

July 23, 2015

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

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION VERIFICATION REGARDING  
LICENSE CONDITION 12.13, ROSS ISR PROJECT, CROOK COUNTY, WY,  
SOURCE MATERIAL LICENSE SUA-1601, DOCKET NO. 040-09091, TAC  
J00725

Dear Mr. Griffin:

By letter dated May 1, 2014, Strata Energy, Inc. (Strata) submitted a report in response to preoperational License Condition 12.13 of Materials License SUA-1601 (Strata 2014). The report, dated May 2014, and prepared by Inter-Mountain Labs Air Science, is titled, "Demonstration of Long-term Representativeness of On-Site Meteorological Data: Ross In-Situ Uranium Recovery Project." Strata's preoperational license condition 12.13 states:

At least 90 days prior to the preoperational inspection, the licensee shall submit its analysis of the meteorological data collected to demonstrate long-term meteorological conditions at the Ross ISR Project. The licensee shall continue to collect meteorological data on a continuous basis at a data recovery rate of at least 90 percent and may not commence operations until the data collected are verified in writing by NRC headquarters staff to be representative of long-term meteorological conditions at the Ross ISR Project. The data collected on-site shall include, at a minimum, wind speed, wind direction, an annual wind rose and a summary of the stability classification.

To support the verification by NRC headquarters staff, the licensee must submit to the NRC a written justification of the similarity or validity of the data. This justification must include an analysis of the statistical data presented to illustrate confidence in the representativeness of the data.

The NRC staff has verified that meteorological data collected by Strata from 2010 through 2013 are representative of long-term meteorological conditions at the Ross ISR Project thus satisfying requirements of license condition 12.13. The staff's evaluation is enclosed.

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 Agencywide Documents Access and Management System (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: NRC Staff Verification of Meteorological Data

(Closes TAC J00725)

cc: D. Schellinger WDEQ

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).

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**/RA/**

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**U.S Nuclear Regulatory Commission Staff Verification of Meteorological Data  
Preoperational License Condition 12.13  
Materials License SUA-1601; Docket No. 040-09091**

By letter dated May 1, 2014, Strata Energy, Inc. (Strata) submitted a report to the U.S. Nuclear Regulatory Commission (NRC) in response to preoperational License Condition 12.13 of Materials License SUA-1601 (Strata 2014). The report, dated May 2014, and prepared by Inter-Mountain Labs Air Science (IML), is titled, "Demonstration of Long-term Representativeness of On-Site Meteorological Data: Ross In-Situ Uranium Recovery Project." Preoperational license condition 12.13 states:

At least 90 days prior to the preoperational inspection, the licensee shall submit its analysis of the meteorological data collected to demonstrate long-term meteorological conditions at the Ross ISR Project. The licensee shall continue to collect meteorological data on a continuous basis at a data recovery rate of at least 90 percent and may not commence operations until the data collected are verified in writing by NRC headquarters staff to be representative of long-term meteorological conditions at the Ross ISR Project. The data collected on-site shall include, at a minimum, wind speed, wind direction, an annual wind rose and a summary of the stability classification.

To support the verification by NRC headquarters staff, the licensee must submit to the NRC a written justification of the similarity or validity of the data. This justification must include an analysis of the statistical data presented to illustrate confidence in the representativeness of the data.

Materials License SUA-1601 was issued to Strata on April 24, 2014 (NRC 2014c).

**Background**

Acceptance criterion 2.5.3(3) of NUREG-1569, "states that the characterization of the site meteorology is acceptable if the meteorological data used for assessing impacts are substantiated as being representative of expected long-term conditions at and near the site (NRC 2003). Additional guidance on assessing whether short-term meteorological is representative of long-term conditions is provided in the fourth paragraph of Regulatory Position C.1 of Regulatory Guide 3.63, "Onsite Meteorological Measurement Program for Uranium Recovery Facilities – Data Acquisition and Reporting," (NRC 1988) which states:

The minimum amount of meteorological data needed for a siting evaluation is considered to be that amount of data gathered on a continuous basis for a consecutive 12-month period that is representative of long-term (e.g., 30 years) meteorological conditions in the site vicinity. To determine whether the period during which the onsite data was collected is representational, compare a concurrent period of meteorological data from a National Weather Service (NWS) station with the long-term meteorological data from that NWS station. The NWS station selected for this comparison should, if possible, be in a similar geographical and topographical location and be reasonably close (preferably within 50 miles (80 kilometers)) to the site. In some sections of the country, the spacing between NWS stations may necessitate the selection of an NWS station more than 50 miles away. The reduced data and supportive documentation

should be retained and should be available for review for the period of facility operation.

