ATTACHMENT D6-2b

Evaluation of the LC16M Pump Test

Petrotek

LOST CREEK REGIONAL HYDROLOGIC TESTING REPORT #2

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EXECUTIVE SUMMARY

- Lost Creek ISR, LLC (LC ISR. LLC) plans to develop and extract uranium from in-situ recovery (ISR) mine units within the HJ Horizon and, potentially, the UKM Sand of the Battle Spring Formation located at the Lost Creek Project Area (LCPA). To support State and Federal permit applications necessary for the project, LC ISR, LLC has completed the second of three regional pumping tests. This test targeted the Production Zone (HJ Horizon) aquifer on the south side of the Lost Creek Fault within the proposed Permit Area. For the 2007 hydrogeologic and mineral characterization program, LC ISR, LLC plans to install approximately 70 new wells in the LCPA. The majority of those wells were installed at the time of testing.

- Results from the pump test performed in the HJ Horizon south of the Lost Creek Fault have demonstrated hydraulic communication between the Production Zone pumping well and the surrounding monitor wells south of the fault. Based on the wells installed to date, this test has also confirmed that the Lost Creek Fault provides a significant barrier to groundwater flow within the HJ Horizon. During the test, responses observed in the HJ Horizon on the north side of the fault were an order of magnitude less than those on the south.

- The pump test results provide sufficient aquifer characterization of the HJ Horizon such that permitting can proceed and demonstrates that the HJ Horizon has sufficient transmissivity for ISR operations.

- Based on the limited data for the overlying and underlying aquifers, some responses were observed that coincide with the beginning and ending of the pump test. The cause for these responses is unknown at this time. Geologic data indicate that the overlying and underlying confining shale units are continuous throughout the permit area. While LC ISR, LLC has undertaken an extensive abandonment program of historic boreholes, it is unknown whether additional boreholes are responsible for the responses observed. Additional data will be collected during subsequent testing to better understand the integrity of the overlying and underlying confining shale units. Based on testing results to date, it is anticipated that the minor communication between the HJ Horizon and the overlying and underlying sands can be managed through operational practices, detailed monitoring, and engineering operations. In this regard, the potential communication observed at Lost Creek is much lower (e.g., up to five to ten times less) than has been observed in other ISR operations where engineering practices were successfully implemented to isolate lixiviant from overlying and underlying aquifers.

1.0 INTRODUCTION

1.1 BACKGROUND

The Lost Creek Project Area (LCPA) is located in the northeastern portion of the Great Divide Basin of Wyoming, within Sweetwater County (Figure 1-1). LC ISR, LLC plans to develop and extract uranium from ISR mine units within the HJ Horizon and possibly the UKM Sand of the Battle Spring Formation. This report provides a summary of the second regional hydrogeologic test conducted in the HJ Horizon completed in 2007 at LCPA to support State and Federal permit applications necessary for the project.

The LCPA is located in all or parts of Sections 13 through 14, and 23 through 26 of T25N, R93W and Sections 16 through 21, and 29 through 31 of T25N, R92W. Figure 1-1 shows the LCPA and its relationship to the Great Divide Basin. Figure 1-2 presents the location of the pumping well and monitor wells used for this test.

There are no operational ISR operations within ten miles of the LCPA. COGEMA's Christensen Ranch and PRI's Smith-Highland Ranch uranium project are located approximately 150 miles to the northeast and east, respectively. The primary Production Zone at Lost Creek is the HJ Horizon that occurs between depths of 300 and 450 feet below ground surface, although typically the ore bearing sand is found in the middle portion of the HJ horizon.

In this area, water is beneficially used for livestock watering as well as for purposes related to mining (monitoring, test wells, dewatering, industrial, stock, reservoir supply, and miscellaneous). Currently, water is not used for domestic or irrigation purposes within two miles of the proposed Permit Area.

1.2 REGULATORY REQUIREMENTS

The objectives of the regional pumping test, as stated in the Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) Chapter 11 (and associated guidelines) and Nuclear Regulatory Commission (NRC) NUREG 1569 (Section 2.7; Hydrology), are to:

1. Determine the hydrologic characteristics of the Production Zone Aquifer;
2. Demonstrate hydrologic communication between the Production Zone pumping well and the surrounding Production Zone monitor wells;
3. Assess the presence of hydrologic boundaries, if any, within the Production Zone Aquifer over the area evaluated by the Pump Test; and,
4. Evaluate the degree of hydrologic communication, if any, between the Production Zone and the overlying and underlying aquifers in the vicinity of the pumping well.

