2.G GEOLOGIC DATA ON INJECTION AND CONFINING ZONES

For Class II Wells (Not Applicable to this Application)

2.H OPERATING DATA

Submit the following proposed operating data for each well (including all those to be covered by area permits): (1) average and maximum daily rate and volume of the fluids to be injected; (2) average and maximum injection pressure; (3) nature of annulus fluid; (4) for Class I wells, source and analysis of the chemical, physical, radiological and biological characteristics, including density and corrosiveness, of injection fluids. If the information is proprietary, maximum concentrations only may be submitted, but all records must be retained.

RESPONSE

Maximum Injection Pressure

Each well has been designed for operation under positive pressure to be supplied by using an injection pump. Since no site-specific data are available, the default value of 0.68 psi/ft will be used for the fracture gradient of the Minnelusa Formation as suggested by the University of Wyoming Enhanced Oil Recovery Institute (http://eori.uwyo.edu/database.asp). Due to a lack of data for the Deadwood Formation, the same fracture gradient will be applied to that formation. Should formation testing in DW No. 1 indicate that the use of an alternate fracture gradient is appropriate, the calculations will be modified accordingly based on site-specific data. Injection fluid is assumed to be comprised of a brine with a maximum specific gravity of 1.008 (SG of 15,000 mg/l TDS brine) that fills the tubing from the surface to the depth of the injection zone. Maximum wellhead injection pressure for each well is calculated and presented in Table H-1. These calculations include allowances for pressure loss in tubing due to friction.

Based on the calculated wellhead fracture pressure values listed in Table H-1 (assuming a maximum continuous specific gravity of 1.008), it is requested that a maximum wellhead injection pressure of 424 psi, 816 psi, 512 psi, and 904 psi be authorized for future injection activities at DW Nos. 1 (Minnelusa), 2 (Deadwood), 3 (Minnelusa),and 4 (Deadwood), respectively. It is requested that injection limitation be defined by these surface pressures, not by rate.

Average Rates, Volumes and Pressures

The range of injection rates and pressures is expected to fluctuate depending on the demands of the ISL project along with variables related to the well and the reservoir conditions. Injection rates are projected to average between 50 and 75 gpm based on continuous operations. However, injection may occur in a periodic or "batch mode" depending on demand.

Average injection pressures during active operations are expected to range from approximately 300 to 800 psi depending on the permitted injection pressure, history of recent well capacity demands, and the condition of the well and the injection reservoirs.

Annulus Pressure

Annulus pressure will be maintained at a minimum of 100 psi above tubing pressure, except during the course of workovers and/or maintenance operations.

Nature of Annulus Fluid

In the proposed Dewey-Burdock Wells, the annulus space between the injection tubing and the well protection casing will be sealed and filled with fresh water containing a corrosion inhibitor, an oxygen scavenger and a biocide as may be deemed necessary by the operator. Annulus fluids will

include Baker Petrolite CRW0037F or Unichem Technihib 366W corrosion inhibitors and bactericides, CRW 132 oxygen scavenger, A-303 corrosion inhibitor, Knockout 50 oxygen scavenger, and Bacban 3 Biocides or suitable equivalents. No permit condition regarding specific brands or fluid additives are requested or required.

Monitoring the pressure changes in the sealed annulus space is a means of verifying the continued mechanical integrity of the well. The monitoring equipment material will be non-corrosive, not subject to biologic degradation, and preferably non-freezing at winter temperatures. At this time, methanol, diesel, heat tracing, and/or a wellhouse heater may be used at the wellhead and annulus tank system to manage any potential for weather related problems in the surface equipment.

Each well is to be operated, and operating data reported, according to the requirements outlined in Table H-2.

Injectate Characteristics

The proposed wells are intended for management of ISL mining related wastewater from the Powertech Dewey-Burdock Project. The density of the injectate is estimated to be up to 1.008 (SG of 15,000 mg/l TDS brine). The Dewey-Burdock ISL Project is not yet an operating mine, so an example analysis of the injectate is not available. As such, the following paragraph and Table H-3 describing typical liquid waste from ISL facilities from the USNRC, NUREG-1910, Vol. 1, GEIS, Section 2.7.2, has been included in this document. As required by applicable law, Powertech will treat to radionuclide standards outlined in 10 CFR 20, Appendix B, Table 2.

