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**DIRECTORY AND PROFILE OF LICENSED
URANIUM-RECOVERY FACILITIES**

by

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1. EXECUTIVE SUMMARY

The purpose of this report is to present a directory and profile of licensed uranium-recovery facilities throughout the United States. A preliminary document was prepared by Argonne National Laboratory in 1979 which served as the basis for Appendix I to the Generic Environmental Impact Statement (GEIS) on Uranium Milling (NUREG-0706). Much of the data contained in Appendix I was developed from information in reports distributed by the U.S. Environmental Protection Agency through 1977. Directory and Profile of Licensed Uranium-Recovery Facilities updates or amends previous documents to reflect changes at each site as of December 1981. It provides a uniform description of conventional uranium mills, solution-mining (in-situ) facilities, and heap leach operations for the purpose of producing marketable quantities of yellowcake [U_3O_8 , $(NH_4)_2U_2O_7$, or $Na_2U_2O_7$]. Numerical data are also reported on licensed facilities which use other techniques to recover or process uranium. Such facilities include operations recovering uranium from copper mining leach liquors and wet process phosphoric acid. Projects for research and development, pilot-scale projects, proposed operations, or any other facility not in possession of a source material license from NRC or an Agreement State is not included in this report.

Since this document has been formulated with the intent of covering factual information about uranium mills, a description of each facility is provided. The directory begins with a narrative about the mill, outlining historical information, various aspects of process circuits, the tailings area, the embankment retention system, decommissioning of the operation, and facility reclamation. Immediately following the narrative section is a data sheet summarizing the principal operating characteristics of the operation. The sheet is divided into five sections as follows: location/ownership information, licensing data, parameters regarding uranium processing, effluent and tailings characteristics, and radiological parameters.

Although record yellowcake production occurred during 1980, reports from 1981 indicate a decline in production. For calendar year 1982, a greater decrease in production is expected. During 1981, several of the larger mills curtailed their operations, while others either shut down completely or temporarily closed until demand for U_3O_8 catches up with supply.

Information and data for this report were obtained by frequent contacts with the appropriate licensing authority (NRC, States of Arizona, Colorado, Florida, Louisiana, New Mexico, Texas, and Washington) and facility operators. The majority of parameters that describe permanent features of each facility have been obtained and are presented in the tables. Other characteristics, however, are dynamic in nature, such as those pertaining to tailings areas, effluent releases, and dose assessments. When gathering information for the document, it was found that a significant amount of environmental monitoring data at mills has been recorded by both regulators and licensees, but much of it

remains unevaluated. For this reason it has not been possible in all cases to provide completed charts with current information in regard to radiological parameters. Since operational monitoring programs continue until the mill tailings are reclaimed and all site decontamination and decommissioning efforts are completed, the need arises for continual reporting of updated radiological information. Therefore, an updated version of this NUREG report will be issued annually by ANL to reflect the current changes of each facility.

2. DESCRIPTION OF LICENSED URANIUM-RECOVERY FACILITIES

2.1 CONVENTIONAL MILLS

The two most commonly used methods of mining uranium ores are surface, or open-pit, mining and underground mining. After the ore is mined, it is shipped to a mill for processing by conventional milling techniques. The conventional milling process involves the following basic steps: (1) ore handling and preparation, (2) uranium concentration, and (3) product recovery. Ore handling and preparation include such processes as ore blending, crushing, fine ore storage, grinding, and possibly drying or roasting to improve handling or solubility properties. In newer mills, use of wet, semi-autogenous grinding eliminates the need for dry crushing operations. Uranium concentration consists of hydrometallurgical extraction or leaching techniques, using either dilute sulfuric acid or alkaline carbonate solutions as lixiviants, followed by further concentration of leached uranium by ion exchange or solvent extraction. The product is recovered from solution by chemical precipitation, followed by drying and packaging for shipment.

The wastes produced by milling of uranium contain a mixture of radioactive and nonradioactive materials. Solid, liquid, and gaseous effluents are released to the environment to a greater or lesser extent, depending on the process-control and waste-management measures instituted by the mill operator.

The tailings represent the bulk of the wastes, and with the exception of the recovered uranium and process losses, account for practically all of the ore solids and the process additives, including water. As discharged from the operating mill, the tailings consist of a mixture of solids and solutions varying in chemical and physical compositions depending on the nature of the ore and the process used.

Treatment of mill wastes always involves impoundment, with disposal of excess water by evaporation. In some cases, mill waste solutions are neutralized by addition of lime and/or treated by barium chloride coprecipitation, or ion exchange (one mill). Only one U.S. uranium mill operates a point discharge. It also occasionally uses lime neutralization of solvent extraction raffinate prior to discharge. One operating mill is using subsurface impoundment (in a mined-out open pit) for waste disposal.

The tailings impoundment is usually created by damming a ravine that is strategically placed with respect to surface topography and groundwater drainage. The solids settle out as the slurry discharged from the mill moves downstream toward the dam. A pond is created, permitting evaporation of water from the surface. In some cases, liquids from the pond are decanted to evaporation ponds.

At most conventional mills, water is recycled from the tailings pond to the process circuit; the amount recycled, as a percent of total water input, varies from 25% to 83%. Recycled water, which for acid leach mills has a pH of about 2, not only reduces water consumption in the leaching operations, but also reduces acid requirements in leaching. Nearly all fresh water used by operating mills in the United States is pumped from deep aquifers.

Tailings-management methods, while varying from mill to mill, have become more effective in recent years. Mill management has devised numerous methods for reducing radioactive emissions from tailings piles. Regulations pertaining to both management of the tailings during operation and tailings disposal at the end of mill life have been promulgated by the NRC and the States of Colorado, New Mexico, Texas, and Washington. None of the conventional mills for which data are supplied in this report have yet begun reclamation of tailings piles. All have improved tailings management schemes since development of new procedures started in the early 1970s.

A list of the owners, names, and locations of existing conventional mills is provided in Table 2.1-1. The approximate locations of all recovery facilities are also shown on the map in Figure 2.1-1. Descriptions and data sheets for the existing conventional mills are presented on the pages which follow.

Some abbreviations for technical terms are used throughout the tables and data sheets. Their meanings are given below:

- CCD = Counter-current decantation
- SX = Solvent extraction
- PVC = Polyvinyl chloride
- IX = Ion exchange
- SAG = Semi-autogenous grinding
- AGL = Above ground level

Table 2.1-1. Owners, Names, and Locations of Existing Conventional Uranium Mills (alphabetical by owner)

Owner	Name	State	Code† ¹	Page† ²
Anaconda Co.	Bluewater Mill	NM	NM-A-C-22	2-13
Atlas Minerals Div.	Moab Mill	UT	UT-N-C-01	2-27
Chevron Resources Co.	Panna Maria Mill	TX	TX-A-C-02	2-23
Conoco/Pioneer Nuclear	Conquista Mill	TX	TX-A-C-23	2-25
Cotter Corp.	Canon City Mill	CO	CO-A-C-03	2-5
Dawn Mining Co.	Ford Mill	WA	WA-A-C-04	2-37
Energy Fuels Nuclear, Inc.	White Mesa Mill	UT	UT-N-C-05	2-30
Exxon Minerals Co.	Highland Mill	WY	WY-N-C-06	2-41
Federal American Partners	Gas Hills Mill	WY	WY-N-C-21	2-43
Homestake Mining Co.	Grants Mill	NM	NM-A-C-07	2-15
Homestake Mining Co.	Pitch Project	CO	CO-A-C-25	2-8
Kerr-McGee Nuclear Corp.	Ambrosia Lake Mill	NM	NM-A-C-08	2-17
Minerals Exploration Co.	Sweetwater Mill	WY	WY-N-C-15	2-45
Pathfinder Mines Corp.	Gas Hills Mill	WY	WY-N-C-09	2-48
Pathfinder Mines Corp.	Shirley Basin Mill	WY	WY-N-C-10	2-51
Petrotomics Co.	Shirley Basin Mill	WY	WY-N-C-11	2-53
Plateau Resources Ltd.	Shooting Canyon	UT	UT-N-C-24	2-33
Rio Algom Corp.	Lisbon Mill	UT	UT-N-C-20	2-35
Rocky Mountain Energy Co.	Bear Creek Mill	WY	WY-N-C-12	2-55
Sohio Petroleum Co./ Reserve Oil & Minerals	L-Bar Mill	NM	NM-A-C-18	2-19
Union Carbide Corp.	Uravan Mill	CO	CO-A-C-13	2-10
Union Carbide Corp.	East Gas Hills Mill	WY	WY-N-C-14	2-58
United Nuclear Corp.	Church Rock Mill	NM	NM-A-C-16	2-21
Western Nuclear, Inc.	Sherwood Mill	WA	WA-A-C-17	2-39
Western Nuclear, Inc.	Split Rock Mill	WY	WY-N-C-19	2-61

†¹ Code numbers have been assigned for each facility for the purposes of this report; the code for a given mill is the same in the text and on the data sheet that immediately follows the mill description.

†² Page of this document on which mill description begins.

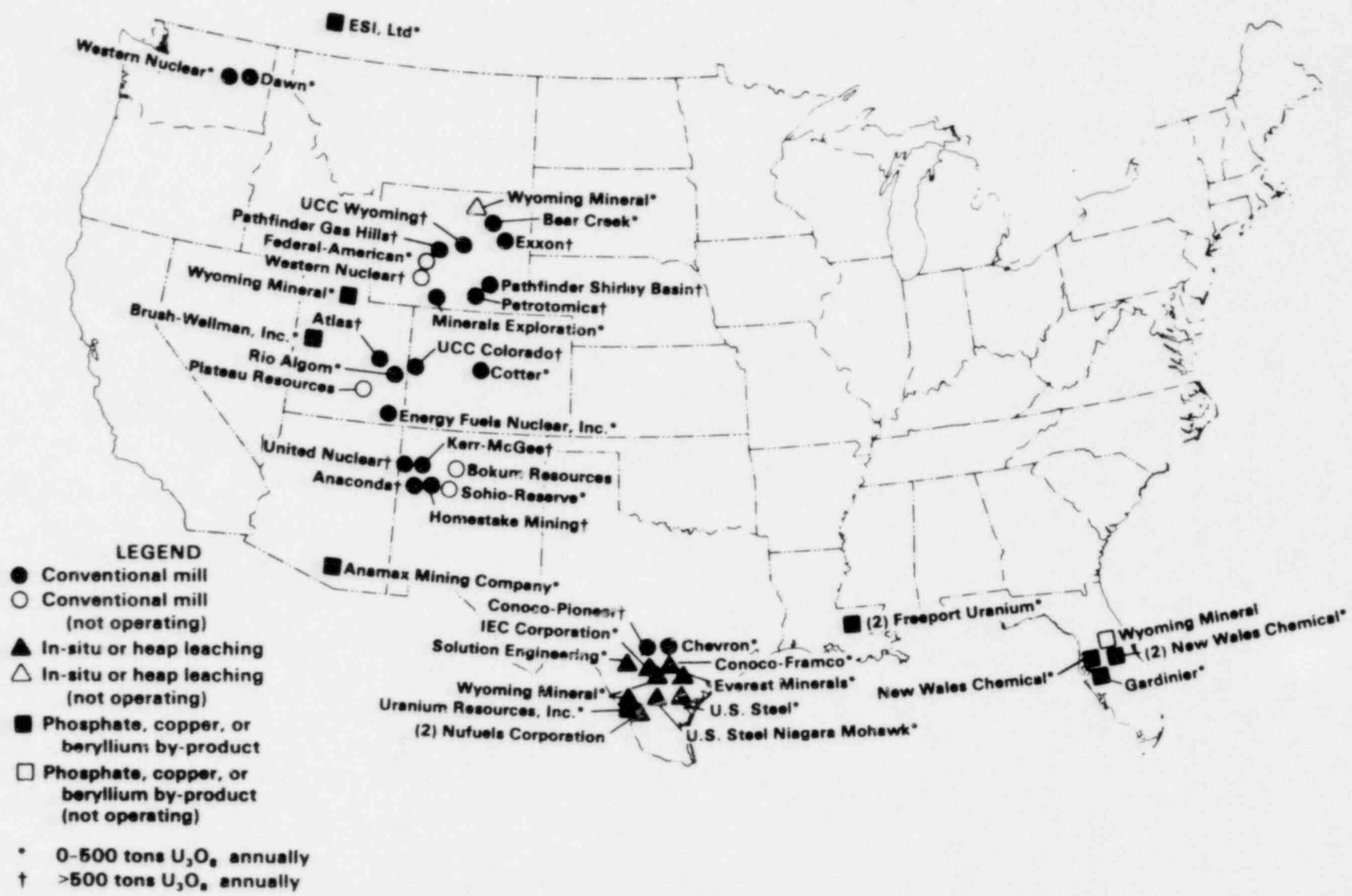


Fig. 2.1-1. Location of Uranium-Recovery Facilities. [Page 12 of "Uranium Production," by J.Q. Jones (Mineral Assessment Division, U.S. DOE, Grand Junction, CO). Presented at 1981 Uranium Industry Seminar, U.S. DOE]

2.1.1 Colorado

2.1.1.1 Cotter Corp. Canon City Mill (Code # CO-A-C-03)*

The new Canon City Mill at Canon City, Colorado, is operated by Cotter Corp. (a subsidiary of Commonwealth Edison) to recover uranium and vanadium through use of a two-stage, acid-leach process. The first-stage leach is at atmospheric pressure, followed by an autoclave leach at elevated pressure. Ore is supplied from underground mines owned by the company in southwestern Colorado and from the Schwartzwalder Mine near Golden, Colorado, 190 km (120 mi) away. Topographically, the site is a northerly-drained alluvial valley bounded by steep sandstone ridges on the east, southwest, and northwest.

The new acid leach mill, which was completed in 1979, replaced Cotter Corp.'s alkaline leach mill, which had been in operation since August 1958. The original mill was a large pilot plant that could process about 68 MT (75 ST) per day. Over its 20-year operating period, the original mill was expanded to a capacity of 1088 MT (1097 ST) per day. The original tailings dam was developed from a starter dike; further construction of the tailings impoundment was done with mechanical equipment using tailings sands. To improve tailings management, in 1971 the company constructed its first lined pond; it covered an area of about 0.8 ha (2 ac). A second lined pond [covering 5.3 ha (13 ac)] was constructed in 1973. Its dam was about 7.6 m (25 ft) high and impounded about $2.5 \times 10^5 \text{ m}^3$ (200 ac-ft). The pond was lined with 20-mil PVC and was used for evaporation of mill liquids. It contained a limited amount of solids.

Over the years, tailings liquid has seeped from the old tailings impoundment. Cotter Corp. placed the new mill at the old site so that a single impoundment could satisfy the requirements for the new mill and also provide a place for relocation of the old mill tailings.

The new tailings impoundment was put in use on August 3, 1979. The impoundment is divided into two compartments to accommodate tailings from three different process systems: the new acid-leach mill, the old alkaline-leach mill, and a nearby spent catalyst plant that generates alkaline waste from the extraction of five different metals from spent catalysts. The primary portion of the impoundment receives tailings from the new mill; tailings from past alkaline-leach milling operations are being reprocessed in the old mill and placed in the secondary portion of the impoundment.

The main tailings dam is being constructed in stages by the downstream method. A section through the dam from upstream to downstream includes the liner cover, the Hypalon liner, the core, the sand chimney drain, and the shell. The impoundment contains subdrains for collection of any water that might come from underground sources. The auxiliary dam used to form the secondary portion of the impoundment was constructed to its ultimate height during the first construction period. The primary dam will be raised to its ultimate

*Code numbers have been assigned for each facility for the purposes of this report, and the code for a given mill is the same in the text and on the data sheets that accompany this report.

height in two or three additional stages. The storage volumes in the primary and secondary impoundments are $7.6 \times 10^6 \text{ m}^3$ (6200 ac-ft) and $1.7 \times 10^6 \text{ m}^3$ (1350 ac-ft), respectively. The respective pond areas are 61 ha (150 ac) and 20 ha (50 ac). The maximum heights of the primary and auxiliary dams (measured under centerline of dam) will be 35 m (115 ft) and 18 m (60 ft), respectively. The approximate embankment volumes are $2.3 \times 10^6 \text{ m}^3$ ($3 \times 10^6 \text{ yd}^3$) and $3.4 \times 10^5 \text{ m}^3$ ($4.5 \times 10^5 \text{ yd}^3$).

Following the removal of tailings from the old ponds, contaminated materials will either be removed and replaced with clean materials, or can be covered with clay, earth, and topsoil, similar to the final cover to be placed on the new tailings pond. The reclamation plan for the new impoundment will include use of the tailings dewatering system to remove, by settling, as much solution as possible. This solution will be placed in the secondary pond for evaporation. As the surface of the pond dries and crusts over, the first cover material will be added. The cover will be 3 m (10 ft) thick and will consist of 0.6 m (2 ft) of clay, 2.3 m (7.5 ft) of sandstone, siltstone, and shale, followed by 0.15 m (0.5 ft) of topsoil. The final reclamation step will be installation of rocked ditches for drainage erosion control, followed by revegetation. About $2.5 \times 10^5 \text{ m}^3$ ($3.2 \times 10^5 \text{ yd}^3$) of topsoil has been stock-piled for use in the final reclamation program.

Current mill tailings under management total about $0.9 \times 10^6 \text{ MT}$ ($1 \times 10^6 \text{ ST}$). Current capacity of the milling facilities is 1100 MT (1200 ST) per day.

Facility Name: Canon City Mill
Type: Conventional Uranium Mill
Location -

Code Number: CO-A-C-03

Site Name: Canon City Mill

City: Canon City State: CO County: Fremont

Ownership -

Mill Contact: Jim Cain

Owner: Cotter Corp.

Title: Radiation Safety Officer

Address: P.O. Box 751

Telephone: (303) 275-7413

Canon City, CO 81212

LICENSING DATA

Regulatory Authority: State of Colorado

First Issued: 1958

License Number: 369-015

Last Renewed in Entirety: 1972

Current Status of Operation: Active

Last Amended: 1979/08

Days of Operation/Year: 350

Expires: 1978/01

Project Life (years, est): 1990

Surety Type:

Years for Complete Reclamation:

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Schwartzwalder

Grinding Method: SAG

U₃O₈ Production
(tons/year): 806

Type: Underground

Leach Method: Acid & Basic

Ore Grade (%): 0.23-0.35

Clarification:

Metals in Ore Recovered: Y

Concentration:

U₃O₈ Purity (%): 93

Extraction Efficiency (%):

Precipitation:

Throughput (tons/day): 1200

Calcining Temp: Low fired

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 1.0x10⁶

Total Pond Area (acres): 200

% Water Recycled:

Total Area, Tailings (acres): 200

Number Evaporation Ponds: None

Method of Tailings

pH: 4.2

Mill Water Consumption
(gpm):

Disposal: Above ground

Liner Types: Hypalon/clay

Dam Height (feet, AGL): 115, 60

Seepage Rate
(gpm): None

Freeboard Height (feet):

Cover Material: Clay, sandstone, siltstone, shale, topsoil

Construction Method

Thickness: 10 feet

of Dam: Upstream

Rn Flux (pCi/m²/s):

Underlying

Strata: Surface bedrock

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Ra-226, Rn-222, Pb-210

Method of Concentration Determination: UDAD

Dose to Nearest Offsite Individual: 3.8 mrem/yr

Location of Nearest Offsite Individual: 1.5 mi N

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Text Description (page): 2-5

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised:

2.1.1.2 Homestake Mining Co., Pitch Mill (Code #C0-A-C-25)

Homestake Mining has applied for and received a license to construct a 540 MT (600 ST) per day mill, but has indefinitely delayed construction.

Facility Name: Pitch
Type: Conventional Uranium Mill
Location -

Code Number: CO-A-C-25

Site Name: Pitch City: Slick Rock State: CO County: San Miguel
Ownership - Mill Contact:
Owner: Homestake Mining Title:
Address: Telephone:

LICENSING DATA

Regulatory Authority: State of Colorado First Issued:
License Number: License granted Last Renewed in Entirety:
Current Status of Operation: Const. delayed Last Amended:
Days of Operation/Year: Expires:
Project Life (years, est): Surety Type:
Years for Complete Reclamation: Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Grinding Method: U_3O_8 Production
(tons/year):
Type: Leach Method:
Ore Grade (%): Clarification:
Metals in Ore Recovered: Concentration: U_3O_8 Purity (%):
Extraction Efficiency (%): Precipitation:
Throughput (tons/day): 600 T/day Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): Total Pond Area (acres): % Water Recycled:
Total Area, Tailings (acres): Number Evaporation Ponds:
Method of Tailings Disposal: pH: Mill Water Consumption
(gpm):
Liner Types: Dam Height (feet, AGL): Seepage Rate
(gpm):
Cover Material: Freeboard Height (feet):
Thickness: Construction Method
of Dam:
Rn Flux (pCi/m²/s): Underlying
Strata:

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:
Method of Concentration Determination:
Dose to Nearest Offsite Individual:
Location of Nearest Offsite Individual:
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-8

Data Compiled by: Lee Busch Date Compiled: 1982/05

Date Data Revised:

2.1.1.3 Union Carbide Corp., Uravan Mill (Code # CO-A-C-13)

The Uravan Mill is in western Colorado in an area of rugged canyons and mesas. It is 80 km (50 mi) south of Grand Junction, Colorado. The mill is adjacent to the San Miguel River, a tributary of the Colorado River. Uranium, vanadium, and radium recovery operations were begun at the site in 1915 by the Standard Chemical Co. The Union Carbide Corp. purchased the property in 1936, and except for the period 1946-1950, has produced vanadium and/or uranium at the site since then.

At various times the mill has been used to process ore from more than 200 mines; individual mines delivered from as little as 90 MT (100 ST) to more than 900,000 MT (1×10^6 ST) of ore. Presently, the mill receives ore from about 20 underground mines, five of which are company owned and supply about 85% of the feed for the mill.

Vanadium is normally present with uranium in the ores of the Uravan mineral belt in vanadium to uranium ratios that vary from 3:1 to 10:1. For this reason, vanadium product liquor (18% V_2O_5) is the major mill product, with lesser quantities of yellowcake (85% U_3O_8). The ore must be subjected to a hot, highly oxidizing, two-stage acid leach to achieve economical recovery of uranium and vanadium.

Several mill effluent streams are segregated for separate treatment. The pond system used consists of a tailings pond, solvent extraction (SX) raffinate ponds, and barium chloride ponds, all of which are unlined. The tailings pond receives waste slurry from the CCD circuit [14 L/s (220 gpm)]. After a period for settling of solids, the liquid is decanted and returned to the mill at the rate of 11 L/s (175 gpm) for use as a wash solution for the CCD circuit. The tailings pond covers an area of about 32 ha (80 ac) on a hillside adjacent to the mill. Seepage collected in a toe dam is recycled to the mill process. Hillside runoff is treated with barium chloride, the solids are allowed to settle, and the resulting radium-free liquid is then discharged to the San Miguel River at a rate of 9 L/s (150 gpm).

Six solvent extraction (SX) raffinate ponds, located across the river from the mill, receive barren solution from the vanadium SX section of the mill. The effluent contains about 100 to 200 mg/L vanadium and high total dissolved solids (TDS) in the form of Al and SO_4 . The liquid portion of the effluent is disposed by evaporation and seepage to the soil and to the San Miguel River [seepage rate of 5.4 L/s (85 gpm)--1.9 L/s (30 gpm) to the river, 3.5 L/s (55 gpm) to the soil]. The vanadium content of the seepage is reportedly reduced by a factor of 50 as the solution seeps through the earthen pond walls; however, the TDS load is not decreased. Vanadium is precipitated in the SX ponds and is recovered (by dredging) as a slime containing 3% to 5% V_2O_5 . The slime is sent to the mill for recovery of vanadium. After evaporation of the pond liquid, a crystalline material, believed to be aluminum sulfate, remains and is scraped out and disposed of in the tailings pond. When SX ponds fill with solids, liquid raffinate is diverted to lime-treatment units and subsequently thickened. The clarified solution is discharged, and the settled solids are dredged and discarded to the tailings pond. The six SX raffinate ponds cover an area of 12 ha (30 ac), half of which is pond water.

The amount of tailings under management is 8.8×10^6 MT (9.8×10^6 ST). The capacity of the mill is 1200 MT (1300 ST) of ore per day.