Regulatory Guide 3.63 does not include guidance on acceptable methods, qualitative or quantitative, for comparing concurrent and long-term meteorological data from a nearby NWS station. In its application for the Ross In Situ Recovery (ISR) Project (Strata 2011a, 2011b, 2012), Strata provided the results of a linear regression analysis to demonstrate that its baseline year of on-site meteorological measurements (January 2010 through December 2010) were representative of long-term conditions at the site, in accordance with the guidance in Regulatory Guide 3.63. In its January 2014 Safety Evaluation Report, NRC staff evaluated Strata's regression analysis and found that the applicant had "demonstrated that the meteorological data used for meteorological data used for assessing impacts are substantiated as being representative of expected long-term conditions at and near the Ross ISR Project site and thereby meets SRP Section 2.5.3 acceptance Criterion (3) (NRC 2003)." (NRC 2014a). However, in April 2014, NRC staff prepared a supplemental Safety Evaluation Report (sSER) for the Ross In Situ Recovery (ISR) Project (NRC 2014b). In its sSER, staff stated that it had "determined that it had misapplied interpretations of the linear regression analysis in the original SER and is issuing this supplemental Safety Evaluation Report (sSER) to correct that finding." Specifically, NRC staff stated:

...while NRC Staff found the linear regression analysis acceptable in the SER (NRC, 2013; 2014[a]), the NRC staff has determined subsequently that neither linear regression nor correlation analyses are appropriate statistical tests for representativeness of data sets. While linear regression and correlation analyses describe relationships between variables, a statistical test for representativeness requires an analysis of data populations (e.g., short- and long-term wind data at a given site).

Acceptable statistical methods to be used to substantiate representativeness are not addressed in RG 3.63 (NRC, 1988). The NRC staff finds the following statistical approaches acceptable: 1) testing summary statistics, such as the mean from the short- and long-term data (see, for example, Chapter 5 of Brooks and Carruthers, 1953), and 2) testing the statistics for similarity or validity of the data by using a statistical method such as the Student's T test, Chi square test for distribution, Kolmogorov-Smirnov test for distribution, etc., as appropriate (see, for example, Chapter 12 of NRC, 2011). Strata has not provided such tests; therefore, the NRC staff is requiring Strata to substantiate that the short-term meteorological data used for assessing impacts are representative of long-term conditions at or near the project by including a license condition to Strata's operating license.

As a result of the staff's supplemental evaluation, staff included license condition 12.13 in Strata's Materials License SUA-1601 (NRC 2014c).

#### NRC Staff Evaluation

In its May 2014 report prepared for Strata in response to LC 12.13, Inter-Mountain Labs (IML) evaluated all four years of meteorological data that Strata had collected from January 2010 through December 2013. IML evaluated the representativeness of Strata's four years of on-site meteorological data by using longer term data available from the Eagle Butte Mine, which is located 30 miles west of the Ross ISR Project site. After considering data from four sites, the

