse of formula (4. Sodium chloride brine solutions from the recycle and barren eluant tanks are passed over the pregnant resin. By mass action, uranyl tri-carbonate anions are driven off the resin and chloride anions are loaded in their place. The uranium rich eluted solution is pumped over to the pregnant eluant tank and held for subsequent processing.

PRECIPITATION

Pregnant eluant is "batched" into the precipitation circuit. In the first precipitation tank, hydrochloric acid is added until the pH has been lowered to 2. Carbon dioxide gas is driven off through this reaction. Peroxide is added in the second tank to aid in the digestion. Subsequently, NaOH is added in the fourth precipitation tank until the pH rises to 7.4. At this point, uranium oxide becomes insoluble and precipitates out as a slurry. Subsequent processing is confined to filtration and washing for removal of impurities.

T.D.H. REQUEST:

2. Maximum amount (in pounds) of slurry you anticipate on having on hand at any one time.

URI RESPONSE:

Subsequent to its application for a Radioactive Material License, URI has reconsidered the amount of yellowcake slurry it wishes to keep on hand. The amended quantity desired is 100 curies or approximately 340,000 pounds of U_3O_8.

1214 283

T.D.H. REQUEST:

3. Reference page 26, what will the radioactive concentration be of the spray used for irrigation for surface restoration?

URI RESPONSE:

Spray irrigation of treated waters is one of two fluid disposal methods being considered by URI. Prior to action to implement any irrigation activity, URI will present supporting technical data to the Texas Department of Health. No action will be taken unless URI has received permission to do so from the Texas Department of Health.

At present, targeted Ra226 concentration for irrigation waters will neither exceed 30 pCi/l in any one day nor 3 pCi/l for a 30 day average. (40 CFR Part 100.52 (a)(1))

1214 284

T.D.H. REQUEST:

4. What is the anticipated radioactive concentration of the water going into the deep disposal well? Is it more or less concentrated than water from the ore body prior to solution mining?

URI RESPONSE:

The anticipated radioactive concentration of waters delivered to the deep disposal well will be the same, or less than those encountered in the Longoria production zone (see URI Response to TDH Request #8).

T.D.H. REQUEST:

5. What is the total amount of activity anticipated to be injected in the deep disposal well?

URI RESPONSE:

The amount of activity injected into the disposal well is dependent upon three factors:

1. life of project;
2. restoration procedure; and
3. degree of radiometric concentration variability in production zone groundwater.

Only an anticipated minimum and maximum can be given. Calculated minimum and maximum values and assumptions used in calculating those values are given below:

CASE 1. Minimum Anticipated Activity - 1.53×10^{-2} Ci Assumptions:

a.) Fluids injected are derived only from normal plant operations, i.e. bleed, wash water, decant, etc.

b.) Average disposal rate equals 8 gpm.

c.) Longoria productive life is 3.75 years.

d.) Restoration will be accomplished via alternative procedures requiring no deep well disposal.

CASE 2. Maximum Anticipated Activity - 4.66×10^{-1} Ci Assumptions:

a.) Same as a.), b.), and c.) above.

b.) Restoration will be accomplished via production zone fluid extraction. All produced fluids will be disposed by deep well injection.

1214 286

T.D.H. REQUEST:

6. What is the amount of Radon-222 anticipated to be released from the various plant operations per day, per week, per month, year and for the anticipated lifetime of the plant?

URI RESPONSE:

Based on previous analyses of in situ uranium leach operations, (NUREG-0481 and NUREG-0489), anticipated Radon 222 emission from the Longoria operation is as follows:

	WELL FIELD (including surge tanks)	PLANT (including waste pond)
Daily	0.21 Ci	0.004 Ci
Weekly	1.46 Ci	0.027 Ci
Monthly (30 days)	6.26 Ci	0.115 Ci
Yearly	76 Ci	1.400 Ci
Life (3.75 years)	285 Ci	5.250 Ci

T.D.H. REQUEST:

7. How will the waste water be delivered to Arnco? (If by pipeline, whose land does it go over (under) and how will leakage/breaks be dealt with.)

URI RESP SE:

Waste water will be transported to Arnco in the yellowcake slurry trailer. If an accident should occur resulting in a spill, the URI Spill Contingency Plan would be put into effect.

T.D.H. REQUEST:

8. Baseline radiometric data for the ore zone and limits it will be restored to.

URI RESPONSE:

Baseline chemical and radiometric data are enclosed. For well location, refer to Fig. 7 of the URI Radioactive Material License Application.

The ore zone will be restored to baseline condition, i.e. a mean of 50 pCi/l with a 3 sigma deviation of 227 pCi/l.

T.D.H. REQUEST:

9. Baseline radiometric data for the surface of the site and limits it will be restored to.

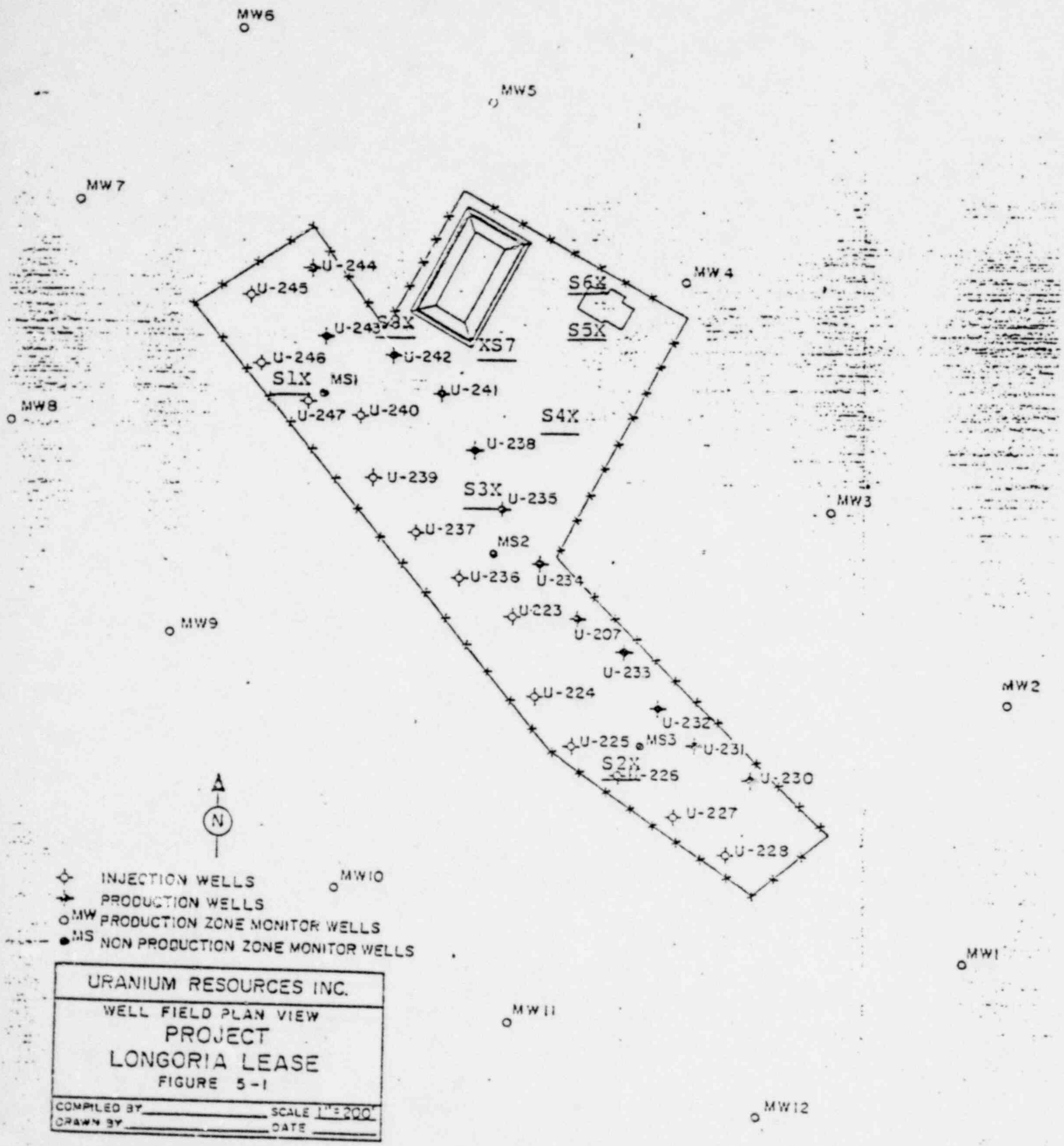
URI RESPONSE:

Soil samples were collected at eight locations in and around the plant area (See enclosed location map). Each location was sampled at the surface and at a depth of six inches. The analytical results are as follows:

SAMPLE LOCATION NUMBER	DEPTH	URANIUM mg/kg	Ra226 pCi/g(dry wgt.)	GROSS ALPHA pCi/g	GROSS BETA pCi/g
S1	Surface	0.55	1.2 ± 0.4	4 ± 6	13 ± 6
S1	6"	0.14	1.0 ± 0.3	2 ± 5	9 ± 6
S2	Surface	0.25	1.1 ± 0.5	5 ± 6	9 ± 6
S2	6"	0.17	<0.3	2 ± 5	9 ± 6
S3	Surface	0.15	1.1 ± 0.2	3 ± 5	8 ± 6
S3	6"	0.13	<0.3	1 ± 5	9 ± 6
S4	Surface	0.16	1.1 ± 0.2	4 ± 6	10 ± 6
S4	6"	0.08	<0.3	0 ± 4	12 ± 6
S5	Surface	0.14	1.7 ± 0.2	0 ± 4	10 ± 6
S5	6"	0.12	<0.3	2 ± 5	18 ± 6
S6	Surface	0.12	<0.3	4 ± 6	12 ± 6
S6	6"	0.12	0.9 ± 0.3	3 ± 5	13 ± 6
S7	Surface	0.10	2.0 ± 0.2	2 ± 5	13 ± 6
S7	6"	0.12	<0.3	1 ± 5	10 ± 6
S8	Surface	0.12	0.4 ± 0.2	2 ± 5	15 ± 6
S8	6"	0.14	<0.3	1 ± 5	8 ± 6

The plant site surface will be restored to levels consistent with those reported as baseline.

