

EPA REGION 8'S RESPONSE TO PETITION FOR REVIEW

**ATTACHMENT GG - Part 2**

Letter dated June 19, 2017 from Oglala Sioux Tribe  
President Weston to EPA Administrator Scott Pruitt

Administrative Record Document No. 864

The operational-phase monitoring program presently envisioned is described in the paragraphs below.

Ground Water - Samples of ground water will be collected quarterly from at least two locations in the vicinity of the Burdock mining operations. Initial operational monitoring will include analyses for uranium and radium-226 content, and possibly for gross alpha content. Analyses for thorium-230, lead-210, or polonium-210 content may be conducted periodically, and these or other analyses will be conducted as required.

Surface Water and Sediment - Samples of surface water and bottom sediment will be taken quarterly from at least two locations in Beaver Creek. Water will be monitored for uranium and radium-226 content and sediment will be monitored for uranium, thorium-230, and radium-226. Gross alpha analysis may be performed on some samples. Any other analyses required by applicable regulations will also be performed.

Soil and Vegetation - Soil sampling will be conducted at least semi-annually at a minimum of one control and one indicator ("downwind") location around each mine. Uranium, thorium-230, and radium-226 analyses will be performed on all samples, while lead-210 or polonium-210 analyses will be performed on selected samples.

Vegetation will be sampled at least one time per year at a minimum of one control and one indicator ("downwind") location around each mine. Normally, samples will be taken during the growing season. Uranium, thorium-230, and radium-226 analyses will be performed on all samples while lead-210 or polonium-210 analyses will be performed on selected samples.

Air - Samples from the high-volume monitors discussed in Section 2.7.4 will be composited for quarterly analyses for uranium, thorium-230, radium-226, and lead-210 content. Plans are not finalized regarding the collection of samples for determination of radon-222 or radon-222 progeny concentrations. However, it is anticipated that either radon or radon progeny will be determined on a continuous basis for one week each month. Sampling locations for radon or its progeny are expected to be the same as those used for the high-volume sampling. Any sampling and analyses required by applicable regulations would be performed.

Results of the monitoring program will be evaluated periodically and appropriate changes in the program will be made. Such changes may include increasing or decreasing the frequency of sampling or the number of sampling locations, relocating some sampling locations, or discontinuing some sections of the monitoring program if measurements are consistently negligible. Sampling and analyses required by applicable regulations would in any case be performed.

## 2.8 References

1. Regulatory Guide 1.109. U.S. Nuclear Regulatory Commission. Washington DC (for comment) March 1976.
2. Garner, R. J. Transfer of Radioactive Materials from the Terrestrial Environment to Animals and Man. CRC Critical Reviews in Environmental Control. September 1971.
3. Brenchley, D. L., et al. Environmental Assessment Methodology for the Nuclear Fuel Cycle. BNWL-2219. Battelle Pacific Northwest Laboratories. Richland, Washington. July 1977.
4. Methodology based on materials in EPA-520/9-73-003B. U.S. Environmental Protection Agency. Washington, DC. October 1973.
5. "Meteorology and Atomic Energy. 1968," D. H. Slade, ed. Report TID-24190. U.S. Atomic Energy Commission. Washington, DC. July 1968.
6. "Natural Background Radiation in the United States." NCRP Report No. 45. National Council on Radiation Protection and Measurements. Washington, DC. November 1975.
7. Environmental Information Report - Edgemont, South Dakota, Uranium Mill; Tennessee Valley Authority; January 1976. Also, Semiannual Effluent Release Reports Nos. 2 and 4 for the Edgemont, South Dakota, Uranium Mill; Tennessee Valley Authority; August 1976 and August 1977.
8. Ford, Bacon and Davis Utah Inc. Engineering Assessment of Inactive Uranium Mill Tailings, Edgemont Site, Edgemont, South Dakota, prepared for the U.S. Nuclear Regulatory Commission under contract No. E(05-1)-1658, May 1978.

## 2.9 Flora and Fauna

### 2.9.1 Vegetation

2.9.1.1 Description - Surveys to document major vegetation types and floristic elements on the Edgemont project area were conducted for TVA during the period from fall 1975-fall 1976<sup>1</sup>. Three major vegetation regions are transected by the project area: grassland, ponderosa pine, and desert shrub.<sup>2</sup> Grassland vegetation communities are dominated by buffalo grass (Euchloe dactyloides (Nutt.) Engelm.), blue grama (Bouteloua gracilis (HBK) Lag.), western wheatgrass (Agropyron smithii Rydb.), Sandberg bluegrass (Poa secunda Presl.) and little bluestem (Andropogon scoparius (Michx.) Nash). The ponderosa pine (Pinus ponderosa Lawson) region extends out of the Black Hills to include a large portion of the project area in both South Dakota and Wyoming. Major species within this zone are ponderosa pine, Rocky Mountain juniper (Juniperus scopulorum Sarg.) and sedge (Carex spp.). Big sagebrush (Artemisia tridentata Nutt.) and black greasewood (Sarcobatus vermiculatus Hood. Emory) communities, part of the desert shrub region, cover a major portion of the project area, especially dominating the western half and extending westward into the Powder River basin.

Vegetation on the project area has not extensively deteriorated from livestock use, but intensive overgrazing occurs in some areas (particularly near water). Overgrazed areas can also be found where sheep are being pastured. Although sheep grazing is important in portions of the project area in Wyoming, rangeland use is predominantly by cattle. Other domestic animals on or adjacent to the project area are horses, pigs, and goats. Generally, 2.7 to 3.9 ha (6.6 to 9.5 acre) are required to support one animal unit (a 1,000-pound cow and calf, five sheep or the equivalent) for one year on and near the project area.<sup>3</sup>

Crop production is generally limited to dry land hay or grain. Native hay crops usually yield less than 3,360 kg/ha (1.5 ton/acre). Wheat yields vary, but are generally below 3 m<sup>3</sup>/ha (35 bu/acre). Other crops occasionally grown on the project area include dry land corn, barley and oats.

Fourteen major vegetation types were identified on the project areas: (1) abandoned--invaded (orphan mine lands), (2) silver sagebrush, (3) silver sagebrush--big sagebrush, (4) big sagebrush--medium stand, (5) big sagebrush--heavy stand, (6) sand sagebrush, (7) grassland, (8) little bluestem grassland, (9) prairie dog town, (10) rough breaks, (11) black greasewood--big sagebrush, (12) black greasewood, (13) cottonwood bottom, and (14) ponderosa pine. Variations in species composition occur within most vegetation types as a result of such factors as microclimatic differences, slope aspect, gradient (angle), and length, grazing pressure, and moisture availability.

Of the major communities, those covering the greatest portion of the project area are: (1) sagebrush, (2) ponderosa pine, (3) rough breaks, and (4) grassland, (Table 2.9.1.1-1). In the big sagebrush, medium stand type, vegetative ground cover averaged 23 percent (76 percent of the surface area is litter, rocks and bare ground), of which grasses comprise approximately



two-thirds. In the ponderosa pine, understory species average 8 percent ground cover. Grasses, the major life form on the rough breaks, comprise nearly half the total cover of 14 percent. Grassland averages 17 percent ground cover and is dominated by grasses with 12 percent cover. The ten remaining communities range from an average total percent ground cover of 16 percent on little bluestem grassland to 30 percent on silver sagebrush--big sagebrush.

Shrubs, a major portion of the ground cover in three communities (silver sagebrush, big sagebrush, heavy stand and black greasewood), comprise between one-third and one-half of total cover. Shrub density ranges from 50 plants/ha (20/acre) on the grassland to 14,602 plants/ha (5,912/acre) on big sagebrush, heavy stand. Other vegetation types with high shrub densities are black greasewood--big sagebrush, sand sagebrush, and silver sagebrush--big sagebrush. Of the plant species recorded for the project area, approximately 60 percent are forbs, 20 percent grasses, 10 percent shrubs, and 5 percent grasslike species. Trees, half-shrubs and succulents comprise the remaining 5 percent. Table 2.9.1.1-2 summarizes the 14 plant communities. In the Edgemont area, ponderosa pine stands have increased and encroachment into surrounding grasslands has occurred in the past 50 to 100 years.\* Fire has occasionally been used to limit seedling invasion into adjacent little bluestem grasslands found along the margins of pine stands.

Ponderosa pine averaged 40.5 trees per hectare (16/acre) across the project area with a range of 21 to 67 trees/ha (9-27/acre). Over 95 percent of all trees had a DBH (Diameter at Breast Height--i.e. 1.6 m (4.5 ft) above ground) less than 33 cm (13 in). Trees with a DBH less than 12.7 cm (5 in) were not included in calculations. Over 80 percent had a DBH less than 20.3 cm (8 in). Pine stands were generally healthy and free of disease, except for an occasional tree infected by fungi or infested with pine bark beetles (Dendroctonus spp.). Timber stands in the area are used locally as a source of wood for firewood, fences, corrals, homesteads, barns, and small bridges.

No threatened or endangered plant species were found on or near the project areas.<sup>5</sup> Two plant species collected in Wyoming during summer 1976 were identified as being new state records. These two species, Dalea enneandra and Triodanis perfoliata, had not been previously collected in Wyoming. Neither species is considered threatened or endangered.

2.9.1.2 Impacts - Approximately 32 ha (80 acre) of shrub land, woodland, and grass land will be directly impacted by the proposed mining activities. Secondary activities such as house construction, road development and upgrading, and other off-site construction activities which will occur primarily in and near Edgemont will result in only minimum surface area disturbance. Table 2.9.1.2-1 lists disturbed areas by habitat type for each mine site.

Most of the 32 ha (80 acre) of vegetation will be displaced by construction of mine shafts, holding ponds, and other attendant facilities. Approximately 0.2 percent of the sagebrush, 0.01 percent of the pine and 0.03 percent of the grassland communities in the lease area will be disrupted by

Table 2.9.1.1-1

Areal Extent of Major Community Types

| <u>Community</u>   | <u>Approximate Area</u><br><u>Hectares (Acres)</u> |
|--------------------|----------------------------------------------------|
| Sagebrush          | 10,570 (26,100)                                    |
| Ponderosa pine     | 7,290 (18,000)                                     |
| Grassland          | 5,060 (12,500)                                     |
| Prairie dog town   | 700 (1,740)                                        |
| Rough breaks       | 3,640 (8,980)                                      |
| Greasewood         | 490 (1,200)                                        |
| Cottonwood bottoms | 930 (2,300)                                        |

Table 2.9.1.1-2

## Plant Communities of the Edgemont Project Area

| Community                      | Total Perennial Cover (percent) | Representative Dominant Species                                                                                               |
|--------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Abandoned-invaded              | 10.5                            | buffalo grass, blue grama, sand dropseed, needleandthread western wheatgrass                                                  |
| Silver sagebrush               | 26.0                            | silver sagebrush, buffalo grass, western wheatgrass, blue grama, sandberg bluegrass                                           |
| Big sagebrush, medium stand    | 23.0                            | big sagebrush, buffalo grass, blue grama, western wheatgrass, sandberg bluegrass                                              |
| Silver sagebrush-big sagebrush | 30.0                            | big sagebrush, silver sagebrush, buffalo grass, blue grama, western wheatgrass                                                |
| Big sagebrush, heavy stand     | 23.0                            | big sagebrush, blue grama, buffalo grass, sandberg bluegrass, western wheatgrass                                              |
| Sand sagebrush                 | 21.0                            | sand sagebrush, big bluestem, sandseed, plains prickly pear, threadleaf sedges, blue grama                                    |
| Grassland                      | 17.0                            | buffalo grass, blue grama, sandberg bluegrass, threadleaf sedge                                                               |
| Little bluestem                | 16.0                            | little bluestem, needle leaf sedge, wild buckwheat, prairie sandreed, Louisiana sagewort                                      |
| Prairie dog town               | 17.0                            | buffalo grass, blue grama, plains prickly pear, scarlet globe mallow                                                          |
| Rough breaks                   | 14.0                            | big sagebrush, wild buckwheat, blue grama, buffalo grass, side oats grama                                                     |
| Black greasewood-big sagebrush | 19.0                            | black greasewood, big sagebrush, western wheatgrass, blue grama, alkali sacaton                                               |
| Black greasewood               | 18.5                            | black greasewood, blue grama, sand dropseed, buffalo grass, western wheat grass                                               |
| Cottonwood bottoms             | 16.5                            | plains poplar, western wheatgrass, buffalo grass, yellow sweet clover, common dandelion                                       |
| Ponderosa pine                 | 8.1                             | ponderosa pine, skunkbush sumac, blue grama, buffalo grass, western wheatgrass, big sagebrush, fringed and Louisiana sagewort |

mining activities. These will be lost for the life of the mine or until reclamation practices are implemented. While these areas will be reclaimed, it is not likely that revegetated areas will closely resemble the existing plant species composition and diversity (i.e., it will be impossible to reintroduce all species lost). Disturbed areas that are not promptly revegetated will be susceptible to wind and water erosion (see Chapter 3).

Dust and gases resulting from construction and operation at mines may adversely affect some species of vegetation, especially near haul roads. Mine waste material generated as a result of underground and open pit mining may contain toxic materials. All toxic material will be handled in compliance with applicable regulations. If it is buried, it will be covered with material suitable for revegetation.

At the Burdock mine site, a layer of impermeable shale 87 m (285 ft) thick lies between the shallowest aquifer and the ground surface. For this reason, depressuring of the aquifers will result in no adverse impacts to vegetation.

The water from the underground Burdock mine will cause a temporary change in vegetation composition along the discharge waterway. After being treated (see Section 2.6.3), the water will be discharged in a natural drainage for approximately 2.4 km (1.5 mi) before entering Beaver Creek near the Cheyenne River. This relatively small flow of water will cause a slight shift along a narrow meandering course from arid to wetland vegetation for the life of the mine. After the mining activity ends and the water flow ceases, the vegetation in the drainage area will revert to a species composition similar to what is presently existing.

No threatened or endangered plant species or unique plant communities are known in the project area.

Due to the relatively small acreage of vegetation that will be impacted by the project and mitigation efforts employed, impacts to vegetation should not be of a significant adverse nature.

2.9.1.3 Mitigation - Vegetation impact mitigating measures will consist of the reclamation measures discussed in Chapter 3, the watering of roads to decrease dust problems, and the use of existing roads which will reduce the need for new road construction thereby reducing the amount of habitat disturbed.

## 2.9.2 Wildlife

2.9.2.1. Description - Wildlife investigations for this project were conducted during the period from fall 1975-fall 1977. The investigations were coordinated with personnel of the South Dakota Department of Game, Fish and Parks; Wyoming Game and Fish Department; U.S. Fish and Wildlife Service; and the U.S. Forest Service. The purpose of these investigations was to document important wildlife resources of the project area to allow assessment of future mining and reclamation activities.

Table 2.9.1.2-1

Area Disturbed Due to Mining

| Mine Site                      | <u>Plan Community</u>              |          |          |          |           |          |
|--------------------------------|------------------------------------|----------|----------|----------|-----------|----------|
|                                | Area Disturbed in Hectares (Acres) |          |          |          |           |          |
|                                | <u>H<sup>1</sup></u>               | <u>M</u> | <u>G</u> | <u>A</u> | <u>GB</u> | <u>P</u> |
| Burdock No. 1                  | 8 (20)                             | 4 (10)   | 2 (5)    | -        | -         | -        |
| Burdock No. 2                  | -                                  | 13 (33)  | -        | -        | 1 (2)     | -        |
| Spencer Richardson             | -                                  | -        | -        | -        | -         | -        |
| Runge East                     | -                                  | 1 (3)    | -        | 2 (4)    | -         | 1 (3)    |
| Darrow                         | -                                  | -        | -        | -        | -         | -        |
| Subtotal                       | 8 (20)                             | 18 (46)  | 2 (5)    | 2 (4)    | 1 (2)     | 1 (3)    |
| Total = 32 hectares (80 acres) |                                    |          |          |          |           |          |

H = Big sagebrush, heavy stand

M = Big sagebrush, medium stand

G = Grass land

A = Abandoned-invaded

GB = Black greasewood-big sagebrush

P = Ponderosa pine

The plant community complex described in Section 2.9.1 supports a diverse fauna. Numerous species of mammals, birds, reptiles, and amphibians are known to occur in the Black Hills and outlying areas.<sup>6,7,8,9</sup> A number of these species are important hunting resources while others have high esthetic and ecological value.

Wildlife field investigations for the most part were performed in conjunction with vegetation field studies during the period from fall 1975-fall 1976. These investigations were qualitative evaluations aimed at documenting the existence of critical wildlife habitats (e.g. threatened or endangered species, important big game wintering areas, sage grouse (Centrocercus urophasianus) strutting grounds, trout water, etc.).

After the Burdock underground mining site was located, it was discovered that the surface facilities will destroy a few acres of an existing prairie dog (Cynomys ludovicianus) town. For this reason, after consultation with the U.S. Fish and Wildlife Service and the South Dakota Department of Game, Fish, and Parks, TVA conducted an extensive black-footed ferret (Mustela nigripes) survey on the project area prairie dog town in September 1977 and found no evidence of ferrets.<sup>14,15</sup>

The Wyoming and South Dakota game and fish agencies consider the following habitat types to be of critical importance to wildlife in the project area: (1) aquatic habitat, (refer to Section 2.9.3.2) (2) riparian habitat, (3) shrublands, (4) rimrocks and canyons, and (5) ponderosa pine.<sup>10,11,12</sup>

Riparian habitat is found along permanent and ephemeral stream courses. Due to structure, composition and increased density of riparian vegetation, it serves as important nesting, spawning, resting, and escape cover area. Riparian habitat in the lease area is heavily used by turkey (Meleagris gallopavo) and mule deer (Odocoileus hemionus) and whitetailed deer (Odocoileus virginianus). White-tailed deer are primarily restricted to cottonwood bottoms along the Cheyenne River.<sup>11,12</sup>

Shrublands, particularly sagebrush, are extremely important to numerous species, especially antelope (Antilocarpa americana) and mule deer. Shrublands provide important winter feeding areas and in the case of sagebrush, strutting grounds for the sage grouse.

Ponderosa pine affords yet another habitat type and is utilized by a number of species for feeding, nesting, and escape cover. Wild turkey, raptors (hawks and owls) and mule deer utilize pine stands extensively.

A significant niche of rimrock and canyon habitat in the project area is that occupied by birds of prey which heavily use this habitat for feeding and nesting. Eleven species of hawks, owls, and vultures are considered common in the area and 22 species have been recorded.<sup>9</sup> Not all of these species intensively use rimrock and canyon areas but many nest and feed in these areas. This habitat also supports small birds, small mammals, deer, turkey, and reptiles and provides a rich food source for many predator species.



Due to moderate climate in the project area, big game species such as mule deer and antelope do not move to winter ranges but utilize the same habitat throughout the year. Off the project area to the north and east at higher elevations (Elk Mountain), big game species move to lower elevations during winter.

Hunting on and near the project area is primarily for antelope, deer, and turkey.<sup>11,12</sup> Since white-tailed deer are restricted to river bottom habitat along the Cheyenne River, hunting for mule deer is more common. Due to existing land use conditions, there is limited habitat for sharptail grouse (Pedioecetes phasianellus) and ring-necked pheasant (Phasianus colchicus). Sage grouse inhabit the South Dakota project area but there is no season for this species. In Wyoming, pheasant, chukar (Alectoris graeca), sage grouse, sharptail grouse and dove (Zenaidura macroura) are hunted. Waterfowl hunting on area streams and reservoirs is popular and significant numbers of migrating ducks and geese pass through the area. Cottontail rabbits (Sylvilagus spp.) also provide important small game hunting opportunities.

Predator red fox (Vulpes fulva), bobcat (Lynx rufus), coyote (Canis latrans) and varmint (prairie dog) hunting is also popular in the area.<sup>11,12</sup> Mountain lion (Felis concolor) and bear (Ursus americanus) are not considered game species by South Dakota and therefore are not hunted. Bear are hunted in Wyoming but due to lack of suitable habitat, would not be expected on the Wyoming portion of the project area. The mountain lion is considered a trophy game animal in Wyoming and may be expected on the project area. Trapping for beaver (Castor canadensis), muskrat (Onychomys leucogaster), and predators such as coyotes, red fox, and bobcat occurs in the area.<sup>11,12</sup>

The project area could provide potential habitat for the following threatened or endangered species:<sup>13</sup>

- Peregrine falcon (Falco peregrinus - endangered)
- Southern bald eagle (Haliaeetus leucocephalus endangered)
- Blackfooted ferret (Mustela nigripes - endangered)

None of these species were seen on or near the site during field investigation.

The peregrine is known to inhabit the Black Hills and conceivably could occur on or near the project area. The southern bald eagle could be found in the area during winter as a transient. The ferret is not known to be in the area but potential exists because of the presence of suitable habitat conditions (prairie dog towns). Black-tailed prairie dog towns provide habitat for the endangered ferret which preys on prairie dogs. After consultation with the U.S. Fish and Wildlife Service and the South Dakota Department of Game, Fish, and Parks, TVA conducted a ferret survey on the project area prairie dog towns in September 1977 and no found evidence of ferrets.<sup>14,15</sup>

**2.9.2.2 Impacts** - As shown in Section 2.9.1, 32 ha (80 acre) of habitat will be lost for the life of the mines. The bulk of the disturbance will occur at the Purdock shaft sites since these will cause new habitat disruption. The Spencer Richardson and Darrow mines are existing open pits for which the

surface disturbance should not be significantly increased; and no further habitat disturbance should occur. The Runge East mine is an existing underground mine that will be reopened, but little further surface disturbance will occur at this site.

Of a total of 32 ha (80 acre) of habitat lost, 26 ha (66 acre) will be sagebrush. This will result in the reduction of food and cover for a number of wildlife species. Antelope, in particular, are an important game species which heavily depend upon sagebrush habitat. Impacts to, less mobile species such as small mammals, reptiles and amphibians will be more severe due to their small home range and their inability to relocate. Due to the vast area of sagebrush, grassland, and pine found on or near the project area, loss of 32 ha (80 acre) of habitat should not cause significant adverse impacts to wildlife species (see discussion in Section 2.9.1.2).

Two or three holding ponds will be developed at the Burdock No. 1 shaft. Water will be released from the pond into an adjoining natural drainage (ephemeral stream) and will be suitable for livestock and wildlife use. Dewatering operations will not adversely affect streams or reservoirs.

The bald eagle and peregrine falcon should not be adversely affected by this project since habitat critical to their survival will not be impacted. They could be impacted by harassment and illegal shooting. Efforts to control this potential impact are discussed in Section 2.9.2.3).

Construction at the Burdock shaft sites will destroy several acres of prairie dog towns but field investigations indicated ferrets were not present.

As discussed in Section 2.10, employment growth as a result of the project will amount to 160 people. Based upon this growth, it is estimated that the total population increase in the region attributable to this project will be about 565 persons (refer to Section 2.10). Increased road traffic of commuters and the influx of new people will cause additional stresses to the wildlife resource of the region. By using the percentage of the population in the State of South Dakota who hunt (23 percent), it is estimated that approximately 130 hunters will move into the area as a result of the project.<sup>16</sup> Illegal hunting and harassment of wildlife constitute a potentially significant impact, particularly to big game species and the diverse raptor fauna of the region. It is difficult to quantify the magnitude of these potential impacts. Mitigation measures are discussed below.

2.9.2.3 Mitigation - Attempts to minimize impacts to wildlife will be made through reclamation and conducting a wildlife ecology information and education program for project employees. The reclamation program will ensure that all disturbed areas are revegetated (Chapter 3). Revegetated areas will not closely resemble existing plant communities in species composition and diversity, (e.g., shrublands will probably more closely resemble grasslands after reclamation). Even though vegetation composition on the reclaimed areas will be different from existing cover, the small amount of disturbance from mining (underground and extraction from existing pits) will cause only

very local changes that are insignificant to regional wildlife populations.

In an effort to help mitigate impacts to wildlife populations from the influx of additional people into the region, a condensed education program will be prepared by TVA in cooperation with Wyoming and South Dakota Fish and Game personnel. The objective of this program is to create in project employees an appreciation and awareness of regional fish and game values. The program will stress the need and importance of fish and game laws and notify employees that disregard of these laws may be cause for disciplinary action in addition to the penalty prescribed by law.

### 2.9.3 Aquatic Biota

#### 2.9.3.1 Nonfish

2.9.3.1.1 Sampling: Sites and Frequency - Surface waters flowing through the Edgemont project area were sampled in September 1975 and in June 1976 to document the composition and diversity of indigenous aquatic communities during dry and wet seasons, respectively. Sampling sites were selected based on the following criteria: (1) the need to delineate preoperational conditions in the vicinity of potential mining activities\*, and (2) the need to delineate the biota indigenous to each of the representative habitat types (riffles, pools, vegetative areas) and each of the major substrates (silt, clay, detritus, cobbles, submerged and emergent aquatic plants). Two sites, Pass Creek and an unnamed pond near Burdock No. 1 shaft were sampled only in 1976 because they were not identified as being in the vicinity of mining activities until after the 1975 survey was completed. The upper two stations on Beaver Creek (Wyoming) were not sampled in 1976 because of flooding. Biological sampling stations and their proximity to the proposed mining sites are illustrated on Figure 2.9.3.1-1.

2.9.3.1.2 Description of Habitat and Stream Classification - Surface waters of the Edgemont project area provide habitats suitable for a variety of aquatic biota. Habitats range from dry stream courses which contain water only during or after heavy precipitation to streams which contain some flow throughout the year. The majority of the streams have intermittent and/or interrupted flows, being subject to alternate periods of drying and flooding. The effects of variable discharge upon habitat are significant as such discharges may deposit quantities of silt at one time and then scour the substrate at another.<sup>17</sup> Variable discharge also affects the habitat when periods of extremely low flow exist, since much of the benthic substrate can be exposed and subjected to rapid drying.

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\*Based on information available at that time

There are five aquatic systems which occur near or on the Edgemont project area. These are: Beaver Creek and its major tributary, Stockade Beaver Creek (State of Wyoming Class I waters), Pass Creek (State of South Dakota--intermittent stream), Unnamed Pond (holding pond for mine dewatering), Cheyenne River (State of South Dakota--warm water semi-permanent fish life propagating waters, limited contact recreation, wildlife and stock watering, and irrigation), and Cottonwood Creek (perennial stream). Representative riffle pool habitats characterize the creeks and the Cheyenne River. The unnamed pond provides habitat for aquatic organisms for only a portion of the year.

2.9.3.1.3 - Description of Indigenous Fauna and Flora - The flora and fauna of the aquatic habitats in the site vicinity are representative of aquatic environments in semi-arid climates. Wide fluctuations in species diversity and numbers occurred and are expected due to frequent changes in habitat availability. No rare, threatened or unique species were identified from any of the site visits. Similarly, no unique habitats were identified. Detailed descriptions of the fauna and flora are available in a TVA report.<sup>18</sup>

2.9.3.1.4 Potential Impacts to Indigenous Faunal and Floral Communities Posed by Mining at this Site - Biological populations of intermittent streams are transient and/or ephemeral. Recolonization of temporary dried areas is accomplished through surface water drift, survival of desiccant resistant eggs, new egg deposition, and groundwater migration of larvae or adults. Water released from ponds will meet all NPDES requirements for the protection of aquatic life; thus, the primary impact of mining operations will be an increase in habitat, stream flow, and flow duration; and thus an increase in aquatic biological populations. The only undesirable aspect associated with such a population increase would be the corresponding increase in the population numbers, and perhaps the number of species of biting (pest) arthropods. These pests would most likely include mosquitos, black flies, horseflies, and deer flies. A secondary impact would involve compositional changes in the biota as a result of increased flow and/or physiochemical alterations. These compositional shifts would probably be insignificant with regard to most, if not all, of the biota because (1) they would be temporary (only during mining operations), and (2) the organisms would remain in surrounding areas and could recolonize affected areas as soon as mining ceased. Unusual or special precautions should not be necessary for protection of the area's nonfisheries biotic communities.

2.9.3.1.5 Mitigation - General mitigative measures which will be employed to the extent practical to prevent or reduce possible impacts include: (1) construction of dikes and ditches before other major surface construction and during the dry season to reduce suspended solids runoff during periods of heavy rainfall, (2) the initial release of pond effluents will be gradual so that any potential scouring of the streambeds will be minimized, (3) strict adherence to provisions stipulated within the NPDES permit.



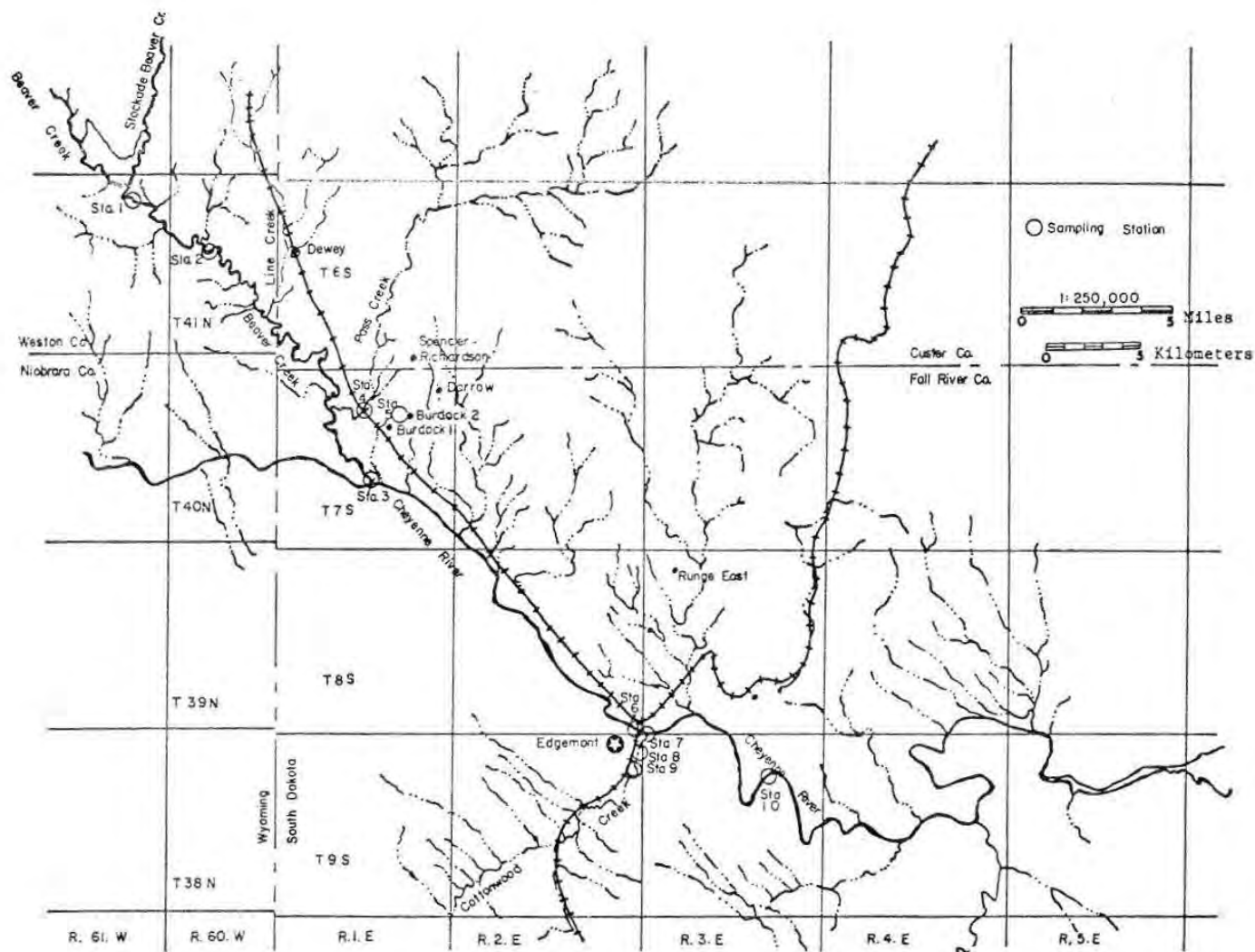


Figure 2.9.3.1-1 Biological Sampling Stations and Potential Mining Sites on the Edgemont Project Area

### 2.9.3.2 Fish

2.9.3.2.1 Description - As discussed in Section 2.9.2.1, the Wyoming and South Dakota game and fish agencies consider the aquatic habitat as one type of habitat to be of critical importance to wildlife in the project area.

