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Docket 40-8786
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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WMUR:KBW
Docket No. 40-8786

MEMORANDUM FOR: Docket No. 40-8786

FROM: Kristin B. Westbrook
Operating Facilities Section I
Uranium Recovery Licensing Branch
Division of Waste Management

SUBJECT: ENVIRONMENTAL IMPACT APPRAISAL FOR URANIUM RESOURCES INCORPORATED'S NORTH PLATTE ISL R&D PROJECT

Attached is the Environmental Impact Appraisal (EIA) prepared in support of the issuance of Source Material License SUA-1400 for Uranium Resources Inc., North Platte In-Situ R&D Leach Mine Project.

Kristin B. Westbrook

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Approved By: J. J. Linehan

John J. Linehan, Section Leader
Operating Facilities Section I
Uranium Recovery Licensing Branch
Division of Waste Management

Case Closed: 04008786N01E

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UNITED STATES NUCLEAR REGULATORY COMMISSION
ENVIRONMENTAL IMPACT APPRAISAL
BY THE
DIVISION OF WASTE MANAGEMENT
IN CONSIDERATION OF THE ISSUANCE OF
SOURCE MATERIAL LICENSE NO. SUA-1400 FOR
URANIUM RESOURCES INC.
NORTH PLATTE PROJECT, CONVERSE COUNTY, WYOMING
DOCKET NO. 40-8786

OCTOBER 1981

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TAKEN FROM
USGS
GILBERT
LAKE
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WYOMING
7.5
MINUTE
SERIES
TOPOGRAPHIC
MAP

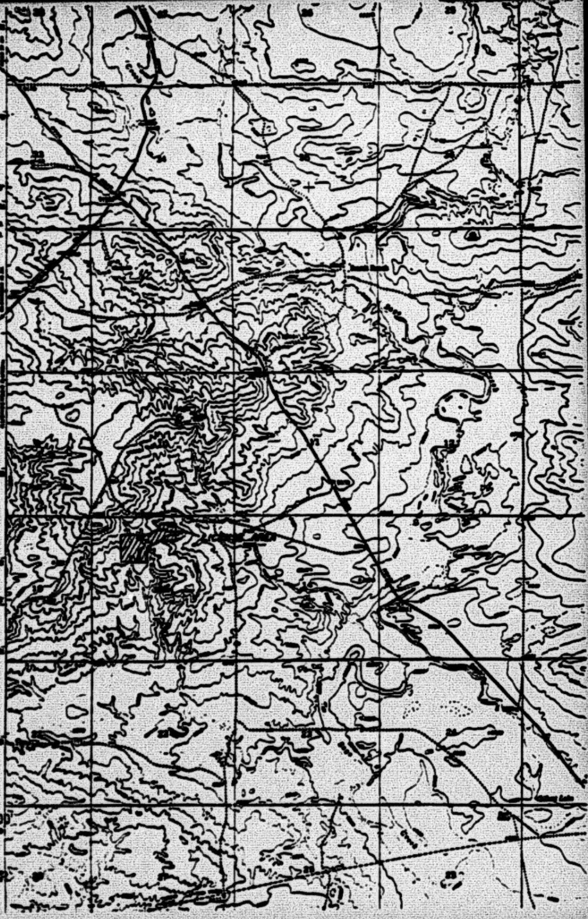

FIGURE
2.2.01

CI = 20'
SCALE 1" = 2000'
1:24000

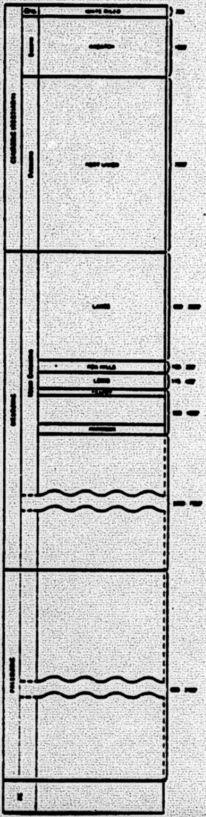

FIGURE 2.2.02 STRATIGRAPHIC COLUMN: VERTICAL SEQUENCE OF ROCK FORMATIONS IN THE SOUTH POWDER RIVER BASIN

TABLE 2.2.01 HYDROGEOLOGIC UNITS IN THE VICINITY OF THE PROPOSED SITE

Geologic Age	Hydro-geologic Unit	Approximate Thickness (feet)	Lithologic Character-istics	Hydrologic Character-istics
Eocene	Wasatch Formation	0-500	Fine- to coarse-grained lenticular arkosic sand-stone, and interbedded claystone and siltstone	Groundwater production generally good, but lenticular nature restricts aquifer use locally; yields of as much as 140 gpm have been produced
Paleocene	Fort Union Formation	3000	Fine- to coarse-grained, lenticular sandstone, and interbedded carbon-aceous shale and coal	Groundwater production good beneath site; yields of 550 gpm have been produced over prolonged periods
Cretaceous	Lance Formation	3000	Fine- to medium-grained sandstone, and inter-bedded sand, shale, and claystone	Groundwater production largely unknown in vicnity of site; probably would not yield over 20 gpm
Cretaceous	Fox Hills	500-700	Fine- to medium-grained sandstone, and inter-bedded thin sandy shale	Groundwater production largely unknown in vicinity of site; probably would not yield over 100 gpm

Sources: Hodson et al., 1973; Hodson, 1971; Harshbarger and Associates, 1974.

Most of the Paleocene Fort Union rocks were derived from soft Cretaceous shales and sandstones and, therefore, are mainly fine-grained clastics. Deposition in the Powder River Basin area was primarily from large sluggish streams with associated coal swamps. By late Paleocene time, however, erosion had apparently cut into the crystalline core at the end of the ancestral Laramie Mountain and intermittent floods of arkosic sediment poured into the southern end of what is now the Powder River Basin. Alluvial fans were formed, with attendant braided streams forming wedges of sand interfingered with the normal fine-grained Fort Union sediments. It is these wedges that form the aquifer zones of the upper Fort Union. Figure 2.2.03, shows the Powder River Basin regional geology and uranium mining areas.

The uranium-bearing sandstone in the proposed test area has been designated as the "2" sand (see Figure 2.2.04). The production zone is generally 30-50 ft. in thickness. The aquifers and aquicludes above and below the "2" production zone are also designated by numbers; the lower the number the deeper the zone.

The aquifer which underlies below the "2" production aquifer is designated as the "1" sand. This sand is fine-grained, gray-green and moderately silty to slightly clayey. The "1" sand is approximately 15' thick.

Separating the "1" and "2" sands is the "1" clay. This clay is usually silty and occasionally sandy. It is dark gray-green in color. The thickness is approximately 12'-15' thick.

The "2 ab" sand sequence is directly above the "1" clay. Where reduced, its color is gray-green and pyrite is found in clusters adhering to organic particles. The "2" sand contains the ore. This sand is very fine to medium grained but occasionally it becomes coarse grained. It is subangular, poor to moderately sorted and has fair porosity which can be locally reduced by characteristic interbeds of clay.

Above the "2 ab" sand is the "2" clay. This clay pinches out in the vicinity of the outer ring of monitoring wells, near monitor well NPMW-2 and monitor well NPMW-3 (see Figures 2.2.04 and 2.2.05). The production zone can be considered as a continuous sand, the "2 abc" sand with a clay stringer. This clay stringer is the "2" clay.

Above the "2 abc" sand is the zone designated as the "3" clay. The clay is dark gray to green-gray in color and is silty. It contains relatively small intervals of fine-grain sand interbeds which are believed to be insignificant in terms of permeability. This is due to the mixture in the sandy zones of a variety of particle sizes and very thick clay interbeds. The predominantly clay "3" zone is approximately 260 ft. thick.

The "3" sand immediately overlies the "3" clay. It is typically very fine to medium-grained although it becomes very coarse-grained locally. It is light gray-green in color, subangular, has fair porosity with stringers of silt and clay and small isolated beds of clay. It averages 80 ft. in thickness.

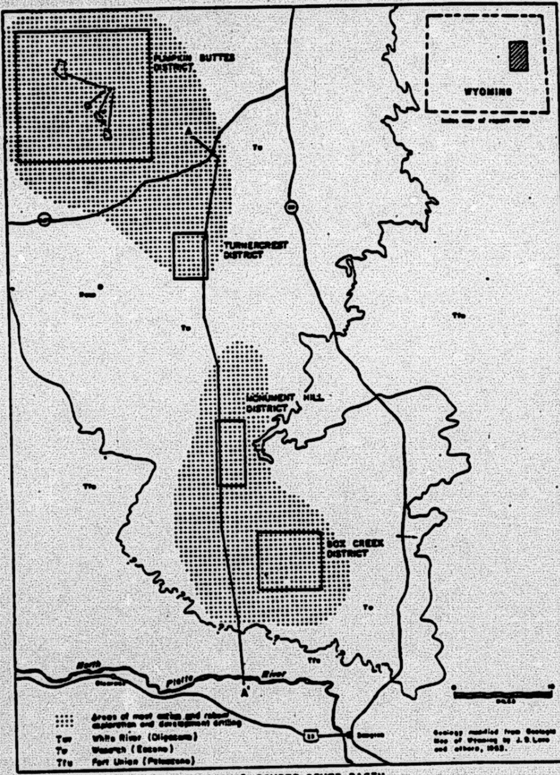

Figure 2.2.03 POWDER RIVER BASIN

GEOLOGY AND URANIUM MINING AREAS

SCHEMATIC DIAGRAM OF THE #1 THRU #4 AQUIFERS AND AQUICLUDES

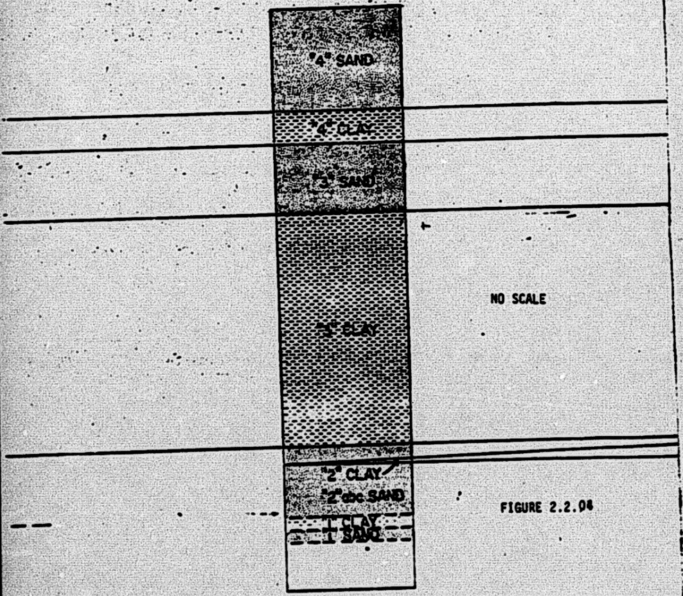

FIGURE 2.2.04

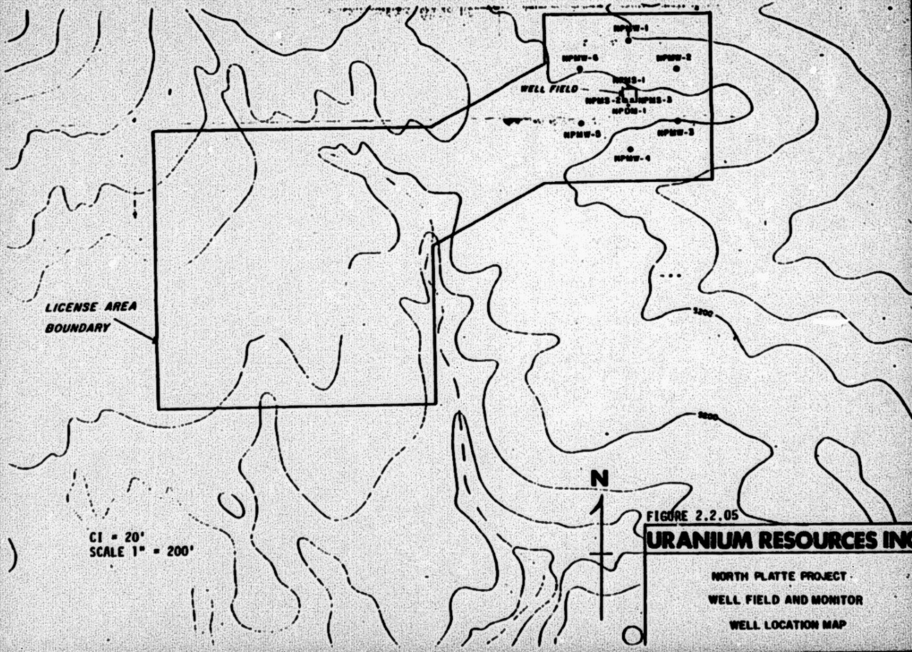

FIGURE 2.2.05

URANIUM RESOURCES INC

NORTH PLATTE PROJECT

WELL FIELD AND MONITOR

WELL LOCATION MAP

Above the "3" sand is the "4" clay. This is a silty-sandy clay and is medium to dark gray. Its average thickness is 40 ft.

The shallowest continuous sand in the review area is the "4" sand. It is very fine to medium-grained, gray-green colored, silty, subangular to subrounded. This sand averages 40-60 ft. in thickness. The base of the Wasatch Formation is represented by this sand. The upper Wasatch has been eroded and is not present in this area.

Figure 2.2.04 shows the "1" through "4" sands and clays. The designated sands 1-4 are considered to be aquifers and the clays 1-4 are the separating aquicludes.

2.2.2 Water Quality and Pump Testing

As a result of the lack of development in this area, the groundwater that is present in the "4," "3," "2," and "1" aquifers is not used for drinking water, stock, or other uses, within 1/2 mile (.08 km) of the site boundary.

Uranium Resources Incorporated has submitted water quality data from all of the injection wells, production wells, and the monitor wells. NRC has received adequate baseline data except for some newer wells. Additional monitoring wells have been installed in order to monitor the "1" sand aquifer (well NPDM-1), the "2" sand aquifer (NPMS-1), the "3" sand aquifer (well NPMS-2), and the "4" sand aquifer (well NPMS-3).

Based on the water quality data submitted by URI from the production-injection wells and monitor wells, the water quality in the "2 abc" sand aquifer exceeds, at times, USEPA drinking water standards for the following: pH, gross alpha, gross beta, iron, radium and TDS. In all cases TDS is between USEPA's (250 mg/1) and Wyoming's (500 mg/1) drinking water standards. The water quality in the adjacent "1" and "3" aquifers is of similar quality but is not nearly as high in radium as the "2" sand. Although, the radium in the "1" and "3" sand is above USEPA drinking water quality the levels are within a treatable range. The "1" and "3" sand water quality will be evaluated further as additional data from the newer wells which monitor these zones is received. It should be noted that well NPMS-3 which monitors the uppermost "4" aquifer has been dry to date so there is no water quality data for this aquifer. Appendix A of this document contains baseline water quality data.

The wells DM-1, MS-1, MS-2, and MS-3 will be used for monitoring excursions through the confining beds above and below the production sand aquifer. Because these wells were added after the sampling program was underway, it is necessary to establish additional baseline data. The NRC staff will require data for 4 samples from each well. This additional data will be required to be submitted by URI prior to the injection of lixiviant.

Uranium Resources Incorporated conducted a pump test at their North Platte property. The purpose of the pump test was to evaluate the hydrogeologic properties of the uranium source bed, including anisotropy in the horizontal plane of this aquifer, the presence of hydrologic boundries, and the determination of potential hydraulic connection. Figures 2.2.06 and 2.2.07 and Table 2.2.02 pertain to the pump test results obtained by URI. Figure 2.2.06 shows the various transmissivities calculated from the wells in the "2 ab" aquifer. Figure 2.2.07 shows the cone of depression. Table 2.2.02 summarizes the results of the pump test for the production aquifer. Based on NRC staff review, the results calculated by URI seem reasonable. Detailed results of analyses pertaining to the pump tests is contained in Appendix B of this document.

The pump test consisted of one pumping well (P-1) and 13 observation wells (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, I-1, I-2, I-3, I-4, MS-1, MS-2, and DM-1). The wells P-1 and wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, I-1, I-2, I-3, and I-4 are completed into the "2 ab" sand stratum. Wells MS-1, MS-2, and DM-1 are completed into the "2 c" sand, "3" sand and "1" sand, respectively. Water level drawdown for MS-1, MS-2, and DM-1 do show some response to pumpage (Figures B-12, B-13, and B-16 of Appendix B respectively).

URI attributes the response of well MS-1 to water movement around the "2" clay which pinches out in the vicinity of well MW-2. The NRC staff concludes that this is a likely explanation which is confirmed by the geophysical logs. These logs show that the "2" clay is not present in MW-2. This is of no consequence since the "2 abc" sand is considered as the production zone and the "2" clay is not considered to be an aquiclude. URI agrees with this interpretation.

The "3" sand, which is separated from the "2" sand by 260 ft. of clay was monitored during the pump test by utilizing well MS-2. A water level rise of approximately .15 ft. was observed after the first few hours of the pump test. URI states that this results from a reduction of upward pressure on the "3" clay from pumping the "2 ab" sand. The NRC staff agrees that water levels in adjacent aquifers are likely to respond in this manner.

URI, attributes the water level response (of approximately .2 ft.) in well DM-1 to changes in barometric pressure and antecedent water level change trends. URI adjusted the water levels in well DM-1 for barometric pressure changes and the water level trend. URI assumed a barometric efficiency of one (1) for the aquifer. This assumption was the basis of their adjustment and is considered by the NRC staff to be reasonable and consistent with usual practices. Although the barometric pressure and prior trends do appear to account for the response in DM-1, which is separated from the production zone by approximately 15' of clay, the response could indicate leakage.

Well P-1 was pumped at approximately 9.7 gpm for 4200 minutes while water levels in the observation wells were measured. Recovery measurements were taken for 4320 minutes. Drawdown and recovery data were plotted on full logarithmic and semi-log paper to determine the transmissivity and storativity of the "2 ab" sand, and the existence or absence of boundaries.

Table 2.2.02 presents the summary of aquifer properties for the production aquifer. This table gives the transmissivities from the log-log, semi-log

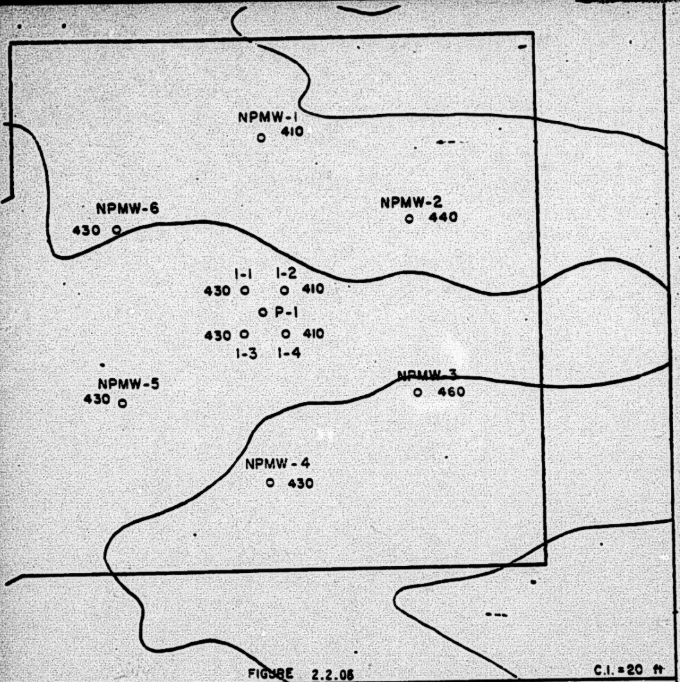

FIGURE 2.2.06

C.I. = 20 ft

URANIUM RESOURCES INC

NPMW-5 WELL LOCATION AND NUMBER

430 TRANSMISSIVITY IN gal/day/ft

NORTH PLATTE PROJECT
TRANSMISSIVITY OF
THE 2ab AQUIFER

SCALE 1" = 100'

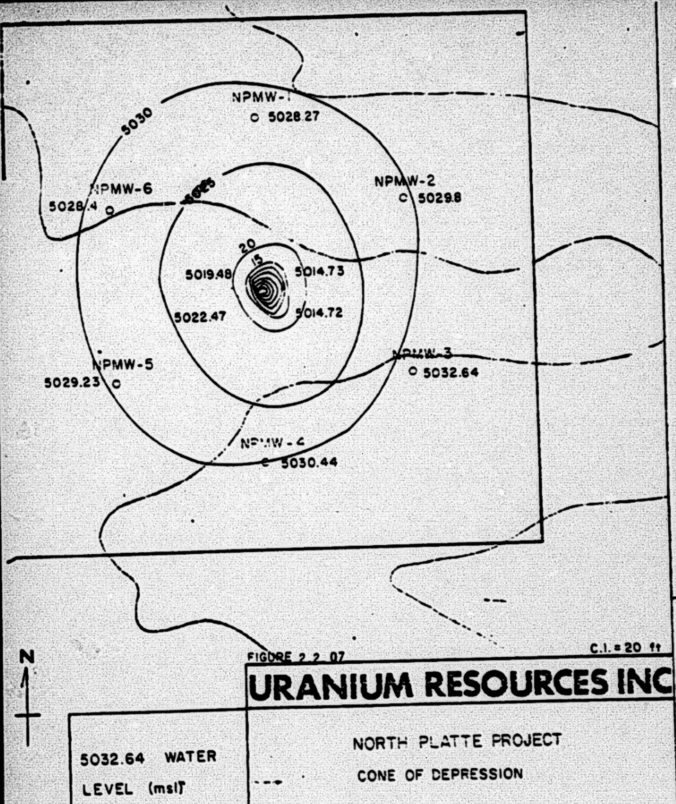

FIGURE 2.2.07

C.I. = 20 ft

URANIUM RESOURCES INC

5032.64 WATER LEVEL (msl)

NORTH PLATTE PROJECT

CONE OF DEPRESSION

SCALE 1" = 100'

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SUMMARY AND CONCLUSIONS

This Environmental Impact Appraisal was prepared by the staff of the U.S. Nuclear Regulatory Commission (NRC) and issued by the Commission's Office of Nuclear Material Safety and Safeguards.

