STATE OF WYOMING
DEPARTMENT OF ENVIRONMENTAL QUALITY
UNDERGROUND INJECTION CONTROL PERMIT ISSUED UNDER
WYOMING WATER QUALITY RULES AND REGULATIONS
CHAPTER 13

CLASS I INJECTION WELL

(X) New
( ) Modified
County: Sweetwater

Permit Number: **09-586**
Previous Permits: none
UIC Facility Number: WYS-037-00122

In compliance with the Wyoming Environmental Quality Act (W.S. 35-11-101 through 1104, specifically 301(a)(i) through 301 (a)(iv), Laws 1973, Ch. 250, Section 1) and Wyoming Water Quality Rules and Regulations (WQRR) Chapter 13 (Ch13).

Applicant:

Lost Creek ISR, LLC
5880 Enterprise Drive, #200
Casper, WY 82609
(307) 265-2373

Lost Creek ISR, LLC, hereafter referred as the permittee, is authorized to drill, complete, and operate the proposed wells LC DW No. 1 (already drilled but not completed), LC DW No. 2, LC DW No. 3, LC DW No. 4, and LC DW No. 5 according to the procedures and conditions of application 09-586 and to the requirements and other conditions of this permit. Issuance of a permit for a proposed well does not obligate the Department of Environmental Quality to approve injection if doing so would endanger human health or the environment or if the well does not comply with all the terms and conditions of this permit (Ch13, Sec8(e)).

This is an area permit for five wells of the
Lost Creek Disposal Wellfield.
No additional wells may be constructed under this permit without prior permit modification.

This permit shall become effective on the date of issuance and is valid for 10 years thereafter Any proposed well not completed before expiration of this permit will not be included in a renewal or modification of this permit.

Louis B. Harmon
for John Wagner, Administrator
Water Quality Division
Herschler Building 4-W, 122 West 25th Street
Cheyenne, WY 82002
(307)-777-7781

28 May 2010
Date

John V. Corra, Director
Department of Environmental Quality
Herschler Building 4-W, 122 West 25th Street
Cheyenne, WY 82002

5/28/10
Date

GDL/rm/10-0450

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### A. Discharge Zones

The disposal wells are authorized to inject into the Fort Union Formation within the intervals specified in Table 1:

**Table 1. Discharge Zone(s)**

| Well Name | Surface Elevation | Depth to Top of Discharge Zone | Depth to Bottom of Discharge Zone | Gross Discharge Zone Thickness | Depth bgs |
|---|---|---|---|---|---|
| LC DW No. 1 | 6,816 ft | 6,139 ft | 9,590 ft | 3,451 ft | 2,774 |
| LC DW No. 2 (proposed) | 6,873 ft | 6,250 ft | 8,350 ft | 2,100 ft | 1,477 |
| LC DW No. 3 (proposed) | 6,984 ft | 6,350 ft | 8,450 ft | 2,100 ft | 1,466 |
| LC DW No. 4 (proposed) | 6,959 ft | 6,450 ft | 8,550 ft | 2,100 ft | 1,591 |
| LC DW No. 5 (proposed) | 6,995 ft | 6,600 ft | 8,700 ft | 2,100 ft | 1,705 |

Perforations in addition to those listed in the application may be installed within the intervals given above. Perforations above or below these intervals require the prior written approval of the Administrator.

The confining zone above the discharge zone consists of approximately 300 feet of shale at the base of the Wasatch Formation with minor sandstone and siltstone in beds less than 20 feet thick and trace coal.

**B. Wells and Areas of Review**

The wells authorized by this permit are located as shown in Table 2:

**Table 2. Well Location(s)**

| Well Name | Legal Description | Northing* | Easting* |
|---|---|---|---|
| LC DW No. 1 | NE1/4 SW1/4 Section 25, T25N, R93W | 4,665,776 | 261,383 |
| LC DW No. 2 (proposed) | NE1/4 SE1/4 Section 19, T25N, R92W | 4,667,177 | 263,882 |
| LC DW No. 3 (proposed) | SE1/4 SW1/4 Section 13, T25N, R93W | 4,668,717 | 261,479 |
| LC DW No. 4 (proposed) | NW1/4 SE1/4 Section 18, T25N, R92W | 4,668,854 | 263,537 |
| LC DW No. 5 (proposed) | NW1/4 SE1/4 Section 17, T25N, R92W | 4,669,109 | 265,433 |

*UTM Zone 13, NAD83 (meters)

Sixteenth sections included in the Area of Review (Ch13, Sec5(b)(iv)(E)) are listed in Table 3.

**Table 3. Legal Description(s) of the Area(s) of Review**

| Well Name | Quarter-Quarters | Section | Township |
|---|---|---|---|
| LC DW No. 1 | NWNW, NENW | 1 | T24N, R93W |
| | all NE, all NW | 2 | |

