SAFETY EVALUATION REPORT

STRATA ENERGY, INC'S LICENSE AMENDMENT REQUEST TO MODIFY THE LIST OF PARAMETERS FOR THE WELLFIELD BASELINE SAMPLING AT THE ROSS ISR PROJECT, CROOK COUNTY, WYOMING

DATE: June 26, 2015

DOCKET: 04009091

LICENSE NO.: SUA-1601

LICENSEE: Strata Energy, Inc.

SITE: Ross ISR Project

PROJECT MANAGER: John L. Saxton

TECHNICAL REVIEWER: John L. Saxton

BACKGROUND

By letter dated May 27, 2015, Strata Energy, Inc. (Strata) submitted a license amendment request to modify License Condition 11.3(D) (Agencywide Documents Access and Management System (ADAMS) Accession Number ML15149A023). The modification consists of revising Table 5.7-2 *Wellfield Baseline Aqueous Sampling Parameter List* in the approved license application, which License Condition 11.3(D) incorporates by reference.

REGULATORY REQUIREMENTS

NRC issued Strata the Source and Byproduct Materials License SUA-1601 in April 2014. License Condition 11.3(D) states the following:

> (D) Sampling and Analyses. Four samples shall be collected from each well to establish background levels. The sampling events shall be at least 14 days apart. The samples shall be analyzed for parameters listed in Table 5.7-2 of the approved license application. The third and fourth sample events can be analyzed for a reduced list of parameters; the parameters that can be deleted from analysis are those below the minimum analytical detection limits (MDL) during the first and second sampling events provided the MDLs meet the data quality objectives for the sampling.

As discussed with Strata, because License Condition 11.3(D) specifically incorporates by reference Table 5.7-2 of the approved license application, the table can be modified only through a license amendment.

TECHNICAL EVALUATION

Strata's request is to remove the following 14 parameters from the list of parameters to be analyzed for the baseline sampling:

Turbidity
Oxidation-Reduction Potential (ORP)
Dissolved Oxygen
Iron, total
Manganese, total
Uranium, suspended
Lead-210, dissolved
Lead-210, suspended
Polonium-210, dissolved
Polonium-210, suspended
Radium-226, suspended
Radon-222
Thorium-230, dissolved
Thorium-230, suspended

The request also includes adding two parameters[1] to the list as follows:

Silica
Manganese, dissolved

A comparison of Table 5.7-2 from the approved license application and the proposed amendment is attached.

Strata's rationale for the request is that the parameters are: (1) not included or consistent with applicable guidance of the Wyoming Department of Environmental Quality (WDEQ) or the U.S. Nuclear Regulatory Commission (NRC); (2) difficult to sample and/or measure; (3) not needed to effectively establish baseline groundwater quality for determination of restoration standards or upper control limits; and (4) not used at other NRC-licensed or operating facilities.

Strata also argues that the guidance is not clear regarding the sampling aliquot for the various parameters (i.e., dissolved, suspended or total) resulting in variation in sampling programs for various licensees. In its request, Strata provides a table comparing the parameters included at several NRC-licensed facilities and recommended by the various guidance documents.

Staff's Review

Staff reviewed the list of parameters in the approved license application (i.e., Table 5.7-2) during the initial license application review using guidance in NUREG-1569 (NRC, 2003). The applicable acceptance criteria as listed in NUREG-1569 state the following:

> *The applicant should identify the list of constituents to be sampled for baseline concentrations. The list of constituents in Table 2.7.3-1 is accepted by the NRC for in situ leach facilities. Alternatively, applicants may propose a list of constituents that is tailored to a particular location. In such cases, sufficient*

[1] The narrative of Strata's request only discusses silica as the added parameter; however, the "revised" Table 5.7-2 includes "Manganese, dissolved" as a parameter which was not included in the original table. Staff understanding that Strata's intent is to replace "Manganese, total" with "Manganese, dissolved".

> *technical bases must be provided for the selected constituent list.* (Acceptance Criterion 2.7.3(4))
>
> *The applicant should identify the list of constituents sampled for baseline concentrations. Table 2.7.3-1 provides a list of acceptable constituents for monitoring at in situ leach facilities. Alternatively, applicants may propose a list of constituents that is tailored to a particular location. In such cases, sufficient technical bases must be provided to demonstrate the acceptability of the selected constituent list.* (Acceptance Criterion 5.7.8.3(1))

In this case, the list of constituents as proposed by Strata in the original application exceeded the recommended lists in Table 2.7.3-1 of NUREG-1569 or the applicable guidance of Wyoming. Strata carried over the comprehensive list to the wellfield baseline sampling from the sampling program it had developed for site characterization sampling for the application (compare Table 5.7-2 with Table 2.7-11 of the approved application).[2] The comprehensive list that Strata developed combined constituents for various programs (i.e., field stability parameters to establish stability during purging from the low-flow sampling methodology, wellfield baseline constituents pursuant to NUREG-1569 and other guidance documents (e.g., WDEQ Guideline 4 (WDEQ, 2013)), and effluent monitoring program constituents pursuant to Regulatory Guide 4.14 (NRC, 1980)).