The testing procedures and results are presented and discussed in this report. It is noted that the regional pump test is not intended to replace mine unit-scale testing that is routinely conducted under WDEQ/LQD mine unit permit applications. Rather, the test is designed to obtain the requisite data required for characterization of the regional hydrology at the LCPA in support of submitting an NRC Source Materials License application and a WDEQ/LQD Permit to Mine application.

1.3 PURPOSE AND OBJECTIVES

The purpose of this report is to demonstrate that the recently completed hydrologic test meets the requirements and objectives of WDEQ and NRC as previously stated. This report demonstrates that the HJ Horizon on the south side of the proposed LCPA has been sufficiently evaluated with respect to hydrogeologic conditions and is suitable for ISR mining. This test was conducted within the HJ Horizon on the south side of the Lost Creek Fault. The Lost Creek Fault trends west-southwest across the LCPA. Potential production zones exist on both sides of the fault. An earlier test was completed in the HJ Horizon on the north side of the fault. Results of that test are described in the Lost Creek Regional Hydrologic Testing Report #1 (Petrotek Engineering Corporation 2007). Another test was recently completed (November 2007) that targeted the deeper UKM Sand on the north side of the fault. Results of the analysis of that test are pending.

The objective of this report is to present the information required by WDEQ/LQD and NRC NUREG 1569 (Section 2.7; Hydrology) for a Hydrologic Test Report. In accordance with these regulations the following information is included or referenced:

- A description and maps of the proposed permit area;
- Geological cross-sections, including data from monitor wells and test holes (these data are provided in the WDEQ Permit to Mine Application of which this report is an attachment);
- Isopach maps of the Production Zone, Overlying Confining Unit and Overlying Sands, and Underlying Confining Unit and Underlying Sands (these data are provided in the WDEQ Permit to Mine Application of which this report is an attachment);
- Well completion reports;
- A description of hydrologic testing;
- Discussion of the hydrologic test results including raw pump test data, type curve matches, potentiometric surface maps, water level graphs, drawdown maps, and other hydrologic data with interpretation and conclusions, as appropriate; and,
- Verification, based on the test data, that: (1) the monitor wells completed within the Production Zone are in communication with the pumping well; and (2) there is adequate confinement between the HJ Horizon Production Zone and the overlying (LFG Sand) and underlying (UKM Sand) aquifers, and (3) the Lost Creek Fault acts as a hydraulic barrier.

1.4 REPORT ORGANIZATION

This report includes eight sections, the first being this introduction. The site-specific hydrogeologic conditions are discussed in Section 2. Information related to the monitor well locations and completions is included in Section 3. Section 4 presents the hydrologic (pump) test design and procedures. Section 5 discusses the barometric effects on observed water levels. The test results are presented in Section 6. Analytical methods are presented in Section 7. Conclusions from the testing and analysis and references are included in Sections 8 and 9, respectively.

Field activities for the Lost Creek Pump Test were jointly performed by LC ISR, LLC, Leppert & Associates, Inc. (LAI) and Petrotek Engineering Corporation (Petrotek) personnel. Geologic interpretations were performed by LC ISR, LLC geologists. Aquifer test analyses were performed and this report written by Petrotek.

2.0 SITE CHARACTERIZATION

2.1 HYDROSTRATIGRAPHY

The entire Permit Area is covered by the upper part of the Battle Spring Formation. The total thickness of the Battle Spring Formation under the Permit Area is about 6,200 ft. The Battle Spring Formation unconformably overlies the Fort Union Formation. LC ISR, LLC has employed the following nomenclature for the hydrostratigraphic units of interest within the Battle Spring Formation. The primary Production Zone is identified as the HJ Horizon. The HJ Horizon is subdivided into the Upper (UHJ), Middle (MHJ) and Lower (LHJ) Sands. The HJ Horizon is bounded above and below by aerially extensive confining units identified as the Lost Creek Shale and the Sage Brush Shale, respectively. Overlying the Lost Creek Shale is the FG Horizon. The deepest sand in the FG Horizon, the Lower FG (LFG) Sand, is the overlying aquifer to the HJ Production Zone (HJ Horizon). Beneath the Sage Brush Shale is the KM Horizon. The uppermost sand within the KM Horizon, designated the Upper KM (UKM) sand, is a secondary Production Zone and also the underlying aquifer to the Primary Production Zone (HJ Horizon). An unnamed shale unit separates the UKM and Middle KM (MKM) Sand. The MKM Sand is the underlying aquifer to the UKM Production Zone. The shallowest occurrence of groundwater within the Permit Area occurs within the DE Horizon, which is above the FG Horizon. Figure 2-1 depicts the hydrostratigraphic relationship of these units.

