TECHNICAL EVALUATION REPORT
CENTRAL PROCESSING PLANT UPGRADE
CROW BUTTE RESOURCES, INC., CRAWFORD, NEBRASKA

DOCKET NO.: 40-8943

LICENSE NO.: SUA-1534

DATE: October 23, 2007

FACILITY: Crawford, Nebraska

TECHNICAL REVIEWERS: Stephen J. Cohen, Robert Lukes

PROJECT MANAGER: Stephen J. Cohen

SUMMARY AND CONCLUSIONS

By letter dated, October 17, 2006, Crow Butte Resources, Inc. (CBR) submitted to the U.S. Nuclear Regulatory Commission (NRC) a request to amend Source Materials License SUA-1534 to increase the flow in its central processing plant (CPP) from 18,900 liters per minute (Lpm) (5,000 gallons per minute (gpm) to 34,000 Lpm (9,000 gpm) (CBR, 2006). The NRC staff reviewed CBR's request. By letter dated March 9, 2007, the NRC staff issued a Request for Additional Information (RAI) for CBR to address dose modeling and process flow issues (NRC, 2007a). 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, the NRC staff determined that the amendment request is acceptable and approves the CPP upgrade.

BACKGROUND

CBR operates an *in situ* leach (ISL) uranium recovery facility in Crawford, NE (Figures 1 and 2). Currently, the CPP throughput is 18,900 Lpm (5,000 gpm). CBR would like to increase throughput to 34,000 Lpm (9,000 gpm) to accommodate a separate low-grade circuit that more efficiently depletes well fields of uranium. CBR expects that this continued well field depletion would facilitate restoration. To increase throughput, CBR intends to install 6 new ion exchange (IX) columns within the existing CPP building. No building expansion is required to accomplish this upgrade, and the yellowcake output will remain below CBR's current 909,090-kilogram (kg) (2,000,000-pound (lb)) limit.

TECHNICAL REVIEW

Description of Upgrade

CBR will install six pressurized, downflow, IX columns that will be operated with 2 columns in series. Each set of 2 columns will be capable of processing 5,700 to 7,600 Lpm (1,500 to 2,000 gpm) of process solution. CBR will install these columns in the existing restoration area of the main facility. Each column will be nominally 3.5 meters (m) (11.5 feet (ft)) in diameter. CBR will relocate the existing restoration IX columns to the research and development (R&D)

building. Ancillary tanks used to treat the additional effluent include a resin screen deck, screen waste tank, resin transfer tank, and an elution tank. Figure 3 presents the proposed plant modifications.

After the IX resin in the new columns is loaded with uranium, the resin will be cleaned and sized in an upgraded screening circuit. Uranium will be stripped from the resin using the same elution circuit presently used in the process facility. This circuit uses an eluant containing a mixture of sodium chloride and sodium bicarbonate. Pregnant eluant subsequently flows to the existing yellowcake circuit for precipitation, dewatering, and drying. CBR's existing yellowcake circuit has adequate capacity to process the additional 68,200 to 113,640 kg (150,000 to 250,000 lb.) of U_30_8 per year.

Analysis of Waste Volume

Although the CPP throughput would approximately double, the volume of liquid waste would not significantly increase over current liquid waste volumes. The primary component of the liquid waste stream is the bleed. Bleed is that portion of the injection volume that is sent to the deep disposal well instead of the well field. CBR must maintain a specific bleed rate to control subsurface fluids to prevent excursions, and this bleed rate depends upon the number of active well fields. Active well fields include: (1) well fields currently under extraction; and (2) any low-grade well fields that still exist, but are not under restoration.

The current bleed is 2.4 percent of the current inflow (120 gpm bleed versus 5,000 gpm plant flow). In comparison, the proposed bleed is 1.3 percent of the proposed flow (120 gpm bleed versus 9,000 gpm plant flow). The NRC staff considers the proposed 1.3 percent bleed rate to be sufficient to maintain control over subsurface fluids. Thus, increasing the injection activity is not expected to increase the volume of liquid waste. The NRC staff notes that CBR is adequately handling the current volume using present storage and disposal methods (i.e., evaporation pond and deep disposal well).

