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Docket Nos. 40-8981; 40-8958
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MEMORANDUM FOR: Docket File Nos. 40-8981; 40-8958

FROM: Gary R. Konwinski, Project Manager

SUBJECT: ENVIRONMENTAL ASSESSMENT (EA) FOR URANERZ U.S.A., INC., RUTH AND NORTH BUTTE PROJECTS

Attached is the Environmental Assessment (EA) prepared in support of the issuance of commercial source material licenses for Uranerz U.S.A., Inc., Ruth and North Butte Projects. Several environmentally related license conditions have been attached to the EA. With the inclusion of these license conditions and those contained in the accompanying Safety Evaluation Report (SER), commercial operation of the sites will pose no significant impacts.

/S/

Gary R. Konwinski
Project Manager

Attachment:
Environmental Assessment

PM:URFO
GRKonwinski/db
12/21/90

DD:URFO
EFHawkins
12/21/90

D:URFO:RIV
REHall
12/21/90

bcc:

Docket File No. 40-8981
Docket File No. 40-8958
LFMB
PDR/DCS
URFO r/f
ABBeach, RIV
LLO Branch, LLWM
GRKonwinski
JHaes, RCPD, WY
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UNITED STATES NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL ASSESSMENT

PREPARED BY THE

URANIUM RECOVERY FIELD OFFICE

IN CONSIDERATION OF AN APPLICATION FOR TWO

SOURCE MATERIAL LICENSES

FOR

URANERZ U.S.A., INC.

RUTH AND NORTH BUTTE COMMERCIAL IN-SITU LEACH OPERATIONS

LOCATED IN

JOHNSON COUNTY AND CAMPBELL COUNTY, WYOMING

DOCKET NO. 40-8958, SOURCE MATERIAL LICENSE SUA-1539

DOCKET NO. 40-8981, SOURCE MATERIAL LICENSE SUA-1540

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1. INTRODUCTION

1.1 Background

By letters dated October 3, 1988, and March 7, 1989, Uranerz U.S.A, Inc. (Uranerz) submitted two applications for source material licenses to commercially operate the Ruth and North Butte in-situ leach facilities.

Source Material License SUA-1401 was issued in October, 1981, for the Ruth Research and Development (R&D) scale operation. The commercial operation will be an expansion of the R&D operation and will incorporate the existing facilities of the R&D as well as other facilities to support the North Butte operation. An Environmental Assessment was prepared in the consideration of the issuance of Source Material License SUA-1401 for the R&D scale operation. The R&D operation commenced in October 1981 and terminated in January 1984. Following this operation, the site was restored and remains in a partially decontaminated and shutdown status at this time.

The R&D facility is located in southeast Johnson County, Wyoming, about 52 air-miles north of Casper. Similarly, the commercial operation will be located in the same area; however, it covers a larger land mass than the R&D facility. The Ruth site will include portions of Sections 13, 14, 23, 24, 25, and 26 of Township 42 North, Range 77 West. The North Butte site will occupy portions of Sections 18 and 19 of Township 44 North, Range 75 West, as well as portions of Sections 13, 22, 24, and 25 of Township 44 North, Range 76 West. The Ruth site has approximately 1414 acres, while the North Butte site occupies 322 acres. Figure 1.1.01 shows the approximate locations of the two sites.

Land ownership at the two sites is controlled by T. Chair Land Company, Uranerz, the Bureau of Land Management, and Moore Land Company Trust. Uranerz maintains leases with numerous holders of mineral rights.

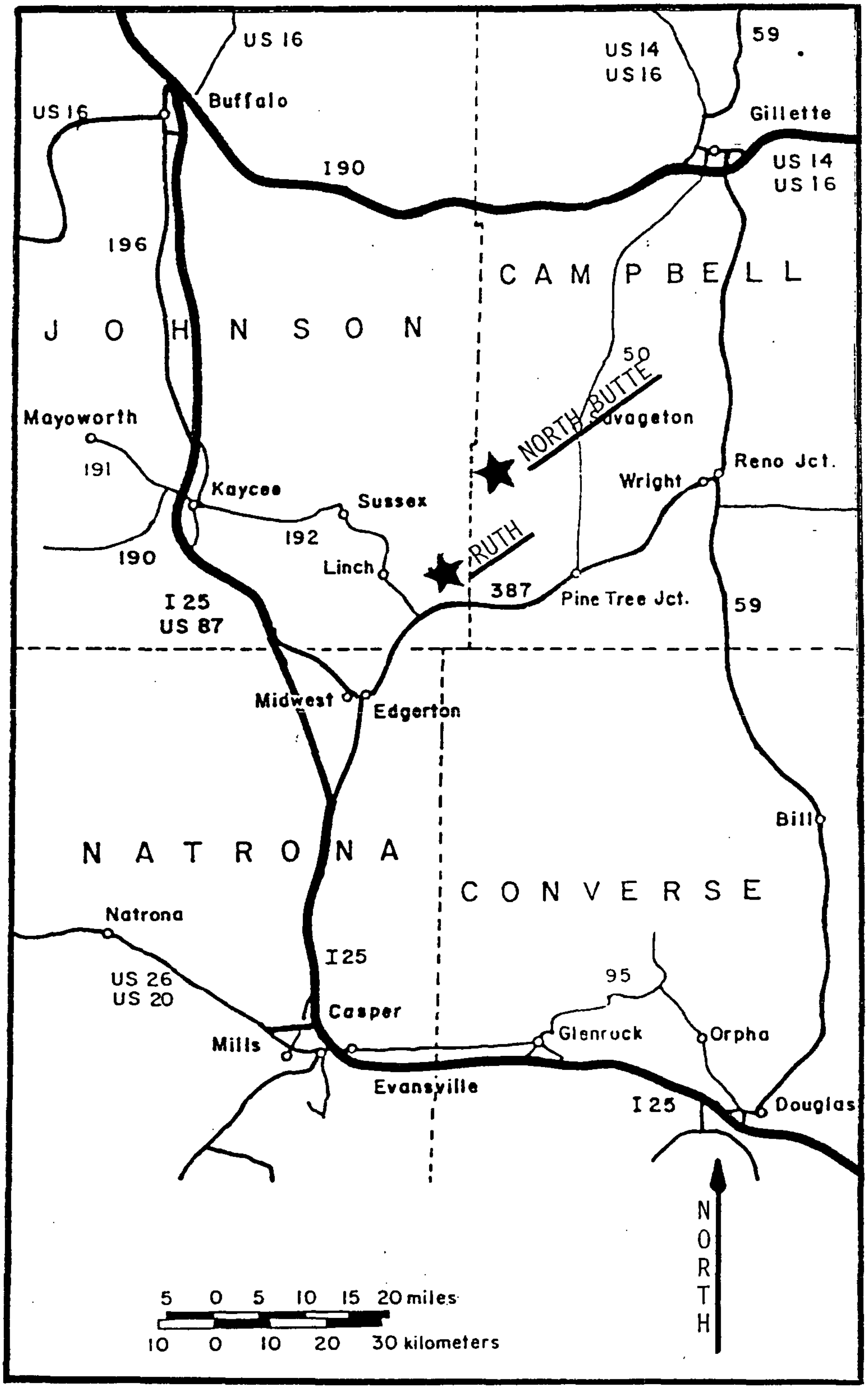
Uranerz proposes to in-situ leach uranium contained in a confined aquifer of the Wasatch Formation which consists of several interbedded sandstones. Ore depths range from 500 to 600 feet below the land surface. The ore body is irregularly shaped and will be divided into numerous mining units.

The majority of the well-field development will take place at the North Butte site. This site will be fully equipped to produce a yellowcake product from its own well fields, as well as other facilities. One of these facilities will be the Ruth site. The Ruth facility will be designed to be a fully-operational satellite facility where uranium will be loaded onto resins in ion exchange columns. The resin will be periodically transferred to the North Butte site for drying and packaging.

Flow rates from the Ruth and North Butte sites will be 1000 gallons per minute (gpm) and 3000 gpm, respectively. The uranium will be loaded on resins at either the Ruth or the North Butte sites. Further processing, consisting of drying and packaging, will take place at the North Butte facility.

Figure 1.1.01

SITE LOCATION MAP



Following the uranium recovery operation in an individual mining unit, the ground water will be restored. The restoration method may involve a combination of ground-water sweep, reverse osmosis with permeate injection, use of a reductant, and well-field recirculation. The primary goal of restoration activities is to return the ground-water chemistry to baseline concentrations.

1.2 Proposed Action

By Form NRC-2, submitted with the Ruth and North Butte applications, Uranerz applied for source material licenses for the Ruth and North Butte operations to allow commercial scale operations. Numerous revisions were made to the documents with a final product being completed during December 1990.

This EA discusses the environmental aspects of the commercial operation of the Ruth and North Butte projects and summarizes the environmental effects associated with their operations. Additional information concerning the safety aspects of the proposed action is contained in the accompanying Safety Evaluation Report (SER).

1.3 Review Scope

1.3.1 Federal and State Authorities

Under Part 40 of Title 10 of the Code of Federal Regulations (CFR) (Domestic Licensing of Source Material), a NRC license is required in order to "...receive, possess, use, transfer...any source material..." 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 and wastes generated by the operation which includes above-ground wastes from in-situ operations.

In accordance with 10 CFR Part 51, this EA serves to (a) briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact, (b) fulfill the NRC's compliance with the National Environmental Policy Act when no environmental impact statement is necessary, and (c) facilitate preparation of an environmental impact statement when one is necessary. Should the NRC issue a finding of no significant impact, no environmental impact statement would be prepared and the commercial source material license would be granted subject to operating conditions contained in the source and byproduct material license.

The State of Wyoming, Department of Environmental Quality, Land Quality Division (WDEQ), administers and implements the State's rules and regulations. In an independent action, Uranerz has applied for, and will be required to receive, a permit from the State of Wyoming prior to commencing operation of the proposed commercial scale operation.

1.3.2 Basis for NRC Review

The NRC is preparing this EA review of the proposed licensing action, in accordance with Title 10, CFR, Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.

In conducting this assessment, the staff considered the following:

- Environmental information submitted by the applicant to support their application for a commercial license.
- Operational history of the research and development operations, including inspection reports, quarterly environmental monitoring reports, radiological safety audits, and well-field restoration information.
- Information supplied in discussions with the State of Wyoming relating to the State permitting actions and aquifer exemption procedures.
- Information derived from professional papers, journals, and textbooks; NRC regulations and regulatory guides, as well as independent consultants.

2. SITE DESCRIPTION

2.1 Location and Land Use

The proposed Ruth and North Butte facilities are located in Johnson and Campbell Counties, respectively, as shown on Figure 1.1.01. Both facilities are located in the Power River Basin of a rather remote section of Wyoming. The predominate land use in the proposed project area is livestock grazing. There are no cultivated lands, however oil and gas operations are located adjacent to the proposed operations. Uranerz holds claims or leases for all the production rights to the lands to be mined. There is a complex list of other individuals and entities that have agreements with Uranerz. After mining, the land will be reclaimed and returned to its original use.

The environmental assessment of the projects is based upon the license applications. The applications are valid only for the described activities. To assure that other environmental disturbance is not created without sufficient assessment, Uranerz will be required by license condition to environmentally evaluate future activities prior to their implementation. Following the evaluation, Uranerz will be required to seek a license amendment.

2.2 Geology and Hydrogeology of the Ore Body

2.2.1 Hydrogeologic Setting

The project area topography consists of flat to gently sloping terrain with an occasional unnamed draw. There are two prominent physiological features within the project area. Crawford Draw and its associated flood plain extend across the Ruth site. At the North Butte site, there is a more extreme elevation change due to the proximity of the project area to the topographic high of North Butte. Due to the erosion associated with this feature, there are several incised drainages.

The sedimentary strata that Uranerz proposes to leach are Eocene age deposits found entirely within the Wasatch Formation. A typical section would have several fine grained sands and shales overlying the production zone. The production zone consists of the C, B, and A sands that may or may not be separated by interbedded shales and nonmineralized sandstones. Thin coal beds utilized as stratagraphic markers are common in the area. At the Ruth site, the A-sand is heavily mineralized and therefore is the designated production zone. Both the B and C sands are either poorly mineralized or have hydrologic characteristics that are not favorable for solution mining. The North Butte site has a slight stratagraphic change in that the C, B, and A sands thicken to an average vertical section of 386 feet. They are often heavily mineralized and therefore all three sands will be mined in this area. A typical stratagraphic column is shown in Figure 2.2.1.1.

The uranium deposits at the Ruth and North Butte sites are typical Powder River Basin roll front deposits. Within the mineralized zones, there are several vertically superimposed individual roll fronts. Precipitation of the uranium resulted when the oxidized water containing the uranium encountered reducing conditions. These reducing conditions are probably the result of hydrogen sulfide, and to a lesser degree, organic material and pyrite that were present in the aquifer. Due to multiple roll front deposits that moved through the vertically separated sandstones, the mineralization varies in its degree and concentration.

The Ruth and North Butte project areas are located in seismic risk Zone 1. This relatively quiet seismic region could expect minor disturbances from distant earthquakes. Few earthquakes capable of producing damage have originated in this region. The most probable source of earthquakes affecting the project site would be a moderate seismic risk belt that extends along the Wyoming-Idaho border, more than 200 miles west of the permit area.

2.2.2 Water Quality

Uranerz submitted a compilation of water quality data for selected wells within and around the areas proposed for commercial production. At the Ruth site, 12 wells were sampled with a total of 118 sampling events. The majority of the samples were analyzed for 34 ground-water constituents. Due to this, a wide spectrum of baseline ground-water data has been collected. Similarly, 10 wells were sampled at the North Butte site. These wells represent 69 sampling events for 34 ground-water parameters. The wells utilized for baselining purposes are shown in Table 2.2.2.1.

The wells that were sampled at the Ruth and North Butte sites have collected adequate data to represent regional water quality. Uranerz has determined baseline water quality primarily on a regional scale. However, prior to mining, Uranerz will be required to establish baseline water quality within the mining zone, at the mining zone perimeter, as well as in the first aquifers overlying and underlying the respective mining zones. These water quality data will be utilized to determine monitoring requirements, restoration success, and the extent of their impacts. Additionally, these data will be utilized to calculate upper control limits to determine if excursions are taking place. Should an excursion take place, Uranerz will be required, by license condition, to implement corrective actions as well as submit a report on their efforts.

2.2.3 Aquifer Testing and Ore Zone Containment

A total of five aquifer tests were utilized to determine the hydrogeologic conditions that exist at the sites. Two tests were run at the Ruth site. The original test, consisted of several testing events and supported the licensing of the Ruth R&D facility. These tests indicated that adequate ore zone confinement existed above and below the mineralized zone. These tests were confirmed with several years of mining, restoration, and stability monitoring which indicated that confinement of the lixiviant could be expected. In addition to the original test and the actual mining operation, a 7-day test was conducted at the Ruth site from July 5 through July 12, 1988. The ore sand (A sand) at the Ruth site was stressed by pumping at an average rate of 4.85 gpm, while nine A sand observations wells were monitored for drawdown. The adjacent

Figure 2.2.1.1

TYPICAL STRATAGRAPHIC SECTION FOR THE RUTH & NORTH BUTTE SITES

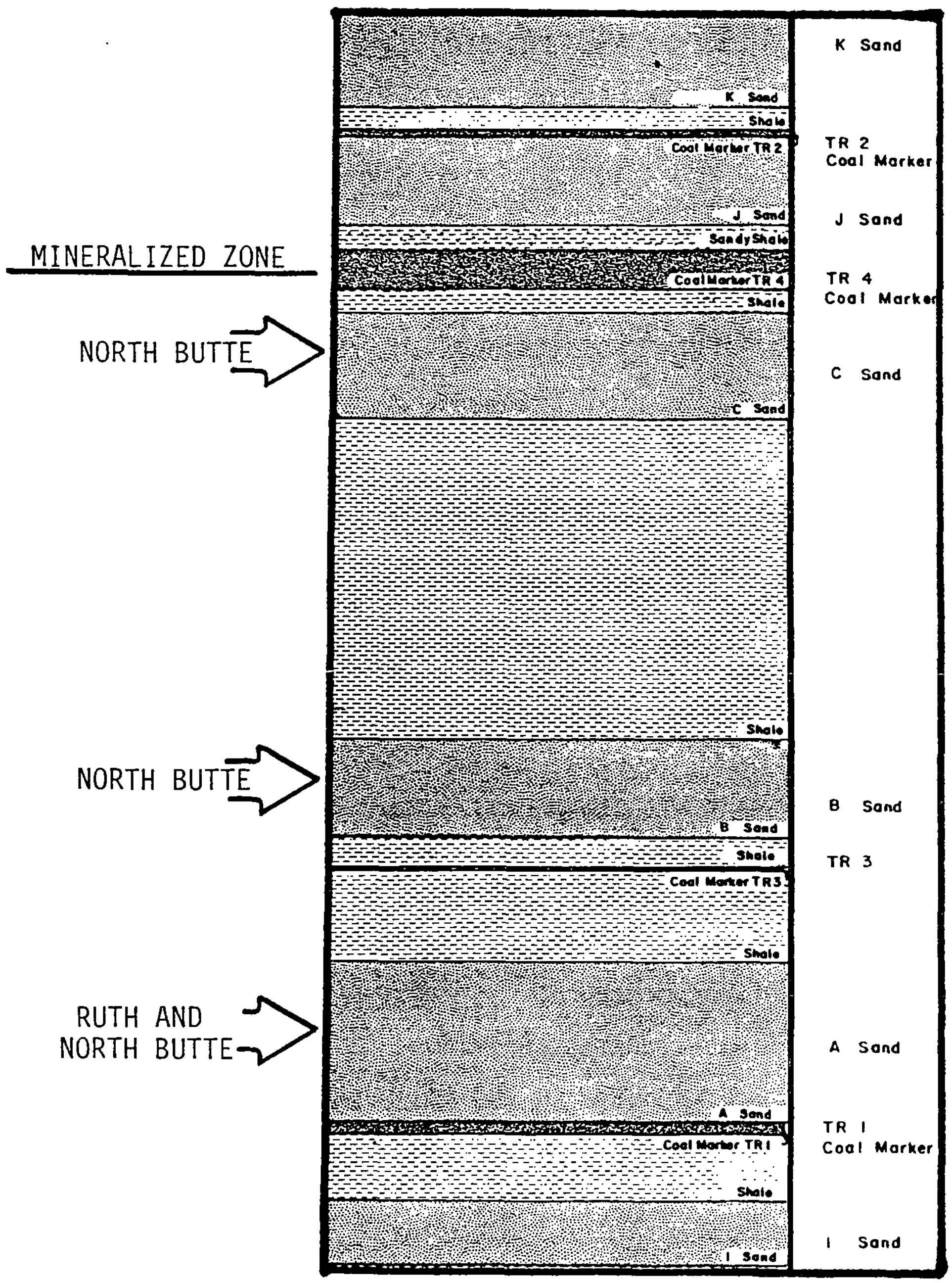


Table 2.2.2.1

Baseline Water Quality Sampling Sites

RUTH SITE

Aquifer/Sand	Well No.	Period	No. of Samples
Ore Body/A-sand	3L	07/80	1
	4L	06/12-10/80	3
	7L	02/80	1
	8L	06/80-10/80	3
	1-M-20	03/82-12/84	12
	4-M-20	03/82-12/84	12
	5-M-20	03/82-12/84	12
	7-M-20	03/82-12/84	13
	Moore South	02/80-06/88	23
Upper/B-sand	1-M-30	03/82-12/84	13
	Moore North	02/80-06/88	22
Lower/1-sand	1-M-10	03/82-12/84	13

NORTH BUTTE SITE

Aquifer/Sand	Well No.	Period	No. of Samples
Ore Body/A-sand	SSE-L (313-W)	10/80-04/88	5
	SS1-L (302-W)	10/78-04/88	10
	SS2-L (1282-W)	10/80-04/88	5
Ore Body/B-sand	SSE-M (310-W)	10/79-04/88	6
	SS1-M (303-W)	11/78-04/88	10
Ore Body/C-sand	SS1-U (304-W)	10/78-04/88	10
Ore Body/BC-sand	SS2-M (1283-W)	10/80-04/88	5
Upper/F-sand	SSE-U (311-W)	08/79-04/88	7
	SS2-U (1281-W)	10/80-04/88	6
	SS1-F (364-W)	10/80-04/88	5

aquitards to the A sand (upper and lower) were monitored to obtain field vertical permeabilities of the aquitards. The upper (B sand) and lower (1 sand) adjacent aquifers were also monitored to determine the response in these two aquifers from the stress on the A sand aquifer.