Thickness (isopach) maps of target production zones (HJ and UKM), as well as the shale units above HJ (Lost Creek Shale) and below HJ (Sage Brush Shale) are presented in Appendix D5 - Lost Creek Project, WDEQ Permit to Mine Application (LC ISR, 2007).

2.2 OVERLYING UNITS: LFG SAND AND LOST CREEK SHALE

The overlying aquifer designated for this Pump Test is the LFG Sand, a member of the FG Horizon. The LFG Sand is continuous throughout the LCPA and ranges from 20 to 50 feet thick. The Lost Creek Shale is the confining layer that separates the overlying LFG Sand and Production Zone HJ Horizon. The Lost Creek Shale appears to be continuous throughout the Permit Area and ranges from 5 to 45 feet thick, with typical thickness of 10 to 25 feet. Additional description of the LFG Sand can be found in Appendix D6 - Lost Creek Project- WDEQ Permit to Mine Application(LC ISR, 2007)

2.3 PRODUCTION ZONE: HJ HORIZON

The Production Zone aquifer is designated as the HJ Horizon and includes the UHJ, MHJ and LHJ Sands. The HJ Horizon is continuous throughout the Permit Area with a total thickness ranging from 100 to 160 feet, and averages approximately 120 feet. As mentioned above, the majority of mineralization within the HJ Horizon occurs in the middle portion (MHJ). For purposes of this report and because no laterally extensive confining units have been observed between the UHJ, MHJ and LHJ Sands, discussions and analyses presented herein will focus on the HJ Horizon as a single hydrostratigraphic unit. Additional description of the HJ Horizon can be found in Appendix D6 - Lost Creek Project- WDEQ Permit to Mine Application(LC ISR, 2007).

2.4 UNDERLYING UNITS: SAGE BRUSH SHALE AND UKM SAND

The underlying aquifer is designated as the UKM Sand, a member of the KM Horizon. The total thickness of the UKM Sand is typically 30 to 60 feet and is continuous throughout the Permit Area. The Sage Brush Shale is the confining layer that separates the underlying UKM Sand and the Production Zone HJ Horizon. The Sage Brush Shale appears to be continuous throughout the Permit Area and ranges from 5 to 75 feet thick. Additional description of the UKM Sand and Sage Brush Shale can be found in Appendix D6 - Lost Creek Project- WDEQ Permit to Mine Application (LC ISR, 2007).

2.5 STRUCTURE

In the proposed Permit Area, the Battle Spring Formation dips to the west at a rate of three degrees. A "scissor fault" that extends the length of the Permit Area from the west-southwest to the east-northeast has been identified and is referred to as the Lost Creek Fault. Maximum displacement of the Fault at the west end of the Permit Area is around 45 feet, downthrown to the north; whereas the displacement on the east side of the Permit Area is about 80 feet with the downthrown side to the south. Near the middle of the Permit Area, at the hinge of the scissors fault, there is essentially no displacement. In the vicinity of the LC16M Pump Test, the Fault is downthrown to the south.

Of interest with respect to ISR operations, is the degree of hydraulic connection between hydrostratigraphic units across the Fault. As described above, the maximum observed displacement across the Fault is approximately 80 feet. The thickness of the HJ Horizon averages about 120 feet thick throughout the Permit Area. This indicates that the HJ Horizon should have sand to sand contact across the Fault everywhere within the Permit Area. However, water level data and previous pump tests have indicated that hydraulic communication within the HJ Horizon across the Fault is limited and that groundwater flow within the HJ Horizon is impeded. The Fault acts as a low permeability barrier to groundwater flow. The faulting appears to have reduced permeability, at least locally, within the HJ Horizon. This second regional pump test further evaluates this phenomenon.

2.6 PREVIOUS TESTING

Several historic pumping tests were conducted on the Lost Creek project in 1982 and 2006 to assess hydraulic characteristics of the Production Zone as well as overlying and underlying hydrostratigraphic units. Historic testing was performed by Hydro-Search Inc. (1982) and Hydro-Engineering, Inc. (2006). A regional pump test was conducted by LC ISR, LLC in the HJ Horizon north of the Fault in 2007 (Petrotek 2007). A summary of these tests is presented in Appendix D6 of the Lost Creek WDEQ Permit to Mine (LC ISR, LLC, 2007).

