

April 19, 2004

Michael L. Griffin  
Manager of Environmental and Regulatory Affairs  
Crow Butte Resources, Inc.  
86 Crow Butte Road  
P.O. Box 169  
Crawford, NE 69339-0169

SUBJECT: LICENSE AMENDMENT 17, CROW BUTTE RESOURCES *IN SITU* LEACH FACILITY, LICENSE NO. SUA-1534, LICENSE CONDITION 10.3.C (TAC LU0022)

Dear Mr. Griffin:

We have completed our review of your request to amend Material License SUA-1534, License Condition (LC) 10.3.C., dated March 4, 2004, in which Crow Butte Resources, Inc., requested that LC 10.3.C be amended to incorporate by reference the Groundwater Restoration Plan (Revision 3). Based on our analysis documented in the enclosed Technical Evaluation Report (TER) (Enclosure 1), we approve your request. Therefore, LC 10.3.C has been changed as follows:

- C. Groundwater restoration goals shall be established on a parameter-by-parameter basis for the constituents identified in License Condition 10.3.B. The primary goal of restoration shall be on a parameter-by-parameter basis to return the average well field unit concentration to baseline conditions. The secondary goal of groundwater restoration shall be on a parameter-by-parameter basis to return the average well field unit concentration to the numerical class-of-use standards established by the Nebraska Department of Environmental Quality, as described in section 6.1.3 of the approved license application. The licensee shall conduct groundwater restoration activities in accordance with the groundwater restoration plan submitted by letter dated March 4, 2004.

[Applicable Amendment: 11, 15, 17]

The revised license is forwarded as Enclosure 2.

As discussed in the TER, pursuant to 10 CFR 51.22(c)(11), neither an environmental assessment or an environmental impact statement is warranted for this action.

These changes to Materials License SUA-1534 were discussed between you and Mr. John Lusher, the NRC Project Manager for the Crow Butte facility, on April 8, 2004. If you have any questions concerning this letter or the enclosure, please contact Mr. Lusher at (301) 415-7694 or by e-mail to [JHL@nrc.gov](mailto:JHL@nrc.gov).

M. Griffin

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In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> .

Sincerely,

***/RA/***

Gary S. Janosko, Chief  
Fuel Cycle Facilities Branch  
Division of Fuel Cycle Safety  
and Safeguards  
Office of Nuclear Material Safety  
and Safeguards

Docket No.: 40-8943  
License No.: SUA-1534

Enclosures:

1. Technical Evaluation Report
2. Materials License SUA-1534, Amendment 17

cc: Stephen P. Collings, CBR, Denver  
Dave Miesbach, Nebraska, UIC, DEQ  
Dave Carlson, Nebraska, UIC, DEQ  
Sheryl K. Rogers, Nebraska, RMP, PHA

M. Griffin

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## TECHNICAL EVALUATION REPORT

**DOCKET NO.:** 40-8943

**LICENSE NO.:** SUA-1534

**FACILITY:** Crow Butte Resources *In Situ* Leach Uranium Project, Dawes County, Nebraska (TAC LU0022)

**PROJECT MANAGER:** John H. Lusher

**TECHNICAL REVIEWER:** Ron C. Linton, Hydrogeologist

### SUMMARY AND CONCLUSIONS:

Crow Butte Resources, Inc., (CBR) has requested that Licence Condition (LC) 10.3.C be amended to incorporate by reference the Groundwater Restoration Plan (Revision 3) dated March 4, 2004.

CBR has proposed that the CBR Safety and Environmental Review Panel (SERP) have the responsibility to determine when restoration has been achieved in accordance with the restoration standards from LC 10.3 on a mine unit basis. If the SERP determines restoration has been achieved, the SERP will recommend initiation of stability monitoring. The Nebraska Department of Environmental Quality (NDEQ) Director will be notified of the decision and will either accept or deny initiation of stability monitoring. After stability monitoring is complete, the Nuclear Regulatory Commission (NRC) has the final review authority and responsibility to declare the mine unit restored.

