# ENVIRONMENTAL ASSESSMENT
# FOR AMENDMENT TO SOURCE MATERIALS LICENSE SUA-1534
# FOR A CENTRAL PROCESSING PLANT UPGRADE

**CROW BUTTE RESOURCES, INC.**
**IN SITU LEACH URANIUM RECOVERY FACILITY**
**CRAWFORD, DAWES COUNTY, NEBRASKA**

**October 2007**

**Source Materials License SUA-1534**
**Docket No. 40-8943**

**Prepared By:**

**U.S. Nuclear Regulatory Commission**
**Office of Federal and State Materials**
**and Environmental Management Programs**
**Division of Waste Management and Environmental Protection**

# ENVIRONMENTAL ASSESSMENT FOR A CENTRAL PROCESSING PLANT UPGRADE CROW BUTTE RESOURCES, INC. IN SITU LEACH URANIUM RECOVERY FACILITY CRAWFORD, DAWES COUNTY, NEBRASKA

## INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) staff is considering a request by Crow Butte Resources, Inc. (CBR), to upgrade its central processing plant (CPP) throughput from 18,900 liters per minute (L/min) (5,000 gallons per minute (gpm)) to 34,000 L/min (9,000 gpm). By letter dated October 17, 2006, CBR submitted a license amendment application request for the aforementioned CPP upgrade to the NRC staff (CBR, 2006). The staff reviewed CBR's application, and, by letter dated March 9, 2007, issued a request for additional information (RAI) regarding dose modeling and process flow issues (NRC, 2007). CBR responded to this RAI by letter dated April 27, 2007 (CBR, 2007). Based on its review of the information provided in the amendment request and RAI response, NRC staff has determined that the proposed CPP upgrade is acceptable and intends to approve it. This environmental assessment (EA) documents the NRC staff's environmental review of this proposed action.

### Background

CBR operates an in situ leach (ISL) uranium recovery facility near Crawford, Dawes County, Nebraska (see Figures 1 and 2). The proposed CPP upgrade would accommodate a separate low-grade circuit that would, to a greater degree, deplete previously utilized wellfields of residual uranium. To increase throughput, CBR intends to install up to six new ion exchange (IX) columns and four ancillary tanks within the existing CPP building. No building expansion is required to accomplish this upgrade and the yellowcake output will remain below the current CBR annual limit of 909,100 kilograms (kg) (2,000,000 pounds (lbs)).

### Need for the Proposed Action

CBR states that the additional CPP capacity would facilitate extraction of residual uranium from previously utilized, low-grade wellfields. This is desirable given the current uranium market conditions and the fact that the world is now producing approximately 60 percent of the current uranium needs for nuclear power generation (World Nuclear Association, 2007). CBR also states that further reduction of uranium concentrations in the residual ore would facilitate restoration of the wellfield (CBR, 2006).

### Proposed Action

As previously stated, CBR proposes to increase its plant throughput from 18,900 L/min (5,000 gpm) to 34,000 L/min (9,000 gpm) through the addition of up to six IX columns and four ancillary tanks in the current CPP building. The new IX columns will be pressurized downflow columns and will be operated in sets of two columns in series. Each set of two columns will be capable

of processing 5,700 to 7,600 L/min (1,500 to 2,000 gpm) of process solutions and will be installed in the existing CPP. Each column will be nominally 3.5 meters (m) (11.5 feet (ft)) in diameter and 4.6 m (15 ft) high. CBR will relocate several existing restoration IX columns in the CPP to the existing research and development (R&D) building. Ancillary tanks will be used as part of the upgraded resin screening circuit and will include a resin screen deck, screen waste tank, resin transfer tank, and an elution tank. This equipment will be located in an area of the CPP that currently contains no equipment. Figure 3 presents the proposed plant modifications.

After the IX resin in the new columns is loaded with uranium, it will be cleaned and sized in the upgraded screening circuit, which consists of the equipment described previously. Uranium will be stripped from the resin by means of the same eluant circuit presently used in the CPP. This eluant is a mixture of sodium chloride and sodium bicarbonate. Pregnant eluant will subsequently flow to the existing yellowcake circuit for precipitation, dewatering, and drying. The existing yellowcake circuit has adequate capacity to process the additional 68,200 to 114,000 kg (150,000 to 250,000 lbs) of yellowcake per year from the new processing circuit.

