

**DEPARTMENT OF ENVIRONMENTAL QUALITY  
LAND QUALITY DIVISION**



**GUIDELINE NO. 4**

**IN SITU MINING**

**NONCOAL**

**(Revision Date: October 28, 2013)**

**GUIDELINE No. 4  
IN SITU MINING – NONCOAL**

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## **I. Introduction**

This document is a guideline only. Its contents are not to be interpreted by applicants, operators, or Wyoming Department of Environmental Quality (DEQ) Land Quality Division (LQD) staff as mandatory. The exception is where clear statutory or regulatory requirements are included. These requirements are designated by the use of words such as ‘must’, ‘shall’ and ‘required’. Its preparation is the result of numerous requests from applicants and operators for guidance in preparation of a comprehensive application or amendment. If an operator wishes to pursue other alternatives, they are encouraged to discuss these alternatives with the LQD staff.

This guideline is intended to be comprehensive and all headings may not apply to all operators. While it is intended to cover all noncoal in situ operations, the focus is on in situ uranium. Applicants for other noncoal minerals should review the Guideline and then discuss modifications or additional guidance with the LQD sections. Applicants for Research and Development Licenses should follow this Guideline unless different or additional information is requested or required by LQD. A table of contents is provided to direct the applicant to the appropriate topic for individual permitting needs. Several Reference Documents are also attached to this Guideline which provide additional information on their respective topics.

### **A. Definitions for Purpose of the Guideline**

Attachment I of Reference Document 1, General Information, is a list of definitions that apply to in situ mining. It includes definitions from the Wyoming Environmental Quality Act (ACT), LQD Rules and Regulations (R&R), and some were developed to explain terms used in this guideline. If the definition is from the Act or LQD R&R, a citation is given. Any text after a citation was added to further explain how the term is used for in situ mining.

**Applicants are strongly urged to use the preapplication process as described in Guideline No. 24.** When used properly this process significantly reduces the time for permit review and lowers the level of frustration by all parties. Flowcharts of the agency’s review process for both permit applications and new wellfield package revisions are provided in Attachment II of Reference Document 1, General Information.

### **B. Supporting Documents**

Prior to resource inventory or development of an in situ application, the applicant should review the following documents which can be obtained from the Land Quality Division website.

1. Wyoming Environmental Quality Act (as amended).
2. Land Quality Division NonCoal Rules and Regulations specifically Chapters 2, 3, 7, and 11.

3. Water Quality Division Rules and Regulations, specifically Chapters 2, 3, and 8.
4. Land Quality Division Guidelines:
  - No. 1 Soil and Overburden
  - No. 2 Vegetation
  - No. 5 Wildlife
  - No. 6 Organization and topic outline for an Application for a Permit to Mine or an Amendment
  - No. 8 Hydrology
  - No. 10 Fencing
  - No. 11 Cultural Resources
  - No. 15 Alternate Sediment Control
  - No. 24 Preapplication Process for Permit Applications

**C. Application Format and Organization**

Attachment III of Reference Document 1, General Information, provides details regarding the number of copies, format, and a checklist of the permit application. The attachment contains a list of the major sections and subsections of the application such that it can be used as a checklist by the applicant.

**D. Noncoal Statute and Rule and Regulation Citations**

Attachment VII of Reference Document 1, General Information, provides a reference to the various statutes and LQD Rules and Regulations for major sections of the permit application.

**II. Permit Introduction**

**A. Permit Introduction**

The applicant should provide a brief description of the proposed operation at the beginning of the application. This description should include the location, type of mining and processing that will occur, life of the operation, the size of the permit area, and the number of acres proposed to be affected.

**B. Confidential Information**

The applicant may request material that may be considered as trade secrets to be held confidential. The purpose of this section is to consolidate in the introduction all requests and justification for confidential information. The application should contain justification and demonstration to the Administrator that such information should be held confidential. The information will be held confidential until such

time a decision is rendered by the Director in consultation with the Administrator. The decision will be made before the end of the Technical Review process. If LQD concurs that the information meets the criteria for being a trade secret, the information will be placed in a locked/restricted access. (See W.S. §35-11-1101)

### **III. Part I, Adjudication File and Appendix C - Permit to Mine (In Situ) and Research & Development License (In Situ)**

The adjudication portion of the application is organized into a part that is submitted in loose form which will be filed into what LQD calls the File-1-Of and a second part that is submitted in 3-ring binders. Appendix C information is contained in both sections for ease of review. Reference Document 2, Adjudication, contains detailed instructions for organization and content of the adjudication file.

### **IV. Part II, Appendix D, Environmental Baseline Data**

As stated in the title of this section, Appendix D **ONLY** contains baseline information. While the applicant is required to discuss and/or interpret the baseline, the applicant is **NOT** to include operational discussion or commitments in the appendix. The baseline information remains the same for the life of the operation but operation methods may change.

#### **A. Appendix D-1, History and Land Use**

This appendix should briefly describe the history of the permit as it relates to the regional historic setting particularly the impacts and uses of the land. This appendix may utilize and/or refer to useful elements of the cultural resource inventory for the permit area. This appendix should list, describe and map the historical and present land uses within the permit area. Include any lands that have been listed as rare or uncommon by the Wyoming Environmental Quality Council (EQC) or other lands that have mining restrictions or are designated off limits to mining by any federal agency. Use only the acceptable land use categories listed below. These land uses are defined in Attachment I of Reference Document 1, General Information.

- Cropland
- Pastureland
- Grazingland
- Forestry
- Residential
- Industrial commercial

- Recreational
- Fish and Wildlife Habitat
- Developed Surface Water Resources

Some land uses overlap especially natural resource uses such as oil and gas and coal bed methane development. These overlapping uses should be identified.

**B. Appendix D-3, Cultural and Paleontological Resources**

1. A professionally conducted Level III pedestrian survey fulfilling the U.S. Secretary of Interior's Standards for Archaeology and Historic Preservation should be tabbed in this appendix but placed in a separate volume, so it can be filed separately under "restricted access".
2. The tabbed section of this appendix should briefly summarize the archaeological and paleontological resources of the permit and adjacent areas in a summary manner. The summary should not describe sites in detail or show their location.
3. For guidance in the preparation of Appendix D-3 please refer to LQD Guideline No. 11.

**C. Appendix D-4, Climatology**

This appendix shall include a description of climatic conditions of the site. The climatology report should be structured to include an introduction, methodology and equipment description, site analysis, representativeness of off-site stations, and recommended operational monitoring. Meteorological data should be presented in a graphic or tabular format as appropriate. Baseline data should include a minimum of 1 year of data collection, although it is recommended that additional available data be used to extend the monitoring period.

*Data from the nearest official weather reporting station(s) may be used. However, if operations are more than 50 miles from an official weather station that is permanently staffed, or orographic effects preclude acceptable extrapolation of data, an on-site meteorological station **may** be required.* The Nuclear Regulatory Commission (NRC) generally will require an on-site meteorology station. A map and table including the locations of meteorological stations used in relation to the project should be provided.

1. Precipitation: (This information may be necessary for evapotranspiration assessment.)
  - a. Average monthly and average total annual precipitation (in inches) for the proposed permit area.

- b. Precipitation depth (inches) for the 2-, 10-, 25-, 50-, and 100-year, and 1-, 6-, and 24-hour storm events.
  - c. Any storm event precipitation data collected at the mine site should be presented. The most useful data would include continuous precipitation for each storm event, presented in intervals of ten minutes or less.
2. Wind: Submit the average monthly and yearly wind direction and velocity recorded at the nearest official weather station or as measured on site. Wind rose diagrams and frequency distribution charts are appropriate.
  3. Temperature (recommended): Maximum, minimum, average monthly, and annual temperature for each representative meteorological station. Depending on model, temperature may be necessary for evapotranspiration assessment.
  4. Additional recommended parameters for monitoring and analysis include heating and cooling degree-days, relative humidity, dew point, and barometric pressure. Note: At a minimum, barometric pressure measurements should be collected during aquifer pumping.
  5. The applicant should note any additional meteorological measurement program requirements as set forth by the NRC.

**D. Appendix D-5, Hydrogeology**

For in situ mining, the geology and groundwater hydrology are critical elements of the application and are interconnected. For in situ uranium mining and other in situ operations that include mining in a saturated zone, the groundwater portion will be combined with D-5, Geology and D-6 will only consist of surface water hydrology. Reference Document 3, Hydrogeology, contains the detailed information requirements for this section. Reference Document 10, Premining Water Quality and Quantity Sampling, provides instruction on sampling and analysis.

**E. Appendix D-6, Surface Hydrology**

For describing the baseline conditions of surface water quantity and features, the level of detail may be less than those of a surface mine. However, spills and other unanticipated conditions have the potential to impact surface water; therefore, some level of detail is required. Reference Document 5, Surface Water, of this guideline contains the information for this section. If the proposed operation will significantly impact surface water features, the applicant should consult LQD Guideline 8 and contact LQD for additional guidance.

**F. Appendix D-7, Soils**

In situ mines generally have less surface disturbance than conventional surface mines. Accordingly, LQD requires an Order 3 soils survey for the permit area

with an order 1/2 soil survey and laboratory analysis for areas on affected lands. Additional detail on the baseline requirements for soils can be found in Reference Document 6, Topsoil and Subsoil Management and the Associated Erosion Control, and Temporary Seeding/Stabilization of Disturbed Areas, of this guideline.

## **G. Appendix D-8, Vegetation**

A survey of vegetative cover and species diversity on the proposed affected land determined by scientifically acceptable sampling procedures, as described in Guideline 2, Vegetation will be required. Production sampling will not be required.

### **1. General Inventory Procedures for Baseline Measurements**

a. **All Sampling Plans Should Be Approved by LQD Prior to Implementation.** Other methods and types of baseline vegetation inventories may be acceptable if they meet or exceed the objectives of this guideline.

#### **b. Baseline Vegetation Map/Mapping**

- i. Plant community mapping should extend ½ mile outside the permit area. All plant communities should be clearly delineated and labeled.
- ii. Delineate the extent and location of each Reference Area (REFA), if applicable.
- iii. Delineate the extent and location of areas dominated by noxious weed species. Note that noxious weed species differ from county to county.
- iv. Delineate the location of any threatened or endangered species observed.
- v. The map should show the outline of the permit boundary and the outline of all areas to be affected by the proposed operation.
- vi. Display the locations of all vegetation sample points.
- vii. Display the location and direction of all plant community photos.
- viii. If not otherwise provided in the application, include a summary of the total number of acres disturbed and a breakdown of the proposed disturbance by plant community.
- ix. All vegetation maps should include section lines, township-range information, North arrow, legend, map scale, and other important map related information. See Attachment IV of Reference

Document 1, General Information, of this guideline for map formatting and information that should be included.

- c. Threatened or Endangered Plant Species, Noxious Weeds  
A survey of the area to be affected (regardless of the size of disturbance) should be conducted to note the presence of any threatened or endangered plant species, and any noxious weeds. Photographs of T&E species should be submitted. The relative abundance of any of these species noted should be described and include an estimate of the extent of noxious weeds.
- d. Photographs  
Original (or digital color copies of) photographs of the plant communities to be disturbed as well as a view of the Extended Reference Area (EXREFA) should be included in the application. If REFAs were used, then photos of each REFA (by plant community) should be included in the application.

2. General Format for Appendix D-8

The following is a suggested outline for organization of Appendix D-8.

- a. Table of Contents  
A summary of the major entries, including lists of figures, tables, and maps.
- b. Introduction  
A description of the location and general features of the permit area and the personnel (or firm) conducting the baseline inventory.
- c. Methods  
A description of all procedures used in the baseline inventory, which includes:
  - i. Delineation and mapping of plant communities, REFAs or EXREFAs and other land units.
  - ii. Cover sampling of plant communities
    - A. Specific calendar dates of all sampling
    - B. Selection of sample points
    - C. Transect procedures
    - D. Sampling intensity and sample adequacy
  - iii. Selection and Sampling REFAs and/or EXREFAs
  - iv. Species List
  - v. Data for Cropland or Hayland

3. Threatened and Endangered Species

4. Results and Discussion

A presentation and interpretation of the vegetation data, to include:

- a. A description of plant communities or other land units.
- b. A description of each REFA or EXREFA and discussion of its representative nature.
- c. A tabular summary of the total acreage of each plant community and affected acreage of each plant community (see Table 1, Appendix V, Guideline 2).
- d. A summarized cover sampling data for each plant community(see Table 2, Appendix V, Guideline 2).
- e. A summarized cover sampling data for the REFAs (see Table 2, Appendix V, Guideline 2), if applicable.
- f. A comparison of cover sampling data between each plant community and its representative REFA (see Table 3, Appendix V, Guideline 2), if applicable.
- g. An evaluation of sample adequacy and confidence level achieved for each plant community and its representative REFA (see Table 4, Appendix V, Guideline 2).
- h. A species list, selenium indicators, species of special concern and noxious (designated) or declared weeds (see Appendices I, III and IV, Guideline 2).
- i. A species diversity table (see Table 4).

5. Literature Cited

6. Raw Data

**H. Appendix D-9, Wildlife**

1. As required in LQD NonCoal Rules and Regulations, Chapter 2, Section 1(f), the applicant shall consult with the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service prior to submission of a permit application to determine specific additional permitting requirements. Copies of all correspondence to and from the agencies should be included.
2. A species of particular importance is Sage Grouse. Information concerning this species must be addressed pursuant to the requirements of the Governor's Executive Order No. 2011-5 dated June 2, 2011.
3. The applicant should consult LQD Guideline No. 5, Wildlife.

**I. Appendix D-10, Wetlands Habitat**

1. Appendix D-10 must contain copies of the wetland delineation, descriptions of proposed disturbances, and mitigation information.
2. The U.S. Army Corps of Engineers (USACE) must be contacted for specific instructions on what the Corps requires for wetland delineation and mitigation for the mining project.
3. While USACE acceptance/approval is not required before LQD permit approval, USACE will not allow disturbance to begin until they have done so. All documentation of USACE approval or mitigation requirements must be submitted to LQD for inclusion into the permit and determination if a permit revision is required. Generally, LQD will place a condition on the permit for the operator to supply this information.

**J. Appendix D-11, Background Radiological Surveys**

1. This appendix must include a description of the natural gamma of all lands within the impacted area as required by W.S. § 35-11-428(a)(i).
2. Not all of the data from the required NRC survey is necessary to be part of the LQD permit application. The applicant may provide a summary of the results and reference the NRC report.

**K. Appendix D-12, Draft Statement of Basis**

The Statement of Basis is a synopsis of the reclassification/exemption request, and will be derived from information submitted as part of the application. See Reference Document 7, Attachment 1 for an example.

**V. Part III, Aquifer Reclassification/Exemption**

- A. Describe the aquifers to be classified or exempted. Information from other sections of the application may be referenced and only summarized in this section. However, an attachment to the permit must contain all the required information to justify a reclassification and aquifer exemption. The attachment will be provided to the WQD and US EPA for their review and action. See Reference Document 7, Aquifer Reclassification Exemption, for additional detail.

**VI. Part IV, Mine (Operations) Plan**

**A. Introduction**

1. W.S. § 35-11-429 lists specific content requirements of every in situ permit. This includes the following:

*“Prohibit any significant change in mining technique, method of operation, recovery fluid used, mining and reclamation plans or other activities that would jeopardize reclamation or protection of any waters of the state unless a permit revision has been approved by the director.”*

This statement is required in the discussion of mining methods.

2. It is recognized that in situ operations, especially for uranium, require an extensive drilling program to accurately delineate the ore zone, gather specific wellfield hydrology, and determine the placement of wells. Except for perhaps the first wellfield, this data is collected as the operation advances and is submitted to the LQD after the permit is approved. This information is called a “Wellfield Package.” Information for the first wellfield may be submitted as part of the initial permit application. Subsequent or new wellfields cannot be operated until the associated Wellfield Package is approved. The requirements of the Wellfield Package are given in Section VI and Reference Document 9, Wellfield Package, of this guideline. Each permit application must include a list of the items that will be submitted in a Wellfield Package. The review process for a wellfield package not contained in the permit is found in Attachment II of Reference Document 1, General Information.

## **B. Site Description and Facilities Layout and Maps**

### **1. Description of Facilities**

Provide a contour (topographic) map(s) locating the proposed facilities within the permit area, including plant buildings, satellite buildings, header houses, impoundments, roads and public highways, utilities and easements, temporary and permanent drainage diversions, stockpiles for topsoil, product and waste, chemical storage areas, pipelines related to the mining operations, disposal wells, and wellfields. Attachment IV of Reference Document 1, General Information contains information concerning map requirements.

- a. Central Processing and Satellite Plants
- b. Other buildings; information regarding buildings should include a general description of the type and size of buildings to be constructed
- c. Fencing and access control
- d. Chemical Storage Facilities

Provide a discussion of the chemicals to be located or stored on site. Include both those used for the mining process and the nonprocess-related chemicals. Include a description of the safety precautions to prevent the chemicals from entering the environment.

## 2. Roads

Provide a discussion and description of all access roads leading to the proposed permit area and roads providing access within the permit area to plants, wellfield buildings, miscellaneous facilities and monitor wells. Include all roads listed in LQD Rules & Regulations Chapter 1, Section (ax). Specify the preexisting roads that require no upgrading, the preexisting roads that will be upgraded, and the roads that will be constructed.

- a. The location and classification of all roads must be provided on a map.
- b. The location and size of all culverts should be shown on a map.
- c. The design and construction of any stream crossings should be discussed in this section. Basic hydrologic information demonstrating that crossing designs and culvert sizing are appropriate may be required, but the minimum size is 18 inches.

## 3. Proposed Wellfields

Discuss and show on a map the proposed wellfields for the permit area. This should include the projected monitor well ring as required by Chapter 11.

## 4. Utility Corridors

- a. Discuss and show on a map the location of all existing utility corridors. Also show all proposed utility corridors serving the facilities area and the mine wellfields.
- b. All new power lines built within the permit area owned by the applicant must be constructed to protect and deter raptor perching. Power lines should be built, at a minimum, to standards identified in the *Suggested Practices for Raptor Protection on Power Lines—The State of the Art in 2006* (Avian Power Line Interaction Committee 2006) to minimize electrocution potential.

## 5. Proposed Pipeline Locations

Discuss and show on a map the location of all proposed pipelines that will serve the facilities area and the mine wellfields. The applicant should minimize the footprint of pipelines and locate them such that disturbed areas are consolidated. However, it is not recommended that high pressure pipelines such as those serving deep disposal wells be co-located with wellfield pipelines.

## 6. Deep Disposal Wells

The number and location of deep disposal wells must be discussed and shown on a map. This discussion includes the following:

- a. Proposed Deep disposal well construction details, including:

- i. Compliance with Wyoming Department of Environmental Quality/Water Quality Division (WDEQ/WQD) Class I disposal well standards;
- ii. General discussion of depth
- iii. All surface related disturbances including the location of all pipelines servicing the well;

#### 7. Drainage Plan

Show on a map(s) the drainage of the site and describe what steps will be taken to prevent erosion of disturbed areas.

### **C. Topsoil and Subsoil Salvage and Protection**

#### 1. Soil

- a. Topsoil - means the A and E Horizons or any combination thereof (Non Coal Rules and Regulations (R&R), Chapter 1, Section. 2(bm)).
  - b. Subsoil - means the B and C Horizons excluding consolidated bedrock material (R&R, Chapter 1, Section 2(bi)).
  - c. Suitable Topsoil and Subsoil - means topsoil and subsoil that meets or exceeds the criteria established in the WDEQ/LQD Guideline No. 1, "Topsoil and Overburden", or those criteria otherwise authorized by the LQD Administrator.
  - d. Long-Term Topsoil/Subsoil Stockpile - means a stockpile that exists for a period greater than six months. These stockpiles are associated with more extensive and permanent facilities, such as plant areas, satellite facilities, office areas and primary access roads. These stockpiles might not be used for reclamation of these areas for 10 years or more after stockpile construction. Long-term stockpiles require a topsoil sign with letters at least 6 inches high placed either on the pile or in close proximity of its base. The stockpile must be seeded with a temporary seed mix as soon as the pile is completed or when topsoil salvage operations are completed for the season.
  - e. Short-Term Topsoil/Subsoil Stockpile - means a stockpile that exists for a period less than six months. These small stockpiles are associated with drilling mud pits, pipeline or utility line construction, and similar activities where topsoil/subsoil will be quickly reapplied. Short-term stockpiles do not require temporary seeding/revegetation or topsoil signs but they should be flagged or have other temporary means of alerting equipment operators not to drive on or otherwise contaminate the piles.
2. The Administrator may authorize topsoil to remain on areas where minor disturbance will occur associated with construction and installation activities

including but not limited to light-use roads, signs, wellfields, utility lines, fences, monitoring stations, and drilling provided that the minor disturbance will not destroy the protective vegetative cover, increase erosion, nor adversely affect the soil resource. In situ mining operations have the potential to negatively impact the native vegetation and the topsoil resource.

3. In addition to the normal discussion regarding topsoil such as salvage depths and the volume to be salvaged and stockpiled, the applicant is requested to develop Best Management Practices for topsoil salvage and protection including the temporary seeding/stabilization of disturbed areas. Reference Document 6, Topsoil and Subsoil Management and the Associated Erosion Control, and Temporary Seeding/Stabilization of Disturbed Areas, has additional detail concerning topsoil protection.
4. The applicant must indicate on an appropriate mine operations map the areas which will have the topsoil and/or subsoil salvaged and placed in a long term topsoil stockpile and those areas where mine operations will take place but the topsoil will not be salvaged. This information for specific wellfields could be included in the wellfield package. (see 6 below)
5. The purpose of erosion/ control is to protect native vegetation and topsoil from contamination and prevent receiving waters from being impacted. The application should include a brief discussion of the sedimentation control measures and include a reference to the WQD Storm Water Permit. IAW WQD a copy of the plan will be maintained on site. (see Reference Document 6, Topsoil and Subsoil Management and the Associated Erosion Control, and Temporary Seeding/Stabilization of Disturbed Areas).
6. Describe the procedure(s) used to protect the topsoil and subsoil, as required in Chapter 3,Section 2(c)(i) through (iii), from excessive compaction, degradation, and wind and water erosion where stockpiling of topsoil and subsoil is necessary.
7. Include a map showing areas where topsoil and subsoil salvage will occur, including construction of wells and pipelines, (salvage information for individual wellfields may be submitted with the respective wellfield package) and include a discussion of the:
  - a. estimated topsoil and subsoil salvage depth for each area;
  - b. estimated volume to be salvaged from each area;
  - c. estimated amount to be placed in each stockpile; and
  - d. identify the stockpile location(s).
8. Describe the methods used to stabilize disturbed areas that will not be immediately reclaimed. LQD strongly recommends seeding these areas during the next possible seeding window. Include the following:

- a. A description of the areas
- b. A temporary seed mix
  - i. Species to be planted
  - ii. Pounds of pure live seed for each species and total for the mix
- c. Seed bed preparation
- d. Planting methods and equipment to be used.
- e. Whether mulch will be used

**D. Description of Mining**

1. Description of Production Zone(s)

Provide a description of the location within the permit area and show on a map where underground injection is to be authorized.

2. Recovery fluid(s) or lixiviant

Describe the lixiviant proposed to be used including its chemical makeup and concentration.

3. Description of mining processes.

- a. Provide a description of chemical reactions that may occur during mining as a result of recovery fluid injection. If the process is to be held confidential as a trade secret, provide a statement to that effect in accordance with W.S. § 35-11-1101(a) and request that these pages be removed from the permit and be retained in the confidential files.
- b. Major chemical reactions or physical processes anticipated at each step in the process should be described. This section should identify the composition and average and maximum volume of fluid to be injected during operation. Special processes and reactions, such as those involved in ion exchange, reverse osmosis, or high pressure water injection should also be identified in this section. The anticipated volume and composition of waste waters or materials generated by the mining operation should be described.

4. Assessment of Impacts to Water Resources on Adjacent Lands and Potential Mitigation

W.S. § 35-11-428(iii)(E) requires an assessment of impacts to water resources on adjacent lands and the steps that will be taken to mitigate the impacts.

- a. For the groundwater assessment, the operator should provide a 5-foot drawdown map for each potentially affected aquifer and consider and discuss potential impacts to wells within the 5-foot drawdown contour.

- b. For the surface water assessment, the operator should include potential impacts to specific resources such as ponds, wetlands, etc.
  - c. Include consumptive use amounts
  - d. Potential impacts to offsite groundwater
  - e. Steps to mitigate potential impacts
5. Development and Delineation Drilling
- Describe the ongoing developmental and delineation drilling within the permit boundary.
- a. Include general discussion of all drill holes within the permit area, including geotech holes and developmental drilling holes.
  - b. Discuss the Practices, procedures and techniques to abandon holes, see LQD Non-Coal Chapter 8.
  - c. Reporting commitments

**E. Include discussion of Wellfield Design and Construction**

- 1. Wellfield Design
  - a. Typical patterns(s) layout and dimensions. The classic in situ pattern is the five spot with a production well surrounded by four injection wells. While the pattern dimensions vary, the application should indicate the range of distances between the injection wells. Other patterns are also used based on the variability in the physical dimensions of the ore body. These include a line or staggered pattern. The application should describe these and give a typical distance between wells.
  - b. The monitoring well network used for excursion detection should be explained and shown on a map. Wells should be installed in aquifers which show the potential for being affected above, within, and below the production zone, and should be used for identifying excursions from the production zone. Monitor well spacings should reflect directional transmissivity and other conditions identified through on-site pump tests. The width of the area between the production field and the monitor wells should be such that the monitor wells are within the zone of control of pumping wells which would be used to control excursions. (See Reference Document 9, Wellfield Package).
  - c. The operator is responsible for restoring all groundwater affected by the mining process, including the area between the production field and the monitor wells, if it has been affected. It is therefore in the operator's best interest to establish as small a buffer zone as is operationally feasible. Monitor wells typically should be completed in the lower portion of the

first aquifer/sand above the ore and in the upper portion of the first aquifer below the ore. Placement of these wells should be based upon knowledge of the nature and extent of the confining layer and the presence of drill holes, hydraulic gradient, and historic abandonment procedures.

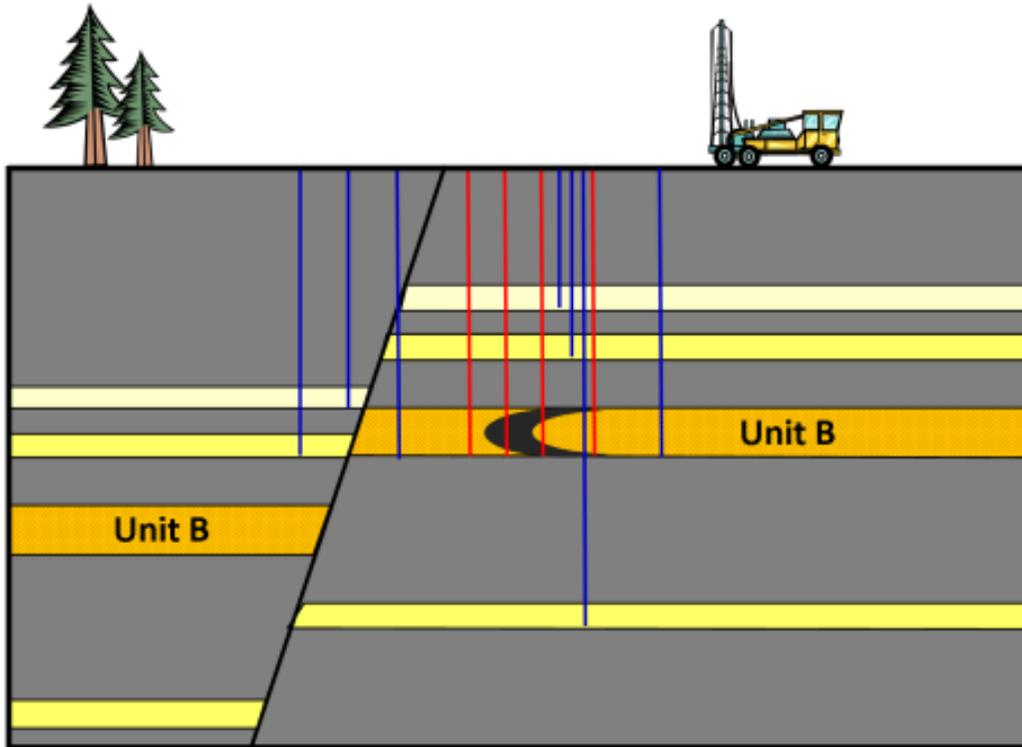
- d. A site specific, technically sound method for locating monitor wells, including but not limited to:
  - i. Gradient consideration,
  - ii. Dispersivity of recovery fluids,
  - iii. The initial excursion recovery measures employed by the operator,
  - iv. The normal mining operational flare (the lateral and vertical extent of affected area under normal operating conditions),
  - v. Model the distance an excursion is likely to travel down gradient in 60 days based on injections continuing for 2 weeks and the production well is turned off, and
  - vi. The recoverability within the allowable regulatory time frame, as specified in Chapter 11 of the Land Quality NonCoal Rules and Regulations, should be employed,
  - vii. Monitor well locations and the possible lateral extent of an excursion are to be located using the groundwater flow model MODFLOW, or other technically justified method with prior approval of LQD.
- e. Monitor well spacing may be increased if trend wells are used. (See Reference Document 9, Wellfield Package).
- f. All perimeter monitor wells completed in the production zone must be in hydraulic communication with the production zone. Additional wells with lesser spacing may be necessary in preferred flow path zones. It is recommended that trend wells be monitored and the data maintained on site for inspection. For trend wells, unless an excursion occurs at the monitor well ring, remedial action is not required.
- g. Operational or monitoring wells in proximity to hydrogeologic features, including faults, need to take into consideration the hydraulic effects of such features and appropriately place monitor wells. For example, if a wellfield is producing from “Unit B” on one side of a fault, monitoring wells on the opposite side of the fault should be placed in the unit that is structurally adjacent to the offset “Unit B”. There may be a need to place monitoring wells in multiple aquifers (above, below, and in the production unit) across fault zones depending upon the geology, confinement or interconnection resulting from the faulting, and vertical hydraulic gradients.

h. The monitoring network must be superimposed on a topographic map identifying the wellfield area. The extent of the ore zone, faults and other hydrogeologic boundaries should be identified on the map.

i. Headerhouse Design

Include a description, discussion, and typical plan details of the headerhouses, manifolds, trunklines, and other pipelines associated with the wellfield. Include the size and burial depth of the different pipelines and any testing of these facilities to ensure they are ready for operations. Include any fluid control methods, spill detection, alarm systems, and containment features within the headerhouses.

### Hypothetical Cross-Fault Monitoring



injection/production wells = red

monitoring wells = blue

#### 2. Well Installation and Completion

a. Typical completion details for all monitor wells.

The operator must include typical details for monitor well construction in the permit. Reference Document 8, Well Installation Completion, of this

guideline provides additional guidance on monitor well construction. Wellfield packages must contain construction details for all monitor wells. Attachment V of Reference Document 1, General Information, of this guideline lists the well construction information that should be provided in an electronic format. Attachment V of Reference Document 1, General Information, also provides a link to LQD's website for the required spreadsheet.

b. Typical completion details for injection and production wells.

A detailed description of the typical proposed well completion procedures for injection and recovery wells, as required by Section 6 of LQD NonCoal Rules and Regulations, Chapter 11. At a minimum, the casing size and type, wellbore diameter, centralizers, screens, gravel pack, annular sealant properties, displacement technique, sealant setting time and under reaming must be described.

c. Well Development.

Describe the procedures used to develop the wells such as air lifting, swabbing, pumping, or accepted development stimulation techniques. Also describe the type of monitoring (i.e., pH and conductivity) performed to ensure the development activities have been effective.

d. Mechanical Integrity Testing (MIT) details (see also Reference Document 8, Well Installation Completion.