CBR has proposed that monthly ground-water composite samples be accepted between quarterly ground-water grab samples during the stability monitoring period as defined in the CBR Groundwater Restoration Plan. The NDEQ Underground Injection Control (UIC) program requires monthly stability monitoring samples. The NDEQ has stated that monthly composite sampling is permissible under its UIC Program. Grab sample analysis will continue on a quarterly basis.

The staff has reviewed the proposed changes and agrees with the request. The last sentence in LC 10.3.C should read:

"The licensee shall conduct groundwater restoration activities in accordance with the Groundwater Restoration Plan submitted by letter dated March 4, 2004."

The only change to this license condition is the date change from January 30, 2003, to March 4, 2004.

### BACKGROUND:

CBR submitted a request to amend Source Materials Licence SUA-1534 to change the approved Groundwater Restoration Plan for its *In Situ* Leach (ISL) facility in Dawes County, Nebraska. CBR proposes that the CBR SERP have the ability to determine when restoration

has been achieved in accordance with the restoration standards from LC 10.3 and when to initiate stability monitoring. Currently under the license, only the NRC can approve the initiation of stability monitoring. CBR also proposes to change the stability monitoring program as specified in the Groundwater Restoration Plan that is incorporated by reference in LC 10.3.C. The stability monitoring program in the currently approved plan requires sampling and analysis of each individual restoration well (grab samples) on a monthly basis throughout the stabilization period of six months. CBR proposes the following changes:

- The CBR SERP will determine if well field restoration has achieved the restoration standards from LC 10.3 on a mine unit basis. If so, the SERP will recommend the initiation of stability monitoring and notify the NDEQ Director. The NDEQ Director can either deny or approve initiation of stability monitoring.
- CBR will sample and analyze discrete grab samples from each individual restoration well during the first round of stability monitoring. These samples will be split with the NDEQ according to UIC permit requirements. A physical composite sample will be analyzed along with the grab samples.
- In subsequent monthly stability monitoring samples, each designated restoration well will be sampled as required in the plan. A physical composite sample of these individual well samples will be analyzed. A portion of the individual samples will be properly preserved for additional individual analysis if the composite sample shows increasing trends in monitored parameters.
- Quarterly grab samples will be analyzed between the first and final round of stability monitoring along with a physical composite sample.
- Grab samples from each individual restoration well will be analyzed during the final round of stability monitoring. These samples will be split with the NDEQ according to UIC permit requirements. A physical composite sample will be analyzed along with the grab samples.
- CBR will continue quarterly grab sampling after the six-month stability monitoring period for all monitored constituents that exhibit significant increasing trends. Sampling will continue until no increasing trends are observed or until continued restoration is initiated.

## **TECHNICAL EVALUATION:**

### **SERP Review of Restoration Data and Initiation of Stability Monitoring**

The current Groundwater Restoration Plan (January 30, 2003) requires that CBR submit post-restoration data to the NRC before initiation of stability monitoring. This data must demonstrate that the mine unit meets the established restoration criteria. CBR proposes that the CBR SERP can effectively determine whether the mine unit meets the restoration standards and can approve initiation of stability monitoring based on the NRC performance-based license. Once the SERP has determined that restoration has been achieved based on LC 10.3, stability monitoring would be initiated. CBR will notify the NDEQ Director that restoration parameters

have been met and stability monitoring has been initiated. The NDEQ director will either accept or deny initiation of stability monitoring.

This procedure is consistent with guidance in NUREG-1569, Section 6.1:

In conducting these evaluations, the reviewer should consider the technical evaluations conducted by a state or another federal agency with authorities overlapping those of the NRC. The desired outcome is to identify any areas where duplicative NRC reviews may be reduced or eliminated.

The guidance encourages the NRC to consider reviews of state agencies. In this case, CBR will need to obtain the approval of the NDEQ Director to proceed with stability monitoring. Removing the NRC review role at this step only removes duplication of review, not the need for regulatory review. Regulatory review will be done by the NDEQ Director, who will either approve or deny initiation of stability monitoring.