The tests performed at the Ruth site indicate that the A-sand aquifer, which is the production zone, has an average transmissivity of 110 gal/day/ft, vertical hydraulic conductivity ranging from 1.2E-4 cm/sec to 7.7E-5 cm/sec, and the horizontal hydraulic conductivity was calculated to be 1.0E-4 cm/sec. These hydraulic conductivities are typical for the mineralized sandstones known to occur in the Powder River Basin.

Field permeabilities were measured to be 7.0E-8 cm/sec to 1.0E-7 cm/sec for the upper and lower aquitards, respectively. In consideration of these values, it would require approximately 55 years for the lixiviant to move across the minimum 20 feet of aquitard. This does not take into consideration operational forces that would overproduce in the mineralized zone and therefore draw water into the production zone rather than allow it to flow out.

The various hydrostratagraphic units at the Ruth site and their relationship to one another are shown in Figure 2.2.1.1. Similarly, the well configuration and various strata of completion are shown in Figure 2.2.3.1.

Two aquifer tests were performed at the North Butte site in 1988, to determine aquifer characteristics as well as aquitard parameters. An additional supplementary test was also performed, but will not be individually discussed because its results are combined with the other tests. Unlike the Ruth site, no R&D operations had taken place; therefore, there was no previous data to utilize. However, the hydrostratagraphic units at the North Butte site were similar, due to their common depositional origin, to those at the Ruth site.

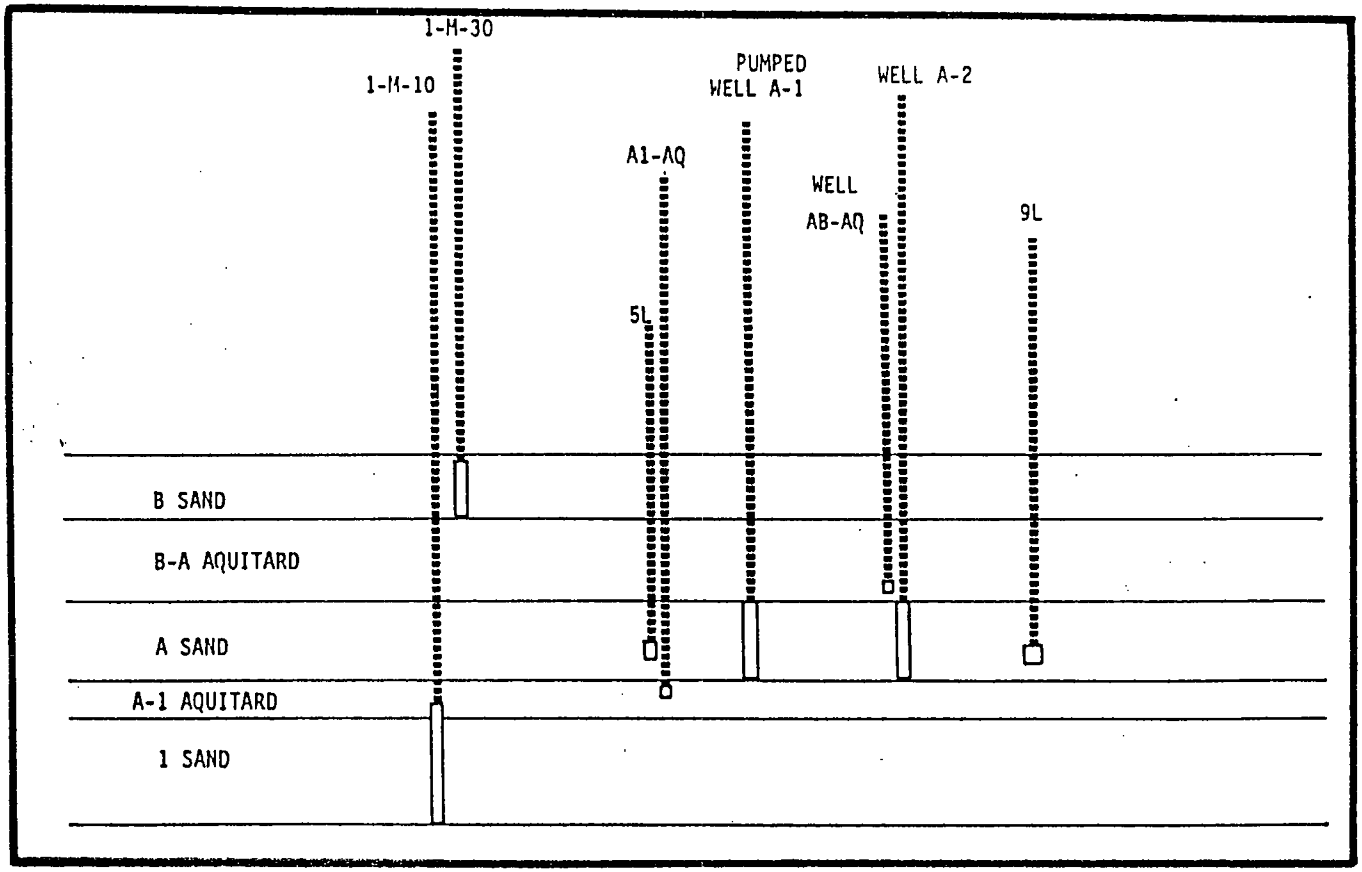
The tests performed at the North Butte site indicate that the A, B, and C sands represent mineralized aquifers which are mineable. Natural hydrogeological barriers in the form of aquitards exist above and below the individual mineralized sands or above and below groups of sands. The A aquifer had a hydraulic conductivity that ranged from 4.0E-4 cm/sec to 3.1E-4 cm/sec, while the B and C aquifers had measured hydraulic conductivities of 4.6E-4 cm/sec and 3.5E-4 cm/sec, respectively. Without exception, the aquitards separating the A, B, and C sands or the BC sand from other aquifers in the area displayed hydraulic conductivities ranging from 6.0E-8 to 6.7E-9 cm/sec.

The various hydrostratagraphic units encountered at the North Butte site as well as the well configurations that were utilized are shown in Figures 2.2.3.2 and 2.2.3.3.

The aquifer tests and the successful operation of the Ruth R&D site indicate that the mineralized zones at the proposed Ruth and North Butte sites are well confined by aquitards having relatively poor hydraulic conductivities. Generally, there are two or three orders of magnitude difference in hydraulic conductivity between the various mineralized zones and their aquitards. Such a difference indicates that adequate confinement exists to control the migration of lixiviant.

Figure 2.2.3.1

AQUIFER TEST WELL CONFIGURATION
FOR THE RUTH SITE



3. PROCESS DESCRIPTION

3.1 In-Situ Leaching Process

The in-situ leach method of uranium recovery was first applied in south Texas in 1975. Since that time, numerous other facilities have been developed on both the research and development scale as well as the commercial scale. For the most part, these ventures have shown that uranium can be economically recovered and the ground-water quality restored to baseline or premining class of use standards.

There are many environmental advantages to in-situ leaching of uranium over conventional mining methods such as open pit mining or underground mining. Conventional extraction methods can produce a significant impact on the environment due to open pits, mine dewatering, spoil piles, etc. The greatest impact of the in-situ leach extraction method is a temporary impact to the ore zone ground-water quality. This impact is termed temporary because, in most instances, the ground water can be restored to its baseline quality, premining use, or potential use category. In-situ leaching permits economic recovery of deep, low-grade sandstone uranium deposits currently economically unrecoverable by conventional mining methods. The extent to which in-situ leaching can be conducted is limited in that the ore zone conditions must be suitable for containing and controlling lixiviant during the leaching process.

The mechanics of in-situ leaching are relatively simple in theory. An oxidant-charged lixiviant is injected into the production zone aquifer through injection wells. With slight pH adjustments, the reduced uranium is oxidized and solubilized when contacted by the lixiviant. Following this, the uranium-rich solution is drawn to the recovery wells where it is pumped to the surface and transferred to the processing facility.

During production, there is a constant movement of mining solution through the aquifer from the outlying injection wells to the internal recovery wells. The injection and recovery wells can be arranged in any of a number of geometric patterns depending on ore body configuration, aquifer permeability, and operator preference; however, most often, they are in a five- or seven-spot pattern. Monitor wells surround the well-field pattern area, both vertically and horizontally, and are screened in appropriate stratigraphic horizons to detect any lixiviant that may migrate out of the production zone. Due to confining layers above and below the mining zone and the continual movement of lixiviant to centrally located recovery wells, excursions of mining solutions are rare.

Once the uranium-rich solution reaches the processing facility, it is pumped through a bed of ion exchange resins where the uranium is absorbed onto the resins. The barren solution from the ion exchange vessel is cycled back to the injection circuit for chemical reconstitution and reinjection into the well field for further uranium recovery.

Figure 2.2.3.2

AQUIFER TEST WELL CONFIGURATION
FOR THE NORTH BUTTE SITE,
"A" & "B" SANDS

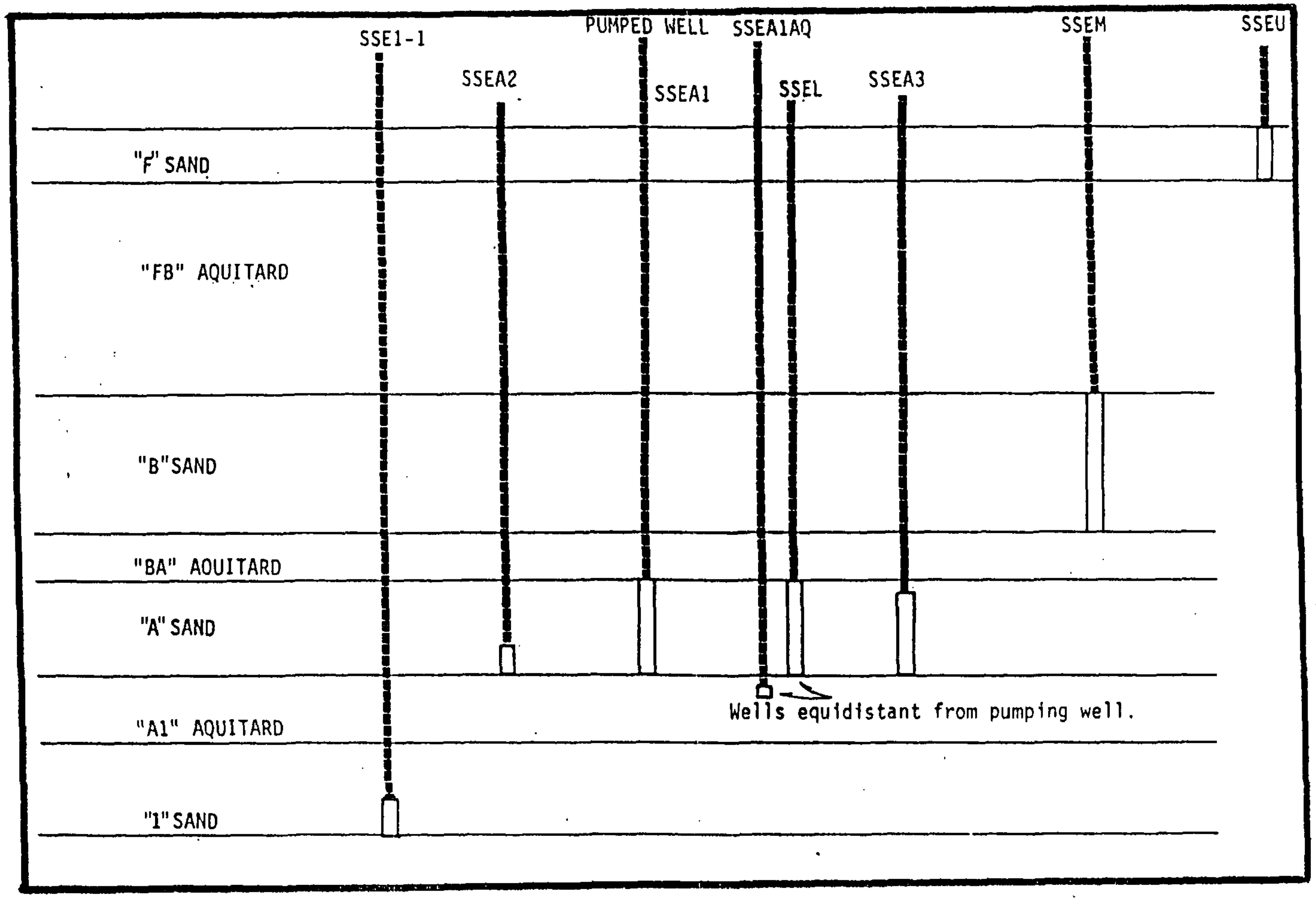
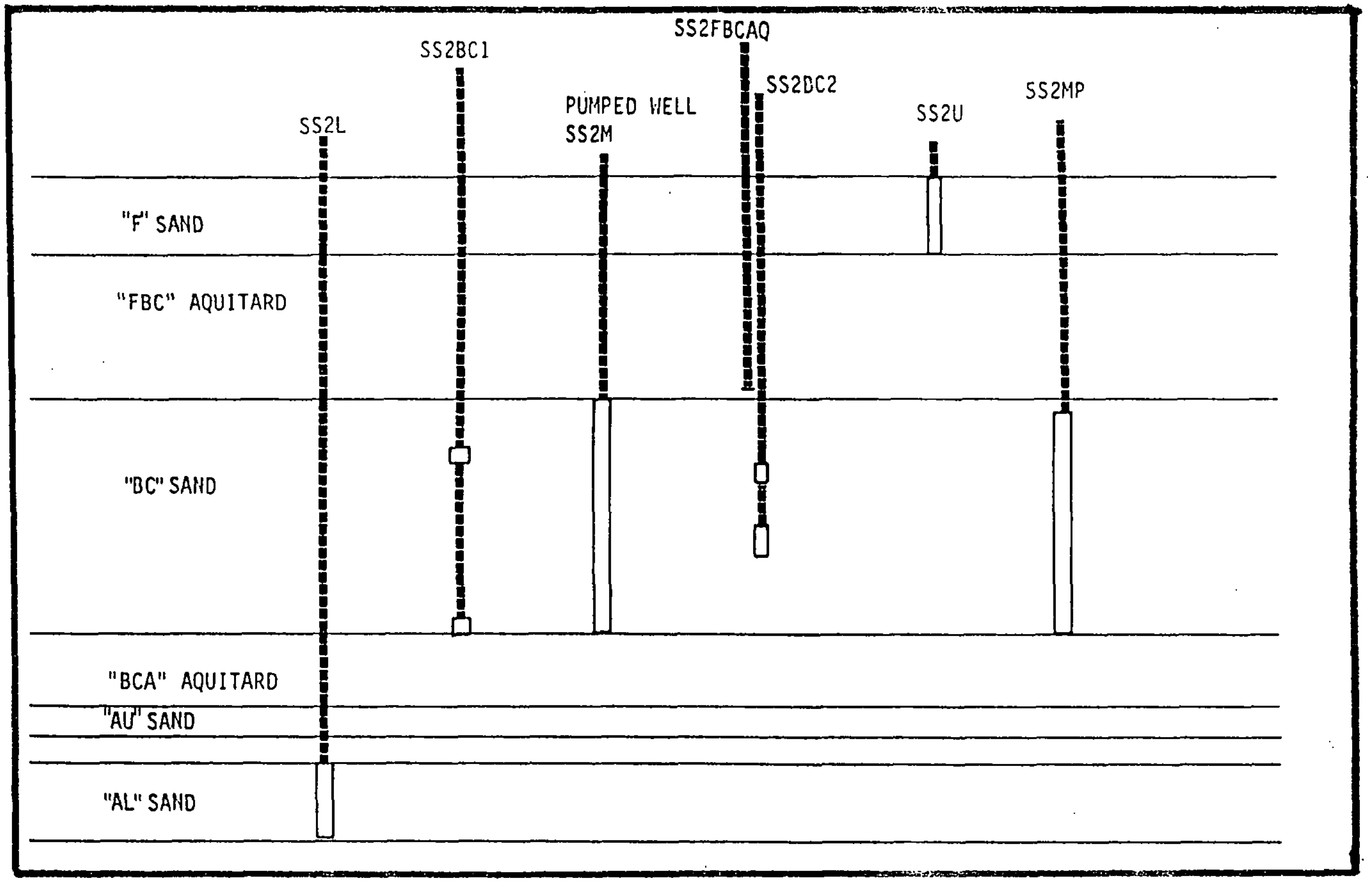


Figure 2.2.3.3

AQUIFER TEST WELL CONFIGURATION
FOR THE NORTH BUTTE SITE,
"BC" SAND



When the resin bed becomes saturated with uranium, the resins are eluted or stripped by passing a strong chloride solution through the resin bed. The resultant concentrated uranium solution is transferred to tanks where the uranium is precipitated out of solution by the addition of hydrochloric acid, sodium hydroxide, and hydrogen peroxide. The resulting product is a uranium slurry that is approximately one-half water. This product may either be shipped as a slurry, processed slightly more to a wet cake, or dried.

3.2 The Ore Body

The production unit at the Ruth and North Butte sites consists of the A, B, and C sandstone units of the Wasatch Formation, separately or in combination. In these formations, the uranium is found in several vertically separated roll front deposits as well as in a rather large roll front deposit where the B and C sands intermingle. The ore body is extremely well known at both sites. Over a 16-year period from 1967 to 1983, 1120 exploration holes were drilled at the Ruth site. Similarly, over a 21-year period from 1967 to 1988, 2720 exploration holes were drilled at the North Butte site.

During formation of the deposits, the precipitation of the uranium resulted when the oxidized ground water which contained the uranium, entered areas of reducing conditions. These reducing ground-water conditions were probably the result of hydrogen sulfide and to a lesser degree, organic material and pyrite that are present in the formation, as well as other dissolved materials. When the uranium-enriched ground water encountered these conditions, the uranium became insoluble and precipitated as mineral coatings on sand grains and within pore spaces.

The physical shape of the ore deposit is dependent on the local permeability of the sandstone matrix, its continuity and distribution in the geologic unit as well as the oxidation/reduction front in the paleo aquifer. The Ruth ore body, which is proposed to be mined, consists of a rather elongated deposit which is approximately 2000 feet long and 300 to 500 feet wide. This contrasts sharply with the proposed mining area for the North Butte site. This mining area has a rather sinuous shape reminiscent of past fluvial deposition. The Ruth and North Butte areas that are proposed to be mined are shown in Figures 3.2.1 and 3.2.2.

For in-situ leaching to be successful, the ore deposit must be (1) located in a saturated zone, (2) bounded above and below by suitable confining layers, (3) of adequate permeability, and (4) be amenable to chemical leaching. As described above, the proposed mining area has favorable hydrogeological and structural characteristics to allow in-situ leaching of uranium. The hydrogeology and aquifer characteristics indicate that mining solutions will be contained within the production zone. Further evidence of this is demonstrated by the operational history of the R&D project.

3.3 Well Field Design and Operation

The proposed mining project is divided into two separate operations. The operations at the Ruth site will be divided into three mining units, each unit will represent approximately 3 years of production, and contain about 1.1 million pounds of recoverable uranium. Due to the possibilities of the ore body boundaries being changed as a result of future ore reserve information, the actual configuration of the various well fields, as well as the ultimate final boundaries of the mining units will be determined when the production and injection wells are installed.

The North Butte ore body has been divided into nine mining units. Complete design of mining unit I has been completed, and the design calls for 311 production wells, 350 injection, and 29 monitor wells. Each mining unit ranges from 1.2 million to 1.8 million pounds of uranium. The ore body will be mined through the use of a series of five- or seven-spot patterns installed over the mineralized section of the formation. A single five-spot pattern is roughly rectangular and consists of four injection wells surrounding a single central recovery well. Spacing between the wells in any five-spot will vary depending on the topography and ore characteristics. Where five-or seven-spot configurations are impractical, line drives consisting of alternating or staggered injection and production wells will follow narrow ore trends. The various injection and recovery patterns are shown in Figure 3.3.1. The proposed mining schedule is currently under evaluation; however, flow rates for the first year of production will not exceed 1000 gpm at the Ruth site and 3000 gpm at the North Butte site. The flow rate determines the amount of effluent that the facility will produce. Due to this, the process will be limited by license condition to a maximum flow rate of 4000 gpm, of which 1000 gpm will be at the Ruth site and 3000 gpm will be processed at the North Butte site. Similarly, yellowcake production will be limited to 1,000,000 pounds annually, as this was the input to the MILDOS program (see Section 4.2.2).

The various types of injection and production wells will be monitored by perimeter monitoring wells designed to determine if excursions are taking place. The appropriate location of the monitor wells, due to the natural ground-water gradient that exists, will vary with the portion of the mining unit that is being monitored. Therefore, perimeter monitor well spacing varies from 400 feet, in downgradient directions, to 1000 feet in upgradient directions. The monitor well designs for the Ruth and North Butte projects are shown in Figure 3.3.2. Prior to installation of additional mining units, the licensee will be required by license condition to submit a monitor well installation program.