| Well Name | Quarter-Quarters | Section | Township |
|---|---|---|---|
| | all NE, NENW | 3 | |
| | all 30 | | T25N, R92W |
| | all SE, all SW, all NW, SWNE | 19 | |
| | SWNW, NWSW, SWSW | 29 | |
| | all but SESE | 31 | |
| | all 24, 25, 26, 35, 36 | | T25N, R93W |
| | SESE, SWSE, SESW, SWSW | 13 | |
| | SESE | 14 | |
| | all but NWNW | 23 | |
| | all NE, all SE | 27 | |
| | all NE, NESE, SESE | 34 | |
| LC DW No. 2 (proposed) | NENW, NWNW | 6 | T24N, R92W |
| | NENE, NWNE, NENW, NWNW | 1 | T24N, R93W |
| | all 17, 18, 19, 20, 21, 28, 29, 30, 31, 32 | | T25N, R92W |
| | SENE, SWNE, SENW, SWNW, all SW, all SE | 7 | |
| | SWNE, SENW, SWNW, all SW, all SE | 8 | |
| | NWSW, SWSW, SESW | 9 | |
| | SWSW | 15 | |
| | all but NENE | 16 | |
| | NWNW, SWNW, NWSW, SWSW | 22 | |
| | NWNW, SWNW, NWSW | 27 | |
| | NENE, NWNE, SWNE, all NW, NESW, NWSW, SWSW | 33 | |
| | all 13, 24, 25 | | T25N, R93W |
| | all SE, SESW, SWSW | 12 | |
| | NENE, SENE, all SE | 14 | |
| | NENW, all NE, SENW, NESW, SESW, all SE | 23 | |
| | SENW, all NE, NENW, all SE | 26 | |
| | NENE, SENE | 35 | |
| | all NE, all NW, NESW, NWSW, all SE | 36 | |
| LC DW No. 3 (proposed) | all 7, 18, 19, 30 | | T25N, R92W |
| | SWNW, all SW, NWSE, SWSE, SESE | 6 | |
| | NWNW, SWNW, SENW, all SW, NWSE, SWSE | 8 | |
| | NWNE, SWNE, all NW, all SW, all SE | 17 | |
| | NWNE, SWNE, all NW, all SW, NWSE, SWSE | 20 | |
| | all NW, NWSW | 29 | |
| | NENW, NWNW | 31 | |
| | all 11, 12, 13, 14, 15, 22, 23, 24, 25, 26 | | T25N, R93W |
| | SENE, SWNE, SENW, SWNW, all SW, all SE | 1 | |
| | SENE, SWNE, SENW, all SW, all SE | 2 | |
| | NESE, SESE, SWSE | 3 | |
| | all NE, NENW, SENW, SWNW, all SW, all | 10 | |

| Well Name | Quarter-Quarters | Section | Township |
|---|---|---|---|
| | SE | | |
| | NENE, SENE, NESE, SESE | 16 | |
| | NENE, SENE, NESE, SESE | 21 | |
| | all NE, NENW, NWNW, SENW, NESW, all SE | 27 | |
| | NENE, NWNE, NENW, NWNW, SENE | 35 | |
| | NENE, NWNE, NENW, NWNW, SWNW, SENW, SWSE | 36 | |
| LC DW No. 4 (proposed) | all 6, 7, 8, 16, 17, 18, 19, 20, 21, 29, 30 | | T25N, R92W |
| | NWSW, SWSW, SESW | 4 | |
| | SENE, SWNE, all NW, all SW, all SE | 5 | |
| | all but NENE | 9 | |
| | NWNW, SWNW, NWSW, SWSW | 15 | |
| | SWNW, NWNW, NWSW | 22 | |
| | NWNE, SWNE, all NW, NESW, NWSW, SWSW | 28 | |
| | NENE, NWNE, NENW, NWNW | 31 | |
| | NWNE, NENW, NWNW | 32 | |
| | all 12, 13, 14, 23, 24, 25 | | T25N, R93W |
| | all NE, SENW, SWNW, all SW, all SE | 1 | |
| | NESE, SESE, SWSE | 2 | |
| | all NE, NENW, SENW, all SW, all SE | 11 | |
| | all NE, NENW, NESE | 26 | |
| | NENE, NWNE | 36 | |
| LC DW No. 5 (proposed) | all 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20, 21, 22, 28, 29 | | T25N, R92W |
| | SWNE, SENW, SWNW, NWNW, all SW, all SE | 3 | |
| | NWNW, SWNW, all SW | 11 | |
| | all NW, all SW | 14 | |
| | all NW, NWSW, SWSW | 23 | |
| | all NE, all NW, NESW, NWSW, SWSW | 27 | |
| | all but SWSW | 30 | |
| | NENE | 31 | |
| | NENE, NWNE, NENW, NWNW | 32 | |
| | NWNE, NENW, NWNW | 33 | |
| | all 13 | | T25N, R93W |
| | SENE, all SE | 1 | |
| | all but NWNW | 12 | |
| | all NE, all NW, NESW, SESW, all SE | 24 | |
| | all NE, NESE | 25 | |
| | SESE, SWSE | 31 | T26N, R92W |
| | SESE, SWSE, SESW, SWSW | 32 | |
| | SESE, SWSE, SESW, SWSW | 33 | |

Results of the area of review calculations are shown in Table 4. The area of review is based on the larger of the radius of a pure waste cylinder, the radius of the cone of influence, or the minimum radius (Ch13, Sec5(b)(iv)).

## C. Groundwater Classification

The groundwater in the Fort Union Formation aquifer system within the mine permit boundary (LQD TFN 4 6/268) and with upper and lower boundaries defined by the discharge zones in Table 1 is classified as Class VI according to Wyoming Department of Environmental Quality (WDEQ), WQRR, Chapter 8. This classification was made for the following reason(s):

- The depth and location make use of the water economically and technologically impractical (WQRR Chapter 8. Section 4.d.ix.C).

## D. Authorized Operations

Well Design – Injection shall be conducted through tubing which has been secured by a packer within 500 feet of the top of the receiver aquifer (Ch13, Sec9(d)(xxv)) and which has been isolated from the long string casing by a fluid-filled annulus.

Injection Rates - Each well is allowed a maximum instantaneous injection rate shown in Table 6 provided that the surface pressure limitations are not exceeded. The permittee shall set an alarm to detect increases in the injection rate above the maximum permitted instantaneous rate and shall immediately cease injection when the alarm is triggered; or shall install a kill switch to prevent injection at above the permitted rate.

**Table 4. Area of Review**

| | LC DW No. 1 | LC DW No. 2 (proposed) | LC DW No. 3 (proposed) | LC DW No. 4 (proposed) | LC DW No. 5 (proposed) |
|---|---|---|---|---|---|
| Radius of Pure Waste Cylinder (ft) | 400 | 400 | 400 | 400 | 400 |
| Radius of Cone of Influence (ft) | 8,700 (9,200)* | 11,400 (12,550)* | 11,650 (12,100)* | 12,100 (13,500)* | 12,600 (14,200)* |
| Minimum Radius of Area of Review (ft) | 1,320 | 1,320 | 1,320 | 1,320 | 1,320 |

*Radius calculated with Theis equation and well function (exponential integral) rather than log approximation.