The Uravan Mill is the only uranium mill in the United States discharging liquid effluent directly to a river. A composite waste stream, consisting of tailings pond seepage, yellowcake thickener overflow, cooling water, and occasionally the neutral solution from lime treatment of the vanadium SX raffinate is released to the San Miguel River. These effluents first are treated with barium chloride, settled in a series of ponds, monitored, and discharged under a National Pollutant Discharge Elimination System (NPDES) permit. The series of settling ponds have a total capacity of 6600 m^3 (8600 yd^3) and encompass an area of 3200 m^2 ($34,000 \text{ ft}^2$).

Analytical data are available for the discharge stream from the Uravan Mill. Notable trends in the data are: (1) levels of Ra-226 in the discharge occasionally exceed the permissible limit; (2) TDS levels are high and do not meet the standards of the Colorado River Basin Salinity Control Act; (3) toxic organics have been identified in the raw and treated effluent; and (4) some analyses show high mercury and selenium levels in the discharge. The Uravan Mill was shut down for six months during 1981, but has started up again.

Facility Name: Uravan Mill
Type: Conventional Uranium Mill
Location -

Code Number: CO-A-C-13

Site Name: Uravan Mill
Ownership -
Owner: Union Carbide Corp.
Address: P.O. Box 94
Uravan, CO 81436

City: Uravan State: CO County: Montrose
Mill Contact: Roger K. Jones
Title: Environmental Engineer
Telephone: (303) 862-7301

LICENSING DATA

Regulatory Authority: State of Colorado
License Number: SUA-673
Current Status of Operation: Active
Days of Operation/Year:
Project Life (years, est):
Years for Complete Reclamation:

First Issued: 1935
Last Renewed in Entirety: 1970
Last Amended: In process
Expires: 1975/07
Surety Type:
Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine:
Type: Underground
Ore Grade (%): 0.15-0.20
Metals in Ore Recovered: V₂O₅
Extraction Efficiency (%): 95
Throughput (tons/day): 1300

Grinding Method: U₃O₈ Production
(tons/year): 580
Leach Method: Acid
Clarification: CCD
Concentration: IX U₃O₈ Purity (%): 85
Precipitation: NH₃ or H₂O₂
Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 9.8x10⁶
Total Area, Tailings (acres): 110
Method of Tailings
Disposal: Above ground
Liner Types: None
Cover Material:
Thickness:
Rn Flux (pCi/m²/s):

Total Pond Area (acres): 79
Number Evaporation Ponds: 6
pH:
Dam Height (feet, AGL):
Freeboard Height (feet):
Construction Method
of Dam:
Underlying
Strata: Impervious sandstone

% Water Recycled: 27
Mill Water Consumption
(gpm): 500
Seepage Rate
(gpm): 85

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:
Method of Concentration Determination:
Dose to Nearest Offsite Individual:
Location of Nearest Offsite Individual:
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-10

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised:

2.1.2 New Mexico

2.1.2.1 Anaconda Co., Bluewater Mill (Code # NM-A-C-22)

Anaconda's Bluewater Uranium Mill is in the heart of the Grants Mineral Belt, about 15 km (10 mi) northwest of Grants, New Mexico, in a small alluvium and volcanic-filled valley known as the San Jose River Valley. The Zuni Mountains, a northwest-trending range, lie about 25 km (15 mi) southwest of the mill. Mesas surround the San Jose River Valley to the north, east, and south.

From 1953 to 1956, a carbonate leaching process was used at the mill to extract uranium. Parallel mill circuits were provided in 1955 to permit both alkaline and acid leaching of limestone and sandstone ores. By 1959 it was more economical to treat the available ore in the acid-process mill, and the carbonate mill was shut down. The acid-leach process now used differs from the usual acid-leach circuit in that MnO_2 is used as an oxidant rather than $NaClO_3$, and MgO is the precipitation reagent (rather than NH_3).

Between 1955 and 1978, the Bluewater Mill extracted uranium from a throughput of 3500 MT (3850 ST) per day of ore containing about 0.25% U_3O_8 . Since completion of a recent expansion, the mill has processed a daily average of 5400 MT (6000 ST) of ore with a quality of less than 0.2% U_3O_8 .

The tailings from the mill are pumped to an abovegrade impoundment that covers about 110 ha (270 ac) and is about 8 m (25 ft) above the basaltic rock formation. The tailings retention area is constructed in a natural basin to the north of the mill area. The tailings pond is enclosed by earthen embankments. The downstream faces of the embankments have a 2:1 slope and in some areas are covered with vegetation. The upstream slope is riprapped in areas where necessary. The total surface area of the tailings pile is 107 ha (265 ac), and the area of liquid on the pile is about 12 ha (30 ac). The maximum height of the tailings pile at the southern end is about 18 m (60 ft). There are about 17×10^6 MT (19×10^6 ST) of tailings in this active pile. Tailings from the formerly used carbonate-leaching process are located southeast of the currently used tailings pond. In late 1977, these carbonate-leach tailings were covered with an average of 85 cm (35 in) of silt-clay. The dry area of the carbonate impoundment presently covers about 6 ha (14 ac). Additional tailings of the old acid-leaching process are located along the northwestern edge of the current tailings pond and have a dry area of about 14 ha (35 ac). Tailings in all of the impoundments total 32×10^6 MT (35×10^6 ST).

Before reconstruction of the present dikes, tailings overflows were collected in catch basins. Overflow deposits in the catch basins are about 1.2 m (4 ft) deep. The tailings management plan was altered in 1978 when additional evaporation ponds were built and a new tailings management system was implemented to increase moisture in the beach area. Deep-well injection of liquid wastes was ended. Four decant ponds totaling 89 ha (220 ac) are now in operation, and plans call for the phased construction of 11 more such ponds as needed. Wells to monitor groundwater quality also are planned.

This mill was to be shut down in March 1982.

Facility Name: Bluewater Mill
Type: Conventional Uranium Mill
Location -

Code Number: NM-A-C-22

Site Name: Bluewater Mill City: Grants State: NM County: Valencia
Ownership - Mill Contact: Mead A. Stirland
Owner: The Anaconda Co. Title: Mgr., Env. Health & Safety
Address: P.O. Box 638 Telephone: (505) 876-2211 x253
Grants, NM 87020

LICENSING DATA

Regulatory Authority: State of New Mexico First Issued: 1953
License Number: SUA-647 (AEC) Last Renewed in Entirety: 1971
Current Status of Operation: Active Last Amended: 1981/11
Days of Operation/Year: Expires: 1976/02
Project Life (years, est): Surety Type:
Years for Complete Reclamation: Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Jackpile Grinding Method: U₃O₈ Production
Type: Underground & surface Leach Method: Acid (tons/year): 3377
Ore Grade (%): 0.15-0.20 Clarification: CCD
Metals in Ore Recovered: None Concentration: SX U₃O₈ Purity (%): 87
Extraction Efficiency (%): 90 Precipitation: MgO
Throughput (tons/day): 6820 Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 35x10⁶ Total Pond Area (acres): 270 % Water Recycled: None
Total Area, Tailings (acres): 491 Number Evaporation Ponds: 4
Method of Tailings Disposal: Above ground pH: 2.0-5.0 Mill Water Consumption (gpm):
Liner Types: CPE & PVC Dam Height (feet, AGL): Freeboard Height (feet): 4 Seepage Rate (gpm): 240
Cover Material:
Thickness: Construction Method of Dam: Natural basin, downstream
Rn Flux (pCi/m²/s): Underlying Strata: Clay, silt, & sand

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:
Method of Concentration Determination:
Dose to Nearest Offsite Individual:
Location of Nearest Offsite Individual:
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-13

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised:

2.1.2.2 Homestake Mining Co., Grants Mill (Code # NM-A-C-07)

Homestake operates the Grants Uranium Mill 16 km (10 mi) northwest of Grants, New Mexico, in a level area in the Ambrosia Lake mining district. The mill opened in 1958 at a design throughput capacity of 1590 MT (1750 ST) per day; this was increased to 3100 MT (3400 ST) per day in 1967. Current production averages 3100 MT (3500 ST) per day, split evenly between production from underground mines, which are less than 32 km (20 mi) from the mill, and "toll" ore. Toll ore, about 15% of which is in limestone requiring use of an alkaline leach, has an average grade of 0.10% U_3O_8 ; the ore from underground sandstone mines averages 0.15% U_3O_8 . In addition to yellowcake production, an 8% vanadium by-product (in solution) is recovered and sold to Union Carbide.

On February 8, 1977, a break occurred in the tailings dam and the entire contents of the tailings pond spilled into vacant land controlled by the mill operator. The spill covered an area of 10 to 20 ha (25 to 50 ac) to a depth of about 3 cm (1 in).

The Grants Mill differs from other New Mexico mills in two basic ways: (1) ore is leached with an alkaline solution, and (2) the manufacture of yellowcake does not depend on first passing pregnant solution through ion-exchange or solvent-extraction circuits. The mill practices both process recycle and recycle for tailings dilution. Because an alkaline-leach process is employed, ore is finely ground to expose more uranium to the leach solution. As a consequence, fine tailings are produced. The tailings are discharged to a four-sided, abovegrade impoundment covering a total area of 110 ha (260 ac). The total tailings pile surface area is 60 ha (150 ac) at the base. About 20 ha (50 ac) of the surface area of the pile is covered by tailings solution to a maximum depth of 0.5 m (1.5 ft). As of April 1980, the pile consisted of about 17×10^6 MT (19×10^6 ST) of tailings material and reached a maximum height of 26 m (85 ft). A 1.5-m (5-ft) freeboard and 15-m (50 ft) beach are maintained around the pile.

The subsoil is about 30 m (90 ft) thick and has relatively high permeability, a condition that aggravates the problem of seepage from the tailings pond. The subsoil is underlain by a sandstone formation. An aquifer is located under the ponds. Seepage from the tailings pond is being collected in down-gradient collection wells and returned to the pond. Groundwater contaminated by pond seepage is being pumped from depths of 12 to 18 m (40 to 60 ft).

Facility Name: Grants Mill
Type: Conventional Uranium Mill
Location -

Code Number: NM-A-C-07

Site Name: Grants Mill
Ownership -
Owner: United Nuclear Corp.
Address: P.O. Box 98
Grants, NM 87020

City: Grants State: NM County: McKinley
Mill Contact: Edward Kennedy
Title: Dir. Environmental Affairs
Telephone: (505) 287-4450

LICENSING DATA

Regulatory Authority: State of New Mexico First Issued: 1958
License Number: SUA-708 (AEC) Last Renewed in Entirety: 1971
Current Status of Operation: Active Last Amended: In process
Days of Operation/Year: Expires: 1976/02
Project Life (years, est): 45 Surety Type:
Years for Complete Reclamation: Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Grinding Method: Dry U₃O₈ Production
(tons/year): 909
Type: Underground Leach Method: Basic
Ore Grade (%): 0.10-0.15 Clarification: Filtration
Metals in Ore Recovered: V Concentration: U₃O₈ Purity (%): 81
Extraction Efficiency (%): 86-88 Precipitation: NaOH, NH₃
Throughput (tons/day): 3500 Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 19x10⁶ Total Pond Area (acres): 150 % Water Recycled: 5
Total Area, Tailings (acres): 260 Number Evaporation Ponds: None
Method of Tailings Disposal: Above ground pH: 10.3 Mill Water Consumption
(gpm): 383
Liner Types: None Dam Height (feet, AGL): Seepage Rate
(gpm):
Cover Material: Freeboard Height (feet): 5
Thickness: Construction Method
of Dam: Downstream
Underlying
Strata: Highly permeable subsoil
Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:
Method of Concentration Determination:
Dose to Nearest Offsite Individual:
Location of Nearest Offsite Individual:
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-15

Data Compiled by: Ron Sundell Date Compiled: 1302/01/77

Date Data Revised:

2.1.2.3 Kerr-McGee Nuclear Corp., Ambrosia Lake Mill (Code # NM-A-C-08)

In terms of tons of ore processed per day, Kerr-McGee's Ambrosia Lake Mill is the largest uranium mill in the United States. It is located in a flat area of the Grants Mineral Belt about 40 km (25 mi) north of Grants, New Mexico. Two parallel acid-leach processing circuits are operated simultaneously to extract uranium (and molybdenum by-products).

The mill began operations in November 1958 with a rated capacity of 3270 MT (3600 ST) per day. Capacity has since been expanded to 6350 MT (7000 ST) per day, and sufficient ore is proven to maintain this processing rate for at least 20 more years. Seven company-owned underground mining operations at Church Rock and Ambrosia Lake and several toll shippers supply the required ore.

All process water for the mill is obtained from the underground mines. It is treated by ion exchange before being fed to the mill at the rate of about 1.2 metric tons of water per metric ton of ore. About 1% of the total U_3O_8 produced in the mill results from treatment of the mine water. Treated mine water not used in the mill is used by a local rancher for agricultural purposes.

There are 25×10^6 MT (27×10^6 ST) of tailings at the Ambrosia Mill. The tailings impoundment system consists of 21 tailings and decant ponds covering 140 ha (350 ac). The total active tailings pile surface area is 100 ha (250 ac), with about 16 ha (40 ac) of this area covered by tailings solution. The maximum height of the pile is about 30 m (100 ft). The tailings dam is constructed of coarse tailings and slimes.

Decant solutions and lateral seepage from the tailings ponds are collected in a catchment basin from which each of the decant ponds can be filled. The pond system can also be operated in a cascade fashion, with overflow from one decant pond flowing to another. The newest decant ponds are lined with 0.25-mm polyvinyl chloride on the bottoms and 0.50-mm chlorinated polyethylene on the sides.

A June 20, 1977, amendment to the operating permit for the Ambrosia mill permits use of 7300 MT (8000 ST) of tailings per month as backfill for a nearby Kerr-McGee underground mine.

Facility Name: Ambrosia Lake Mill

Code Number: NM-A-C-08

Type: Conventional Uranium Mill

Location -

Site Name: Ambrosia Lake Mill

City: Grants

State: NM County: McKinley

Ownership -

Mill Contact: James Cleveland

Owner: Kerr-McGee Nuclear Corp.

Title: Supt. Env. & Ind. Hygiene

Address: P.O. Box 213

Telephone: (505) 287-8851

Grants, NM 87020

LICENSING DATA

Regulatory Authority: State of New Mexico

First Issued: 1958

License Number: SUA-616 (AEC)

Last Renewed in Entirety: 1971

Current Status of Operation: Active

Last Amended: 1981/11

Days of Operation/Year: 343

Expires: 1976/02

Project Life (years, est):

Surety Type:

Years for Complete Reclamation:

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Name of Mine:

Grinding Method: SAG dry U₃O₈ Production
(tons/year): 4290

Type: Underground

Leach Method: 2 parallel acid circuits

Ore Grade (%): 0.20

Clarification: CCD, SS

Metals in Ore Recovered: Mo concentrate

Concentration: SX U₃O₈ Purity (%): 80-90

Extraction Efficiency (%): 97

Precipitation: NH₃

Throughput (tons/day): 7000

Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 27x10⁶

Total Pond Area (acres): 250

% Water Recycled: None

Total Area, Tailings (acres): 350

Number Evaporation Ponds: 21

Method of Tailings

pH: 1.2

Mill Water Consumption
(gpm): 1350

Disposal: Above ground

Liner Types: PVC and CPE

Dam Height (feet, AGL): 8

Seepage Rate
(gpm): 340

Freeboard Height (feet):

Cover Material:

Thickness:

Construction Method

of Dam: Tails & slimes; downstream

Rn Flux (pCi/m²/s):

Underlying

Strata: Sandy silt underlain by shale

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual:

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Text Description (page): 2-17

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised:

2.1.2.4 Sohio Petroleum/Reserve Oil & Minerals, L-Bar Mill (Code # NM-A-C-18)

The L-Bar Uranium Mill is located in an area of flat terrain about 29 km (18 mi) north of Laguna, New Mexico. Ore for the mill is obtained from an underground mine in the Jackpile sandstone formation. The mine and mill are operated by Sohio on 1200 ha (3000 ac) of the 49,000-ha (120,000-ac) L-Bar Ranch. Alluvial deposits underlying the site are composed of silty clay and occasional gravel extending 3 to 9 m (10 to 30 ft) below ground level. Groundwater levels are variable at the site, averaging about 100 m (330 ft) beneath the surface.

The mill, which uses an acid-leach process, began operations in 1976 with a capacity of 1500 MT (1650 ST) per day. Sufficient ore is proven to maintain this rate for 10 to 15 more years. A typical ore sample contains 0.225% U_3O_8 , 0.08% V_2O_5 , 1.01% iron, and 0.12% sulfur. Water for milling operations is obtained from wells and mines. In addition to the extensive use of in-process recycle, the company intermittently recycles water from the tailings pond to repulp tailings. A problem peculiar to the L-Bar Mill has been zirconium buildup in the SX organic solvent. To remedy this, the organic phase is stripped of Zr and Mo in the final SX mixer-settler unit, and a bleed stream containing Mo and Zr is disposed of in the impoundment system.

A pond system consisting of a tailings pond with catchment basin and two solvent-extraction raffinate ponds is used at the mill. The tailings impoundment is built above ground on natural materials, with an engineered earthen starter dam to the west that keys into the natural topography on the north and south. In addition, there is a small saddle dam to the east. The dam has been lifted by the upstream method of spigotting of tailings. Of the total impoundment area of 73 ha (180 ac), about 20 to 25 ha (50 to 60 ac) are covered with tailings. The surface area of liquid in the impoundment is about 30 ha (75 ac). The pile consists of about 1.4×10^6 MT (1.6×10^6 ST) of tailings material and reaches a maximum height of 7 m (23 ft). The tailings pond is lined with treated clay; the raffinate ponds are unlined. Waste flow to the tailings pond consists of tailings slurry containing 1500 MT (1660 ST) per day of solids and 18 L/s (280 gpm) of waste solution. About 11 L/s (170 gpm) of SX raffinate is sent to the raffinate ponds, the exact amount depending on the amount of tailings-pond decant that is recycled. Seepage from the impoundment system, estimated at 730 m^3 /day (135 gpm), represents 31% of the total effluent discharged to the ponds. Lateral seepage from the tailings pond is collected by a toe dam and the liquid is returned to the pond.

This mill was shut down in May 1981.

Facility Name: L-Bar Mill
Type: Conventional Uranium Mill

Code Number: NM-A-C-18

Location -

Site Name: L-Bar Mill City: Seboyeta State: NM County: Valencia

Ownership -

Mill Contact: James Bazemore

Owner: Sohio Petroleum Co./Reserve Oil & Minerals Title: Environmental Specialist

Address: P.O. Box 25201

Telephone: (505) 242-2762

Albuquerque, NM 87125

LICENSING DATA

Regulatory Authority: State of New Mexico

First Issued: 1976

License Number: NH-SOH-ML-09

Last Renewed in Entirety: 1975

Current Status of Operation: Inact. since 1981/05

Last Amended:

Days of Operation/Year: 330

Expires: 1980/07

Project Life (years, est): 1990

Surety Type:

Years for Complete Reclamation:

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Jackpile

Grinding Method:

U_3O_8 Production
(tons/year): 737

Type: Underground

Leach Method: Acid

Ore Grade (%): 0.15-0.23

Clarification: CCD

Metals in Ore Recovered: None

Concentration: SX

U_3O_8 Purity (%): 80

Extraction Efficiency (%):

Precipitation: NH₃

Throughput (tons/day): 1660

Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 1.6×10^6

Total Pond Area (acres): 60

% Water Recycled: None

Total Area, Tailings (acres): 180

Number Evaporation Ponds: 2

Method of Tailings

pH: 1.6

Mill Water Consumption
(gpm): 500

Disposal: Above ground

Liner Types: Clay mixed with salts

Dam Height (feet, AGL): 5

Seepage Rate

Cover Material:

Freeboard Height (feet):

(gpm): 135

Thickness:

Construction Method

of Dam: Earthen starter & saddle dams

Rn Flux (pCi/m²/s):

Underlying

strata: Silty clay & gravel

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual:

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Text Description (page): 2-19

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised:

2.1.2.5 United Nuclear Corp., Church Rock Mill (Code # NM-A-C-16)

The site topography at United Nuclear's Church Rock Mill, located 32 km (20 mi) northeast of Gallup, New Mexico, consists of rolling hills. The mill, which opened in 1977, is designed to use acid-leach extraction to process about 3600 MT (4000 ST) of ore per day from company-owned underground mines. The ore contains 0.15% to 0.20% U_3O_8 , the uranium occurring as coffinite in a fine- to medium-grained feldspathic sandstone matrix. Fresh water for mill operations is obtained from underground mines. Yellowcake is the only mill product.

The tailings pond is formed by a dam built from native clays and compacted coarse tailings. The pond has three compartments separated by earthen embankments. The total surface area of tailings, including the dam and a stormwater interceptor ditch, is 80 ha (200 ac). As of April 23, 1980, the entire area was in use. The surface area of liquid on the tailings was about 11 ha (28 acres). The maximum depth of tailings was about 15 m (50 ft). The storage capacity of the pond is about $10 \times 10^6 \text{ m}^3$ ($365 \times 10^6 \text{ ft}^3$). The available evaporative area is 65 ha (160 acres). Alluvial deposits underlying the impoundment system are 1 to 30 m (3 to 90 ft) thick, with percolation rates of 1.2 to 8.2 m/yr (4 to 27 ft/yr).

In July 1979, there was a break in the tailings dam and about $350 \times 10^6 \text{ L}$ ($93 \times 10^6 \text{ gal}$) of effluent and 1000 MT (1100 ST) of tailings spilled on or into nearby soil and streams. This spill resulted in release of almost all of the impounded liquid but less than 1% of the solids. The streams carried the spilled tailings to Rio Puerco, through Navajo grazing lands, and finally into Arizona. The mill was temporarily closed and corrective measures were taken. The mill reopened in the fall of 1979. Cleanup efforts are still underway.

Facility Name: Church Rock Mill

Code Number: NM-A-C-16

Type: Conventional Uranium Mill

Location -

Site Name: Church Rock Mill

City: Gallup

State: NM County: McKinley

Ownership -

Owner: United Nuclear Corp., Mining & Milling

Mill Contact: Todd Miller

Address: P.O. Drawer QQ

Title: Environmental Specialist

Gallup, NM 87301

Telephone: (505) 722-6651

LICENSING DATA

Regulatory Authority: State of New Mexico

First Issued: 1977

License Number: NM-UNC-ML-14

Last Renewed in Entirety: 1977

Current Status of Operation: Active

Last Amended:

Days of Operation/Year: 365

Expires: 1981/01

Project Life (years, est): 4

Surety Type:

Years for Complete Reclamation:

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Name of Mine:

Grinding Method:

U₃O₈ Production
(tons/year): 1243

Type: Underground

Leach Method: Acid

Ore Grade (%): 0.15-0.20

Clarification: CCD

Metals in Ore Recovered: None

Concentration: SX

U₃O₈ Purity (%): 80-90

Extraction Efficiency (%):

Precipitation: NH₃

Throughput (tons/day): 4000

Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 2.4x10⁶

Total Pond Area (acres): 197

% Water Recycled: None

Total Area, Tailings (acres): 204

Number Evaporation Ponds: None

Method of Tailings

Disposal: Above ground

pH:

Mill Water Consumption
(gpm): 723

Liner Types: None

Dam Height (feet, AGL):

Seepage Rate

Freeboard Height (feet):

(gpm): 164

Cover Material:

Construction Method

Thickness:

of Dam: Native clays & compacted tailings

Rn Flux (pCi/m²/s):

Underlying

Strata: Clay & silt/sand

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual:

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Text Description (page): 2-21

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised:

2.1.3 Texas

2.1.3.1 Chevron Resources Co., Panna Maria Mill (Code # TX-A-C-02)

The Panna Maria Mill, located 160 km (100 mi) northwest of Corpus Christi, Texas, began operations in January 1979. The mill processes about 2300 MT (2600 ST) per day of a mixture of low-, medium-, and high-grade sandy clay ore averaging 0.07% U_3O_8 .

Tailings are contained in an aboveground impoundment surrounded by dikes. The dikes have clay interiors keyed onto a natural clay base. A dike partition separates the tailings pond into two compartments, only one of which is currently in use for tailings storage. The amount of tailings under management is 1.4×10^6 MT (1.6×10^6 ST).