The solid waste generated from the additional flow is expected to increase proportionally to the waste generated by the existing operation. (Figures 4 and 5) The volume of solid waste is minimal and consists mainly of filter bags used to collect broken resin and clay particles from the injection water.

ENVIRONMENTAL PROTECTION

If CBR increased its CPP capacity, more well fields could operate simultaneously, increasing the possibility of releases of barren or pregnant leaching solution (or lixiviant). Such releases may occur due to leaks or ruptures of pipe or casing failures in wells that service the well fields. Such leaks could contaminate soil and ground water and require CBR to remediate the contamination.

The NRC staff considered the environmental impacts of such leaks or ruptures in the environmental assessment (EA) for the February 1998 license renewal for CBR (NRC, 1998). In Sections 6.2 and 6.4 of the 1998 EA, the NRC staff discusses how CBR mitigates pipeline and well failures. According to Section 6.2 of the 1998 EA, CBR uses: (1) pressure tests to test piping before installation; and (2) sensors to monitor piping while in use. To ensure well casing

integrity, CBR performs mechanical integrity tests every 5 years on each well and repairs those wells that fail. CBR also performs subsurface investigations to determine if leaking wells have contaminated ground water or subsurface soils.

Since 1991, CBR has released approximately 2,793,330 L (738,000 gallons) of fluids through piping and valve leaks. Approximately two thirds of this volume is barren lixiviant, consisting of native ground water, sodium bicarbonate, and hydrogen peroxide or oxygen. Trace quantities of uranium may be found in barren lixiviant. The remaining volume is pregnant lixiviant, which contains higher concentrations of uranium. As part of its decommissioning plan, CBR will reclaim contaminated soils when each mine unit is decommissioned.

CBR maintains a network of shallow monitoring wells that monitor the unconfined Brule Formation overlying the Chadron Formation, the uranium recovery unit. CBR uses these wells to detect the effects of significant piping leaks from barren and pregnant lixiviant lines. To date, water quality has not been impacted by the piping or valve leaks. NRC staff documented the potential environmental effects of increasing the CPP throughput, as discussed in this TER, in a separate EA dated October 23, 2007 (NRC, 2007b).

PUBLIC AND OCCUPATIONAL HEALTH

Benefits of Selected Equipment

The new IX columns are pressurized downflow columns, which replace the upflow columns currently being used. Pressurized downflow columns are beneficial from a health physics perspective because these columns keep radon in solution during normal operations. Upflow columns vent radon during normal operations. Because radon is the primary contributor to dose for this site, keeping radon in solution significantly reduces occupational and public exposures.

Dose Modeling

The NRC staff assessed air quality and occupational and public health and safety to determine the impact of the new IX columns and resin screening circuits. Gaseous radon-222 is the primary source of radiological impact to the environment from site operations. CBR compared the existing and proposed circuits. 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. The MILDOS-AREA model required CBR to obtain site-specific data for input into the model, as well as make some assumptions about the input data. Valid input data (i.e., reasonably conservative data) is critical in obtaining a reasonably conservative estimate of the dose commitments to the public. The NRC staff evaluated the input data used by CBR for the MILDOS-AREA model and determined that reasonably conservative assumptions were used for the input data.

The results indicated that almost doubling the CPP throughput would not result in a corresponding increase in dose. As previously stated, CBR will install pressurized downflow IX columns instead of the upflow columns currently used. Downflow columns keep radon in solution, which significantly decreases the radon released, as well as its associated dose, from these tanks. Upflow columns vent radon while in use, which makes radon doses from these tanks higher than the downflow columns. Radon is only released from downflow columns when the resin within these columns is being replaced.