Due to the arid regional climate, surface water (aquatic habitat) is extremely important. Table 2.9.3.2-1 lists fishery resources found on or adjacent to the project area.

Permanent streams and warm water reservoirs support such species as channel catfish (Ictalurus punctatus), bluegill (Lepomis macrochirus), carp (Cyprinus carpio), and numerous nongame species (plains top minnow (Fundulus sciadicus), plains minnow (Stygognathus placitus), black bullhead (Ictalurus Melas), and plains killifish (Fundulus kansae)). Cold water streams and reservoirs are stocked with trout. Aquatic habitat provides valuable watering areas for big game, turkey, and important nesting and feeding area for waterfowl and shorebirds.

2.9.3.2.2 Impacts - Two or three holding ponds will be developed at the Burdock No. 1 shaft. Water will be released from the pond into an adjoining natural drainage (ephemeral stream) and will be suitable for livestock and wildlife use. Dewatering operations will not adversely affect surface water streams or reservoirs.

As previously discussed in Section 2.9.2.2, employee growth as a result of the project will amount to 160 people with an estimated total population growth of 565. The influx of new people will cause additional stresses to the fish resource of the region. It is difficult to assess the magnitude of these potential impacts. Measures to be taken to ensure mitigation of these potentially severe impacts are discussed below. By using the percentage of the population in the State of South Dakota who fish (24 percent) it is estimated that approximately 135 fishermen will move into the area as a result of the project.<sup>16</sup> Careful planning and coordination between TVA, its operator, and the various state and federal agencies, will be necessary to reduce impacts.

2.9.3.2.3 Mitigation - The condensed education program discussed in Section 2.9.2.3 is applicable to help mitigate impacts to fish populations.



Table 2.9.3.2-1  
Fishery Resources on and Adjacent to Edgemont Property

| <u>Water Body</u>     | <u>Status</u> <sup>1</sup> | <u>Fishing</u>               |
|-----------------------|----------------------------|------------------------------|
| <u>Streams</u>        |                            |                              |
| Cheyenne River        | P                          | Catfish                      |
| Beaver Creek          | P                          | Catfish                      |
| Cascade Creek         | P                          | Trout                        |
| Pass Creek            | E                          | -                            |
| Plum Creek            | E                          | -                            |
| Piney Creek           | E                          | -                            |
| Red Canyon Creek      | E                          | -                            |
| Cottonwood Creek      | P                          | Catfish                      |
| Hat Creek             | P                          | Catfish                      |
| Stockade Beaver Creek | P                          | Catfish                      |
| <u>Reservoir</u>      |                            |                              |
| Stock Ponds           | P                          | Bass, bluegill               |
| MW Reservoir          | P                          | Trout                        |
| LAK Reservoir         | P                          | Trout, bass,<br>yellow perch |
| McMaster Reservoir    | P                          | Trout                        |

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1. E=Ephemeral, P=Permanent

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## 2.10 Socioeconomic Considerations

2.10.1 Socioeconomic Environment - Projects creating increases in an area's basic employment (such as mining) have many positive effects but also have the potential for disrupting communities by overloading their public and private services and facilities. The net effect is contingent upon many factors including the existing capabilities of a community to absorb the projected additional growth. This section presents information regarding the capabilities of the governmental entities likely to absorb portions of the population increase.

2.10.1.1 Definition of the Impact Area - Examination of the regional map (see Figure 1.1.1-1) for the project area makes the definition of the impact area relatively straightforward. While uranium miners are willing to commute long distances 82 to 107 km (51-67 road mi)<sup>1</sup>, they are unlikely to locate that far away if they are moving into an area with communities closer to the project. In this case, two communities--Edgemont and Hot Springs--are close enough to the project area to serve as potential locations for new residents. Also, they are both in Fall River County in which the project is located.

2.10.1.2 Impact Area Characteristics - Community profiles for Edgemont and Hot Springs are discussed in sections 2.10.1.2.1 and 2.10.1.2.2, respectively. These profiles contain a brief description of the status of community development, the facilities and services presently available, and the outlook for community growth and expansion. This information forms the basis for evaluating the potential for impacts created by the population influx presented in section 2.10.2.

### 2.10.1.2.1 Edgemont

Population and Employment - Since 1960, population and employment have undergone significant shifts in Edgemont. In 1960, the population was about 1,800 but by 1970, this had decreased to about 1,200 as a result of the closing of the Flack Hills Army Depot in 1967. Although some small industries have located near Edgemont, the community reverted to essentially a small trade and service center for the surrounding agriculture-based population. However, the advent of major energy-related development in the west has begun to alter the situation. The biggest change has been the expansion of Burlington Northern Railroad's operation in Edgemont. As a result of coal activities in Wyoming, Burlington Northern's employees have increased from 20 in 1968 to about 200. This increase has included both construction employees for upgrading the tracks and train crews. As a result, Edgemont has reached an estimated population between 1,800 and 2,000.

The decrease in population because of the earlier loss of job opportunities resulted in another important characteristic of the county--a very low unemployment rate. From 1970 to 1974, it never exceeded 2.5 percent while the South Dakota rate stayed around 4 percent.

Education - Edgemont Independent School District No. 23-1 serves all but the eastern part of Fall River County.

Enrollment in the spring of 1977 totaled 432 students. Edgemont has consolidated all schools into one large structure, but has divided it up for administrative purposes. The enrollments and capacities are:

|                   | <u>Enrollment</u> | <u>Maximum Capacity</u> |
|-------------------|-------------------|-------------------------|
| High School       | 109               | 159                     |
| Junior High       | 67                | 107                     |
| Elementary School | 256               | 304                     |

While physical capacity exists, part of the facility dates back to 1931. Also a large amount of the equipment was acquired from the schools in Igloo which were closed when the army depot closed.

Transportation - U.S. Highway 18 is the major highway through Edgemont. It runs through Hot Springs [43 km (27 mi)] to the east and into Wyoming to the west. This highway is presently being upgraded in the Edgemont Area. Already mentioned is the Burlington Northern Railroad which offers freight service. Bus service is provided by Continental Trailways with connections to Rapid City in the north and Denver, Colorado, to the south. The Edgemont area is also served by a sod runway which accommodates small private aircraft.

Utilities - Communications - Privately provided utilities include Black Hills Power and Light (electricity) and Peoples Telephone and Telegraph Company (telephone). The city provides water, sewer, and solid waste collection.

Water supply is obtained from wells with a flow estimated to be adequate for a population of 10,000. Present storage is  $2.6 \times 10^6$  l (700,000 gal) which corresponds to the peak daily use. Although the quantity of the supply is adequate, the water is very hot ( $53^\circ$  C,  $128^\circ$  F) and high in minerals which is damaging to water mains and valves. Recently a \$150,000-Local Public Works grant was approved to finish a partially completed reservoir. The reservoir will have a capacity of about  $23.8 \times 10^6$  l ( $6.3 \times 10^6$  gal) and will also serve as a cooling pond to lessen the adverse effects on the distribution system.

Wastewater treatment is provided by a single stabilization lagoon. Based on limited sampling, the facility does not meet the requirements of the National Pollutant Discharge Elimination System (NPDES) permit. Priority for funding the design of proposed improvements to the facility is 66 out of 117 towns in the state.

Solid waste disposal is contracted by the city with a private operator. The operator provides once-a-week pickup and also operates the city-owned and state approved landfill.

Housing - The recent surge in population growth has placed a great deal of pressure on the existing housing. From 1962 to 1976 only three houses were built, but the railroad expansion has resulted in 16 being built in the last year. Plans have also been made to build two 8-unit apartments, a 25-unit trailer park, and 10 to 12 modular units which are on order. In



addition, a senior citizens unit is expected to release about 18 older homes for purchase or rent. Expansion of the water and sewer distribution and collection systems is a constraint on any large-scale housing development.

One developer from Rapid City has plans for a 6.9 ha (17 acre) development containing a mixture of dwelling types and some commercial establishments. This scale of development is also contingent upon the emergence of a significantly expanded market.

Health, Police and Fire Protection - There are two dentists and one optometrist in Edgemont. One physician has established an outpatient clinic with services available on weekday afternoons. Most medical services must be obtained in Hot Springs, 43 km (27 mi) away. Ambulance service is provided by the volunteer fire department. About 10 members have completed an 81-hour emergency medical technician course.

Twenty-four-hour police protection is provided by four full-time and one part-time patrolmen. The department has two patrol cars and two persons serving as dispatchers. The local department is supported by a local deputy sheriff based in Edgemont.

Fire protection is provided by a 40-member volunteer fire department. Its equipment consists of two pumpers, one a 3,785 l (1,000 gal) pumper, two 4-wheel drive rural service trucks with 530 l (200 gal) capacity each, a salvage truck with smoke extractor, and a 16,000 l (6,000 gal) tanker used for water supply for rural fires. The insurance classification of Edgemont is eight [on a scale of 1 (best) to 10 (worst)].

Recreation - Volunteers presently operate the recreation program although local officials have indicated plans for hiring a recreation director to organize activities. There are two tennis-basketball courts, and the high school has a football-baseball complex. Activities in the summer include softball and hardball leagues for all ages and the city leases the motel swimming pool for public use during certain hours. In the winter, there are a few men's basketball teams.

#### 2.10.1.2.2 Hot Springs

Population and Employment - Hot Springs underwent a small population decline from 1960 to 1970 dropping from 4,943 to 4,434. Since this period, the population has increased to approximately 4,800.

Employment in the government sector is one of the major reasons for the relative stability of the population. The Veterans Administration Center which employs about 500 people contains 232 general hospital beds and 511 domiciliary care beds. At the State Veterans Home, about 100 people are employed caring for about 69 patients. Since Hot Springs serves a very large trade area, trades and services employment constitutes the other major employment sector.

Education - Hot Springs Independent School District No. 23-2 covers the northeastern part of Fall River County. Enrollment in the spring of 1977 totaled 1,162 distributed among four elementary schools, one middle school and one senior high school. However, three of the elementary schools are rural schools and would not serve children of persons moving to Hot Springs. Thus, the relevant enrollments and capacities are:

|                   | <u>Enrollment</u> | <u>Maximum Capacity</u> |
|-------------------|-------------------|-------------------------|
| High School       | 381               | 420                     |
| Middle School     | 312               | 270                     |
| Elementary School | 427               | 500                     |

Overcrowding exists in the middle school while excess capacity is available in both the high and elementary school.

Transportation - Bus service is provided by Continental Trailways and the Omaha-Rapid City bus line. Continental Trailways provides a direct connection with Rapid City to the north and Denver (through Edgemont) to the south. The Omaha-Rapid City bus line also connects with Rapid City but goes to Chadron, Nebraska, and other stops across Nebraska.

Rapid City offers the nearest commercial airline connection. However, there is a municipal airport in Hot Springs which serves light aircraft. This airport has a 1,372 m (4,500 ft) asphalt runway and 1,158 m (3,800 ft) sod runway and two hangars with fuel availability. Lights are operable by radio control.

Utilities - Communication - Private utilities include Black Hills Power and Light (electricity) and Peoples Telephone and Telegraph Company (telephones). The city provides water, sewer, and solid waste disposal service.

Water supply is from groundwater sources which are adequate for the existing population. Additional sources exist which can be tapped to serve population growth. Improvements are planned which include expanding storage capacity by  $9.5 \times 10^6$  l ( $2.5 \times 10^6$  gal) and building a new water collection gallery from which water is pumped to the central storage reservoir.

Wastewater treatment facilities are old and provide inadequate treatment. Improvements have been designed which would provide treatment capacity for 6,500 people. Priority for funding these improvements is 16 in the state which is expected to result in construction beginning in 1978.

Housing - Conventional housing is in short supply, but market response to increased demand should be assisted by the large availability of building lots in the city. Construction on these lots could make use of existing utility lines thus eliminating both the time and expense associated with developing new unserved areas. Mobile homes supplement conventional housing with about 15 mobile home parks containing about 300 spaces. The individual vacant building lots are not available for placement

of mobile homes because community regulations restrict mobile homes to approved mobile home parks.

Health, Police and Fire Protection - The Southern Hills General Hospital is the only civilian hospital in the area. It contains 50 beds and is operating at about 30 percent occupancy. Further, the auxiliary facilities already in the hospital are sized to serve 150 beds. Thus, it has a great deal of capacity to serve additional needs. Four doctors, one surgeon, and three general practitioners are in the community and utilize the hospital. There are also two dentists and two optometrists in Hot Springs. In addition to the general hospital, there is a 50-bed nursing home which is operating at capacity.

The police department which provides 24-hour protection has six patrolmen, three desk sergeants, and a dispatcher shared with the county. There is a new city-county jail and the department has two patrol cars.

Fire protection is provided by a volunteer department consisting of 57 men. Facilities include two 1,892 l (500 gal) pumpers, a ladder truck, smoke extractor, two rural service pumper trucks and an emergency ambulance.

Recreation - A full range of community recreation facilities is available. Swimming is available at the Evans Plunge and Larive Lake. Tennis courts are located at the high school and at Butler Park. The high school also has a football field and baseball facilities are available at the VA center. There is a nine-hole golf course at the country club and another under construction at Butler Park. Recreation activities are sponsored by various civic organizations such as the American Legion, Jaycees, VFW and Elks.

## 2.10.2 Socioeconomic Impacts

2.10.2.1 Introduction - This section discusses potential socioeconomic impacts of this project in the context of all known energy-related development in the area. This analysis is based on a set of assumptions which TVA considers reasonable in light of present information. However, methodology and results are presented in some detail to enable the effects of variations to be easily assessed.

2.10.2.2 Magnitude and Distribution of Impacts - A number of energy-related developments are occurring or expected in the Edgemont area. These include expansion of railroad and related activity, the proposed project, and another small uranium mining operation. Based on present plans, the total energy-related employment is expected to increase from about 200 in 1975 to 1,155 in 1981. TVA's operator employed about 40 people in the Edgemont area in 1975. Employment for the Edgemont mining project and associated exploration and milling will level off at 200 in 1981. Thus, employment growth from 1975 to 1981 totals 955 with the project accounting for 160.

Increases in basic employment such as mining and transportation will eventually result in increases in secondary employment such as clerks, barbers, etc. In 1973, the ratio of

secondary to basic employment in Fall River County was about one. Assuming this ratio to hold through 1981, 955 secondary employment opportunities will be created with 160 due to this project.

Estimating the employee influx associated with the employment increase took into account the size of the present population within commuting distance, the unemployment rate, the types of skills required, etc. The new employees for the Edgemont project will consist primarily of underground miners and supervisory personnel which are skills generally in short supply. The other mining activity will face a similar situation. The railroad-related activities will use skills more generally available or more easily developed than underground mining. However, Fall River County had an unemployment rate of about 2 percent from 1970 through 1974 which indicates a lack of available individuals in the area. Considering these factors, an employee influx rate of 90 percent was used for energy-related development.

Secondary employment is made up largely of positions filled by women or young people. Thus, as new mining employees move in with their families, they will create a pool of potential secondary employees. Based on these considerations, a secondary employee influx rate of 50 percent was used.

Converting the employee influx into a population estimate was based on 75 percent of the employees having families and 25 percent being single. Family size was based on national trends and averages because these employees would be drawn from a multi-state area. The family size used was three. Applying the various rates and factors to a basic employment increase of 955 results in a population increase of about 3,350. For the project, the 160 new jobs result in a population increase of 565. Of the total population influx, 755 were school age (0.75 school-age child per family) with 125 due to the project.

To evaluate the potential impacts on community facilities, the total population increase was distributed between the towns of Edgemont, Hot Springs, and Igloo-Provo (see Table 2.10.2.2-1). Igloo-Provo is not considered as part of the project impact area because no significant portion of the project employees are expected to locate there. However, Igloo is the location of one of the railroad-related projects and could be expected to absorb a portion of the associated population increase. Some employees may scatter among the small settlements in the area or in isolated individual dwellings. However, this is expected to be only a small fraction (less than 5 percent) and is not subtracted from the total allocated to the impact communities. Based on factors such as community size, distance from the work location, employee characteristics, and other judgments, Edgemont was projected to receive 600 of the basic employee influx and Hot Springs, 240.

Secondary employee distribution is expected to follow a different pattern because of the predominant role played by Hot Springs in this sector. A total of 480 secondary employees were distributed with 360 to Hot Springs and 120 to Edgemont. The total employee influx to each community was 720 to Edgemont and 600 to Hot Springs. This produces an estimated population influx



of 1,800 to Edgemont and 1,500 to Hot Springs. Of the total population influx, the project accounts for 340 (19 percent) in Edgemont and 225 (15 percent) in Hot Springs.

Table 2.10.2.2-1 summarizes the employment and population influx discussed above and presents projections of the school-age influx and projected housing demand.

One general and fundamental conclusion can be drawn from just the total population influx projections. Edgemont is faced with the prospect of very rapid growth while Hot Springs should be able to accommodate the growth with no significant problems. Generally, communities can absorb indefinitely annual population growth rates of 5 percent or less without special fiscal or administrative actions. Growth rates between 5 and 10 percent require special efforts to maintain adequate service levels and facilities over an extended period, but it is generally possible and feasible. At growth rates greater than 10 percent, for periods exceeding 5 years, the demand for services and facilities calls for additional expenditures at a much faster rate than additional revenues are generated so that facilities and service levels often deteriorate<sup>2</sup>. Edgemont is projected to grow at an average annual rate of about 17 percent and Hot Springs at about 5 percent. Even without the proposed project, Edgemont's growth rate would still be about 14 percent which could still create a very stressful situation.

These projections are subject to an important qualification. Rapid growth in Edgemont could create conditions which would cause some of the influx projected for Edgemont to locate in Hot Springs. However, there is no information upon which to quantify this possibility. Also, it would not occur until the situation in Edgemont had deteriorated to unacceptable levels. Thus, projections of impacts for specific community facilities and services will be based on the projections as presented.

2.10.2.3 Impacts on Schools - Edgemont school system is projected to receive 415 additional students and Hot Springs, 340. By continuing to use present facilities up to their rated capacity, Edgemont would have to provide additional space for 277 students or about 10 classrooms. Hot Springs would require space for an additional 230 students (about 8 classrooms) if the present level of overcrowding were to continue. If the overcrowding was to be relieved, space would be required for 272 students (about 10 classrooms).

There are no plans in either school system to expand facilities. In the immediate future, the excess capacity can be used to accommodate the students. If permanent facilities are expected to meet future needs, the lead time required to plan, locate, design, and construct a school means that efforts should be undertaken very soon. If present school sites are adequate, portable classrooms can be purchased and placed in use in a much shorter time. However, if the latter alternative is to be a conscious decision rather than one forced by future enrollments, planning should begin very soon.

2.10.2.4 Impacts on Housing - On the average, 105 new dwelling units per year will be required in Edgemont and 90 in



Table 2.10.2.2-1

Edgemont Uranium Mining Project  
Selected Socioeconomic Impact Indicators  
Comparison of Project to Total in the Area

|                   | <u>Edgemont</u>          |                            | <u>Hot Springs</u>       |                            | <u>Igloo-Provo</u>       |                            |
|-------------------|--------------------------|----------------------------|--------------------------|----------------------------|--------------------------|----------------------------|
|                   | <u>Total<sup>1</sup></u> | <u>Project<sup>2</sup></u> | <u>Total<sup>1</sup></u> | <u>Project<sup>2</sup></u> | <u>Total<sup>1</sup></u> | <u>Project<sup>2</sup></u> |
| Employee Influx   |                          |                            |                          |                            |                          |                            |
| Basic             | 600                      | 115                        | 240                      | 30                         | 20                       | 0                          |
| Secondary         | 120                      | 20                         | 360                      | 60                         | 0                        | 0                          |
| Total             | 720                      | 135                        | 600                      | 90                         | 20                       | 0                          |
| Population Influx | 1,800                    | 340                        | 1,500                    | 225                        | 50                       | 0                          |
| School-Age        | 405                      | 75                         | 340                      | 50                         | 10 <sup>3</sup>          | 0                          |
| Housing Demand    | 630                      | 120                        | 525                      | 80                         | 20                       | 0                          |

1. Total due to all energy-related development including the TVA project.

2. Amount due to TVA project alone.

3. Included in the Edgemont school district.

Hot Springs. In Edgemont, there may be approximately 70 additional dwellings by mid-1978 plus the potential of one small 6.9 ha (17 acre) development. In Hot Springs, there are no announced plans for new housing developments. Thus, it will be very difficult for new residents to find a place to live, let alone find the type of dwelling they prefer. Given the high level of demand, the cost and length of time to construct conventional homes, most of the new dwellings will likely be mobile homes plus some modular dwellings. Planning for this growth is important so that the needed development in the near future provides a sound basis for longer-term development.

2.10.2.5 Impact on Water and Sewer Systems - Water supply capacity does not create a constraint to achieving the projected population growth in either Edgemont or Hot Springs. Hot Springs' distribution system is extensive and undergoing improvement which should enable the water to be provided where needed without major additional extensions. In Edgemont, water line extensions required by new development could become a constraint. Financing could be one significant problem but use of a mix of available mechanisms--bonds, grants, loans, rate structure, agreements with developers, etc.--could provide the necessary funds. Just as important are the extension plans so that lines are located and sized to meet long-term development without duplication or undersized lines. This planning should begin soon in order to provide the basis for proposing financing.

In Edgemont, the population growth could further overload the present sewage treatment system until the planned improvements are made. However, the improvements are based on a future population of 2,000. Thus, it appears that the design should be adjusted to take into account the new growth. An alternative to tying into the sewer system is to use septic tanks, because soils in the vicinity of Edgemont are generally suitable.

Hot Springs is faced with a situation similar to Edgemont in that, until planned improvements are made, more population growth could further overload the existing sewage treatment system. In addition, the improvements are planned to serve a population of 6,500. Based on the projections in this analysis, the population of Hot Springs will be approximately 6,300 in 1981 so some thought should be given to revising the design in order to extend the time until expansion is required. Septic tanks may offer an alternative to tying onto the sewer system in the Edgemont area but soil characteristics in the Hot Springs area essentially prohibit this alternative.

2.10.2.6 Impact on Medical Services - Most of the demand for medical services in Edgemont will probably transfer to Hot Springs. If this occurs, the demand for emergency medical services could essentially double. The increased population could also make feasible the establishment of a satellite clinic from the hospital in Hot Springs.

In Hot Springs, the Southern Hills General Hospital is fully adequate to meet the needs of the total population influx. Based on Department of Health, Education, and Welfare criteria for a physician shortage (one physician to 1,500 people), the eight doctors already in Hot Springs would also be adequate to

serve the total influx. However, that would likely result in a lessened level of service based on the present physician to population ratio of 1 to 1,050. Using the existing ratio, three more physicians would be required.

2.10.2.7 Other Impacts - Population increases on the order of those projected for Edgemont and Hot Springs will create a need to expand most other public services and facilities such as police protection, solid waste disposal, fire protection, and recreation. In Edgemont, the doubling of population indicates a probable doubling of all of these aspects of government. In Hot Springs, the increase is about 30 percent which indicates that certain elements might be capable of accommodating without a proportional expansion. Depending on the pattern of new development, it might be possible that existing fire protection equipment and personnel would be completely adequate. It is also possible that recreation and police protection will have some ability to absorb additional demand without either expansion or significant reduction in the level of service. On the other hand, solid waste pickup and disposal would be more directly proportional to increases in population.

2.10.3 Socioeconomic Mitigation - Mitigation of the potentially adverse impacts described in section 2.10.2 will take place through a combination of three types of actions. The first which could possibly take place is direct action by the project; for example, providing funds for a planning program. The second is indirect action by the project such as payment of taxes by the project and its employees. The third is external action by others such as Federal loans or grants. All three types of actions function within a legislative framework set forth by the state and Federal government. The degree to which mitigation occurs depends upon how well existing legislation works and the extent to which new state and Federal legislation is enacted which would supplement the existing revenue flow.

Direct actions by the companies impacting the area could take many forms, but the most likely is in the area of housing in order to attract and keep employees. However, there are no announced plans at this time. TVA is prepared to cooperate with other companies in the area to work with the communities to provide direct assistance for other purposes. One purpose for which assistance already has been requested is a planning program for Edgemont. This planning program would work toward the timely provision of the additional services and facilities required by the rapid population growth. TVA is presently evaluating funding this program in cooperation with other impacting industries and the city of Edgemont.

For operating expenses local governmental entities rely heavily on gross receipts tax, gasoline tax, property tax, state redistributions and revenue sharing. Gross receipts tax, gasoline tax and most redistribution follow very closely changes in population and income and do not lag very far behind. To specifically aid energy-impacted areas, South Dakota amended its severance tax act to increase the rate and provide partial redistribution to the counties in which the minerals are produced. The new rate is 4.5 percent and until the end of 1979, two-thirds of the collected tax will go to the producing county and one-third to the State. From 1980 on, the split will be 50

percent for the county and 50 percent for the State until the county receives \$300,000 over which amount the State retains everything. At the county level, the board of county commissioners is responsible for allocating the funds "for school, roads, law enforcement and municipal purposes to offset social, economic or physical impacts, either direct or indirect, resulting from the extraction of severed energy minerals in the county." Property tax revenue and revenue sharing can lag up to two years behind increases in population.

School districts with children whose parents are working at TVA's mill may qualify for operating funds from the Federal government under P.L. 81-874. The funding varies directly with changes in membership, but some lag could occur if the membership is growing rapidly. State support for school operating funds functions in a similar manner.

Local funding of major capital expenditures is generally through bonds. The level and life of the projects affecting the impact area should provide a strong basis for revenue bonds. Bonds subject to tax rate and assessment limits may be more difficult to float on a timely basis due to the lag in new development being listed on the tax rolls.

Other support for capital expenditures comes from Federal grants and loans. Extensive use of this mechanism is already in evidence in the area for such things as water and sewer system improvements. In the future, areas with high rates of growth due to energy development may qualify for higher priorities, larger projects, smaller local shares, etc.

Housing is generally expected to be developed and financed by conventional means. The source of funds for large-scale development is nationwide and the number and duration of employment opportunities should indicate a sound investment opportunity. However, some initial reluctance may be encountered which could result in the direct project participation described above.

Interest in mitigating energy-related socioeconomic impacts is quite high at the Federal level. The U.S. Senate is considering a bill (S. 1493) to assist energy-impacted states, local governments, and Indian tribes. The bill proposes a program of grants and loans for planning and implementation of actions to mitigate impacts arising from energy-related development.

## 2.10 References

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## 2.11 Natural, Scenic, and Cultural Resources

### 2.11.1 Scenic and Natural Features

Description - The topographic variety of the Edgemont project area provides a number of features of scenic and natural interest, principally canyon formations and Ponderosa pine-covered hills interspersed with the grass and sagebrush-covered plains which comprise the majority of the project area. Distinctive natural and scenic features on or in the vicinity of the project site are identified in Figure 2.11.1-1. Although the characteristics and variety of these features provide aesthetic appeal, none are unique to the area.<sup>1</sup>

The only feature in the project vicinity proposed for special scenic designation is Red Canyon-Fourmile Creek Drive extending from U.S. Highway 18 east of Edgemont to U.S. Highway 16 west of Custer. This area is proposed by the South Dakota Department of Transportation for inclusion in the Federal scenic roads and parkways plan.<sup>2</sup> The Red Canyon segment of the route passes in a north-south direction between the central and southern blocks of the project area and intersects one disjuncted 6 ha (15 acre) parcel under lease. The proposed Runge East mine site is located approximately 1.9 km (1.2 mi) west of the route at the nearest point.

Major regional scenic resources and tourism associated with these attractions are discussed in Section 2.11.4.

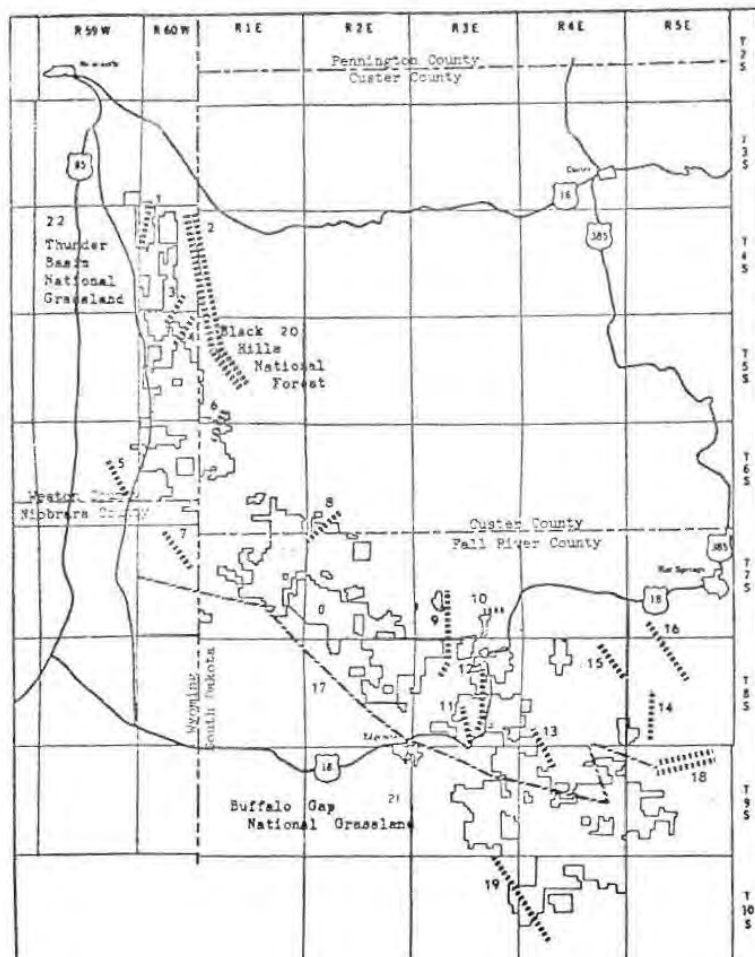
Impacts - Surface disturbance from mining operations will be very limited. The reclamation program will ensure that such alterations eventually blend with the existing landscape.

Intervening topography between the Runge East mine site and the proposed scenic road through Red Canyon precludes viewing of the site from the route. Primary access to the Runge East mine is from existing roads to the west, and these routes will be used as haul roads. Thus, the project will not adversely affect the proposed scenic road, or other scenic and natural features.