Facility Name: Panna Maria Mill
Type: Conventional Uranium Mill
Location -

Code Number: TX-A-C-02

Site Name: Panna Maria Mill
Ownership -
Owner: Chevron Resources Co.
Address:

City: Panna Maria State: TX County: Karnes
Mill Contact:
Title:
Telephone:

LICENSING DATA

Regulatory Authority: State of Texas
License Number: 9-2402
Current Status of Operation: Active
Days of Operation/Year:
Project Life (years, est):
Years for Complete Reclamation:

First Issued: 1979
Last Renewed in Entirety:
Last Amended:
Expires: 1984
Surety Type:
Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine:
Type:
Ore Grade (%): 0.07
Metals in Ore Recovered: None
Extraction Efficiency (%):
Throughput (tons/day): 2600

Grinding Method: U₃O₈ Production
(tons/year): 495
Leach Method: Acid
Clarification: CCD
Concentration: SX U₃O₈ Purity (%): 98
Precipitation: NH₃
Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 1.6x10⁶ Total Pond Area (acres): 250 % Water Recycled:
Total Area, Tailings (acres): 250 Number Evaporation Ponds: None
Method of Tailings Disposal: Above ground pH: 2.0 Mill Water Consumption (gpm):
Liner Types: None (clay interiors) Dam Height (feet, AGL): Seepage Rate (gpm):
Freeboard Height (feet):
Cover Material:
Construction Method of Dam: Clay dikes
Thickness:
Underlying Strata: Clay
Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:
Method of Concentration Determination: Environmental data, MILDOS
Dose to Nearest Offsite Individual:
Location of Nearest Offsite Individual:
Dose at Site Boundary (nearest downwind): 1.7 mrem/year
Dose at Site Boundary (closest to source): Av. 0.2 mrem/year

Text Description (page): 2-23

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised:

2.1.3.2 Continental Oil/Pioneer Nuclear, Conquista Mill (Code # TX-A-C-23)

The Conquista Mill, a joint venture of Continental Oil (operator) and Pioneer Nuclear, is located near Falls City, Texas, about 48 km (30 mi) southeast of San Antonio. The topography is relatively flat. The operation is the only open-pit uranium mine-mill complex in the state.

The mill has been in operation since 1972 and is expected to continue through 1990, when ore reserves will be depleted. Production capacity of the mill is 3100 MT (3500 ST) of ore per day. This production includes about 540 MT (600 ST) per day of toll-processed ore from Exxon Minerals' Felder open-pit mine in Live Oak County.

The mill recycles nearly all of the water sent to the main tailings pond--less the amount evaporated and the amount entrained with the solid tailings. Tailings slurry and SX raffinate bleed are pumped to the tailings pond. A separate impoundment is provided for the composite stream of barren solution from uranium precipitation and waste extract from the molybdenum scrubber in the SX circuit. These are solutions that cannot be recycled because they are contaminated with high levels of dissolved salts or metallic impurities. Provisions have been made to collect any pond seepage; however, since plant startup, no seepage has been detected. This is attributed to the underlying bentonitic clay and natural shale.

One side of the tailings pond has been keyed into the side of a hill. Dikes have been built around the other three sides of the impoundment. The embankment consists of clays and earthen materials. The mill operators expect to raise the dikes by 6 m (20 ft) in the near future. Currently, the tailings pond is half covered with water and stores 5.6×10^6 MT (6.2×10^6 ST) of solids.

This mill was shut down in July 1981. Waste solids from in-situ mining are being disposed in the Conquista tailings pile.

Facility Name: Conquista Mill
Type: Conventional Uranium Mill

Code Number: TX-A-C-23

Location -

Site Name: Conquista Mill City: Falls City State: TX County: Karnes
Ownership - Mill Contact:
Owner: Conoco/Pioneer Nuclear Title:
Address: Telephone:

LICENSING DATA

Regulatory Authority: State of Texas First Issued: 1972
License Number: 9-1634 Last Renewed in Entirety:
Current Status of Operation: Active Last Amended:
Days of Operation/Year: 365 Expires:
Project Life (years, est): 1990 Surety Type:
Years for Complete Reclamation: Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Grinding Method: U₃O₈ Production
Type: Surface Leach Method: Acid (tons/year): 759
Ore Grade (%): 0.08 Clarification: CCD
Metals in Ore Recovered: None Concentration: SX U₃O₈ Purity (%)
Extraction Efficiency (%): Precipitation: NH₃
Throughput (tons/day): 3500 Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 6.2x10⁶ Total Pond Area (acres): 200 % Water Recycled: 82
Total Area, Tailings (acres): 220 Number Evaporation Ponds: 1
Method of Tailings Disposal: Above ground pH: 1-3 Mill Water Consumption (gpm): 550
Liner Types: None Dam Height (feet, AGL): Seepage Rate (gpm): None detected
Cover Material: Freeboard Height (feet):
Thickness: Construction Method of Dam: Hill & 3 dikes of clay & earthen materials
Rn Flux (pCi/m²/s): Underlying Strata: Bentonitic clay & shale

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:
Method of Concentration Determination: UDAD
Dose to Nearest Offsite Individual:
Location of Nearest Offsite Individual:
Dose at Site Boundary (nearest downwind): Avg. around site = 0.04 mrem/year
Dose at Site Boundary (closest to source):

Text Description (page): 2-25

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11 Date Data Revised:

2.1.4 Utah

2.1.4.1 Atlas Minerals Division of Atlas Corp., Moab Mill (Code # UT-N-C-01)

The Moab Mill is located in a mountainous area in Utah on the Colorado River about 5 km (3 mi) northwest of the city of Moab. The mill processes ores from the Big Indian area and from several small private mines in other districts. The number of independent shippers using the mill has ranged from 20 to 70, and the mill is the only processor available within reasonable trucking distance of many of these mines.

The mill has undergone several major process changes since operations began in November 1956. Primarily because of changes in the ore, the original acid process was changed to an alkaline process utilizing the same resin-in-pulp extraction equipment. In 1968, an acid-leaching and solvent-extraction process was added, with recovery of vanadium from the acid-leach circuit and copper from the alkaline-leach circuit. For many years, the mill wastes were discharged into the Colorado River, but this practice was stopped in 1977, and all liquid wastes now are impounded in a tailings pond. In addition, the alkaline-leach processing circuit has recently been altered to reduce liquid effluents to the tailings pond.

The acid-leach circuit was designed to process 540 MT (600 ST) per day of vanadium-bearing ores with an average assay of 0.25% U_3O_8 and 1.5% V_2O_5 . Recoveries of V_2O_5 and U_3O_8 are about 80% and 96%, respectively. The modified alkaline-leach circuit was designed to process 540 MT (600 ST) of high-lime and copper-bearing ores daily, with an average assay of 0.20% to 0.25% U_3O_8 and up to 1% copper. The circuit will recover U_3O_8 and copper at about 94% and 80% efficiency, respectively. The mill has the capacity to process up to about 1300 MT (1430 ST) of ore per day and to produce up to 830 MT (920 ST) of U_3O_8 (about 60% from the acid leach and 40% from the alkaline leach), 2400 MT (2600 ST) of V_2O_5 , and 50 MT (55 ST) of copper annually, depending on ore grades.

The mill facilities include a system to treat river water (to reduce hardness), raw wastewaters (to remove suspended and settleable solids), and decant water from the tailings pond (to remove radium by $BaCl_2$ coprecipitation). The solids extracted in the water-treatment system are stored in a number of small ponds within the plant boundary. Liquid and solid effluents from the milling operation are impounded in the tailings pond. The tailings area, covering over 80 ha (200 ac), is located above and adjacent to the Colorado River. The tailings impoundment is enclosed by four embankment walls composed primarily of tailings. About 50 ha (120 ac) of the site are covered with tailings to a depth of nearly 25 m (80 ft). The impoundment contains 7.0×10^6 MT (7.7×10^6 ST) of tailings, and about 3.6×10^6 MT (4×10^6 ST) of additional tailings are expected to be produced through the remaining lifetime of the mill. Supplemental storage volume will be needed to accommodate the additional tailings.

The seepage rate from the tailings pond in the past has been about 1×10^{-4} m³/s (1.7 gpm) per acre of pond surface. However, future seepage rates are expected to be lower because the rate at which water flows to transport the tailings to the pond has been reduced from 6×10^{-2} m³/s to 1×10^{-2} m³/s (1000 to 200 gpm), thereby reducing the quantity of water flowing over the more permeable beach tailings. Also, sealing of the pond is postulated to have occurred as a

result of the mixing of the tailings from the acid- and alkaline-leach circuits and resultant deposition of gypsum in the tailings pond.

Wind entrainment of dry tailings is limited by three factors at the site: (1) prevailing wind speed is low, (2) ore for the alkaline circuit is not ground as finely as some ores subjected to alkaline leach, and (3) a gypsum crust forms over the tailings as they dry. Furthermore, particulate emissions are controlled by the constant wetting of about half of the exposed tailings during normal filling operations at the pond, and by use of a 0.3-m (1-ft) earthen cover on the exposed surfaces of the tailings embankment.

Land presently occupied by mill buildings (35 ha, or 85 ac) and Atlas Minerals land not used for milling operations (about 80 ha, or 200 ac) can be restored to its original use following mill shutdown. The tailings pile area (presently 47 ha, or 115 ac) will be stabilized, but will not be available for total reclamation. Reclamation will begin within two years following mill shutdown, allowing sufficient time for the surface water to evaporate from the tailings pond. The pile will then be shaped and contoured in such a manner that the slime tailings will be covered by at least 1.5 m (5 ft) of sand tailings and with final slopes no steeper than 10 horizontal to 3 vertical. The tailings will be capped with clay brought from offsite, then overlain by silty, fine sand obtained from the site and 0.3 m (1 ft) of topsoil or gravel. Atlas has proposed a clay layer of 0.3 m (1 ft) over non-slimes areas and 0.5 m (1.5 ft) in areas where 1.5 m (5 ft) of non-slimes overlie slimes. The silty, fine sand will be 0.7 m (2.3 ft) thick in non-slimes areas and 0.8 m (2.7 ft) thick in areas where 1.5 m (5 ft) of non-slimes overlie slimes. After it is covered, the area will be revegetated with appropriate plant species.

Facility Name: Moab Mill
Type: Conventional Uranium Mill
Location -

Code Number: UT-N-C-01

Site Name: Moab Mill

City: Moab

State: UT County: Grand

Ownership -

Mill Contact: Richard Blubaugh

Owner: Atlas Corp.

Title: Reg. Affairs Mgr.

Address:

Telephone: (801) 259-5131

LICENSING DATA

Regulatory Authority: NRC
License Number: SUA-917
Current Status of Operation: Active
Days of Operation/Year:
Project Life (years, est): 1994
Years for Complete Reclamation: 5

First Issued: 1956
Last Renewed in Entirety: 79/4
Last Amended: 81/3
Expires: 84/4
Surety Type: none
Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine:
Type: Underground
Ore Grade (%): 0.20-0.25
Metals in Ore Recovered: V, Cu
Extraction Efficiency (%): 94-96
Throughput (tons/day): 1959

Grinding Method: Dry rod U₃O₈ Production
(tons/year): 919
Leach Method: Acid & Basic
Clarification: CCD & Filtration
Concentration: SX U₃O₈ Purity (%): 96
Precipitation: H₂O₂, NH₃, NaOH
Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 7.7x10⁶ Total Pond Area (acres): 120 % Water Recycled: 57
Total Area, Tailings (acres): 200 Number Evaporation Ponds: None
Method of Tailings Disposal: Above ground pH: 7.0 Mill Water Consumption (gpm): 121
Liner Types: None Dam Height (feet, AGL): 100 Seepage Rate (gpm):
Freeboard Height (feet): 6
Cover Material: Sand tailings, clay, sand, topsoil
Thickness: 9 feet Construction Method of Dam: Primarily tailing embankments
Underlying Strata: Silt & fine to coarse sand
Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Ra-226
Method of Concentration Determination: MILDOS
Dose to Nearest Offsite Individual: 73.6 mrem/yr (lung)
Location of Nearest Offsite Individual: 0.5 mi east
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-27

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 82/4

2.1.4.2 Energy Fuels Nuclear, Inc., White Mesa Mill (Code # UT-N-C-05)

The White Mesa Uranium Mill is near the western edge of the Blanding Basin in southeastern Utah, about 8 km (5 mi) south of Blanding, Utah. The site is located on a nearly flat peninsula platform (White Mesa) tilted slightly to the south-southeast and surrounded on almost all sides by deep canyons, washes, and valleys. The mill and associated tailings disposal ponds are on Blanding silt loam, a deep soil formed from windblown deposits of fine sands and silts.

The mill, operated by Energy Fuels Nuclear, Inc., began operation in July 1980. It is expected to have an operating lifetime of 23 years. Energy Fuels Nuclear owns 600 ha (1480 ac), of which 195 ha (485 ac) are being used for milling, ore buying, and tailings disposal. There will be no onsite mining activities; instead, mines within 160 km (100 mi) of the company's ore-buying stations in Blanding and Hanksville will supply the required ore. Energy Fuels Nuclear controls reserves of about 8600 MT (9500 ST) of U_3O_8 . Principal uranium minerals in the sedimentary host rock are uraninite and coffinite. Only uranium, vanadium, and copper are present in sufficient quantities to warrant processing. Copper extraction currently is not economical.

The mill has an acid-leach, solvent-extraction process designed to recover about 730 MT (800 ST) of U_3O_8 annually. Vanadium by-product recovery is expected to yield 1500 MT (1600 ST) annually, containing less than 0.005% U_3O_8 in the final vanadium product. The mill will use about 5.9×10^5 m³ (480 ac-ft) of water per year from the Navajo sandstone aquifer. No recycle of ponded water is planned.

Tailings will be produced at a rate of about 1800 MT (2000 ST) of solids per day and will be discharged in a water slurry (pH 1.4-1.8, 50% solids) to a six-cell impoundment system (two cells for evaporation and four for tailings disposal) that will cover 130 ha (330 ac). The tailings system features simultaneous construction, operation, closure, and reclamation activities. At any given time, 40 ha (100 ac) will be used for stockpile and borrow areas. Each cell will have a maximum area of 40 ha (100 ac). There could be two cells drying or undergoing reclamation while a third is being filled. If the cell being filled is 50% beach, there could be a total of about 100 ha (250 ac) of tailings area subject to dusting. This system is designed to store 15 years accumulation of production tailings, and the total volume of tailings expected to be produced over the project lifetime will approach 7×10^6 m³ (2×10^8 ft³). Presently, 0.5×10^6 MT (0.6×10^6 ST) of tailings are under management. The evaporation cells and one tailings cell will be lined with a multicomponent liner of synthetic material and clayey-silt; the remaining cells will be lined with a 0.6-m (2-ft) layer of compacted clay (permeability $\sim 3 \times 10^{-8}$ cm/s).

Upon termination of mill operations, all remaining disturbed land will be reclaimed and restored to its original use (grazing). The proposed reclamation program calls for a cover consisting of a 0.6-m (2-ft) layer of compacted clay obtained from offsite deposits, a 1.2-m (4-ft) layer of silt-sand overburden material obtained onsite, a 1.8-m (6-ft) layer of rock, and a 15-cm (6-in) layer of topsoil. The tailings cover will be seeded with a mixture of grasses, forbs, and shrubs. The approximate volumes of material required would be 7.5×10^5 m³ (1×10^6 yd³) of clay, 1.5×10^6 m³ (2×10^6 yd³) of overburden, 2.3×10^6 m³ (3×10^6 yd³) of rock, and 2.3×10^5 m³ (3×10^5 yd³) of topsoil. The NRC staff has recommended a riprap or gravel cover over the entire basin

as an optional erosion-control measure. The final choice between gravel and vegetation can be made based on some years of testing and research currently in progress. Discounting and deflating the expected costs to 1978 dollars (10% discount rate and 8% rate of inflation per annum), the total estimated costs for the reclamation program is about \$21 million.

Energy Fuels Nuclear will be required to submit a decommissioning plan for the White Mesa mill prior to the termination of the license. The NRC will require that the reclaimed tailings impoundment area be deeded to the Federal government. Energy Fuels Nuclear is committed to maintain a surety bond with the NRC to cover reclamation and mill decommissioning costs.

Facility Name: White Mesa Mill

Code Number: UT-N-C-05

Type: Conventional Uranium Mill

Location -

Site Name: White Mesa Mill

City: Blanding

State: UT County: San Juan

Ownership -

Mill Contact: C.E. Baker

Owner: Energy Fuels Nuclear, Inc.

Title: Licensing & Safety Dir.

Address: Suite 900, Three Park Central

Telephone: 303-623-8317

1515 Arapahoe, Denver, CO 80202

LICENSING DATA

Regulatory Authority: NRC

First Issued: 1981

License Number: SUA 1358

Last Renewed in Entirety:

Current Status of Operation: Active

Last Amended: 81/12

Days of Operation/Year: 340

Expires: 84/8

Project Life (years, est): 2003

Surety Type: Under review

Years for Complete Reclamation: 4

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Name of Mine:

Grinding Method: SAG

U₃O₈ Production
(tons/year): 799

Type:

Leach Method: Acid

Ore Grade (%): 0.13

Clarification: CCD

Metals in Ore Recovered: V

Concentration: SX

U₃O₈ Purity (%): 90

Extraction Efficiency (%): 94

Precipitation: NH₃

Throughput (tons/day): 1995

Calcining Temp: Low Fired

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 0.6x10⁶

Total Pond Area (acres): 333

% Water Recycled: None

Total Area, Tailings (acres): 333

Number Evaporation Ponds: 2 cells

Method of Tailings

pH: 1.4-1.8

Mill Water Consumption
(gpm): 300

Disposal: Below Ground

Liner Types: Synthetic

Dam Height (feet, AGL): 20-37

Seepage Rate

Freeboard Height (feet):

(gpm):

Cover Material: Clay, silt-sand overburden, rock, & topsoil

Construction Method

Thickness: 12.5 ft.

of Dam:

Underlying

Rn Flux (pCi/m²/s):

Strata: Sandy silt, sandstone

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Pb-210, Ra-226, Rn-222

Method of Concentration Determination: Environmental data, MILDOS

Dose to Nearest Offsite Individual: 1.6 mrem/year (bone)

Location of Nearest Offsite Individual: 3.2 mi SSE

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Text Description (page): 2-30

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 1982/07

2.1.4.3 Plateau Resources, Ltd., Shootering Canyon Mill (Code # UT-N-C-24)

Construction of the Shootering Canyon Mill began on September 21, 1979. The facility has a design capacity of 680 MT (750 ST) ore per day; however, the operating capacity could be increased to about 900 MT (1000 ST) per day with limited modification.

The primary mill circuit involves semi-autogenous grinding of the sandstone ores, followed by dissolution of the uranium from the finely ground material with the use of sulfuric acid. The uranium-rich acid solution is separated from the leached sands in a six-stage counter-current decantation process. The waste sands are discharged as tailings to an open impoundment site. The tailings storage site has been prepared below grade for gravity flow; in addition, the site was prepared with a clay-sealed base to prevent seepage of radioactive material. A unique under-drainage system was installed to drain the tailings liquid from the slurry to reduce the hydraulic head on the clay liner, thus reducing the probability of underground seepage.

Uranium in solution is transferred from the aqueous acid phase to an organic phase by a solvent extraction process. Ammonium sulfate is used to remove the uranium from the organic phase, followed by uranium precipitation with the injection of ammonia gas. The final precipitate (yellowcake) is further washed, dried, and packed into drums. When the mill reaches full production capacity, the work force will total about 50 employees.

Facility Name: Shooter Canyon
Type: Conventional Uranium Mill

Code Number: UT-N-C-24

Location -

Site Name: Shooter Canyon

City:

State: UT County: Garfield

Ownership -

Owner: Plateau Resources, Ltd.

Mill Contact:

Title:

Address:

Telephone:

LICENSING DATA

Regulatory Authority: NRC

First Issued: 79/9

License Number: SUA-1371

Last Renewed in Entirety:

Current Status of Operation: To start in 1982

Last Amended:

Days of Operation/Year: 340

Expires: 1984

Project Life (years, est): 15

Surety Type: Surety mandated

Years for Complete Reclamation: 1-2 after shutdown

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Lucky Strike, T&F M

Grinding Method: Rod mill U₃O₈ Production
(tons/year): 250

Type: Underground

Leach Method: Acid

Ore Grade (%): 0.1% average

Clarification: CCD

Metals in Ore Recovered: U only

Concentration: SX

U₃O₈ Purity (%): 90%

Extraction Efficiency (%): 90%

Precipitation: NH₃

Throughput (tons/day): 800

Calcining Temp: 700°C (1300°F)

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons):

Total Pond Area (acres): 70

% Water Recycled:

Total Area, Tailings (acres): 70

Number Evaporation Ponds: 6 cells in main pond

Method of Tailings

pH: 4

Mill Water Consumption

Disposal:

(gpm): 348

Liner Types: Local clay (2 ft)

Dam Height (feet, AGL): 118

Seepage Rate

Cover Material:

Freeboard Height (feet): 13 (max)

(gpm): 2-50 ac-ft/yr

Thickness:

Construction Method
of Dam: Engineered

Rn Flux (pCi/m²/s):

Underlying
Strata: Sandstone

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual: 10 mrem/year

Location of Nearest Offsite Individual: Ticaboo (2.5 mi SSW)

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Text Description (page): 2-33

Data Compiled by: Lee Busch Date Compiled: 1982/01

Date Data Revised:

2.1.4.4 Rio Algom Corp., Lisbon Mill (Code # UT-N-C-20)

The Lisbon mine-mill complex is located in a valley in a mountainous region in Utah, about 48 km (30 miles) southeast of Moab. The mill has been in operation since 1971 and based on projected tonnage of reserves plus a contingency for unknown additional ore, at the beginning of 1980 was expected to continue operations for about four to five years. Ore is obtained from underground mines located adjacent to the mill.

The Lisbon alkaline-leach mill has the lowest specific use of fresh water of any mill in the country. In-process recycle is practiced, and liquid from the tailings pond is recycled to the filtration stage of the milling operation. Uranium is recovered from pond water by ion exchange (37% efficient). Cross-country aeration (oxidation while the water is flowing through an open trench) and barium chloride coprecipitation of mine water recovered from a depth of 920 m (2700 ft) are used to oxidize hydrosulfides and reduce radium concentrations to acceptable levels prior to discharge of the water to a local agricultural user.

The tailings retention area was constructed by erecting an earth-fill, clay-core dam across a natural basin. The impoundment consists of two tailings ponds situated in a small west-trending drainage area of slightly more than a square mile. Each pond is retained by natural soil embankments placed across the valley's drainage course. The ponds are designated as "upper" and "lower" tailings ponds. The upper pond lies directly upstream and east of the lower pond in such a manner that the rear of the lower pond is adjacent to the mill site. Although both ponds are unlined, they are dug into natural clay to reduce seepage rates. In the spring, mine water is pumped to the lower tailings pond for treatment prior to extracting uranium and sodium. Pond water is then decanted to the upper pond, where it can be recycled to the mill. A problem peculiar to the lower pond is the upward migration of sodium decahydrate crystals. Sprays are used to mitigate wind entrainment of these crystals and of the solid tailings.

At mill startup, tailings were deposited in the lower tailings pond only. The upper pond was built in 1974 but not used until 1976. The lower pond has reached its full storage capacity, and all tailings are being discharged into the upper pond. As of the end of 1979, about 1.6×10^6 MT (1.8×10^6 ST) of tailings had been generated by the mill, resulting in about 1.1×10^6 m³ (940 ac-ft) of tailings contained in the two tailings ponds.

In October 1981, operations were reduced to 50% of capacity.

Since there is only a small amount of capacity remaining in the storage area of the upper tailings pond, Rio Algom has recently proposed raising the existing lower tailings embankment by 7.6 m (25 ft). Such an increase would provide sufficient tailings storage for the next five years of mill operation.

Facility Name: Lisbon Mill
Type: Conventional Uranium Mill
Location -

Code Number: UT-N-C-20

Site Name: Lisbon Mill

City: La Sal

State: UT County: San Juan

Ownership -

Owner: Rio Algom Corp.

Mill Contact: M.D. Lawton

Address: Moab, Utah

Title: Pres. & Mine Mgr.

