December 8, 2015

Mr. John Cash, Vice President
Lost Creek ISR, LLC
5880 Enterprise Drive, Suite 200
Casper, WY 82609

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION, LICENSE AMENDMENT REQUEST TO REMOVE LICENSE CONDITIONS 12.10, 12.11, AND 12.12, LOST CREEK IN-SITU RECOVERY, LLC, SWEETWATER COUNTY, WYOMING, LICENSE SUA-1598 (TAC J00717)

Dear Mr. Cash:

By letter dated July 12, 2013, (U.S. Nuclear Regulatory Commission (NRC) Agencywide Documents Access and Management System (ADAMS) Accession No. ML13282A381), Lost Creek In-Situ Recovery, LLC (LCI) submitted a request to amend NRC Materials License SUA-1598 by removing License Conditions (LCs) 12.10, 12.11, and 12.12. On November 15, 2013, LCI submitted its standard operating procedures (ADAMS Accession No. ML13324A962) referenced in its July 12, 2013, response. On November 3, 2014, NRC staff issued a technical evaluation report on the LCI submittals pertaining to LC 12.10 (ADAMS Accession No. ML14289A073). The staff found that the information provided by LCI was insufficient and requested additional information within 30 days. On January 16, 2015, LCI submitted a revised response to License Condition 12.10 (ADAMS Accession No. ML15029A423). On May 21, 2015, NRC staff issued requests for additional information (RAI) on LC 12.10 (ADAMS Accession No. ML15125A090). On July 28, 2015, LCI provided its response to NRC staff's May 21, 2015, RAI (ADAMS Accession No. ML15218A055).

The NRC staff has no further requests regarding LCI's responses to License Conditions 12.10 B), 12.10 C), 12.10 D), and 12.12. However, during its technical review, NRC staff identified certain areas of deficiency in LCI's responses to License Condition 12.10 A) and 12.11 for which it is requesting additional information. The staff's RAI is enclosed, herein. The NRC staff is willing to meet with LCI to discuss and/or clarify the staff's expectations for the enclosed RAI, otherwise please either respond to this RAI or provide a schedule for submitting your responses within 30 days of receipt of this letter.

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

If you have any questions, please contact me at (301) 415-0697, or at John.Saxton@nrc.gov.

Sincerely,

/RA/

John Saxton, Hydrogeologist
Uranium Recovery Licensing Branch
Division of Decommissioning, Uranium Recovery,
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket No.: 040-09068
License No: SUA-1598

Enclosure:
Requests for Additional Information

cc:
Mr. Miles Bennett, WDEQ
Mr. Brian Wood, WDEQ
Mr. John Russell, BLM

If you have any questions, please contact me at (301) 415-0697, or at John.Saxton@nrc.gov.

Sincerely,

/RA/

John Saxton, Hydrogeologist
Uranium Recovery Licensing Branch
Division of Decommissioning, Uranium Recovery,
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket No.: 040-09068
License No: SUA-1598

Enclosure:
Requests for Additional Information

cc:
Mr. Miles Bennett, WDEQ
Mr. Brian Wood, WDEQ
Mr. John Russell, BLM

DISTRIBUTION:
RKellar/RIV LGersey/RIV

ADAMS Accession No.: ML15308A392

OFC	DUWP	DUWP	DUWP	DUWP	DUWP
NAME	D. Brown	J. Saxton	S. Achten	B. VonTill	J. Saxton
DATE	11/4/15	12/7/15	12/7/15	12/8/15	12/8/15

OFFICIAL RECORD COPY

U.S. Nuclear Regulatory Commission
Requests for Additional Information
Lost Creek ISR, LLC
Technical Review of Request to Remove License Conditions 12.10, 12.11, and 12.12
From Source Material License SUA-1598

The purpose of the following Request for Additional Information (RAI) is to provide the additional information and data that are necessary for the U.S. Nuclear Regulatory Commission (NRC) to review a license amendment request from Lost Creek ISR, LLC (LCI) to remove License Conditions (LCs) 12.10, 12.11, and 12.12 from its Materials License SUA-1598.

Description of Deficiency

LCI did not include NRC Form 313 with the July 12, 2013, license amendment request.