reasons provided by IML for selecting data from the Eagle Butte Mine are: the mine's proximity, similar elevation, and similar terrain; its long period of record; a high data recovery rate (98.5% recovery); and low instrument thresholds and high data resolution. The staff observed that Eagle Butte Mine is not a National Weather Service (NWS) station. Regulatory Position C.1 of Regulatory Guide 3.63 recommends that licensees use a NWS station to demonstrate representativeness. The nearest NWS station is located at the airport in Gillette, WY, which is located about 33 miles west-southwest of the Ross ISR Project. With regard to its selection of Eagle Butte Mine data, IML stated that the Eagle Butte Mine data complies with EPA guidance for meteorological monitoring (EPA 2000). IML also stated that the Gillette NWS station has only 15 years of data and its wind data has only extremely coarse ( $10^\circ$ ) resolution. The staff reviewed EPA's guidance, which also states in Section 6.7, "Use of Airport Data," that airport instruments are generally less sensitive, which can result in a higher incidence of recorded calm winds. For the reasons stated by IML and on the basis of the staff's evaluation above, the staff finds that the Eagle Butte Mine is an appropriate site for determining representativeness of meteorological data. Consistent with NRC staff's findings in the staff's April 2014 sSER, IML applied multiple quantitative statistical tests, in addition to qualitative comparisons of wind direction and wind speed frequency distributions, wind rose comparisons, and linear regression analysis. IML applied these tests to compare data from the Eagle Butte Mine for two timeframes: (1) a 4-year period from January 2010 through December 2013 that is concurrent with Strata's on-site data; and (2) a 15-year period of data collected from the Eagle Butte Mine site over a non-overlapping period from 1995 through 2009. The quantitative statistical tests that IML applied include: the Chi-Square ( $\chi^2$ ) test; the Student's t-test; Levene's test (a variation on the t-test); and linear correlation and linear regression. IML also stated that it did not use the Kolmogorov-Smirnov test because that test is unable to distinguish between clearly dissimilar wind patterns. IML also provided its evaluation of these methods in Appendix A of its report (Strata 2014).

NRC staff evaluated all of the analyses provided by IML to determine whether the aggregate of all quantitative and qualitative analyses supports Strata's finding that its 4 years of on-site meteorological data is representative of long-term conditions at the site.

#### *Qualitative analyses*

NRC staff examined wind roses for Eagle Butte Mine depicted in Figure 2 of the IML report. Staff finds that a visual comparison of the wind roses for the concurrent and long-term periods reveals a strong similarity between the two periods. Both concurrent and long-term wind roses show a prevalence of winds from the south, northwest and north-northwest. Winds from the east tend to be least frequent and percent of calm winds are both 0.2%. As depicted on the wind roses, there are no significant differences in the wind speed frequencies for any matched pair of directions. For example, for winds from the north, there appears to be a low frequency of calm to 4 mph winds, a greater frequency of 4 to 7.4 mph winds, about equal frequencies in the next two wind speed categories (7.4 to 12.1 mph and 12.1 to 19.0 mph) and successively lower frequencies for the next two categories (19.0 to 25.8 mph and > 25.8 mph).

NRC staff also examined bar charts for Eagle Butte Mine data depicted in Figures 1 and 5 of the IML report. The charts include both concurrent and long-term wind speed, wind direction, and stability class frequency data. NRC staff finds that Figures 1 and 5 also support a strong similarity between concurrent and long-term data. For example, among all wind speed categories (e.g., calm to 3 mph, 4 to 7 mph, 8 to 12 mph), the largest difference between concurrent and long-term wind speeds frequencies was less than about 1%.

### *Regression analysis*

NRC staff examined Figures 6, 7, and 8 of the IML report, which shows regression of concurrent versus long-term wind speed, wind direction, and wind speed and direction joint frequencies. IML calculated the coefficient of determination value for linear regression ( $R^2$ ) to be 0.9987 for wind speed, 0.9617 for wind direction, and 0.9512 for joint wind speed and direction, assuming regression through the origin. Staff reproduced the wind speed and wind direction values using an Microsoft Excel 2013 spreadsheet and also examined the values of  $R^2$  without assuming regression through the origin (i.e., zero intercept), and without converting hourly data to frequency data. The staff's values for  $R^2$  without assuming regression through the origin were 0.9989 and 0.9619, for wind speed and wind direction, respectively. Given that the maximum value of  $R^2$  is 1, these values indicate strong correlation between concurrent and long-term conditions, and that variations in the frequency distributions of the concurrent period of on-site meteorological data (2010-2013) are significantly explained by variations in the frequency distributions of the long-term meteorological conditions.