Typically, when a proposed list includes all "acceptable" constituents plus additional constituents, staff does not perform a rigorous technical basis analysis for the additional constituents and none was explicitly stated in the Safety Evaluation Report (NRC, 2014). To remove the constituents from the approved list requires justification by the licensee and evaluation and approval by the staff.

The constituents turbidity, ORP, and dissolved oxygen are those parameters measured in the field during groundwater sampling/purging. The intent of those parameter measurements is an indication that sufficient purging of a well has occurred and that groundwater samples could be obtained that are representative of the aquifer. The licensee is correct that NUREG-1569 does not include those constituents on the recommended list nor are they typically measured at most ISR facilities. Strata proposes to measure pH, specific conductivity[3], temperature, and depth to water[4] in the field.[5] These field sampling parameters are consistent with the recommendations in NUREG-1569 and the current industry-standard sampling methodologies for establishing the extent of purging of a well prior to sampling. In fact, the current industry standard practice for purging a well is a hybrid of a fixed volume and stability monitoring that is acceptable to NRC and other agencies (USGS, 2006; Yeskis and Zavala, 2002).

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[2] The comprehensive list was for surface water as well as groundwater.

[3] The licensee lists "field conductivity" and most facilities report the measurement as "conductivity"; however, based on the reported units, and consistent with the recommendations in NUREG-1569, the parameter to be measured is actually "specific conductivity."

[4] Depth to water is not listed on the recommended list in Table 2.7.3-1 of NUREG-1569; however, the depth to water is measured for all acceptable sampling methodologies.

[5] Although Strata will include these parameters in in the sampling program, Strata incorrectly reports on Table 1 of the amendment request that measurement of pH and specific conductivity in the field is not recommended by NUREG-1569.

Strata proposes to remove iron (total), manganese (total) and uranium (suspended) from the list while maintaining the dissolved fractions for each of those constituents in the revised program. Strata is correct that NUREG-1569 does not specifically state whether the dissolved or total fractions should be monitored for those constituents.[6] Historically, guidance from Wyoming specified that total iron and total manganese be measured, but, as Strata correctly states in the amendment request, recent revisions to the guidance have changed the constituents to dissolved iron and dissolved manganese.

Iron and manganese are not considered hazardous constituents. Both are sensitive to oxidation state of the aquifer and thus useful in establishing a baseline if the oxidation state of the aquifer is affected by the operations, which is the case for ISR operations. The difference between the total and dissolved fractions in groundwater is that the total fraction also includes the constituents attached to particles or colloidal material in groundwater, which are collectively referred to as sediment load or the "suspended" fraction.

In this case, should the oxidation state of the aquifer change resulting in an increase in iron or manganese, an increase is anticipated to affect both dissolved and total fractions. Furthermore, because of the well construction and frequency of sampling, groundwater samples from wells used for the groundwater detection monitoring programs have low sediment loads, which would minimize differences between the dissolved and total fractions. Therefore, staff finds that the change to dissolved iron and dissolved manganese acceptable as this change will not impact the baseline data as it will be used to establish restoration success or excursion monitoring.

Similar arguments would apply to suspended uranium, though uranium is a hazardous constituent. The licensee is correct that NRC's NUREG-1569 and Wyoming's Guideline 4 guidance for wellfield baseline sampling does not specify the fraction (i.e., dissolved, suspended or total) to be measured for radium-226 or radium-228. NRC's Regulatory Guide 4.14 does specify that only the dissolved fraction should be measured in the monitoring wells surrounding the impoundment (regulated unit) but that the dissolved and suspended fractions should be measured for the nearby water supply wells (NRC, 1980). Historically, NRC licensees only measured the dissolved fraction (if the historic documentation specified which fraction was analyzed) for the wellfield baseline data. For monitoring purposes (for baseline data), staff finds that the change of removing suspended uranium and keeping only the dissolved uranium fraction acceptable. However, licensee's Table 5.7-2 was also referenced for the environmental review program which included monitoring of water from nearby water supply wells. For the purposes of that program, staff will require both dissolved and suspended uranium fractions to be measured for the environmental and effluent preoperational data.