- i. Provide a schedule for and description of the procedures to demonstrate and maintain mechanical integrity of all Class III injection wells as required of Chapter 11.
- ii. The mechanical integrity testing plan must include a commitment to quarterly reporting of mechanical integrity test results to the LQD.

3. Well Corrective Action Plan

Include a plan for wells that fail MIT or are improperly sealed, completed, or abandoned. The plan shall include a time schedule and steps or modifications that are necessary to prevent movement of fluid into unauthorized zones.

4. Notice of Completion of Construction

LQD R&R Chapter 11 requires an operator to submit a notice of completion of construction to the administrator before commencement of injection in a new injection or production well. Reference Document 8, Well Installation Completion, provides additional detail concerning the reporting procedures.

- a. Provide a discussion and list the information that will be provided to the administrator.

- b. The notice shall be signed by a company representative and include the MIT results.

**F. Wellfield Package Information**

1. Conceptual Wellfield Package.

The applicant should describe the type of information that will be submitted for future wellfields. See Section VI and Reference Document 9, Wellfield Package, of this guideline for additional information.

2. The applicant should acknowledge if the testing plan to obtain the necessary hydrological information changes from the procedures previously approved by LQD, the new plan will be required to be submitted to LQD for approval.
3. If the wellfield package is for a wellfield that was not previously identified in the permit, a revision to the permit with public notice will be required. A previously unidentified wellfield will also most likely result a change in the aquifer reclassification and aquifer exemption.

**G. Wellfield Operational Control and Monitoring of Wellfields**

Provide a description of the proposed methods of operation, including:

1. Injection Rate and Pressure

- a. Include the fracture and fluid pressure of each production zone
- b. Injection rate, with the average and maximum daily rates and the volume of fluid to be injected;
- c. Typical discussion of injection pressures, with average and maximum injection pressures, as required by LQD Chapter 11. Include a discussion or comparison to the formation pressure and steps to be taken to prevent fractures in the confining zone;

2. Operational Control of Injection Fluids

- a. Describe the procedure(s) to assure that the installation of recovery, injection, and monitor wells will not result in hydraulic communication between the production zone and overlying or underlying stratigraphic horizons.
- b. Proposed injection procedure.
- c. The applicant needs to describe how the pressures and flow rates will be monitored. Electronic monitoring of pressures and flow rates at both the headerhouse and at the well head are suggested. The monitoring devices should be connected to the central control facility with alarms to alert

operators of problems and allow automatic or quick response by wellfield operators.

- d. Describe the procedures utilized to verify that the injection and recovery wells are in communication with monitor wells completed in the production zone and employed for the purposes of detecting excursions.

### 3. Wellfield Monitoring

- a. Include the proposed method for calculating the Upper Control Limits (UCLs). See Reference Document 4, Upper Control Limit Calculation, for additional detail.

- b. The frequency of monitoring UCLs during mining is somewhat dependent on hydraulic conductivity. Sampling and analysis for UCLs should be done twice monthly and at least 10 days apart.

- c. Parameters

- i. A parameter set should be developed for the detection of excursions. Excursion parameters are process specific. Factors that should be considered in the selection of excursion parameters include the potential of constituents to participate in reactions such as sorption, oxidation/reduction, and precipitation. Possible excursion parameters may include the following:

- (A) For Uranium:

- TDS or conductivity

- Chloride

- Sulfate

- Bicarbonate or Total Alkalinity

- Sodium

- (B) For other minerals, please contact the LQD

- ii. Water level measurements should be part of any excursion monitoring program.

### 4. Water Balance

Include water balance calculations that demonstrate that the liquid waste disposal facilities (surface impoundments, land application, deep well injection) are adequate to process the proposed production and restoration efforts at any time. This will include:

- a. Production only

- b. Concurrent production and restoration – this may be separated into different phases of restoration such as production and groundwater sweep, production and Reverse Osmosis, etc.
- c. Restoration only
- d. Plant water
- e. Water from pump tests, see discussion in Section M, page 25.
- f. Design Throughput and Production

Provide a description of the design capacity of the plant facilities, including the process stream, waste stream, any makeup water, and the source of the water.

#### 5. Definition of Completion of Mining

With in situ mining operations, it is difficult to determine when mining is complete and restoration activities should start. Include a discussion of the criteria that will be used for determining when mining is completed.

### **H. Excursion Response and Additional Monitoring**

#### 1. Introduction

Excursion detection, control, and cleanup procedures should be identified in this section, considering both horizontal and vertical excursions. The monitoring network described in the wellfield design section should be referenced and parameters used to detect and confirm excursions should be identified. An excursion measured at a monitor well does not automatically mean the operator has violated their Underground Injection Control (UIC) permit.

#### 2. Monitoring During Excursions

- a. If UCLs are exceeded (e.g. 2 or more), then the sampling and analysis should be repeated within 24 hours of receipt of analytical data. If results of both the first and second sampling events indicate if two or more UCLs are exceeded, then the excursion will be considered confirmed.
- b. If the second sample does not indicate the UCLs have been exceeded, a third sample shall be collected within 24 hours of receipt of the second sampling data. If neither the second nor the third samples indicate the UCLs were exceeded, the first sample shall be considered in error. If confirmed by either the second or third sample, the well will be considered to be on excursion status and should be reported verbally to the agency within 24 hours.

- c. If the results of the confirmatory sampling event are not received within 30 days of the initial sampling event, then the excursion is considered to be confirmed. Check regs as there may be another rule

3. Corrective action plan

The operator should include a discussion in the application that describes the steps to be taken and addresses the possible scenarios discussed in this section:

- a. The applicant must describe the actions to be implemented to correct and control an excursion event. The actions must be identified for both horizontal and vertical excursions.
- b. Samples are required to be collected and analyzed on a weekly basis until the excursion is controlled.

4. Reporting procedures

In the event of an excursion, the Land Quality Division must be verbally (by phone or email-read receipt) notified within 24 hours. Written notification describing implementation of the approved plan is required within 5 days. (See Chapter 11) of the Land Quality NonCoal Rules and Regulations.)

5. Excursion Control Actions (reference the regulations)

- a. The operator should implement the recovery plan and continue monitoring. Samples will be collected and analyzed on a weekly basis until the excursion is controlled. The excursion is considered controlled when it can be demonstrated through water quality and groundwater gradient or, if applicable, pressure measurements, that recovery fluid in unauthorized areas is declining. It is important to realize there is a difference between “controlling” an excursion and “recovery” of excursion fluid.
- b. If the excursion is not controlled within 30 days after confirmation of the excursion, a suite of samples should be analyzed for the parameters listed in LQD R&R Chapter 11. At the time UCLs are no longer exceeded, a suite of samples should again be analyzed for those parameters.
- c. In this section, the operator should include a statement recognizing that if an excursion is not controlled within 60 days after confirmation of the excursion, the administrator (after consultation with the director), may terminate, revoke, or modify the mining operation (see W.S. § 35-11-429).
- d. If the excursion is controlled but the fluid is not recovered within 60 days after confirmation of the excursion, the operator will submit a plan and compliance schedule to WDEQ within 90 days after confirmation of the excursion. The plan and schedule must meet the requirements of LQD

R&R Chapter 11. Slow recovery of excursion fluid may result in an increase in the reclamation bond.

## **I. Well Maintenance, Repair and Abandonment**

1. Provide a maintenance plan to ensure:
  - a. A commitment to protect all monitoring wells to the extent possible until their removal and reclamation (see also Reference Document 9, Wellfield Package).
  - b. Wells are sufficiently covered to protect against entrance of undesirable material into the well;
  - c. The wells are marked and can be clearly seen; and
  - d. The area surrounding each well is kept clear of brush or debris; and
  - e. Monitoring equipment is appropriately serviced and maintained so the monitoring requirements of Chapter 11 can be met.
  - f. MIT methods and schedule
  - g. Provide corrective action plan for MIT failure, and improperly sealed, completed and abandoned wells
2. Well Plugging and Abandonment
  - a. All In-Situ mine permits are required to include plans for well repair, plugging and conversion. All wells must be properly abandoned in accordance with the approved plans to prevent adverse changes in water quality or quantity and to prevent a hazard to people, livestock, wildlife and machinery. A well is considered “abandoned” when it has not been used for a period of 2 year, unless the owner demonstrates his intention to use the well again by properly maintaining the well. Chapter 11 requires repair or plugging and abandonment within 120 days of wells which have failed a Mechanical Integrity Test (MIT).
  - b. Prior to abandonment, all pumps, pipes, wiring and any obstruction or debris that may interfere with the adequate plugging operations shall be removed from the well.
  - c. Chapter 11, Section 70 of the Water Quality Division (WQD) Rules and Regulations describes acceptable well abandonment procedures. In general WQD requirements consist of placement of impermeable material (material with a permeability of  $10^{-7}$  cm/sec or less), such as neat cement, sand-cement grout, concrete, or bentonite clay, (use of drilling muds is not acceptable) in the same interval as confining units and extending 50 feet above and below screened or perforated zones. Fill material may be placed opposite permeable water bearing units. Fill material consists of clay, silt

sand, gravel, crushed stone, native soil, and mixtures of these materials. Materials containing drilling muds or organic matter are not acceptable. In most instances it is preferable to fill the entire hole from bottom to top with impermeable material.

- d. The SEO promulgated their Part III, Water Well Minimum Construction Standards in June, 2011. Those rules require that any well which is abandoned or permanently removed from service be entirely plugged from bottom to top with specified approved grout materials.
- e. Typically the casing is cut off approximately 2 feet below ground surface and the upper 2 feet is filled to the surface with suitable material. A steel plate or equivalent permanent tag showing the permit number, well number and date of plugging must be affixed to the top of the plug.
- f. Within 15 days after a well has been plugged and abandoned, the owner shall file a plugging record with the WQD and retain a copy on site until termination of the permit. Chapter 11 of LQD Rules requires that plugging and abandonment reports be filed with LQD and SEO no later than 12 months after well abandonment.

**J. Wastewater Production and Disposal Capacity**

1. Type, ( i.e., plant waste streams - where produced, and quantity)
2. Disposal locations and capacity and any treatment technology
  - a. Deep disposal wells
  - b. Evaporation ponds
  - c. Land application of wastewater
  - d. Surface Discharge
  - e. Other Methods approved by the Administrator

**K. Lined Pond Inspections, Monitoring, Leak Detection, and Control**

Describe the procedures and schedule for inspection and monitoring of lined ponds and their leak detection systems. Describe the procedures and schedule for inspection and monitoring of Wellfield and Plant Releases – Potential and Proposed Actions and their leak detection systems.

**L. Wellfield and Plant Releases**

1. The potential for wellfield and plant releases should be discussed along with an indication of likely contaminants involved. Spill control and cleanup

procedures should be outlined. Wellfield and Plant Release Potential – At a minimum, address the potential at the following areas:

- a. wellfields
  - b. pipelines
  - c. lined ponds
  - d. deep disposal wells
2. Wellfield and Plant Release Prevention Plan
  3. Proposed Wellfield and Plant Release Response
  4. Reference Clean Up Standards – such as DEQ VRP, NRC and EPA.
  5. Wellfield and Plant Release Reporting

#### **M. Other Wastes and Disposal**

1. Water from pump tests.
  - a. If an operator plans to discharge pump test water to a surface drainage, the operator will apply for a WYPDES permit using the procedures and mechanisms already in place;
  - b. If an operator plans to inject pump test water to the subsurface, the operator will apply for a separate WQD UIC permit using the procedures and mechanisms already in place;
  - c. If the operator plans to apply the water to the land surface and takes the position that the water will not enter or threaten to enter either surface or groundwater, the operator shall submit documentation to the WQD administrator which provides justification for that position. If the administrator concurs with the operator, the administrator will send a letter of concurrence to the operator with a copy to the LQD. That letter will state that it is conclusion of the WQD administrator that the WQD lacks jurisdiction provided the pump test water is applied as described by the operator. If the WQD administrator does not concur with the operator's position that there will be no discharge or threat to discharge to waters of the state, the administrator will send a letter to the operator, with a copy to LQD, giving the basis for that decision.

WQD will clearly state in its letter of concurrence it is making a decision only on WQD's authority to require a permit. WQD will not be passing judgment on any other aspect of the disposal including authorizations or approvals that may be needed from the land owner or any other governmental agency. Also, be aware that WQD will retain its authority to inspect the operation to insure that it is being done as described.

An operator who chooses to take the land application approach and wishes to get a letter of concurrence from WQD, should contact the WQD Administrator early in the process so there can be a discussion on exactly what information WQD will require.

2. Other liquid wastes
  - a. Radiological contaminated liquid wastes (under NRC jurisdiction and disposed under NRC regulation not to be reviewed by LQD)
  - b. Hazardous wastes
  - c. Domestic liquid wastes
3. Solid wastes
  - a. Describe the various types of solid wastes to be generated,
  - b. The amount of each type.
4. Disposal method
  - a. Nonradionuclide contaminated wastes

#### **N. Subsidence**

An estimate of the amount of subsidence and a monitoring plan should be outlined in the application. Costs associated from backfilling subsidence areas should be included in the bond estimation. If subsidence is not a problem for the type of mining, indicate so in the application.

#### **O. Wildlife Monitoring and Mitigation Plan**

Once potential impacts have been identified by the company, methods to minimize impacts to wildlife during and after mining should be developed and described in the mine operations plan. Impact abatement procedures will often be tailored to fit individual sites. Possible mitigation includes proper fencing, obtaining or providing recreational access, controlled speed limits, programs to educate employees about game laws and sensitive wildlife species, replacement of dead snags, creation or development of water sources, protection of riparian areas from grazing, reestablishment of raptor nesting sites, wildlife-oriented reclamation, problem solving research, and habitat improvement projects. Mine personnel are encouraged to develop new and innovative techniques (within legal constraints) to help offset mine impacts. All fence designs should be provided, referencing specific types described in Guideline 10. The U.S. Fish and Wildlife Service (USFWS), Office of Ecological Services, should be contacted early regarding raptor nest conflicts and the possible presence of threatened or endangered species. The outcome of this consultation should be discussed in the mine operations plan. Mitigation procedures should be described and supported

by a letter of concurrence from the USFWS. The mitigation plan should include the following items:

1. Big game
2. Sage grouse
3. Raptors
4. Migratory birds
5. Threatened and endangered species

**P. Mining Schedule**

Provide a discussion and illustration that shows anticipated start and end dates for major activities including facilities construction, and for each satellite plant and each wellfield construction and operation. At a minimum, this will include

- a. A list of the proposed wellfields;
- b. A map(s) which shows the proposed sequence for mining of the wellfields;
- c. A proposed time schedule for construction, mining, and restoration each wellfield; and
- d. The capacity of the water/waste water treatment systems and correlation of the capacity with the mining and restoration schedules.

**Q. Summary and Table of Required Monitoring and Reporting**

Include a section that summarizes all reporting requirements and include a table that lists all items that are to be reported to LQD. The table should include type of report, content summary, frequency of report, etc.

**VII. Part IV, Reclamation/Restoration Plan**

**A. General Reclamation Schedules**

The plan should include a schedule for reclamation broken down by different types of disturbance and different phases of reclamation work for each wellfield proposed in the application. The plan and schedule must consider instances where mining in a wellfield is completed but restoration cannot be initiated because ongoing mining activities in an adjacent wellfield. It must also consider where in the above example a restoration in a portion of a wellfield may be initiated. There may also be instances where mining in a portion of a large or

long, linear wellfield may be completed and the rest of the wellfield is still in production but due the size or distance between the producing and non-producing portions of the wellfield restoration may begin. See also requirement in Section IV. J.5 of the mine operations plan to define when mining is completed in a wellfield or portion of a wellfield.

## **B. Groundwater Restoration**

### **1. Introduction**

Aquifer restoration activities, including procedures, chemistry, facilities, equipment required and the expected final water quality should be briefly summarized. The timetables for restoration activities should be discussed.

### **2. Statement of Best Practicable Technology**

The application should clearly state what is considered Best Practicable Technology (BPT) for the permit at the time of approval. Changes in technology resulting in a new BPT may be added or required to be added to the permit as a revision. This discussion should include a reference to the following:

- a. Research and development activities conducted at the site and/or
- b. Comparison to other In Situ Leach (ISL) sites.

The aquifer restoration methodologies described in item B.3 of this section should be compared to other ISL sites for which groundwater has been restored. The purpose of this comparison is to show that groundwater can be restored and that the restoration methods constitute BPT. This comparison should include the following:

- i. Geology
- ii. Mineralogy
- iii. Premining water quality
- iv. Geochemistry (including major ions)
- v. Lixiviant
- vi. Anticipated postmine/prerestoration water quality
- vii. Reductants used
- viii. Restoration methods
- ix. Pore volumes for each process
- x. Length of time for wellfield restoration
- xi. Restored groundwater quality

### 3. Target Restoration Values

- a. Include a discussion of the Target Restoration Values and how they are established.
- b. Each wellfield package should include the proposed Target Restoration Values for that wellfield.

### 4. Methodology/Process Description and Chemistry

Aquifer restoration procedures should be detailed in this section. Process description and chemistry should be specifically described. The anticipated volume, flow rates, and composition of water generated during restoration should be identified. Restoration water quality and water levels should be monitored and sampled at the very beginning and at the very end of restoration. Parameters to be analyzed should include the full suite as listed in Reference Document 10, *Premining Water Quality and Quantity Sampling*, of this guideline.

### 5. Monitor Network during Groundwater Restoration

A specific monitoring plan for both active and stability phases of restoration should be outlined. This may have to be modified depending on excursion events during mining. If there are changes to the approved restoration plan an updated plan should be submitted to Land Quality Division prior to beginning groundwater restoration.

### 6. Restoration Volumes and Flow Rates

- a. Pore Volume Displacement Estimate
- b. Restoration Pore Volume Displacements
- c. Restoration Flow Rates
- d. Restoration Fluid Disposal

### 7. Stability Plan

#### a. Well Selection

Wells initially selected and listed in the reclamation plan will be used to determine restoration success. Both injection and production wells should be selected.

Based on the reclamation plan and the restoration success, the restoration sampling wells should be selected for monitoring during stability. (These wells should be identified in the reclamation plan to ensure appropriate baseline information is available, however, it is recognized that some wells may need to be changed or redesignated due to mining activities).

#### b. Stability Period

When the restoration goal is achieved, active restoration should be discontinued and a stability period of 12 months will begin. The end of the stability period is a decision making point for the DEQ, i.e., more restoration, longer stability period, or overall success. The restoration sampling wells should be monitored during the stability period generally - every two months or quarterly basis for a full suite of parameters in Reference Document 10, Premining Water Quality and Quantity Sampling, except those shown to be unaffected by mining and restoration processes.

c. Evaluation of Stability Data

- i. The data should be analyzed on the basis of wellfield averages. In no case will wells of different baseline class be averaged together.
- ii. The data should be examined on a parameter by parameter basis.
- iii. The data should be examined over time (the twelve month period) to identify any trends - techniques such as scatter plots, trend, regression analysis and standard statistics should be used. A determination of aquifer stability should be made upon the "trends" in the data; i.e., an acceptably stable aquifer should not exhibit rapid upward or downward trends or be oscillating back and forth over a wide range of values beyond baseline variability.
- iv. The data should be evaluated against baseline quality and variability to determine if the restoration goal is met - the primary restoration goal is always baseline. The secondary goal is to restore the water within class of use. The secondary goal of restoration within class of use is applicable for "problem" parameters if and only if BPT has been demonstrated.
- v. Statistical methods should be used to compare the restored aquifer data with the baseline, e.g. analysis of variance and t-test. It is important to address all of the assumptions inherent in the particular statistical method chosen. The restoration success will be evaluated on the basis of statistically equivalent populations between baseline and post-restoration data. Normally the same wells are used premining and post restoration.
- vi. Potentiometric surface maps should be developed to reflect aquifer conditions at the end of the stability monitoring period. Following a decision that the aquifer geochemistry is relatively stable, data should be evaluated on a parameter by parameter basis to determine if:
  - parameters have met baseline.
  - parameters are above baseline but below class of use.
  - parameters are above class of use.

8. Demonstration of Best Practicable Technology (BPT). The permit shall only contain a brief discussion of what will be submitted. The following shall be submitted as part of wellfield restoration package.

When submitting a wellfield restoration package to the division, the following items need to be discussed and documented. The permit should discuss how the operator plans to address and document these topics.

- a. Type of Technology—The type of technology may be different for different circumstances.
- b. Application of Technology - Has the technology been used correctly? As an example, reverse osmosis evaluation should include:
  - i. Number of gallons and/or pore volumes pumped
  - ii. Number of gallons reinjected
  - iii. Quality of water produced vs. reinjected
  - iv. Future Wastewater disposal capacity
  - v. Document that active restoration was discontinued at the appropriate time. LQD and the operator should agree when restoration should be discontinued.
  - vi. Proper maintenance and operation of equipment
- c. Economics - Consider the amount it would cost to gain further reduction in parameters, (e.g., if it requires a very large expenditure for a relatively small gain in water quality). Consideration of economics only applies if parameters fall within the class of use.

NOTE: If parameters are above class of use, then further restoration may be required.

9. Demonstration of groundwater restoration success. The permit shall contain only a brief description of how the operator will demonstrate restoration success. The operator must explain how they will demonstrate or evaluate groundwater restoration success. In general, the goal of groundwater restoration is to return the affected aquifers to a reduced environment. At the end of the stability period the LQD will evaluate groundwater restoration success based on the criteria presented below. When submitting a request for approval of aquifer restoration, the operator should provide documentation that addresses each criterion.

(The following is adapted from *In Situ Wellfield Restoration Criteria* dated January 2005 by Richard Chancellor, LQD Administrator. It is assumed the restored aquifer has been demonstrated to be “stable”).

- a. Evaluation of BPT

The first step in determining if groundwater has been restored is an evaluation of the use of BPT as required by the Environmental Quality Act (EQA). The permit will define BPT. While technology may change over the course of the life of the permit, the permit will still govern. However, the permit may be revised to include newer technology or to allow for testing of innovative technologies, particularly if those technologies would afford greater protection to adjacent aquifers.

b. Parameter by parameter water quality evaluation

The second step is an evaluation if the restored groundwater on a parameter by parameter basis with the pre-mining condition of the groundwater as outlined in the Stipulated Agreement (*Kerr-McGee Nuclear Corporation v. Robert Sundin et al.*). Wellfield averages will be used to determine the condition of the premine groundwater. LQD may also consider the range of individual premine parameters in the event the postmine average is above the premine average.

In the likely event that not all parameters have been returned to the premine average, the postmine groundwater will be compared to the premine class-of-use on a parameter-by-parameter basis. Each parameter will be reviewed to its premine class-of-use (see WQD Chapter 8 for class-of-use discussion). This evaluation will be used to determine if there are parameters that are of concern that may impact water. See Water Quality Rules & Regulations, Chapter 8, Section 5(a).

In many cases, the premining groundwater will be Class IV(A). During mining, the well will have been reclassified by WQD to Class V. After mining the water must be returned to its Class of Use (commonly Class IV(A)).

c. Potential impact on adjacent groundwater

The last step in evaluating groundwater restoration is the potential impact on groundwater adjacent to, and outside of, the reclassification boundary. Groundwater in the production zone cannot impact the adjacent groundwater to the extent that the adjacent groundwater no longer meets its premine Class-of-Use. Additionally, adjacent groundwater must be protected such that concentrations of constituents for which Maximum Contaminant Levels (MCLs) have been established by the U.S. EPA (e.g., uranium and selenium) do not exceed those MCLs, or background, whichever is higher.

d. Modeling

If the groundwater in the production zone is restored to its premining condition on a parameter-by-parameter basis, no further evaluation is required. If there are parameters that exceed the premining conditions, the operator will be required to use appropriate modeling to demonstrate that those parameters above the premining conditions will not degrade the adjacent

groundwater to the extent that the groundwater will no longer meet its previous class-of-use and that concentrations of constituents for which MCLs have been established by the U.S. EPA do not exceed those MCLs, or background, whichever is higher. If the adjacent groundwater class-of-use will be impacted, the operator will be required to conduct additional restoration. If the modeling indicates the adjacent class-of-use will not be impacted and that concentrations of constituents for which MCLs have been established by the U.S. EPA do not exceed those MCLs, or background, whichever is higher, a monitoring program sufficient to verify the model may be required.

### **C. Assessment of Impacts to Water Resources**

The purpose of this section is to compare measured impacts to the impacts projected prior to mining. If the actual impact is greater than that projected the operator should discuss the differences and elaborate if additional mitigation is required. This assessment is due for each wellfield and at the end of the operation.

1. 5-foot drawdown maps for all affected aquifers compared to the premining projections. If the drawdown is greater than projected, specific private wells located within the 5-foot contour must be evaluated and determined if additional mitigation is warranted.
2. Assessment of impacts to specific resources such as ponds, wetlands, etc. and compared to the premining projections to determine if additional mitigation is warranted. Refer to the Surface Water reference document for additional guidance regarding surface water.

### **D. Decontamination and Decommissioning**

1. Disposal of buildings and facilities. The plan should include procedures for disposing of buildings and other facilities.
2. Toxic materials - The procedures for permanently disposing of any toxic or acid forming materials should be provided.
3. Lined pond decommissioning.
4. Wellfield decommissioning.
5. Soil decontamination.

### **E. Surface Reclamation**

1. Post-mining land use. The proposed post-mining land use should be specified along with a discussion of the actions the operator will take to achieve that land use.

2. Process facilities and road reclamation. Describe the steps and how the facilities and roads will be prepared for reclamation.
3. Contouring and final topography including drainage restoration. The plan should demonstrate that surface affected lands will blend with adjacent topography and land uses and any drainages will be re-established.
4. Wildlife habitat. Where wildlife habitat will be part of the post-mine land use, LQD regulations require development of a plan to restore this use. All habitat reclamation procedures should be described in the reclamation plan of the permit application.
5. Surface preparation. The plan should indicate any surface preparation to be undertaken before topsoiling.
6. Topsoil application, estimated volumes and replacement depths

Topsoil replacement methods and schedules should be included. Minimum depth of topsoil replacement should be specified. The addition of soil amendments that are planned should be indicated.

7. Revegetation practices. The plan for revegetation should include species to be seeded, rate of seeding, and method and time of seeding. If cover crops, mulch, fertilizer, or irrigation will be used, this should be discussed in detail including methods and timing, rates, locations, and water quality.
  - a. Seed mixtures

Include a table of the permanent seed mix listing the species by scientific and common name and the number of pounds of pure live seeds (PLS). LQD strongly recommends using native species. The seed mix will generally contain cool and warm season grasses and forbs. The total PLS for the seed mix should be no more than 12 to 14 pounds but the LQD district office should be consulted for composition and amount.
  - b. Reseeding methods
  - c. Include any special areas such as sage grouse habitat that require special measures or seed mixes.
  - d. Protection of Newly Seeded Areas

The plan should include measures and specifications to be used for protecting newly revegetated areas from grazing animals. A site maintenance plan which includes contingencies to correct weed establishment or erosional instability should be included.
8. Erosion control practices during and after reclamation

Discuss and show the design and location of any erosion control practices.
9. Weed control

The plan should include monitoring and when and what steps will be taken to control invasive weeds on the reclaimed areas. The applicant should be aware that each county has their own list of noxious weeds which may be different from the state requirements.

10. Evaluation of surface reclamation success

Provide a discussion of the methods used to determine revegetation success. See Guideline 2 for further information.

11. Reclamation and postmining environmental monitoring

Monitoring plans for reclamation and postmining environmental monitoring should be briefly outlined in the permit application. Detailed plans should be developed in consultation with and submitted to the LQD before commencement of mining. See Guideline 2 for further information.

**F. Restoration/Reclamation Cost Estimates**

Restoration/Reclamation of in situ facilities has constraints not experienced by traditional surface mining operations. These constraints include capacity limitations on water treatment equipment, the need to maintain the proper water balance in the wellfields, pipeline and especially waste water disposal capacity. These constraints result in an extended time frame to complete groundwater restoration and mine closure. Other unique constraints include the disposal of radionuclide contaminated material and electrical power consumption and costs.

The plan should include an estimate of the reclamation costs broken down by different types of disturbance and different phases of reclamation work. Costs should be based on reclaiming the entire affected area after the first year as if the mine were to shut down at that time and be completely reclaimed including the removal of all facilities. Cost estimates should include restoration of the anticipated affected groundwater as well as surface reclamation. Information regarding buildings must include the following detail in part to enable accurate reclamation bond review:

- Size – width, length, and height
  - Material
  - Concrete thickness – floor and footers
  - Sump detail
1. Most operators use a similar version of a spreadsheet that allows for efficient calculation of the bond estimate. It is recommended that the operator contact the LQD for sample formats successfully used by other operators to promote equality and consistency across the industry.

2. The bond estimate must be accompanied by a projected time schedule (Gantt chart) showing the completion schedule for each major reclamation operation/task.
3. The bond estimate must include an itemized accounting of all labor costs, including number and categories of personnel, salaries, and total hours required for the completion of the various reclamation tasks. A Gantt chart is suggested to display this information.
4. All assumptions and backup calculations must be included to support the bond estimate.

## **VIII. Mine Wellfield Package**

### **A. LQD Consultation**

As discussed in IV above, wellfield packages are used to provide the detailed information for new wellfields. Before conducting any sampling or testing for a wellfield package, the operator should consult with LQD to clarify the content, testing, and methods required to satisfy the statutory and DEQ regulatory requirements. Reference Document 9, Wellfield Package, provides discussion and requirements necessary for a wellfield package.

### **B. Approval Process**

Wellfield packages will not require from WQD a new aquifer reclassification or from EPA a new aquifer exemption as long as the package will not change the aquifer reclassification or exemption boundary approved by WQD or EPA, respectively, with the initial permitting action. Packages for wellfields that were not in the original permit as well as wellfields that were identified but whose size or shape changes which results in a change to the exemption boundary will require both a WQD aquifer reclassification and EPA aquifer exemption. Public notice will also be required. See Reference Document 1, General Information, Attachment II for a flowchart of the wellfield package process.

## **IX. Research and Development License**

### **A. Introduction**

1. This portion of the guideline gives information specific to R&D Licenses. It only provides information requirements that are different from, or in addition to, the requirement for a permit. Unless specifically stated, the information below is in addition to the requirements for a permit. If a topic is not

discussed, then the information requirements are the same as an in situ mining permit.

2. The research and development license is available to allow testing of new technology or proven technology in a new geologic setting. Therefore, operations under the license should identify procedures to be tested and evaluated.
3. The purpose of this section is to identify the research aspects of the research and development license. This section is meant to justify the areas in the license where exact mining and reclamation procedures, timetables, methods or results can only be generally described.

## **B. Adjudication**

Instead of a Form 1-UIC, a Research and Development License application submits a Form 5 R&D License, In-Situ.

## **C. Appendix D-8 Vegetation**

1. The area to be permitted for the R&D license should be mapped according to plant communities. The area to be affected should be delineated on this map. If the area to be affected (surface affected acreage is that which requires seeding for reclamation purposes and includes disturbances associated with roads) is less than 10 acres in size, a qualitative description of the vegetation communities is adequate. However, if the R&D will disturb more than 10 acres, quantitative sampling of the affected lands will be necessary. Parameters to be measured include % cover for each species (or life form categories), total cover and a species list. Measurements should be conducted in accordance with the current LQD Guideline No. 2.

## **D. Identification and Description of Research Methods**

A description of each research area proposed in the mine and reclamation plan should be written. The description should define the anticipated techniques to be tested, the expected manner of implementation of the techniques, and the expected results.

## **E. Records and Reporting**

A plan should outline the records that will be kept by the operator to identify the procedures actually used in the research areas and to identify the dates those procedures were implemented. For example, record keeping of the chemical composition of fluids, the volumetric water balance, injection pressures and volumes, burn intervals, and other standard operating procedures should be

described in an efficient technical manner. The daily logs describing normal operational procedures may be reviewed by Division personnel on site visits.

**F. Disposal of Product**

A plan should be outlined for disposal of any product produced by the research project.