3.0 MONITOR WELL LOCATIONS, INSTALLATION, AND COMPLETION

3.1 WELL LOCATIONS

The majority of the LCPA monitor wells are located within the planned mine units of the proposed permit area. The monitor wells included in the pump test are shown on Figure 1-2.

3.2 WELL INSTALLATION AND COMPLETION

For this test, LC ISR, LLC included 36 wells (Figure 1-2), including 23 Production Zone (HJ Horizon) monitor wells, 4 Overlying (LFG Sand) monitor wells, 7 Underlying (UKM Sand) monitor wells, 2 monitor wells in the deeper MKM sand and LC16M (pumping well completed in the HJ Horizon). LC16M was located on the south side of the Lost Creek Fault and was installed specifically for use as a pumping well.

All of the wells used for this test are located in Sections 17, 18, 19 and 20, Township 25 North, Range 92 West (Figure 1-2), and were constructed with 4.5-inch nominal diameter casing. The wells were developed using standard water well construction techniques, including air lifting, pumping, swabbing, and/or surging. Completion information for each well is provided in Appendix A. Specific data related to well location, construction, completion interval, and initial water levels are provided in Table 3-1.

4.0 PUMP TEST DESIGN AND PROCEDURES

4.1 TEST DESIGN

As mentioned above, this is the second of three regional hydrologic tests to be conducted in the LCPA. This test, conducted from the HJ Horizon on the south side of the Lost Creek Fault, was designed to:

1. Demonstrate hydraulic communication between the Production Zone (HJ Horizon) pumping well and the surrounding Production Zone monitor wells;
2. Assess the hydrologic characteristics of the Production Zone aquifer within the test area;
3. Evaluate the presence or absence of hydrologic boundaries in the Production Zone within the LCPA; and,
4. Demonstrate sufficient confinement between the Production Zone and the Overlying and Underlying aquifers for the purposes of ISR mining.

The general testing procedures were as follows:

- Install In-Situ Level TROLL data logging transducers (vented) in wells to record changes in water levels during tests. Verify setting depths and head readings with manual water level measurements.
- Measure and record background water levels and barometric pressure for a minimum of 96 hours prior to the test.
- Run the pumping well at a constant rate (or as close as practical).
- Record water levels and barometric pressure throughout background, pumping, and recovery periods.

4.2 PUMP TEST EQUIPMENT

The test was performed using a Grundfos 40S50-15, 5 hp, 460V, 3-phase electrical submersible pump powered by a portable diesel generator. The pump was set at a depth of 425 feet (approximately 42 feet off the bottom of pumping well [LC16M]). The static depth to water in LC16M was approximately 179 feet, providing for 250 feet of head above the pump. Flow from the pump was controlled with a manual gate valve. Surface flow monitoring equipment included a NUFLO™MCII totalizer (provided by LC ISR, LLC) and a SeaMetrics DL-75 Data Logger (provided by LAI). Per discussions with WDEQ/LQD, no Temporary Discharge Permit was required; discharge water was land applied approximately 300 feet downgradient of the pumping well via a manifold and 5 perforated 1" HDPE lines to minimize erosion.

Water levels in twelve wells (including the pumping well, nine HJ Horizon observation wells, and one well in the overlying and underlying aquifers) were measured and recorded with In-Situ Level TROLL transducer/dataloggers. The pressure rating for the transducers ranged from 15 to 100 psi. The transducers were programmed to record depth to water measurements at 10 minute intervals (during background monitoring, and the pumping and recovery periods). A summary of the monitoring equipment used is presented in Table 4-1.

In addition to the wells that were continuously monitored using the Level TROLL transducers, numerous other wells were periodically measured for depth to water using a hand lowered electronic water level meter. This allowed for a more extensive assessment of the potentiometric surface before, during and after the pump test. A list of wells that were included in the hand measurement rounds is provided in Table 4-1.

Petrotek, LC ISR, LLC and LAI personnel installed the monitoring equipment prior to testing. Petrotek and LC ISR, LLC and LAI personnel verified the datalogger programming and equipment layout, and performed the step-test. Thereafter, LC ISR, LLC and LAI personnel collected the daily downloads and transferred the data to Petrotek for review/QA/QC for the duration of the long term pumping test. Table 4-2 contains the drawdown and responses observed for each well.