### 2.11.2 Historical Resources

Description - A historical and cultural site survey of the Edgemont Project area was conducted.<sup>1</sup> An archaeological survey of portions of Fall River and Custer Counties, South Dakota, done for TVA by the South Dakota Archaeological Research Center also addressed historic sites. The Historic Sites Survey included the documentation of essentially all habitable structures, structure remains, and manmade improvements existing within or on the immediate fringe of the Edgemont project area. These were plotted on maps and accompanied by both written and pictorial descriptions of features. Copies of these materials have been furnished to the State Historic Preservation offices of Wyoming and South Dakota.

Using these inventory records as a guide, a field review was conducted to evaluate significance of sites and assess potential impacts. Since the majority of the project area and sites in question were located in Fall River and Custer Counties, South Dakota, representatives of the South Dakota Historic Preservation



# LEGEND

Distinctive natural features on or adjacent to the project area:

1. Whoopup Canyon
2. Elk Mountains
3. Clifton Canyon
4. Carr Canyon
5. Rattlesnake Ridge
6. Plum Canyon
7. Twentyone Divide
8. Bennett Canyon
9. Red Canyon
10. Matias Peak
11. Sheep Canyon
12. Dead Horse Canyon
13. Chilson Canyon
14. Cascade Spring and Falls
15. Lindsey Canyon
16. Arabaugh Canyon
17. Cheyenne River
18. Angostura Reservoir
19. Unnamed Ridge
20. Black Hills National Forest
21. Buffalo Gap National Grassland
22. Thunder Basin National Grassland

Figure 2.11.1-1 Natural Features on or in the Vicinity of the Edgemont Uranium Mining Project

Office participated in the field review, which also included the project area in Weston County, Wyoming. In a subsequent meeting, these representatives reviewed the results of the field analysis.

No sites currently listed in the National Register of Historic Places are located within the project area. Other than the route of the Cheyenne and Deadwood Stage which passes through the town of Edgemont, no Register sites are located within 8 km (5 mi) of the project area boundaries. One potential Register site, the Whoop-up Canyon Petroglyph, is located at the northern extremity of the project area in Weston County, Wyoming. This site appears in the State Register of Historic Places and is proposed for nomination to the National Register. The petroglyphs, appearing on both sides of the narrow canyon, are contained in a section extending over perhaps 27-37 m (30-40 yd).

Six of the approximately 600 "ghost towns" recorded<sup>(1)</sup> in the Black Hills region are within the vicinity of the project area, along with three sidings of the Chicago, Burlington, and Quincy Railroad. Two of these "towns" containing the remains of a few buildings are on the fringe of the project area itself and the rail sidings (little remains except ruins) are within the area. These sites were generally poor and were judged to have no historical or architectural significance.

The S&G (Sturgis and Goddell) Ranch Site (extant 1870's) may represent one of the first permanent pioneer settlements in the region. It is located at the edge of the project area near the site of the former town of Dewey (new buildings now exist on the rail siding at this postal station). Little remains of the ranch site except foundation stones, a few logs, and a cellar. Scattered domestic debris was noted. Further photographic documentation of this site and the site of two abandoned ranch buildings at other locations is being done for the South Dakota Historic Preservation Office by TVA for purposes of completing their research. These sites are privately owned.

No other features of interest were noted in the evaluation and field review. Other than the site of the S&G Ranch, no additional sites or structure eligible or potentially eligible were judged to exist within or immediately adjacent to the project area.

Impacts - The proposed mining activity will not directly or indirectly impact any sites or structures with architectural or historical significance. No such sites or structures are on lands proposed to be mined nor are any found within the fenced compounds associated with mining activity. Sites with any identified potential are located at considerable distances from the proposed mining so that indirect impact is of no consequence. Knowledge gained from the inventory and the evaluation process associated with this proposal should measurably add to the states' information about cultural resources in the counties involved.

The State Historic Preservation officers of South Dakota and Wyoming are in general agreement with the impact analysis contained herein.

Because of this, TVA believes that no adverse effect from the proposed project will occur to any historic site or structure now in or potentially eligible for inclusion in the National Register of Historic Places.

2.11.3 Archaeology - Archaeological reconnaissances and surveys were performed intermittently in the project area from March 1975 until August 1977 by the State of South Dakota's Archaeological Research Center. One hundred twenty-six (126) archaeological sites and seventy-five (75) archaeological loci were encountered. The sites range in time from Paleo to Plains Villages and consist of pictograph and petroglyph sites to small resource exploitation sites to large habitation sites occupied for extended periods of time. Although no sites listed in the National Register will be affected by the project, National Register eligibility status for the surveyed sites is currently being evaluated by the State of South Dakota.

No archaeological sites are located in the 1/4 section with either the Burdock shafts or the Darrow Extensions. One site is located in the 1/4 section with the Spencer-Richardson mine, and two sites are located in the 1/4 section with the Runge East mine.

Archaeological site avoidance was maintained during the exploration phase of the project, and site avoidance is the continued goal during development and mining. Where required, sites in the area of mining activity will be fenced. If during the course of mining it becomes necessary to adversely impact a site that has been determined eligible for the National Register appropriate mitigation of the impact will be implemented through consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Office.

Mining personnel will be made aware that archaeological resources exist in the project area. Known archaeological sites will be delimited, and if a new site is discovered, the state archaeologist will be notified and the site protected, pending investigation.

#### 2.11.4 Recreation

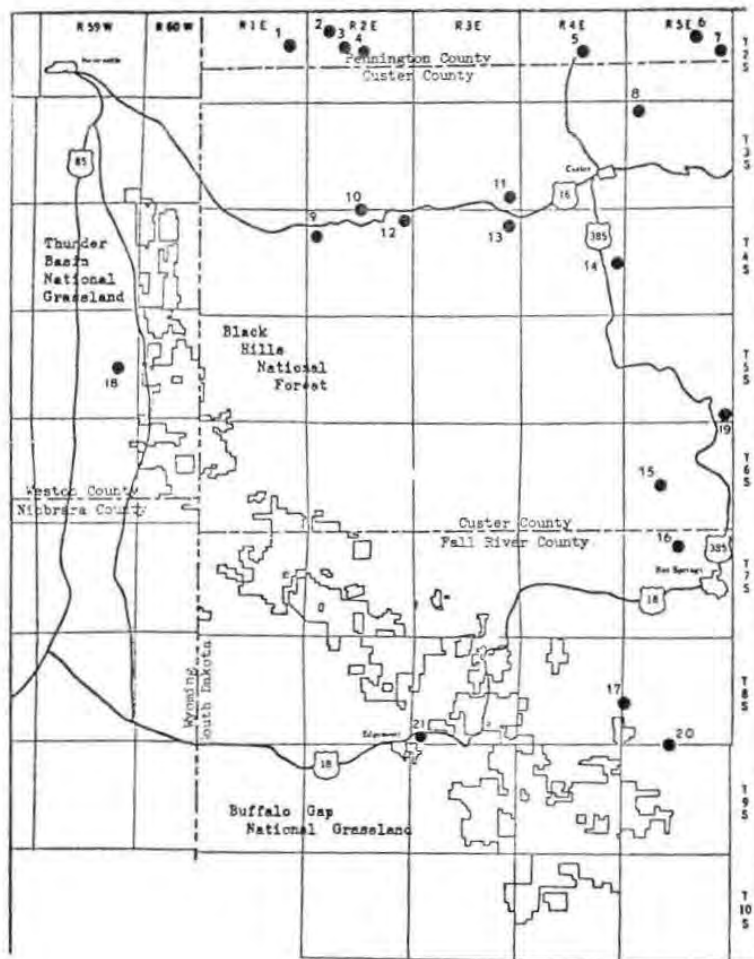
Description - No existing recreation facilities are located on the Edgemont project area. As discussed in Section 2.11.1, the project area and vicinity possess a number of scenic features which have some potential recreation value, including a proposed scenic road through Red Canyon. Fringe areas of the Black Hills National Forest are located within the project area, but these areas have no developed facilities and potential use is limited further by poor accessibility.

Recreational activity in the project vicinity is associated chiefly with tourism and hunting. Because of the proximity of the project area to the Black Hills and other western South Dakota-eastern Wyoming attractions, the project vicinity is exposed to more tourist activity than other regions of these states. Hunting activity is discussed in Section 2.9.2. Due to low flows and turbid water conditions, fishing and other water-based recreation activity on project vicinity streams is very limited.

Major regional recreation areas and attractions include Buffalo Gap and Thunder Basin National Grasslands, Wind Cave National Park, Jewel Cave National Monument, Mt. Rushmore National Memorial, Custer State Park, and Angostura State Recreation Area as well as the Black Hills National Forest. These and other regional facilities are identified in Figure 2.11.4-1. A wide variety of public and commercial recreation facilities and services are associated with these areas.<sup>2,3</sup>

Impacts - The Edgemont project will not result in significant impacts to recreational activity in the project area. Project-related impacts will be negligible. No mining is currently planned on National Forest lands, and any future proposals for mining on these lands would be subject to the continuing review and approval of the U.S. Forest Service. Portions of the project area are visible from scenic overlooks located south and southeast of the properties on U.S. Highway 18 and South Dakota Highway 89, respectively; but the proposed mining activities are removed from highways. As noted in Section 2.11.1, the proposed scenic road through Red Canyon would not be affected visually or by traffic associated with mine operations at the nearby Runge East mine. Thus, impacts will be confined essentially to increased use of regional recreation facilities and pressure on wildlife resources from in-moving project employees. Within the context of overall regional development, cumulative recreation impacts from in-movers associated with this and other mining projects become more important because of limited state, county, and municipal recreation lands and facilities in this area.<sup>3</sup> However, project-related effects on regional recreation opportunities are expected to be minor. (See Section 2.10 for information related to community recreation and the project's relationship to regional development patterns and cumulative socioeconomic impacts).





project area:

1. Rogers Lake
2. Ice Cave
3. Bear Trap Cave
4. Igloo Cave
5. Oreville Campground
6. Pine Creek Natural Area
7. Mt. Rushmore National Memorial
8. Sylvan Lake - Custer State Park - The Needles
9. Teepee WC
10. Jasper Cave
11. Harry Mills Campground
12. Jewel Cave National Monument
13. Comanche Park Campground
14. Beecher Rock
15. Onyx Cave
16. Cold Brook Reservoir
17. Cascade Springs
18. MW Lake
19. Wind Cave National Park
20. Angostura Reservoir and State Recreation Area
21. Cheyenne River Campground

Figure 2.11.4-1 Location of Recreation Areas in the Vicinity of the Edgemont Uranium Mining Project

### 2.11 References

1. Mine Reclamation Consultants, Historical Resources in the Edgemont Lease Area. Unpublished Manuscript. TVA. Norris, Tennessee.
2. South Dakota Division of Parks and Recreation. South Dakota Comprehensive Outdoor Recreation Plan. 1975.
3. University of Wyoming, Division of Business and Economic Research. Outdoor Recreation in Wyoming. Vol 1-3, 6-7. 1969-72.

## 2.12 Other Considerations

### 2.12.1 Liquid Wastes

2.12.1.1 Underground Mine Water - Of the three underground mine areas identified, only the Burdock area is expected to require significant depressuring. Depressuring will be accomplished by pumping two or three wells located around the periphery of each mine shaft and by the mine's subsurface drainage system. Each of the peripheral dewatering wells at Burdock No. 1 shaft will be pumped at an average rate of 14.2 l/s (225 gal/min), beginning prior to shaft construction and lasting for as long as needed during the mining. The subsurface drainage system routes infiltrated water to each shaft's mine sump for pumping to the surface. This flow for the Burdock No. 1 shaft is estimated to be 42.6 l/s (675 gal/min).

This mine water, if contaminated, will be temporarily retained in impervious holding ponds before release into the local drainages. The pond effluents must comply with the applicable limitations which will be established in the NPDES permit for the mining operations. Other than suspended solids, it is anticipated that radium-226 and possibly uranium will be the only constituents that may occur in sufficiently high concentrations to require treatment before discharge. If radium removal is necessary, a barium chloride coprecipitation process will probably be used in conjunction with the impervious, settling pond system. Any uranium removal necessary will be by ion exchange. No significant adverse water quality impacts are anticipated from the discharge of the mine waters into the local drainage.

The rate of water discharge associated with depressuring at Burdock No. 2 shaft is not known at this time but will be less than that identified for shaft No. 1. Little or no water is expected from the Darrow and Punge East mines. The water from each of these mines will be managed in a similar manner as described for Burdock No. 1 shaft, if necessary.

2.12.1.2 Surface Mine Water - Ground water is not expected to be encountered at the Spencer Richardson surface mines. Any water accumulated in the open pit will be managed in a manner similar to the underground mines, if necessary (see Section 2.12.1.1).

2.12.1.3 Runoff - Area runoff outside the boundary of the mining operations will be diverted around the areas disturbed by mining. Runoff from overburden storage, topsoil storage, revegetated areas, and other disturbed areas will be controlled as necessary by a system of dikes, trenches, ponds or other appropriate measures. Except for ore-storage runoff, which may be controlled separately, any runoff at the mine sites contaminated by radioactive constituents will be routed to the mine water treatment facilities described in section 2.12.1.1.

2.12.1.4 Sanitary Wastes - The sanitary wastes at the Burdock mine will be treated by conventional, state-approved systems, consisting probably of a combination of septic tanks, and/or sewage lagoons. At the other proposed mines, portable

toilet facilities will be provided. All systems will be operated in accordance with state and Federal requirements.

2.12.2 Solid Waste - All solid waste, by defined as Public Law 94-580, generated by the mining and associated activities will be stored, collected, and disposed of in accordance with applicable solid waste management regulations (local, state, or federal). Municipal-type solid waste will be generated at a rate of approximately 1.8 kg (4 lb) per worker per day. This solid waste will consist primarily of paper, cans, bottles, rags, wrappers, containers, packing materials, oil filters, and garbage. At the peak employment of 140 people, about 252 kg (560 lb) of solid waste will be generated per day. Since this is a relatively small quantity of waste, the most economical method of disposal will be to use a local, approved sanitary landfill.

Scrap wood will be offered to the general public for salvage (firewood or other use). Residue from public salvage will be burned and/or buried on-site, or disposed of off-site with the "domestic-type" solid waste. The recoverable resource portion of domestic-type solid waste (metals, rubber, etc.) will be recovered for sale if feasible.

All potentially hazardous wastes (as defined by P.L. 94-580) will be stored in suitable labeled containers on-site until they can be transported to an approved hazardous or chemical waste disposal facility.

2.12.3 Noise - A survey of onsite baseline noise was conducted May 2, 1978, at the proposed mining sites on the Edgemont properties. Weather conditions during daytime measurements consisted of partly cloudy skies and wind speeds relatively constant in a range between 22 to 33 m/s (10-15 mi/h) with gusts up to 67 m/s (30 mi/h). Wind screens were used to minimize the wind effects. Nighttime values were taken under clear skies and low wind speeds of 0 to 11 m/s (0-5 mi/h). Baseline noise levels were recorded for approximately 15 min at each of the locations during both day and night. These measurements were used to calculate the  $L_{eq}$ ,  $L_d$ ,  $L_n$ , and  $L_{dn}$ . The  $L_{eq}$  is an equivalent steady state noise level which in the stated period of time would contain the same noise energy as the time varying noise measured during the same time period. The day/night equivalent sound level ( $L_{dn}$ ) is a  $L_{eq}$  for a 24-hour period with a 10 dB weighting applied to nighttime values. A daytime equivalent ( $L_d$ ) is a  $L_{eq}$  for the daytime period (0700-2200 hours) and nighttime equivalent ( $L_n$ ) is a  $L_{eq}$  for the nighttime period (2200-0700 hours).

At the proposed mining sites, baseline noise levels are low compared to EPA guidelines.<sup>1</sup> The major sources of noise at these locations are the proximity of railroad tracks and wind noise through nearby vegetation (pines). Other noise sources are birds and other animals, both domestic and wild, and some vehicle traffic on nearby roads. There are 35-40 coal-hauling trains per day, each consisting of 100-110 cars. It is estimated that as many as 80 such trains per day will pass along this route by 1980.

Construction Noise - Noise radiated from the mining areas during construction will have minimum impact on residents of the

area. The area is scarcely populated with only 25 people living in nine residences within the vicinity 3.2 km (approximately 2 mi) of the mines. Noise radiated during construction will originate from the use of heavy construction equipment located above ground. Federal noise regulations covering noise emissions from construction equipment, such as crawler tractors, portable compressors, and medium and heavy duty trucks, will be met.

Operational Noise - Operational noise from the mining operations will originate from ore hauling equipment and pumps; surface-mounted equipment such as ventilation fans and compressors; and other heavy equipment as listed in Tables 1.1.2.1-1 and 1.1.2.2-1. Mine ventilation equipment and compressors are expected to operate 24 hours per day while other equipment will operate only 8 hours per day with the possible exception of truck operations for 16 hours per day. Noise levels at the site boundaries are not expected to exceed 60 dB(A) during daytime hours and 55 dB(A) during nighttime hours. The nearest residence is approximately 1.8 km (1.1 mi) from a proposed underground mining site. The average baseline-noise level for the area is approximately 66dB ( $L_{dn}$ ). With a property line sound level of 60 dB(A), impact from mining operations at that residence will be insignificant. This sound level should be well within the EPA guideline values. There are no known noise ordinances near the mine sites.

When mining operations begin a survey will be made to determine site boundary noise levels. Operation of these mines shall conform with all applicable noise regulations.



## 2.12 References

1. U.S. Environmental Protection Agency Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety, Report No. 550/9-74-004. March 1974.

### 3. Reclamation

Purpose: The objective of this reclamation plan is to outline the procedures which will be used to return lands disturbed during mining and associated operations to a self-sustaining and productive vegetation. This reclamation plan is flexible and designed to take advantage of the most appropriate procedures for each site to be reclaimed. Inasmuch as the proposed plan of reclamation is written to comply with state and federal regulations, it is standard procedure for the area. As individual sites are identified, this reclamation plan will be supplemented with a detailed plan covering only the immediate area of disturbance. In South Dakota, specific reclamation objectives and procedures will be established after consultation between TVA and the surface landowners. Since the land is primarily used for livestock grazing, reclamation for livestock grazing will be the primary objective. The South Dakota Department of Wildlife, Fish, and Parks; the South Dakota Conservation Commission; and other appropriate Federal and state agencies will be consulted when the surface owner has other land-use objectives. There is no mining planned on the Wyoming property. If mining is extended into Wyoming, however, affected land will be reclaimed to a use equal to or greater than its highest previous use. Standards adopted by the Wyoming Department of Environmental Quality, Land Quality Division, will be followed and the reclamation goal will be to establish the vegetative cover on the affected land such that it will be capable of renewing itself under natural conditions.

Successful reclamation requires the use of (1) proven water conservation and wind and water erosion prevention practices; (2) soil and plant species compatibility; (3) proper time, depth, rate of seeding and transplanting techniques; (4) topsoil or other material identified as suitable for a plant growth medium; and (5) experienced personnel who can make on-the-spot judgments on the adequacy of the seedbed, moisture, and other physical conditions of the soil on the area to be revegetated.

### 3.1 Topsoil and Overburden Stockpiling

Since most of the planned mining will be underground, surface disturbance will be limited. Topsoil will be removed from all areas affected by mining activities (see Section 1.1), segregated from other overburden materials, and marked in accordance with the applicable regulations. Where feasible, stockpiles will be located on leeward slopes of existing hills and away from existing drainages to protect them from prevailing winds and from water erosion. If the stockpiled topsoil is not to be used for as long as six months, it will be seeded to provide temporary cover.

### 3.2 Surface Preparation

If new open pits are developed, they will be backfilled with overburden. Extended surface mining from old pits and other surfaces disturbed by mining activities will be graded and contoured to blend in with the surrounding undisturbed topography and covered with topsoil or suitable subsoil (see Section 3.4). If final placement and shaping of overburden material results in excessive compaction, the top 46 to 61 cm (18-24 in) will be ripped while the material is relatively dry so that better shattering will be obtained.

Haul roads that are abandoned will be ripped and covered with topsoil. Shafts in the underground mine areas will be sealed in accordance with applicable Federal and state regulations. Procedures described in Section 3.4 through 3.7 will be implemented.

### 3.3 Placement of Overburden Containing Undesirable Materials

Underground mine waste will be tested for toxic materials. If toxic concentrations are encountered, the stockpiled material will be covered with an impermeable layer of nontoxic overburden (according to the appropriate state requirements) and compacted to minimize release into surface and subsurface water or, some other approved method of handling will be used. Upon permanent disposal, no toxic material will be placed into the subsurface hydrologic system nor within 2.4 m (8 ft) of the surface. Results of the overburden analysis<sup>2</sup> from the Spencer Richardson mine show that overburden materials should not pose a revegetation problem. Both the topsoil and subsoil at the Spencer Richardson mine have chemical and physical properties which make them suitable for use as a surface covering. Other overburden ranges from moderately to highly saline, but will be covered with at least .3 m (1 ft) of subsoil and topsoil prior to revegetating.



#### 3.4 Topsoil Preparation

Fifteen to 22 cm (6-9 in) of topsoil will be spread over the shaped and prepared surfaces. Care will be exercised to avoid movement of topsoil when it is wet, particularly heavy, fine-textured material. If periods occur when permanent cover cannot be established, topsoil will be graded to provide a rough surface to minimize wind and water erosion. Before seeding, the need for surface modification (such as scarification) for water conservation will be determined and implemented.

### 3.5 Species, Seeding Rates, and Methods of Application

Table 3.5-1 lists the species and rates suggested for the various soil conditions. The species listed are adapted to the climatic and soil conditions existing in the area and are highly palatable to livestock, tolerant to grazing, and available for year-round use by livestock. The seed mixtures are designed to yield the maximum number of seedlings that the area can support. If other land use objectives are sought by the surface land owners, appropriate governmental agencies will be consulted for advice on seeding mixtures. Modification of the seeding mixtures will be considered throughout the period of reclamation if onsite performance of the species indicates that changes are needed.

Drill seeding will be used where practical. Seeding will be on the approximate contour so drill furrows will trap moisture and prevent excessive erosion of the newly seeded areas. If slopes are too steep for drill equipment, the seed mixture will be broadcast at approximately twice the rate given in Table 3.5-1 and followed by brush drag or similar treatment to ensure seed coverage, or seed may be applied by other acceptable methods such as hydroseeding.

TABLE 3.5-1

Recommended Seeding Rates  
of Pure Live Seed kg/ha (lb/acre)\*

| <u>Species</u>                                   | <u>Ordinary Uplands</u> | <u>Heavy Soils Depressions</u> | <u>Sandy Soils</u> | <u>Wet or Subirrigated Areas</u> |
|--------------------------------------------------|-------------------------|--------------------------------|--------------------|----------------------------------|
| <u>Agropyron smithii</u><br>Rosana               | 4(4.5)                  | 6(6.7)                         |                    | 4(4.5)                           |
| <u>Agropyron dasystachyum</u><br>Critana         | 3(3.4)                  | 3(3.4)                         |                    |                                  |
| <u>Agropyron riparium</u><br>Sodar               |                         | 2(2.2)                         | 3(3.4)             | 3(3.4)                           |
| <u>Bouteloua curtipendula</u><br>Pierre or Butte | 2(2.2)                  |                                |                    |                                  |
| <u>Calamovilfa longifolia</u>                    |                         |                                | 1(1.1)             |                                  |
| <u>Schizachyrium scoparium</u><br>Blaze          | 2(2.2)                  | 2(2.2)                         | 2(2.2)             |                                  |
| <u>Oryzopsis hymenoides</u>                      |                         |                                | 3(3.4)             |                                  |
| <u>Stipa viridula</u><br>Lodorm                  |                         |                                | 2(2.2)             |                                  |
| <u>Agropyron elongatum</u><br>Alkar or Orbit     |                         |                                |                    | 4(4.5)                           |
| <u>Astragalus cicer</u>                          |                         |                                |                    | 3(3.4)                           |
| <u>Atriplex canescens**</u>                      |                         |                                | 2(2.2)             |                                  |

\*Rates indicated are for drilled stands.

\*\*Add to mixture if a palatable shrub is desired by landowner.

### 3.6 Time of Seeding and Protection of Seeded Areas

Due to the low annual precipitation (see Section 2.7), seeds must be sown when maximum moisture is present for germination and seedling establishment. Fall seeding will be done from October 1 until the ground freezes, about December 1. Spring seeding will be done between March 15 and May 1.

To ensure optimum plant establishment, seeded areas will be protected by fencing, herding, or similar approved animal control techniques, for two growing seasons or until the vegetation cover becomes self-sustaining. TVA will seek the cooperation of the surface owners to achieve successful reclamation. Weed control should not be needed once the desired plant species become established.

### 3.7 Planting of Trees and/or Shrubs

Areas which are to be reclaimed for tree and shrub production will receive the same preparation as those for grazing. A good stand of desirable grasses will provide understory cover and prevent invasion by weeds as well as help control erosion.

The trees to be transplanted will be placed in depressions approximately 18.6 dm<sup>2</sup> (decimeter<sup>2</sup>), (2.0 ft<sup>2</sup>) to trap additional moisture and aid in establishment. The depressions will be made after the grass seeding to minimize competition between the new transplants and grasses. Ponderosa pine or a mixture of ponderosa pine and Rockymountain juniper will be planted on the dry upland sites.



### 3.8. Previously Mined Pits

On the project area there are several unreclaimed pits and adits left by previous owners of the mineral rights. These mines date back as far as 1951 and were developed prior to effective regulations on reclamation. Where TVA will extend existing mines, new surface disturbed areas will be reclaimed in accordance with the procedures described in the preceding sections. As a minimum, this will consist of reclamation to a condition equivalent to that existing before mining by TVA.

### 3.9 Reclamation Schedule

As mining and associated activities are completed on any area, reclamation as described in Sections 3.2 thru 3.7 will be implemented. If the former activities cease during a seeding and planting season, reclamation procedures will be implemented immediately. If not, the procedures will be implemented the following season.

### 3.10 Alternative to the Proposed Reclamation

Reclamation alternatives will be governed by mining; i.e., in the event of mining and/or associated activities, the most site specific reclamation information available will be followed. However, roads and buildings or other structures may be retained by the surface owners for uses after mining activities have ceased. This would be reported to the South Dakota State Conservation Commission (or the Wyoming Land Quality Division in the case of Wyoming property), and these facilities would then become the responsibility of the surface owner.

### 3.11 Reclamation Monitoring

An onsite revegetation monitoring program will be conducted. TVA will work with the South Dakota Conservation Commission and/or the Wyoming Land Quality Division and other agencies suggested by them to develop a program with acceptable monitoring techniques.

### 3. References

1. TVA, Division of Forestry, Fisheries, and Wildlife Development. Reclamation plan, Edgemont lease. January 1977. In TVA Files.
2. Colorado School of Mine Research Institute. Chemical and Physical properties of Edgemont topsoil. May 1977. In TVA Files.

#### 4. Alternatives to the Proposed Actions

In developing this proposal, TVA considered the following alternatives:

1. No Action - TVA has a statutory obligation to supply an ample amount of electricity at the lowest feasible cost to the area TVA serves. Since by 1986 nearly half of TVA's installed capacity of  $48 \times 10^6$  kw will be nuclear fueled, an adequate supply of uranium must be made available on a timely basis. Not participating in the proposed action would require TVA to obtain an equal amount of uranium from other sources. TVA has identified no advantages, environmental or other, which would accrue from adoption of this alternative. Pursuing this course would impair TVA's ability to provide the required power without incurring substantially higher costs. Therefore, no action is considered to be an unacceptable alternative.
2. Purchase of Uranium - TVA has the largest commitment to power production from nuclear sources of any electric generating system in the United States. This large commitment requires a stable, long-term, ensured supply of uranium fuel. This objective is best met through a diversity of sources; therefore, it is unwise to depend entirely on purchase of uranium for the only source of supply. In addition, the present market conditions for the purchase of uranium are not favorable. The supply-demand imbalance has created a situation in which many uranium producers are able to sell their product at a premium without regard to cost of production. It is, therefore, to TVA's benefit and that of the utility industry as a whole, to take steps to increase uranium production. To this end, TVA has begun mineral rights acquisition activities to provide a stable long-term supply and to allow the acquisition of uranium at a lower cost than that which would be possible through purchases on the open market.
3. Mining Other Properties - TVA is also considering participating in mining ventures at other locations. However, substantial lead times are required in order to properly plan, develop, and achieve production from an uranium mine. Although exploration and planning for other mining ventures are continuing, this does not preclude the necessity for the proposed project. Moreover, a decision by TVA to abandon this proposal in favor of mining at other locations would not preclude the development of these properties by someone else. Furthermore, mining at other locations would likely result in similar types of impacts of equivalent magnitude.
4. Alternative Mining Techniques - Alternative mining techniques were considered before choosing the methods outlined herein. In TVA's opinion, the planned mining techniques represent the best balance among environmental, economic, technical, and other factors. Mining techniques will be continually reevaluated with the above factors in mind and as additional minable reserves are discovered.



5. Delay in Mining Schedule - Although delay in the proposed mining for several years might allow the incorporation of future technological advances in mining techniques which would result in reduced environmental impacts, we have identified none which are expected to be available during the life of the project. The timing of uranium production from the Edgemont project is critical because this production is needed to fuel TVA's reactors during the early 1980's. In the event production is delayed, it would be necessary to obtain substitute fuel from other sources which would be mined by present technology and probably at greater cost to TVA. Since TVA has identified no significant environmental or other benefits from a delayed mining schedule, the cost of delayed production dictates the rejection of this alternative.
6. Conclusions - The alternatives of no action, of purchasing uranium or of mining at other locations do not avoid the types of environmental impacts which will result from the proposed Edgemont mining project, nor would these alternatives prevent development in the proposed project area because the identified ore deposits would most probably be mined by other producers. Moreover, each of the alternatives considered would result in higher economic cost to TVA than the proposed action.

##### 5. Adverse Environmental Effects Which Cannot Be Avoided

Mine-water discharge will cause a temporary depression of ground water levels in the Lakota Formation and to a lesser extent, in the Fall River Formation in the vicinity of the mines, and water levels in wells in the area will decline. Many artesian wells that now flow within the affected area will cease to do so after mining operations begin; however, the aquifers will remain saturated and water will still be available by pumping except possibly in the immediate vicinity of the mine.

The increase in population due to the project will place additional pressure on the surrounding communities and counties to provide needed community services.

There will be a minor alteration of specific topographic features near the shaft sites due to the mine waste piles. However, the land surface will be reclaimed to blend with the natural topography.

There will be a temporary minor degradation of air quality in the immediate vicinity of the mining operations due to fugitive dust and exhaust emissions from combustion-driven mining and support vehicles and equipment and releases of radon and short-lived radon progeny from the shafts and ore piles. This degradation is not expected to exceed air quality standards and will cease after the project is completed.

There will be a loss of plant and animal species from mined areas. Reclamation will mitigate impacts to flora and fauna, but it is unlikely that reclaimed communities will closely resemble existing species composition and diversity.

There will be a temporary change in land use from rangeland and forest to mineral extraction during the life of the project. However, since the operation is primarily underground mining, surface disturbance will be minimal. No surface subsidence is anticipated.