1214 290



X Sample Location
S6 Sample Number

Soil Sample Location Map

1214 291

T.D.H. REQUEST:

10. How many wells and at what depths, will be used to monitor for vertical excursions from the production zones?

URI RESPONSE:

Wells MS-1, MS-2 and MS-3 will serve as shallow monitors. These wells are completed from 578' to 598'; 576' to 596'; and 576' to 596' respectively. The production zone interval extends from 624' to 690' below ground level. For location of the shallow monitor wells refer to Fig. 7 of the URI Radioactive Material License Application.

T.D.H. REQUEST:

11. A sketch of the slurry tank trailer and its loaded volume.

URI RESPONSE:

The United States Department of Transportation specifications for a MC 312 bulk liquid container-trailer are enclosed with a design sketch of the URI slurry trailer. The loaded volume will be 2520 gallons separated equally into two compartments of 2100 gallon capacities apiece.

1214 293

§ 178.337-15 Pumps and compressors. See § [illegible].33 (g) (6) and (10) of this subchapter.

§ 178.337-16 Testing. (a) Inspection and tests. Inspection of materials of construction of the tank and its appurtenances and original test and inspection of the finished tank and its appurtenances must be as required by the ASME Code and as further required by this specification except that for tanks constructed in accordance with Part UHT of the ASME Code the original test pressure must be at least twice the tank design pressure.

(b) Weld testing and inspection.

(1) Each tank constructed in accordance with Part UHT of the ASME Code must be subjected, after postweld heat treatment and hydrostatic tests, to a wet fluorescent magnetic particle inspection to be made on all welds in or on the tank shell and heads both inside and out. The method of inspection must conform to Appendix VI of the ASME Code, paragraph UA-70 through UA-72 except that permanent magnets shall not be used.

(2) On tanks of over 3,500 gallons water capacity other than those described in subparagraph (1) of this paragraph unless fully radiographed, a test must be made of all welds in or on the shell and heads both inside and outside by either the wet fluorescent magnetic particle method conforming to Appendix VI of the ASME Code, liquid dye penetrant method, or ultrasonic testing in accordance with Appendix U of the ASME Code. Permanent magnets must not be used to perform the magnetic particle inspection.

(c) All defects found shall be repaired, the tanks shall then again be postweld heat treated, if such heat treatment was previously performed, and the repaired areas shall again be tested.

§ 178.337-17 Marking. (a) Metal identification plate. Each tank shall have a non-corrosive metal plate permanently affixed by brazing or welding around its perimeter, on the right side near the front, in a place readily accessible for inspection and maintained legible. On multitank vehicles plates shall be attached to each tank at the front in a place readily accessible for inspection. Each insulated tank shall have an additional plate, as described, affixed to the jacket in the location specified. Neither the plate itself nor the means of attachment to the tank or jacket may be subject to attack by the tank contents. If the plate is attached directly to the tank by welding it shall be welded thereto before the tank is postweld heat treated. The plate shall be plainly marked by stamping, embossing, or other means of forming letters into the metal of the plate, with the following information in addition to that required by the ASME Code, in characters at least ¼ inch high:

Vehicle Manufacturer
Vehicle Manufacturer's Serial Number
D. O. T. Specification Number MC-331
Vessel Material Specification Number
Water Capacity in Pounds (see Note 1)
Original Test Date

NOTE 1: See § 173.315 (a) regarding water capacity.

(b) Each tank motor vehicle must also be marked as required by § 177.823.

§ 178.337-18 Certification. (a) For each tank the tank vehicle manufacturer shall supply and the owner shall obtain the tank manufacturer's data report required by the ASME Code, and a certificate stating that the completed tank vehicle is in complete compliance in all respects with specification MC 331 including the ASME Code. The certificate must be signed by a responsible official of the fabricating firm. The certificate must state whether or not it includes certification that all valves, piping, and protective devices comply with the requirements of the specification. If it does not so certify, the installer of any such valve, piping, or device shall supply and the owner shall obtain a certificate asserting complete compliance with these specifications for such devices. The certificate, or certificates, will include sufficient sketches, drawings, and other information to indicate the location, make, model, and size of each valve and the arrangement of all piping associated with the tank.

(1) The certificate must contain a statement indicating whether or not the cargo tank was post-weld heat treated for anhydrous ammonia as specified in § 173.337-1(f).

(b) The owner shall retain the copy of the data report and certificates and related papers in his files throughout his ownership of the tank and for at least one year thereafter; and in the event of change in ownership, retention by the prior owner of nonfading photographically reproduced copies will be deemed to satisfy this requirement. Each motor carrier using the tank, if not the owner thereof, shall obtain a copy of the data report and certificate and retain them in his files during the time he uses the tank and for at least one year thereafter.

§ 178.340 General design and construction requirements applicable to specifications MC 306 (§ 178.341), MC 307 (§ 178.342), and MC 312 (§ 178.343) cargo tanks.

§ 178.340-1 Specification requirements for MC 306, MC 307 and MC 312 cargo tanks. (a) Specification MC 306, MC 307 and MC 312 cargo tanks constructed on or after December 1, 1967, for the bulk transportation of hazardous commodities must meet the requirements contained in this section in addition to the requirements of each applicable specification as contained in § 178.341 (MC 306), § 178.342 (MC 307) and § 178.343 (MC 312).

(b) All of these specification requirements are minimum requirements.

§ 178.340-2 General requirements. (a) Every cargo tank and vessel shall be designed and constructed in accordance with the best known and available practices in addition to the other applicable cargo tank specification requirements.

(b) Those requirements relating to parts and accessories applicable to all motor vehicles engaged in interstate commerce as contained in Part 393 of the Motor Carrier Safety Regulations are an integral part of this specification.

(c) Where applicable the additional requirements prescribed in Part 173 to accommodate specific commodities are considered an integral part of these specifications.

(d) Multi-purpose cargo tank.

(1) A single cargo tank may be divided into compartments of different specification construction. Each such compartment shall conform to specification requirements concerned.

(2) A single cargo tank may be physically altered to comply with another cargo tank specification in these regulations; or altered to accommodate a commodity not requiring a DOT specification tank.

§ 178.340-3 Material. (a) All sheet and plate material for shell, heads, bulkheads and baffles for cargo tanks which are not required to be constructed in accordance with the American Society of Mechanical Engineers' Boiler and Pressure Vessel Code shall meet the following minimum applicable requirements:

(1) ALUMINUM ALLOYS (AL). Only aluminum alloy material suitable for fusion welding and in compliance with one of the following ASTM specifications shall be used:

ASTM B-209 Alloy 5052	ASTM B-209 Alloy 5254
ASTM B-209 Alloy 5086	ASTM B-209 Alloy 5454
ASTM B-209 Alloy 5154	ASTM B-209 Alloy 5652

POOR ORIGINAL

1214 294

All heads, bulkheads, baffles, and ring s... ...ers may use 0 temper (annealed) or stronger tempers. All shells shall be made of materials with properties equivalent to H 32 or H 34 tempers, except that lower ultimate strength tempers may be used if the minimum shell thicknesses in Table II in §§ 178.341-2, 178.342-... or 178.343-2 are increased in inverse proportion to the lesser ultimate strength.

(2) STEEL.

	Mild steel (MS)	High strength low alloy steel (HSLA)	Austenitic stainless steel (SS)
Yield	25,000 psi	45,000 psi	25,000 psi
Ultimate strength	45,000 psi	60,000 psi	70,000 psi
Elongation, 2-inch samples	20%	25%	30%

§ 178.340-4 Structural integrity. (a) Maximum stress values. The maximum calculated stress value must not exceed 20 percent of the minimum ultimate strength of the material as authorized in § 178.340-3, except when ASME Code pressure vessel design requirements apply.

(b) Loadings. Cargo tanks shall be provided with additional structural elements as necessary to prevent resulting stresses in excess of those permitted in paragraph (a) of this subsection. Consideration shall be given to forces imposed by each of the following loads individually, and where applicable a vector summation of any combination thereof:

(1) Dynamic loading under all product load configurations.

(2) Internal pressure.

(3) Superimposed loads such as operating equipment, insulation, linings, hose tubes, cabinets and piping.

(4) Reactions of supporting lugs and saddles or other supports.

(5) Effect of temperature gradients resulting from product and ambient temperature extremes. Thermal coefficients of dissimilar materials where used should be accommodated.

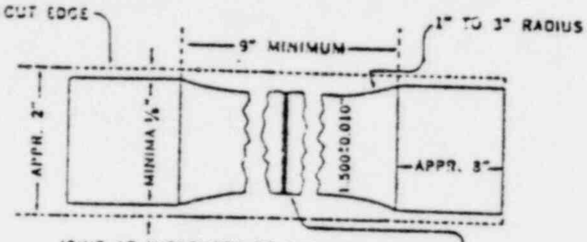
§ 178.340-5 Joints. (a) Method of joining. All joints between tank shells, heads, baffles (or baffle attaching rings), and bulkheads shall be welded in accordance with the requirements contained in this section.

(b) Strength of joints (Aluminum Alloy (AL)). All welded aluminum alloy joints shall be made in accordance with reco... good practice, and the efficiency of a joint shall be not less than ... percent of the properties of the adjacent material. Aluminum alloys shall be joined by an inert gas arc welding process using aluminum-magnesium type of filler metals which are consistent with the material suppliers recommendations.

(c) Strength of joints (Mild Steel (MS), High Strength Low Alloy (HSLA), Austenitic Stainless Steel (SS)). Joints shall be welded in accordance with recognized good practice and the efficiency of any joint shall be not less than 85 percent of the mechanical properties of the adjacent metal in the tank.

(1) Combinations of mild steel (MS), high strength low alloy (HSLA) and/or austenitic stainless steel (SS), may be used in the construction of a single tank, provided that each material, where used, shall comply with the minimum requirements specified in § 178.340-3 (a) for the material used in the construction of that section of the tank. Whenever stainless steel sheets are used in combination with sheets of other types of steel, joints made by welding shall be formed by the use of stainless steel electrodes or filler rods and the stainless steel electrodes or filler rods used in the welding shall be suitable for use with the grade of stainless steel concerned, according to the recommendations of the manufacturer of the stainless steel electrodes or filler rods.

