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Western Division

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40-8714
March 13, 1987

Mr. Randolph Wood, Director (2)
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
Herschler Building - Third Floor
122 West 25th Street
Cheyenne, Wyoming 82002

RE: COLLINS DRAW PROJECT FINAL RESTORATION PLAN
RESEARCH AND DEVELOPMENT LICENSE NO. 3RD

Dear Mr. Wood:

Based on our meeting with you and your staff on December 12, 1986, the Wyoming Department of Environmental Quality (WDEQ) has determined that groundwater restoration has been completed at the Collins Draw Project site with the exception of groundwater selenium concentrations in the B Well Field production zone. The WDEQ has recommended that a reductant be used in an attempt to lower the selenium concentrations.

We have reviewed the available technical information on the use of hydrogen sulfide (H_2S) and other reductants to reduce groundwater selenium concentrations. We have met with the representatives of Uranerz and Everest Minerals to discuss the use of reductants at their respective project sites. In addition, laboratory tests were conducted on a sample of the B Well Field production zone groundwater to determine the relative effectiveness of H_2S and sodium sulfide (Na_2S) to reduce the selenium.

During the laboratory testing, we determined that H_2S and Na_2S reductants will significantly reduce the dissolved selenium concentration in the groundwater. However, the laboratory tests did not confirm that the groundwater selenium concentration could be reduced to comply with a numeric limit. We have also determined that the technology of using reductants, by injecting the reductant with a recirculating groundwater stream, is still in a developmental stage. Even though reduction technology was successfully used at both the Uranerz and the Everest Minerals projects sites, there were significant differences in injection methods, reductant concentration, reaction products, corrosion and deterioration of equipment, etc. The successful application of reductants is dependant on the geochemistry and hydrochemistry of the production zone, the mineral and groundwater selenium concentrations, chemical equilibrium between the minerals and the groundwater, hydrologic characteristics of the aquifer, the concentration and rate of reductant injection and dispersion into the aquifer, and other site specific factors. The success achieved at the Uranerz

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and the Everest Minerals project sites does not provide a direct corollary to the Collins Draw Project site due to site specific differences in production zone selenium concentration, pH, lixiviant employed, hydrology, mineralogy, etc. Unfortunately, there are too many site specific variables for either the WDEQ or Cleveland-Cliffs to predict the degree of selenium reduction that can be achieved in the production zone at the Collins Draw Project site. Consequently, we cannot commit to reducing and/or stabilizing the selenium concentrations to any level.

The following Final Restoration Plan has been developed based on the reductant injection program that was conducted during restoration of the Everest Minerals project site. As described in the Final Restoration Plan, Cleveland-Cliffs and the Thunderbird Joint Venture propose to inject hydrogen sulfide reductant into the B Well Field production zone in an attempt to reduce the groundwater selenium concentration to as low as technically and economically practicable. The hydrogen sulfide will be dissolved in a recirculating groundwater stream of one pore volume. Sodium sulfide was not selected as the reductant due to the potential for the sodium ion to cause swelling of the clay minerals in the production zone and, therefore, restrict transmissivity. Also, hydrogen sulfide was successfully used at both the Uranerz and the Everest Minerals project sites. Following reductant injection, a 6-month program will be conducted to monitor the groundwater selenium concentrations in the B Well Field. No additional efforts are planned to reduce the concentration of any other constituent. Cleveland-Cliffs assumes that H_2S injection will be the final groundwater clean-up step required by the WDEQ, and we anticipate that implementation of this plan will result in WDEQ's approval of restoration and, subsequently, will result in license termination.

FINAL RESTORATION PLAN

Reductant Injection Program

To reduce selenium concentrations in the B Well Field production zone to as low as technically and economically practicable, Cleveland-Cliffs will inject hydrogen sulfide (H_2S) into the production zone with a recirculating groundwater stream during May and June 1987. Approximately 100 gpm of groundwater will be pumped from the production zone aquifer to the well field control shack by production wells (Wells 190, 262, 276, 283, 288, and 303). A process flow diagram is shown in Figure 1. The actual number and location of wells in the B Well Field are shown in Figure 2. In the well field control shack, the groundwater produced by each individual production well will be metered, and the water from all production wells will be combined in a production header pipeline. The groundwater will then be piped from the well field control shack to a nearby fiberglass surge tank. From the surge tank, the groundwater will be pumped through filters as necessary, and then to the H_2O - H_2S mixer where H_2S will be dissolved in the groundwater. A trailer-mounted H_2S supply tank will be parked on a stable, level area located