When all parameters are stable and the restoration criteria are met as discussed in the Groundwater Restoration Plan, Section 3, CBR will submit final reports to the regulatory agencies and request that the mine unit be declared restored. If, at the end of restoration activities, the parameters are not at or below the approved standards, CBR will either reinitiate certain steps of the restoration plan or submit documentation to the NRC that the best practical technology has been used in restoration. The documentation will include a justification for alternate parameter value(s) including available water quality data and a narrative of the restoration techniques used. The NRC will have the final determination to declare that well field restoration is complete or to require further restoration.

### **Stability Monitoring Program, Sampling Requirements**

The current stability monitoring program is outlined within the Groundwater Restoration Plan (January 30, 2003). The stability monitoring program requires that monthly grab samples are analyzed from all restoration wells for six months. At the end of six months, the Groundwater Restoration Plan defines stability as a lack of significant increasing contaminant trends, but does not define the frequency of monitoring if significant increasing trends still exist. CBR has proposed several changes in the stability monitoring program. These changes will meet the goals of monitoring the concentrations of the restoration parameters to determine that there are no significantly increasing trends following groundwater restoration while reducing the analytical cost of sampling.

Currently, monthly stability monitoring grab samples are used to calculate a mathematical average for each parameter in the mine unit. The proposed changes would replace the mathematical average with a physical average obtained from physically mixing a portion of each grab sample to create one composite sample. Individual grab samples would continue on a quarterly basis. The combination of quarterly grab samples and monthly composite samples would be used to confirm that all areas of the mine unit have remained stable during the stability monitoring period.

NUREG-1569 Section 6.1.3.(5) defines the purpose of the stability monitoring program as follows:

The purpose of a stability monitoring program is to ensure that chemical species of concern do not increase in concentration subsequent to restoration. The applicant should specify the length of time that stability monitoring will be conducted, the number of wells to be monitored, the chemical indicators to be monitored, and the monitoring frequency. These requirements will vary based on site-specific post-extraction water quality and geohydrologic and geochemical characteristics. Before final well field decommissioning is completed, all designated monitor wells must be sampled for all monitored constituents. Well fields may be decommissioned when all constituent concentrations meet approved restoration standards and no post-restoration degradation in ground-water quality occurs outside of the aquifer exemption boundary.

This section clearly directs the applicant to specify the length of time that stability monitoring will be conducted, the number of wells to be monitored, the chemical indicators to be monitored, and the monitoring frequency. This section also stipulates that before final well field decommissioning is completed, all designated monitor wells must be sampled for all monitored constituents.

CBR has based its proposed changes of the stability monitoring program from using monthly grab samples to using a mix of grab samples and physical composite samples on ASTM standard D 6051 - 96 (Reapproved 2001), "Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities." The ASTM guidance discusses the advantages and appropriate use of composite sampling, including field procedures and techniques to mix the composite sample and procedures to collect an unbiased and precise subsample from a larger sample. The guidance also discusses the advantages and limitations of using composite samples in designing sampling plans for characterization of wastes and potentially contaminated media. While the ASTM guidance focuses on solid materials, the attributes and limitations of composite sampling apply equally to static liquid samples.

The ASTM guidance cites several advantages to composite sampling. The principal advantage of sample compositing is cost reduction where analytical costs are high relative to sampling costs. Compositing of samples may also reduce the variance of an estimated averaged concentration and increase the efficiency of locating and identifying hot spots.

CBR's cost for analysis of the restoration parameters is several hundred dollars per sample. CBR estimates that the current stability monitoring program for mine units 2-9 would cost a minimum of \$300,000. The proposed change would reduce this cost to CBR by nearly two-thirds. CBR has demonstrated the principal advantage needed to justify compositing is that analytical costs are high relative to sampling costs.

