UPDATED INFORMATION

for

THE ADJUDICATION FILE

for the
LOST CREEK PROJECT
Wyoming

There have been some changes in the oil and gas leases since the application for the Lost Creek Project was submitted in December 2007. To reflect those changes, the information in Appendices A and B has been updated, and Plates A-3 and B-3 have been revised. The pagination and page cross-references have also been updated as necessary.

Specifically, one new federal oil and gas leaseholder, Kirkwood Oil & Gas, is associated with two new leases. These leases are within the permit area and within ½ mile of the permit area. This information has been added to Appendices A-3 and B-3 and Plates A-3 and B-3.

Additionally, a lease within ½ mile of the permit area has expired. This lease was associated with two federal oil and gas leaseholders, Michiwest Energy & Bolyard Land. This information has been deleted from Appendix B-3 and Plate B-3.

RESPONSES TO WDEQ/LQD COMMENTS
of 8/26/08
for

APPENDIX D-5
GEOLOGY

for the
LOST CREEK PROJECT
Wyoming

Appendix D5 - Geology

Please note that, while the complete text of the appendix was resubmitted, the only changes to the text are those outlined in the following responses. To keep the pagination simple, it was easier to resubmit the complete text. The Table of Contents has also been updated to reflect the new page numbers.

1) ***Section D5.1.1 & Table D5-1.*** ***Section D5.1.1, paragraph 2, Section D5.1.1 paragraph 1, and Table D5-1(Permit Area Stratigraphy) state that within the permit area the Ft. Union Formation is 4,650 feet thick yet the Geologic Cross Section (Figure D5-2a) Schematic only illustrates the Ft. Union as being 1,000-2,000 feet thick. This is the same for other formation thicknesses (e.g. Battle Springs and Wasatch are said to be 6,200 feet thick, yet the cross section only shows them to be 4,000 feet thick). This discrepancy between Figure D5-2a, Table D5-1and the text needs to be corrected. (AB)***

   The schematic cross section (Figure D5-2a) has been redrawn closer to scale.

2) ***Figure D5-1.*** ***Figure D5-1 is a Regional Geologic Map. This map indicates the faults in the area, but does not indicate the Lost Creek Fault within the permit area. This is a significant and well documented feature within the permit area, and should be indicated on the Figure. (AB)***

   Only major regional faults, such as those illustrated on the State of Wyoming geologic map or regional maps, are illustrated on Figure D5-1, "Regional Geologic Map". Some of the faults illustrated on the regional map have displacements of 5,000 feet or more. In contrast, the Lost Creek fault zone is a minor fault system with throws from zero feet to a maximum of 80 feet; therefore, it is not illustrated on the regional map. It is, however, illustrated on the property-scale maps (e.g., Figure D6-13), and more detail about any faulting within the Permit Area that could impact the in situ operations will be provide with the mine unit packages.

3) ***Section D5.1.2, paragraph 2.*** ***This section discusses the presence of the Lost Soldier Anticline to the northeast of the permit area. Looking at Figure D5-1 it is not readily apparent where the axis of this anticline is located. If possible, please delineate the Lost Soldier Anticline on Figure D5-1. (AB)***

   On the Regional Geologic Map (Figure D5-1), there are many anticlines and synclines illustrated; none of which are named. The Lost Soldier Anticline is located in the northeast portion of T26N, R90W. Rather than identify the Lost Soldier Anticline on the regional map, which might be misleading as to its importance

relative to the Lost Creek Project, a sentence has been added to the text to indicate the location. In addition, the map symbol for an anticline has been added.

Just to the east of the Lost Soldier anticline on the regional map lies the parallel Bair Syncline. The map symbol of the Bair Syncline was changed to illustrate this structure which was originally shown as an anticline.

4) ***Plates D5-1a – D5-1e.*** ***These plates provide one generalized and several detailed geologic cross sections down the centerline of the ore body, and across the centerline of the ore body. In addition, Figure D5-2a provides a very generalized geologic cross section across the northern portion of the permit area. LQD Non-Coal Rules, Chapter 11, Section 3(a)(viii) requires cross sections that show geologic features within the entire permit area, and how they relate to the production zone. Extending cross sections F, G, and H to the boundaries of the permit area with any available drill hole data, will help to provide this information. (AB)***

The cross sections have been updated with the information from new borings and wells completed in 2008. As noted on the Index Sheet for the changes to Appendix D-5, Plates D5-1b through D5-1e have been replaced, and two new plates (Plates D5-1f and D5-1g) have been added. The references in the text to these plates have also been updated.

5) ***Figure D5-2b and Figure D6-10.*** ***These figures show a stratigraphic column against a geophysical log, yet the type and scale for the log is not provided. Also the description is generalized and does not indicate the stratigraphic detail that should have been recorded in the field. It is requested that the Figure title be changed to read 'Generalized Stratigraphic column'. (AB)***

Figures D5-2b and D6-10 have been redrawn, based on a more representative log, and the requested information included. The title of Figure 5-2b in the Table of Contents was also changed to be the same as the title on the figure.

6) ***Several of the Plates, beginning with Plate D5-1a indicate the mine unit boundaries, yet the proximity of Mine Unit 6 to the eastern boundary of the proposed permit area, will need to be changed to allow for the monitor well ring and aquifer exemption boundary to be within the permit boundary. (AB)***

As noted in Section OP3.2 of the Operations Plan, the specifics of each mine unit will depend upon the ore distribution, the hydrogeologic conditions specific to each mine unit, and "development requirements", such as access concerns and boundary limitations. The mine unit boundaries displayed on the figures and plates are

conceptual and are not intended to indicate the specific extent of either the 'pattern area' (i.e. the production and injection wells), the monitor well ring, or the aquifer exemption area for a given mine unit. For example, the boundary of Mine Unit 5 on Plate 5-1a extends west beyond the most concentrated portion of the ore trend because of the possibility for developing the more isolated ore occurrences on the western end of the ore trend. Similarly, part of the ore trend extends northeast outside Mine Unit 6 because the entire ore trend cannot be encompassed with the current permit boundaries. The risks associated with mine unit development near the permit boundary, such as the potential for an off-site excursion, are understood and will be taken into account in designing the actual pattern area and monitor ring. As discussed during the September 22, 2008 meeting between LQD and Ur-Energy, Inc. personnel at the LQD Lander Office, the maps submitted with each mine unit application will show the definitive boundaries, based on the specific physical conditions for that mine unit.

7) ***Section D5.3.5.*** ***Section D5.3.5 discusses the Short-Term Probabilistic Hazard Analysis, yet does not explain how the potential estimated accelerations would affect the well structure, pipelines or buildings on site. Please add this information to the text. (AB)***

The following sentences have been added almost at the end of Section D5.3.5 to explain the potential impacts:

> These accelerations (3.9 – 9.2 percent g) are roughly comparable to intensity V earthquakes which can result in cracked plaster and broken dishes, but minor or no construction damages (Case, 2002). All facilities, including the processing plant, pipelines and well structures, at Lost Creek will be designed and constructed to sustain an intensity V earthquake. In addition, the observations of injection, production, and pipeline pressures and associated monitor well measurements, necessary for the in situ operation, will provide short-term information about any unanticipated seismic impacts.