1. This action is administrative.

2. The proposed action is the issuance of Source Material and Byproduct Material License SUA-1400 to Uranium Resources Inc., for implementation of the North Platte Project Site Research and Development In Situ Leach Project, Docket 40-8786, in accordance with the Company's statement in its application and accompanying technical report of March 31, 1981 and their submittals dated July 22, 1981, August 17, 1981, and October 21, and 27, 1981.

   The proposed project consists of solution extraction (in situ leaching) operations involving uranium ore deposits within the Uranium Resources Inc., North Platte Project Site in Converse County, Wyoming. Research and development activities will include a maximum 100 gpm process plant, two small evaporation ponds, and one five-spot well pattern within a ring of monitor wells. The project has an estimated lifetime of one (1) year.

3. Summary of environmental and adverse effects:

   a. The site is primarily used as grazing land for livestock and wildlife. Initiation of the project would result in the temporary removal of a maximum of approximately 1-2 acres of land from grazing. The removal of one to two acres from this very low density grazing area is expected to have a negligible impact on any specific livestock member or on any populations of livestock. Likewise, no adverse impacts are expected for large wild game animals. Small wild animals could have individual members adversely affected. The number of small animals disturbed or otherwise adversely affected is expected to be very minimal and no adverse impacts on any populations are expected. All disturbed areas are required to be reclaimed.

   b. The long-term effects of the research and development project on groundwater use are expected to be minimal. Groundwater in the ore zone within the immediate area of the well patterns is expected to temporarily contain increased concentrations of radioactive and toxic elements during the operation. Restoration should return this water to a condition that is consistent with its premining use (or potential use). Surface water will not be affected by normal operations.

   c. There will be no discharge of liquid effluents from the North Platte Project Site. Atmospheric effluents are expected to be within acceptable limits, and the effects will be insignificant.

4. The principal alternatives considered were the following:

   a. Alternative mining methods.

      Open-pit, underground, and solution extraction (in situ leaching) methods were considered, as well as a comparison of impacts associated with each. Solution extraction is the selected method for mining the designated ore deposits. The surface impacts associated with in situ leaching will be much less severe than the impacts that would result with open-pit or underground uranium mining accompanied by conventional milling. With proper well field management and monitoring, the impacts to groundwater and surface water should also be considerably less.

   b. Alternative leach solutions.

      An alkaline rather than an acid leach solution will be utilized. A sodium bicarbonate solution containing an oxidant will be used to solubilize the uranium underground. The staff concludes than an alkaline solution is suitable and environmentally more desirable than an acid solution.

   c. Alternative of no licensing action.

      The denial of a source material license is an alternative available to the NRC. If denied, the designated ore deposits could not be mined using the solution extraction method. The staff concludes that this project can be conducted in a manner which protects public health and safety and the environment.

5. The Environmental Impact Appraisal will be made available to the public and to government agencies in October 1981.

6. From the analysis and evaluation made in this statement, it is proposed that the source material license contain the following conditions:

   1. Authorized Use: For uranium recovery from pregnant lixiviant in accordance with statements, representations, and conditions contained in the licensee's March 30, 1981, Technical Report: Sections A-1, B-4, B-5-d-5, B-5-d-7-a, B-9, C-1, C-2, and in supplements dated July 22, 1981, August 17, 1981, and October 21 and 27, 1981. Wherever the word "will" is used in the licensee's submittals, it shall denote a requirement. Notwithstanding the above, the following conditions shall override any conflicting statements contained in the licensee's application and supplements.

   2. The uranium in-situ solution mining operations shall be performed on a maximum injection-production well field area of .06 acres within the area shown in Figure c-5-2 of the March 31, 1981 Technical Report submitted by URI to the United States Nuclear Regulatory Commission (USNRC), Uranium Recovery Licensing Branch. This area calculation (.06 acres) does not include the outer ring of monitor wells NPMW-1 through NPMW-6.

3. Variation from the sodium carbonate-bicarbonate leach solution with hydrogen-peroxide, oxygen, or peroxide added, shall require prior USNRC, Uranium Recovery Branch approval through amendment of this license. The licensee shall explain the proposed variation and assess its environmental impacts with respect to groundwater quality, the pond water characteristics, restoration methods and criteria, and monitoring requirements.

4. The ten (10) wells (6 perimeter ore zone monitor wells and 3 shallow and 1 deep monitor well) shown on Figure C-5-2 of the licensee's March 31, 1981 Technical Report shall be used for groundwater quality monitoring during solution mining operations and during groundwater restoration. These wells shall be sampled for chloride and conductivity every two (2) weeks and once every month for alkalinity, calcium, chloride, vanadium, sodium, conductivity, and uranium. Prior to termination of lixiviant addition or at six (6) months after operations begin, whichever comes first, a set of samples from all of the monitor wells shall be analyzed for the full suite of water quality indicators listed in Table 5.1.01 of the EIA.

5. Upper control limit (UCL) criteria shall be applied to monitor wells to determine when action must be taken to control excursions during mining. The USNRC shall require that the excursion indicator set include the following: chloride, conductivity, alkalinity, calcium, vanadium, sodium, and uranium. The UCLs shall be based on the mean for each indicator for each individual monitor well. Proposed upper control limits for the seven (7) excursion indicators above shall be submitted to the USNRC, Uranium Recovery Licensing Branch, Washington, D.C. 20555, prior to injection of lixiviant. Well NPMS-1, which is open to the 2c sand, shall be exempt from establishment of UCLs as per Section 5.1.1 of the EIA.

   If any two excursion indicators in a well exceed the upper control limit (UCL) or if one excursion indicator exceeds its UCL by 20% of its UCL, the licensee shall take another water sample within forty-eight (48) hours and analyze it for at least the seven (7) indicators listed above. An excursion is confirmed if two or more UCL values are exceeded or if one UCL value is exceeded by 20% or more of its UCL. Corrective action to mitigate the situation shall be initiated by the licensee when an excursion is confirmed and the USNRC, Uranium Recovery Branch shall be notified within forty-eight (48) hours by telephone and within seven (7) days in writing. Corrective actions shall be maintained until the excursion is concluded. In addition to corrective actions, sampling frequency and analysis of excursion status wells shall be at least once every seven (7) days, for the seven (7) indicators listed above, as long as those wells are on excursion status. An excursion is considered concluded when the concentrations of excursion indicators are below the concentration levels defining an excursion.

The objective of restoration shall be to return the groundwater quality, on a groundwater quality indicator-by-indicator basis, to baseline conditions. The licensee shall submit restoration criteria to the USNRC, Uranium Recovery Licensing Branch for review and approval in the form of a license amendment prior to initiation of restoration.

During restoration operations, the licensee shall sample and analyze the composite restoration stream on a biweekly basis. Water quality sampling and analysis of representative injection or recovery wells in the well field shall be done on a monthly basis to monitor differences in the restoration progress within the well field. Sampling and analysis of all monitor wells shall continue on a routine operational basis, as defined in License Condition No. 4.

9. The volume of discharges to the two evaporation ponds shall be recorded. Quarterly samples of bleed solution shall be analyzed for calcium, chloride, alkalinity, sodium, uranium, radium-226, sulfate, and TDS. The results shall be included in the quarterly report as per License Condition No. 14, below.

The two evaporation ponds shall be monitored for leaks on a daily basis. Any fluid detected in the standpipes of the pond leak detection systems shall be analyzed initially for chloride and conductivity. If these concentrations exceed Wyoming Drinking Water Standards, then fluids shall be analyzed for calcium, chloride, alkalinity, sodium, uranium, radium-266, selenium, arsenic, sulfate, and TDS. If the chemical quality of the fluid found in the stand pipe exceeds Wyoming Drinking Water Standards for any of the indicators tested, the licensee shall take immediate steps to repair the leak and the USNRC, Uranium Recovery Branch shall be notified within forty-eight (48) hours. Water quality samples taken at the standpipe shall be sampled for all ten (10) indicators at least every seven (7) days during the leak period and for at least two weeks following repair, if any residual liquid remains in the standpipes. The results of all standpipe analysis shall be reported to the NRC in the quarterly report as per License Condition No. 14, below.

A report describing the actions taken by the licensee to repair the pond and the results of those actions shall be included with the quarterly report described in License Condition No. 14, below.

10. The uranium recovery plant shall be operated at a maximum flow rate of one-hundred (100) gpm. Pressures at the well heads of injection wells in the ore zone shall not exceed 100 psi.

11. The water level of each monitor well shall be monitored once daily for the first two (2) weeks of continuous operation of the wellfield. After the initial two (2) weeks, water level monitoring can be decreased to once a week. An exception to this shall be wells NPOM-1 and NPMS-1 which shall have continuous water level recorders.

Net flow rates for the well field shall be recorded whenever monitor well water levels are measured; barometric pressure at the site or vicinity and its effect on water levels should also be recorded. Hydrologic monitoring shall continue as described in this condition until groundwater quality restoration begins.

An evaluation of the net flow balance, along with water level data, in graphical and tabular form shall be submitted in a separate section of each quarterly report, as decribed in License Condition No. 14 below, until the monitoring is discontinued.

Flow rates on each injection and production well and injection pressures shall be checked at least once per day. This check, noting any significant variations, shall be recorded on a daily operational log.

12. Exploration boreholes, post-test boreholes, and all wells within the wellfield area not used in production or monitoring and not properly cased or sealed within a specific unit shall be plugged prior to injecting lixiviant to comply with Wyoming Department of Environmental Quality (WDEQ) requirements. All wells shall be plugged prior to decommissioning the site for unrestricted use.

13. The licensee shall conduct mechanical well integrity tests on each well that will be used for injection before leach solution injection commences. The USNRC, Uranium Recovery Licensing Branch shall be provided with a report, prior to lixiviant injection, that describes in detail all mechanical integrity tests and their results after testing is complete. If any well fails the test it shall be repaired or plugged. In addition, the USNRC shall be notified by the above report that any wells which initially failed the tests have been repaired or plugged. The test outlined on Page C-30 of the licensee's March 31, 1981 submittal shall be modified to a ten (10) minute pressure test. If the pressure drop is less than 2-3% or 2-3 psi over the test period, the casing is considered competent. All other aspects of the test shall be as stated in the licensee's March 31, 1981 submittal or shall be approved in advance by the USNRC, Uranium Recovery Licensing Branch.

14. A quarterly report shall be submitted to the USNRC, Uranium Recovery Licensing Branch that summarizes the status of the NAD in situ test program. This report shall include supporting analytical data, evaluations regarding important environmental aspects of the operations, such as water quality and water level data, lixiviant migration control, waste generation volumes; and volumes and representative chemical analyses of injected lixiviant, and pregnant solution produced. The quarterly report shall include all data on environmental monitoring as well as groundwater data. For the groundwater data, the term "not detected", "less than the lower limit of detection", or similiar terms shall not be used. In those cases where the value is less than the lower limit of detection, the detection limit shall

be given and this shall be accompanied by a notation of less than. All water quality and water level data shall be presented in tabular and graphical form, with a written summary explaining what the data show.

15. The licensee shall submit plans for decontaminating and decommissioning the well field and process facility sites at least ninety (90) days prior to decommissioning. These plans shall require USNRC, Uranium Recovery Licensing Branch approval in writing.

16. The licensee shall maintain a surety to cover the cost of all groundwater restoration and all reclamation and decommissioning, including the cost of offsite disposal of radioactive solid process or evaporation pond residues. The licensee shall provide a copy of the surety along with a cost breakdown to the USNRC, Uranium Recovery Licensing Branch and receive approval of the surety in the form of a license amendment prior to injection of lixiviant.

17. The licensee shall perform the radiological environmental monitoring program as outlined in Table 5.2.01 of the EIA. Preoperational data from this program shall be provided to the USNRC, Uranium Recovery Licensing Branch in the first quarterly report discussed in License Condition 14, above.

18. The licensee shall immediately notify the U.S. Nuclear Regulatory Commission, Region IV, Office of Inspection and Enforcement, 611 Ryan Plaza Drive, Suite 1000, Arlington, Texas 76011, and the U.S. Nuclear Regulatory Commission, Uranium Recovery Licensing Branch, Washington, D.C. 20555, by telephone and telegraph, of any failure of an evaporation pond, any break or rupture of any pipeline, or any similar failure of any other fluid or material conduit or storage facility which results in an uncontrolled release of radioactive materials, or of any unusual conditions which if not corrected could lead to such a failure. This notification shall be followed, within seven days, by submittal of a written report detailing the conditions leading to the failure or potential failure, corrective actions taken, and results achieved. This requirement is in addition to the requirements of 10 CFR Part 20.

The licensee shall comply with the following regarding operation and construction of the evaporation ponds:

19a. The site of the ponds shall be that site investigated in the report entitled "Geotechnical Investigation for the Proposed URI No. 1 Reservoir to be constructed for the Uranium Resources Incorporated, North Platte In Situ Mine located in the NW ¼ of Section 15, R73W T34N, 6th P.M., Converse County, Wyoming" by Chen and Associates, Inc. dated July 23, 1981.

b. The pond embankments shall have a maximum height of 10 feet, exterior and interior slopes of 4H:1V and 3H:1V respectively, and a crest width of 6 feet. The embankment fill shall consist of interbedded sand and clay soils excavated from the site and compacted to 100 percent of their maximum dry densities and placed within optimum to +2 percent of their optimum moisture contents as determined by ASTM D-698. For each significantly different solid type used for fill material, a moisture-density curve shall be developed using the ASTM method above.

c. Embankment fill shall be laid down in loose lifts not to exceed 12 inches in thickness. No frozen materials or oversized material (greater than 6") shall be used as fill and no fill shall be placed on top of frozen materials.

d. The method of compaction testing that shall be utilized to ensure compliance with item "b" above is the "Density of Soil in Place by the Sand Cone Method" (ASTM D-1556), or "Density of Soil and Soil-Aggregate in place by Nuclear Methods" (ASTM D-2922). If the latter method is utilized, the nuclear density measurement equipment shall be calibrated as prescribed in ASTM D-2922 by use of the sand cone method.

e. The location of each moisture-density field test shall be randomly selected by the engineer-in-charge to be representative of the work performed. As a minimum, there shall be a test taken for each lift, each construction shift during which fill is placed, and when the engineer deems additional testing is necessary. In no case, however, shall more than 2,000 cubic yards of material be compacted without a test. The results of the tests and the location where each test was taken shall be recorded and included with the construction report (item "m"). All areas that fail the moisture-density testing shall be reworked and retested.

f. Prior to placing the material forming the layer in which the leak detection pipes are placed, the subgrade shall be scarified and recompacted to the criteria in item "b" above, and graded to a surface tolerance of less than or equal to 0.1 feet over a 10-foot straightedge. If necessary, clay materials shall be added to any observed areas of permeable sands to achieve a base that is at least two orders of magnitude less permeable than the leak detection layer.

g. The leak detection 1-inch diameter PVC piping network and the inspection tubes shall be installed at the locations shown on Figure C-4-2 of "Uranium Resources Inc., North Platte Project Application and Technical Report," dated March 1981. The perforated pipe shall be placed in shallow trenches cut into the subgrade and a bedding layer of sand shall then be placed in the trenches and in a

6-inch layer directly beneath the pond liner. At least two permeability tests, or gradation tests correlated to permeability, shall be performed on the bedding sand to verify the required minimum of two orders of magnitude greater permeability than that of the subgrade.

h. Prior to liner placement, the leak detection system shall be tested to assure that it functions properly. The leak detection system operation tests shall consist of discharging water at four different flow rates varying from 1 to 50 gallons per minute on top of the leak detection bedding material. The locations in each pond shall be visually selected by the engineer to be as far as possible from the perforated collection tubes. Two of the four tests shall be performed in each pond. The sump shall then be monitored to determine if the water reaches the sump. If water is detected in the sump, the system shall be deemed acceptable. If water does not reach the sump, the system shall be checked, repaired, or reconstructed. The liner shall not be installed until the above described test is passed. The licensee shall record the travel time, amount and flow rate of water discharged, and the amount and flow rate of water collected at the sump. The USNRC, Uranium Recovery Licensing Branch shall be notified by telephone of the results of the tests, within two (2) days after their completion.

i. The ponds shall be lined with a 36-mil reinforced Hypalon liner anchored in trenches at the crest of the impoundments. The liner shall meet and be installed in accordance with the specifications provided in Attachment II to the licensee's letter to John J. Linehan dated August 17, 1981.

j. The licensee shall maintain at least two feet of freeboard between the embankment crest and the pond level.

k. The licensee shall at all times maintain sufficient reserve capacity in the evaporation pond system to enable the transfer of the contents of a pond to other ponds in the event of a leak. In the event of a leak and subsequent transfer of liquid, the freeboard requirements of condition "j" shall be discontinued while the liner is being repaired.

l. A fence that prevents the intrusion of game animals into the evaporation pond areas shall be maintained.

m. Within 6 months after completion of the ponds, the licensee shall submit a report detailing the construction methods, construction controls, quality assurance programs, and testing methods that were actually utilized in the construction of the ponds and the installation of the leak detection system and liner. The report shall also provide test results obtained during construction and as-built drawings showing details of construction of the various components of the pond.

n. The licensee shall notify Region IV, USNRC, Office of Inspection and Enforcement, Arlington, Texas and the Uranium Recovery Licensing Branch, USNRC, Washington, D.C., at least three weeks prior to the completion of the ponds to provide adequate time for onsite inspections by the USNRC.

21. This license shall not be terminated until the USNRC has determined that all site reclamation, decommissioning, and well field restoration has met all applicable standards and regulations.

7. The position of the NRC is as follows:

Solution extraction of uranium is a developing technology. Uncertainties regarding environmental impacts, particularly with respect to groundwater contamination and the effectiveness of groundwater restoration techniques, have been recognized. Testing and data collection in a research and development project is proposed by the applicant to eliminate the uncertainties. The scope of the proposed project is sufficiently limited in size to enable continued development of solution mining technology without significant environmental risk.

The position of the Nuclear Regulatory Commission is that, after weighing the environmental, economic, technical, and other benefits of the Uranium Resources North Platte Project against negative environmental considerations, and considering available alternatives, the action called for under the National Environmental Policy Act of 1969 (NEPA) and 10 CFR Part 51 is the issuance of a Source Material and Byproduct Material License to the applicant, subject to License Conditions No. 6(1) through (21) above.

ENVIRONMENTAL IMPACT APPRAISAL FOR URANIUM RESOURCES INCORPORATED NORTH PLATTE PROJECT

1. INTRODUCTION

1.1 Background

Uranium Resources Incorporated (URI) applied to the U.S. Nuclear Regulatory Commission (NRC) for an NRC Source Material and Byproduct Material License to construct and operate an in situ leach uranium extraction and recovery facility in Converse County, Wyoming. The project, known as "North Platte" Project, is a research and development (R&D) project designed to develop the environmental parameters and operating characteristics expected for a full-scale operation.

The North Platte R&D Project Site consists of about one (1) acre located approximately 14 air miles (22.5 km) northwest of Douglas and 15 air miles (24 km) northeast of Glenrock, (Figure 1.1.01). The project site is in Section 15, T34N, R73W.

The applicant proposes to extract in situ, uranium contained in an aquifer designated as the "2" sand zone of the top of the Fort Union Formation (geologic formation) at a depth of about 575 feet. Sodium carbonate-sodium bicarbonate solution and an oxidizing agent would be injected into the uraniferous unit of the Fort Union Formation and recovered through a single five-spot well pattern during the extraction process. The well pattern would consist of four injection wells surrounding a central production well. The anticipated production flow rate will be up to 100 gallons per minute (gpm).

The applicant proposes to restore the groundwater system to its premining condition and use (or potential use) after mining is completed. This is to be accomplished by recycling mine formation water back into the formation after ion exchange treatment until satisfactory water quality has been reached.

1.2 Proposed Action

By letter to the NRC dated March 31, 1981, Uranium Resources Incorporated requested a license to receive, possess, use, and transfer source material and byproduct material in the course of research and development work associated with in situ extraction of uranium at their North Platte Project Site in Converse County, Wyoming.