Permitted Wastes - Wastes to be injected are described as follows:
Liquid waste generated by uranium mining using in-situ leaching at the Lost Creek Project including operation bleed streams, yellowcake wash water, sand filter and ion exchange wash water, on-site laboratory waste water, reverse osmosis brine, groundwater restoration and groundwater sweep solutions, plant washdown water, wash waters used in cleaning or servicing the waste disposal system equipment, and stormwater.

Fluids produced during the drilling, completion, testing, or stimulation of wells or test holes related to mining operations at the Lost Creek Project; or during the workover or abandonment of any such well; and drilling equipment wash water.

North American Industry Classification System (NAICS) – 212291

The radionuclide-bearing waste produced at this facility by in-situ uranium mining has been defined by the Atomic Energy Act as Section 11e.(2) byproduct material and is regulated by the Nuclear Regulatory Commission (NRC) under Title 10 Code of Federal Regulations Part 40. It is not "solid waste" according to Title 40 Code of Federal Regulations Part 261.4(a)4 and is consequently not hazardous waste. Because Wyoming is a "non-agreement" state, the NRC retains jurisdiction over in-situ mining wastes and the permittee shall not use the injection wells for waste disposal without the proper NRC license.

The expected concentration ranges for selected chemical species are listed in Table 7.

**Table 5. Water Quality of the Discharge**

| | Units | Median | Maximum | Minimum |
|---|---|---|---|---|
| Calcium | mg/L | unknown | 1,000 | 200 |
| Sodium | mg/L | unknown | 3,000 | 150 |
| Potassium | mg/L | unknown | 1,000 | 10 |
| Bicarbonate | mg/L | unknown | 4,000 | 1,500 |
| Carbonate | mg/L | unknown | 500 | 0 |
| Sulfate | mg/L | unknown | 2,000 | 80 |
| Chloride | mg/L | unknown | 4,000 | 200 |
| Ammonia (as N) | mg/L | unknown | 500 | 50 |
| pH | s.u. | unknown | 9 | 6 |
| Total Dissolved Solids (TDS) | mg/L | unknown | 15,000 | 4,000 |
| Uranium (as $U_3O_8$) | mg/L | unknown | 15 | 1 |
| $^{228}$Radium | pCi/L | unknown | 3,000 | 300 |

Permission to discharge other non-hazardous waste may be authorized through a minor permit modification (Ch13, Sec8(d)(v)). Additional monitoring may be required for additional waste types.

Permitted Corrosion Inhibitors, Anti-Scalants, and Biocides - Corrosion inhibitors, anti-scalants, and biocides may be added to the waste stream with the prior written approval of the Administrator.

Injection Pressure - The injection pressure in each injection well shall be limited to the fracture pressure of the receiver except as necessary during well stimulation approved by the Administrator (Ch13, Sec9(d)(ii)). Temporary limits are listed for each well in Table 6. The temporary limit applies until recalculation of the parameters in Table 6 following completion of a step-rate test. Exceeding the limiting surface injection pressure (LSIP) in Table 6 or creating or propagating fractures within the receiver or confining zone once waste disposal has commenced are violations of this permit and shall be reported pursuant to Section K of this permit. A high-pressure kill switch shall be installed on the injection tubing and set to preclude violations of injection pressure limits.

For each well, the permittee shall conduct a step-rate injection test within one year of permit issuance or well completion (i.e., casing cemented and perforated), whichever comes later, to determine the actual fracture pressure of the receiver (Ch13, Sec9(d)(ii)). Such tests shall be conducted using both surface and downhole gauges or transducers. The downhole device shall be placed within one hundred vertical feet of the packer. For a conclusive result, at least three of the injection rate steps below the fracture threshold will be colinear. Upon completion of the test, the permittee shall recalculate the maximum surface injection pressure (MSIP) and LSIP.

If the recalculated LSIP is greater than the temporary LSIP in Table 6, the permittee must obtain the approval of the Administrator before operating the well at a pressure above the temporary LSIP. If the new LSIP is less than the temporary LSIP in Table 6, the permittee must cease injection and not restart discharge until the wellhead pressure can be maintained below the recalculated LSIP. The permittee may conduct additional step-rate injection tests, at its discretion, to refine estimates of MSIP as injection continues.

Step-rate data, analyses, and interpretations may be included in the well completion report or submitted separately to the Administrator within one month of completion of the test or with the next quarterly report, whichever is later.

Annulus Pressure – The annulus between the injection tubing and the long string casing shall be filled with a corrosion-inhibiting fluid and be monitored and maintained in a way that allows reliable leak detection. The annulus pressure shall be maintained within the limits set in Table 6. During periods of continuous injection, the annulus pressure should be reasonably constant but large variations in pressure are allowed during startup and shutdown. The permittee shall set alarms to detect increases or decreases in annulus pressure that could indicate loss of mechanical integrity and shall immediately cease injection and shut the well in when an alarm is triggered; or the permittee shall install a kill switch to stop injection if the casing, tubing, packer, or well head leak. Settings for low- and high-pressure alarms shall take into account annulus pressure changes due to variations in temperature of the annulus fluid.