8) ***Section D5.2.2, Structure.*** ***This section discusses there being one minor fault, the Lost Creek Fault, within the permit area, yet the maps in this section indicate a second fault to the west of the Lost Creek fault, yet within the permit area. This fault should be discussed in detail. (AB)***

As additional subsurface data has become available from on-going exploration drilling, the information on the fault system has been refined. The text in Section 5.2.2 has been updated to reflect the current information. Pursuant to the discussion during the September 22, 2008 meeting of LQD and Ur-Energy, Inc. personnel at the

LQD Lander Office, as additional information about this fault system is collected in the vicinity of a given Mine Unit, that information will be provided with the relevant Mine Unit Package.

9) ***Plate D5-1a. On the cross sections please show the formations present to the total depth of the boring, i.e. if the boring (e.g. TE61, P2-19, TT40, LC3) crosses into the no name shale and or Middle KM horizon, and below, this should be indicated on the cross sections. (AB)***

The total depth of each boring has been added to the cross-section. Where possible, available information has been added about the current interpretation of the stratigraphy below the deepest formations of concern for this application, i.e., below the interval of the HJ Horizon to be mined and below the associated underlying aquifer to be monitored for a downward vertical excursion. However, the stratigraphic interpretation of the extent of the deeper ore sands and associated aquitards is still conceptual and does not extend throughout the site because drilling of the deeper horizons has not been as intense as in the shallower horizons. As noted in Section OP1.2 of the Operations Plan, Ur-Energy will request a permit revision, and provide more extensive stratigraphic and hydrologic information, prior to mining any ore sands deeper than those in the HJ Horizon.

10) ***Plates D5-1a through D5-1e. Geologic Cross Sections should be reviewed, approved and stamped by a licensed Wyoming Professional Geologist, as per the Wyoming Geologists Practice Act. (AB)***

Mr. Bill Boberg signed a complete set of geologic maps and cross-sections, which were submitted with the copy of the application sent to the WDEQ LQD Cheyenne Office in December 2007. Both the Lander and Cheyenne copies of the new maps and cross-sections submitted with these responses have been stamped by Mr. Cal Van Holland.

11) ***Plates D5-1b through D5-1e. Plates D5-1b – D5-1e show many places where the Sage Brush Shale has mineralized zones of ore, e.g. TG19-20, TG68-20, TG12-20, TG58-20, TG2-10, TG9-17, TG10-17, and TG11-17. The presence of mineralized zones within the Sage Brush Shale brings to question the ability of this unit to act as an adequate aquitard between the LHJ and UKM sands. The Sage Brush Shale is defined as a fine sand and shale unit. How fine is the sand if it had enough transmissivity to be a receiving unit for the Uranium? The overlying Lost Creek Shale also has some minimal mineralization within it. What is the likelihood that these shales could leach out Uranium altering the integrity of the unit. It is requested that the MKM be fully characterized for baseline, north and south of the***

fault, as it may end up being the underlying aquifer that needs to be protected during mining of both the HJ horizon and potentially the UKM horizon. (AB)

Aquifers in the Battle Spring Formation typically consist of thick sequences of multiple, medium to coarse-grained, fluvial channel-fill sands. *Mapable* sand units (for example: the UHJ Sand) may range from five to 50 feet in composite thickness, and typically consist of multiple stacked channel-fill sands. *Aquifers*, in turn, typically consist of multiple stacked sand units. Sand units are commonly separated vertically by locally thick beds of mudstone, claystone, siltstone or fine-grained sands. These interbeds represent local aquitards and aquicludes which can be considered internal to the regional aquifer. Total composite thickness of an aquifer (for example: the HJ Horizon) is commonly in excess of 100 feet.

Aquiclides and aquitards (for example: the LCS or SBS Shales) represent quiescent floodplain and overbank sedimentary environments between channel fill sequences. Generally referred to as 'shales' they are, in essence, sedimentary sequences dominated by mudstone and claystone lithology; but also may include substantial amounts of siltstone and fine-grained sands. These lithologies can exhibit considerable lateral facies changes and interfingering, and are often transitional to the aquifers above or below. As a result, dramatic thickening and thinning of the aquicludes can occur locally. In addition, their upper and lower boundaries are often gradational. Aquicludes may even exhibit localized occurrences of mineralization in the vicinity of lithologic interfingering and facies changes with mineralized sands.

The attached figure (Illustration of the Character of Aquifers and Aquicludes at the Lost Creek Project) details the lithologic changes over a 400-foot section in the central portion of Mine Unit One. Because of the depositional variability of the sediments, one purpose of the more detailed assessments of the geologic and hydrologic conditions in the Mine Units is to provide information that could affect operating and monitoring conditions, e.g., positioning of an overlying monitoring well where the overlying shale is thin. Given the extremely low concentration of uranium mineralization in the shale, even if the uranium were removed through mining, it would not result in any noticeable alteration of the shale's integrity. Also, the uranium mineralization is epigenetic so the structural integrity of the shale was developed before emplacement of the uranium and is therefore independent of the uranium. The shale layers in question are strongly reduced which will largely prevent the oxidation and subsequent dissolution of uranium mineralization even if mining solutions were to come into contact with the uranium.

12) ***Plates D5-2a, and D5-2c Isopach Maps of the Lost Creek Shale and Sagebrush Shale (respectively). For areas where the isopachs indicate the unit thickness is less than ten feet thick, please indicate at specific drill hole sites, what the thickness is at that location, so the reviewer knows how much less than ten feet in thickness the aquitard is at a given location. (AB)***

The isopachs have been updated with the information from new borings and wells completed in 2008, and the actual unit thicknesses have been added where the thicknesses are less than ten feet. As noted on the Index Sheet for the changes to Appendix D-5, Plates D5-2a through D5-2d have been replaced.

13) ***Section D5.2.4. Historic Uranium Exploration Activities, and Plate AD5-2a-c Location Map of Historical Drill Holes. It is stated that there are at least 560 exploration holes in the area, and Attachment D5-2 lists the holes northing and easting, year drilled and ID. Please also include depth of hole and discuss further the efforts made to locate the old drill holes, and whether or not it was confirmed that the hole had been properly abandoned. If the hole was abandoned through recent efforts, the plugging procedure and date should be indicated as well. The map should be updated to indicate the status of each drill hole location. Once operations commence, it is important that these historic drill holes do not provide a pathway for production fluids to migrate to underlying or overlying aquifers. (AB)***

Section D5.2.4 has been renamed (Subsurface Exploration Activities) because more than just historic uranium exploration is discussed in the section. It has also been divided into two subsections, the first of which describes uranium exploration and the second of which summarizes other exploration. The discussion in the first subsection has also been expanded to include: the results of efforts to obtain information about the known historic holes, including hole depths; descriptions of re-abandonment efforts that have been needed to date; and steps that will be taken to identify any improperly abandoned drill holes in the mine units. Table D5-2 (Abandonment Information for Historic Exploration Holes) and Attachment D5-3 (Communication with WDEQ LQD related to Drill Hole Abandonment) have been also been added.