Plans have been formulated for the first several years of well-field operation and subsequent uranium production. The mining and restoration schedule proposed by Uranerz for the Ruth and North Butte sites is shown in Table 3.3.1.

Figure 3.2.1

THE NORTH BUTTE ORE BODY
CONFIGURATION

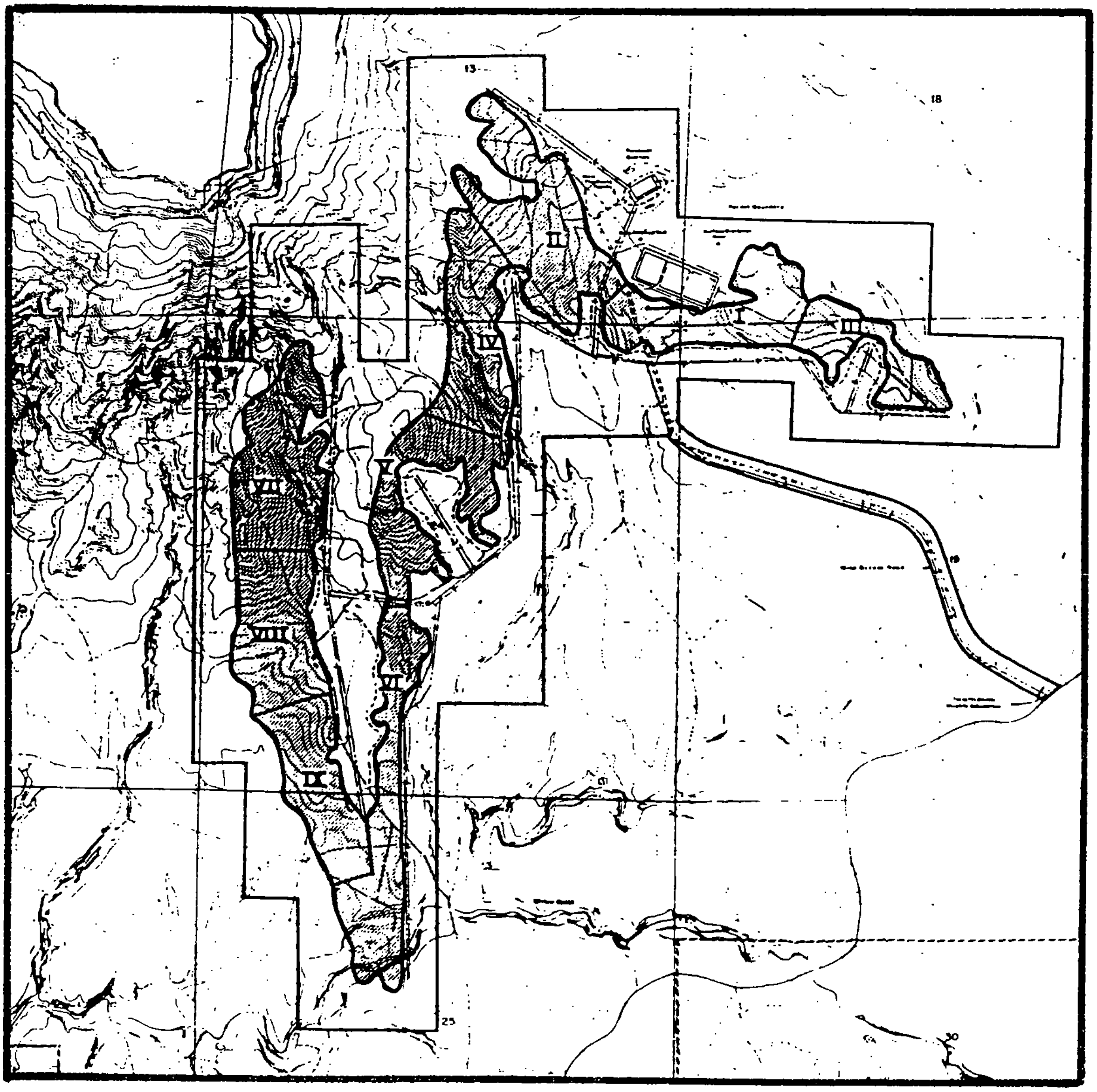


Figure 3.2.2

THE RUTH ORE BODY
CONFIGURATION

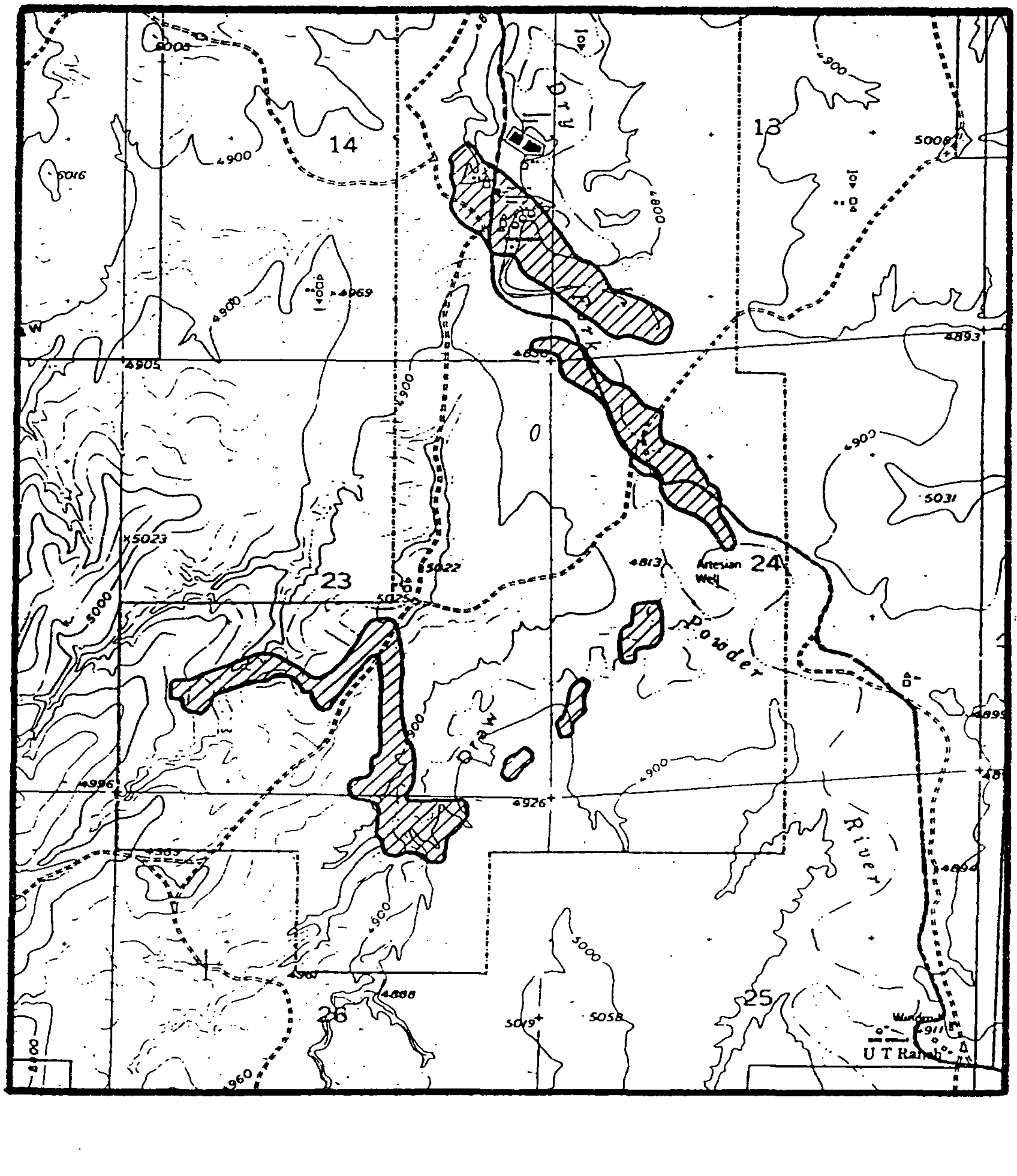
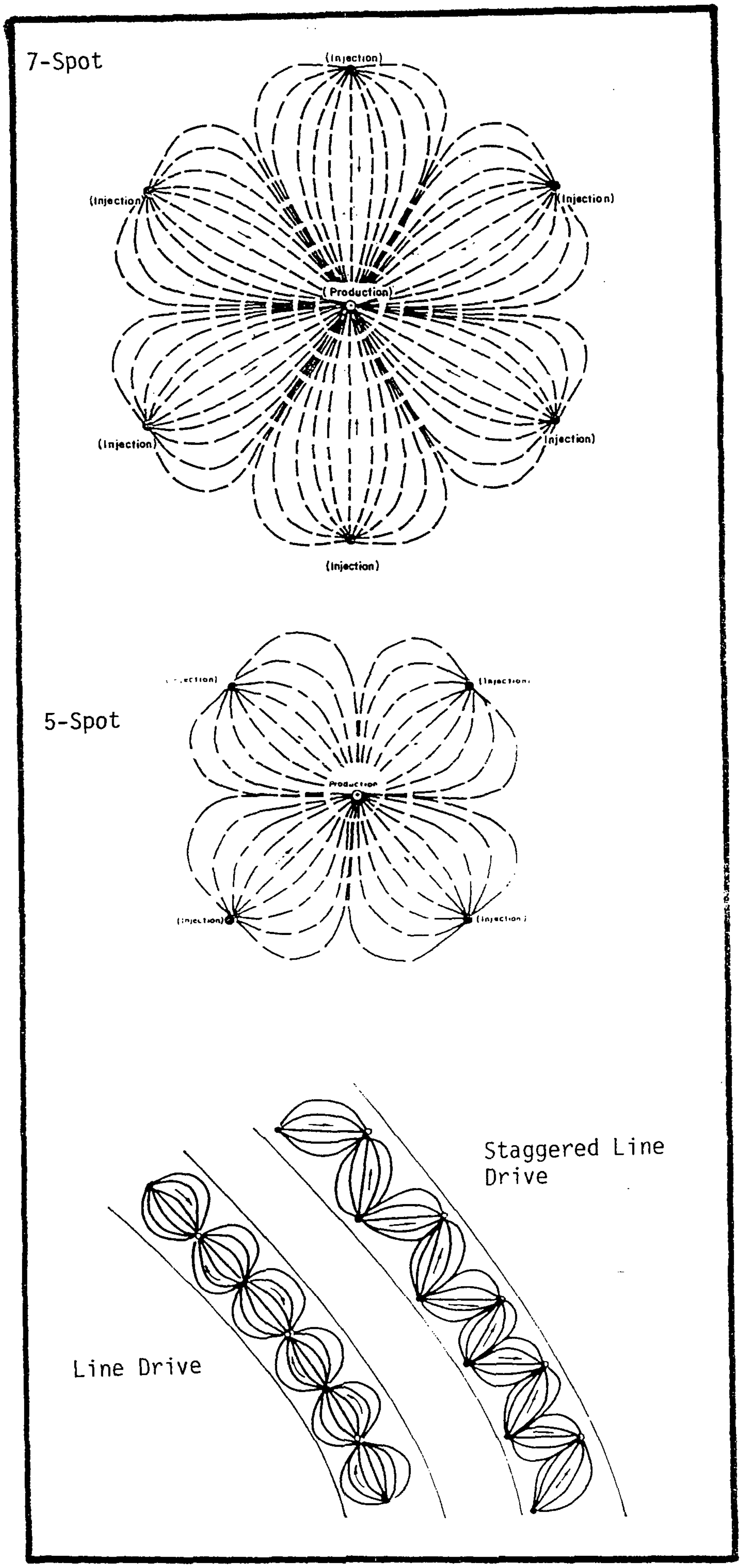


Figure 3.3.1

TYPICAL INJECTION AND RECOVERY WELL PATTERNS



Prior to the injection of lixiviant in a given mining unit, Uranerz will be required by license condition to submit a request for well field authorization. The request will include the baseline water quality data for the excursion monitor wells and the restoration sampling wells located in the mining unit under consideration. Uranerz has also proposed to submit a map showing the location of installed monitoring wells that will monitor the mining areas included with each request for well field authorization. This phased well field authorization technique will allow continual regulatory oversight based upon experience gained during mining operations.

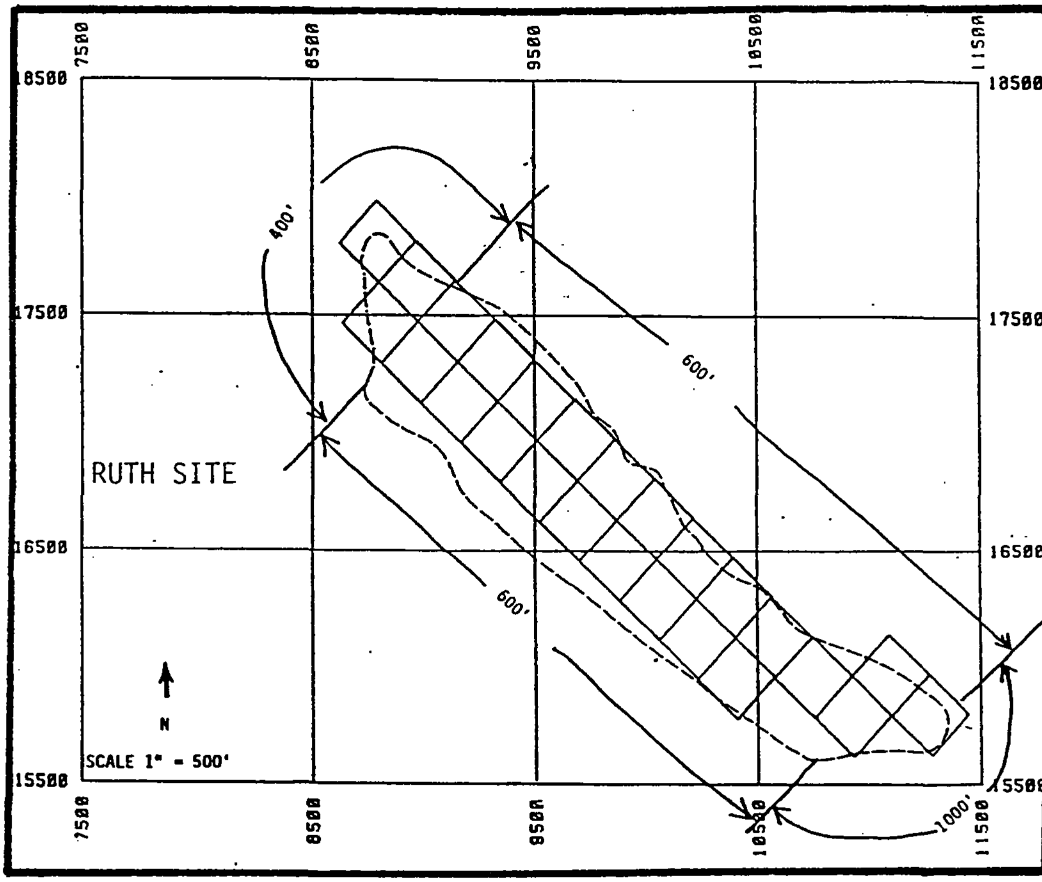
Well completion will be similar for all wells at both sites. The wells will be drilled utilizing a rotary drill rig. A pilot hole will be drilled from the surface to a depth approximately 8 feet beneath the bottom of the lowest anticipated ore zone. The diameter of this pilot hole will be approximately 5-1/8 inch in diameter. At least 4 heavy drill collars will be used along the casing to insure as little vertical deviation as possible. Bentonite and drilling mud additives will be used to insure a clean open hole. Following the drilling to total depth, circulation and removal of the drill stem, the hole will be logged by geophysical methods. The logging parameters will include the following as necessary:

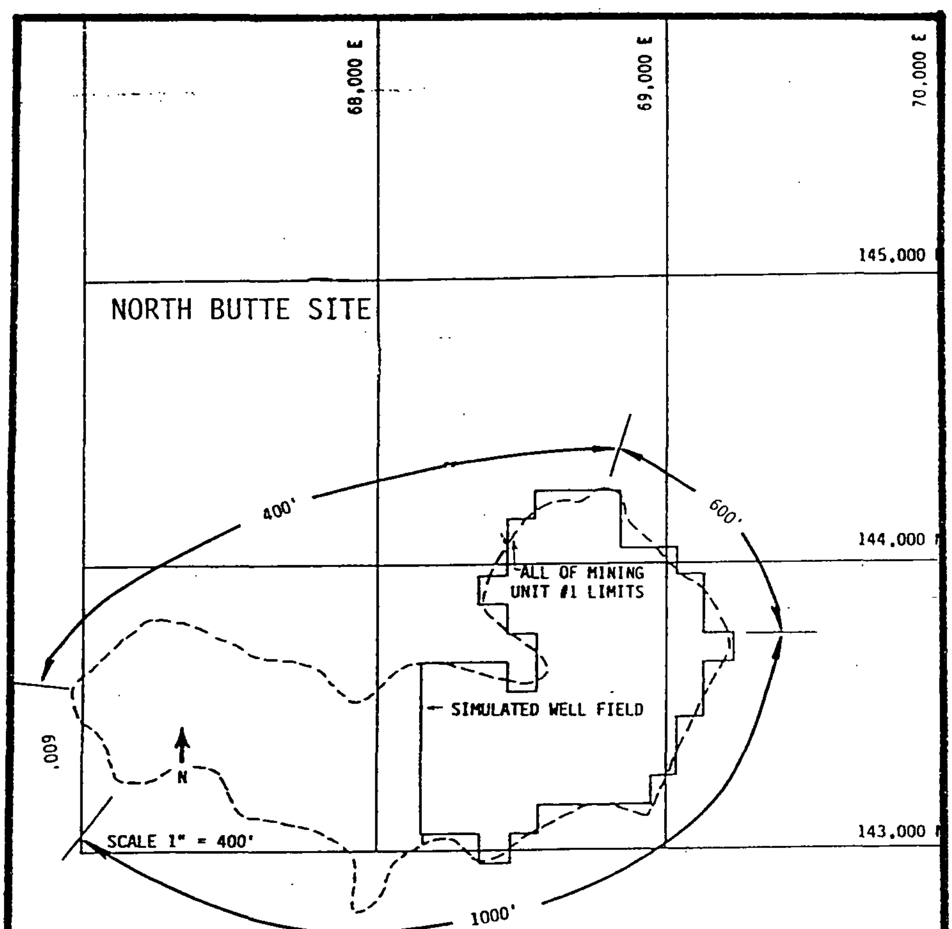
- Natural gamma for recognition and assessment of the uranium bearing zones.
- Resistance for identifying the different lithologic zones and their boundaries.
- Spontaneous potential for a back-up method of determining lithologic zones and their boundaries.
- Neutron to assist in marker bed identification and to help ascertain porosity.
- Deviational survey to locate the bottom of the well in reference to the surface location.

Upon receipt of the log, if the uranium content is sufficient and the deviation of the hole is acceptable, the hole will be reamed to a diameter of 6-3/4 to 7-1/2 inch to its total depth. This is done to facilitate the setting of the casing, and provide a sufficient annulus to insure a good cement seal around the casing. The enlarged hole is then circulated with drilling mud to create a good wall cake and to prevent swelling of the clays. If the hole does not meet economic criteria or suffers from excessive vertical deviation, it will be abandoned by either filling it with heavy bentonite abandonment mud, bentonite chips or cementing it to the surface. The hole will be marked and identified on the surface until mining is completed at which time the surface marker will be removed. A well meeting the desired criteria will be cased following reaming. The casing used will most likely be 4-1/2 inches interior diameter yelomine of at least 200 pounds per square inch (psi) strength. It is also possible that 4.33 inches inside diameter fiberglass may be used along with some Schedule 90 polyvinyl chloride (PVC). PVC centralizers will be placed at the bottom of the casing and approximately every 100 feet up the casing to insure proper alignment of the casing within the borehole. Figure 3.3.3 represents a typical casing arrangement and well head completion.

Figure 3.3.2

RUTH AND NORTH BUTTE MONITOR WELL SPACING.





Both injection and production wells will be completed in the same manner. The standard completion method for injection and production wells will be underreaming. underreaming involves the use of a specialized tool with spring loaded, pressure activated blades. The underreaming tool is lowered on the end of the drill string to a precise depth determined from gamma logs. When the desired interval is encountered the blades of the underreamer are engaged. The underreamed interval may be screened, however in most cases the exposed interval will be left open. Screening will only be used in areas where the mineralized sand stores are not of sufficient competence to stand open for an extended period of time. A typical underreamed well is shown in Figure 3.3.4.