### Regulatory Environment

The NRC issues source material licenses under Title 10, Part 40, "Domestic Licensing of Source Material," of the *Code of Federal Regulations* (10 CFR Part 40). In addition, the Uranium Mill Tailings Radiation Control Act of 1978, as amended, requires persons who conduct uranium source material operations to obtain a byproduct material license to own, use, or possess tailings and wastes generated by the operations. The NRC staff has prepared this EA in accordance with 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," which implements the NRC's environmental protection program under the National Environmental Policy Act of 1969 (NEPA). In accordance with 10 CFR Part 51, an EA serves to: (1) briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement (EIS) or determine that a finding of no significant impact (FONSI) is appropriate; (2) facilitate preparation of an EIS when one is necessary; and (3) demonstrate the NRC's compliance with NEPA when an EIS is unnecessary. Evidence presented herein describes the proposed action, impacts of the proposed action, and impacts of alternatives to the proposed action, including the no-action alternative.

## ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

The proposed action involves installing up to six IX columns and the screening circuit equipment within the existing CPP. No building construction is required; consequently, the footprint of the CPP will not be expanded. CBR will not open any new wellfields, beyond those currently addressed by its license, as a result of this proposed action. The NRC staff, therefore, does not expect the proposed action to impact geology, surface water, endangered and threatened species, transportation, and historic and cultural resources. The staff also does not expect significant environmental impacts to groundwater, socioeconomic conditions, soil, air quality, and public and occupational exposures, as discussed below.

## Public and Occupational Doses

The NRC staff assessed air quality, public safety, and occupational safety to determine whether the new IX and resin screening circuits would impact the site environs. Gaseous radon-222 is the primary source of radiological impact to the environment from site operations. CBR used MILDOS-AREA, a dispersion model approved by the NRC, to estimate the dose commitments received by individuals and the general population from the operation of the proposed plant, including both the existing and proposed IX circuits. The MILDOS-AREA model required CBR to obtain site-specific data for input into the model, as well as to make certain assumptions about the input data. Validity of the input data is the critical aspect in obtaining a reasonably conservative estimate of the dose commitments to the public. The NRC staff has evaluated the input data for the MILDOS-AREA model and has determined that CBR used reasonably conservative assumptions for these data.

A review of the results indicated that an almost doubling of the CPP throughput would not result in a corresponding increase in dose. As previously stated, CBR will be installing pressurized downflow IX columns instead of the upflow columns currently used. Downflow columns keep radon in solution, which dramatically decreases the radon release and its associated dose from these tanks. Upflow columns vent radon while in use, which makes radon doses from these tanks higher than those resulting from downflow columns. Radon is only released from downflow columns when replacing the resin within these columns.

A review of the MILDOS-AREA results indicates that all nearby residents will receive a dose of 25 millirem per year (mrem/yr) or less from the entire modified CPP, which includes both the existing and proposed IX circuits. The highest doses are estimated to be 25, 18.9, 16.2, and 15.5 mrem/yr to the four nearest residents to the site, with all other nearby residents receiving less than 8 mrem/yr. These results indicate that the estimated dose to the nearest resident and members of the public is significantly below the 100-mrem/yr public dose limit specified in 10 CFR 20.1301, “Dose Limits for Individual Members of the Public.”

Inspections of the CBR operations also indicate that it maintains occupational safety programs, in compliance with 10 CFR 20.1101, “Radiation Protection Programs,” that will maintain worker doses below the 5-rem/yr limit in 10 CFR 20.1201, “Occupational Dose Limits for Adults.” For example, the NRC staff 2006 inspection report for the CBR facility indicated that the highest employee and average employee exposures were 425 mrem and 118 mrem, respectively, in a single year (NRC, 2006). The average exposure is approximately 2 percent of the 5-rem/yr limit. The NRC staff determined from a review of materials provided by CBR, and those obtained independently, that the proposed action would not significantly impact air quality or occupational and public health and safety.

## Soil and Groundwater

### *Piping and Well Leaks*

Increasing the capacity of the CPP will allow more wellfields to operate simultaneously, resulting in more opportunities for releases of barren or pregnant lixiviant. Such releases could occur because of leaks or ruptures of pipe or casing failures in wells that service the wellfields. Such leaks could result in the contamination of soil and/or groundwater that would then require remediation.