2.7.2 Liquid Wastes

Liquid wastes from ISL facilities are generated during all phases of uranium recovery; construction, operations, aquifer restoration, and decommissioning. Liquid wastes may contain elevated concentrations of radioactive and chemical constituents. Table 2.7-3 shows estimated flow rates and constituents in liquid waste steams for the Highland ISL facility (NRC, 1978). Liquid waste streams are predominantly production bleed (1 to 3 percent of the process flow rate) and aquifer restoration water (NRC, 1997a). Additional liquid waste streams are generated from well development, flushing of depleted eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant wash down water.

TABLE H-1 Maximum Injection Pressure for Dewey-Burdock Disposal Wells

	DW No. 1	DW No. 2	DW No. 3	DW No. 4
Fracture Gradient (psi/ft)	0.68	0.68	0.68	0.68
Injection Depth (ft)	1615	3100	1950	3435
Fluid Specific Gravity	1.008	1.008	1.008	1.008
Water Gradient (psi/ft)	0.433	0.433	0.433	0.433
Calculated Fracture Pressure (psi)	1098	2108	1326	2336
Hydrostatic Pressure of Fluid Column (psi)	705	1353	851	1499
Pressure Loss in Tubing (psi)	31	61	38	67
Maximum Injection Pressure at Surface (psi)	424	816	512	904

TABLE H-2 Operating, Monitoring, and Reporting Requirements for Dewey-Burdock Disposal Wells

Characteristic	Value	Minimum Monitoring Frequency	Minimum Reporting Frequency
Average Injection Rate	2,571 bpd max.	Continuous	quarterly
Instantaneous Injection Rate	1.7 bpm max.	Continuous	quarterly
Cumulative Volume	2,571 bpd max.	Continuous	quarterly
Max. Injection Pressure	Well Specific	Continuous	quarterly
Ave. Injection Pressure	Well Specific	Continuous	quarterly
Annulus Pressure*	100 psig min.	Continuous	quarterly
Annulus/Tubing Pressure Differential	100 psig min.	Continuous	quarterly
Sight Glass Level	Visible	daily when operated	quarterly
Annulus Fluid Addition Or Removal	-	Daily	quarterly
Chemical Composition of Injected Fluids	-	quarterly	within 30 days of sampling
Physical Characteristics of Injected Fluids	-	quarterly	within 30 days of sampling

* Except during maintenance and workover operations

TABLE H-3 Example Analysis of Injectate from Typical ISR Project

Table 2.7-3. Estimated Flow Rates and Constituents in Liquid Waste Streams for the Highland *In-Situ* Leach Facility*					
	Water Softener Brine	**Resin Rinse**	**Elution Bleed**	**Yellowcake Wash Water**	**Restoration Wastes**
Flow Rate, gal/min	1	<3	3	7	450
As, ppm					0.1–0.3
Ca, ppm	3,000–5,000				
Cl, ppm	15,000–20,000	10,000–15,000	12,000–15,000	4,000–6,000	
CO_3, ppm		500–800			300–600
HCO_3, ppm		600–900			400–700
Mg, ppm	1,000–2,000				
Na, ppm	10,000–15,000	6,000–11,000	6,000–8,000	3,000–4,000	380–720
NH_4, ppm			640–180		
Se, ppm					0.05–0.15
Ra-226, pCi/L	<5	100–200	100–300	20–50	50–100
SO_4, ppm					100–200
Th-230, pCi/L	<5	50–100	10–30	10–20	50–150
U, ppm	<1	1–3	5–10	3–5	<1
Gross Alpha, pCi/L					2,000–3,000
Gross Beta, pCi/L					2,500–3,500
*NRC. NUREG–0489, "Final Environmental Statement Related to Operation of Highland Uranium					