The purpose of this proposal is to determine if the ore at North Platte Project Site can be extracted in an environmentally sound way that is economical.

This impact appraisal discusses the environmental aspects of the proposed application. The proposed action is to grant a license to Uranium Resources Incorporated.

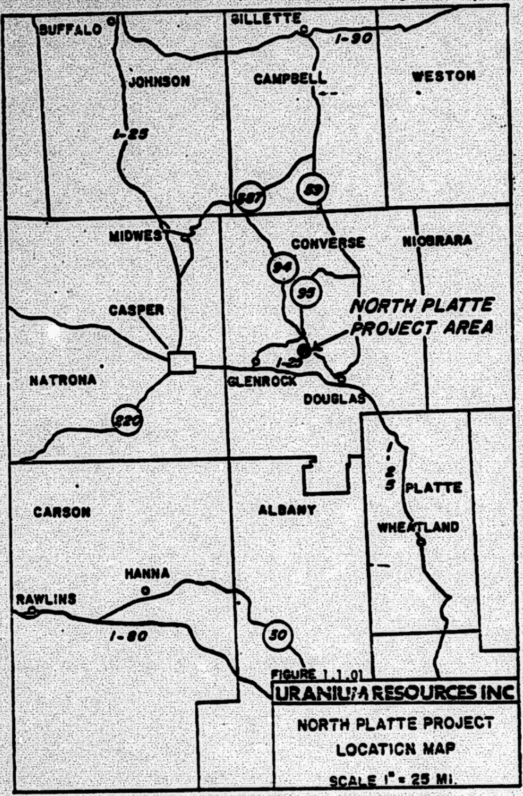


FIGURE 1.1.01

URANIUM RESOURCES INC

NORTH PLATTE PROJECT
LOCATION MAP

SCALE 1" = 25 MI.

1.3 Review Scope

1.3.1 Federal and State Authorities

Under 10 CFR Part 40, an NRC license is required in order to "...receive, possess, use, transfer...any source material..." (that is, uranium and/or thorium in any form, or ores containing 0.05% or more by weight of those substances). In addition, the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) requires persons who conduct uranium source material operations to obtain a byproduct material license to own, use, or possess tailings generated by the operation (including above-ground wastes from in situ operations). Under 10 CFR Part 51, this environmental appraisal has been prepared. Because the subject application is not regarded as a major federal action that could significantly affect the quality of the human environment, an environmental impact statement will not be prepared.

The State of Wyoming Department of Environmental Quality (WDEQ) administers the state's Environmental Quality Act of 1973 and implementing rules and regulations. Uranium Resources Incorporated has applied for a license from the WDEQ to operate the proposed facility.

1.3.2 Basis of NRC Review

An environmental impact appraisal for the licensing has been performed by the Division of Waste Management, Uranium Recovery Licensing Branch (WMUR) of the NRC. This report documents that appraisal. The staff has performed the appraisal of environmental and safety considerations associated with the proposed license in accordance with Title 10, Code of Federal Regulations Part 51, Licensing and Regulatory Policy and Procedures for Environmental Protection.

In conducting this appraisal, the staff considered the following:

- Environmental information and supplements submitted by the applicant to the NRC in March 1981, July 1981, August 1981, and October 1981 to support the application for a license;
- Information supplied in discussion by the State of Wyoming, Department of Environmental Quality, Land Quality Division relating to state licensing actions; and
- Site visit by NRC staff on April 7, 1981.

2. SITE DESCRIPTION

2.1 Location and Land Use

The proposed R&D license area is located in the South Powder River Basin, Wyoming, approximately 15 air miles (24 km) northeast of the town of Glenrock and 14 air miles (22.5 km) northwest of Douglas. Figure 1.1.01 shows the site location.

The lands contained within the license area were historically used for cattle and wildlife grazing. The land is leased by Uranium Resources Incorporated from a private owner. Most major land ownership in the area remains in the hands of ranching families. However, leasing has taken place allowing for expanding development of the area's resources.

The area receives a minimal amount of precipitation most of which occurs as flash thunderstorms. Subsequent rapid runoff has resulted in a sparse vegetation cover and dissected topography as a result of intermittent stream flow. The resulting land is useful for low density grazing of cattle and sheep. There are no cultivated lands within or immediately adjacent to the permit area. Figure 2.1.01 shows the regional topography.

During recent years, the discovery of uranium has introduced an additional use to the area. This change has resulted in the dual use of the land for grazing and uranium mining.

Use of land in and adjacent to the permit area by native wildlife is a natural occurrence. Larger game animals such as deer and antelope would be expected to pass through the area. Small game species exist in and adjacent to the permit area but are not abundant due to the lack of ground cover. A fence will be constructed to keep larger animals out.

2.2 Geology and Hydrogeology of the Ore Body

2.2.1 Hydrogeologic Setting

The project area is on the southwest flank of the Powder River Basin, near the axis of the basin. The Powder River Basin is a north-south aligned asymmetric syncline. At the eastern and western boundaries of the permit area, the strata dip generally toward the axis some 2° to 5° to the west and east, respectively. Near the outcrop of the Wasatch-Fort Union formational contact, the strata dip locally as much as 20°.

The license area is located on a topographic high. There is no surface water on the site. The nearest geologic structure is the Powder River Basin synclinal axis. No major faults or folds have been detected in the site area. Figure 2.2.02 illustrates the stratigraphy at the project area and Table 2.2.01 shows the hydrogeologic units in the vicinity of the proposed site.

The geology of the permit area consists of both Wasatch Formation of early Eocene age and the Fort Union Formation of Paleocene age. The Wasatch Formation consists of 500-600 ft. of interbedded claystones, sandy siltstones, and relatively clean sandstones.

The Fort Union unconformably underlies the Wasatch Formation. It is composed of interbedded semiconsolidated fine-to-coarse-grained sandstone, siltstone, claystone, lignite, and coal. The host sandstones for the North Platte Project deposits are in the upper Fort Union Formation.

TABLE 2.2.02 SUMMARY OF AQUIFER PROPERTIES IN THE 2 SAND PRODUCTION ZONE

WELL NO.	AQUIFER THICKNESS (ft)	LOG-LOG (Theis)				SEMI-LOG (Straight Line)				RECOVERY		
		T	K		S	T	K		S	T	K	
		(gpd/ft)	(ft/day)	(Darcy)		(gpd/ft)	(ft/day)	(Darcy)		(gpd/ft)	(ft/day)	(Darcy)
P-1	30	-	-	-	-	350	1.6	0.64		430	1.9	0.79
MW-1	8	410	2.0		$5.0x10^{-5}$	500	2.4	0.90	$3.4x10^{-5}$	410	2.0	0.80
MW-2	23	440	2.6	1.0	$9.9x10^{-5}$	500	2.9	1.2	$9.1x10^{-5}$	390	2.3	0.93
MW-3	32	460	1.9	0.79	$1.2x10^{-4}$	470	2.0	0.81	$1.5x10^{-4}$	410	1.7	0.70
MW-4	33	430	1.7	0.71	$7.9x10^{-5}$	500	2.0	0.83	$5.5x10^{-5}$	410	1.7	0.68
MW-5	39	430	1.5	0.60	$4.8x10^{-5}$	470	1.6	0.66	$3.6x10^{-5}$	430	1.5	0.60
MW-6	27	430	2.1	0.87	$4.8x10^{-5}$	430	2.1	0.87	$3.1x10^{-5}$	340	1.7	0.69
I-1	20	430	2.9	1.2	$4.8x10^{-5}$	520	3.5	1.4	$1.2x10^{-5}$	330	2.2	0.90
I-2	22	410	2.5	1.0	$1.3x10^{-5}$	490	3.0	1.2	$2.8x10^{-6}$	400	2.4	1.0
I-3	20	430	2.9	1.2	$5.3x10^{-5}$	530	3.5	1.5	$1.5x10^{-5}$	430	2.9	1.2
I-4	18	410	3.0	1.2	$1.0x10^{-5}$	500	3.7	1.5	$1.8x10^{-6}$	300	2.0	1.2

drawdown, and recovery analyses for this test. The average transmissivity using the Theis nonequilibrium technique is calculated to be 430 gal/day/ft. Average values of 490 and 400 gal/day/ft were obtained from the semi-log drawdown and recovery plots respectively.

Storage coefficients for the production aquifer (as calculated from log-log analyses) varied from 1.0×10^{-5} to 1.2×10^{-4}. The range of storage coefficients from the semi-log (straight line) analyses varied over a larger range (1.8×10^{-6} to 1.5×10^{-4}). A storage coefficient of 5×10^{-5} is thought to be representative of the "2" sand aquifer system in this area.

URI applied the Theis nonequilibrium technique and the Jacob modified nonequilibrium technique to determine the transmissivity and storativity values for the "2 ab" sand. The log-log plots of drawdown versus time for observation wells MW-1 through MW-6 match the Theis type curve fairly well. However, the early drawdown data for observation wells I-1 through I-4 do not plot on the Theis-type curve. URI attributes the deviation to well bore storage effects. Well bore storage is generally the cause of deviations from the predicted Theis response for early time periods. Nevertheless, it remains a possibility that deviations from the predicted Theis response that occur in the drawdown data may be an indication of potential leakage, but the well bore storage effects are believed to be the predominant factor.

The semi-log plots of drawdown versus time for wells MW-1 through MW-6 and I-1 through I-4 show the effects of a negative boundary after approximately 1000 minutes of pumping. As indicated by URI, these deviations may be due to barrier boundaries. Table 2.2.02 indicates that the thickness of the "2 ab" sand ranges from 8 feet to 39 feet, which could result in similiar changes because deviations from the predicted response may be due to changing transmissivities which correspond to changing thicknesses. In a likewise manner, changes in transmissivity may simulate the effects of leakage in the data plots.

A complete characterization of the multiple aquifer-aquiclude system at the test site is not possible based on the type of pump test conducted by URI. To fully define and quantify the vertical hydraulic conductivity (leakage potential) of the confining beds would require a more elaborate testing program which would include monitor wells completed in the confining beds themselves. Although the pump test analysis conducted by URI cannot adequately quantify leakage, it can indicate a potential for significant leakage (deviations of the field curves from the Theis-type curve, usually at later times during the test). The field data, as plotted by URI, do not show any significant deviations from the Theis-type curve (type curve represents a nonleaky condition) which would indicate a significant potential for leakage. Those deivations from the Theis-type curve during early times were explained previously in this section.

Although use of the Theis equation to predict drawdowns during the operational phase of this project could lead to overestimating the predicted drawdowns in response to pumping and/or underestimating water level rises in response to injection if significant leakage was occurring at the site, the results of the pump test would have given this indication. However, the results do not indicate potential leakage of a significance to warrant a more comprehensive pump testing program. This is particularly true considering the size, scope, and duration of the proposed project.

Overestimating the drawdown resulting from pumping of well P-1 while injecting lixiviants into four injection wells could lead to the development of energy gradients away from the injection wells. This could result in the migration of lixiviants beyond the influence (cone of depression) of the pumping well P-1. For this reason, a ring of monitoring wells is essential to the project.

2.2.3 Confinement of the Ore Zone

The hydraulic integrity of the clay aquitards is the controlling factor over leakage from the producton "2 abc" sand. The "1" and "3" clay aquitards which separate the "2" sand from underlying and overlying aquifers appear to be geologically sound aquitards, in terms of vertical thickness and lateral continuity. This conclusion is based on cuttings sample logs, the regional geology, and the geophysical logs. In addition, exploration holes within the zone of pumping influence have been cemented from bottom to top and should not adversely affect the hydraulic integrity of the aquitards by creating artificial pathways for the movement of contaminants.

The NRC staff expects that no major leakage through the confining beds will occur. No potential for significant leakage has been indicated by the pump test drawdown results. In addition, the well field will be operated in such a way that net withdrawals shall exceed net injection quantities (producing a potentiometric depression in the ore zone in the well field).

The NRC staff concludes that it is possible to conduct this R&D project without significant environmental risks. This is based on the small size and short duration of the project, the geophysical and cuttings logs, and the required programs for defining and correcting excursions for groundwater restoration, for water-level monitoring, and for water quality monitoring.

3. PROCESS DESCRIPTION

3.1 In Situ Leaching Process

In situ leaching of uranium is a recent addition to the list of conventional mining methods currently used to extract uranium in Wyoming. Basically, in situ leaching involves (1) the injection of a leach solution (lixiviant) into a uranium-bearing ore body to complex the contained uranium, (2) mobilization of the uranium complex formed, and (3) surface recovery of the solution bearing the uranium complex via production wells. Uranium is then separated from the leach solution by conventional milling unit methods (ion exchange).

There can be many environmental advantages to in situ leaching of uranium. While the conventional extraction of minerals produces significant impact on the environment, if hydrogeologic conditions are favorable, the impacts of solution mining are much less. The greatest impact of in situ extraction is to ore zone groundwater quality which, in most instances, can be restored to near baseline quality or the premining quality use or potential use category. Compared with the conventional uranium mining and milling operations, in situ leaching will also permit economical recovery of deep, lower-grade uranium deposits, thereby enhancing the nation's uranium reserves. The extent to which in situ mining can be conducted is limited in that the ore zone conditions must be suitable for containing and controlling leach solutions during the mining process (conditions described in Section 3.2).

3.2 The Ore Body

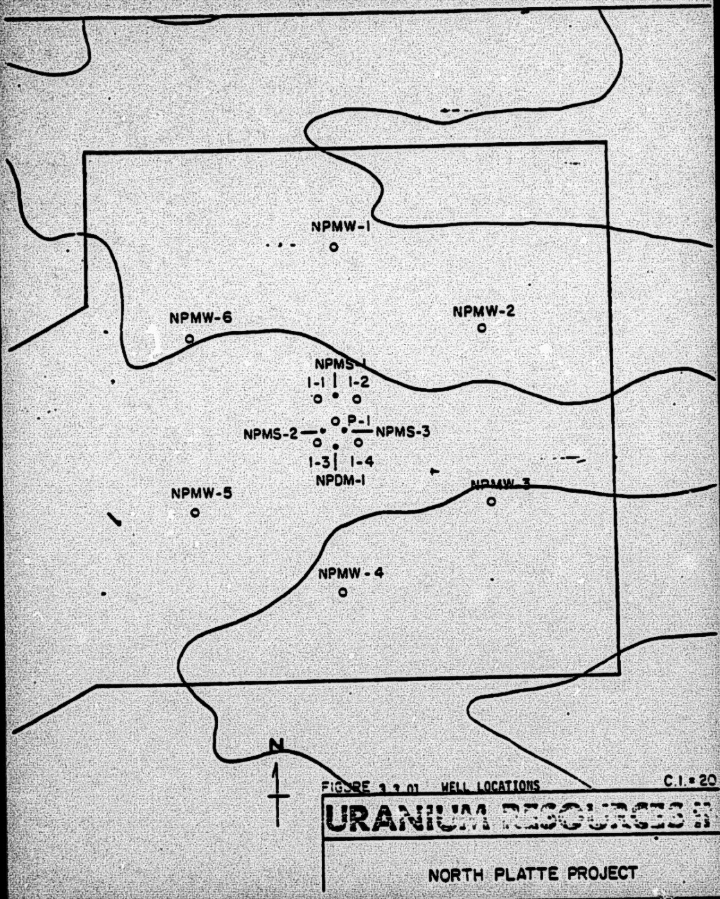
At the North Platte Project Site, the ore sandstone contains roll-type uranium deposits which are generally associated with fluvial sandstones and conglomerates. The mineral in the ore is concentrated by a uranium rich, oxidized groundwater moving down the hydrologic gradient into a reducing environment in a host sand. Uranium is precipitated along the interface of the oxidized groundwater and groundwater in the reduced environment. The interface is referred to as the oxidizing front. The physical shape of an ore roll (ore zone) is dependent on the local permeability of the matrix material and its continuity and distribution in the geologic unit. Such ore bodies are prevalent in most of the established uranium mining districts in the western United States. In situ leaching, however, can be conducted only on those ore deposits that meet certain criteria. These generally include: (1) the ore deposit must be located in a saturated zone, (2) the ore deposit must be confined both above and below by confining layers of low permeability, (3) the ore deposit must have adequate permeability, and (4) the ore deposit must be amenable to chemical leaching.

The ore of the "2" sand zone at the North Platte Project Site appears to have been deposited as described above and is believed to have the characteristics necessary to allow in situ leaching of uranium. Borings taken at the site show the ore zone to be saturated. The aquifer pumping test conducted in 1981 indicates that the ore zone permeability is adequate and that the deposit is amenable to chemical leaching. As discussed in Section 2.2.3, the ore zone is believed to be confined and leakage should not be significant at the site. The capacity of the aquitards to confine lixiviant movement to the ore zone will be verified during the R&D testing, as described in Section 5.1.2.

3.3 Well Field and Recovery Plant Design and Operation

The R&D well field at the North Platte Project Site includes 4 leaching wells, one production well, and 10 monitor wells, near and in the well field, (Figure 3.3.01). The leaching wells in this initial program were drilled to a depth of around 550-585 ft. on a conventional five-spot pattern with a spacing of approximately 50 feet between the injection wells. The production well is in the center and is 50 ft. from each injection well (see Figure 3.3.01). Six perimeter monitor wells were completed in the "2" sand around the test site. Monitor wells were completed in each of the aquifers above ("3" sand) and below ("1" sand) the "2" sand within the injection well pattern area, and one has been completed in the upper ("4" sand) aquifer.

The injected fluid will be a sodium carbonate-sodium bicarbonate leach solution with hydrogen peroxide and/or oxygen added.


NPMW-1
NPMW-2
NPMW-6
NPMS-1
1-1
1-2
P-1
NPMS-2
NPMS-3
1-3
1-4
NPDM-1
NPMW-5
NPMW-3
NPMW-4
N
FIGURE 3.3.01 WELL LOCATIONS
C.I.=20
URANIUM RESOURCES
NORTH PLATTE PROJECT

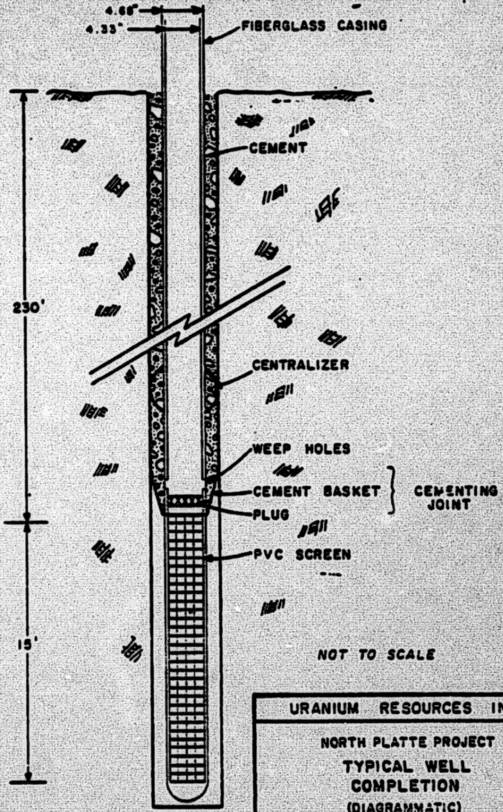
All wells will be drilled to the specified depth, cased with fiberglass, and cemented with a sufficient volume of cement to isolate the completion interval from all other aquifers. Typical well completions are illustrated in Figure 3.3.02. Data on well elevations, depths, and completion intervals for wells drilled in the test area are listed in Table 3.3.01. A small header building will be installed near the well field to house the individual well metering and control facilities to protect them from the weather. The individual flow lines will be buried and the well heads will be covered with insulated boxes to prevent freezing in the winter months. The produced fluid will be pumped from the well field through pipelines to the uranium recovery facility. At the recovery plant, the uranium will be removed by solid resin ion exchange and chemicals will be added to the barren fluid to return it to the desired concentration to be reinjected in the leach zone to recover additional uranium. The production and injection rates will be metered and controlled to ensure that the groundwater flow in the area is toward the leach test area. A system bleed of .03 to 5 gpm is expected to be sufficient to provide the necessary control.

The restoration of the groundwater in the mining zone after completion of the chemical mining phase will in itself be an R&D effort to determine the most effective way to accomplish the restoration. Restoration technology is currently in the development stage and one or more combinations of existing methods will be utilized to reduce the concentration of any contaminants remaining in the groundwater to acceptable levels.

Before leach solution injection commences, each injection well will be field-tested to demonstrate mechanical integrity of the well casing, which will be fiberglass. The testing will be done according to the licensee's March 31, 1981 submittal (p. C-30) except that the time the test is run will be modified by license condition. URI proposed to run the test for one hour and they consider a pressure loss of less than 10% or 10 psi over the test period to demonstrate the competency of the casing. The allowances proposed by URI are due to the possibility of seepage through the packer.

This test has been slightly modified by mutual agreement to a 10-minute test with an allowable pressure loss of less than 2-3%. The reason for a short test is to help ensure that the results are accurate. If pressure loss is due to leakage around the packer, quickly identifying this and resetting or moving the packer slightly often seals such leakage and can eliminate packer leakage as a cause for pressure loss. NRC will consider the test to be passed if the test meets the pressure loss allowance listed above.

