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LOST CREEK ISR, LLC

November 11, 2010

Tanya Palmateer Oxenberg, PhD
Project Manager
U.S. Nuclear Regulatory Commission
Mail Stop T8F5
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

Re: Lost Creek Project, Requested Clarifications
Docket No. 40-9068
TAC No. LU0142

Dear Doctor Oxenberg,

Pursuant to your request, Lost Creek ISR, LLC is providing in duplicate revisions to the Technical Report to clarify three items as follows:

1. Comparison of long-term and short-term meteorological data;
2. The qualifications of the health physics designee; and
3. Additional supporting information for the decommissioning plan

With regard to the Decommissioning Plan, Lost Creek ISR discussed soil clean-up criteria in sections 4.2.5.6, 5.7.1.3, and 6.5 of the Technical Report. These sections include discussions of the immediate and post mining soil cleanup criteria and the justification behind the numbers presented (NUREG CR 6733). Given the relatively low concentrations of radium and uranium expected in the lixiviant at Lost Creek as well as the administrative and engineering controls to be deployed, it is unlikely that any soil clean-up activities will be required during mining or post mining. One reason for the expectation for low radium levels is that a slip stream of production fluid will be treated by reverse osmosis throughout the production life of each mine unit. This treatment method will remove around 98% of the radium in water that is treated. Even though soil cleanup at the site is not likely to be necessary, Lost Creek ISR, LLC commits in the Technical Report to performing post-spill and post-mining radiological surveys and soil analysis and to using the clean-up criteria in 10 CFR 40 Appendix A criterion 6.

Although these revisions are very minor they will result in pagination changes of the Technical Report. Instructions detailing the page changes are also attached. If you have any questions regarding this submittal, please feel free to contact me or Dr. Charles Kelsey at the Casper office.

Regards,

Lost Creek ISR, LLC
By its Manager, Ur-Energy USA Inc.

By: ______________________
John W. Cash, Director of Regulatory Affairs

Cc: Mrs. Melissa Bautz – Lander LQD
Ms. Ramona Christenson – LQD Cheyenne
Nancy Fitzsimmons – Ur-Energy USA Inc., Littleton

NRC TECHNICAL REPORT LOST CREEK PROJECT INDEX SHEET FOR CHANGES			Date: 11/11/2010 Docket No.: 40-9068 TAC No.: LU0142
TR VOLUME NUMBER	**PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED**	**PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED**	**DESCRIPTION OF CHANGE**
1 of 4	Pages i through xxiv	Pages i through xxiv	Updated overall Table of Contents.
	Section 2.5 - Meteorology, Climatology and Air Quality		
	Page 2.5-i	Pages 2.5-i and 2.5-ii	Updated section Table of Contents
	Pages 2.5-1 through 2.5-6	Pages 2.5-1 through 2.5-7	Text added in response to discussion with NRC personnel.
	--	Attachment Tab	Tab added for new attachment.
	--	Attachment 2.5-1	Attachment added to verify that the short-term meteorological data used to compare the LC site to the Rawlins station were representative of the long-term Rawlins meteorology.
2 of 4	Pages i through xxiv	Pages i through xxiv	Updated overall Table of Contents.
3 of 4	Pages i through xxiv	Pages i through xxiv	Updated overall Table of Contents.
	Section 5.0 (Operational Organization, Management, Programs, & Training)		
	Page 5-i	Page 5-i	Updated section Table of Contents
	Pages 5-19 through 5-21	Pages 5-19 and 5-19a through 5-21	Section 5.4.3.2 (Designee) revised in response to discussion with NRC personnel.
	Section 6.0 (Groundwater Quality Restoration, Surface Reclamation, and Facility Decommissioning)		
	Page 6-i	Page 6-i	Updated section Table of Contents
	Pages 6-1 through 6-4, 6-19 and 6-20	Pages 6-1 through 6-4a, 6-19 and 6-20	Text revised in response to discussion with NRC personnel.
4 of 4 (Confidential)	Pages i through xxiv	Pages i through xxiv	Updated overall Table of Contents.

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Attachment 2.4-1 Historic and Cultural Resources
(separate volume – requesting NRC confidentiality)
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Attachment 2.5-1 Statistical Analysis and Comparison of the Meteorological Data from the Lost Creek and Rawlins Stations
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2.5 Meteorology, Climatology and Air Quality

This section describes meteorology, climatology, and air quality in the region in which the Project is located. Both regional (long-term) and site-specific data (one year) are discussed to describe climatological conditions at the Permit Area. Where site-specific data are not available, data from the closest representative location are presented.

The Project is located in the Great Divide Basin, in south-central Wyoming. The Permit Area is located in the intermountain semi-desert ecoregion (Wyoming State Climate Office, 2005), which has cold winters and short, hot summers (Bailey, 1995). The average annual temperatures range from 40 to 52 degrees Fahrenheit (°F) in this ecoregion. The average annual precipitation ranges from five to 14 inches (Bailey, 1995). The nearest water bodies of any size are Pathfinder and Seminoe Reservoirs, shown on **Figure 2.5-1,** which are on the order of 50 miles downwind of the Lost Creek site and on the other side of the Continental Divide. It is unlikely these water bodies have any impact on meteorological measurements at Lost Creek. All other water bodies shown on **Figure 2.5-1** are seasonal, at best, and unlikely to have any impact on the measurements.

2.5.1 Meteorology and Climatology

Meteorological stations within 50 miles of the Project site are shown in **Figure 2.5-1**. The National Weather Service (NWS) meteorological station closest to the Permit Area with a long period of record is Muddy Gap, Wyoming (High Plains Regional Climate Center [HPRCC], 2007a). This station is 28 miles northeast of the Permit Area; and temperature, precipitation, snowfall and snow depth data have been collected since 1949. The Muddy Gap station is in the same Climate Division as the Project location, Climate Division 10 (CLIMAS, 2005), which means that these locations have similar climatic characteristics. Camp Creek is at a higher elevation in somewhat more rugged terrain (WRCC RAWS, 2010), and is not representative of conditions at the Project site.

The Lost Soldier (LS) meteorological station was installed at a location near Bairoil in April 2006, based on anticipated project development. The LS meteorological station is about 12 miles northeast from the Permit Area (**Figure 2.5-1**). After deciding to permit the Lost Creek Project before the Lost Soldier Project, the Lost Creek (LC) meteorological station was installed within the Lost Creek Permit Area in May 2007 to collect on-site data (**Figure 2.5-1**). Information collected from the LS and Muddy Gap stations was originally used to describe on-site conditions, due to the relatively short duration of the LC record at that time; additional data from the LC station has since been incorporated in this document. NRC also requested information as to the applicability of the LS data to the LC site [Request for

Additional Information (RAI) from NRC (Nov 2008 RAI Section 2.9 #7)], and that information has also been incorporated. The original presentation of the data (in either tables or figures) has been retained, and the more recent comparisons added. For example, the original comparison of temperature data from the LS and Muddy Gap stations was included in **Table 2.5-1**. That table has been renumbered as **Table 2.5-1a**, and the comparison of temperature data from the LC, LS, Muddy Gap, Jeffrey City, and Rawlins stations added as **Table 2.5-1b**. NRC also requested verification that the short-term meteorological data used to compare the LC site to the Rawlins station were representative of the long-term Rawlins meteorology. The comparison statistics are presented in **Attachment 2.5-1**. There is conclusive evidence that the Rawlins station meteorology is representative of the LC station meteorology, and that the short-term data are representative of the long-term meteorology.