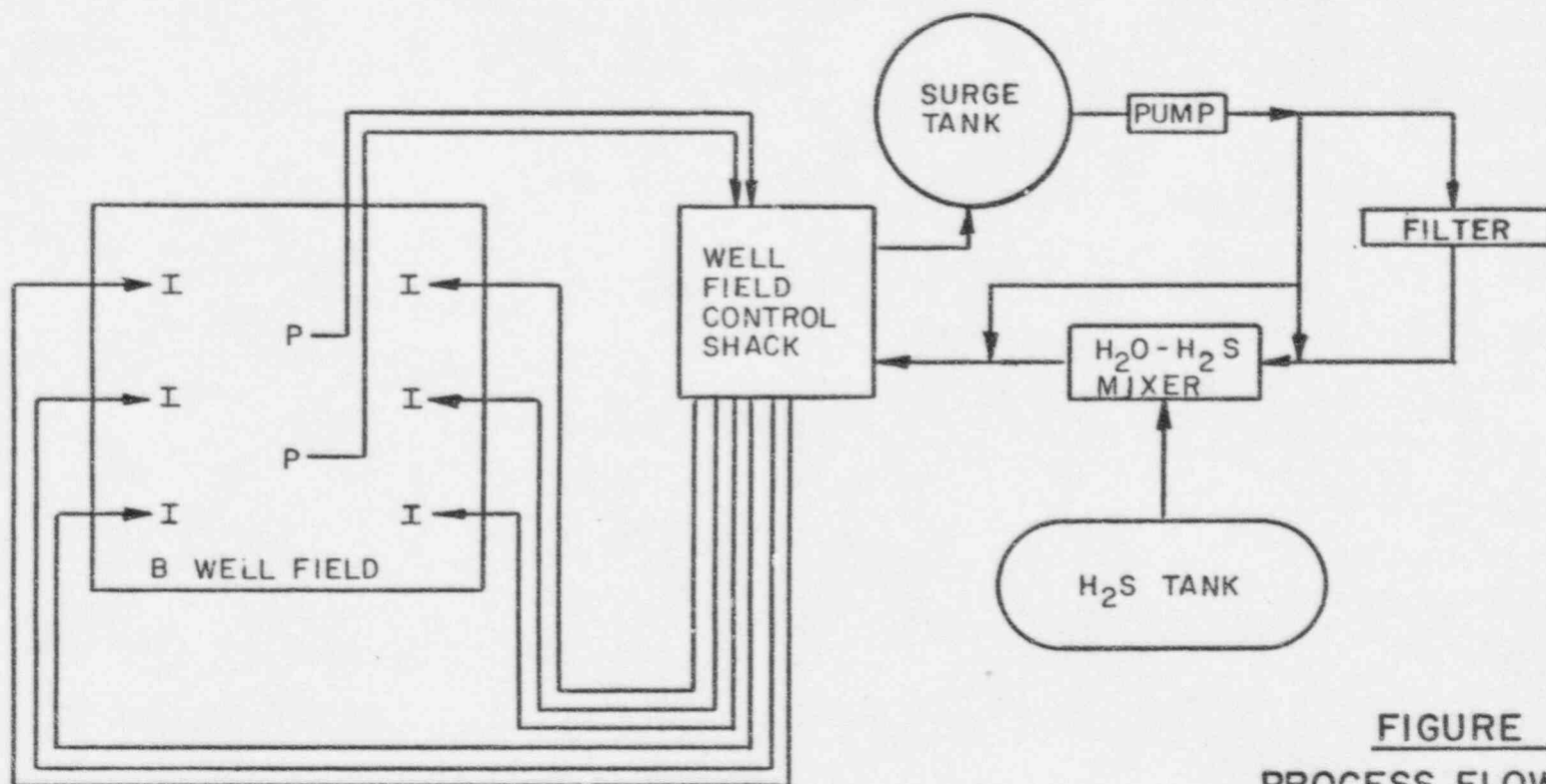


FIGURE 1
PROCESS FLOW DIAGRAM
RESTORATION PROGRAM
COLLINS DRAW PROJECT
(NOT TO SCALE)