The ASTM guidance cites several limitations to composite sampling. The principal limitation of sample compositing involves the loss of discrete information contained in a single sample and the potential for dilution of the contaminants in a single sample with uncontaminated water. Dilution may leave "hot spots" overlooked. Compositing and retesting may also not be cost effective if the goal is to detect hot spots and a large proportion of the samples are expected to test positive for an attribute. Compositing of samples does not work well if chemical interaction

occurs between constituents in the samples being combined, if volatiles are lost during mixing, or if the sample cannot be properly mixed. Compositing may not be used where regulations specify that a grab sample must be collected.

At CBR, there are no limitations for compositing due to chemical interactions, mixing or loss of contaminants due to volatilization. NUREG-1569, Section 6.1.3.(5), does not specify that grab samples are required, only that all designated monitor wells must be sampled for all monitored constituents before final well field decommissioning is completed. Additionally, the guidance in NUREG-1569 does not discuss the need to identify hot spots or variations in chemical contamination within the mine unit. NUREG-1569, Section 6.1.3.(4) states:

The applicant has the option of determining numerical restoration limits for each monitored constituent on a well-by-well basis, or as a mathematical average applied over the entire well field.

CBR uses the mathematical average applied over the entire well field for compliance with restoration limits. The mine unit average at CBR is determined as a mathematical average of the individual grab samples. Physical monthly composite samples would replace mathematical monthly grab samples between the quarterly grab sample events. There should be very little difference between the mathematical average and the physical average. To ensure minimal difference between the mathematical and physical averages, CBR will analyze a physical composite sample when grab samples are analyzed to compare the results from both methods.

Although NUREG-1569, Section 6.1.3.(4) does not require the applicant to look for hot spots or variations in chemical contamination within the mine unit, NUREG-1569, Section 6.1.3.(6) stipulates:

Ground-water restoration operations, and the expected post-reclamation ground-water quality, must not adversely affect ground-water use outside the exploited production zone.

One of the limitations noted by ASTM and in other publications on composite sampling is the potential dilution of contaminants and the subsequent lack of data that would fail to show hot spots and variations of contamination. One or two highly contaminated wells in a mine unit may be overlooked without discrete grab samples. In a well field that contains well samples that have very low contamination, one or two highly contaminated well samples may become diluted in a composite sample causing a hot spot to be missed. Contaminants from the hot spot may threaten ground water that is located outside of the exploited production zone, especially if the hot spot is on the hydrologically downgradient side of the mine unit.

CBR will analyze grab samples as part of the stability monitoring program on a quarterly basis. Quarterly sampling will help to determine that if hot spots exist, that they are not overlooked, and that ground water outside of the production zone is not likely adversely affected. Quarterly sampling is consistent with NRC decommissioning guidance for materials' licensees for ground-water characterization activities during the decommissioning process. NUREG-1757, Volume 2, Appendix F.5 states:

After an initial sampling round in which each monitoring well is sampled, representative samples should be collected and analyzed on a quarterly basis.



The CBR stability monitoring program requires monthly sampling of constituents. NUREG-1569 does not have a monthly monitoring requirement. The monthly monitoring requirement is based on NDEQ UIC Permit requirements. The UIC Permit requires that during stabilization, the permittee will monitor all designated restoration wells on a monthly basis for all the parameters listed in the restoration table. The NDEQ has agreed that composite samples would be acceptable as monthly sampling between quarterly grab samples for their UIC program (David Miesback, personal communication).

NUREG-1569, Section 6.1.3.(3) states:

Generally, the acceptance criteria for restoration success are based on the ability to meet the predetermined numerical standard of the restoration program and the absence of significant increasing trends of monitored indicator constituent concentrations during the stability monitoring period.

The Groundwater Restoration Plan defines restoration success as the absence of significant increasing trends for monitored constituents. The plan requires that quarterly grab sample monitoring continue for the individual constituents that are showing significant increasing trends or until continued restoration is initiated. Monitored constituents that exhibit no significant increasing trends could be removed from the sampling plan upon regulatory agency approval.