Telephone: (801) 259-5904

LICENSING DATA

Regulatory Authority: NRC

First Issued: 1972

License Number:

Last Renewed in Entirety: 1977

Current Status of Operation: Active

Last Amended:

Days of Operation/Year: 363

Expires: 1982; under timely renewal

Project Life (years, est): 1984

Surety Type:

Years for Complete Reclamation:

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Lisbon

Grinding Method:

U₃O₈ Production
(tons/year): 460

Type: Underground

Leach Method:

Ore Grade (%): 0.20

Clarification: Filtration

Metals in Ore Recovered: None

Concentration:

U₃O₈ Purity (%): 94-95

Extraction Efficiency (%): 97

Precipitation: NaOH, NH₃

Throughput (tons/day): 748

Calcining Temp: Low fired

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 1.8x10⁶

Total Pond Area (acres): 35

% Water Recycled: 72

Total Area, Tailings (acres): 35

Number Evaporation Ponds: None

Method of Tailings

pH: 10.9

Mill Water Consumption
(gpm): 55

Disposal: Above ground

Liner Types: None

Dam Height (feet, AGL):

Seepage Rate

Cover Material:

Freeboard Height (feet):

(gpm): Not measurable

Thickness:

Construction Method

of Dam: Earth fill, clay core dam

Rn Flux (pCi/m²/s):

Underlying

Strata: Sandy silt & silty clay

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual:

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Text Description (page): 2-35

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 1982/07

2.1.5 Washington

2.1.5.1 Dawn Mining Co., Ford Mill (Code # WA-A-C-04)

The Ford Uranium Mill [400 MT (440 ST) per day] is operated by Dawn Mining Co. in the rolling hills of eastern Washington State, about 83 km (45 mi) northwest of Spokane. The site is on a terrace formed by glaciofluvial materials. About 0.8 km (0.5 mi) away on the northern and western sides of the site flows Chamokane Creek. Ore is obtained from the Midnight open-pit mine, about 40 km (22 mi) northwest of the mill. Dawn mines ore in crystalline host rock, a distinctive feature of the operation. The ore reserves of the Midnight mine, expected to last about four or five years more, are on the Spokane Indian Reservation. Average ore grades have fluctuated between 0.10% and 0.25% U_3O_8 over the life of the mine.

Owned 51% by Newmont Mining Corp. and 49% by Midnight Mines, Inc., Dawn operated from 1957 through 1964 under the AEC's concentrate-purchase program. The mill was temporarily shut down in 1965 and then reopened in late 1969 after being rehabilitated and reconditioned. To date, more than 4.5×10^6 kg (10×10^6 lb) of U_3O_8 have been recovered from about 2×10^6 MT (2.2×10^6 ST) of ore averaging 0.225% U_3O_8 .

The Ford Mill incorporates two-stage-agitation, acid-leach removal of uranium from ore and a column ion-exchange circuit consisting of four pressurized cylinders, each containing a fixed bed of anion-exchange resins. Precipitation is carried out in two stages. In the first stage, the pH is raised with lime to precipitate iron, which is present in the ore as pyrite. Following separation of the iron precipitate, uranium is precipitated from solution with ammonia in the second stage. Waste rock and solutions are neutralized with lime and pumped to a single tailings pond.

There is no recycle of water from the impoundment. The company indicates that this is because a considerable amount of silica is solubilized in the leaching process, and if that silica were allowed to build up in mill solutions, it could displace uranium-loading sites on the resins and thus reduce ion-exchange efficiency.

The tailings pond is a conventional impoundment, roughly rectangular in shape. The pond is separated into three compartments by natural-material embankments. The pond is unlined, and it is estimated that most of the liquid coming into the tailings pond is lost through seepage. The pond contains about 2.0×10^6 MT (2.2×10^6 ST) of tailings. The tailings pond was filled during 1980, and a new disposal area designed for subgrade disposal of tailings is being developed. A pit has been excavated immediately south of the present tailings dam. The surface area of the pit will be 11 ha (28 ac). The structure is 20 m (65 ft) deep and has a total volume of about 1.5×10^6 m³ (2×10^6 yd³), which is adequate for about 13 years of mill production at the rate of 1.5×10^6 MT (1.7×10^6 ST) of ore per year. The entire pit floor and side slope surface will be lined with a reinforced 30-mil synthetic Hypalon liner. Elimination of seepage from the tailings pond area by use of the new lined disposal facility will result in a solution-disposal problem, and Dawn is considering several plans for management of process water.

Facility Name: Ford Mill
Type: Conventional Uranium Mill
Location -

Cooc Number: WA-A-C-04

Site Name: Ford Mill City: Ford State: WA County: Stevens
Ownership - Mill Contact:
Owner: Dawn Mining Co. Title:
Address: Telephone:

LICENSING DATA

Regulatory Authority: State of Washington First Issued: 1957
License Number: Last Renewed in Entirety: In process
Current Status of Operation: Active Last Amended: 1981
Days of Operation/Year: 354 Expires: 1980
Project Life (years, est): Surety Type:
Years for Complete Reclamation: Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Grinding Method: U₃O₈ Production
(tons/year): 186
Type: Surface Leach Method: Acid
Ore Grade (%): 0.13-0.15 Clarification: CCD
Metals in Ore Recovered: None Concentration: IX U₃O₈ Purity (%): 81.5
Extraction Efficiency (%): 92 Precipitation: NH₃
Throughput (tons/day): 440 Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 2.2x10⁶ Total Pond Area (acres): 106 % Water Recycled: None
Total Area, Tailings (acres): 106 Number Evaporation Ponds:
Method of Tailings pH: 1.6 Mill Water Consumption
Disposal: Above ground (gpm): 100
Liner Types: None Dam Height (feet, AGL): Seepage Rate
Freeboard Height (feet): (gpm): 57-159
Cover Material:
Thickness: Construction Method
of Dam: Natural material embankments
Underlying
Rn Flux (pCi/m²/s): Strata: Gravelly loamy sands

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Pb-210, Ra-226, Rn-222
Method of Concentration Determination: Environmental data, MILDOS
Dose to Nearest Offsite Individual:
Location of Nearest Offsite Individual: 0.5 mi
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-37

Data Compiled by: Ron Sunde Date Compiled: 1982/01/11

Date Data Revised:

2.1.5.2 Western Nuclear, Inc., Sherwood Mill (Code # WA-A-C-17)

The Sherwood Uranium Mill is operated by Western Nuclear, Inc., in eastern Washington State about 64 km (40 mi) northwest of Spokane, Washington, as part of the Sherwood Uranium Project. Land surface in the mill area is mostly gently sloping and relatively smooth and uniform. Western Nuclear obtains low-grade ore for the mill from an open-pit mine nearby at Wellpinit. The mill and mine are on leased land on the Spokane Indian Reservation. The lease specifies that Spokane Indians will be given preference in hiring. At present, 70% of the employees are Indian. The Sherwood deposits are about 6 km (4 mi) south of the deposits mined for Dawn Mining Co.'s Midnight operation, but the ores for the two operations were deposited differently. Western Nuclear began the Sherwood Project in 1978 on established reserves of 7×10^6 MT (8×10^6 ST) of 0.089% U_3O_8 . The ore is emplaced in 23×10^6 m³ (30×10^6 yd³) of overburden and waste. On a tonnage basis, the waste-to-ore ratio is about 7.3:1. The mine operates at a cutoff of 0.02% U_3O_8 , and the mill, which uses an acid-leach process, operates at a cutoff of 0.035% U_3O_8 .

Tailings slurry from the mill is neutralized by reaction with lime (28 kg of lime per metric ton of ore) before it is pumped to the tailings pond, which has an area of 17 ha (42 ac). The pond is in a valley immediately south and east of the mill area. The upslope face of the tailings dam, as well as the settling area behind the dam, is lined with Hypalon. The 40-mil liner on the dam face is further protected by a layer of coarse-settled solids. The tailings basin behind the dam is protected by diversion canals.

Solution is decanted from the tailings pond and either recycled to the process or treated with barium chloride to remove Ra-226. The precipitate is deposited in a small Hypalon-lined pond of 370 m² (4000 ft²) south of the tailings pond. Decant from this small pond is evaporated in an unlined pond. Bench-scale tests on samples of neutralized effluent indicate that more than 90% removal of Ra-226 is achieved by $BaCl_2$ treatment. Maximum capacity of the $BaCl_2$ treatment system is about 760 m³/day (140 gpm), which represents about 30% of the total liquid effluent to the ponds. An additional 50% to 70% of the effluent can be recycled to the mill to decrease water usage. Many of the most advanced wastewater treatment concepts in the uranium industry are used at the mill.

The reclamation plan is to restore areas to a condition suitable for grazing and forestry, with the tailings pond to be covered to limit radiation to a level no more than 2.5 times that of natural background levels.

The current amount of tailings under management is 1.5×10^6 MT (1.7×10^6 ST).

Facility Name: Sherwood Mill
Type: Conventional Uranium Mill
Location -

Code Number: WA-A-C-17

Site Name: Sherwood Mill City: Wellpinit State: WA County:
Ownership - Mill Contact:
Owner: Western Nuclear, Inc. Title:
Address: Telephone:

LICENSING DATA

Regulatory Authority: State of Washington First Issued: 1978
License Number: Last Renewed in Entirety: In process
Current Status of Operation: Active Last Amended:
Days of Operation/Year: 350 Expires:
Project Life (years, est): 1990 Surety Type:
Years for Complete Reclamation: Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Grinding Method: U₃O₈ Production
Type: Surface Leach Method: Acid (tons/year): 260
Ore Grade (%): 0.05-0.09 Clarification: CCD
Metals in Ore Recovered: None Concentration: SX U₃O₈ Purity (%): 90
Extraction Efficiency (%): Precipitation: NH₃
Throughput (tons/day): 2090 Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 1.7x10⁶ Total Pond Area (acres): 42 % Water Recycled: 50-75
Total Area, Tailings (acres): 42 Number Evaporation Ponds: 1
Method of Tailings Disposal: Above ground pH: 6.0-7.0 Mill Water Consumption (gpm): 442
Liner Types: Hypalon Dam Height (feet, AGL): Seepage Rate (gpm): None
Cover Material: Freeboard Height (feet):
Thickness: Construction Method of Dam:
Rn Flux (pCi/m²/s): Underlying Strata: Highly permeable sand & gravel

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Ra-226, Rn-222
Method of Concentration Determination: Environmental data, MILDOS
Dose to Nearest Offsite Individual:
Location of Nearest Offsite Individual:
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-39

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised:

2.1.6 Wyoming

2.1.6.1 Exxon Minerals Co., Highland Mill (Code # WY-N-C-06)

Exxon's Highland mine and mill complex is in an area of rolling hills and stream valleys 100 km (60 mi) northeast of Casper, Wyoming, in the Powder River Basin. Exxon has been conducting mining and milling operations at the Highland location since 1972. The uranium ore processed at the mill is currently extracted from Exxon's surface mines and underground mine on the Highland property. The mill also produces concentrate from solutions and slurries containing uranium recovered from tailings solutions, and from a pilot in-situ leaching process operated at Highland.

The Highland mill processes an average of 2710 MT (2990 ST) of ore per day, but has attained levels as high as 2950 MT (3250 ST) per day in recent operations. This throughout is 50% more than the original design capacity when the mill opened in 1972. The increase was achieved primarily through mill modifications, such as changing electric motor horsepower ratings, altering process lines, and refining and adding to instrumentation. Because of a high degree of automation in the plant, five workers can control the entire mill, which produces about 880 MT (970 ST) of yellowcake per year.

Tailings are contained in a natural valley enclosed by an earthen, clay-core dam. The tailings pond covers an area of 80 ha (200 ac). The tailings surface slopes from both the west and east (embankment face) toward the pond. A small cutoff and pumpback system 210 m (700 ft) downstream of the embankment returns 3 L/s (50 gpm) of collected seepage to the pond. Large areas of the delta and beach portions of the tailings pond have been covered with a chemical substance used to fix dry tailings. Mill personnel state that this approach appears to be effective in preventing excessive wind entrainment of tailings particulates, but that sufficient data has not been collected to fully evaluate the method. Plans call for reclamation of a large part of the delta area with fill dirt in the future.

Exxon has already reclaimed 220 ha (550 ac) (1978)--more than one-fourth of the land it has disturbed. In all, an estimated 1200 ha (3000 ac) will be disturbed by mining and milling operations. Exxon moves about 32,000 m³ (42,000 yd³) of overburden daily in mining operations, or about 11 × 10⁶ m³ (15 × 10⁶ yd³) annually. The cost of reclaiming land will be about \$5000 per hectare (\$2000 per acre). Exxon expects to spend \$2.5 million to \$3 million to reclaim tailings pond waste.

The amount of tailings under management is about 7 × 10⁶ MT (8 × 10⁶ ST).

Facility Name: Highland Mill
Type: Conventional Uranium Mill
Location -

Code Number: WY-N-C-06

Site Name: Highland Mill
Ownership -
Owner: Exxon Minerals Co.
Address: P.O. Box 2180
Houston, TX 77001

City: Douglas State: WY County: Converse
Mill Contact: James Gilchrist
Title: Env. & Reg. Affairs Mgr.
Telephone: 713-895-1172

LICENSING DATA

Regulatory Authority: NRC
License Number: SUA-1139
Current Status of Operation: Active
Days of Operation/Year: 355
Project Life (years, est): 1996
Years for Complete Reclamation: 5

First Issued: 1972
Last Renewed in Entirety: 82/1
Last Amended: 81/6
Expires: 87/1
Surety Type: Bond
Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine:
Type: Underground & surface
Ore Grade (%): 0.25
Metals in Ore Recovered: None
Extraction Efficiency (%):
Throughput (tons/day): 3245

Grinding Method: U₃O₈ Production
(tons/year): 968
Leach Method: Acid
Clarification: CCD
Concentration: SX U₃O₈ Purity (%): 97
Precipitation: NH₃
Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 8x10⁶
Total Area, Tailings (acres): 200
Method of Tailings Disposal: Above Ground
Liner Types: None
Cover Material: Clay, local sand
Thickness: 10 feet
Rn Flux (pCi/m²/s):

Total Pond Area (acres): 90 % Water Recycled: None
Number Evaporation Ponds: None
pH: 1.5-2.0 Mill Water Consumption (gpm): 800-900
Dam Height (feet, AGL): 100 Seepage Rate (gpm):
Freeboard Height (feet): 10
Construction Method of Dam: Clay-core dam
Underlying Strata: Fine sandy loams - clay loam

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:
Method of Concentration Determination: MILDOS
Dose to Nearest Offsite Individual: 9.76 mrem/year (lung)
Location of Nearest Offsite Individual: 2.5 mi NE
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-41

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 1982/04

2.1.6.2 Federal American Partners, Gas Hills Mill (Code # WY-N-C-21)

The Federal American Partners' Gas Hills Mill is in a hilly area of Wyoming, about 80 km (50 mi) east of Riverton. Operation of the mill began in October 1959 with an initial rated capacity of 470 MT (520 ST) of ore per day. The mill is now licensed for a capacity of 860 MT (950 ST) per day; current plans call for expansion of the mill capacity to about 2000 MT (2200 ST) per day. The Eluex process is used at the mill, with ion-exchange carried out in a resin-in-pulp circuit. The mill processes ores from surface and underground mines operated by Federal American Partners in the Gas Hills area. All of these ore reserves are leased by the TVA. Current ore reserves are sufficient for about ten years of mill operation at the expanded rate of 2000 MT (2200 ST) per day. The project life may be extended if additional ore reserves are located.

Mill tailings are being pumped to a conventional aboveground impoundment formed by a peripheral earth dam. Free liquid from the pond is pumped to a decant pond. The tailings pond was projected to reach its maximum capacity by late 1981. Federal American Partners is evaluating the feasibility of disposing of mill waste below grade in the Sagebrush-Tablestakes open-pit mine. The total belowgrade tailings area would be about 24 ha (60 ac) and would provide ten years of capacity for mill tailings wastes. Currently, solution from the aboveground impoundment is not recycled; however, the disposal pit plan will allow for the decant of solutions back to the mill or into the decant pond. This should decrease the amount of fresh water used at the mill. The pit will be clay-lined. This lining, along with the practice of recycle, is expected to reduce seepage from 13 L/s (200 gpm) to 3.2 L/s (50 gpm).

Reclamation of the tailings-disposal system will involve both the aboveground impoundment and the proposed subsurface disposal area. Following the filling of the subsurface disposal area, the tailings will be covered to a level that will provide erosional integrity and control release of radioactivity from radon gas to a level approaching background. The surface cover will be revegetated and a postoperative monitoring program will be developed by Federal American Partners to maintain proper surveillance of radionuclides in the vicinity. For the aboveground impoundment, two main reclamation alternatives are being studied by Federal American Partners--reclamation of the tailings in place or moving them to the proposed below-grade disposal area at an open-pit mine.

This mill was shut down in September 1981.

Facility Name: Gas Hills Mill
Type: Conventional Uranium Mill
Location -

Code Number: WY-N-C-21

Site Name: Gas Hills Mill
Ownership -
Owner: Federal American Partners
Address:

City: Gas Hills State: WY County: Fremont
Mill Contact: Ken Watts
Title: Env. Coord.
Telephone: (307) 457-6671

LICENSING DATA

Regulatory Authority: NRC First Issued: 1959
License Number: SUA-667 Last Renewed in Entirety: 1971
Current Status of Operation: Inact. since 1981/09 Last Amended: Timely renewal 1982
Days of Operation/Year: 340 Expires:
Project Life (years, est): 1990 Surety Type:
Years for Complete Reclamation: Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Grinding Method: Dry U₃O₈ Production
(tons/year): 351
Type: Underground & surface Leach Method: Acid
Ore Grade (%): 0.12 Clarification: SS
Metals in Ore Recovered: None Concentration: SS, IX U₃O₈ Purity (%): 96
Extraction Efficiency (%): 91 Precipitation: NH₃
Throughput (tons/day): 960 Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 4.6x10⁶ Total Pond Area (acres): 105 % Water Recycled: None
Total Area, Tailings (acres): 129 Number Evaporation Ponds: 1
Method of Tailings Disposal: Above ground pH: 1.5-2.0 Mill Water Consumption (gpm): 350
Liner Types: None Dam Height (feet, AGL): Seepage Rate (gpm): 200
Cover Material: Freeboard Height (feet):
Thickness: Construction Method of Dam: Peripheral earth dam
Rn Flux (pCi/m²/s): Underlying Strata: Shallow loamy topsoil

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: Rn-222, Ra-226, Th-230
Method of Concentration Determination:
Dose to Nearest Offsite Individual: Less than 25 mrem/yr
Location of Nearest Offsite Individual: About 5 mi NW
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-43

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 1982/07

2.1.6.3 Minerals Exploration Co., Sweetwater Uranium Project (Code # WY-N-C-15)

The Sweetwater Uranium Mill is within the Red Desert portion of Wyoming's Great Divide Basin. The mill is in northeastern Sweetwater County, about 64 km (40 mi) northwest of Rawlins. Topography of the basin is relatively flat, broken only by a few low ridges.

The mill, which began operations in early 1981, will have an operating lifetime of about 15 years. Minerals Exploration Co. (MEC) has obtained the mining rights on about 24,800 ha (61,200 ac) from the U.S. Bureau of Land Management and from the State of Wyoming. Only a portion of the mining rights will be utilized for the Sweetwater Project. MEC estimates that the underground deposits consist of about 15×10^6 MT (16×10^6 ST) of uranium ore containing 7000 MT (7700 ST) of uranium oxide.

The tailings from the milling operation will be discharged by a slurry pipeline to a four-cell impoundment about 150 m (500 ft) southeast of the mill. This impoundment will consist of a quadrilateral tailings basin divided into four separate cells. Each cell will be excavated to about 7 m (23 ft) above the water table and will be lined on the bottom and on the interior dam slopes with a synthetic membrane material. The cells will be constructed as individual units, and construction of each successive cell will take place as necessary to meet ongoing tailings storage and water evaporation requirements. The dam confining each cell will be designed as a zone structure. The entire impoundment will have sufficient storage and evaporative capacity to service the mill over its full life. The total area covered by the impoundment will be about 120 ha (300 ac), and the internal area containing the mill tailings will cover about 100 ha (250 ac).

All tailings will be deposited sufficiently below the natural surface [at least 3 m (10 ft)] so that the required reclamation cover will not create a distinct aboveground mound. The area confined by the dam and the top 3 m (10 ft) of the excavated portion of each cell will only be used for storage and evaporation of tailings liquid. Part of the water will be decanted from the pond to dilute the tailings slurry discharged from the mill, leaving a balance of about 32 L/s (500 gpm) as net discharge to the impoundment. The tailings will normally be covered with water, but at times when the tailings are not covered, MEC will implement an interim stabilization program to control wind erosion.

Following the completion of active milling and after a postoperational drying period sufficient to provide a satisfactory working surface, the tailings will be covered with an 3.3- to 8.5-m (11- to 15-ft) cap consisting of materials used in the above-grade dams and 0.3 m (1 ft) of topsoil, and then revegetated. At least 3 m (10 ft) of the cap will be below the natural grade in all areas. Material from the dams not needed to cover the tailings will either be used in reclamation of mine pits or transported to a waste dump. MEC estimates that placement of the cover material and revegetation will cost about \$2,258,000.

MEC has proposed general procedures for decommissioning of the mill site, but will be required by the NRC to submit a plan near the end of the useful life of the project that includes a cost estimate and surety arrangements.

Currently, about 0.9×10^6 MT (1×10^6 ST) of tailings have accumulated at the Sweetwater Mill.

Facility Name: Sweetwater Mill
Type: Conventional Uranium Mill

Code Number: WY-N-C-15

Location -

Site Name: Sweetwater Uranium Proj. City: Rawlins State: WY County: Sweetwater

Ownership -

Owner: Minerals Exploration Co.
Address: P.O. Box 1500
Rawlins, WY 82301

Mill Contact: Larry Snyder
Title: Safety/Env. Adm.
Telephone: 307-328-1476

LICENSING DATA

Regulatory Authority: NRC
License Number: SUA 1350
Current Status of Operation: Active
Days of Operation/Year: 310
Project Life (years, est): 11
Years for Complete Reclamation: 5

First Issued: 1981
Last Renewed in Entirety:
Last Amended:
Expires: 84/2
Surety Type: Bond
Surety Amount: \$10 million
Surety Holder: Am. Casualty, Nat'l. Fire Ins.

PROCESSING OF URANIUM

Name of Mine: Sweetwater

Grinding Method: SAG

U₃O₈ Production
(tons/year): 450

Type: Underground

Leach Method: Acid

Ore Grade (%): 0.05

Clarification: CCD

Metals in Ore Recovered: None

Concentration: SX

U₃O₈ Purity (%): 90

Extraction Efficiency (%): 91.7

Precipitation: NH₃

Throughput (tons/day): 3000

Calcining Temp: High fired

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 1x10⁶

Total Pond Area (acres): 240

% Water Recycled: None

Total Area, Tailings (acres): 300

Number Evaporation Ponds: 2

Method of Tailings

Disposal: Above ground

pH: 1.5-2.0

Mill Water Consumption
(gpm): 500

Liner Types: PVC, Hypalon

Dam Height (feet, AGL): 41

Seepage Rate
(gpm): Negligible

Freeboard Height (feet): 5

Cover Material: Subsoil, topsoil (2 ft)

Construction Method

Thickness: 11-15 feet

of Dam: Zone Structure

Rn Flux (pCi/m²/s): 210

Underlying

Strata: Alluvium

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Pb-210, Ra-226

Method of Concentration Determination: UDAD

Dose to Nearest Offsite Individual: 0.03 mrem/year (lung)

Location of Nearest Offsite Individual: Bairo1, 21 mi NE

Dose at Site Boundary (nearest downwind): 6.37 mrem/year (lung)

Dose at Site Boundary (closest to source):

Text Description (page): 2-45

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 1982/04

2.1.6.4 Pathfinder Mines Corp., Gas Hills Mill (Code # WY-N-C-09)

The Gas Hills Uranium Mill is operated by Pathfinder Mines Corp. (formerly Lucky Mc Corp.) in the Gas Hills region of Fremont, Wyoming, about 40 km (25 mi) northeast of Jeffrey City. The mill is near the divide between Fraser and Reid Draws at an elevation of about 2000 m (6540 ft). Both Fraser and Reid Draws are relatively steep-gradient drainageways (19 m/km). The upper portion of Reid Draw drainageway (342 ha, or 845 ac) is contained behind the embankment dam of tailings pond No. 4 and serves as part of the mill tailings retention system.