LEGEND
B WELL FIELD

- PRODUCTION WELL
- INJECTION WELL
- ▲ EXCURSION MONITOR WELL
- POSTRESTORATION MONITOR WELL

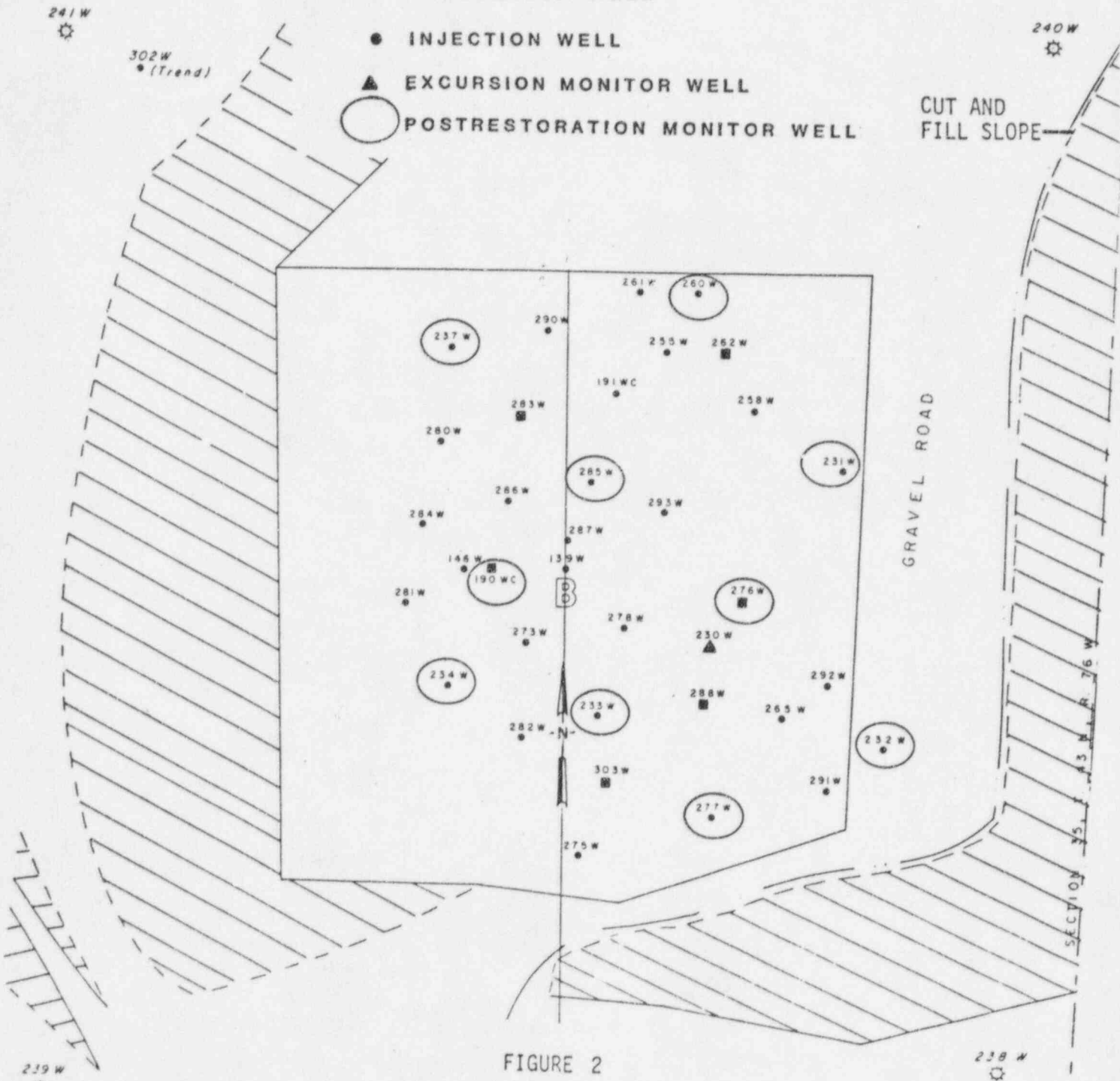


FIGURE 2
WELL FIELD AREA
COLLINS DRAW PROJECT
1 INCH = 50 FEET

near the B Well Field. A stainless steel tube will extend from the H_2S tank to an H_2S flow control meter and valve and to the H_2O - H_2S mixer. Following dissolution of H_2S in the groundwater, the groundwater with reductant will be returned to the well field control shack, where the water stream will be separated into individual streams for injection into the injection wells (all wells in the B Well Field except for the production wells and Monitor Well 230). The flow of each individual injection stream will be controlled and metered. The H_2S laden groundwater will be injected into the production zone aquifer through tubes extending from the top of the injection wells to approximately 350 feet below the static water level. Injection at this depth will minimize H_2S volatilizing from the injection stream. Except for a vent on the surge tank, the reductant injection circuit will be a closed loop system in order to minimize the release of H_2S . To aid ventilation, the entire reductant injection circuit will be located outside of the process building near the B Well Field.