### **Other ISL Licence Stability Monitoring Programs**

The stability monitoring program from the License Application of the Power Resources Inc., Smith Ranch - Highland Uranium Project site and the COGEMA Mining Inc., Irigaray and Christensen Ranch site are cited below as comparisons to the proposed CBR stability monitoring program.

Power Resources Inc., Smith Ranch - Highland Uranium Project, Converse County, WY, Reclamation Plan, Chapter 6.1.4, Restoration Stability Monitoring Stage:

Following concurrence from the Wyoming Department of Environmental Quality that restoration has been achieved in the mining area, a six-month stability period is assessed to show that the restoration goal has been adequately maintained. The following restoration stability monitoring program is performed during the stability period:

The monitor ring wells (m-wells) are sampled once every two months and analyzed for the UCL parameters, chloride, total alkalinity (or bicarbonate) and conductivity; and

At the beginning, middle, and end of the stability period, the MP-Wells will be sampled and analyzed for the parameters in Table 5-1 of Chapter 5. (27 parameters).

COGEMA Mining Inc., Irigaray and Christensen Ranch site, Johnson and Campbell Counties, WY, Restoration and Reclamation Plans, Chapter 6.1.2.4, Stabilization Monitoring:

A post-restoration stabilization monitoring period of nine months is typically instituted at the end of restoration. Within this time frame, the designated restoration wells are sampled at the beginning, then at the end of every three month period, providing a total of four samples during the nine-month period of stability monitoring. The samples are analyzed for a full suite of chemical and radiological analyses. As the aquifer requires time to equilibrate after the active restoration, more frequent sampling of these wells is not recommended.

Monitor wells are typically sampled on a quarterly basis during the post-restoration stability period. Analyses include the three excursion parameters.

The stability monitoring programs for the Power Resources Inc., and the COGEMA ISL facilities are six months and nine months respectively, with grab samples taken on a quarterly basis. The request from CBR would be consistent with both of these licensee stability monitoring programs.

#### **ENVIRONMENTAL REVIEW:**

The staff has determined that the proposed licensing action is procedural in nature and that the following conditions have been met:

- . There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite;
- . There is no significant increase in individual or cumulative occupational radiation exposure;
- . There is no significant construction impact; and
- . There is no significant increase in the potential for or consequences from radiological accidents.

Therefore, the staff has concluded that this license amendment meets the requirements in 10 CFR 51.22(c)(11) for a categorical exclusion. Consequently, neither an environmental assessment nor an environmental impact statement is required.

## REFERENCES:

American Society for Testing and Materials (ASTM) Standard D 6051-96 (2001), Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities, 1996.

COGEMA Mining, Inc., Irigaray - Christensen Ranch 1996 License Renewal Application, SUA-1341, January 5, 1996, as amended.

Crow Butte Resources, Inc., Crow Butte Uranium Project, Application for Renewal of USNRC Radioactive Source Materials License, SUA-1534, December 1995, as amended.

Lancaster, V., and Keller-McNulty, S., Composite Sampling, Part I, Environmental Testing and Analysis, July/August 1998, pp. 15-18.

Power Resources, Inc., Smith Ranch - Highland Uranium Project, Source Material License Application, USNRC License No: SUA-1548, May 6, 2003, as amended.

Rajagopal, R., and Williams, L. R., Economics of Sample Compositing as a Screening Tool in Ground Water Monitoring, Ground Water Monitoring Review, 1989, pp. 186-192.

United States Environmental Protection Agency, EPA/240/R-02/005, Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan EPA QA/G-5S, December 2002.

----- EPA -230-R-95-005, EPA Observational Economy Series, Volume 1: Composite Sampling, August 1995.

United States Nuclear Regulatory Commission, NUREG-1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications, June 2003.

----- NUREG-1757, Volume 2, Consolidated NMSS Decommissioning Guidance, Characterization, Survey, and Determination of Radiological Criteria, Final Report, September 2003