Statement of Basis, Groundwater Reclassification, Exemption Boundary

I. Groundwater Re-classification Justification:

The Consolidated Permits Regulations (40 CFR §146.04 and §144.7) allow EPA, or approved State programs with Environmental Protection Agency (EPA) concurrence, to exempt underground sources of drinking water from protection under certain circumstances. An underground source of drinking water may be exempted if:

A. It does not currently serve as a source of drinking water and;

B. It cannot now and will not in the future serve as a source of drinking water because:

1) It is mineral, hydrocarbon, or geothermal energy producing, or it can be demonstrated by a permit applicant as a part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible;

2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;

3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or

4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or

C. The Total Dissolved Solids content of the ground water is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.

Uranerz Energy Corporation (Uranerz) has submitted an application to the Wyoming Department of Environmental Quality (WDEQ) to operate an in-situ uranium project in Campbell and Johnson Counties, Wyoming. Pursuant to Wyoming Water Quality Rules and Regulations (WQRR) Chapter VIII, Section 4(d)(viii): Groundwater of the State found closely associated with commercial deposits of hydrocarbons and/or other minerals, or which is considered a geothermal resource, is Class V (Hydrocarbon Commercial), Class V (Mineral Commercial) or Class V (Geothermal) Groundwater of the State.

WQRR, Chapter 8, Section (d) (viii) (B) further states: A discharge into a Class V (Mineral Commercial) Groundwater of the State shall be for the purpose of mineral production and shall not result in the degradation or pollution of the associated or other groundwater and, at a minimum, be returned to a condition and quality consistent with the pre-discharge use suitability of the water.

(Enclosed is a CD containing the following documents to assist in the review: Addendum MPI, Attachments 1 and 2, Figure 3-12 Projected Schedule, a pdf of this Statement of Basis, and Appendices JD-D5 and JD-D6 for Jane Dough)

II. Geographic Extent of Aquifer: (Attachment 1)

The Uranerz Jane Dough Unit of Nichols Ranch project consists of an area immediately to the south of the Nichols Ranch Unit and is located in Sections 20, 21, 27, 28, 29, 30, 31, 32, 33 and 34 T 43N., R.76W., in Campbell and Johnson Counties, Wyoming.

Uranerz proposes to inject fluids into aquifers referenced in the Mine Plan application as the AB Sand aquifer for the Jane Dough Unit. The horizontal boundary of each aquifer proposed to be reclassified to
Class V (mineral-commercial) is the monitoring well ring plus the buffer zone as depicted on the attached map (Attachment 1). The operator has modeled the groundwater hydraulic properties of the aquifer to establish re-classification boundaries outside of the monitoring well ring. A buffer zone of 195 feet was obtained from the Jane Dough groundwater properties.

Uranerz’s calculation of the distance beyond the monitor ring for the aquifer exemption area for the Jane Dough wellfields is presented below. Defining an aquifer exemption area beyond the monitor ring wells is needed to account for the area that could potentially be affected in the event an excursion is indicated at the monitoring well ring. Inclusion of this additional area within the exempted aquifer boundary will allow effective uranium mining using the in situ recovery (ISR) mining method while remaining protective of ground-water resources. This calculation is similar to the approach used to determine the proposed exemption area for the Nichols Ranch and the Lost Creek ISR facilities.

Several factors may contribute to limited potential migration of ISR fluids beyond the monitoring well ring at the time an excursion is first detected. These factors are related both to wellfield and monitor ring geometry, and the hydrology of the ground-water flow.

The first component in the determination of the extension beyond the monitor ring is a simple trigonometric calculation of the distance that a potential excursion could extend beyond a monitor ring before being detected by a monitor ring well. Attachment 2 shows this distance as ΔT and has a value of 59 feet for 500 foot spacing between monitor ring wells.

The second component of the aquifer exemption area is the distance of ground-water movement between the time of initial detection and the time that recovery operations are implemented. There is also a potential lapse introduced by the sampling frequency and likely need for additional sampling to confirm the excursion. The first parameter in the calculation of ground-water velocity is the gradient of the piezometric surface during the excursion. Figure MPI.1-11 of Addendum MPI for the Jane Dough Unit in the Nichols Ranch Permit presents the potentiometric surface after 60 days with a local imbalance. The gradient in the area of the monitor well ring is 0.066 ft/ft adjacent to the imbalance area. The second parameter in the ground-water velocity is the hydraulic conductivity of 0.25 ft/day. This value was the average hydraulic conductivity for the A Sand presented for the Jane Dough Unit in the Nichols Ranch Permit. The third value is the effective porosity of 0.05 which was also obtained from the Nichols Ranch Permit. These three parameters in Darcy’s equation yield a ground-water velocity of 0.33 ft/day. An interval of 60 days was used to calculate the ground-water movement distance between the time of initial detection and the initiation of excursion retrieval. This interval allows for the previously mentioned time lapse that may occur. This produces a ground-water movement distance of 19.8 feet (Δd).