Basis for Request

Title 10, *Code of Federal Regulations* (10 CFR), 40.44, "Amendment of licenses at request of licensee," requires that application for amendment of a license shall be filed on NRC Form 313 in accordance with §40.31 and shall specify the respects in which the licensee desires the license to be amended and the grounds for such amendment.

Request for Additional Information

1. Please provide a completed NRC Form 313 associated with the July 12, 2013, request.

Description of Deficiency

With regard to LC 12.10, LCI has not justified its determination that only natural uranium, radon, and radon progeny are principal radionuclides which will be accounted for by surveys and/or monitoring from all point and diffuse sources.

Basis for Request

The regulations in 10 CFR 40.65 describe requirements for each licensee authorized to possess and use source material in uranium milling to specify, on a semi-annual basis, the quantity of each of the principal radionuclides released to unrestricted areas in liquid and gaseous effluents. The guidance in Regulatory Guide 4.14, Regulatory Position 2.1.1, states that samples "should be representative (not necessarily isokinetic) and adequate for the determination of the release rates and concentrations of uranium, thorium-230, radium-226, and lead-210" (NRC 1980).

Regulatory Guide 4.14 does not define the phrase "principal radionuclides," but rather specifies the four radionuclides (i.e., uranium, thorium-230, radium-226, and lead-210) that should be measured. The NRC staff is not aware of any other definition of "principal radionuclides" as it applies to in-situ uranium recovery facilities. The NRC staff understands that LCI's proposal to monitor only uranium, radon, and radon progeny, is consistent with the description of gaseous

effluent and airborne particulate matter in NUREG/CR-6733, “A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees” (NRC 2001). However, the generic description of ISR facilities contained in Section 2 of NUREG/CR-6733 was not intended to provide justification for excluding radionuclides from air effluent reporting. Also, though it is not relevant to uranium recovery facility licensing, the NRC staff is also aware that Regulatory Guide 4.16, “Monitoring and Reporting Radioactive Materials in Liquid and Gaseous Effluents From Nuclear Fuel Cycle Facilities,” which applies to nuclear fuel cycle facilities other than uranium milling facilities and nuclear power reactors, defines “principal radionuclides” to include any radionuclide that constitutes at least 1 percent of the total activity released or contributes at least 1 percent of the exposure estimated for a member of the public from a specific effluent stream (NRC 2010).

In its January 16, 2015, letter, LCI stated the following reasons why thorium-230, radium-226, and lead-210 should not be considered principal radionuclides: (1) in-situ mining brings relatively small quantities of these radionuclides to the surface; (2) these radionuclides remain in solution throughout most of the process; (3) these radionuclides grow in slowly in yellowcake after it is dried, and uranium is usually packaged within 72 hours of separation; (4) there is minimal opportunity for yellowcake to become airborne; and, (5) recent air sample results for thorium-230, radium-226, lead-210, and polonium-210 which indicate each of these radionuclides is present at less than 4 percent of the derived air concentration (DAC) in 10 CFR Part 20, Appendix B, Table 1 (LCI 2015a).

The NRC staff does not agree that LCI has justified why thorium-230, radium-226, and lead-210 should not be considered principal radionuclides. With regard to item (1) above, LCI stated in its January 16, 2015, letter that the concentration of radium-226 in production fluid was 2,700 pCi/L in December 2014 (LCI 2015a). By comparison, the NRC staff estimates the concentration of natural uranium at a typical level of 50 parts per million in production fluid is equivalent to about 34,000 pCi/L natural uranium. Given that the concentration of radium-226 in production fluid could be approximately 5 to 10 percent of the natural uranium concentration, NRC staff doesn’t agree that the radium-226 concentrations are “relatively small.” Also, with regard to items (2) through (5) above, LCI stated that it’s measurements of air concentrations of thorium-230, radium-226, lead-210, and polonium-210 were each up to 4 percent of the DAC. By comparison, plant air sample results provided by LCI for its 2014 public dose calculation indicate that natural uranium concentrations in air ranged from an average of 2.29×10^{-12} µCi/mL to a maximum of 1.52×10^{-11} µCi/mL, or between 1 and 5 percent of the DAC for Class W natural uranium (LCI 2015c). This indicates that concentrations of thorium-230, radium-226, lead-210, and polonium-210, which LCI stated are present at concentrations up to 4 percent of the DAC, are comparable to plant air concentrations of natural uranium.