For radium, the licensee's revision includes continued sampling of the dissolved fraction for both radium-226 and radium-228 but requests to remove suspended fraction of radium-226 from the list (the original Table 5.7-2 did not include the suspended fraction for radium-228). The licensee is correct that NRC's NUREG-1569 and Wyoming's Guideline 4 guidance for wellfield baseline sampling does not specify the fraction (i.e., dissolved, suspended or total) to be measured for radium-226 or radium-228. NRC's Regulatory Guide 4.14 (RG 4.14) does specify that the dissolved fraction should be measured in the monitoring wells for the impoundment and dissolved and suspended fractions for the nearby water supply wells (NRC, 1980). Historically, NRC licensees only measured the dissolved fraction (if the historic documentation specified

[6] The "suspended" fraction is actually the "total" minus the "dissolved" fractions.

which fraction). For the wellfield baseline data purposes, staff finds that the change to only the dissolved radium-226 and radium-228 fractions acceptable. However, licensee's Table 5.7-2 was also referenced for the environmental review program which included monitoring of water from nearby water supply wells. For the purposes of that program, staff will require both dissolved and suspended radium-226 and radium-228 fractions to be measured for the environmental and effluent preoperational data.

Although thorium-230 is a constituent listed in RG 4.14 for conventional mills (NRC, 1980), NUREG-1569 specifically discusses why thorium-230 is not a constituent of concern for in situ recovery operations (NRC, 2003). Historically, thorium-230 is not included in the baseline data for existing ISR operations. Therefore, staff finds that removal of thorium-230 from the list acceptable.

The remaining constituents that the licensee is requesting to remove from the list of wellfield baseline sampling are the radionuclides in the radon-222 decay chain (radon-222, lead-210, polonium-210). For radon-222, the licensee is correct that NRC's NUREG-1569 and Wyoming's Guideline 4 guidance on sampling for well baseline sampling does not specify this constituent. Historically, NRC licensees have not included radon for wellfield baseline monitoring. Furthermore, because a portion of the parent radium-226 is removed from the system during operations (the system is defined as the groundwater and aquifer matrix), and the short half-life of radon-222, the operations are not expected to increase radon-222 in groundwater after operations. Therefore, staff finds that the removal of radon-222 from the list of constituents acceptable.

For lead-210 and polonium-210, the licensee is correct that NRC's NUREG-1569 and Wyoming's Guideline 4 guidance for wellfield baseline sampling does not specify these constituents. NRC's Regulatory Guide 4.14 (RG 4.14) does specify that the dissolved fraction should be measured in the monitoring wells for the impoundment and dissolved and suspended fractions for the nearby water supply wells (NRC, 1980). Historically, NRC licensees have not measured these radionuclides. Furthermore, published data indicates that lead is strongly sorbed to soil (Focazio et al., 2001). In addition, lead-210 decays primarily through beta decay and polonium-210 decays primarily through alpha decay. These isotopes would both be measured in the gross alpha and gross beta measurements performed by the licensee. Typically, these radionuclides are included in the environmental program and not the groundwater protection monitoring program to establish restoration success or excursion monitoring. Therefore, staff finds that removal of the radionuclides from the baseline data for the groundwater protection detection monitoring programs will not affect those programs. The licensee will be required to monitor those constituents for the environmental monitoring program.

In summary, staff finds that the proposed modification to the list of parameters to be analyzed for the wellfield baseline data will not impact the effectiveness of the groundwater protection monitoring programs for the wellfield (restoration and excursion monitoring) and is consistent with recommendations in the applicable guidance documents. Therefore, staff approves the proposed amendment request.

ENVIRONMENTAL REVIEW

This license amendment belongs to a category of actions which the NRC has determined do not individually or cumulatively have a significant effect on the environment. Such actions qualify for a categorical exclusion under 10 CFR 51.22(c) and do not require an environmental assessment. Specifically, the NRC staff has determined that this amendment to NRC Source and Byproduct Materials License SUA-1601 is categorically excluded from further environmental review under 10 CFR 51.22(c)(11) because the amendment results in change in process operations and equipment, with (i) no significant change in the types or significant increase in the amounts of any effluents that may be released offsite, (ii) no significant increase in individual or cumulative occupational radiation exposure, (iii) no significant construction impact, and (iv) no significant increase in the potential for or consequences from radiological accidents.

