



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

November 23, 2015

Mr. Michael Griffin  
Vice President of Permitting, Regulatory  
and Environmental Compliance  
Strata Energy, Inc.  
PO Box 2318  
Gillette, WY 82717-2318

SUBJECT: VERIFICATION OF MINE UNIT 1 WELLFIELD PACKAGE SOURCE AND  
BYPRODUCT MATERIALS LICENSE SUA-1601, ROSS IN-SITU RECOVERY  
(ISR) PROJECT, CROOK COUNTY, WYOMING, TAC L00789

Dear Mr. Griffin:

Enclosed, please find the U.S. Nuclear Regulatory Commission (NRC) staff's "*Technical Evaluation Report, Materials License SUA-1601, Verification of Mine Unit 1 Wellfield Package*". Based on staff's review as documented in the report, staff herein provides verification of the Mine Unit 1 Wellfield Package pursuant to SUA-1601 Condition 10.13, and, as a prerequisite, SUA-1601 Condition 10.12 (Abandonment of Historic Drill Holes).

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 regarding this action, please contact me at 301-415-0697 or by e-mail at [John.Saxton@nrc.gov](mailto: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.: 040-09091 License No.: SUA-1601

Enclosure:  
Technical Evaluation Report for Mine  
Unit 1 Wellfield Package Verification

cc: D. Schellinger WDEQ

November 23, 2015

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Vice President of Permitting, Regulatory  
and Environmental Compliance  
Strata Energy, Inc.  
PO Box 2318  
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Docket No.: 040-09091 License No.: SUA-1601

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**Technical Evaluation Report, Materials License SUA-1601,  
Verification of Mine Unit 1 Wellfield Package**

DATE: November 17, 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

This is a U.S. Nuclear Regulatory Commission (NRC) staff Technical Evaluation Report (TER) for a request submitted by Strata Energy, Inc. (Strata) on July 17, 2015 (Strata, 2015a), to review and for verification that the submitted Mine Unit 1 (MU1) Wellfield Package, as amended, meets requirements of license SUA-1601.

**Background**

Strata, as license holder for the Source and Byproduct Materials License SUA-1601, is required to submit to NRC staff, for review and verification, the initial wellfield package for a new wellfield, in this case, Mine Unit 1. The language of license condition 10.13, which is the applicable license condition, states:

10.13 Wellfield Package. Prior to conducting principal activities in a new wellfield, the licensee shall submit a hydrologic test data package (wellfield package) to the NRC. The initial wellfield package will be submitted for NRC staff review and verification. Each wellfield package shall be submitted at least 60 days prior to the planned start date of lixiviant injection. In each wellfield data package, the licensee will document that: (1) all perimeter monitoring wells are screened in the appropriate horizon in order to provide timely detection of an excursion; and (2), the baseline values to establish ground water protection standards and Upper Control Limits (UCLs) for the Wellfield in accordance with LC 11.3. The wellfield package will adequately define heterogeneities that may affect the chemical signature and ground-water flow paths within the ore zone as described in Sections 2.7.3.2.3, 3.1.1 and 5.7.8.1 of the approved license application.

In addition to License Condition 10.13, License Condition 10.12 also requires that the licensee document in a wellfield package efforts to identify and properly abandon all drill holes. The specific language of License Condition 10.12 is the following:

Enclosure

- 10.12 Prior to conducting tests for a wellfield data package, the licensee will attempt to locate and abandon all historic drill holes within: A) The perimeter well ring for the Wellfield; and B) To the extent the historic drill holes extend into the first underlying aquifer, the area that is downgradient of the Wellfield and is between the perimeter well ring for the Wellfield and the closer of either
- i. The Ross Project license area boundaries shown in figure 1.4-2 of the approved license application; or
  - ii. The outer boundary of the exempted aquifer as defined by the Class III UIC permit issued by the Wyoming Department of Environmental Quality.

The licensee will document such efforts to identify and properly abandon all drill holes in the wellfield data package.

[Applicable Amendment: 1]

The above license conditions form the regulatory basis for staff's review. As defined in License SUA-1601, a verification means a written acknowledgement by 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.