**Table 6. Maximum Injection Rates, Annulus Pressures, and Maximum and Limiting Surface Injection Pressures (MSIP, LSIP)**

| | LC DW No. 1 | LC DW No. 2 (proposed) | LC DW No. 3 (proposed) | LC DW No. 4 (proposed) | LC DW No. 5 (proposed) |
|---|---|---|---|---|---|
| Maximum Injection Rate (bbl/day) | 1,714.3 | 1,714.3 | 1,714.3 | 1,714.3 | 1,714.3 |
| Maximum Annulus Pressure (psig) | 800 | 800 | 800 | 800 | 800 |
| Minimum Annulus Pressure (psig) | 200 | 200 | 200 | 200 | 200 |
| Fracture Gradient, $F_r$ (psi/ft) | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Depth to Top of Perforations, $D_p$ (ft) | 6,139 | 6,300 | 6,400 | 6,500 | 6,650 |
| Temperature in Well* (°F) | 102 | 98 | 99 | 100 | 101 |
| TDS of Injectate (mg/L) | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 |
| Density of Injectate, $\rho_j$ (g/cm$^3$) | 1.0131 | 1.0132 | 1.0132 | 1.0132 | 1.0132 |
| Injectate Fluid Gradient (psi/ft) $grad_j = \rho_j \cdot 12\frac{in}{ft} \cdot 16.387\frac{cm^3}{in^3} / 453.592\ \frac{g}{lb}$ | 0.4392 | 0.4393 | 0.4392 | 0.4392 | 0.4392 |
| $MSIP = (D_p \cdot F_r) - (D_p \cdot grad_j)$ (psig) | 373 | 383 | 389 | 395 | 404 |
| $LSIP = 0.9 \cdot MSIP$ (psig) | 336 | 344 | 350 | 355 | 364 |

*Average of the injectate (assumed to be 50° F) and formation temperatures.

New Well Construction - The permittee shall obtain written acceptance of financial assurance from WDEQ prior to completion of LC DW No. 1 and prior to construction of each of the other wells. The well(s) covered by this permit shall be cased and cemented so as to prevent movement of fluid from the well(s) or borehole(s) into any underground source of drinking water (USDW) (Ch13, Sec11(a)). All well materials shall be compatible with the wastes that may be contacted (Ch13, Sec11(b)) and the casing and cement shall be designed for the life expectancy of the well (Ch13, Sec11(c)).

Any well stimulation activities require prior approval of the Administrator.

The packer at the bottom of the tubing shall be set within 500 feet of the top of the authorized discharge zone (Table 1) for each well and within a zone of good quality cement bond as shown by a cement bond log (Ch13, Sec9(d)(xxv)).

Injection into a well may not begin until:

1. Well construction is complete (Ch13, Sec9(d)(xxix)); and

2. The permittee has submitted a well completion and testing report and the "Notification of Completion of Construction of Injection Well" (available on the WQD - UIC Program web site - http://deq.state.wy.us/wqd/groundwater/uicprogram/index.asp) for a newly constructed or modified well; and

3. The permittee has provided the Administrator with sufficient notice to allow for inspection of the well (Ch13, Sec9(d)(xxiv); and

4. Mechanical integrity of the well and cement bonding of the long string casing have been proven or demonstrated to the satisfaction of the Administrator; and

5. The permittee has demonstrated financial assurance (Ch13, Sec17(a)).

6. The permittee has received written approval from the Administrator to begin injection.

**E. Prohibitions**

**This permit does not allow for the injection of any hazardous waste** as defined in 40 CFR 261.3 or in Wyoming Solid Waste Management Rules and Regulations, Chapter 2. Injection of any substance defined as a hazardous waste, whether hazardous by listing or by characteristic is a violation of this permit.

No person shall conduct any authorized injection activity in a manner that results in a violation of any permit condition or representations made in the application (Ch13, Sec18(b)(i)).

No person shall conduct any authorized injection activity in a manner that results in a movement of fluids out of the receiver (Ch13, Sec18(b)(ii)).

No zone or interval other than the discharge zone shall be used as a receiver for the discharge (Ch13, Sec18(b)(ii)(A)).

No uncased hole may be used as a conduit for the discharge, excepting that portion of a hole in the discharge zone (Ch13, Sec18(b)(ii)(B)).

No annular space between the wall of the hole and casing in the hole may be used as a conduit for discharge, excepting in that portion of a hole in the discharge zone (Ch13, Sec18(b)((ii)(C)). The annular space may receive fluids used in cementing casing during the cementing process.

No person shall construct, install, modify, or improve an authorized injection facility except in compliance with this permit (Ch13, Sec18(b)(iii)).

**F. Operation and Maintenance**

Each injection well shall be constructed, operated, and maintained to prevent movement of fluid from the well into any USDW (Ch13, Sec11(a)).

The permittee shall operate and maintain all facilities and systems of treatment and control which are installed or used by the permittee to achieve compliance with the conditions of the permit. Proper operation and maintenance includes mechanical integrity of the well, effective performance, adequate funding, operator staffing and training, and laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit (Ch13, Sec9(d)(vi)).

The permittee is required to operate the facility in accordance with statements, representations and procedures presented in the complete permit application and supporting documents as accepted and approved by the Administrator. If such procedures conflict with those in this permit, the conditions in this permit shall take precedence (Ch13, Sec18(b)(i)).

Measuring and recording devices shall be tested and calibrated at a frequency sufficient to ensure accurate and precise measurements. A record of the date of the most recent calibration or maintenance shall be retained at the well site.

**G. Entry and Inspection**

The permittee shall allow the Administrator, or an authorized representative of the Administrator (upon presentation of credentials and during normal working hours) to enter the premises where a regulated facility is located, or where records are kept under the conditions of this permit; to inspect and photograph the discharge and related facilities and equipment; to review and copy reports and records required by this permit; to collect fluid samples for analysis; to measure and record pressures and water levels; to observe and record data from monitoring equipment; and to perform any other function authorized by law or regulation (Ch13, Sec9(d)(xii)).

Inspectors shall not be required by the permittee to sign any waiver of liability.

## H. Environmental Monitoring Program for Groundwaters of the State

The permittee shall furnish the Administrator any information necessary to establish a monitoring program if requested to do so (Ch13, Sec9(d)(xiii)).

No groundwater monitoring program under this permit, other than that described in Section I, is required because of the reduction in risk of pollution due to the depth and confinement of the receiver aquifers (Ch13, Sec13(a)(ii)).