Therefore, LCI should also measure thorium-230, radium-226, and lead-210 in its air effluent monitoring program, in accordance with Regulatory Guide 4.14, Regulatory Position 2.1.1, or provide sufficient justification why these radionuclides should not be measured.

Request for Additional Information

2. Please include thorium-230, radium-226, and lead-210 as principal radionuclides in the air effluent monitoring program or provide sufficient justification as to why these radionuclides should not be considered principal radionuclides.

Description of Deficiency

With regard to its response to LC 12.11, the methodology that LCI uses to estimate surface contamination detection capability, or scan minimum detectable concentrations (MDCs), does not account for: (1) radionuclide mixtures likely to present at the Lost Creek ISR Project; (2) weighted counting efficiencies of the proposed instruments, including consideration of surface efficiencies; (3) calibration of portable instruments for low energy beta-emitting radionuclides; (4) the influence of low background count rates on the calculation of the scan minimum detectable concentration; and (5) residence time of instruments over potentially contaminated surfaces in both the scan mode or static survey mode.

In its submittals dated July 12, 2013, and November 15, 2013, LCI provided a table of minimum detectable activities (MDAs) and MDCs for representative Lost Creek Site Survey Instruments (LCI 2013a) and its standard operating procedures for contamination detection and control (LCI 2013b). LCI stated that the Ludlum Model 43-93 detector with a Ludlum Model 2360 data logger is the main instrument used for contamination release surveys. LCI stated that this instrument is used for personnel survey procedures for release, where the release limit to unrestricted areas is 1,000 dpm per 100 cm^2. LCI also stated that the Ludlum Model 3 survey meter with 44-9 pancake GM detector, and the Ludlum Model 26 integrated GM pancake frisker have higher MDA and MDC values and will be used for surveying items in the plant and wellfield, such as 11e.(2) byproduct material waste.

LCI's method for calculating instrument MDCs is provided in its Standard Operating Procedure No. SOP_LC_HP-004, "Radiation Detection Instrumentation" (LCI 2013b).

The NRC staff recently approved another ISR licensee's methodology for calculating MDCs of survey instruments used in a contamination control program (NRC 2015c). The methodology described in that example was consistent with existing NRC guidance, and addresses each of the deficiencies identified above. This method demonstrates that a contamination control program which relies principally on the Ludlum Model 43-93 detector is feasible, provided appropriate attention is given to scan rates and static survey times.

Basis for Request

As provided in NUREG-1569, Acceptance Criterion 5.7.6.3(8), the staff considered the guidance contained in NUREG-1575, Revision 1 (NRC 2000) in its evaluation of LCI's scan MDCs.

Request for Additional Information

3. Please provide a revised description of the methodology for calculating MDCs of survey instruments used to release equipment and materials for unrestricted use and for personnel contamination surveys. The revised description should address both counting systems used for swipe surveys (e.g., the Ludlum Model 3030P described in LCI SOP_LC_HP-011, "Alpha/Beta Counting Systems," (LCI 2013b)) and portable instruments.

    a. In the revised description of LCI's methodology, please address the mixtures of radionuclides likely to be present at the LCI Project, including, at a minimum, the radionuclide mixtures anticipated for lixiviant and for yellowcake.

    b. In the revised description of LCI's methodology, please account for surface efficiencies in the determination of counting efficiencies of LCI's instruments. As noted in a previous licensing action (NRC 2015b, c), NRC staff has previously endorsed the ISO 7503-1 (ISO 1988) approach for assigning default surface efficiencies based on particle type (i.e., alpha or beta) and energy.

    c. In the revised description of LCI's methodology, please describe how surface contamination survey instruments are calibrated for detection of low-energy beta particles associated with short-lived uranium progeny and other low-energy beta-emitting contaminants.

    d. In the revised description of LCI's methodology, please describe appropriate alpha and beta scan MDCs equations in addition to alpha and beta static survey equations.

4. Using a revised methodology for calculating MDCs of survey instruments, please provide revised estimates of MDCs and demonstrate that appropriate LCI target levels and regulatory limits are met, in accordance with LC 12.11.

5. Please identify the important parameters in calculating MDCs which should be controlled by procedure (e.g., residence time), and commit to including these parameters in appropriate procedures and training programs.