Meteorological instrumentation at the LS and LC stations consists of the following sensors mounted on a 10 m tower:

- Vaisala Temperature and Relative Humidity Probe: temperature range of -40 to 60°C; accurate to ±2% at 10-90% relative humidity and to ±3% at greater than 90% humidity; shielded by RM Young 10-Plate Gill Solar Radiation Shield and mounted at 2 m.
- Dual Met One Model 062 Temperature Probes: used for measurement of differential temperature (ΔT) for dispersion and inversion modeling; temperature range of -50 to 50° C; sensors accurate to ±0.05° C; sensors co-calibrated for a maximum error per degree of differential temperature of 0.02° C; shielded by Met One Model 077 Aspirated Shields and mounted at 2 m and 10 m.
- Met One 3-Cup Anemometer and Wind Vane: range of 0 to 50 m/s (0 to 110 mph); anemometer accurate to ±0.11 m/s when less than 10.1 m/s or ±1.1% of true when greater than 10.1 m/s; vane accurate to ±4°; mounted at 10 m.
- Texas Electronics Tipping Bucket Rain Gage with 8" Orifice: accurate to ±1% at rain fall rates up to 1 inch/hour; resolution of 0.01 inches; mounted on freestanding post approximately 1 m high, and 5 m from tower.
- LI-COR Silicon Pyranometer: measures incoming radiation with wavelengths in the daylight spectrum; measures wavelengths between 400 and 1100 nm; accurate to within 3-5%; mounted at 10 m.

The sensors were connected to a Campbell Scientific CR10X data logger at the LS station and a CR1000 data logger at the LC station. The data recovery rate for each station was greater than 90 percent.

2.5.1.1 Temperature

Based on the Muddy Gap data, July is the warmest month; the average maximum daily temperatures are approximately 85°F; and the average minimum daily temperatures are approximately 55°F. January is the coldest month; the average daily maximum temperatures are 30 to 35°F; and the average minimum daily temperatures are approximately 10 to 15°F. The maximum temperature on record is 100°F in July, while the minimum temperature on record is -40°F in December. The average monthly temperatures at the LS station collected in 2006 and 2007 were generally within range of the long-term averages at Muddy Gap. Temperature data from these stations that was available at the time the TR was originally submitted, in October 2007, are compared in **Table 2.5-1a**.

Average monthly high and low temperatures from LC and four of the closest stations (LS, Muddy Gap, Jeffrey City, and Rawlins), including data available after October 2007, are compared in **Table 2.5-1b**. The LC data is generally within the range of the other stations, with the exception that temperatures in the winter months appear to be somewhat lower. However, that is probably due to the short record for LC (in some cases just one month), as compared to the other stations.

2.5.1.2 Precipitation

The Permit Area is drier than many areas in the State of Wyoming. **Figure 2.5-2a** shows the total monthly precipitation for available Muddy Gap and LS data at the time the TR was originally submitted in October 2007.

The mean annual precipitation at the Muddy Gap station from 1949 through 2005 was 10.0 inches. Precipitation is distributed throughout the year, but the mean monthly precipitation exceeds one inch only in April, May, and June. May is the wettest month, with 1.9 inches of mean precipitation. Actual annual moisture may be somewhat higher, since precipitation gages capture only a small proportion of snowfall under windy conditions.

The precipitation at the LS station from May 2006 to April 2007 showed that precipitation for this period was much lower than normal. Regional data showed the area received 50 to 70 percent less rainfall than average (HPRCC, 2007b).

Average monthly precipitation data from LC and four of the closest stations (LS, Muddy Gap, Jeffrey City, and Rawlins), including data available after October 2007, are compared in **Figure 2.5-2b**. The LC data is within the range of the other stations, taking into account the variability in precipitation amounts due to local thunderstorms and the recent regionally low precipitation.

2.5.1.3 Humidity and Evaporation

The average relative humidity at the Permit Area is low in the summer, with the lowest average occurring in June (30.2 percent). The relative humidity is elevated during the winter, where the highest average occurred in February (75.6 percent). The monthly maximum and minimum humidity measured at the LS meteorological station is provided in **Table 2.5-2a** and the average monthly maximum and minimum humidity measured at the LC and LS meteorological stations is provided in **Table 2.5-2b**.

Information on total evaporation by month is included in **Section 3.7.1.5** and **Table 3.7-4** of the Lost Creek Environmental Report (ER).

2.5.1.4 Wind, Mixing, and Stability

The annual average wind speed at a height of ten meters measured between April 2006 and April 2007 was 23 feet per second (ft/s) (7.0 meters per second [m/s]) at the LS meteorological station located near Bairoil, about 15 miles from the Permit Area. The wind speed is highest in February and November (29.9 and 29.2 ft/s or 9.1 and 8.9 m/s, respectively). The lowest wind speeds occur in July and August (16.4 and 16.7 ft/s or 5.0 and 5.1 m/s, respectively). The prevailing wind direction is from the west-northwest and west for most of the year (**Figure 2.5-3a**), with some variability occurring in the spring. The wind data from the LC station is compared to that from the LS station in **Figure 2.5-3b**. The predominant wind at the LC station is from the west-northwest and from the west-southwest at the LS station. The differences may be due to topographic variability or due to the relatively short period of record, particularly given the weather variability over short distances (e.g., summer thunderstorms)

Atmospheric stability was categorized into six classes according to Pasquill (Pasquill, 1961). Calculations were made using wind speed and solar radiation data collected at the site. The data show that relatively stable conditions (stability class D, E, or F), which contribute to good dispersion conditions, occur 87 percent of the time, making atmospheric inversion conditions unlikely. The stability class distribution at the LS station for January 2007 through December 2007 is shown in **Table 2.5-3.** The stability classes for the two stations are essentially the same (**Figure 2.5-4**). Data collected for Lander/Riverton Wyoming indicated that the average annual mixing height is 348 meters in the morning and 2,300 meters in the afternoon. These can also be considered the inversion heights (Holzworth, 1972).

2.5.1.5 Violent Weather

Tornadoes are more prevalent in eastern Wyoming than in western Wyoming, because mountain ranges in western Wyoming are barriers to the flow of warm, moist air that causes tornadoes. In Sweetwater County, 19 tornados were reported in a 55-year period, none of which caused an injury or death. An individual tornado would affect only a portion of the County; therefore, chances are small that the Permit Area would experience a tornado. The Fujita Scale is used to rate the intensity of a tornado by examining the damage caused to man-made structures (The Tornado Project, 2003). The most destructive tornado recorded in Sweetwater County from 1950 to 2004 was an F-1 "moderate" tornado, which would be unlikely to cause extensive damage to the Project.