WEST

EAST

LC103

LC99

LC94

LC91

LC88

534,700 N
745,300 E

100'

100'

100'

100'

534,700 N
745,700 E

SP

RES.

Depth (ft.)

300

350

400

450

500

550

Weak Mineralization

Mineralization

Channel-fill

Channel-fill

Sand Unit

datum

Mineralization

FG

LOST CREEK SHALE

UHJ

local aquiclude

MHJ

HJ

local aquiclude

LHJ

SAGEBRUSH SHALE

KM

LOST CREEK PROJECT

ILLUSTRATION OF THE CHARACTER OF AQUICLUDES AND AQUIFERS

Sand

Mudstone, Claystone, Siltstone

Mineralized Sand

Ur-Energy USA
C. VanHolland
12-12-08

RESPONSES TO WDEQ/LQD COMMENTS
of 8/26/08

for

APPENDIX D-6
HYDROLOGY

for the
LOST CREEK PROJECT
Wyoming

Appendix D6 - Ground Water

Note: Comments 1 through 13 relate to Appendix D5 - Geology.

14. ***Section D-6. Detailed stratigraphic and well completion logs should be provided within the permit document for all monitoring wells. It is preferable if this information can be compiled on one log form. Notation of each horizon within the stratigraphic column would also be helpful. LQD Guideline 8, Appendix 5 describes the information to be included for each well. (AB)***

    A new attachment has been added with the well completion logs for the permit area monitoring wells. The existing Attachment D6-3 (Groundwater Quality Laboratory Results) has been renumbered to Attachment D6-4, and the title page and CD changed. Attachment D6-3 is now titled Well Completion Logs. A list of the wells for which logs are included in the attachment is at the beginning of the attachment.

    Cross references to the new attachment have been added at the end of Section D6.2.2 and in Attachment D6-2a (Comment #44). Because of the size of the new Attachment D6-3 (Well Completion Logs), Volume 3 of the application has been separated into Volume 3a, which contains all of Appendix D6 through Attachment D6-2b, and Volume 3b, which contains Attachments D6-3 and D6-4.

15. ***Figure D6-10, Site Hydrostratigraphic Units. Please indicate the well ID for the geophysical log presented. Also please indicate the type and scale of the log on the figure. Also, the actual geophysical logs for all monitoring wells should be included as part of the permit application. (AB)***

    Figure D6-10 has been revised to include a more representative log, as well as the other information requested. Geophysical logs for all the monitoring wells are included on the Well Completion Forms in the new Attachment D6-3 (see Comment #14).

16. ***Figure D6-27a, Piper Diagram – Average Water Quality at Individual Monitoring Wells. The legend designates which well is represented by which symbol, and the wells are grouped by color, yet it does not indicate which horizon the wells are monitoring. Please add the horizon noted by each color. (The colors are not consistent with which formation they represent, i.e. other Figures use green to indicate the DE horizon wells, whereas the Piper diagrams use red). (AB)***

    The figure has been revised to clearly indicate which horizon each well is monitoring.

17. ***Figures D6-6 through D6-28b (maps), Figures in Attachment D6-2a and D6-2b. Petrotek maps. Please add a layer of topography to these maps. (AB)***

Surface topography has been added to the figures as requested.

18. ***Figures D6-11a through D6-11c. The potentiometric surface maps are limited in scope and only represent a small portion of the permit area. The potentiometric surface maps should be representative of the entire permit area. Also given the barrier nature of the fault, both sides of the fault need to be adequately characterized. Additional baseline groundwater monitoring wells with adequate distribution across the permit area will need to be installed for this purpose. (AB)***

Ten additional baseline groundwater monitoring wells were installed in the fall of 2008. The new wells are identified by the prefix MB in the well name. The locations of the new wells are shown on revised Figures D6-9 and D6-24, and Table D6-5 has been revised to include the new well completion information. The wells were drilled as clusters so each of the horizons of interest (DE, LFG, HJ and UKM) is monitored across the permit area and on both sides of the Lost Creek Fault. Water levels measured in December 2008 from the new wells and the previously existing baseline wells were used to generate potentiometric surface maps of the DE, LFG, HJ and UKM horizons (Figures D6-11e through D6-11h). These maps are discussed in Section D6.5.2.2. The original potentiometric surface maps (Figures D6-11a through D6-11c) are retained in the permit application to provide better resolution in the vicinity of proposed Mine Unit 1 and are discussed in Section D6.2.2.2

19. ***Figures D6-11a through D6-11c. No potentiometric surface map for the DE horizon has been provided. All potentially affected aquifers are to be characterized, and the potentiometric surface for the aquifers should be presented for the entire permit area, both north and south of the fault. Additional monitoring wells will be necessary to obtain this information. (AB)***

Additional monitor wells were installed in the DE horizon in the fall of 2008. Water levels measured in December 2008 from those new wells and the previously existing DE wells (LC29M, LC30M and LC31M) were used to generate a potentiometric surface map of the DE horizon across the permit area. The potentiometric surface map of the DE Horizon is included as Figure D6-11e and is discussed in Section D6.5.2.2.

20. ***Section D6.2.2.1, Hydrostratigraphic Units, HJ Horizon. If the UKM sand ends up being mined, it is stated that the LHJ sand will be the overlying aquifer. Yet for the purposes of protecting the overlying and underlying aquifers, if the UKM becomes a mineable unit, after the HJ unit has been impacted, then the relative overlying***

aquifer to be protected would be the LFG, and the underlying aquifer would be the MKM. (AB)

Pursuant to discussions at the September 22, 2008 meeting with WDEQ-LQD in Lander, since the MKM is neither being mined at this time nor serving as an underlying aquifer, additional characterization is not required. LC ISR LLC agrees to fully characterize the MKM and provide the information to LQD if an amendment to the Permit is sought to allow mining of the UKM.

21. ***Section D6.2.2.2. Section D6.2.2.2, page D6-14, paragraph 2 references Figure D6-11d, as indicating the differences in water levels across the fault based on 1982 and 2006 data. It goes on to state that the data is insufficient. It is not clear what is gained by this figure since Figure D6-11a clearly shows the difference in water level within the HJ Horizon and across the fault zone. (AB)***

This figure demonstrates that the water level difference within the HJ has persisted for over 25 years. The data indicate that groundwater flow across the fault within the HJ horizon is, and has been, negligible under normal static conditions, otherwise the water levels on both sides of the fault would be at similar elevations. Also, the similarity in water levels from 1982 to 2006 between wells that are located on the same side of the fault (LC16M and 20-1M on the south side of the fault and wells LC19M and 18-1M on the north side of the fault) shows that there has been little change in the hydrogeologic system during that period, indicating that it is unlikely that there has been significant hydraulic communication or leakage between horizons. These data suggest that historic boreholes in this area do not appear to be providing a significant pathway for groundwater to move between horizons, at least under static, non pumping conditions.