### *Chi-Square ( $\chi^2$ ) test*

IML applied the  $\chi^2$  test to compare concurrent (2010-2013) and long-term (1995-2009) wind speed, wind direction, and stability class distributions at the Eagle Butte Mine (Strata 2014). The frequency for each wind speed, wind direction, and stability class distributions were converted to equivalent hours in one year. The  $\chi^2$  test of wind speed data confirm that both the concurrent (2010-2013) and long-term (1995-2009) distributions are similar. IML also calculated a phi coefficient, which adjusts  $\chi^2$  result for large sample sizes, which confirmed that wind speed distributions are similar. The  $\chi^2$  test of wind direction data suggested that concurrent (2010-2013) and long-term (1995-2009) distributions are not similar. However, IML's calculation of the phi coefficient for wind direction confirmed that distributions are similar. Similarly, the  $\chi^2$  test of stability class data suggested that concurrent (2010-2013) and long-term (1995-2009) distributions are not similar, but the phi coefficient for stability class confirmed that distributions are, in fact, similar. A separate  $\chi^2$  test of stability class data in which data were converted to percent, rather than hours per year, suggested that concurrent (2010-2013) and long-term (1995-2009) distributions are similar, which was confirmed by the phi coefficient test.

NRC staff evaluated IML's analysis by independently calculating the  $\chi^2$  and phi coefficient statistic for wind speed and direction and confirmed IML's results. Therefore, NRC staff finds that the  $\chi^2$  test also indicates the distributions of the concurrent and long-term data are similar, which indicates that the concurrent period of on-site data (2010-2013) is representative of long-term conditions.

### *Student's t-test*

IML applied a two-sample t-test to assess similarity between each wind speed class and wind direction class. This required 7 t-tests for wind speed and 17 t-tests for wind direction. The results indicated that there is insufficient evidence to conclude a difference between the short-term and long-term wind speed data. IML did not present the results of a t-test on stability class data.

NRC staff evaluated IML's analysis by using IML's estimates of mean values and standard deviations for each class of wind speed and direction and independently calculating the t-test statistic for wind speed classes. NRC staff confirmed IML's results. Therefore, NRC staff finds that the t-test also indicates the distributions of the concurrent and long-term data are similar, which indicates that the concurrent period of on-site data (2010-2013) is representative of long-term conditions.

#### *Levene's test*

IML also applied Levene's test to test the assumption relied upon in the t-test that the unknown variances of the two populations (i.e., concurrent (2010-2013) and long-term (1995-2009) data) are equal. IML's results of Levene's test validated the Student's t-test results.

The staff agrees that Levene's test is an appropriate test for equality of variances (i.e., homoscedasticity) with unequal sample sizes, as described in Section 14.7 of NUREG-1475 (NRC 2011). The staff independently evaluated equality of variances by qualitatively examining plots of residuals (i.e., the differences between short-term wind data results in each class and the fitted point on the regression) versus the long-term data. The staff did not observe evidence of unequal variances, such as residuals that grow systematically larger with smaller or larger results in the long-term data.

#### *Kolmogorov-Smirnov test*

IML stated that the application of the Kolmogorov-Smirnov (K-S) test to meteorological data always results in the conclusion that distributions are not different, even when they clearly are different. As a result, IML eliminated this method as an appropriate alternative.

The staff agrees that the Eagle Butte Mine data does not satisfy the requirements of the K-S test. The NRC's description of the K-S test in Section 11.8 of NUREG-1475 (NRC 2011) states that the K-S tests has limitations, including that it was designed for continuous variables. In the case of wind data, the results are discrete variables (i.e., integer hour values between 0 and 8,760 hours). Also the test is known to be insensitive to discrepancies between the two tested distributions in the tail areas of the distribution. For wind data, particularly wind speed, it is important that representativeness be reliably demonstrated in the less frequent and low speed range of wind speeds, as well as the more frequent average speeds, so a test that is insensitive to less frequent regions of the data is not desirable.

#### *Conclusion*

On the basis of the results of both qualitative and quantitative comparisons of concurrent (2010-2013) and long-term (1995-2009) wind data from the nearby Eagle Butte Mine, the NRC staff has verified that Strata's baseline four years of on-site meteorological monitoring data (January 2010 through December 2013) are representative of long-term conditions at the site thus satisfying requirements of license condition 12.13 regarding the collection of data and the prerequisite for commencement of operations. Staff will address removal of the condition from the license at a future time.

#### References

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