(d) Compliance test. Compliance with the requirements contained in paragraph (b) or (c) of this subsection for the welded joints indicated in paragraph (a) of this subsection shall be determined by preparing from materials representative of those to be used in tanks subject to this specification and by the same technique of fabrication, 2 test specimens conforming to figure as shown below and testing them to failure in tension. One pair of test specim... may represent all the tanks to be made of the same combination of materials by the same technique of fabrication, and in the same shop, within six months after the tests on such samples have been completed. The butt welded specimens tested shall be considered qualifying other types or combinations of types of weld using the same filler material and welding process as long as parent metals are of the same types of material.



TENSILE SPECIMEN

§ 178.340-6 Supports and anchoring. (a) Cargo tanks with frames not made integral with the tank as by welding, shall be provided with restraining devices to eliminate any relative motion between the tank and frame which may result from the stopping, starting or turning of the vehicle. Such restraining devices shall be readily accessible for inspection and maintenance, except that insulation and jacketing are permitted to cover the restraining devices.

(b) Any cargo tank designed and constructed so that it constitutes in whole or in part the structural member used in lieu of a frame, shall be supported in such a manner that the resulting stress levels in the cargo tank do not exceed those specified in § 178.340-4 (a). The design calculations of the support elements shall include loadings imposed by stopping, starting and turning in addition to those imposed as indicated in § 178.340-4 (b) using 20% of the minimum ultimate strength of the support material.

§ 178.340-7 Circumferential reinforcement. (a) Tanks with shell thicknesses less than ⅜ of an inch shall in addition to the tank heads be circumferentially reinforced with either bulkheads, baffles, or ring stiffeners. It is permissible to use any combination of the aforementioned reinforcements in a single cargo tank.

(1) Location. Such reinforcement shall be located in such a manner that the maximum unreinforced portion of the shell be as specified in Table II of the applicable specification and in no case more than 60 inches. Additionally such circumferential reinforcement shall be located within one inch of points where discontinuity in longitudinal shell sheet alignment exceeds 10 degrees unless otherwise reinforced with structural members capable of maintaining shell sheet stress levels permitted in § 178.340-4 (a).

(b) Baffles. Baffles or baffle attaching rings if used as reinforcement members shall be circumferentially welded to the tank shell. The welding must not be less than 50% of the total circumference of the vessel and the maximum unwelded space on this joint shall not exceed 40 times the shell thickness.

(c) Double bulkheads. Tanks designed to transport different commodities which if combined during transit will cause a dangerous condition or evolution of heat or gas shall be provided with compartments separated by an air space. This air space shall be vented and be equipped with drainage facilities which shall be kept operative at all times.

(d) Ring stiffeners. Ring stiffeners when used to comply with this section shall be continuous around the circumference of the tank shell and shall have a section modulus about the neutral axis of the ring section parallel to the shell at least equal to that determined by the following formula:

$$\frac{I}{C}\text{ (Min)} = 0.00027\ WL\text{ (MS, HSLA \& SS) Steel}$$

$$\frac{I}{C}\text{ (Min)} = 0.00067\ WL\text{ (AL) Aluminum Alloy}$$

where:

$\frac{I}{C}$ = section modulus (inches)³;

W = tank width or diameter (inches);

L = ring spacing (inches); i.e., the maximum distance from the midpoint of the unsupported shell on one side of the ring stiffener to the midpoint of the unsupported shell on the opposite side of the ring stiffener.

(1) If a ring stiffener is welded to the tank shell (with ...ch circumferential weld not less than 50% of the total circumference of the vessel and the maximum unwelded space on this joint not exceeding 40 times the shell thickness) a portion of the shell may be considered as part of the ring section for purposes of computing

1214 295

POOR ORIGINAL

the ring section modulus. The maximum portion of the shell to be used in these calculations is as follows:

Circumferential ring stiffener to tank shell welds	Distance between parallel circumferential ring stiffener to shell welds	Shell section credit
1	....	20t
2	Less than 20t	20t + W
2	20t or more	40t

where:

t = shell thickness;
W = distance between parallel circumferential ring stiffener to shell welds.

(2) If configuration of internal or external ring stiffener encloses an air space, this air space shall be arranged for venting and be equipped with drainage facilities which shall be kept operative at all times.

§ 178.340-8 Accident damage protection. (a) Appurtenances: The term "appurtenance" means any cargo tank accessory attachment that has no liquid product retention or other liquid containment function, and provides no structural support to the tank.

(1) The design, construction, and installation of any appurtenance to the shell or head of the cargo tank must be such as to minimize the possibility of appurtenance damage or failure adversely affecting the product retention integrity of the tank.

(2) Structural members, such as the suspension subframe, overturn protection and external rings, when practicable, should be utilized as sites for attachment of appurtenances and any other accessories to a cargo tank.

(3) Except as prescribed in subparagraph (5) of this paragraph, the welding of any appurtenance to a shell or head must be made by attachment to a mounting pad. The thickness of a mounting pad must not be less than that of the shell or head to which it is attached. A pad must extend at least 2 inches in each direction from any point of attachment of an appurtenance. Pads must have rounded corners or otherwise be shaped in a manner to preclude stress concentrations on the shell or head. The mounting pad must be attached by a continuous weld around the pad.

(4) The appurtenance must be attached to the mounting pad so there will be no adverse affect upon the product-retention integrity of the tank if any force is applied to the appurtenance, in any direction, except normal to the tank, or within 45° of normal.

(5) Skirting structures, conduit clips, brakeline clips, and similar lightweight attachments, which are of a metal thickness, construction, or material, appreciably less strong but not more than 72 percent of the thickness of the tank shell or head to which such a device is attached, may be secured directly to the tank shell or head if each device is so designed and installed that damage to it will not affect the product retention integrity of the tank. These lightweight attachments must be secured to the tank shell by continuous weld or in such manner as to preclude formation of pockets, which may become sites for incipient corrosion.

(b) Rear bumpers. Every cargo tank shall be provided with a rear bumper to protect the tank and piping in the event of a rear end collision and minimize the possibility of any part of the colliding vehicle striking the tank. The bumper shall be located at least 6 inches to the rear of any vehicle component which is used for loading or unloading purposes or may at any time contain lading while in transit. Dimensionally, the bumper shall conform to 49 C.F.R. 393.86. Structurally, the bumper shall be designed to successfully absorb (no damage which will cause leakage of product) the impact of the vehicle with rated payload, with a deceleration of 2 "g" using a factor of safety of two based on the ultimate strength of the bumper material. For purposes of these regulations such impact shall be considered uniformly distributed and applied horizontally (parallel to the ground) from any direction at an angle not exceeding 30° to the longitudinal axis of the vehicle.

(c) Overturn protection. All closures for filling, manhole or inspection openings shall be protected from damage which will result in leakage of lading in the event of overturning of the vehicle by being enclosed within the body of the tank or dome attached to the tank or by guards.

(1) When guards are required, they shall be designed and installed to withstand a vertical load of twice the weight of the loaded tank and a horizontal load in any direction equivalent to one-half the weight of the loaded tank. These design loads may be considered independently. Ultimate strength of the material shall be used as a calculation base. If more than one guard is used each shall carry its proportionate share of the load. If protection other than guards are considered the same design load criteria is applicable.

(2) Except for pressure actuated vents no overturn protection is required for non-operating nozzles or fittings less than five inches in diameter (which do not contain product while in transit) that project a distance less than the inside diameter of the fitting. This projected distance may be measured either from the shell or the top of an adjacent ring stiffener provided such stiffener is within 30 inches of the center of the nozzle or fitting.

(3) If the overturn protection is so constructed as to permit accumulation of liquid on the top of the tank, it shall be provided with drainage facilities directed to a safe point of discharge.

(d) Piping.

(1) Product discharge piping shall be provided with protection in such a manner as to reasonably assure against the accidental escape of contents. Such protection may be provided by:

(i) A shear section located outboard of each emergency valve seat and within 4 inches of the vessel which will break under strain and leave the emergency valve seat and its attachment to the vessel and the valve head intact and capable of retaining product. The shear section shall be machined in such a manner as to abruptly reduce the wall thickness of the adjacent piping (or valve) material by at least 20%; or

(ii) By suitable guards capable of successfully absorbing a concentrated horizontal force of at least 8000 pounds applied from any horizontal direction, without damage to the discharge piping which will adversely affect the product retention integrity of the discharge valve.

(2) Minimum road clearance. The minimum allowable road clearance of any cargo tank component or protection device located between any two adjacent axles on a vehicle or vehicle combination shall be at least ½ inch for each foot separating such axles and in no case less than 12 inches.

(3) Strength of piping, fittings, hose and hose couplings. Hose, piping and fittings for tanks to be unloaded by pressure shall be designed for a bursting pressure of at least [illegible] psig and not less than four times the pressure to which, in any instance, it may be subjected in service by the action of any vehicle mounted pump or other device (not including safety relief valves), the action of which may be to subject certain portions of the tank piping and hose to pressures greater than the design pressure of the tank. Any coupling used on hose to make connections shall be designed for a working pressure not less than 20% in excess of the design pressure of the hose and shall be so designed that there will be no leakage when connected.

(4) Provision for expansion and vibration. Suitable provisions shall be made in every case to allow for and prevent damage due to expansion, contraction, jarring and vibration of all pipe. Slip joints shall not be used for this purpose.

(5) Heater coils. Heater coils, when installed, shall be so constructed that the breaking-off of their external connections will not cause leakage of contents of tank.

(6) Gauging, loading, and air-inlet devices. Gauging, loading and air-inlet devices, including their valves, shall be provided with adequate means for their secure closure, and means shall also be provided for the closing of pipe connections of valves.

§ 178.340-9 P[illegible] (a) Loading or unloading pumps mounted on tractor or tr[illegible] used, shall be provided with automatic means to prevent [illegible] pressure from exceeding the design pressure of the tank mounted [illegible]ment.

§ 178.340-10 Certification. (a) Certification as required in paragraphs (b) and (c) of this subsection shall indicate that such cargo tank has been designed, constructed and tested in accordance with the applicable specification MC 306, MC 307, or MC 312 (§ 178.341, 178.342 or 178.343).

(1) Multi-purpose tanks. If a cargo tank is divided into compartments and each compartment is constructed in accordance with the requirements of a different MC Specification, there shall be a metal plate required in paragraph (b) of this subsection, located on the right side, near the front of each compartment, in a place readily accessible for inspection. Details pertaining to the multipurpose configuration shall also be clearly indicated on the manufacturer's certificate required in paragraph (c) of this subsection.