The NRC will be provided with a report, prior to lixiviant injection, that describes all mechanical integrity tests and their results after testing is complete. Any wells which fail the test will be repaired or plugged. In addition, NRC will be notified when all of the wells which initially failed the tests have been repaired or plugged.



URANIUM RESOURCES INC.

NORTH PLATTE PROJECT

TYPICAL WELL COMPLETION (DIAGRAMMATIC)

FIGURE 3.3.02

TABLE 3.3.01

SUMMARY OF AQUIFER
INTERVALS THAT ARE SCREENED
IN THE PRODUCTION, INJECTION, AND
MONITORING WELLS

WELL#	SCREEN INTERVAL (MSL)	FT. OPEN	AQUIFER SCREENED
P-1	4660.25-4630.25	30	2 ab
I-1	4660.62-4630.62	30	2 ab
I-2	4659.14-4629.14	30	2 ab
I-3	4665.78-4637.78	30	2 ab
I-4	4662.32-4632.32	30	2 ab
NPMW-1	4645.94-4605.94	40	2 ab
NPMW-2	4666.69-4626.69	40	2 abc
NPMW-3	4667.23-4627.23	40	2 abc
NPMW-4	4675.21-4635.21	40	2 ab
NPMW-5	4670.68-4630.68	40	2 ab
NPMW-6	4666.14-4626.14	40	2 ab
NPMS-1	4690-4680	10	2c
NPMS-2	5035.89-4960.89	25	3
NPMS-3	5113.83-5083.83	30	4
NPDM-1	4599.70-4584.70	15	1

3.4 Lixiviant Chemistry

Dissolution of the uranium ore from the sand grain host of the two subsurface ore zones will be accomplished by employing either dissolved oxygen (O_2) or hydrogen peroxide (H_2O_2) as the oxidizing agent in a solution of formation water and sodium carbonate-bicarbonate (Na_2CO_3 - $NaHCO_3$) leachant solution (lixiviant). The sodium carbonate-bicarbonate will be introduced into circulating water from the ore zone aquifer along with a measured amount of oxidant and pumped back into the ore zone. The anticipated production flow rate from the well field will not exceed 100 gpm. Table 3.4.01 shows the composition and the expected high and low ranges for the lixiviant concentrations.

The lixiviant used by URI will be sodium carbonate sodium-bicarbonate. In the event that recovery inefficiency warrants a change in the basic lixiviant character during the R&D operation, prior application to and approval by the NRC in the form of a license amendment for such a variation will be required.

3.5 Uranium Recovery Process

The uranium, solubilized and recovered as a carbonate-complex will be produced from the well field pattern and will be directed, at a flow rate less than 100 gpm, to ion exchange columns housed in a recovery plant. There the extracted uranium will be absorbed by the ion exchange medium and eluated with a sodium chloride (NaCl) - sodium carbonate (Na_2CO_3) solution. The resulting uranium rich eluant will be acidified with hydrochloric acid (HCl) to release the uranyl ions (UO_2^{++}) to the solution. Uranium will then be precipitated with hydrogen peroxide (H_2O_2) in the form $UO_4 \cdot nH_2O$. The precipitate will be thickened, forming a yellowcake slurry which will be transported as a wet product to a uranium processing plant. All yellowcake shipments will be made in compliance with applicable regulations. A block flow schematic for the recovery plant is shown in Figure 3.5.01. The barren effluent from the absorption column will be reconstituted with sodium carbonate sodium-bicarbonate and oxidant and reinjected to the ore zone at the well field. Composition of the waste stream and flow rates from various operation steps to the evaporation ponds are given in Table 3.5.01.

Uranium Resources Incorporated shall be allowed to operate the plant capacity to 100 gpm. However, prior approval from the NRC is required before any recovery process rate greater than 100 gpm is used.

3.6 Description of Process Plant, Ponds, and Wastes

3.6.1 The Process Plant

The solution processing equipment, laboratory, showers, restrooms, and office space will be located as shown in Figure 3.6.01.

3.6.2 Solar Evaporation Ponds

Two identical evaporation ponds, each 100 feet by 100 feet in size, will be constructed adjacent to the plant area for temporary disposal of liquid wastes

TABLE 3.4.01

LIXIVIANT COMPOSITION AND CONCENTRATION

CHEMICAL SPECIES	RANGE LOW*	RANGE HIGH*
Ca	11	650
Mg	3.6	500
Na	348	4500
K	8.7	250
CO_3	1	200
HCO_3	172	5000
SO_4	46	4000
Cl	382	5000
NO_3-N	.02	5.0
SiO_2	9	100
TDS	1020	12000
pH	6	10
Mo	0.01	600
U	0.001	50

* All values in mg/l except for pH.

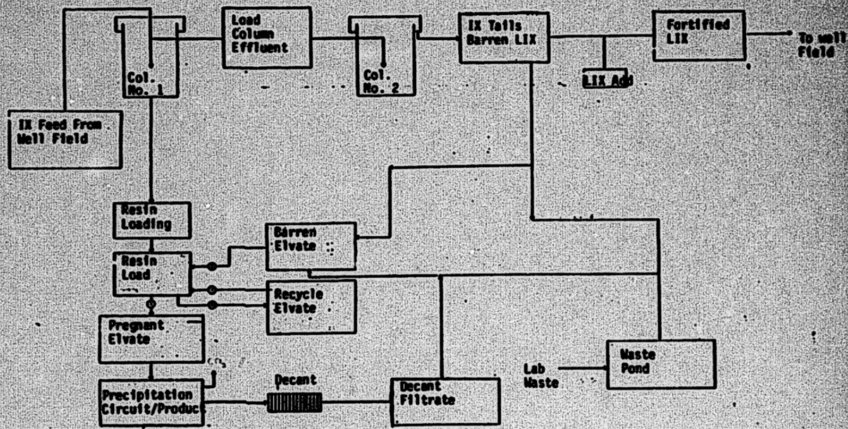


FIGURE 3.5.01

BLOCK FLOW SCHEMATIC FOR THE RECOVERY PLANT

TABLE 3.5.01 PLANT WASTE STREAMS

	LIXIVIANT BLEED	RESIN WASH	LAB	ELUANT BLEED
Location [1]	A	B	C	
Volume [2]				
Min.	360	100	20	300
Expected	720	175	100	500
Max.	1440	200	144	600
Disposition [3]	WP	WP	WP	WP
Concentrations [4]				
Ca	475	475	500	400
Mg	400	400	400	400
Na	4,500	4,500	20,000	40,000
K	250	250	20,000	150
CO_3	400	800	100,000	2,000
HCO_3	5,000	5,000	100,000	2,000
SO_4	3,000	3,000	100,000	2,000
Cl	2,500	2,500	100,000	90,000
NO_3N	5.0	5.0	100,000	400
Fl	50	50	500	50
TDS			100,000	90,000
pH	6-9.5	6-9.5	<1-14	3.0-9.5
U	50	50	100	50
V	10	10	100	30
Mo	300	300	100	4,000
As	15	15	100	100

Notes:

2. All values in gallons per day
3. WP - waste pond
4. All values in mg/l except for pH; all are maximum except for pH where range is given.

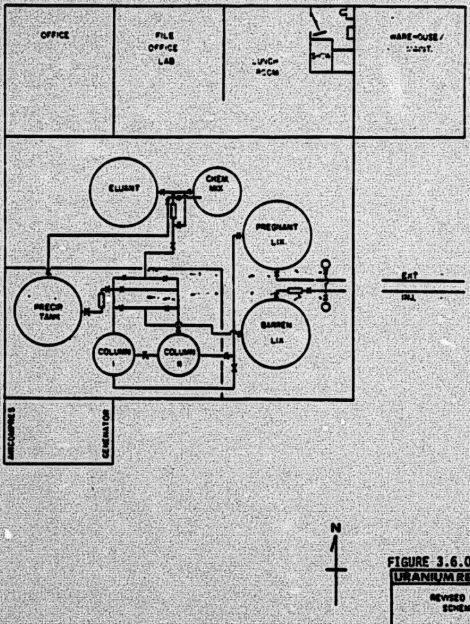


FIGURE 3.6.01

URANIUM RESOURCES I

REVISED PLANT SCHEMATIC

from the processing. The normal operating capacity of each pond will be approximately 202,000 gallons, allowing for three feet of freeboard. NRC calculations show that only two ft. of freeboard are needed. The ponds will be partially excavated below existing grade, with an average excavation of from 5 to 6 feet in depth, and partially constructed above grade, with approximately 4 to 5 feet of compacted fill required to achieve the embankment crest elevations. The embankments, constructed of material excavated from the pond interior, will have a crest width of approximately 6 feet, a 3 horizontal to 1 vertical interior slope (upstream slope) and a 4 horizontal to 1 vertical exterior slope (downstream slope). The depth from the embankment crest to the pond bottom will be 10 feet.

Each pond will be constructed with a synthetic liner of 36 mil impervious reinforced Hypalon. The liners will be underlain by an underdrain leak detection system consisting of 1-inch diameter perforated PVC collector pipes placed in shallow trenches cut into the subgrade. A bedding layer of coarse-grained sand will then be placed in the trenches and in a 6-inch thick layer directly beneath the pond liner. The collector pipes lead to inspection tubes, one for each pond, thereby providing two independent leak detection systems.

URI's submittals did not propose a sampling program for leak detection indicators. NRC is requiring a program that is in accordance with other similar R&D projects. Discharges to the pond will be sampled quarterly for calcium, chloride, alkalinity, sodium, TDS, radium-226, sulfate, uranium, selenium, and arsenic. The leak detection system standpipes will be checked daily to ensure the pond liner is not leaking. Any fluid detected in the standpipes will be analyzed initially for chloride and conductivity to determine if the pond is leaking. If these concentrations exceed Wyoming drinking water standards, the water will be analyzed for all ten (10) indicators at least every seven (7) days during the leak period and for at least two weeks following repair, if any residual liquid remains in the standpipes. The results of all standpipe analysis will be included in the required quarterly report.

Uranium Resources Incorporated will take corrective action in the case of a leak, such as transferring the liquid waste to another pond and repairing the leak. Uranium Resources Incorporated will always maintain sufficient freeboard to allow for pumping the contents of one pond into the other in the event of a major leak.

3.6.3 The Wastes

Liquid waste generation is expected to be minimal and disposal of such wastes will consist of storage in lined ponds with subsequent evaporation.

Plant waste streams during mining operations are identified on Figure 3.5.01. Their volume source and disposition are given in Table 3.5.01.

Assuming that 10 pore volumes of 135,000 gallons each must be evacuated to obtain restoration limits, a total 1,350,000 gallons must be circulated through the ion exchange circuit. By concentrating the ionic species on the resin and circulating the barren stream back into the formation, the solution going to the waste ponds as a result of the elution process will total approximately 165,000 gallons. The volume containment for each pond, allowing for 3 ft. of freeboard in the 100' 100' x 10' deep ponds with 3 to 1 slopes, is approximately 200,000 gallons. Therefore, it is expected that adequate capacity will be available for the complete restoration within either pond.

Upon completion of restoration, the solids remaining in the evaporation ponds and the synthetic liner will be disposed of in a licensed mill tailings disposal facility as per URI's submittals.

3.7 Groundwater Restoration, Reclamation, and Decommissioning

3.7.1 Groundwater Restoration

Restoration is defined as the returning of affected groundwater to its baseline condition or to a condition consistent with its premining use (or potential use) upon completion of leaching activities. Restoration is intended to reduce the concentration of toxic contaminants remaining in the groundwater to acceptable levels.

Uranium Resources Incorporated is proposing a rather innovative restoration method. This method will utilize nonselective anion-cation exchange resins in the existing pilot plant to remove contaminants from the water in the production zone. This water will be pumped back into the ground and the process continued for 3 to 6 pore volumes or until the groundwater is at a quality equivalent to its premining state. Each pore volume consists of approximately 135,000 gallons. Two potential problems may exist with this particular restoration technique which need to be addressed during the pilot operation.

The eluate solutions which are used in the anion and cation exchange columns are not compatible in that one is acid and one alkaline. Therefore, after the anion exchange resin is eluted it must be completely washed of residual caustic to prevent contamination of the cation exchange resin during the IX process. Although washing in itself is not a technical problem, the volume of washwater must be minimized because it is an additional volume of liquid which must be evaporated. Tests will be performed to determine the minimum resin washing required to satisfactorily remove caustic from the resin.

A second problem which was encountered during laboratory restoration studies was that the value for U_3O_8 was not restored to premining baseline after four pore volume sweeps. This would be expected because the formation, which was reduced at the onset of mining, remains in the oxidized state. In attempting to reestablish the aquifer to its reduced state, minute concentrations of a reducing gas (H_2S) will be added to the final pore sweep. It is expected that this will cause the uranium to drop out of solution and the water quality will reach background with respect to uranium. The most suitable concentration of reducing gas will be addressed during the R&D operation.

The ion exchange approach for restoration was selected over reverse osmosis technology because of the large kilowatt demand to run the reverse osmosis equipment. However, if for any reason the ion exchange technology does not meet URI's expectations, a reverse osmosis unit will be used to clean the water. Figures 3.7.01 and 3.7.02 show the restoration flow paths for each of these two methods.

The restoration criteria for the groundwater will be based on water quality sampling and testing criteria that are established for the production injection well field on a groundwater quality indicator by indicator basis for all indicators listed in Table 5.1.01 of the EIA. All indicators are to be returned to as close to baseline as is reasonably achievable.

Uranium Resources Incorporated has proposed that the high data value for each chemical indicator throughout the whole field plus three (3) standard deviations be used as restoration criteria. The NRC staff finds this criteria to result in unacceptably high values such that the water quality would be allowed to deteriorate too far beyond its premining condition. In addition, to simply use the high value does not reflect the true variability shown by the baseline data. Therefore, URI will be required to submit restoration criteria which more accurately reflect the existing baseline water quality, in the form of a license amendment prior to initiation of restoration.

Restoration goals for monitoring wells that were ever considered to be on excursion status will be submitted by URI prior to restoration and each monitor well will be considered separately. Any monitor wells ever considered to be on excursion status will be restored on an individual basis for each groundwater indicator listed in Table 5.1.01 of the EIA.

Restoration will begin within sixty (60) days after leaching operations are completed. Restoration efforts will continue until the NRC finds that all groundwater quality indicators meet the restoration water quality criteria.

3.7.2 Reclamation and Decommissioning

At the completion of all leaching and restoration activities, Uranium Resources Incorporated will decommission the recovery facilities and reclaim all land affected by leach operations.

According to URI's proposals, at the termination of the operation, all structures such as tanks, buildings, and foundations will be removed, and all remaining disturbed areas will be reclaimed in accordance with the regulations of the Wyoming Department of Environmental Quality. All wells will be plugged with

URANIUM RESOURCES INC
RESTORATION FLOW SHEET
ION EXCHANGE METHOD

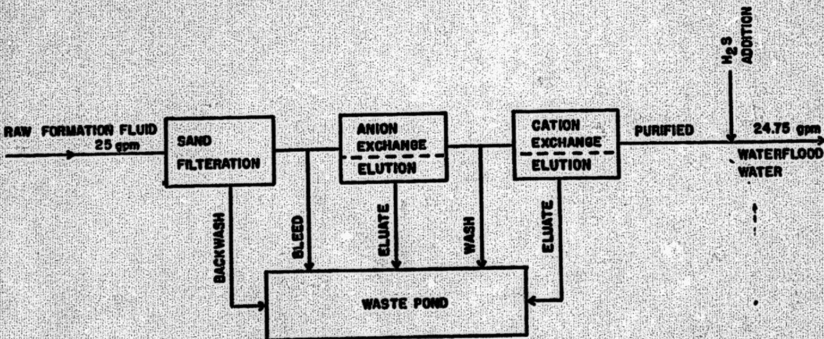


FIGURE 3.7.01

URANIUM RESOURCES INC
RESTORATION FLOW SHEET
REVERSE OSMOSIS METHOD

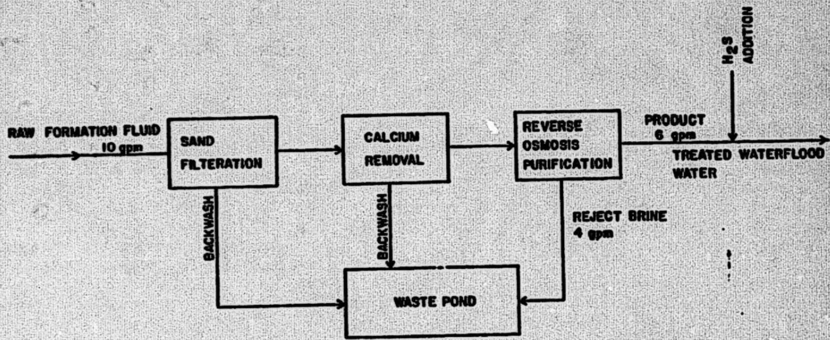


FIGURE 3.7.02

cement and/or other approved material and the casing will be cutoff three feet below the surface. Any solids remaining in the evaporation pond will be removed and disposed of in a licensed mill tailings pond. The evaporation pond sites will be leveled and contoured to blend with the natural terrain, covered with topsoil, and revegetated. If it is decided to expand the pilot operation into a commercial-scale operation, the reclamation would be deferred and completed as per the approved plan for the commercial-scale operation. A bond for the total amount of the estimated reclamation costs will be posted with the Wyoming Department of Environmental Quality, Land Quality Division, to ensure funds are available for the reclamation program.

Uranium Resources Incorporated will be required to submit a detailed decontamination and decommissioning plan for the well field and process facility sites at least ninety (90) days prior to decommissioning. These plans will include schedules, radiation survey details, and details on the final disposition of the contaminated waste and equipment.

4. EVALUATION OF ENVIRONMENTAL IMPACTS

4.1 Introduction

In situ leaching of uranium is a relatively new and developing technology. Major human health and environmental concerns with this technique of mining are the potential impacts of mining on groundwater quality, the impacts of evaporation pond leakage, if it were to occur, radiological impacts, and disposal of wastes.

4.2 Groundwater Impacts

4.2.1 Excursions

Excursions of contaminated groundwater in a well field can be due to improper balances between injection/extraction rates, undetected high permeability strata or geological faults, improperly abandoned exploration drill holes, discontinuity and unsuitability of the confining units to prevent movement of lixiviant out of the ore zone, cracked well casings and faulty well construction, and hydrofracturing of the ore zone or surrounding units. Based on the information previously discussed and operational controls to be implemented, none of the above are expected to be a problem. Past experience from other R&D leaching projects and commercial scale in situ leach projects indicates that if proper steps are taken in monitoring and operating the well field, excursions, if they occur, can be controlled and damage to the environment prevented. Though past experience cannot always predict the future, there are two reasons to conclude that if excursions do occur at the URI's North Platte Project Site, they will be controlled and impact minimal.

(1) Compared to full-scale operations, the size of the well field and the expected quantity of contaminating fluid injected into the ore zone (both

variables relate to the potential to mitigate excursions) at an R&D operation are very small. Since in the past, excursions have been effectively controlled in large, full-scale operations by increasing the negative potentiometric pressure in the well field, it is expected that excursions, if they occur, can be controlled at URI's small R&D well field in the same manner.

(2) The monitoring program at the URI's North Platte Project wellfield, as described in Sections 5.1.1 and 5.1.2, monitors water quality in the ore zone and adjacent aquifers and will provide early detection of any lateral and vertical excursions.

4.2.2 Evaporation Pond Seepage and Spills

Accidental leaks from the evaporation ponds could, if uncontrolled, contaminate shallow aquifers and locally reduce groundwater quality. The proper installation of impermeable synthetic bottom liners in the solar evaporation ponds should eliminate such seepage. Furthermore, if a pond leak were to develop, the monitoring program described in Sections 3.6 and 5.1.3 should allow for early detection and repair of the leak, thereby minimizing the impacts and the quantity of leakage. The use of impermeable pond liners, quality control during liner installation, and the leak monitoring and repair program will minimize the impact of any pond leaks on groundwater quality.

4.2.3 Restoration of Groundwater

Groundwater restoration will include groundwater treatment using ion exchange resins to remove contaminants from ore zone water with subsequent reinjection of the treated groundwater and, if necessary, contaminated groundwater removal (i.e., groundwater sweep). Past experience has shown that restoration of groundwater to premining conditions is feasible. The staff believes that the proposed groundwater restoration plan, as described in Section 3.7.1, is suitable, and that the groundwater quality impacts of in situ operations at the North Platte Project Site will be minimal. The specific plan will be submitted to the NRC at least ninty (90) days prior to termination of mining activities, for NRC review and approval. This is included as a license condition.

4.3 Radiological Impacts

4.3.1 Introduction

Estimates of radiation doses from the operation and the steps taken by URI to minimize doses will be considered in this section. Individuals living in the area may be potentially exposed to minor amounts of airborne radionuclides and deposition of radioactive material on the land surface or in groundwater.