A review of the MILDOS-AREA results indicates that all nearby residents will receive a dose of 25 millirem/year (mrem/yr) or less from the modified CPP, which includes both the existing and proposed IX circuits. The highest doses are estimated to be 25 mrem/yr, 18.9 mrem/yr, 16.2 mrem/yr, 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 doses represent an increase of approximately 22 percent over the current doses, resulting from the 5,000 gpm operation. 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. NRC staff documented the potential dose effects of increasing the CPP throughput in a separate EA dated October 23, 2007 (NRC, 2007b),

The NRC staff has inspected CBR's operations and notes that it maintains occupational safety programs in compliance with 10 CFR 20.1101. These programs ensure that CBR will maintain worker doses below the 5 rem/yr limit as required by 10 CFR 20.1201. For example, NRC staff's 2006 inspection report for the CBR indicated that the highest employee and average employee exposures were 425 mrem and 118 mrem, respectively, in one year (NRC, 2006). The average exposure is approximately 2 percent of the 5 rem/yr limit. The NRC staff determined from a review of CBR-provided and independently obtained data that the proposed amendment would not significantly impact air quality and occupational and public health and safety.

FINANCIAL ASSURANCE

CBR has not updated its financial assurance to account for decommissioning the additional 6 IX columns and ancillary equipment. However, License Condition 9.5 states the following:

> At least 90 days prior to beginning construction associated with any planned expansion or operational change which was not included in the annual surety update, the licensee shall provide, for NRC approval, an updated surety to cover the expansion or change.

Therefore, NRC staff will have the opportunity to review the financial assurance for this expansion of operations prior to activation.

PROPOSED LICENSE AMENDMENTS

9.2 All written notices and reports to NRC required under this license shall be addressed to the Deputy Director, Decommissioning and Uranium Recovery Licensing Directorate, Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs, Mailstop ~~T7-E18~~ T8-F5, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by express delivery to 11545 Rockville Pike, Rockville, MD 20852-2738.

Required telephone notification shall be made to the NRC Operations Center at (301) 816-5100, unless otherwise specified in license conditions.

[Applicable Amendment: 7, 12, 21, 22]

9.3 The licensee shall conduct operations in accordance with the commitments, representations, and statements contained in the license application dated December 1995, as amended by submittals dated April 1, June 25, July 28, October 31, 1997,

January 14, 2000, September 12, 2001, April 19, 2002, September 25, 2002, October 11, 2002, August 28, 2003, September 8, 2003, October 10, 2003, March 4, 2004, ~~and~~ September 22, 2004, October 17, 2006, and April 27, 2007, which are hereby incorporated by reference, except where superseded by license conditions below.

Whenever the word "will" or “shall” is used in the above referenced documents, it shall denote a requirement.

[Applicable Amendments: 11, 12, 14, 15, 16, 17, 18, 22]

10.5 The plant throughput shall not exceed a maximum flow rate of ~~5000~~9,000 gallons per minute, excluding restoration flow. Annual yellowcake production shall not exceed 2 million (2,000,000) pounds.

[Applicable Amendments: 22]

REFERENCES

Crow Butte Resources, Inc., 2006, Request for License Amendment for Plant Upgrade, October 17, 2006 [ADAMS Accession No. ML063390348].

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

U.S. Nuclear Regulatory Commission, 1998, Environmental Assessment for Renewal of Source Material License No. SUA-1534, Crow Butte Resources, Inc, February 1998 [ADAMS Accession No. ML071520242].

U.S. Nuclear Regulatory Commission, 2006, NRC Inspection Report 040-08943/06-001, September 8, 2006 [ADAMS Accession No. ML062540084].

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

U.S. Nuclear Regulatory Commission, 2007b, Environmental Assessment, Central Processing Plant Upgrade, Crow Butte Resources, Inc., Crawford, Nebraska, SUA-1534 [ADAMS Accession No. ML072360283].