Uranerz has proposed that following completion, all monitor, injection and production wells will be integrity tested prior to being put into use, and retested at least once every 5 years. Wells will also be tested after each occasion when a cutting tool or any other equipment is put in the well which has the potential to damage the casing. Due to the importance of maintaining well integrity, the testing procedure will be required by license condition.

Two methods will be utilized to integrate test wells. Method number one will employ the use of two inflatable packers. The lower packer will be set in the well at a depth of about ten feet above the completed interval. The packer will be lowered on a one-quarter inch steel cable along with a one-quarter inch nylon high pressure tube for inflation. Prior to setting the packer at the top of the well, the lower packer will be inflated and the casing filled with water. The upper packer will then be set and inflated. Nitrogen will be used to inflate the packers and to put pressure on the casing between the packers. The interval between the packers will be pressurized to the maximum anticipated injection pressure plus 20 percent.

Method two will utilize casing cementing pressure coupled with single point resistance test. At the Ruth project the maximum anticipated injection pressure is 200 psi. Each monitor, injection and production well casing will be required to maintain pressure within 10 percent of the initial test pressure for a period of 10 minutes.

At the North Butte project the maximum injection pressure is 140 psi or 90 percent of the tested formation fracture pressure if higher than 140 psi. As at the Ruth site each injection and production well will be required to maintain pressure within 10 percent of the initial test pressure for a period of 10 minutes.

Upon passing the integrity test, a well will be deemed acceptable for service. If a well should fail the integrity test, it will be retested. If a well continues to fail repeated tests, it will be declared unusable and will not be put into service. The problem well will be either repaired and retested, or abandoned by the proper procedure. A well must pass the integrity testing procedure before it can be used in the solution mining process. Records of integrity testing on all injection and production wells and monitor wells used in the mining process will be kept on the premises and will be available for inspection. Additionally, the integrity testing data will be submitted to the NRC on a calendar quarter basis.

Table 3.3.1

Mining and Reclamation Schedules
for the Ruth and North Butte Sites

Mining and Reclamation Schedule Ruth Site

Year of Operation	Mining Unit To Be Mined	Mining Unit To Be Restored	Mining Unit To Be Reclaimed
1	I	-	-
2	I	-	-
3	I	-	-
4	II	I	-
5	II	I	-
6	III	I & II	-
7	III	II	I
8	-	II & III	-
9	-	III	II
10	-	III	-
11	-	-	III

Mining and Restoration Schedule

Mining Unit	Mining Period (Year)	Restoration Period (Year)
Mining Unit I	1-4	5-7
Mining Unit II	4-6	7-9
Mining Unit III	6-8	9-11
Mining Unit IV	8-10	11-13
Mining Unit V	10-12	13-15
Mining Unit VI	12-15	15-18
Mining Unit VII	15-17	18-20
Mining Unit VIII	17-19	20-23
Mining Unit IX	19-22	23-26

Figure 3.3.3

WELLHEAD AND CASING
COMPLETION METHODS

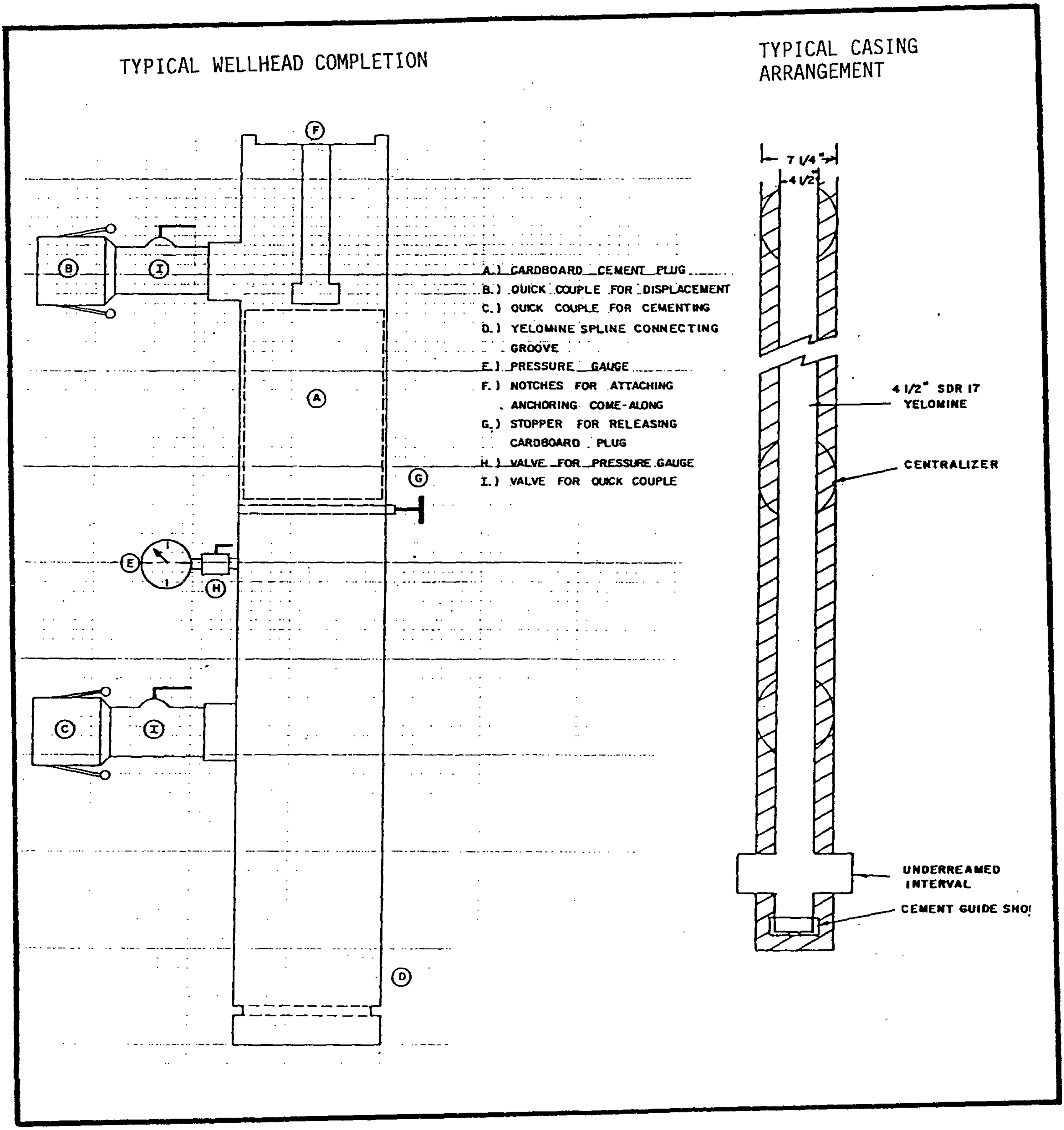
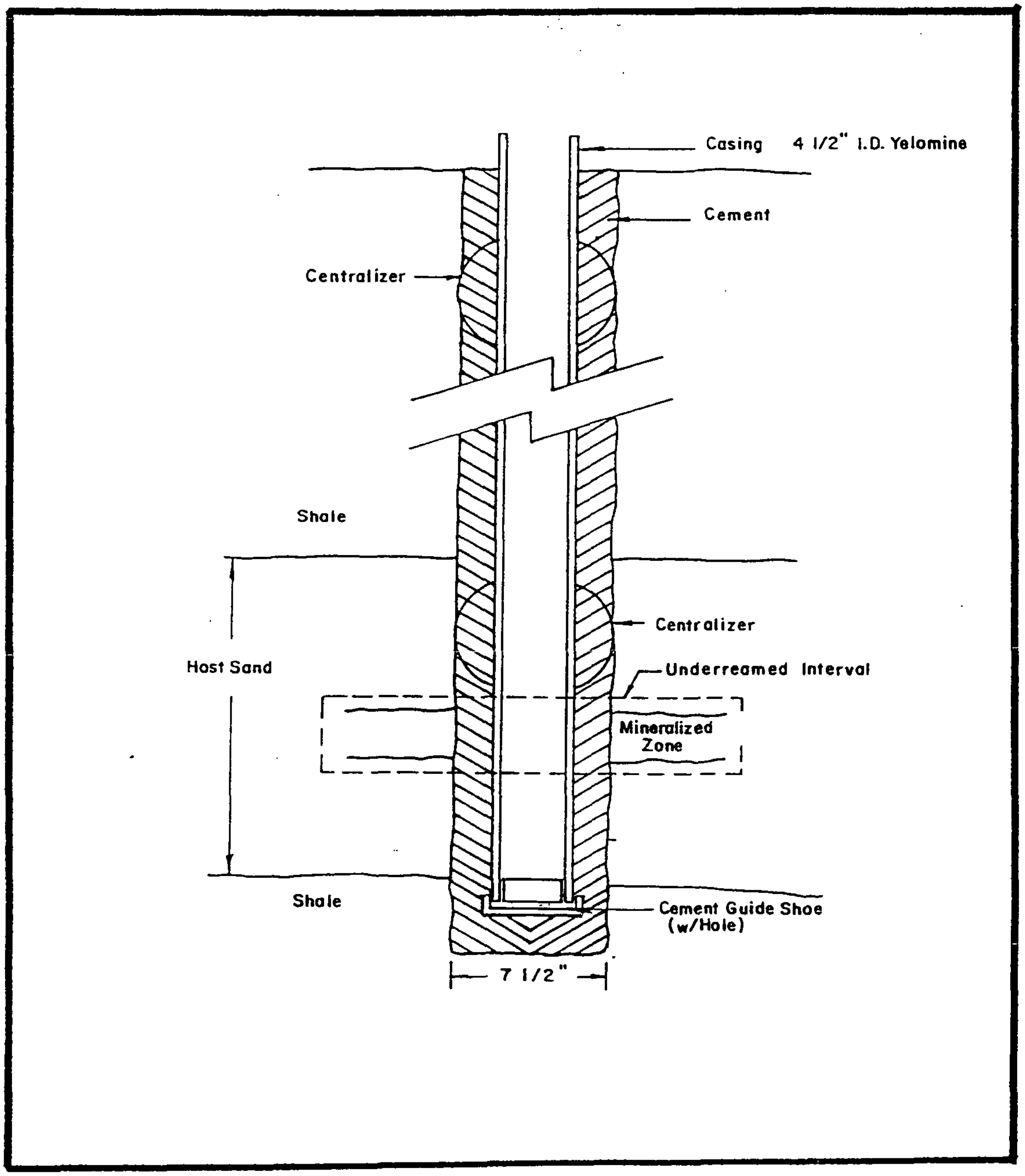


Figure 3.3.4

TYPICAL WELL UNDERREAMING
ARRANGEMENT



3.4 Lixiviant Chemistry

The lixiviant for the in-situ uranium leaching process will be diluted sodium carbonate/bicarbonate aqueous solution. During the injection of lixiviant, oxygen or hydrogen peroxide will be added to oxidize the uranium underground. Carbon dioxide is also provided to lower the pH to about neutral and as an additional source of carbonate/bicarbonate.

The barren solution, after leaving the uranium ion exchange system, will be refortified with chemicals prior to the reinjection into the mineralized zone. The process continues until the uranium is exhausted. The expected maximum concentration of the bicarbonate, and the pH range at the Ruth and North Butte commercial leaching processes are 5,000 mg/l, and 6.0 to 8.5 standard units.

3.5 Uranium Recovery Process

The uranium will be mined from the mineralized formations at a combined flow rate not to exceed 4000 gpm. Uranium recovered during the mining operations will be processed, stored, shipped, dried and packaged as shown in Figures 3.5.1 and 3.5.2.

The environmental analysis is based, in part, on this process diagram. Any significant changes to the process, therefore, will require an amendment to the license. During mining, the well field waters will be enriched with uranium as well as several other metals associated with the formation. Data from the R&D project indicate that trace metals such as arsenic, selenium, vanadium, iron and manganese are liberated during the leaching process and are mobilized with the uranium. Consequently, the metal-enriched ground-water solution is pumped to the surface and transferred from the well field by utilizing buried pipelines.

The Ruth site will be a satellite facility of the main processing plant located at the North Butte site. At the Ruth site the primary process will involve ion exchange. The loaded resins will be trucked to the North Butte site for subsequent elution, precipitation and drying.

Once the majority of the ion exchange sites on the ion exchange column resins are filled with uranium, the column is taken off stream. The loaded column is then stripped (eluted) of uranium through an elution process. In the elution process, the uranium is stripped from the resin beads with a concentrated solution of sodium carbonate and sodium chloride. The product of elution is a pregnant eluant that is commonly discharged into a holding tank prior to trucking to the North Butte processing site.

When a sufficient volume of pregnant eluant is held in storage, it is acidified to destroy the uranyl carbonate complex ion that has been created. Hydrogen peroxide is then added to the solution to precipitate the uranium. The precipitated uranyl peroxide slurry (yellowcake) is pH-adjusted and allowed to settle. Following this the clear solution is decanted and either recirculated back to the barren eluant storage tank or treated as a waste and sent to the solution evaporation ponds. The yellowcake is further dewatered and washed.

Figure 3.5.1

RUTH PROCESS FLOW SHEET

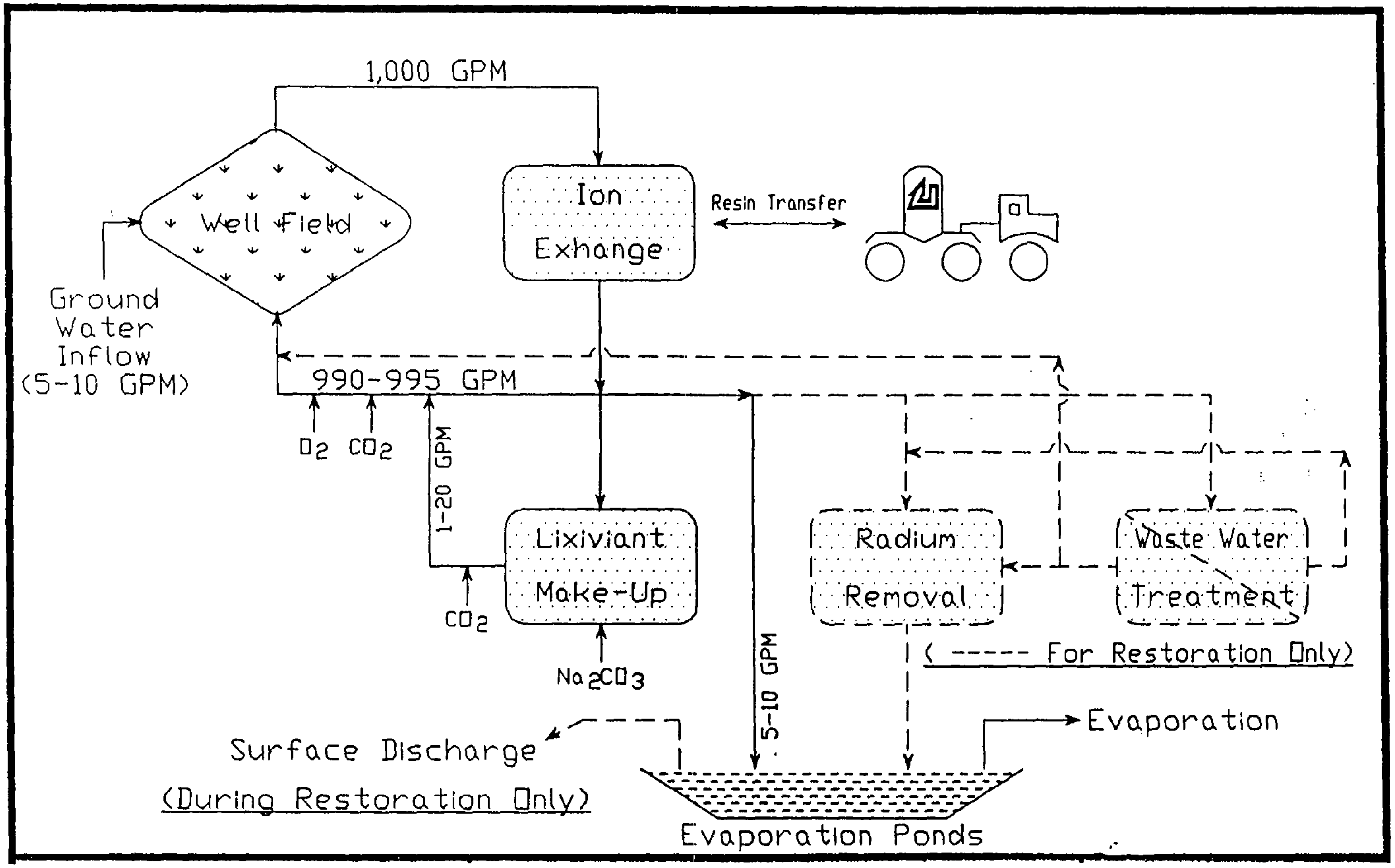
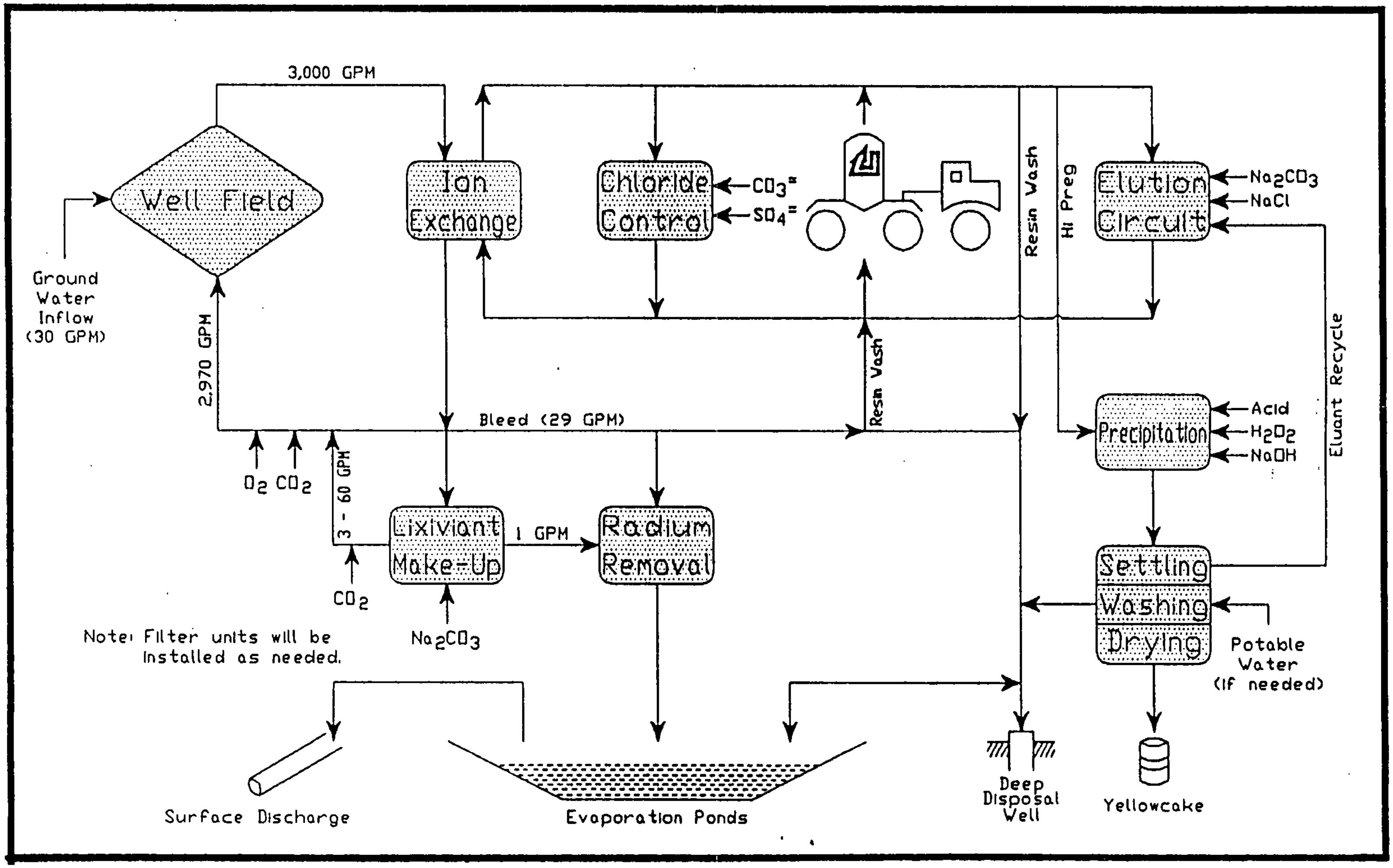


Figure 3.5.2

NORTH BUTTE PROCESS FLOW SHEET



The resulting uranium slurry will be shipped as a wet cake or dried on-site. The Ruth and North Butte facilities expect to produce approximately 1,000,000 pounds of yellowcake per year. Of this total, the Ruth site will produce 300,000 pounds and the North Butte site is designed to produce 700,000 pounds of product annually.