(i) If a cargo tank is constructed in accordance with the requirements of one specification and may be physically altered to meet another cargo tank specification in this part; or physically altered to accommodate a commodity not requiring a specification tank, such alterations shall be clearly indicated on the manufacturer's certificate required in paragraph (c) of this subsection and the tank mounted multi-purpose plate required in paragraph (b) (2) of this subsection.

1214 296

(2) Specification shortages. If a cargo tank is manufactured which does not meet all of the applicable specification requirements, thereby requiring subsequent manufacturing involving the installation of additional components, parts, appurtenances or accessories, it is permissible for the original manufacturer to affix the metal certification plate required in paragraph (b) of this subsection. The specification requirements not complied with shall be indicated on the manufacturer's certificate required in paragraph (c) of this subsection. When the cargo tank is finally brought into complete compliance, the date such compliance is accomplished shall be stamped on the metal certification plate. The certificate shall indicate the pertinent details, date and concern (manufacturer or carrier) accomplishing complete compliance.

(b) Metal certification plate. There shall be on every cargo tank (or tank compartment if constructed to different specification) a metal plate not subject to corrosion located on the right side, near the front, in a place readily accessible for inspection. Such plate shall be permanently affixed to the tank by means of soldering, brazing, welding, or other equally suitable means; and upon it shall be marked in characters at least 3/16 inch high by stamping, embossing, or other means of forming letters into or on the metal of the plate itself, at least the information indicated below. The plate shall not be so painted as to obscure the markings thereon.

(1) If a cargo tank is to be physically altered to meet another specification (or to accommodate a commodity not requiring a specification tank) such combinations shall be indicated beside Specification Identification. Additionally the metal multi-purpose plates required in subparagraph (2) of this paragraph are required.

Vehicle manufacturer........................
Manufacturer's serial number........................
Specification Identification[1]........................
DOT MC 306; or MC 307; or MC 312........................
Date of manufacture........................
Original test date........................
Certification date........................
Design pressure........................PSIG
Test pressure........................PSIG
Head material........................
Shell material........................
Weld material........................
Lining material........................
Nominal tank capacity by compartment (front to rear)....US Gal.
Maximum product load........................lbs.
Loading limits........................GPM and/or PSIG
Unloading limits........................GPM and/or PSIG

[1] The following material designations (or combinations thereof) must be added: Aluminum Alloy (AL); Mild Steel (MS); High Strength Low Alloy (HSLA); Austenitic Stainless Steel (SS). For example "DOT MC 306-AL" for cargo tanks made of aluminum. A multi-purpose cargo tank example would be "Combination MC 306 SS-307 SS."

(2) Metal multi-purpose plate. If a cargo tank is to be physically altered, metal multi-purpose plates shall be mounted adjacent to the metal certification plate readily accessible for inspection. The mounting of the plates shall be such that only the plate identifying the applicable specification is legible at all times the cargo tank is in complete compliance with such specifications. The mounting of the plates (or plate assembly) shall be secured in such a manner as to be capable of retaining the plate when subjected to normal operating conditions. The same marking size and method used on the certification plate shall be used. The plate shall contain at least the information contained below:

SPECIFICATION IDENTIFICATION MC ____
EQUIPMENT NECESSARY

	Quantity[1]
Vents	
Pressure actuated	
Fusible	
Frangible	
Product discharge	
Top	
Bottom	
Pressure unloading fitting	
Covers	
Manhole	
Fill opening	

[1] The number required to meet applicable specification. If no physical change is required the letters NC shall follow the number required. If cargo tank is not so equipped the word "NONE" shall be inserted.

(i) Color coding: Those parts which must be changed or added to meet the applicable specification requirements and the appropriate multi-purpose plate shall be identified using the following colors:

MC 306	RED
MC 307	GREEN
MC 312	YELLOW
Non Spec.	BLUE

Additionally those parts to be changed or added shall be stamped with the appropriate MC Spec. Number____.

(c) Manufacturer's certificate. A certificate signed by a responsible official of the manufacturer of the cargo tank, or from a competent testing agency, certifying that each such cargo tank is designed, constructed and tested in accordance and complies with the requirements contained in the applicable specification shall be procured, and such certificate shall be retained in the files of the carrier during the time that such cargo tank is employed by him plus one year. In lieu of this certificate, if the motor carrier himself elects to ascertain that any such tank fulfills the requirements of the specification by his own test, he shall similarly retain the test data.

§ 178.341 Specification MC 306; cargo tanks.

§ 178.341-1 General requirements. (a) Specification MC 306 cargo tanks must comply with the general design and construction requirements in § 178.340 in addition to the specific requirements contained in this section.

(b) Design pressure. The design pressure of each cargo tank shall not be less than that pressure exerted by the static head of the fully loaded tank in the upright position.

§ 178.341-2 Thickness of shells, heads, bulkheads and baffles. (a) Material thickness. The minimum thicknesses of tank material authorized in § 178.340-3 shall be predicated on not exceeding the maximum allowable stress level (§ 178.340-4 (a)) but in no case less than those indicated in Tables I and II below:

TABLE I—MINIMUM THICKNESS OF HEADS, BULKHEADS AND BAFFLES
(Mild Steel (MS), High Strength Low Alloy Steel (HSLA), Austenitic Stainless Steel (SS) in United States Standard Gauge—Aluminum Alloy (AL)—expressed in decimals of an inch)

	Volume Capacity in Gallons Per Inch											
	10 or Less			Over 10 to 14			14 to 18			18 and Over		
	MS	HSLA SS	AL	MS	HSLA SS	AL	MS	HSLA SS	AL	MS	HSLA SS	AL
Thickness...	14	15	.096	13	14	.109	12	13	.130	11	12	.151

1214 297

POOR ORIGINAL

Gaskets, if used, shall be of suitable material not subject to attack by lading.

(1) Closures shall have structural capability of withstanding internal fluid pressures of 40 psig or one and one-half times the design pressure of the tank whichever is greater without permanent deformation. Safety devices to prevent the manhole and/or fill cover from opening fully when internal pressure is present shall be provided.

§ 178.342-4 Vents. (a) Each cargo tank compartment shall be provided with safety relief devices in accordance with the requirements contained in this paragraph. All of such devices shall communicate with the vapor space. Shut-off valves shall not be installed between the tank opening and any safety device. Safety relief devices shall be so mounted, shielded or drained as to eliminate the accumulation of water, the freezing of which could impair the operation or discharge capability of the device.

(b) Total capacity. Every cargo tank compartment shall be provided with one or more devices with sufficient capacity to limit the tank internal pressure to a maximum of 130% of the tank design pressure. This total venting capacity shall be not less than that determined from Table III, using the external surface of the cargo tank or tank compartment as the exposed area.

(c) Pressure-actuated venting (spring loaded). Every cargo tank compartment shall be equipped with pressure-actuated vent or vents set to open at not less than the tank design pressure. The minimum venting capacity for pressure actuated vents shall be 12,000 cubic feet of free air per hour (14.7 psia and 60° F.) per compartment or 12,000 cubic feet of free air per hour (14.7 psia and 60° F.) for each 350 square feet of exposed tank area, whichever is greater. This minimum capacity shall be measured at a pressure of 130% of the tank design pressure. Pressure actuated devices shall be designed to function in case of pressure rise when in any condition of roll over attitude. If pressure (maximum limits to be included on the metal certification plate § 178.340-10 (b)) unloading devices are provided, the relief valve shall have sufficient capacity to limit the tank internal pressure to 130% of design pressure.

(d) Fusible and frangible venting. If the pressure-actuated venting required by paragraph (c) of this subsection does not provide the total venting capacity required by paragraph (b) of this subsection, additional capacity shall be provided by adding fusible and/or frangible venting devices. Each fusible device shall have a minimum area of 1.25 square inches and shall be actuated by elements which operate at a temperature not exceeding 250° F. when the tank pressure is between the tank design pressure and 130% of the tank design pressure. Such fusible elements shall be so located as to not be in contact with the lading under normal operating conditions. The bursting pressure of frangible devices shall be not less than 130% nor more than 150% of the tank design pressure.

TABLE III

MINIMUM EMERGENCY VENT CAPACITY IN CUBIC FEET FREE AIR/HOUR (14.7 PSIA AND 60° F.)

Exposed area square feet	Cubic feet free air per hour	Exposed area square feet	Cubic feet free air per hour
20	15,500	275	214,300
30	23,700	300	225,100
40	31,600	350	245,700
50	39,500	400	265,000
60	47,400	450	283,200
70	55,300	500	300,500
80	63,300	550	317,300
90	71,200	600	333,300
100	79,100	650	345,500
120	94,900	700	363,700
140	110,700	750	378,200
160	126,500	800	392,200
180	142,300	850	405,900
200	155,100	900	419,300
225	191,300	950	432,300
250	203,100	1,000	445,000

NOTE 1: Interpolate for intermediate sizes.

(e) Flow testing and marking of vents. Each type and size of venting devices shall be flow tested in the ranges specified in the applicable preceding paragraphs. The actual rated flow capacity of the vent in cubic feet of free air per hour at the pressure in psig at which the flow capacity is determined shall be stamped on the device.

(1) These flow tests may be conducted by the manufacturer or may be delegated to a certified agency.

§ 178.342-5 Outlets. (a) Each product discharge opening shall be equipped with a self-closing shut off valve, designed, installed, and protected in accordance with § 178.340-8 (d) and operated so as to assure against the accidental escape of contents. These valves shall be located inside the tank or within the welded flange, its companion flange, nozzle, or coupling. Such product discharge valves (outflow) shall, in addition to normal means, be closed by (1) an automatic heat actuated means which will become effective at a temperature not over 250° F., (2) a secondary closing means, remote from tank filling or discharge openings, for operation in event of fire or other accident.

(b) Vapor return lines, if used, may be equipped with an excess flow valve at the tank connection if a positive shut-off valve is provided between the excess-flow valve and the hose connection.

§ 178.342-6 Gauging devices. (a) Gauge device design. Every tank compartment except tanks filled by weight, shall be equipped with one or more gauging device which shall indicate accurately the maximum permitted liquid level in each compartment. Additional gauging devices may be installed but may not be used as primary controls for filling of cargo tanks at pressures above atmospheric. Acceptable gauging devices for use at pressures above atmospheric are the rotary tube, the adjustable slip tube and the fixed length dip tube. Gauge glasses are not permitted to be installed on any cargo tank.