22. ***Section D6.2.2.2, Potentiometric Surface, Groundwater Flow Direction and Hydraulic Gradient, page D6-14. Although hydraulic gradient is the change in head over distance between two wells, for the sake of the permit application, the hydraulic gradient across the potentiometric surface needs to be determined. As stated in comments 18 and 19, the potentiometric surface of each aquifer needs to be established, on both sides of the fault, and then the hydraulic gradient of this surface calculated with a minimum of three wells. The potentiometric surface should be representative of the permit area, and not just the area in the center of the permit area, adjacent to the fault zone. It seems possible that the gradient may be more generally to the south, yet when the fault zone is encountered, it changes to parallel this hydrologic barrier. Additional groundwater monitoring wells will need to be installed to obtain this information. (AB)***

As described in the response to Comments 18 and 19, additional monitor wells were installed in the fall of 2008 that provide more complete coverage across the permit area. Potentiometric surface maps were generated from water level data collected from the new and previously existing baseline monitor wells. Hydraulic and vertical hydraulic gradients have been calculated from the new data and are included in revised Tables D6-7 and D6-8, which have been renumbered Tables D6-7a and D6-7b. The additional well locations confirm that the predominant groundwater flow direction is to the southwest, generally parallel to the Lost Creek Fault system.

23. ***Section D6.2.2.3, Aquifer Properties, Page D6-16. The 1982 Pump tests were performed by Hydro-Search, the 2006 Pump tests were performed by Hydro-Engineering. Please reference who (Petrotek) conducted the 2007 Pump tests. (AB)***

The first sentence of the discussion of the 2007 Pump Tests has been modified to indicate that Petrotek conducted those tests.

24. ***There are 14 potentially active groundwater wells within 0.5 miles of the permit area, and many more historic groundwater wells within the permit boundary or 0.5 mile perimeter with abandoned or canceled permits. What is the status of the abandoned and cancelled wells? Is their proper abandonment documented? If not, are there well completion logs for these wells to indicate if they have a specific screened interval? The current status of these wells needs to be clearly defined to ensure that they are not a potential pathway between aquifers. Water Rights (AB)***

Please see the responses to Comments #13, #25, #30, and #33.

25. ***Section D6.3, Table D6-12a. There are numerous Kennecott, Tg and BLM/Tg groundwater permits within or adjacent to the permit area. The status is listed as adjudicated, abandoned, or cancelled. Further discussion regarding the status of these permits needs to be included in Section D6.3 and Table D6-12a. Were wells drilled under all of the permits listed? Are there abandonment records for any of the wells? Has any effort been made to locate these wells and verify their status? There needs to be assurances that these wells will not act as a potential conduit for the movement of production fluids between aquifers. (AB)***

In response to this comment, Tables D6-12a and D6-12b (and the associated Plates D6-1a and D6-1b) were modified for clarity, as outlined below. However, the responses to Comments #13 and #30 address the concerns about efforts to locate drill holes and wells and the potential for wells outside the Permit Area to act as conduits for movement of production fluid, respectively.

The formatting of Tables D6-12a and D6-12b was modified to distinguish between a well and a point of use, and Plates D6-1a and D6-1b were modified accordingly. All of the wells have at least one associated point of use. According to W.S. §41-3-930(a), "Any person who intends to acquire the right to beneficial use of any underground water in the state of Wyoming, shall," . . . "file with the state engineer an application for a permit to make the appropriation" . . . "The application shall contain" . . . "the location by legal subdivision of the proposed well or other means of obtaining the underground water" and "the location by legal subdivision of the area or point of use". Therefore, WSEO maintains records of permitted wells with associated point(s) of use. The tables present wells *and* the points of use associated with the wells, which may be difficult to observe with the previous formatting. During this modification, it was notable that certain points of use were within the area of interest but their associated wells were outside of that area. To accommodate any questions that may arise, these wells *not* within the area of interest were included in the table and highlighted to differentiate them from the wells within that area.

26. ***Section D6.3, Page D6-21. Will the public and private wells near the permit area be impacted by mining operations? Will they be within the zone of influence of the pumping operations? If they are within or near the zone of influence, and the completion details of the well are unknown, these wells should be replaced by the operator, prior to mining. Otherwise these wells could become a conduit for the movement of production water between aquifers. (AB)***

Please see response to Comment #30.

27. ***Table D6-14, Baseline Water Quality Monitoring Parameters. Please indicate on the table whether the analysis is for Total or Dissolved. For Iron, both total and dissolved analysis must be performed. (AB)***

Iron was analyzed for both total and dissolved fractions. Table D6-14 (Baseline Water Quality Monitoring Parameters) has been modified to indicate that the analyses for trace constituents were analyzed for dissolved concentrations, with the exception of iron and manganese which were analyzed for total and dissolved concentrations. Table D6-15 (which is now Table D6-15a, see Comment #37) has been updated to include both the total and dissolved concentrations.

28. ***In addition to Table D6-14, the permit application must provide the Groundwater Monitoring Program for the site. It should include a list of the monitoring wells, sampling frequency, sampling protocol, QA / QC procedures etc. As new monitoring wells are added in the future, the permit will be revised by a Non-Significant revision to the permit to add or drop monitoring wells. (AB)***

A copy of the Groundwater Monitoring Program is attached. Rather than incorporate this into the baseline portion of the permit application, LC ISR, LLC will incorporate it into the Operations Plan, which is currently being revised in response to LQD comments of January 2009.

29. ***Section D6.3 Groundwater Use. Paragraph 4 references the East Eagle Nest Draw Well, it should be made clear if this is the fourth BLM well. In addition, although not officially permitted, the fourth BLM well and/or Eagle Nest Draw well should be documented in Table D6-12a, and Plate D6-1a. (AB)***

The fourth paragraph in Section D6.3 has been modified to indicate that the East Eagle Nest Draw Well is the fourth BLM well.

30. ***Section D6.3, Page D6-21. The last paragraph states that throughout the phases of the project the operator will correspond with BLM to ensure the wells that provide stock water are not adversely impacted. Since it is not clear where any of these wells are screened [Well 4775 (at 280 ft. depth), and 4777 (at 200 ft. depth), 4451at 900 ft. depth, and the Eagles Nest Draw well (at 370 ft. depth)], it may be necessary to replace these water supplies prior to mining operations, to ensure that they are clearly isolated from any mining influence. (AB)***

This response addresses general concerns with respect to water levels and water quality and then addresses the BLM wells specifically.

The in situ mining of the HJ Horizon will impact the water levels and water quality of that horizon; however, the water level impacts will extend laterally much farther than the water quality impacts. With respect to water levels, if any of the public or private wells near the Permit Area are screened within the HJ Horizon, then they could be impacted by drawdown resulting from ISR operations, depending on their proximity to those operations, as discussed in Section 3.6.3.3 of the Operation Plan. In contrast, with respect to water quality, the impacts must be contained within the mine unit for efficient mining and as required by environmental regulation. The mining solutions used to recover uranium are maintained within the mine unit through the implementation of a hydrologic bleed. To ensure the hydrologic bleed is adequate, a comprehensive system of monitor wells is installed around each mine unit and in overlying and underlying zones. Identification of an excursion would result in corrective action to prevent further migration outside the mine unit.