3.6 Description of Process Plant, Ponds and Wastes

3.6.1 The Process Plant

The process plant at the Ruth site is proposed to be housed in the existing building. It is approximately 100 feet long by 40 feet wide. In addition to processing equipment, the building will house personnel support facilities consisting of change rooms, restrooms and offices. A diagram of the proposed plant is shown in Figure 3.6.1.1.

The North Butte plant will include an ion exchange circuit similar to the one at the Ruth site. It will include several ion exchange columns which can either have their contents transferred to tank trucks for processing at another facility or move onto the elution and precipitation circuits. From this point the product will be pumped to a room dedicated to product drying, drumming and storage. Although the exact plant layout is not yet determined a generalized diagram showing the North Butte site is shown in Figure 3.6.1.2. The licensee will be required to submit the detailed plant layout, in the form of a license amendment, to NRC for review and approval prior to initiation of operations.

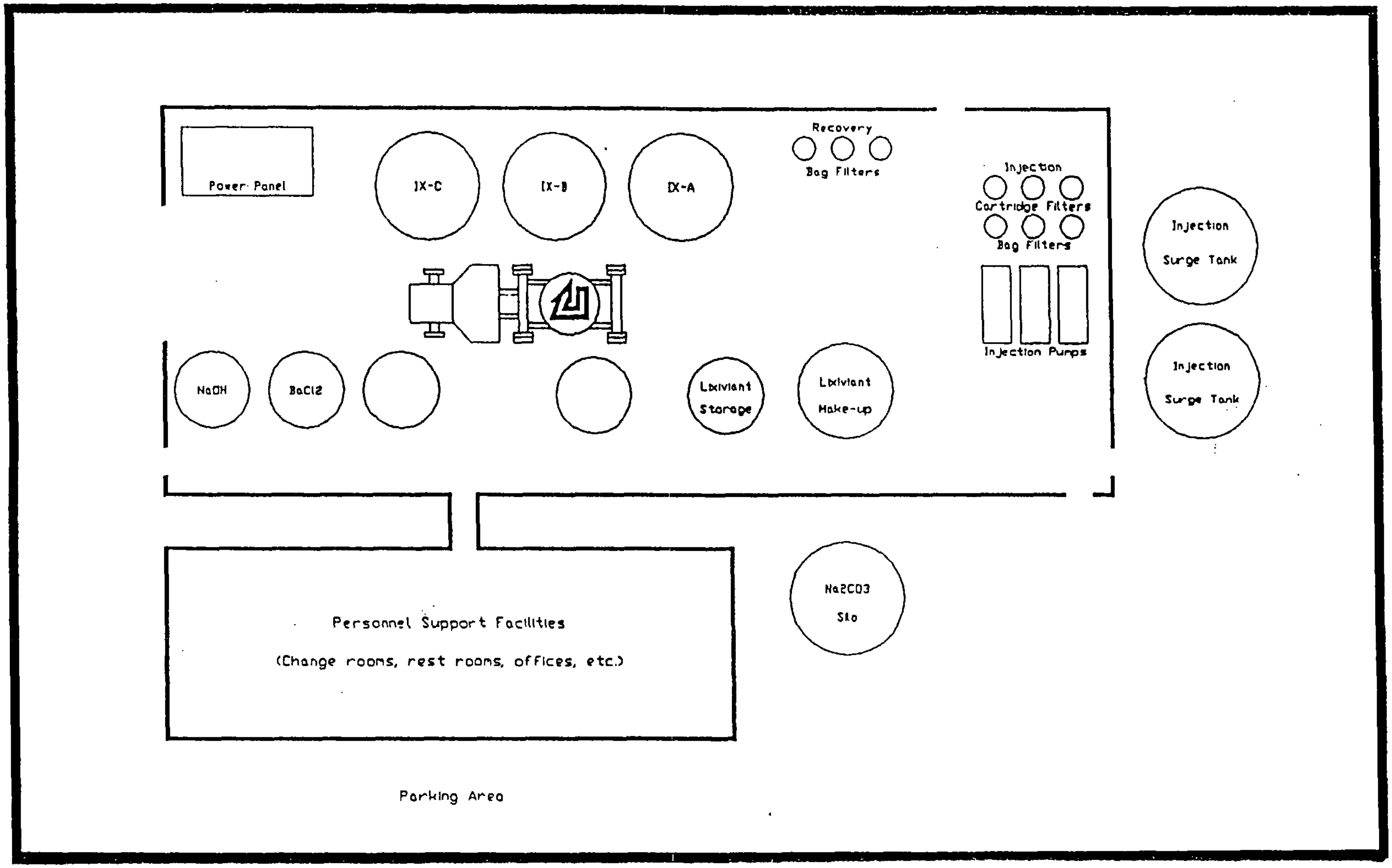
3.6.2 Solar Evaporation Ponds

At the Ruth site two solar evaporation ponds currently exist. These ponds were utilized for waste water generated during the R&D operations that previously existed at the site. Both of these ponds will be utilized as evaporation surfaces during operations and discharge points during restoration activities. Three evaporation ponds will be constructed at the North Butte site. They will be located adjacent to the well fields and will be utilized to store and evaporate waste process solutions.

Freeboard requirements will be necessary to ensure that the ponds do not accidentally discharge byproduct materials to the environment. The evaporation ponds at the Ruth site currently have a 3-foot freeboard requirement which will be required by license condition to apply during commercial operations. The ponds proposed for the North Butte site have not had final plans developed. Therefore, to ensure that an environmentally sound process is designed, Uranerz will be required by license condition to propose a design for review and approval prior to construction of the ponds or initiation of operations.

Figure 3.6.1.1

THE RUTH PROCESSING FACILITY



3.6.3 Wastes

Liquid and solid wastes will be generated at both the Ruth and North Butte facilities. Operation of the process circuits will result in two primary sources of liquid waste: the eluant bleed and the production bleed. These wastes will be routed to water treatment facilities or the evaporation ponds at an average flow of 5 to 10 gpm for the Ruth site and 15 to 20 gpm at the North Butte site. These bleed rates will result in 10.5 million to 21 million gallons of liquid waste per year. Several liquid waste disposal options have been proposed by Uranerz.

The Ruth site will utilize evaporation from the solar evaporation ponds as the primary method of disposal. During restoration surface discharge under a NPDES permit will likely be utilized depending upon the resulting water quality. The North Butte site will utilize evaporation from solar evaporation ponds, surface discharge during restoration, and deep well injection.

The injection of waste liquids by use of a deep well is becoming commonly used in the solution mining industry. It represents an inexpensive and environmentally sound method to dispose of bleed solutions. The deep well injection is proposed to take place in the Parkman, Teapot, and Teckla sands. Their average depth below the land surface is approximately 8300, 8000 and 7700 feet respectively. The rate of injection and the various years of operations are shown below:

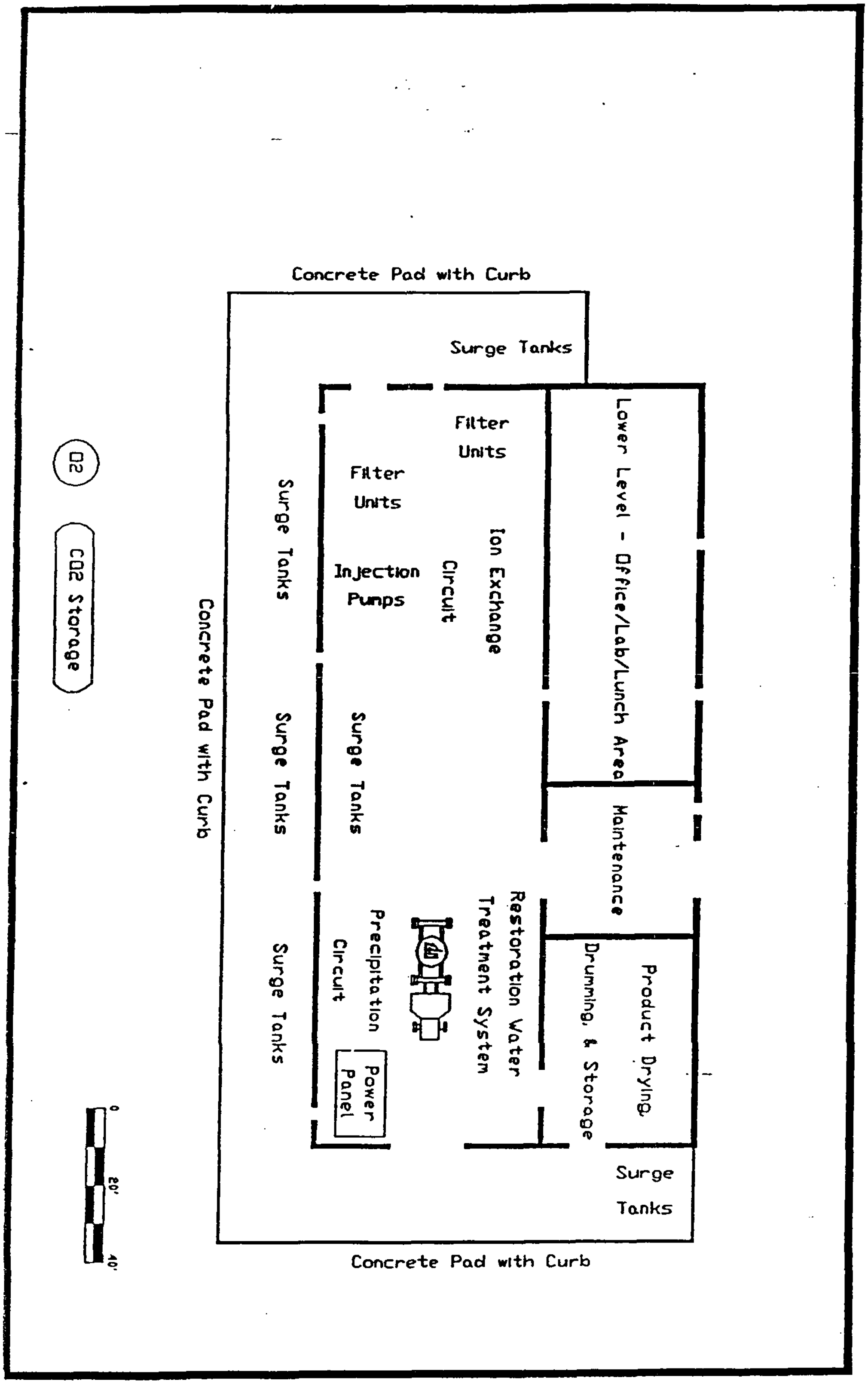
Year of Operations	Rate of Injection (gpm)	Gal/Yr ($x 10_6$)	Cumulative (Gal $x 10_6$)	Radius of Influence (ft)
1	150	78.89	78.89	244
2	150	78.89	157.78	345
5	150	78.89	394.45	546
10	150	78.89	788.90	771
20	150	78.89	1577.80	1091
30	150	78.89	2366.70	1336

The various sands proposed to be utilized for deep well injection are capable of receiving 150 gpm for 30 years. This rate of injection for the time period would influence water quality at distances of up to 1336 feet from the injection point.

Although no water quality information was available from the two wells proposed for injection, water quality data from wells in these formations located 50 miles to the southeast was reviewed. The wells, their location, the total disolved solids (TDS) concentration and the sand that was monitored are shown below:

Figure 3.6.1.2

THE NORTH BUTTE PROCESSING FACILITY



Well	Location Sec - T - R	TDS	Formation
Diam Sham	33 - 40N - 69W	11,522 ppm	Teckla
11 - Jenkins	33 - 40N - 60W	10,526 ppm	Teckla
14 - 1 Dangaard	14 - 36N - 71W	16,322 ppm	Teapot
4 - 15 Steinle	15 - 36N - 70W	19,954 ppm	Teapot
28 Inexco	16 - 36N - 69W	17,830 ppm	Parkman
44 - 2	2 - 38N - 73W	12,230 ppm	Parkman

The water quality data indicates that TDS tends to increase in a southeastern direction. Therefore, it is deduced that the TDS concentration at the point of injection are probably 9000 to 10,000 mg/l.

In the area of the North Butte ISL Project, the Parkman, Teapot, and Teckla sands are not considered to be useable aquifers because of their depth (7,700 to 8,700 ft) and the generally poor water quality. Although the TDS of disposed water will range between 1000 and 50,000 mg/l, the overall average salinity of the disposed water will be less than the salinity of the water in the receiving sands. The typical bleed stream water is shown below:

TYPICAL BLEEDSTREAM (UNTREATED)

Water Quality
(mg/l)

	Wellfield Bleed	Restoration Effluent	Process Effluent
HCO3	400 - 3,000	220 - 10,000	400 - 10,000
Cl	50 - 1,000	50 - 5,000	1,000 - 35,000
SO4	100 - 1,000	450 - 12,000	1,000 - 10,000
Na	400 - 3,000	400 - 10,000	1,000 - 30,000
TDS	1,500 - 7,000	2,000 - 35,000	1,000 - 50,000
pH	6.5 - 7.5	5.5 - 9.0	2 - 9.0
Uranium pCi/l	0 - 5	<0.10 - 15	0 - 500
Radium pCi/l	100 - 2,000	<1.0 - 7,500	100 - 10,000

Above and below the sands that will be the zones of injection there are shale layers that are confining beds. Logs of these strata indicate that they are 300 to over 900 feet thick. Due to their mineralogical character and thickness, migration of the injected fluids will not be an issue. The waste water flow is shown in Figure 3.6.3.1 and the diagrams of the two deep disposal wells are shown in Figure 3.6.3.2.

Therefore, disposal of waste water via these deep disposal wells is acceptable. Uranerz will be required by license condition to utilize these deep disposal wells consistent with their application for disposal as well as maintain an accounting of the amount of waste water disposed. Such disposal will also require a permit from the State of Wyoming.

To assure that all liquid wastes are accounted for, Uranerz will be required by license condition to return all liquid effluents to the process circuit or to the appropriate disposal system. By maintaining the liquid wastes in these locations, the environmental assumptions utilized in this assessment remain valid. Optional disposal methods will require an amendment proposal and environmental assessment.

Sanitary wastes from the restrooms, change areas and lunchrooms will be disposed of in septic systems. The size, design and installation will be as specified by the State of Wyoming. Solid wastes generated by the site will consist of spent resins, filters, empty reagent containers, miscellaneous pipe and fittings, and domestic trash. These wastes will be classified as contaminated or noncontaminated waste, according to their radiological survey results.

Contaminated solid waste will be separated into two categories. The first category will be waste which has some salvage value and can be decontaminated to unrestricted release limits of noncontaminated waste. This type of waste may include piping, valves, instrumentation, equipment and any other item which can be decontaminated. Decontaminated materials will have radiation levels lower than those specified in NRC Branch Technical Position "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, and Special Nuclear Material." All decontaminated wastes will be inspected and surveyed by the radiation safety officer or trained assistant prior to their release from the site to assure that appropriate decontamination procedures have been observed.

The second category of waste will include items which have no salvage value and have been contaminated during uranium recovery operations. The most common type of this material is radium contaminated filters. These materials will be required by license condition to be stored in a secure area until such time as they can be shipped to a licensed waste disposal site or licensed mill tailings facility for disposal.

Uranerz does not currently have a waste disposal agreement. Consistent with NRC policy, Uranerz will be required by license condition to have a valid waste disposal option prior to allowing the site to be operated.

Noncontaminated solid waste will be collected at the site on a regular basis and disposed of in the nearest sanitary landfill. The waste is surveyed as per "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" to assure that no contaminated waste is released from the site.

3.7 Ground-Water Restoration, Reclamation and Decommissioning

3.7.1 Ground-Water Restoration

Ground-water restoration is achieved when the quality of all ground water affected by the injection or recovery fluids is returned to baseline quality, or quality of use consistent with the uses for which the water was suitable

Figure 3.6.3.1

DEEP WELL INJECTION
FLOW CHART

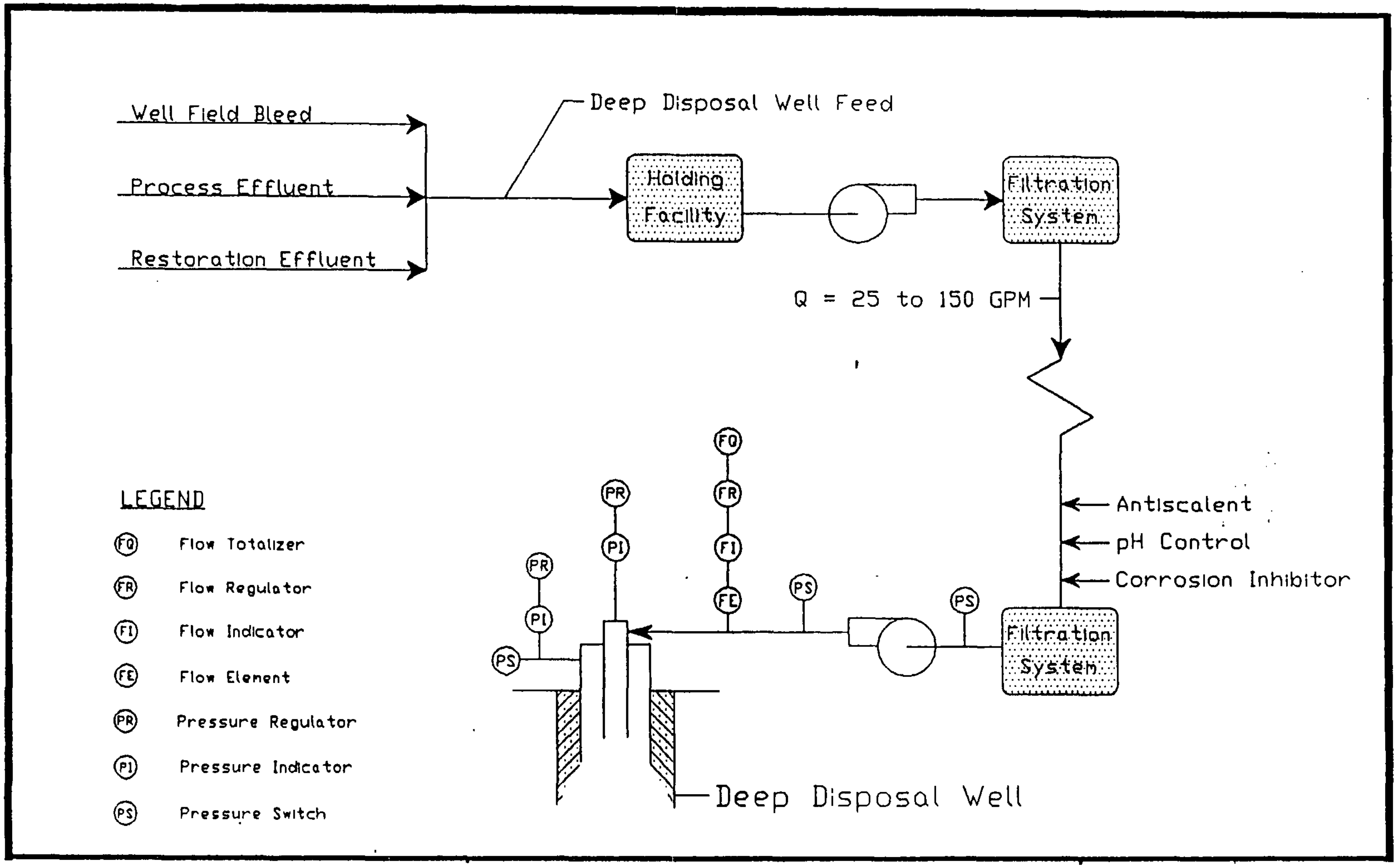
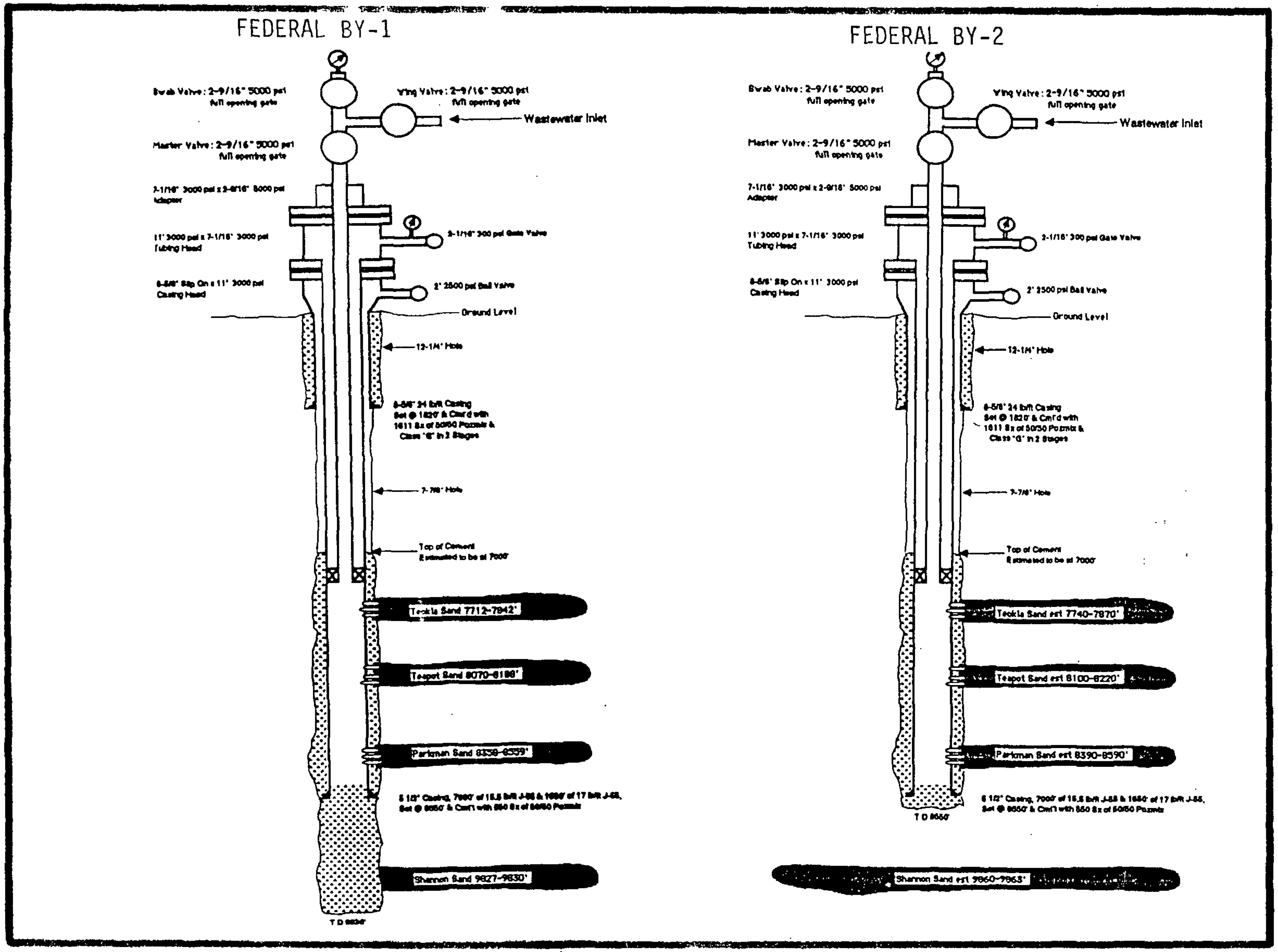