## I. Monitoring Requirements

1. The permittee shall retain records of all monitoring information (Ch13, Sec9(d)(xiv)) including all calibration and maintenance records and all original chart recordings for a period of three years after closure of the facility (Ch13, Sec15(g)), at which time the permittee shall notify the Administrator and either deliver the records to the Water Quality Division (WQD) or discard them as directed by the Administrator.

2. Records of monitoring information shall include:

   a. The date, exact place, and time of sampling or measurements;

   b. The name(s) of individual(s) who performed the sampling or measurements;

   c. The types of sample containers used, methods of preservation, and holding times;

   d. The date(s) analyses were performed;

   e. The name(s) of individual(s) who performed the analyses;

   f. The analytical techniques or methods used;

   g. The results and precision of such analyses.

Operational Monitoring (Ch13, Sec13(b)(ii)):

Injection Pressure - The permittee shall monitor the injection pressure continuously and record the readings on a strip chart recorder, a circular chart recorder, or electronically (Ch13, Sec13(i)).

Injection Rate and Volume - The permittee shall monitor the injection rate and volume continuously and record both on a strip chart recorder, circular chart recorder, or electronically (Ch13, Sec13(i)).

Annulus Pressure - The permittee shall continuously monitor the pressure of the casing - tubing annulus and record the pressures on a strip chart recorder, a circular chart recorder, or electronically (Ch13, Sec13(i)).

Discharge Zone Reservoir Pressure, Reservoir Boundaries or Anomalies, Hydraulic Conductivity, and Skin Factor - The permittee shall shut-in each well covered by this permit annually for a period of time long enough to observe a valid pressure fall-off curve (Ch13, Sec13(e)). For the first test, the minimum duration of injection and fall-off shall be calculated according to the equations on page A-4 of the "UIC Pressure Falloff Testing Guideline" (USEPA Region 6, August 2002), or the equivalent equations in subsequent editions. Durations for subsequent tests shall be longer than wellbore storage and skin effects and sufficient for accurate estimates of aquifer permeability. Tests shall be analyzed by the permittee using commonly accepted methods to obtain hydraulic conductivity or permeability, transmissivity, and skin factor and to identify reservoir boundaries (including flow in fractures) and other anomalies such as partial penetration or layering. The test method chosen should be justified by a review of relevant assumptions and actual well and aquifer conditions. Along with the analysis and interpretation, the permittee shall submit plots of injection rate, pressure, and the pressure derivative versus time on appropriate graphs. If the method used differs from previous methods used for the same well, the analyst should discuss the comparability of the results.

Digital data, results, analyses, and interpretations for the fall-off test shall be submitted to the Administrator within one month or with the next quarterly report after the test is done, whichever is later (Ch13, Sec15(f)). These data shall include pressures starting with the introduction of the pressure-measuring device into the well (or for at least one hour prior to test start for a permanently installed downhole device); and injection rates starting at least twice the fall-off period before the start of the fall-off test.

Radius of Influence - The results of each pressure fall-off test shall be used to update the radius of influence calculation for each discharge zone. These updates shall account for historical injection and remaining project life. The permittee shall provide a map showing the updated radius of influence and all wells which penetrate the confining zone within the old and new radii of influence.

If the updated radius of influence for any discharge zone expands to encompass wells not previously identified as within the area of review, construction and plugging and abandonment records for those wells shall be submitted to the Administrator. For those wells which the Administrator determines to be inadequately completed or plugged or which lack sufficient supporting information, the permittee shall submit a corrective action plan to prevent movement of fluid into any USDW through those wells. Upon approval by the Administrator, this plan shall be incorporated as a permit requirement.

Physical and Chemical Properties of the Injectate - The permittee shall monitor the quality of the injectate quarterly (Ch13, Sec15(c)(v)), when significant process changes occur, or when operating changes may significantly alter the waste stream (Ch13, Sec13(h)). The samples must be representative of the waste as it enters the wells. If all the wells receive waste from the same pipe exiting the uranium processing plant, samples may be collected from that pipe rather than from individual wells. Table 7 lists the analytes and parameters to be analyzed quarterly. WQD may approve alternate methods to those listed in Table 7 upon receipt of a written request describing the procedures, precision, and accuracy of the proposed method and a comparison of the proposed method with that in Table 7.

The first five parameters in Table 7 shall be measured weekly at the mine site and averaged mathematically for the quarter. Samples for uranium and radium analysis shall be collected weekly and physically composited for the quarter and then analyzed once per quarter at a lab certified by USEPA for radionuclide analysis.

**Table 7. Analyte and Parameter List for Quarterly Analyses of Injectate**

| EPA Analytical Method | Analyte or Parameter | CAS Number |
|---|---|---|
| SM2550 B | Temperature | None |
| 120.1 | Specific Conductance | None |
| SM4500-$H^+$ B | pH | None |
| | Specific Gravity | None |
| SM2540 | Total Dissolved Solids | None |
| 200.7 or 200.8 | Uranium | 7440-61-1 |
| 903.0 | $^{226}$Radium | 13982-63-3 |

Note: Methods preceded by "SM" are standard methods.

Limiting Concentrations of Injectate - Upper control limits for this permit are listed in Table 8. pH has both upper and lower control limits and concentrations must remain within the range indicated in Table 8. Exceedances of these values are a violation of this permit and require notification under Section K of this permit.

**Table 8. Control Limits for Injected Waste**

| Analyte or Parameter | Upper Control Limit |
|---|---|
| pH | 6.0 > pH < 10 s.u. |

## J. Sampling and Test Procedures

The following units are to be used where applicable: pounds (mass) per square inch for pressure with gage or absolute pressure noted (psig or psia); standard oil field barrels (bbl, equivalent to 42 gallons) for fluid volume; standard oil field barrels per day (bbl/day) for fluid flow rates; milligrams per liter (mg/L) for analyte concentrations other than pH in standard log units or radium, radioactive strontium isotopes, and gross alpha particle radioactivity in picoCuries per liter (pCi/L). The permittee may report equivalent quantities in other units in addition to those above.