4.3 POTENTIOMETRIC SURFACES

Figure 4-1 presents potentiometric elevations the Production Zone (HJ Horizon) within the LCPA from water level measurements on November 21, 2007. The data are considered representative of static conditions within the HJ Horizon because the water levels were collected after an extended period in which there were no drilling activities or pumping tests being conducted in the immediate vicinity. That measurement round is also the most comprehensive set of water levels collected to data as all available monitor wells were included. Based on those data, the direction of groundwater flow within the HJ Horizon both north and south of the fault is predominantly to the west-southwest. The hydraulic gradient is similar on both sides of the fault at between 0.003 and 0.006 ft/ft (15.8 to 31.6 ft/mile) The steep gradient observed in the potentiometric surface from the north to the south side of the fault is most likely a manifestation of a lower permeability transition area associated with the fault smear zone and/or secondary faulting and fracturing near the fault as described in the Lost Creek Regional Hydrologic Test Report #1 (Petrotek 2007). The observed potentiometric surface configuration is consistent with groundwater flow systems impacted by lower permeability zones as studied and modeled by Freeze (1969). Although limited groundwater leakage occurs across the fault, the majority of groundwater flow on both sides of the fault appears to be generally parallel to the fault, to the west-southwest. Water level data used for preparation of this map are presented in Table 3-1.

The number of data points within the Overlying (LFG Sand) aquifer and the Underlying (UKM Sand) aquifer, are limited, but indicate a generally similar groundwater flow direction and gradient as in the HJ Production Zone aquifer.

Water level data were collected from the LC15M (LFG), LC-16M (HJ) and LC17M (UKM) well cluster to evaluate vertical hydraulic gradients. Water level data indicate the potentiometric surface of the HJ Horizon (LC16M) is approximately 21.2 feet lower than the potentiometric surface of the overlying LFG Sand (LC15M) (Table 3.1). The data suggest that the LFG Sand is not in hydraulic communication with the HJ Horizon, but has the potential to drain to it if an artificial pathway was created (improperly constructed well or improperly abandoned borehole). Additionally, the potentiometric surface of the HJ Horizon is approximately 7.4 feet higher than the potentiometric surface of the underlying UKM Sand (LC17M) at this location, also suggesting that the HJ Horizon is not in hydraulic communication with the UKM Sand.

4.4 BACKGROUND MONITORING, TEST PROCEDURES AND DATA COLLECTION

The majority of the testing equipment (e.g., pump, flow meters, Level TROLLs) was installed and checked by Petrotek and LAI on October 7 and 8, 2007. A step-rate test was conducted on October 8, 2007. Rates used in the step test were 27.5, 35.0 and 46.0 gallons per minute (gpm).

The background-monitoring followed the step test and ran for a period of 14 days. Water levels were recorded every 10 minutes during background monitoring.

In-Situ® Level TROLLS® were programmed to record water levels every 10 minutes during the pumping and recovery periods. Pumping rate data for this test are shown on Table 4-3. A CD containing the water level data for the step test, background monitoring, pumping, and recovery periods is included in Appendix D.

5.0 BAROMETRIC PRESSURE CORRELATIONS AND CORRECTIONS

5.1 MONITORING EQUIPMENT

As discussed earlier, all twelve of the In-Situ Level TROLL transducers used were vented (gauged). In-Situ has stated that if vented transducers are used, the vent eliminates the impact of barometric pressure on the sensor. However, a change in water levels due to barometric changes will occur whether a vented sensor is used or not. Hence, use of vented equipment eliminates the barometric impact on the sensor, but does not correct the water level measurements for barometric effects on the aquifer. In this regard, the vented Level TROLLs are barometrically *compensated*, but not *corrected*. If significant variations in water levels are observed, the data may require correction for fluctuations in water levels associated with changes in barometric pressure.