Figure 3.6.3.2

DEEP DISPOSAL WELL DIAGRAMS AND RECEIVING FORMATIONS



prior to the operation. The primary purpose of the restoration process is to reduce to acceptable levels the concentration of contaminants remaining in the ground water after uranium recovery has stopped. Uranerz has proposed to return water quality of the affected ground waters to the premining quality of use. This is not entirely consistent with baseline. Therefore, Uranerz will be required by license condition to have as its target, returning the water in the affected aquifer to baseline conditions. As was evidenced in the R&D restoration demonstration, baseline levels for all ground-water parameters cannot always be met. Therefore, a secondary ground-water restoration goal of returning the water to a quality consistent with its premining use will be established. To assure that NRC has a reasonable amount of time to review all restoration plans, the license will stipulate that at least 3 months prior to termination of a mining unit, a ground-water restoration plan be submitted for NRC review and approval.

In 1983, Uranerz conducted a pilot R&D in-situ uranium solution mining operation at the Ruth site. The R&D operation used a sodium carbonate/bicarbonate lixiviant which is the same lixiviant proposed for the commercial operation. The mining phase was very successful and met or exceeded all design and production goals. In February, 1984, Uranerz commenced aquifer restoration operations using a three part plan consisting of ground-water sweep, reverse osmosis (RO) treatment, and reductant addition. Aquifer restoration was successfully achieved in about 11 months of restoration operations. The mining chemistry to be used by Uranerz during the commercial operation is the same as that used during the R&D phase and the restoration technique to be employed by Uranerz during the commercial operation is the same technique that was used for the R&D restoration program. With the restoration experience of the R&D program, it is likely that a much more efficient restoration sequence will result during commercial scale restoration. The use of a reductant will take place if necessary to the success of the restoration effort.

Some parameters of the pre-mining ground-water quality in a mining unit will be elevated above baseline as solution mining activity progresses. The quality of the pre-mining ground water is affected from two primary sources. The first source is the mining and processing reagents added to the water to accomplish the leaching reaction which contain such ions as sodium, bicarbonate, oxygen, and chloride. The second source is the oxidation process that gradually takes place during mineral extraction and generates sulfate and metal oxides that are more soluble in the higher oxidation state than in the reduced species. These constituents are naturally present in the ore body host rock and with the addition of oxygen become mobile and are released into the ground water.

Specific restoration values will be established prior to mining for each mining unit by computing an average baseline of representative wells on a frequency of one restoration sampling well per four acres of well field area, randomly located. Since operational wells can be used for both recovery or injection during mining, no designation of well service is specified for restoration sampling wells. On a parameter-by-parameter basis, the average of the pre-mining or baseline values from the restoration sampling wells in a mining unit will be compared to the average post-restoration values from the same restoration sampling wells to assess the restoration results.

Once the average concentration of the recovery stream meets the above goals, the restoration operation will terminate in that mining unit. A final round of samples will be collected and analyzed from the designated restoration sampling wells to document the results of the aquifer restoration program. At this point, Uranerz has proposed a post-restoration stability monitoring period that will continue for six monthly sampling events.

If no significant increasing trends are identifiable during the 6-month stabilization period, restoration will be deemed successful. A summary report requesting approval of restoration will be submitted along with the appropriate water quality data. After written notice is received that restoration has been achieved, wells will be plugged and the surface reclaimed as described later.

NRC experience indicates that 6 months is not always an adequate period of time to determine if the restored waters have fully equilibrated with aquifer. Therefore Uranerz will be required by license condition to extend the stability monitoring period to one year, consisting of at least nine sampling events.

3.7.2 Reclamation and Decommissioning

Following the successful conclusion of the aquifer restoration stability period in a particular mining unit, the well field piping, well heads and associated equipment will be removed and, if serviceable, taken to a new mining unit for continued service. Well field equipment that is no longer usable will be surveyed and either placed in a contaminated material storage area of a non-contaminated bone yard located near the plant for subsequent removal from the site. If the final mining unit is being reclaimed, the non-salvageable contaminated and non-contaminated piping, well heads and associated equipment will be trucked from the site to approved disposal facilities.

At the same time that the final mining unit is being dismantled the equipment in the plant will be decontaminated and either sold or trucked to a disposal facility. Any equipment that cannot be decontaminated will be either transferred to an NRC or agreement state source material licensee or disposed of at an NRC or agreement state approved facility. The building will also be completely decontaminated during this phase of the reclamation.

As soon as the evaporation ponds have sufficiently dried, the sludge in the bottoms of the ponds will be assayed for radioactivity. If the residue is contaminated it will be trucked from the site to an approved disposal site. The artificial pond liner will also be trucked to an approved disposal site.

Once the contaminated residue and liner are removed from the bottom of the ponds, the leak detection pipe will be removed and the bottom of the ponds will receive radiological surveys. Any contaminated soil will be removed from the site and disposed of at an approved disposal site. The game fence surrounding the evaporation ponds will be removed during this phase of reclamation; however, the stock fence around the perimeter of the plant/ponds area will remain in place.

To assure that a detailed reclamation plan is reviewed and approved, Uranerz will be required to submit such a plan to the NRC at least 12 months prior to the planned start of decommissioning.

All injection, production and monitor wells will be plugged and abandoned prior to final closure of the site and after the restoration has been successfully completed, according to State of Wyoming standards. Currently these standards for well plugging utilize an approved abandonment mud which will be mixed in a cement unit and pumped through a hose, which is lowered to the bottom of the well casing using a reel. When the hose is removed, the casing is topped off and a cement plug placed on top. A hole is then dug around the well, and at a minimum, the top 3 feet of casing is removed. The hole is backfilled and the surface revegetated.

After the equipment, building, piping and associated support facilities have been decontaminated or removed from the well field area, a gamma survey will be conducted over the same well field grid as was surveyed prior to well field development.

It will be a requirement that all buried piping be removed from the well fields. The gamma survey results will be compared with those detected initially. Soil samples will then be obtained from locations which display elevated gamma readings. These soil samples will be analyzed for natural uranium and radium-226 content. Based upon the results, contaminated soil will be removed and shipped to an approved disposal site. The gamma survey and soil sampling results will create a data base to assure that the site is radiologically safe for unrestricted use. All survey results will be independently verified by the NRC, as deemed necessary.

The plant area will be comprised of compacted earth, some surface covering material, a cement foundation and the building. Once the building and cement pads have been removed, a gamma survey will be made of the compacted area. Any areas with elevated gamma readings will be sampled for radium and natural uranium to determine if contaminated soils need to be removed. The compacted area will then be recontoured with excess soil placed in the pond pits and the topsoil replaced. A final gamma survey will be performed and the results compared with the preoperational survey.

4. EVALUATION OF ENVIRONMENTAL IMPACTS

4.1 Ground-Water Impacts

4.1.1 Excursions

An excursion occurs when lixiviant fortified ground water moves beyond the expected confines of a mining unit and is detected in a monitor well. It is common practice to dramatically degrade the water quality within the mineralized zone during mining. The unexpected migration of these mining solutions could occur based upon a variety of circumstances. Most causes of excursions are from an improper balance between injection and recovery rates, undetected high permeability strata or geologic faults, improperly abandoned exploration drill holes, discontinuity and unsuitability of the confining units which allow movement of the lixiviant out of the ore zone, poor well integrity or hydrofracturing of the ore zone or surrounding units. The likelihood of these situations occurring due to the hydrologic and geologic conditions which occur at the site are extremely remote. Based upon the differential hydraulic conductivities which exist at the site, it is improbable that a vertical excursion would occur. It is much more likely that a horizontal excursion may occur. Horizontal excursions are primarily controlled by well field overproduction. Should overproduction fail, lixiviant fortified waters could move to a monitor well. Should such an event take place, it is commonly reversed by increasing the overproduction rate and thereby drawing the lixiviant back into the mining zone. Based on the information previously discussed and operational controls to be implemented, none of the above are expected to be a problem. Furthermore, the operational history of the R&D site indicates that no excursion events took place.

4.1.2 Evaporation Pond Seepage and Spills

Accidental leaks from the evaporation ponds could, if uncontrolled, contaminate shallow aquifers and locally degrade ground-water quality. The proposed installation of a synthetic bottom liner in the solar evaporation ponds at the Uranerz site makes such an occurrence a highly unlikely event. Should a leak occur, there will be sufficient capacity in another evaporation pond to allow the transfer of contents from the leaking pond while repairs are being made. Furthermore, if a pond leak developed, the monitoring program described in Section 5.1.2 would allow for early detection and repair of the damaged cell, thereby minimizing the quantity of leakage. Based on the use of synthetic pond liner as well as the leak monitoring and repair program, the impact of pond leaks on ground-water quality has been determined to be minimal or nonexistent.

Spills from the evaporation ponds resulting from dike failure could result in unacceptable contamination of surface and ground waters. Because the pond embankments and the minimum acceptable freeboard from the top of the berms to the ponds' free water surfaces have been based on NRC design standards and the evaporation ponds will be routinely inspected. Due to these precautions, spills from the evaporation ponds or embankment failures are extremely unlikely.

4.1.3 Ground-Water Restoration

Ground-water restoration will include ground-water sweep, permeate injection/reductant and aquifer recirculation. Each of these stages of restoration modifies the water quality of the mining zone. As was previously discussed, the R&D operation was successful in restoring the ground-water quality to below baseline concentrations for the majority of the constituents as well as to baseline concentrations for several other constituents. There are also a minimal number of constituents which had their concentrations raised slightly during the mining/restoration effort; however, no premining uses of the water were precluded.

Restoration of the mining zone will result in varying water quality within the aquifer. This is in part due to the complete mixing that will take place as well as to the change in oxidation state that will result from the injection of mining solutions. Uranerz will be required to restore the aquifer to a use that is consistent with the premining use. Based on the R&D demonstration as well as restoration efforts at in-situ mining operations in other parts of the country, no impacts on the aquifer are expected.

4.2 Radiological Impacts

4.2.1 Introduction

The primary sources of radiological impact to the environment in the vicinity of the proposed project are naturally occurring radiation and radon-222. The average annual total-body dose rate from natural background radiation to the population in the site vicinity is estimated to be about 150 millirems. Diagnostic medical procedures result in an average annual dose of 75 millirems.

This section described project-contributed incremental radiological effects on the environment in the vicinity of the proposed projects. Exposure pathways are discussed as are the estimated radiological impacts resulting from emissions associated with the facility. The impacts to nearby individuals are estimated as are potential radiation exposures of project employees and biota other than man.

Because the proposed operations at the Ruth and North Butte facilities do not involve displacement of ore from the orebody, there will be no radionuclide particulate associated with ore. Uranerz has proposed to dry the yellowcake product at the North Butte site, therefore there will be the potential for a particulate release from the dryer stack. To assure that particulate releases are within regulatory limits, Uranerz will be required to monitor the air environment at the facility restricted area boundary, sample the effluent from the yellowcake dryer stack, and maintain the dryer's effluent control systems to the manufacturers specifications. A diagram of the proposed vacuum dryer is shown in Figure 4.2.1.

Uranerz utilized the MILDOS computer model to estimate the radionuclides that will be released into the environment. Imputs to the model included radon-222 and particulate concentrations resulting from the planned in-situ operations at the North Butte and Ruth ISL projects. The operational plan for the Ruth facility states that there will not be a dryer on-site and that uranium loaded resins will be shipped to an NRC licensed mine for final processing. Accordingly, the MILDOS modeling for the satellite Ruth facility was incorporated into the model run for the planned North Butte facility which will most likely receive the uranium loaded resins. Background data and operational information from the Ruth R&D project were included in the North Butte model run. The model results indicate that maximum permissible concentration for restricted areas are not exceeded at any of the modeled receptors. The inputs to the model represented sufficiently accurate estimates of the radionuclides that could be expected. Likewise, the uptake pathways considered ingestion and inhalation. Because the modeled parameters represented a most probable, yet conservative estimate, the modeling effort was considered representative of the proposed projects impact to the air environment.

4.2.2 Offsite Impacts

Radioactive emissions of radon-222 will be released to the atmosphere by way of a production surge tank vent. A common manifold will vent radon-222 to the atmosphere. Similarly the yellowcake dryer stack could potentially emit particulates to the atmosphere. Because these two stacks are the primary point sources they are considered the origins for radiological releases and are utilized to determine compliance with regulatory limits for radionuclides in air.

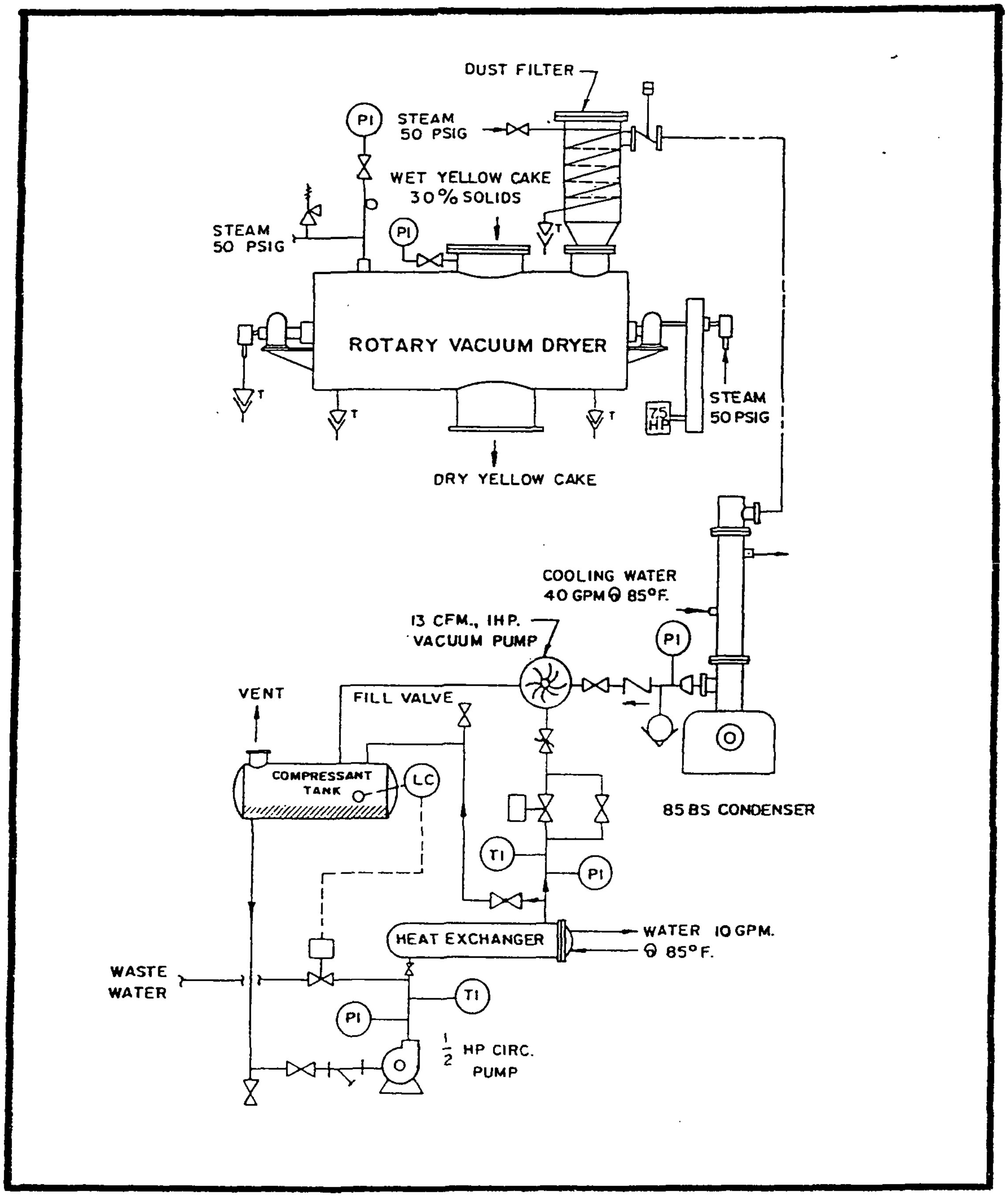
The estimated radiation dose at a reference point depends on the distance and direction of the point with respect to each of the sources, as well as the wind directional frequency toward the receptor from each of the sources. Doses are generally higher at locations downwind from the radiological source. As radon is transported by wind, its daughters grow, which potentially results in higher dose commitments farther from the plant until the radon is further diluted by dispersion. The inverse of this situation is true for particulates which generally drop out of the air flow or rapidly disperse.

10 CFR Part 20, "Standards for Protection Against Radiation," lists acceptable levels of radionuclides in air for restricted areas and unrestricted areas. A restricted area represents an area where access is controlled by the licensee for purposes of protection from radiation and radioactive materials. Therefore, only employees, contractors, and others under the direct control of the licensee are allowed into restricted areas and their exposure is monitored. Unrestricted areas represent locations where protection from radiation is not required because radionuclides are less than maximum permissible concentrations (MPC). To determine the impacts associated with venting radon-222 to the atmosphere as well as generating uranium particulates from product drying, the percentage of MPC at various locations around the proposed processing site was determined.

Further receptors were modeled for radon-222 and particulate concentrations utilizing the combined source terms of the Ruth and North Butte proposed projects. Each receptor and its distance from the source term is shown in Table 4.2.2.1

Figure 4.2.1

TYPICAL VACUUM
DRYER



To determine the doses that could be expected at the above receptors the cumulative radon emanation from both the Ruth and North Butte projects as well as the particulate release from the North Butte dryer was considered. The analysis assumed that each receptor would ingest 100 percent of their vegetables and milk from local sources and 5 percent of their meat, while breathing the calculated air environment for 365 24-hour days annually. Table 4.2.2.1 shows the calculated dose for each receptor for eight radionuclides.