**G. Reporting Procedures**

A plan for submitting technical summaries of research results and the present status of the operation should be submitted as described in the license application. At the cessation of operations, operator should submit a final technical report of all research results, logs, procedures, conclusions, etc., to the LQD.

**H. Confidential Material**

Materials or record requests for confidential status will be reviewed pursuant to W.S. § 35-11-1101.

**I. Upper Control Limits**

Monitor wells should have Upper Control Limits established on a well by well basis for an R&D. A wellfield average may be used for a commercial permit with Upper Control Limits determined using the procedures outlined in Reference Document 4, Upper Control Limit Calculation

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## Reference Document 1: General Information

This Reference Document contains information not directly related to an in situ permit or the mine operation but includes process related and other general information related to in situ permits. This Reference Document contains the following attachments:

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## Attachment I — Definitions for Purpose of the Guideline

If the definition is from the Act or LQD R&R, a citation is given. Any text after a citation has been added to further explain how the term is used for in situ mining.

1. “Adjacent lands” means all lands within ½ mile of the proposed permit area (W.S. §35-11-103(e)(vii)). Also known as “adjacent areas.”
2. “Affected land” means the area of land from which overburden is removed, or upon which overburden, development waste rock or refuse is deposited, or both, including access roads, haul roads, mineral stockpiles, mill tailings excluding uranium mill tailings, and mill facilities, within the Nuclear Regulatory Commission (NRC) license area, impoundment basins excluding uranium mill tailings impoundments, and all other lands whose natural state has been or will be disturbed as a result of the operations (W.S §35-11-103(e)(xvi)).
3. “Aquifer” is a zone, stratum, or a group of strata that stores and transmits water in sufficient quantities for a specific use. LQD NonCoal R&R Chapter 1, Section 2(g): Note: Sufficient quantities generally means ½ gallons per minute (gpm) sustained for 24 hours.
4. “Background” means the constituents or parameters and the concentrations or measurements which describe water quality and quantity variability prior to the injection of recovery fluid (LQD R&R Chapter 11. It may also be called baseline.

“Best Practicable Technology (BPT)” means a technology based process justifiable in terms of existing performance and achievability (in relation to health and safety) which minimizes, to the extent safe and practicable, disturbances and adverse impacts of the operation on human or animal life, fish, wildlife, plant life and related environmental values. W.S. §35-11-103(f)(i).

5. “Compliance Schedule” means a schedule of remedial measures included in a permit including an enforceable sequence of interim requirements (for example, actions, operations, or milestone events) leading to compliance with the applicable statutes and regulations. LQD R&R Chapter 11.
6. “Excursion” means any unwanted and unauthorized movement of recovery fluid out of the production zone as a result of in situ mining activities. W.S. §35-11-103(f)(ii).
7. “Exempted Aquifer” means an aquifer or its portion that meets the criteria in the definition of “underground source of water” but which has been exempted according to the procedures of LQD R&R Chapter 11.
8. Facilities
  - a. Permanent or Long-Term Facilities - means office complexes, satellite buildings, main plant facility areas, wellfield headerhouse buildings, construction equipment, evaporation ponds, and oxygen and other gas or chemical storage areas.

- b. Temporary Structures and Storage Areas - means those structures or areas used to support short term construction (less than six months) activity. These activities include equipment (cement, bentonite, piping, vehicles, trailers, etc.) storage, lay-down or staging areas
9. “File-1-Of” refers to the first file folder in the Cheyenne LQD filing system. This first file folder contains the adjudication material that is submitted in loose form, any replacement/revisions to those forms and superseded forms. Other file folders contain general correspondence and are labeled file X of Y with Y being the total number of folders for the permit and X being chronological sequence of folders.
10. “Groundwater Restoration”. means the condition achieved when the quality of all groundwater affected by the injection of recovery fluids is returned to a quality of use equal to or better than, and consistent with the uses for which the water was suitable prior to the operation by employing the best practicable technology. W.S. §35-11-103(f)(iii).
11. “Land uses” means specific uses or management-related activities, rather than the vegetation or cover of the land. Land uses may be identified in combination when joint or seasonal uses occur.
- a. “Cropland” means lands used for the production of adapted crops for harvest, alone or in a rotation with grasses and legumes, and includes row crops, small-grain crops, hay crops, nursery crops, orchard crops, and other similar specialty crops.
  - b. “Pastureland” is land used primarily for the long-term production of adapted, domesticated forage plants to be grazed by livestock or occasionally cut and cured for livestock feed.
  - c. “Grazingland” includes rangelands and forestlands where the indigenous native vegetation is actively managed for grazing, browsing, occasional hay production and occasional use by wildlife. (W.S. § 35-11-103(e)(xxvii))
  - d. “Forestry” means land used or managed for the long-term production of wood, fiber, or wood-derived products.
  - e. “Residential” includes single and multiple-family housing, mobile-home parks, and other residential lodgings.
  - f. “Industrial commercial” is lands used for:
    - i. Extraction or transformation of materials for fabrication of products or long-term storage of products. This includes such short-term uses as petroleum refining and oil and gas production.
    - ii. Retail or trade of goods or services, including hotels, motels, stores, restaurants, and other commercial establishments.
  - g. “Recreational” is lands used for public or private leisure activities, including developed recreational facilities such as parks, camps, and amusement areas, as

well as areas for less intensive uses such as hiking, canoeing, and other undeveloped recreational uses.

- h. “Fish and wildlife habitat” means land dedicated wholly or partially to the production, protection, or management of species of fish or wildlife. (W.S. § 35-11-103(e)(xxvi))
  - i. “Developed water resources” includes lands used for storing water for beneficial uses such as stock ponds, irrigation, fire protection, flood control, and water supply.
12. “License Area” means, with respect to an In Situ Research and Development Testing License, an area described in the license application within which all affected land and water is contained. LQD Chapter 11. Unless specifically designated otherwise, the term license area refers to the area covered by an R&D license and not the license to mine or the NRC license.
  13. “License to Mine for Minerals” means the certification from the administrator that the licensee has the right to conduct mining operations on the subject lands in compliance with the Act; for which a valid permit exist; that he has deposited a bond conditioned on his faithful fulfillment of the requirements thereof; and that upon investigation the administrator has determined the licensed mining operation is with the purposes of the Act. W.S. § 35-11-103(e)(xiii).
  14. “Monitor Well” means a well constructed or utilized to measure static water levels and/or to obtain liquid, solid or gaseous analytical samples or other physical data that would be used for controlling the operation or to indicate potential circumstances that could affect the environment. (Chapter 1,Section 2(aj))
  15. “Potentiometric Surface” is the surface that coincides with the static level of water in an aquifer. The surface is represented by the levels to which water from a given aquifer will rise under its full head. (Chapter 1,Section 2(aq))
  16. “Production Zone” means the geologic interval into which recovery fluids are to be injected or extracted. W.S. §35-11-103(f)(v).
  17. “Production Zone” means the geologic units within which the production zones are contained. LQD R&R Chapter 11.
  18. “Reclamation” includes groundwater restoration. W.S. § 35-11.103(f)(vi)
  19. “Recovery Fluid” means any material which flows or moves, whether semisolid, liquid, sludge, gas or other form or state, used to dissolve, leach, gasify or extract a mineral. W.S. §35-11-103(f)(vii)
  20. “Responsible Corporate Officer” means:
    - a. A president, secretary, treasurer, or vice president of the corporation in charge of a principal business functions, or any other person who performs policy or decision-making functions for the corporation, or

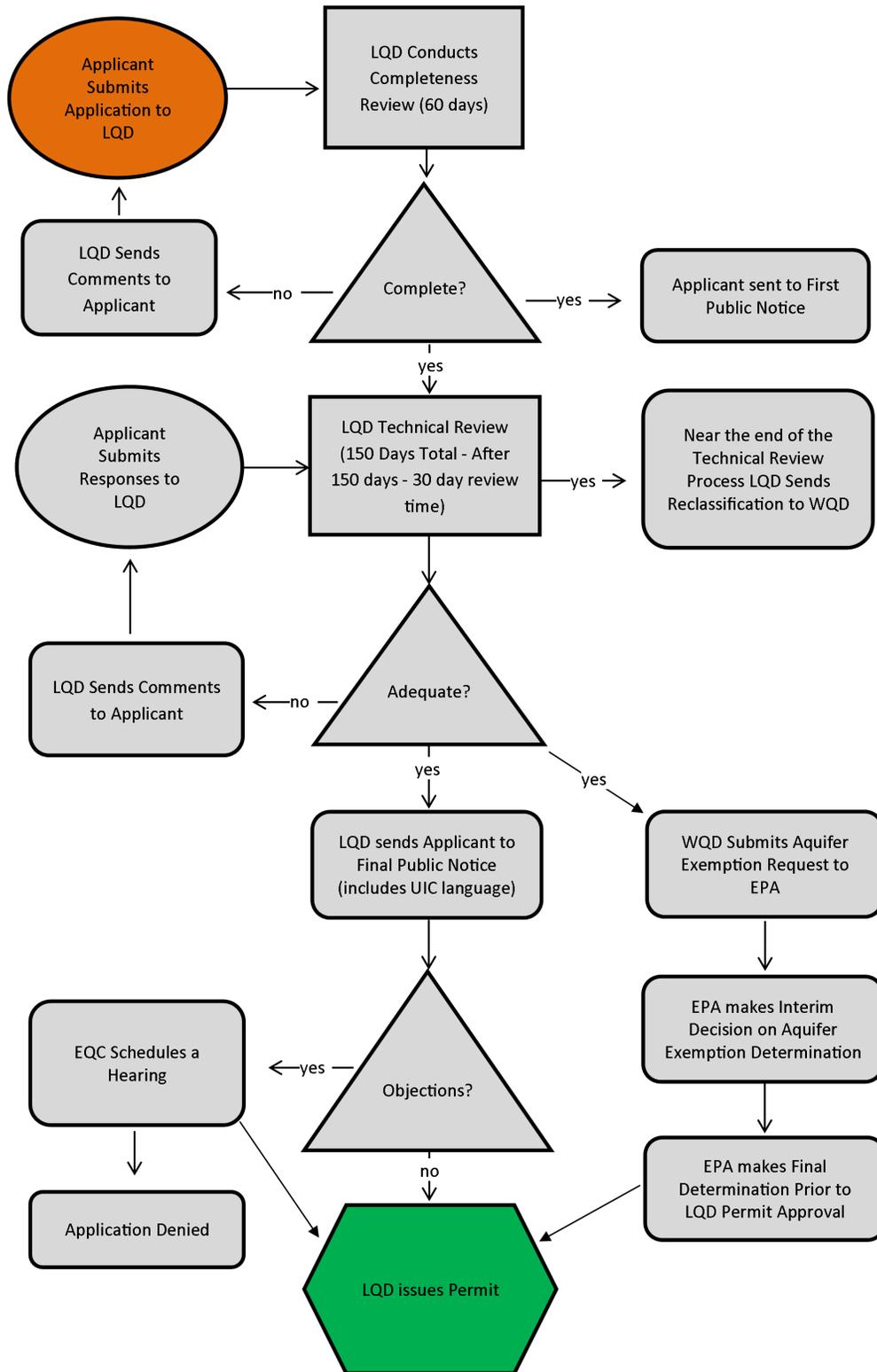
- b. The manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures, or
  - c. In the case of a partnership or a sole proprietorship, by a general partner or the proprietor, respectively. LQD R&R Chapter 11.
21. “Reverse Osmosis” or RO is a water filtration method that uses a pressurized system and membrane to trap many types of ions and molecules.

## 22. Roads

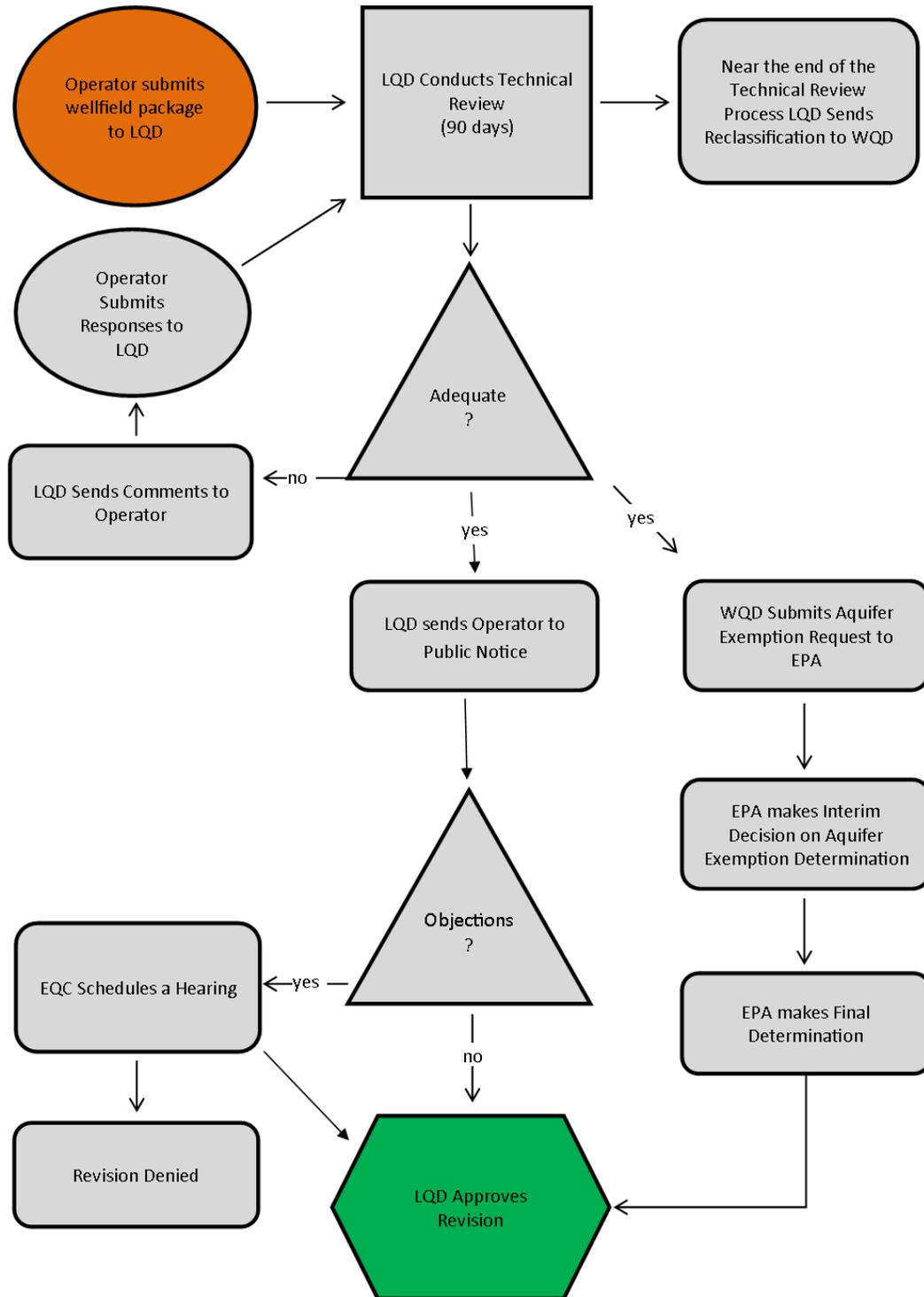
- a. Primary Access Road - means a road constructed (topsoil salvage, culverts, etc.) at an ISL facility that may necessitate cut and fill with gravel surfacing, or other material, and is constructed for long-term use. These roads are typically used for routine access to the main facility areas including office areas, satellite facilities and include all haul roads as defined in Chapter 1, Section. 2(ax)(i).
  - b. Secondary Access Road - means a road constructed (topsoil salvage, culverts, etc.) at an ISL facility that provides access to wellfield headerhouses with limited cut and fill construction. These roads are used for long-term traffic. They may be surfaced with aggregate or other appropriate material.
  - c. Temporary Wellfield Access Road - means a road used at an ISL facility for temporary access to drilling sites, wellfields in development, or ancillary areas assisting wellfield development. These roads are temporary in nature (generally in use 2-6 months) and consist of designated two track trails where the land surface is not typically modified to accommodate the road. If blading or surfacing of these types of roads becomes necessary, they shall no longer be deemed temporary. Such roads must meet the construction and other requirements of a primary or secondary access road.
  - d. Well Access Roads (i.e., used to access production, injection, and monitor wells within the monitor ring or wellfield pattern area) - means roads used at an ISL facility for access to wells within the wellfield. These roads are used for limited travel and consist of designated two-track trails where the land surface is not modified to accommodate the road. They are used until they are no longer needed to access the desired location within the wellfield. If blading or surfacing of these roads becomes necessary, they shall no longer be deemed a well access road and be required to meet the construction requirements of a primary or secondary access road.
23. Spill - also known as a release. “Release” includes, but is not limited to, any sudden spilling, leaking, pumping, pouring, emptying, emitting, discharging, dumping, addition of, escaping, leaching, or unauthorized disposal of any oil or hazardous substance which enters, or threatens to enter, waters of the state. WQD R&R Chapter 4, Section 3(d).

24. "State Decision Document" serves as a summary of, or reference to, all terms and conditions within an approved in situ mining permit application, an approved Research and Development Testing License application, or an approved application to revise a permit or Research and Development Testing License. This document is compiled by the Administrator and provides a summary of, or reference to, all UIC related terms and conditions, compliance provisions, and monitoring requirements included in the permit or Research and Development Testing License. LQD R&R Chapter 11. The format for a State Decision Document (SDD) can be found in Reference Document 1, General Information, Attachment VIII.
25. "UCL or Upper Control Limit" means a value greater than the maximum value  $c$  of a chemical or physical parameter that can be attributed to natural fluctuations and analytical variability. UCL parameters and amounts are determined from baseline sampling and agreed upon by the administrator and the operator prior to initiation of mining. UCLs are used to determine when there is movement of recovery fluid out of authorized areas or unapproved changes to a chemical or physical parameter. For certain parameters, such as pH, a UCL may be defined as an acceptable range of values. LQD Chapter 11.
26. "Waters of the state" means all surface and groundwater, including waters associated with wetlands, within Wyoming. W.S. §35-11-103(c)(vi).
27. "Wellfields"
  - a. "Wellfield Area" means the surface area overlying the injection and recovery zones. This area may be all or a portion of the entire area proposed for the injection and production of recovery fluid throughout the life of the mine. LQD Chapter 11 interprets this to include everything within and including the monitor well ring.
  - b. "Wellfield Pattern Area - means the area within the wellfield that contains the wellfield patterns of injection and production wells, headerhouses, and associated pipelines and buried electrical lines. The wellfield pattern area does not extend out to the monitor well ring.

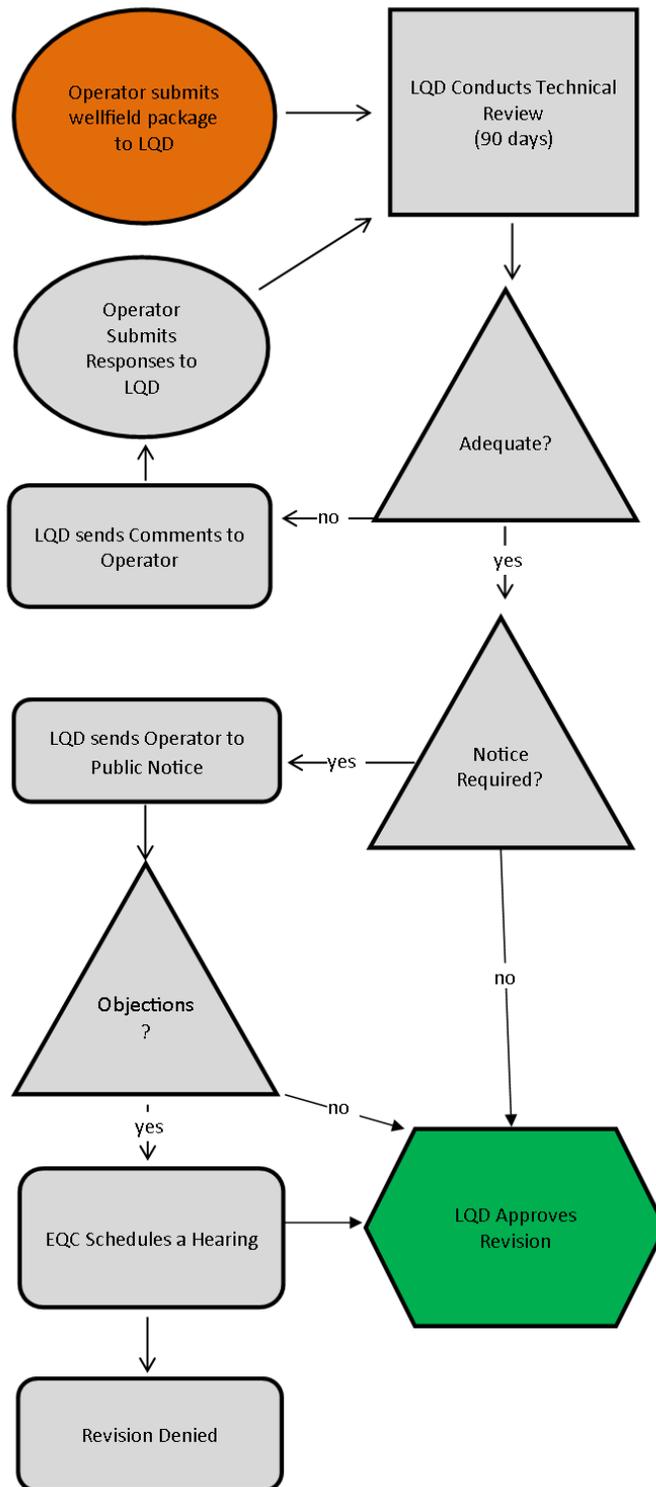
## Attachment II: Permit Application Review Process Flowchart



# Wellfield Package that *does* Enlarging to Aquifer Exemption Boundary Review Process Flowchart



# Wellfield Package that *Does Not* Enlarge Aquifer Exemption Boundary Review Process Flowchart



## **Attachment III: Permit Application Format and Organization Checklist**

### **Introduction/Format**

A single application (consisting of 2 copies, 3 copies if BLM surface or mineral) (note: for operations in District I, the number of copies are 1 and 2 respectively) for a permit to mine or a research and development testing license should be submitted to the Administrator of the Land Quality Division. It should consist of five sections as described below. The administrator requires the format and order of all applications follow this guideline to promote consistency and efficiency of staff review.

The first section of the application is the adjudication file, containing the "Permit to Mine" and "License to Mine" forms, bonds, notification, receipts, consent forms, and Appendices A through C. Items in Section II, A through H of the adjudication file section should be submitted in a loose form and not be bound. This information will be placed in the File-1-Of. The File -1-Of is the first file folder that LQD maintains in their file cabinets for the permit. The remaining items of the adjudication section should be submitted as discussed in the next paragraph.

The second section of the application contains baseline supporting information. The third through fifth sections are the aquifer exemption, mine or operations plan and the reclamation plan, respectively. Information for these sections should be submitted as follows:

- In loose leaf 3 ring binders to allow easy substitution of pages for revisions or additions.
- The binders should be no larger than 4 inches thick.
- The text should be printed on 8.5 x 11 inch paper with standard margins and unique page numbers on all pages.
- The pages should also include the submittal or revision date. The paper should be about 20 pound weight or better.
- All figures and tables larger than 8.5 x 11 inch paper should be folded to fit into the application and should be physically attached to the appropriate location in the application or folded into a labeled map pocket.
- All figures and tables should be numbered and referenced in the text.
- In addition to the hard copy, the applicant shall submit water-quality and water-quantity data in an electronic format.

The applicant is strongly encouraged not to repeat information from different parts of the application with the exception of Appendix C. For example, Appendix D-5 will contain a thorough discussion of the geology and ore body. The mine operations plan requires a description of the ore body that is going to be mined. The applicant should not repeat the entire discussion in D-5 in the mine operations plan. A summary and reference to D-5 will suffice

along with any additional detail not included in D-5 that specifically addresses the ore body to be mined.

Each 3-ring binder should have its own table of contents for that volume. Volume 1 should contain a master table of contents that covers the entire application. Each binder or volume should be clearly labeled and include the sections of the application included in that volume. (i.e., Nuclear Power, Inc. Bright Lights Project, Big County, Wyoming , Volume 3, Appendix D-6 through Appendix D-11) This information should be placed on the front of the binder and on the spine.

The Land Quality Division will be the primary reviewing agency for WDEQ. The Water Quality Division will review specific portions of the application to reclassify the groundwater near the end of the LQD Technical Review. A single permit or license will be granted by the department upon the recommendation of the LQD administrator. The application should contain a section devoted to the information required to support the aquifer reclassification. Near the end of the Technical Review process, LQD will forward the section to WQD. WQD will review this information only to the extent to allow the classification of the groundwater. When the application is deemed technically adequate, the LQD informs the operator to initiate final public notice. This notice will also contain the necessary information for the aquifer exemption. When the LQD declares the application to be technically adequate, the WQD will forward this section/package to the U.S. EPA with a request for an aquifer exemption. The U.S. EPA will issue an interim decision within 45 days. If there are no objections to the LQD public notice process, the U.S. EPA interim decision becomes final. If there are objections, the U.S. EPA will await resolution of the objections before deciding if the interim decision requires modification. Additional information concerning the aquifer exemption can be found in Reference Document 7.

## **Organization**

The following is a listing of the major headings for the application. It is not meant to be all inclusive but to give the applicant guidance of the content and the preferred order of the application. It is anticipated that appropriate subheadings will be added by the applicant to address all the items discussed in this guideline.

**File-1-Of:** The following adjudication materials shall be submitted in a loose format in the following order: (the applicant may wish to place a second copy of all but number 3 in the 3-ring binders with the rest of the application).

1. Form 1 UIC
2. Form 3
3. Proof of Publication (to be filed later once notified by LQD to commence the public notice process)
4. Bond Instrument (to be filed once dollar amount is set by LQD)
5. Appendix C Legal Land Description of Proposed Permit Area

6. Surface Owner Consent.

**Three-Ring Binders.** The other application materials are submitted in a 3-ring binder. Avoid placing too much material in a binder such that it will not close properly. This creates a potential for pages to come loose and be misplaced or lost. The binders should be no more than 4 inches thick.

Note: this is not a table of contents of the guideline but a suggested outline of the permit document.

## Part I Adjudication

- Forms and Information Submitted In Loose Form**
  - Form 1 UIC
  - Form 3
  - Permit Fees
  - Proof of Publication (to be filed later once notified by LQD to commence the public notice process). Original in file folder File-1-Of. If requested, a copy is inserted in the volume.).
  - Reclamation Bond Instrument (to be filed once dollar amount is set by LQD)
  - Appendix C Legal Land Description of Proposed Permit Area
- Appendices Submitted in 3-Ring Binders**
  - Certification page required by LQD R&R Chapter 11
  - Appendix A (owners within permit area)
  - Appendix B (owners within ½ mile)
  - Appendix C (duplicate of what is in File-1-Of)
  - Surface Owner Consent
  - Appendix E (General site information including regional geography)
  - Other permits or approvals (Only a table is required)
  - Hazardous Waste Management program under RCRA;
  - UIC program under the Safe Drinking Water Act (as it pertains to wells other than Class III wells);
  - WYPDES program under the Clean Water Act (CWA);

- Prevention of Significant Deterioration (PSD) program under the Clean Air Act (CAA);
- Nonattainment program under the CAA;
- National Emission Standards for Hazardous Pollutants preconstruction approval under the CAA;
- Dredge and fill permits under Section 404 of the CWA;
- U.S. Nuclear Regulatory Commission Source Material License;
- State Engineer permits;
- Documentation of County Zoning Compliance; or
- Other relevant environmental permits, including state permits.

## **Part II Baseline**

- Appendix D-1 History and Land Use**
- Appendix D-3 Cultural and Paleontological Resources.**
- Appendix D-4 Climatology**
  - Annual precipitation
  - Average wind speed
  - Temperature
  - Other
- Appendix D-5 Hydrogeology**
  - Regional setting
  - Regional geology
  - General geologic setting
  - Regional geologic map and cross section(s)
  - Regional hydrostratigraphy
  - Regional structural Geology
  - Regional Surficial Geology
  - Regional hydrogeology

- Regional potentiometric surfaces
- Regional groundwater recharge and discharge
- Regional hydraulic connection of aquifers
- Regional water quality
- Permit Area Hydrogeology
- Site geology
- Site geology and hydrostratigraphy
- Isopach maps
- Cross sections
- Site structural geology
- Ore and rock mineralogy and geochemistry
- Site hydrogeology
- Potentiometric surfaces
- Site groundwater recharge and discharge
- Site-specific groundwater and surface water interactions
- Hydraulic properties of the aquifer(s) and aquitard(s)
- Wells and drill holes within and adjacent to the permit
- Wells
- Drill holes and abandoned wells
- Site water quality
- Monitoring network and parameters
- Methods
- Sampling results (field and laboratory)
- Statistical analysis and water-quality relationships and trends
- Premining Groundwater Classifications
- QA/QC procedures
- General mine unit hydrogeology

- Seismology (Note: although this is a requirement of NRC it logically goes here. The applicant has the option of including this information in D5.)
- Appendix D-6 Surface Hydrology**
  - Regional surface hydrology description
  - Local surface hydrology permit area description
  - Watershed and stream channel characterization
  - Water quantity measurements
  - Baseline water quality
  - Surface water rights
  - Surface water and groundwater interactions
  - Potential for erosion and flood damage to facilities
  - Erosion Control Measures
- Appendix D-7 Soils**
  - Permit area order 3 survey
  - Affected area order 1-2 survey
- Appendix D-8 Vegetation**
  - Introduction
  - Methods
  - Mapping of plant communities
  - Cover sampling discussion/details
  - Selection and Sampling REFAs and/or EXREFAs
  - Species list
  - Data for Cropland or Hayland
  - Cover sampling discussion/details
  - Threatened and endangered species
  - Results and discussion
  - Literature cited

- Raw Data
- Appendix D-9 Wildlife**
  - Introduction
  - Documentation of WG&F and USFWS consultation
  - Habitat
  - Species list
  - Sage Grouse
  - Survey Methods and results
- Appendix D-10 Wetlands Habitat**
  - Wetlands delineation
  - Comparison to proposed disturbances
  - Mitigation information
  - Army Corps of Engineers documentation
- Appendix D-11 Background Radiological Surveys**
  - Gamma survey of all lands required by W.S. § 35-11-428(b)(i).
  - Summary of NRC required survey.

### **Part III Aquifer Reclassification/Exemption and Assessment of Impacts**

All permit applications must contain a section concerning the Aquifer Exemption (see LQD R&R Chapter 11). All proposed wellfields must be included in the request. The information below gives a summary of the required information. A more detailed discussion can be found in Reference Document 7, Aquifer Reclassification Exemption.

- Exemption Justification and Documentation**
  - Geographic extent of aquifer to be reclassified/exempted
  - Aquifer properties
  - Name of formation and aquifers
  - Elevation of each aquifer
  - Average thickness and range for each aquifer

- Confining units above and below
- Hydraulic properties of the aquifers
- Geologic properties
- Regional geology
- Site geology
- Premining groundwater classification
- Current use information
- Ambient groundwater data
- Commercial Productivity of the ore deposit
- Amenability to mining
- Description of mineralized zone
- Process description
- Assessment of Impacts**
  - Include consumptive use amounts
  - 5-foot drawdown maps for all affected aquifers
  - Assessment of impacts to specific resources such as wells, ponds, wetlands, etc.
  - Potential impacts to offsite groundwater
  - Steps to mitigate potential impacts.