Depending on the mill location chosen, there will be an increase in vehicular emissions resulting from the transport of the uranium ore to the mill, an increase in vehicular traffic, and associated increased wear and tear on public roads.

#### 6. Irreversible and Irretrievable Commitments of Resources

The principal irreversible and irretrievable commitment of resources will, of course, be the use of the mined uranium for energy production. It is estimated that a minimum of  $1.9 \times 10^6$  kg ( $4.3 \times 10^6$  lb) of  $U_3O_8$  will be extracted. As much as 10 percent of the underground minable ore will be left in the ground. About  $8.5 \times 10^6$  l ( $2.2 \times 10^6$  gal) of petroleum fuels will also be expended plus a yet to be determined amount of electricity. Some of the materials used in the mine and support buildings and equipment will also be unrecoverable.

7. Relationship Between Local Short-Term Uses Of The  
Environment Versus Long-Term Productivity

There will be no significant long-term effects on the environment due to the proposal. During the proposed mining, approximately 32 ha (80 acre) would become unavailable for other uses. Virtually all of this new disturbance would be reclaimed after mining (see Chapter 3) and would then be available for essentially the same purposes as before mining. Differences in aquifer water levels attributable to aquifer depressuring for mining should be insignificant relative to premining levels about 10 years after completion of the project.

## 8. Milling

Plans for milling of the Edgemont ores are in the early stages of development. Alternative locations, processes, and capacities are being evaluated. A maximum capacity is expected to be 680 t/d (750 ton/d), and the following analysis is based upon this capacity. Process parameters used in this analysis are from one process under study, but should not differ significantly if an alternative process is selected.

A design feed of 0.12 percent  $U_3O_8$  and 0.18 percent  $V_2O_5$  ore will provide a daily mill input of 817 kg (1,800 lb)  $U_3O_8$  and 1,226 kg (2,700 lb)  $V_2O_5$ . Probable extraction efficiencies will be 98 percent for uranium and 80 percent for vanadium.

The mill site fenced area should be about 80 ha (200 acre). Additional land may be purchased around the fenced site as a buffer zone and to allow for future expansion should ore reserves be expanded greatly.

Tailings disposal facilities will be of two types. A pond of about 16 ha (40 acre) will be required for disposal of solid tailings for ten years of mill operation, assuming that the thickness of tailings does not exceed 12 m (40 ft). A lined evaporation pond will also be required for waste effluent. This pond should not exceed 8 ha (20 acre) in size.

All of the non-recoverable  $U_3O_8$  is expected to be released to the solid tailings disposal pond. Approximately 20 percent of this  $U_3O_8$  is expected to be dissolved in the residual liquid in the solid tailings. Practically all of the non-recoverable  $V_2O_5$  will also be released to the solid tailings. Only about 3 percent of this should be dissolved in the interstitial liquid. Less than 1 percent of the lost  $V_2O_5$  is expected to be released to the evaporation pond.

Water consumption for the entire process should be about 246,000 l/d (65,000 gal/d). Annual fuel consumption is expected to be 159,000 l (42,000 gal) propane, 5,110,000 l (1,350,000 gal) No. 6 fuel oil, and 350,000 l (92,400 gal) No. 2 fuel oil. In addition, approximately 933 kW of electrical power will be required to operate the mill.

It is believed the following sections provide a reasonable discussion on a generic basis of the potential environmental impacts of a uranium milling facility of the type and capacity anticipated to be required. However, the impacts could be somewhat different depending on advances in the state-of-the-art in uranium milling techniques and the details of the final mill design. When milling arrangements have been agreed upon, a more detailed environmental assessment of the proposed mill and mill site will be developed in the context of the application for the mill license.

In summary, no unacceptable environmental impacts associated with building and operating a mill were identified in this generic assessment.

### 8.1 Air

Operation of the Edgemont mill facility will result in increased ambient concentrations of gaseous pollutants (sulfur oxides, nitrogen oxides, hydrocarbons, and carbon monoxide) and suspended particulate matter. Fugitive dust and fossil fuel combustion emissions will both contribute to the increase in ambient concentrations.

Fugitive dust releases will result from construction and hauling activities; tailings piles, ore piles, and stockpiles; and other disturbed land surfaces associated with the milling operation. However, mitigative procedures are expected to reduce the potential for significant nonradiological air quality impacts due to fugitive dust releases. Estimates of the emission rates of dust discharged to the atmosphere from the dust control equipment are presented in section 8.2 of this chapter.

The combustion of fossil fuels will release pollutants to the atmosphere. It is estimated (based on the annual fuel consumption rates presented in preceding section) that approximately 42 l/h (11 gal/h) of No. 2 fuel oil, 19 l/h (5 gal/h) of propane and 855 l/h (226 gal/h) of No. 6 fuel oil will be consumed, producing approximately 18.3 g/s (145 lb/h) of sulfur oxides, 1.25 g/s (10 lb/h) of particulates, 0.15 g/s (1.2 lb/h) of carbon monoxide, 0.03 g/s (0.2 lb/h) hydrocarbons, and 1.8 g/s (14 lb/h) of nitrogen oxides. The use of gasoline-powered vehicles will generate additional combustion emissions.

These combustion products will be emitted from multipoint sources at varying locations and with different release characteristics. Therefore, detailed assessment of the air quality impacts which can be expected to result from these emissions is not possible until more specific design information becomes available. However, the Edgemont mill facility will meet all applicable ambient air quality standards and air pollution control regulations.



## 8.2 Radiological

During operation of a uranium mill, small amounts of radioactive materials are released to the atmosphere and ground and surface waters. These releases may result in exposure of area residents to above-background concentrations of radioactive materials, primarily through inhalation of air and ingestion of food or water. Of importance in some cases, may be direct irradiation by materials confined on the mill site.

For conventional drying and packaging, discharges to the atmosphere from dust control equipment will consist of the off-gas from the ore dryer, the effluent from two baghouses on the crushing circuit, and the effluent from the scrubber serving the yellowcake finishing circuit. The ore dryer will operate at about 6,800 l/s (14,400 ft<sup>3</sup>/min) with the off-gas at a temperature of 70° C (160° F). With two cyclones in series in the offgas stream, ore dust will be emitted at a rate of about 20 kg/h (45 lb/h). The baghouses will include a large baghouse operating at about 7,900 l/s (16,800 ft<sup>3</sup>/min) and emitting less than 2.3 kg/h (5 lb/h) ore dust and a small baghouse operating at 520 l/s (1,100 ft<sup>3</sup>/min) and emitting less than 0.5 kg/h (1 lb/h) ore dust. The yellowcake finishing circuit scrubber will be essentially 100 percent efficient with no detectable quantities of yellowcake dust expected in the effluent stream.

Radioactive particles may also be suspended into the atmosphere as a result of wind action on exposed ore stock piles and mill tailings. Radon-222 and its short-lived decay products also will be released to the atmosphere from the mill building, the tailings retention system, and ore stock piles. Releases to area waters will result from leakage, if any, from the tailings ponds. With proper design, construction, and operation of the mill, concentrations of radioactive materials released to the environment will be below applicable regulatory limits. The health and safety of the public should not be impaired either by the planned releases or by accidental or short-term releases. Further, direct radiation is not expected to be an important exposure pathway for a mill. The releases would be significantly reduced if the yellowcake is shipped as a slurry rather than undergoing conventional drying and packaging processes.

### 8.3 Water

Impacts on water quality resulting from the proposed uranium mill should be minimized by utilizing proper design, construction, and operation procedures. However, impacts could result from nonradiological liquid effluents produced in the milling process.

The uranium mill will be designed to prevent the release of radioactive liquid effluent directly to the surface water as required by Federal Regulations.\* Liquid discharge from the mill is to tailings ponds. The liquid waste streams contain natural uranium, thorium-230, and radium-226, as well as nonradiological waste products (kerosene, amine, alcohol, and waste resins) of the leaching and precipitation process.

The liquid phase of the tailings contains a portion of the organic phase from the solvent-extraction step. Chemical laboratory waste and runoff from the ore storage areas during heavy precipitation will also be routed to the tailings pond. Contamination of the ground water might occur due to seepage both vertically and horizontally from the tailings pond; however, the tailings ponds will be designed to minimize this seepage.

Hazardous or toxic materials will be handled and stored to prevent accidental releases to the environment.

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\*40 CFR Part 436 (1976)

#### 8.4 Land

Impacts of the uranium mill to land use will probably include removal of range land from grazing and wildlife usage for the mill facilities and tailings ponds estimated at 80 ha (200 acre). The locating of the mill and facilities will be done with a knowledge of any historical or archaeological sites in the area so impacts to these sites can be minimized. Land disturbance in relation to transportation could include the construction of new roads and upgrading of existing roads, the extent of which depends on the specific location of the mill.

Impacts to the soil will be localized within the mill site area. General impacts will include disruption of the soil forming processes, mixing of existing soils, and destruction of the soil which will have an effect on vegetation and subsequently wildlife. Because of the limited amount of area to be disturbed by a mill operation, these impacts will not be significant in terms of regional land use.

Effects to vegetation and wildlife include the disturbance to the land and vegetation in the area of the mill. Destruction of some animals may occur due to increased traffic on local roads. Hunting pressure on local populations of game species would probably increase.

#### 8.5 Socioeconomic

Construction of a new uranium mill can impact communities in several ways. An increased number of employees associated with the mill has the potential for impacting a community's public and private facilities and services. The trend in mill design is toward increased automation. In the future, a mill of this capacity could probably be operated with about 60 employees. Increased traffic will result from commuters and operation of construction vehicles. Resulting impacts would be an increased accident frequency, possible inconvenience to local residents due to increased traffic, and increased wear and tear on the roadways. Because of the small amount of current traffic and relatively small amount of traffic generated by the mill, the impacts due to increased traffic should not cause unacceptable conditions.

Section 2.10 discusses other socioeconomic impacts arising from population influx due to the mill.

#### 8.6 Safety

The environment may be affected by accidents associated with the milling of uranium. The occurrence of accidents related to the mill operation will be minimized through proper design, manufacture, and operation, as well as through a quality assurance program designed to establish and maintain safe operations. A detailed analysis of potential accidents will be addressed in the required environmental assessment when mill location, design and operating procedures are known.

### 8.7 Transportation

The mode of transport of ore to the mill has not been determined but in all probability will be by heavy-duty diesel-powered trucks. The impact associated with the transport of this ore will relate primarily to the generation of increased air pollutants and an increase in vehicular congestion. There is the possibility of other similar operations in the area contributing to the generation of increased air pollution and traffic. The actual transportation impacts of this mill and others cannot be accurately determined at this time.

Accidents during transportation of yellowcake to a  $UF_6$  conversion facility could result in releases of this material to the environment. Yellowcake is conventionally packaged at the mill in 208 l (55 gal), sealed steel drums containing about 360 kg (800 lb.). According to published statistics,<sup>1,2</sup> the probability of truck accidents involving shipment of the yellowcake occurring is in the range of  $2.6$  to  $4.2 \times 10^{-6}/km$  ( $1.6$  to  $2.6 \times 10^{-6}/mi$ ). Only a small fraction of the accidents would result in the release of the contents of the shipping container. A recent accident (September 1977) involving a shipment of yellowcake resulted in a spill of 6,800 kg (15,000 lb) on the ground and truck trailer. It was estimated\* that approximately 56 kg (123 lb) of  $U_3O_8$  would be released to the atmosphere. The consequence for the accident area with a population density of 5.52 people/ $km^2$  (2.13 people/ $mi^2$ ) would be a 50 year dose commitment of 0.146 man-rem. Natural background results in a 50 year integrated lung dose of 19 man-rem. Even for a large spill, cleanup of the released material and contaminated soils would be readily accomplished, thus further reducing the risk of significant radiation exposures. Another method which could be used is shipping yellowcake slurry in a tanker truck. In the event of an accident, the release of radionuclides would be reduced, and cleanup of the released material and contaminated soil could be more readily accomplished than cleanup of a dry spill.



#### 8. References

1. Environmental Survey of Transportation of Radioactivity Materials to and from Nuclear Plants; U.S. Atomic Energy Commission. Directorate of Regulatory Standards. WASH-1238. December 1972.
2. An Assessment of the Risk of Transporting Plutonium Oxide and Liquid Plutonium Nitrate by Truck. Battelle Northwest Laboratories Report BNWL-1046. August 1975.
3. Clarke, R. K. et al. "Severity of Transportation Accidents". Sandia Laboratory Report SLA-74-0001, Vol. I-IV. Unpublished.
4. U.S. Nuclear Regulatory Commission. Draft Environmental Statement Related to the Operation of Moab Uranium Mill, Atlas Mineral Division Atlas Corporation. Office of Nuclear Materials Safety and Safeguards. Docket No. 3453. November 1977.

Appendix A

The Associated Soil Series Interpretations and  
Estimated Engineering Properties of the Edgemont  
Project Area Soils

# APPENDIX A

TABLE A-1 SOIL INTERPRETATIONS FOR USE AS TOPSOIL AND SUITABILITY OF SOIL MATERIAL FOR PLANT GROWTH

| MAP<br>SYMBOL | SOIL SERIES                              | SLOPE<br>(PERCENT) | COMPOSITION<br>(PERCENT) | THICKNESS<br>OF "A"<br>HORIZON<br>IN INCHES | SUITABILITY<br>AS TOPSOIL <sup>1</sup> | REMARKS                                                | DEPTH TO<br>BEDROCK<br>IN INCHES | SUITABILITY OF<br>SOIL MATERIAL<br>FOR PLANT<br>GROWTH <sup>2</sup> | REMARKS                     |
|---------------|------------------------------------------|--------------------|--------------------------|---------------------------------------------|----------------------------------------|--------------------------------------------------------|----------------------------------|---------------------------------------------------------------------|-----------------------------|
| 10            | PITS, MINE                               | ---                | 95                       | ---                                         | ---                                    | ---                                                    | ---                              | POOR                                                                | TOO ROCKY                   |
| 16            | HISLE-SLICKSPOTS<br>COMPLEX              | 0-6                | 65                       | 2                                           | POOR                                   | THIN LAYER, EXCESS<br>SODIUM, DENSE<br>COMPACT SUBSOIL | 20-40                            | POOR                                                                | EXCESS SODIUM               |
|               | HISLE PART                               |                    | 25                       | ---                                         | ---                                    | ---                                                    | ---                              | ---                                                                 | ---                         |
|               | SLICKSPOTS PART                          |                    | 25                       | ---                                         | ---                                    | ---                                                    | ---                              | ---                                                                 | ---                         |
| 19B           | SATANTA LOAM                             | 2-6                | 85                       | 9                                           | GOOD                                   | ---                                                    | > 60                             | GOOD                                                                | ---                         |
| 19C           | SATANTA LOAM                             | 6-9                | 85                       | 9                                           | GOOD                                   | ---                                                    | > 60                             | GOOD                                                                | ---                         |
| A-1<br>40B    | NORKA SILT LOAM,<br>SANDSTONE SUBSTRATUM | 2-6                | 85                       | 7                                           | FAIR                                   | BEDROCK BELOW 30<br>INCHES                             | > 30                             | FAIR                                                                | THIN LAYER                  |
| 42D           | BUTCHE-BONEEK LOAMS                      | 3-15               | 60                       | 4                                           | POOR                                   | THIN LAYER                                             | < 20                             | POOR                                                                | THIN LAYER                  |
|               | BUTCHE PART                              |                    | 25                       | 6                                           | FAIR                                   | THIN LAYER, SLOPE,<br>TOO CLAYEY                       | > 40                             | FAIR                                                                | TOO CLAYEY, SLOPE           |
|               | BONEEK PART                              |                    | 25                       | ---                                         | ---                                    | ---                                                    | ---                              | ---                                                                 | ---                         |
| 42E           | BUTCHE-ROCK OUTCROP<br>COMPLEX           | 15-30              | 60                       | 4                                           | POOR                                   | THIN LAYER, SLOPE                                      | < 20                             | POOR                                                                | SLOPE, THIN LAYER,<br>ROCKS |
|               | BUTCHE PART                              |                    | 25                       | ---                                         | ---                                    | ---                                                    | ---                              | ---                                                                 | ---                         |
|               | ROCK OUTCROP PART                        |                    | 25                       | ---                                         | ---                                    | ---                                                    | ---                              | ---                                                                 | ---                         |
| 49B           | TUTHILL FINE SANDY<br>LOAM               | 0-6                | 85                       | 15                                          | GOOD                                   | ---                                                    | > 60                             | GOOD                                                                | ---                         |
| 69B           | NORKA SILT LOAM                          | 2-6                | 90                       | 6                                           | GOOD                                   | ---                                                    | > 60                             | GOOD                                                                | ---                         |

TABLE A-1 (Continued)

|     |      |                                      |       |    |     |      |                        |       |      |
|-----|------|--------------------------------------|-------|----|-----|------|------------------------|-------|------|
| A-2 | 76D  | MINNEQUA-MIDWAY SILTY CLAY LOAMS     | 6-25  |    |     |      |                        |       |      |
|     |      | MINNEQUA PART                        |       | 50 | 13  | POOR | SLOPE                  | 20-40 | POOR |
|     |      | MIDWAY PART                          |       | 40 | 8   | POOR | SLOPE, THIN LAYER      | < 20  | POOR |
|     | 79F  | SHINGLE-PENROSE-ROCK OUTCROP COMPLEX | 15-40 |    |     |      |                        |       |      |
|     |      | SHINGLE PART                         |       | 55 | 9   | POOR | THIN LAYER, SLOPE      | < 20  | POOR |
|     |      | PENROSE PART                         |       | 20 | 6   | POOR | THIN LAYER             | < 20  | POOR |
|     |      | ROCK OUTCROP PART                    |       | 15 | --- | ---  | ---                    | ---   | ---  |
|     | 86   | DEMAR SILTY CLAY LOAM                | 0-2   | 90 | 3   | POOR | THIN LAYER, TOO CLAYEY | > 40  | POOR |
|     | 90   | GRUMMIT-SNOMO CLAYS                  | 3-15  |    |     |      |                        |       |      |
|     |      | GRUMMIT PART                         |       | 55 | 6   | POOR | TOO CLAYEY             | < 20  | POOR |
|     |      | SNOMO PART                           |       | 30 | 7   | POOR | TOO CLAYEY             | > 40  | POOR |
|     | 91   | GRUMMIT-ROCK OUTCROP COMPLEX         | 3-40  |    |     |      |                        |       |      |
|     |      | GRUMMIT PART                         |       | 60 | 6   | POOR | TOO CLAYEY, TREES      | < 20  | POOR |
|     |      | ROCK OUTCROP PART                    |       | 30 | --- | ---  | ---                    | ---   | ---  |
|     | 95A  | KYLE CLAY                            | 0-2   | 90 | 4   | POOR | TOO CLAYEY             | > 60  | POOR |
|     | 95B  | KYLE CLAY                            | 2-6   | 85 | 4   | POOR | TOO CLAYEY             | > 60  | POOR |
|     | 96B  | PIERRE CLAY                          | 2-6   | 85 | 4   | POOR | TOO CLAYEY             | 20-40 | POOR |
|     | 97D  | PIERRE-SAMSIL CLAYS                  | 6-25  |    |     |      |                        |       |      |
|     |      | PIERRE PART                          |       | 60 | 4   | POOR | TOO CLAYEY, SLOPE      | 20-40 | POOR |
|     |      | SAMSIL PART                          |       | 25 | 3   | POOR | TOO CLAYEY, SLOPE      | < 20  | POOR |
|     | 197D | PIERRE-GRUMMIT CLAYS                 | 6-25  |    |     |      |                        |       |      |
|     |      | PIERRE PART                          |       | 55 | 4   | POOR | TOO CLAYEY, SLOPE      | 20-40 | POOR |
|     |      | GRUMMIT PART                         |       | 30 | 6   | POOR | TOO CLAYEY             | < 20  | POOR |

1. Suitability for use as topsoils refers generally to the A horizon.

2. The column "Suitability of Soil Material (Mixed) for Plant Growth" refers to suitability of materials to 60 inches or to bedrock that will support vegetation or is a medium of plant growth, based upon general texture, structure, erodibility, available water capacity, soluble salt content, depth, and accessibility or availability.

TABLE A-2 ESTIMATED ENGINEERING PROPERTIES OF SOILS

| MAP<br>SYMBOL<br>(1) | SOIL SERIES<br>(2)               | DEPTH TO<br>SEAS-<br>ONAL<br>WATER |              | DEPTH<br>FROM<br>SURFACE<br>(5) | CLASSIFICATION                    |                     |                           | LIQUID<br>LIMIT<br>(8) | PLASTIC-<br>ITY<br>INDEX<br>(9) | PERMEA-<br>BILITY<br>(10) | AVAILABLE<br>WATER<br>CAPACITY<br>(11) | REAC-<br>TION<br>(12) | SALINITY<br>(13) | SHRINK-<br>SWELL<br>POTENTIAL<br>(14) | CORROSION        |          |
|----------------------|----------------------------------|------------------------------------|--------------|---------------------------------|-----------------------------------|---------------------|---------------------------|------------------------|---------------------------------|---------------------------|----------------------------------------|-----------------------|------------------|---------------------------------------|------------------|----------|
|                      |                                  | BED-<br>ROCK<br>(3)                | TABLE<br>(4) |                                 | DOMINANT<br>USDA TEXTURE<br>(6)   | AASHO<br>(7)        | UNCOATED<br>STEEL<br>(15) |                        |                                 |                           |                                        |                       |                  |                                       | CONCRETE<br>(16) |          |
| ---                  | ---                              | IN.                                | FT.          | IN.                             | ---                               | ---                 | ---                       | ---                    | ---                             | IN/HR                     | IN/IN OF SOIL                          | pH                    | MMOHS/CM         | ---                                   | ---              | ---      |
| 42E                  | BONEEK,<br>BEDROCK<br>SUBSTRATUM | 40-<br>60                          | >6.0         | 0-6                             | SILT LOAM                         | A-4,<br>A-6         | 25-40                     | 5-15                   | 0.6-<br>2.0                     | 0.19-0.22                 | 6.1-<br>7.3                            | ---                   | ---              | LOW                                   | MODERATE         | LOW      |
|                      |                                  |                                    |              | 6-17                            | SILTY CLAY<br>LOAM, SILTY<br>CLAY | A-6,<br>A-7         | 35-50                     | 11-25                  | 0.2-<br>0.6                     | 0.11-0.17                 | 6.1-<br>7.8                            | ---                   | ---              | MODERATE                              | MODERATE         | LOW      |
|                      |                                  |                                    |              | 17-50                           | SILTY CLAY<br>LOAM, LOAM          | A-4,<br>A-6,<br>A-7 | 30-45                     | 5-20                   | 0.6-<br>2.0                     | 0.17-0.20                 | 7.4-<br>9.0                            | ---                   | ---              | MODERATE                              | HIGH             | LOW      |
|                      |                                  |                                    |              | 50-60                           | BEDROCK                           |                     |                           |                        |                                 |                           |                                        |                       |                  |                                       |                  |          |
| A-3<br>42D           | BUTCHE                           | <20                                | ---          | 0-4                             | FINE SANDY<br>LOAM                | A-4                 | 20-30                     | NP-7                   | 0.6-<br>6.0                     | 0.12-0.15                 | 6.1-<br>7.8                            | ---                   | ---              | LOW                                   | MODERATE         | MODERATE |
|                      |                                  |                                    |              | 4-9                             | STONY FINE<br>SANDY LOAM          | A-4                 | 20-30                     | NP-7                   | 0.6-<br>6.0                     | 0.12-0.15                 | 6.1-<br>7.8                            | ---                   | ---              | LOW                                   | MODERATE         | MODERATE |
|                      |                                  |                                    |              | 9-12                            | BEDROCK                           |                     |                           |                        |                                 |                           |                                        |                       |                  |                                       |                  |          |
| 86                   | DEMAR                            | 40-<br>50                          | >6.0         | 0-3                             | SILTY CLAY<br>LOAM                | A-6<br>A-7          | 30-45                     | 8-20                   | 0.6-<br>2.0                     | 0.16-0.20                 | 6.1-<br>7.3                            | <2                    | ---              | MODERATE                              | HIGH             | MODERATE |
|                      |                                  |                                    |              | 3-13                            | CLAY                              | A-7                 | 40-60                     | 20-35                  | <0.06                           | 0.08-0.12                 | 5.1-<br>7.3                            | <2                    | ---              | HIGH                                  | HIGH             | MODERATE |
|                      |                                  |                                    |              | 13-45<br>45-60                  | CLAY<br>BEDDED SHALE              | A-7                 | 40-60                     | 20-35                  | <0.06                           | 0.08-0.12                 | <5.0                                   | 8-16                  | ---              | HIGH                                  | HIGH             | HIGH     |
| 90<br>91<br>197D     | GRUMMIT                          | 5-20                               | ---          | 0-9                             | CLAY                              | A-7                 | 50-65                     | 20-35                  | 0.6-<br>2.0                     | 0.08-0.12                 | 3.6-<br>5.5                            | ---                   | ---              | HIGH                                  | HIGH             | HIGH     |
|                      |                                  |                                    |              | 9-60                            | SHALE                             |                     |                           |                        |                                 |                           |                                        |                       |                  |                                       |                  |          |
| 16                   | HISLE                            | 20-<br>40                          | ---          | 0-29                            | CLAY                              | A-7                 | 45-85                     | 20-55                  | <0.06                           | 0.05-0.12                 | 6.1-<br>8.4                            | ---                   | ---              | HIGH                                  | HIGH             | MODERATE |
|                      |                                  |                                    |              | 29-60                           | SHALE                             |                     |                           |                        |                                 |                           |                                        |                       |                  |                                       |                  |          |

TABLE A-2 (Continued)

|     |                           |       |      |       |                                       |          |       |       |          |           |         |     |          |          |          |
|-----|---------------------------|-------|------|-------|---------------------------------------|----------|-------|-------|----------|-----------|---------|-----|----------|----------|----------|
| 95A | KYLE                      | >60   | >6.0 | 0-4   | CLAY                                  | A-7      | 50-75 | 20-45 | <0.06    | 0.08-0.12 | 6.6-7.8 | --- | HIGH     | HIGH     | LOW      |
| 95B |                           |       |      | 4-60  | CLAY                                  | A-7      | 50-75 | 20-45 | <0.06    | 0.08-0.12 | 7.9-8.4 | <4  | HIGH     | HIGH     | LOW      |
| 75D | MIDWAY                    | 6-20  | ---  | 0-17  | SILTY CLAY LOAM                       | A-6, A-7 | 45-60 | 20-35 | 0.06-0.2 | 0.17-0.20 | 7.4-8.4 | 2-8 | HIGH     | HIGH     | MODERATE |
|     |                           |       |      | 17-60 | SHALE                                 |          |       |       |          |           |         |     |          |          |          |
| 76D | MINNEQUA                  | 20-40 | ---  | 0-5   | SILTY CLAY LOAM                       | A-4, A-6 | 30-40 | 8-15  | 0.6-2.0  | 0.19-0.22 | 7.4-8.4 | --- | MODERATE | HIGH     | LOW      |
|     |                           |       |      | 5-24  | SILTY CLAY LOAM, SILT LOAM            | A-4, A-6 | 30-40 | 5-15  | 0.6-2.0  | 0.17-0.20 | 7.4-8.4 | --- | MODERATE | HIGH     | LOW      |
|     |                           |       |      | 24-60 | CHALK AND LIMESTONE                   |          |       |       |          |           |         |     |          |          |          |
| 65B | NORKA                     | >60   | >6.0 | 0-6   | SILT LOAM                             | A-4      | 20-30 | 2-7   | 0.6-2.0  | 0.19-0.22 | 6.6-8.4 | --- | LOW      | LOW      | LOW      |
|     |                           |       |      | 6-11  | SILTY CLAY LOAM, CLAY LOAM            | A-4, A-6 | 30-40 | 5-15  | 0.2-0.6  | 0.17-0.20 | 6.6-8.4 | --- | MODERATE | MODERATE | LOW      |
|     |                           |       |      | 11-60 | SILT LOAM, LOAM                       | A-4      | 15-25 | NP-7  | 0.6-2.0  | 0.16-0.20 | 7.4-8.4 | --- | LOW      | MODERATE | LOW      |
| 40B | NORKA, BEDROCK SUBSTRATUM | 30-60 | ---  | 0-7   | SILT LOAM                             | A-4      | 20-30 | 2-7   | 0.6-2.0  | 0.19-0.22 | 6.6-8.4 | --- | LOW      | LOW      | LOW      |
|     |                           |       |      | 7-15  | CLAY LOAM, SILTY CLAY LOAM            | A-4, A-6 | 30-40 | 5-15  | 0.2-0.6  | 0.17-0.20 | 7.4-8.4 | --- | MODERATE | MODERATE | LOW      |
|     |                           |       |      | 15-30 | CLAY LOAM, SILTY CLAY LOAM, SILT LOAM | A-4, A-6 | 30-40 | 5-15  | 0.6-2.0  | 0.17-0.20 | 7.4-8.4 | --- | LOW      | MODERATE | LOW      |
| 75F | PENROSE                   | 10-20 | ---  | 0-6   | LOAM, CLAY LOAM                       | A-4      | 15-30 | NP-10 | 0.6-2.0  | 0.16-0.18 | 7.9-8.4 | --- | LOW      | HIGH     | LOW      |
|     |                           |       |      | 6-14  | SHALY CLAY LOAM                       | A-4      | 15-25 | NP-10 | 0.6-2.0  | 0.14-0.17 | 7.9-8.4 | --- | LOW      | HIGH     | LOW      |
|     |                           |       |      | 14-16 | LIMESTONE                             |          |       |       |          |           |         |     |          |          |          |



TABLE A-2 (Continued)

|     |             |         |           |      |       |                                        |             |       |       |              |           |             |     |          |          |          |
|-----|-------------|---------|-----------|------|-------|----------------------------------------|-------------|-------|-------|--------------|-----------|-------------|-----|----------|----------|----------|
| A-5 | 96B<br>197D | PIERRE  | 20-<br>40 | ---  | 0-29  | CLAY, SILTY<br>CLAY                    | A-7         | 50-75 | 22-45 | <0.06        | 0.08-0.12 | 6.6-<br>8.4 | --- | HIGH     | HIGH     | MODERATE |
|     |             |         |           |      | 29-34 | SHALY CLAY                             | A-7         | 50-85 | 25-60 | <0.06        | 0.08-0.12 | 6.6-<br>8.4 | --- | HIGH     | HIGH     | MODERATE |
|     |             |         |           |      | 34-60 | SHALE                                  |             |       |       |              |           |             |     |          |          |          |
|     | 97D         | SAMSIL  | 4-20      | ---  | 0-18  | CLAY, SHALY<br>CLAY                    | A-7         | 50-85 | 25-60 | 0.06-<br>0.2 | 0.08-0.12 | 7.4-<br>8.4 | --- | HIGH     | HIGH     | MODERATE |
|     |             |         |           |      | 18-60 | SHALE                                  |             |       |       |              |           |             |     |          |          |          |
|     | 19B<br>19C  | SATANTA | >60       | >6.0 | 0-9   | LOAM                                   | A-4,<br>A-6 | 25-35 | 2-15  | 0.6-<br>2.0  | 0.18-0.20 | 6.1-<br>7.3 | --- | LOW      | HIGH     | LOW      |
|     |             |         |           |      | 9-20  | LOAM, SANDY<br>CLAY LOAM               | A-6,<br>A-7 | 30-45 | 11-25 | 0.6-<br>2.0  | 0.16-0.18 | 6.6-<br>8.4 | --- | MODERATE | HIGH     | LOW      |
|     |             |         |           |      | 20-60 | LOAM                                   | A-4,<br>A-6 | 20-35 | 2-15  | 0.6-<br>2.0  | 0.16-0.18 | 7.4-<br>8.4 | --- | LOW      | HIGH     | LOW      |
|     | 79F         | SHINGLE | 10-<br>20 | ---  | 0-13  | LOAM, SHALY<br>LOAM                    | A-6         | 30-40 | 5-15  | 0.6-<br>2.0  | 0.16-0.17 | 7.9-<br>9.0 | --- | MODERATE | HIGH     | LOW      |
|     |             |         |           |      | 13-60 | SHALE                                  |             |       |       |              |           |             |     |          |          |          |
|     | 90          | SNOMO   | 40-<br>60 | ---  | 0-45  | CLAY, SILTY<br>CLAY                    | A-7         | 50-70 | 20-38 | 0.6-<br>2.0  | 0.08-0.12 | 3.6-<br>5.5 | --- | HIGH     | MODERATE | HIGH     |
|     |             |         |           |      | 45-60 | SHALE                                  |             |       |       |              |           |             |     |          |          |          |
|     | 49B         | TUTHILL | >60       | >6.0 | 0-10  | FINE SANDY<br>LOAM                     | A-4         | 20-35 | NP-10 | 0.6-<br>6.0  | 0.14-0.17 | 6.1-<br>7.8 | --- | LOW      | LOW      | LOW      |
|     |             |         |           |      | 10-24 | FINE SANDY<br>LOAM, SANDY<br>CLAY LOAM | A-4,<br>A-6 | 25-40 | 5-15  | 0.6-<br>2.0  | 0.09-0.18 | 6.1-<br>7.8 | --- | MODERATE | MODERATE | LOW      |
|     |             |         |           |      | 24-60 | FINE SANDY<br>LOAM, SANDY<br>LOAM      | A-4         | 20-30 | MP-10 | 0.6-<br>6.0  | 0.09-0.15 | 6.1-<br>8.4 | --- | LOW      | MODERATE | LOW      |

Appendix B

Archaeological Clearance Material

Cultural Affairs

August 30, 1978

Mr. Maxwell D. Ramsey  
Recreation Program Coordinator  
Tennessee Valley Authority  
Norris, Tennessee 37828

Re: Edgemont Uranium Mining Project  
Fall River and Custer Counties

Dear Sir:

This office has been notified of your intention to undertake the above federally involved action. To assist your compliance with Section 106 of the National Historic Preservation Act (PL 89-665); Executive Order 11593, Protection and Enhancement of the Cultural Environment; 36 CFR 800; and other laws and regulations pertinent to the protection of historic, archaeological or culturally significant properties, the State Historic Preservation Officer makes the following comment:

The above project has been reviewed and determined to have no effect on significant cultural sites. However, should archaeological, historical or cultural materials be discovered in the course of the undertaking, work disturbing those materials shall cease immediately, and the State Historic Preservation Officer notified of their existence. An immediate assessment of their importance will follow, and appropriate mitigation recommendations issued.