Procedures and methods for sample collection and analyses shall be implemented by the permittee to ensure that the samples are representative of the groundwater, water, or wastes being sampled (Ch13, Sec14(a)).

A trip blank of distilled water shall be collected for each quarterly sampling date and a duplicate sample shall be collected at least once per year. Blank and duplicate results and chain-of-custody forms shall be included in the quarterly reports.

Procedures for mechanical integrity tests are described in Section M.

Procedures for pressure fall-off tests are described under Operational Monitoring in Section I.

Procedures for step-rate injection tests are described under Injection Pressure in Section D.

**K. Records and Reports**

1. Record Retention - The permittee shall retain copies of all reports required by this permit, and records of all data used to complete the application for this permit until the permit expires. As described in Section I.2, monitoring records shall be retained for three years after well closure (Ch13, Sec15(g)).

2. Electronic Data Deliverable (EDD) Reporting – The permittee shall use EDD reporting if required by the Administrator.

3. Compliance Schedule Reports – If a compliance schedule is required by the Administrator, reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any such schedule shall be submitted no later than thirty days following each schedule date (Ch13, Sec9(d)(xx)).

4. Noncompliance Event Reports – See Section S.

5. Other Noncompliance Reports - The permittee shall report all instances of noncompliance not reported otherwise and submit the information listed for the written report in Section S with the next quarterly report (Ch13, Sec9(d)(xxii)).

6. Quarterly Reports - Quarterly reports shall be submitted to the Administrator no later than 30 days after the end of each calendar quarter (Ch13, Sec15(a) and 15(c)). The mailing address is: UIC Program Supervisor, DEQ – Water Quality Division, 122 W. 25th St. – 4W, Cheyenne, WY 82002. The quarterly results shall also be submitted online at http://gem.trihydro.com within 30 days of the end of quarter. The written quarterly report shall include the following information:

   a. The minimum, average, and maximum instantaneous injection rates for each well for each month of the quarter. The page showing the maximum injection rates shall also show the maximum permitted injection rate for comparison.

   b. The minimum, average, and maximum daily injection pressures for each well for each month of the quarter (Ch13, Sec15(c)(i)). The table or graph showing the maximum injection pressures shall also show the maximum permitted injection pressure for comparison and the pressures at which any alarms or kill switches are activated.

   c. The total injection volume in barrels for each well for each month of the quarter, the total for the quarter, and the total cumulative volume of waste injected to date (Ch13, Sec15(c)(iv)).

d. The maximum and minimum annulus pressures for each well for each month of the quarter. The table or graph showing the annulus pressures shall also show the pressures at which any alarms or kill switches are activated.

e. Any quarterly analytical results required by Section I of this permit (Ch13, Sec15(c)(v)).

f. Any permit exceedances within the quarter.

g. Any events that triggered alarms or shutdowns and the responses taken during the quarter shall be fully described (Ch13, Sec15(c)(iii)).

h. Any well tests conducted more than thirty days before the end of the quarter (e.g., mechanical integrity, pressure fall-off, or step-rate injection) (Ch13, Sec15(f)) and reports of well workovers (Ch13, Sec(c)(vi)). See also item K.8.

7. Annual Reports - Annual reports shall be submitted to the Administrator at the same address as the quarterly reports. They are due no later than thirty days after the end of each calendar year (Ch13, Sec15((c)). The annual report for each well shall include the following information in addition to that required for the quarterly report:

a. A graphical representation of the injection pressures and volumes for the previous five year's operation and a digital file (e.g., .csv, .txt., .xls, .xlsx) containing these data. The graph shall have calendar dates as the abscissa and pressure and volume as the ordinates.

b. Graphical representations of the quality of the injected waste over time and a digital file (e.g., .csv, .txt., .xls, .xlsx) containing these data. The graphs shall show the injectate quality for the previous five year's operation and shall be prepared on scales appropriate to the variation observed.

8. Well Tests – Reports of well tests conducted less than thirty days before the end of a calendar quarter shall be submitted within thirty days of test completion (Ch13, Sec15(f)).

9. Reports for Aborted Operations - A comprehensive report for any aborted or curtailed operation, which results in the complete termination of discharge or associated activity, shall be submitted to the Administrator within thirty (30) days of termination in lieu of an annual report (Ch13, Sec15(d)).

10. Reports of Plugging and Abandonment – A report of plugging and abandonment (Section N) shall be submitted as soon as practicable after a well is plugged (Ch13, Sec9(d)(xxvii)).

11. Well Completion Report – A report of well construction, completion, and testing and "Notification of Completion of Construction of Injection Well" shall be submitted prior to injection into a new or modified well (see New Well Construction in Section D).

**L. Permit Conditions**

This permit is issued for a period of ten years (Ch13, Sec9(a)). If the permittee wishes to continue injection after the expiration date of this permit, he should apply to the Administrator at least four months prior to the expiration date of this permit (Ch13, Sec9(d)(iii)).

It shall not be a defense for the permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit (Ch13, Sec9(d)(iv)).

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation.

The filing of a request by the permittee, or at the instigation of the Administrator, for permit modification, revocation, or termination, or the notification of planned changes or anticipated noncompliance shall not stay any condition of this permit (Ch13, Sec9(d)(ix)).

After notice and opportunity for a hearing, the Administrator may modify or revoke a permit, in whole or in part, during its term for cause. Causes include, but are not limited to, the following:

1. Noncompliance with terms or conditions of this permit (Ch13, Sec8(e)(i));

2. Failure in the application or during the issuance process to disclose fully all relevant facts, or misrepresenting any relevant facts at any time (Ch13, Sec8(e)(ii)); or

3. Failure of the casing, cement, or the confining layer; or

4. A determination that the activity endangers human health or the environment and can only be regulated to acceptable levels by a permit modification or termination (Ch13, Sec8(e)(iii)).

Permits will be automatically terminated after closure and release of financial responsibility by the Administrator (Ch13, Sec8(i)).