The data presented in Table 4.2.2.2 indicates that at the nearest modeled receptors: North, 100 meters; East, 150 meters; West, 150 meters; and South, 100 meters, only fractions of unrestricted MPCs are expected to occur. The summation of the individual radionuclides indicates the each of the modeled receptors are expected to continually receive less than 1 percent of unrestricted MPC. The highest concentrations are expected to be encountered East, 150 meters and at the Pfister Ranch, located 1 mile to the East.

As indicated in Table 4.2.2.2, projected radioactivity concentrations near the project site fall well below NRC limits. To ensure that offsite concentrations are maintained below permissible limits, the staff will require the applicant to monitor radon and particulate concentrations near the site boundary.

4.2.3 In-Plant Safety

As was previously discussed, MPC limits exist for restricted and unrestricted areas. Although both are continually verified based upon air monitoring, only the restricted area concentrations are routinely utilized to determine individual exposures. Uranerz will be required to implement an in-plant radiation safety program that contains the basic elements required for, and found to be effective at, other uranium in-situ leach operations to assure that exposures are kept as low as reasonably achievable (ALARA). The scope of the program has been sized to account for the nature of the commercial operations. In general, the program will include the following:

- Airborne and surface contamination sampling and monitoring;
- Personnel exposure monitoring;
- Qualified management of the safety program and training of personnel;
- Written radiation protection procedures; and
- Periodic audits by highly qualified outside parties 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 sufficient to protect in-plant personnel by keeping radiation doses as low as reasonably achievable.

Table 4.2.2.1

Modeled Receptors

Receptor	Coordinates x	y	z	Distance (Kilometers)
North 100 Meters	.00	.10	1.00	.10
East 150 Meters	.10	.00	1.00	.10
West 150 Meters	-.10	.00	1.00	.10
South 100 Meters	.00	-.10	1.00	.10
Pfister Ranch	.70	-1.78	1.00	1.91
Pumpkin Butte Ranch	3.93	-5.64	1.00	6.87
W. Schlautmann Ranch	5.84	4.14	1.00	7.16
L. Gilberts Ranch	9.60	2.41	1.00	9.90
Earl Camblin Ranch	10.51	-2.35	1.00	10.77
John Groves	9.45	6.70	1.00	11.58
Town of Savagetown	11.12	8.84	1.00	14.21
Ruby Ranch	11.34	-5.79	1.00	12.73
Jack Christensen	-5.35	-1.52	1.00	5.56
Bud Christensen	.15	10.06	1.00	10.06

Table 4.2.2.2

Fraction of Maximum Permissible Concentration
of 8 Radionuclides at 14 Receptors

Receptor	U-238	U-234	TH-230	RA-226	RA-222 [1]	PB-210	BI-210	PO-210	Summation of Radionuclides
	Radionuclide								
North 100 Meters	2.86 E-4	3.57 E-4	8.93 E-5	7.17 E-7	1.32 E-4	1.10 E-6	7.49 E-9	2.04 E-7	8.66 E-4
East 150 Meters	3.24 E-4	6.05 E-4	1.01 E-4	8.12 E-7	1.87 E-4	1.16 E-6	8.44 E-9	2.31 E-7	1.02 E-3
West 150 Meters	2.20 E-4	2.75 E-4	6.88 E-5	5.52 E-7	1.81 E-4	1.02 E-6	5.84 E-9	1.57 E-7	7.47 E-4
South 100 Meters	3.30 E-5	4.13 E-5	1.03 E-5	8.28 E-8	9.61 E-5	7.91 E-7	1.16 E-9	2.36 E-8	1.82 E-4
Pfister Ranch	3.10 E-4	3.88 E-4	9.70 E-5	7.78 E-7	6.30 E-4	1.42 E-6	8.11 E-9	2.22 E-7	1.43 E-3
Punikin Butte Ranch	4.60 E-5	5.75 E-5	1.44 E-5	1.15 E-7	3.48 E-4	1.93 E-6	1.63 E-9	3.92 E-8	4.68 E-4
W. Schlautmann Ranch	5.35 E-5	6.69 E-5	1.67 E-5	1.34 E-7	4.28 E-4	2.5 E-6	2.01 E-9	3.83 E-8	5.68 E-4
L. Gilberts Ranch	2.64 E-5	3.31 E-5	8.26 E-6	6.63 E-8	3.84 E-4	3.23 E-6	1.61 E-9	1.89 E-8	4.55 E-4
Earl Camblin Ranch	2.55 E-5	3.19 E-5	7.97 E-6	6.40 E-8	3.66 E-4	3.18 E-6	1.57 E-9	1.82 E-8	4.35 E-4
John Groves	2.20 E-5	2.75 E-5	6.87 E-6	5.51 E-8	2.63 E-4	2.66 E-6	1.49 E-9	1.57 E-8	3.22 E-4
Town of Savagetown	1.59 E-5	1.98 E-5	4.96 E-6	3.98 E-8	2.13 E-4	2.66 E-6	1.49 E-9	1.14 E-8	2.75 E-4
Ruby Ranch	1.69 E-5	2.12 E-5	5.30 E-6	4.25 E-8	2.38 E-4	2.37 E-6	1.24 E-9	1.21 E-8	2.84 E-4
Jack Christensen	6.38 E-5	7.97 E-5	1.99 E-5	1.60 E-7	7.07 E-4	2.84 E-6	2.02 E-9	4.56 E-8	8.73 E-4
Bud Christensen	1.83 E-5	2.28 E-5	5.71 E-6	4.58 E-8	2.59 E-4	2.16 E-6	1.14 E-9	1.31 E-8	3.08 E-4

[1] Ra-222 units expressed in working levels.

4.3 Waste Disposal

The NRC has taken the position in regulations on uranium milling (10 CFR 40, Appendix A, Criterion 2) that byproduct material from uranium in-situ leach operations should preferably be disposed of at existing tailings disposal sites or other licensed radioactive burial grounds to avoid proliferation of waste sites. Therefore, the NRC shall require that solid wastes generated at the Uranerz projects be disposed of at an existing licensed radioactive waste disposal site (see Section 3.6.3 for further discussion on the disposal of byproduct material). To assure that all contaminated wastes remain under control of Uranerz, the license will stipulate that areas within the restricted areas at the Ruth and North Butte sites be maintained for temporary storage of contaminated materials.

5. MONITORING

5.1 Ground Water

Ground-water monitoring will be done prior, during and after the proposed operations. Prior to well field installation, ground-water data is collected to determine ground-water quality and define aquifer properties. This regional data is built upon during well field development when data is collected to establish upper control limits and restoration criteria. During and following mining and restoration, additional ground-water monitoring is performed to verify the effect, if any, on the aquifer.

5.1.1 Water-Quality Monitoring

Numerous water quality monitoring wells will be located in and around the various well fields. Similarly all solar evaporation ponds will be equipped with leak detection systems. All monitor wells will be sampled on a routine basis during extraction operations to determine if mining solutions are being contained within the mining zone. Monitoring for vertical excursions will take place in the first saturated aquifers overlying and underlying the mineralized zones. Monitoring for horizontal excursions will encircle the various mining units with wells completed in the mineralized formations at distances of 400 to 1000 feet from the production area.

Excursion indicators will include conductivity, chloride, and carbonates plus bicarbonate. Monthly samples for these parameters will be collected from monitor wells associated with well fields during mining and restoration.

An excursion will be assumed if any two excursion indicators in any monitor well exceed their respective upper control limits (UCLs) or a single excursion indicator exceeds its UCL by 20 percent. The UCLs for each excursion indicator will be defined as the maximum baseline water quality value plus 20 percent.

If two UCL values are exceeded in a well or if a single UCL value is exceeded by 20 percent, a verification sample will be taken within 24 hours after results of the first analyses are received. If the second sample does not indicate exceedance of the UCLs, the first sample shall be considered in error. If the second or third sample indicates elevated levels of excursion indicators, the well will be placed on excursion status.

Should a well be confirmed to be on excursion status, a corrective action program will be required to return the water quality to baseline concentrations. During and following such an event, the sample frequency will be increased to weekly for the excursion indicators until the excursion is concluded.

If corrective actions have not been effective within 60 days since the first excursion verification, injection of lixiviant within the well field on excursion shall be terminated until such time as the problem is solved and aquifer clean-up is complete. Since ground-water travel times are relatively slow in these formations, the amount of lixiviant involved in the excursion is generally small, and it usually takes several weeks for water quality to begin to improve, the 60-day time limit is considered reasonable.

Quality Assurance (QA) programs will be maintained by site personnel. All QA programs will be conducted according to the Regulatory Guide 4.15 "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment." Standard QA procedures will be maintained throughout the project life.

5.1.2 Evaporation Reservoir Leak Detection Monitoring

Uranerz will be required to inspect the leak detection system on a daily basis during operations. If water is detected in the leak detection system, chemical assays will be for chloride, and TDS.

The detection of elevated levels of these constituents in the leak detection system will be reported to the NRC within 48 hours. All assay results will be reported in writing as soon as they are available. If a leak is confirmed, the damaged pond will be emptied immediately by transferring the solution to the other pond so that remedial actions can be made. Additionally, solution evaporation ponds will have a designed freeboard to reduce the risk of spillage from precipitation events and wave activity.

5.2 Environmental Monitoring

Uranerz has had a surface radiological monitoring program for the Ruth R&D site. The program consists of a number of monitoring sites which have during previous operations sampled surface water, soils, sediments, vegetation, direct radiation, air particulates, radon and ground water. The proposed radiological monitoring program for both the Ruth and North Butte commercial operations are shown in Tables 5.2.1 and 5.2.2. Similarly, the monitoring locations for air particulates, radon, ground and surface waters, soil, sediment, vegetation and direct radiation are shown in Figures 5.2.1 and 5.2.2.

Uranerz will be required by license condition to monitor the various environs and report the results on a semiannual frequency. Additionally, they will be required by license condition to maintain all monitoring records for a minimum of 5 years. These records will, among other things, include a log of all significant solution spills that have taken place at the site.

The environmental monitoring program is designed to determine if the environmental assessment of the project accurately represents the impact on the environment. To assure that a high quality sampling and analytical program is maintained, Uranerz will be required by license condition to prepare, review and update standard operating procedures for all environmental monitoring required for the operation. These standard operating procedures will be reviewed by the Radiation Safety officer to determine if proper radiation measurements are being applied.

6. ALTERNATIVES

6.1 Introduction

The action that the Commission is considering is the issuance of a source material license pursuant to Title 10, Code of Federal Regulations, Part 40. The alternatives available to the Commission are:

- Issue the license.

- Deny the application and not issue the license.

The selection of either alternative is based on a consideration of a number of factors related to protection of health, safety and the environment. Section 40.32 of 10 CFR 40 states that an application for a specific license will be approved if, among other things:

- The application is for a purpose authorized by the Atomic Energy Act;

- The applicant is qualified by reason of training and experience to use the source material for the purpose requested in such a manner as to protect health and minimize danger to life or property;

- The applicant's proposed equipment, facilities and procedures are adequate to protect health and minimize danger to life or property; and

- The issuance of the license will not be inimical to the common defense and security or to the health and safety of the public.

In determining if these stipulations will be met, pursuant to 10 CFR, Part 51, an environmental assessment is performed to determine if an environmental impact statement is required or if a finding of no significant impact can be determined. If the stipulations discussed above are met and either a finding of no significant impact is made or the environmental impact statement finds that the impact is acceptable after weighing the environmental, economic, technical and other benefits against environmental costs, and considering available alternatives, then the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values.

6.2 No License Alternative

If any of the stipulations are not met, including the environmental considerations discussed above, the action called for would therefore be denial of the proposed license.

TABLE 5.2.1
RUTH ISL PROJECT
RADIOLOGICAL MONITORING PROGRAM

	Sample Collection				Sample Analysis	
Type of Sample	Number	Location	Method	Frequency	Frequency	Type of Analysis
AIR						
Particulates	None	No Baseline Air Particulate Sampling Conducted Because the Ruth ISL Project is a Satellite Operation with no Yellowcake Dryer.				
Radon	Seven	Baseline Sampling Sites (R1 thru R7)	Passive Track-Etch Radon Monitors	Continuous	Quarterly	Average Rn-222 Concentration (pCi/l)
WATER						
Ground Water	Varies with Each Well Field	Excursion Monitor Wells	Pump	Twice Monthly	Each Sample	Spec. Conductivity Chloride Carb. plus BiCarb.
Surface Water	Three	Baseline Sampling Sites (SWS U (new), SWS L and SWS U (old)	Grab	Once per Year in Spring if Water Present	Each Sample	Natural Uranium
SOIL	Four	Baseline Sampling Sites (North, South, East and West)	Grab (top 5 cm)	Annually	Each Sample	Natural Uranium, Ra-226, Pb-210
SEDIMENT	Five	Baseline Sampling Sites (Sed. D (4 sites) and Sed. U)	Grab	Annually	Each Sample	Natural Uranium, Ra-226, Th-230 Pb-210
VEGETATION	Four	Baseline Sampling Sites (North, South, East and West)	Composite of Dominant Vegetation Present	Two Times During Grazing Season	Each Sample	Ra-226 Pb-210
DIRECT RADIATION	Seven	Baseline Sampling Sites (R1 thru R7)	Dosimeter	Quarterly	Each Sample	Gamma Exposure Rate in uR/hr Using a Continuous Intergrating Device

Note: See Environmental Monitoring Sites Map for Location

TABLE 5.2.2
NORTH BUTTE ISL PROJECT
RADIOLOGICAL MONITORING PROGRAM

Type of Sample	Number	Location (Sample Collection)	Method (Sample Collection)	Frequency (Sample Collection)	Frequency (Sample Analysis)	Type of Analysis (Sample Analysis)
AIR						
Particulates	Three	Baseline Sampling Sites; Includes Nearest Residence (NB 7, NB 10, NB 12)	Continuous Air Sampler with Glass Fiber Filter	48 Hours Once Per Month	Quarterly Composite of Filters According to Location	Natural Uranium Thorium Ra-226, Pb-210 (pCi/ml)
Radon	Six	Baseline Sampling Sites (NB 8 thru NB 13)	Passive Track-Etch Radon Monitors	Continuous	Quarterly	Average Rn-222 Concentration (pCi/l)
WATER						
Ground Water	Varies with Well Field	Excursion Monitor Wells	Pump	Twice Monthly	Each Sample	Spec. Conductivity Chloride Carb. plus BiCarb.
Surface Water	Three	Baseline Sampling Sites	Grab	Once Per Year in Spring if Water Present	Each Sample	Natural Uranium and Ra-226
SOIL	Three	Baseline Sampling Sites (NB 8, NB 10, NB 12)	Grab (top 5 cm)	Annually	Each Sample	Natural, Uranium Ra-226, Pb-210
SEDIMENT	Three	Baseline Sampling Sites (SWS 1, SWS 2 and SWS 3)	Grab	Annually	Each Sample	Natural Uranium, Ra-226, Th-230 Pb-210
VEGETATION	Three	Baseline Sampling Sites (NB 8, NB 10 and NB 12)	Composite of Dominant Vegetation Present	Two Times During Grazing Season	Each Sample	Ra-226 Pb-210
DIRECT RADIATION	Six	Baseline Sampling Sites (NB 8 thru NB 13)	Dosimeter	Quarterly	Each Sample	Gamma Exposure Rate in uR/hr Using a Continuous Intergrating Device

Note: See Environmental Monitoring Sites Map for Location

Figure 5.2.1

RUTH ENVIRONMENTAL
MONITORING LOCATIONS

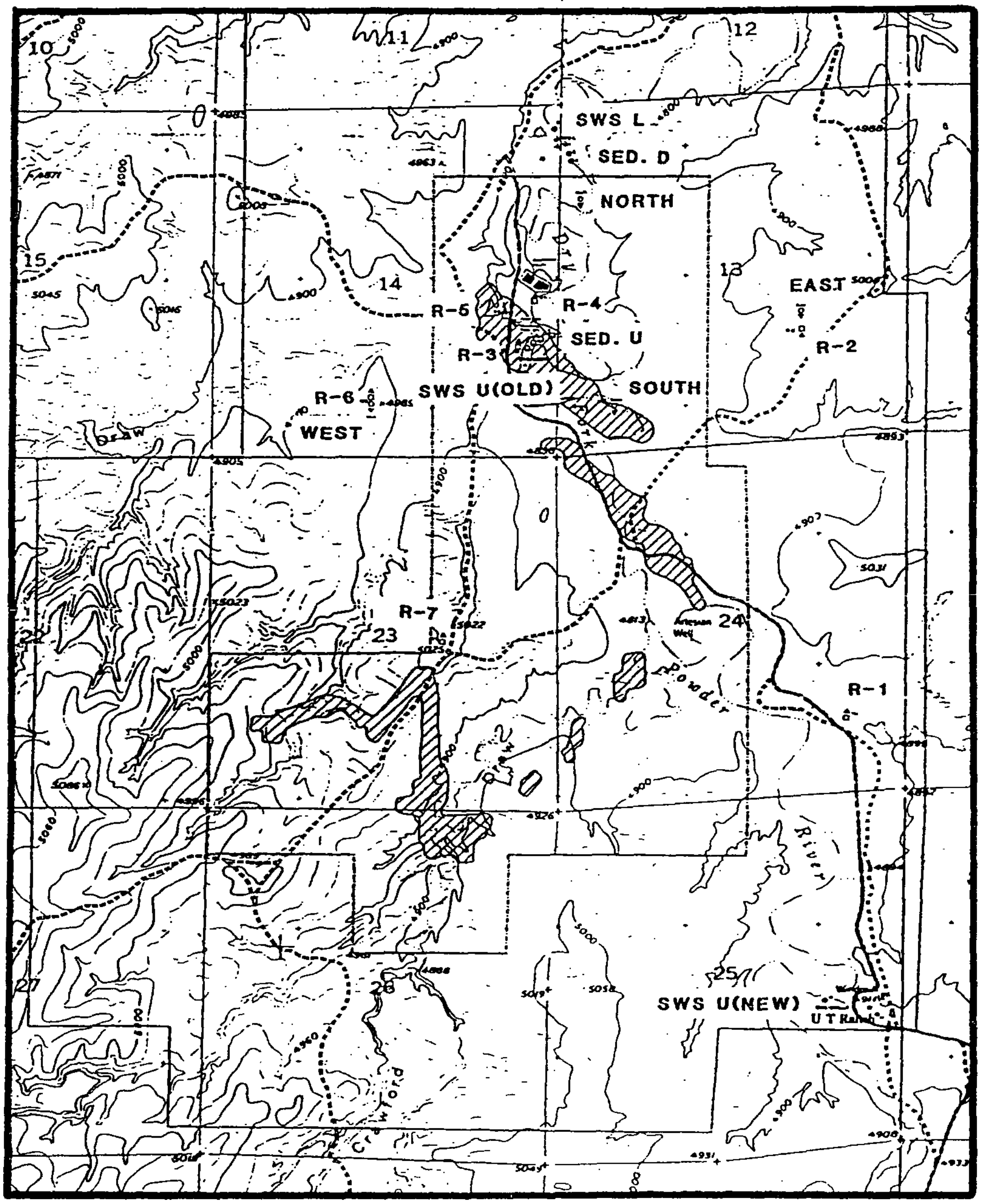
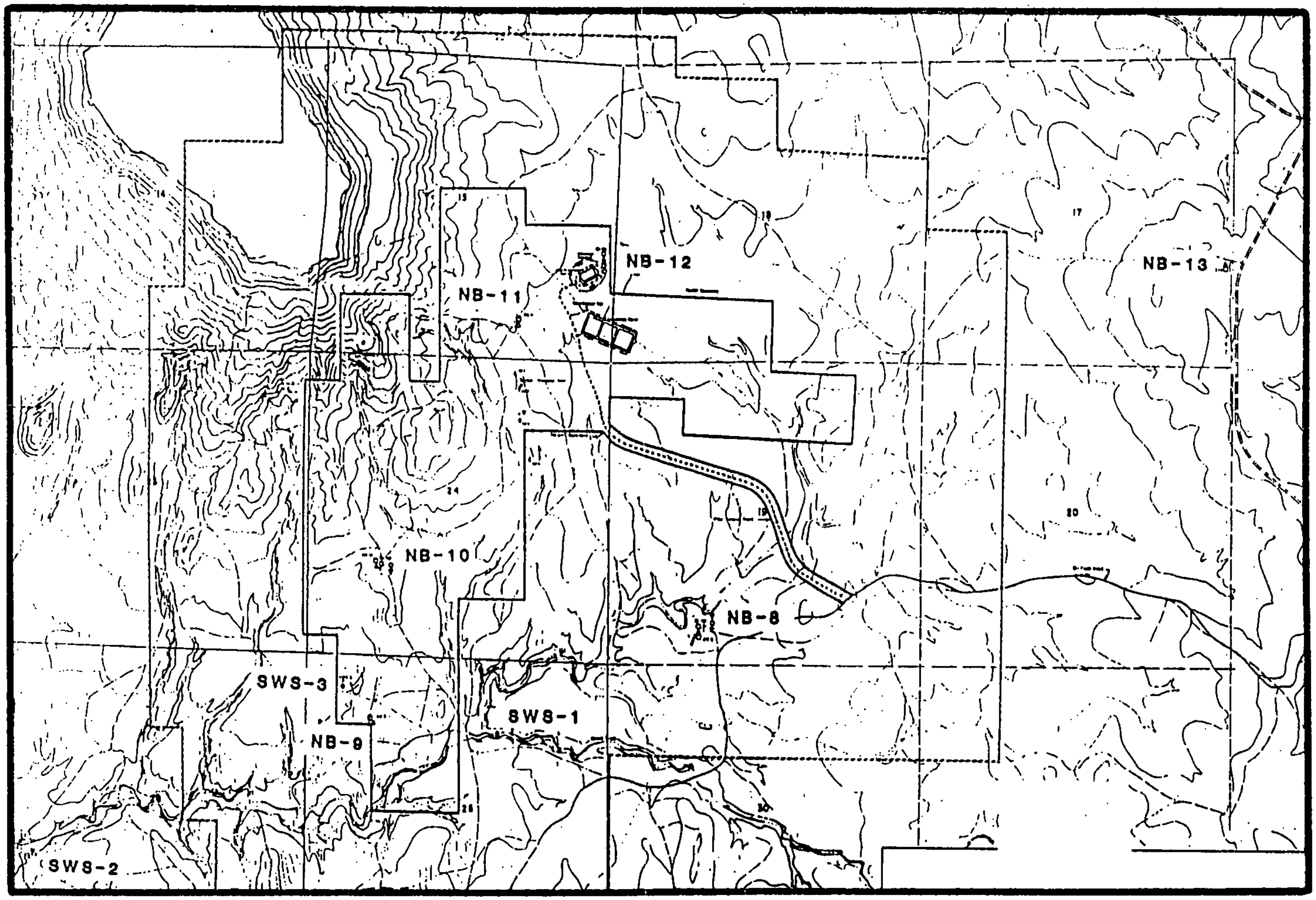


Figure [illegible]

NORTH BUTTE ENVIRONMENTAL
MONITORING LOCATIONS



7. SUMMARY AND ENVIRONMENTAL FINDINGS

Based upon the staff evaluation of the Uranerz application for commercial operation, the operational history of the R&D site, the NRC decided to issue a draft finding of no significant impact in the Federal Register. Documents used in preparing the assessment included operational data from the research and development in-situ leach operation and the licensee's application. Based on the review of the operational data as well as the incremental increase associated with the commercial operation as detailed in the licensee's application materials, the Commission has determined that no significant impact will result from the proposed action.