This mill first began producing yellowcake in 1958 with a nominal ore-processing capacity of 850 MT (935 ST) per day. Since then the capacity has been expanded to about 2300 MT (2600 ST) of ore per day. The mill uses a two-stage acid-leach process and was the first in the United States to incorporate the moving-bed ion-exchange technique originally developed in South Africa. It is also unique among U.S. uranium mills in using anion exchange for concentration of uranium from the feed solution.

Company-owned open-pit mining operations 1.5 to 3 km (1 to 2 mi) from the mill supply 95% of the ore; the remaining 5% is produced at two underground operations--the West Gas Hills Mine and the East Gas Hills Mine. The ore grade has averaged 0.25% U_3O_8 in past operations and is expected to average 0.15% in the future. Although mines adjacent to the mill also could provide fresh water for ore processing, availability of hot [57°C (135°F)] well water at the site makes it advantageous from a process standpoint to use well water in the mill and to treat mine water for discharge.

The tailings retention system consists of five tailings ponds encompassing 55 ha (135 ac). The ponds are situated sequentially in a small natural ravine north-northwest of the mill and are dug into an underlying shale formation. Clay core dams keyed into the shale provide protection against lateral seepage. The permeability of the shale bedrock is low, and the vertical seepage rate from the ponds is only about 22 m³/day (4 gpm). Only two of the five tailings ponds now contain tailings. The total tailings area of these two ponds is 32 ha (80 ac). The average tailings depth is now 11 m (36 ft) and is expected to increase to 33 m (110 ft) by the end of milling operations (1996). The remaining three ponds are now used for solution evaporation.

In 1963, there was a flooding incident at the mill site in which 8.7×10^7 L (2.3×10^7 gal) of impounded tailings solution were released to the environment. This incident prompted an enlargement of the tailings impoundment to its current capacity. The existing system, with a minimum of 1.5 m (5 ft) of freeboard, is estimated to provide 8.7×10^8 L (2.3×10^8 gal) of emergency storage.

Reclamation of the site will begin after total evaporation of the ponds (estimated to be six to eight years after cessation of operation). All contaminated areas will be buried under a layer of clay 0.6 m (2 ft) thick. Next, the area will be overlain with 1 m (3.5 ft) of subsoil material. An additional 0.15 m (0.5 ft) of plant-growth media or topsoil will then be spread over the surface. About two years would elapse before vegetation would be established. The estimated cost of this program is about \$1.8 million (1976 dollars).

The current amount of tailings under management is 5.8×10^6 MT (6.4×10^6 ST).
Pathfinder is negotiating sale of 80% of this operation to Cogema of France.

Facility Name: Gas Hills Mill
Type: Conventional Uranium Mill
Location -

Code Number: WY-N-C-09

Site Name: Gas Hills Mill
Ownership -
Owner: Pathfinder Mines Corp.
Address: PO Box 831
Riverton, WY 82501

City: Jeffrey City State: WY County: Fremont
Mill Contact: R.W. Payser
Title: Env. Coordinator
Telephone: 307-457-6626

LICENSING DATA

Regulatory Authority: NRC
License Number: SUA-672
Current Status of Operation: Active
Days of Operation/Year: 340
Project Life (years, est): 1997
Years for Complete Reclamation:

First Issued: 1958
Last Renewed in Entirety: 78/1
Last Amended: 81/7
Expires: 83/1
Surety Type: Bond
Surety Amount: \$17.3 million
Surety Holder: State of WY

PROCESSING OF URANIUM

Name of Mine:
Type: Underground & Surface
Ore Grade (%): 0.15-0.25
Metals in Ore Recovered:
Extraction Efficiency (%):
Throughput (tons/day): 2800

Grinding Method: U₃O₈ Production
(tons/year): 1279
Leach Method: Acid
Clarification: CCD
Concentration: SX, IX U₃O₈ Purity (%): 90
Precipitation: NH₃
Calcining Temp: Low fired

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 6.4x10⁶ Total Pond Area (acres): 81
Total Area, Tailings (acres): 135 Number Evaporation Ponds: 3
Method of Tailings Disposal: Above ground pH: 2.0
Liner Types: None Dam Height (feet, AGL):
Freeboard Height (feet): 15
Cover Material: Clay, subsoil, topsoil
Thickness: 10.5 feet Construction Method
of Dam: Clay core dams
Underlying Strata: Alluvium
Rn Flux (pCi/m²/s):

% Water Recycled: 57
Mill Water Consumption
(gpm): 306
Seepage Rate
(gpm): 4

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:
Method of Concentration Determination:
Dose to Nearest Offsite Individual:
Location of Nearest Offsite Individual: Lucky Mc Camp
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-48

Data Compiled by: Ron Sunde11 Date Compiled: 1982/01/11

Date Data Revised: 1982/04

2.1.6.5 Pathfinder Mines Corp., Shirley Basin Mill (Code # WY-N-C-10)

Pathfinder Mines Corp. (formerly Lucky Mc Uranium Corp.) operates the Shirley Basin Uranium Mill in an area of plains and rolling hills about 72 km (45 miles) south of Casper, Wyoming.

Underground operations [to a depth of 76 m (250 ft)], were used to mine the Shirley Basin property during the period 1960 through 1963; solution mining was used to maintain production from 1963 through 1970. The mill was completed in 1971, and mining was converted to open-pit methods. The grinding part of the mill is autogenous, with no preliminary crushing. There are no conveyors in the plant. Static-bed resin columns extract uranium following acid leaching. The only recent change in mill equipment has been the installation of a new yellowcake dryer and the addition of a cyclone wash that washes sands through five successive cyclones in series. This addition increased mill throughput from 1100 to 1600 MT (1210 to 1800 ST) per day. About 8.6×10^6 kg (19×10^6 lb) of uranium concentrates will be produced over the 12-year lifetime of the mill.

The tailings pile currently covers about 60 ha (150 ac) and contains 5×10^6 MT (5.5×10^6 ST). The impoundment system is unique in that wastes are segregated into two streams--a tailings slurry and overflow solution from yellowcake washing thickeners. The tailings slurry is pumped to a tailings pond, where seepage control is provided by a compacted sandy clay blanket lining the pond bottom. There is no recycle from the tailings pond. Yellowcake thickener overflow is sent to a recycle pond, where it is mixed with cooling water and recycled to the grinding circuit. A collection ditch with a return pump returns about 0.6 L/s (10 gpm) of seepage to the impoundment system.

At present, the tailings pond requires only a single-sided retention dam. The fill material for the dam and for the keyway consists of sandy clay excavated from the open-pit mine.

Mine water is used along with some well water as fresh water for the milling process. Chemical analysis indicates the presence of a toxic organic pollutant in the mine water. After dilution, barium chloride coprecipitation, cross-country aeration (flow in an open trench), and settling, the treated mine water is discharged containing 2.4 µg/L of this pollutant.

Facility Name: Shirley Basin Mill

Code Number: WY-N-C-10

Type: Conventional Uranium Mill

Location -

Site Name: Shirley Basin Mill

City: Casper

State: WY County: Carbon

Ownership -

Owner: Pathfinders Mine Corp.

Mill Contact: Jack Russell

Title: Mine Manager

Address: Shirley Basin Mine

Telephone: 307-356-4312

Shirley Basin, WY 82615

LICENSING DATA

Regulatory Authority: NRC

First Issued: 1971

License Number: SUA 442

Last Renewed in Entirety: 77/9

Current Status of Operation: Active

Last Amended: 81/8

Days of Operation/Year:

Expires: 82/9

Project Life (years, est): 1983

Surety Type: Bond

Years for Complete Reclamation:

Surety Amount: \$40 million

Surety Holder: State of WY

PROCESSING OF URANIUM

Name of Mine:

Grinding Method: Autogenous U_3O_8 Production
(tons/year): 1125

Type: Surface

Leach Method: Acid

Ore Grade (%): 0.16

Clarification: CCD, SS

Metals in Ore Recovered: None

Concentration: IX U_3O_8 Purity (%): 90

Extraction Efficiency (%):

Precipitation: NH_3 , MgO , H_2O_2

Throughput (tons/day): 1800

Calcining Temp: 1500°F

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 5.5×10^6 Total Pond Area (acres): 150 % Water Recycled: 31

Total Area, Tailings (acres): 232 Number Evaporation Ponds: None

Method of Tailings Disposal: Above Ground

pH: 2

Mill Water Consumption (gpm): 500

Liner Types: None

Dam Height (feet, AGL): 60

Seepage Rate (gpm): 10 to 30

Cover Material:

Freeboard Height (feet): 4

Thickness:

Construction Method of Dam: Single-sided retention dam

Rn Flux ($pCi/m^2/s$):

Underlying Strata: Sandstone

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual: Heward Ranch

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Text Description (page): 2-51

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 1982/04

2.1.6.6 Petrotomics Co., Shirley Basin Mill (Code # WY-N-C-11)

Petrotomics' Shirley Basin Uranium Mill is located in a hilly area about 100 km (65 mi) south of Casper in the eastern Shirley Basin area of Wyoming. The mill began operations in 1962 at the designed capacity of 480 MT (530 ST) per day; in 1967, new facilities were built to increase the capacity to 910 MT (1000 ST) per day and convert the solvent-extraction circuit from brine stripping to ammonium sulfate stripping (ammonia gas is now used). In early 1975, Getty Oil and Skelly Oil acquired Kerr-McGee Nuclear Corp.'s one-half interest in Petrotomics. The mill was closed from 1974 until 1977 for refurbishing and process improvements. The mill now is processing ores from UJV (a joint venture of Getty and Skelly) and from the Jenkins Project of Utility Fuels, Inc. UJV holds properties in the Shirley Basin estimated to contain 6.4×10^6 MT (7×10^6 ST) of uranium reserves. At the present average processing rate of 1400 MT (1600 ST) per day, the expected operating life is about 20 years.

The combined tailings slurry is pumped to a tailings area 140 m (450 ft) from the mill. The area was formed by damming a natural ravine with sand built up with mine overburden. The tailings dam is situated near the head of a small tributary drainage to Sand Creek. The tailings retention system currently consists of the main tailings pond (65 ha, or 160 ac) and three catchment basins and emergency dams that collect and return lateral seepage or overflow from the tailings area.

Solution from the tailings pond is heated and recycled to the leach circuit at the rate of 0.13 metric ton of solution per metric ton of ore. The strongly acidic solution is very corrosive, especially at elevated temperatures. Increased recycle would not be economical because of the high cost of heating the corrosive recycle solution to the desired temperature.

The tailings pond was constructed with an underlying layer of clay to reduce seepage. The capacity of the tailings pond has been reached and Petrotomics has constructed an addition to the existing dam. The embankment addition was constructed downstream of the existing embankment, incorporating the existing embankment in the upstream toe of the larger embankment. The crest elevation of the embankment addition is 22 m (70 ft) above the original ground surface and 11 m (35 ft) above the crest of the existing tailings dam. The embankment is constructed with sandy clays, siltstone, and claystone. The impoundment contains about 2.8×10^6 MT (3×10^6 ST) of tailings.

Operations at this mill were reduced to 50% of capacity in July 1981.

Facility Name: Shirley Basin Mill

Code Number: WY-N-C-11

Type: Conventional Uranium Mill

Location -

Site Name: Shirley Basin Mill

City: Casper

State: WY County: Carbon

Ownership -

Owner: Petrotonics

Mill Contact: Steve Phitt

Address: P.O. Box 2509

Title: Mill R50

Shirley Basin, WY 82615

Telephone: 307-234-9341

LICENSING DATA

Regulatory Authority: NRC

First Issued: 1962

License Number: SUA-551

Last Renewed in Entirety:

Current Status of Operation: Active

Last Amended: 81/10

Days of Operation/Year: 344

Expires:

Project Life (years, est): Thru 1994

Surety Type: Bond

Years for Complete Reclamation:

Surety Amount: \$2 million

Surety Holder: Seaboard Surety Co.

PROCESSING OF URANIUM

Name of Mine:

Grinding Method: Rod Mill U₃O₈ Production
(tons/year): 514

Type: Surface

Leach Method: Acid

Ore Grade (%): 0.10

Clarification: CCD

Metals in Ore Recovered: None

Concentration: SX

U₃O₈ Purity (%): 89-90

Extraction Efficiency (%): 97

Precipitation: NH₃, MgO

Throughput (tons/day): 1600

Calcining Temp: 1200°F

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 3.0x10⁶ Total Pond Area (acres): 160 % Water Recycled: 16

Total Area, Tailings (acres): 160 Number Evaporation Ponds: None

Method of Tailings

pH:

Mill Water Consumption
(gpm): 167

Disposal: Above ground

Liner Types: Clay

Dam Height (feet, AGL): 65

Seepage Rate
(gpm):

Cover Material: Clay cap, topsoil

Freeboard Height (feet): 15

Thickness: 3 m clay, 6 in. top soil

Construction Method
of Dam: Downstream

Rn Flux (pCi/m²/s):

Underlying
Strata: Claystone, siltstone, & sandstone

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Ra-226

Method of Concentration Determination: UDAD

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual: 2 mi, Shirley Basin Townsite

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Text Description (page): 2-53

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 1982/04

2.1.6.7 Rocky Mountain Energy Co., Bear Creek Mill (Code # WY-N-C-12)

The Bear Creek Mill is part of a uranium project that includes open-pit mining operations in Converse County, Wyoming, about 72 km (45 mi) northeast of Casper. The site is in the southern portion of the Eastern Powder River Basin, between the Bighorn Mountains and the Black Hills. The mill is located in the Bear Creek watershed, which drains northeastward into the Cheyenne River. The Bear Creek drainage area is mostly flat, with some rolling hills and ridges consisting of outcropping sandstone. The site is within the Thunder Basin National Grassland, which consists of intermingled federal, state, and private land.

Rocky Mountain Energy Co. dedicated its 900 MT (990 ST) per day Bear Creek complex on September 22, 1977. Production has since been increased to 1270 MT (1400 ST) per day, a rate that will likely be maintained until 1990. The U_3O_8 content of the ore ranges from less than 0.1% to 1.0%. Rocky Mountain Energy has mineral claims and leases for all of the uranium ore deposits the company plans to mine.

The tailings impoundment is 300 m (1000 ft) west of the mill in a natural basin enclosed by an earth and rock dam. The dam is in a valley of the intermittently flowing Long Creek, a tributary of Bear Creek. The dam will have a maximum height of 15 m (50 ft) and a length of 460 m (1500 ft). Embankment materials for the dam will come from borrow excavation of weakly cemented bedrock in mine pits. An offsite source will furnish the graded gravelly sand material to be placed in the chimney drain.

The total area of tailings retention is 61 ha (150 acres). About 48 ha (120 ac) (80%) are covered with liquid, and the remaining 12 ha (30 ac) are exposed as dry beaches. The average depth of tailings will be about 7 m (23 ft) by the end of 20 years of operation. The area is underlain by alluvium and claystone of relatively limited permeability.

To improve stability, seepage through the tailings dam foundation will be controlled by excavating a cutoff trench to the top of the bedrock beneath the center of the dam and backfilling with impervious material. Construction of a 5-m (17-ft) (maximum height) dike about 240 m (800 ft) downstream of the tailings dam has been proposed as an additional measure to contain seepage from the tailings pond. Extending upstream from the dike's center will be a bentonite-filled trench reaching down to bedrock. Seepage collected in this trench will be pumped back to the tailings pond.

Reclamation will be staged, with the initial efforts beginning as soon as an area has reached sufficient depth and dryness (probably within six years). The tailings will be covered with a 25-cm (10-in) compacted clay cap and then with 1.8 m (6 ft) of earth, of which at least the top 15 cm (6 in) will be topsoil. Soil amendments (e.g., fertilizer, organic matter) will be added as necessary. The area will be revegetated with appropriate plant species. A monitoring and maintenance program will be established following reclamation to ensure stability of the pile.

Rocky Mountain Energy has also submitted a general plan for decommissioning of the processing facilities and ancillary structures. The firm will be required to submit a more detailed program near the end of the useful life of the project.

The amount of tailings under management is about 2.7×10^6 MT (3×10^6 ST).

Facility Name: Bear Creek Mill
Type: Conventional Uranium Mill

Code Number: WY-N-C-12

Location -

Site Name: Bear Creek City: Casper State: WY County: Converse

Ownership -

Owner: Rocky Mountain Energy Corp. Mill Contact: John Yellich
Address: 10 Long Peaks Drive Title: Env. Coordinator
Box 200, Broomfield, CO 80020 Telephone: 303-469-8844

LICENSING DATA

Regulatory Authority: NRC First Issued: 1977
License Number: SUA 1310 Last Renewed in Entirety:
Current Status of Operation: Active Last Amended: 81/11
Days of Operation/Year: 280 Expires: 82/7
Project Life (years, est): 1987 Surety Type: Bond
Years for Complete Reclamation: 5 Surety Amount: \$50 million
Surety Holder: American Ins. Co., SF, CA

PROCESSING OF URANIUM

Name of Mine: Bear Creek Grinding Method: SAG U₃O₈ Production
(tons/year): 800
Type: Surface Leach Method: Acid
Ore Grade (%): 0.10-0.15 Clarification: CCD
Metals in Ore Recovered: None Concentration: SX U₃O₈ Purity (%): 90
Extraction Efficiency (%): 98% Precipitation: NH₃
Throughput (tons/day): 2000 Calcining Temp: 1200°F

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 3x10⁶ Total Pond Area (acres): 50 % Water Recycled: 36
Total Area, Tailings (acres): 150 Number Evaporation Ponds: None
Method of Tailings Disposal: Above ground pH: 1.3 Mill Water Consumption
(gpm): 280
Liner Types: None Dam Height (feet, AGL): 60 Seepage Rate
(gpm): 10
Cover Material: Clay, subsoil, topsoil Freeboard Height (feet): 10
Thickness: 7 feet Construction Method of Dam: Earth & rock dam
Rn Flux (pCi/m²/s): 280 Underlying Strata: Alluvium-sand, silt, clay

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Ra-226, Rn-222
Method of Concentration Determination: UDAD
Dose to Nearest Offsite Individual: 4.6 mrem/year (bone)
Location of Nearest Offsite Individual: Manning Ranch, 3 mi WSW
Dose at Site Boundary (nearest downwind):
Dose at Site Boundary (closest to source):

Text Description (page): 2-55

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 1982/04

2.1.6.8 Union Carbide Corp., East Gas Hills Mill (Code # WY-N-C-14)

The East Gas Hills Mill is part of the Union Carbide Uranium Project in the southeastern portion of the Wind River Basin of Wyoming. The mill is about 95 km (60 mi) west of Casper in an area of rolling hills interspersed with relatively flat areas.

An acid-leach system (RIP-Eluex system) is used for recovery of uranium. Recycled solution from the impoundment system is used to wash sands after sand-slime separation. Additional pond decant solution is used for tailings dilution. The mill began operations in early 1960 with a capacity of about 1000 MT (1100 ST) per day; in January 1980, the capacity was increased to 1300 MT (1400 ST) per day. Open-pit operations at company-owned mines in East and West Gas Hills supply the ore. Sufficient ore is proven to maintain the current milling rate for five to ten more years. During the anticipated total active life of the project (1960-1986), about 12×10^6 MT (13×10^6 ST) of mill tailings will have been produced. The retention capacity [7.6×10^6 MT (8.4×10^6 ST)] of the mill's original above-grade tailings impoundment has been reached, and since January 1980, tailings have been discharged to a depleted open-pit mine with a capacity of 2.3×10^6 MT (2.5×10^6 ST). The pit has an area of 11 ha (26 ac), is clay-lined on the bottom, and has an in-pit dewatering system. The associated evaporation area consists of two ponds with a combined surface area of 9.7 ha (24 ac). A second mine pit will be available for tailings disposal in 1982. The maximum height of the embankment of the original abovegrade tailings pond (and expansions) is about 14 m (45 ft). The pool depth is about 3 m (10 ft). The original retention system has an area of 60 ha (150 ac), of which 12 ha (30 ac) are covered by liquid. An area of about 40 ha (100 ac) of the total 50 ha (120 ac) of dry tailings deposit is considered effective area for source-term estimation.

Seepage from the original tailings pond averages about 6.3 L/s (100 gpm). The vertical and lateral velocities of the seepage front are estimated to be a maximum of about 30 m (100 ft) per year and 12 m (40 ft) per year, respectively. Changes in water characteristics measured in monitoring wells on the site have indicated that there has been some flow of tailings water and migration of some ions from the pond to the adjacent and underlying overburden. There is no evidence, however, that toxic elements such as selenium or arsenic have yet reached the monitor wells. Radioactive contaminants in onsite wells are well below the limits set for unrestricted areas. Seepage from the tailings stored at the A-9 open-pit mine and associated evaporation ponds is expected to be within the range of 1 to 2.5 L/s (17 to 40 gpm).

Upon cessation of operations, the area devoted to the mill will be reclaimed and returned to its former use as rangeland, but the 60-ha (148-ac) tailings area and 2-ha (5-ac) heap leach area may be unavailable for further productive use. Under the present reclamation plan, Union Carbide is committed to provide a uniform cover of 0.3 m (1 ft) of clay and 3 m (10 ft) of overburden over the entire tailings area. This will require about $180,000 \text{ m}^3$ ($6.5 \times 10^6 \text{ ft}^3$) of clay costing \$454,000 and $1.8 \times 10^6 \text{ m}^3$ ($65 \times 10^6 \text{ ft}^3$) of overburden costing \$1,840,000. When the cost of revegetation is added, the basic materials needed for the reclamation program will cost about \$2,400,000. Union Carbide has also provided a general plan for the decommissioning of the mill structures and will submit a detailed plan prior to termination of the milling operation. Union Carbide is committed to maintaining a surety bond with the State of Wyoming to cover reclamation and mill-decommissioning costs.

Union Carbide also operates a heap leach facility in the mill area at its East Gas Hill site. The water used in the process [1.7 L/s (27 gpm)] is taken from a nearby mine pit, and U_3O_8 is recovered from the high-grade leach liquor by a solvent-extraction process. The organic phase is pumped to the existing mill circuit. Union Carbide expects to recover 140,000 kg (310,000 lb) of U_3O_8 from the low-grade ore.

Facility Name: East Gas Hills Mill

Code Number: WY-N-C-14

Type: Conventional Uranium Mill

Location -

Site Name: East Gas Hills Mill

City: Casper

State: WY County: Natrona

Ownership -

Owner: Union Carbide Corp.

Mill Contact: Tom Wong

Address: Gas Hills Station

Title: Env. Coordinator

Riverton, WY 82501

Telephone: 307-457-2311

LICENSING DATA

Regulatory Authority: NRC

First Issued: 1960

License Number:

Last Renewed in Entirety: 1981

Current Status of Operation: Active

Last Amended: 81/12

Days of Operation/Year: 355

Expires: 86/1

Project Life (years, est): 1985

Surety Type:

Years for Complete Reclamation:

Surety Amount: \$4 million

Surety Holder:

PROCESSING OF URANIUM

Name of Mine:

Grinding Method: SAG

U₃O₈ Production
(tons/year): 650

Type: Surface

Leach Method: Acid

Ore Grade (%): 0.15-0.18

Clarification: SS

Metals in Ore Recovered: None

Concentration: SX

U₃O₈ Purity (%): 95

Extraction Efficiency (%): 92

Precipitation: NH₃

Throughput (tons/day): 1400

Calcining Temp:

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 8.4x10⁶

Total Pond Area (acres): 130

% Water Recycled: 56

Total Area, Tailings (acres): 174

Number Evaporation Ponds: 2

Method of Tailings

pH: 1.6

Mill Water Consumption
(gpm): 240

Disposal: Below grade (old mine)

Liner Types: clay cap

Dam Height (feet, AGL): 45

Seepage Rate
(gpm): 100

Cover Material: Clay, overburden

Freeboard Height (feet):

Thickness: 11 feet

Construction Method
of Dam:

Rn Flux (pCi/m²/s):

Underlying
Strata: Coarse sand with silt

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination: MILDOS

Dose to Nearest Offsite Individual: 2.24 mrem/year (lung)

Location of Nearest Offsite Individual: J&E Ranch 5 mi NE

Dose at Site Boundary (nearest downwind): 41.9 mrem/year

Dose at Site Boundary (closest to source):

Text Description (page): 2-58

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 82/4

2.1.6.9 Western Nuclear, Inc., Split Rock Mill (Code # WY-N-C-19)

The Split Rock Uranium Mill is part of Western Nuclear's operations in the Crook's Gap and Gas Hills Uranium Districts of Fremont County, Wyoming. The operations include the Split Rock mill, the Green Mountain IX plant, the Day-Lona and Bullrush heap leaches, and the Frazer-Lamac and Roxmine sites. The Green Mountain IX plant recovers soluble natural uranium (90% efficient) from mine water, at a current rate of 9.5 to 13 L/s (150 to 200 gpm) of water containing 14 to 20 ppm U_3O_8 . The Day-Loma, Bullrush, Frazier-Lamac, and Roxmine facilities, at which treatment of source materials was previously authorized, are inactive at present and licensed for possession only.