There are no public or private wells, other than those installed by LC ISR, LLC within the Permit Area. The four BLM wells are the closest wells to the Permit Area. A geologic review of these wells indicates that two of the wells, the Battle Spring

Draw Well No. 4777 and the East Eagle's Nest Draw Well, are too shallow to be completed within the HJ Horizon. The other two wells, the Boundary Well No. 4775 and Battle Spring Draw No. 4451, are of sufficient depth that they could intersect the HJ Horizon. However, as a precaution, all of the BLM wells will be periodically monitored to determine if mining from the proposed ISR has impacted the wells.

The technically sound and legally mandated safeguards of installing a monitor ring for excursion detection and of excursion control are sufficient to ensure the wells noted by the reviewer are not impacted by mining lixiviant. Pursuant to the discussion during the September 22, 2008 meeting with WDEQ LQD in Lander, these wells will not need to be preemptively replaced.

31. ***Tables D6-12a and D6-12b, Groundwater Permits.*** ***These tables list Map ID and therefore need to cross reference Plates D6-1a, and D6-1b and vice or versa. (AB)***

Please see response to Comment #25.

32. ***Section D6.3 and Table D6-12a.*** ***An explanation should be provided when there are two or more line items for the same permit number. For example there are two listing for the BLM Battle Springs Draw Well No. 4451, yet the only distinction is that one listing is indicated as a headgate outlet well, and one listing is 'Information not provided by the WSEO database." Figure D6-19 appears to be a photo of the well, yet the table and Plate D6-1a, seem to indicate there are two wells. Please clarify how the wells are designated on the table and map. (AB)***

Please see response to Comment #25.

33. ***Section D6.4.2.1 Groundwater Monitoring Network and Parameters.*** ***Paragraph one references 12 wells within the permit area that were installed by Conoco prior to 1982. This is the first mention of these wells. What is the status of these wells? Why are they not included in Table D6-12a? Are there well completion logs available? If they were abandoned, are there any abandonment records? Have these wells been located to determine their status? Table D6-12a should be a comprehensive source of information of any well that is known to once exist within or near the permit area, regardless of whether there is a SEO permit on file. (AB)***

The twelve wells discussed in Section D6.4.2.1 and shown on Figure D6-23 were installed as part of a joint venture between Conoco and Texasgulf Inc. The wells, permit numbers P61528W thru P61539W, are shown in Table D6-12a as being drilled by Texasgulf Inc. Each of the twelve wells was abandoned as documented in a September 16, 1987 letter from Texasgulf Inc. to the State Engineer's office. According to the letter, each of the twelve wells was filled with concrete. The letter,

which constitutes all of the historic knowledge pertaining to these wells, is included in Attachment D5-3 of the application for your review.

The above information is also summarized in text added at the end of the first paragraph Section D6.4.2.1.

34. ***Table D6-13 Lost Creek Project Groundwater Permits.*** ***In addition to this table, a separate table should be presented which is the comprehensive groundwater monitoring network wells. If viable information is available from historic monitoring wells (e.g. the Conoco wells), i.e. the screened interval is known, then these wells can be presented as a subset of the table. If the water supply wells are going to be sampled they should also be included. (AB)***

Table D6-13, as originally submitted, included all of the LC ISR, LLC wells in the comprehensive groundwater network; however, the table has been re-arranged for clarity. All those permits for which wells have been drilled, including monitoring and supply wells, are included at the beginning of the table. Those permits for which wells have not yet been drilled are included at the end of the table. Future information about wells will be included in the mine unit applications.

As noted in the response to Comment #33, the information about the Conoco wells is included in Table D6-12a. The information about the LC ISR, LLC permit (Table D6-13) was purposely separated from the information about permits granted to other entities because LC ISR, LLC has control over the content and quality of the information and construction related to its permits, but does not have similar control over information or construction related to other permits.

35. ***Section D6.4.2 Site Groundwater Quality.*** ***The majority of the baseline groundwater monitoring wells are located within the footprint of the mineralized zone and the mine units. Additional baseline groundwater monitoring wells need to be established outside the mine unit, up gradient and downgradient of the mine units, and north and south of the fault(s). (AB)***

Additional baseline water quality monitor wells have been installed, as described in the responses to Comments #18, #19 and #22. The new wells will be sampled for the same constituents as the previously installed baseline monitor wells. At least four sampling events will be conducted at each well. Results of the sampling events will be provided when available.

As suggested, an additional 10 regional monitor wells were installed to collect data outside the mineralized zone; Wells MB-01 through MB-10. The installation of these wells brings the total number of regional wells to 27. The revised data included in this response includes the hydrologic information gained from the additional wells.

Pumps will be installed in the wells this spring so baseline water quality may also be determined over the course of a year. As discussed during the September 22, 2008 meeting with WDEQ-LQD in Lander, the results of sampling will be provided to LQD upon completion of the sampling program.

36. ***Section D6.4.2.2 Groundwater Quality Sampling Results. Page D6-26, paragraph 3 states that "there is no significant difference in major water chemistry between the production zone and overlying and underlying aquifers". The next paragraph explains some constituents that exceeded WQD Class I standards at individual wells. Please provide a separate section for each aquifer (similar to Section D6.2.2.1) which discusses their individual water quality, based on the baseline monitoring. (AB)***

A separate section discussing the water quality of the production zone and overlying and underlying aquifers has been prepared and is included in Section D6.4.2.2.

37. ***Table D6-15. Analytical Results of Baseline Monitoring. If an analyte has exceeded the WQD Class I standard please flag that value within the table, noting the designation with a footnote. (AB)***

Table D6-15 has been replaced with Tables D6-15a and D6-15b. Table D6-15a includes the analytical results, with flags to indicate which concentrations exceeded WQD and/or EPA criteria, and Table D6-15b lists the WQD and EPA criteria. The references in the text to Table D6-15 have also been updated to include both Table D6-15a and D6-15b.

38. ***Section D6.5.2 Site Groundwater Conceptual Model. LQD Non-Coal Rules, Chapter 11, Section 3(xiv) regulations require that the following parameters be described for each potentially affected aquifer: aquifer thickness, velocity and direction of groundwater movement, storage coefficients or specific yield, transmissivity or hydraulic conductivity, direction of preferred flow under hydraulic stress , extent of hydraulic connection between the receiving strata and overlying and underlying aquifers, and hydraulic characteristics of any influencing boundaries in or near the propose well field area. The attached table indicates information that has been presented in the application, and where there are gaps in the aquifer characteristics required. (AB)***

A table has been developed that incorporates much of the data required under LQD Non-Coal Rules, Chapter 11 Section 3(xiv). The table has been incorporated into the permit as Table D6-11 - Summary of Aquifer Characteristics. It is referenced at the end of the next to last paragraph in Section 6.2.2.3.