This permit will be reviewed by WQD at least once every five (5) years, and may be reviewed more frequently (Ch13, Sec9(b)). Permits that do not satisfy the review criteria are subject to modification, revocation and reissuance, or termination (Ch13, Sec9(c)).

The conditions in this permit supersede any application content (Ch13, Sec18(b)(i)).

## M. Mechanical Integrity

Mechanical integrity shall be maintained continuously and tested at intervals of no longer than five years. The test used to determine mechanical integrity shall be a two part test approved by the Administrator (Ch13, Sec9(d)(vii)). The two parts shall be conducted no more than three months apart unless prior approval is obtained from the Administrator.

Part I of the mechanical integrity test shall demonstrate the absence of leaks through the packer, tubing, casing, and wellhead (Ch13, Sec9(d)(vii)(A)). Prior to the commencement of waste injection and at intervals of no longer than five years thereafter, and more frequently if required by the Administrator, the casing - tubing annulus of each well shall be pressure tested such that the surface annulus pressure is at least 100 psi greater than the maximum historical injection pressure, which may be less than the LSIP (Table 6), and that the annulus pressure at the packer is at least 20 psi greater than the tubing pressure at the packer. A pressure change of less than 10% after thirty minutes shall be considered successful. A continuous record of the injection pressure during the test on a chart or at intervals of one minute or less, the specific gravities of the annulus and tubing fluids, and the injection pressure at the time of the test shall be submitted to the Administrator along with the other test results.

Part II of the mechanical integrity test shall demonstrate the absence of fluid movement behind the casing (Ch13, Sec9(d)(vii)(B)) above the topmost perforation. Prior to the commencement of waste injection and at intervals of no longer than five years thereafter, and more frequently if required by the Administrator, each well shall be logged using a radioactive tracer survey or oxygen activation log and a temperature survey. The static temperature log shall start more than two hours, and preferably more than 24 hours, after injection has ceased. The results and their interpretation shall be submitted to the Administrator along with the next quarterly report.

Other types of logs may be substituted for Part II of the mechanical integrity test if they satisfy Chapter 13. Section 9. (d) (vii) and are approved by the Administrator.

WQD shall be notified at least 30 days prior to a mechanical integrity test.

In the case of a failed mechanical integrity test in a well that has begun waste disposal, the well shall be immediately shut-in (Ch13, Sec9(d)(viii)). The Administrator shall be notified by telephone at (307) 777-7781 within twenty-four hours of the test and a written report shall be submitted within seven days. Injection shall not resume until the well has been repaired, a complete mechanical integrity test has been passed, and written permission to resume operation has been obtained from the Administrator.

**If at any time injection occurs in any zone not within the discharge zone, a permit violation has occurred.** The operator shall prepare an estimate of the volume and quality of all wastewaters which were injected outside of the discharge zone. In the case where any aquifer meeting the standards for Class I through IVA under Wyoming Water Quality Rules and Regulations, Chapter 8, has been contaminated due to out of zone injection, the operator shall prepare and implement a plan to recover these solutions. Injection shall not resume until the well

has been repaired, a complete mechanical integrity test has been passed, and written permission to resume operation has been obtained from the Administrator.

**N. Plugging and Abandonment**

Any well under this permit shall be plugged and abandoned within six months after:

- Permit expiration (unless application for a new permit has been made and has not been denied by the Administrator);
- Final cessation of injection activities; or
- The permittee has removed equipment required for the proper operation and monitoring of the well (except for temporary removal during well maintenance).

The permittee shall notify the Administrator of plans to convert or abandon a well at least 90 days prior to the start of any conversion or abandonment activity (Ch13, Sec9(d)(xxvi)). The permittee shall follow the plugging and abandonment procedure described in the application or subsequently prescribed by the Administrator. The procedure shall include well plugging, abandonment, surface reclamation and seeding of the well site, closure of related surge ponds, and removing or purging and plugging of any underground piping. In no case shall the procedure be less stringent than that required by USEPA for Class I non-hazardous waste disposal wells at the time of abandonment (e.g., Title 40 Code of Federal Regulations Part 146.10)

As soon as practicable after plugging and abandonment of any well covered by this permit, the permittee shall submit a plugging and abandonment report describing all activities and detailing any deviations from the original plan (Ch13, Sec9(d)(xxvii)).

**O. Duties of the Permittee**

Duty to Comply - The permittee shall comply with all conditions of this permit (Ch13, Sec9(d)(i)), all rules and regulations of the Department of Environmental Quality, and all applicable state and federal laws. Nothing in this permit relieves the permittee of any duties under applicable regulations.

Duty to Mitigate - The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit (Ch13, Sec9(d)(v)).

Duty to Give Notice of Changes - The permittee shall give advance notice to the Administrator as soon as possible of any planned physical alteration or additions, other than authorized operation and maintenance, to the permitted facility and receive authorization prior to implementing the proposed alteration or addition (Ch13, Sec9(d)(xvi)).

Duty to Warn of Noncompliance - The permittee shall give advance notice to the Administrator of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements (Ch13, Sec9(d)(xvii)).

Duty to Provide Information for Permit Modification - The permittee shall furnish the Administrator within a reasonable time, any information which the Administrator may request to

determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit(Ch13, Sec9(d)(xi)).

Duty to Provide Records – The permittee shall furnish the Administrator, upon request, copies of records required to be kept by this permit (Ch13, Sec9(d)(xi)).

Duty to Amend Permit - Any modification that will result in a violation of any permit condition shall be reported to the Administrator through the submission of a new or amended permit application and shall not be implemented until a new or modified permit has been issued (Ch13, Sec9(d)(xvii)).

Duty to Correct - The permittee shall report all instances where it becomes aware that it failed to submit any relevant facts in the permit application, or where it submitted incorrect information in a permit application or in any report to the Administrator, and shall promptly submit such facts or information (Ch13, Sec9(d)(xxiii)).

Duty to Monitor - Monitoring results shall be obtained and reported at the intervals specified elsewhere in this permit (Ch13, Sec9(d)(xix)).