The NRC considered the environmental impacts of such leaks or ruptures in the EA for the February 1998 license renewal for CBR (NRC, 1998). Sections 6.2 and 6.4 of the 1998 EA discuss the means by which CBR mitigates pipeline and well failures. According to Section 6.2 of the 1998 EA, CBR uses pressure tests and sensors to test piping before installation and to monitor piping while in use, respectively. To monitor well casing integrity, CBR performs mechanical integrity tests every 5 years on each well and repairs those wells that fail the tests. CBR has also performed subsurface investigations to determine whether groundwater or subsurface soils have been contaminated by leaking wells.

***Excursions***

The simultaneous operation of more wellfields also increases the opportunities for excursions, which occur when lixiviant-fortified groundwater migrates beyond the expected confines (horizontal or vertical) of a wellfield. Excursions may occur because of an improper balance between injection and recovery rates, undetected high permeability strata or geologic faults, improperly abandoned exploration drill holes, discontinuity and unsuitability of the confining units that allow movement of the lixiviant out of the ore zone, poor well integrity, or hydrofracturing of the ore zone or surrounding units. The potential for horizontal excursions is primarily controlled through wellfield bleed. Should an excursion occur, CBR would implement the appropriate actions, as described below.

Section 5.4.2 of the 1998 EA addresses excursions (NRC, 1998) by describing the corrective actions employed by CBR staff, which include the following:

- notifying the NRC as required by license condition
- discontinuing injection of ISL solutions into nearby injection wells
- drilling additional wells to delineate the extent of the excursion
- reviewing all well completion records and mechanical integrity test results for the wells surrounding the excursion well, reviewing historic water levels, and increasing the sampling frequency
- implementing groundwater remediation efforts, as needed

***Waste Generation***

Additional plant flow would normally correspond to an increase in the volume of liquid waste (primarily in the form of process water bleed) generated at the CBR facility. This additional bleed would be disposed in the facility's disposal well or in the evaporation ponds. However, this plant upgrade will not significantly increase the quantity of liquid waste.

To control subsurface hydraulics, CBR is currently maintaining a water bleed as if full mining activity were occurring. The current bleed is 2.4 percent of the current inflow, while the proposed bleed is 1.3 percent of the proposed inflow. The proposed bleed rate is sufficient for subsurface hydraulic control; consequently, increasing the mining activity is not expected

to increase liquid waste generation. Present storage and disposal methods include evaporation ponds and a deep disposal well, which adequately handle the current 454-L/min (120-gpm) bleed.

Solid waste generated from the additional flow (see Figures 4 and 5) is expected to increase proportionally to the waste generated by the existing operation. This waste is fairly minimal and consists mainly of filter bags collecting broken resin and clay particles from the injection water. Criterion 2 of Appendix A, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," to 10 CFR Part 40 requires that all solid waste be disposed off site at an NRC-licensed facility.

***Groundwater Restoration***

In its application, CBR asserts that further depletion of a lower grade ore body would expedite the restoration process because the ore body would contain lower concentrations of uranium and other metals after the extraction phase ends. This argument disregards certain basic facts. Restoration involves the removal of residual contaminated material that has been liberated from the ore body, not constituents that remain in the ore body. Considering that injecting lixiviant liberates uranium and other metals and degrades water quality within the wellfield (NRC, 1998), contaminant releases to the aquifer will continue during lower grade extraction, notwithstanding the lower uranium concentrations within the ore.

Although CBR's argument is incorrect, the NRC staff determined that the additional contamination to groundwater in the wellfield is not a significant impact, as noted in the 1998 license renewal EA in Sections 4.1.2, 4.1.3, and 5.4.2, which discuss groundwater restoration and excursions (NRC, 1998). In particular, CBR performs a series of restoration steps, including groundwater transfer, groundwater sweep, groundwater treatment, and wellfield circulation, to remove and/or fix residual contamination within the ore body. This strategy successfully restored Mine Unit 1, which was approved by the NRC staff on February 13, 2003 (NRC, 2003) and the R&D area.

***Conclusions***

A review of information provided by CBR and independently obtained indicates that no significant impacts would result from the proposed action. CBR has procedures to minimize the likelihood of a release and the effects of excursions. CBR also has an effective procedure for restoring groundwater within the wellfield after extraction is completed.

## Socioeconomic Conditions

The NRC staff does not expect the proposed action to impact significantly the socioeconomic conditions in or near Crawford, Nebraska. CBR does not expect to increase its staff significantly, although contractors will be hired temporarily to install the new circuits. CBR will be producing more yellowcake from this facility; however, the amount will not have a broad effect on commerce in the area.