5.2 BAROMETRIC CORRECTIONS

As was demonstrated under the Lost Creek Regional Hydrologic Test #1, barometric pressure had a negligible impact on water levels (Petrotek 2007). Two methods of correction were evaluated in Test #1. One method, referred to as the Manual Correction, involved evaluating the data based on total head (i.e., the elevation of water in the well plus barometric pressure as feet of water), and normalizing the values to the initial barometric pressure at the start of each pump test. The second method utilized a program that was developed to analyze barometric and tidal effects for the Waste Isolation Pilot Project (WIPP) in New Mexico. The program is identified as BETCO (Sandia Corporation, 2005). BETCO was developed as a method to remove water level fluctuations due to barometric pressure and earth tides through the application of a multiple regression analysis. The BETCO software is publicly available at http://www.sandia.gov/betco as freeware. Results of the comparison of the two correction methods indicated that barometric pressure had minimal impact on water levels prior to, during and after the pumping test in the HJ Horizon observation wells. This was largely because the drawdown response in each of the monitored HJ Horizon observation wells on the same side of the fault was more than 10 feet. Because the second pump test is evaluating hydrologic conditions in the same aquifer system and in the same general location as the first test, barometric pressure corrections were not performed on data from Test #2. Original, uncorrected data from the vented Level TROLLs were used in the analyses of Test #2, as discussed in the following section of this report.

A comparison of the barometric pressure observed during the LC16M and LC19M tests indicate that the magnitude of change was similar in both tests (Figure 5-1).

6.0 TEST RESULTS

6.1 BACKGROUND TRENDS

As mentioned previously, water level stability data were collected prior to the start of the pump test. Plots of the background, pumping, and recovery data for wells completed in the HJ Horizon and monitored with transducers are shown in Figures 6-1 through 6-10. Water level data for the overlying (LFG Sand) and underlying (UKM Sand) wells are presented in Figures 6-11 and 6-12, respectively. Water level vs. barometric pressure plots for all wells monitored during the test are presented in Appendix B.

In general, water levels in the HJ Horizon north and south of the fault were slightly decreasing just prior to the start of the test. The overall trend for the week prior to the test was neither increasing nor decreasing. Background water levels in the LFG Sand and UKM Sand were also trending slightly downward prior to start of the test. Anomalies observed during background monitoring were largely attributed to ongoing delineation drilling activities.

6.2 PUMP DURATION AND RATE

The test was started at 14:10 on October 22, 2007. The pump test was terminated when the generator failed sometime between 01:00 and 01:10 on October 28, 2007 (based on water level response recorded on the transducer in the pumped well). The total length of pumping was approximately 7,560 minutes (5.5 days). The average pumping rate during the LC16M test was 37.4 gallons per minute.

6.3 HJ HORIZON RESPONSE

Drawdown observed in the monitor wells completed in the HJ Horizon, approximately 4 days into the test, is presented in Figure 6-13. The drawdown shown on the figure is based on hand-measured values. There were 24 HJ Horizon wells included in the hand measurements as opposed to only 10 wells with transducers. Therefore, the hand measurement data set was used to illustrate the drawdown response across the area of interest. As shown in the Figure, significant drawdown was observed in all of the HJ Horizon monitor wells located on the south side of the Fault after pumping LC16M for 4 days. Prior to shut-in of LC16M, maximum drawdown observed in the pumping well was 69.3 feet. All of the HJ Horizon observation wells located south of the Fault recorded over 10 feet of drawdown by the end of the test. As mentioned above, the potentiometric level on the north side of the fault ranges from 5 to 15 feet higher on the north side than the south side under static, non-pumping conditions. At monitor well HJMP107, located just south of the fault, approximately 27.4 feet of drawdown was observed at the end of the test. On the north side of the fault, minimum drawdown was observed (typically less than 1 foot) with a maximum of 3 feet at HJT-104. The total head difference across the fault at the end of the pump test was on the order of 30 to 40 feet. As such, significant hydraulic stress was applied to the aquifer across the Fault. Based on the significant drawdown that occurred in the HJ Horizon south of the fault in response to pumping at LC16M and the minimal response to the HJ Horizon north of the Fault during the test, the Lost Creek Fault is a significant barrier to groundwater flow in this area. The drawdown observed in wells north of the fault during the test, although minimal; suggests that some leakage across the fault occurs. The degree and significance of the leakage will be further investigated with additional mine unit scale pump tests.

6.4 CONFINING UNIT RESPONSE

During the pumping test, small responses were observed from the overlying aquifer observation well (LC17M) and underlying aquifer observation well (LC15M), (Figures 6-11 and 6-12, respectively). The observed responses correlate with the beginning and ending of the LC16M pump test. Responses were also noted in other overlying and underlying observation wells that were hand measured. The responses ranged from 0.3 to 1.0 feet in the overlying aquifer and 0.3 to 2.1 feet in the underlying aquifer by the end of the test (Table 4.2). Response was also observed in overlying monitor wells HJMO-112, HJMO-113, and HJMO-114, and underlying monitor wells HJMU-112, HJMU-113, and HJMU-114, although these wells were only measured with hand tags. The water level plots for these wells are included in Appendix B. The communication observed at Lost Creek is much lower (e.g., five to ten times less) than has been observed in other ISR operations where engineering practices were successfully implemented to isolate lixiviant from overlying and underlying aquifers.