(b) Fixed level indicators. All liquid level gauging devices, except those on tanks provided with fixed maximum level indicators, shall be legibly and permanently marked in increments of not more than 20° F. to indicate the maximum levels to which the tank may be filled with liquid at temperatures above 20° F. In the event that it is impractical to put these markings on the gauging device, this information shall be marked on a suitable plate affixed to the tank in a location adjacent to the gauging device.

(c) Dip tubes. A fixed length dip tube gauging device, when used, shall consist of a dip pipe of small diameter equipped with a valve at the outer end, and extending into the tank to a specified fixed length. On horizontally-mounted cylindrical tanks, the fixed length to which the tube extends into the tank shall be such that the device will function to indicate when the liquid reaches the maximum level permitted by these regulations.

§ 178.342-7 Method of test. (a) Test pressure. The standard test pressure for each required test shall be 40 psig or a minimum of 1.5 times design pressure whichever is greater.

(b) Method of test. Every cargo tank shall be tested by complete filling (including domes if any) with water or other liquid having a similar viscosity and applying a pressure of not less than the standard test pressure specified in paragraph (a) of this subsection. The pressure shall be gauged at the top of the tank. The tank shall hold the prescribed pressure for at least 10 minutes. All tank accessories shall be leakage tested after installation and proved tight at not less than the design pressure of the tank, except that hose used on such tanks may be tested either before or after installation. Failure to successfully meet the test criteria shall be deemed evidence of failure to meet the requirements of this specification. Tanks failing to pass this test shall be suitably repaired. The suitability of the repair shall be determined by the same method of test.

(i) When divided into compartments. When the interior of the tank is divided into compartments, each compartment shall be tested as a separate tank with adjacent compartments empty and at atmospheric pressure.

§ 178.343 Specification MC 312; cargo tanks.

§ 178.343-1 General requirements. (a) Specification MC 312 cargo tanks must comply with the general design and construction requirements in § 178.340 in addition to the specific requirements contained in this section.

1214 298

(b) Tank design. Cargo tanks built unde[r th]is specification that are unloaded by pressure in excess of 15 p.s.i.g. must be designed and constructed in accordance with and fulfill all requirements of the ASME Code. No tank shall have head, bulkhead, and baffle or shell thicknesses less than that specified in § 178.343-2, Tables I and II, nor shall the spacing of bulkheads, baffles or shell stiffeners exceed that specified in § 178.340-7.

(c) Design pressure sha[ll be] not less than pressure used for unloading.

§ 178.343-2 Thickness of shell, heads, bulkheads and baffles of of non-ASME Code tanks. (a) Material thickness. The minimum thicknesses of tank material authorized in § 178.340-3 shall be predicated on not exceeding the maximum allowable stress level in § 178.340-4 (a) but in no case less than those indicated in Tables I and II listed below, or the accompanying aluminum alloy formula:

TABLE I—MINIMUM THICKNESS OF HEADS, BULKHEADS, AND BAFFLES

(Mild Steel (MS) High Strength Low Alloy Steel (HSLA), Austenitic Stainless Steel (SS), in United States Standard Gauge—unless otherwise expressed in fractions of an inch

	Volume Capacity in Gallons Per Inch											
	10 or Less			Over 10 to 14			14 to 18			18 and Over		
	Product Weight in Pounds Per Gallon @ 60° F.											
	10 lbs. and Less	Over 10 to 13 lbs.	13 lbs. to 16	10 lbs. and Less	Over 10 to 13 lbs.	13 lbs. to 16	10 lbs. and Less	Over 10 to 13 lbs.	13 lbs. to 16	10 lbs. and Less	Over 10 to 13 lbs.	13 lbs. to 16
Thickness	12	10	8	10	8	7/64	9	7/64	3/16	8	3/16	3/16

TABLE II—MINIMUM THICKNESS OF SHELL SHEETS

(Mild Steel (MS), High Strength Low Alloy Steel (HSLA), Austenitic Stainless Steel (SS) in United States Standard Gauge—unless otherwise expressed in fractions of an inch)

Maximum Shell Radius	Distance Between Bulkheads, Baffles or Ring Stiffeners	Volume Capacity in Gallons Per Inch											
		10 or Less			Over 10 to 14			14 to 18			18 and Over		
		Product Weight in Pounds Per Gallon @ 60° F.											
		10 lbs. and Less	Over 10 to 13 lbs.	13 lbs. to 16	10 lbs. and Less	Over 10 to 13 lbs.	13 lbs. to 16	10 lbs. and Less	Over 10 to 13 lbs.	13 lbs. to 16	10 lbs. and Less	Over 10 to 13 lbs.	13 lbs. to 16
Less than 70"	36" or Less	12	10	8	12	10	8	12	10	8	10	8	7/64
	Over 36"-54"	12	10	8	12	10	8	10	8	7/64	9	7/64	7/64
	54" Thru 60"	12	10	8	10	8	7/64	9	7/64	3/16	8	3/16	3/16
70" or More Less than 90"	36" or Less	12	10	8	12	10	8	10	8	7/64	9	7/64	7/64
	36"-54"	12	10	8	10	8	7/64	9	7/64	3/16	8	7/64	3/16
	54" Thru 60"	10	8	7/64	9	7/64	3/16	8	3/16	3/16	7/64	3/16	7/64
90" or More Less than 125"	36" or Less	12	10	8	10	8	7/64	9	7/64	3/16	3/16	8	3/16
	36"-54"	10	8	7/64	9	7/64	3/16	8	3/16	3/16	[illegible]	3/16	7/64
	54" Thru 60"	9	7/64	3/16	8	3/16	3/16	7/64	3/16	7/64	7/64	3/16	7/64
125" or more	36" or Less	10	8	7/64	9	7/64	3/16	8	3/16	3/16	7/64	3/16	7/64
	36"-54"	9	7/64	3/16	8	3/16	3/16	7/64	3/16	7/64	7/64	3/16	7/64
	54" Thru 60"	8	3/16	3/16	7/64	3/16	7/64	7/64	3/16	7/64	3/16	7/64	3/16

(1) Aluminum alloy formula:

$$\text{Thickness of Aluminum Alloy Materials} = \text{Steel Thickness from Tables I \& II} \times \left(\frac{3 \times 10^7}{E}\right)^{\frac{1}{3}}$$

Where E = Modulus of Elasticity of the material to be used.

(b) Lining. Except as provided in paragraph (c) of this subsection, cargo tanks shall be lined and the material used for lining each cargo tank subject to this specification shall be homogenous, nonporous, imperforate when applied, not less elastic than the metal of the tank proper, and substantially immune to attack by the commodities to be transported therein. It shall be directly bonded or attached by other equally satisfactory means. Joints and seams in the lining shall be made by fusing the material together, or by other equally satisfactory means.

(c) Conditions under which tanks need not be lined. Tanks need not be lined as provided in paragraph (b) of this subsection, if:

(1) The material of the tank is substantially immune to attack by the materials to be transported therein; or,

(2) The material of the tank is thick enough to withstand 10 years normal service without being reduced at any point to less thickness than that specified in paragraph (a) of this subsection corresponding to its type; or,

(3) The chemical reaction between the material of the tank and the commodity to be transported therein is such as to allow the tank to be properly passivated or neutralized and if the tank is not frequently cleaned and not used in the transportation of other commodities.

§ 178.343-3 Closure for manholes. (a) Each compartment shall be accessible through a 15 inch minimum inside diameter manhole. The manhole cover shall be designed to provide a secure closure of the manhole. All joints between manhole covers and their seats shall be made tight against leakage of vapor and liquid. Gaskets, if used, shall be of suitable material not subject to attack by the lading.

(1) The manhole cover shall have structural capability of withstanding internal fluid pressures equal to one and one-half times the design pressure of the tank and in no case less than 15 psig without permanent deformation. Safety devices to prevent the manhole and/or all cover from opening fully when internal pressure is present shall be provided.

§ 178.343-4 Vents. (a) Safety vent. Every cargo tank compartment shall be equipped with suitable pressure relief devices as required by the ASME Code, or shall be fitted with suitable rupture discs in lieu of mechanical pressure relief valves. Such discs shall be designed to rupture at not to exceed one and one-half times the design pressure of the tank. If air inlet devices are provided a relief valve shall have adequate capacity to limit tank pressure to 130% of design pressure at maximum inlet flow rate.

1214 299

Such maximum limits to be inclu... on the metal certification plate § 178.340-10 (b) Air inlet lines if permanently connected to an air source shall be equipped with a check valve. Shut-off valves between the tank and relief valve or rupture disc are prohibited.

§ 178.343-5 Outlets. (a) Each outlet at or near the top of a tank, used for discharge of lading, must be equipped with a shutoff valve located as close as practical to the point of outlet from the tank. Each such outlet having its discharge end below the top liquid level in the tank must be equipped with an additional shutoff valve, blank flange, or sealing cap at the discharge end of the outlet.

(b) Except as provided in paragraphs (c) and (d), of this section; each bottom outlet must be equipped with a shutoff valve designed, installed, and protected as follows:

(1) Product piping must be protected in such a manner as to reasonably assure against the accidental escape of contents. Such protection must be provided by:

(i) A shear section located out-board of each valve seat and within 4 inches of the vessel which will break under strain and leave the valve seat and its attachment to the vessel and the valve head intact and capable of retaining product. The shear action shall be machined in such a manner as to abruptly reduce the wall thickness of the adjacent piping (or valve) material by at least 20 percent; or

(ii) By suitable guards capable of absorbing a concentrated horizontal force of at least 6,000 pounds applied from any horizontal direction, without damage to the discharge piping which will adversely affect the product retention integrity of the discharge valve.

(2) Each bottom outlet valve must be located inside the tank or immediately adjacent at the outlet point outside the tank.

(i) The valve seat must be located inside the tank or within the welded flange, its companion flange, nozzle, or coupling at the point of outlet from the tank.

(ii) Each bottom discharge valve must be equipped with a remote means to activate a valve closure manually from a point no less than 10 feet away.

(3) In addition, a blank flange, sealing cap, or shutoff valve is required at the discharge end of the outlet.

(c) A bottom ope...g for purposes other than lading discharge may be closed by a bolted blank flange at the tank shell. If any piping extends from such an opening, it must be fitted with a shutoff valve designed, installed, and protected as described in paragraph (b) (1) of this section. In addition a supplemental closure is required at the discharge end of this piping.