The Permit Area is located in an area that has statistically shown lower density of lightning strikes. The probability of hail is also low, with six occurrences recorded in a 24-year period (Curtis and Grimes, 2007).

Although severe winter storms are generally less violent than summer storms, the relative duration of the winter storms (a day or more) compared to summer storms (generally a few hours) and the combination of heavy snow, strong winds, and low temperatures require that all Wyoming residents be aware of and prepared for the possibility. A history of blizzards in Wyoming is provided in Chapter 19 of the State of Wyoming Multi-Hazard Mitigation Plan (WOHS, 2008).

2.5.2 Air Quality - Non-Radiological Parameters

The overall air quality in the Project region is good. The area is sparsely populated and is not heavily developed with industrial sources of air pollution. Air quality for radiological parameters is discussed in Section 2.5.9. (Measurement of natural gamma and Rn-222 was originally discussed in this section, but has been moved to Section 2.9 (Background Radiological Characteristics).)

Air Quality Standards

National Ambient Air Quality Standards (NAAQS) exist for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), lead, and particulate matter small enough to move easily into the lower respiratory tract (particles less than ten micrometers in aerodynamic diameter, designated Particulate Matter [PM_{10}]). The NAAQS are expressed as pollutant concentrations that are not to be exceeded in the ambient air, that is, in the outdoor air to which the general public has access (40 CFR Part 50.1(e)). Primary NAAQS are designated to protect human health; secondary NAAQS are designated to protect human welfare by safeguarding environmental resources (such as soils, water, plants, and animals) and manufactured materials. Primary and secondary NAAQS are presented in **Table 2.5-4**. The closest monitoring station to the Permit Area is in Rawlins, and shows that regional air quality is in compliance with the NAAQS and Wyoming Ambient Air Quality Standards (WAAQS) (BLM, 2004c).

In addition to ambient air quality standards, which represent an upper bound on allowable pollutant concentrations, there are national standards for the Prevention of Significant Deterioration (PSD) of air quality (40 CFR § 51.166). The PSD standards differ from the NAAQS in that the NAAQS provide maximum allowable concentrations of pollutants, while PSD requirements provide maximum allowable increases in concentrations of pollutants for areas already in compliance with the NAAQS. PSD standards are, therefore, expressed as allowable increments in the atmospheric concentrations of specific pollutants. Allowable PSD increments currently exist for three pollutants: NO_2, SO_2, and PM_{10}. Increments are particularly relevant when a major proposed action (involving either a new source or a major modification to an existing source) may degrade air quality without exceeding the NAAQS, as would be the case, for example, in an area where the ambient air is very clean. One set of allowable increments exists for Class II areas, which cover most of the US. A much more stringent set of allowable increments exists for Class I areas, which are specifically designated areas where the degradation of ambient air quality is severely restricted. Class I areas include certain national parks and monuments, wilderness areas, and other areas as described in 40 CFR § 51.166(e) and 40 CFR Part 81:400-437. Maximum allowable PSD increments for Class I and Class II areas are given in **Table 2.5-5**. Class I areas, as designated in the Rawlins Resource Management Plan (RMP), include the Savage Run Wilderness and Rocky Mountain National Park. PSD Class I areas receive the highest degree of protection from air pollution; only small amounts of particulate, SO_2, and NO_2 air pollutants are allowed in these areas (BLM, 2004c).

Air Particulate (PM_{10}) Sampling

Air particulate matter in the Permit Area was sampled using two Mini Volumetric (MiniVol) samplers with ten micron (PM_{10}) filters. Dust trapped by these filters is the size considered most detrimental to human health. Two samplers were used as a pair, with samples collected concurrently, upwind and downwind of the Permit Area, at three locations: Northern (LCAIR9&10); Central (LCAIR13&14); and Southern (LCAIR11&12). The sampling duration was approximately 24 hours, and the results were time-adjusted for a 24-hour period. **Figure 2.5-5** shows the sampling locations, and the results are presented in **Table 2.5-6**.

The average PM_{10} concentration in June 2006, including both upwind and downwind sampling locations, was 8.5 micrograms per cubic meter ($\mu g/m^3$). The maximum value was 10.5 $\mu g/m^3$ and the minimum value was 5.4 $\mu g/m^3$. For comparison, the average PM_{10} in Casper Wyoming was 18.8 $\mu g/m^3$ from 1990 through 1994 (Natural Resources Defense

Council, 2007). At the northern sampling location, the PM_{10} concentration in the upwind sample was more than 70% higher than the downwind sample. At the central and southern sampling locations, the upwind and downwind samples differed by 15% or less. The sample collection runs lasted between 21.5 to 28 hours. In February 2007, the PM_{10} concentration at the central sampling location was about one-half of the concentration in June 2006, possibly due to slightly damper soil conditions.

The NAAQS criteria for PM_{10} set a limit of 150 $\mu g/m^3$ for a 24-hour period, not to be exceeded more than once per year on an average over three years. The data show that for both upwind and downwind locations, this standard was not exceeded. More information on dust and emissions from Project activities are covered in **Section 7.1.7** of this TR, and also in **Section 4.7** of the ER.

Attachment 2.5-1

Statistical Analysis and Comparison of the Meteorological Data from the Lost Creek and Rawlins Stations

Statistical Analysis and Comparison of the Meteorological Data from the Lost Creek and Rawlins Stations

Description of Data: All available data from the Lost Creek meteorological station, since the beginning of its operation in 2007 through 2009, were compared to paired data from the Rawlins meteorological station in order to examine whether the meteorological data from the two stations are sufficiently similar (comparable). Furthermore, in order to examine the representativeness of the meteorological data obtained during 2007 – 2009 (short-term), the historical (long-term) data obtained from the Rawlins station were also examined and presented here for comparison.

Description of Statistical Analysis: In order to examine the similarities of the above mentioned data sets, wind (speed and direction), temperature (average daily high, low, and overall average temperatures), and precipitation (total average monthly precipitation) data obtained from the Lost Creek and Rawlins stations were analyzed. In order to examine the wind parameters, scalar (vs. vector) calculations for obtaining mean wind speed and direction, as well as standard deviations (STDVs) for these two parameters were applied according to the methods presented in the ANSI 3.11-2005 guidance (ANS, 2005). The means and STDVs for temperature and precipitation values were obtained using statistical analysis in Microsoft Excel 2010.

Comparison of Wind Parameters

For an observed set of wind speed samples, the scalar mean wind speed is defined as the average speed derived from all valid samples in the averaging period. In determining the scalar mean wind direction, standard statistical methods for linear data sets are difficult to implement since wind direction is a circular function with a crossover point at 360 or 0 degrees. The scalar mean wind direction can be approximated by the unit vector wind direction, that is, by the arctangent of the mean sine and mean cosine of the valid wind direction samples in the averaging period (ANS, 2005).