#### **Part IV Mine Operations Plan**

- Introduction**
- Site Description, Facilities Layout and maps**
  - Facilities - detailed plan with map including access
  - Central processing and satellite plants
  - Other Buildings
  - Fencing and access control
  - Chemical Storage Facilities

- Process- related chemicals
- Nonprocess-related chemicals
- Design throughput and production
- Roads:
  - description including existing, constructed, upgraded, and nonconstructed
  - location and classification,
  - culvert location and size
- Stream crossing details.
- Proposed wellfields, including monitor well ring located on a map.
- Utility corridors
  - both existing and proposed
- Powerline raptor protection
- Proposed pipeline locations
- Deep disposal wells.
- Well construction details
- Monitoring and instrumentation
- Reporting requirements
- Ponds
- Location map
- Evapotranspiration
- Plan view and cross section
- Design details
- Liner systems
- leak detection details
- QA/QC procedures during construction
- Wildlife mitigation measures

- Documentation of SEO approval
- Drainage Plan
- Topsoil Salvage and Protection Plan and Temporary Stabilization/Seeding Plan**
  - Soil management plan
  - Protection from excessive compaction
  - During facilities construction
  - During road construction
  - Stockpile design, capacity, protection and locations
  - Protection during wellfield delineation and construction
  - Pipeline installation
  - Designated travel corridors, colocation of pipelines, and utilities
  - Access during wellfield development
  - Protection during wellfield operations
  - Map of areas to be salvaged, disturbed but not salvaged
  - Erosion/sedimentation control measures
  - Procedures to protect topsoil and subsoil
  - Estimated volume to be salvaged and stockpiled
  - Temporary stabilization/seeding of disturbed areas
  - Areas to be seeded
  - Temporary seed mix
  - Seed bed preparation
  - Planting methods and equipment
  - If mulch will be used
  - WQD storm water BMPs (not the whole permit)
- Description of Mining**
  - Production zone description,

- Recovery fluids or lixiviant description
- Chemistry of mining
- Development and delineation drilling
- Wellfield Design and Construction**
  - Wellfield Design
  - Typical Pattern(s) layout and dimensions,
  - Monitor well network and Map
  - Monitor well completion/screened interval
  - Modeling method for determining monitor well spacing
  - Trend wells
  - Hydraulic communication
  - Special hydrogeologic features
  - Map of monitoring network
  - Upper Control Limits calculation methods
  - Headerhouse design
  - Fluid control methods
  - Spill detection methods
  - Monitoring systems
  - Alarm systems
  - Topsoil salvage and protection during construction
  - Cross section and plan view during typical well installation
  - Cross section and plan view during typical pipeline installation
  - Well Installation and Completion
  - Completion details for all monitor wells
  - Typical completion details for injection and production wells
  - Well development

- Mechanical Integrity Testing details
- Well Corrective Action Plan
- Notice of completion of construction
- Wellfield Package Information**
  - Conceptual wellfield package information
- Wellfield Integrity**
  - Fracture and fluid pressure
  - Procedures to assure installation of wells will not result in hydraulic communication.
  - Describe procedures to verify communication with monitor wells
  - Excursion verification, reporting and corrective action
  - Wellfield leak detection and instrumentation
  - Wellfield monitoring during mining and excursions
  - Introduction
  - Required statutory language
  - Frequency of monitoring
  - Parameters to be monitored
- Wellfield Method of Operation**
  - Mining schedule
  - Injection rate and pressure
  - Operational Control of injection fluids
  - Water balance
  - Production only
  - Concurrent production and restoration
  - Restoration only
  - Plant make up water
  - Definition of completion of mining

- Excursion Response**
  - Corrective actions plan
  - Reporting procedures
  - Excursion control actions
- Well Maintenance, Repair and Abandonment**
  - Wells capped or covered
  - Wells marked
  - Area around well clear of brush and debris
  - Equipment serviced and maintained
  - MIT methods and schedule
  - Provide corrective action plan for MIT failure, and improperly sealed, completed and abandoned wells
  - Describe impermeable abandonment material
  - Casing cut off a minimum of two feet below ground surface
  - A permanent tag showing well number and other information affixed to top of plug.
- Wastewater Production and Disposal Capacity**
  - Type, (pump tests, monitor well purge water, plant waste streams, etc.) where produced, and quantity
  - Disposal locations and capacity
  - Deep disposal wells
  - Evaporation ponds
  - Land application
  - Surface Discharge
  - Other Methods approved by the Administrator
- Pond Inspections, Monitoring, Leak Detection and Control**
- Surface Spills and Leaks– Potential and Proposed Actions**

- Spill/release potential
- Spill/release prevention plan
- Proposed spill/release response
- Reporting commitments including cause, amount, Horizontal and vertical extent, location, etc.
- Clean-up standards
- Clean-up of not reportable spills/releases
- Other Wastes and Disposal All waste streams must be listed, identified and characterized.**
  - Water from pump tests
  - Other liquid wastes
  - Radiological contaminated liquid wastes
  - Hazardous wastes
  - Domestic liquid wastes
  - Solid Wastes
  - Type
  - Amount
  - Disposal
  - Radionuclide contaminated wastes
  - Nonradionuclide contaminated wastes
- Subsidence**
- Wildlife Monitoring and Mitigation Plan**
  - Big game
  - Sage grouse
  - Raptors
  - Migratory birds
  - Threatened and endangered species

- Drill Holes**
  - Cover all drill holes with in the permit area including geotech holes
  - Practices, procedures and techniques to abandon holes
  - Reporting commitments
- Confidential Information (W.S. 35-11-1101)**
- Summary and Table of Required Reporting**

#### **Part IV Restoration/Reclamation Plan**

- General Restoration/Reclamation Schedule**
  - Reclamation Schedule
  - List of proposed wellfields
  - Map of restoration sequence
  - Proposed time schedule
- Groundwater Restoration**
  - Introduction
  - Statement of best practicable technology (at permit approval)
  - On site research & development activities
  - Comparison to other ISL sites.
  - Target Restoration Values
  - How they are established
  - Required statutory language
  - Methodologies/process description and chemistry
  - Monitoring network during restoration
  - Restoration volumes and flow rates
  - Pore volume displacement estimate
  - Restoration pore volume displacements
  - Restoration flow rates

- Restoration fluid disposal
- Capacity of water/wastewater systems
- Stability plan
- Well selection
- Stability period
- Data evaluation
- Documentation of best practicable technology (post-restoration)
- Type of technology
- Application of technology
- Economics
- Demonstration of restoration success
- Evaluation of BPT
- Parameter by parameter water quality evaluation
- Potential impact on adjacent groundwater
- Modeling
- Summary
- Decontamination and Decommissioning Plan**
  - Disposal of buildings and facilities
  - Disposal of toxic materials
  - Pond decommissioning
  - Wellfield decommissioning
  - Soil decontamination
- Surface Reclamation**
  - Postmining land use
  - Process facilities and road reclamation
  - Deep disposal well surface facilities

- Contouring and final topography including drainage restoration
- Wildlife habitat
- Surface preparation
- Topsoil application, estimated volumes and replacement depths
- Revegetation practices
- Seed mixtures
- Reseeding methods
- Special areas
- Protection of newly seeded areas
- Erosion control practices during and after reclamation
- Weed control
- Evaluation of surface reclamation success
- Postreclamation and postmining environmental monitoring.
- Restoration/Reclamation Cost Estimate**

## **Attachment IV: Maps and Aerial Photographs**

### **I. Maps (Plates, Figures, Diagrams, etc.)**

#### **A. Title Block**

Title Block located in lower right hand corner with the following information as a minimum:

1. Applicant's name
2. Title of map.
3. Permit number if applicable.
4. Date map was drawn (or date of photography, if based from aerial photo).
5. Each date map was revised.
6. Map sheet page number, exhibit number, etc.
7. Scale and contour interval.
8. North arrow.

#### **B. Section, Township, and Range lines and numbers**

Must have an accurate delineation of Section, Township, and Range lines and numbers.

#### **C. Permit Boundary**

1. The permit boundary must be clearly outlined and identified on all maps.
2. Any amendment areas should be clearly differentiated from the original permit boundary and other amendment boundaries
3. At a minimum, amendment boundaries must be clearly identified on the Appendix C Mine Operations Plan and Restoration/Reclamation maps.
4. All permit and amendment boundaries should agree with the written legal description in Appendix "C" of adjudication files.

#### **D. Legend**

Legend clearly describing information on map (all symbols and lines identified).

#### **E. Map Location Key**

If only a portion of permit or amendment area is shown, a map location key showing area with respect to total permit or amendment area should be on map.

**F. Consecutive Map Sheets**

If more than one map sheet is used for a specific subject, each sheet should be numbered consecutively, 1 of 4, 2 of 4, etc.

**G. Reference to Other Information**

Reference on the map any enlarged view, cross sections, or more detailed information contained elsewhere

**H. Contours**

1. Contour intervals should normally not exceed ten (10) feet, but will depend on the nature of topography in the area.
2. Contour intervals must be the same for premining and postmining maps.
3. Distinct contour lines with contour elevations identified along the contour lines at a reasonable interval and frequency across the map.

**I. Map Clutter**

Map sheets should not include excessive information to the point of not being able to clearly depict the features presented. If necessary, additional map sheets should be included to separate information in a rational manner and to accommodate a reasonable map sizes.

**J. Map Scale**

1. Appendix A, B, C and E maps can be submitted at a scale of 1"=2000'.
2. All other maps must be at a scale of 1"=1000' or greater (e.g., 1"=500'). To show greater detail, scales maybe increased by even multiples of the original scale. For example, for a 1"=1000' scale map, detailed maps should be at 1"=200', 1"=400 and 1"=500'. To the extent possible the scales should be consistent (also be consistent with annual report maps)
3. Premine and postmine contour maps must be at the same scale and
4. Baseline vegetation and soils maps must be at the same scale.

**II. Aerial Photographs**

**A. Date**

Any aerial photographs should be current and show the date the photograph was taken.

**B. Edge Distortions**

Eliminate edge distortions on mosaics.

**C. Additional Information**

If used in place of a map, it should contain, at a minimum, all information required in items 1 -7 for maps (above).

## **Attachment V: Format for Submittal of Electronic Data**

In addition to the required paper copies, it is recommended that an electronic copy of the entire permit application and supporting documents be submitted to the LQD. Submittal of materials in both paper and electronic format will help expedite the review process. All electronic media will be stored in a secure cabinet in the Records Area in the Cheyenne LQD Office

The LQD has a specific data format that should be followed for certain types of data. For hydrologic monitoring data the following Uranium Mining Data Submission Spreadsheets are available on LQD's website: [http://deq.state.wy.us/lqd/Uranium\\_Data.htm](http://deq.state.wy.us/lqd/Uranium_Data.htm)

- Uranium Well Details (monitoring well location and completion information)
- Uranium Field Water-Quality Data (surface water and groundwater water-quality data collected in the field)
- Uranium Groundwater Level Data (groundwater elevation data relative to mean sea level)
- Uranium Lab Water-Quality Data (surface water and groundwater water-quality data analyzed in the laboratory)
- Uranium Surface Water Flow Data (streamflow data for surface water monitoring stations)
- Uranium Surface Water Station Details (surface water station location and equipment information)

LQD has developed a spreadsheet for reporting Notices of Completion of Construction (NOCC) for Class III wells, available on LQD's website

- Copy1 of Final Uranium Well Details 1 18 2011.xls

LQD also developed a spreadsheet for reporting mechanical integrity testing (MIT) data, available on LQD's website:

- MIT Reporting Data

Additional data that are requested in electronic format include:

- Geophysical Logs for Bore Holes
- Aquifer Pump Test Data
- Spatial data including permit area, key operational features, and monitoring sites
  - Data should be compatible with ArcGIS or CAD
  - Data submitted should be in an appropriate and recognized coordinate system. If alternate coordinate systems are used, operators should clearly identify the coordinate system used.

## **Attachment VI: LQD Permit Maintenance and Records Management**

### **I. Introduction**

This attachment outlines LQD's document and records management regarding in situ operations. In situ mining permits may consist of the original application; permit changes; monitoring and other records required to be submitted by the operator; and annual reports. Permit changes consist of new wellfield packages, permit text/commitment changes and permit amendments (the addition of new lands).

#### **A. Approved Permits**

Upon approval, the permit binders are placed in the LQD document area. General correspondence is kept in file cabinets organized by the permit number.

#### **B. Permit Changes**

Changes submitted by an operator are assigned a Temporary File Number (TFN). TFN documents are located in the LQD document area organized by LQD District but separate from the approved permits. Correspondence regarding TFN's is maintained in a file cabinet organized by the TFN. The significance of the change will dictate if public notice and opportunity for comment is required.

##### **1. Permit text/commitment changes.**

Once approved, the new permit text is placed into the permit document and superseded material is placed in a "Change Volume" along with an index sheet provided by the operator which outlines which pages, tables, figures or maps which have been replaced. The Change Volume may also contain pertinent correspondence.

##### **2. Wellfield Packages**

Wellfield packages are submitted in stand-alone binders containing the necessary information outlined in this Guideline. Wellfield packages are processed as a permit change as outlined above. Wellfield packages may or may not require public notice. Once approved, the binder containing the wellfield package is placed on the shelf next to the approved permit. Some wellfield packages such as a new wellfield not identified in the approved permit, will also change text, maps and figures in the original permit. This additional information will be processed (reviewed and approved) with the wellfield package but will be incorporated into the permit document upon approval. An index sheet outlining the changes will be required similar to item 1 above.

##### **3. Permit Amendments**

When new lands are added to an approved permit, the change will be processed as a permit amendment. Amendments are processed similar to a new permit application. Preferably, the new information is incorporated into

the approved permit upon approval but circumstances may dictate that the amendment be kept as a stand-alone document.

**C. Monitoring Reports**

The LQD will maintain a volume(s) placed with the permit documents to house all required monitoring reports. Specialized reports such as wellfield releases and excursion reports will be housed in separate binders placed with the permit documents.

**D. Annual Reports**

Once LQD accepts an annual report it will be placed on the shelf with the permit document.

## **Attachment VII: Noncoal Statute and Rule and Regulation Citations for the In Situ Completeness Criteria**

### **I. Application Format and Organization - Addendum 3**

- A. Introduction and Format: W.S. § 35-11-427 and W.S. § 35-11-428(a); Chapter 2, Section 1(a); Chapter 11.**
- B. Number of copies: Chapter 11.**

### **II. Adjudication—Reference Document 2**

#### Section I – Loose Material

- A. Form 1-UIC: Application for Permit to Mine W.S. § 35-11-406(a)(i), (ii), (iii), (vi)(B), (vi)(C) and (vi)(D), (x) and (xi); W.S. § 35-11-428(a).**
- B. Form 3: License to Mine, W.S. § 35-11-410.**
- C. Permit Fees**
  - 1. New permits  
W.S. § 35-11-406(a)(xii).
  - 2. Amendments  
W.S. § 35-11-406(a)(xii).
  - 3. License to mine  
W.S. § 35-11-410(b)(vi).
- D. Proof of Publication/Notice W.S. § 35-11-406(j)**
- E. Reclamation Bond W.S. § 35-11-403(a)(ii); W.S. § 35-11-410(c); W.S. § 35-11-417.**
  - 1. Types  
W.S. §35-11-410(c); W.S. § 35-11-417; W.S. § 35-11-418
  - 2. Self Bonds Chapter 6, Sec. 2(a); Chapter 11.
  - 3. Individual Instructions  
W.S. §35-11-410(c); Chapter 6, Sec. 2(a).
- F. Appendix "C" W.S. § 35-11-406(a)(vi); W.S. § 35-11-428(a).**
  - 1. Legal Land Description
    - a. By Legal ¼ ¼ Section  
W.S. § 35-11-406(a)(vi)(A); W.S. § 35-11-428(a); Form 1 UIC, Section 3(c)(i); Form C-1.

- b. By bearing and distance/licensed surveyor  
W.S. § 35-11-406(a)(vi)(A); W.S. § 35-11-428(a); Form 1-UIC, Section 3(c)(i); Form C-2.
  - c. No Right to Mine  
W.S. § 35-11-406(a)(vi)(A); W.S. § 35-11-428(a); Form 1-UIC, Section 3(c)(ii).
  - d. Lands in other permits and Agreements  
W.S. § 35-11-406(a)(ix); W.S. § 35-11-428(a); Form 1-UIC, Section 3(c)(iii).
- 2. U.S. Geological Survey topographic map  
W.S. § 35-11-406(a)(viii)

**G. Surface Owner Consent**

- 1. Residential or agricultural land owner  
W.S. § 35-11-406(b)(xi).
- 2. Not covered by above statute  
W.S. § 35-11-410(b)(xii).
- 3. Near certain structures  
W.S. § 35-11-410(m)(viii)

**III. Section II – Material in 3-Ring Binders**

**A. Certification LQD R&R Chapter 11**

**B. Appendix "A" (For lands within the permit area) W.S. § 35-11-406(a)(iv); W.S. § 35-11-428(a).**

- 1. List of owners  
W.S. § 35-11-406(a)(iv); Chapter 11.
  - a. Surface rights  
W.S. § 35-11-406(a)(iv); Form 1-UIC, Section 3(a).
  - b. Mineral rights  
W.S. § 35-11-406(a)(iv); Form 1-UIC, Section 3(a).
- 2. Map(s) of above.  
W.S. § 35-11-406(a)(ix)(A); Form 1-UIC, Section 3.(b).

**C. Appendix "B" (For lands adjacent [within one-half mile] to the permit area)**

- 1. List of adjacent owners

W.S. § 35-11-406(a)(v) and (ix)(A)

a. Surface rights

W.S. § 35-11-406(a)(v) and (ix)(A); W.S. § 35-11-428(a); Chapter 2, Section 1(a) and (b); Form 1-UIC, Section 3(b)(i).

b. Other valid estate of record

W.S. § 35-11-406(a)(v); W.S. § 35-11-428(a);

2. Map(s) of above.

W.S. § 35-11-406(a)(v) and (ix)(A); W.S. § 35-11-428(a);

**D. Appendix C (Duplicate of II.C. above) Chapter 2, Section 1(a); Chapter 11.**

**E. Appendix "E", W.S. § 35-11-406(a)(viii) and (ix); Chapter 2, Section 2(a); Form 1-UIC, Section 3(e).**

1. U.S.G.S. Topographic map

W.S. § 35-11-406(a)(viii) and (b)(v); Form 1-UIC, Section 3(c)(iv).

a. Permit boundary

W.S. § 35-11-406(a)(vi); Chapter 2, Section 1(c); Form 1-UIC, Section 3(e).

b. Lands to be affected

W.S. § 35-11-406(a)(vi)(C) and (a)(ix); Chapter 11; Form 1-UIC, Section 3(e)(i).

c. Digital file of boundary

W.S. § 35-11-406(a)(vi)(A); W.S. § 35-11-428(a)

2. Additional information

W.S. § 35-11-406(a)(ix); Chapter 2, Section 1(c) and Section 2(a)(i).

a. Roads

W.S. § 35-11-406(a)(ix); Form 1-UIC, Section 3(e)(iii).

b. Drainage areas

W.S. § 35-11-406(a)(ix); Form 1-UIC, Section 3(e)(ii).

c. Adjudicated and owners of water rights

W.S. § 35-11-406(a)(vii); Chapter 11.

d. Well owners

W.S. § 35-11-406(a)(ix); Chapter 11; Form 1-UIC, Section 3.(e)(iii).

e. SEO well permits

W.S. § 35-11-406(a)(ix); Chapter 11.

- f. Building information  
W.S. § 35-11-406(a)(ix)(B); Form 1-UIC, Section 3(e)(vi).
- g. Other mining disturbances  
W.S. § 35-11-406(a)(ix); Form 1-UIC, Section 3(e)(iv).
- h. Boundaries of Special districts  
W.S. § 35-11-406(a)(ix)(D).
- i. Drill holes and monitor wells  
Chapter 11

**F. Listing of Other Permits or Construction Approvals, Chapter 11.**

- 1. RCRA, Chapter 11,
- 2. Non Class III UIC Wells, Chapter 11.
- 3. WYPDES, Chapter 11.
- 4. PSD under Clean Air Act, Chapter 11.
- 5. Nonattainment under CAA, Chapter 11.
- 6. CAA Hazardous Pollutants, Chapter 11.
- 7. Section 404 of CWA, Chapter 11.
- 8. NRC License, Chapter 11.
- 9. State Engineer Permits, Chapter 11.
- 10. County zoning compliance, Chapter 11.
- 11. Other, Chapter 11

**G. Appendix D, Environmental Baseline Data**

**H. Appendix "D-1" – History and Land Use.**

W.S. § 35-11-428(a)(i); W.S. § 35-11-428(a)(iii)(B); Chapter 2, Section 2(a)(i)(A).

**I. Appendix "D-3" – Cultural and Paleontological Resources.**

W.S. § 35-11-428(a)(iii)(B); Chapter 2, Section 2(a)(i)(A); Chapter 2, Section 2(a)(i)(J).

**J. Appendix "D-4" - Climatology.**

W.S. § 35-11-428(a)(i) , Chapter 11.

- 1. Temperature  
W.S. § 35-11-428(a)(i)
- 2. PrecipitationW.S.

§ 35-11-428(a)(i)

3. Wind

W.S. § 35-11-428(a)(i)

4. Other LQD recommended

5. NRC requirements

NRC Regulatory Guide 3.63

**K. Appendix "D-5"—Hydrogeology, W.S. § 35-11-428(a)(ii); Chapter 11.**

**IV. Reference Document 3, Hydrogeology**

**A. Introduction/Electronic Data, Chapter 2, Section 1(a); Chapter 11**

**B. Regional Setting**

1. Regional Geology

W.S. § 35-11-428(a)(ii); Chapter 11.

a. General Geologic Setting

b. Regional Geologic Map and Cross Sections

c. Regional Hydrostratigraphy

d. Regional Structural Geology

2. Regional Hydrogeology

Chapter 11.

a. Regional Potentiometric Surfaces

b. Regional Groundwater Recharge and Discharge

c. Regional Hydraulic Connection of Aquifers

3. Regional Water Quality

**C. Permit area hydrology**

1. Site Geology & Hydrostratigraphy Chapter 11.

2. Site Hydrogeology Chapter 11.

3. Wells and Drill Holes Chapter 11.

4. Site Water Quality Chapter 11.

**D. Reference Document 10 Premine Sampling**

Some of the sections do not have rules so they were not included

**V. Quality Assurance Program: Chapter 11.**

- A. Appendix "D-6" – Surface Water Hydrology. W.S. § 35-11-428(a); Chapter 11**
- B. Reference Document 5, Surface Water**
  - I. Introduction and Electronic Data Chapter 2, Section 1(a); Chapter 11.
  - II. Regional Surface Hydrology, W.S. § 35-11-406(a)(ix); W.S. § 35-11-428(a).
  - III. Local Surface Hydrology, W.S. § 35-11-406(a)(ix); W.S. § 35-11-428(a).
- C. Watershed and Stream Channel Characterization, W.S. § 35-11-406(a)(ix); W.S. § 35-11-428(a).**
  - 1. Watershed Network
  - 2. Watershed Delineation
  - 3. Stream Characterization
  - 4. Stream Morphology
  - 5. Potential Offsite Changes
- D. Water Quantity Measurements Chapter 11.**
  - 1. Monitoring station description
  - 2. Monitoring station maintenance
  - 3. Runoff Volume and Peak Flows
- E. Baseline Water Quality, Chapter 11.**
- F. Water Rights , W.S. § 35-11-428(a)(i); Chapter 11.**
  - 1. Within the permit
  - 2. Within one-half mile
- G. Surface Water and Groundwater Interactions, Chapter 11.**
- H. Potential for Erosion and Flood Damage to Facilities Chapter 2, Section 2(e).**
- I. Appendix "D-7" — Soil Assessment.**
  - W.S. § 35-11-406(b)(viii); W.S. § 35-11-428(a)(i); Chapter 11.
  - 1. Soils Survey
    - Chapter 11.

2. Salvage depths  
Chapter 11.

**J. Appendix "D-8" — Vegetation Inventory.**

W.S. § 35-11-406(b), W.S. § 35-11-428(a)(i), Chapter 11.

**K. Appendix "D-9" — Wildlife, W.S. § 35-11-406(a)(vii); Chapter 11.**

1. Consultation with WY Game and Fish and US Fish and Wildlife Chapter 2, Section 1(f)
2. Sage Grouse, Governor's Executive Order No. 2011-5 dated June 2, 2011.

**L. Appendix "D-10" — Wetlands Habitat.**

W.S. § 35-11-103(c)(x) through (xvi); W.S. § 35-11-308 through 311.

**M. Appendix "D-11" — Baseline Radiological Surveys, W.S. § 35-11-129(a)(i)**

**N. Aquifer Reclassification/Exemption Chapter 11.**

**VI. Mine (Operations) Plan**

**A. Introduction**

1. Required language W.S. § 35-11-429

**B. Site Description and Facilities Layout: W.S. § 35-11-406(b)(ii), (v) and (vii); W.S. § 35-11-428(a)(iii)(C), (D), (F) and (G).**

1. Description of Facilities:

W.S. §35-11-428(a)(iii)(C), Chapter 11, W.S. § 35-11-406(b)(ix) and (xiii), W.S. § 35-11-428(a)(ii)(C), (D).

2. Roads

W.S. § 35-11-406(b)(viii), (xiii) and (xv), W.S. § 35-11-428(a)(i) and (iii)(C) and (D), Chapter 11

3. Proposed wellfields

Chapter 11

4. Utility corridors

W.S. § 35-11-406(a)(ix)

5. Proposed pipeline locations

Chapter 11

6. Deep disposal wells

Chapter 11

7. Ponds  
Chapter 11
8. Drainage plan  
W.S. § 35-11-428(a)(iii)(D)

**C. Topsoil Salvage & Protection and Temporary Stabilization/Seeding Plan**

W.S. § 35-11-406(b)(viii), (xiv) and (xv), W.S. § 35-11-428(a)(i) and (iii)(C) and (D) Chapter 11

1. Best management plan
2. Estimated volume salvaged and stockpiled
3. Temporary Stabilization/seeding of disturbed areas
4. WQD Storm Water BMPs

**D. Description of Mining**

1. Description of the Ore Zone(s):  
W.S. § 35-11-428(a)(ii)(B); Chapter 11
2. Recovery fluids or lixiviant description  
Chapter 11
3. Chemistry of Mining:  
W.S. § 35-11-428(a)(ii)(B), Chapter 11.
4. Development and delineation drilling  
W.S. § 35-11-428(a)(iii)(A), Chapter 11

**E. Wellfield Design, and Construction: W.S. § 35-11-406(b); W.S. § 35-11-428(a)(iii)(A), (C) and (F); Chapter 11.**

1. Wellfield Design: 35-11-406(b);  
W.S. § 35-11-428(a)(iii)(A), (C) and (F); Chapter 11.
2. Headerhouse design  
W.S. § 35-11-428(a)(iii)(C), Chapter 11.
3. Topsoil salvage and protection during construction  
Chapter 11, W.S. § 35-11-406(b)(viii), (xiv) and (xv), W.S. § 35-11-428(a)(i) and (iii)(C) and (D), W.S. § 35-11-428(a)(iii)(C), (D) and(G).
4. Well installation and completion  
Chapter 11.
5. Notice of completion of construction

Chapter 11

**F. Wellfield Package Information, Chapter 11**

**G. Wellfield Integrity: W.S. § 35-11-428(a)(ii)(B), W.S. § 35-11-428(a)(iii)(A) and (F); Chapter 11.**

1. Fracture pressure, fluid pressure, and characteristics
2. Procedures to prevent hydraulic communication due to well installation  
W.S. § 35-11-428(a)(iii)(A), Chapter 11.
3. Monitor Well communication
4. Excursion verification
5. Wellfield leak detection
6. Wellfield monitoring

**H. Wellfield Methods of Operations: W.S. § 35-11-406(b), W.S. § 35-11-406(b)(xvi); W.S. § 35-11-428(a)(iii)(A), (C), (D), (F); Chapter 11.**

1. Mining schedule  
W.S. § 35-11-406(b); W.S. § 35-11-406(b)(xix); Chapter 11;
  - a. Proposed wellfields  
W.S. § 35-11-406(b)(xix); W.S. § 35-11-428(a)(iii)(C); Chapter 11.
  - b. Map showing sequence of mining  
W.S. § 35-11-406(b)(xix); W.S. § 35-11-428(a)(iii)(A), (C), (D), (F); Chapter 11.
  - c. Proposed time schedule  
W.S. § 35-11-406(b)(xix); W.S. § 35-11-428(a)(iii)(A), (C), (D), (F); Chapter 11.
  - d. 3.c.vi. Expected changes in pressures:  
Chapter 11.
  - e. Capacity of treatment systems correlated to mining and restoration schedules  
W.S. § 35-11-406(b)(xix); W.S. § 35-11-428(a)(iii)(A), (C), (D), (F); Chapter 11.
2. Injection rate and pressures:  
Chapter 11.
3. Operational Control of Injection Fluids.
  - a. Proposed injection procedure:

- b. Chapter 11.
- c. Electronic monitoring

Chapter 11

- 4. Water Balance Water balance calculations:

Chapter 11

- 5. Definition of Completion of Mining

Chapter 3, Section 3(k)

**I. Excursion response**

- 1. Corrective Action Plan

Chapter 11

- 2. Reporting Procedures

Chapter 11

- 3. Excursion Control Actions

Chapter 11

**J. Well Maintenance, Repair and Abandonment: W.S. § 35-11-406(b)(xiii); W.S. 35-11-428(a)(iii)(F); Chapter 11.**

- 1. Covered

Chapter 11.

- 2. Marked

Chapter 11.

- 3. Clear of debris

Chapter 11.

- 4. Monitoring equipment maintained

Chapter 11.

- 5. Mechanical Integrity Testing:

W.S. § 35-11-406(b)(ix); W.S. § 35-11-428(a)(iii)(F); Chapter 11.

- 6. Corrective Action Plan for MIT Failure and Repair and Abandonment of Wells:

W.S. § 35-11-406(b)(iv) and (ix); W.S. § 35-11-428(a)(iii)(A) and (F); Chapter 11.

**K. Wastewater production and disposal, Chapter 11**

- 1. Type

- 2. Disposal locations and capacity

- L. Pond Inspections, Monitoring, Leak Detection and control, Chapter 11**
- M. Surface spills and leaks – potential and proposed actions Chapter 11**
- N. Other Wastes and Disposal Chapter 3, Section 2(c)(v); Chapter 11**
  - 1. Other liquid wastes
  - 2. Solid Wastes
  - 3. Disposal
- O. Subsidence, Chapter 11**
- P. Wildlife Monitoring and Mitigation: W.S. § 35-11-406(b)(xiii), W.S. § 35-11-428(a)(i) and (a)(iii)(F); Chapter 11; Governor’s Executive Order No. 2011-5 dated June 2, 2011.**
- Q. Drill Holes, W.S. § 35-11- 404**
- R. Confidential Information, W.S. § 35-11- 1101(a); Chapter 11.**
- S. Summary and Table of Required Reporting: W.S. § 35-11-428(a)(iii)(F), W.S. § 35-11-430(b), Chapter 11.**

**VII. Restoration/Reclamation Plan**

- A. General Restoration/Reclamation Schedule: W.S. § 35-11-406(b)(xix), W.S. § 35-11-428(a)(iii)(B), (E), (G) and (H), Chapter 11.**
  - 1. Reclamation schedule
  - 2. List of proposed wellfields:  
Chapter 11.
  - 3. Map of restoration sequence:  
Chapter 11.
  - 4. Proposed time schedule:  
Chapter 11.
- B. Groundwater Restoration, W.S. § 35-11-428(a)(iii)(H); Chapter 11.**
  - 1. Introduction
  - 2. Statement of BPT
  - 3. Target Restoration Values
  - 4. Methodologies/process description and chemistry
  - 5. Monitoring network during restoration  
Chapter 11

6. Restoration volumes and flow rates
7. Capacity of water/wastewater systems:  
Chapter 11.
8. Stability plan
9. Documentation of best practicable technology (post-restoration)
10. Demonstration of restoration  
W.S. § 35-11-406(b)(xix); W.S. § 35-11-428(a)(iii)(B), (E), (G) and (H);  
Chapter 11.