The third component is presented in Attachment 2 as DHF which accounts for the dispersion of the ground water and the potential heterogeneities in the aquifer. Dispersion of a constituent could extend or increase the travel distance by roughly 10% of the calculated geometric distance. Dispersion of the ground water is affected by the heterogeneity of the aquifer, but does not account for all of the potential variations in hydraulic properties that could occur at a site. The maximum measured hydraulic conductivity was at least 40% higher than the average value used in these calculations at the Jane Dough Unit site. Sedimentary deposits associated with uranium mineralization can have a wide range of degrees of cementation, porosity, sandstone thickness, fines content, and other related physical properties. The resulting variation in aquifer properties can cause a significant different ground-water velocity or travel distance between two flow paths. An increase in expected travel distance of 20% is therefore used to account for the potential variations in the travel distance for different flow paths under heterogeneous aquifer properties conditions including dispersion. This 20% extension is applied to the 500 feet distance from the monitor ring to the wellfield, plus ΔT, plus Δd and results in a DHF distance of 115.8 feet.
The three components added together result in an extension of the aquifer exemption boundary to 195 feet beyond the monitor ring wells. Attachment 2 shows the three components of the calculation and the proposed location of the aquifer exemption area as an offset 195 feet beyond the monitor ring wells.

The proposed aquifer exemption around the Jane Dough Production Area #1 and #2 monitor ring wellfields is shown in Attachment 1 in this Statement of Basis for Jane Dough which uses the extension of the monitor ring wells by an offset outward of 195 feet. The limits of aquifer exemption boundary will be described by a series of straight lines.

A legal description of the geographic location of the aquifer proposed to be reclassified to Class V (mineral commercial) is as follows:

**Jane Dough Unit**

*Township 43 North: Range 76 West*

Sec. 20  E½; E½ W½

Sec. 21  W ½

Sec. 27  SW¼ SW¼

Sec. 28  except NE¼ NE¼

Sec. 29  except NW¼ NW¼

Sec. 30  E½ SE¼

Sec. 32  N½ NW¼

Sec. 33  N½ NE¼

Sec. 34  NW¼ NW¼

**III. Commercial Producibility of the Ore Deposits** *(Permit Application Mine Plan, Volume VII, Section 3.3)*

Estimated uranium oxide (U₃O₈) resources at the Jane Dough Unit are 4,237,000 pounds. The central plant at Nichols Ranch unit would operate at no more than the maximum permitted flow rate of 3,500 gpm and the plant is expected to produce 500,000 pounds of uranium per year. Enclosed on the CD is Figure 3-12 (from the Mine Plan) which illustrates the projected schedule.

**IV. Geologic Properties**

A. **Regional Geology** *(Permit Application Mine Plan: Section D5.2)*

The proposed facility will be located in the Powder River Basin of northeastern Wyoming. The Powder River Basin is a north-northwest trending asymmetric syncline. The basin is bounded by the Bighorn Mountains to the west, the Black Hills to the east, and the Hartville Uplift and Laramie Mountains to the south. The Wasatch contains thick lenses of coarse sands deposited in a high-energy fluvial environment. The sandstone horizons are the host rocks for the uranium deposits in the southern Powder River Basin.

B. **Site Geology** *(Permit Application Mine Plan: Section D5.3)*

The Wasatch Formation crops out at the Jane Dough and Nichols Ranch ISR project.
Wasatch Formation was deposited in a multi-channel fluvial and flood plain environment. The source of the sediment, as evidenced by the feldspar grains in the sandstones, was the nearby Laramie and Granite Mountains.

In the project area, there are seven identified fluvial sandstone units. These are locally referred to, in ascending order as the 1 Sand, A Sand, B Sand, C Sand, F Sand, G Sand, and H Sand. The D, E, and J Sands are not present in the area. The H Sand consists of erosional remnants at the surface. Separating the sand units are horizons composed of siltstones, mudstones, carbonaceous shales and poorly developed coals.

The ore body at the Nichols Ranch is a typical Powder River type roll front deposit. Uranium ore is found at the interface of a naturally occurring chemical boundary between reduced sandstone facies and oxidized sandstone facies.

Within the Jane Dough Unit of the Nichols Ranch Permit Area, mineralization is found in a 100-foot thick sandstone body known as the A Sand which extends over an area of several square miles. The A Sand is connected to the B Sand where the AB Mudstone is missing in the eastern portion of Production Area 1 (PA1) and Production Area 2 (PA2). The production aquifer in this area is the combined A and B Sand even though the ore is only in the A Sand. Where the A and B Sands have no visible aquiclude on the resistivity and/or gamma log, the unit is referred to as the AB Sand.