Initially, there will be six production wells and 25 injection wells operating simultaneously. The production rate or injection rate at each respective operating well may vary in order to maximize uniform H_2S dispersion in the well field. Also, as necessary, specific production wells could be changed to injection wells and vice versa. The well field will be operated as a balanced system (groundwater production will equal groundwater injection). Also, the well field will be operated to prevent excess positive or negative pressures near the edge of the well field that could cause flow into or away from the well field. No wastewater will be produced by reductant injection and groundwater recirculation. During reductant injection, the groundwater from the production wells will be analyzed daily to determine H_2S and selenium concentrations.

One pore volume of groundwater will be pumped from the B Well Field at an approximate rate of 100 gpm. Initially, hydrogen sulfide will be dissolved in the groundwater at a concentration of 400 mg/l, based on H_2S injection conducted by Everest Minerals. Concentrations may be adjusted, as required, to attain optimum operating conditions. Then the H_2S laden groundwater will be returned to the production zone also at a rate of approximately 100 gpm. The B Well Field is calculated to contain 3,303,204 gallons of groundwater per pore volume [1 Pore Volume = (Well Field area) x (Production Zone Aquifer Thickness) x (Porosity) x (Factor of 1.5)]. Assuming a concentration of 400 mg/l H_2S , approximately 11,200 pounds of H_2S would be injected with the pore volume of recirculating groundwater.

Excursion Monitoring Program

During reductant injection, excursion monitoring for selenium will be conducted once every two weeks at the five excursion monitor wells, rather than monthly monitoring as currently authorized. If at the termination of reductant injection, there are no confirmed excursions, then excursion monitoring will be terminated. Conversely, if at the termination of restoration there are confirmed excursions, excursion monitoring will continue

at those monitor wells indicating an excursion until two consecutive samples indicate that the excursion has been controlled. Excursions can be controlled by pumping the well field in the region of the excursion in order to pull the excursion back into the well field.

Groundwater Monitoring Program

Following completion of reductant injection, each well in the B Well Field will be sampled and analyzed for selenium. Thereafter, every other month for a 6-month period a groundwater sample will be collected and analyzed from each of the following 10 wells: 190, 231, 232, 233, 234, 237, 260, 276, 277, and 285. The locations of these wells are shown on Figure 2.

Reporting

Following completion of reductant injection, Cleveland-Cliffs will submit a letter report to the WDEQ that documents the quantity of H_2S injected into the B Well Field production zone; the quantity of groundwater recirculated during reductant injection; and the resultant post-restoration selenium concentration monitored at each well. Following completion of the 6-month B Well Field groundwater monitoring program, Cleveland-Cliffs will submit a report on the selenium concentrations in the B Well Field during the monitoring program, will plug and abandon the wells, and will complete surface reclamation.

Reclamation Bond

Table 1 shows a total estimated cost of \$191,200 to complete reductant injection and groundwater monitoring as described herein, and to complete well plugging and surface reclamation as previously estimated and approved by the WDEQ. Cleveland-Cliffs has a reclamation surety bond registered with the WDEQ in the amount of \$450,000 which adequately assures sufficient funds to complete the work proposed in this Final Restoration Plan and to complete reclamation of the Collins Draw Project site.