The mill is 3.2 km (2 mi) north of Jeffrey City, Wyoming, at the base of several foothills of the Granite Mountains. The Split Rock mill began operations in 1957 with an ore-processing capacity of 360 MT (400 ST) per day. Major modifications and modernizations of the process have increased the processing rate to 1500 MT (1650 ST) per day. About half of the daily ore feed for the mill comes from open-pit mines in the Gas Hills district and half from Western Nuclear's underground operations in the Crook's Gap district. The ore grade has ranged from 0.15% to 0.30% U_3O_8 during past operations and is expected to range from 0.05% to 0.15% in the future.

Tailings have been deposited in an area east to southeast of the plant since the beginning of operations. On April 12, 1977, tailings slurry escaped from the impoundment as a result of a breach in the embankment at the northwestern corner of the pond. About 10 m (33 ft) of the embankment was breached, resulting in the release of about 7.5×10^6 L (2.0×10^6 gal) of tailings slurry. Mitigative measures implemented since the incident should prevent similar failures in the future.

For the estimated 20 remaining years of mill operation, the retention embankment will be incrementally increased. The active tailings-disposal area now occupies 34 ha (85 ac). The tailings pond surface area is about 20 ha (50 ac). It is estimated that in 20 years the area occupied by the current and old tailings pond, dam, and embankment will have increased to a maximum of about 90 ha (230 ac). Therefore, over half of the 160-ha (400-ac) site will be occupied by the tailings area. Of this, 50 ha (125 ac) will be subject to dust and radon emission. Western Nuclear will use chemical and physical methods to control dust emissions.

Substantial seepage [76 L/s (1200 gpm)] of tailings water is occurring and will continue to occur with the current tailings management plan. About 85% of the liquid effluent pumped to the tailings pond is lost by seepage, the highest percentage of any mill for which seepage data are available. Six to eight surface seepage ponds, radiating out from the tailings pond to the south and southwest, are usually present (total surface area of at least 2.5 ha, or 6 ac). The most obvious indicators of this seepage are the acidic pH and high concentrations of NO_3-N , NH_3-N , sulfates, and Mn, as well as elevated trace- and heavy-element concentrations, in the seepage pond waters. Seepage has resulted in some degradation of onsite and adjacent offsite groundwater.

Western Nuclear's proposed reclamation plan includes placement of a clay cap over the dried, regraded tailings and for 15 m (50 ft) beyond the tailings pile. The clay cap will be compacted to a thickness of 0.3 m (1 ft), and

1.8 m (6 ft) of local soil will be placed over the cap and compacted. The area then will be covered with topsoil and revegetated. Currently 11×10^6 MT (12×10^6 ST) of tailings are under management.

This mill was shut down in June 1981.

Facility Name: Split Rock Mill
Type: Conventional Uranium Mill
Location -

Code Number: WY-N-C-19

Site Name: Split Rock Mill
Ownership -
Owner: Western Nuclear, Inc.
Address: 134 Union Blvd.
Lakewood, CO 80228

City: Jeffrey City State: WY County: Fremont
Mill Contact: Grey Boyden
Title: Dir., Env. & Ind. Safety
Telephone: 303-986-4571

LICENSING DATA

Regulatory Authority: NRC
License Number: SUA-56
Current Status of Operation: Inact. since 1981/06
Days of Operation/Year: 348
Project Life (years, est): 2000
Years for Complete Reclamation: 5

First Issued: 1957
Last Renewed in Entirety: 80/12
Last Amended: 81/12
Expires: 85/12
Surety Type: Bond
Surety Amount:
Surety Holder:

PROCESSING OF URANIUM

Name of Mine: Golden Eagle
Type: Underground & surface
Ore Grade (%): 0.05-0.15
Metals in Ore Recovered: None
Extraction Efficiency (%): 95
Throughput (tons/day):

Grinding Method: SAG
Leach Method: Acid
Clarification: SS
Concentration: SX
Precipitation: NH₃
Calcining Temp:

U₃O₈ Production
(tons/year): 1650

U₃O₈ Purity (%): 90-95

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): 12x10⁶ Total Pond Area (acres): 46
Total Area, Tailings (acres): 85 Number Evaporation Ponds: None
Method of Tailings Disposal: Above ground pH: 1.7
Liner Types: None Dam Height (feet, AGL): 33
Cover Material: Clay, local soil (sand), topsoil Freeboard Height (feet):
Thickness: 7+ feet Construction Method of Dam: Fan type
Rn Flux (pCi/m²/s): Underlying Strata: Sandy subsoil

% Water Recycled: None

Mill Water Consumption (gpm): 1415

Seepage Rate (gpm): 1200

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Ra-226
Method of Concentration Determination: MILDOS
Dose to Nearest Offsite Individual: 9.6 mrem/yr (lung)
Location of Nearest Offsite Individual: 1 mi. E
Dose at Site Boundary (nearest downwind): 17 mrem/yr (lung)
Dose at Site Boundary (closest to source):

Text Description (page): 2-61

Data Compiled by: Ron Sundell Date Compiled: 1982/01/11

Date Data Revised: 1982/04

2.2. IN-SITU OPERATIONS

The term "in-situ" refers to a mining method in which a chemical solution (lixiviant) that solubilizes uranium is injected under pressure into an underground ore deposit and the enriched solution is pumped to the surface for extraction of uranium by chemical means. In recent years, in-situ leaching (solution mining) of uranium has proven to be an efficient method of uranium production. It reduces the need for conventional milling throughout the United States. The primary advantage of in-situ leaching is that it permits economical recovery of low-grade uranium deposits, thereby enhancing the nation's uranium reserves. The average grade of ore mined is about 0.05% U_3O_8 , ranging from 0.02 to 0.12% U_3O_8 .

Ideally, the ore body should be underlain by an impermeable stratum to prevent loss of lixiviant to other formations. Solution movement is controlled by forced flow through properly spaced injection and production (recovery) wells. Water-pressure differential confines the lixiviant within the limits of the well pattern, which usually includes four injection wells evenly spaced around one production well. A production unit consists of multiple well patterns interconnected in one specific area.

The lixiviant is prepared with onsite groundwater and with chemicals selected to cause dissolution of the uranium. The chemicals used depend upon characteristics of the ore formation, groundwater makeup, and certain environmental considerations, and usually consist of an anionic agent such as bicarbonate/carbonate, plus a strong oxidant to solubilize the uranium. The most widely used carbonates are ammonium carbonate and sodium carbonate. Hydrogen peroxide and pure oxygen are the only oxidants used. A high volume of pure oxygen dissolved in the lixiviant stream is rapidly gaining acceptance as the most efficient oxidant. Overall efficiency of the leaching process improves as depth and formation pressure increase.

The uranium-rich solution is pumped to the surface and passed through an ion-exchange system where the uranium is collected on resin beads. The barren lixiviant is recycled and prepared chemically for reinjection into the leach field. The loaded resin is then passed through an elution column where the uranium is removed and transferred as slurry to the precipitation circuit. The uranium-bearing slurry is passed through a thickener and finally a centrifuge to increase the uranium content to about 60% U_3O_8 . After precipitation and thickening, the material is either dried and packaged at the site or is shipped as a slurry concentrate to a conversion facility.

Criteria and conditions for successful solution mining operations are: (1) the ore deposits must be located below the static water table, (2) the ore must be confined both above and below by impervious layers, (3) the deposit must have adequate permeability, (4) the mineralogy of the ore must be determined to choose the proper chemical leaching process, and (5) the direction and velocity of underground regional waterflow must be known.

Potential advantages to in-situ solution mining compared with conventional mining and milling methods are as follows. In-situ leaching permits the recovery of lower-grade mineralization, minimizes environmental impact, and reduces capital costs and manpower requirements. The potential disadvantage is related to the groundwater restoration at the end of the leach cycle. Experience with the cleanup process has been limited to a few cases. Thus

far, complete restoration has proven to be difficult (lasting as long as seven years) but results have been acceptable. New technology is under development which considers use of smaller amounts of chemical reagent and introduction of more oxygen into the lixiviant to facilitate the final cleanup process.

Development of in-situ mining and milling has been rapid. Texas, an Agreement State, has large ore deposits of the type best suited for in-situ mining. There were three uranium production facilities using in-situ mining in the United States in 1976, all of which were in Texas. By 1981, this number had increased to 15 licensed operations in Texas and 2 in Wyoming. Twelve more projects are in planning or pilot stages but are not yet licensed for production. Operations at the Irigary site in Wyoming have been temporarily suspended.

Development of methods for waste management and disposal of the by-products from in-situ mining has also been rapid. Operations in Texas have been in the forefront of this work, and the methods used there are typical of those used in other in-situ projects throughout the United States.

The majority of in-situ mining wastes consists of bleed-off solutions of used lixiviant, wash solutions from the ion-exchange column filter media, eluant bleed solutions, and used plant water (sanitary and laboratory). All such solutions are pumped to a small wastewater pond (typically less than one acre) for natural evaporation.

The liquid wastes, which are not normally segregated as to radioactivity, are disposed of by reinjection into the earth. Reinjection of these wastes at depths of about 10 times the in-situ mine depth is the predominant method licensed in Texas. Licenses have also been granted to reinject wastes into deep oil wells for use in secondary or tertiary oil-recovery systems. The radioactivity in such liquid wastes is considered minimal.

Solid wastes (mostly metal carbonates and used resin) that result from filtering operations are placed in a designated solid-waste impoundment. Radioactive solid wastes are segregated, and after thickening they are drummed separately and stored for transport to licensed disposal sites. Licensed sites for radioactive solids include tailing piles of conventional mills. (For example, much of the drummed radioactive solid wastes from in-situ projects in Texas are being disposed of at the Conquista tailings pile.)

When a leach zone is depleted, as evidenced by the uranium content of the production solution, restoration begins. It is achieved by groundwater sweeping, also referred to as pore-volume flushing or pore-volume displacement. This procedure, which has been approved by the State of Texas, involves simultaneous active and passive restoration activities. Active restoration consists of withdrawal of residual fluids from the well field by pumping. Passive restoration consists of the migration of uncontaminated groundwater from outside the field inward in response to pumping, thus displacing residual fluids that have not yet been extracted by pumping.

Fluids recovered by the active restoration technique are treated by reverse osmosis. The reject stream is disposed by subsurface injection. The purified stream can be sprayed onto the permit area as part of the surface restoration and irrigation program and/or reinjected into the host formation for subsurface

restoration. If for any reason the purified stream does not meet acceptable standards for surface irrigation, reverse osmosis treatment is stopped and all fluids are disposed of by subsurface injection.

Restoration rate is monitored by analyzing water samples taken from a network of monitoring wells. The samples are analyzed for ion conductivity, uranium, radium-226, and other pertinent constituents. When evaluation of the data indicates that adequate restoration has occurred, i.e., measurements are at or near original baseline measurements, designated production-zone wells are sampled and analyzed to establish the end point of the restoration process.

The reclamation and restoration procedures are designed with the objective that long-term care and ongoing active maintenance will not be required for the site, and the surface will be returned to its prior use. With respect to aquifer restoration, it is believed that under ideal conditions, groundwater from outside the leaching field will completely displace the lixiviant, thus producing a water quality condition that is the same as the average baseline quality.

The recovered uranium is shipped in a slurry form (about 50% solids) to another site (such as a conversion facility), or to a conventional mill for drying or calcining, or it may be dried on the site. Depending upon many of the parameters contained in the following data charts, production rates of producing in-situ projects vary from 100 to 500 tons U_3O_8 per year.

All licensed in-situ facilities are listed alphabetically by owner and state in Table 2.2-1. Data sheets on individual facilities are presented on following pages.

Table 2.2-1. Owners, Names, and Locations of Existing In-Situ Mining Facilities (alphabetical by owner)

Owner	Site	State	Code	Page
Caithness Mining Corp.	McBryde Joint Venture	TX	TX-A-IS-15	2-68
Chevron Resources Co.	Palangana Dome Project	TX	TX-A-IS-14	2-69
Conoco, Inc.	Trevino	TX	TX-A-IS-13	2-70
Everest Minerals Corp.	Hobson Solution Mining Project	TX	TX-A-IS-12	2-71
Everest Minerals Corp.	Las Palmas Project	TX	TX-A-IS-11	2-72
Everest Minerals Corp.	Mt. Lucas Project	TX	TX-A-IS-10	2-73
Inter-Continental Energy Corp.	Zamzow/Pawnee*	TX	TX-A-IS-09	2-74
Nufuels Corp. (Mobil)	El Mesquite-Holiday-O'Hearn Projects	TX	TX-A-IS-08	2-75
Nufuels Corp. (Mobil)	Nell Project	TX	TX-A-IS-07	2-76
Nufuels Corp. (Mobil)	Piedra-Lumbre	TX	TX-A-IS-06	2-77
Ogle Petroleum, Inc.	Bison Basin Project	WY	WY-N-IS-17	2-84
Tenneco Uranium Co.	West Cole Project	TX	TX-A-IS-05	2-78
Uranium Resources, Inc.	Longoria Project**	TX	TX-A-IS-03	2-79
Uranium Resources, Inc.	Benavides Project**	TX	TX-A-IS-18	2-80
U.S. Steel	Texas Uranium Operations	TX	TX-A-IS-04	2-81
Wyoming Minerals Corp.	Bruni Project	TX	TX-A-IS-02	2-82
Wyoming Minerals Corp.	Lamprecht Project	TX	TX-A-IS-01	2-83
Wyoming Minerals Corp.	Irigaray Project	WY	WY-N-IS-16	2-85

*Two sites, but same license number.

**The Longoria and Benavides projects are operated under the same license.

Facility Name: McBryde Joint Venture

Code Number: TX-A-IS-15

Type: In-situ Mine

Location -

Site Name: McBryde

City: Hebbronville

State: TX County: Duval Co.

Ownership -

Mill Contact: Carl Bowden/Armando Salinas

Owner: Caithness Mining Corp.

Title: RSO

Address: P.O. Box 818

Telephone: (512) 527-4078

Hebbronville, TX 73681

LICENSING DATA

Regulatory Authority: TX

First Issued: 1980/12

License Number: 8-2922

Last Renewed in Entirety: New

Current Status
of Operation: Active

Last Amended: 1980/02

Days of Operation/Year: 365

Expires: 1983/12

Project Life (years, est.): 5

Surety Type: None

Years for Complete Restoration: 3

Surety Amount: None

Surety Holder: None

PROCESSING OF URANIUM

Permit Area (acres): 401

Ore Grade (%): 0.07

Precipitation: HCl, H₂O₂, NaOH

Well Field Area (acres): 16.3

Lixiviant Type: NaCl + oxidant

Calcining Temp: Not calcined

Production Zone
Area (acres): 16.3

Flow Rate to
Extractor (gpm): 1000

U₃O₈ Production
(tons/yr): 100

Number of Injection
Wells: 12/unit

Uranium Content of Pregnant
Solution:

By-Products
Recovered: None

Number of Production
Wells: 6/unit

Extraction Efficiency (%):

U₃O₈ Transportation

Concentration: IX

Form: Slurry (Kerr-McGee)

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons):

Total Pond Area (acres):

Reinjection Rate
(gpm):

Method of Solid Waste
Disposal: Conquista tailings pile

Number Evaporation
Ponds: 1

Lixiviant Recycle Rate
(gpm): About 60%

Number of Disposal
Wells: 2

Number Calcite Ponds: None

Seepage Rate
(gpm): About 60%

Liner Types: Synthetic

pH: Above 7

Cover Material:

Freeboard Height (feet):

Thickness: 36 mil

Underlying Strata: Sand

Rn Flux (pCi/m²/s): 25.5 Ci/yr

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: Rn-222 only

Method of Concentration Determination: Plant production rates

Dose to Nearest Offsite Individual: 7.3 mrem/year

Location of Nearest Offsite Individual: 1 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Palangana Dome Project

Code Number: TX-A-IS-14

Type: In-situ Mine

Location -

Site Name: Palangana Dome Proj. City: Box 528, Benavides State: TX County: Duval

Ownership -

Mill Contact: Carlos Hughes

Owner: Chevron Resources

Title: Mine manager

Address: 1746 Cole Blvd. P.O. Box 4001

Telephone: (512) 256-3337

Golden, CO, 80401

LICENSING DATA

Regulatory Authority: TX

First Issued: 1968/03

License Number: 8-1234

Last Renewed in Entirety: Under review

Current Status
of Operation: Inactive (1980/12)

Last Amended:

Days of Operation/Year: 365

Expires: 1978/12

Project Life (years, est.): 11

Surety Type:

Years for Complete Restoration: 3

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Permit Area (acres): 31

Ore Grade (%): 0.08

Precipitation:

Well Field Area (acres):

Lixiviant Type: Bicarbonate

Calcining Temp: Low fired

Production Zone

Flow Rate to
Extractor (gpm):

U₃O₈ Production
(tons/yr): 45

Area (acres): 3

Number of Injection

Uranium Content of Pregnant
Solution: 32 ppm

By-Products
Recovered: None

Wells: 1800

Number of Production

Extraction Efficiency (%): 75

U₃O₈ Transportation
Form: Wet

Wells: 450

Concentration:

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons): Small

Total Pond Area (acres): 1

Reinjection Rate
(gpm):

Method of Solid Waste
Disposal:

Number Evaporation
Ponds: 2

Lixiviant Recycle Rate
(gpm):

Number of Disposal
Wells:

Number Calcite Ponds: None

Seepage Rate
(gpm):

Liner Types: Hypalon

pH: 7.4

Cover Material: Earthen

Freeboard Height (feet):

Thickness:

Underlying Strata:

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual:

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Trevino

Code Number: TX-A-IS-13

Type: In-situ Mine

Location -

Site Name: Trevino

City: Box 579 Hebronville State: TX County: Duval

Ownership -

Mill Contact: Calvin Dupnik/Don Potter

Owner: Conoco, Inc.

Title:

Address: 557 17th St.

Telephone: (512) 527-4093

Denver, CO 80202

LICENSING DATA

Regulatory Authority: TX

First Issued: 1980/12

License Number: 8-2923

Last Renewed in Entirety: New

Current Status
of Operation: Active

Last Amended:

Days of Operation/Year: 365

Expires: 1983/12

Project Life (years, est.): 7

Surety Type: Self

Years for Complete Restoration: 3

Surety Amount:

Surety Holder: Conoco

PROCESSING OF URANIUM

Permit Area (acres): 5840

Ore Grade (%):

Precipitation: HCl, H₂O₂, NaOH

Wellfield Area (acres): 200

Lixiviant Type: HCO₃ + oxidant

Calcining Temp: Not done

Production Zone

Flow Rate to

U₃O₈ Production

Area (acres): 152

Extractor (gpm): 3600

(tons/yr): 375

Number of Injection
Wells:

Uranium Content of Pregnant
Solution:

By-Products
Recovered: None

Number of Production
Wells:

Extraction Efficiency (%):

U₃O₈ Transportation
Form: Slurry

Concentration: IX

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons): Minimal

Total Pond Area (acres): 4

Reinjection Rate
(gpm):

Method of Solid Waste
Disposal: Conquista tailings pond

Number Evaporation
Ponds: 2

Lixiviant Recycle Rate
(gpm): 2200

Number of Disposal
Wells: 2

Number Calcite Ponds: 1

Seepage Rate
(gpm): 2200

Liner Types: 30 mil plastic

pH: Above 7

Cover Material:

Freeboard Height (feet):

Thickness:

Underlying Strata: Clay and Shale

Rn Flux (pCi/m²/s): Rel. 95.4 Ci/yr

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual: 25 mrem/year

Location of Nearest Offsite Individual: 1 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Hobson Solution Mining Project

Code Number: TX-A-IS-12

Type: In-situ Mine

Location -

Site Name: Hobson

City: Hobson

State: TX County: Karnes

Ownership -

Owner: Everest Minerals Corp.

Mill Contact: Lupe Rocha

Title:

Address: P.O. Box 1339

Telephone: (512) 873-7301

Corpus Christi, TX 78403

LICENSING DATA

Regulatory Authority: TX

First Issued: 1979/06

License Number: 8-2663

Last Renewed in Entirety:

Current Status

Last Amended: 1982/02

of Operation: Active

Days of Operation/Year: 365

Expires: 1982/06

Project Life (years, est.): 11

Surety Type: Self

Years for Complete Restoration: 9

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Permit Area (acres): 182.0

Ore Grade (%): 0.07-0.18

Precipitation: HCl, H₂O₂, NaOH

Well Field Area (acres): 70.3

Lixiviant Type: Alk. CO₃ + oxidant

Calcining Temp: None

Production Zone

Flow Rate to

U₃O₈ Production

Area (acres): 27.3

Extractor (gpm):

(tons/yr): 100

Number of Injection

Uranium Content of Pregnant

By-Products

Wells: 50

Solution: 200 ppm

Recovered: Mo, if needed

Number of Production

Extraction Efficiency (%): 70-80

U₃O₈ Transportation

Wells: 22

Concentration: IX

Form: Slurry

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons): Minimal

Total Pond Area (acres):

Reinjection Rate

(gpm): 10, waste liq.

Method of Solid Waste

Number Evaporation

Lixiviant Recycle Rate

Disposal: Conquista

Ponds: None

(gpm):

Number of Disposal

Number Calcite Ponds: 1

Seepage Rate

Wells:

(gpm):

Liner Types: 30 mil plastic

pH:

Cover Material:

Freeboard Height (feet): 12

Thickness:

Underlying Strata:

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Pb-210, Ra-226, Ra-222

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual: Less than 1 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Las Palmas Project

Code Number: TX-A-75-11

Type: In-situ Mine

Location -

Site Name: Las Palmas

City: Hebbronville

State: TX County: Jim Hogg & Duval

Ownership -

Owner: Everest Minerals

Mill Contact: Tom Demming

Title:

Address: 1420 Bank and Trust Twr, P.O. Box 1339

Telephone: (512) 883-2831

Corpus Christi, TX 78403

LICENSING DATA

Regulatory Authority: TX

First Issued: 1981/01

License Number: 8-2929 (2 stages)

Last Renewed in Entirety: New

Current Status
of Operation: Active

Last Amended:

Days of Operation/Year: 365

Expires: 1986/01

Project Life (years, est.): 1988-1995

Surety Type: Self

Years for Complete Restoration: 2

Surety Amount:

Surety Holder: Everest Minerals

PROCESSING OF URANIUM

Permit Area (acres): 3100

Ore Grade (%): 0.07

Precipitation: HCl, H₂O₂, NaOH

Well Field Area (acres): 51

Lixiviant Type: HCO₃ & oxidant

Calcining Temp: Not done

Production Zone

Area (acres): 32

Flow Rate to
Extractor (gpm): 3000

U₃O₈ Production
(tons/yr): 100

Number of Injection

Wells: 180

Uranium Content of Pregnant
Solution: 40-120 ppm

By-Products
Recovered: None

Number of Production

Wells: 80

Extraction Efficiency (%): 70-80

U₃O₈ Transportation
Form: Resin or slurry

Concentration: IX

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons): Minimal

Total Pond Area (acres): None

Reinjection Rate
(gpm):

Method of Solid Waste
Disposal: Conquista

Number Evaporation
Ponds: None

Lixiviant Recycle Rate
(gpm): 2300

Number of Disposal
Wells:

Number Calcite Ponds:

Seepage Rate
(gpm): None

Liner Types: 36 mil Hypalon

pH:

Cover Material:

Freeboard Height (feet):

Thickness:

Underlying Strata: Clay

Rn Flux (pCi/m²/s): 25.5 Ci/year

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Pb-210, Ra-226, Rn-222

Method of Concentration Determination:

Dose to Nearest Offsite Individual: 7.3 mrem/yr

Location of Nearest Offsite Individual: 1 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Mt. Lucas Project

Code Number: TX-A-15-10

Type: In-situ Mine

Location -

Site Name: Dinero

City: Dinero

State: TX County: Live Oak

Ownership -

Mill Contact: Guadalupe L. Rocha

Owner: Everest Minerals

Title: RSO

Address: P.O. Box 1339

Telephone: (512) 887-7301

Corpus Christi, TX 78403

LICENSING DATA

Regulatory Authority: TX

First Issued: 1981/08

License Number: 8-3068

Last Renewed in Entirety:

Current Status

Last Amended: 1980/02

of Operation: Under development

Days of Operation/Year:

Expires: 1986/08

Project Life (years, est.):

Surety Type: Self

Years for Complete Restoration: 2

Surety Amount: Determined by state

Surety Holder: Everest Minerals

PROCESSING OF URANIUM

Permit Area (acres): 2772

Ore Grade (%):

Precipitation:

Well Field Area (acres): 200

Lixiviant Type: HCO₃ plus oxidant

Calcining Temp:

Production Zone

Flow Rate to

U₃O₈ Production

Area (acres):

Extractor (gpm):

(tons/yr): 150

Number of Injection

Uranium Content of Pregnant

By-Products

Wells:

Solution: 200 ppm

Recovered: None

Number of Production

Extraction Efficiency (%):

U₃O₈ Transportation

Wells:

Concentration: IX

Form: Slurry

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons):

Total Pond Area (acres): 1

Reinjection Rate

(gpm): Total

Method of Solid Waste

Number Evaporation

Lixiviant Recycle Rate

Disposal:

Ponds: 1

(gpm): Total

Number of Disposal

Number Calcite Ponds:

Seepage Rate

Wells:

pH:

(gpm):

Liner Types: 36 mil Hypalon

Freeboard Height (feet):

Cover Material:

Underlying Strata: Clay

Thickness:

Rn Flux (pCi/m²/s): 38.1 Ci/year

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual: 11 mrem/yr

Location of Nearest Offsite Individual: 1 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/08

Facility Name: Zamzow/Pawnee

Code Number: TX-A-IS-09

Type: In-situ Mine

Location -

Site Name: Pawnee

City: Pawnee

State: TX County: Live Oak/Bee

Ownership -

Owner: Inter-Continental Energy Corp.