Means and STDVs of scalar wind speed and directions from Lost Creek (short-term) and Rawlins (both short-term and long-term) are summarized in **Table 1**. As is apparent from the results shown in **Table 1**, the mean wind speed at the Lost Creek station (9.47 knots) was found to be well-matched to the mean wind speed from the paired data at the Rawlins station (9.79 knots). Data from both stations indicate that the mean wind direction is from the west southwest.

Table 1. Comparison of Wind Data: Wind Speed and Direction

Meteorological Station	Period of Record	Mean Scalar Wind Speed (knots)	STDV Scalar Wind Speed	Mean Scalar Wind Direction (degrees)	STDV Scalar Wind Direction
Lost Creek	6/14/2007-11/30/2007; 2/23/2008-8/31/2009	9.47	5.90	245	83.9
Rawlins (short-term)	6/14/2007-11/30/2007; 2/23/2008-8/31/2009	9.79	7.30	267	66.4
Rawlins (long-term)	1/01/1973-6/13/2007	11.1	6.81	244	61.0

The mean wind speed at the Rawlins station over the long-term (11.1 knots) was slightly higher than the mean of the 2007-2009 period at the same station (9.79 knots), but was well in the historical range. The mean wind directions for both stations indicate that the majority of the winds blow out of the west southwest.

Comparison of Temperature Parameters

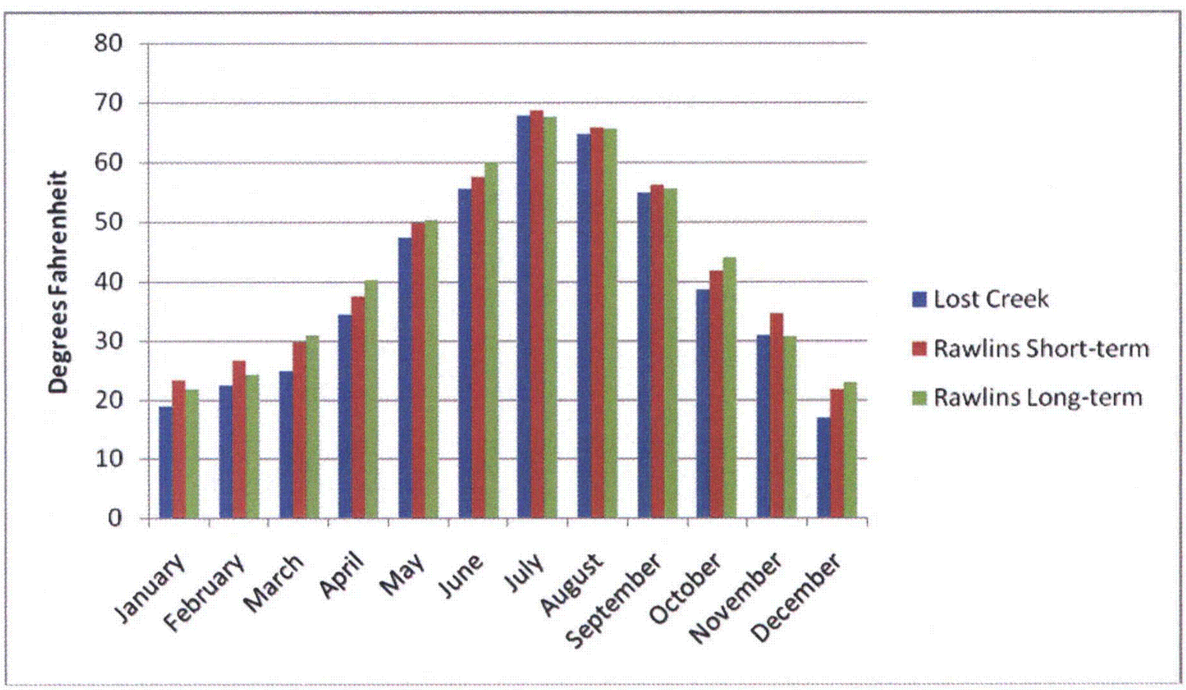
In order to examine the compatibility of temperature characteristics for Lost Creek and Rawlins, average, high, and low daily temperatures were compared. Available complete monthly data for the Lost Creek station ranging from 07/07-11/07 and 3/08-11/09, matched data from Rawlins, and long-term data from Rawlins (1951-2008) were used for this comparison.

The average daily temperatures for each month during 2007 – 2009 at Lost Creek and Rawlins are presented in **Table 2**. On average, Rawlins was slightly warmer than Lost Creek during this time period; however, average daily temperatures at Lost Creek and Rawlins are in the same range, i.e., within the 95% confidence intervals for the two data sets to overlap. The confidence intervals (CIs) are defined as the mean of the data set ±2x the Standard Error (SE), where SE = STDV/square root of number of samples (N). Variations in daily temperatures during all months are very similar. Average daily temperatures for Lost Creek and Rawlins (short-term and long-term) are presented in **Figure 1**.

Table 2. Comparison of Average Daily Temperatures (Degrees Fahrenheit)

Period of record:	07/2007-11/2007; 3/2008-11/2009					
Station:	Lost Creek			Rawlins		
Statistic:	Ave Daily Temp	95% CI	STDV	Ave Daily Temp	95% CI	STDV
January	19	15-23	11	23	19-28	12
February	22	20-25	7	27	24-29	7
March	25	22-27	10	30	26-33	10
April	34	32-37	9	37	35-40	9
May	47	45-49	8	50	48-52	8
June	55	53-57	8	58	56-59	6
July	68	67-69	5	69	68-70	4
August	65	64-66	6	66	65-67	5
September	55	53-56	7	56	55-58	7
October	39	37-40	9	42	40-44	9
November	31	29-33	8	35	33-37	9
December	17	13-21	10	22	18-25	10

Figure 1. Comparison of Average Daily Temperatures (Degrees Fahrenheit)



The average daily high and low temperatures each month for the short-term Lost Creek and both the short-term and long-term Rawlins station data are presented in **Figure 2** and **Figure 3**, respectively, and in **Table 3**. Again, highs and lows measured at the Rawlins station over the short-term were generally a few degrees warmer than those measured at the Lost Creek station, but both high and low average daily temperatures were generally within the same range, as indicated by the overlap of the majority of the 95% CIs. One exception to this is the slightly more extreme low temperatures observed during the winter months at the Lost Creek station. These data also demonstrate that the short-term Rawlins data are statistically very similar to the long-term Rawlins temperature data and can be considered representative of the long-term temperature record.