PROPOSED LICENSE CONDITIONS

Based on NRC's review as discussed above, License Conditions 9.2 and 11.3 of NRC Source and Byproduct Materials License SUA-1601 will be amended as follows:

9.2 The licensee shall conduct operations in accordance with the commitments, representations, and statements contained in the license application dated January 4, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML110120063), which is supplemented by submittals dated February 28, 2011 (ML110800187), March 30, 2012 (ML121030404), April 6, 2012 (ML121020343), August 10, 2012 (ML12227A369), January 18, 2013 (ML130370654), October 14, 2013 (ML13295A230), October 17, 2013 (ML13296A026), February 28, 2014 (ML14091A036) and May 27, 2015 (ML15149A023). The approved application and supplements, hereby, are incorporated by reference, except where superseded by specific conditions in this license. The licensee must maintain the approved, updated, license application on site.

Whenever the word "will" or "shall" is used in the above referenced documents, it shall denote a requirement. The use of "the Wellfield" in this license is synonymous with the use of mine unit as defined in the approved license application. The use of "verification" in this license with respect to a document submitted for NRC staff review means a written acknowledgement by U.S. Nuclear Regulatory Commission (NRC) staff that the specified submitted material is consistent with commitments in the approved license application, or requirements in a license condition or regulation. A verification will not require a license amendment.

[Applicable Amendment: 2]

11.3 Establishment of Background Water Quality. Prior to injection of lixiviant in a wellfield, the licensee shall establish background water quality data for the ore zone, overlying and underlying aquifers. The background water quality sampling shall provide representative baseline data and establish ground water protection standards and excursion monitoring upper control limits, as described in Section 5.7.8 of the approved license application and this license condition.

The data for each mine unit shall consist, at a minimum, of the following sampling and analyses:

A) Ore Zone. To establish a Commission-approved background concentration pursuant to Criterion 5B(5)(a) of 10 CFR Part 40 Appendix A, samples shall be collected from production and injection wells at a minimum density of one production or injection well per two acres of wellfield production area, or, if a wellfield production area is sufficiently isolated from the other wellfield production areas in the Wellfield, a minimum of two wells. Wells selected for the baseline data will be the same ones used to measure restoration success and stabilization.

B) Perimeter Monitoring Wells. Samples shall be collected from all perimeter monitoring wells that will be used for the excursion monitoring program. The perimeter wells will be installed for a wellfield in accordance with information presented in Section 3.1.6 of the approved license application. In no case will the perimeter monitoring wells be installed outside of the exempted aquifer as defined by the Class III UIC permit issued by the Wyoming Department of Environmental Quality.

C) Overlying and Underlying Aquifers. Samples shall be collected from all monitoring wells in the first overlying and first underlying aquifer at a minimum density of one well per 4 acres of wellfield.

D) Sampling and Analyses. Four samples shall be collected from each well to establish background levels. The sampling events shall be at least 14 days apart. The samples shall be analyzed for parameters listed in Table 5.7-2 of the approved license application, as revised by the May 27, 2015 submittal (ML15149A023). The third and fourth sample events can be analyzed for a reduced list of parameters; the parameters that can be deleted from analysis are those below the minimum analytical detection limits (MDL) during the first and second sampling events provided the MDLs meet the data quality objectives for the sampling.

E) Background Water Quality. For the perimeter ring monitoring wells (Section B) and monitoring wells in the overlying and underlying aquifers (Section C), the background levels shall be the mean values on a parameter-by-parameter, well-by-well, wellfield or sub-set of the wellfield basis, as deemed appropriate, in accordance with Section 5.7.8.1 of the approved license application. The UCLs for monitoring wells in the perimeter ring and overlying and underlying aquifers are established per LC 11.4. For the ore zone monitoring wells, the background levels shall be established on a parameter-by-parameter basis using either the wellfield, sub-set of the wellfield or well-specific mean value. The established background value for each parameter shall be based on the mean value plus a statistically valid factor to account for spatial variability in the data, in accordance with Section 6.1.1.1 of the approved license application.

[Applicable Amendment: 2]

REFERENCES

Focazio, M. J., Z. Szabo, et al. (2001). Occurrence of Selected Radionuclides in Ground Water used for Drinking Water in the United States: A Reconnaissance Survey, 1998. Water-Resources Investigations Report.

NRC, 1980. Regulatory Guide 4.14, Revision 1, "Radiological Effluent and Environmental Monitoring at Uranium Mills", Washington, DC., April 1980.