Additional drilling and logging during 2007 and 2008 will provide a more detailed understanding of the stratigraphic section and confining units at the LCPA. One additional pump test was completed in November 2007 in the UKM Sand, and additional hydrologic testing will be conducted for each mine unit. Future work will provide additional data with which to re-evaluate the responses in the underlying and overlying units observed during the recent testing. In this regard, it is anticipated that the overlying/underlying responses observed to date will be resolved and communication between the underlying and overlying aquifers, if significant, will be understood to a degree such that mining can proceed in accordance with NRC and WDEQ regulations.

7.0 TEST ANALYSIS

7.1 ANALYTICAL METHODS

Drawdown data collected from the monitor wells (with transducers) were graphically analyzed to determine aquifer properties of Transmissivity and Storativity. The primary analysis method used was Theis (1935). The assumption used in this analysis was that the aquifer is confined and has a saturated thickness of 120 feet. The Theis Recovery (1935) analysis was also performed for the pumping well and observation wells. As noted, minor responses in observation wells across the fault were observed. However, the magnitude of those responses was so low that quantitative analyses were not performed. Water level plots for all the wells are presented in Appendix B.

The test data were analyzed using the Theis method because this method is mathematically valid for all distances and times. The significant assumptions inherent in this method include:

- The aquifer is confined and has apparent infinite extent;
- The aquifer is homogeneous and isotropic, and of uniform effective thickness over the area influenced by pumping;
- The potentiometric surface is horizontal prior to pumping;
- The well is pumped at a constant rate;
- The pumping well is fully penetrating; and,
- Well diameter is small, so well storage is negligible.

These assumptions are reasonably satisfied, with the exception of the uniform thickness of the aquifer and infinite extent of the aquifer. Locally, the HJ Horizon at LCPA is not homogeneous and isotropic; however, over the scale of the pump test, it can be treated in this manner. As previously discussed, and verified with the pumping test, the Fault acts as a significant hydraulic barrier to groundwater flow and therefore limits the effective extent of the aquifer. In this regard, water level responses from all the wells in the HJ Horizon likely are impacted by the Fault. The Transmissivity (T) and hydraulic conductivity (K) results obtained from these analyses are likely to be lower than the actual values, yet will be representative of conditions that will be observed during mining in the vicinity of the fault.

Because none of the monitor wells were completed within the confining units, a Neuman-Witherspoon (1972) analysis was not performed. The software used to graphically analyze the data was AquiferTest Pro ver 3.5 (Waterloo Hydrogeologic, Inc., 2002).

Water level stability data collected during the pre-test and post-test periods along with barometric pressure (Appendix B) were used to assess the background trends. No significant recharge or trend corrections were warranted for any of the wells.

7.2 ANALYTICAL RESULTS

Transmissivity (T) results from the Theis analysis were calculated using both drawdown and recovery portions of the test data. Transmissivity results from the LC16M pump test for the HJ Horizon aquifer range from 57 to 110 ft^2/d, with an average T value of 76.2 ft^2/d (Table 7-1). Based on an average thickness of 120 feet, the average K is 0.63 ft/d (Table 7-1). Assuming a water viscosity of 1.35 cp (50 degrees F) and a density of 1.0, this equates to a permeability of approximately 310 millidarcies (md). Storativity (S) of the HJ Horizon aquifer ranges from 3.5 E-05 to 9.1 E-04, with an average value of 2.9 E-04 (Table 7-2). These values are consistent with, although slightly higher than, the aquifer properties determined from the HJ Horizon pump test on the north side of the Fault.

An example of a type curve match using the Theis method is provided in Figure 7-1 Type curve matches for all of the HJ Horizon monitor wells included in the pump test are provided in Appendix C. Water level data for all monitor wells from background through pumping and recovery are included in Appendix D on a CD ROM.

7.3 TRANSMISSIVITY DISTRIBUTION

The transmissivity results at LCPA correlate reasonably well with the thickness of the HJ Horizon and the permeability transition zone located near the fault (Figure 7-2). In general, higher T values are reported in the areas of thicker and/or cleaner sand, while lower T values are reported in areas of lower permeability near the fault transition zone or where the sand thickness decreases. On a regional scale, the observed variation in T is not expected to significantly impact ISR mining and has no apparent regulatory implications. Further, field operations will be modified to achieve mine unit balance in light of the variation in T.