### **Evaluation**

Staff reviewed the July 17<sup>th</sup> submittal and found it addressed the required items for a wellfield package but several items which needed clarification and/or revision for staff's verification as is discussed below. The July 17<sup>th</sup> submittal included a description of the licensee's hydrogeologic conceptual model, geological cross sections, well spacing of the monitoring wells in the perimeter well ring and overlying and underlying aquifers, results of three pumping test, mechanical integrity testing, efforts to abandon historical drill holes, a groundwater numeric model, and the mine unit baseline water quality including discussions on the statistical analyses to establish the groundwater protection standards for the ore zone and upper control limits for the excursion monitoring program.

The objects of the initial pumping test were 1) to demonstrate that the perimeter wells and OZ wells (future production/injection wells) within the mine unit are in hydraulic communication, 2) to evaluate the level of hydraulic communication between the production zone and the overlying and underlying intervals, and 3) to evaluate the aquifer hydraulic characteristics of the OZ aquifer within the mine unit (Strata, 2015a). The initial pumping test consisted of monitoring responses at 26 ore zone baseline wells, 19 perimeter monitoring wells, 14 wells in the overlying aquifer (SM Unit) and 14 wells in the underlying aquifer (DM Unit). The pumping was conducted at a centrally located well (MU1-OZ02) at an average pumping rate of 31.7 gallons per minute (gpm) during the 3.16-day pumping phase. The pumping test included an antecedent (background) phase, pumping phase and recovery phase.

Staff agrees that the pumping test, as designed, was sufficient to meet the stated objects based on the conceptual model documented in the license application.

The licensee states that no responses to the pumping test was observed at wells in the SM or DM units. The licensee acknowledges that a small decline was observed in water levels at all wells screened in the SM unit but that decline was not attributed to the pumping test (Strata, 2015a).

Staff reviewed the responses and agrees with the licensee that the responses in the SM Unit wells do not correlate with the pumping activity. However, the fluctuations (approximately 1 foot) are greater than expected for a typical confined aquifer and likely attributed to the proximity of the wellfield its source area (the outcrop area is located less than 100 feet to the east).

The licensee acknowledges that all DM wells were recovering from the sampling event that occurred prior to the pumping test, in some cases as little as six days before the start of the background period. The license explains that the DM Unit has a low transmissivity and, as a result, all DM wells require several weeks for water levels to recover following a sampling event (Strata, 2012a).

Staff finds that the recovery from the prior sampling hampered the detection of a response at the DM Unit wells. In some cases, the recovery from the sampling event resulted in a 20-foot increase in water levels during the pumping test. With that recovery, it is difficult to distinguish a response if one were negligible. Staff reviewed that data and agrees that any response to the pumping test would be negligible (i.e., less than 0.1 feet). Furthermore, reviewing the data for the OZ wells following a sampling event at several DM Unit wells (which resulted in drawdowns at the DM Unit well in excess of 100 feet), staff did not identify any response in the OZ wells following those sampling events. Therefore, staff has reasonable assurance that the responses to the DM Unit wells from the initial pumping test are negligible and finds that the licensee has performed an adequate pumping test for this purpose.

The licensee reports that six perimeter monitoring wells (PM12, PM13, PM14A, PM15, PM16 and PM17) and one ore zone well (MU1-OZ23) did not exhibit responses during the initial pumping tests (Strata, 2012a). All of the wells that did not exhibit a response are located in the southeastern corner of the wellfield. The licensee attributes the lack of response to heterogeneities in the ore zone, specifically a fine grained, low permeable, horizon forming a hydraulic barrier separating the southeastern section of the wellfield from the remaining area. To test this hypothesis, the licensee performed a second pumping test in the southeastern portion of the wellfield.

The second pumping test consisted of monitoring responses at three ore zone baseline wells, six perimeter monitoring wells, three wells in the overlying aquifer (SM Unit) and three wells in the underlying aquifer (DM Unit). The pumping was conducted at well MU1-OZ23 at an average

pumping rate of 4.8 gpm during the 5.03-day pumping phase. The pumping test included an antecedent (background) phase, pumping phase and recovery phase.