## ENVIRONMENTAL IMPACTS OF THE ALTERNATIVE TO THE PROPOSED ACTION

The only alternative to the proposed action is the no-action alternative in which the NRC staff denies the amendment request for the CPP upgrade and requires CBR to either mix low-grade and high-grade uranium solutions (pregnant lixiviant) within the current limits of its license or cease uranium extraction from low-grade wellfields. No environmental impacts would occur from the no-action alternative.

Implementing the no-action alternative has no apparent benefits. The no-action alternative would preclude CBR from tapping the low-grade wellfields, which would forestall the occurrence of potential leaks, pipe ruptures, spills, or excursions during low grade extraction operations. However, CBR has the appropriate procedures in place to prevent or mitigate the consequences of leaks, ruptures, spills, and excursions. Therefore, the no-action alternative would unduly deny CBR the benefit of increased yellowcake production despite the fact that implementation of the proposed action has no significant environmental impacts.

## AGENCIES CONSULTED

Because the proposed action occurs within the footprint of the current CBR structures, the NRC staff determined that no impacts to endangered and threatened species and cultural and historic resources would result. However, the NRC staff elected to consult with the Nebraska State Historic Preservation Office (SHPO), U.S. Fish and Wildlife Service (FWS), and the Nebraska Department of Environmental Quality (NDEQ). The staff sent draft EAs to each agency on July 11, 2007. By letter dated August 8, 2007, the Nebraska SHPO stated that no historic structures would be affected by the proposed project (SHPO, 2007).

The NDEQ commented that the flow rate specified in the draft EA differed from that approved by NDEQ. The NRC staff responded that wellfield restoration flow is not included in the plant throughput for the NRC license, while, according to CBR, the NDEQ-approved flow rate includes wellfield restoration flow. Therefore, the NDEQ and CBR must resolve the differences between the NRC-approved and the NDEQ-approved flow rate.

By letter dated September 25, 2007, FWS stated that the project would not impact wildlife refuges, Bald and Golden Eagle habitat, endangered species or migratory birds. FWS did request information regarding migratory bird surveys and avoidance measures. NRC staff responded that no such information exists because the proposed project occurs within existing buildings; therefore, such impacts are unlikely.

## CONCLUSIONS

The NRC staff has assessed the environmental impacts associated with the request from CBR for a license amendment to its CPP and documented the results of the assessment in

this EA. The staff performed this assessment in accordance with the requirements of 10 CFR Part 51. In conducting the assessment, the staff considered the following:

- information in the license amendment application
- information in the response to the staff's RAI
- information from dose modeling reports
- communications with CBR staff and representatives, the State of Nebraska, and FWS
- information from NRC staff site visits and inspections

The NRC staff has concluded that the proposed action will comply with the licensing requirements found in Appendix A to 10 CFR Part 40. Occupational and public exposure to radiation will be significantly less than the limits in 10 CFR 20.1201 and 10 CFR 20.1301, respectively. On the basis of this EA, the NRC staff concludes that there are no significant environmental impacts and the license application does not warrant the preparation of an EIS. Accordingly, the staff has determined that a FONSI is appropriate.

## List of Preparers

Stephen J. Cohen, Project Manager and Hydrogeologist, Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs

Robert G. Lukes, Health Physicist, Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs

## REFERENCES

Crow Butte Resources, Inc., Request for License Amendment for Plant Upgrade, October 17, 2006 (ADAMS Accession No. ML633903480).

Crow Butte Resources, Inc., License Amendment for Plant Upgrade, Response to Request for Additional Information, April 27, 2007 (ADAMS Accession No. ML071290026).

U.S. Nuclear Regulatory Commission, Environmental Assessment for Renewal of Source Material License No. SUA-1534, Crow Butte Resources, Inc., February 1998 (ADAMS Accession No. ML007152042).

U.S. Nuclear Regulatory Commission, NRC Inspection Report 040-08943/06-001, September 8, 2006 (ADAMS Accession No. ML0062540084).

U.S. Nuclear Regulatory Commission, Request for Additional Information, License Amendment Request for a Plant Upgrade, Crow Butte Resources, Inc., Crawford, Nebraska, March 9, 2007 (ADAMS Accession No. ML070540341).

World Nuclear Association, World Uranium Mining Page (http://www.world-nuclear.org/info/inf23.html), May 2007.

# FIGURES