NRC, 2003. NUREG-1569, "Standard Review Plan for In-Situ Leach Uranium Extraction License Applications—Final Report", Washington, DC., June 2003.

NRC, 2014. "Safety Evaluation Report (Revised Jan 2014) for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming, Materials License No. SUA-1601", Docket No. 04009091, ADAMS Accession No. ML14002A107, February 4, 2014.

USGS, 2006. "Collection of water samples (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Chap. A4, September 2006", U.S. Geological Survey accessed September 26, 2012 at http://pubs.water.usgs.gov/twri9A4/.

WDEQ, 2013. "Guideline No. 4 In Situ Mining Noncoal", Wyoming Department of Environmental Quality, Land Quality Division, October 2013 (Table 2 Update 2/6/2014).

Yeskis, D. and B. Zavala, 2002. "Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers", U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, EPA 542-S-02-001, accessed August 23, 2012 at www.clu-in.org/tio/tsp.

Comparison of Table 5.7-2

Approved License Application

Parameter	Units
Field	
Field conductivity	umhos/cm
Field pH	s.u.
Field turbidity	NTUs
Depth to water	Ft
Temperature	Deg C
ORP	Millivolts
Dissolved oxygen	mg/L
General	
Alkalinity (as CaCO3)	mg/L
Ammonia	mg/L
Fluoride	mg/L
Laboratory conductivity	umhos/cm
Laboratory pH	s.u.
Nitrate/nitrite	mg/L
Total dissolved solids	mg/L
Major Ions	
Calcium	mg/L
Magnesium	mg/L
Potassium	mg/L
Sodium	mg/L
Bicarbonate	mg/L
Carbonate	mg/L
Chloride	mg/L
Sulfate	mg/L
Metals	
Aluminum, dissolved	mg/L
Arsenic, dissolved	mg/L
Barium, dissolved	mg/L
Boron, dissolved	mg/L
Cadmium, dissolved	mg/L
Chromium, dissolved	mg/L
Copper, dissolved	mg/L
Iron, dissolved	mg/L
Iron, total	mg/L
Lead, dissolved	mg/L
Manganese, total	mg/L
Mercury	mg/L
Molybdenum, dissolved	mg/L
Nickel, dissolved	mg/L
Selenium, dissolved	mg/L
Silver, dissolved	mg/L
Uranium, dissolved	mg/L
Uranium, suspended	mg/L
Vanadium, dissolved	mg/L
Zinc, dissolved	mg/L
Radiological	
Lead 210, dissolved	pCi/L
Lead 210, suspended	pCi/L
Polonium 210, dissolved	pCi/L
Polonium 210, suspended	pCi/L
Ra-226, dissolved	pCi/L
Ra-226, suspended	pCi/L
Ra-228, dissolved	pCi/L
Radon-222	pCi/L
Th-230, dissolved	pCi/L
Th-230, suspended	pCi/L
Gross alpha	pCi/L
Gross beta	pCi/L

Amendment Request

Parameter	Units
Field	
Field conductivity	umhos/cm
Field pH	s.u.
Depth to water	Ft
Temperature	Deg C
General	
Alkalinity (as CaCO3)	mg/L
Ammonia	mg/L
Fluoride	mg/L
Silica, dissolved	Mg/L
Laboratory conductivity	umhos/cm
Laboratory pH	s.u.
Nitrate/nitrite	mg/L
Total dissolved solids	mg/L
Major Ions	
Calcium	mg/L
Magnesium	mg/L
Potassium	mg/L
Sodium	mg/L
Bicarbonate	mg/L
Carbonate	mg/L
Chloride	mg/L
Sulfate	mg/L
Metals	
Aluminum, dissolved	mg/L
Arsenic, dissolved	mg/L
Barium, dissolved	mg/L
Boron, dissolved	mg/L
Cadmium, dissolved	mg/L
Chromium, dissolved	mg/L
Copper, dissolved	mg/L
Iron, dissolved	mg/L
Lead, dissolved	mg/L
Manganese, dissolved	mg/L
Mercury	mg/L
Molybdenum, dissolved	mg/L
Nickel, dissolved	mg/L
Selenium, dissolved	mg/L
Silver, dissolved	mg/L
Uranium, dissolved	mg/L
Vanadium, dissolved	mg/L
Zinc, dissolved	mg/L
Radiological	
Ra-226, dissolved	pCi/L
Ra-228, dissolved	pCi/L
Gross alpha	pCi/L
Gross beta	pCi/L

ENCLOSURE 2

LICENSE SUA-1601, AMENDMENT 2