The licensee reported that a muted response was observed in the three ore zone baseline wells, a minor response at one SM well (MU1-SM12), no responses at the DM wells and responses at all six monitored perimeter ring wells (Strata, 2015a). The licensee stated that results of the second pumping test confirmed its conceptual model of a low permeable zone separating the southeastern portion of the wellfield from the remaining area of the wellfield. The licensee stated that the minor response at the one SM well was attributed to a local phenomenon such as an improperly abandoned drill hole.

Staff finds the licensee's explanation as plausible. However, should an excursion be noted in the future, License Condition 11.5 requires the licensee to cease injection in the area until staff is assured that the leakage is not through a drill hole.

Based upon the above, Staff finds that the pumping tests conducted for the wellfield package is consistent with License Condition 10.13.

Staff had issues with respect to the remaining items required for a wellfield package including the potentiometric surface and the standards calculated by the licensee. Staff held a public meeting on August 10, 2015 to discuss issues regarding the July 17<sup>th</sup> submittal (NRC, 2015a). The issues discussed during the meeting are summarized in the meeting summary (NRC, 2015c). The issues with respect to Staff's verification of the package are as follows:

- Discrepancy between the thickness of the ore zone wells and the value used in the Surety Calculations
- Abandonment of drill holes between the perimeter well ring and aquifer exemption boundary
- Entire set of well completion reports
- Higher than expected potentiometric heads at several perimeter wells
- Proposed Upper Control Limit (UCL) for sulfate for the DM unit

### **Discrepancy between the Thickness of the Ore Zone Wells and the Value used in the Surety Calculations**

During the August 10<sup>th</sup> Public Meeting, Staff identified the discrepancy between the average thickness of the screened interval for the ore zone baseline wells as documented in the MU1 Wellfield Package (approximately 15 feet) and the value used in the surety calculations (8 feet). The discrepancy would result in an underestimation of the surety amount. As the surety review by NRC was in its final stages, and Strata's instrument had been established in the amount approved by Wyoming (and was in the process of concurrence at NRC), Staff and Strata representatives discussed an approach other than to completely revise the surety amount. The approach was to limit the area of the wellfield such that the calculated cost based on the revised thickness resulted in a cost that was less than or equal to the value of the existing instrument.

By letter dated September 30, 2015 (Strata, 2015b), Strata submitted its evaluation that restricting the operation in Mine Unit 1 to the first two header houses, rather than four as used in the original surety calculations, yielded a cost that is less than the existing surety instrument. Staff reviewed and agrees with Strata's evaluation. Consequently, Staff issued Amendment 4 to license SUA-1601 for the annual surety update (NRC, 2015d). The limitation to the first two header houses is included in the amended license condition.

Therefore, this issue has been resolved with respect to verification of the MU1 Wellfield Package.

### **Abandonment of Drill Holes between the Perimeter Well Ring and Aquifer Exemption Boundary**

During the August 10<sup>th</sup> Public Meeting, Staff and Strata representatives discussed the issues surrounding the abandonment of drill holes pursuant to License Condition 10.12. At issue was Strata's compliance with paragraph B of the license condition.<sup>1</sup> An action item for Strata from the public meeting was to submit a letter clarifying Strata's position with respect to this issue.

By letter dated August 21, 2015 (Strata, 2015e), Strata provided a clarification of their position on this issue. Staff reviewed the submission and determined that the information was insufficient for staff to verify that Strata's actions met the license condition. Staff informed Strata of this decision by letter dated September 8, 2015 (NRC, 2015b).

During a public meeting on September 29, 2015 (NRC, 2015e), staff discussed the verification issue with respect to abandonment of drill holes. For Staff, the only issue that existed was determining the downgradient direction. During the public meeting and subsequent clarification during a project-manager to project-manager call, Staff's view was that the downgradient direction includes the present-day southward direction due to the pumping of the existing industrial wells and to the northwest if in the future operations of the industrial wells are discontinued. Staff's view is based on the groundwater numeric flow model results included in Strata's approved license application.