4.3.2 Offsite Impacts

The release of airborne radioactive particles to the atmosphere from this in situ operation are substantially lower than those occurring at a conventional uranium mining-milling operation, since only solutions are brought to the surface during mining and there is no drying of the product. Radon will be released from leach solutions and vented from the building to the atmosphere. Because these releases will be very small and there are no permanent residences or temporary residences within a 5-mile radius of the plant site, there are no significant radiological impacts expected offsite. More specifically, based on comparison of this project (size, location of residents) with other in situ cases where exposures and airborne concentrations of radioactivity have been calculated (that is, NUREG-0489), exposures should be well below allowable limits of 10 CFR Part 20 and 40 CFR Part 190.

Additionally, URI will conduct an environmental monitoring program that evaluates the concentrations of radionuclides in the environment that could lead to offsite exposures (see Section 5.2). The staff considers that the environmental monitoring program will be sufficient to evaluate the radiological impact of the in situ leach operations at the North Platte Project Site.

4.3.3 In-Plant Safety

URI will establish and conduct an in-plant radiation safety program. The staff is requiring a program that contains the basic elements required for, and found to be effective at, other source material extraction operations to assure that exposures are kept as low as is reasonably achievable (ALARA). The scope of the program has been geared to account for the small size of the proposed R&D project. In general, the program will include the following:

(1) airborne and surface contamination sampling and monitoring;

(2) personnel exposure monitoring;

(3) management of the safety program and training of personnel;

(4) written radiation protection procedures; and

(5) periodic audits by individuals meeting certain qualifications and frequent inspections to assure the program is being conducted in a manner consistent with the ALARA philosophy.

The staff considers the program of in-plant safety, as required by license conditions, sufficient to protect in-plant personnel by keeping radiation doses as low as is reasonably achievable. The staff evaluation of this program and the associated license conditions are contained in the Safety Evaluation Report issued in October 1981.

4.4 Waste Disposal

The NRC has taken the position in its regulations on uranium milling 10 CFR 40, Appendix A, Criterion 2, that the small volume of wastes generated at in situ operations should preferably be disposed of at existing tailings disposal sites or other licensed burial ground to avoid proliferation of waste sites. The staff will require, as proposed by URI, that the solid wastes generated at the North Platte Project Site described in Section 3.6.3 will be disposed of at an existing licensed tailings disposal site.

5. MONITORING

5.1 Groundwater

5.1.1 Water Quality Monitoring

The layout of all monitor wells is shown in Figure 2.2.05. Uranium Resources Incorporated has proposed that during extraction operations, a water sample from each monitor well will be collected once every two weeks and analyzed for conductivity, chloride, bicarbonate, calcium, and uranium. The wells used for production and injection will not be included in the operational phase of water quality monitoring.

Based on present and past experience the NRC has found that mobility of various ionic species is often inconsistent from site to site. Because it is difficult to predict the precise chemistry of the pregnant solution in advance, the NRC has attempted to establish an excursion indicator set reflecting the various cations, anions, and trace elements which are typically mobilized at a solution mining operation, while at the same time taking into consideration the proposed lixiviant chemistry and baseline quality at the specific site. The NRC shall require that the excursion indicator set include the following: chloride, conductivity, alkalinity, calcium, vanadium, sodium, and uranium. This differs from URI's proposal in that vanadium, a trace metal, and sodium, a primary constitutent in the lixiviant, have been added.

NRC has found it unnecessary to analyze water samples for all elements of the excursion indicator set on a biweekly basis as proposed by URI. Adequate excursion control can be maintained by monitoring two (2) lead indicators on a biweekly basis and other elements of the excursion set on a monthly basis. Therefore, the NRC shall require that during mining, all monitor wells will be sampled once every two (2) weeks and tested for chloride and conductivity, and once every month for alkalinity, calcium, chloride, vandium, sodium, conductivity, and uranium. Each monitor well shall be sampled and analyzed for the parameters listed in Table 5.1.01 of the EIA once during operations or at six months whichever comes first. All monitor wells will have water level measurements taken once every week with the exception of the two (NPMW-1 and NPMS-1) with continuous water level recorders. Results of all sampling will be reported and shown graphically, to illustrate trends, in a quarterly report to the NRC. The preinjection potentiometric levels are shown on Figure 5.1.01.

URI has proposed that the high data value plus three (3) standard deviations be used to determine the upper control limits (UCLs) for each chemical used as an excursion indicator. The NRC staff finds this criteria to result in

TABLE 5.1.01
LONG LIST OF GROUND WATER QUALITY INDICATORS TO BE SAMPLED

A. Trace and Minor Elements

Aluminum	Flouride	Radium 226
Arsenic	Iron	Selenium
Barium	Lead (Total and -210)	Uranium
Boron	Manganese	Vanadium
Cadmium	Mercury	Zinc
Chromium	Molybdenum	Silica
Cobalt	Nickel	Silver
Copper		

B. Common Constituents

Ammonia	Chloride	Potassium
Bicarbonate	Magnesium	Sodium
Calcium	Nitrate	Sulfate
Carbonate	Nitrite	

C. Physical Parameters

Specific Conductivity[1]	Gross Alpha[3]	Total Dissolved Solids[3]
Temperature[2]	Gross Beta[3]	
pH[1]	Appearance, color, odor[2]	

[1]Field and laboratory determination

[2]Field only

[3]Laboratory only

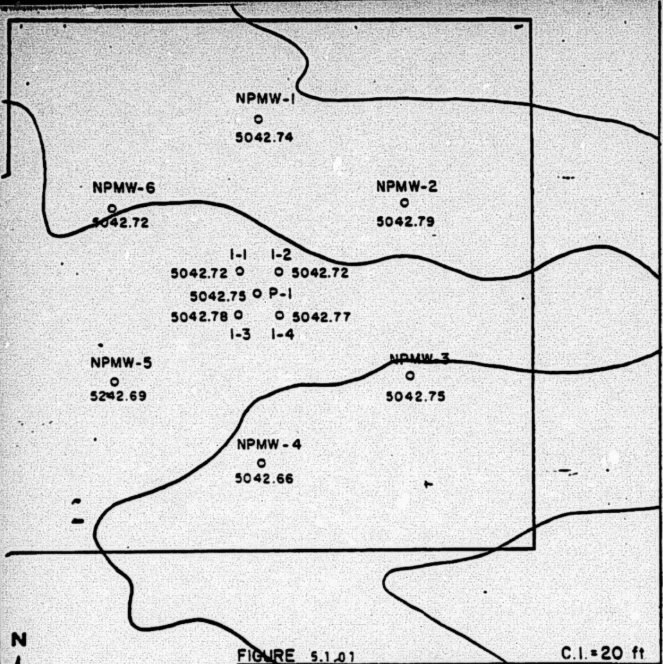


FIGURE 5.1.01

C.I. = 20 ft

URANIUM RESOURCES INC

5042.66 - WATER LEVEL (msl)	NORTH PLATTE PROJECT POTENTIOMETRIC SURFACE 8-12-80 SCALE 1" = 100'

unacceptably high values such that the water quality might be allowed to deteriorate continuously to an unacceptable degree with no preventative actions required. In addition, to simply use the high value does not reflect the true variability shown by the baseline data. Therefore, UCLs will be required to be submitted prior to lixiviant injection by license condition. The UCLs will be based on the mean for each individual monitor well for each of the excursion indicators listed above plus two (2) standard deviations and an error estimate based on standard methods for water quality sampling. The data already submitted show the seasonal fluctuations are not significant and are not expected to affect the establishment of correct UCLs. This basis for determining the UCLs has been accepted by the Wyoming Department of Environmental Quality for URI's North Platte Project. Well NPMS-1 which is open to the 2c sand (see Section 2.2.1) is exempt from the establishment of UCLs.

If any two excursion indicators in a well exceed the upper control limit (UCL) or if one excursion parameter exceeds its UCL by 20% of its UCL, the licensee shall take another water sample within forty-eight (48) hours and analyze it for at least the seven indicators listed above. An excursion is confirmed if two or more UCL values are exceeded or if one UCL value is exceeded by 20% or more of its UCL. Corrective action to mitigate the situation shall be initiated by the licensee when an excursion is confirmed and the NRC shall be notified within forty-eight (48) hours by telephone and within seven (7) days in writing. Corrective actions shall be maintained until the excursion is concluded. In addition to corrective actions, monitoring shall be intensified; sampling frequency and analysis of excursion status wells shall be at least once every seven (7) days for the seven indicators listed above, as long as those wells are on excursion status. An excursion is considered concluded when the concentrations of excursion indicators are below the concentration levels defining an excursion.

If corrective actions have not been effective within ninety (90) days of excursion confirmation, the injection of lixiviant shall be terminated. Resumption of injection shall require NRC approval in the form of a license amendment.

In addition to the monitor wells, a system bleed of .03 to 5 gpm will be employed to create a local low pressure area in the leach field area. This procedure will cause the natural groundwater surrounding the leach area to flow into the well field area, further reducing the risk of an excursion.

5.1.2 Water Level Monitoring

Changes in potentiometric levels in the ore zone aquifer perimeter wells and monitor wells may give early warnings of potential excursions. However, water level changes must be regarded cautiously, since they may be associated with regional or barometric changes. If the water level in a monitor well changes significantly from its premining baseline level and if the potentiometric change is determined to be caused by wellfield activities, the change may be indicating inefficiency in adjustment of wellfield flow rates and an early warning of an excursion. At this point, Uranium Resources Incorporated shall notify the NRC of the condition and take steps to alleviate the problem. A report concerning the change in water level and actions taken will be provided to the NRC in a quarterly report. The corrective actions taken and the results of those actions shall also be a part of the report.

5.1.3 Evaporation Pond Leak Detection

The evaporation ponds will be lined with 36 ml Hyplon to eliminate seepage of waste solutions; a collection system below the liner which is connected to standpipes should collect leakage which may occur. The leakage detection standpipes will be monitored daily and any liquid detected will be sampled as detailed in Section 3.6.2. The liner provides environmental protection against evaporation pond leakage and the collection system monitoring program assures that corrective action, as required by license conditions, is promptly taken in the event of a leak.

5.2 Environmental Monitoring

Uranium Resources Incorporated has performed a limited preoperational surface radiological environmental monitoring program. Their preoperational monitoring program consisted of direct gamma measurements over 35 acres using a 500 ft. grid pattern.

Based on NRC review of the submitted preoperational surface radiological environmental monitoring program, Uranium Resources Incorporated shall be required to develop additional preoperational radiation data for the atmosphere, soil, and vegetation. The direct gamma survey, which has been completed, is considered adequate. Additional monitoring shall be as shown in Table 5.2.01. Results of the preoperational monitoring program will be reported in the first quarterly report. Table 5.2.01 also lists the required operational radiological environmental monitoring program for radon and direct gamma.

The required program for radiological environmental monitoring should be sufficient to confirm the assumption that there will be negligible radiological impacts from the operation and to develop information to assess potential impacts from a commercial-scale operation.

6. ALTERNATIVES

6.1 Introduction

Alternatives applicable for the URI's North Platte Project are not to issue the license, to mine the ore body by conventional methods or to mine by in situ extraction using another lixiviant chemistry.

6.2 No License Alternative

The NRC can choose not to license the North Platte Project Site. Such an action would not be consistent with present or past policy. United States policy has been to encourage the development of uranium resources to the extent economically

Table 5.2.01 Radiological Environmental Monitoring Programs

Type of Sample	Number	Location	Method	Frequency	Type of Analysis
			PREOPERATIONAL		
Radon	2	Upwind at site boundary Downwind at site boundary	Continuous or grab[1]	Monthly or quarterly[2]	Rn-222 (pCi/ℓ)
Soil	4	Wellfield * Evaporation Ponds *	Grab samples - Surface sample 0 to 5cm depth - Subsurface sample 5 to 15cm depth	Once prior to operation	U-nat, Ra-226 (pCi/g -dry weight)
			OPERATIONAL		
Radon	2	Upwind at site boundary Downwind at site boundary	Continuous or grab[1]	Monthly or quarterly[2]	Rn-222 (pCiℓ)
Direct gamma	3	At same locations used for air sampling and at evaporation pond area	Survey meter or dosimeter	Quarterly	Gamma exposure rate (μR/hr)

1 A grab sample shall consist of at least four (4) separate forty-eight (48) hour samples using the "Tedlar Bag Method" during a period of one (1) month.

2 Although a monthly sampling frequency is recommended, a quarterly sampling frequency is acceptable where a continuous passive radon detector is used.

* After strip of topsoil

and environmentally feasible to provide fuel for nuclear reactors. If URI was not allowed to test the North Platte Project Site, nuclear fuel which could be obtained from uranium at the site would not be available.

6.3 Conventional Mining Methods

The uranium would probably not be economically recoverable using a conventional method (that is, surface or underground mining followed by milling) rather than by in situ leaching. Surface and underground mining are generally used for high grade ores or mineral bodies close to the surface. There is generally significant disturbance of surface environments by excavation and subsidence associated with conventional mining techniques. Additionally, the milling that follows conventional mining produces large volumes of tailings wastes. The North Platte Project Site has neither high grade ore nor is the ore close to the ground surface (being approximately 575 feet down). In situ leaching does not disturb surface environments over large areas and produces much less waste than conventional milling methods.

6.4 Lixiviant Chemistry

Uranium Resources Incorporated is proposing to use sodium carbonate sodium-bicarbonate as lixiviant for their operation. In general, the choice of lixiviant is acidic or alkaline. At a site where the groundwater is carbonate, as at URI's North Platte Project Site, alkaline lixiviant will mobilize fewer hazardous elements from the ore body than an acidic one.

Ammonia carbonate could have been used rather than sodium carbonate; however, ammonia tends to absorb to clays (making restoration difficult) and may break down into carcinogenic nitrites. Ammonia carbonate is therefore not as desirable as sodium carbonate because of the potential environmental impacts.

In general, the alternatives offer no overriding benefit and the proposed operation as conditioned by the license is, in terms of environmental protection, acceptable.

7. FINDING OF NO SIGNIFICANT IMPACT

Based on this environmental appraisal, the staff finds that the proposed operation will not have a significant impact on human health or the environment. The specific reasons for drawing this conclusion are:

- The control and monitoring of the groundwater is sufficient for detecting any excursion, either vertical or horizontal;

- The evaporation ponds shall be lined to eliminate seepage of waste solutions; a collection system below the liner which is connected to the standpipes should collect leakage which may occur. This assures that required corrective action is promptly taken in the event of a leak.

- Radiological releases from the uranium extraction operations will be very small (exposures which are small fractions of radiological exposure standards will result) and closely monitored to detect any problems;

- Radioactive wastes will be disposed of at an existing NRC-licensed tailings disposal site; and

- The proposed restoration and reclamation plan should be sufficient to return the land and the groundwater to its premining use (or potential use). On a parameter by parameter basis, groundwater quality will be returned to as close to baseline as is reasonably achievable.

Kristin B. Westbrook

Kristin B. Westbrook, Project Manager
Operating Facilities Section I
Uranium Recovery Licensing Branch

Approved: John J. Linehan

John J. Linehan, Section Leader
Operating Facilities Section I
Uranium Recovery Licensing Branch

APPENDIX A

WATER QUALITY DATA

URANIUM RESOURCES INC.

NORTH PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - # P-1

FORMATION: 2 sb

DEPTH: TOP 4663.25 [illegible] BOT 4627.25 msl

BOTTOM OF: casing 4660.29 [illegible] screen 4630.[illegible]

DISTANCE FROM WELLFIELD: within

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-22-80 SAMPLE	8-14-80 SAMPLE	1-15-81 SAMPLE	5-27-81 SAMPLE
Total dissolved solids (calc.)	---	---	---	343	335	338	329	340
Total dissolved solids (Obs.)	500	500	5000	352	378	342	296	342
Conductivity @ 68°F., micromhos	---	---	---	490	455	483	450	490
Total alkalinity as $CaCO_3$	---	---	---	144	150	144	126	152
Total hardness as $CaCO_3$	---	---	---	58	72	67	57	73
Sodium (Na) (calc.)	---	---	---	100	93	93	94	95
Sodium (Na) (Obs.)	---	---	---	106	97	100	93	87
Potassium (K)	---	---	---	7	7	9	5	4
Calcium (Ca)	---	---	---	10	17	25	16	26
Magnesium (Mg)	---	---	---	8	7	7	4	8
Sulfate (SO_4)	250.0	250.0	3000.0	121	114	124	119	118
Chloride (Cl)	250.0	250.0	2000.0	10	8	4	12	8
Carbonate (CO_3)	---	---	---	14	5	8	43	9
Bicarbonate (HCO_3)	---	---	---	146	173	176	66	185
pH units	6.5-8.5	6.5-9.0	6.5-8.5	9.1	8.6	9.3	9.0	8.2
Aluminum (Al)	---	---	5.0	1.7	0.8	0.3	3.7	0.1
Ammonia (as N)	---	.5	---	0.16	0.20	0.22	0.27	0.32
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	ND	0.16
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	0.03
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.61	0.61	0.52	0.60	0.38
Iron (Fe)	.3	.3	---	1.63	1.36	0.48	0.61	0.31
Lead (Pb)	.05	.05	0.1	ND	ND	ND	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND	0.01	0.03
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	ND	ND
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	ND	ND
Phenols	---	0.001	---	ND	ND	ND	ND	0.18
Selenium (Se)	0.01	0.01	0.25	ND	ND	ND	ND	ND
Silica (SiO_2)	---	---	---	12	11	8.6	20.1	8.4
Silver (Ag)	0.05	0.05	---	ND	ND	ND	ND	ND
Zinc (Zn)	5.0	5.0	25.0	ND	ND	0.06	1.60	0.70
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	0.028	0.020	0.014	0.028	ND
Total Organic Carbon (TOC)	---	---	---	3.0	ND	ND	3	
Radium-226, pCi/l	5.0	5.0	5.0	202.1±3.91	230.9±5.4	26.3±1.57	189±3	393±5
Gross Alpha, pCi/l	15.0	15.0	15.0	293±43	799±133	452±28	389±35	202±58
Gross Beta, pCi/l	50.20			206±24	634±87	861±23	433±46	107±34
SAR				33.33	26.56	27.74	29.73	27.42
Water Level (msl)								
Trip [illegible]								

[illegible] PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - I-1

FORMATION: 3 sb

DEPTH: top 4667.62 msl; bot 4626.62 msl

BOTTOM OF: casing 4660.62 msl; screen 4630.62 msl

DISTANCE FROM WELLFIELD: within

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-23-80 SAMPLE	8-14-80 SAMPLE	11-25-80 SAMPLE	1-15-81 SAMPLE	4-22-81 SAMPLE
Total dissolved solids (calc.)	---	---	---	324	322	327	333	319	322
Total dissolved solids ([illegible])	500	500	5000	328	326	326	324	350	306
Conductivity @ 68°F., micromhos	---	---	---	495	500	460	480	488	500
Total alkalinity as $CaCO_3$	---	---	---	120	124	120	125	115	121
Total hardness as $CaCO_3$	---	---	---	33	29	29	21	17	8
Sodium (Na) (calc.)	---	---	---	96	96	96	101	101	103
Sodium (Na) ([illegible])	---	---	---	115	97	88	90	90	87
Potassium (K)	---	---	---	14	17	14	19	14	23
Calcium (Ca)	---	---	---	8	5	5	5	5	3
Magnesium (Mg)	---	---	---	3	4	4	2	1	0
Sulfate (SO_4)	250.0	250.0	3000.0	121	114	126	123	119	118
Chloride (Cl)	250.0	250.0	2000.0	10	12	4	8	11	13
Carbonate (CO_3)	---	---	---	36	24	43	48	67	53
Bicarbonate (HCO_3)	---	---	---	73	102	55	55	0	0
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	9.2	9.6	9.2	9.7	10.0	10.3
Aluminum (Al)	---	---	5.0	0.1	0.1	0.2	3.1	1.1	0.7
Ammonia (as N)	---	.5	---	0.15	0.30	0.22	0.37	0.39	0.26
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	ND	ND	0.05
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	ND	0.05	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.59	0.57	0.51	0.63	0.62	0.70
Iron (Fe)	.3	.	---	0.03	0.14	0.20	1.22	0.72	0.07
Lead (Pb)	.05	.05	0.1	ND	ND	ND	ND	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND	0.02	0.01	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	0.02	0.02	0.02
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	ND	0.01	ND
Phenols	---	0.001	---	ND	ND	ND	0.00	0.19	0.11
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	[illegible]	ND	0.01
Silica (SiO_2)	---	---	---	6.7	7.7	10.7	[illegible].2	12.9	10.4
Silver (Ag)	0.05	0.05	---	ND	ND	ND	0.02	ND	ND
Zinc (Zn)	5.0	5.0	25.0	ND	ND	0.03	0.19	0.16	0.06
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	ND	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	ND	0.005	0.013	0.008	0.001	0.001
Total Organic Carbon (TOC)	---	---	---	2.0	ND	1	2	3	2
Radium-226, pCi/l	5.0	5.0	5.0	192.0± 4.2	300.0± 4.4	42.0± 1.95	40.2± 2.2	87±2	73
Gross Alpha, pCi/l	15.0	15.0	15.0	225±38	351±45	519±35	146±30	122±16	80
Gross Beta, pCi/l	50.00			302±25	387±33	597±33	187±22	277±15	91
SAR				40.93	45.23	43.35	47.61	53.99	84.10
Water Level (msl)									
Rate purged (gpm)									

URANIUM RESOURCES INC.