References

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." Washington, DC

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic Licensing of Source Material." Washington, DC

ISO (International Organization for Standardization). 1988. ISO–7503–1, "Evaluation of Surface Contamination – Part 1: Beta Emitters and Alpha Emitters (first edition)." ISO: Geneva, Switzerland. 1988.

LCI (Lost Creek ISR, LLC). 2013a. Letter from J. Cash, LCI to J. Saxton, NRC, dated July 12, 2013, RE: Lost Creek ISR Project, License SUA-1598, Docket 040-09068, Amendment Request to Remove License Conditions 12.10, 12.11, and 12.12. ADAMS Accession No. ML13282A381.

LCI (Lost Creek ISR, LLC). 2013b. E-mail from M. Gaither, LCI to J. Saxton, NRC, dated November 15, 2013, Re: SOPs for Lost Creek LC 12.10 SUA-1598, ADAMS Accession No. ML13324A962.

LCI (Lost Creek ISR, LLC). 2015a. Letter from J. Cash, LCI to NRC, dated January 16, 2015, Re: Reply to NRC's November 3, 2014 Letter Regarding License Condition 12.10 Lost Creek ISR Project License SUA-1598, Docket 040-09068, TAC J00717. ADAMS Accession No. ML15029A423.

LCI (Lost Creek ISR, LLC). 2015b. Letter from J. Cash, LCI to NRC, dated July 28, 2015, Re: Reply to NRC's May 21, 2015 Letter Regarding License Condition 12.10, Lost Creek ISR Project License SUA-1598, Docket 40-9068, TAC J00717. ADAMS Accession No. ML15218A055.

LCI (Lost Creek ISR, LLC). 2015c. Letter from J. Cash, LCI to NRC, dated July 28, 2015, Re: 2014 ALARA Audit and Public Dose Calculation, Lost Creek ISR Project License SUA-1598, Docket 40-9068, TAC J00717. ADAMS Accession No. ML15218A013.

NRC (U.S. Nuclear Regulatory Commission). 1980. Regulatory Guide 4.14, Revision 1, "Radiological Effluent and Environmental Monitoring at Uranium Mills." Washington, DC, ADAMS Accession No. ML003739941.

NRC (U.S. Nuclear Regulatory Commission). 2000. Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). NUREG-1575, Washington, DC: NRC, Office of Nuclear Regulatory Research. Accession No. ML003761476.

NRC (U.S. Nuclear Regulatory Commission). 2001. NUREG/CR-6733, "A Baseline Risk-Informed, Performance-Based Approach for In-Situ Leach Uranium Extraction Licensees." ADAMS Accession No. ML012840152.

NRC (U.S. Nuclear Regulatory Commission). 2010. Regulatory Guide 4.16, Revision 2, "Monitoring and Reporting Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Cycle Facilities." Washington, DC, ADAMS Accession No. ML101720291.

NRC (U.S. Nuclear Regulatory Commission). 2014. NRC letter to J. Cash, Lost Creek ISR, LLC, dated November 3, 2014, re: Staff's Evaluation of Lost Creek's Submittal to Satisfy License Condition 12.10 and Amend the Source and Byproduct Materials License SUA-1598 (TAC J00717). ADAMS Accession No. ML14289A073.

NRC (U.S. Nuclear Regulatory Commission). 2015a. NRC letter to J. Cash, Lost Creek ISR, LLC, dated May 21, 2015, re: Request for Additional Information, Response to License Condition 12.10, Lost Creek ISR, LLC, Sweetwater County, WY, License SUA-1598 (TAC J00717). ADAMS Accession No. ML15125A090.

NRC (U.S. Nuclear Regulatory Commission). 2015b. Letter from J. Saxton, NRC to Mr. M. Griffin, Strata Energy, Inc., dated October 15, 2015, Re: Request for Additional Information on Submittal Regarding License Condition 12.8, Ross ISR Project, Crook County, WY, Source Material License SUA-1601, Docket No. 040-09091, TAC J00735. ADAMS Accession No. ML15278A115.

NRC (U.S. Nuclear Regulatory Commission). 2015c. Letter from A. Persinko, NRC to Mr. M. Griffin, Strata Energy, Inc., dated October 28, 2015 Re: Amendment 4, Source and Byproduct Materials License SUA-1601, Ross In-Situ Recovery (ISR) Project, Crook County, WY, Removal of License Condition 12.8, Docket No. 040-09091, TAC J00735. ADAMS Accession No. ML15295A045.