By letter dated October 5, 2015 (Strata, 2015c), Strata provided a plan for abandonment of the drill holes to meet requirements of Paragraph B of License Condition 10.12. Strata stated that this plan should provide sufficient information for Staff to verify the license condition and that the abandonment records would be available for Staff to review during the pre-operational inspection. Staff reviewed the submittal and found Strata's list of drill holes in the downgradient direction was consistent with Staff's determination with the exception of approximately two dozen drill holes. During the pre-operational inspection that occurred during the week of November 2, Staff reviewed the drill holes that were abandoned and the two-dozen exception drill holes. Staff found that Strat's abandonment of the drill holes met the requirements of License Condition 10.12.

Therefore, this issue has been resolved with respect to verification of the MU1 Wellfield Package.

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<sup>1</sup> The issue is documented in depth in the referenced documents.

## **Entire Set of Well Completion Reports**

During the August 10<sup>th</sup> Public Meeting, Staff stated that the MU1 Wellfield Package only contained boring logs for those monitoring wells included in the geologic cross sections and that logs for all monitoring wells were needed. Strata representatives stated that the boring logs for the remaining wells will be submitted. Strata submitted the boring logs missing from the package in its addendum (Strata, 2015g). Staff reviewed the additional boring logs and finds them acceptable.

Therefore, this issue has been resolved with respect to verification of the MU1 Wellfield Package.

## **Higher-than-expected Potentiometric Heads at Several Perimeter Wells**

During the August 10<sup>th</sup> Public Meeting, Staff asked Strata representatives about the “perched” conditions to explain the higher-than-expected potentiometric heads at several perimeter wells as the aquifer is fully confined. Strata representatives acknowledged that “perched” perhaps was a poor word choice; their explanation was that the potentiometric heads reflect a higher head in the high portion of the aquifer in that area. Staff asked whether or not the higher heads suggest connection to the overlying aquifer because the heads were similar to those expected in the overlying aquifer. The opinion of Strata representatives was that the higher heads did not reflect a connection to the overlying aquifer.

Staff had issues with the lack of supporting information for Strata’s interpretation or conceptual model for the higher heads. Therefore, Staff could not verify that the wellfield package met License Condition 10.13 requirement that “[t]he wellfield package will adequately define heterogeneities that may affect the chemical signature and ground-water flow paths within the ore zone”. By letter dated September 8, 2015 (NRC, 2015b), Staff documented its concerns.

During a September 29<sup>th</sup> public meeting (NRC, 2015e), Strata representatives provided to Staff summary information on an aquifer test conducted on the overlying aquifer with monitoring conducted at the perimeter wells with the higher-than-expected potentiometric head. Strata representatives reported that a response was noted in two perimeter wells, PM12 and PM19. Staff informed strata representatives that the documentation on the testing must address the issue of impacts on future monitoring.

By letter dated October 9, 2015 (Strata, 2015d), Strata documented its evaluation of the aquifer test. However, the information supplied was insufficient as discussed in a October 10, 2015 Public Meeting (NRC, 2015f). During the public meeting, Strata representatives proposed installing a nested well at the two wells (PM12 and PM19) that exhibited a response during the overlying unit aquifer test. The nested wells will not be screened in the upper sand lense of the ore zone to which Strata attributed the higher-than-expected potentiometric heads. Staff agreed that the limited screened zone would resolve the issue assuming the overlying sand lense was indeed the source of the higher-than-expected heads. By letter dated October 23, 2015 (Strata, 2015f), Strata documented the work proposed for the installation of the nested wells. During the pre-operational inspection, Staff observed one of the nested wells in the field shortly after installation. The nested wells data are included in the addendum to the MU1 Wellfield Package (Strata, 2015g).



Therefore, this issue has been resolved with respect to verification of the MU1 Wellfield Package.

### **Proposed Upper Control Limit (UCL) for sulfate for the DM unit**

During the August 10<sup>th</sup> Public Meeting, Staff questioned Strata representatives about the proposed Upper Control Limit (UCL) for the excursion parameter sulfate for the lower unit. Specifically, the anticipated sulfate concentration in the lixiviant was less than the proposed UCL which would negate the possibility for detection of an excursion.