Additional comments:

This office wishes to extend its gratitude to the TVA for its efforts to protect the cultural resources of the area in question.

Your cooperation in this matter is most appreciated.

Yours truly,

*Steven A. Little*

John J. Little  
State Historic Preservation Officer

jla

cc: Robert Alex

The Office of Cultural Preservation of the Department of Education and Cultural Affairs coordinates South Dakota's archaeological research, museums, historical preservation and historical resource in a program designed to preserve our natural and cultural heritage.

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**From:** [Jeffery C. Parsons](#)  
**To:** [Shea, Valois](#)  
**Cc:** ["Roger Flynn"](#)  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments #7  
**Date:** Monday, June 19, 2017 3:49:05 PM  
**Attachments:** [TVA Analysis of Aquifer Tests at the Proposed Burdock Uranium Mine Site Boggs and Jenkins.pdf](#)  
[USGS Groundwater Restoration at Uranium In-Situ Recovery Mines, South Texas Coastal Plain.pdf](#)

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Email #7

\*\*\*\*\*

Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

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**From:** Jeffery C. Parsons [mailto:[wmap@igc.org](mailto:wmap@igc.org)]  
**Sent:** Monday, June 19, 2017 3:45 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #6

\*\*\*\*\*

Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

---

**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:43 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #5

\*\*\*\*\*

Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

---

**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:39 PM  
**To:** [shea.valois@epa.gov](mailto:shea.valois@epa.gov)  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #4

\*\*\*\*\*

Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

---

**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:38 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

\*\*\*\*\*

Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

---

**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:37 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #2

\*\*\*\*\*

Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:36 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** Oglala Sioux Tribe Comment Attachments

Ms. Shea – in support of the comments submitted this day (June 19, 2017) by the Oglala Sioux Tribe, attached are supplemental documents. As there are several such documents, there are likely to be a series of emails to follow. Thank you.

\*\*\*\*\*

Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

Tennessee Valley Authority  
Office of Natural Resources  
Division of Water Resources  
Water Systems Development Branch

ANALYSIS OF AQUIFER TESTS CONDUCTED  
AT THE PROPOSED BURDOCK URANIUM MINE SITE  
BURDOCK, SOUTH DAKOTA

Report No. WR28-1-520-109

Prepared by  
J. M. Boggs  
and  
A. M. Jenkins

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Norris, Tennessee  
May 1980



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## ABSTRACT

Separate aquifer tests were conducted in two aquifers which may be affected by TVA's proposed uranium mining operation near Burdock, South Dakota. In April 1979, a constant-discharge test was conducted in the Chilson member of the Lakota formation which comprises the principal ore body and an aquifer of regional importance. The hydraulic properties of both the Lakota (Chilson) aquifer and the overlying Fuson shale aquitard were determined. A second test was conducted in July 1979 in the Fall River aquifer which overlies the Fuson. The hydraulic characteristics of the Fall River aquifer and a second estimate of the Fuson aquitard properties were obtained from the test. The test results indicate that the two aquifers are hydrologically connected via (1) general leakage through the Fuson shale, and (2) direct pathways, probably in the form of numerous old (pre-TVA) unplugged exploration boreholes.

The hydraulic properties of the Fall River, Fuson and Lakota units obtained from the aquifer test analyses were incorporated into a computer model of the site geohydrologic system. These parameters were refined in a calibration process until the model could reproduce the drawdown responses observed during the Lakota aquifer test. Results indicate the transmissivity and storativity of the Lakota (Chilson) aquifer are approximately 1400 gallons per day per foot (gpd/ft) and  $1.0 \times 10^{-4}$ , respectively. The Fall River aquifer has an estimated transmissivity of 400 gpd/ft and a storativity of about  $1.4 \times 10^{-5}$ . The hydraulic conductivity of the Fuson aquitard is estimated at approximately  $10^{-3}$  foot per day. The specific storativity of the Fuson was not measured but is assumed to be about  $10^{-6}$  feet<sup>-1</sup>.



## INTRODUCTION

This report describes the aquifer testing program conducted at the proposed uranium mine site in Burdock, South Dakota. The purpose of the program was to determine the hydrogeologic conditions in the mining area in order-to predict mine dewatering requirements and impacts.

The Fall River formation and the Chilson member of the Lakota formation comprise the principal aquifers in the vicinity of the proposed mine. These aquifers are separated by the Fuson shale member of the Lakota formation which acts as an aquitard. The uranium deposits to be mined lie within the Chilson unit.

Two unsuccessful aquifer tests were conducted at the site prior to those described in this report. The first test was conducted at the Burdock test well in February 1977. Pumping took place from both the Fall River and Lakota aquifers during the 14-day test. The test results were invalidated by questionable well discharge measurements and by mechanical difficulties with a deep-well current meter used to measure the quantity of water pumped from each aquifer. A second test lasting three days was performed in November 1977. Pumping was restricted to the Lakota aquifer during the test in order to determine the potential for leakage through the Fuson shale from the overlying Fall River aquifer. The results of the test were inconclusive because (1) five observation wells used in the test were subsequently found to be improperly constructed and (2) pressure gauges used to monitor pumping response at several wells malfunctioned during the test.



The problems associated with the two earlier tests were corrected for the tests described in this report. The defective observation wells were pressure sealed with cement grout and replaced with properly constructed wells. More reliable instrumentation for monitoring potentiometric heads in observation wells was used in subsequent tests.

## HYDROGEOLOGY

### Regional Setting

The proposed mine site is located in the northwestern corner of Fall River County, South Dakota, less than one mile southeast of the community of Burdock. Geologically, the site is situated on the southwest flank of the Black Hills Uplift (see Appendix, Figure 1). The stratigraphy of the region consists of a sequence of rocks ranging in age from Precambrian to Recent which crop out peripherally to the Black Hills. The Precambrian rocks crop out near the center of the Black Hills, and progressively younger rocks crop out to the southwest. Surficial rocks in the site area range in age from lower Cretaceous to Recent. A generalized stratigraphic column for the site is shown in Table 1.

The major structural features of the region are the southwesterly-trending Dewey and Long Mountain structural zones. Faults, fractures and breccia pipes in these zones are believed to affect the ground-water regime.

### Aquifers

The principal aquifers in the region are the alluvial deposits associated with the Cheyenne River and its major tributaries, the Fall River formation, the Lakota formation, the Sundance formation, and the Pahasapa (or Madison) formation. Except for the alluvium, these aquifers crop out peripherally to the Black Hills where they receive recharge from precipitation. Ground-water movement is in the direction of dip, radially from the central Black Hills. In most instances, ground water in these aquifers is under artesian conditions away from the



TABLE 1: GENERALIZED STRATIGRAPHIC COLUMN FOR SITE REGION  
(FROM KEENE, 1973)

| PERIOD        | FORMATION NAME                | SYM-<br>BOL | COLUMN                                                                              | LITHOLOGIC DESCRIPTION                                                                                                                                                     | THKNS.<br>IN FEET | HYDROLOGIC CHARACTERISTICS                                                                                                                                |
|---------------|-------------------------------|-------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Quaternary    | Alluvium                      | Qal         |  | Gravel, sand, and silt floodplain deposits. Alluvial terraces and windblown material.                                                                                      | 1-30              | Good to excellent aquifer along floodplains; terraces generally non-productive except for scattered springs.                                              |
|               | Pierre Fm.                    | Kp          |  | Dark gray shale, weathering brown or buff and containing many fossiliferous concretions.                                                                                   | 1000+             | Relatively no value as an aquifer; locally large diameter wells in stream valleys may yield small amounts of highly mineralized water during wet seasons. |
|               | Niobrara Fm.                  | Kn          |  | Scattered concretions which form "tepee buttes". Black fissile shale, cone-in-cone concretions.                                                                            | 100-225           | No known wells.                                                                                                                                           |
|               | Turner sand                   |             |  | Gray calcareous shale, weathering yellow and impure chalk with Oolite concretions.                                                                                         |                   |                                                                                                                                                           |
|               | Carlisle Fm.                  | Kcr         |  | Light gray shale with thin sandstone layers.                                                                                                                               | 520-540           | Relatively impermeable; possible small yields from Turner and Wall Creek sands.                                                                           |
|               | Wall Creek sand               |             |  | Bed of impure limestone.                                                                                                                                                   |                   |                                                                                                                                                           |
|               | Greenhorn Lms.                | Kg          |  | Thin bedded hard limestone, weathering creamy white, contains <i>Isocrinus</i> <i>labialis</i> .                                                                           | 50                | Too thin and dense to be an aquifer.                                                                                                                      |
|               | Belle Fourche Fm.             |             |  | Light gray shale, bentonite, large concretions.                                                                                                                            |                   |                                                                                                                                                           |
|               | Mowry Shale                   |             |  | Light gray siliceous shale.                                                                                                                                                | 870               | Newcastle sand may yield water, permeability is variable.                                                                                                 |
|               | Graneros Group                | Kgs         |  | Thin brown-to-yellow sandstone.                                                                                                                                            |                   |                                                                                                                                                           |
| Cretaceous    | Newcastle sand                |             |  | Black shale.                                                                                                                                                               |                   |                                                                                                                                                           |
|               | Skull Creek Shale             |             |  | Interbedded red-brown massive sandstone and carbonaceous shales.                                                                                                           | 30-165            | Largest producer in the area. Yields up to 60 gpm of highly mineralized water (flow). Water quality generally poor, sometimes yields hydrogen sulfide.    |
|               | Fall River Fm.                | Kfr         |  | Gray-to-purple shale, thin shales.                                                                                                                                         | 0-180             |                                                                                                                                                           |
|               | Fusion Shale                  |             |  | Light gray massive limestone.                                                                                                                                              | 0-25              |                                                                                                                                                           |
|               | Minnewasta Lms.               |             |  | Coarse, hard, cross-bedded sandstone, buff-to-gray, coal beds locally near base.                                                                                           | 130-230           | Relatively good aquifer from the lower Chilson member, up to 30 gpm artesian flow.                                                                        |
| Jurassic      | Lakota Fm.                    | Klk         |  | Green-to-maroon shale, thin sandstone.                                                                                                                                     | 0-125             | No known wells, possible aquifer.                                                                                                                         |
|               | Morrison Fm.                  | Km          |  | Fine grained, massive, vari-colored sandstone.                                                                                                                             | 0-240             | No known wells, possible aquifer.                                                                                                                         |
|               | Unkpapa Fm.                   | Ju          |  | Alternating beds of red sandstone and red-to-green marine shales.                                                                                                          | 250-450           | Produces small amounts of water from the sands suitable for domestic use.                                                                                 |
|               | Sundance Fm.                  | Jsd         |  | Red silty shale, limestone, and anhydrite near the top.                                                                                                                    |                   | Poor producer, small yields of sulfate water.                                                                                                             |
| Triassic      | Speartfish Fm.                | Rs          |  | Redbeds.                                                                                                                                                                   | 400               |                                                                                                                                                           |
| Permian       | Minnekahta Lms.               | Cmk         |  | Gypsum locally near the base.                                                                                                                                              |                   |                                                                                                                                                           |
|               | Opache Fm.                    | Co          |  | Pale brown, to gray dense, crystalline limestone.                                                                                                                          | 50                | Locally secondary fracture porosity.                                                                                                                      |
|               |                               |             |  | Red finely bedded sandstones and shales, purple shale near top.                                                                                                            | 100               | No known wells.                                                                                                                                           |
| Pennsylvanian | Minnelusa Fm.                 | Cml         |  | Converse sand, red-to-yellow cross bedded sand. Red marker, thin red shale near middle. Leo sands, series of thin limestones. Dolomite at bottom with basal laterite zone. | 755-1040          | Permeability variable, tremendous flows of warm mineralized water recorded near the periphery of the Black Hills. Excellent potential.                    |
| Mississippian | Osage Fm.                     | Cps         |  | Massive, light colored dolomite and limestone, cavernous in upper 100 feet.                                                                                                | 165-465           | Most promising aquifer in the area. The 2 wells in this aquifer produce large amounts of water suitable for domestic use.                                 |
| Precambrian   | Metamorphic and igneous rocks | PC          |  | Granite, schists, quartzite, and slates.                                                                                                                                   | ---               | No potential.                                                                                                                                             |



outcrop area, and water flows from numerous wells in the area at ground surface.

The Fall River and Lakota formations which form the Inyan Kara Group are the principal aquifers in the region. The alluvium is used locally as a source of domestic and stock water. The Sundance formation is used near its outcrop area in central and northwestern Fall River County. The Pahasapa (Madison) formation is locally accessible only by very deep wells and is the source for five wells in the city of Edgemont.

The Fall River and Lakota aquifers are of primary concern because of the potential impact of mine dewatering on the numerous wells developed in these aquifers in the vicinity of the mine. At the proposed mine site, the Fall River consists of approximately 120 feet of interbedded fine-grained sandstone, siltstone and carbonaceous shale. The Fall River aquifer is overlain by approximately 250 feet of the Mowry and Skull Creek shales unit, which act as confining beds. Twenty-six domestic and stock-watering wells are known to be developed in the Fall River formation within a four-mile radius of the mine site. Many of these are flowing at the surface.

The Fall River formation is underlain by Fuson shale member of the Lakota formation. Thickness of the Fuson is on the order of 60 feet in the site vicinity. The Fuson acts as a leaky aquitard between the Fall River and Lakota aquifers. A physical examination of undisturbed core samples of Fuson indicates that the shale itself has a very low permeability. However, aquifer tests suggest a direct connection through the Fuson which may be the result of some as-yet-unidentified structural features or old unplugged exploration holes.

The Chilson member of the Lakota formation is the second most widely used aquifer in western Fall River County, as the source for some 23 wells within a four-mile radius of the mine site. It is also the uranium-bearing unit to be mined. The Chilson consists of about 120 feet of consolidated to semi-consolidated, fine-grained sandstone and siltstone. It is underlain by the Morrison formation consisting of interbedded shale and fine-grained sandstone. Regionally, the Morrison is not considered an aquifer. Under conditions of groundwater withdrawal from the Chilson, the Morrison is expected to act as an aquitard.

Recharge to the Fall River and Lakota aquifers is believed to occur at their outcrop areas. Bowles (1968) has theorized that recharge to these aquifers may also be derived from the upward movement of ground water along solution collapses and breccia pipes from the deeper Minnelusa and Pahasapa aquifers. The solution collapse and breccia pipe features lie within the Dewey and Long Mountain structural belts.



### AQUIFER TEST DESIGN

The objective of the aquifer testing program was to obtain sufficient quantitative information about local hydrogeologic conditions to enable prediction of mine dewatering requirements and impacts to both the Fall River and Lakota aquifers. Since the two aquifers involved are separated by the Fuson aquitard, two distinct pumping tests were required to obtain the necessary information about each formation: one test in which the Lakota aquifer was pumped, and another in which pumping was limited to the Fall River aquifer. During both tests ground-water levels were monitored in observation wells developed in each of the three formations. Data obtained from these tests were then analyzed to obtain estimates of the hydraulic properties of the aquifers and aquitard.

The Burdock test well was constructed approximately 600 feet north of the proposed mine shaft. Total depth of the well is 559 feet. The well is screened in both the Fall River and Lakota aquifers as shown in Figure 2.

Fifteen observation wells were constructed within an approximate one-mile radius of the pumping well as indicated in Figure 3. Seven of these wells are developed in the Fall River formation, five in the Lakota, and three in the Fuson. In addition, there is a single well developed in the Sundance formation located approximately one mile from the test well. This well was not constructed specifically for the aquifer tests, but was monitored periodically during the Lakota aquifer test. Construction details for these wells are given in Table 2.



TABLE 2. Observation Well Construction Details

| <u>Well<br/>No.</u> | <u>Total<br/>Depth<br/>(feet)</u> | <u>Casing<br/>Diameter<br/>(inches)</u> | <u>Depth Interval of<br/>Open Borehole or<br/>Well Screen<br/>(feet)</u> | <u>Distance From<br/>Pumped Well<br/>(feet)</u> |
|---------------------|-----------------------------------|-----------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------|
| B-10LAK             | 550                               | 4                                       | 510-550                                                                  | 195                                             |
| B-10FU              | 395                               | 4                                       | 377-395                                                                  | 255                                             |
| B-10FR              | 350                               | 4                                       | 300-350                                                                  | 177                                             |
| B-11LAK             | 570                               | 4                                       | 525-570                                                                  | 405                                             |
| B-11FU              | 440                               | 4                                       | 420-440                                                                  | 350                                             |
| B-11FR              | 376                               | 4                                       | 334-376                                                                  | 373                                             |
| B-11LAK             | 550                               | 4                                       | 504-550                                                                  | 618                                             |
| B-11FR              | 360                               | 4                                       | 315-360                                                                  | 620                                             |
| B-9LAK              | 545                               | 1                                       | 503-545                                                                  | 1540                                            |
| B-9FR               | 293                               | 1                                       | 251-293                                                                  | 1540                                            |
| B-7LAK              | 441                               | 1                                       | 399-441                                                                  | 2507                                            |
| B-7FR               | 252                               | 1                                       | 210-252                                                                  | 2540                                            |
| Sundance<br>Well    | 880                               | 7 7/8                                   | 666-780                                                                  | 4763                                            |

Inasmuch as water levels in each hydrogeologic unit will respond differently during pumping tests, it is important that each observation well reflect the potentiometric head in the intended uncased borehole interval. Several observation wells used in previous tests were suspected of leaking along the grout seal placed in the annular space between well casing and borehole wall. As a result, special precautions were taken to ensure proper construction of the observation wells used in the present tests. A geophysical device known as a cement logging probe was used to check the continuity of the cement grout seal in each well after construction. All were found to be properly sealed.

The so-called ratio-method of multiple-aquifer test analysis (Neuman and Witherspoon, 1973) requires that the response of water levels in both the pumped and unpumped aquifers and in the intervening aquitard be monitored during the test. Water level responses in these units must be measured in wells located at approximately the same radial distance from the pumped well. To obtain the necessary data, two groups of observation wells were constructed, each group having one well developed in the Fall River, one in the Fuson, and one in the Lakota (Chilson member). The B-10 group was located approximately 200 feet northeast of the pumping well, while the B-1 group was located approximately 375 feet to the southwest. These well groups were located close to the pumped well to ensure response in the aquitard and in the unpumped aquifer, if such responses were to occur at all. The remaining well groups (B-7, B-9 and B-11 series) contain only Fall River and Lakota wells.



Under natural conditions, the test well and all monitor wells except for those of the B-7 group flow at ground surface if not capped. The two previous tests conducted at the site indicated that observation wells in the pumped aquifer located close to the pumping well would become non-flowing at some point during the test. Thus, pressure sensing devices would be required during the early part of the test and depth measuring techniques during later periods. To ensure adequate data records, each flowing well was equipped with two pressure measuring devices. Malfunctions of several pressure gauges on previous tests pointed out the need for a back-up pressure measuring device.

Three types of pressure sensors were used: mercury manometers, electronic pressure transducers, and mechanical pressure gauges. The B-1 and B-10 observation well groups were equipped with mercury manometers and pressure transducers. As the closest wells to the pumping center, the data from these wells are most important in the multiple aquifer analysis and warrant the best instrumentation. Pressure transducers from all wells were wired to a central terminal and could be monitored frequently during the tests. Each well in groups B-9 and B-11 was equipped with a mercury manometer and a mechanical pressure gauge. Electric probes were used to measure water levels in the non-flowing wells of the B-7 group. These devices were also used to measure water levels in other wells which became non-flowing during pumping tests. Potentiometric head in the pumped well was measured with a mercury manometer, an air line and an electric probe.

### LAKOTA AQUIFER TEST

Several months prior to the Lakota test, a pneumatic packer was set within the Fuson section of the test well to prevent communication between the Fall River and Lakota aquifers through the well. A submersible pump was set below packer to restrict pumping to the Lakota aquifer. Well-head valves on the test well and other artesian observation wells were closed to prevent flow in order to bring the ground-water system into equilibrium before testing.

Hydrographs for the test well and observation wells prior to test are shown in Figures 4 and 5. These hydrographs typify the basic relationship between the potentiometric heads in the Fall River, Fuson and Lakota, i.e., heads are highest in the Lakota, lowest in the Fall River, and at an intermediate position within the Fuson. The irregular readings recorded during January and February 1979 were due to depressurization of the aquifers during the installation of instrumentation and new wells. The pre-test ground-water level configuration in the Lakota aquifer on April 18 is shown in Figure 6.

### Test Procedures and Results

A constant-discharge aquifer test was initiated at 1300 hours on April 18, 1979. Discharge from the well was pumped via pipeline to a stock-watering pond located approximately 0.75 miles from the test well. Pumpage was measured with an in-line flow meter and with an orifice plate and manometer device at the end of the discharge line. The pumping rate varied little during the test ranging from 201 to 205 gpm and averaging 203 gpm. The pumping phase of the test lasted for



73 hours (3.04 days) and was followed by a 30 day period of recovery measurements.

Figure 7 shows a semilogarithmic graph of drawdown ( $s$ ) versus time ( $t$ ) for the pumping well (Lakota aquifer). Erratic readings during the first 200 minutes of the test are the result of problems with the airline equipment, and are not due to discharge variations. These difficulties were subsequently corrected, but in general airline measurements are believed to be accurate only to within about  $\pm 2$  feet.

Semilog graphs for the observation well groups are shown in Figures 8 through 12. Note that a slight initial increase in hydrostatic pressure is indicated in the Fall River and Fuson wells of the B-10 and B-1 well groups. This anomalous trend is more pronounced in the Fuson wells than in the Fall River wells and persists for approximately 90 minutes in B-10FU. The response is believed to be due to an increase in pore pressure resulting from deformation of the matrix of these formations.<sup>1</sup> In any case, the anomalous trend was recorded by both the pressure transducers and mercury manometers, and is not the result of measurement error.

The Jacob straight-line method (see Walton, 1970, pp. 130-133) was applied to the semilog graphs for the Lakota wells to obtain the values of transmissivity ( $T$ ) and storativity ( $S$ ) presented in Table 3. In the case of the closer observation wells, two straight-line

<sup>1</sup>During the early stages of pumping, water removed from the Lakota in the immediate vicinity of the well causes compaction of the aquifer. This, in turn, may cause the overlying strata to flex slightly in the area where the underlying support of the Lakota has been reduced. The resulting deformation in the overlying formations causes compressive forces which temporarily increase pore pressures in these materials. Subsequently, the effect of pumping-induced depressurization is transmitted through the overlying materials, gradually lowering the hydrostatic pressure.



TABLE 3. Lakota Aquifer Properties

| Well No. | Jacob Method |                   |                      |                   | Theis Method         |                   |                      |                   | Recovery Method   |                   |
|----------|--------------|-------------------|----------------------|-------------------|----------------------|-------------------|----------------------|-------------------|-------------------|-------------------|
|          | $r$<br>(ft)  | $T_e$<br>(gpd/ft) | $S_e$                | $T_d$<br>(gpd/ft) | $S_d$                | $T_e$<br>(gpd/ft) | $S_e$                | $T_d$<br>(gpd/ft) | $T_e$<br>(gpd/ft) | $T_d$<br>(gpd/ft) |
| PW-LAK   | 0.67         | 1980              | --                   | 1260              | --                   | --                | --                   | --                | --                | --                |
| B-10LAK  | 195          | 2680              | $7.6 \times 10^{-5}$ | 1370              | $3.5 \times 10^{-4}$ | 2530              | $8.4 \times 10^{-5}$ | 1660              | 2060              | 1300              |
| B-11LAK  | 405          | 2140              | $4.4 \times 10^{-5}$ | 1340              | $1.2 \times 10^{-4}$ | 2120              | $4.8 \times 10^{-5}$ | 1550              | 1970              | 1240              |
| B-11LAK  | 620          | --                | --                   | --                | --                   | 2530              | $1.1 \times 10^{-4}$ | 1530              | --                | 1250              |
| B-9LAK   | 1540         | --                | --                   | --                | --                   | --                | --                   | 1370              | --                | 1290              |
| B-7LAK   | 2507         | --                | --                   | --                | --                   | --                | --                   | 1760              | --                | 1500              |
| Average: |              | 2270              | $6.0 \times 10^{-5}$ | 1320              | $2.4 \times 10^{-4}$ | 2390              | $8.1 \times 10^{-5}$ | 1570              | 2015              | 1270              |

NOTE: Subscript "e" denotes an aquifer parameter determined using early drawdown (or recovery) data. Similarly, subscript "d" denotes a parameter computed from late data.

solutions were possible: one using the early data and another using the late data. Note that data for wells B-7L, B-9L and B-11L cannot be analyzed by the Jacob method because data do not satisfy the criterion that  $r^2S/4Tt \leq 0.01$  (consistent units), where  $r$  is the distance between the pumped well and the observation well.

Logarithmic graphs of drawdown data for all observation wells are given in Figures 13 through 17. Theis curve-matching techniques (Walton, 1970, pp. 209-211) were applied to the Lakota curves to obtain  $T$  and  $S$  estimates for the Lakota aquifer. As with the Jacob analyses, two curve-match solutions were possible: one using the early, steeply-rising portions of the  $s$ - $t$  curves, and another using the later data. Both solutions are given in Table 3.

A semilogarithmic graph of distance versus drawdown (Figure 18) was constructed by plotting the final drawdown in each Lakota well versus its radial distance from the pumped well. The Jacob straight-line techniques were applied to these data to obtain  $T$  and  $S$  values for the Lakota of 1780 gpd/ft and  $7.7 \times 10^{-5}$ , respectively. However, this type of analysis is applicable only to nonleaky aquifer systems. Since leakage obviously occurred during the test, the results are considered unreliable.

Contour maps of the final drawdown in the Lakota and Fall River aquifers at the end of the test are shown in Figures 19 and 20, respectively. The drawdown cone in both aquifers is slightly elongated in a northwesterly direction. This is probably an indication of anisotropic transmissivity, with the transmissivity in the direction parallel to the axis of elongation being somewhat greater than that in the direction normal to the axis of elongation. The principal direction of trans-



missivity parallels the strike of a regional fracture-joint set, suggesting a possible explanation for the observed drawdown configuration.

Following the pumping phase of the test, water level recovery measurements were made at all observation wells for a period of 30 days. Attempts were also made to monitor recovery in the pumped well using an airline. However, data collected were highly erratic suggesting a malfunction of the airline equipment. Semilogarithmic graphs of residual drawdown versus  $t/t'$  (ratio of time since pumping started to time since pumping stopped) for the observation wells are shown in Figures 21 through 25. Lakota graphs were analyzed using Jacob straight-line techniques to obtain the estimates of transmissivity presented in Table 3. Again, two straight-line fits are possible for the closer Lakota wells. Both are given in Table 3.

#### Interpretation of Test Results

The drawdown trends recorded in the observation wells indicate some important qualitative information about hydrogeologic conditions at the proposed mine site, in addition to providing a basis for determining hydraulic properties of materials. The relative response of the Fall River, Fuson and Lakota formations as reflected in the B-10 and B-1 groups (Figures 13 and 14), is not typical of the response that would be expected in an ideal leaky multiple aquifer system. Ideally, the  $s$ - $t$  curve for the intervening aquitard lies between the curves for the pumped and unpumped aquifers. That is, in a logarithmic plot of  $s$ - $t$  data the aquitard (Fuson) curve would lie below the curve for the pumped aquifer (Lakota), and above the curve for the unpumped aquifer (Fall River). However, "ideal" trends are not evident in the

observed data until after 300 minutes of pumping in the case of the B-10 group, and not until after 2000 minutes in the case of the B-1 group. The fact that a greater pumping response is observed in Fall River formation than in the Fuson during the early part of the test indicates that direct (though restricted) avenues through the Fuson must exist. This condition was suspected before the test, and is believed to be the result of numerous old, unplugged uranium exploration boreholes in the test site vicinity. The shift to a more ideal relationship among the s-t curves exhibited during the latter part of test possibly indicates that general leakage through the Fuson itself has caught up with leakage through the open boreholes.