39. <u>Section D6.5.2.2 Potentiometric Surface and Hydraulic Gradients.</u> Paragraph one provides the hydraulic gradient for the HJ Horizon. As mentioned in previous comments, the Division is requesting that both sides of the fault be characterized separately. (AB)

Horizontal and vertical hydraulic gradients have been calculated for both sides of the fault and are included in revised Tables D6-7a and D6-8. The text in this section of the permit application has also been revised with the updated gradient information. Tables D6-7a and D6-7b were previously numbered Tables D6-7 and D6-8, but were renumbered to allow for addition of Table D6-11 (in response to Comment #38) without renumbering all the tables in the section. Tables D6-9, D6-10a and D6-10b, and D6-11a and D6-11b were also renumbered to D6-8, D6-9a and D6-9b, and D10a and D6-10b, respectively.

40. <u>Section D.5.2.2 Potentiometric Surface and Hydraulic Gradients.</u> Paragraph one states that from the pump tests the communication between the HJ aquifer and the overlying and underlying aquifers may be through historic boreholes that were improperly abandoned, leakage through the confining shale units, or contact of sands juxtaposed across the fault. All work done to relocate and either verify proper abandonment or re-abandon old drill holes, should be included within the permit application. Any additional work completed to better define the cause for the communication must be submitted as a revision to the permit document. (AB)

Section D5.2.2 discusses structure and not hydrologic connectivity. However, the concern is understood and addressed with the following response.

In response to this comment and Comment #13 (on Appendix D5), Table D5-2 was generated for inclusion in the application. The table summarizes the work performed by LC ISR LLC and previous operators to locate and re-abandon historic holes. Additional pumping tests, such as mine unit tests, will be performed in the future to further characterize ore zone confinement. Test results will be submitted to WDEQ-LQD for review.

The following sentence have been added at the end of the third paragraph of section D6.5.2.2 to provide a cross-reference to the discussion in Section D5.2.4.1 about abandoment work:

> More detail about abandonment work is provided in Section D5.4.2.1. In particular, Table D5-2 is a summary of efforts to relocate and re-abandon historic holes, and Attachment D5-3 includes historic memos regarding previous operators attempts to relocate and re-abandon holes.

41. ***Section D.5.2.3 Aquifer Properties.*** ***The second paragraph states that additional long term multi-well pump tests were to be performed in the fall of 2007. These tests would provide more data on overlying and underlying aquifer characteristics. If this information is now available, it should be submitted for review as part of the permit application. (AB)***

    The pump test in question was used to further characterize the UKM aquifer and therefore, pursuant to discussions at the September 22, 2008 meeting with WDEQ-LQD in Lander, is not required for permitting of the HJ aquifer.

42. ***Attachment D6-2a, Figures 6-2, 6-6,6-8, and 6-10.*** ***The y-axis titles are backwards, the Pumping Well (PW) elevation should be on the right handed axis. Please correct and replace the figures. (AB)***

    Figures 6-2, 6-6, 6-8, and 6-10 in Attachment D6-2a have been changed as requested.

43. ***Attachment D6-2a.*** ***Figure 7-1 is the Theis curve for the LC16M pumping well, yet this attachment is the evaluation of the LC19M pump test. (AB)***

    The figure was intended to be the Theis curve match for the response of Well HJT-104 during the LC19M pump test. The correct figure is included in this submittal.

44. ***Attachment D6-2a, Appendix A.*** ***As stated in Comment 14, please provide well completion details, boring logs, and any geophysical logs for all monitoring wells. If the informati)on is not inserted into Appendix A, its location should be referenced. (AB)***

    A cross reference to the new Attachment D6-3 (Well Completion Forms) has been added to Page 6 of Attachment D6-2a.

Water Well Sampling Procedure

Contents

I. Purpose

This procedure outlines the approved groundwater sampling protocol for the Lost Creek Project. All individuals involved with the groundwater sampling program; including affected policy makers and supervisors, water samplers, and on-site laboratory personnel, will be familiar with this procedure. When adhered to, this procedure will result in the timely collection, analysis, documentation, and reporting of required groundwater samples.

II. Applicable Regulations and Guidance

The following regulations, guidelines and technical papers were consulted during the writing of this procedure. Any changes made to this document must be consistent with at least the relevant regulations.

A. Wyoming Department of Environmental Quality

- Wyoming Statutes §35-11-428 thru 430
- Land Quality Division Rules and Regulations Chapter 11 "Non-coal In Situ Mining"
- Land Quality Division Guideline No. 4 "In-Situ Mining"
- Land Quality Division Guideline No. 8 "Hydrology Coal and Non-Coal"

B. Nuclear Regulatory Commission

- 10 CFR 40.65
- 10 CFR 40 Appendix A Criterion 5(B)5
- Regulatory Guide 3.46
- Regulatory Guide 4.14
- NUREG 1569 "Standard Review Plan for In Situ Uranium Extraction License Applications"

C. Other

- ASTM Designation D6051-96 (Reapproved 2006) "Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities.

III. Well Types

A. Storage Pond Wells

A series of monitor wells will be installed around the storage ponds to detect the presence of leakage. The wells are completed just above the uppermost aquitard where the water will tend to accumulate. These wells will generally be dry unless they are affected by significant precipitation events or by leakage from one of the ponds.

B. Regional Wells

A total of 27 regional monitor wells were installed to collect pre-operational water quality and hydrologic data. Generally, it is not necessary to collect water quality data from these wells during operations unless there is a reason to believe they have been impacted by operations. Quarterly water level readings will be taken during the life of the mine to document the impact of operations on water levels. Well numbers are:

LC29M, LC30M, LC31M, LC15M, LC18M, LC21M, LC25M, LC16M, LC19M, LC22M, LC26M, LC27M, LC28M, LC17M, LC20M, LC23M, LC24M, and MB-01 through MB-10.

C. Wellfield Monitor Wells

i. Pre-Operational

As a part of the baseline assessment, all the mine unit monitor wells will be sampled at least four times at intervals at least 14 days apart. Water levels will be measured at the same frequency as the monitor well sampling. The Pre-Operational Baseline Table in Section V.A. outlines the constituent list for each type of monitor well.

ii. Operational

Excursion detection will consist of sampling the perimeter, overlying and underlying monitor wells at least twice per month, and no less than ten days apart, and analyzing the samples for the upper concentration limit (UCL) parameters. The monitor wells will be sampled as per the schedule outlined in the Operational Table in Section V.B. except in the event of inclement weather, mechanical failure, holiday scheduling, or other factors that may result in placing an employee at risk or potentially damaging the surrounding environment. In these situations, the EHSO/RSO, or his designee, will document the cause and the duration of any delays. In no event shall a delay be greater than five days.

Water levels will be measured at the same frequency as the monitor well sampling. Sudden changes in water levels may indicate that the mine unit flow is out of balance.