**C. Decontamination and Decommissioning Plan W.S. § 35-11-406(b)(xix); W.S. § 35-11-428(a)(iii)(F); Chapter 11.**

1. Disposal of Buildings and facilities.  
W.S. § 35-11-406(b)(iv) and (xix), W.S. § 35-11-428(a)(iii)(G) and (H);  
Chapter 11.
2. Disposal of toxic materials
3. Pond decommissioning:  
W.S. § 35-11-406(b)(iv) and (ix) and (xi); W.S. § 35-11-428(a)(iii)(G) and (H);  
Chapter 11
4. Wellfield decommissioning:  
W.S. § 35-11-406(b)(iv) and (xix), W.S. § 35-11-428(a)(iii)(G), W.S. § 35-11-406(b)(iv) and (xix), xiii, Chapter 11.
5. Soil decontamination:  
W.S. § 35-11-406(b)(ix)(xiii) and (xix), W.S. § 35-11-406(b)(iv) and (xix), G,  
Chapter 11.

**D. Surface Reclamation: W.S. § 35-11-406(b)(i),(viii)(ix), (xv) and (xix), W.S. § 35-11-428(a)(iii)(G), Chapter 11.**

1. Postmining land use:  
W.S. § 35-11-406(b)(i), (ii), (iv), (viii) (ix), (xiii), (xiv) and (xix), W.S. § 35-11-428(a)(iii)(A) and (G), Chapter 11.
2. Process facilities and road reclamation:  
W.S. § 35-11-406(b)(i), (ii), (iv), (viii), W.S. § 35-11-428(a)(iii)(G), Chapter 11.
3. Deep disposal well surface facilities  
Chapter 11
4. Contouring and final topography including drainage restoration

W.S. § 35-11-406(b)(ii), (xiv) and (xv); W.S. § 35-11-428(a)(iii)(G), Chapter 11.

5. Wildlife habitat

Chapter 11

6. Surface preparation

Chapter 11

7. Topsoil application, estimated volumes and replacement depths:

W.S. § 35-11-406(b)(viii), W.S. § 35-11-428(a)(iii)(G), Chapter 11.

8. Revegetation practices:

W.S. § 35-11-406(b)(xv), W.S. § 35-11-428(a)(iii)(G), Chapter 11.

a. Seed mixtures:

W.S. § 35-11-428(a)(iii)(G), Chapter 11.

b. Reseeding methods:

W.S. § 35-11-428(a)(iii)(G), Chapter 11.

c. Special areas

Chapter 11

d. Protection of newly seeded areas:

W.S. § 35-11-428(a)(iii)(G), Chapter 11.

9. Erosion control practices during and after reclamation

W.S. § 35-11-406(b)(ii), (viii), (xiii) – (xv); W.S. § 35-11-428(a)(iii) (E) and (G), Chapter 11.

10. Weed control

Chapter 3, Section 2(d)(ix)

11. Evaluation of surface reclamation success:

Chapter 11.

12. Postreclamation and postmining environmental monitoring

Chapter 11

**E. Restoration/Reclamation Cost Estimate: W.S. § 35-11-428(a)(iii)(J), Chapter 11.**

1. Cost of Removing Buildings:

W.S. § 35-11-428(a)(iii)(J), Chapter 11.

2. Costs of topsoiling and reseeding:

W.S. § 35-11-428(a)(iii)(J), Chapter 11.

3. Costs of groundwater restoration:  
W.S. § 35-11-428(a)(iii)(J), Chapter 11
4. Cost of capping, plugging and sealing of all wells:  
W.S. § 35-11-428(a)(iii)(J), Chapter 11.
5. Costs of personnel:  
W.S. § 35-11-428(a)(iii)(J), Chapter 11.

## **VIII. Mine Wellfield Package**

### **A. Wellfield Data Package: W.S. § 35-11-428(a)(iii), Chapter 11.**

1. Aquifer test/communication perimeter monitor wells  
W.S. § 35-11-428(a)(iii), Chapter 11.
2. Potentiometric Maps  
W.S. § 35-11-428(a)(iii), Chapter 11.
3. Water quality. Upper and lower aquifers and ACLs  
W.S. § 35-11-428(a)(iii), Chapter 11.
4. Monitor well maps and construction details  
W.S. § 35-11-428(a)(iii), Chapter 11.
5. Ave. Production unit baseline water quality  
W.S. § 35-11-428(a)(iii), Chapter 11.
6. Proposed Target Restoration Values  
W.S. § 35-11-428(a)(iii), Chapter 11
7. Map showing area impacted by mining

## **Attachment VIII: State Decision Document (SDD) Format**

A State Decision Document (SDD) is required by LQD Rules and Regulations Chapter 11 . As stated in this rule, an SDD serves as a summary of, or reference to, all terms and conditions within an approved in situ mining permit application. The document is compiled by the LQD permit coordinator and signed by the Administrator. It provides a summary and documentation of all UIC-related terms and conditions, compliance provisions, and monitoring requirements included in the permit. It is a requirement that each section of the SDD includes a reference or references to specific discussions, tables, figures, or maps of the permit. Each section should begin with an affirmative statement that the application contains the required material and the material has been found to be satisfactory. If the reviewer cannot make the affirmative statement, then a special condition may be necessary.

If special conditions are proposed to be attached to the approval of the permit they should be discussed in detail (why a condition is necessary, what information or action is required, time or deadlines involved, and wording of the condition) in the appropriate section of the SDD. All special conditions will be consolidated at the end of the SDD and added to the Form 1-UIC.

A draft SDD will be sent to the applicant along with the notice to proceed to final public notice. The applicant will have an opportunity to respond the special conditions before permit approval. Note that this response is limited to correcting any errors in the condition or directing the division to the appropriate location in the permit of the required information. The applicant **CANNOT** revise any material in the application once public notice has been initiated. Ideally, the fact that a special condition is proposed to be attached to the permit should not come as a surprise to the applicant since the condition should be based on unresolved review comments.

### **I. Description of the Operation**

#### **A. General Information**

This section gives a general location of the permit area along with the total number of acres to be permitted and the acreage that will be disturbed. Other information includes the number of wellfields, satellite plants, disposal wells, and any other significant feature of the permit.

This section can also include a brief history of the site as it relates to past exploration or mining activities

#### **B. Confidential Information**

Include a discussion if any confidential information has been accepted as part of the application. Only list the topic but not details of the information.

## **II. Adjudication**

### **A. General**

This section is devoted to the information required in the adjudication section of the permit. There should be specific mention of the necessary forms such as Form 1-UIC, and Form 3. Other important items include Surface and Mineral Ownership and Surface Owner Consent. The SDD should identify the location of the information whether in the adjudication file or the specific volume of the permit document.

### **B. Reclamation Performance Bond**

There should be specific discussion of the reclamation performance bond as it is the guarantee to the state that money to remediate environmental impacts to the lands and waters of the state will be. The type and amount of bond should be documented. In most cases this information may not be available until during the public notice process when the applicant finalizes the bond instrument. Some operations may have several bond instruments and if so, each should be addressed separately. Who is the payee on the bond should be noted. Some bonds may be payable to both the state and the federal government.

## **III. Baseline Information**

### **A. Premine Land Use**

The volume and section in the permit containing a discussion of the premine land use should be noted. There should be a short discussion of the major premine use(s) and a reference to a map or figure in the permit where the land uses are shown.

### **B. Cultural Resources**

Important aspects of the Cultural Resources section are consultation and concurrence from the State Historic Preservation Office (SHPO), and if applicable, the federal land managing agency. The location of letters granting concurrence should be identified. There should also be a summary of the number of sites found and those recommended eligible for listing on the National Register. It is also important to discuss any required mitigation or actions required to avoid any sites.

**C. Climate**

This section only requires a brief reference to where the meteorology section is located in the permit. Any unique items such as what meteorology station is being used for the permit should also be mentioned.

**D. Soils**

Important discussion items include location of the soil descriptions, soil maps and the average soil salvage depths.

**E. Vegetation**

Besides the reference to the location in the permit, the major plant communities should be noted along with any prohibited and restricted noxious or designated weeds. The degree of infestation should be noted especially if a species such as cheatgrass comprises a significant portion of the permit area.

**F. Wildlife**

Documentation of consultation with the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service must be noted along with a reference to the location of their letters of concurrence is required. The location of the survey in the permit must be given. Special mention of any threatened, endangered, proposed, candidate, or petitioned species or the lack of should be made. The discussion should state whether or not any designated critical or crucial habitats occur in the area. Also important are any mitigation requirements either during or after mining are required.

**G. Wetlands**

This section should document that a wetlands survey was conducted and was deemed adequate. The number of acres of wetlands within the permit area should be stated along with how many acres fall within the proposed affected areas. The documentation must include consultation with the U.S. Army Corps of Engineers and their letter designating the wetlands and any required mitigation. If mitigation is required, the SDD discussion should reference where in the permit the mitigation plans are found and that the proposed plans were deemed adequate.

**H. Radiological Description**

This includes a brief statement that the required surveys were completed, that the surveys were adequate and where the reference to the survey is located within the permit.

## **I. Surface Water Hydrology**

Besides identifying the location of this material in the permit, this section should include a summary of significant streams and waterbodies located within and near the permit boundary. The discussion should mention if any waterbodies will be physically disturbed or otherwise impacted by the mining operations.

## **J. Hydrogeology**

### **1. Description of the Mineral Zone**

A summary of the mineralogy described in the permit should be given along with average grades of the various mining zones.

### **2. Groundwater Hydrology**

This section must include a summary of the major aquifers in the area, including overlying and underlying aquifers and confining units and a description of the ore zone(s). It should also note if any of the ore zone sands are absent in parts of the permit area. Similarly, the discussion should include if any of the confining units thin or disappear across the permit area.

### **3. Aquifer to Be Mined**

This section should more fully describe the following topics:

- a. Subsurface Depth
- b. Aquifer Thickness
- c. Confining Formations
- d. Groundwater Classification

The WDEQ/WQD will classify the groundwater in the production zone at the near the end of the permitting process. This section should include that classification action and reference the letter or memorandum from WQD which classifies the aquifer(s) within the permit area.

- e. Proposed Aquifer Exemption Boundary

The permit is required to include what aquifers or sections of aquifers are requested to be exempted along with a map showing the area. This section of the SDD summarizes this information along with the justification given for the exemption and where it may be found in the permit.

### **4. Abandoned Wells and Drill Holes**

The SDD should note where in the permit document the applicant has included the following:

- a. the locations of these wells and holes
- b. what steps the applicant has taken or will take to verify they were properly abandoned.

## **IV. Mine Operations Plan**

### **A. Geochemistry**

This section should state the type of lixiviant to be used and the resultant chemical reactions to be expected. The SDD should describe how the lixiviant has been used successfully in the past. W.S. § 35-11-429 includes required language that applies to this section and an affirmative statement is required as to its presence.

### **B. Mining Schedule**

The SDD should summarize the schedule and reference where it is contained in the permit. The discussion should include the different phases of wellfield development and mining and construction of satellite plants (if applicable).

### **C. Topsoil Handling and Protection**

In addition to the normal topsoil salvaging and stockpiling commitments, the SDD should particularly note the special topsoil protection actions proposed by the operator during wellfield development. Of particular interest is whether there is a typical cross section or drawing that shows how topsoil will be protected during this process. A map showing the areas of long-term topsoil salvage and stockpile locations must be referenced.

### **D. Monitoring and Reporting Programs of Ore Zone and Aquifers That May Be Affected**

This section should summarize the different monitoring commitments including the reporting requirements. Of particular interest is the location of a table that summarizes all the various monitoring activities and their reporting requirements.

### **E. Excursions**

The discussion regarding excursions should be more detailed than other sections because of their importance and possible consequences. Items to be addressed and referenced include: list of parameters, sampling frequency, actions to be taken if UCLs are exceeded, reporting frequency, possible corrective actions, and scenarios of uncontrolled or unrecovered excursions. W.S. § 35-11-429 includes required

language that applies to this section and an affirmative statement is required as to its presence.

#### **F. Waste Water Handling and Disposal**

Besides the method of disposal, the capacity of the disposal systems should be compared to the quantities of expected liquid waste generated. The liquid waste balance during mining, during mining and restoration, and during restoration should be discussed. If deep disposal wells are proposed, details such as the receiving formation, depth, and separation from other aquifers should also be discussed and referenced.

### **V. Reclamation Plan**

#### **A. Restoration and Reclamation Schedule**

This should also include descriptions of the groundwater restoration methods and documentation of their success either at the proposed location through an R&D site or at other in situ operations with similar hydrogeology and using similar mining methods. Groundwater restoration and surface decontamination and reclamation schedules should be referenced.

#### **B. Restoration Standards**

The restoration standards are set during the wellfield package review process but a discussion of how they will be established should be included in the application. The SDD should reference where this discussion is found in the permit. W.S. § 35-11-429 includes required language that applies to this section and an affirmative statement is required as to its presence.

#### **C. Reclamation of Structures and Facilities**

Items to be covered in this section include: well plugging and abandonment, wellfield surface disturbances, utility lines, pipelines, building demolition, gamma surveys, and final reclamation. The discussion should also include where at NRC-licensed disposal facilities the operator will dispose of equipment that cannot be decontaminated.

#### **D. Bond Estimate**

This section should reference where the details of the bond estimate are located. It should also include a discussion of the major assumptions on which the estimate is based. The reviewer may also compare the estimate to other in situ bond estimates to ensure all items are covered and the costs are comparable.

## **VI. Public Notice**

This section will document that the public notice requirements have been met. It will consist of two parts.

- A.** The first will state when the public notice for completeness was satisfied. It will state what days and in which newspaper it was published.
- B.** The second part will be similar except it will also note when the applicant was contacted to begin public notice and that notice was initiated within 15 days. The documentation will also confirm that within 5 days of the first public notice, that all surface owners of record of the land within the permit area, to all surface owners of record of land adjacent to the permit boundary and to any surface owners within ½ mile of the proposed mining site. The documentation will also show that within 5 days of the first notice that a copy of the application mine operations plan map was mailed to the Wyoming Oil and Gas Conservation Commission. This section will show that the applicant included a proof of notice and sworn statement of mailing which will be attached to and become part of the application (File-One-Of).

## **VII. Specific Permit Requirements of In Situ Operations**

W.S. § 35-11-429 contains language that is required to be contained in every in situ application. While some sections of the SDD refer to this language, this section of the SDD consolidates and addresses all of the required content. For each of the statements, below the SDD will state where in the permit it is found.

- A.** Verbal notice to the administrator of excursions as soon as practicable after the excursion is confirmed, followed by reasonable notice.
- B.** Authorize the administrator to terminate or modify the mining operation if an excursion cannot be controlled or mitigated within the constraints of the permit.
- C.** Authorize the council upon the recommendation of the director to modify water-quality criteria used for groundwater restoration when information made available after issuance of the permit warrants a modification.
- D.** Prohibit any significant change in mining technique, method of operation, recovery fluid used, mining and reclamation plans or other activities that would jeopardize reclamation or protection of any waters of the state unless a permit revision has been approved by the director.

Chapter 11 also lists specific conditions that are to be incorporated into the permit either expressly or by reference. This section should state where in the permit each of the conditions is located.

### **VIII. Special Conditions**

As mentioned in the introduction, there are instances where some permit issues were not resolved during the review process. Some issues may be resolved by placing a special condition to the approval of the permit. The wording of each special condition is presented and discussed in this section. This includes what section of the permit is being conditioned, background or history of the issue, what information or change is required, and any special time frames for resolution, which may include a schedule for interim steps. Some special conditions are for the life of the permit while others have to be corrected or resolved before the operator may conduct certain activities.

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 2012

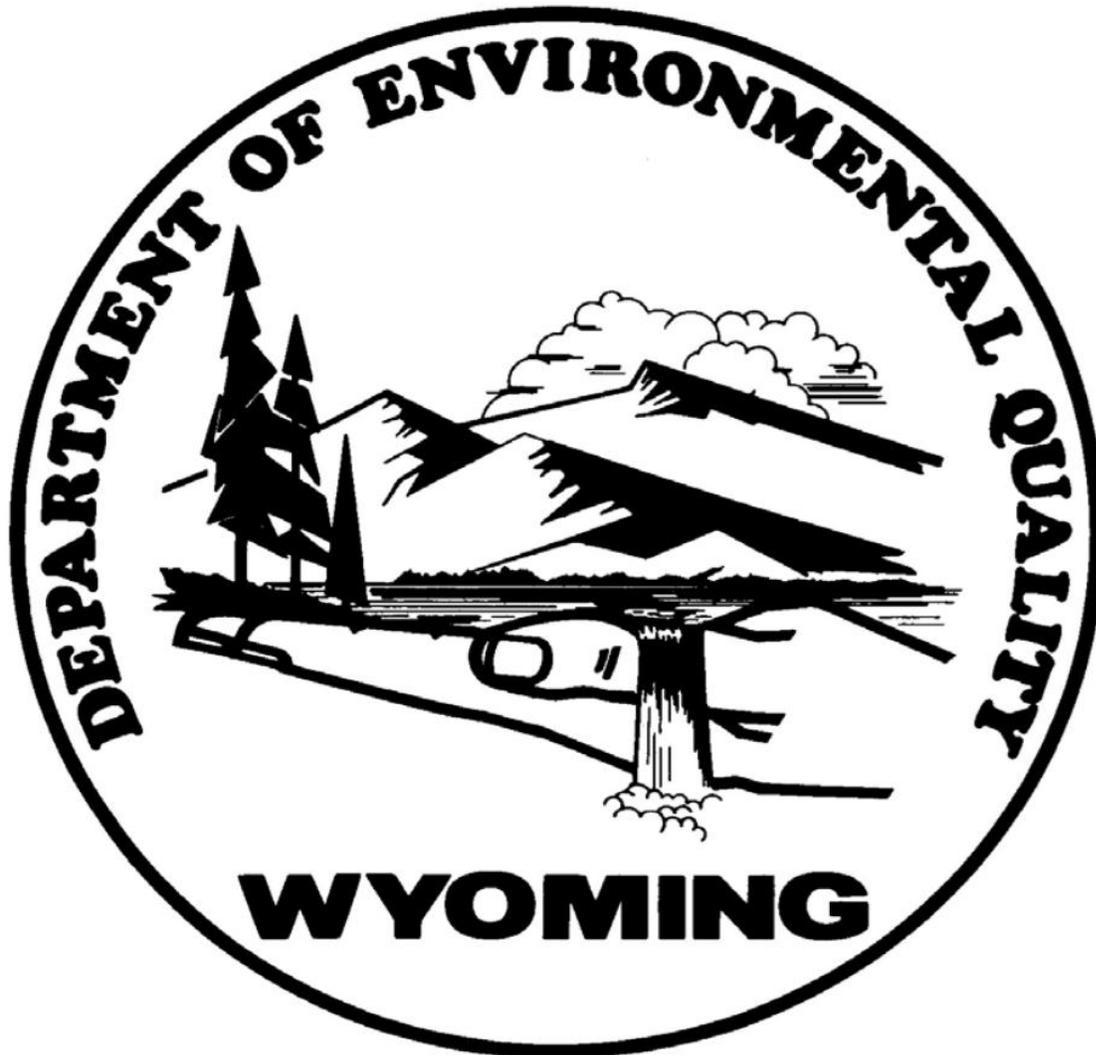
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Administrator, Land Quality Division

**Attachment IX: In Situ Annual Report Format**

DEPARTMENT OF ENVIRONMENTAL QUALITY

LAND QUALITY DIVISION



IN SITU ANNUAL REPORT FORMAT (ISARF)

## **GENERAL PURPOSE STATEMENT FOR THE IN SITU ANNUAL REPORT FORMAT (ISARF)**

This In Situ Annual Report Format (ISARF) and content outlined below are required by the Land Quality Division (LQD) Administrator under provisions of the Wyoming Environmental Quality Act (ACT) WS §35-11-411 and the LQD NonCoal Rules and Regulations (LQD NC R&R) Chapter 11. This document applies to permitted in situ mines.

### **PURPOSES:**

1. Document fulfillment of commitments and conditions in the permit and any previous Annual Reports.
2. Evaluate bond adequacy and set the bond amount for the upcoming report period.
3. Document deviations from the permit during the current report period.
4. Evaluate conformance of monitoring data to permit commitments and LQD, NC R&R.
5. Identify issues arising from the information provided, and discuss any required actions.

### **The LQD will review In Situ Annual Report (ISAR) and make the following determinations:**

1. Compliance with the permit commitments and conditions.
2. Reclamation bond amount required for the upcoming report period.
3. Conformance of monitoring information to permit commitments and LQD NC R&R, results support permit projections, identification of issues arising from the information provided, **and** any required actions.
4. Whether operator's responses to comments have been deemed acceptable.

The operator shall be required to address any comments or deficiencies in the ISAR as identified by the LQD. Acceptance of the ISAR shall be documented by a letter to the operator, followed by an Administrator's letter setting the new reclamation bond amount.

The operator shall complete and submit the Title/Certification Page (see page 5) and tables (listed in Section C ,see page 4) as presented and use the numbering and headings for each required item in the annual report in the order presented in this ISARF.

Operators should not restate the text of the ISARF in their annual report. An objective of this ISARF is to have consistent formats among in situ reports from all operators.

Consistent formatting will reduce the time involved in locating and evaluating information.

Two (2) paper copies and two (2) electronic copy of the ISAR are to be submitted to the LQD District Office on or within thirty (30) days before the permit anniversary date. The District Office shall forward a copy to the Administrator. One (1) additional electronic copy shall be submitted to the Federal Land Management agency (Bureau of Land Management (BLM) or the U.S. Forest Service (USFS)), if applicable. Upon acceptance

of the ISAR by LQD, two (2) final electronic copies shall be provided by the operator and, if applicable, one (1) additional final electronic copy to the federal land managing agency (BLM or USFS).

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 2013

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Deputy Director, Department of Environmental Quality  
Administrator, Land Quality Division

## **SUBMITTAL FORMAT REQUIREMENTS**

### **A. General**

1. The ISAR shall be contained within one or more 3-ring binders. Each binder shall be labeled on the cover and on the spine with the operator's name, permit number, facility name and reporting period.
2. Each binder shall have a table of contents listing the sections/headings outlined below, all attachments, maps, tables, etc.
3. Every page of the ISAR shall be numbered with a unique page number.
4. Every map shall have a unique title and number attached within the 3-ring binder or contained within a map sleeve.
5. Maps shall be formatted as outlined below.
6. Any revised materials submitted at a later date in response to LQD review comments shall have a revision date on each page.

### **B. Content and Format for Maps**

Each map must be provided in the format specified below (the operator may reference permit maps if such maps are current):

1. The base for all ISAR maps must be a current clear and legible contour map or a current aerial photograph. The contour base should correspond to or be based upon an existing permit map at the same scale as the permit map. The preferred scales for maps and aerial photographs are: 1"=200', 1"=400' and 1" = 500'. The map scale should be consistent from year to year and map to map. The preferred contour interval is ten (10) feet. Use of different scales and contour intervals may be approved on a case-by-case basis by the LQD District Supervisor.
2. Individual map sheets should be of a reasonable size and generally should not exceed forty-eight (48) inches.
3. Each map must have a complete title block, including:
  - a. Complete map title.
  - b. Operator and facility name and address.
  - c. Permit number.
  - d. Annual Report period.
  - e. Scale.
  - f. North arrow.
  - g. Contour interval.
  - h. Date of map or date and source of photography.
4. Each map must have a complete legend, including:
  - a. Clearly labeled legal subdivisions of section, township and range. Northings and eastings and/or state plane coordinates are generally useful and acceptable when provided in addition to the legal subdivisions.
  - b. Notation of the permit area boundary.
  - c. Notation of all structures not identified directly on the map.

### **C. Submittal of Electronic Data**

In addition to the two (2) electronic copies of the ISAR that is required, LQD requests certain information be submitted in electronic format to aid in review and long term tracking of activities. Most forms of current electronic media will be accepted, though please contact the LQD if uncertain. The following Uranium Mining Data Submission Spreadsheets are available on LQD's website:

[http://deq.state.wy.us/lqd/Uranium\\_Data.htm](http://deq.state.wy.us/lqd/Uranium_Data.htm)

- Uranium Well Details
- Uranium Field Water Quality Data
- Uranium Groundwater Level Data
- Uranium Lab Water Quality Data
- Uranium Surface Water Flow Data
- Uranium Surface Water Station Details

## **REQUIRED ISAR CONTENTS**

### **IX. Title/Certification**

The ISAR shall be signed by a responsible corporate officer or duly authorized representative (see LQD R&R Chapter 11 Section 2(g)). Any responsible corporate officer or duly authorized representative signing the ISAR shall make the following certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for known violations.

### **II. Mine Operations**

Identify any revised schedule or timetable of mining operations and estimate the numbers of acres to be affected during the next one (1) year reporting period. As required in §35-11-412 (iii).

#### **A. Operating Wellfields**

1. A map and well completion details table depicting the identification and location of all operating wellfields. Maps and tables can be submitted electronically.

2. A map and well completion details table depicting the location of all wells including deep disposal wells installed in conjunction with the mining activity. Maps and tables can be submitted electronically.

**B. Water Balance/Hydrology**

Include the Following:

1. The total quantity of recovery fluid injected and total quantity of recovery fluid extracted during the reporting period for each wellfield area, including a description of how these quantities were determined;
2. An updated potentiometric surface map(s) for all aquifer(s) that are or may be affected by the mining operation may be requested at the Administrator's discretion.
3. Summarize the handling of the wastewater stream.

**C. Spills**

1. A summary of all reportable spills during the reporting period, including dates of occurrence, location, quantity, quality, extent of affected area shown on a map with GPS points, and causes.

**D. Excursions**

1. Summarize all wells on or off excursion during the report period and include any existing excursion mitigation costs in the bond as a line item.

**E. Mechanical Integrity Testing Results for Existing Wells**

1. Annual summary i.e. total number of: wells, passed, failed, abandoned, replaced

**F. New Affected Lands during the Reporting Period**

1. List the depth and volume of topsoil and subsoil salvaged and stockpiled. Show all stockpiles both short term and long term on a map. Include the topsoil pile identification number, and protection measures employed and show the location on a map.

2. List the volume of subsoil removed and stockpiled. Include the location, subsoil stockpile identification number, and protection measures employed.
3. Describe new buildings constructed, location, purpose, and square footage.
4. Describe new ponds constructed including location, purpose, size, capacity, disturbance acreage.
5. New roads and utilities such as pipelines and power lines shown on a map and total acres disturbed indicated.
6. Other.

**G. New Wells/Wellfields Installed During the Reporting Period.**

A brief discussion of all new wells and wellfields installed during the reporting period. All new wells and wellfields should be located on the annual report map.

**H. Report any stimulation activities for Class III wells**

Identify well ID, type of stimulation and date.

**I. Environmental Monitoring**

Summarize and interpret monitoring results for the reporting period for the following items.

- Groundwater
- Surface Water
- Wildlife (Include monitoring as required by the Wyoming Game & Fish Department or the U.S. Fish and Wildlife Service)
- Other

Specifically, discuss any significant trends or anomalies. Include graphs, charts, and time plots to visually substantiate the summaries and interpretation. Along with hard copies submit all water-quality and -quantity data electronically

**J. Deviations or Unanticipated Events or Conditions**

1. Individually list and describe all deviations from the approved Mine Plan (do not include approved incidental boundary revisions (IBR) or non-significant

revisions (NSRs) which were approved during the report period. These include but are not limited to the quantity of minerals removed, the number of acres affected, and groundwater or waste water produced.

2. List all unanticipated events or conditions and remedial actions taken during the report period. These could include the discovery of significant archaeological or paleontological importance, unanticipated subsidence, or faulting.

#### **K. Projected Operations**

1. Discuss the projected mining operations and disturbances for the coming year. Specifically, identify any new wells or wellfield packages that will be submitted for approval or installation.
2. Provide the general location, number of holes, diameter, and average depth of drill holes to be drilled in the next reporting period.

### **III. Reclamation/Restoration Activities**

Identify any revised schedule or timetable of reclamation/restoration activities and estimate the numbers of acres to be affected during the next one (1) year reporting period. As required in §35-11-412 (iii)

#### **A. Groundwater Restoration Activities**

1. Describe the progress of all restoration activities, including: identification of restored wellfields, identification of wellfields with restoration in progress, and wellfields where restoration is planned for the next reporting period.

#### **B. Well Plugging and Abandonment Reports**

1. Report the total number of any wells abandoned during the report period. At a minimum this report must include the well name, well spatial location, the depth and plugging technique. (Note: If all of the data mentioned above has been provided in the operator's quarterly monitoring reports then this data should be summarized in the Annual Report and reference made to those quarterly monitoring reports.)
2. Well abandonment reports shall be made available to the LQD. Well abandonment reports for SEO permitted wells shall be made available to the SEO per LQD Chapter 11, Section 15 (e).

### **C. Surface Reclamation Activities Past and Present**

1. For each affected area where reclamation activities occurred, describe, including the number of acres, and locate on a map the affected areas that were:
  - a. Contoured.
  - b. Topsoiled and subsoiled (include the depth and amount of cubic yards used). A tabulation of soil stockpiles that documents new and depleted stockpile volumes should be maintained in the Annual Report.
  - c. Seeded with temporary seed mix (include the seed mix, number of Pure Live Seed (pls) pounds used, and date seeded).
  - d. Seeded with permanent seed mix (include the seed mix, number of pls pounds used, and date seeded for each area).
  - e. Tabulate historic acres and newly disturbed areas and all reclamation completed during the report period.

### **D. Deviations or Unanticipated Events or Conditions**

1. Individually list and describe all deviations from the approved Reclamation/Restoration Plan during the report period which were not approved as a revision or a non-significant revision. The operator does not need to include approved revisions or non-significant revisions (NSRs). These include but are not limited to the quantity of pore volumes removed, the number of acres reclaimed, and waste water produced.

## **IV. Drill Hole Reporting**

All drilling activities occurring within the permit boundary will be covered by the mining permit and must be reported in the ISAR.

Information required to be reported in the ISAR for all drilling within the permit boundary is listed below. Drill hole reporting requirements are found in W.S. 35-11-404(d-e) and available from WDEQ-LQD website.

[http://deq.state.wy.us/lqd/downloads/Forms/Abandoned\\_DrillSite\\_Report\(9\\_2008\).pdf](http://deq.state.wy.us/lqd/downloads/Forms/Abandoned_DrillSite_Report(9_2008).pdf)

**A. A USGS Quad or other contour map, of adequate detail depicting the following:**

1. Outline of the general area of activity.
2. Location of any constructed access roads, temporary roads, and drill hole locations.

**B. A tabulated listing of the drill holes**

Use the Abandoned Drill Site Report Form.

**C. Description of the nature and extent of disturbances, and a description of the reclamation of those locations indicated in (A) above.**

**D. Tabulation of the following:**

1. Seed mixture used.
2. Method and date of seeding.
3. Location(s) where seed mixture was used.

**V. Reclamation Performance Bond Estimate**

**A. Purpose Statement**

The purpose of this section is to provide renewal reclamation performance bond calculations and to assess the adequacy of the current bond calculations and total dollar value. Applicable provisions of The Act include WS §35-11-417(c) (ii) and WS §35-11-411(a) (iii) and (d).

**B. Most operators use a similar version of a spreadsheet that allows for efficient calculation of the bond estimate. It is recommended that the operator contact the LQD for sample formats successfully used by other operators to promote equality and consistency across the industry.**

**C. The bond estimate must be accompanied by a projected time schedule (Gantt chart) showing the completion schedule for each major reclamation operation/task.**

**D. The bond estimate must include an itemized accounting of all labor costs, including number and categories of personnel, salaries, and total hours required for the**

completion of the various reclamation tasks. A Gantt chart is suggested to display this information.

- E.** All assumptions and backup calculations must be included to support the bond estimate in an annually consistent format.

## Reference Document 2: Adjudication

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The Adjudication File must contain the following information.