The leakage condition which is apparent in the response of the Fuson and Fall River wells is not evident in the Lakota well data. Under ideal conditions, the rate of drawdown in the Lakota observation wells would be expected to gradually decrease and perhaps even level off completely for some period of time. However, the opposite effect is noted in Lakota s-t plots, particularly the semilog graphs for B-10 LAK and B-1 LAK (Figures 8 and 9). The rate of drawdown increases in the latter stages of pumping which might indicate decreasing transmissivity of the Lakota aquifer in the site vicinity. The decrease in transmissivity may be due to aquifer thinning or possibly a facies change to less permeable materials. In any case, it is suspected that the leakage effects in the Lakota drawdown data are masked by the conflicting effect of a decreasing transmissivity in the site vicinity.

In general, the agreement between the Theis and Jacob analyses of s-t data is good. T values computed using early drawdown data average 2390 gpd/ft using the Theis method, and about 2270



gpd/ft using the Jacob method. Early data storativities are also in good agreement averaging  $6.0 \times 10^{-5}$  for the Jacob method and  $8.1 \times 10^{-5}$  for the Theis method. The T values computed from the late data ( $T_\ell$ ) are significantly lower than those determined from the early data, whereas late storativities are larger. The Jacob method yields  $T_\ell$  values which average 1320 gpd/ft and storativities averaging  $2.4 \times 10^{-4}$ . The Theis method produced an average  $T_\ell$  of 1570 gpd/ft and an average  $S_\ell$  of  $1.2 \times 10^{-4}$ . The late Theis T values are somewhat higher than the Jacob T's because the Theis method gives some consideration to the earlier data which the Jacob method does not. Transmissivities estimated by the recovery data average 1270 gpd/ft, and are in close agreement with the late Jacob results, although slightly lower.

Ordinarily, in selecting representative T and S for the pumped aquifer in a leaky multiple aquifer system, more emphasis would be placed on the early data collected in the pumped aquifer at the pumped well and closest observation wells. These data are considered least affected by leakage. However, because of the apparent decrease in transmissivity of the Lakota aquifer during the latter stages of the test, it is believed that Lakota parameters computed from the late data are more representative of aquifer properties under a long-term pumping situation such as mine dewatering. On this basis the average transmissivity of the Lakota is estimated to be 1400 gpd/ft and the average storativity  $1.8 \times 10^{-4}$ .



### FALL RIVER AQUIFER TEST

Following completion of recovery measurements associated with the Lakota aquifer test, pumping equipment in the Burdock well was rearranged for the Fall River test. A submersible pump was set within the Fall River section of the well and the pneumatic packer reset below the pump in the Fuson section of the well in order to restrict pumping to the Fall River. A preliminary test of the pump and other equipment lasting less than one hour was conducted on May 29. Unexpectedly, the Fall River aquifer was capable of yielding only about 10 gpm on a sustained basis. Since other Fall River wells in the region yield up to 40 gpm, it was assumed that either the well screen was encrusted or the well was not fully developed, or both. An unsuccessful effort was made to develop the well by pumping. A television camera was subsequently lowered into the well to examine the well screen. Little or no encrustation was observed on the screen. Ultrasonics were used in the well to remove any existing encrustation but the yield of the well was not improved. The low productivity of the well is, therefore, attributed to locally poor water-bearing characteristics of the Fall River formation.

### Test Procedures and Results

A constant discharge test commenced at 1100 hours on July 24. Water levels in all geologic units were stable prior to the test, as there was no pumping activity in the site vicinity since the completion of well development on July 3. Discharge was measured with an in-line flowmeter, and checked with a 55-gallon container and stopwatch.

During the test the pumping rate varied from 7.6 to 10.4 gpm, and averaged 8.5 gpm. Ground-water levels were monitored in all observation wells shown in Figure 3. The constant discharge test was terminated at 1200 hours on July 26 after 49 hours of pumping. Subsequently, ground-water level recovery measurements were made for a period of six days.

Semilog graphs of drawdown data recorded at the pumped well and observation well groups B-1, B-10 and B-11 are shown in Figures 26 through 29, respectively. No graphs are presented for B-11LAK or the B-7 and B-9 groups as there was no measureable drawdown in these wells. Except for B-11FR, these graphs exhibit a typical straight-line drawdown trend during the first part of the test, followed by a gradual decrease in slope towards the end of the test. This slope change is the result of leakage from adjacent formations, and/or an increase in aquifer transmissivity at some distance from the pumped well. The Jacob method was applied to the semilog graphs to obtain the transmissivity and storativity values shown in Table 4. The  $T_e$  and  $S_e$  values were obtained using early drawdown data recorded during approximately the first 500 minutes of the test.  $T_l$  and  $S_l$  values were computed from data recorded after about 1000 minutes. The only reliable estimates are considered to be those computed for B-1FR and B-10FR. Drawdown data for the pumped well is affected by wellbore storage which is significant in this test because of the relatively low pumping rate. The pumped well drawdown data may also be affected by low well efficiency. The semilog plot for B-11FR cannot be analyzed by the Jacob method because the criterion that  $r^2S/4Tt \leq 0.01$  is not satisfied for any of the data.



TABLE 4. Fall River Aquifer Properties

| Well No. | r (ft) | Jacob Method      |                      |                   |       | Theis Method      |                      | Recovery Method   |                   |
|----------|--------|-------------------|----------------------|-------------------|-------|-------------------|----------------------|-------------------|-------------------|
|          |        | $T_e$<br>(gpd/ft) | $S_e$                | $T_d$<br>(gpd/ft) | $S_d$ | $T_e$<br>(gpd/ft) | $S_e$                | $T_e$<br>(gpd/ft) | $T_d$<br>(gpd/ft) |
| PW-FR    | 0.67   | 16.(?)            | --                   | --                | --    | --                | --                   | 11(?)             | --                |
| B-10FR   | 177    | 140.              | $1.8 \times 10^{-5}$ | 410.              | --    | 150.              | $1.7 \times 10^{-5}$ | 80.               | 340.              |
| B-11FR   | 373    | 150.              | $0.8 \times 10^{-5}$ | 420.              | --    | 150.              | $1.1 \times 10^{-5}$ | 90.               | 350.              |
| B-11FR   | 618    | --                | --                   | --                | --    | --                | --                   | --                | --                |
| Average: |        | 145               | $1.3 \times 10^{-5}$ | 415.              | --    | 150.              | $1.4 \times 10^{-5}$ | 85.               | 345.              |

yields suggests that the Fall River aquifer is less permeable in the mine site vicinity than in certain surrounding areas. The aquifer parameters computed from the early drawdown and recovery data are believed to be representative of the aquifer in the immediate vicinity of the test wells. Parameters obtained from analysis of the late data are probably more representative of regional aquifer characteristics.

### FUSON AQUITARD PROPERTIES

The hydraulic properties of the Fuson aquitard were estimated using an analytical technique known as the "ratio method" developed by Neuman and Witherspoon (1973). The method requires (1) a knowledge of the transmissivity and storativity of the pumped aquifer; (2) draw-down data for the pumped and unpumped aquifers and the aquitard measured in wells located at approximately the same radial distance from the pumped well; and (3) the vertical distance between the aquifer-aquitard boundary and the perforated section of each aquitard well ( $Z$ ). The method yields a value of aquitard hydraulic diffusivity,  $\alpha'$ , equal to  $K'_v/S'_s$ , where  $K'_v$  is the vertical hydraulic conductivity of the aquitard and  $S'_s$  is the specific storativity of the aquitard. To determine  $K'_v$  or  $S'_s$  from  $\alpha'$ , either  $K'_v$  or  $S'_s$  must first be known. In the following analyses a value of  $S'_s = 10^{-6} \text{ ft}^{-1}$  is assumed for the Fuson aquitard. Experience indicates that specific storativities of geologic materials do not vary over as wide a range as do hydraulic conductivities. For this reason, and considering the difficulty and expense of obtaining an accurate measure of  $S'_s$  over the site vicinity, it appears justifiable to assume a value of  $S'_s$  typical of similar geologic materials.

The first step in the analysis is to compute a value of  $s'/s$  at a given radial distance from the pumped well,  $r$ , and at a given time,  $t$ . Next a value of  $t_D$  (dimensionless time for the aquifer equal to  $tT/r^2S$ ) is determined. The values of  $s'/s$  and  $t_D$  are used to compute a value for  $t'_D$  (dimensionless time for the aquitard equal to  $K't/S'_sZ^2$ ) using a family of type curves given in Figure 3 of Neuman and Witherspoon (1973). The vertical hydraulic conductivity of the aquitard  $K'_v$  is then obtained from the following equation:



$$K'_v = t'_D Z^2 S'_s / t \quad (1)$$

Since separate pumping tests were conducted in the Lakota and Fall River aquifers, it is possible to calculate two independent values of  $K'_v$  for each well group. Fuson aquitard properties computed by the ratio method along with certain pertinent parameters used in the calculations are presented in Table 5.

Note that since the Fall River, Fuson and Lakota observation wells in each well group do not lie at exactly the same radial distance from the pumped well, an average radial distance  $r_{avg}$  is used in the calculations. The  $r_{avg}$  values shown in Table 5 were obtained by averaging the radial distance for the pumped aquifer observation well and the radial distance for the aquitard observation well. Also note that the column labeled "Time Interval" represents the time interval during which  $K'_v$  values were computed. Generally, three or four values of  $K'_v$  were computed at specific times within this interval. These values were then averaged to obtain the  $K'_v$  values shown in Table 5.

The vertical hydraulic conductivity of the Fuson ranges from about  $10^{-4}$  ft/d at the B-1 well group to about  $10^{-3}$  ft/d at the B-10 well group. The agreement between the conductivities computed at each well group site for both tests is good. The reason for the order of magnitude difference between the conductivities at the different well sites is unknown, but may be related to errors caused by differences in the radial distances of observation wells--these differences being somewhat greater for the wells of the B-10 group.

TABLE 5. Fuson Aquitard Properties

| Test    | Well Group | $r_{avg.}$<br>(ft) | Z<br>(ft) | Time Interval<br>(min.) | $(gpd/ft^2)^{K'v}$   | (ft/d)               |
|---------|------------|--------------------|-----------|-------------------------|----------------------|----------------------|
| Lakota  | B-10       | 225                | 28        | 100-393                 | $2.0 \times 10^{-2}$ | $2.7 \times 10^{-3}$ |
|         | B-1        | 378                | 11        | 100-393                 | $1.0 \times 10^{-3}$ | $1.3 \times 10^{-4}$ |
| Fall R. | B-10       | 216                | 25        | 100-300                 | $4.8 \times 10^{-3}$ | $6.6 \times 10^{-4}$ |
|         | B-1        | 362                | 40        | 1200-2350               | $1.3 \times 10^{-3}$ | $1.8 \times 10^{-4}$ |

The magnitudes of computed conductivities are slightly higher than expected on the basis of the physical characteristics of the Fuson, although they are still within reason. The presence of open boreholes may have caused a more rapid drawdown response in the Fuson monitor wells than would have occurred otherwise. As a result, the calculated  $K'_v$  values are probably larger than the actual conductivity of the Fuson shale. The calculated  $K'_v$  values are, however, probably smaller than the effective  $K'_v$  of the aquitard in the areas where it is breached by open boreholes.



### COMPUTER MODEL SIMULATIONS

The hydraulic properties estimated for the Fall River, Fuson and Lakota formations were incorporated into a computer model of the site geohydrologic system. Simulations of the Lakota aquifer test were performed to see if the model could reproduce the drawdown responses observed during the test. An acceptable match between the measured and computed responses would indicate the validity of the estimated formation properties, and thus enhance the credibility of the model for predicting mine dewatering requirements and impacts.

A finite element numerical model developed by Narasimhan et al. (1978) was used for the aquifer test simulations. The aquifer/well-field system was modeled in three dimensions using axial symmetry. The hydraulic properties of the Fall River, Fuson and Lakota formations obtained from the aquifer test analyses were used as initial input data (see Table 6). Uniform properties were assumed for each hydrogeologic unit. The shale units which lie above the Fall River formation and those which lie below the Lakota were assumed to be impermeable in the model. All simulation comparisons were made for the Lakota aquifer test. The Lakota test stressed a larger portion of the multiple aquifer system than did the Fall River test, and more closely approximates the flow regime expected during mine dewatering.

A comparison of the measured and computed results for the initial simulation run are shown in Figure 38. In general, the agreement between the computed and observed drawdown graphs for the Lakota aquifer are good. However, there are large discrepancies in the Fall River and Fuson responses.

TABLE 6. Parameters Used In Computer Simulations

| Formation        | Initial Parameters |                      |                      |                   |                              | Final Parameters |                      |                      |                 |                              |
|------------------|--------------------|----------------------|----------------------|-------------------|------------------------------|------------------|----------------------|----------------------|-----------------|------------------------------|
|                  | $T$<br>(gpd/ft)    | $S$<br>(--)          | $K_v$<br>(ft/d)      | $K_v/K_h$<br>(--) | $S_s$<br>(ft <sup>-1</sup> ) | $T$<br>(gpd/ft)  | $S$<br>--            | $K_v$<br>(ft/d)      | $K_v/K_h$<br>-- | $S_s$<br>(ft <sup>-1</sup> ) |
| Fall River       | 150.               | $1.4 \times 10^{-5}$ | $5.6 \times 10^{-2}$ | 1/3               | $1.2 \times 10^{-7}$         | 400              | $1.4 \times 10^{-5}$ | $4.6 \times 10^{-2}$ | 1/10            | $1.2 \times 10^{-7}$         |
| Fuson            | 0.13               | $6.0 \times 10^{-5}$ | $1.7 \times 10^{-4}$ | 1/3               | $1.0 \times 10^{-6}$         | 0.45             | $6.0 \times 10^{-5}$ | $1.0 \times 10^{-3}$ | 1/1             | $1.0 \times 10^{-6}$         |
| Lakota (Chilson) | 1400.              | $1.8 \times 10^{-4}$ | $5.0 \times 10^{-1}$ | 1/3               | $1.5 \times 10^{-6}$         | 1400.            | $1.0 \times 10^{-4}$ | $1.5 \times 10^{-1}$ | 1/10            | $8.3 \times 10^{-7}$         |



Several attempts were made to improve the match between the computed and observed drawdown responses by trial-and-error adjustment or calibration of model parameters. The most reliable parameters, such as the computed Lakota and Fall aquifer coefficients, were only slightly altered in the calibration process, whereas the least reliable parameters, including the ratio of vertical to horizontal permeability and the Fuson properties, were allowed to vary over a wider (though reasonable) range. The hydraulic properties within each hydrogeologic unit were assumed to be uniform throughout the calibration process.

The set of hydraulic parameters yielding the best agreement between measured and observed drawdown data is given in Table 6. The final parameter set differs only slightly from the original. The largest changes were made in the  $K_v/K_h$  terms which were unknown to begin with; and in the Fuson hydraulic conductivity which was increased by a factor of five. Both the early and late Fall River T values computed from the aquifer test analyses (150 and 415 gpd/ft, respectively) were tested during model calibration. The drawdown response of the model was found to be relatively insensitive to the value of T used. A transmissivity of 400 gpd/ft is included in the final parameter set as it is believed to be more characteristic of the aquifer regionally.

The match between the measured and computed drawdown responses, shown in Figure 39, is considered acceptable in light of the fact that uniform aquifer-aquitard properties were used in the model. The apparent discrepancies are believed to be due to the heterogeneity and anisotropy of the actual system. The departures which occur during the early phase of the simulation appear large, but are not significant.

The ability of the model to predict the long-term response of system is more important. Thus, more significance is attached to the agreement between the simulated and observed results for the latter part of the test which, in most cases, is quite good. The final set of aquifer-aquitard properties are considered to represent a valid basis for future predictive modeling.



### SUMMARY AND CONCLUSIONS

The aquifer test results indicate that the Fuson member of the Lakota formation is a leaky aquitard separating the Fall River and Lakota aquifers. The hydraulic communication between the two aquifers observed during the tests is believed to be the result of (1) general leakage through the primary pore space and naturally occurring joints and fractures of the Fuson shale, and (2) direct connection of aquifers via numerous old unplugged exploratory boreholes. Whereas, the former leakage mechanism is a regional characteristic of the Fuson, leakage caused by borehole short-circuiting is probably limited to the relatively small area of intensive uranium exploration in the Burdock vicinity.

The Lakota (Chilson) aquifer has an estimated transmissivity of approximately 1400 gpd/ft and a storativity of about  $1.0 \times 10^{-4}$ . These properties are representative of the Lakota in the area affected by the pumping test, and are consistent with what is known or suspected about the aquifer regionally. The transmissivity and storativity of the Fall River aquifer are estimated at approximately 400 gpd/ft and  $1.4 \times 10^{-5}$ , respectively. Test results indicate that the transmissivity of the Fall River may be considerably less than 400 gpd/ft in the immediate vicinity of the test site. However, the selected transmissivity value is more consistent with regional aquifer characteristics.

The hydraulic conductivity of the Fuson aquitard is estimated at approximately  $10^{-3}$  ft/d. The specific storativity of the Fuson was not measured but is assumed to be about  $10^{-6}$  ft<sup>-1</sup>. If open boreholes

are present at the test site as suspected, the computed hydraulic conductivity is probably higher than the true conductivity of the shale, yet lower than the effective conductivity of the aquitard where short-circuited by open boreholes. For this reason, the selected aquitard conductivity of  $10^{-3}$  ft/d should provide a conservative estimate of mine dewatering impacts. Outside of the relatively small area where the aquitard is breached by boreholes, leakage between the two aquifers will be governed by the true conductivity of the shale which is probably on the order of  $10^{-4}$  ft/d or less.

The hydraulic properties of the Fall River, Fuson and Lakota (Chilson) formations computed from aquifer test data were incorporated into a computer model of the site geohydrologic system. These parameters were refined through repeated simulations of the Lakota aquifer test until the model could reproduce the drawdown responses observed during the test. The agreement between the observed and computed responses indicates the validity of the aquifer-aquitard properties, and should enhance the credibility of future predictive models using these parameters.



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APPENDIX

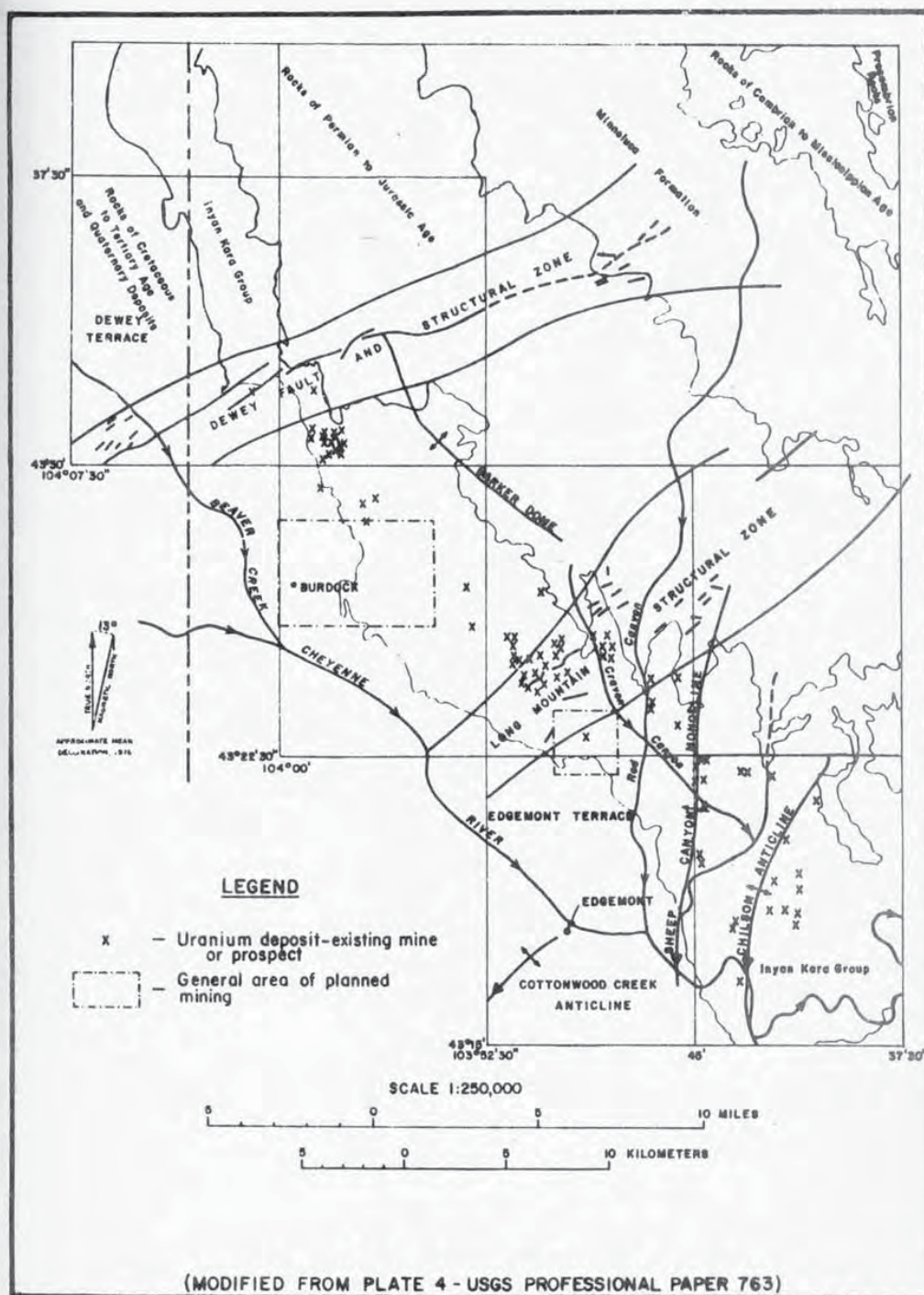


Figure 1 : Generalized Geologic Map of Site Region



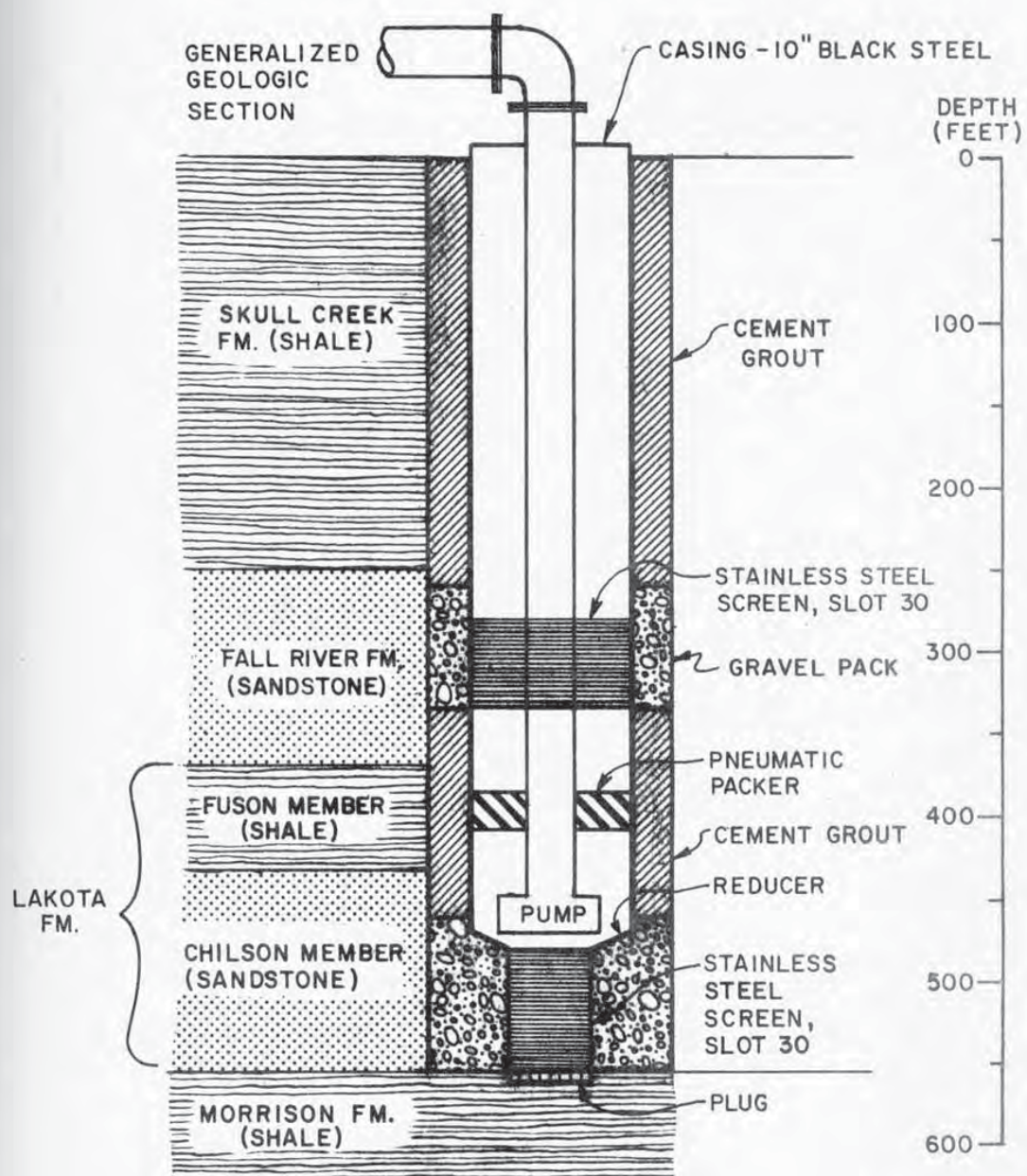


Figure 2 : Burdock Well Profile



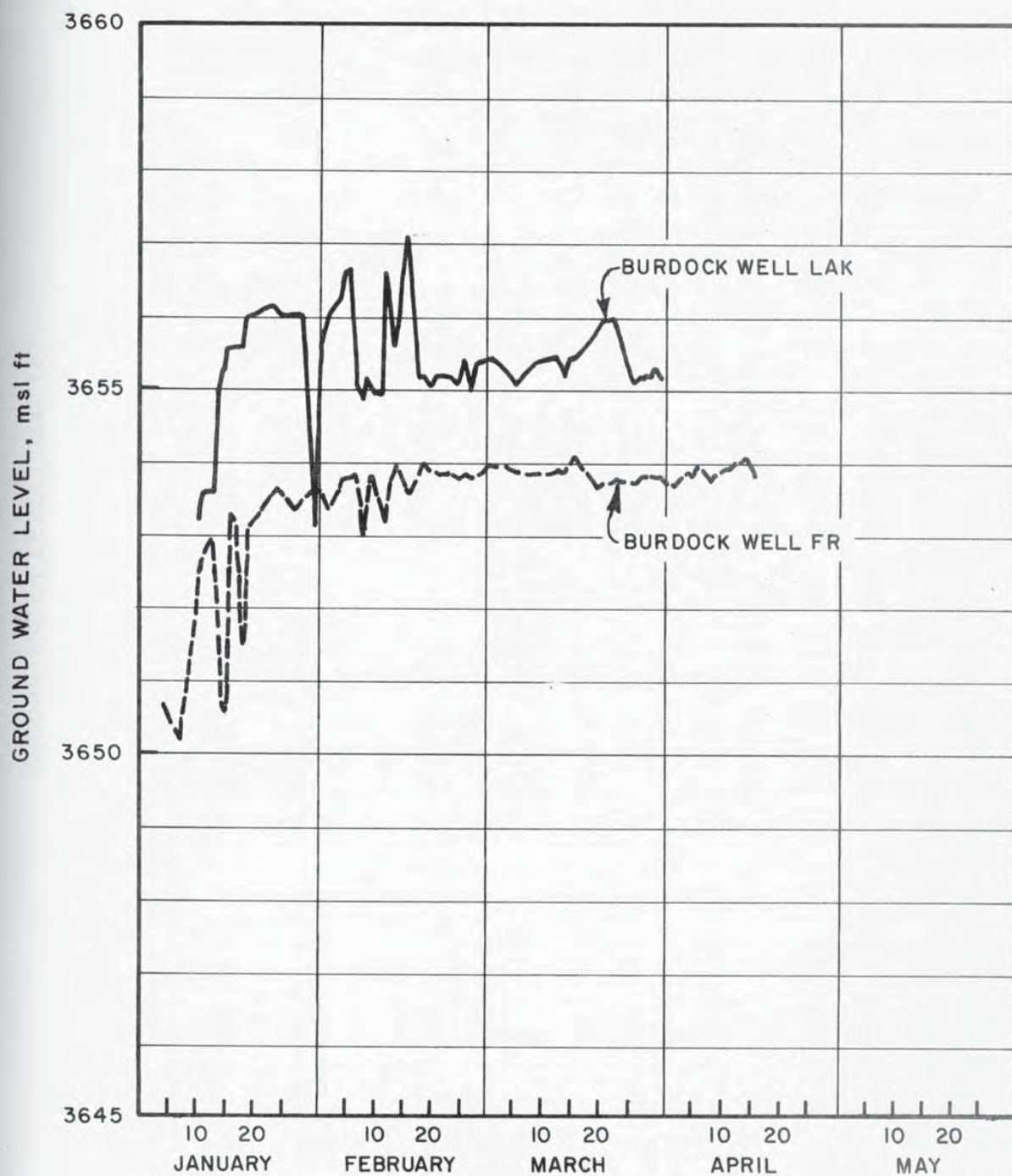


Figure 4 : Hydrographs for Burdock Test Well,  
January 1 through April 17, 1979

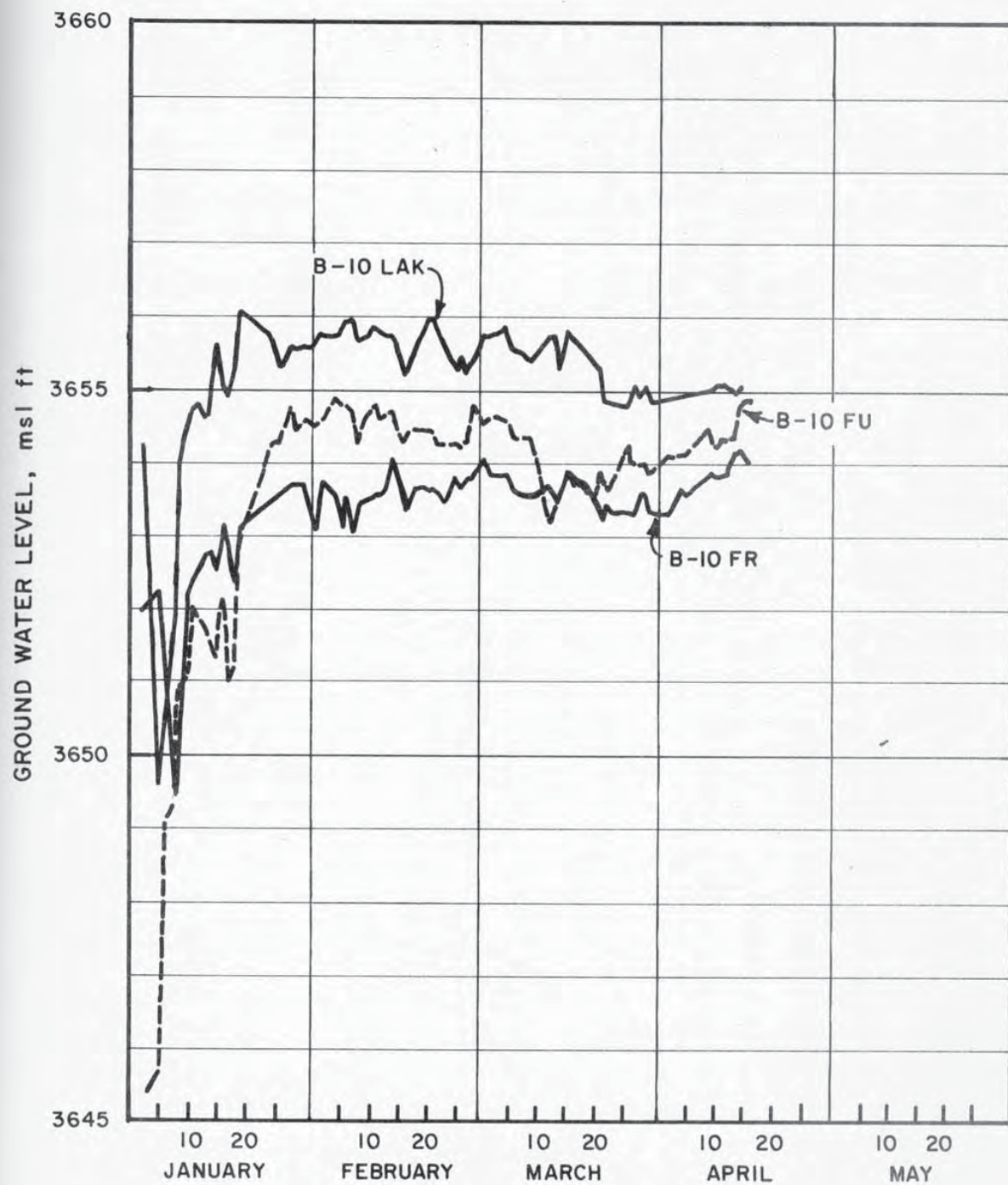


Figure 5 : Hydrographs for B-10 Observation Well Group, January 1 through April 17, 1979