The following statements support the draft findings of no significant impact and summarize the conclusion resulting from the environmental assessment.

(1) The ground-water monitoring program proposed by Uranerz is sufficient to monitor the operations and will provide a warning system that will minimize any impact on ground water. Furthermore, aquifer testing indicates that the production zone is adequately confined, thereby assuring hydrologic control of mining solutions.

(2) Radiological effluents from the proposed operation of the well field and processing plant will be only small percentages of regulatory limits and will be continuously monitored.

(3) Radioactive wastes will be minimal and will be disposed of at an approved site in accordance with applicable Federal and State regulations.

(4) Ground water, based upon previous testing, can be restored to baseline concentrations or applicable class of use standards.

(5) Environmental monitoring is adequate to determine if releases are within regulatory limits.

In accordance with 10 CFR Part 51.35(a), the Director of the Uranium Recovery Field Office, made the determination to issue a draft finding of no significant impact in the Federal Register and to receive comments on the proposed operation for a period not to exceed 30 days. No comments were received during this period and, accordingly, a final finding of no significant impact will be issued concurrent with issuing the licenses.

8. CONCLUSION AND ENVIRONMENTAL LICENSE CONDITIONS

Upon completion of the environmental review of the Ruth and North Butte applications the staff has concluded that the operation of these facilities in accordance with the following license conditions, will be protective of the environmental and fulfills the requirements of 10 CFR Part 40. The staff therefore recommends that Uranerz be issued two source material licenses, allowing the commercial operation of the Rüth and North Butte sites, subject to the following enviornmental related conditions:

The Ruth environmental conditions are:

- The results of effluent and environmental monitoring described in the submittal dated November 13, 1990 shall be reported in accordance with 10 CFR Part 40, Section 40.65, to the NRC, Uranium Recovery Field Office. The report shall also include injection rates, recovery rates and injection manifold pressures.

- Before engaging in any activity not previously assessed by the NRC, the licensee shall prepare and record an environmental evaluation of such activity. When the evaluation indicates that such activity may result in a significant adverse environmental impact that was not previously assessed or that is greater than that previously assessed, the licensee shall provide a written evaluation of such activities and obtain prior approval of the NRC in the form of a license amendment.

- The licensee shall submit a detailed decommissioning plan to the NRC at least 12 months prior to planned final shutdown of mining operations. The decommissioning plan shall include a proposal to remove all buried process piping.

- All liquid effluents from process buildings and other process waste streams, with the exception of sanitary wastes, shall be returned to the process circuit, discharged to the solution evaporation ponds, or disposed of by way of NPDES permit.

- The licensee shall submit baseline water quality data for all mining units from wells established in the mining zone, the mining zone perimeter as well as the upper and lower aquifers. All baseline data shall be submitted to the NRC, Uranium Recovery Field Office, for review and approval 2 months prior to mining. The data shall, at a minimum, consist of the sample analyses shown in Table 16.1 of the license application dated October 3, 1988.

- Prior to mining, baseline water quality data for each mining unit shall be established at the following minimal density: all mining zone perimeter monitor wells, one upper and lower aquifer monitor well per four acres of well field, and one production/injection well per acre.

- The licensee shall, 2 months prior to lixiviant injection, propose in the form of a license amendment, upper control limits (UCLs) for all monitoring wells utilized for excursion monitoring in each mining unit.

  If two UCLs are exceeded in a well or if a single UCL value is exceeded by 20 percent, the licensee shall take a confirmation water sample within 48 hours and analyze it for chloride, conductivity and total alkalinity. If the second sample does not indicate exceedance, a third sample shall be taken within 48 hours. If neither the second or third indicate exceedance, the first sample shall be considered in error.

  If the second or third sample indicates an exceedance, the well in question shall be placed on excursion status and the NRC shall be notified by telephone within 24 hours and within 7 days in writing from the time the confirmation sample was taken. Upon confirmation of an excursion, the licensee shall implement a corrective action and increase the sampling frequency for the excursion indicators to once every 7 days. An excursion is considered concluded when the concentrations of excursion indicators are below the concentration levels defining an excursion for three consecutive 1-week samples.

- Upper control limits (UCLs) for specific conductivity and carbonate plus bicarbonate shall be the mean of the baseline wells plus five standard deviations. The UCLs for chloride shall be the mean of the baseline wells plus five standard deviations or the mean plus 15 mg/l whichever is greater.

- A written report shall be submitted to the NRC, Uranium Recovery Field office, within 2 months of excursion confirmation. The report shall describe the excursion event, corrective actions taken and results obtained. If the wells are still on excursion at the time the report is submitted, injection of lixiviant within the well field on excursion shall be terminated until such time that aquifer cleanup is complete.

- The licensee shall perform well integrity tests on each injection, production, and monitor well before the wells are utilized and on wells that have been serviced. The integrity test shall pressurize the well to 240 pounds per square inch (psi). A well shall have passed the test if it maintains 90 percent of the test pressure after 10 minutes. At the licensee's option, a single point resistance test may be utilized. Any well casing failing the integrity test that cannot be repaired, shall be plugged and abandoned according to State of Wyoming standards. Each well utilized for mining or monitoring shall be retested every 5 years.

  Additionally, flow rates on each injection and recovery well and manifold pressures on the entire system shall be measured and recorded daily. During well-field operations, injection pressures shall not exceed the integrity test pressure at the injection well heads.

- The licensee shall utilize sodium carbonate/bicarbonate as the lixiviant with an oxygen or hydrogen peroxide oxidant. Any variation from this combination shall require a license amendment.

- The solution evaporation ponds shall have 3 feet of freeboard.

  Additionally, 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 and subsequent transfer of liquid, the freeboard requirements shall be suspended during the repair period.

- The licensee shall perform and document weekly visual inspections of the evaporation pond embankments, fences, and liners, as well as measurements of pond freeboard and checks of the leak detection system. Any fluid detected in the standpipes shall be analyzed for chloride, TDS, sodium, uranium, and radium-226. Should analyses indicate that the pond is leaking, the NRC, Uranium Recovery Field Office, shall be notified by telephone within 48 hours of verification and the pond level lowered by transferring its contents into an alternate cell. Standpipe water quality samples shall be analyzed for the above parameters once every 7 days during the leak period and once every 7 days for at least 2 weeks following repairs.

  A written report shall be filed with the NRC, Uranium Recovery Field Office, within 30 days of first notifying the NRC that a leak exists. This report shall include analytical data and describe the mitigative action and the results of that action.

- Six months prior to construction of the proposed additional evaporation pond, the licensee shall submit a design, in the form of a license amendment, for NRC review and approval.

- The licensee shall maintain a log of all significant solution spills and notify the NRC, Uranium Recovery Field Office, by telephone within 48 hours of any failure which may have a radiological impact on the environment. Such notification shall be followed, within 7 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 maintain an area within the restricted area boundary for storage of contaminated materials prior to their disposal. Prior to lixiviant injection the licensee shall submit a waste disposal agreement to the NRC, Uranium Recovery Field Office, in the form of a license amendment, for review and approval. All contaminated wastes and evaporation pond residues shall be disposed at a licensed radioactive waste disposal site.

- At least 3 months prior to termination of uranium recovery in a mining unit, the licensee shall submit to the NRC, Uranium Recovery Field Office, in the form of a license amendment, a plan for ground-water restoration and at least 12 months of post-restoration monitoring, consisting of at least 9 sampling events. The goal of restoration shall be to return the ground-water quality, on a mining unit average, to baseline concentrations.

- The licensee shall maintain an NRC-approved financial surety arrangement, consistent with 10 CFR 40, Appendix A, Criterion 9, adequate to cover the estimated costs, if accomplished by a third party, for completion of the NRC-approved site closure plan including: above-ground decommissioning and decontamination, the cost of offsite disposal of radioactive solid process or evaporation pond residues, and ground-water restoration. Within 3 months of NRC approval of a revised closure plan and cost estimate, the licensee shall submit, for NRC review and approval, a proposed revision to the financial surety arrangement if estimated costs in the newly-approved site closure plan exceed the amount covered in the existing financial surety. The revised surety shall then be in effect within 3 months of written NRC approval.

  Annual updates to the surety amount, required by 10 CFR 40, Appendix A, Criterion 9, shall be provided to the NRC at least 3 months prior to the anniversary of the effective date of the existing surety instrument. If the NRC has not approved a proposed revision 30 days prior to the expiration date of the existing surety arrangement, the licensee shall extend the existing arrangement, prior to expiration, for 1 year. Along with each proposed revision or annual update, the licensee shall submit supporting documentation showing a breakdown of the costs and the basis for the cost estimates with adjustments for inflation, maintenance of a minimum 15 percent contingency, changes in engineering plans, activities performed, and any other conditions affecting estimated costs for site closure. The licensee shall also provide the NRC with copies of surety related correspondence submitted to the State of Wyoming, a copy of the State's surety review, and the final approved surety arrangement. The licensee must also ensure that the surety, where authorized to be held by the State, expressly identifies the NRC-related portion of the surety and covers the above-ground decommissioning and decontamination, the cost of offsite disposal, soil and water sample analyses, and ground-water restoration associated with the site. The basis for the cost estimate is the NRC-approved site closure plan or the NRC-approved revisions to the plan. The reclamation/decommissioning plan, cost estimates, and annual updates should follow the outline in the attachment to this license entitled, "Recommended Outline for Site Specific Reclamation and Stabilization Cost Estimates."

  Three months prior to the expected commencement of site construction, the licensee shall submit a surety instrument acceptable to the State of Wyoming and the NRC in an amount no less than $4,597,813. This surety shall be written in favor of the State of Wyoming or the NRC for the purpose of complying with 10 CFR 40, Appendix A, Criterion 9, and shall be continuously maintained until a replacement is authorized by both the State and the NRC. Site construction activities shall not be commenced until the NRC and the State accept the surety arrangement.

The North Butte environmental conditions are:

- The results of effluent and environmental monitoring described in the submittal dated November 13, 1990 shall be reported in accordance with 10 CFR Part 40, Section 40.65, to the NRC, Uranium Recovery Field Office. The report shall also include injection rates, recovery rates and injection manifold pressures.

- Six months prior to evaporation pond construction, the licensee shall submit a design, in the form of a license amendment, for NRC review and approval.

- The licensee is authorized to dispose of process waters by way of deep well injection, in accordance with their submittal dated November 13, 1990. Additionally, the quantity of water injected shall be recorded.

- Before engaging in any activity not previously assessed by the NRC, the licensee shall prepare and record an environmental evaluation of such activity. When the evaluation indicates that such activity may result in a significant adverse environmental impact that was not previously assessed or that is greater than that previously assessed, the licensee shall provide a written evaluation of such activities and obtain prior approval of the NRC in the form of a license amendment.

- The licensee shall, 6 months prior to installation, submit a description of the emission control equipment for the yellowcake drying and packaging areas that is at least 99 percent efficient. Additionally, annual throughput of the yellowcake dryer shall not exceed 1,000,000 pounds of U_3O_8.

- The licensee shall submit a detailed decommissioning plan to the NRC at least 12 months prior to planned final shutdown of mining operations. The decommissioning plan shall include a proposal to remove all buried process piping.

- All liquid effluents from process buildings and other process waste streams, with the exception of sanitary wastes, shall be returned to the process circuit, discharged to the solution evaporation ponds, disposed by way of NPDES permit, or injected via the deep well disposal program.

- Any significant changes in the process circuit as shown in figure 15.21 of the application, dated March 7, 1989, shall require approval by the NRC, Uranium Recovery Field Office in the form of a license amendment. Three months prior to initiation of construction detailed process flow diagrams shall be submitted to the NRC, Uranium Recovery Field Office, for review and approval.

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- The licensee shall submit baseline water quality data for all mining units from wells established in the mining zone, the mining zone perimeter, and the upper aquifer. All baseline data shall be submitted to the NRC, Uranium Recovery Field Office, for review and approval 2 months prior to mining. The data shall, at a minimum, consist of the sample analyses shown in Table 16.1 of the license application dated March 7, 1989.

- Prior to mining, baseline water quality data for each mining unit shall be established at the following minimal density: all mining zone perimeter monitor wells, one upper aquifer monitor well per four acres of well field, and one production/injection well per acre.

- The licensee shall, 2 months prior to lixiviant injection, propose in the form of a license amendment, upper control limits (UCLs) for all monitoring wells utilized for excursion monitoring in each mining unit.

  If two UCLs are exceeded in a well or if a single UCL value is exceeded by 20 percent, the licensee shall take a confirmation water sample within 48 hours and analyze it for chloride, conductivity and total alkalinity. If the second sample does not indicate exceedance, a third sample shall be taken within 48 hours. If neither the second or third indicate exceedance, the first sample shall be considered in error.

  If the second or third sample indicates an exceedance, the well in question shall be placed on excursion status and the NRC shall be notified by telephone within 24 hours and within 7 days in writing from the time the confirmation sample was taken. Upon confirmation of an excursion, the licensee shall implement a corrective action and increase the sampling frequency for the excursion indicators to once every 7 days. An excursion is considered concluded when the concentrations of excursion indicators are below the concentration levels defining an excursion for three consecutive 1-week samples.

- Upper control limits (UCLs) for specific conductivity and carbonate plus bicarbonate shall be the mean of the baseline wells plus five standard deviations. The UCLs for chloride shall be the mean of the baseline wells plus five standard deviations or the mean plus 15 mg/l whichever is greater.

- A written report shall be submitted to the NRC, Uranium Recovery Field office, within 2 months of excursion confirmation. The report shall describe the excursion event, corrective actions taken and results obtained. If the wells are still on excursion at the time the report is submitted, injection of lixiviant within the well field on excursion shall be terminated until such time that aquifer cleanup is complete.

- The licensee shall perform well integrity tests on each injection, production, and monitor well before the wells are utilized and on wells that have been serviced. The integrity test shall pressurize the well to 168 pounds per square ince (psi) or 90 percent of the formation fracture pressure, if higher than 140 psi. A well shall have passed the test if it maintains 90 percent of the test pressure after 10 minutes. At the licensee's option, a single point resistance test may be utilized. Any well casing failing the integrity test that cannot be repaired, shall be plugged and abandoned according to State of Wyoming standards. Each well utilized for mining or monitoring shall be retested every 5 years.

Additionally, flow rates on each injection and recovery well and manifold pressures on the entire system shall be measured and recorded daily. During well-field operations, injection pressures shall not exceed the integrity test pressure at the injection well heads.

- The licensee shall utilize sodium carbonate/bicarbonate as the lixiviant with an oxygen or hydrogen peroxide oxidant. Any variation from this combination shall require a license amendment.

- The licensee shall maintain a log of all significant solution spills and notify the NRC, Uranium Recovery Field Office, by telephone within 48 hours of any failure which may have a radiological impact on the environment. Such notification shall be followed, within 7 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 maintain an area within the restricted area boundary for storage of contaminated materials prior to their disposal. Prior to lixiviant injection the licensee shall submit a waste disposal agreement to the NRC, Uranium Recovery field Office, in the form of a license amendment for review and approval. All contaminated wastes and evaporation pond residues shall be disposed at a licensed radioactive waste disposal site.

- At least 3 months prior to termination of uranium recovery in a mining unit, the licensee shall submit to the NRC, Uranium Recovery Field Office, in the form of a license amendment, a plan for ground-water restoration and at least 12 months of post-restoration monitoring, consisting of at least nine sampling events. The goal of restoration shall be to return the ground-water quality, on a mining unit average, to baseline concentrations.

- The licensee shall maintain an NRC-approved financial surety arrangement, consistent with 10 CFR 40, Appendix A, Criterion 9, adequate to cover the estimated costs, if accomplished by a third party, for completion of the NRC-approved site closure plan including: above-ground decommissioning and decontamination, the cost of offsite disposal of radioactive solid process or evaporation pond residues, and ground-water restoration. Within 3 months of NRC approval of a revised closure plan and cost estimate, the licensee shall submit, for NRC review and approval, a proposed revision to the financial surety arrangement if estimated costs in the newly-approved site closure plan exceed the amount covered in the existing financial surety. The revised surety shall then be in effect within 3 months of written NRC approval.

Annual updates to the surety amount, required by 10 CFR 40, Appendix A, Criterion 9, shall be provided to the NRC at least 3 months prior to the anniversary of the effective date of the existing surety instrument. If the NRC has not approved a proposed revision 30 days prior to the expiration date of the existing surety arrangement, the licensee shall extend the existing arrangement, prior to expiration, for 1 year. Along with each proposed revision or annual update, the licensee shall submit supporting documentation showing a breakdown of the costs and the basis for the cost estimates with adjustments for inflation, maintenance of a minimum 15 percent contingency, changes in engineering plans, activities performed, and any other conditions affecting estimated costs for site closure. The licensee shall also provide the NRC with copies of surety related correspondence submitted to the State of Wyoming, a copy of the State's surety review, and the final approved surety arrangement. The licensee must also ensure that the surety, where authorized to be held by the State, expressly identifies the NRC-related portion of the surety and covers the above-ground decommissioning and decontamination, the cost of offsite disposal, soil and water sample analyses, and ground-water restoration associated with the site. The basis for the cost estimate is the NRC-approved site closure plan or the NRC-approved revisions to the plan. The reclamation/decommissioning plan, cost estimates, and annual updates should follow the outline in the attachment to this license entitled, "Recommended Outline for Site Specific Reclamation and Stabilization Cost Estimates."

Three months prior to the expected commencement of site construction, the licensee shall submit a surety instrument acceptable to the State of Wyoming and the NRC in an amount no less than $4,920,705. This surety shall be written in favor of the State of Wyoming or the NRC for the purpose of complying with 10 CFR 40, Appendix A, Criterion 9, and shall be continuously maintained until a replacement is authorized by both the State and the NRC. Site construction activities shall not be commenced until the NRC and the State accept the surety arrangement.