NORTH PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - I-2

FORMATION: 2 ab

DEPTH: TMD 4664.64 msl; BHC 4636.64 msl

BOTTOM OF: casing 4659.14 msl; screen 4629.14 msl

DISTANCE FROM WELLFIELD: within

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-23-80 SAMPLE	8-14-80 SAMPLE	11-29-80 SAMPLE	1-15-81 SAMPLE	4-23-81 SAMPLE
Total dissolved solids (calc.)	---	---	---	336	307	326	337	344	330
Total dissolved solids (dis.)	250	500	5000	346	306	335	308	322	328
Conductivity @ 65°F., micromhos	---	---	---	495	475	465	480	490	470
Total alkalinity as $CaCO_3$	---	---	---	128	136	130	128	124	125
Total hardness as $CaCO_3$	---	---	---	43	46	46	43	40	50
Sodium (Na) (calc.)	---	---	---	102	91	95	103	105	97
Sodium (Na) (dis.)	---	---	---	109	97	97	95	90	78
Potassium (K)	---	---	---	7	7	10	6	7	4
Calcium (Ca)	---	---	---	9	10	10	12	11	18
Magnesium (Mg)	---	---	---	5	5	5	3	3	3
Sulfate (SO_4)	250.0	250.0	3000.0	124	110	124	125	132	131
Chloride (Cl)	250.0	250.0	2000.0	12	8	4	12	12	8
Carbonate (CO_3)	---	---	---	17	12	26	14	24	22
Bicarbonate (HCO_3)	---	---	---	122	139	105	127	102	120
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	9.2	8.9	8.7	8.9	8.6	8.1
Aluminum (Al)	---	---	5.0	0.1	0.1	ND	ND	0.2	ND
Ammonia (as N)	---	.5	---	0.17	0.22	0.32	0.51	1.06	.25
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	ND	ND	0.06
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	ND	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.46	0.62	0.53	0.61	0.59	0.62
Iron (Fe)	.3	.3	---	0.04	0.06	0.12	0.20	0.16	0.03
Lead (Pb)	.05	.05	0.1	ND	ND	ND	ND	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND	ND	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	ND	ND	0.03
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	ND	ND	ND
Phenols	---	0.001	---	ND	ND	ND	ND	0.06	0.07
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	ND	ND	0.01
Silica (SiO_2)	---	---	---	6.4	7.5	8.6	9.0	10.7	8.8
Silver (Ag)	0.05	0.05	---	ND	ND	ND	0.02	ND	ND
Zinc (Zn)	5.0	5.0	25.0	ND	ND	ND	0.01	0.14	0.03
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	ND	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	ND	0.004	0.006	0.008	0.002	0.004
Total Organic Carbon (TOC)	---	---	---	2.0	ND	1	2	2	1
Radium-226, pCi/l	5.0	5.0	5.0	126.0± 3.4	112.0± 3.15	25.5± 1.44	153±3.1	16±2	37
Gross Alpha, pCi/l	15.0	15.0	15.0	297±47	288±41	246±35	207±24	75±11	255
Gross Beta, pCi/l	50.00			108±20	134±24	342±31	316±26	83±8	70
SAR				38.35	33.53	34.79	37.31	39.69	29.91
Water Level (msl)									
Base-Confined Level									

NORTH PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - 2-3

FORMATION: [illegible]

DEPTH: TOP 4667.78 [illegible]

BOTTOM OF: [illegible] 4035.78

DISTANCE FROM WELLFIELD: within

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-10-80 SAMPLE	7-23-80 SAMPLE	8-14-80 SAMPLE	11-20-80 SAMPLE	1-15-81 SAMPLE	4-23-81 SAMPLE
Total dissolved solids (calc.)	---	---	---	331	313	320	319	316	314
Total dissolved solids (meas.)	500	500	5000	348	340	324	304	294	322
Conductivity @ 68°F., micromhos	---	---	---	473	325	465	470	450	420
Total alkalinity as $CaCO_3$	---	---	---	130	130	130	123	123	114
Total hardness as $CaCO_3$	---	---	---	43	48	46	35	33	43
Sodium (Na) (calc.)	---	---	---	100	93	94	99	98	95
Sodium (Na) (meas.)	---	---	---	104	97	98	93	90	89
Potassium (K)	---	---	---	8	7	12	7	7	6
Calcium (Ca)	---	---	---	9	11	10	9	10	14
Magnesium (Mg)	---	---	---	5	8	5	3	2	3
Sulfate (SO_4)	250.0	250.0	3000.0	121	119	125	118	109	121
Chloride (Cl)	250.0	250.0	2000.0	10	8	4	19	14	10
Carbonate (CO_3)	---	---	---	22	17	27	29	62	16
Bicarbonate (HCO_3)	---	---	---	115	124	124	90	24	110
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	9.4	9.2	8.8	9.3	9.7	8.5
Aluminum (Al)	---	---	5.0	0.1	0.1	ND	ND	0.1	ND
Ammonia (as N)	---	.5	---	0.15	0.21	0.30	0.20	0.27	0.16
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	ND	ND	0.06
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.3	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	ND	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.34	0.38	0.49	0.59	0.55	0.65
Iron (Fe)	.3	.3	---	0.08	0.07	0.06	0.06	0.18	ND
Lead (Pb)	.05	.05	0.1	ND	ND	ND	ND	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND	ND	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	ND	ND	0.02
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	ND	ND	ND
Phenols	---	0.001	---	ND	ND	ND	ND	0.08	0.11
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	ND	ND	0.01
Silica (SiO_2)	---	---	---	7.5	9.0	8.6	8.3	11.6	10.7
Silver (Ag)	0.05	0.05	---	ND	ND	ND	ND	ND	ND
Zinc (Zn)	5.0	5.0	25.0	ND	ND	ND	ND	0.10	0.03
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	ND	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	ND	ND	ND	ND	0.002	0.003
Total Organic Carbon (TOC)	---	---	---	2.0	ND	2	2	1	1
Radium-226, pCi/l	5.0	5.0	5.0	83.2±2.3	122.9±2.7	37.3±2.46	142±3.4	1±1	0
Gross Alpha, pCi/l	15.0	15.0	15.0	266±42	304±61	183±23	184±16	22±7	36
Gross Beta, pCi/l	50.00			234±23	319±28	239±22	189±19	22±6	36
SAR									
Water Level (msl)				37.80	32.53	34.32	40.42	40.02	33.89
Rate pumped (gpm)									

[illegible] RESOURCES INC.

[illegible] PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL #3-6

FORMATION: [illegible]

DEPTH: [illegible] 4669.37 [illegible] 4629.37 msl

SCREEN OF: [illegible] 4662.37 msl' [illegible] 4622.37 msl

DISTANCE FROM WELLFIELD: within

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-23-80 SAMPLE	8-14-80 SAMPLE	11-20-80 SAMPLE	3-13-81 SAMPLE	6-13-8[illegible] SAMPLE
Total dissolved solids (calc.)	---	---	---	316	311	328	325	302	310
Total dissolved solids (meas.)	320	500	5000	294	286	318	316	324	320
Conductivity @ 25°C., micromhos	---	---	---	475	570	465	470	450	450
Total alkalinity as $CaCO_3$	---	---	---	114	126	130	128	127	123
Total hardness as $CaCO_3$	---	---	---	38	39	47	38	35	36
Sodium (Na) (calc.)	---	---	---	97	94	94	104	93	97
Sodium (Na) (meas.)	---	---	---	102	97	99	93	90	78
Potassium (K)	---	---	---	9	8	11	7	8	5
Calcium (Ca)	---	---	---	7.	9	12	10	9	11
Magnesium (Mg)	---	---	---	3	4	4	3	3	2
Sulfate (SO_4)	250.0	250.0	3000.0	120	113	125	123	105	111
Chloride (Cl)	250.0	250.0	2000.0	10	8	4	10	8	9
Carbonate (CO_3)	---	---	---	17	19	22	14	62	20
Bicarbonate (HCO_3)	---	---	---	105	115	115	127	29	85
pH units	6.5-8.5	6.5-9.0	6.5-8.5	9.1	8.9	8.7	8.7	9.7	8.6
Aluminum (Al)	---	---	5.0	0.1	<0.2	ND	ND	0.2	ND
Ammonia (as N)	---	.5	---	0.12	0.19	0.21	0.22	0.34	0.27
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	ND	ND	ND
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	0.05
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05						
Copper (Cu)	1.9	1.0	.5	ND	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	ND	ND	ND	ND	ND	ND
Iron (Fe)	.3	.3	---	0.63	0.61	0.62	0.62	0.49	0.50
Lead (Pb)	.05	.05	0.1	ND	0.10	0.07	0.11	0.13	0.03
Manganese (Mn)	.05	.05	---	ND	ND	ND	ND	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	ND	ND	ND
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	ND	ND	0.04
Phenol	---	0.001	---	ND	ND	ND	ND	ND	ND
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	0.06	ND	0.07
Silica (SiO_2)	---	---	---	ND	ND	ND	ND	ND	0.01
Silver (Ag)	0.05	0.05	---	6.0	7.3	8.6	7.9	10.5	8.8
Zinc (Zn)	5.0	5.0	25.0	ND	ND	ND	ND	ND	ND
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	ND	0.11	0.03
Uranium (U_3O_8)	---	5.0	5.0	ND	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	---	---	---	ND	0.004	0.006	0.004	0.003	0.012
Radium-226, pCi/l	5.0	5.0	5.0	ND	ND	1	3	3	1
Gross Alpha, pCi/l	15.0	15.0	15.0	103.0±2.0	215.4±4.5	66.5±2.60	89.8±3.	52±8	66
Gross Beta, pCi/l	50.00			453±47	367±45	272±25	279±31	62±11	228
SAR				327±20	250±27	337±23	288±29	61±11	223
Water Level (msl)				43.38	36.37	33.33	40.79	37.97	38.05
Rate purged (gpm)									

URANIUM RESOURCES INC.

NORTH PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - [illegible]-1

FORMATION: [illegible]

DEPTH: [illegible] 4655.94 [illegible] 4685.94 msl

SECTION OF: [illegible] 4639.44 [illegible] 4619.44 msl

DISTANCE FROM [illegible] 1983 [illegible]

PARAMETER	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-23-80 SAMPLE	8-14-80 SAMPLE	12-29-80 SAMPLE	3-18-81 SAMPLE	4-23-81 SAMPLE
Total dissolved solids (calc.)	---	---	---	336	309	321	295	299	300
Total dissolved solids (Obs.)	500	500	5000	298	336	334	270	333	288
Conductivity @ 68°F., micromhos	---	---	---	475	475	485	480	440	420
Total alkalinity as $CaCO_3$	---	---	---	123	120	122	109	122	116
Total hardness as $CaCO_3$	---	---	---	42	41	32	25	28	29
Sodium (Na) (calc.)	---	---	---	93	94	97	94	96	95
Sodium (Na) (Obs.)	---	---	---	100	95	95	87	90	88
Potassium (K)	---	---	---	8	7	12	7	6	5
Calcium (Ca)	---	---	---	10	8	6	7	8	10
Magnesium (Mg)	---	---	---	4	5	4	2	2	1
Sulfate (SO_4)	250.0	250.0	3000.0	119	118	123	108	104	111
Chloride (Cl)	250.0	250.0	2000.0	14	6	4	12	10	8
Carbonate (CO_3)	---	---	---	19	10	17	17	85	14
Bicarbonate (HCO_3)	---	---	---	110	137	115	90	37	122
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	9.2	8.9	8.6	9.0	9.4	8.7
Aluminum (Al)	---	---	5.0	0.1	ND	ND	0.15	0.1	ND
Ammonia (as N)	---	.5	---	0.19	0.33	0.34	0.50	0.64	0.48
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	ND	ND	ND
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05						
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	ND	ND	ND	ND	ND	ND
Iron (Fe)	.3	.3	---	0.60	0.50	0.50	0.60	0.61	0.62
Lead (Pb)	.05	.05	0.1	ND	ND	0.16	ND	0.15	0.06
Manganese (Mn)	.05	.05	---	ND	ND	ND	ND	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	ND	ND	ND
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	0.02	ND	ND
Phenols	---	0.001	---	ND	ND	ND	ND	ND	ND
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	ND	0.08	0.07
Silica (SiO_2)	---	---	---	ND	ND	ND	ND	ND	0.01
Silver (Ag)	0.05	0.05	---	7.1	7.9	8.6	9.63	12.2	0.9
Zinc (Zn)	5.0	5.0	25.0	ND	ND	ND	ND	ND	ND
Vanadium (V_2O_5)	---	---	0.1	ND	ND	0.03	ND	0.06	0.04
Uranium (U_3O_8)	---	5.0	5.0	ND	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	---	---	---	ND	0.008	0.007	0.003	0.043	0.007
Radium-226, pCi/l	5.0	5.0	5.0	ND	ND	ND	5	3	3
Gross Alpha, pCi/l	15.0	15.0	15.0	37.0±3.0	20.3±0.9	24.3±1.40	0.0±0.8	8.2±0.7	0.86
Gross Beta, pCi/l	50.00			238±36	43±12	183±14	29±8	31±10	7.0
SAR				286±33	31±8	88±18	38±12	19±6	8.0
Water Level (msl)				37.60	36.87	43.30	44.31	42.9X	40.31
Face pumped (gpm)									

A-6

[illegible] RESOURCES INC.

NORTH PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - [illegible]

FORMATION: [illegible]
DEPTH: [illegible] 4493.19 [illegible] 4471.39 [illegible]
BOTTOM OF: [illegible] 4466 [illegible] 4638 [illegible]
DISTANCE FROM WELLFIELD: 316'

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-23-80 SAMPLE	8-14-80 SAMPLE	11-29-80 SAMPLE	1-13-81 SAMPLE	6-23-8[illegible] SAMPLE
Total dissolved solids (calc.)	---	---	---	342	323	343	331	318	337
Total dissolved solids (meas.)	500	500	5000	338	328	326	322	310	316
Conductivity @ 25°C, micromhos	---	---	---	475	500	500	500	460	475
Total alkalinity as $CaCO_3$	---	---	---	134	134	138	134	130	134
Total hardness as $CaCO_3$	---	---	---	44	53	57	53	65	57
Sodium (Na) (calc.)	---	---	---	103	94	96	104	88	96
Sodium (Na) (meas.)	---	---	---	105	90	99	95	90	81
Potassium (K)	---	---	---	8	7	10	6	5	5
Calcium (Ca)	---	---	---	11	13	13	13	16	16
Magnesium (Mg)	---	---	---	4	5	6	5	6	4
Sulfate (SO_4)	250.0	250.0	3000.0	134	116	130	120	115	121
Chloride (Cl)	250.0	250.0	2000.0	18	8	4	13	10	8
Carbonate (CO_3)	---	---	---	19	24	19	26	58	31
Bicarbonate (HCO_3)	---	---	---	112	115	129	110	56	100
pH units	6.5-8.5	6.5-9.0	6.5-8.5	9.1	8.9	8.6	8.4	9.2	8.7
Aluminum (Al)	---	---	5.0	0.1	0.2	ND	ND	0.3	ND
Ammonia (as N)	---	.5	---	0.21	0.25	0.25	0.25	0.29	0.2
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	ND	ND	ND
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	ND	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.39	0.60	0.86	0.63	0.56	0.[illegible]
Iron (Fe)	.3	.3	---	0.22	0.22	0.09	0.29	0.38	0.[illegible]
Lead (Pb)	.05	.05	0.1	ND	ND	ND	ND	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND	ND	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	ND	0.01	0.[illegible]
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	ND	ND	ND
Phenols	---	0.001	---	ND	ND	ND	ND	ND	0.[illegible]
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	ND	ND	0.[illegible]
Silica (SiO_2)	---	---	---	7.1	8.2	6.4	8.3	15.4	7.[illegible]
Silver (Ag)	0.05	0.05	---	ND	ND	ND	ND	ND	ND
Zinc (Zn)	5.0	5.0	25.0	ND	ND	ND	ND	0.06	0.[illegible]
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	ND	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	ND	0.005	0.008	0.014	0.068	0.[illegible]
Total Organic Carbon (TOC)	---	---	---	ND	ND	4	2	3	4
Radium-226, pCi/l	5.0	5.0	5.0	60.0±2.7	31.0±1.5	16.3±1.71	26.0±1.5	13±1	6.[illegible]
Gross Alpha, pCi/l	15.0	15.0	15.0	321±40	85±23	31±8	67±13	43±12	40
Gross Beta, pCi/l	50.00			130±24	54±15	60±10	67±13	72±9	43
SAR									
Water Level (msl)				37.81	31.33	31.15	34.67	26.53	30
Rate pumped (gpm)									

[illegible] INC.

NORTH PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - [illegible]-3

FORMATION: 3 [illegible]
DEPTH: TOP 4699.23 [illegible] BOT 4633.23 msl
SCREEN OF: [illegible] 4669.23 msl' [illegible] 4729.23 msl
DISTANCE FROM ORE ZONE: 153'

ITEM	EPA STANDARD	WYOMING STANDARD	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-21-80 SAMPLE	8-14-80 SAMPLE	11-20-80 SAMPLE	1-15-81 SAMPLE	AVG.
Total dissolved solids (calc.)	---	---	---	309	236	303	322	302	310
Total dissolved solids (meas.)	500	500	5000	342	288	276	294	338	323
Conductivity @ 68°F., micromhos	---	---	---	445	475	445	450	430	449
Total alkalinity as $CaCO_3$	---	---	---	113	104	104	113	121	122
Total hardness as $CaCO_3$	---	---	---	21	23	23	20	23	25
Sodium (Na) (calc.)	---	---	---	98	94	91	102	97	103
Sodium (Na) (meas.)	---	---	---	103	96	93	108	103	94
Potassium (K)	---	---	---	10	8	15	6	8	6
Calcium (Ca)	---	---	---	5	4	4	7	8	7
Magnesium (Mg)	---	---	---	2	3	3	3	2	3
Sulfate (SO_4)	250.0	250.0	3000.0	117	115	124	125	110	111
Chloride (Cl)	250.0	250.0	2000.0	10	10	4	12	10	10
Carbonate (CO_3)	---	---	---	38	28	36	19	62	60
Bicarbonate (HCO_3)	---	---	---	53	73	54	95	82	37
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	9.4	9.5	9.5	8.9	9.3	9.5
Aluminum (Al)	---	---	5.0	0.9	0.3	0.3	ND	0.3	ND
Ammonia (as N)	---	.5	---	0.19	0.19	0.22	0.27	0.27	0.25
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	ND	ND	ND
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	ND	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.70	0.69	0.85	0.69	0.95	0.16
Iron (Fe)	.3	.3	---	1.33	0.29	0.07	0.25	0.09	0.04
Lead (Pb)	.05	.05	0.1	ND	ND	ND	ND	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND	ND	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	0.01	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	ND	ND	ND
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	ND	ND	0.02
Phenols	---	0.001	---	ND	ND	ND	ND	ND	ND
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	ND	ND	0.07
Silica (SiO_2)	---	---	---	ND	ND	ND	ND	ND	0.02
Silver (Ag)	0.05	0.05	---	11	7.9	10.7	11.1	12.0	13.3
Zinc (Zn)	5.0	5.0	25.0	ND	ND	ND	ND	ND	ND
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	0.01	0.03	0.03
Uranium (U_3O_8)	---	5.0	5.0	ND	ND	ND	ND	ND	ND
Total Organic Carbon (TOC)	---	---	---	ND	ND	ND	0.017	ND	0.00
				3.0	ND	4	2	2	1
Radium-226, pCi/l	5.0	5.0	5.0	46.3±	8.1±	13.7±	10.9±	2.9±0.4	31
				1.96	0.8	1.31	1.0		
Gross Alpha, pCi/l	15.0	15.0	15.0	249±38	8±6	19±4	40±12	29±8	18
Gross Beta, pCi/l	50.00								
SAR				282±18	11±6	12±5	43±12	32±7	25
Water Level (msl)				52.25	50.25	48.64	48.62	43.38	47.6
Rate purged (gpm)									

[illegible]

GROUND WATER ANALYSIS REPORT

WELL - [illegible]

FORMATION: [illegible]
DEPTH: TOP 4623.71 [illegible] BOT. 4626.71 [illegible]
SCREEN OF: [illegible]
DISTANCE FROM WELLFIELD: 119'