(d) Bottom outlet valves need not meet subparagraph (b) (2) (ii) of this section when the cargo tank is transporting a corrosive liquid containing solids in suspension in sufficient quantity that settling may form a layer of solid material that may interfere with sealing of the valve seat.

§ 178.343-6 Gauging devices. (a) No applicable requirement.

§ 178.343-7 Method of test. (a) Test for leaks. Every cargo tank shall be tested by completely filling the tank and dome with water or other liquid having a similar viscosity, the temperature of which shall not exceed 100° F. during the test, and applying a pressure of one and one-half times the design pressure but not less than 3 psig. The pressure shall be gauged at the top of the tank. The tank shall hold the prescribed pressure for at least ten minutes without failure, undue distortion, leakage or evidence of impending failure. All closures shall be in place while test is made. During these tests, operative relief devices shall be clamped, plugged or otherwise rendered inoperative; such clamps, plugs and similar devices shall be removed immediately after the test is finished.

(b) Test for distortion or failure. Every cargo tank shall be tested by the pressures prescribed in paragraph (a) of this subsection and shall withstand such pressures without undue distortion or other indication of impending failure. If there is undue distortion, or if failure impends or occurs, the cargo tank shall not be placed in or returned to service unless an adequate repair is made. The adequacy of the repair shall be determined by the same method of test.

(c) Test of heating system. After an interior heating system consisting of coil piping is installed, and before the tanks to which they are fitted are placed in service, the heating system shall be tested. Systems employing media such as steam or hot water under pressure for heating the contents of cargo tanks shall be tested with hydrostatic pressure and proved to be tight at 200 psig

SUBPART K

SPECIFICATIONS FOR GENERAL PACKAGINGS

§ 178.350 Specification 7A; general packaging Type A.

§ 178.350-1 General requirements. (a) Each packaging must meet all applicable requirements of § 173.24.

§ 178.350-2 Specific requirements. (a) Each packaging must be so designed and constructed that it meets the standards for Type A packaging (see §§ 173.389 (j) and 173.398 (b).

§ 178.350-3 Marking. (a) Marking on the outside of each packaging as follows: "USA DOT-7A Type A" and "Radioactive Material."

(b) The letter and number size and additional marking requirements of § 173.24 of this subchapter must be complied with.

APPENDICES TO PART 178

APPENDIX A—SPECIFICATIONS FOR STEEL

TABLE 1

Open-hearth, basic oxygen, or electric steel of uniform quality. The following chemical composition limits are based on ladle analysis:

Designation	Chemical composition, percent-ladle analysis		
	Grade 1[1]	Grade 2[1,2]	Grade 3[1,4,5]
Carbon	0.10/0.20	0.24 maximum	0.22 maximum
Manganese	1.10/1.60	0.50/1.00	1.25 maximum
Phosphorus, maximum	0.04	0.04	0.045[6]
Sulfur, maximum	0.05	0.05	0.05
Silicon	0.15/0.30	0.30 maximum	
Copper, maximum	0.40		
Columbium		0.01/0.04	
Heat treatment authorized	(3)	(3)	(3)
Maximum stress (p.s.i.)	35,000	35,000	35,000

[1] Addition of other elements to obtain alloying effect is not authorized.

[2] Ferritic grain size 6 or finer according to ASTM E112-63.

[3] Any suitable heat treatment in excess of 1,100° F., except that liquid quenching is not permitted.

[4] Other alloying elements may be added and shall be reported.

[5] For compositions with a maximum carbon content of 0.15 percent on ladle analysis, the maximum limit for manganese on ladle analysis may be 1.40 percent.

[6] Rephosphorized Grade 3 steels containing no more than 0.15 percent phosphorus are permitted if carbon content does not exceed 0.15 percent and manganese does not exceed 1 percent.

CHECK ANALYSIS TOLERANCES

A heat of steel made under any of the above grades, the ladle analysis of which is slightly out of the specified range, is acceptable if the check analysis is with the following variations:

Element	Limit or maximum specified (percent)	Tolerance (percent) over the maximum limit or under the minimum limit	
		Under minimum limit	Over maximum limit
Carbon	To 0.15 inclusive	0.02	0.03
	Over 0.15 to 0.40 inclusive	0.03	0.04
Manganese	To 0.60 inclusive	0.03	0.03
	Over 0.60 to 1.15 inclusive	0.04	0.04
	Over 1.15 to 2.50 inclusive	0.05	0.05
Phosphorus[1]	All ranges		0.01
Sulfur	All ranges		0.01
Silicon	To 0.30 inclusive	0.02	0.03
	Over 0.30 to 1.00 inclusive	0.05	0.06
Copper	To 1.00 inclusive	0.03	0.03
	Over 1.00 to 2.00 inclusive	0.05	0.05
Nickel	To 1.00 inclusive	0.03	0.03
	Over 1.00 to 2.00 inclusive	0.05	0.05
Chromium	To 0.90 inclusive	0.03	0.03
	Over 0.90 to 2.10 inclusive	0.05	0.05
Molybdenum	To 0.20 inclusive	0.01	0.01
	Over 0.20 to 0.40 inclusive	0.02	0.02
Zirconium	All ranges	0.01	0.06
Columbium	To 0.04 inclusive	0.005	0.01
Aluminum	Over 0.10 to 0.20 inclusive	0.04	0.04
	Over 0.20 to 0.30 inclusive	0.05	0.05

[1] Rephosphorized steels not subject to check analysis for phosphorus.

APPENDIX B—SPECIFICATIONS FOR PLASTICS

TABLE I

Polyethylene must have the following properties, as determined by the American Society For Testing Materials (ASTM) methods designated. Tests must be performed on resin with additives included:

Property	Type I	Type II	Type III	ASTM method
Density, g/cc	0.910-<0.926	0.926-<0.941	0.941-0.965	D 1505-68
Melt index (flow rate)	2.0 max.	1.0 max.	1.0 max.	D 1238-65T
Tensile strength	1,100 p.s.i min.	1,300 p.s.i.	3,000 p.s.i.	D 638-68
Elongation	400% min.	400%	75%	D 638-68

Except for the regulations covering "Ammonium nitrate (no organic coating)" and "Ammonium nitrate fertilizer" as they relate to shipping papers and markings on packagings. These materials which were formerly described in accordance with section 172.5 as "Ammonium nitrate with no organic coat. fertilizer, containing 90 percent or more shipping papers and so marked on packing" may continue to be so described on packagings until June 30, 1975.

Other materials may be added to polyethylene resin provided they do not adversely affect the physical properties specified above.

1214 300

T.D.H. REQUEST:

12. What laboratory will handle your bioassay program and what limits will they be looking for in micrograms of uranium per liter of urine. (See enclosed guide.) Who will analyze your water samples for Radium 226, gross alpha, and gross beta?

URI RESPONSE:

Jordan Laboratories, Inc. of Corpus Christi, Texas conducts the bioassay program for URI. Their detection limit is 1 microgram uranium per liter of sample. All urine analyses will be corrected to standard gravity. Jordan Laboratories Inc. will also perform Radium 226, gross alpha and gross beta analytical work for URI.

T.D.H. REQUEST:

13. On page 23 it is stated that the waste holding pond would be drained to repair leaks. How will it be drained if there is only one pond?

URI RESPONSE:

If for any reason the pond cannot be used, the contained fluid will be evacuated and placed into the slurry trailer. Subsequently it will be transported to Arnco for deep well injection. Thereafter all process fluids will be transported directly to Arnco until the pond liner can be repaired. The pond will be placed back in service after all repairs have been made.

T.D.H. REQUEST:

14. What will be done with the solid waste in the holding pond when the operation is finished? How will the pond be restored?

URI RESPONSE:

Solid waste remaining in the pond at the cessation of mining will be placed in plastic lined 55 gallon drums. Subsequently, it will be transported by licensed carrier (e.g. Todd Shipyards) to a licensed L.S.A. disposal site (e.g. Chem-Nuclear Barnwell, South Carolina).

The anticipated procedure for restoration will be as follows:

Stage 1. Pre-Removal Activities

All fluids will be evacuated from the pond before radioactive solid waste removal activity commences. The sides of the pond will then be scrubbed with mild acid solution (10% HCl) to insure that anything above the solid waste is relatively free of activity. Subsequently, a diked concrete loading pad will be constructed next to the pond. It is here that the solid waste will be placed in drums.

A diked concrete ramp will be constructed from the ponds interior to the loading ramp. The ramp will be the conveyance over which the solid waste will be carried. Thereafter a backhoe will be contracted to handle the waste (note if non URI employee operator is required, he will be monitored by T.L.D. just as a plant employee).

Stage 2. <u>Removal of Radioactive Solid Waste</u>

Each morning the Field Environmental and Safety Coordinator will conduct a meter survey to determine ambient radiation conditions. The length of working activity within the pond site will be determined as follows:

SURVEY READING Micro R/hr at 3' working distance	ALLOWABLE WORKING TIME hours/day
2300	8
4700	4
9400	2
18900	1

This survey will be updated through the workday at two hour intervals.

Workers in the pond site will be kept to a minimum. Each worker will wear water proof protective outer suits, rubber boots, goggles, and high efficiency cartridge respirators. When a worker leaves the pond site for any reason, he will remove the protective gear at the change shack located immediately next to the pond site. Prior to leaving at the end of each workday, workers will shower and change clothes. Any inner garments worn by a worker will not leave the plant site.

The backhoe will gather up solid waste in the pond, transport it to the loading pad, and load it into the drums. Any material falling outside the drum will be picked up by shovel and placed into the drum.

Each drum will be sampled, sealed, thoroughly washed, and transported to a holding pad. Samples from each ten drum lot will be blended and analyzed for radioactive concentration.

Once the backhoe is no longer effective in solid waste removal it will be decontaminated by mild acid scrubbing.

Stage 3. <u>Pond Closure</u>

Once all solid wastes have been removed, the pond liner will be decontaminated and subsequently disposed as an industrial waste. If decontamination is not possible the liner will be cut into sections, drummed as an L.S.A. waste, and disposed in the same fashion as the solid waste.

After the liner is removed, the sand under-lying the pond will be checked for contamination. If the sand is contaminated it will be disposed in a manner similar to the radioactive solid waste. If it is not contaminated it will be left in place.

Thereafter, the pond will be filled with two feet of compacted impermeable clay. The earth material originally excavated will then be placed on the clay. The pond site will then be graded to a crown and a native grass will be established on the surface.