## **VI. Forms and Information Submitted in Loose Form**

### **A. Form 1-UIC: Application for Permit to Mine**

One form must contain the original signature(s). If the entity is a corporation the seal must be legibly affixed; if the corporation does not have a seal “no seal” must be written. The applicant must initial and date the bottom of each page. Additional Form 1UICs may be copies. The applicant may submit two original Form 1-UIC if they desire to have an original signed form for their files rather than a copy.

The applicant must contact the Wyoming Secretary of State to determine if their entity structure must formally register to do business in Wyoming and the required entity name listing.

### **B. Form 3: License to Mine Application**

One form must contain the original signatures and have a legible corporate seal. If the entity is a corporation the seal must be legibly affixed; if the corporation does not have a seal “no seal” must be written. The applicant must initial and date the bottom of each page. Additional Form 3s may be copies. A new Form 3 is not required for renewals or amendments.

### **C. Permit Fees**

1. New permit applications or renewal applications require a minimum fee of \$100.00 plus \$10.00 for each acre within the permit area. The maximum fee is \$2,000.00.
2. Permit amendment applications require a fee of \$200.00 plus \$10.00 for each acre within the amended area. The maximum fee is \$2000.00.
3. Form 3. License to Mine: a \$25.00 license filing fee is required.

### **D. Proof of Publication/Notice**

This information will be submitted after the LQD notifies the applicant to commence public notice. It is the only information other than the reclamation bond instrument that may be added to the application once final public notice is initiated.

1. LQD will provide the publication notice format. Publication and notification is not to begin until written consent from the LQD has been received.
2. Proof of Notice will consist of the affidavit of publication executed by the newspaper.

3. Proof of Filing will consist of an affidavit of filing from the County Clerk just before the start of publication.
4. Proof of Notification shall be sent to all surface owners of record of the land within the permit area, surface owners of record of immediately adjacent lands, surface owners within ½ mile of the proposed mining site, and a copy of the mine operations plan map sent to the Wyoming Oil and Gas Conservation Commission. Such proof consists of a notarized “Affidavit of Notice,” the format for which will be included with the Second (Final) Public Notice Format.

#### **E. Reclamation Bond Instrument**

1. Reclamation performance bond submitted in one or a combination of the following: original execution of a surety bond, cash, certified check, Federally Insured Automatically Renewable Certificate of Deposit or CDARS, Letter of Credit, Government Securities, self-bonding. For operations conducted on federal surface, the bond instrument must also be acceptable to the federal land managing agency which is often more restrictive. Contact the LQD for applicable rules and format. The performance bond may be submitted after the bond amount has been set by the District.

- a. Corporate Surety Bond

This bond must be executed on the Division’s required form. It must be an original execution and be accompanied by a Power of Attorney for the Surety's Attorney-in-Fact. It is wise to investigate with surety companies the time necessary to process a surety bond. The bond must be approved by the Attorney General's Office and the LQD prior to approval of the application.

- b. Federally Insured, Automatically Renewable Certificates of Deposit or CDARS.

These must be made out solely to the Wyoming Department of Environmental Quality – Land Quality Division “Payee” unless federal lands are involved and the federal land managing agency (FMLA) requires the bond instrument be made to both the state and the FLMA. If the purchaser’s name is listed “Nonpayee” must be cited. Interest and 1099s go to the benefit of the purchaser.

- c. Government Backed Securities (example: Treasury Bills, Money Markets)

- d. Self-Bond

See Chapter 6 of the Land Quality NonCoal Rules and Regulations for details on this type of bond.

- e. Letters of Credit

See Chapter 12 of the Land Quality NonCoal Rules and Regulations on details on this type of bond. The Wyoming Department of Environmental Quality - Land Quality Division forms must be used.

f. Cash - U.S. Dollars

If a personal or company check is submitted as cash bond, three weeks waiting is required to assure that the check will be paid by the bank. The application cannot be approved until the check has cleared the bank. To avoid any delay in approval, a certified or cashier's check should be used.

2. In the instance that a self-bond will be proposed as a performance bond, the self-bond application must be included with the initial (permit) application package.
3. For individual instructions on filing reclamation performance bonds contact the LQD Bonding Specialist.

**F. Appendix C: Legal Land Description of Proposed Permit Area**

1. Lands in the permit area are to be tabulated on LQD Forms C-1 and C-2 and signed by the applicant. The separate tabulations are as follows:
  - a. Tabulation of all lands in the proposed permit (or amendment) area, including all transportation corridors and facilities, etc., by legal (1/4 1/4) section, township, range, county, and municipal corporation, if any, (LQD Form C-1, one copy must contain an original signature) and number of acres for each entry listed.
  - b. If a bearing and distance description is used, it must be presented in either quadrant bearings or azimuths with horizontal distances and "bearing and distance" or "metes and bounds" description (LQD Form C-2, one copy must contain an original signature). The number of acres in each bearing and distance description must be listed. A certified statement from a licensed surveyor stating the metes and bounds of the permit area close must be included.
  - c. For lands where the applicant claims no right to mine, a tabulation by legal description, of all those lands within the permit (or amendment) area with the number of acres for each entry.
  - d. List and map identifying the location of all lands in the permit area which also occur in other permit areas (i.e., dual permitted and/or license to mine areas), including the land use agreements (e.g., easements, encroachments, overstrip agreements, etc.) and all supporting legal documents.
2. An original U.S. Geological Survey topographic map, clearly outlining and identifying the lands within the proposed Permit or R&D License area. Photo copies or other similar copies are not acceptable unless prior approval is obtained from the LQD.

**G. Surface Owner Consent, including:**

1. Instrument of consent from the resident or agricultural owner, if different from the mineral estate owner, granting permission to enter and commence surface mining, and also written approval of the applicant's mining and reclamation plans.
2. Instrument of consent from the surface landowner, if different from the owner of the mineral estate, including any lands privately owned but not covered by the provisions of W.S. §35-11-406(b)(xi), to the mining and reclamation plan.
3. Landowner Consent - If the applicant proposes to affect any land which lies within 300 feet of an existing occupied dwelling, home, public building, school, church, community or institutional building, park or cemetery, then written consent of said landowners must be obtained and placed in the permit application.
4. If BLM lands are present within the proposed permit area, the timing of granting consent could present complications as LQD does not consider an application complete until all consents are provided in the permit. However, BLM approval of the mining operation may come late in the Technical Review process. The LQD and BLM have cooperated to allow a mine application to be considered complete and proceed to Technical Review before final BLM approval has been granted.
  - a. If federal minerals will be mined under surface administered by the BLM, “consent” is considered granted when BLM approves the 3809 plan of operation. Upon receipt of a 3809 plan of operations, the BLM Authorized Official (AO) may provide LQD with a statement that the operator has mining claims and he has received a plan of operations required by 43 CFR 3809. Final consent is not given until the operations plan is approved. LQD and BLM have agreed to use the BLM’s acknowledgement of the applicant’s right to file an operations plan as satisfaction of the LQD completeness criteria. Once the BLM approves the operations plan, the applicant will submit the approval or other documentation from the BLM to LQD as an addition to the permit. Close coordination is required between the applicant, BLM, and LQD to ensure the LQD permit application and the BLM plan of operations are similar and are approved relatively at the same time.
  - b. On BLM managed lands where the mineral will not be mined but is adjacent to the mining area and whose surface will be used for stockpiles, roads, or other surface uses, may gain approval several different ways under Title 43 regulations. These include negotiating with the adjacent claim holder if applicable or file for a right-of-way for surface use.
  - c. If BLM managed lands are proposed to be within the permit area but no mining or disturbance is to occur on those lands, consent from the BLM is required to show that BLM concurs with those lands to be within the permit

area. The consent may take the form of some type of surface use agreement issued by the BLM.

- d. On split estate lands, if the operator has consent from the private surface owner to mine uranium, a 3809 plan of operations does not have to be filed with the BLM (see 43 CFR 3809.31(d)).
5. For lands managed by the State Land and Investment Board, an Instrument of Consent will be required from the board or its representative.

## **VII. Appendices Submitted in Three-Ring Binders**

### **A. Certification Page**

The front of the first volume must have a certification page containing language required by LQD R&R Chapter 11 signed by a “Responsible Corporate Officer” or a “Duly Authorized Representative.” Attachment 1 to this reference document contains a sample certification page.

### **B. Appendix "A" (For lands within the permit area)**

1. List of names, in alphabetical order, and last known addresses of:
  - a. Owners of record of the surface rights within Permit area.
  - b. Owners of record of the mineral rights within Permit area.
2. Maps showing locations of ownership in 1.a. and 1.b. above.

### **C. Appendix "B" (For lands adjacent [within one-half mile] to the permit area)**

1. List of names, in alphabetical order, and last known addresses of:
  - a. Owners of record of surface rights of lands immediately adjacent to the proposed Permit,
  - b. Any other persons having a valid legal estate of record within one-half (1/2) mile of the Permit area such as water rights and rights-of-way owners, etc.
2. Maps showing the locations of the ownership in 1.a. and 1.b. above.

### **D. Appendix C (duplicate of what is filed in File-One-Of)**

### **E. Appendix “E”**

1. The permit application shall show the following information on a U.S.G.S. topographic map base, clearly outlining and identifying the lands to be within the proposed permit and amendment area:
  - a. The permit and amendment area boundary (clearly identified).
  - b. Lands to be affected over the life of the mine.
  - c. A digital file containing the proposed permit boundary in .DWG or shapefile format.
2. In addition, Appendix E shall contain the following information on maps, based upon public records, at a scale between 1" = 400' to 1000', as well as the additional lists as specified:
  - a. Location and names, where known, of all existing roads, railroads, public or private rights-of-way and easements, utility lines, pipelines, buildings, lakes, streams, creeks, springs and other surface water courses, oil wells, gas wells, and water wells.
  - b. Drainage area within and surrounding the proposed permit area, including all surface water features.
  - c. Location and listing of the ownership and use of all buildings on or adjacent to the proposed affected portions of the permit area.
  - d. Probable limits of all previously disturbed or proposed disturbance by underground mining, and probable limits of all surface mining (active or inactive), on or adjacent to the land proposed to be affected.
  - e. Map and list of the political boundaries of special districts such as water, police, fire, conservation; public and private parks; and cemeteries
  - f. List of all known drill holes and monitor wells of 4 inches or less than diameter that have not been registered with the State Engineers Office.

**F. Listing of Other Permits or Construction Approvals**

Provide a listing of activities to be conducted by the applicant which require permits or construction approvals and the status of those permits or construction approvals under the following programs:

1. Hazardous Waste Management program under RCRA;
2. UIC program under the Safe Drinking Water Act (as it pertains to wells other than Class III wells);
3. WYPDES program under the Clean Water Act (CWA);
4. Prevention of Significant Deterioration (PSD) program under the Clean Air Act (CAA);
5. Nonattainment program under the CAA;

6. National Emission Standards for Hazardous Pollutants preconstruction approval under the CAA;
7. Dredge and fill permits under Section 404 of the CWA;
8. U.S. Nuclear Regulatory Commission Source Material License;
9. State Engineer permits;

A copy of the WQD/SEO approved pond design does not have to be included in the original license application but should be inserted later after WQD/SEO approval.

10. Documentation of county zoning compliance

Written verification from the city or county (appropriate zoning or planning department) of approval for the mining operation (if affecting new lands) or that no zoning ordinances apply. (W.S. 35-11-406(m)(iii))

11. Other relevant environmental permits, including State permits.

Copies of requested approved state and federal permits associated with this application (e.g. well permits, pond construction permits, discharge permits, fish and wildlife service permits) should be placed in the license application. It is not necessary to include the documentation associated with these permits, but simply build a table to illustrate the various approvals.

**Reference Document 2**  
**Attachment 1 Sample Certification Page**

**Certification**

\_\_\_\_\_ **Mine,**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for known violations.

Signed this \_\_\_\_\_ day of \_\_\_\_\_, 201\_\_\_\_\_

\_\_\_\_\_ (Responsible Corporate Officer) \_\_\_\_\_ (title) \_\_\_\_\_  
(or Duly Authorized Representative)

\_\_\_\_\_ (printed name)

## Reference Document 3: Hydrogeology

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## **I. Introduction**

The hydrogeologic material submitted must be certified by a Professional Geologist or qualified Professional Engineer registered in the state of Wyoming. The hydrogeology should be described using referenced and published information.

The information in D-5 has three levels of detail: (1) regional (macro scale extending approximately 15 miles beyond the permit boundary), (2) permit area (in a general manner describes the entire permit area and adjacent areas even those areas that will not be affected), and (3) the mine unit description (finer detail of the ore bodies to be mined and the potential impact area of the mining). Much of the finer detail will be submitted with the wellfield packages.

Much of the hydrogeology information should also be submitted electronically. Reference Document 1, Attachment V lists the data and provides a link to the location within LQD's website that contains the required spreadsheets.

## **II. Regional Setting**

This section shall include, at a minimum, a discussion on the regional geologic setting, a generalized geologic map, and cross sections illustrating the regional hydrogeologic setting. An outline of potential discussion topics are provided below.

### **A. Regional Geology**

1. General Geologic Setting
2. Regional Geologic Map and Cross Section(s)
3. Regional Hydrostratigraphy
4. Regional Structural Geology
5. Regional Surficial Geology

### **B. Regional Hydrogeology**

1. Regional Potentiometric Surfaces
2. Regional Groundwater Recharge and Discharge
3. Regional Hydraulic Connection of Aquifers

### **C. Regional Water Quality**

### **III. Permit Area Hydrogeology**

This section shall include site-specific hydrogeology (geology and groundwater) information for the proposed permit area and adjacent areas such as hydrostratigraphic units, cross sections, structural geology, ore mineralogy, aquifer properties, well and drill hole information, and baseline water quality. An outline of discussion topics and further requirements are provided below.

#### **A. Site Geology**

1. Site Geology and Hydrostratigraphy
2. Isopach Maps
3. Cross Sections
4. Site Structural Geology
5. Ore and Rock Mineralogy and Geochemistry

#### **B. Site Hydrogeology**

1. Potentiometric Surface
2. Site Groundwater Recharge and Discharge
3. Site-Specific Groundwater and Surface Water Interactions
4. Lab tests illustrating the hydraulic properties of the Aquifer(s) and Aquitard(s).

#### **C. Wells & Drill Holes within the Permit Boundary.**

Include a commitment in the Mine Operations Plan to update the wells and drill hole information in the annual report and place a copy in Appendix D-5 of the permit.

#### **D. Site Water Quality**

See Reference Document 3

#### **E. Site Geology**

1. Site Geology and Hydrostratigraphy

Hydrostratigraphy includes all geologic formations and units within the permit area and adjacent areas including aquifers and aquitards. For each hydrostratigraphic unit, the name, general description, depositional environment, extent, thickness, and continuity should be described. Hydrostratigraphic units should be identified and described using stratigraphic columns, lithologic and geophysical logs, geologic maps, and published data.

a. Production Zone(s) and Overlying and Underlying Aquitards

Particular detail should be given to describing the production zone and aquitards above and below. This information is important to demonstrate that there is containment between the production zone and the overlying and underlying aquifers. Supporting documentation shall include a discussion of cores, well logs, stratigraphic cross sections, stratigraphic columns, hydraulic properties, etc.

2. Isopach Maps

An isopach (thickness) map should be generated for each production zone aquifer, overlying aquitard, overlying aquifer, underlying aquitard, and underlying aquifer. The average unit thickness and range should be described in the application.

3. Cross Sections

The hydrogeology in the Permit or License area and adjacent areas should be described using geologic cross sections and should be confirmed with geophysical logs and field investigation. The number of cross sections required to generally describe the permit area is very site specific. Generally, a minimum of one north/south and one east/west trending section for every square mile is recommended. However, the applicant is strongly advised to contact the LQD for the number of cross sections appropriate for the proposed permit area and adjacent areas before submittal. Whenever possible, include monitor wells as cross sections, when they are close to a cross section line. The information and the level of detail suggested for the cross sections are provided below.

a. Cross sections extending through the affected area should identify:

- Potentiometric surface(s);
- Monitoring wells projected onto the cross section line, their slotted or screened interval(s) and an indication of the water level;
- Lithologies;
- The production zone to be mined;
- Geologic features such as faults, paleochannels, etc.;
- Extent of mining (vertical and horizontal);
- Any historic underground mine workings;
- Aquifers and aquitards;
- Areas of aquifer communication;

- Hydrologic boundaries;
  - Recharge and discharge areas; and
- b. Consistent vertical and horizontal scales on all cross sections are advised.
  - c. Supporting information may include geophysical logs (resistivity, gamma ray, self-potential, density) and/or lithologic logs.
  - d. Legible electronic copies of drill hole logs for every hole and well used to develop the cross sections should be included in the application.
  - e. The minimum spacing between drill holes or wells used for developing the cross sections should be sufficient to justify the geologist's interpretation. Site conditions and availability of data will dictate the minimum spacing between drill holes or wells but at a minimum there should be one drill hole or well every 1,500 feet along the cross section.
  - f. The horizontal and vertical extent of the production zone is to be shown on the cross sections passing through proposed wellfields. This is accomplished by indicating the location of the particular roll fronts in the aquifer(s) in question and highlighting the zone to be mined.
4. Site Structural Geology
    - a. Geologic Structures

Geologic features that could influence aquifer properties or serve as hydrologic boundaries such as faults, fractures, outcrops, and dip should be described.
    - b. Structural Contour Maps

A structural contour (elevation) map should be generated for each production zone aquifer, overlying aquitard, overlying aquifer, underlying aquitard, and underlying aquifer. The average elevation and depth and range should be described in the application.
  5. Ore and Rock Mineralogy and Geochemistry

A geochemical, lithological, and mineralogical description of the production zone and any aquifers that may be affected by the injection of recovery fluid must be included in the permit application.

    - a. Core Analysis

As part of the geology, the geochemical characterization of the rock is to be included. Core samples or other physical samples should be analyzed and the results should be included in the permit.
    - b. Ore Zone Mineralogy

This section must contain a description of the mineralogy of the host rock in addition to the description of the ore. The average ore minerals, grade, should be described.

c. Ore Amenability to Solution Mining

This section should contain a brief summary or reference to the recovery solution to be used during mining. A discussion on geochemistry and the ability of the solution to dissolve the ore should be included.

**F. Site Hydrogeology**

1. Potentiometric Surface

a. Water Level Data Collection – Baseline Monitoring

Water level elevations should be measured quarterly for one year. Continuous monitoring should be considered where hydrographs are needed for assessment of groundwater recharge or discharge zones. Closed-in pressure readings may be necessary in gassy wells and flowing artesian wells.

b. Potentiometric Surface Maps of All Affected Aquifers

i. Potentiometric surfaces with sufficient data points to spatially define all potentially affected aquifers including all overlying and the vertically adjacent underlying aquifers and production zone aquifers must be submitted. Potentiometric surfaces should be extended into all units which are in good hydraulic communication with the aquifer, including clinker, alluvium, etc.

ii. The premining potentiometric surface for these aquifers should be defined and located on a 1 inch = 1,000 foot scale map(s) which encompass the permit area and adjacent areas. This map should also show well locations, groundwater recharge and discharge areas, and other hydrogeologic features. Wells used in developing the potentiometric surface map should all be located and identified on the map with the particular water elevation and date of observation at each well shown. Legible electronic copies of logs of drill holes and wells used to develop the potentiometric surface maps are requested.

iii. Hydrologic Boundaries

iv. adequately stress the system to test aquifer properties;

2. Site Groundwater Recharge and Discharge

3. Site-Specific Groundwater and Surface Water Interactions

4. Hydraulic Properties of the aquifers.

a. Hydraulic Properties of Affected Aquifers

This section will present the hydraulic properties, aquifer characteristics and variability for the water saturated portions of the production zone and aquifers which may be affected by the mining process. Information to provide may include, but is not limited to, velocity, storage coefficients or specific yields, transmissivity or hydraulic conductivity, the direction(s) of preferred flow under hydraulic stress in the saturated zones of the production zone, and a discussion of how the values were derived.

b. Hydraulic Connection and Containment of Aquifers

The extent of hydraulic connection and containment between the production zone; overlying aquifers; underlying aquifers; and the hydraulic characteristics of any influencing boundaries in or near the proposed wellfield area(s) shall be determined and described.

c. Pump Tests

Any baseline aquifer pumping test should be designed to:

- i. determine transmissivities, storage coefficients, hydrologic boundaries, leakage, aquifer homogeneity, and isotropy. For example, a multi-well pump test evaluation, as described by Theis (1935), Cooper and Jacob (1946), Boulton (1954), or as summarized by Lohman (1979) is suggested.
- ii. Assess the hydro containment of any aquitards
- iii. determine any hydrologic communication that may occur between the production zone and overlying and underlying aquifers;
- iv. adequately stress the system to test aquifer properties;
- v. determine the quantity of groundwater to be removed at various stages of mining;
- vi. estimate the areal extent of static water level declines in potentially affected aquifers;
- vii. evaluate potential impacts to adjacent water resources due to mining, and
- viii. estimate groundwater conditions and aquifer characteristics likely to exist after reclamation.
- ix. A minimum of one pump test in each aquifer to be mined is required. If faulting occurs within the production zone, multiple pump tests may be needed to characterize conditions within each fault block and across the fault.
- x. Production zone, overlying and underlying. Monitor wells located in aquifers above and below the pumped aquifer should be placed in close proximity to the pumping well.

- xii. Generally, aquifer pump tests utilizing the Neuman-Witherspoon method (for leaky confined aquifers) of analysis or other method yielding equivalent information are recommended.
- xiii. Identify both a chronological order of events and decisions that were made during testing.
- xiv. The following information should be submitted for each aquifer or pump test:
  - a) All data obtained from the aquifer pump tests and measurements necessary to evaluate the pumping results; and
  - b) Methods of analyses:
    - List the methods of analyses and equations used;
    - List the assumptions upon which the equations are based;
    - List how assumptions were met by the physical conditions; and
    - Present sample calculation.
  - c) Graphs which show:
    - All drawdown and recovery data;
    - Curve or line fits;
    - Match points,  $u$  [a dimensionless time parameter],  $W(u)$  [well function; exponential integral];
    - Boundary and casing storage effects;
    - Pump interruptions;
    - Discharge adjustments; and
    - $t_0$  [time pumping began to when pumping ended].
  - d) Maps indicating the pumping well, monitoring wells, and associated maximum drawdown results for each test.
  - e) Correction factors and their associated supportive data and the method used for data adjustment strongly encourage to include barometric pressure
  - f) Results of analyses:

- xv. If the pump test shows communication between aquifers that could be attributed to historic drill holes a reasonable attempt will be made to locate those holes and properly sealed. The pump test will be rerun under the same parameters to determine if the sealing had desired effect.

## **G. Wells and Drill Holes within and Adjacent to the Permit**

### 1. Wells

#### a. Well Location and Construction

Tabulate the appropriate information from Appendix E, including the names (or numbers), descriptions, and a map of all wells installed for water supply or monitoring and all wells which penetrate the production zone aquifer(s). The description shall include: names of present owners, well completion data, producing interval(s), aquifer, and variations in water level to the extent such information is available in the public records and from a reasonable inspection of the property. It may be necessary to conduct downhole inspections to determine well depth and completion intervals for wells within the permit boundary if such information is not available.

#### b. Site groundwater use

A brief summary of groundwater use in the area should include aquifers used and estimates of the amount of water (gpm) consumed for domestic, stock, or irrigation purposes. Impacts to groundwater levels or quality from local users or nearby operations that may affect the groundwater quality or quantity should be noted.

#### c. Well completion reports

A summary table of all available well completion and well development details for monitor wells and other wells located within the permit boundary should be submitted. Consult the LQD to determine if it may be acceptable to submit this information in electronic format.

#### d. Groundwater Water Rights

Tabulate and either provide a map or reference another map in the application of all adjudicated and permitted groundwater rights. Locations and present owners of all wells inside and within 3 miles of the permit area should be included. Information concerning plugging and well completion and producing interval(s) (to the extent such information is available in the public record or by a reasonable inspection of the property) is also requested.

2. Historic Drill Holes and Abandoned Wells (Historic is any well or drill hole that was drilled or installed prior to the permit application being submitted. To the extent that records are available.)
  - a. Provide a summary of historic exploration and development activities.
  - b. Drill Hole and abandoned wells, Maps and Tables  

A list and map of all abandoned wells and drill holes, giving location, total depth, producing interval(s), type of use, condition of casing, plugging procedures, date of completion, and date of plugging for each well or drill hole within the permit area and on adjacent areas to the extent such information is available in public records and from a reasonable inspection of the property.
  - c. Geophysical and Driller's Logs  

In addition to the logs supporting the cross sections mentioned above, legible electronic geophysical logs are also required for any monitor well, any well used in a pump test, or any well or drill hole used to gather data that is used to provide required information in the permit (e.g. to prepare, potentiometric surface maps). As a practice, LQD will accept a representative data set, based on LQD's choosing, with the rest available on the mine site.
  - d. Verification of proper well abandonment  

To ensure proper abandonment procedures were used, plugging should be verified to the extent such information is available in public records and from a reasonable inspection of the property.

## **H. Site Water Quality**

Groundwater quality must be defined for the license or permit area. Groundwater quality data must be collected for a sufficient length of time to identify any important spatial and time variant properties of all of the potentially affected aquifers, to show the premining hydrogeochemistry of the area, and to identify existing or anticipated impacts of adjacent mines on the groundwater quality within the license or permit area. Detailed information regarding the premining or baseline water quality sampling and analysis is provided in Reference Document 10, Premining Water Quality and Quantity Sampling, 11.

1. Monitoring network and parameters
2. Methods
3. A Summary of the Sampling Results (field and laboratory)
4. Statistical Analysis and Water Quality Relationships and Trends
5. Premining Groundwater Classifications

In accordance with WQD RR Chapter 8, the WDEQ Groundwater Section will classify the groundwater in the producing horizon based on existing use and ambient quality of the groundwater. The operator shall reference the specific maps and data in the Permit Application necessary for the WDEQ to complete groundwater classifications.

6. QA/QC procedures

#### **IV. General Mine Unit Hydrogeology**

Information on specific mine units or wellfield areas is to be submitted with each wellfield data package. This section may be omitted from the permit application document if the first wellfield data package is not being submitted simultaneously. Each wellfield data package shall be in a separate three-ring binder including the first wellfield if it is submitted with the initial permit application.

The main purpose of the wellfield data package is to increase the resolution of hydrogeologic information at the specific mine units. Reference Document 9, Wellfield Package, of this document contains specific information about the approach and requirements for the wellfield data package.

#### **V. Seismology**

This section is optional and the operator may include a discussion of regional and local seismology required by the NRC. While not required by LQD, the applicant may include this information in this section.

Items for analysis may include

- Seismic Hazard Review,
- Seismicity,
- Historic Seismicity Near Permit Area,
- Seismic Risk, and
- Probabilistic Seismic Hazard Analysis.

# Reference Document 4: Upper Control Limit Calculation

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# I. Upper Control Limit (UCL) Parameters and Calculations

## A. Selection of UCL Parameters for Uranium.

Excursions are detected through the use of systematic water-quality sampling at monitoring wells surrounding the active mining zone, both laterally and vertically. UCL parameters should be selected based on their reliability to detect an excursion event. At least three parameters are recommended to be included in each excursion monitoring program. Available data on R&D and commercial scale in situ mining operations indicate that certain parameters are typically good excursion indicators, while others are good only under certain geologic settings. The following parameters have been shown to be reliable excursion-detection parameters:

<b>Parameters</b>	<b>Units</b>
Conductivity	umhos/cm @ 25 C
Chloride	mg/L as Cl
Total Alkalinity	mg/L as CaCO <sub>3</sub>

Note: Total Alkalinity should not be used where the pH's are greater than 9.6 or less than 4.5.

Additional parameters that have demonstrated an ability to detect excursions are as follows:

<b>Parameters</b>	<b>Units</b>
Calcium	mg/L as Ca
Sodium	mg/L as Na
Sulfate	mg/L as SO <sub>4</sub>
Total Dissolved Solids	mg/L residue @ 180 C

## B. Statistical Assumptions

Various statistical methods for analyzing water quality data bases are recommended. These methods may be sensitive to:

1. Significant departures from a normal distribution,
2. Serial dependence, and
3. Temporal trends.

A good review of this topic is found in Harris et al. (1987). In general, the skewness coefficient is a recommended test for normality; a sampling frequency no shorter than every two weeks is recommended to reduce serial dependence; and at least a two month sampling (4 samples per well) period is recommended to incorporate temporal variability into a water quality data base for UCL determination.

### C. Screening the UCL Parameter Data Base for Errors and Outlier Populations

1. Data bases should be routinely screened through the use of (1) quality control (QC) checks and (2) checking and correcting any transcription errors. In addition to these data-screening steps, a baseline data base should be statistically evaluated for outliers.
2. Outliers are anomalously high or low values relative to the other values comprising a data base. An outlier can result from one or more of the following conditions:
  - a. Transcription errors.
  - b. Sampling errors.
  - c. Analytical errors.
  - d. Incorrect units of measurements.
  - e. Natural water quality variability.
  - f. Differences in geology within the sampled aquifer.
  - g. Improper or incomplete well development
3. If the source of error responsible for an outlier is detected, then the anomalous value can possibly be corrected. However, there is often insufficient information available to evaluate an error source. The inclusion of an outlier in a data base can have a disproportionately large influence on statistical analyses of water quality data. Because there are no reliable methods for evaluating whether an outlier is due to an error or the result of natural water quality variability, a technique for discarding outliers from a data base is needed. The proposed screening technique accounts for wide variations in parameter values while still being capable of detecting outliers that fall outside of a statistically calculated interval. The following tolerance-limit formula (Loftis et al., 1987) is recommended for screening outliers from baseline data used to calculate UCL values:

$$x = k S \alpha = 0.05, p = 0.99$$

where:

x = mean of observations in sample

k = tolerance limit factor

S = standard deviation of sample

4. The tolerance limit factor (k) is a function of sample size (n), confidence level (1 - alpha), and proportionality values (p).

Consider the following total alkalinity concentrations:

Total Alkalinity, mg/L as CaCO<sub>3</sub>

Well 37	100.8	93.6	97.0	87.4	86.3
Well 38	85.3	93.0	87.2	85.5	85.1
Well 39	98.0	92.5	92.0	87.8	85.7
Well 40	76.6	80.3	66.0	86.3	73.0
Well 41	91.5	91.0	92.2	85.1	87.4
Well 42	93.0	94.3	93.8	84.9	79.4
Well 43	94.5	93.5	105.0	84.7	86.3
Well 44	92.0	94.0	94.0	85.7	89.6
Well 45	85.7	88.1	89.5	81.3	95.0
Well 46	86.6	85.5	92.2	92.0	84.2
Well 47	91.3	93.2	93.2	84.7	85.1

**Step 1.** There are no hard and fast rules regarding the initial selection of potential outliers. A recommended method is to visually screen the data base for anomalous values or groups of values, then subjectively identify whether these values are especially high or low relative to the other values in the data base.

Initial Outlier Estimate: 105.0, 66.0

**Step 2.** Calculate the tolerance interval, excluding the use of the two potential outliers (i.e., 105.0 and 66.0). See table for "k" values. [Loftis et al., 1987]

$$\bar{x} = 88.83$$

$$S.D. = 5.38$$

$$k(n = 53) = 3.094$$

$$\bar{x} + k S$$

$$88.83 \pm (3.094 \times 5.38)$$

$$(72.2 \text{ to } 105.5)$$

**Step 3.** An evaluation of the tolerance interval indicates that the value 105.0 is marginally acceptable and therefore should be included in the baseline data base for statistical calculations.