During routine sampling, if two of the three UCL values are exceeded in a monitor well, or if one UCL value is exceeded by 20 percent, the well will be re-sampled within 24 hours of receipt of the results from the routine sampling and analyzed for the excursion indicators. If the second sample does not exceed the UCLs, a third sample will be taken within 24 hours of receipt of the second sample results. If neither the second or third sample results exceed the UCLs, the first sample will be considered in error. If the second or third sample verifies an exceedance, the well in question is placed on excursion status.

In the event of an excursion, the sampling frequency of the monitor well on excursion status will be increased to weekly. If an excursion is not corrected within 30 days, a sample will be collected and analyzed for parameters listed in WDEQ-LQD Guideline 8 Appendix I Sections IV and VA(1) and the applicable

EPA MCLs. Once parameters no longer exceed the UCLs, a final sampling and analysis of the WDEQ-LQD Guideline 8 parameters will be performed. An excursion is when the UCLs of two parameters are exceeded for an individual well or when a single parameter exceeds the UCL by more than 20%. An excursion is corrected when two consecutive weekly sample rounds confirm the definition of an excursion is no longer met.

iii. Restoration & Stabilization

During restoration the perimeter and underlying and overlying monitor wells will typically be sampled on a monthly basis for UCL parameters. Wells which have experienced an excursion within the past year will be sampled semi-monthly. The production monitor wells will be sampled, at a minimum, at the beginning of restoration and the end. The final restoration sample may also serve as the initial stabilization sample.

Upon completion of restoration and notification of WDEQ-LQD, a groundwater stabilization monitoring program will begin in which the production monitor wells used to evaluate restoration success will be sampled. Each production monitor well will be sampled at the beginning of stabilization and once per quarter for a period of 12 months and analyzed for Guideline 8 parameters. This will yield a total of 5 sample rounds. For the initial stabilization sampling round, each monitor well within the wellfield will be analyzed individually for the Guideline 8 parameters. Since the success of stabilization is based on the average groundwater chemistry, LC ISR, LLC may elect to physically average the quarterly groundwater samples by compositing before analysis versus mathematically averaging the assay results of each individual well. A split from each individual well will be maintained for future analysis if a specific parameter(s) is problematic. All composite sampling will be performed in accordance with ASTM Standard D 6051-96 (Reapproved 2006) which details proper methodologies for composite sampling. If any parameter is below detection limits during the initial stabilization sampling round, no additional analysis will be required during quarterly sampling. The monitor ring, overlying, and underlying monitor wells will be sampled for the UCL parameters monthly throughout stability.

D. Public Wells

Before beginning operations, public wells (wells that may be used for irrigation, watering livestock, or human consumption and are within 2 kilometers (1.24 miles)) will be sampled quarterly for at least one year if the owner consents and the pumping system is in working order. During operations and until groundwater restoration and stabilization are complete; all public wells within two kilometers of active wellfields will be sampled on a quarterly basis if the owner consents and the pumping system is in working order. At a minimum, the samples will be analyzed for natural uranium and radium-226.

Results of the analysis will be included in the NRC semi-annual report and the WDEQ Annual Report. If analysis show that the water quality has deteriorated, an investigation will be initiated by EHS Department to determine the cause and any necessary corrective action. The only well within 2 kilometers of the first mine unit is the Battle Spring Draw Well No. 4451 NE, NW of S21, T25N, R92W.

IV. Sampling Schedule

A. Pre-operational Baseline

Monitor Well Type	Frequency	Analytes[1]	Comments
Storage Pond	Quarterly for one year unless dry	If retrievable water is present analyze for pH, U_{nat}, chloride, bicarbonate, sulfate, and conductivity	
Regional	Quarterly for one year	Guideline 8[2]	
Wellfield	Production Zone 4 total samples at least 14 days apart each	2 rounds of Guideline 8 and 2 rounds of short list[3]	
	Perimeter, Overlying, Underlying 4 total samples at least 14 days apart each	1 round of Guideline 8 and 3 rounds of UCL s	
Public	Quarterly for one year	Ra-226 and U_{nat}	

1 – The listed analytes are in addition to the field parameters pH and temperature which should be collected for all well samples.
2 – Guideline 8 refers to those parameters listed in the WDEQ-LQD Guideline 8, Appendix 1, Section IV and V(A)(1).
3 - Short list consists of those parameters that were detectable during the first and/or second rounds

B. Operational

Monitor Well Type	Frequency	Analytes[1]	Comments
Storage Pond	Monthly	If retrievable water is present analyze for pH, U_{nat}, chloride, bicarbonate, sulfate, and conductivity	Notify EHS/RSO if water level increases or water quality is similar to pond water quality
Regional	Quarterly	Water levels only	Notify EHS/RSO if water level increases or decreases significantly
Wellfield	Production Zone None	None	
	Perimeter, Overlying, Underlying Semi-monthly at least ten days apart[2]	Chloride, bicarbonate, conductivity	Notify EHS/RSO if water level changes significantly or if UCLs are approached or exceeded
Public	Quarterly	Ra-226 and U_{nat}	Notify EHS/RSO if water level changes significantly or if UCLs are approached or exceeded

1 – The listed analytes are in addition to the field parameters pH and temperature which should be collected for all well samples.
2 – In the event of an excursion, affected monitor wells will be sampled weekly for the UCL parameters. If the excursion is not corrected within 30 days a Guideline 8 analysis will also be performed.

C. Restoration & Stabilization

Monitor Well Type	Frequency	Analytes[1]	Comments
Storage Pond	Monthly	If retrievable water is present analyze for pH, U_{nat}, chloride, bicarbonate, and conductivity	Notify Supervisor EHS/RSO if water level increases or water quality is similar to pond water quality
Regional	Quarterly	Water levels only	Notify Supervisor EHS/RSO if water level increases or decreases significantly
Wellfield	Production Zone During restoration a minimum of 1 round at the beginning of restoration and 1 round before beginning stabilization. During stabilization 1 round at the beginning and once each quarter for a year	Guideline 8	Notify Supervisor EHS/RSO if water level changes significantly or if analysis indicates an upward trend
	Perimeter, Overlying, Underlying Semi-monthly at least ten days apart during restoration and monthly during stabilization	Chloride, bicarbonate, conductivity	Notify Supervisor EHS/RSO if water level changes significantly or if analysis indicates an upward trend
Public	Quarterly	Ra-226 and U_{nat}	

1 – The listed analytes are in addition to the field parameters pH and temperature which should be collected for all well samples.

V. Field Sampling Procedure

A. Water Level Measurement

A water level reading should be taken and documented on the well sampling form before sampling any well with an accessible wellhead. Some private or BLM wells may not have the necessary ports at the wellhead to allow a measurement to be taken. In such cases it is not necessary to take a water level reading. Water levels readings must be accurate to within 0.1 feet. Acceptable tools for taking water level readings are an electronic line (e-line) or a sounder. When possible the reading should be taken down the stand pipe to avoid entanglement with the power cable. On the rare occasion that the check valve has not been removed from the pump, the reading will have to be taken in the annulus between the stand pipe and the casing.