During the pre-operational inspection, NRC Staff and Strata discussed possible revisions to the UCLs for the excursion monitoring program. In the MU1 Wellfield Data Package Addendum (Strata, 2015g), Strata proposed UCLs for three grouping of wells within DM unit for the excursion parameters sulfate and specific conductivity. The grouping is based on the elevated sulfated detected in the groundwater at two wells. Both wells are spatially correlated. This grouping is permitted by License Condition 11.4.

In addition, Strata had revised the extent of the patterned areas within Mine Unit 1 and consequently removed two wells from the baseline data used to establish the Commission-approved background values for this mine unit and a monitoring well in the overlying and underlying aquifers (Strata, 2015g). Because the plan is to not install production patterns in that area, Staff agrees with the revisions as documented in the addendum.

Therefore, this issue has been resolved with respect to verification of the MU1 Wellfield Package.

### **Conclusion**

The NRC staff finds that Strata has provided a Mine Unit 1 Wellfield Data Package, as amended, that meets requirements in the applicable license conditions or regulations and meets commitments in the approved license application. Staff has concluded that this finding is verification of this initial wellfield package in accordance with License Condition 10.12.

### **References**

- NRC, 2015a. "August 10, 2015 Public Meeting Announcement to Discuss Staff's Issues with Verification of Strata's Mine Unit 1 Wellfield Package", Docket No. 040-09091. ADAMS Accession No. ML15211A448, July 2015.
- NRC, 2015b. "Critical Issues for Verification of Mine Unit 1 Wellfield Package", Docket No. 040-09091. ADAMS Accession No. ML15243A422, September 8, 2015.
- NRC, 2015c. "August 10, 2015 Public Meeting Summary of Discussion of Verification Issues on the Mine Unit 1 Wellfield Package", Docket No. 040-09091. ADAMS Accession No. ML15281A292, October 15, 2015.
- NRC, 2015d. "License Amendment 4 to SUA-1601, Strata Energy, Inc. Ross ISR Project in Crook County, Wyoming", Docket No. 040-09091. ADAMS Accession No. ML15295A049, October 28, 2015.

- NRC, 2015e. "September 29, 2015 Public Meeting Summary", Docket No. 040-09091. ADAMS Accession No. ML15323A073, November 20, 2015.
- NRC, 2015f. "October 20, 2015 Public Meeting Summary", Docket No. 04009091, ADAMS Accession No. ML15324A286, November 20, 2015.
- Strata, 2015a. Strata Energy, Inc., Ross ISR Project, Mine Unit 1 Wellfield Data Package, Docket No. 040-09091. ADAMS Accession No. ML15209A703, July 17, 2015.
- Strata, 2015b. Strata Energy, Inc. Ross ISR Project, Mine Unit Injection Limitation, Docket No. 040-09091. ADAMS Accession No. ML15289A056, September 30, 2015.
- Strata, 2015c. Response to License Condition 10.12, Critical Verification Issue for Mine Unit 1 Wellfield Data Package, Docket No. 04009091. ADAMS Accession No. ML15289A188, October 5, 2015.
- Strata, 2015d. Response to License Condition 10.13 Critical Verification Issue for Mine Unit 1 Wellfield Data Package, Docket No. 04009091. ADAMS Accession No. ML15296A443, October 9, 2015.
- Strata, 2015e. Response to the August 10, 2015 Public Meeting Discussion on License Condition 10.12, Docket No. 04009091. ADAMS Accession No. ML15246A134, August 21, 2015.
- Strata, 2015f. Additional Response to License Condition 10.13 Critical Verification Issue for Mine Unit 1 Wellfield Data Package, Docket No. 04009091. ADAMS Accession No. ML15296A433, October 23, 2015.
- Strata, 2015g. Mine Unit 1 Wellfield Data Package Addendum, Docket No. 04009091. ADAMS Accession No. ML15316A054, November 11, 2015.