**Step 4.** Recalculate the tolerance interval including the value 105.0, but excluding the value 66.0.

$$\bar{x} = 89.13$$

$$S.D. = 5.77$$

$$k(n=54) = 3.094$$

$$\begin{aligned} & x \pm k S \\ & 89.13 + (3.094 \times 5.77) \\ & (71.3 \text{ to } 107.0) \end{aligned}$$

At an alpha = 0.05 and p = 0.99, one can assert with a degree of confidence (1 - alpha) that the proportion of the population of possible alkalinity values contained between 71.3 and 107.0 mg/L as CaCO<sub>3</sub> is at least 99 percent. The use of an alpha - 0.05 is based solely on the historical use of this alpha value for statistical evaluations of hydrology data, while the 99% proportionality value is used because it is the highest value for which k values are available.

Note: For a given sample size (n) of 100, only one value should be expected to be discarded as an outlier when it may actually be a representative value.

**Step 5.** At this point, the iterative process of calculating tolerance intervals for outlier detection is complete. The conclusion is that the value 66.0 is considered an outlier and will be discarded from the data base.

Note: If one or more wells have parameter values that contain a relatively large number of outliers then these wells should be treated separately as an additional baseline data base for one or more UCL parameters.

#### **D. Calculation of UCL Values**

1. Upper Control Limits are needed to detect the uncontrolled migration of production fluid outside of a wellfield in either a lateral or vertical direction. The use of UCLs for conservative parameters provides a reliable basis for determining when an excursion occurs.
2. The establishment of UCL values based on the variability of the baseline data base is recommended. The use of a baseline mean value plus three standard deviations for calculating NPDES standards was proposed by the National Academy of Science (1977) in a report to the EPA. Using parameter values that follow a normal distribution, the probability of a single observation falling beyond the boundary designated as  $X + 3 S.D.$  is 0.00135, or 0.135 percent..

However, if different methods or laboratories are used to analyze collected water samples after the baseline data base has been established, then the calculated probability of exceeding UCL values may be less accurate.

3. The rationale used to evaluate the adequacy of various methods to calculate UCLs is based on two criteria:
  - a. the UCL for any parameter should not be exceeded in the baseline data base after it has been screened for outliers, and
  - b. the proper calculation of an UCL for any parameter should enable detection of an excursion event within one or two sample collections (based on a 2-

week sampling interval). These criteria are based on minimizing the probability of committing a Type I and Type II error. In general, the preferred method is one that results in the highest UCL value while still being capable of detecting an excursion event.

4. A method that uses the baseline mean plus 5 standard deviations is the recommended method for calculating UCLs. Use of this proposed method should result in adequate excursion control, yet minimize the possibility of incorrectly placing wells in excursion status.
5. For situations where chloride values are very low and show little variation during baseline data collection, the LQD is willing to consider allowing the upper control limit for chloride to be set at the average baseline value plus 15 mg/L if that value is greater than the average baseline value plus five standard deviations. This option will only be considered for chloride.

#### **E. Trend Wells**

The use of trend wells has enabled in situ operators to detect production fluid migration prior to the fluid reaching excursion monitoring wells. Parameter value changes in a trend well can signal a water balance problem in the active wellfield that may not be otherwise evident to the operator. These wells are typically located between the injection/production wells and the monitor wells in the active wellfield. Water-quality analyses of samples collected from trend wells will not result in regulatory corrective action. Their use is as a preventive measure to allow greater operational control of wellfield fluids and to decrease the possibility of having to halt production to restore a much more extensive plume of mine fluids had an excursion been detected at the excursion-monitoring wells.

## **II. Conclusions and Recommendations**

The following is a list of recommendations relating to the use of baseline data for calculating UCLs.

- A. UCL parameters should be selected based on their reliability to detect an excursion event. At least three parameters are recommended to be included in each excursion monitoring program.
- B. For UCL determination, a sampling frequency of 4 samples taken at a minimum of 2 weeks apart is recommended.
- C. For UCL determination, baseline data bases should be screened for outliers. A recommended method of outlier detection is discussed in this Reference Document.

- D.** A well (or wells) that produces anomalous water-quality data, for any UCL parameter, should be treated separately for UCL calculations.
- E.** The use of an empirically-derived method for calculating UCL values is proposed. The formula is: baseline mean plus 5 standard deviations, after the baseline data base has been screened for outliers.
- F.** The beneficial use of trend wells located between the active wellfield and the excursion monitoring wells is recommended. Trend well water quality data need not be submitted to the LQD.
- G.** A review of water-quality changes during an excursion event indicates that excursion status criteria could reliably be based on the exceeding of two out of three UCL parameters
- H.** It is recommended that the operator have a program that evaluates well data for trends and use action limits for any UCL parameter and place on “alert” status as possibly trending towards an excursion and consider pre-emptive actions to prevent an excursion.

**Table 1A**

Values of “k” for various sample sizes (Page 1 of 2)

n	$\alpha = 0.95$			$\alpha = 0.99$		
	0.90	0.95	0.99	0.90	0.95	0.99
2	32.019	37.674	48.430	160.193	188.491	242.300
3	8.380	9.916	12.861	18.930	22.401	29.055
4	5.369	6.370	8.299	9.398	11.150	14.527
5	4.275	5.079	6.634	6.612	7.855	10.260
6	3.712	4.414	5.775	5.337	6.345	8.301
7	3.369	4.007	5.248	4.613	5.488	7.187
8	3.136	3.732	4.891	4.147	4.936	6.468
9	2.967	3.532	4.631	3.822	4.550	5.966
10	2.839	3.379	4.433	3.582	4.265	5.594
11	2.737	3.259	4.277	3.397	4.045	5.308
12	2.655	3.162	4.150	3.250	3.870	5.079
13	2.587	3.081	4.044	3.130	3.727	4.893
14	2.529	3.012	3.955	3.029	3.608	4.737
15	2.480	2.954	3.878	2.945	3.507	4.605
16	2.437	2.903	3.812	2.872	3.421	4.492
17	2.400	2.858	3.754	2.808	3.345	4.393
18	2.366	2.819	3.702	2.753	3.279	4.307
19	2.337	2.784	3.656	2.703	3.221	4.230
20	2.310	2.752	3.615	2.659	3.168	4.161
25	2.208	2.631	3.457	2.494	2.972	3.904
30	2.140	2.549	3.350	2.385	2.841	3.733
35	2.090	2.490	3.272	2.306	2.748	3.611
40	2.052	2.445	3.213	2.247	2.677	3.518
45	2.021	2.408	3.165	2.200	2.621	3.444
50	1.996	2.379	3.126	2.162	2.576	3.385
55	1.976	2.354	3.094	2.130	2.538	3.335
60	1.958	2.333	3.066	2.103	2.506	3.293

**Table 1A**

Values of “k” for various sample sizes (Page 2 of 2)

	$\alpha = 0.95$			$\alpha = 0.99$		
65	1.943	2.315	3.042	2.080	2.478	3.257
70	1.929	2.299	3.021	2.060	2.454	3.225
75	1.917	2.285	3.002	2.042	2.433	3.197
80	1.907	2.272	2.986	2.026	2.414	3.173
85	1.897	2.261	2.971	2.012	2.397	3.150
90	1.889	2.251	2.958	1.999	2.382	3.130
95	1.881	2.241	2.945	1.987	2.368	3.112
100	1.874	2.233	2.934	1.977	2.355	3.096
150	1.825	2.175	2.859	1.905	2.270	2.983
200	1.798	2.143	2.816	1.865	2.222	2.921
250	1.780	2.121	2.788	1.839	2.191	2.880
300	1.767	2.106	2.767	1.820	2.169	2.850
400	1.749	2.084	2.739	1.794	2.138	2.809
500	1.737	2.070	2.721	1.777	2.117	2.783
600	1.729	2.060	2.707	1.764	2.102	2.763
700	1.722	2.052	2.697	1.755	2.091	2.748
800	1.717	2.046	2.688	1.747	2.082	2.736
900	1.712	2.040	2.682	1.741	2.075	2.726
1000	1.709	2.036	2.676	1.736	2.068	2.718

Source: **Miller, I., and J. E. Freund, 1977.** *Probability and Statistics for Engineers*, Second Edition, Prentice-Hall, Inc., NJ, p. 505.

## Reference Document 5: Surface Water

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## **I. Introduction**

Baseline information is required due to the potential for surface disturbance to native watersheds and their associated drainage channels. Reference Document 1, General Information, Attachment V contains a list of the surface water data to be submitted electronically and a link to LQD's website for the required spreadsheet. .

## **II. Regional Surface Hydrology**

Present a brief discussion of the regional surface water features in the area.

## **III. Local Surface Hydrology**

For surface waters within the permit area and on adjacent lands include the following:

### **A. Watershed and Stream Channel Characterization**

Names, descriptions, and a map of all such waters, including ephemeral drainages and permanent impoundments.

#### **1. Watershed Network**

A drainage network map (scale 1 inch = 1000 feet) of the permit and adjacent areas on the topographic base map should be included in the application. The applicant should:

- a. Include all streams with defined channels (the extent of stream channels should be checked in the field and/or with aerial photography); a defined channel is generally distinguished by a "blue line" on a quadrangle map, yet judgment should be used to identify stream channels relative to the scale and type of map being used;
- b. Distinguish perennial, intermittent, and ephemeral streams;
- c. Show boundaries of contributing watersheds;
- d. Locate stream gages; and
- e. Show playas, groundwater discharge areas, impoundments (stock ponds), springs and other hydrologic features (water wells, stock tanks, and windmills).

#### **2. Watershed Delineation**

Provide a table identifying drainage area for all watersheds that will be affected by mining activities.

## **B. Water Quantity Measurements**

Baseline information needs to be gathered in order to assess potential impacts from the proposed operation. Generally speaking, ISR operations do not physically disturb a stream channel to the point of requiring reconstruction. Most are not withdrawing water from the surface water system or using ponds as a means of sediment control, thus direct impacts to surface water quantity are not easily detectable. What is of concern is protection of operation facilities, be it actual facility buildings, header houses, or wells. A framework for establishing the event frequency should be based upon the expected life of the facility, such that design consequences can be identified.

## **C. Baseline Water Quality**

Reference Document 10, Premining Water Quality and Quantity Sampling, includes information on developing the baseline sampling plan and reporting and analysis of results for the application, as well as baseline water quality constituent, quality control measures, and holding times.

## **D. Surface Water Rights**

List and map all permitted surface water rights within and adjacent to (½-mile buffer) the permit area boundary. If water will be impounded on site as part of the sediment control program, the listing of water rights should be extended to three miles downstream of the permit area boundary. The listing is typically found in Appendix E and reference to the information location should be identified in Appendix D6.

The following information should be tabulated for each surface water right:

- a. Source;
- b. Permit number;
- c. Location;
- d. Facility name (reservoir, ditch);
- e. Applicant name;
- f. Acre-feet; and
- g. Use (industrial, irrigation, stock, etc.).

## **E. Surface Water and Groundwater Interactions**

Any surface water and groundwater interactions should be identified and discussed. Information should include the following:

1. The location, flow, water quality, and aquifer source of springs and seeps.
2. General relationship of streams to alluvial groundwater systems, including influences on water quality.

**F. Potential for Erosion and Flood Damage to In Situ Recovery Facilities**

If applicable, the proximity of surface water features to in situ recovery facilities, including wellfields, should be discussed.

**G. Erosion Control Measures**

Drilling activities at long-term in situ mine operations have shown a critical need for erosion and sediment control to protect native soils/vegetation as well and to prevent additional contributions of sediment to streamflow or to runoff outside the affected land.

1. LQD requests ISL operations include within the permit, text discussion which details the Best Management Practices for erosion and sediment control including the following:
  - a. Description and drawings of typical Erosion Control Measures (ECM) to be employed on the mine site. This should include generic design information such as rock size for check dams, installation specifications, etc. The description should also include the usual conditions under which each measure will be used.
  - b. A maintenance and inspection plan including inspection frequencies for each type of ECM.
  - c. A detailed map of all ECMs in the Annual Report

Erosion control and soil protection are essential. The Water Quality Division, WYPDES Storm Water Program requires a Storm Water Pollution Prevention Plan (SWPPP). Applicants are required to obtain a Stormwater Discharge Permit from DEQ / Water Quality Division. As part of this process a Storm Water Pollution Prevention Plan (SWPPP) must be prepared, which contains the detail of each erosional control measures. The applicant should provide LQD with a summarized version of this information provided in the SWPPP, which lists the typical options of best management practices that the applicant may employ at various locations across the permit area. A map showing the specific and exact location of each potential best management practice is not necessary, as this information is continually updated and available in the SWPPP. However, the longer-term erosional control measures should be maintained and updated on a map as part of the Annual Report, for inspection and surety calculation purposes.

## 2. Temporary Diversions

Minimum standards require that temporary diversion channels be designed for the 2-yr, 6-hr event or a duration that yields a higher peak flow. However, it is recommended that the design event recurrence interval be chosen based on the structure's expected lifetime and an appropriate probability of failure for the function of the diversion. Recommended design event return periods are:

Life of the Diversion	Storm Event Return Period
<3 years	10 - year
3 – 10 years	25 - year
11 – 20 years	50 - year
>20 years	100 - year

Hydrology and hydraulic calculations should be submitted with each diversion design, and designs of diversion structures should consider

## 3. Culverts

Culverts must be designed to pass the predicted peakflow from the 10-year storm event (at a minimum) without static head at the entrance. The minimum cover over the culvert must be sufficient to prevent collapse of the culvert; however, one foot or one-half the culvert diameter of cover is typically recommended. Culverts must be a minimum of 18 inches in a diameter for ease of maintenance. Erosion control measures for the inlet and outlet as well as a maintenance plan should be specified.

# Reference Document 6: Topsoil and Subsoil Management, Erosion Control, and Temporary Seeding/ Stabilization

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This Reference Document intends to assist all interested parties in the management of soils at In Situ Leaching Operations (ISL). It briefly addresses the baseline requirements but the major focus is on management and protection of the topsoil resource during construction and mining operations.

Permittees may propose alternative methods to achieve the basic performance standards embodied in the Wyoming Environmental Quality Act and the LQD NonCoal Rules and Regulations, Chapter 11, "In Situ Mining". However, the procedures provided in this Reference Document are those recommended by the LQD. If any permittee proposes alternative handling procedures, the LQD staff and permittee must agree that alternative procedures are acceptable before using the procedures in the field or before approval of any permitting actions.

## **I. Applicable NonCoal Rules and Regulations**

The following list of NonCoal Rules and Regulations should be reviewed for handling of soils at all in situ mining operations.

Environmental Protection Performance Standards

Chapter 3, Section 2(c)(i); Topsoil  
Chapter 3, Section 2(c)(ii); Subsoil

In Situ Mining

Chapter 11; A soil survey ...  
Chapter 11; A description of the nature and depth of the topsoil...  
Chapter 11; The procedure(s) used to protect the topsoil...  
Chapter 11; Procedures for insuring that all acid-forming, or toxic materials...  
Chapter 11; Procedures for ground surface preparation, depth of topsoil replacement.

## **II. Baseline Characterization of the Soil Resource**

Generally, all soils within the permit areas at ISL operations should be surveyed at an Order 3 level using methods of the Natural Resource Conservation Service (NRCS). This level of soil survey should be completed before the permit application is submitted. Please refer to Guideline No.1, "Soils and Overburden" for more information on soil baseline characterization.

## **III. Best Management Practices**

1. The Administrator may authorize topsoil to remain on areas where minor disturbance will occur associated with construction and installation activities including but not limited to light-use roads, signs, wellfields, utility lines, fences, monitoring stations, and drilling provided that the minor disturbance will not destroy the protective vegetative cover, increase erosion, nor adversely affect the soil resource. The objective of topsoil and subsoil management plans at In Situ Leaching (ISL) operations is to minimize

disturbance and impacts to the soils and premine vegetation resource, thereby allowing the postmining land use conditions to be established.

2. The purpose of erosion/sedimentation control is to protect native vegetation and topsoil from contamination and prevent receiving waters from being impacted. The application should include a brief discussion of the erosion/ sedimentation control measures. A copy of the WQD Storm Water Pollution Prevention Permit and Plan(s) should be available for review onsite.

These objectives are accomplished by but not limited to the following:

- a. Limiting areas of disturbance during each wellfield delineation, construction, and operation. The LQD policy of not salvaging topsoil from the entire wellfield is based largely on the concept of having significant areas of native vegetation and topsoil undisturbed in the wellfield.
  - b. Limiting the disturbance and reestablishing the land use is accomplished by minimizing temporary access roads, and segregating topsoil and subsoil during mud pit, pipeline, wellfield construction and other excavations. It is important that the operators protect vegetation, topsoil, and subsoil by reducing traffic routes and promptly replacing the soil where necessary to minimize the impact of mining, protect the soil resource, and help the recovery of vital vegetation.
  - c. Minimize disturbance below the surface, preserve soil structure, and to facilitate the reestablishment of native vegetation. The operator must thoroughly plan access and pipeline routes to maintain the greatest area of undisturbed topsoil and vegetation.
  - d. Avoid mixing of overburden material with native or salvaged topsoil.
  - e. Minimize the spilling or splashing of drilling fluids, cuttings, or cement on areas outside the mud pit.
  - f. Establish well designed and properly constructed erosion control practices.
  - g. Complete temporary or final seeding of the topsoil resource as soon as practicable.
3. Topsoil and subsoil are generally not stripped and stockpiled for the entire wellfield area. However, soil stripping in specific wellfield areas where traffic is concentrated (e.g., wellfield pattern area as defined below) may be necessary in site specific situations. The physical and biological characteristics should be considered in all decisions to strip the soil resource. These characteristics should be considered when evaluating the potential for soil erosion or soil contamination.
  4. For all areas that will have soil stripped or displaced, salvageable soil depths should be confirmed in the field by qualified personnel before initiation of any disturbance. This confirmation may be accomplished by conducting an Order 1-2 soil survey or by digging verification holes on 3 acre grid spacing across the disturbance area. The Order 1-2 soil survey is a standard level of soil characterization used to assess mining impacts. The information gathered from the more detailed delineation of soil depth should be submitted in the permit application for known wellfields. For new wellfields, this information shall be submitted as a part of the wellfield approval package, before wellfield development.

5. A major concern of LQD is the proper protection of the topsoil resource during wellfield installation. The number of drill holes, wells, and the amount of traffic results in a great potential for topsoil compaction, contamination, and loss. A detailed discussion of the operator's BMPs for topsoil handling during wellfield installation and other areas should be included in the mine operations plan section of the application. The information provided in this Reference Document should be considered when developing the BMPs.
6. The Mine Operations Plan should include BMPs that describe soil protection for the following areas:
  - a. Facility areas – both permanent or long-term and temporary areas
  - b. Roads – include all categories of roads
  - c. Topsoil stockpiles, including
    - i. Location
    - ii. Design details such as slope, volume, toe ditches or berms
    - iii. Temporary seeding including seed mix, quantity and seeding methods
  - d. Well installation, including drill pad and mud pits, including
    - i. a typical cross section and plan view of the area of a well installation (these will show the temporary stockpiling or grading areas of topsoil and subsoil); and
    - ii. typical location of the mud pit relating to the drill rig, stockpiles, etc.; measures taken to keep contaminants off the native or stockpiled topsoil (the typical depth of the mud pit and if overburden will be removed, how it will be handled to prevent mixing with the topsoil and subsoil)
  - e. Pipeline installation: Include information similar to well installation section above.
  - f. Erosion control methods
    - i. Description and drawings of typical erosion control measures to be employed on the mine site. This should include generic design information such as rock size for check dams, installation specifications, etc. The description should also include the usual conditions under which each measure will be used.
    - ii. A maintenance and inspection plan including inspection frequencies for each type of erosion control measure
    - iii. A detailed map of all erosion control measures in the Annual Report
  - g. Designated travel corridors, colocation of pipelines and utilities, etc.
  - h. Access during wellfield development
  - i. Wellfield operations

## **IV. Access During Delineation Drilling Activities**

### **A. Minimize the number of Temporary Wellfield Access Roads.**

Strategically locating roads such that they offer the most direct route between operations will result in minimizing these roads. Road placement should avoid drainages, wet or low areas, and take advantage of desirable surface conditions (i.e., ridge line, sandy soils, etc.).

### **B. Minimize the extent of Temporary Wellfield Access Roads.**

Vehicles should stay within designated travel ways of minimal width. Soils are not generally salvaged from these Temporary Wellfield Access Roads.

### **C. Minimize disturbance to Vegetation**

Vehicle tracks within the wellfield area are unavoidable. However, the operator should limit the disturbance to the vegetation within the wellfield. Patches of undisturbed vegetation on this area will enhance the reestablishment of vegetation both during the producing stages and for final reclamation. Non-essential activities should be reduced or suspended during adverse weather conditions. For example, reduction of activities should occur during very wet periods when soils are saturated and travel is difficult. This recommendation may assist in limiting deep rutting of native areas inside and outside the Wellfield Pattern Area.

### **D. Minimize vehicular activity during wellfield construction.**

Minimize vehicular activity during wellfield construction outside the areas that will undergo wellfield development (i.e., outside of Wellfield Pattern Areas). The wellfield area between the wellfield pattern area and the ring of monitoring wells should have limited designated travel routes during the installation process. Multiple two-tracks crisscrossing the undisturbed vegetation outside the wellfield pattern area is detrimental to the vegetation and soil. The LQD recommends planned access to desired areas of the wellfield pattern area.

## **V. Soil (Topsoil and Subsoil) Protection at Facilities Areas and Operational Roads**

Most soils in Wyoming have a limited depth of topsoil. The amount of soil that should be stripped from facilities and roads, as discussed below, should be evaluated on a site specific basis as allowed by Chapter 3, Section 2 (c)(ii)(A) and (B).

**A. Permanent or Long-Term Facilities.**

Soils should be salvaged from permanent or long-term facilities areas, associated pad (parking) areas, and long-term storage areas. Salvaged soils should be stored in long-term stockpiles.

**B. Temporary Structures and Storage Areas.**

Temporary structures used for short-term construction activity or storage (less than six months) are generally not stripped of soils. However, topsoil and perhaps subsoil should be stripped where it is likely that the soil will be adversely affected by compaction due to repetitive traffic or contaminated by fuel, oil, grease, drilling mud or other such construction materials. The LQD should be consulted when these materials are planned for storage. The conditions, characteristics, duration, and types of items to be stored should be considered before a decision is made to strip the soil from these storage areas.

**C. Primary Access Roads.**

All suitable soil should be salvaged from the Primary Access Roads that service the permanent/long-term facilities. Salvaged soil is stored in long-term stockpiles.

**D. Secondary Access Roads.**

1. Soil should be salvaged from the Secondary Access Roads that service the wellfields and headerhouses. The depth of soil stripped should be site specific as determined by the soil horizons, texture, and other factors that will effect erosion or road stability. These soils are stockpiled in long-term stockpiles.
2. Secondary access roads are constructed progressively as headerhouses are located and wellfield installation proceeds. These roads usually include a gravel surface. During reclamation, an effort should be made to remove the gravel before ripping, in preparation of soil replacement. Furthermore, gravel road surfaces containing aggregate of greater than 1.5 inches should be removed before preparing for soil replacement. Any remaining gravel should be ripped and disced into the road base before final soil application.

**E. Monitoring Well Access Roads.**

The soils are generally not salvaged from these roads. These designated travel ways are typically two-track trails that are located such that the number and length of roads are minimized. Sensitive areas such as springs and wetlands are avoided. Travel should typically be limited to light-duty vehicle use.

## **F. Long-term soil stockpiles**

Long-term soil stockpiles are constructed and designed in accordance with Chapter 3, Section 2 (c)(i)(B) of the LQD NonCoal Rules and Regulations. These stockpiles should have containment berms or ring ditches to conserve the resource and are seeded as soon as possible with a temporary seed mix to protect the pile from wind and water erosion. These piles also require a topsoil sign with letters at least 6 inches high to be located on the pile or close proximity of their base. Erosion from stockpiles may be controlled by:

1. Utilizing a flat construction profile.
2. Locating stockpiles away from drainage ways.
3. Using contour plowing, seeding, and mulch on stockpiles.
4. Establishing an approved vegetative cover as soon as possible.
5. For large stockpiles, grading contour ditch outlets to stabilized outlets and drainage ways.
6. For large stockpiles, grading toe ditches to zero grade with less than 0.5 acre-foot capacity.

## **VI. Well Installation, Delineation Drilling and Mud Pits**

### **A. Protection of Undisturbed Topsoil and Vegetation.**

Of particular concern is the protection of undisturbed topsoil and vegetation during wellfield installation. The number of drill holes, wells, and the amount of traffic results in a great potential for topsoil compaction, contamination, and loss.

### **B. Mud Pit Construction.**

Mud pit constructions are constructed to minimize disturbance to the topsoil and subsoil resource. This construction is accomplished by limiting the size of these excavations, segregating suitable soils to the extent practicable and reapplying the material in the reverse order after activities are completed.

### **C. Placement of soil during Well Construction and delineation drilling.**

During mud pit construction, soil is removed from the excavation and placed in a temporary stockpile. The soil may be placed on native topsoil. There are times when the depth of the mud pit exceeds the salvage depth of the soil resource. The depth of the well relative to the depth of soil, and specific site conditions, should be considered when determining where the underlying material should be stockpiled. The soil stockpile should be located such that it is not mixed with the pile of deeper

earthen material and placed to ensure that it is protected from contamination. Compaction by vehicular traffic should be avoided after stockpiling is completed. Flagging or other physical means should be used to alert operators to avoid the temporary soil stockpiles. Upon completion of wellfield development activities (well installation, pipeline and electrical installation), this stockpiled soil is replaced. Seeding should be accomplished at the earliest appropriate season, either fall or early spring.

**D. Minimize Contamination from Drilling Fluids.**

Care should be taken during delineation drilling, pilot hole drilling, and well installation to minimize the spilling and/or splashing of drilling fluids, cuttings, or cement on areas outside the mud pit.

**E. Backfilling Mud Pits.**

When mud pits are backfilled, soils are replaced in the reverse order they were removed. Parent material or subsoil last removed are replaced first. Soils is placed on the surface of the pit.

**F. Soil Conservation during Wellfield Installation.**

The applicant must present a detailed plan for preventing topsoil compaction, contamination and loss during the wellfield installation and drilling activities. This will include

1. A discussion of the above activities and the steps that will be taken to prevent topsoil loss, compaction, and contamination.
2. A typical cross section and plan view of the area of a well installation. These will show the temporary stockpiling or grading of topsoil and subsoil.
3. The typical location of the mud pit and measures taken to keep contaminants off the native or stockpiled topsoil. The typical depth of the mud pit and, if earthen material below the soil will be removed, how it will be handled to prevent mixing with the topsoil and subsoil.

## **VII. Pipeline Installation**

**A. Soil Conservation During pipeline Installation and Removal**

The applicant must present a detailed plan for preventing topsoil compaction, contamination and loss during pipeline installation activities. This will include

1. A discussion of the activities discussed below and the steps that will be taken to prevent topsoil loss, compaction, and contamination.

2. A typical cross-section and plan view of the area of a pipeline installation. These will show the temporary stockpiling, windrowing, or grading of topsoil and subsoil.
3. The measures taken to keep contaminants off the native or stockpiled topsoil. The typical depth of the trench and, if earthen material below the soil will be removed, how it will be handled to prevent mixing with the topsoil and subsoil.

**B. Minimizing Disturbance to the Soil Resource.**

Pipelines should be constructed to minimize disturbance to the topsoil and subsoil resource. This construction should be accomplished by limiting, the size (width) of the pipeline trench, segregating topsoil/subsoil and reapplying this soil after activities are completed. It is not recommended that high pressure pipelines be collocated with wellfield pipelines.

**C. Soil Handling**

During pipeline trench construction, suitable soils should be removed from the trench and temporarily stockpiled or windrowed along the trench. The soil material may be placed on native topsoil. It is very likely the depth of the trench will exceed the salvage depth of the soil resource. The deeper earthen material is piled separately from soil, to the extent practicable.

**D. Soil Replacement.**

When pipeline trenches are backfilled, soils are replaced in the reverse order they were removed. Parent material (deeper earthen material or in some situations C horizon subsoils) are replaced first, with topsoil/subsoil being placed on the surface of the excavation. If topsoil is segregated from the subsoil, then topsoil is replaced over the surface of the subsoil. Seeding should be accomplished at the earliest appropriate season, either late fall or early spring.

## **VIII. Wellfield Operations**

**A. Wellfield Access during Operations.**

During operation, routine access in wellfields should be limited to Secondary Access Roads and Monitoring Well Access Roads. Traffic off these roads should be restricted to necessary well maintenance, field work and ancillary activities.

## **B. Access During Day-to-Day and Adverse Weather.**

Access to each wellhead is a necessary part of the day-to-day operations of an ISL facility. Traffic should be limited to the established designated wellfield access and well access roads to reach all pattern wells. During adverse weather, particularly wet ground conditions, activities in vegetated areas of wellfields should be limited when rutting and impact of the soil structure will occur. If rutting occurs, the ruts should be raked out and seeded as soon as conditions will allow.

## **IX. Temporary Stabilization/Seeding and Erosion Control of Disturbed Areas**

To avoid the loss of the soil resource during exploration, delineation, development, production, and monitoring phases, it is important that ISL operators practice appropriate measures to limit wind and water erosion. Timely revegetation of affected areas assists in protecting the topsoil/subsoil resource from erosion. Erosion control is essential. Aggressive revegetation efforts should be initiated following completion of any construction activities. Any areas where the topsoil/subsoil or vegetation is stripped should be reseeded before the next growing season. Where vegetation is affected by vehicular traffic, the need for reseeded must be evaluated on a site-by-site basis.

The following practices should be considered:

### **A. Vegetation Reestablishment**

The primary means of erosion control at ISL operations is to minimize impact to native vegetation and swiftly reestablish vegetation on disturbed areas. Revegetation is accomplished in two ways:

1. In wellfield areas, quick reestablishment should be accomplished by minimizing the impact to the native vegetation, so vegetation can be reestablished from existing plants and root stock the following growing season;
2. In those areas where the native vegetation is impacted, seeding with an approved temporary seed mix, at the earliest appropriate season either late fall or early spring, is recommended.

### **B. Seeding and Seedbed Preparation**

The affected areas within ISL wellfields, temporary wellfield access roads, drill sites, backfilled pipeline corridors, and any ancillary disturbances, should all be seeded at the earliest appropriate season. All reclaimed roads should be ripped or disced before seeding. Seedbed preparation and seeding operations should be conducted on the contour or perpendicular to the prevailing wind direction on flat or level ground. Traffic is restricted on areas that have been reseeded.

**C. Drainage Bottoms**

Drainage bottoms require special consideration. Drainage bottoms should be avoided in all phases of operation, where practicable. Erosion control measures are essential to protect all drainages. Erosion control measures are dependent on the following: how much disturbance will occur, expected flows, channel geometry and gradient, soil type, and associated conditions. A fast growing cover crop, mulching, erosion netting, or straw bales should be considered to minimize soil erosion and promote revegetation. Care should be taken to obtain weed-free protective materials.

**D. Long-Term Topsoil/Subsoil Stockpiles**

Long-term topsoil/subsoil stockpiles are constructed to conserve the salvaged soil. This stockpiling is accomplished by constructing the pile with gentle side slopes, which permits seeding with mechanical equipment, promotes revegetation, and reduces potential erosion. A ditch and/or berm may be constructed around stockpiles to assist in maintaining the soil in the pile, and assist in demarking its location. Topsoil and subsoil stockpiles should be seeded at the earliest appropriate season, either late fall or early spring. Long-term soils stockpiles should entail fencing, if potential damage from livestock is a concern.

**E. Erosion and Runoff Control**

Primary Access Roads and Secondary Access Roads should be designed and constructed to assure adequate drainage to protect the road surface, base, and surrounding undisturbed areas using best available engineering practices such as energy dissipaters, adequate ditches, and culverts. Turnouts, water bars, or erosion control structures should be used in ditches, where appropriate, to minimize the velocity of runoff and reduce potential ditch erosion.