V. WDEQ Groundwater Classifications

A. WDEQ Groundwater Classification Based on Use (Current Use of Aquifer)

(Permit Application Mine Plan Section Appendix D-6, Volume IV, Section D6.3)

PA1 and PA2 of the Jane Dough Unit: "AB Sand" Aquifer

The only public water supply within four miles of the aquifer exemption area is the Nichols Ranch uranium ISR domestic water well in Section 17, T43N R76W and it is not completed in the AB aquifer. There is no existing use of the "A and B Sands" aquifer within the proposed re-classification area. There is no domestic use of the aquifer within 1.5 miles of the reclassification boundary. Two existing domestic wells (Garden well and Doughstick #3) exist 1.5 miles to the east the aquifer exemption area in the southeast quarter of Section 22, T43N R76W. These two wells are completed in the A Sand and are cross gradient from the natural groundwater flow in this area (see AB Sand flow direction on Attachment 1). The natural groundwater velocity in this area is 12 ft/yr. Even if the usage of these two wells could create a gradient similar to the natural groundwater gradient, the travel distance within 30 years of approximately 360 feet would be less than 5% of the distance from the aquifer exemption edge to these two wells. Therefore the Jane Dough operation does not have the potential to affect the water quality of these two domestic wells. The third nearest domestic well is the Dry Fork #1 in the northeast quarter of Section 24, T43N R77W. This well is downgradient to the northwest and 1.5 miles from the edge of the aquifer exemption area but based on electronic logging of this well it is completed in the 1 Sand below the AB Sand. The 1 Sand is separated from the AB Sand by an aquitard. This map also shows the location of the Nichols Ranch facility plant supply well which is completed below the 1 Sand.

Three existing stock wells (Pats #1 well, well 20-9 and Dry Fork Flowing #3) exist approximately one quarter mile outside of the aquifer exemption area in Sections 20 and 21, T43N R76W. Wells Pats Well #1 and Dry Fork Flowing #3 are completed in the AB Sand while well 20-9 is completed below the AB Sand. Wells 20-9 and Dry Fork Flowing #3 are downgradient of Jane Dough while well Pats #1 is cross gradient from the natural groundwater flow in this area.
VI. Aquifer Properties *(Permit Application Mine Plan: Volume V, Section 2.1)*

A. Name of Formation

The aquifer referenced as the Wasatch Formation AB Sand aquifer contains uranium mineralization and is the production zone in the Jane Dough Unit.

B. Aquifer Elevations

The elevation of the top of the Jane Dough Unit AB Sand aquifer is approximately 4380 feet above MSL (ranges from 4290 to 4480), while the bottom of the unit is at approximately 4075 feet elevation.

C. Aquifer Thickness

The thickness of the AB Sand aquifer is approximately 250 feet (ranges from 160 to 350).

D. Confining Formations

Exhibit JD-D5-17 presents the aquitard thickness for the AB Mudstone. This isopach map shows majority of Production Area 1 (PA1) having an aquitard thickness of greater than 10 feet. The AB Mudstone is missing in the eastern portion of PA1 area and in the PA2 area which makes the CB Mudstone the overlying aquitard in this area. The aquitard thickness of the CB Mudstone is presented in Exhibit JD-D5-26. The Exhibit JD-D5-19 presents the aquitard thickness between the 1 Sand and A Sand in the Jane Dough Unit area. These figures show that these aquitards have adequate thickness to function as a confinement between the AB Sand and the C and 1 Sands.

E. Hydraulic Properties *(Permit Application Mine Plan Section Appendix D-6, Volume IV, Section D6.2.2.1)*

Table JD-D6-3 presents a summary of the aquifer properties for the Jane Dough Unit. This table shows a summary of the aquifer properties for the A, B and 1 Sands and then the Cottonwood Alluvium, F and C Sands for the Jane Dough Unit. For the A Sand aquifer, the single-well aquifer tests are presented first and then the results for the three multi-well aquifer tests are presented. Transmissivities for the A Sand and AB Sand aquifer vary from a low of 38 to a high of 901 gal/day/ft. A value of 330 gal/day/ft is thought to best represent the production aquifer in the Jane Dough Unit area. The hydraulic conductivity (horizontal permeability) varies from 0.10 to slightly less than 0.4 ft/day and a value of 0.25 ft/day is thought to best represent the A sand. Average storage coefficient for the A Sand was 5.4E-4.

VII. Mine Plan Considerations

A. Description of Mineral Zone
1) Mineralogy (*Permit Application, Mine Plan, Volume VII, Section 2.1*)

The ore body is a typical Wyoming-type roll front with a reduced zone and an oxidized zone. The mineralogy of the ore zone consists of uraninite on the surfaces of sand grains. As described in Page MP-4 of Volume V, the average grade of the ore body is above 0.1% U\textsubscript{3}O\textsubscript{8}.