T.D.H. REQUEST:

15. Concerning Appendix 3, will the clean up team be provided by your firm? Who will direct its operation?

URI RESPONSE:

URI will provide the clean up team. The Environmental Manager will direct its operation. If the Environmental Manager is not available, the Production Manager will serve in this capacity. If neither are available, the Plant Superintendent will assume supervision of the clean up team.

T.D.H. REQUEST:

16. A brief description of how the surface of the site will be decontaminated to limits acceptable for unrestricted use.

URI RESPONCE:

At the cessation of all mining restoration activity, URI will conduct a meter survey of the Longoria property, in conjunction with the Texas Department of Health. If URI and the Texas Department of Health concur that there are not contaminated areas remaining, the area will revert to unrestricted use.

If an area is found to be contaminated, all surface material will be treated as an L.S.A. solid waste and disposed in the manner described in URI's response to the Texas Department of Health's Request number 14. Thereafter, URI and the Texas Department of Health will again survey the area to determine the effectiveness of the decontamination.

TEL ~~512~~-884-0371 PO BOX 2552 78403

JORDAN LABORATORIES INC.
CHEMISTS & ENGINEERS
CORPUS CHRISTI, TEXAS
FEBRUARY 15, 1979

URANIUM RESOURCES, INC.
1600 PROMENADE CENTER
RICHARDSON, TEXAS 75080

REPORT OF ANALYSIS

IDENTIFICATION	DATE	URANIUM MG/KG	GROSS ALPHA PCI/G	ALPHA COUNTING ERROR PCI/G	GROSS BETA PCI/G	BETA COUNTING ERROR PCI/G
LONGORIA AREA						
SAMPLE #1 SURFACE	2-11-79	0.55	4	6	13	6
SAMPLE #1 6'	2-11-79	0.14	2	5	9	6
SAMPLE #2 SURFACE	2-11-79	0.25	5	6	9	6
SAMPLE #2 6'	2-11-79	0.17	2	5	9	6
SAMPLE #3 SURFACE	2-11-79	0.15	3	5	8	6
SAMPLE #3 6'	2-11-79	0.13	1	5	9	6
SAMPLE #4 SURFACE	2-11-79	0.16	4	6	10	6
SAMPLE #4 6'	2-11-79	0.08	0	4	12	6
SAMPLE #5 SURFACE	2-11-79	0.14	0	4	10	6
SAMPLE #5 6'	2-11-79	0.12	2	5	18	6
SAMPLE #6 SURFACE	2-11-79	0.12	4	6	13	6
SAMPLE #6 6'	2-11-79	0.12	3	[illegible]	13	6
SAMPLE #7 SURFACE	2-11-79	0.10	2	5	13	6
SAMPLE #7 6'	2-11-79	0.12	1	5	10	6
SAMPLE #8 SURFACE	2-11-79	0.12	2	5	15	6
SAMPLE #8 6'	2-11-79	0.14	[illegible]	5	8	6

LAB. NOS. M17-0932 THROUGH M17-0947

RESPECTFULLY SUBMITTED,

Carl Crownover

CARL F. CROWNOVER

CUSTOMER Uranium Resources, [illegible]
ADDRESS 1600 Promenade Center
CITY Richard, TX 75080
ATTENTION Art Bishop
INVOICE NO 902228

REPORT OF ANALYSIS

SAMPLES RECEIVED 2/20/79 | CUSTOMER ORDER NUMBER

TYPE OF ANALYSIS Soil Analysis - Collected 2/11/79

Sample Identification	Analysis	pCi/g (dry)
URI-S1-0.0 Longoria	Total Radium-226 Gamma Spec.	1.2±0.4
URI-S2-0.0 Longoria	Total Radium-226 By Gamma Spec.	1.1±0.5
URI-S3-0.0 Longoria	Total Radium-226 By Gamma Spec.	1.1±0.2
URI-S4-0.0 Longoria	Total Radium-226 By Gamma Spec.	1.1±0.2
URI-S6-0.0 Longoria	Total Radium-226 By Gamma Spec.	< 0.[illegible]
URI-S7-0.0 Longoria	Total Radium-226 By Gamma Spec.	2.0±0.2
URI-S8-0.0 Longoria	Total Radium-226 By Gamma Spec.	0.4±0.2
URI-S1-0.5 Longoria	Total Radium-226 By Gamma Spec.	1.0±0.3
URI-S3-0.5 Longoria	Total Radium-226 By Gamma Spec.	< 0.3
URI-S6-0.5 Longoria	Total Radium-226 By Gamma Spec.	0.9±0.3
URI-S7-0.5 Longoria	Total Radium-226 By Gamma Spec.	< 0.3
URI-S8-0.5 Longoria	Total Radium-226 By Gamma Spec.	< 0.3
URI-S-0.5 * Longoria	Total Radium-226 By Gamma Spec.	< 0.3
URI-S-0.5* Longoria	Total Radium-226 By Gamma Spec.	< 0.3
URI-S-0. * Longoria	Total Radium-226 By Gamma Spec.	< 0.3

Telephoned Results to Art Bishop on 2/28/79

* Could not determine Identification on these samples.

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APPROVED BY [signature]
Bud Summers, Environmental Sciences Mgr.
2/28/79

Controls for Environmental Pollution, Inc.
P.O. Box 5351 • 1925 Rosina • Santa Fe, New Mexico 87502
Telephone 505/982-9841

1214 309

Texas Department of Health

Raymond T. Moore, M.D.
Commissioner

Philip W. Mallory, M.D.
Deputy Commissioner

1100 West 49th Street
Austin, Texas 78756
458-7111

February 15, 1979

Mr. Arthur L. Bishop
Environmental Manager
Uranium Resources, Inc.
Suite 735 Promenade Bank Tower
1600 Promenade Center
Richardson, Texas 75080

Dear Mr. Bishop:

We are currently processing your application for a Radioactive Material License. Before further action can be taken, we need the following additional information:

1. A brief description of the leach loop. Where and what chemicals are added and stripped from the cycle and reasoning for such.

2. Maximum amount (in pounds) of slurry you anticipate on having on hand at any one time.

3. Reference page 26, what will the radioactive concentration be of the spray used for irrigation for surface restoration?

4. What is the anticipated radioactive concentration of the water going into the deep disposal well? Is it more or less concentrated than water from the ore body prior to solution mining?

5. What is the total amount of activity anticipated to be injected in the deep disposal well?

6. What is the amount of Radon-222 anticipated to be released from the various plant operations per day, per week, per month, year and for the anticipated lifetime of the plant?

7. How will the waste water be delivered to Armco? (If by pipeline, whose land does it go over (under) and how will leakage/breaks be delt with.)

8. Baseline radiometric data for the ore zone and limits it will be restored to.

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1214 310

9. Baseline radiometric data for the surface of the site and limits it will be restored to.

10. How many wells and at what depths, will be used to monitor for vertical excursions from the production zones?

11. A sketch of the slurry tank trailer and its loaded volume.

12. What laboratory will handle your bioassay program and what limits will they be looking for in micrograms of uranium liter of urine. (See enclosed guide.) Who will analyze your water samples for Radium 226, gross alpha, and gross beta?

13. On page 23 it is stated that the waste holding pond would be drained to repair leaks. How will it be drained if there is only one pond?

14. What will be done with the solid waste in the holding pond when the operation is finished? How will the pond be restored?

15. Concerning Appendix 3, will the clean up team be provided by your firm? Who will direct its operation?

16. A brief description of how the surface of the site will be decontaminated to limits acceptable for unrestricted use.

Upon receipt of the above requested information, we will continue to review your application and issue your license as soon as possible.

Sincerely,

W. E. Hellums

William E. Hellums
Supervisor of Industrial Licensing
Radiation Control Branch
Division of Occupational Health
and Radiation Control

1214 311

URANIUM PRODUCTION LEGISLATIVE NEEDS

In the closing hours of the 95th Congress, a law was enacted that impacts greatly on the State of Texas' right to license and regulate the mining and milling of uranium in the State. This law, the "Uranium Mill Tailings Radiation Control Act of 1978" (PL 95-604) requires that a state implement certain legal and regulatory changes in order to retain the authority to license and regulate uranium production activities or else this authority will revert to the U.S. Nuclear Regulatory Commission (the successor agency to the U.S. Atomic Energy Commission).

Historical Background

In 1961, the 57th Session of the Texas Legislature enacted the Texas Radiation Control Act (Article 4590f, Revised Civil Statutes, State of Texas). Among other provisions, this law authorized the Texas Department of Health to promulgate regulations for the licensing and regulation of users of radioactive materials and authorized the Governor of Texas to enter into an agreement with the U.S. Atomic Energy Commission for the State of Texas to assume the responsibility and authority for the licensing and regulation of essentially all users of radioactive materials within the State of Texas.

On March 1, 1963, the date this agreement became effective, the U.S. Atomic Energy Commission transferred 604 licenses, including one conventional uranium mill, to the Radiation Control Branch, Texas Department of Health. During the period from March 1, 1963, to the present, the production of uranium in Texas has been regulated solely by the State of Texas with no Federal control being exercised on these activities. During this time, the production has risen from approximately 264,000 pounds of yellowcake (U_3O_8) per year with an estimated market value of $2,100,000 from one conventional mill to approximately 4,000,000 pounds per year with an estimated market value of $120,000,000 from one conventional mill and nine solution mining projects. An additional conventional mill, two "heap leach" projects, and four solution mining projects have been licensed and are under construction or development. At the present time, Texas ranks third among the states (behind New Mexico and Wyoming) in the production of uranium and accounts for approximately 7% of the total U.S. domestic production. Figure 1 shows the location and type of each licensed uranium producer.

PL 95-604 would pre-empt the State of Texas' right to continue to license and regulate the uranium industry in this State unless certain additional procedures and practices are instituted.

Impact of Title II of PL 95-604

Title II, Uranium Mill Tailings Licensing and Regulations, would require that the U.S. Nuclear Regulatory Commission revoke that portion of its Agreement with the State of Texas dealing with the licensing and regulatory authority over uranium production facilities within Texas and reassert its authority to license and inspect these facilities by November 8, 1981, unless certain procedural and legal requirements are made by the State prior to that date. Pursuant to the Atomic Energy Act of 1954 (as amended), as interpreted by the Courts, the State of Texas could not license, inspect, or impose any safety or environmental requirements on uranium production facilities if the U.S. Nuclear Regulatory Commission revokes that portion of the Agreement.