Mill Contact: Richard Gustafson

Address: P.O. Box 107

Title: Env. Eng.

Tuleta, TX 78162

Telephone: (512) 786-2565

LICENSING DATA

Regulatory Authority: TX

First Issued: 1978/01

License Number: 8-2238

Last Renewed in Entirety: Under timely renewal

Current Status
of Operation: Rest. (Pawnee); prod. (Zamzow)

Last Amended:

Days of Operation/Year: 365

Expires:

Project Life (years, est.): 4

Surety Type:

Years for Complete Restoration: 3

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Permit Area (acres): 316

Ore Grade (%): 0.09-0.15

Precipitation: Steam

Well Field Area (acres): 34

Lixiviant Type: Bicarbonate

Calcining Temp: Low

Production Zone
Area (acres): 34

Flow Rate to
Extractor (gpm): 1500

U₂O₈ Production
(tons/yr): 100

Number of Injection
Wells: 393

Uranium Content of Pregnant
Solution: 20-60 ppm

By-Products
Recovered: None

Number of Production
Wells: 393

Extraction Efficiency (%): 80-90

U₃O₈ Transportation
Form: Dry

Concentration: IX

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons): Minimal

Total Pond Area (acres): Under 1

Reinjection Rate
(gpm):

Method of Solid Waste
Disposal: Conquista tailings pile

Number Evaporation
Ponds: 2

Lixiviant Recycle Rate
(gpm): 1500

Number of Disposal
Wells: 1

Number Calcite Ponds:

Seepage Rate
(gpm): Trace

Liner Types: PVC

pH: 7

Cover Material: None

Freeboard Height (feet):

Thickness: 30 mi

Underlying Strata:

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Pb-210, Ra-226, Rn-222

Method of Concentration Determination: Environmental data

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual: 25 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: El Mesquite-Holiday-O'Hearn Projects

Code Number: TX-A-IS-08

Type: In-situ Mine

Location -

Site Name: El Mesquite

City: Bruni/Hebbronville State: TX County: Duval and Webb

Ownership -

Mill Contact: Don Raver

Owner: Nufuels Corp. (Mobil)

Title: RSO

Address: P.O. Box 2688

Telephone: (512) 747-5401

Corpus Christi, TX 78403

LICENSING DATA

Regulatory Authority: TX

First Issued: 1977/12

License Number: 8-2436

Last Renewed in Entirety: 1980/03

Current Status
of Operation: Active

Last Amended: 1981/03

Days of Operation/Year: 365

Expires: 1980/12

Project Life (years, est.): 17

Surety Type: Bond

Years for Complete Restoration: 14

Surety Amount:

Surety Holder: TX

PROCESSING OF URANIUM

Permit Area (acres): 4500 (total) Ore Grade (%): 0.07

Precipitation: H₂O₂

Well Field Area (acres): 240

Lixiviant Type: Bicarbonate

Calcining Temp: 600°F

Production Zone

Flow Rate to
Extractor (gpm): 3200

U₃O₈ Production
(tons/yr): 750

Area (acres): 500 (3 leases)

Uranium Content of Pregnant
Solution: 30 ppm

By-Products
Recovered: None

Number of Injection
Wells: 650

Extraction Efficiency (%): 93-95

U₃O₈ Transportation
Form: Barrels, dry

Number of Production
Wells: 350

Concentration: IX

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons): Minimal

Total Pond Area (acres): None

Reinjection Rate
(gpm):

Method of Solid Waste

Disposal: Conquista tailings pile

Number Evaporation
Ponds: None

Lixiviant Recycle Rate
(gpm): 10,000

Number of Disposal
Wells: 2

Number Calcite Ponds: None

Seepage Rate
(gpm): None

Liner Types: None

pH:

Cover Material:

Freeboard Height (feet):

Thickness:

Underlying Strata: Sand/gravel

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Ra-226, Rn-222

Method of Concentration Determination: Rn-222 Env. Data (emissions)

Dose to Nearest Offsite Individual: Ann. av. emissions

Location of Nearest Offsite Individual:

Dose at Site Boundary (nearest downwind): Av. ann. boundary

Dose at Site Boundary (closest to source): 0.6 mi - 0.2 to 0.8 pCi/L

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Nell Project

Code Number: TX-A-IS-07

Type: In-situ Mine

Location -

Site Name: Nell

City: Pawnee

State: TX County: Bee and Live Oak

Ownership -

Owner: Nufuels Corp. (Mobil)

Mill Contact: J.L. Long/R. Powell

Title:

Address: P.O. Box 2688

Telephone: (512) 583-9804

Corpus Christi, TX 78403

LICENSING DATA

Regulatory Authority:

First Issued: 1978/11

License Number: 8-2600

Last Renewed in Entirety: Now being renewed

Current Status

Last Amended: 1981/08

of Operation: Inactive (1982/02)

Days of Operation/Year: 365

Expires: 1981/09

Project Life (years, est.):

Surety Type:

Years for Complete Restoration: 1

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Permit Area (acres): 1230

Ore Grade (%):

Precipitation:

Well Field Area (acres): 141

Lixiviant Type: NH₃

Calcining Temp: Low

Production Zone

Flow Rate to
Extractor (gpm):

U₃O₈ Production.
(tons/yr):

Area (acres): 14

Uranium Content of Pregnant
Solution:

By-Products
Recovered:

Number of Injection
Wells:

Extraction Efficiency (%):

U₃O₈ Transportation

Number of Production
Wells:

Concentration:

Form: Slurry to El Mesquite

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons):

Total Pond Area (acres): None

Reinjection Rate
(gpm):

Method of Solid Waste

Number Evaporation
Ponds: None

Lixiviant Recycle Rate
(gpm):

Disposal: Conquista tailings pile

Number Calcite Ponds: None

Seepage Rate
(gpm):

Number of Disposal
Wells:

pH:

Liner Types: None

Freeboard Height (feet):

Cover Material:

Underlying Strata:

Thickness:

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination: MILDOS

Dose to Nearest Offsite Individual: 0.9 mrem/year

Location of Nearest Offsite Individual: 0.6 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Piedra-Lumbre

Code Number: TX-A-IS-06

Type: In-situ Mine

Location -

Site Name: Piedra-Lumbre

City: Freer

State: TX County: Duval

Ownership -

Owner: Nufuels Corp. (Mobil)

Mill Contact: Richard Powell

Title:

Address: P.O. Box 2688

Telephone: (512) 394-7331

Corpus Christi, TX 78403

LICENSING DATA

Regulatory Authority: TX

First Issued: 1978/03

License Number: 8-2485

Last Renewed in Entirety:

Current Status

Last Amended: 1981/01

of Operation: Inactive (19C2/02)

Days of Operation/Year: 365

Expires: 1981/02

Project Life (years, est.):

Surety Type:

Years for Complete Restoration: 25

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Permit Area (acres):

Ore Grade (%):

Precipitation:

Well Field Area (acres): 300

Lixiviant Type: HCO₃-oxidant

Calcining Temp:

Production Zone

Flow Rate to

U₃O₈ Production

Area (acres):

Extractor (gpm):

(tons/yr): 750

Number of Injection
Wells:

Uranium Content of Pregnant
Solution:

By-Products
Recovered:

Number of Production
Wells:

Extraction Efficiency (%):

U₃O₈ Transportation

Concentration:

Form: Slurry to El Mesquite

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons):

Total Pond Area (acres): None

Reinjection Rate
(gpm):

Method of Solid Waste

Number Evaporation
Ponds:

Lixiviant Recycle Rate
(gpm):

Disposal: Conquista tailings pile

Number of Disposal
Wells:

Number Calcite Ponds:

Seepage Rate
(gpm):

Liner Types: None

pH:

Cover Material:

Freeboard Height (feet):

Thickness:

Underlying Strata: Sand/gravel

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: Ra-226

Method of Concentration Determination: Env. data (emissions)

Dose to Nearest Offsite Individual: Ann. av. emiss.

Location of Nearest Offsite Individual:

Dose at Site Boundary (nearest downwind): Av. around boundary (emiss.)

Dose at Site Boundary (closest to source): 0.6 mi -- 0.3 to 0.8 p Ci/L (emiss.)

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: West Cole Project

Code Number: TX-A-15-05

Type: In-situ Mine

Location -

Site Name: West Cole

City: PO Box 111, Bruni State: TX County: Webb

Ownership -

Mill Contact: David Benavides

Owner: Tenneco Uranium Co.

Title: RSO

Address: P.O. Box 1702

Telephone: (512) 747-5417

Corpus Christi, TX 78403

LICENSING DATA

Regulatory Authority: TX

First Issued:

License Number: 9-3024

Last Renewed in Entirety:

Current Status
of Operation: Active

Last Amended:

Days of Operation/Year: 365

Expires:

Project Life (years, est.): 9

Surety Type: Bond

Years for Complete Restoration:

Surety Amount:

Surety Holder: TX

PROCESSING OF URANIUM

Permit Area (acres): 600

Ore Grade (%): 0.07

Precipitation: HCl, H₂O₂, NaOH

Well Field Area (acres): 105

Lixiviant Type: HCO₃, O₂

Calcining Temp:

Production Zone

Flow Rate to
Extractor (gpm): 1300

U₃O₈ Production
(tons/yr): 50-100

Area (acres): 68

Uranium Content of Pregnant
Solution: 25 ppm

By-Products
Recovered: None

Number of Injection
Wells: 180

Extraction Efficiency (%): 97-98

U₃O₈ Transportation
Form: Slurry to conversion

Number of Production
Wells: 135

Concentration: IX

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons): Minimal

Total Pond Area (acres): 0.25

Reinjection Rate
(gpm): 300 to deep well

Method of Solid Waste
Disposal: Licensed site

Number Evaporation
Ponds: 2

Lixiviant Recycle Rate
(gpm): about 1300

Number of Disposal
Wells:

Number Calcite Ponds: None

Seepage Rate
(gpm): None

Liner Types: 30 mil Hypalon

pH: 6-8

Cover Material: Vegetative

Freeboard Height (feet): 2

Thickness:

Underlying Strata: Sand/gravel

Rn Flux (pCi/m²/s): 15 Ci/yr

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Rn-222

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual: 1.5 mi

Dose at Site Boundary (nearest downwind): 2 mrem/yr

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Longoria Project

Code Number: TX-A-IS-03

Type: In-situ Mine

Location -

Site Name: Longoria

City: PO Box 186, Bruni State: TX County: Duval

Ownership -

Mill Contact: Bill Chapman

Owner: Uranium Resources, Inc.

Title: RSO

Address: Suite 735, Promenade Bank Tower

Telephone: (512) 747-5411

Richardson, TX 75080

LICENSING DATA

Regulatory Authority: TX

First Issued: 1979/07

License Number: 8-2704

Last Renewed in Entirety:

Current Status

Last Amended:

of Operation: Active

Days of Operation/Year: 365

Expires: 1982/07

Project Life (years, est.):

Surety Type: Bond

Years for Complete Restoration: 3

Surety Amount:

Surety Holder: TX

PROCESSING OF URANIUM

Permit Area (acres): 600

Ore Grade (%): 0.07

Precipitation:

Well Field Area (acres):

Lixiviant Type: Bicarbonate

Calcining Temp: None

Production Zone

Flow Rate to

U₃O₈ Production

Area (acres): 65

Extractor (gpm): 800

(tons/yr): 50-100

Number of Injection

Uranium Content of Pregnant

By-Products

Wells: 30

Solution: 18-30 ppm

Recovered: None

Number of Production

Extraction Efficiency (%): 97

U₃O₈ Transportation

Wells: 30

Concentration: IX

Form: Slurry to Kerr-McGee

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons): None

Total Pond Area (acres): 0.25

Reinjection Rate
(gpm):

Method of Solid Waste

Number Evaporation

Lixiviant Recycle Rate

Disposal: Licensed disposal site

Ponds: 3

(gpm): 800

Number of Disposal

Number Calcite Ponds:

Seepage Rate

Wells:

(gpm): None

Liner Types: 30 mil hypalon

pH: 6-12

Cover Material: Grass

Freeboard Height (feet):

Thickness:

Underlying Strata: Sand

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Ra-226, Rn-222

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual: 1.5 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Benavides

Code Number: TX-A-15-18

Type: In-situ Mine

Location -

Site Name: Benavides

City: P.O. Box 186, Bruni State: TX County: Duval

Ownership -

Mill Contact: Bill Chapman

Owner: Uranium Resources, Inc.

Title: RSO

Address: Suite 735, Promenade Bank Tower

Telephone: (512) 747-5411

Richardson, TX 75080

LICENSING DATA

Regulatory Authority: TX

First Issued:

License Number:

Last Renewed in Entirety:

Current Status
of Operation:

Last Amended:

Days of Operation/Year:

Expires:

Project Life (years, est.):

Surety Type: Bond

Years for Complete Restoration: 3

Surety Amount:

Surety Holder: TX

PROCESSING OF URANIUM

Permit Area (acres): 200

Ore Grade (%): 0.07

Precipitation:

Well Field Area (acres): 20

Lixiviant Type: Bicarbonate

Calcining Temp:

Production Zone
Area (acres): 20

Flow Rate to
Extractor (gpm): 1200

U₃O₈ Production
(tons/yr): 50-100

Number of Injection
Wells: 180

Uranium Content of Pregnant
Solution: 18-30 ppm

By-Products
Recovered:

Number of Production
Wells: 180

Extraction Efficiency (%):

U₃O₈ Transportation
Form:

Concentration: IX

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons):

Total Pond Area (acres):

Reinjection Rate
(gpm):

Method of Solid Waste
Disposal:

Number Evaporation
Ponds: 3

Lixiviant Recycle Rate
(gpm): 1200

Number of Disposal
Wells:

Number Calcite Ponds:

Seepage Rate
(gpm): None

Liner Types:

pH: 6-12

Cover Material: None

Freeboard Height (feet): 2

Thickness:

Underlying Strata: Sand

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Th-230, Pb-210, Ra-226, Rn-222

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual: 1.5 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/07

Date Data Revised:

Facility Name: Texas Uranium Operations

Code Number: TX-A-IS-04

Type: In-situ Mine

Location -

Site Name: Clay West/Burns Rnch City: George West State: TX County: Live Oak

Ownership -

Mill Contact: Bruce Manninen

Owner: U.S. Steel

Title: RSO

Address: P.O. Drawer V

Telephone: (512) 566-2441

George West, TX 78022

LICENSING DATA

Regulatory Authority: TX

First Issued: 1977/12

License Number: 8-2449

Last Renewed in Entirety: Under renewal

Current Status

Last Amended: 1980/10

of Operation: Active until 1982/07

Days of Operation/Year: 365

Expires: 1980/11

Project Life (years, est.):

Surety Type: Self

Years for Complete Restoration:

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Permit Area (acres):

Ore Grade (%): 0.05

Precipitation: NH₃ or MgO

Well Field Area (acres): 2000

Lixiviant Type: O₂

Calcining Temp:

Production Zone

Flow Rate to
Extractor (gpm): 200

U₃O₈ Production
(tons/yr): About 500

Area (acres): 200

Number of Injection

Uranium Content of Pregnant
Solution: 6-13 ppm

By-Products
Recovered: None

Wells: 3700

Extraction Efficiency (%): 85-90

U₃O₈ Transportation
Form: Dry

Number of Production

Wells:

Concentration: IX

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons):

Total Pond Area (acres): 0.25

Reinjection Rate
(gpm): 2000

Method of Solid Waste

Number Evaporation
Ponds:

Lixiviant Recycle Rate
(gpm):

Disposal: Conquista or Barnwell

Number of Disposal

Number Calcite Ponds:

Seepage Rate
(gpm): Minimal

Wells: 6

Liner Types: Hypalon

pH: 6-8

Cover Material: Vegetative

Freeboard Height (feet): 3

Thickness:

Underlying Strata: Clay/sand

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat, Pb-210, Rn-222

Method of Concentration Determination: Env. data, UDAD

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual: 0.25 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Bruni Project

Code Number: TX-A-IS-02

Type: In-situ Mine

Location -

Site Name: Bruni

City: Bruni

State: TX County: Webb

Ownership -

Mill Contact: P.D. Hollingsworth

Owner: Wyoming Minerals Corp.

Title:

Address: P.O. Box 187

Telephone: (512) 747-5232

Bruni, TX 78334

LICENSING DATA

Regulatory Authority: TX

First Issued: 1978/06

License Number: 8-2537

Last Renewed in Entirety:

Current Status
of Operation: Active

Last Amended: 1981/05 (suspension requested)

Days of Operation/Year: 365

Expires: 1981/06

Project Life (years, est.):

Surety Type:

Years for Complete Restoration:

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Permit Area (acres):

Ore Grade (%):

Precipitation:

Well Field Area (acres):

Lixiviant Type:

Calcining Temp:

Production Zone
Area (acres):

Flow Rate to
Extractor (gpm):

U₃O₈ Production
(tons/yr): 250

Number of Injection
Wells:

Uranium Content of Pregnant
Solution:

By-Products
Recovered:

Number of Production
Wells:

Extraction Efficiency (%):

U₃O₈ Transportation
Form:

Concentration:

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons):

Total Pond Area (acres):

Reinjection Rate
(gpm):

Method of Solid Waste
Disposal:

Number Evaporation
Ponds:

Lixiviant Recycle Rate
(gpm):

Number of Disposal
Wells:

Number Calcite Ponds:

Seepage Rate
(gpm):

Liner Types:

pH:

Cover Material:

Freeboard Height (feet):

Thickness:

Underlying Strata:

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual:

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised:

Facility Name: Lamprecht Project

Code Number: TX-A-IS-01

Type: In-situ Mine

Location -

Site Name: Lamprecht

City: Oakville

State: TX County: Live Oak

Ownership -

Mill Contact: Howard Crawford

Owner: Wyoming Minerals Corp.

Title: Env. Manager

Address: Route 1, Box 650

Telephone: (512) 786-2568

Three Rivers, TX 78071

LICENSING DATA

Regulatory Authority: TX

First Issued: 1978/06

License Number: 8-2538

Last Renewed in Entirety:

Current Status
of Operation: Active

Last Amended: review to suspend operations

Days of Operation/Year: 365

Expires: 1981/06

Project Life (years, est.):

Surety Type: Bond

Years for Complete Restoration:

Surety Amount: \$7.2 mm

Surety Holder: TX

PROCESSING OF URANIUM

Permit Area (acres): 987

Ore Grade (%): 0.05-0.10

Precipitation:

Well Field Area (acres): 61

Lixiviant Type: NH₃/CO₂/H₂O₂

Calcining Temp:

Production Zone

Area (acres): 61

Flow Rate to
Extractor (gpm): 60

U₃O₈ Production

(tons/yr): More than 10

Number of Injection

Wells: 600

Uranium Content of Pregnant
Solution: 20 ppm

By-Products

Recovered: None

Number of Production

Wells: 1200

Extraction Efficiency (%): 75

U₃O₈ Transportation

Form: Slurry

Concentration:

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons): None

Total Pond Area (acres): 1/3

Reinjection Rate
(gpm): 60

Method of Solid Waste
Disposal:

Number Evaporation
Ponds: 2

Lixiviant Recycle Rate
(gpm):

Number of Disposal
Wells: 1

Number Calcite Ponds: None

Seepage Rate
(gpm): None

Liner Types: Hypalon

pH:

Cover Material: Vegetative

Freeboard Height (feet):

Thickness:

Underlying Strata:

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: U-Nat

Method of Concentration Determination: Other than UDAD, MILDOS, & Env. data

Dose to Nearest Offsite Individual: 8.5 mrem/yr

Location of Nearest Offsite Individual: 0.75 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Bison Basin Project

Code Number: WY-N-IS-17

Type: In-situ Mine

Location -

Site Name: Bison Basin

City: Jeffrey City

State: WY County: Fremont

Ownership -

Owner: Ogle Petroleum, Inc.

Mill Contact: Glenn Catchpole

Title:

Address:

Telephone: (307) 332-6276

LICENSING DATA

Regulatory Authority: NRC

First Issued:

License Number: Docket No. 40-8745

Last Renewed in Entirety:

Current Status
of Operation: Active

Last Amended:

Days of Operation/Year: 365

Expires:

Project Life (years, est.): 5

Surety Type: Self

Years for Complete Restoration: 2

Surety Amount:

Surety Holder: Ogle Petroleum

PROCESSING OF URANIUM

Permit Area (acres):

Ore Grade (%):

Precipitation: HCl; H₂O₂; NaOH

Well Field Area (acres): 10

Lixiviant Type: CO₃/HCO₃; O₂/H₂O₂

Calcining Temp: None

Production Zone

Area (acres): 40

Flow Rate to
Extractor (gpm): 1000

U₃O₈ Production
(tons/yr): 225

Number of Injection

Wells: 169

Uranium Content of Pregnant
Solution: 82 ppm av.

By-Products
Recovered: None

Number of Production

Wells: 90

Extraction Efficiency (%):

U₃O₈ Transportation
Form: Slurry to Kerr McGee

Concentration: IX

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons):

Total Pond Area (acres):

Reinjection Rate
(gpm):

Method of Solid Waste

Disposal: Offsite at licensed sites

Number Evaporation

Ponds: 1; others as needed

Lixiviant Recycle Rate
(gpm): 1000

Number of Disposal

Wells:

Number Calcite Ponds:

Seepage Rate
(gpm): 1000

Liner Types:

pH:

Cover Material:

Freeboard Height (feet): 6

Thickness:

Underlying Strata: Sandy siltstone

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination: MILDOS

Dose to Nearest Offsite Individual: Residence, 1.7 mrem

Location of Nearest Offsite Individual: Residence, 6 mi

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised: 1982/07

Facility Name: Irigaray Project

Code Number: WY-N-IS-16

Type: In-situ Mine

Location -

Site Name: Irigaray

City: Midwest

State: WY County: Johnson

Ownership -

Owner: Wyoming Minerals Corp.