2) Geochemistry (*Permit Application, Mine Plan, Volume VII, Sections 2.2.2 and 3.3.4*)

As described on Page MP-4 and Table 3c on Page MP-11 of Volume V, the uranium recovery solution or lixiviant will consist of varying concentrations and combinations of sesqui-carbonate, soda ash, oxygen, peroxide, and carbon dioxide added to the native groundwater. This will promote the dissolution of uranium as a uranyl carbonate complex.

B. Process Description

1. Well Field
   a) Well Construction and Completion (*Permit Application, Mine Plan, Volume VII, Section 3.1.1.2*)

   Well construction and completion methods are discussed beginning on Page MP-8 of Volume V. Wells casings will be fiberglass or PVC SDR-17, SDR 26, SDR-21, Schedule 40 or Schedule 80 polyvinyl chloride (PVC) and cemented into holes with at least three inches of annular spacing. Open hole completion or PVC well screens will be used along with sand and gravel packs.

   b) Mechanical Integrity Testing (*Permit Application, Mine Plan, Volume VII, Section 3.6*)

   Mechanical integrity testing (MIT) procedures can be found on Page MP-20 of Volume V. MIT will be required on all Class III wells every five (5) years and the results of such tests reported to the Land Quality Division at the end of each quarter. The MIT method is based on pressuring the water-filled well casings and monitoring the pressure drop-off over time.

   c) Hydraulic Containment (*Permit Application, Mine Plan, Volume VII, Section 3.4*)

   Hydraulic containment in the mining zone is accomplished by maintaining a cone of depression in the vicinity of the well fields. A "bleed" for each well field will be accomplished by pumping more water from the well field than is injected into it, causing groundwater movement toward the wellfield.

   Since the Jane Dough Unit production area is in a confined aquifer, the bleed rate will range between 1.5 and 0.5%.

2. Groundwater Monitoring Plan
   a) Ore Zone (*Permit Application, Mine Plan, Volume VII, Sections 3.1.1, 3.14.7.8 and 3.14.7.8.10.1*)

   Movement of the mining solution (lixiviant) out of the ore zone aquifer will be monitored by the means of perimeter monitor wells installed at an...
approximate distance of 500 feet from the outer edge of the well field at distances no more than 500 feet apart as described on Pages MP-7 and MP-65 of Volume VII. As described on Page MP-71, Vol. VII of the application, the monitor wells will be sampled twice a month (at least 10 days apart) for the excursion parameters of chloride, total alkalinity and conductivity. The groundwater elevation or potentiometric surface will be also measured prior to sampling of each well. The pH will also be measured in the field as a reference.

b) Underlying and Overlying Aquifers (Permit Application, Mine Plan, Volume VII, Sections 3.1.1.1 and 3.14.7.8.10.1)

Monitor wells will be installed in the overlying and underlying aquifers at a density of one well per every four (4) acres of well field as described on Pages MP-7 of Volume V. The monitor wells will be sampled twice a month (at least 10 days apart) for the excursion parameters of chloride, total alkalinity, and conductivity as described beginning on Page MP-71 of Volume V. The groundwater elevation or potentiometric surface will be also measured prior to sampling of each well. The pH will also be measured in the field as a reference.

In the event that the AB Mudstone is less than ten (10) feet thick, a monitor well will be added to the header house cluster to monitor the lower B Sand. The B Sand monitor wells will be completed in the lower 20 feet of the B Sand. The base of the B Sand is defined as an apparent lithology change approximately 100 feet above the lower marker located below the A Sand. This lower marker is present throughout the Jane Dough Unit and is visible on most electric logs drilled in the area. The contact between the A and B Sands can be seen on Exhibits JD-D5-1 through JD-D5-15, Nichols Ranch, ISR Project, Supportive Information for Wyoming DEQ, Permit to Mine 778, Jane Dough Amendment.

VIII. Notification for Public Participation (Public Notice) (Attachment 3)

The notice of the intent for aquifer re-classification and aquifer exemption will be published in a newspaper of general circulation in the locality of the proposed operation and on the WDEQ website. Any person may request in writing (prior to the end of the public comment period) that a public hearing be held on the proposed groundwater classification and aquifer exemption. Requests should indicate the name and full mailing address of the individual requesting a hearing, the interest that individual has in the project, and the grounds for holding a public hearing. The administrator of the Water Quality Division will determine if a public hearing is warranted.

Requests for a contested case hearing on a final department action appealable to the Council, must be made in writing to the chairman of the Environmental Quality Council and the DEQ Director at 210 West 17th Street, 4th Floor, Cheyenne, WY and state the grounds for the request pursuant to the Wyoming Department of Environmental Quality Rules of Practice and Procedure.

End of Document