Because of the overriding impact of the Fault, no attempt was made to determine directional transmissivity using analytical methods for this pump test. The test data to date are limited and the issue of directional transmissivity will be further investigated during mine unit-scale testing required by NRC and WDEQ/LQD.

As discussed previously, the T results for the HJ Horizon on the south side of the Fault obtained from the test are considered "effective" because of the barrier effect of the Fault. Because of the Fault, the aquifer is not infinite-acting. The Fault effectively reduces the available aquifer by half. The T results are representative of the HJ Horizon on the scale of the pump test, and directly apply to design calculations such as water balance. However, the actual transmissivity of the aquifer, without impacts from the fault, would be higher (e.g., by an approximate factor of 1.5 to 2.0). In other words, there would be less drawdown at the pumping well at a given pumping rate, if the Fault were not restricting flow to the well.

The K results estimated from this test (0.47 to 0.92 ft/d) are calculated by dividing the T by the saturated thickness of the aquifer. Actual K values likely are on the order of 1.0 to 1.5 ft/d. This range of K values would be most representative for estimating groundwater velocity and travel times with regard to mine unit design and exterior monitor well spacing.

7.4 RADIUS OF INFLUENCE

Based on the drawdown response of over 13 feet observed at HJT-103 (located approximately 1,375 feet west of the pumping well), LC16M test results suggest a radius of influence (ROI) in excess of 2,000 feet (Figure 6-13). No observation wells were included in the test that were further than HJT-103 and on the same side of the Fault as LC16M. Minor drawdown responses (less than 1 foot) were observed in several HJ Horizon Monitor wells that were located across the Fault at distances of approximately 2,000 feet. As noted previously, additional mine unit scale testing will be required prior to initiation of operations at Lost Creek.

8.0 SUMMARY AND CONCLUSIONS

- The HJ Horizon monitor wells and pumping well located on the south side of the fault are in hydraulic communication, demonstrating that the HJ Horizon Production Zone has hydraulic continuity. While minor communication was also demonstrated in the HJ Horizon north of the Fault, the response was an order of magnitude smaller suggesting that the Fault is a significant barrier to groundwater flow. Additional (mine unit) scale testing required by NRC and WDEQ will be designed to demonstrate communication throughout each mine unit between the pumping well(s) and the monitor well ring;

- On a regional scale, the HJ Horizon Sand south of the Fault has been adequately characterized with respect to hydrogeologic conditions within the test area at LCPA. The pump test results demonstrate that the HJ Horizon has sufficient transmissivity for in-situ recovery mining operations. The pump test has provided sufficient aquifer characterization of the HJ Horizon such that permitting can proceed, and;

- Geological information suggests that the overlying and underlying shales are continuous throughout the test area. Minor responses were observed during the pump test and the cause of the responses is undetermined at this time. Additional testing will provide additional information regarding the confining characteristics of the overlying and underlying shales.

9.0 REFERENCES

AATA, Lost Creek ISR, LLC, Petrotek Engineering Corporation, 2007. Ur Energy Lost Creek Project, Wyoming Department of Environmental Quality Permit to Mine, December 2007

Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well field history, Am. Geophys. Union Trans., vol. 27, pp. 526-534.

R. A. Freeze, 1969. Theoretical Analysis of Regional Groundwater Flow, Scientific Series No. 3, Inland Waters Branch, Department of Energy, Mines and Resources, Ottawa, Canada.

Freeze, R.A. and J.A. Cherry, 1979. Groundwater, Prentice-Hall, Inc. Englewood Cliffs, New Jersey 07632, 29 p., 233 p.

Hantush, M.S. and C.E. Jacob, 1955. Non-steady radial flow in an infinite leaky aquifer, Am. Geophys. Union Trans., vol. 36, pp. 95-100.

Neuman, S.P. and P.A. Witherspoon, 1972. Field Determination of the Hydraulic Properties of Leaky Multiple Aquifer Systems. Water Resources Research. vol. 8, No. 5.

Petrotek Engineering Corporation 2007. Lost Creek Regional Hydrologic Testing Report #1. Prepared for Lost Creek ISR, LLC, December 2007.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol.16, pp.519-524.

Sandia Corporation, 2005. User Manual for BETCO Version 1.00. ERMS#540534, October 2005.