Figure 2. Comparison of Average Daily High Temperatures (Degrees Fahrenheit)

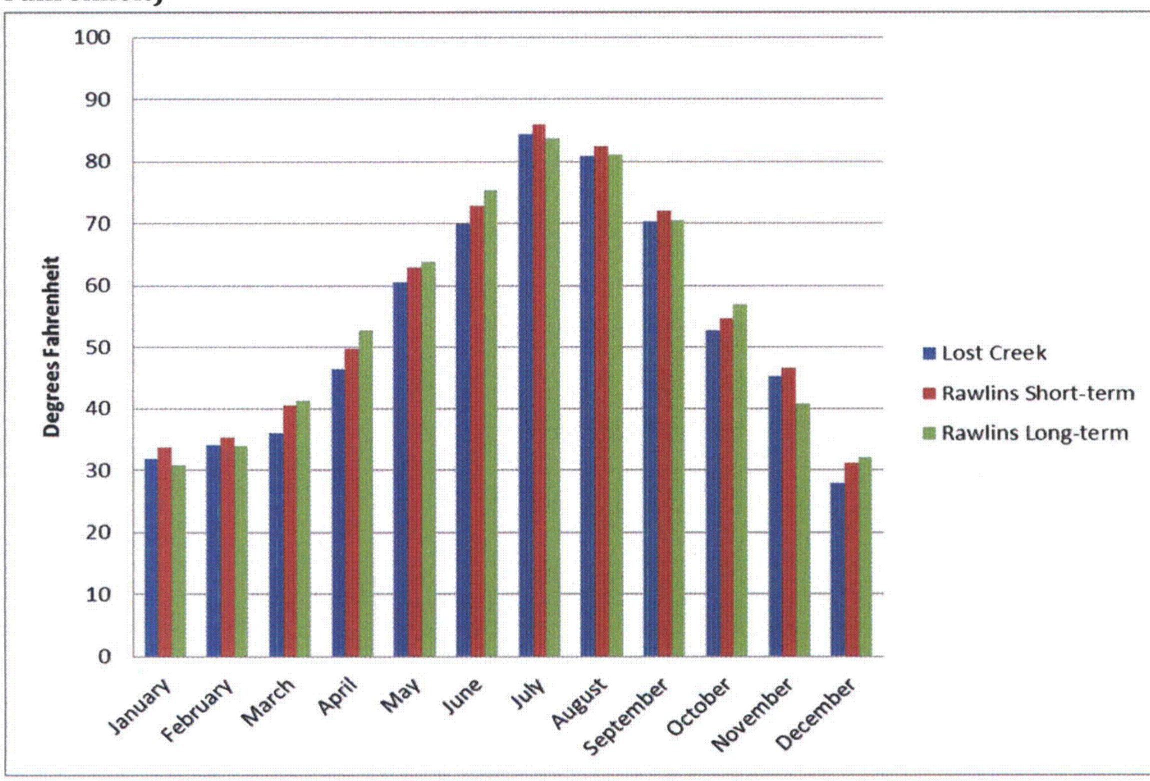


Figure 3. Comparison of Average Daily Low Temperatures (Degrees Fahrenheit)

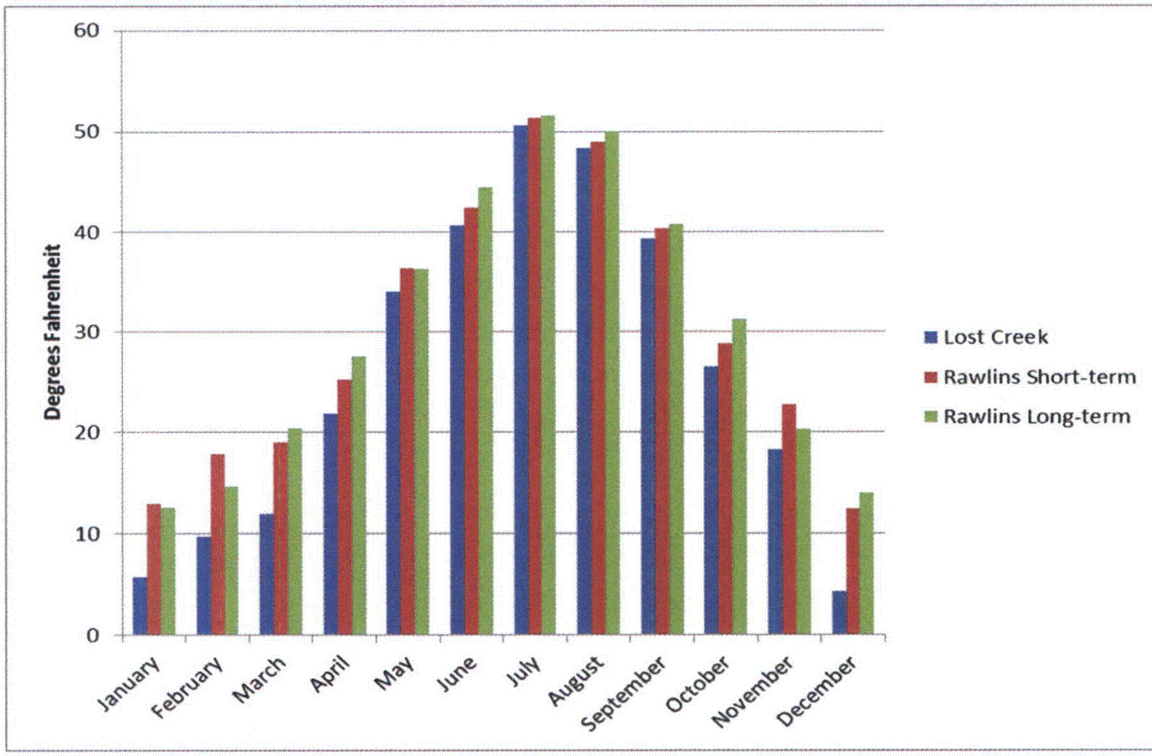


Table 3. Comparison of Average Daily High and Low Temperatures (Degrees Fahrenheit)

Period of record:	07/2007-11/2007; 3/2008-11/2009												1951-2008					
Station:	Lost Creek						Rawlins						Rawlins					
Statistic:	Ave Daily High	95% CI	STDV	Ave Daily Low	95% CI	STDV	Ave Daily High	95% CI	STDV	Ave Daily Low	95% CI	STDV	Ave Daily High	95% CI	STDV	Ave Daily Low	95% CI	STDV
January	32	28-36	11	6	1-11	13	34	30-38	11	13	8-18	14	31	30-32	5	13	11-14	5
February	34	32-36	6	10	6-13	10	35	33-38	6	18	15-21	9	34	33-35	5	15	13-16	5
March	36	33-39	11	12	9-15	11	41	37-44	11	19	15-23	10	41	40-43	5	20	19-22	4
April	47	43-50	12	22	20-24	9	50	47-53	12	25	23-27	8	53	51-54	4	28	27-28	3
May	61	58-63	11	34	33-36	6	63	60-66	11	36	35-38	6	64	63-65	4	36	36-37	2
June	70	67-72	10	41	39-42	5	73	70-76	10	43	41-44	4	75	74-76	4	45	44-45	2
July	84	83-86	6	51	50-52	4	86	85-87	6	51	50-52	5	84	83-84	3	52	51-52	2
August	81	79-82	7	48	47-50	6	83	81-84	7	49	48-50	6	81	80-82	3	50	49-51	2
September	70	68-72	9	39	38-41	7	72	70-74	9	40	39-42	7	70	69-71	4	41	40-42	3
October	53	50-55	13	27	25-28	8	55	52-57	11	29	27-31	8	57	56-58	4	31	31-32	2
November	45	43-47	10	18	17-20	8	47	45-49	10	23	21-25	10	41	39-42	5	20	19-21	4
December	28	24-32	11	4	0-9	12	31	27-35	10	13	9-16	11	32	31-33	4	14	13-15	4