Mill Contact:

Title:

Address:

Telephone:

LICENSING DATA

Regulatory Authority: NRC

First Issued:

License Number: Docket 40-8502

Last Renewed in Entirety:

Current Status

Last Amended:

of Operation: Suspended indefinitely (1981/03)

Days of Operation/Year:

Expires:

Project Life (years, est.): 10-20 years

Surety Type:

Years for Complete Restoration:

Surety Amount:

Surety Holder:

PROCESSING OF URANIUM

Permit Area (acres):

Ore Grade (%):

Precipitation:

Well Field Area (acres):

Lixiviant Type:

Calcining Temp:

Production Zone

Flow Rate to

U₃O₈ Production

Area (acres):

Extractor (gpm):

(tons/yr): 250

Number of Injection

Uranium Content of Pregnant

By-Products

Wells:

Solution:

Recovered:

Number of Production

Extraction Efficiency (%):

U₃O₈ Transportation

Wells:

Concentration:

Form:

EFFLUENT AND TAILINGS CHARACTERISTICS

Solid Waste (tons):

Total Pond Area (acres):

Reinjection Rate
(gpm):

Method of Solid Waste
Disposal:

Number Evaporation
Ponds:

Lixiviant Recycle Rate
(gpm):

Number of Disposal
Wells:

Number Calcite Ponds:

Seepage Rate
(gpm):

Liner Types:

pH:

Cover Material:

Freeboard Height (feet):

Thickness:

Underlying Strata:

Rn Flux (pCi/m²/s):

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated:

Method of Concentration Determination:

Dose to Nearest Offsite Individual:

Location of Nearest Offsite Individual:

Dose at Site Boundary (nearest downwind):

Dose at Site Boundary (closest to source):

Data Compiled by: Lee Busch

Date Compiled: 1982/01/18

Date Data Revised:

2.3 HEAP LEACH OPERATIONS

Heap leaching is a method of uranium recovery utilized for treatment of low-grade uranium ores or old tailings piles (0.01-0.05% U_3O_8) or when a small ore body is identified at a remote location from the mill complex. The heap leaching process consists of leaching ore in a static or semistatic condition either by gravitational flow through a confined ore pile or an existing tailings pile. The top of the heap pile is graded and divided into sections with dikes made from the ore. An acid solution is sprayed or trickled over each section to leach uranium from the ore or tailings. The prepared base of the pile contains pipes or covered drains to collect the uranium-enriched solution after it percolates through the heap. The enriched solution contains approximately one gram U_3O_8 per liter. Normally this solution is processed at the leach site by ion exchange or liquid/liquid extraction for concentration and subsequent precipitation with ammonia. Crude precipitate may be shipped to the mill for further processing through conventional milling circuits. Uranium recovery from the heap leach process is on the order of 50% to 80%.

Six projects are currently licensed and operating intermittently in Texas, Colorado, Wyoming, and Utah. The Utah project involves leaching of uranium from tailings produced by mining of copper. The Pinal Heap Leach is a small (30-40 tons/yr) operation which blasts low-grade ore from a mountainside ore body of the Lucky Boy mine near Globe, Arizona. This ore is placed on two piles and leached. Subsequent concentration and precipitation is conducted on the site, and the uranium is then shipped as a slurry for conversion.

Ownership and location of the six heap leach facilities are shown in Table 2.3-1, and individual data sheets for the sites follow.

Table 2.3-1. Owners, Names, and Locations of Existing Heap Leach Operations (alphabetical by owner)

Owner	Name	State	Code	Page
Minerals Exploration Co.	Sweetwater	WY	WY-N-HL-04	2-87
Pinal Mineral and Mining, Ltd.	Pinal	AZ	AZ-N-HL-06	2-88
Solution Engineering Co.	Susquehanna-Western Inc.	TX	TX-A-HL-01	2-89
Union Carbide Corp.	Maybell Site	CO	CO-A-HL-02	2-90
Union Carbide Corp.	East Gas Hills	WY	WY-N-HL-03	2-91
Wyoming Minerals Co.	Bingham Canyon	UT	UT-N-HL-05	2-92

Facility Name: Sweetwater
Type: Heap Leach Operation
Location -

Code Number: WY-N-HL-04

Site Name: Sweetwater City: Rawlins State: WY County: Sweetwater

Ownership -

Mill Contact:

Owner: Minerals Exploration Co.

Title:

Address:

Telephone:

LICENSING DATA

Regulatory Authority: NRC

License Number:

Years for Complete Reclamation:

Type of Operation: Low grade ore

First Issued: 1981

Current Status of Operation: Active

Expires:

Project Life (years, est.):

Last Amended:

CHARACTERISTICS OF LEACH PADS

Number of Pads: 1

Underlying Strata:

Tons of Material/Pad: 396,000

U₃O₈ Purity (%):

Liner Type:

U₃O₈ Production (tons/year): 65-70

ENVIRONMENTAL MONITORING PROGRAM

Pathways:

Number of Monitor Wells:

Radionuclides Evaluated:

Other:

Data Compiled by: Ron Sundell

Date Compiled: 1982/01/12 Date Data Revised:

Facility Name: Pinal Heap Leach

Code Number: AZ-N-HL-06

Type: Heap Leach Operation

Location -

Site Name: Pinal

City: Globe

State: AZ County: Gila

Ownership -

Owner: Pinal Mineral and Mining, Ltd.

Mill Contact: Thomas Clary

Title: Gen. Mgr. and owner

Address:

Telephone:

LICENSING DATA

Regulatory Authority: NRC

License Number: SUA 1388

Years for Complete Reclamation:

Type of Operation: Heap Leach (R & D)

First Issued:

Current Status of Operation: Active

Expires: 82/10

Project Life (years, est.):

Last Amended:

CHARACTERISTICS OF LEACH PADS

Number of Pads: 2

Underlying Strata:

Tons of Material/Pad:

U₃O₈ Purity (%):

Liner Type:

U₃O₈ Production (tons/year): 37

ENVIRONMENTAL MONITORING PROGRAM

Pathways:

Number of Monitor Wells:

Radionuclides Evaluated:

Other:

Data Compiled by: LSB

Date Compiled: 1982/04

Date Data Revised:

Facility Name: Susquehanna-Western, Inc. (SWI)

Code Number: TX-A-HL-01

Type: Heap Leach Operation

Location -

Site Name: SWI Site

City: Falls City

State: TX County: Karnes

Ownership -

Owner: Solution Engineering Co.

Mill Contact: Tom Fife

Title:

Address: P.O. Box 30

Telephone: (512) 254-3501

Alice, TX 78332

LICENSING DATA

Regulatory Authority: State

License Number: 8-2169

Years for Complete Reclamation:

Type of Operation: Tailings leach

First Issued:

Current Status of Operation: Inactive

Expires: 1982/02

Project Life (years, est.):

Last Amended:

CHARACTERISTICS OF LEACH PADS

Number of Pads:

Underlying Strata:

Tons of Material/Pad:

U₃O₈ Purity (%):

Liner Type:

U₃O₈ Production (tons/year):

ENVIRONMENTAL MONITORING PROGRAM

Pathways:

Number of Monitor Wells:

Radionuclides Evaluated:

Other:

Data Compiled by: Ron Sundell

Date Compiled: 1982/01/12 Date Data Revised:

Facility Name: Maybell Site

Code Number: CO-A-HL-02

Type: Heap Leach Operation

Location -

Site Name: Maybell Site City: Maybell

State: CO County: Moffat

Ownership -

Mill Contact: Robert G. Beverly

Owner: Union Carbide Corp.

Title: Dir. of Environmental Control

Address: P.O. Box 1029

Telephone: (303) 245-3700

Grand Junction, CO 81501

LICENSING DATA

Regulatory Authority: State

License Number: 660-015

Years for Complete Reclamation:

Type of Operation:

First Issued:

Current Status of Operation: Active

Expires: 1981/06

Project Life (years, est.):

Last Amended:

CHARACTERISTICS OF LEACH PADS

Number of Pads:

Underlying Strata:

Tons of Material/Pad:

U₃O₈ Purity (%):

Liner Type:

U₃O₈ Production (tons/year):

ENVIRONMENTAL MONITORING PROGRAM

Pathways:

Number of Monitor Wells:

Radionuclides Evaluated:

Other:

Data Compiled by: Ron Sundell

Date Compiled: 1982/01/12 Date Data Revised:

Facility Name: East Gas Hills

Code Number: WY-N-HL-03

Type: Heap Leach Operation

Location -

Site Name: East Gas Hills City: Casper

State: WY County: Natrona

Ownership -

Mill Contact:

Owner: Union Carbide Corp.

Title:

Address:

Telephone:

LICENSING DATA

Regulatory Authority: NRC

License Number:

Years for Complete Reclamation:

Type of Operation: Low grade ore

First Issued: 1979

Current Status of Operation: Active

Expires:

Project Life (years, est.):

Last Amended:

CHARACTERISTICS OF LEACH PADS

Number of Pads: 2

Underlying Strata:

Tons of Material/Pad:

U₃O₈ Purity (%):

Liner Type: Hypalon

U₃O₈ Production (tons/year):

ENVIRONMENTAL MONITORING PROGRAM

Pathways:

Number of Monitor Wells:

Radionuclides Evaluated:

Other:

Data Compiled by: Ron Sundell

Date Compiled: 1982/01/12 Date Data Revised:

Facility Name: Bingham Canyon

Code Number: UT-N-HL-05

Type: Heap Leach Operation

Location -

Site Name: Bingham Canyon City: Copperton

State: UT County: Salt Lake

Ownership -

Mill Contact:

Owner: Wyoming Minerals Co.

Title:

Address:

Telephone:

Copperton, UT

LICENSING DATA

Regulatory Authority: NRC

License Number:

Years for Complete Reclamation:

Type of Operation: Copper tail leach

First Issued:

Current Status of Operation: Active

Expires:

Project Life (years, est.):

Last Amended:

CHARACTERISTICS OF LEACH PADS

Number of Pads:

Underlying Strata:

Tons of Material/Pad:

U₃O₈ Purity (%):

Liner Type:

U₃O₈ Production (tons/year):

ENVIRONMENTAL MONITORING PROGRAM

Pathways:

Number of Monitor Wells:

Radionuclides Evaluated:

Other:

Data Compiled by: Ron Sundell

Date Compiled: 1982/01/12 Date Data Revised:

2.4 OTHER TYPES OF RECOVERY METHODS

Seventeen other operations of miscellaneous types also are licensed for uranium recovery. These are discussed below, and the number of each type in each state is shown in Table 2.4-1, p. 2-94.

2.4.1 Uranium Recovered as a By-Product of Phosphate Fertilizer Production

The most important miscellaneous recovery method, in terms of annual production, involves use of methods such as solvent-extraction to remove uranium from highly acidic solutions resulting from the milling of phosphate fertilizer process streams. Seven operations are licensed to perform such operations in the United States. In Louisiana, Freeport Uranium Recovery Corp. at Uncle Sam and Agrico-Chem, Williams/Freeport in Donaldson together process 450 MT (500 ST) U_3O_8 per year. The other five licensed operations are in Florida. The two operating plants in Florida (Gardinier Corp, Tampa and New Wales Chemical in New Wales) are each licensed to produce about 450 MT (500 ST) U_3O_8 per year. The other three either have been or will be shut down. These facilities include Wyoming Minerals at Pierce, Florida, and two plants belonging to International Minerals and Chemical Corp (IMC) in central Florida. The IMC plants produced 700 MT (800 ST) U_3O_8 in 1981.

2.4.2 Uranium Production from Treatment of Copper Process Streams

The Anamax Corp. is licensed by the State of Arizona to extract uranium from copper production process streams in Sahuarita, Arizona. It has a production capacity of about 450 MT (500 ST) U_3O_8 per year.

2.4.3 Auxiliary Uranium Recovery Operations

There are seven licensed auxiliary operations that have provided supplemental services to conventional milling operations. These auxiliary operations include ore-buying stations, barreling operations, and ore-sorting facilities. All but one of these are operated by conventional mills. They are usually found at or near the mill site and are located only in Colorado (5) and Utah (2). The ore-buying and sorting operations are used in transporting ore and controlling the quality of ore sent to the mills. Ore is supplied to the mills from a large number of small mines in the Colorado-Utah district. Since the number of small mines in this area has decreased from 150 to 10 within the last two years, there has been a reduction in the need for auxiliary operations.

2.4.4 Rare Earth and Radium Removal Operations

The Rhone-Poulenc Company in Freeport, Texas, produces rare-earth elements, thorium (as a nitrate), and extracts about 45 MT (50 ST) of U_3O_8 per year from the process streams.

There is one mine licensed to remove radium from orewater in Colorado.

Table 2.4-1. Other Types of Operations Licensed to Recover Uranium

State	Phosphate Processes	Copper Leaching Operations	Ore-buying Stations	Barreling Operations	Ore Sorters	Rare Earth Removal Operations	Radium Removal Plants	Vat Leach Operations	Other (Specify)
Arizona		1							
California**									
Colorado			2	2	1		1		
Florida	5								
Louisiana	2								
Nevada**									
New Mexico*									
Oregon**									
Texas						1			
Utah			2						
Wyoming*									
Washington*									

* Conventional uranium processing only.

**States in which uranium bearing ores have been identified but have no licensed uranium recovery operations.

3. STORAGE AND RETRIEVAL OF PRODUCTION-FACILITY DATA

3.1 METHODS USED TO RECORD DATA

Tabular information and data presented in of this report have been recorded and stored on an IBM Office System 6/450 word-processor. The system is compatible with NRC equipment for either direct access or through use of magnetic cards. System 6 can be used as a word processor only, or it can be used, as in the case of this report, as an information storage and retrieval system. The System 6 feature termed "Task File" allows the user to obtain a complete record of each facility or a preselected portion of the recorded information for a specific comparative purpose.

To arrange the information for each uranium-production facility in tabular form, the data were entered into the system as a "file" record. Information for each of the three types of production facilities (conventional, in-situ, and heap leach) was recorded on separate magnetic "diskettes". Because of storage-capacity limitations of the "task file" feature of the System 6/450, for conventional and in-situ operations it was necessary to use two file records on each diskette to store facility parameters--one file record for the information in the top portion of the facility data sheets and one record for the information in the bottom portion of the sheets. All of the parameters for heap leach operations were stored on one file record. For reporting specific data on each data sheet (name of owner for example), a specific "field" number was established. This field number is a discreet location within the composite data chart and is the same for any file record. For example, for each of the in-situ uranium facilities, the type of lixiviant used is entered in field 33 on the first file record. The location of the nearest offsite individual from the same facility is entered in field 33 on the second file record.

3.2 USE OF THE SYSTEM

To obtain information about a particular facility from a diskette, it is necessary to find the facility code number from the indices in Table 2.1-1 (conventional), Table 2.2-1 (in-situ), or Table 2.3-1 (heap leach). This code number indicates, in order, (1) the state name abbreviation, (2) whether the state is an agreement state (A), or non-agreement state (N), the type of facility--conventional (C), in-situ (IS), or heap leach (HL), and an index number (01). The index number identifies the position on the storage diskette at which the data for that facility has been stored. Using the programmed method and the proper diskette for the type of facility of interest, the data entered for each facility can be shown on the System 6 display screen or printed out. In the case of the data sheets presented in Section 2 for individual facilities, blank forms containing only parameters [e.g., ore grade (%)] were first printed, and then System 6 was programmed to print the data recorded in the pertinent fields in the proper positions on the form.

The relationship between the file field numbers in which data are stored and the parameters on the blank table is shown in Table 3.1-1 for conventional facilities, Table 3.1-2 for in-situ facilities, and Table 3.1-3 for heap leach facilities. In all file records, field 1 is the identification number assigned by the System 6 for each file entry, field 2 is the facility name, and field 3 is the code number. Thus it is possible to retrieve data points (field number) and obtain printouts of the name and code of any facility or groups of facilities for any specific parameter within each file record.

Table 3.1-1. Data Sheet for Conventional Mills¹

Facility Name: <u>2</u>		Code Number: <u>3</u>
Type: Conventional Uranium Mill		
Location -		
Site Name: <u>4</u>	City: <u>5</u>	State: <u>6</u> County: <u>7</u>
Ownership -		Mill Contact: <u>11</u>
Owner: <u>8</u>	Title: <u>12</u>	
Address: <u>9</u>	Telephone: <u>13</u>	
<u>10</u>		
<u>LICENSING DATA</u>		
Regulatory Authority: <u>14</u>	First Issued: <u>20</u>	
License Number: <u>15</u>	Last Renewed in Entirety: <u>21</u>	
Current Status of Operation: <u>16</u>	Last Amended: <u>22</u>	
Days of Operation/Year: <u>17</u>	Expires: <u>23</u>	
Project Life (years, est): <u>18</u>	Surety Type: <u>24</u>	
Years for Complete Reclamation: <u>19</u>	Surety Amount: <u>25</u>	
	Surety Holder: <u>26</u>	
<u>PROCESSING OF URANIUM</u>		
Name of Mine: <u>27</u>	Grinding Method: <u>33</u>	U ₃ O ₈ Production (tons/year): <u>39</u>
Type: <u>28</u>	Leach Method: <u>34</u>	
Ore Grade (%): <u>29</u>	Clarification: <u>35</u>	
Metals in Ore Recovered: <u>30</u>	Concentration: <u>36</u>	U ₃ O ₈ Purity (%): <u>40</u>
Extraction Efficiency (%): <u>31</u>	Precipitation: <u>37</u>	
Throughput (tons/day): <u>32</u>	Calcining Temp: <u>38</u>	
<u>EFFLUENT AND TAILINGS CHARACTERISTICS</u>		
Total Weight, Tailings (tons): <u>4</u>	Total Pond Area (acres): <u>11</u>	% Water Recycled: <u>18</u>
Total Area, Tailings (acres): <u>5</u>	Number Evaporation Ponds: <u>12</u>	
Method of Tailings Disposal: <u>6</u>	pH: <u>13</u>	Mill Water Consumption (gpm): <u>19</u>
Liner Types: <u>7</u>	Dam Height (feet, AGL): <u>14</u>	Seepage Rate (gpm): <u>20</u>
Cover Material: <u>8</u>	Freeboard Height (feet): <u>15</u>	
Thickness: <u>9</u>	Construction Method of Dam: <u>16</u>	
Rn Flux (pCi/m ² /s): <u>10</u>	Underlying Strata: <u>17</u>	
<u>RADIOLOGICAL PARAMETERS</u>		
Radionuclides Evaluated: <u>21</u>		
Method of Concentration Determination: <u>22</u>		
Dose to Nearest Offsite Individual: <u>23</u>		
Location of Nearest Offsite Individual: <u>24</u>		
Dose at Site Boundary (nearest downwind): <u>25</u>		
Dose at Site Boundary (closest to source): <u>26</u>		
Text Description (page): <u>27</u>		
Data Compiled by: <u>28</u>	Date Compiled: <u>29</u>	Date Data Revised: <u>30</u>

¹ Numbers indicate IBM OS/6 diskette "field number" at which data is stored.

² Information on top and bottom portions are stored in different file records.

Table 3.1-2. Data Sheet for In-Situ Operations^{†1}

Facility Name: <u>2</u>	Code Number: <u>3</u>
Type: <u>In-situ Mine</u>	
Location -	
Site Name: <u>4</u>	City: <u>5</u> State: <u>6</u> County: <u>7</u>
Ownership -	Mill Contact: <u>11</u>
Owner: <u>8</u>	Title: <u>12</u>
Address: <u>9</u>	Telephone: <u>13</u>

LICENSING DATA

Regulatory Authority: <u>14</u>	First Issued: <u>20</u>
License Number: <u>15</u>	Last Renewed in Entirety: <u>21</u>
Current Status of Operation: <u>16</u>	Last Amended: <u>22</u>
Days of Operation/Year: <u>17</u>	Expires: <u>23</u>
Project Life (years, est.): <u>18</u>	Surety Type: <u>24</u>
Years for Complete Restoration: <u>19</u>	Surety Amount: <u>25</u>
	Surety Holder: <u>26</u>

PROCESSING OF URANIUM

Permit Area (acres): <u>27</u>	Ore Grade (%): <u>32</u>	Precipitation: <u>38</u>
Well Field Area (acres): <u>28</u>	Lixiviant Type: <u>33</u>	Calcining Temp: <u>39</u>
Production Zone Area (acres): <u>29</u>	Flow Rate to Extractor (gpm): <u>34</u>	U ₃ O ₈ Production (tons/yr): <u>40</u>
Number of Injection Wells: <u>30</u>	Uranium Content of Pregnant Solution: <u>35</u>	By-Products Recovered: <u>41</u>
Number of Production Wells: <u>31</u>	Extraction Efficiency (%): <u>36</u>	U ₃ O ₈ Transportation Form: <u>42</u>
	Concentration: <u>37</u>	

†2-----†2

EFFLUENT AND TAILINGS CHARACTERISTICS

Total Weight, Tailings (tons): <u>4</u>	Total Pond Area (acres): <u>11</u>	Reinjection Rate (gpm): <u>17</u>
Method of Solid Waste Disposal: <u>5</u>	Number Evaporation Ponds: <u>12</u>	Lixiviant Recycle Rate (gpm): <u>18</u>
Number of Disposal Wells: <u>6</u>	Number Calcite Ponds: <u>13</u>	Seepage Rate (gpm): <u>19</u>
Liner Types: <u>7</u>	pH: <u>14</u>	
Cover Material: <u>8</u>	Freeboard Height (feet): <u>15</u>	
Thickness: <u>9</u>	Underlying Strata: <u>16</u>	
Rn Flux (pCi/m ² /s): <u>10</u>		

RADIOLOGICAL PARAMETERS

Radionuclides Evaluated: 20
 Method of Concentration Determination: 21
 Dose to Nearest Offsite Individual: 22
 Location of Nearest Offsite Individual: 23
 Dose at Site Boundary (nearest downwind): 24
 Dose at Site Boundary (closest to source): 25

Data Compiled by: 26 Date Compiled: 27 Date Data Revised: 28

†1 Numbers indicate IBM OS/6 diskette "field number" at which data is stored.

†2 Information on top and bottom portions are stored in different file records.

Table 3.1-3. Data Sheet for Heap Leach Operations¹

Facility Name: 2 Code Number: 3
 Type: Heap Leach Operation
 Location -
 Site Name: 4 City: 5 State: 6 County: 7
 Ownership - Mill Contact: 11
 Owner: 8 Title: 12
 Address: 9 Telephone: 13

LICENSING DATA

Regulatory Authority: 14
 License Number: 15 Years for Complete Reclamation: 19
 Type of Operation: 16 First Issued: 20
 Current Status of Operation: 17 Expires: 21
 Project Life (years, est.): 18 Last Amended: 22

CHARACTERISTICS OF LEACH PADS

Number of Pads: 23 Underlying Strata: 27
 Tons of Material/Pad: 24
 U₃O₈ Purity (%): 25 Liner Type: 28
 U₃O₈ Production (tons/year): 26

ENVIRONMENTAL MONITORING PROGRAM

Pathways: 29
 Number of Monitor Wells: 30
 Radionuclides Evaluated: 31
 Other: 32

Data Compiled by: 33 Date Compiled: 34 Date Data Revised: 35

¹ Numbers indicate IBM 05/6 diskette "field number" at which data is stored.

4. REFERENCES

The information presented in this document was obtained from many sources, as indicated by the following list of references. In addition to using information available in published documents, the staff also obtained data through telephone and written communications with personnel from the States of Washington, Texas, Colorado, New Mexico, Louisiana, and Florida. Of the published material, References 4, 23, and 24 were the most heavily used by the staff.

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7. AUTHOR(S) J.S. Warkentien, L.S. Busch, J. DePue, R. Sundell, C. Gordon				3. RECIPIENT'S ACCESSION NO.	
9. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code) Argonne National Laboratory 9700 South Cass Avenue Argonne, IL 60439				5. DATE REPORT COMPLETED MONTH YEAR July 1982	
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15. SUPPLEMENTARY NOTES				8. (Leave blank)	
16. ABSTRACT (200 words or less) The Directory and Profile of Licensed Uranium-Recovery Facilities presents facts, data, and information about conventional uranium mills, in-situ mining facilities, heap leach operations, and other operations which process and produce marketable quantities of yellowcake. In the United States, such facilities are found in Agreement States (Arizona, Colorado, Florida, Louisiana, New Mexico, Texas, and Washington) and in Non-Agreement States (Utah and Wyoming). Each facility is described on a case-by-case basis. Reporting of information on the conventional uranium mills begins with a brief narrative description that outlines general and specific characteristics about the site. Data sheets summarize the principal operating characteristics of the facility by listing the following information: location/ownership, licensing data, processing of uranium, characteristics of effluent releases and/or tailings, and radiological parameters. For in-situ and heap leach facilities, only data sheets are included. Data and information in this report is current through calendar year 1981. The final section contains a description of the system used for storage and retrieval of all information presented.				10. PROJECT/TASK/WORK UNIT NO.	
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