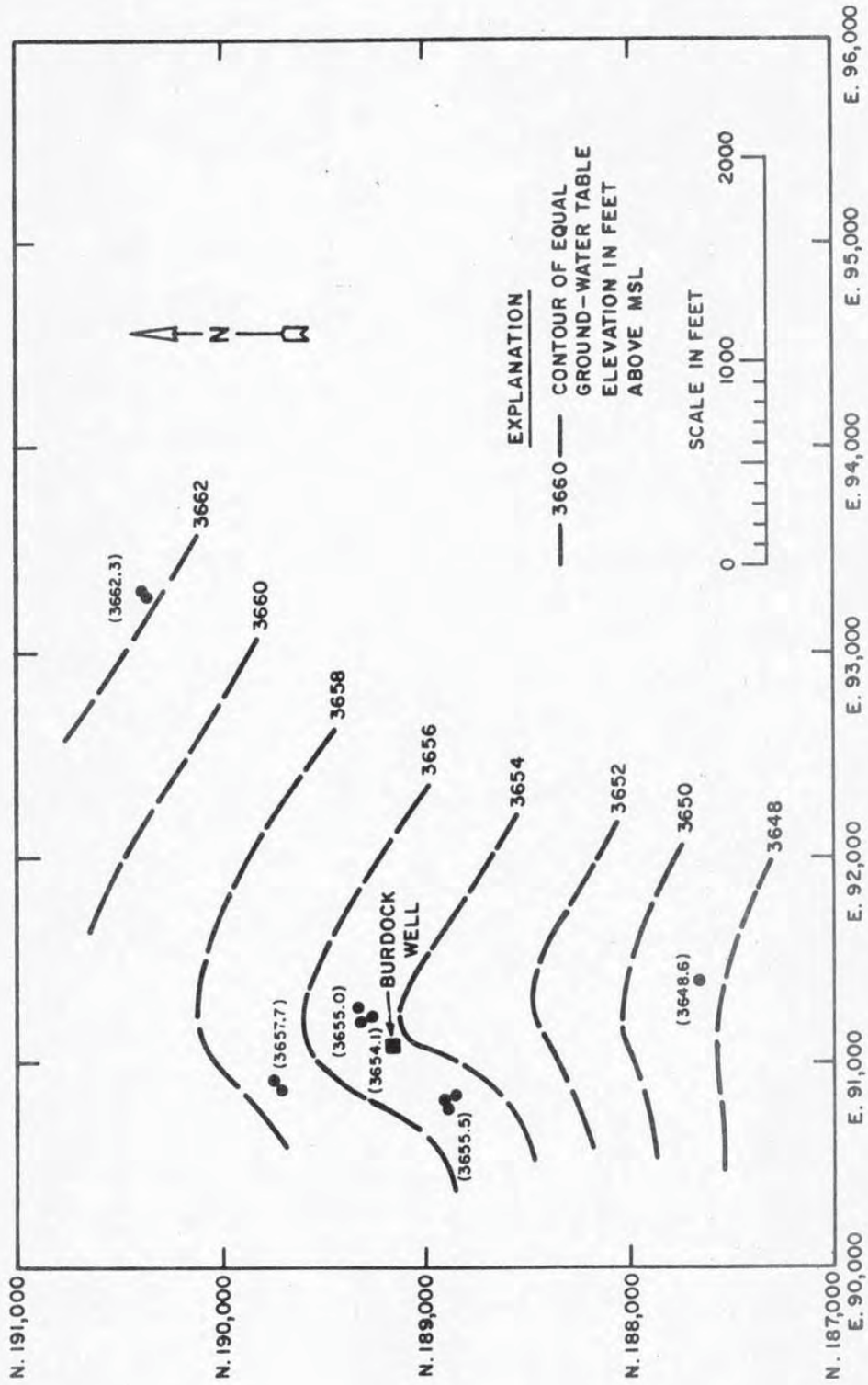


Figure 6 : Pre-Test Ground-Water Level Contour Map for Lakota Aquifer



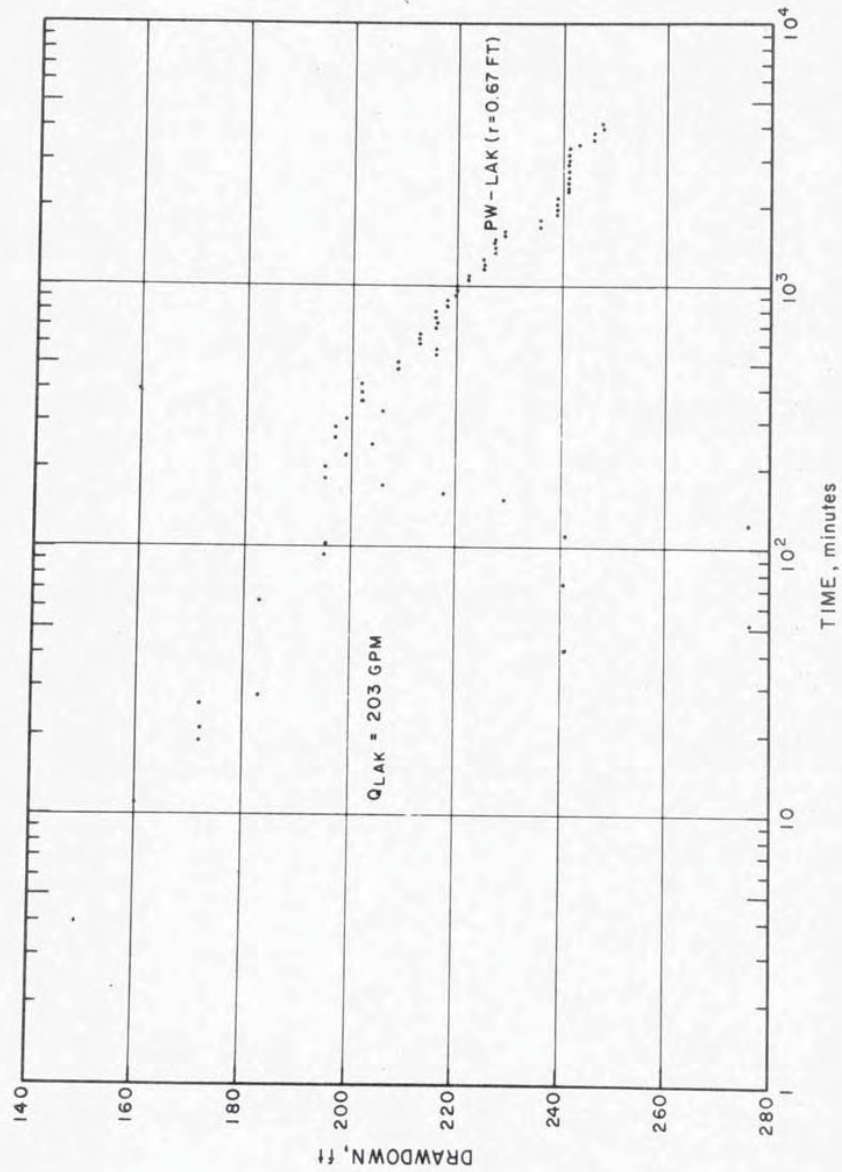


Figure 7: Semilogarithmic Graph of Drawdown for Pumped Well,  
Lakota Aquifer Test



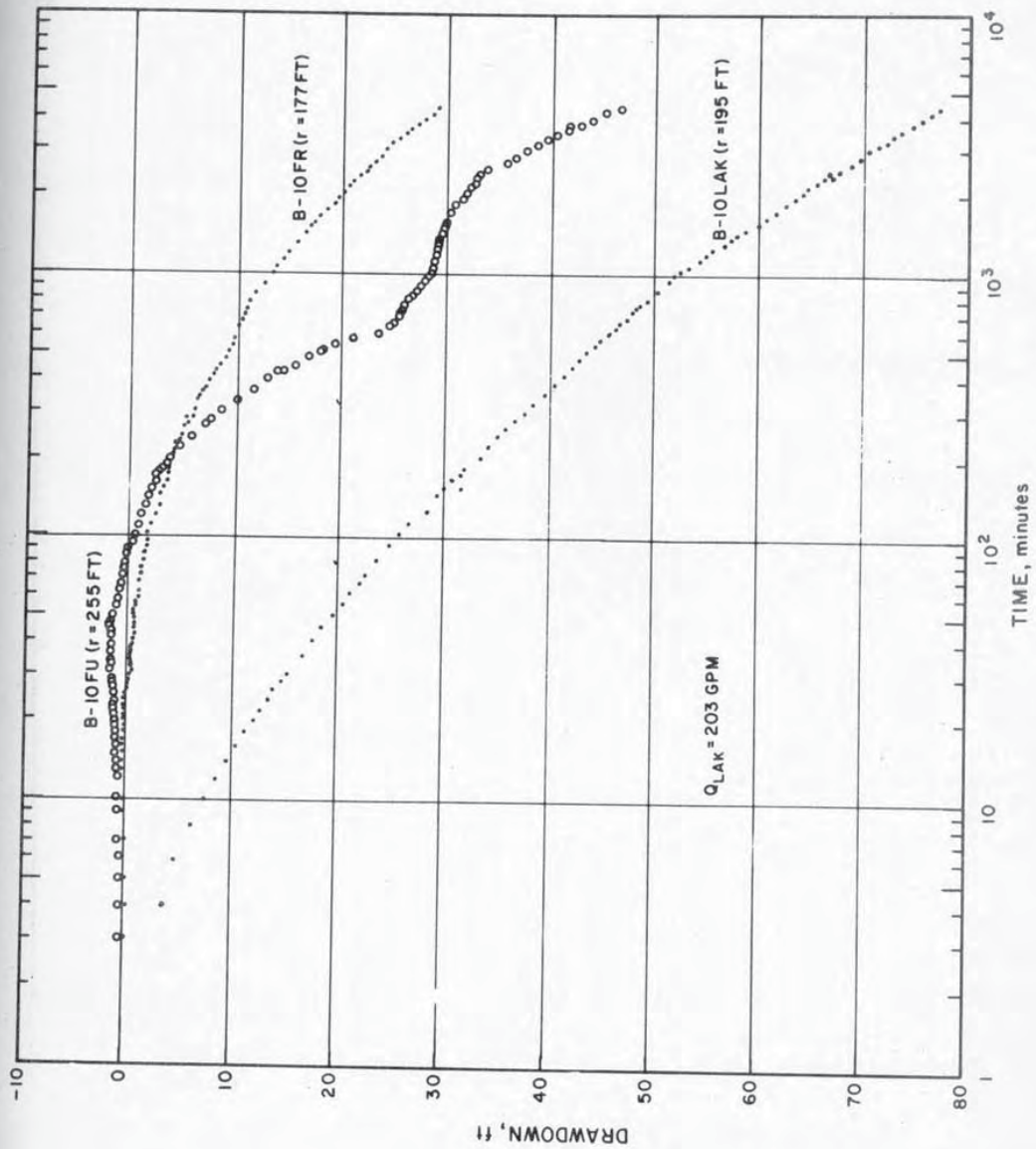


Figure 8 : Semilogarithmic Graphs of Drawdown for B-10 Observation Well Group,  
Lakota Aquifer Test

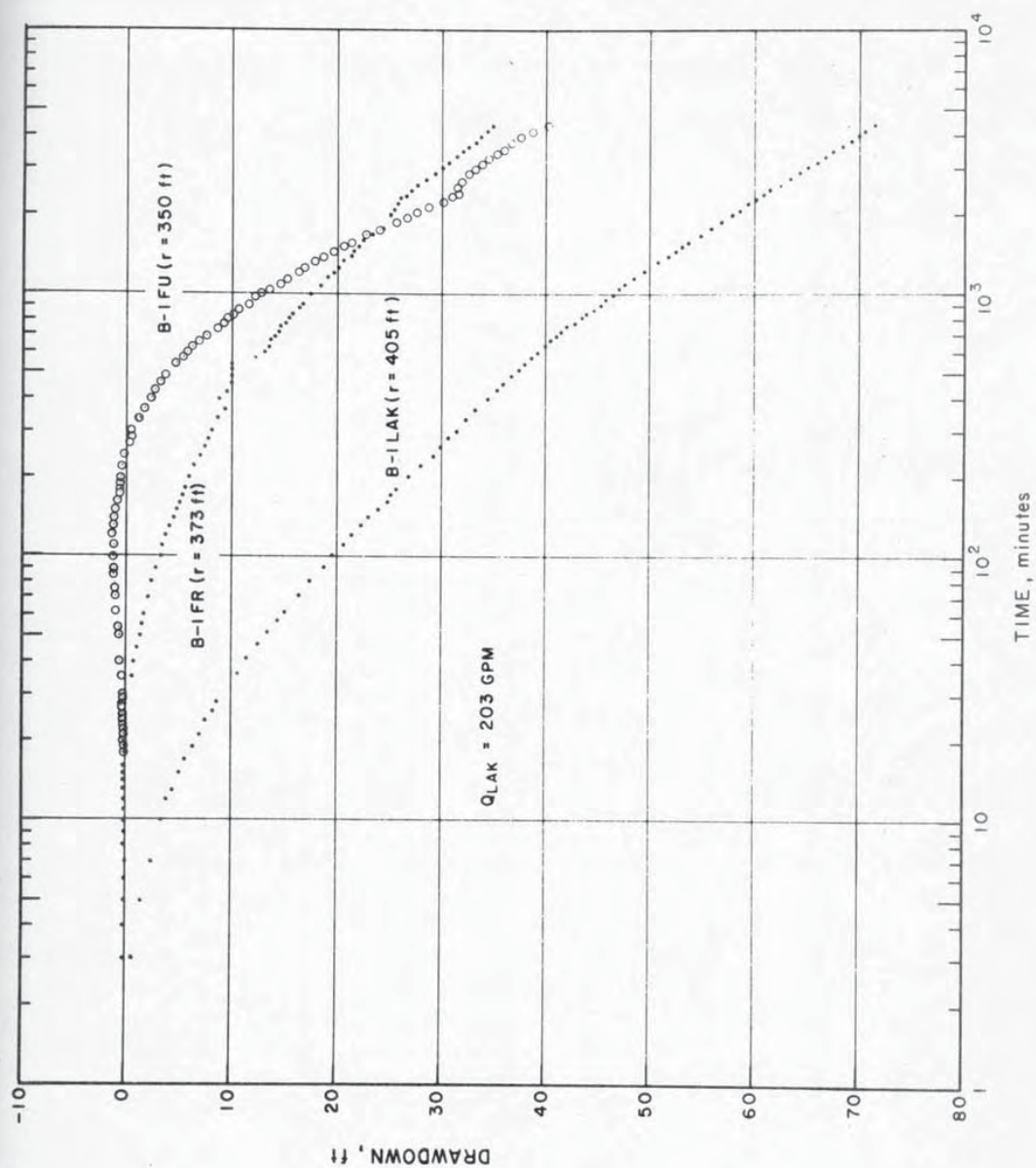


Figure 9: Semilogarithmic Graphs of Drawdown for B-1 Observation Well Group, Lakota Aquifer Test

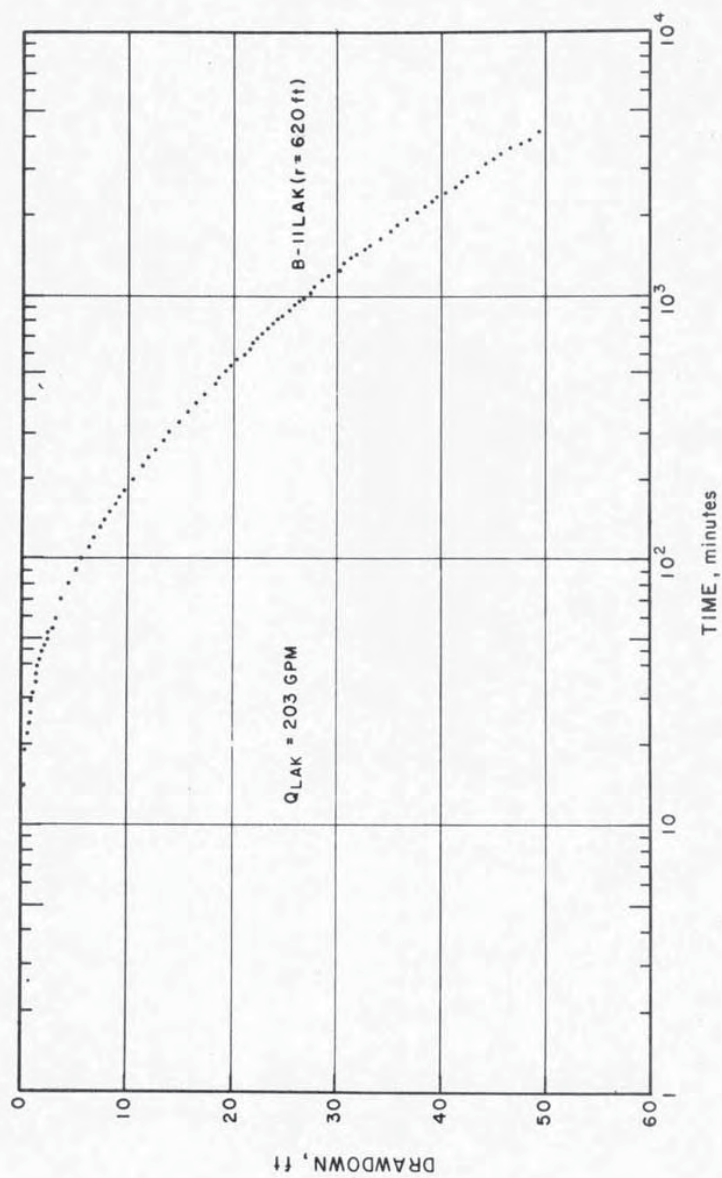


Figure 10: Semilogarithmic Graph of Drawdown for B-11 Observation Well Group,  
Lakota Aquifer Test

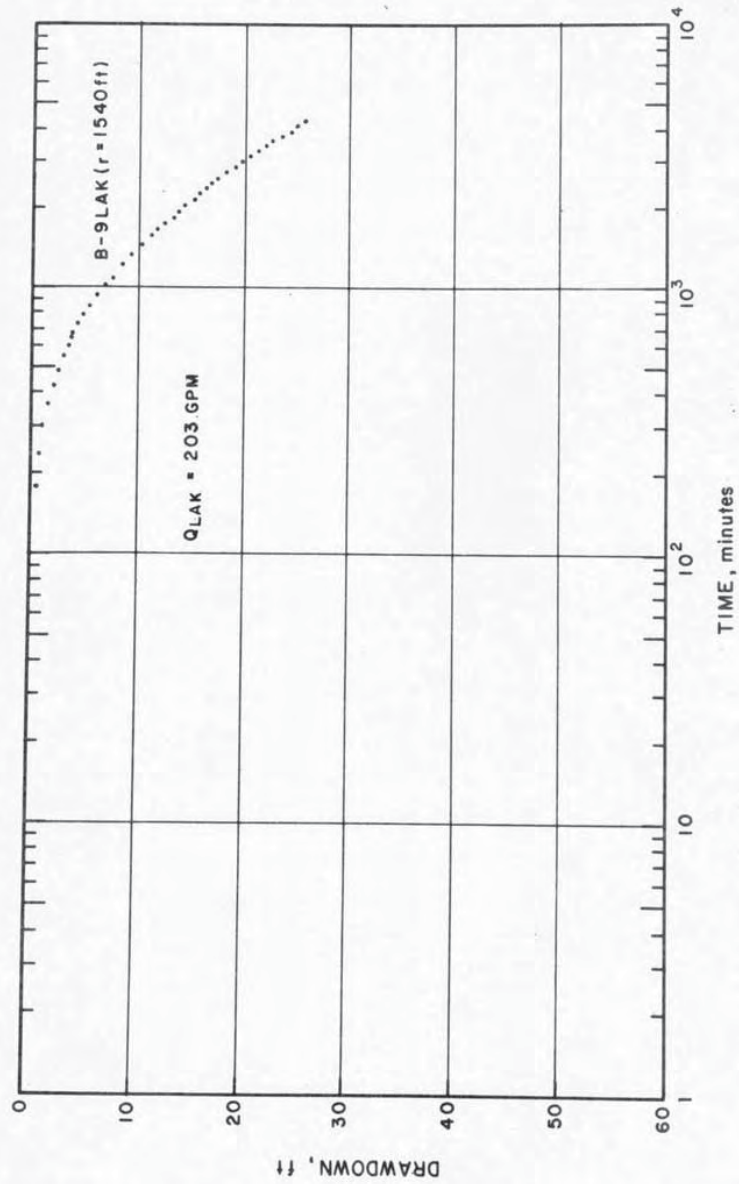


Figure 11: Semilogarithmic Graph of Drawdown for B-9 Observation Well Group, Lakota Aquifer Test



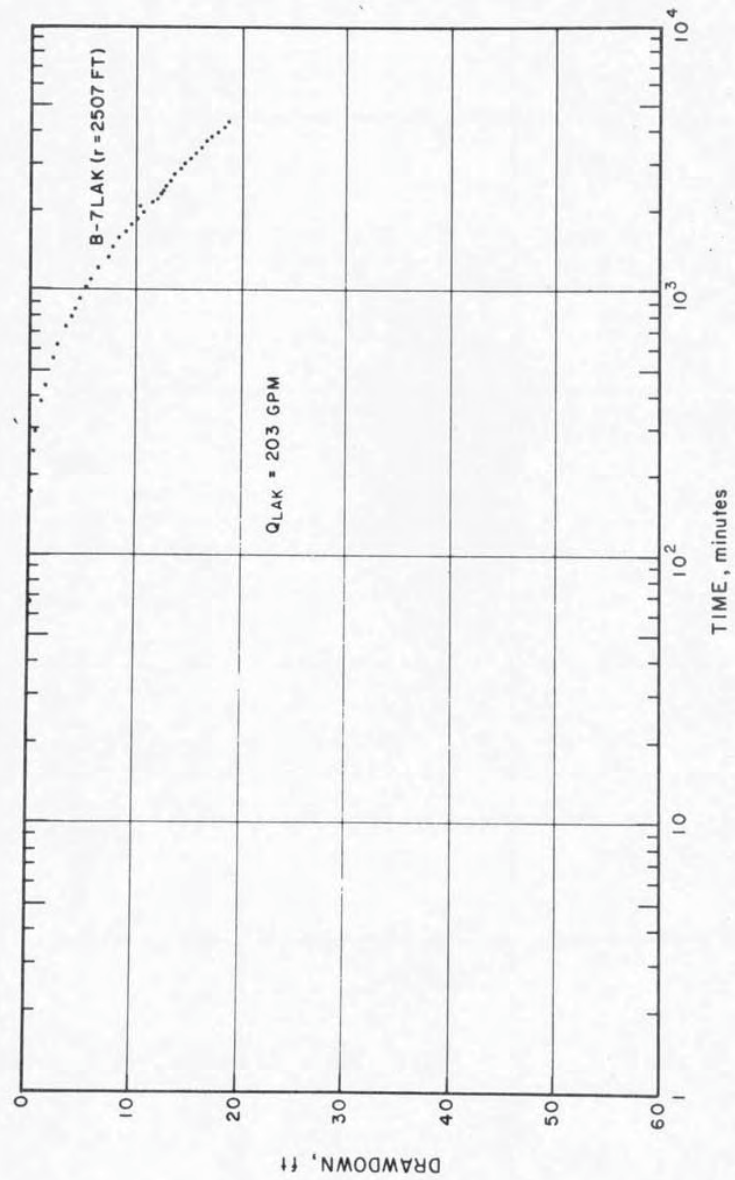


Figure 12: Semilogarithmic Graph of Drawdown for B-7 Observation Well Group,  
Lakota Aquifer Test

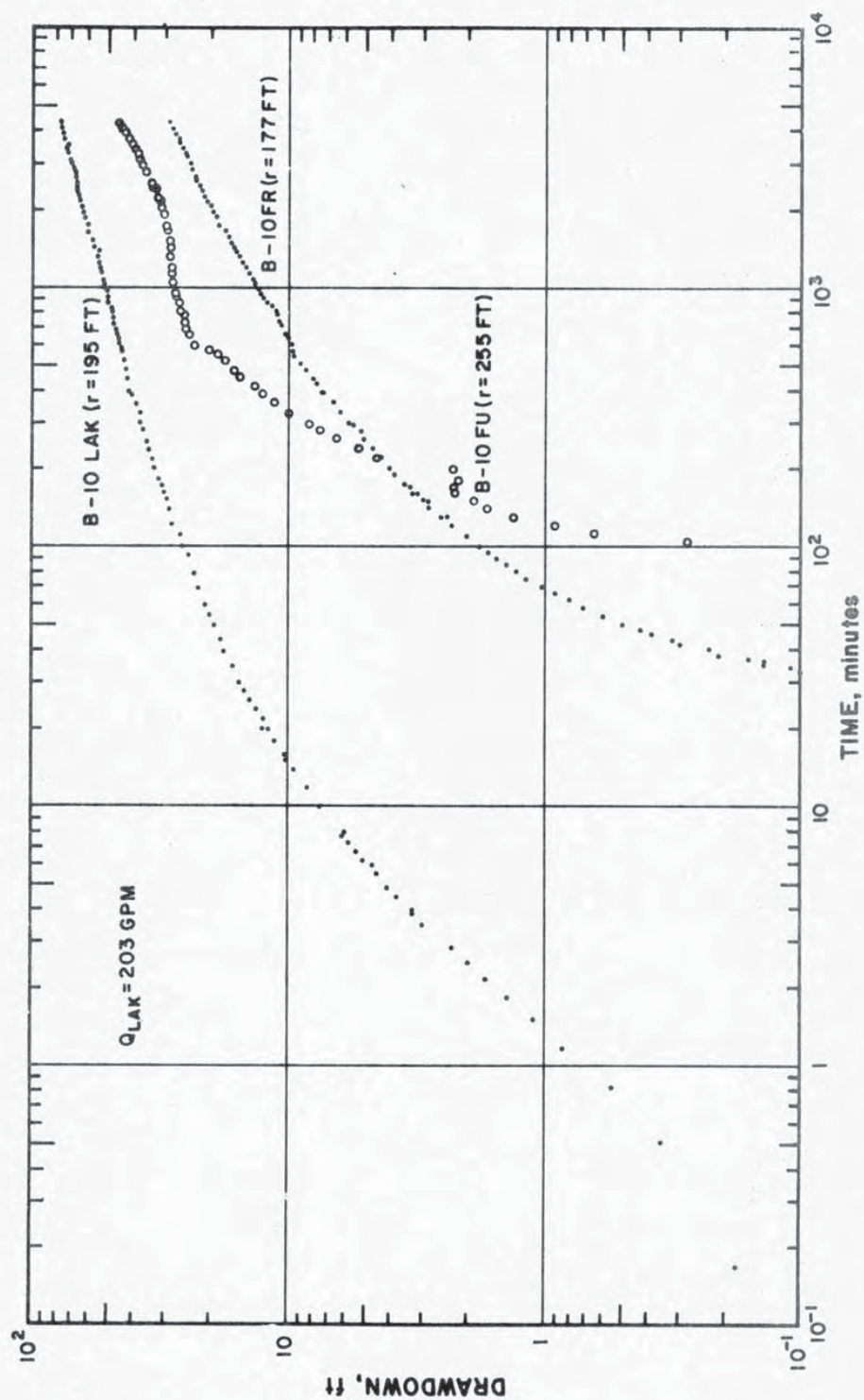


Figure 13 : Logarithmic Graphs of Drawdown for B-10 Observation Well Group, Lakota Aquifer Test