Comparison of Precipitation Parameters

Average total monthly precipitation was compared for available complete monthly data for Lost Creek (07/07-11/07 and 3/08-11/09), matched data from Rawlins, and long-term data (1951-2008) from Rawlins. The average monthly precipitation totals are presented in **Table 4**. Total monthly precipitation amounts over the short-term and long-term, are relatively variable. Taking into account this inherent variation, which is likely due in part to local thunderstorm occurrences, the Lost Creek precipitation averages are generally within the same range, as indicated by the overlap of the 95% CIs, as the paired Rawlins data. However, only one month of data was available for January, February, and December for the short-term data sets, thus it was not possible to calculate a confidence interval for these months. The short-term Rawlins data are also generally in the same range as the long-term Rawlins data, although averages in the months of February, March, and December were lower during 2007 – 2009 than the Rawlins long-term. It should be pointed out, however, that only one year of complete monthly data was available for the short-term in December and February.

Table 4. Comparison of Average Total Monthly Precipitation (Inches)

Station:	Lost Creek			Rawlins Short-term			Rawlins Long-term		
Period of record:	07/2007-11/2007; 3/2008-11/2009			07/2007-11/2007; 3/2008-11/2009			1951-2008		
Statistic:	Ave Monthly Precipitation	95% CI	SDEV	Ave Monthly Precipitation	95% CI	SDEV	Ave Monthly Precipitation	95% CI	SDEV
January	0.16	NA	0.00	0.73	NA	0.00	0.45	0.36-0.55	0.34
February	0.18	NA	0.00	0.10	NA	0.00	0.50	0.40-0.60	0.37
March	0.09	0.07-0.11	0.01	0.12	0.04-0.19	0.05	0.69	0.59-0.80	0.40
April	1.00	0-2.79	1.30	1.26	0-2.67	1.00	1.01	0.85-1.17	0.62
May	1.10	0.83-1.37	0.19	1.53	1.31-1.75	0.16	1.30	1.07-1.52	0.86
June	1.30	0-3.66	1.70	1.23	0-2.72	1.05	0.90	0.72-1.07	0.67
July	0.79	0.07-1.51	0.62	1.00	0.64-1.35	0.31	0.77	0.62-0.92	0.58
August	0.82	0.43-1.21	0.34	0.57	0.43-0.71	0.12	0.76	0.62-0.90	0.51
September	0.92	0.24-1.60	0.59	1.05	0.30-1.80	0.65	0.84	0.67-1.01	0.65
October	0.87	0.16-1.58	0.61	0.91	0.54-1.28	0.32	0.81	0.64-0.98	0.66
November	0.12	0-0.25	0.11	0.28	0.12-0.44	0.14	0.55	0.44-0.66	0.41
December	0.08	NA	0.00	0.00	NA	0.00	0.46	0.38-0.55	0.32

NA= Not Applicable, only one year of data available

Conclusions

Data comparisons for wind, temperature, and precipitation between Lost Creek and Rawlins short-term data demonstrate the meteorological similarities of the two areas. Furthermore, comparison of data from Rawlins short-term and Rawlins long-term data reflect the statistical representativeness of the short-term data.

References

ANS. 2005. American National Standard ANSI 3.11-2005, Determining Meteorological Information at Nuclear Facilities. La Grange Park, Illinois; pp. 31

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- a thorough knowledge of the proper application and use of all health physics equipment used during uranium recovery activities, the chemical and analytical procedures used for radiological sampling and monitoring, methodologies used to calculate exposure to uranium and its daughters, and a thorough understanding of the uranium recovery process and equipment used and how the hazards are generated and controlled during the uranium recovery process.

5.4.3.1 Health Physics Technician

The HPT will have one of the following combinations of education, training, and experience.

Option I:

- an associate degree or two or more years of study in the physical sciences, engineering, or health related field;
- at least a total of four weeks of generalized training (up to two weeks may be on-the-job training) in radiation health protection applicable to uranium recovery facilities; and
- one year of work experience using sampling and analytical laboratory procedures that involve health physics, industrial hygiene, or industrial safety measures to be applied in a uranium recovery facility; or

Option II:

- a high school diploma;
- a total of at least three months of specialized training (up to one month may be on-the-job training) in radiation health protection relevant to uranium recovery facilities; and
- two years of relevant work experience in applied radiation protection.

5.4.3.2 Designee

A "Designee" for the purposes of inspections shall have the following qualifications: a minimum of a high school diploma; training as a radiation worker pursuant to TR Section 5.5 and RG 8.31, Section 2.5; on the job training, and at least three months experience working as a radiation worker at the Lost Creek Facility. The on the job training will be given by the RSO or HPT.

On the job training will include the following at a minimum:

- How to complete the inspection checklist;
- A review of each inspection item in the field so the potential designee understands what they are inspecting and what upset situations require notification of the RSO or HPT;
- A discussion of findings and corrective actions resulting from recent inspections;
- How to contact the RSO or HPT if needed;
- A discussion of how each item on the inspection checklist affects employee safety;
- The Designee in training must accompany the RSO or HPT on at least three complete inspections before being appointed a Designee; and
- To maintain the qualifications of a Designee, the individual must participate in at least two inspections per year with the RSO or HPT.

The RSO may appoint a Designee only when the above training has been completed and the RSO is comfortable that the individual is capable of completing the inspections as required. The designation of an individual will be documented in the training file and made available upon request to an NRC inspector. The Designee has no authority to perform health physics duties outside the scope of his/her regularly assigned duties. For example, the Designee will not have authority to release materials for unrestricted use or to approve a RWP.

5.4.4 Department Heads

These positions require a bachelor's degree in engineering or associated science degree from an accredited college or university or an equivalent level of work experience, plus a minimum of two years of managerial experience in engineering, geology, or operational functions.

5.5 Radiation Safety Training

Employee training will be designed to familiarize employees with all of the necessary precautions to be taken when performing their assigned duties, and radiation safety constitutes a significant portion of this training. New and experienced employees alike will be provided written copies of radiological safety instructions, and will take training courses that address the fundamentals of radiation protection and potential risks of radiation exposure.

The radiological protection program for LC ISR, LLC uranium recovery operations will, in general, include annual worker training to insure that site personnel will, at all times, have sufficient awareness and continuity of knowledge regarding:

- general safety regulations, principals, and procedures;
- the fundamentals of health protection, personal hygiene, and housekeeping requirements;
- basic radiation science and radiation safety principals;
- the Radiation Safety Program for ISR operations at the Permit Area, including all site-specific and operation-specific radiation safety procedures, and radiation protection regulations;
- dose monitoring requirements and procedures and health protection measurements;
- worker rights, responsibilities and notifications, and facility-provided protection;
- contamination and spill control; and
- security and emergency procedures.