Sale and Removal of Process Equipment

In a letter dated November 19, 1986, the WDEQ requested that the following eight items of process equipment remain on site for possible further groundwater restoration:

- | | |
|--------------|---|
| Item No. 1: | Surge tank |
| Item No. 2: | One production-injection skid with pumps and controls |
| Item No. 5: | Reverse-osmosis unit and attachments |
| Item No. 9: | Ion-exchange skid and attachments |
| Item No. 13: | Ion-exchange skid and attachments |
| Item No. 17: | Generator skid with generators |
| Item No. 19: | Well field control shack skid with controls |
| Item No. 26: | Fuel tank for generators |

TABLE 1
TOTAL ESTIMATED FINAL RESTORATION AND RECLAMATION COSTS
COLLINS DRAW PROJECT

	<u>\$1,000</u>
I. RESTORATION PROGRAM COSTS	
A. LABOR	
Foreman, \$50/hr, 40 hr/wk, 4 wks	8.0
4 Technicians, \$20/hr, 42 hr/wk, 4 wks	13.4
B. STANDBY LABOR	
4 Technicians, \$5/hr, 42 hr/wk, 4 wks	3.4
Room and Board Expense, \$50/day, 28 days	1.4
C. TRAINING, START-UP, SHUTDOWN	
Foreman, \$50/hr, 80 hr	4.0
2 Technicians, \$20/hr, 80 hr	3.2
2 Technicians, \$20/hr, 40 hr	1.6
Safety Training	1.0
Safety Equipment Lease	7.0
D. TRANSPORTATION, \$0.45/mi, 160 mi/trip	
Foreman, 5 trips/wk, 6 wks	2.2
Technicians, 2 trips/wk, 4 wks	0.6
E. UTILITIES	
Electric Generators, \$215/day, 33 days	7.1
Propane	1.0
F. LAB ANALYSES	4.0
G. HYDROGEN SULFIDE REDUCTANT	
Transportation	2.8
Trailer Rental	0.9
Chemical	1.5
H. WELL FIELD SUPPLIES	10.0
I. OTHER OPERATING COSTS	13.5
J. NRC LICENSE AMENDMENT FEE	5.0
II. GROUNDWATER MONITORING PROGRAM COSTS	
A. SAMPLING, \$50/hr, 10 hr/day, 2 days/time, 3 times	3.0
B. LAB ANALYSES	3.0
III. WELL PLUGGING AND ABANDONMENT COSTS	28.6
IV. SURFACE RECLAMATION COSTS	<u>33.1</u>
V. SUBTOTAL	159.3
VI. 20% of SUBTOTAL	<u>31.9</u>
VII. TOTAL ESTIMATED COSTS	191.2

Mr. Randolph Wood

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March 13, 1987

Only Item Nos. 1, 2, 17, and 19 will be required for the reductant injection. As soon as possible, Cleveland-Cliffs plans to remove all of the above-listed items of equipment from the site except Items Nos. 1, 2, 17, and 19, and plans to remove Item Nos. 1, 2, 17, and 19 from the site following completion of reductant injection.

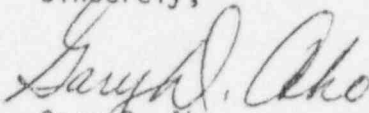
Well Plugging and Abandonment

When practical, Cleveland-Cliffs plans to plug and abandon the wells at the Collins Draw Project site. The wells in the B Well Field and the excursion monitor wells will be plugged and abandoned after completion of the 6-month groundwater monitoring program. Well 250 and Well 266 will not be plugged, but will be subsequently transferred to the landowner.

WDEQ FINAL RESTORATION PLAN APPROVAL

Cleveland-Cliffs and the Thunderbird Joint Venture are prepared to implement this Final Restoration Plan upon receipt of your approval as indicated below. After the implementation of this Final Restoration Plan, we will expect the WDEQ to approve restoration and to authorize surface reclamation for the subsequent termination of our license. We await your timely approval.

Sincerely,



Gary D. Aho
Manager-Western Division

TEL:ms

cc: Roger Shaffer, LQD, WDEQ
William Garland, WQD, WDEQ
R. Dale Smith, NRC✓

APPROVED:

Signature _____

Title _____

Date _____

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SEE REPORT FILE

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SECTION I

RETURN ORIGINAL TO PDR, HQ.

THUNDERBIRD JOINT VENTURE

SECTION II

Collins Draw Uranium In Situ Leach Research and Development Project

Final Report

Decommissioning, Decontamination, and Reclamation

Prepared for The Cleveland Cliffs Iron Company
and The Thunderbird Solution Mining Joint Venture

SECTION III

June 1, 1989

US Nuclear Regulatory Commission License No. SUA-1352

Wyoming Department of Environmental Quality License No. 3RD

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SECTION 1

SECTION 11

SECTION 111

THUNDERBIRD JOINT VENTURE

Collins Draw Uranium In Situ Leach Research and Development Project

Final Report

Decommissioning, Decontamination, and Reclamation

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