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-21-80 SAMPLE	8-14-80 SAMPLE	11-20-80 SAMPLE	1-15-81 SAMPLE	4-23-81 SAMPLE
Total dissolved solids (calc.)	---	---	---	320	320	292	307	292	303
Total dissolved solids (meas.)	500	500	5000	316	325	338	326	304	316
Conductivity @ 25°C, micromhos	---	---	---	475	489	415	450	430	430
Total alkalinity as $CaCO_3$	---	---	---	128	124	118	122	108	118
Total hardness as $CaCO_3$	---	---	---	47	25	16	14	17	37
Sodium (Na) (calc.)	---	---	---	96	100	97	102	96	93
Sodium (Na) (meas.)	---	---	---	100	98	99	92	85	76
Potassium (K)	---	---	---	9	10	13	10	8	6
Calcium (Ca)	---	---	---	13	5	3	4	5	13
Magnesium (Mg)	---	---	---	4	4	2	1	1	1
Sulfate (SO_4)	250.0	250.0	3000.0	120	117	112	105	107	111
Chloride (Cl)	250.0	250.0	2000.0	10	10	4	12	12	8
Carbonate (CO_3)	---	---	---	19	28	48	53	61	23
Bicarbonate (HCO_3)	---	---	---	117	98	37	37	0	85
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	9.1	9.6	9.9	9.7	10.2	8.7
Aluminum (Al)	---	---	5.0	0.1	0.1	0.4	1.24	0.2	0.3
Ammonia (as N)	---	.5	---	0.15	0.41	0.30	0.21	0.31	0.17
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	0.13	ND	0.05
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	ND	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.64	0.62	0.61	0.59	0.60	0.61
Iron (Fe)	.3	.3	---	0.06	0.21	0.23	0.66	0.16	0.19
Lead (Pb)	.05	.05	0.1	ND	ND	ND	ND	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND	ND	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	ND	ND	0.02
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	ND	ND	ND
Phenols	---	0.001	---	ND	ND	ND	0.09	0.08	0.09
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	ND	ND	0.02
Silica (SiO_2)	---	---	---	6.0	9.2	20.7	10.2	12.2	9.2
Silver (Ag)	0.05	0.05	---	ND	ND	ND	ND	ND	ND
Zinc (Zn)	5.0	5.0	25.0	ND	ND	0.03	0.12	0.06	0.03
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	ND	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	ND	0.008	0.009	0.026	0.002	0.015
Total Organic Carbon (TOC)	---	---	---	ND	ND	3	4	2	
Radium-226, pCi/l	5.0	5.0	5.0	97.1±3.2	32.0±1.6	36.5±2.12	11.6±1.	13±1	21
Gross Alpha, pCi/l	15.0	15.0	15.0	530±46	96±19	42±6	73±14	100±17	53
Gross Beta, pCi/l	50.00			212±17	85±12	123±8	80±15	50±5	94
SAR				33.94	47.14	50.19	64.52	37.63	30.37
Water Level (msl)									
Rate pumped (gpm)									

[illegible]

[illegible]

WELL - [illegible]

FORMATION: [illegible]

DEPTH: [illegible] 4679.10 [illegible] 4637.10 [illegible]

SECTION OF: [illegible] 4679.49 [illegible] 4638.48

DISTANCE FROM [illegible]: 175'

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-23-80 SAMPLE	8-14-80 SAMPLE	11-23-80 SAMPLE	1-13-81 SAMPLE	4-23-81 SAMPLE
Total dissolved solids (calc.)	----	----	----	330	330	331	306	323	334
Total dissolved solids (meas.)	330	300	1000	335	336	318	304	312	332
Conductivity @ 25°C., micromhos	----	----	----	475	500	465	420	440	470
Total alkalinity as $CaCO_3$	----	----	----	130	140	134	115	127	144
Total hardness as $CaCO_3$	----	----	----	48	56	51	23	39	61
Sodium (Na) (calc.)	----	----	----	94	96	95	98	97	96
Sodium (Na) (meas.)	----	----	----	101	97	99	100	95	61
Potassium (K)	----	----	----	8	7	10	8	6	5
Calcium (Ca)	----	----	----	11	14	13	6	16	21
Magnesium (Mg)	----	----	----	5	8	9	2	1	2
Sulfate (SO_4)	250.0	250.0	3000.0	114	112	125	113	117	116
Chloride (Cl)	250.0	250.0	3000.0	10	13	4	10	10	8
Carbonate (CO_3)	----	----	----	13	7	17	22	41	26
Bicarbonate (HCO_3)	----	----	----	134	156	120	95	71	132
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	0.1	0.0	0.6	9.2	9.0	8.5
Aluminum (Al)	----	----	5.0	0.2	1.0	0.1	0.36	0.2	0.1
Ammonia (as N)	----	.5	----	0.15	0.10	0.20	0.16	0.23	0.16
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	----	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	----	ND	ND	ND	0.12	ND	ND
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	ND
Cobalt (Co)	----	----	1.0	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	ND	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	0.03	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	----	0.61	0.60	0.33	0.61	0.49	0.16
Iron (Fe)	.3	.	----	0.13	0.34	0.32	0.64	0.25	0.15
Lead (Pb)	.05	.05	0.1	ND	ND	ND	1.32	ND	ND
Manganese (Mn)	.05	.05	----	ND	ND	ND	0.03	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	----	----	----	ND	ND	ND	ND	ND	ND
Nickel (Ni)	----	----	----	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0.	ND	ND	ND	0.53	ND	0.03
Nitrite (as N)	----	1.0	10.0	ND	ND	ND	ND	ND	ND
Phenols	----	0.001	----	ND	ND	ND	0.09	0.10	0.11
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	ND	ND	0.03
Silica (SiO_2)	----	----	----	6.0	0.6	0.6	15.0	15.4	9.0
Silver (Ag)	0.05	0.05	----	ND	ND	ND	ND	ND	ND
Zinc (Zn)	5.0	5.0	25.0	ND	ND	0.03	0.15	0.03	0.03
Vanadium (V_2O_5)	----	----	0.1	ND	ND	ND	ND	ND	ND
Uranium (U_3O_8)	----	5.0	5.0	ND	0.004	0.003	0.006	0.002	0.00
Total Organic Carbon (TOC)	----	----	----	ND	ND	4	3	2	2
Radium-226, pCi/l	5.0	5.0	5.0	22.7±2.6	20.0±1.2	20.7±1.56	16.4±1.	17±1	16
Gross Alpha, pCi/l	15.0	15.0	15.0	563±47	63±13	38±6	89±14	41±7	36
Gross Beta, pCi/l	52.00			231±17	48±9	43±7	77±14	42±9	43.
SAR									
Water Level (ft)				33.23	31.15	32.38	49.00	36.15	30.
Site [illegible]									

URANIUM RESOURCES INC.

NORTH PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - [illegible]-6

FORMATION: 3 sb

DEPTH: [illegible] 4671.64 [illegible] 4610.64 [illegible]

BOTTOM OF: casing 4666.14 [illegible] 4626.14 [illegible]

DISTANCE FROM WELLFIELD: 174'

[illegible]	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-14-80 SAMPLE	7-23-80 SAMPLE	8-14-80 SAMPLE	11-29-80 SAMPLE	1-15-81 SAMPLE	4-23 SAMPLE
Total dissolved solids (calc.)	---	---	---	328	336	354	323	323	328
Total dissolved solids (obs.)	500	500	5000	338	322	332	326	342	332
Conductivity @ 68°F., micromhos	---	---	---	490	475	475	470	450	475
Total alkalinity as $CaCO_3$	---	---	---	130	146	152	130	131	160
Total hardness as $CaCO_3$	---	---	---	44	61	63	50	54	56
Sodium (Na) (calc.)	---	---	---	98	96	98	95	94	92
Sodium (Na) (obs.)	---	---	---	106	100	97	99	78	77
Potassium (K)	---	---	---	8	7	11	7	5	3
Calcium (Ca)	---	---	---	11	16	17	15	20	19
Magnesium (Mg)	---	---	---	4	5	5	3	1	2
Sulfate (SO_4)	250.0	250.0	3000.0	119	114	128	110	114	114
Chloride (Cl)	250.0	250.0	2000.0	10	10	4	10	11	8
Carbonate (CO_3)	---	---	---	19	5	34	19	34	24
Bicarbonate (HCO_3)	---	---	---	120	168	127	129	90	112
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	9.2	8.8	8.7	8.9	8.3	8.7
Aluminum (Al)	---	---	5.0	0.2	0.2	0.2	0.92	0.3	ND
Ammonia (as N)	---	.5	---	0.18	0.19	0.25	0.20	0.32	0.11
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	0.08	ND	ND
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	ND	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.64	0.65	0.58	0.37	0.56	0.6[illegible]
Iron (Fe)	.3	.3	---	0.19	0.27	0.40	0.42	0.22	0.0[illegible]
Lead (Pb)	.05	.05	0.1	ND	ND	ND	ND	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND	0.01	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	0	ND	ND	ND	ND	ND	0.0[illegible]
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	ND	ND	ND
Phenols	---	0.001	---	ND	ND	ND	0.07	0.08	0.1[illegible]
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	ND	ND	[illegible]
Silica (SiO_2)	---	---	---	8.1	6.9	6.4	16.8	12.6	[illegible]
Silver (Ag)	0.05	0.05	---	ND	ND	ND	ND	ND	ND
Zinc (Zn)	5.0	5.0	25.0	ND	ND	0.03	ND	0.07	0.3
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	ND	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	ND	0.005	0.005	0.006	0.008	0.0[illegible]
Total Organic Carbon (TOC)	---	---	---	2.0	ND	3	3	9	2
Radium-226, pCi/l	5.0	5.0	5.0	97.6± 2.7	21.0± 1.5	36.0± 2.29	6.7± 1.0	13±1	4.8
Gross Alpha, pCi/l	15.0	15.0	15.0	580±63	24±9	51±6	30±9	52±7	20
Gross Beta, pCi/l	50.20			233±22	20±10	40±6	20±11	32±6	19
SAR				35.76	29.63	29.35	31.67	29.01	28.
Water Level (msl)									
Rate pumped (gpm)									

[illegible] PROJECT

GROUND WATER ANALYSIS REPORT

WELL - [illegible]-1

FORMATION: 2 [illegible]

DEPTH: [illegible] 4691.58 [illegible] 4679.58 msl

BOTTOM OF: [illegible] 4690 msl [illegible] 4680 msl

DISTANCE FROM WELLFIELD: within

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	7-23-80 SAMPLE	7-14-80 SAMPLE	11-20-80 SAMPLE	1-15-81 SAMPLE	4-23-81 SAMPLE
Total dissolved solids (calc.)	---	---	---	315	336	333	319	320
Total dissolved solids (obs.)	500	500	5000	348	372	318	336	332
Conductivity @ 25°C., umhos/cm	---	---	---	500	515	480	470	460
Total alkalinity as $CaCO_3$	---	---	---	124	144	146	148	160
Total hardness as $CaCO_3$	---	---	---	34	59	82	75	77
Sodium (Na) (calc.)	---	---	---	92	95	86	85	88
Sodium (Na) (obs.)	---	---	---	97	103	85	95	75
Potassium (K)	---	---	---	16	10	7	7	6
Calcium (Ca)	---	---	---	7	12	23	20	21
Magnesium (Mg)	---	---	---	4	7	6	6	6
Sulfate (SO_4)	250.0	250.0	3000.0	110	116	113	102	99
Chloride (Cl)	250.0	250.0	2000.0	12	10	10	10	6
Carbonate (CO_3)	---	---	---	17	19	0	0	0
Bicarbonate (HCO_3)	---	---	---	117	137	178	18	195
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	9.5	8.8	8.1	7.6	8.2
Aluminum (Al)	---	---	5.0	0.3	0.3	ND	0.3	0.3
Ammonia (as N)	---	.5	---	0.25	0.15	0.15	0.13	ND
Arsenic (As)	.05	.05	0.2	ND	ND	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND	ND	ND
Barium (Ba)	1.0	1.0	---	ND	ND	ND	ND	ND
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND	0.09	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.68	0.72	0.79	0.77	0.81
Iron (Fe)	.3	.3	---	0.21	0.20	0.15	0.72	0.68
Lead (Pb)	.05	.05	0.1	ND	ND	ND	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND	0.03	0.01
Mercury (Hg)	.002	.002	.00005	ND	ND	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND	ND	ND
Nitrate (as N)	10.0	10.0	[illegible]	ND	ND	0.05	0.91	0.03
Nitrite (as N)	---	1.0	10.0	ND	ND	ND	0.02	ND
Phenols	---	0.001	---	ND	ND	ND	0.23	0.16
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND	ND	ND
Silica (SiO_2)	---	---	---	8.8	7.3	10.3	19.9	10.5
Silver (Ag)	0.05	0.05	---	ND	ND	ND	ND	ND
Zinc (Zn)	5.0	5.0	25.0	ND	0.10	0.16	0.16	0.36
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	0.024	ND	0.004	ND	0.036
Total Organic Carbon (TOC)	---	---	---	ND	3.0	2	2	7
Radium-226, pCi/l	5.0	5.0	5.0	80.2± 2.3	41.7± 2.4	27.1± 1.4	11±1	1.5
Gross Alpha, pCi/l	15.0	15.0	15.0	229±49	144±34	47±12	21±7	13
Gross Beta, pCi/l	50.00			339±74	80±18	49±14	19±5	21
SAR				30.32	41.36	22.38	22.57	23.41
Water Level (msl)								
Rate pumped (gpm)								

NORTH PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - NPWS-3

FORMATION: 3

DEPTH: top 5036.89 msl; bot 4960.89 msl

SCREEN OF: casing 5035.89 msl; screen 4960.89 msl

DISTANCE FROM WELLFIELD:

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	11-10-80 SAMPLE	1-13-81 SAMPLE
Total dissolved solids (calc.)	---	---	---	305	326
Total dissolved solids (mes.)	250	500	5000	288	354
Conductivity @ 68°F., micromhos	---	---	---	480	450
Total alkalinity as $CaCO_3$	---	---	---	75	132
Total hardness as $CaCO_3$	---	---	---	34	104
Sodium (Na) (calc.)	---	---	---	81	69
Sodium (Na) (mes.)	---	---	---	78	70
Potassium (K)	---	---	---	13	23
Calcium (Ca)	---	---	---	12	40
Magnesium (Mg)	---	---	---	1	1
Sulfate (SO_4)	250.0	250.0	3000.0	137	129
Chloride (Cl)	250.0	250.0	2000.0	12	12
Carbonate (CO_3)	---	---	---	41	17
Bicarbonate (HCO_3)	---	---	---	0	0
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	10.1	11.1
Aluminum (Al)	---	---	5.0	ND	ND
Ammonia (as N)	---	.5	---	0.17	0.16
Arsenic (As)	.05	.05	0.2	ND	ND
Boron (B)	---	0.75	5.0	ND	ND
Barium (Ba)	1.0	1.0	---	0.06	ND
Cadmium (Cd)	0.01	0.01	0.05	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.15	0.10
Iron (Fe)	.3	.3	---	0.12	ND
Lead (Pb)	.05	.05	0.1	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND
Nickel (Ni)	---	---	---	ND	ND
Nitrate (as N)	10.0	10.0	0	0.02	ND
Nitrite (as N)	---	1.0	10.0	ND	ND
Phenols	---	0.001	---	ND	ND
Selenium (Se)	0.01	0.01	0.05	ND	ND
Silica (SiO_2)	---	---	---	4.9	2.8
Silver (Ag)	0.05	0.05	---	ND	ND
Zinc (Zn)	5.0	5.0	25.0	0.02	0.03
Vanadium (V_2O_5)	---	---	0.1	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	0.001	ND
Total Organic Carbon (TOC)	---	---	---	3	4
Radium-226, pCi/l	5.0	5.0	5.0	33±1.0	41±2
Gross Alpha, pCi/l	15.0	15.0	15.0	57±13	26±9
Gross Beta, pCi/l	50.00			26±15	34±8
SAR				11.77	15.24
Water Level (msl)					
Rate pumped (gpm)					

NORTH PLATTE PROJECT

GROUND WATER ANALYSIS REPORT

WELL - MP80-1

FORMATION: 1

DEPTH: top 4519.78 msl; bot 4503.78 msl

ELEVATION OF: casing 4539.78 msl' ground 4534.78

DISTANCE FROM WELLFIELD: within

EXCURSION

ITEM	EPA DRINKING	WYOMING DRINKING	WYOMING LIVESTOCK	11-10-80 SAMPLE	3-13-81 SAMPLE	8-27-81 SAMPLE
Total dissolved solids (calc.)	---	---	---	286	328	267
Total dissolved solids (meas.)	500	500	5000	294	334	264
Conductivity @ 25°C., micromhos	---	---	---	400	430	375
Total alkalinity as $CaCO_3$	---	---	---	166	122	133
Total hardness as $CaCO_3$	---	---	---	46	184	28
Sodium (Na) (calc.)	---	---	---	87	60	66
Sodium (Na) (meas.)	---	---	---	75	70	65
Potassium (K)	---	---	---	7	23	7
Calcium (Ca)	---	---	---	10	40	8
Magnesium (Mg)	---	---	---	5	1	2
Sulfate (SO_4)	250.0	250.0	3000.0	77	120	74
Chloride (Cl)	250.0	250.0	2000.0	9	22	11
Carbonate (CO_3)	---	---	---	25	27	79
Bicarbonate (HCO_3)	---	---	---	132	0	0
pH, units	6.5-8.5	6.5-9.0	6.5-8.5	9.9	11.2	9.9
Aluminum (Al)	---	---	5.0	7.1	ND	0.1
Ammonia (as N)	---	.5	---	0.21	0.14	0.32
Arsenic (As)	.05	.05	0.2	ND	ND	ND
Boron (B)	---	0.75	5.0	ND	ND	ND
Barium (Ba)	1.0	1.0	---	0.14	ND	0.06
Cadmium (Cd)	0.01	0.01	0.05	ND	ND	ND
Cobalt (Co)	---	---	1.0	ND	ND	ND
Chromium (Cr)	0.05	0.05	0.05	ND	ND	ND
Copper (Cu)	1.0	1.0	.5	ND	ND	ND
Fluoride (F)	1.4-2.4	1.4-2.4	---	0.83	0.10	0.01
Iron (Fe)	.3	.3	---	4.40	ND	0.09
Lead (Pb)	.05	.05	0.1	0.15	ND	ND
Manganese (Mn)	.05	.05	---	ND	ND	ND
Mercury (Hg)	.002	.002	.00005	ND	ND	ND
Molybdenum (Mo)	---	---	---	ND	ND	ND
Nickel (Ni)	---	---	---	ND	ND	ND
Nitrate (as N)	10.0	10.0	[illegible]	ND	ND	0.03
Nitrite (as N)	---	1.0	10.0	ND	ND	ND
Phenols	---	0.001	---	0.10	ND	0.07
Selenium (Se)	0.01	0.01	0.05	ND	ND	ND
Silica (SiO_2)	---	---	---	50.3	2.0	5.2
Silver (Ag)	0.05	0.05	---	0.03	ND	ND
Zinc (Zn)	5.0	5.0	25.0	0.30	0.03	0.09
Vanadium (V_2O_5)	---	---	0.1	ND	ND	ND
Uranium (U_3O_8)	---	5.0	5.0	0.005	ND	ND
Total Organic Carbon (TOC)	---	---	---	ND	4	2
Radium-226, pCi/l	5.0	5.0	5.0	10.8±1.1	2±1	2.0±0.4
Gross Alpha, pCi/l	15.0	15.0	15.0	21±9	57±11	3±3
Gross Beta, pCi/l	50.00			45±12	16±9	10±3
SAR				21.77	15.24	25.46
Water Level (msl)						
Rate pumped (gpm)						

APPENDIX B
PUMP TEST DATA PLOTS

Note: The water levels given in Appendix B are the distances (in feet) below the top of the casing and are not given as feet above mean sea level.