Duty to Test - Test results shall be obtained and reported at the intervals specified elsewhere in this permit.

Duty to Provide Current Contact Information – The permittee shall report any changes to physical or mailing address, phone, or email, and any changes of the personnel responsible for complying with this permit to WQD within one month of the change.

**P. Financial Responsibility**

The permittee is required to maintain financial assurance, in a form approved by the Administrator, to close, plug, and abandon the injection well operation and to reclaim the surface facilities in a manner approved by the Administrator (Ch13, Sec17(a)).

The obligation to maintain financial responsibility survives the termination of the permit or the cessation of injection (Ch13, Sec17(c)).

If the institution issuing the financial instrument files for bankruptcy or loses its authority to issue financial instruments, the permittee shall notify the Administrator within two weeks and obtain other financial assurance within two months. If the permittee is named as debtor in any voluntary or involuntary bankruptcy proceeding, it must notify the Administrator within two weeks.

A minimum of $306,270 for plugging and abandonment of injection wells LC DW No. 1, LC DW No. 2, and LC DW No. 3 shall be included in the bond for reclamation and restoration of the Lost Creek ISR Project uranium facilities under Permit to Mine TFN 4 6/268. This bond or replacement financial instrument shall be maintained as long as any of the wells is covered under this permit. Work on any of these wells may not begin until the Administrator of the Land Quality Division has accepted the financial instrument provided by Lost Creek ISR, LLC.

Construction of LC DW No. 4 or LC DW No. 5 may not begin until an appropriate financial instrument has been obtained by the permittee and accepted by the Administrator.

**Q. Special Permit Conditions**

In addition to the conditions required of all permits, the Administrator may establish specific conditions so as to prevent the migration of fluids into USDWs (Ch13, Sec9(e)). The following conditions are established for this permit:

- Due to the presence of faults with surface expression within the project area, the permittee shall collect water quality samples, using a method approved by the Administrator, above and below the confining zone at the base of the Wasatch Formation in each new well to demonstrate the integrity of the confining zone. The number of samples, depths, and analytes shall be chosen by the permittee so as to produce a statistically significant result. The Administrator may waive the sampling requirement on a well-by-well basis. The water quality results, analyses, and interpretations shall be submitted to the Administrator no later than the well completion and testing report required for new wells in Section D.
- If the sampling above demonstrates there may be leakage through the confining zone, the permittee shall submit a revised well construction plan with deeper perforations to be approved by the Administrator prior to well completion.

The following conditions are adopted to comply with the Governor's Executive Order 2008-2 on Greater Sage-Grouse Core Area Protection:

- No construction activities related to the Class I wells may begin until Lost Creek ISR has obtained a permit to mine from the Land Quality Division.
- All activities and habitat disturbances related to the Class I wells shall be covered by the relevant stipulations to protect sage grouse habitat in the permit to mine.
- Any conditions in the permit to mine regarding the Great Basin spadefoot toad shall become conditions of this permit to the extent they are applicable to the construction and operation of the Class I wells.

**R. Signatories Requirement**

All reports filed in conjunction with this permit shall contain the following certification (Ch13, Sec9(d)(xv)):

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment." (Form UIC-1-I Rev 3/93)

All reports required by this permit and other requested information shall be signed by a responsible officer as described in WQRR Chapter 13, Section 5(b)(xiv));

or

By a duly authorized representative. A person is a duly authorized representative only if:

1. The authorization is made in writing by one of the prescribed principals;

2. The authorization specifies either an individual or position having responsibility for the overall operation of the regulated facility or activity; and

3. The written authorization is submitted to the Administrator.

If an authorization is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization must be submitted to the Administrator prior to, or together with, any reports or information to be signed by the new authorized representative.

**S. Noncompliance**

Any permit noncompliance constitutes a violation of WQRR Chapter 13 and is grounds for enforcement action, permit termination, revocation, or modification. Confirmed noncompliance resulting in a migration of injected fluid outside the discharge zone shall be reported to the Administrator at (307) 777-7781 within twenty-four (24) hours from the time the permittee becomes aware of the circumstances and a written report shall be provided within five days (Ch13, Sec9(d)(xxi)).

The oral report should include:

a. Any monitoring or other information which indicates that any contaminant may cause an endangerment to a useable groundwater of the state.

b. Any noncompliance with a permit condition or malfunction of the discharge (injection) system which may cause fluid migration into or between useable groundwaters of the state.

The written report should include:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. If the noncompliance has not been corrected, the anticipated time it is expected to continue; and

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance (Ch13, Sec9(d)(xxi)).

**T. Permit Transfer**

Any transfer of this permit shall be accomplished by the submission of the proper forms for permit transfer to the Administrator. Transfer of this permit must first be approved by the Administrator and no transfer shall be approved unless the proposed permittee agrees to correct any and all noncompliance issues (Ch13, Sec9(d)(xviii) and Ch13, Sec8(k)).

This permit automatically terminates upon completion of a permit transfer (Ch13, Sec8(j)).

The permittee is alone responsible for the operation of the facility covered by this permit. Operation of this facility by another entity is a violation of this permit unless a transfer of this permit has first been accomplished.

## U. Property Rights

This permit does not convey any property rights or any exclusive privileges. This permit does not authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations (Ch13, Sec9(d)(x)).

The state of Wyoming recently passed Wyoming statute §34-1-152 and amended Wyoming statute §34-1-202 regarding the ownership of pore space within the subsurface. WDEQ recommends that permittees consider how these laws may apply to their injection of material into the subsurface.

## V. Severability

The provisions of this permit are severable, and if any provision of the permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

Abbreviations:
USDW – underground source of drinking water (Classes I, II, III, IV(a), Special(A))
USEPA – United States Environmental Protection Agency
WDEQ – Wyoming Department of Environmental Quality
WQD – Water Quality Division of WDEQ
WQRR – WDEQ Water Quality Rules and Regulations