Additionally, radiation safety training for female employees will address:

- risks associated with prenatal radiation exposure, and
- the LC ISR, LLC policy for declared pregnant women, including dose limits and rates.

Managers will also receive additional specialized occupational radiation protection training on their supervisory responsibilities. Each permanent employee that has completed the new employee radiation safety training will annually attend an abbreviated retraining course.

The refresher course will discuss:

- relevant information that has become available during the past year;
- a review of safety problems that have arisen during the past year including results from the ALARA report;
- changes in regulations and license conditions;
- exposure trends; and
- other current topics.

A written or oral test will be conducted following radiation safety training for new employees and annual refreshers. Incorrect answers to test questions will be discussed to ensure a correct understanding of the material. If an employee fails to pass the test (less than 70 percent of the answers being correct), additional training will be provided prior to re-testing. Tests and results will be maintained on file until license termination.

Continual training will be conducted to ensure that personnel maintain awareness of events and issues that could affect the quality of program performance. At least quarterly, employees will be updated on radiation safety issues that arise during the Project.

Specific, detailed worker radiation training materials will be presented in the Radiation Safety Manual which will include materials for initial employee training (eight hours) as well as for ongoing refresher training (four hours), which will occur on an annual basis for each employee. The RSO and HPT will complete 40 hours of appropriate radiation safety refresher training by qualified instructors on a biennial basis. Training of all personnel will be documented with records maintained by the RSO until the license is terminated.

Visitors and contractors will be required to sign in at the office in the Plant and receive appropriate hazard recognition and safety training. Visitors will be instructed on radiological and non-radiological hazard prevention specific to the areas of visitation. Contractors who handle contaminated equipment will receive the same training and radiation safety instruction required of permanent employees. Contractors, who have previously completed the full training for the Project or who have evidence of recent and relevant training elsewhere, will receive job-specific radiation safety instruction. All visitors and contractors that have not received proper training must be escorted by an employee with proper training and knowledge of potential hazards.

6.0 GROUNDWATER QUALITY RESTORATION, SURFACE RECLAMATION, AND FACILITY DECOMMISSIONING

This Section 6.0 comprises the initial Decommissioning Plan for the Project. A variety of restoration and reclamation activities will be phased in throughout the project life as mine units are depleted of uranium. Final Project decommissioning and reclamation will occur once the Plant is no longer in use. **Figure 1.7-2** includes a schedule of activities for the Project, including the restoration and reclamation activities. This schedule is an alternate schedule pursuant to 10 CFR 40.42. While LC ISR, LLC believes the groundwater restoration and surface reclamation can be completed within 24 months for each mine unit, the associated regulatory reviews and approvals will lengthen the schedule beyond 24 months. LC ISR, LLC understands that any revision to the alternate schedule must be requested through a license amendment application.

For each mine unit, LC ISR, LLC will submit, for NRC approval, an initial decommissioning plan as part of the mine unit package. As each mine unit completes production, LC ISR, LLC will submit, for NRC approval, an updated, detailed decommissioning plan to reflect the contamination record of the as-built mine unit, and to incorporate technological advances, regulatory guidance modifications and land use changes. For the processing and support facilities that will not be removed until the end of the Project, LC ISR, LLC will submit for NRC approval, an updated, detailed decommissioning plan for those facilities, i.e., the Project, also to reflect the contamination record of the as-built Project and to incorporate technological advances, regulatory guidance modifications, and land use changes, at least 12 months prior to planned decommissioning of the Project. The decommissioning plans will include a quality assurance program as discussed in TR Section 5.2.

Reclamation of each mine unit and associated header houses involves:

1) groundwater restoration,
2) radiological decontamination,
3) equipment removal/decommissioning (e.g. well abandonment), and
4) surface reclamation (e.g., well site reseeding).

Groundwater restoration may start once uranium recovery is complete at that header house, and restoration of a header house may occur contemporaneously with operation of another header house in the same mine unit. To ensure maximum ore recovery and avoid interference between header houses, contemporaneous production and restoration of adjacent header houses and/or mine units will be carefully evaluated. Once groundwater restoration is complete, decontamination and other reclamation activities will start. Decontamination of equipment and other surface reclamation activities will start when all of a mine unit is restored.

Reclamation of the Plant and support facilities involves similar activities, including:

1) radiological decontamination,
2) equipment removal/decommissioning (e.g., building demolition), and
3) surface reclamation (e.g., road removal, topsoil replacement, and reseeding).

The following sections describe the criteria used to determine when production is complete, the status of the mine unit at the end of operations, the subsequent restoration and reclamation activities, and the criteria used to determine when restoration and reclamation have been successful.

6.1 Completion of Production Operations

Technical, economic, and operational criteria can be reviewed to determine if uranium recovery is complete in a given header house and/or mine unit. The technical criteria comprise the percentage recovery of the estimated ore reserves, the uranium concentration in the production fluid, and the header house flow rates. Typically, the technical criteria for considering production operations complete are:

- a uranium recovery of at least 80 percent;
- a production fluid uranium concentration reduced to a level not significantly greater than the injection fluid; and,
- in some instances, a reduced groundwater flow rate.

The economic criteria comprise the corporate financial objectives, the price of uranium, and the annual production targets. When production targets are no longer being met, and operational changes will not improve the possibility of meeting those targets, then ISR operations may be considered complete.

The Plant ion exchange and processing capacity may also factor into determining if ISR operations have been completed in a given header house or mine unit. If there is unused ion-exchange-recovery and waste-management capacity that can be filled by continued operation of an area, which is essentially depleted but will continue to supply a low-concentration production fluid, it may be economic to continue operation of that header house. Such an extension allows for the recovery of uranium for a period of a few months after the header house operations might normally be considered complete. In addition, such an extension allows for higher percent recovery of uranium, which may facilitate subsequent groundwater restoration. This extension will end when there is no longer sufficient capacity for low-concentration production fluid or the quantity of uranium recovered is insufficient to cover operating costs.

The decision to take a mine unit (out of production and place it into restoration will be based solely on the considerations outlined above. As long as a mine unit is economic and there are not technical issues preventing production, the mine unit will remain in production status. Pursuant to 10 CFR 40.42(d), if an area must be temporarily shut down for any reason, decommissioning will commence within 24 months unless NRC grants an exemption.

For each mine unit, LC ISR, LLC will inform NRC of the transition from production to restoration. Four conditions would trigger NRC notification of decommissioning (restoration) activities: the license has expired, a determination to permanently cease principal activities, no principal activities have been conducted for 24 months under the license, or no principal activities have been conducted in a specific wellfield. Cessation of injection marks the end of principal activities.

A hydrologic bleed sufficient to control mining or restoration solutions will be maintained during all phases, including any hiatus in production, until active restoration is complete. The anticipated water quality in the production zone before restoration is included in Table 6.1-1.