1214 312

FIGURE 1: URANIUM PRODUCTION FACILITIES IN TEXAS

	Company	Near	Type	Status
1.	Continental Oil Company	Falls City	Mill	Active
2.	Solution Engineering	Falls City	Tailings Pond Processing	Active
3.	Chevron Oil Company	Panna Maria	Mill	will begin operation in 2/79
4.	Intercontinental Energy Corporation	Three Rivers	Solution Mining	Active
5.	Intercontinental Energy Corporation	Pawnee	Solution Mining	Active
6.	Wyoming Minerals Corporation	Three Rivers	Solution Mining	Active
7.	Wyoming Minerals Corporation	Bruni	Solution Mining	Active
8.	U.S. Steel Corporation (3 sites)	George West	Solution Mining	Active
9.	Mobil Oil Corporation	Pawnee	Solution Mining	to begin in 1980
10.	Mobil Oil Corporation (3 sites)	Bruni	Solution Mining	1 site active, 2 sites to develop
11.	Union Carbide	Benevides	Solution Mining	Active
12.	Wold Nuclear	Flatonia	Solution Mining	Pilot
13.	Everest Exploration	Hobson	Solution Mining	Application filed
14.	Texaco Oil Corporation	Hobson	Solution Mining	Application filed
15.	Exxon Company, U.S.A.	Three Rivers	Tailings Pond Processing	Application to be submitted
16.	Uranium Resources, Inc.	Hebbronville	Solution Mining	Application filed

1214 313

The legal and procedural requirements of PL 95-604 not currently being met by the State of Texas prior to the issuance of a new license or the renewal of an existing license are:

1. That title to the land on which tailings are disposed and to the tailings be transferred to the State or Federal government prior to termination of the license.

2. That an adequate bond, surety, or other financial arrangement be provided by the licensee to ensure that all requirements established for the decontamination, decommissioning, and reclamation of sites, structures, and equipment can be met and to ensure that funds are available for the long-term maintenance and monitoring of such sites by the State or Federal government.

3. That the State determine that the application for licensure or renewal is in "compliance with standards which shall be adopted by the State...which are equivalent, to the extent practicable, or more stringent than, standards adopted and enforced by the U.S. Nuclear Regulatory Commission..."

4. That the State "provide procedures under State law which include:

   "(i) an opportunity, after public notice, for written comments and a public hearing, with a transcript,

   "(ii) an opportunity for cross examination, and

   "(iii) a written determination which is based upon findings included in such determination and upon the evidence presented during the public comment period and which is subject to judicial review;".

5. That "a written analysis (which shall be available to the public before the commencement of any such proceedings) of the impact of such license... on the environment, which analysis shall include:

   "(i) an assessment of the radiological and nonradiological impacts to the public health of the activities to be conducted pursuant to such license;

   "(ii) an assessment of any impact on any waterway and groundwater resulting from such activities;

   "(iii) consideration of alternatives, including alternative sites and engineering methods, to the activities to be conducted pursuant to such license; and

   "(iv) consideration of the long-term impacts, including decommissioning, decontamination, and reclamation impacts, associated with activities to be conducted pursuant to such license, including the management of any byproduct material,".

1214 314

6. That no major construction activity be permitted prior to the issuance of the assessment mentioned in Item 5 above.

In order to meet these requirements, it will be necessary for the State of Texas to enact statutes which would allow the Texas Department of Health to accept title to tailings areas, to require bonding of licensees, and to establish a dedicated fund for the long-term maintenance and monitoring of these sites. In addition, funding would have to be appropriated to enlarge the Radiation Control Branch staff and to provide increased supportive services.

To the uranium processing industry, Title II of PL 95-604 will mean an increase in the cost of producing uranium due to an increase in the length of time between the submission of a license application and the issuance of the license, the prohibition on construction, the bonding requirements, the land ownership transfer requirements, and the adversary-type public hearings.

The alternative to the State of Texas meeting the requirements imposed by PL 95-604 and retaining the responsibility and authority to license and regulate the uranium processing industry is to allow the U.S. Nuclear Regulatory Commission to have the sole authority over how this industry is regulated within the State of Texas. To those who are familiar with the track record of the U.S. Nuclear Regulatory Commission and its predecessor agency, the U.S. Atomic Energy Commission, in the regulation of the uranium industry, this is not a comforting thought.

The impetus for the enactment of PL 95-604 was the damage to the environment and the radiation exposure to humans resulting from the USAEC/NRC's previous regulatory policies that allowed uranium mill tailings to be used in the construction of homes, businesses, and public facilities in Grand Junction, Colorado, and that allowed tailings piles to be abandoned without adequate restoration in Salt Lake City, Utah, and at other sites in the western states. Since the uranium milling industry in Texas has been under State regulation throughout most of its history, these unsafe practices have not been permitted to occur.

The State of Texas has been a leader in the establishment of uranium mill licensing standards to protect the industry worker and protect the environment. As examples, since the 1960's, the Radiation Control Branch has required that tailings ponds be totally lined, that no tailings be used in tailings pond dam construction, and that the dams be completed prior to the addition of tailings to the pond. The USNRC still has not adopted these standards. At the same time, the State of Texas has encouraged the growth of the industry by licensing, after thorough review, the <u>in situ</u>, or solution mining, of uranium which makes it economically feasible to recover uranium from extremely low-grade ore deposits. After several pilot studies, full-scale production by solution mining has been licensed for six different companies at thirteen locations as of January 1, 1979. The USNRC has only recently licensed, after a two-year application review period, its first full-scale solution mining operation.

To the State of Texas and its citizens, allowing the regulatory authority to revert to the USNRC will result in no local control over the uranium industry and a reliance on a Federal bureaucracy, the USNRC, to protect the environment and the public health and safety of the citizens of Texas. To the uranium mining and milling industry in Texas, it will mean more lengthy licensing procedures and the payment of licensing fees of up to $108,000 per site.

1214 315

Assuming that appropriate legislation is enacted to allow the State of Texas to continue to regulate the uranium industry in Texas, it will be necessary to increase the staff of the Radiation Control Branch in order to meet the requirements of PL 95-604. It will be necessary to employ additional personnel with expertise in engineering, geology, health physics, hydrology, ecology, seismology, finance, law, economics, and computer science to meet the demands of this law. The individuals hired will by necessity need to be experienced and knowledgeable. Such levels of training and experience can only be obtained by staffing these positions at the highest levels in the Merit System positions. Additional funding will also be required for computer time, court reporters, and clerical support staff. It is estimated that an additional $300,000 per year above the budget request submitted by the Radiation Control Branch will be necessary to implement the additional requirements imposed by PL 95-604...

1214 316

Enclosure

SUGGESTED BIOASSAY PROGRAM
FOR URANIUM PROCESSORS

1. Persons to be Monitored - Bioassaays shall be performed for all workers who are routinely exposed to airborne yellowcake dust or uranium ore dust. Bioassays shall also be performed for any worker temporarily exposed to excessive levels of yellowcake or uranium ore dust, such as may occure when maintenance work is performed in high dust areas.

2. Type of Bioassay - Bioassays shall be by means of urinalysis capable of detecting the uranium content of the urine with a sensitivity of at least 5 micrograms uranium per liter of urine. Results shall be obtained within 20 days of the collection. If an outside laboratory is used, results exceeding 30 μg/l shall be reported by telephone.

3. Frequency of Bioassay - Bioassays shall be conducted at least once each month for workers routinely exposed to uranium dust. Workers temporarily exposed shall have a bioassay sample collected two to four days after exposure to the airborne uranium.

4. Actions Based on Bioassay Results - A value of 30 micrograms/liter under equilibrium conditions is considered the limiting value a worker may have for chemical toxicity. A valve of 130 micrograms/liter obtained within two weeks following a single intake of yellowcake indicates a value sufficiently large to cause kidney damage according the the U.S. Nuclear Regulatory Commission. In view of this, the following actions will be taken.

   a) Less then 15 μg/l - None

   b) 15 to 30 μg/l - 1) Confirm results (repeat urinalysis)
      2) Attempt to identify cause of high exposure
      3) Take corrective measures and/or limit worker exposure.

   c) Greater than 30 μg/l - 1) Take actions as given above for 15-30 μg/l
      2) Remove worker from high dust area until bioassay is 15 μg/l or less.
      3) Notify the Agency in writing

   d) Greater than 30 μg/l for four consecutive bioassays or greater than 130 μg/l for any one test - 1) Take actions given above
      2) Have additional urine samples tested for albuminuria.

5. Prevention of Specimen Contamination - Specimens will normally be collected within 2 days after a worker returns to work from the weekend or from his days off. Specimens will be collected at the beginning of a work shift in an area free of uranium contamination and prior to the worker entering the restricted area. Clean disposable containers will be used and the workers will be instructed to wash his hands carefully prior to voiding.

1214 317

6. Analysis - Bioassays shall be analyzed by ______________________________.
(Commercial Laboratory or Licensee)
(If the licensee is to analyze the bioassays, procedures for such analysis should be given.)

7. Quality Control - The bioassays shall be processed along with known control specimens of 15 μg/l and 30 μg/l to provide a means for assuring the accuracy of the tests.

1214 318

TEXAS DEPARTMENT OF WATER RESOURCES
[illegible] N. Congress Avenue
Austin, Texas

TEXAS WATER DEVELOPMENT BOARD
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[illegible] McDonald, Chairman
Dorsey B. Hardeman
Joe R. Carrell

July 20, 1979

Mr. Hub Miller
Nuclear Regulatory Agency
396 Silver Springs
Washington, D. C. 20555

Dear Mr. Miller:

Re: Request For Information on Waste Disposal Wel[illegible]

In response to your request for information on indus[illegible]l waste disposal wells in Texas, please find enclosed an "In[illegible]mation Package" dealing with the Texas Department of Water Resources' disposal well program.

For information pertaining to waste disposal wells or other wells relating to the exploration, production, and development of oil and gas, your inquiry should be directed to the:

Railroad Commission of Texas
Post Office Box 12967, Capitol Station
1124 South IH 35
Austin, Texas 78711

If we may be of any further assistance to you, please contact us and if you get a chance to visit Austin, please come by and see us.

Sincerely yours,

Buck Steingraber

Buck Steingraber, Head
Underground Injection Unit

WAS:vg
Enclosures
cc: Mr. George Singletary, Railroad Commission of Texas

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