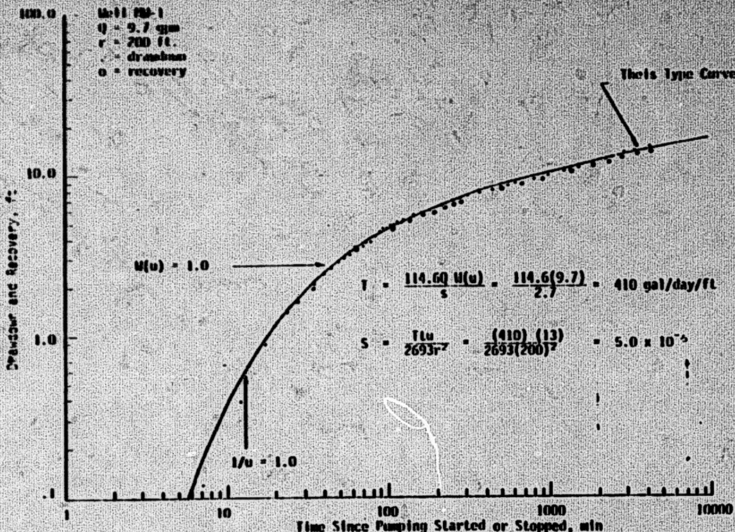


FIGURE B-1 DRAWDOWN AND RECOVERY IN OBSERVATION WELL MW-1(log-log)

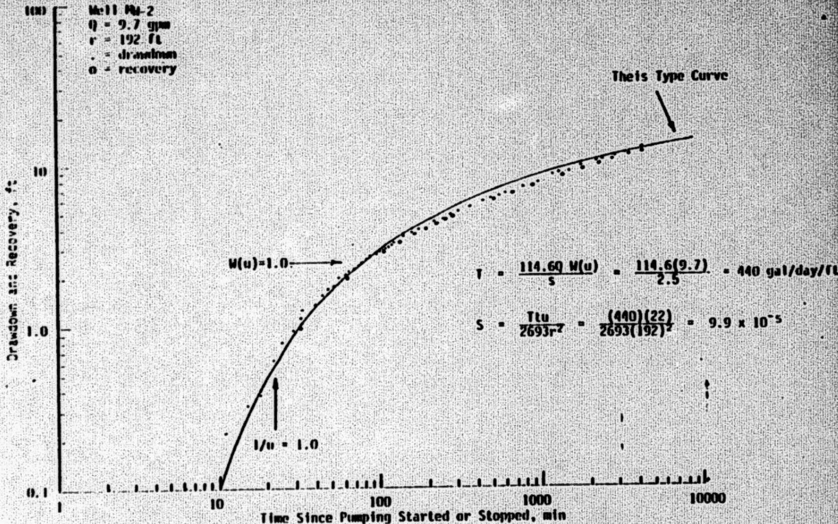


FIGURE B-2 DRAWDOWN AND RECOVERY IN OBSERVATION WELL MW-2(log-log)

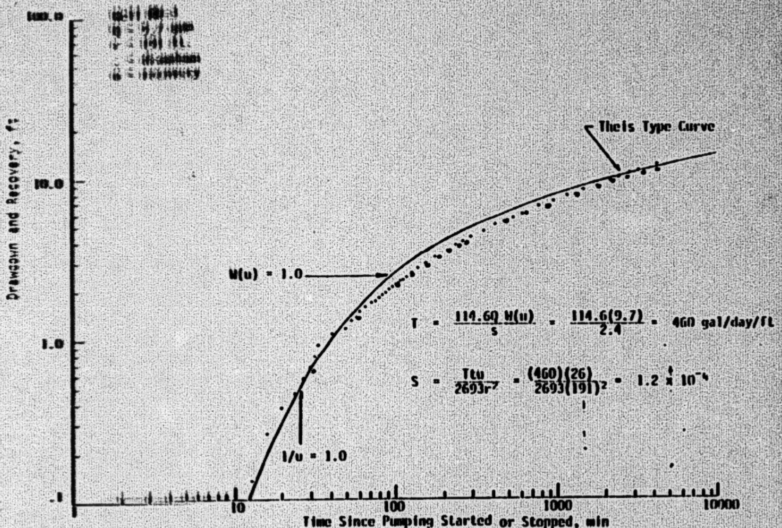


FIGURE B-3 DRAWDOWN AND RECOVERY IN OBSERVATION WELL MW-3(log-log)

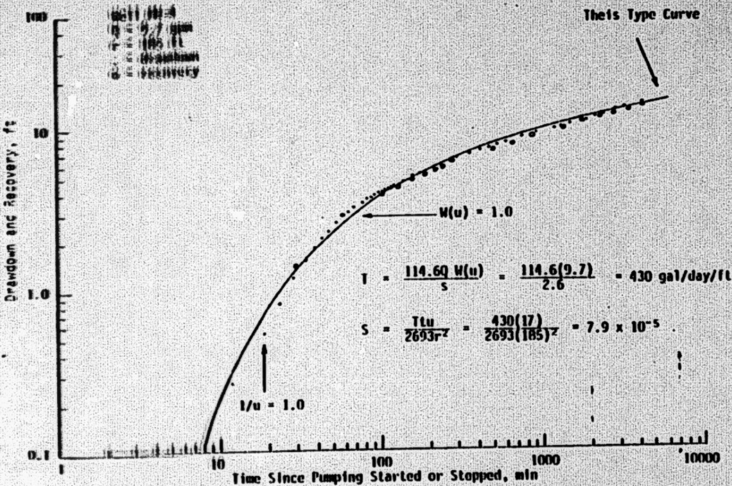


FIGURE B-4 DRAWDOWN AND RECOVERY IN OBSERVATION WELL MW-4 (log-log)

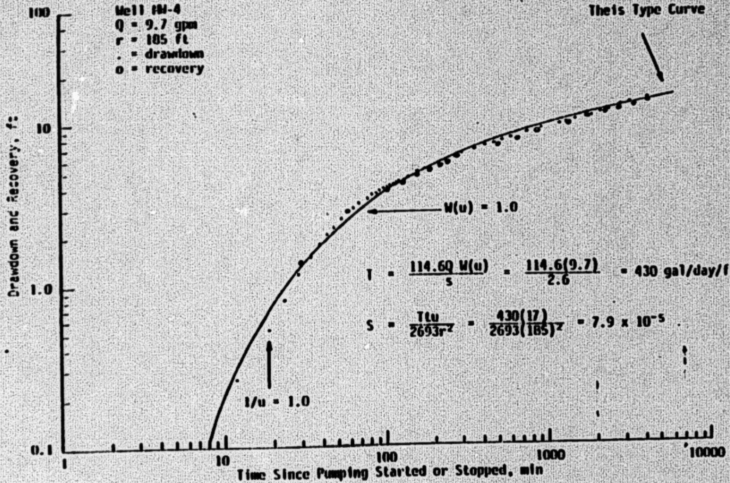


FIGURE B-4 DRAWDOWN AND RECOVERY IN OBSERVATION WELL MW-4 (log-log)

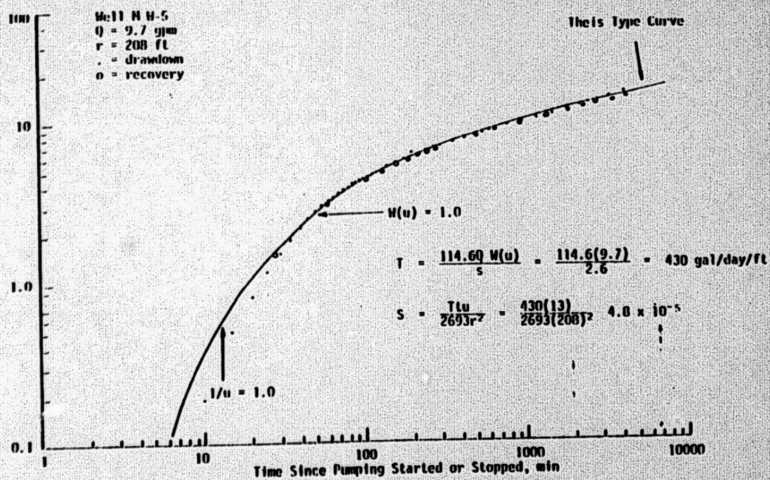


FIGURE B-5 DRAWDOWN AND RECOVERY IN OBSERVATION WELL MW-5(log-log)

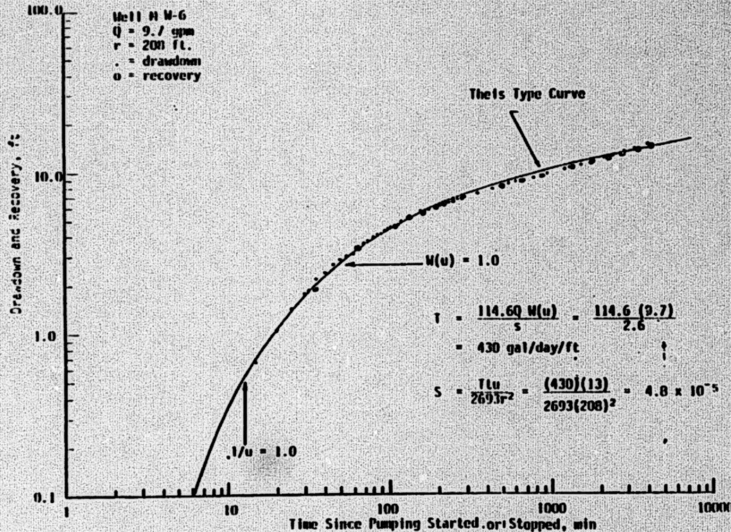


FIGURE B-6 DRAWDOWN AND RECOVERY IN OBSERVATION WELL MW-6(log-log)

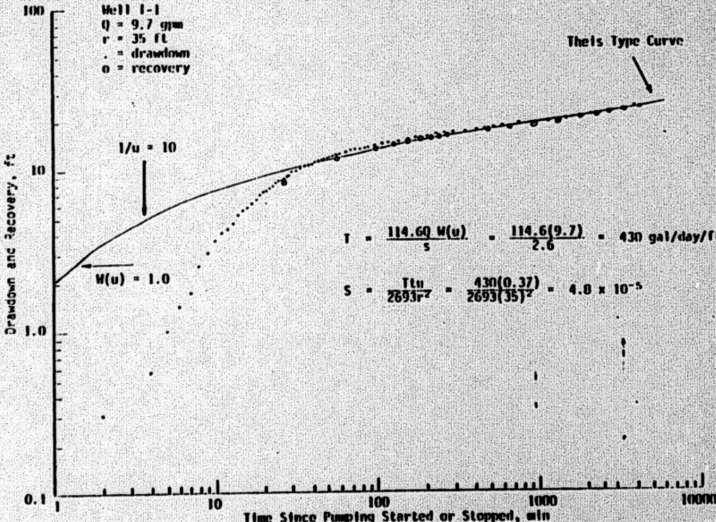


FIGURE D-7 DRAWDOWN AND RECOVERY IN OBSERVATION WELL I-1 (log-log)

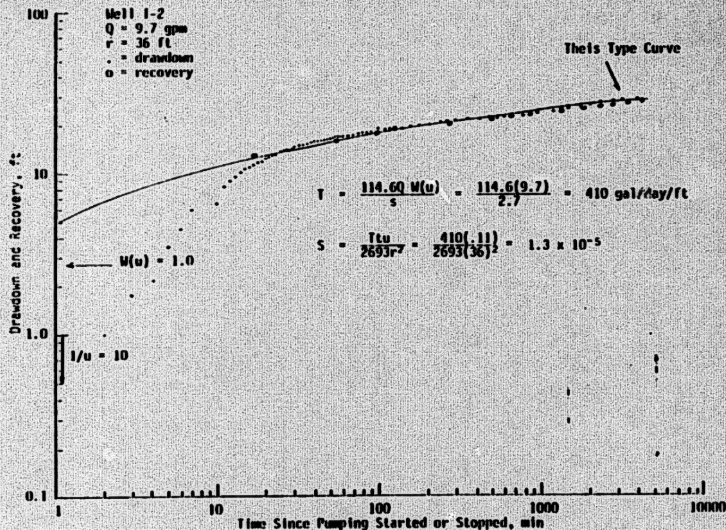


FIGURE B-8 DRAWDOWN AND RECOVERY IN OBSERVATION WELL 1-2 (log-log)

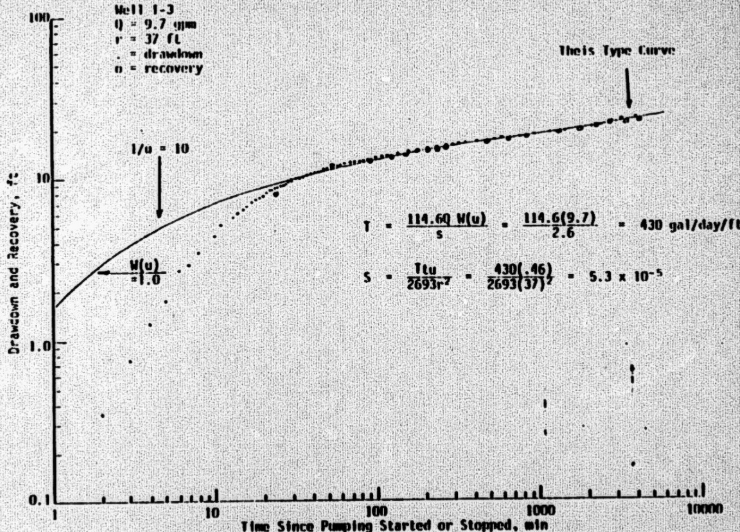
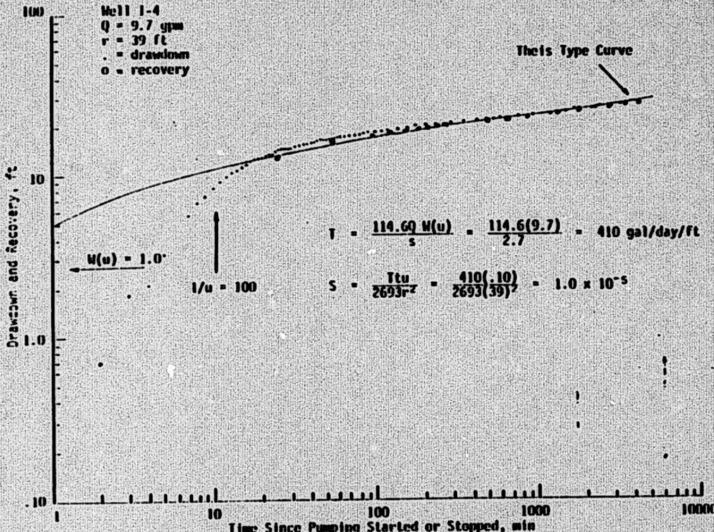


FIGURE B-9 DRAWDOWN AND RECOVERY IN OBSERVATION WELL 1-3 (log-log)



$$T = \frac{114.6Q\,W(u)}{s} = \frac{114.6(9.7)}{2.7} = 410 \text{ gal/day/ft}$$

$$S = \frac{Ttu}{2693r^2} = \frac{410(.10)}{2693(39)^2} = 1.0 \times 10^{-5}$$

FIGURE B-10 DRAWDOWN AND RECOVERY IN OBSERVATION WELL I-4 (log-log)

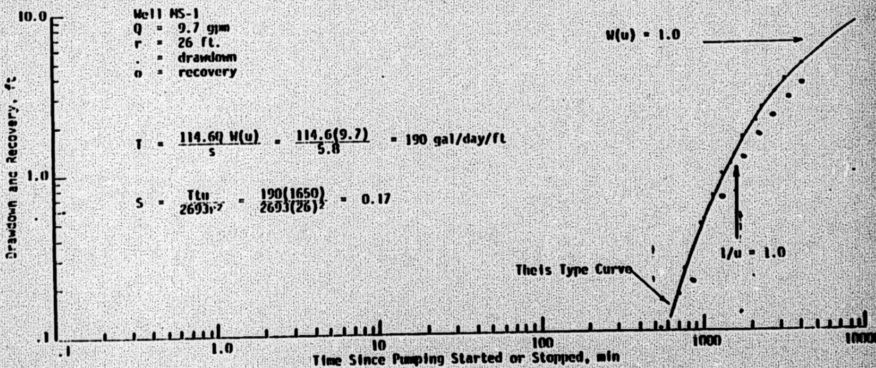


FIGURE B-11 DRAWDOWN AND RECOVERY IN OBSERVATION WELL MS-1 (log-log)

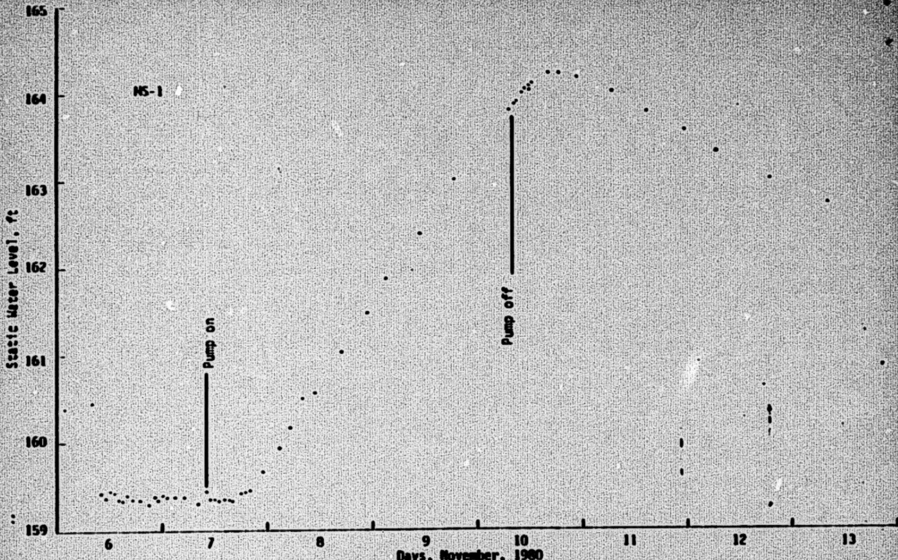


FIGURE B-12 WATER LEVELS IN WELL MS-1 DURING 11/06-11/13/80

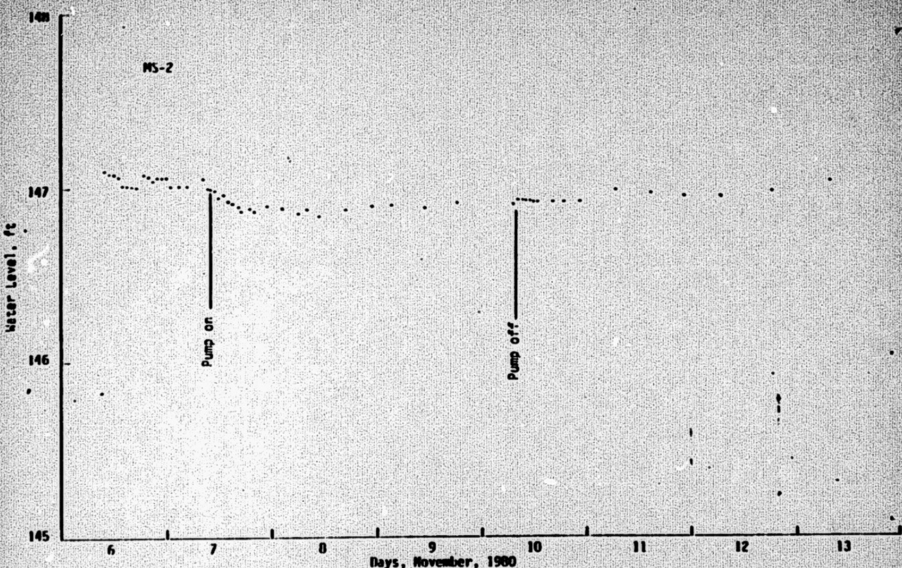


FIGURE B-13 WATER LEVELS IN WELL MS-2 DURING 11/06-11/13/80

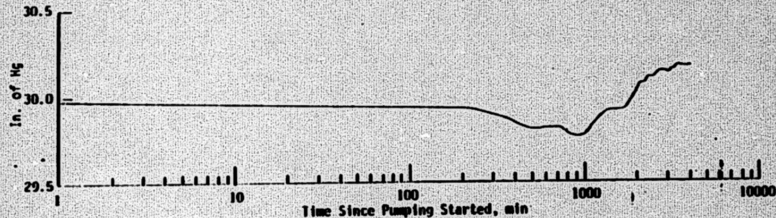


FIGURE B-14 BAROMETRIC PRESSURE DURING THE PUMPING PHASE OF THE TEST

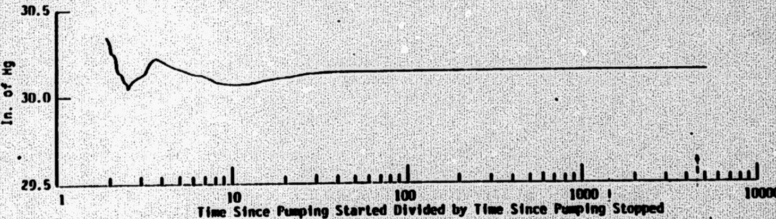


FIGURE B-15 BAROMETRIC PRESSURE DURING THE RECOVERY PHASE OF THE TEST

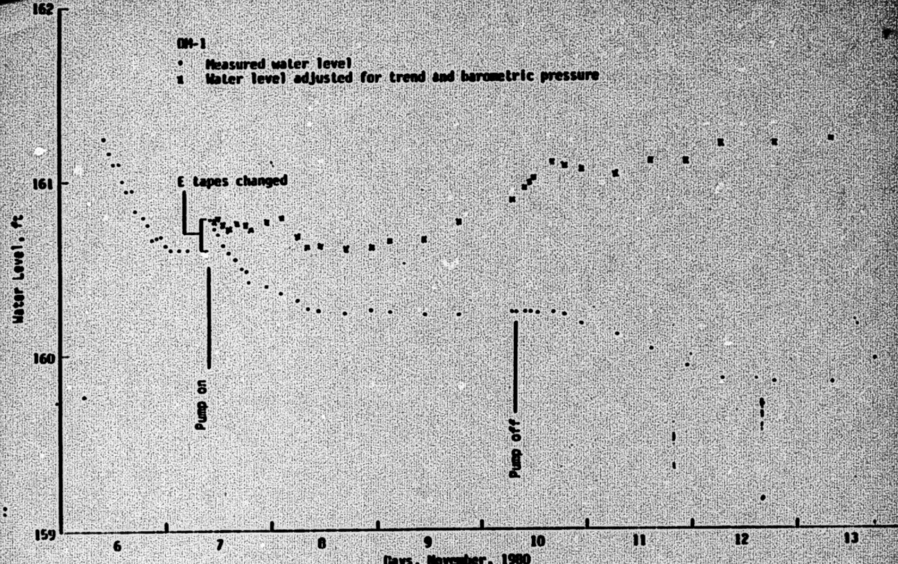


FIGURE B-16 WATER LEVELS IN WELL DM-1 DURING 11/06-11/13/80