## Notice

All existing water wells completed in the production zone which “...*currently serve as a source of water for Class I, II, III, Special (A) or Class IVA uses as described in Chapter 8 of the Water Quality Rules and Regulations...*” {ref: **LQD** Non-Coal Chapter 11, Section 10 (i) (A)} should be plugged and abandoned prior to applying for aquifer reclassification and exemption (ref: **LQD** Non-Coal Chapter 11, Section 8).

### **Reference Document 7: Groundwater Reclassification to Class V (Mineral Commercial) and Aquifer Exemption Process**

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## Reference Document 7

### Groundwater Reclassification to Class V (Mineral Commercial) and Aquifer Exemption Process

#### I. Introduction

The purpose of this guidance document is to provide guidance to operators of In Situ Uranium Recovery (ISR) facilities in order to submit the necessary data for the Wyoming Department of Environmental Quality (WDEQ), Water Quality Division (WQD) to perform a reclassification of a mineral commercial groundwater to Class V (Mineral Commercial). The groundwater reclassification is required to facilitate mining of the uranium ore zones in accordance with state and federal laws.

#### II. Permitting and Review Processes

Toward the end of the Technical Review process for the LQD permit application, the LQD will provide the information necessary in order for WQD, Groundwater Section to reclassify the groundwater(s) containing the production zones to Class V groundwater. This groundwater reclassification is required to obtain an aquifer exemption from the United States Environmental Protection Agency (EPA). The information being requested was extracted from the following documents:

- 1) Underground Injection Control Program: USEPA-Wyoming DEQ MOA, 1983 (MOA), and;
- 2) USEPA Memorandum, Guidance for Review and Approval of State Underground Injection Control (UIC) Programs and Revisions to Approved State Programs, GWPB Guidance #34, Attachment 3, Guidelines For Reviewing Aquifer Exemption Requests.

To facilitate this process, the applicant is requested to compile the information requested in Item III Sections A through F, and any associated figures, to support the groundwater reclassification and aquifer exemption process as part of the LQD permit application (i.e., Appendix D-12: Groundwater Reclassification and Aquifer Exemption). Ideally, Appendix D-12 should be a stand-alone Groundwater Reclassification and Aquifer Exemption volume. This Appendix D-12 volume should have its own Table of Contents and unique pagination. The maps and figures required for this appendix could be replicas of maps and figures that are provided in the permit application; however, these figures may have different titles and figure numbers in this appendix.

In many cases below, a reference to a map, figure or table in the permit application will be adequate to supply the necessary information. Therefore, the referenced application materials shall be submitted electronically by a file format acceptable to DEQ. Please note that a hard copy of the map discussed in Item III, Section II.F is requested.

A total of four (4) copies of the Appendix D-12 volume should be provided by the applicant to LQD. When Appendix D-12 information is deemed “acceptable”, LQD will provide WQD with two copies (one for the WQD District office and one to be submitted to EPA).

WQD will conduct a review of Appendix D-12 to ensure completeness and technical adequacy. WQD will submit a “statement of basis” to the EPA for the groundwater reclassification determination, which will include one copy of the Appendix D-12. WQD will request EPA’s review and concurrence of the proposed groundwater reclassification as part of the EPA’s aquifer exemption process. This request will be submitted to EPA when LQD determines the entire permit application to be technically adequate and directs the applicant to initiate final public notice. The final public notice will contain language informing the public about the request for an aquifer exemption.

As stated in the 1983 MOA, “within 45 days from EPA receipt of the information and findings, EPA will respond to WQD/LQD in writing. This response will be an interim response pending receipt and review by EPA of the results of the public participation process conducted by LQD/WQD. This interim response will become final if there are no comments related to the classification of the ground water during either the comment period or the public hearing, if held. If comments are received during the comment period or the public hearing the interim response will become final if not modified within 20 days of the receipt of all the comments by Region VIII.

### **III. Content and Format (Appendix D12: Groundwater Reclassification and Aquifer Exemption[s])**

#### **A. Geographic Extent of Proposed Aquifer Exemption**

The applicant shall provide a hard copy map as discussed in Item F.1 below, along with an electronic copy of the proposed aquifer exemption area in an electronic format and file structure acceptable to DEQ.

#### **B. Geologic Overview**

The applicant should provide a brief general summary of the regional and site geology.

#### **C. Evaluation Criteria (Ref: EPA Guidance 34, Attachment 3)**

1. Name of formation of aquifer.
2. Subsurface depth or elevation of zone.
3. Vertical confinement from other underground sources of drinking water.
4. Thickness of proposed exempted aquifer.
5. Area of exemption (e.g., acres, square miles, etc.)

6. Water quality analysis of the horizon to be exempted.
7. Demonstration that the aquifer "...does not currently serve as a source of drinking water." (40 CFR 14.4 (a)).

To demonstrate this, the applicant should survey the proposed exempted area to identify any water supply wells which tap the proposed exempted aquifer. The area to be surveyed should cover the exempted zone and a buffer zone outside the exempted area. The buffer zone should extend a minimum of a 1/4 mile from the boundary of the exempted area.

If no water supply wells would be affected by the exemption, the request should state that a survey was conducted and no water supply wells are located which tap the aquifer to be exempted within the proposed area.

#### **D. Mine Considerations—Amenability to Mining**

Applicants for aquifer exemptions to allow new in-situ mining should demonstrate that the aquifer is expected to contain commercially producible quantities of mineral. Information to be provided may include a brief summary of logging which indicate that commercially producible quantities of mineral are present, a description of the mining method to be used, general information on the mineralogy and geochemistry of the mining zone, and a development timetable. (Ref: USEPA Guidance 34, Attachment 3, page 3.)

1. Description of Production Zone;
  - a. Mineralogy
  - b. Geochemistry
2. Process Description;
  - a. Wellfield
  - b. Groundwater Monitoring Plan
3. Timetable for Development.

#### **E. Proposed Aquifer Exemption Boundary**

The applicant should provide a brief general summary of the process used to calculate the proposed aquifer exemption boundary. Reference should be made to the addendum of the Appendix D-12 where further, detailed information can be found.

**F. Addendums**

1. Map: The applicant should supply a hard copy map(s) that clearly depicts the boundary of the proposed aquifer exemption area. The map should be of sufficient scale to clearly show the following items:
  - a. proposed wellfield(s);
  - b. perimeter monitoring wells;
  - c. proposed aquifer exemption boundary;
  - d. permit boundary;
  - e. any drinking water supply wells within ¼ mile of the proposed aquifer exemption boundary or any drinking water supply well that may be effected by the mining operation.
2. Detailed calculations for the proposed aquifer exemption boundary.
3. Copy of WQD aquifer reclassification to Class V Mineral Commercial determination and the “statement of basis” document (as soon as available).
4. Copy of Notification for Public Participation (as soon as available).
5. Copy of USEPA aquifer exemption decision (as soon as available).

## **Reference Document 7: Attachment I Wyoming DEQ/WQD EPA Memorandum of Agreement Appendix A**

### **I. Introduction**

**A. Appendix A of the Memorandum of Agreement between the State of Wyoming DEQ/WQD and the EPA lists the following information requirements: (The EPA has accepted the Mine Operation Plan and Appendix D5 on a CD and the operator may submit this information in an electronic format attached to the Aquifer Exemption binder.)**Definition of the permit area with a map

**B. Application Appendix D-5**

Description of regional and site specific hydrogeology, including the mineralized zone, a map and description of groundwater uses

**C. Mine Operations Plan**

1. Description of mineralized zone including extraction techniques
2. Process description including
  - a. Wellfield
  - b. Monitoring plan

**D. Public Notice Documentation**

As soon as available, affidavits of notice to the public and copies of comments related to the groundwater classification.

## Reference Document 8: Well Installation/Completion

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## **I. Introduction**

The applicant shall describe the different steps and procedures used to install and complete wells. Often the steps and procedures used for injection and production wells are the same and may be combined. Different procedures for monitor wells shall be explained. The topics to be addressed include but are not limited to the following:

### **A. Well Casing Diameter**

The diameter of the well should be appropriate for the type of well being constructed. The annular space shall be large enough to allow a minimum sealing material thickness of 1½ inches between the outside casing diameter (excluding the casing joints) and the internal diameter (i.e., drill bit size) of the bore hole wall.

### **B. Well Construction Methods**

Describe the steps and methods used to construct the wells. This would include the use of pilot holes, type of drill rig used, and use of drilling mud or other drilling fluids. Typical well completion schematics are also required within the permit application.

### **C. Casing**

1. Suggested casing materials for wells include polyvinyl chloride (PVC), steel, HDPE, poly, or stainless steel. Galvanized steel and aluminum should not be used against lixiviant. The applicant needs to consider the depth of the well and the downhole pressures and temperatures when selecting the physical properties of the casing material. The use of screws anywhere on the casing material is not allowed. See also Chapter 11.
2. The applicant shall describe how the casing material will be joined and installed.
3. The description shall also describe the use of centralizers and their spacing. Casing shall be equipped with centralizers placed at a maximum spacing of one per 40 feet to ensure even thickness of annular seal.
4. The well opening must be covered and, for wells located in remote or unattended areas, it is recommended that the well head be closed with a locking cap.

#### **D. Annular and Surface Seals**

1. Describe the procedures and materials used to seal the annulus including the calculations used to determine the amount of cement or other sealing materials required to fill the void.
2. Acceptable materials used to create annular seals include neat cement slurry, sand-cement grout, or bentonite clay mixtures meeting the following requirements (Chapter 11).
  - a. Neat cement slurry shall be composed of Portland Cement and clean water in a proportion to yield a slurry weight of approximately 15 pounds per gallon.
  - b. Sand-cement grout is a mixture of one sack of Portland Cement (94 pounds), sand, and clean water in a proportion of not more than one part by volume sand to one part by volume cement. No more than 6½ gallons of water per sack of Portland Cement (94 pounds) shall be used in the mixture.
  - c. A bentonite clay slurry shall be composed of bentonite clay and clean water in a proportion to yield a slurry consisting of approximately 25% solids by weight of the slurry.
  - d. The sealing material shall be thoroughly mixed before placement so there are no balls, clods, or other features that could reduce the effectiveness of the seal.
  - e. Special quick-setting cement, retardants to setting, cement accelerators, retarders, fluid-loss additives, dispersants, extenders, loss-of-circulation materials and other additives, including hydrated lime to make the mix more fluid or bentonite to make the mix more fluid and reduce shrinkage, may be used, if approved by the Administrator.
  - f. Used drilling mud or drill cuttings from the borehole shall not be used as sealing material.
  - g. The minimum time that must be allowed for materials containing cement to “set” shall be in accordance with ASTM International (formerly American Society for Testing and Materials, ASTM C150-00 “Standard Specifications for Portland Cement” (2000)) or American Petroleum Institute (API) RP 10B “Recommended Practices for Testing Oil-Well Cements and Cement Additives” (22nd ed., 12/1997, with Addendums 1 (10/1999) and 2 (11/00)). When necessary, these times may be reduced by use of accelerators as determined by the well contractor.
  - h. Materials used in annular seals should not be emplaced by gravity or free fall methods, unless for the purposes of topping off to the surface.
  - i. A seal should be placed at the surface of all wells, sufficient to prevent water movement down the annular space.

The Administrator may grant deviations from these guidelines, provided that the operator can supply documentation of reliability, mechanical integrity, design and construction to protect groundwaters of the state.

**E. Screening and Packing**

1. The applicant shall describe any under-reaming techniques, how the correct interval is verified, and screening methods.

**F. Well Development and Stimulation Techniques**

Before baseline water-quality samples are taken, wells must be developed to restore the natural hydraulic conductivity and geochemical equilibrium of the aquifer. The applicant should describe the procedures used to develop the wells such as air lifting, swabbing, pumping, or other accepted development and stimulation techniques. This section should also describe what monitoring (i.e., pH and electrical conductivity) is performed to ensure the development activities have been effective.

**G. Mechanical Integrity Tests (MIT)**

1. MITs are required to be conducted on all Class III wells. While MITs are not required for operational monitoring wells outside the production zone, it is recommended. The pressure in the sealed casing, using packers, should be increased to 120% of the anticipated maximum operating pressure; a monitor well should be tested based on operating pressures of the surrounding production area. A well should maintain 90% of this pressure for 10 minutes to pass the MIT test.
2. The permit is required to include a schedule and describe the method of MIT to meet the requirements of Chapter 11 of LQD R&R. Single-point resistance testing is not a method approved by the administrator.
3. The results of the MIT shall be reported quarterly to the LQD. Reference Document 1, General Information, Attachment V contains a link to a spreadsheet for reporting the details of test. The required information includes:
  - a. Well identification
  - b. Date of the MIT
  - c. Method of testing and testing details such as the following
    - i. Packer depth
    - ii. Initial pressure
    - iii. Final pressure

- iv. Pressure loss
  - d. Casing type
  - e. Depth of casing
  - f. Results of test
  - g. Next test date
1. The report shall also include
    - a. Description of the method of plugging or repair of wells that failed the MIT
    - b. Result of the repair of plugging
    - c. Statement that the wells were plugged in accordance with the permit or prior approval was granted by the administrator for a different method.

## **II. Reporting Class III Well Completion Information**

The following well completion information should be reported:

1. Field identification number and the Wyoming State Engineer's Office permit number if applicable.
2. Location, date drilled, and aquifer represented.
3. Ground elevation and elevation of the measuring point.
4. Drill bit and casing diameter.
5. Packer base depth and elevation.
6. Casing depth and total depth.
7. Slotted or screened intervals (depth and elevation).
8. Total hydraulic head elevation (i.e., closed-in formation pressure if well is gassy or flowing; otherwise, static water level).
9. Method of measuring formation pressure.
10. Casing material and physical properties.
11. Well development techniques.

## **III. Well Acceptance Procedures**

LQD NonCoal Rules and Regulations, Chapter 11 requires an in situ operator to submit Notices of Completion of Construction (NOCC) for all Class III wells before their being placed in service. The LQD has then to inspect or otherwise review each well and to give

notice within 13 days of LQD intent to inspect acceptance or rejection of these wells. If notice is given, the LQD will inspect the well(s) within a reasonable time.

**A. Operator Tasks**

To comply with this regulation, the following procedures will be followed. The operator will send a letter to the LQD District Office enclosing the NOCC lists and requesting acceptance of completion, including

1. Two copies of hardcopy lists of wells for which certification is desired, signed by a company representative
2. Results of the MIT for all wells listed.
3. Two CD-ROMs with completed Excel-compatible spreadsheets containing well information and MIT results. An electronic copy of the spreadsheets may be obtained from the LQD website.

**B. LQD Tasks**

1. Following receipt of the above, the LQD District Office will within 13 days, inform the operator of whether an inspection will be performed and whether the NOCC is acceptable. Those wells found to be unacceptable or questionable shall be brought to the operator's attention at this time.
2. Wells found unsatisfactory must either be repaired or plugged and abandoned. Chapter 11 requires repair or plugging and abandonment within 120 days of wells which have failed an MIT. An inspection following after an inspection that had flagged one or more wells as unsatisfactory should inspect those wells to confirm that the wells have not been placed in service and if 120 days or more have passed, have been repaired, or plugged and abandoned. Information on these wells known to have been plugged and abandoned must be sent to the database office.

**Reference Document 9: Wellfield Package**

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## **I. Development Approach**

The applicant is highly encouraged to submit the first wellfield package with the initial permit application. The applicant should consider the following approach in preparation to the development of the wellfield package:

- A.** Increasing resolution of the geologic and groundwater models
- B.** Preparing the initial wellfield design. The design needs to consider the ability of the monitor well ring to adequately monitor the production zone.
- C.** Preparing a work plan for LQD review before conducting extensive field activities
- D.** Installing additional baseline monitor wells
- E.** Measuring hydraulic properties of the production zone and demonstrating the extent of hydraulic connection between the ore zone and perimeter monitoring wells
- F.** Confinement between the production zone and the deep monitor zone and shallow monitor zone aquifers. Also, demonstrating the hydraulic characteristics of any influencing boundaries in or near the wellfield.
- G.** Installing perimeter monitor wells
- H.** Providing Notices of Completion of Construction of construction for Class III wells.
- I.** Conducting wellfield pump tests
- J.** Providing groundwater model verification
- K.** Preparing and submitting the final wellfield package

## **II. Wellfield Package Contents**

At a minimum, the wellfield package will contain the following:

**A. Map(s)**

A map(s) showing the area to be affected by mining depicting the proposed location of the injection wells, production wells, and locations of existing monitor wells.

**Soil Salvage and Protection**

The applicant must indicate on an appropriate mine operations map the areas which will have the topsoil salvaged and placed in a long term topsoil stockpile and those areas where mine operations will take place but the topsoil will not be salvaged. The information for this section must also include the depth and volume of soil material to be salvaged.

**B. Hydraulic Connection and Confinement/Control**

Demonstration of the lack of hydraulic connection and confinement between the production zone and the vertically adjacent aquifers. The application must also demonstrate the extent of hydraulic connection between the production zone and the horizontal monitor well ring. This includes cross sections, isopachs of all potentially affected aquifers and confining units, potentiometric surface maps, and structural contour maps. Isopach and structural contour maps should include the production zone sand, overlying and underlying aquitard units, and overlying and underlying aquifers. Each proposed production zone sand should be identified separately. The slotted or screened intervals of each perimeter and production zone well will need to be keyed to the specific production zone sand.

**C. Wellfield Specific Pump Tests**

1. Hydraulic properties of production zones
2. During the planning phase, with LQD participation, the anticipated pump test location, pumping rate, and test duration should be determined. The duration of the pump test should be sufficient to adequately stress the overlying and underlying aquifers.
3. Results of aquifer testing which demonstrates that the perimeter zone monitor wells are in communication with the production zone wells.
4. Geologic and hydrologic data from the overlying and underlying aquifers demonstrating the extent of hydraulic communication with the production zone aquifer.

**D. Potentiometric Surface Maps**

Potentiometric surface maps for production zones to be mined, as well as the immediately overlying aquifer(s) (as applicable), and the underlying aquifer(s) (as applicable), as developed from premining water levels.

**E. Baseline Water Quality**

There are four sets of data to be collected for baseline water quality: overlying aquifers, underlying aquifers, the horizontal monitor well ring and the production zone.

**F. Proposed Target Restoration Values**

**G. The Proposed Monitor Well Upper Control Limits**

**H. Aquifer Reclassification and Exemption**

**I. Details of Location, construction and Completion Details for Monitoring Wells**

**J. Summary Tables showing location, construction and completion details for Monitoring Wells**

**K. Mechanical Integrity Test (MIT) Records for Class III Injection Wells**

**L. Abandonment Records**

Include the search for, and handling of exploration drill holes located within the wellfield perimeter monitoring well ring.

**III. The Wellfield Data Package Processing**

The wellfield data package should be submitted (in duplicate) in a three-ring binder.

**A.** Wellfield packages that are for wellfields identified in the current permit will be processed as a minor revision, and will not be required to complete the public notice for the UIC process, as long as the wellfield remains within the current reclassification boundary.

**B.** Wellfield packages that are for wellfields not identified in the current permit will be processed as a major revision and will be required to complete the public notice process.

## Reference Document 10: Premining Water Quality and Quantity Sampling

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## I. Introduction

In an effort to improve the consistency of water quality and quantity data submitted to the Land Quality Division, a permit wide premining or baseline groundwater sampling and analysis plan should be prepared and implemented as part of each research and development (R&D) and commercial scale in situ mining permit. Although a very good discussion of a sampling and analysis plan is covered in the Resource Conservation and Recovery Act guidance document (EPA, 1986) on pages 97-128, the following points are presented to emphasize or elaborate on information provided in the RCRA guidance document. A baseline sampling plan should include information on: monitoring locations, sampling frequency, field measurements, sampling methods, sample preservation and handling methods, chain of custody, quality assurance/quality control measures, and water quality constituents. These items are described in more detail below.

Site-specific conditions, mining operations, and the purposes of collecting water quality data may warrant modifications to recommended procedure. An explanation for such modifications should be provided with the baseline monitoring program submitted to the LQD.

## II. Monitoring Locations and Frequency

### A. Groundwater

#### 1. Sampling Locations

All groundwater aquifers potentially affected by mining operations must be sampled, including: production zones, overlying aquifers, underlying aquifers, alluvial aquifers, and any unit in hydraulic communication with those aquifers. For permit-wide baseline monitoring, a minimum of three, aerially spaced monitoring wells per affected aquifer should be sampled, with a standard guideline of at least one production zone aquifer well per square mile (Table 1 for recommended well location density and sampling frequency). More samples may be necessary for partially confined aquifers and for shallow, water table aquifers which may react more quickly to seasonal changes and to surface affects. Significant springs or seeps in the permit area and within 2 kilometers should also be included for sampling. *Because of variable hydrogeologic conditions and project dimensions, it is recommended that the applicant coordinate with the LQD in determining the exact number and location of monitoring wells before commencement of baseline groundwater monitoring.*

#### 2. Sampling Frequency

For permit-wide baseline sampling, representative groundwater water quality samples should be taken quarterly for a minimum of one year to characterize

potentially affected aquifers. Static groundwater elevations, reported in tenths of a foot, should be measured quarterly for one year; however, based on hydrologic conditions, LQD may request more frequent measurement and reporting. Continuous monitoring should be considered where hydrographs are needed for assessment of groundwater recharge or discharge zones. Closed-in pressure readings may be necessary in gassy wells and flowing artesian wells. A casing extension may be used for flowing artesian wells.

For more detailed mining unit sampling, all monitoring wells per mining unit should be sampled four times (minimum of 2 weeks between samplings). Wellfield wells (injection and production) should be sampled four times (minimum of 2 weeks between samplings) during mine unit baseline characterization at a recommended density of 1 well per 4 acres of mining unit. The first and second sampling events should include analyses for all parameters listed in Table 2. The third and fourth sampling events can be analyzed for a reduced list of parameters as defined by the results of the previous samplings (e.g., if certain parameters are not detected during the first and second samplings, then those elements need not be analyzed for during the third and fourth sample outings). Recommended sampling density and frequency for mine unit monitoring as part of wellfield packages is provided in Table 1.

### 3. Sampling Method

It should be documented that aquifer water and not borehole water is being collected. This can be done by withdrawing at least two casing volumes of water prior to sampling (document pump rate and purging time) or by pumping until pH, conductivity, and temperature readings remain constant (document changes in each constituent against time in tabular form). If recharge cannot match minimal pumping rates in the low permeability aquifers, then a sample can be retrieved by clearing the borehole once and bailing water that subsequently enters the well. Low flow sampling is recommended for low-yielding aquifers. Other techniques may also be employed with prior approval of the LQD. The sample withdrawal technique should be selected based on a consideration of the stability of the parameters of interest and yield of the aquifer. Procedures for evacuating each well prior to sample collection should be documented.

### 4. Description of Alternative Sampling Methods

If methods are used other than those outlined in 40 CFR Part 136, then a brief description of these alternative methods and associated justifications for their use should be included.

**Table 1. Recommended Groundwater Sampling Frequency and Density**

Area to be Sampled	Purpose of Sampling	Frequency	Density	Parameters Sampled for	QA/QC
Regional or Permit Wide	LQD review of regional groundwater quality for initial permitting and for obtaining UIC permit	Quarterly for One year	1 well per mi <sup>2</sup> in The production zone aquifer, minimum of 3 wells for overlying and underlying aquifers	Table 2	1 duplicate per quarter, 1 blank per quarter, and 1 standard reported from the lab per quarter
Mining Unit Monitoring Wells	To establish UCLs & to characterize the geo-chemical environment of the buffer zone in case major excursions alter the buffer zone such that restoration is required	4 samples taken at a minimum of 2 weeks apart	All mine unit monitoring wells, including overlying and underlying aquifers	1 <sup>st</sup> sampling Table 2 Next 3, UCL parameters only	1 duplicate, 1 standard & 1 blank for Table 2 parameter set only
Wellfield Wells	To establish restoration goals	4 samples taken at a minimum of 2 weeks apart	1 well per 4 acres	First 2 samplings, Table 2  Second 2 samplings “short list” as defined by results of previous regional or mining unit samplings	1 duplicate per outing 1 blank per outing 1 standard per outing

**Table 2. Groundwater Quality Laboratory Analysis Parameters (WDEQ/LQD)**

Constituents (reported in mg/l unless noted)	
Major Ions	Metals <sup>3</sup> and Radioactive
Calcium <sup>(d)</sup>	Aluminum <sup>(d)</sup>
Magnesium <sup>(d)</sup>	Arsenic <sup>(d)</sup>
Sodium <sup>(d)</sup>	Barium <sup>(d)</sup>
Potassium <sup>(d)</sup>	Boron <sup>(d)</sup>
Carbonate as CO <sub>3</sub>	Cadmium <sup>(d)</sup>
Bicarbonate as HCO <sub>3</sub>	Chromium <sup>(d)</sup>
Sulfate	Copper <sup>(d)</sup>
Chloride	Iron <sup>(d)</sup>
Ammonia as N	Lead <sup>(d)</sup>
Nitrate as N <sup>5</sup>	Manganese <sup>(d)</sup>
Nitrite + Nitrate as N <sup>5</sup>	Mercury <sup>(d)</sup>
Fluoride	Molybdenum <sup>(d)</sup>
Sodium absorption ratio <sup>1</sup>	Nickel <sup>(d)</sup>
Silica <sup>(d)</sup>	Selenium <sup>(d)</sup>
Total Dissolved Solids <sup>2</sup> (TDS) @ 180°F	Vanadium <sup>(d)</sup>
Conductivity (umhos/cm)	Zinc <sup>(d)</sup>
Alkalinity as CaCO <sub>3</sub>	Uranium <sup>(t)</sup>
pH (field and laboratory, standard units)	<sup>226</sup> Radium <sup>4</sup> pC/L
	<sup>228</sup> Radium <sup>4</sup> pC/L
	Gross Alpha (Radium + Uranium) <sup>6</sup> pC/L

*Table 2 updated 2/6/2014*

d = dissolved concentration (dissolved metals: those metals in an unacidified sample that pass through a 0.45 micron filter; standard methods for the examination of Water and Wastewater, 21<sup>st</sup> Edition, 2005.).

t = total concentration (unfiltered sample). Note: Nitric acid preservation and/or sample digestion will be needed to achieve the “total” status. Also, radiochemical constituents should be reported in pC/L.

$$SAR = Na^+ / \sqrt{(Ca + Mg)^{++} / 2}$$

1 From WQD Chapter 8, Section 2(o). Note: SAR is unit less.

2 TDS analysis requires filtration through a nominal 1-2 micron glass fiber filter.

3 If the turbidity of the sample is less than 20 NTU (Nephelometric Turbidity Units), the samples can be analyzed for total metals. If turbidity is greater than 20 NTU, or in the absence of NTU data, the sample should be analyzed for dissolved metals.

4 Requirements and procedures for the measurement and analysis of gross alpha particle activity, Radium 226 and Radium 228 shall be the same as requirements and procedures of the U.S. Environmental Protection Agency, National Primary Drinking Water Regulations, EPA-816-F-09-004, effective May 2009. <sup>226</sup>Radium and <sup>228</sup>Radium may be reported separately.

5 Nitrate may be analyzed by EPA Method 353.2 (automated colorimetry). However, if nitrate plus nitrite as N exceed 10 milligrams/liter, the well should be re-sampled for nitrate + nitrites separately by an EPA approved standard method for drinking water within 5 working days. Note: this analytical approach somewhat deviates from WQD, Chapter 8, Table 1.

6 To comply with WQD Chapter 8, Table 1.

## B. Surface Water

### 1. Sampling Locations

On all perennial and intermittent streams flowing through the project area or impacted by drainage from the project, well-mixed zones should be sampled both upstream and downstream of the lands to be affected. Also, on-site water impoundments (including lakes, ponds, or stock dams) or off-site impoundments subject to direct drainage from the project site should be sampled. In addition, a reconnaissance sampling program should be conducted to include samples at groundwater discharge points and on channels draining different geologic units. Surface water quality samples should be collected from benchmarked sampling points where flow can be measured or calculated.

### 2. Sampling Frequency

On perennial and intermittent streams, samples should be collected monthly in order to identify seasonal variation. On ephemeral streams, one sample should be taken as early as possible during snowmelt runoff, and one should be taken during a thunderstorm runoff event. The use of passive samplers on ephemeral streams is recommended.

### **III. Field Measurements**

Field data sheets should be generated for each water-quality sample or water level collected. Along with laboratory results, field data sheets should be submitted to LQD. The following parameters serve as a minimum for data to be collected in the field. For low flow sampling ensure the field parameters have stabilized (three consecutive readings spaced 5 minutes apart, are within 10% of previous reading) prior to collecting the sample.

#### **A. Groundwater**

- pH (report to nearest 0.1 standard units)
- temperature (°C)
- electrical conductivity, (umhos/cm corrected to 25°C)
- water level, reported to the nearest 0.1 foot AMSL (above mean sea level) or 0.1 psi
- Water level measurements shall be made immediately before sampling. Wells that are free-flowing artesian should be completely closed in and stabilized before pressure measurements.
- total depth of the well
- number of casing volumes purged prior to sampling, if the casing volume purge method is used (ground water only)

#### **B. Surface Water**

- pH (report to nearest 0.1 standard units)
- temperature (°C)
- electrical conductivity (umhos/cm corrected to 25°C)
- instantaneous discharge (ft<sup>3</sup>/second)
- turbidity (NTUs)
- dissolved oxygen (DO)

### **IV. Sample Preservation and Handling**

Because many parameters are unstable after sample collection and cannot be analyzed in the field due to logistical constraints, sample preservation is recommended. Samples should be kept on ice (4 degrees C) and stored in the dark until analysis. The operator is responsible for ensuring all sample preparation, handling and preservation procedures required for the analytical method used.

## **V. Chain of Custody**

**A. An adequate chain-of-custody program is to be described.**

## **VI. Quality Assurance/Quality Control**

Quality control during sampling should be implemented to detect any data errors that may result from improper sampling or analytical methods, poor sample preservation, or collection of non-representative samples. The following quality control samples should be collected, analyzed and reported for every twenty (20) samples or once every sample collection round, whichever is less, to help verify that the sample collection system is producing reliable information. The results of all field and lab QC samples are to be included along with the analytical reports submitted to the DEQ/LQD, including a comparison of original and duplicate samples and relative percent difference.

**A. Duplicate Samples.**

At randomly selected stations duplicate samples are collected by filling two separate bottle sets from any one station and preserving, storing and shipping the sets in an identical manner. This provides a check of precision.

**B. Sample Preservation Blanks.**

Field blanks are essentially low standards produced in the field. The same quantity of appropriate preservative should be added to sample bottles filled with distilled water. Field blanks check for analytical recognition of zero values, any positive bias from contaminated sample bottles or preservatives, and any contamination from atmospheric sources (e.g., airborne dust).

**C. Documentation of Standardizing or Calibration of Equipment.**

The frequency and method of standardizing or calibrating test equipment brought into the field needs to be documented; typically, this equipment includes pH and conductivity meters.

## **VII. Reporting and Analysis**

The results of water quality analyses should be tabulated in the application. The following information is required to be submitted to LQD for each sample:

1. Sample collection and preservation methods;
2. Sample site identification table (ID, location, aquifer, etc.);
3. Laboratory identification (if different than sample site ID);
4. Date and time of sample collection;
5. Date analyzed;
6. Discharge or water level at time of sampling;
7. Field parameters including field sheets;
8. Raw analytical results (including associated units);
  - Results of QA/QC samples should be included.
  - Samples with analytical results below the detection limit should be reported as “<” detection limit.
  - Premining samples that exceed EPA primary or secondary drinking water standards should be flagged in the raw data tables or compiled in a separate table.
9. Statistical analysis of results.
  - Results should be tabulated for each monitoring site to provide: number of samples collected, mean, median, maximum, and minimum concentrations.
  - When computing statistics, results below the detection limit should be included as either the detection limit or one-half the detection limit, stating which method was chosen.
  - Graphical presentation of water-quality and water level data is encouraged to increase visualization of trends. Examples of such may include piper or trilinear diagrams, stiff diagrams, boxplots, and time-series graphs.