The presence of a check valve prevents the water in the stand pipe from equalizing with the natural pieziometric head.

An e-line used in a contaminated production or injection well may not be used in any non-contaminated well until it has been cleaned and a successful release survey has been performed and documented by the EHS Department.

B. Wellhead Setup

LC ISR, LLC wellheads will be constructed in such a manner that a meter run can be attached to the outlet of the standpipe. The meter run will have a built in flow meter and a port for collecting a water sample. The discharge pipe coming off of the meter run will be designed to spread the water out to prevent soil erosion. Data from the flow meter will be entered on the Well Sampling form as appropriate.

Public wells may not have a wellhead that allows the use of a meter run. In such cases, the sampler will estimate the flow rate so the Well Sampling Form can be completed.

C. Well Purge

The water within the wellbore may become stagnant over time causing the water chemistry to differ from that in the formation. Therefore, it is important to purge the wellbore so formation water can be sampled. A purge volume, also known as a casing volume, is equal to the volume of water within the well bore including the screened interval. A purge volume can be significantly reduced by installing a packer to isolate the water column above the pump. When a packer is used the purge volume will be equal to the volume of water below the packer; including the volume of water within the screened interval.

There are two acceptable methods for ensuring a successful well purge.

i. Two Casing Volume Method

A minimum of two submerged casing volumes must be pumped out before the final sample is collected. No stabilization samples are collected but the field parameters pH in standard units, temperature in degrees Celsius, and conductivity in µmos/cm must be measured and recorded on the well sampling form immediately before collecting the final sample. This method should not be used for new wells that may not be completely developed or for wells that have not been recently pumped. For wells that are routinely sampled, such as wells on a semi-monthly sampling schedule, this is an acceptable method.

ii. Stabilization Method

This method requires at least three purge samples to be collected to confirm the water quality is stable and is therefore representative of the formation. These samples are commonly referred to as stabilization samples. Each of the stabilization samples must be collected at least 0.5 casing volumes apart. The field parameters of pH in standard units, temperature in degrees Celsius, and

conductivity in µmos/cm will be taken and recorded on the well sampling form for each stabilization sample. When three consecutive stabilization samples show less than 10% variation between any of the readings for each field parameter, the final water sample may be collected.

If a well pumps dry during purging then it is clear that all potentially stagnant water has been removed from the wellbore. Simply turn off the pump so the well can recharge then turn the pump on again and make the necessary field measurements and collect the final sample with no additional purge.

D. Field Analysis and Documentation

Field measurements must be taken using an instrument calibrated pursuant to the manufacturer's recommendations and the QA/QC program. The EHS/RSO, or his designee, shall ensure that only instruments capable of meeting the QA/QC guidelines are purchased for use. The well sampler must be familiar with the instruments capabilities and limitations.

Readings will be documented on the Well Sampling Form which is to be generated and maintained by the EHS Department. All Well Sampling Forms will be maintained for the life of the project.

E. Sample Collection and Preservation

Samples will be collected in a clean plastic or glass container. To ensure the container is clean, the sampler must rinse the container with the sample fluid before collecting the final sample. The cap should be placed on the container immediately after sample collection to prevent contamination by foreign matter. Containers may be used multiple times as long as they are cleaned between uses.

Due to the large number of possible preservation requirements, this SOP will only address basic preservation issues. The Supervisor EHS/RSO or site Chemist will provide additional guidance to the sampling crew as needed.
Samples must be kept cool (around 4° C) and in the dark until analysis. Water samples should not be allowed to freeze since this will cause dissolved material to precipitate. The sample should be analyzed as soon as possible. When a sample cannot be analyzed within one day, it may be necessary to acidify the sample to ensure preservation. Consult with the site Chemist or Supervisor EHS/RSO for the proper acidification procedures

VI. QA/QC

The well sampling program will adhere to the following QA/QC requirements to ensure the veracity of resulting data:

- The instrument for analyzing field parameters shall be able to report pH to within 0.2 standard units; temperature to within 0.2° C; and conductivity to within 20 µmhos/cm corrected to 25° C. The instrument will be calibrated in accordance with the

manufacturer's specifications with the results documented. The calibration documentation will be maintained for the life of the project.

- A duplicate sample will be collected at least every 20 samples or once every sample round, whichever is less.
- A blank sample consisting of distilled water will be collected at least every 20 samples or once every sample round, whichever is less, for semi-monthly wellfield samples.
- When major ions are analyzed the results will be compared against the TDS (determined at 180° C) to ensure all major ions were analyzed for and the results are otherwise reasonable.
- Samples will be analyzed using EPA approved methods.
- The Supervisor EHS/RSO, or his trained designee, will review the results of all well sampling to ensure the results are reasonable and that there are no issues of environmental concern. Part of the review will include comparing the results with previous analysis to ensure there are no trends of concern.

VII. Compositing

The primary goal of groundwater restoration is to return the water quality within a mine unit to its baseline class of use. The class of use is determined by considering the average baseline water quality from the production zone monitor wells. The class of use designation is granted to the entire production area and not for each individual production zone monitor well (even though the water quality may vary significantly from well to well). It is possible to determine the average value for each constituent by mathematically averaging individual results from each production zone monitor well or by analyzing a physical composite of the production zone monitor wells. It is generally accepted that the most accurate method is to physically composite the individual samples before analysis. The Supervisor EHS/RSO will determine before a sampling program (baseline, restoration or stabilization) whether to average using the mathematical method or by physical compositing. If physical compositing is used it will be performed pursuant to ASTM Designation D6051-96 (Reapproved 2006) "Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities. Also, if the physical compositing technique is used, a sample from each well will be maintained in case additional information is needed for a specific parameter from a specific well(s). The sample will be maintained for six months at which time even a preserved sample's quality is questionable.

VIII. Employee Training

All individuals supervising or performing well sampling and those working in the on-site laboratory must be familiar with the contents of this procedure. Training shall be performed by an experienced technician or supervisor. A simple letter to file is sufficient documentation that training has been completed. Retraining shall occur every two years for employees routinely engaged in well sampling Retraining shall occur for individuals who have not performed sampling within the past year.

IX. Occupational and Environmental Safety

Well sampling is generally a very safe activity. However, samplers need to be aware of the following hazards so they can work safely.

- Before starting the pump power supply, inspect the electrical outlet and power cable to ensure they are in good repair. If the insulation or wiring appears to be damaged, perform the appropriate Lock Out/Tag Out procedure and notify your supervisor. Never drive over electrical cords;
- The field instrument calibration fluids may present hazards. Read and comply with the requirements in the MSDS for each chemical. The same is true for sample preservation chemicals;
- Always wear a hard hat, steel toe boots and safety glasses or goggles when sampling;
- If a well will not produce water, turn off the power supply and notify your supervisor. Any blockage in the discharge line, such as ice, will cause the stand pipe to rupture or the pump to overheat;
- Keep wellheads and standpipes covered to prevent entry by animals or debris;
- When purging a well ensure the energy of the water is dispersed to prevent soil erosion.