6.2 Plans and Schedules for Groundwater Quality Restoration

The objective of restoration and reclamation is to return the affected groundwater and land surface to the uses for which they were suitable before commencement of the Project operations. To achieve this objective LC ISR, LLC will use Best Practicable Technology (BPT) to return the groundwater in the pattern area to the quality described in 10 CFR Part 40 Appendix A Criterion 5B(5) or to baseline if baseline is higher. If LC ISR, LLC determines that despite the implementation of BPT that the groundwater cannot be returned to background, an Alternate Concentration Limit will be requested. The proposed methods for groundwater restoration are described in this section. Before discussing restoration methodologies, the chemistry of the system is briefly reviewed.

6.2.1 Conditions in the Mineralized Zone Before and After Operations

The uranium deposits underlying the Permit Area are similar to those found at other ISR operations in the US. They are primarily roll front deposits in fluvial sandstones, and the uranium was deposited when oxidized groundwater containing the uranium entered reducing conditions in the subsurface aquifers. The reducing agents were probably organic matter and pyrite and, to a lesser degree, hydrogen sulfide.

ISR operations essentially reverse the natural processes that deposited the uranium. Injection wells introduce lixiviant into the mineralized zone to oxidize the reduced uranium and to complex it with bicarbonates. Pumping from production wells draws the solution through the mineralized zone, oxidizing additional ore between the injection and production wells.

In turn, groundwater restoration essentially reverses the effects of the oxidation during ISR operations and re-establishes the reducing conditions that were present prior to production, to the extent possible. Groundwater sweep removes much of the groundwater oxidized during operations. During the RO phase, residual uranium and other metals mobilized under the oxidized conditions are removed, and the treated water reinjected. As necessary to accomplish restoration, specific reductants such as hydrogen sulfide may be added. Biorestoration may also be applied, if site conditions are suitable for this restoration technology.

6.2.2 Restoration Requirements

LC ISR, LLC commits to return the groundwater to baseline water quality in accordance with NRC regulations. However, if after the application of Best Practicable Technology (BPT), the water quality has not been returned to baseline quality, LC ISR, LLC may seek an alternate restoration standard pursuant to NRC regulations. During all stages of operations, approved standby modes and active restoration, a hydrologic bleed will be maintained on the mine unit such that mining solutions are maintained within the exempted aquifer. The hydrologic bleed will be stopped during stabilization.

Prior to operation of each mine unit, groundwater baseline quality will be determined on the basis of the water quality data collected in accordance with WDEQ regulations and NRC guidance found in NUREG 1569 Section 3.1.3 and 10 CFR 40.31(g). For the wells in the perimeter monitor ring and for wells in overlying and underlying aquifers, the baseline will be determined on a well-by-well basis. For the pattern area, baseline water quality data from monitor wells in the pattern area will be averaged to determine the overall baseline water quality.

Baseline water quality data will be collected from the monitor wells in the perimeter ring, in the pattern area, and in the overlying and underlying aquifers before ISR operations in each mine unit, in accordance with the Testing Proposal which will be submitted to WDEQ-LQD for review and approval. A minimum of four samples will be collected from each well, at least 14 days apart. Each of the four samples will be analyzed for the parameters required per WDEQ-LQD Guidelines 4 and 8, as listed in **Table 6.2-1** with the exception of silver for which LC ISR, LLC is seeking an exemption.

6.5.1 Determination of Site Soil Cleanup Criteria

The pre-existing baseline conditions are presented in **Section 2.9** of this report. Elevated radiation levels resulting from the prior exploration activities and from naturally-occurring conditions will be used in the calculation of appropriate cleanup levels.

The Appendix A cleanup criteria for radium-226 are specified in 10 CFR 40. "Impacted areas" of the site, as defined in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), will be identified based on a "historical" site assessment and characterization survey prior to development of the updated, detailed mine unit and Project decommissioning plans (see beginning of this Section 6.0) submitted for NRC approval prior (12 months prior for the Project) to decommissioning. Direct gamma surveys as well as soil sampling protocols will be developed in accordance with the number and extent of impacted areas. The "benchmark approach" will be used to define the cleanup criteria for other radionuclides, as described in Appendix E to NUREG 1569. Impacted soils will be excavated or treated to meet those criteria.

The cleanup criterion for uranium in soil will be determined in accordance with Appendix E to NUREG-1569 at the time the updated, detailed decommissioning plans (see beginning of this Section 6.0) are developed.

6.5.2 Soil Verification Survey Methodology

A GPS-based gamma radiation survey will be performed of the area to be decommissioned (i.e., mine unit or facility area) using techniques similar to those that were used to determine baseline site conditions. A statistically defensible number of soil samples will be collected throughout the site at varying soil radium-226 concentrations (based on the gamma radiation survey). The soil samples will be analyzed for radionuclides of concern and the results will be plotted against the readings from the area survey. In this manner, a correlation between the two measurement types can be established. If the decommissioning survey reveals any location which appears to approach the decommissioning standard, the baseline background will be subtracted from that location's apparent Ra-226 concentration. If the apparent concentration thus calculated approaches the decommissioning standard, a soil sample will be collected and analyzed to determine actual radionuclide concentrations and to assist in determination of an appropriate remedial action.

The verification survey and final status survey methods will be developed on a statistically valid basis to provide 95 percent confidence that the survey units meet the cleanup guidelines, and those methods will be described in each updated, detailed decommissioning plan (see beginning of this Section 6.0). Several statistical approaches, including but not limited to MARSSIM, will be considered in designing the surveys.

6.5.3 Decommissioning of Non-radiological Hazardous Constituents

During decommissioning, LC ISR, LLC will decommission tanks and piping associated with chemicals which are classified as hazardous (e.g., hydrochloric acid or sulfuric acid). Any remaining bulk quantities of material will be sold to another responsible company or will be transferred to other LC ISR, LLC properties for use. The tanks will then be washed out to remove any residual chemicals, in accordance with appropriate protocols outlined below, and sold or moved to another property for use.

The piping associated with hazardous chemicals will be washed out with water, in accordance with appropriate protocols outlined below. If the piping cannot be re-used by LC ISR, LLC or sold to another company for similar use, the EHS Department shall verify the pipe does not constitute a hazardous material and the piping will be sent to an off-site licensed landfill for disposal. All of the hazardous chemicals proposed for usage at LC ISR, LLC are highly soluble and should be easy to remove from tanks and piping.

All tank and pipe cleaning shall be performed in a manner that is protective of the employees and the environment. A qualified individual in the EHS Department shall review tank and pipe disposal surveys and operations to ensure operations are carried out in a protective manner. All potentially affected employees shall be trained in the hazards of chemicals and how to protect themselves. Equipment and fluids used for cleaning will be collected and disposed of in accordance with applicable regulations.

All sanitary waste will typically be collected and taken into Rawlins, WY or other nearby town and properly disposed of in a licensed landfill.

As discussed in Section 4.3.1 of the TR, non-radiological hazardous wastes will be stored in accordance with OSHA and EPA requirements and disposed of off-site by a licensed contractor.

6.6 Soil Replacement and Revegetation

Areas in which reclamation will be required within the Permit Area include the mine units, in particular where the header houses and roads have been removed, and the Plant area. Disturbed areas will be reclaimed to the approved post-operations land use by regrading the surface to the approximate pre-operations contour, re-establishing

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