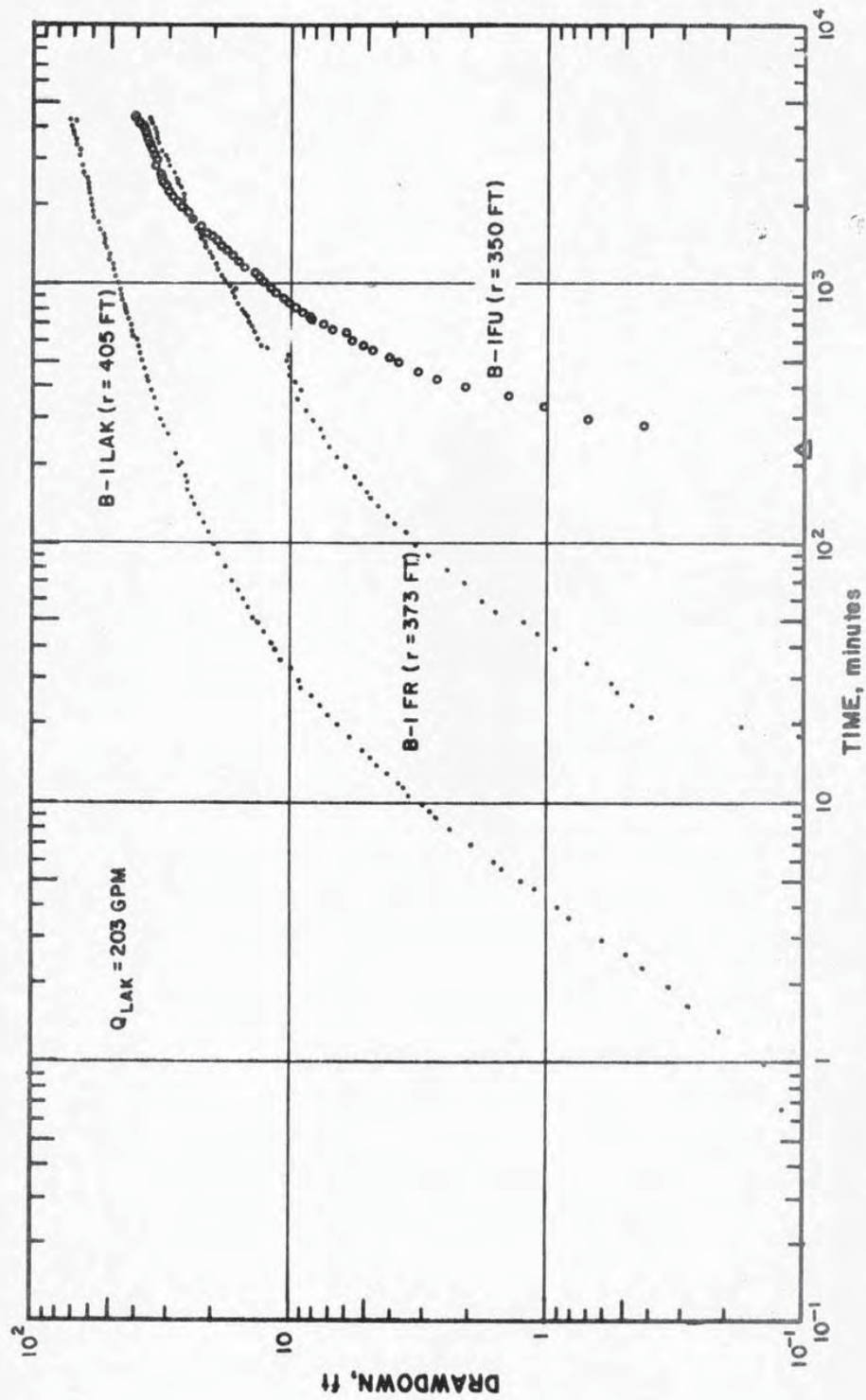


Figure 14 : Logarithmic Graphs of Drawdown for B-1 Observation Well Group, Lakota Aquifer Test

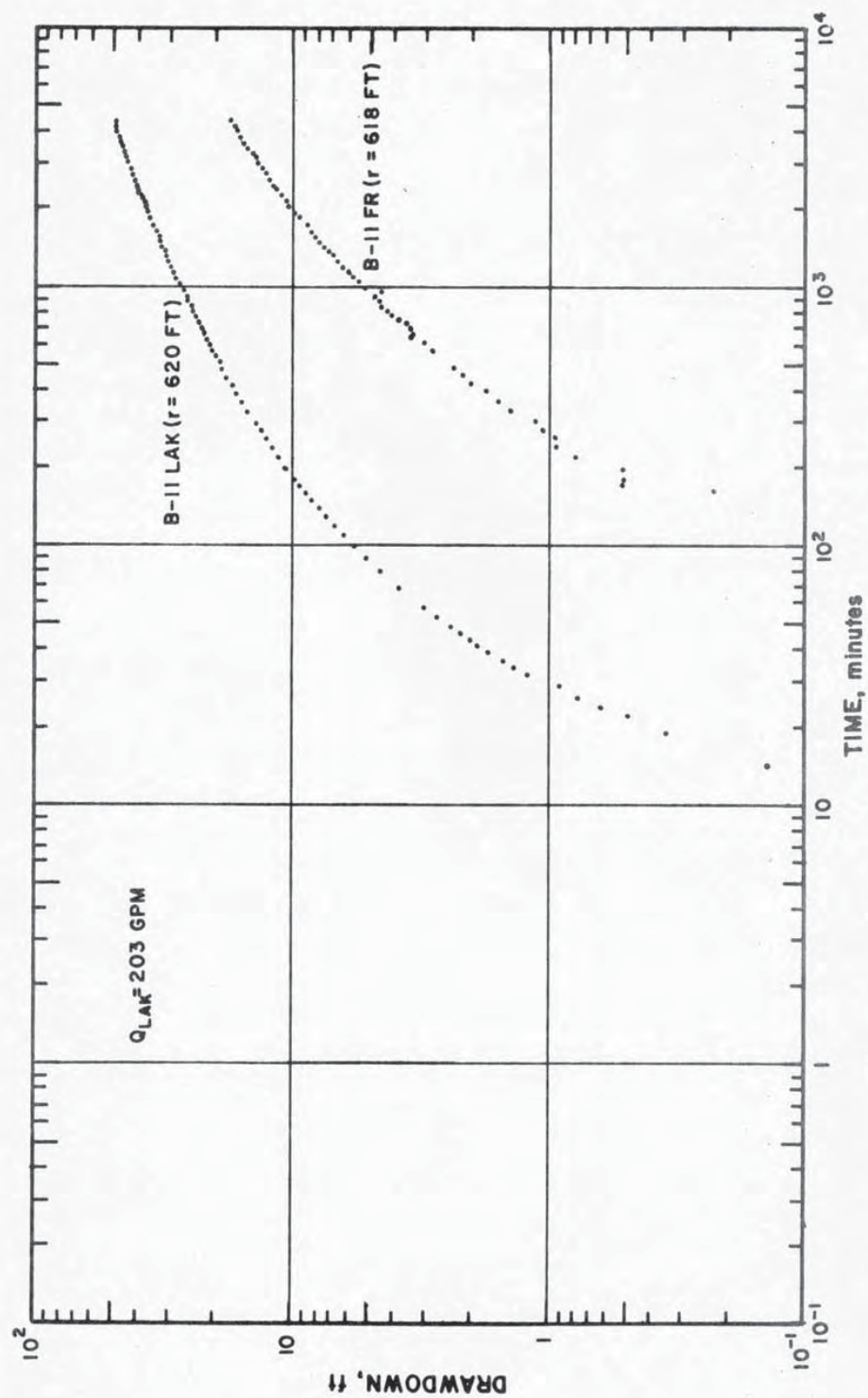


Figure 15: Logarithmic Graphs of Drawdown for B-II Observation Well Group, Lakota Aquifer Test



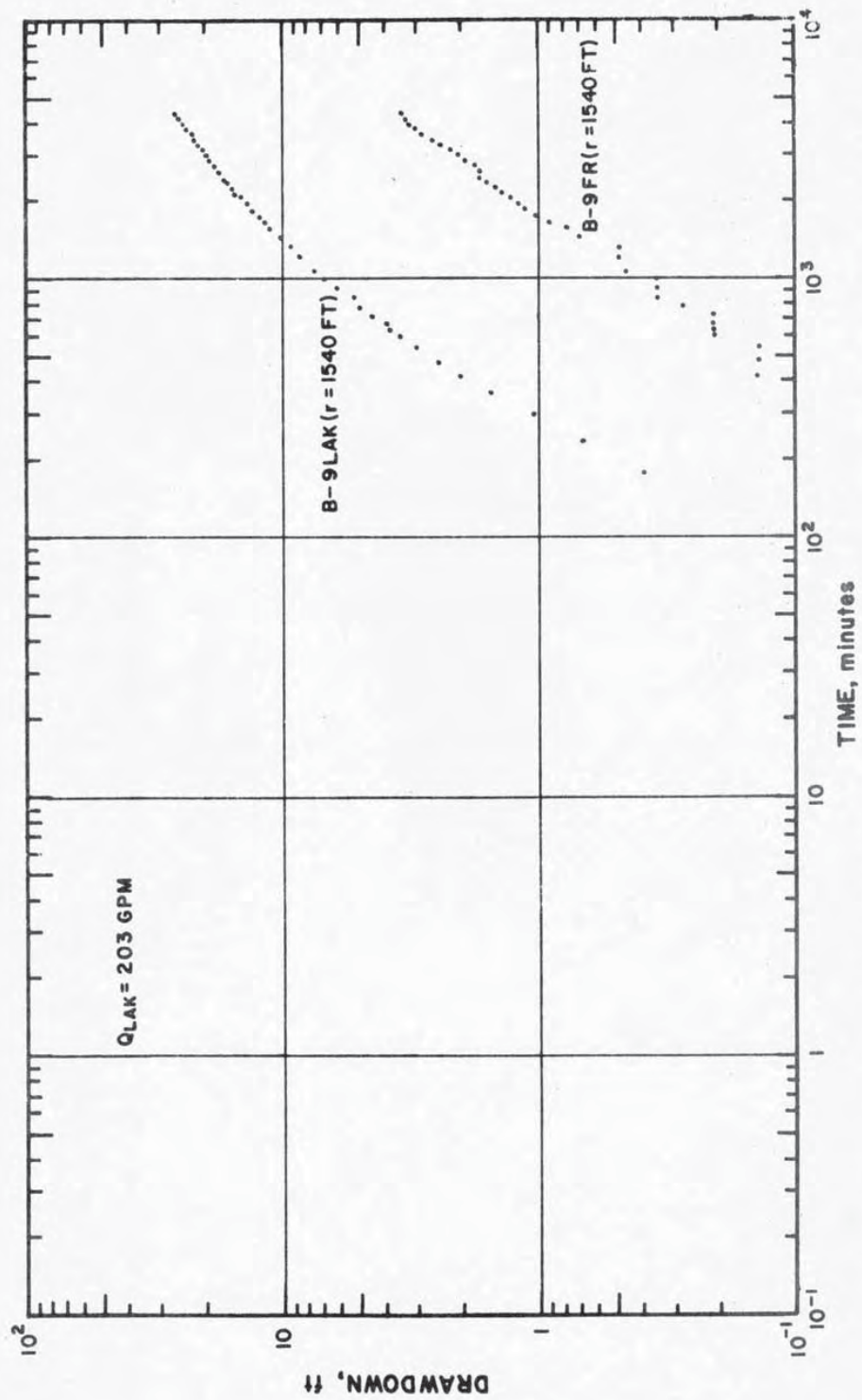


Figure 16 : Logarithmic Graphs of Drawdown for B-9 Observation Well Group, Lakota Aquifer Test

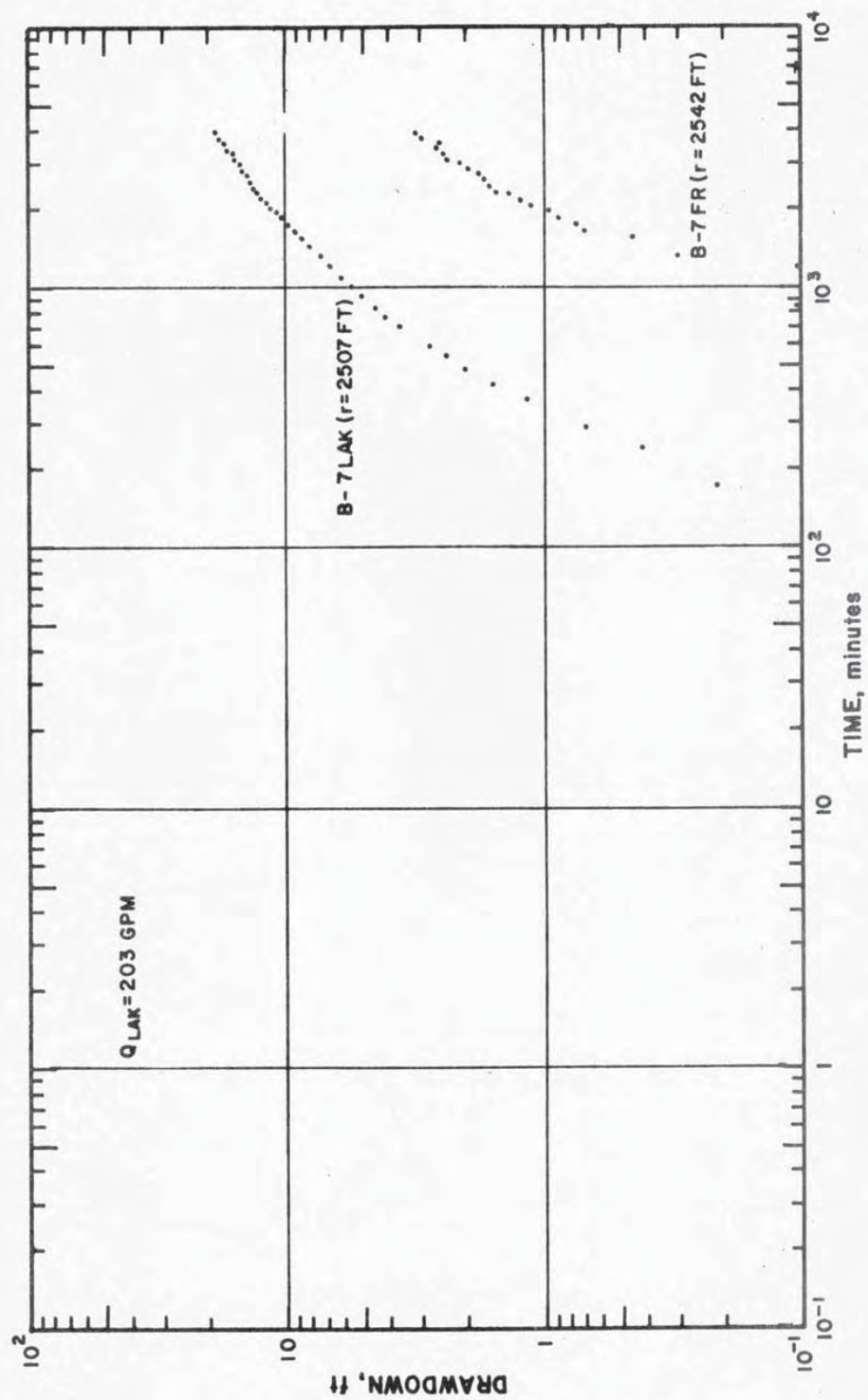


Figure 17 : Logarithmic Graphs of Drawdown for B-7 Observation Well Group, Lakota Aquifer Test

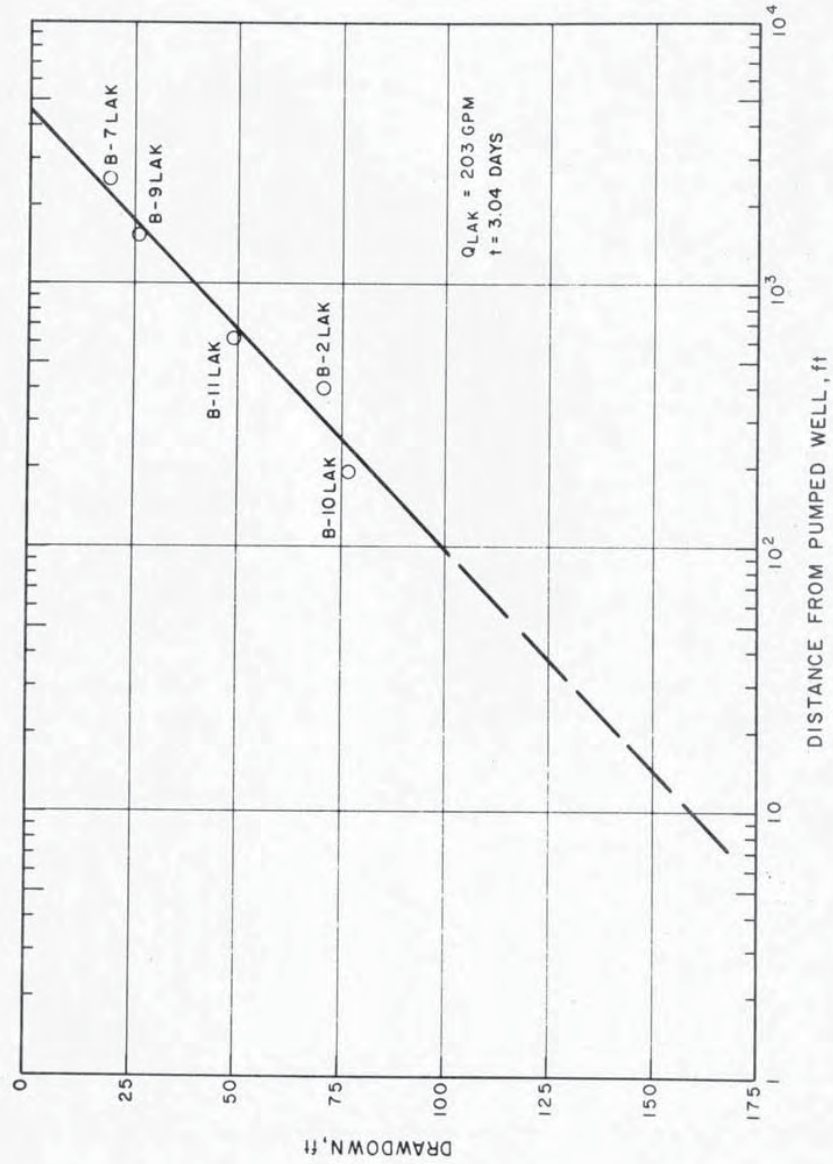


Figure 18 : Semilogarithmic Graph of Distance vs. Drawdown at End of Pumping Test,  
Lakota Aquifer Test

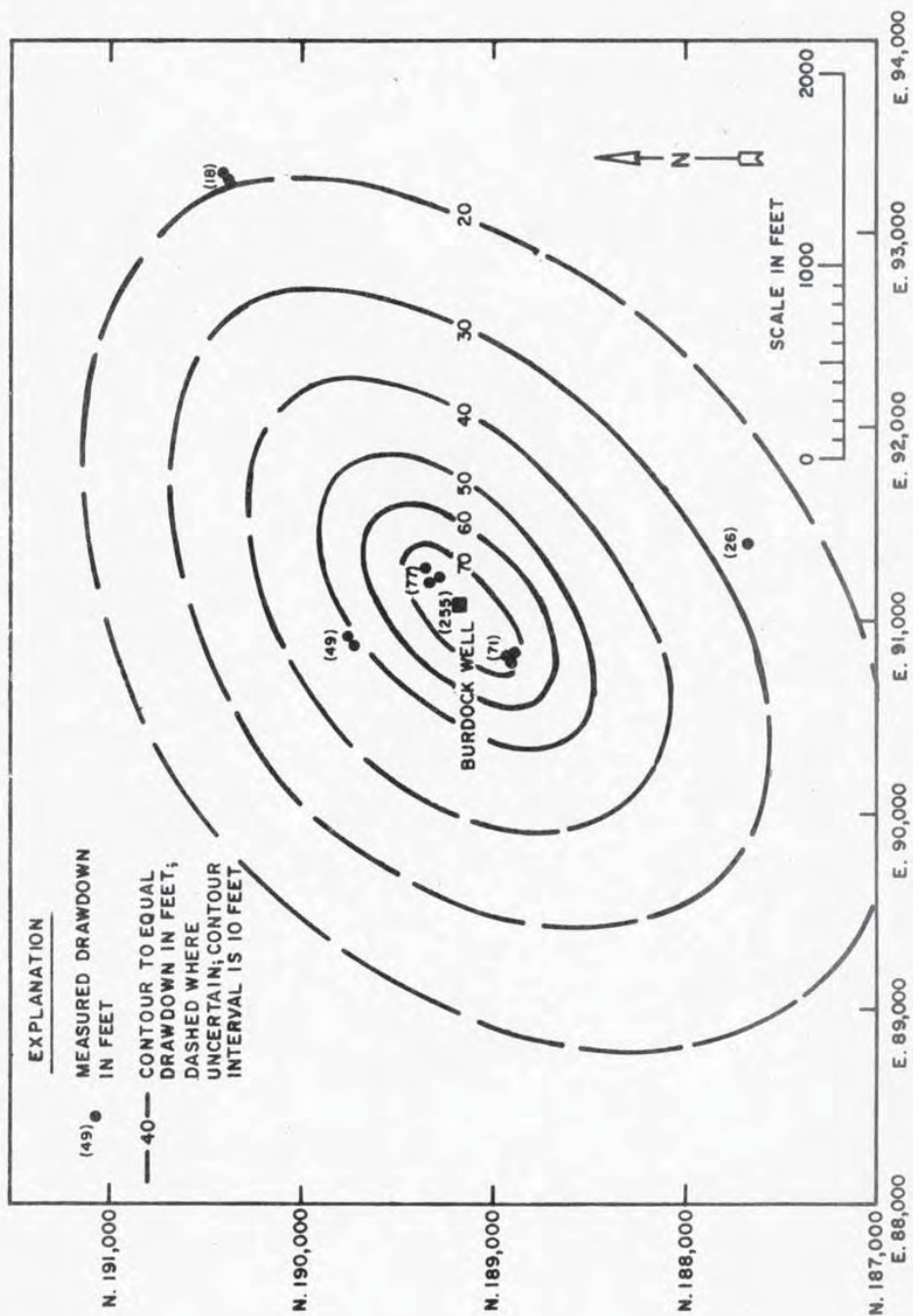


Figure 19 : Drawdown in Lakota Aquifer at End of Lakota Test



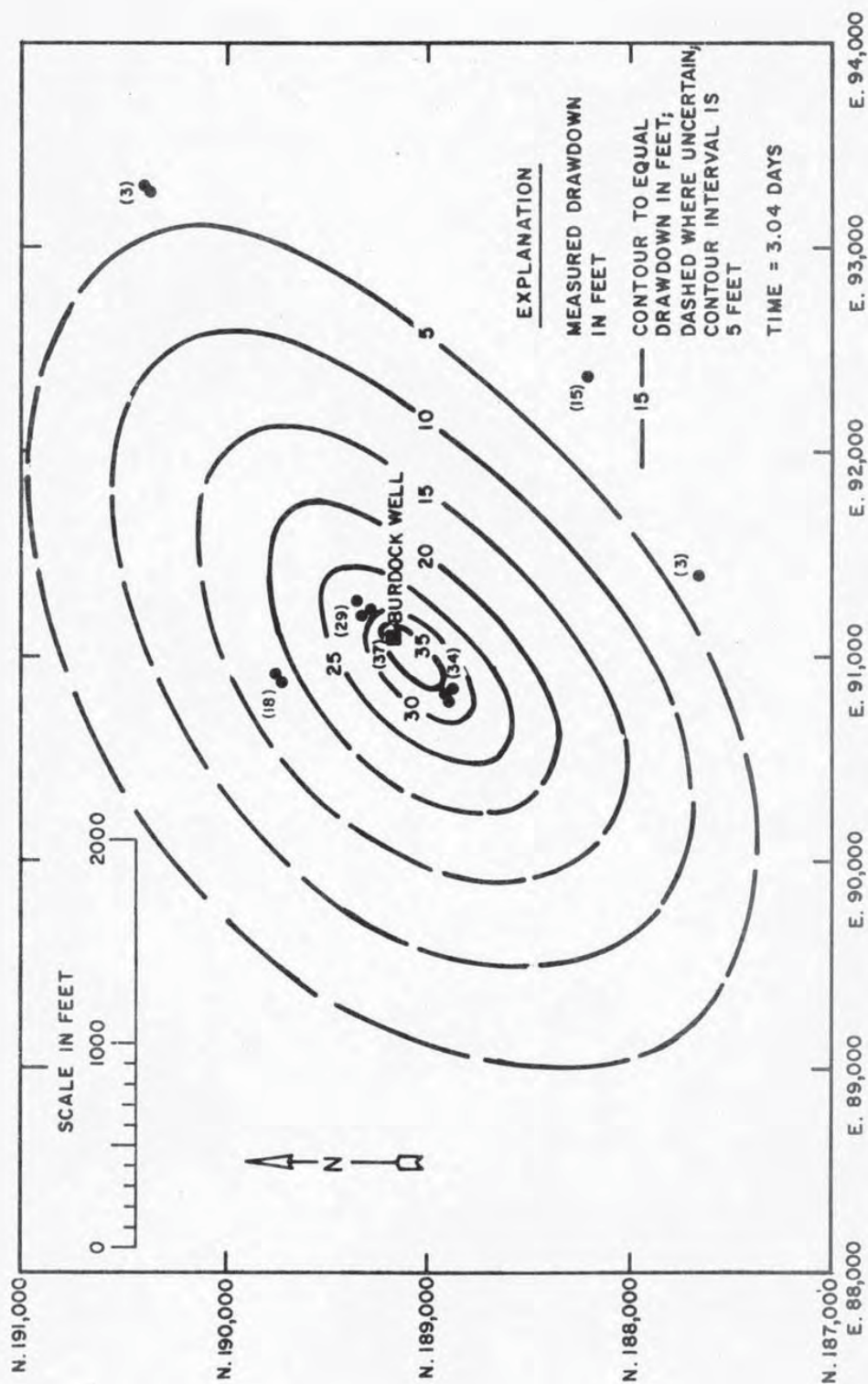


Figure 20 : Drawdown in Fall River Aquifer at End of Lakota Test

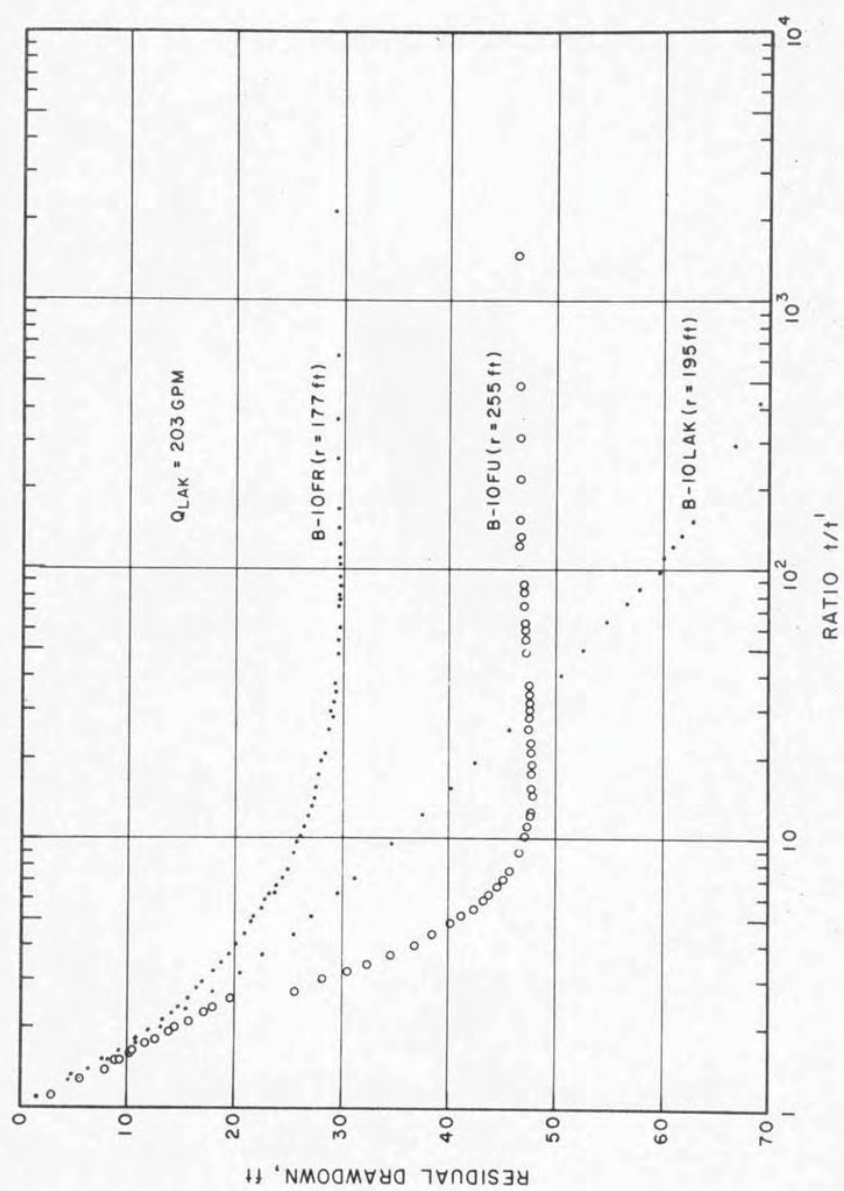


Figure 21: Recovery Graphs for B-10 Observation Well Group, Lakota Aquifer Test

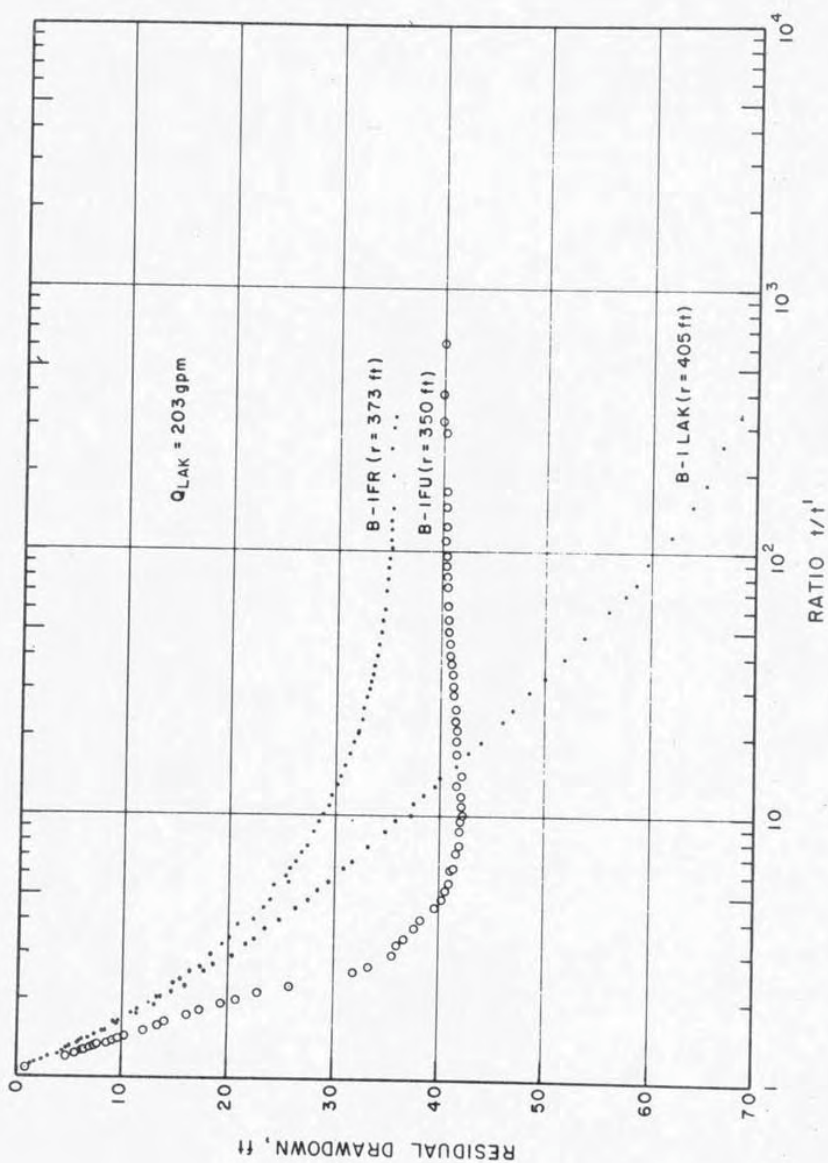


Figure 22: Recovery Graphs for B-1 Observation Well Group, Lakota Aquifer Test



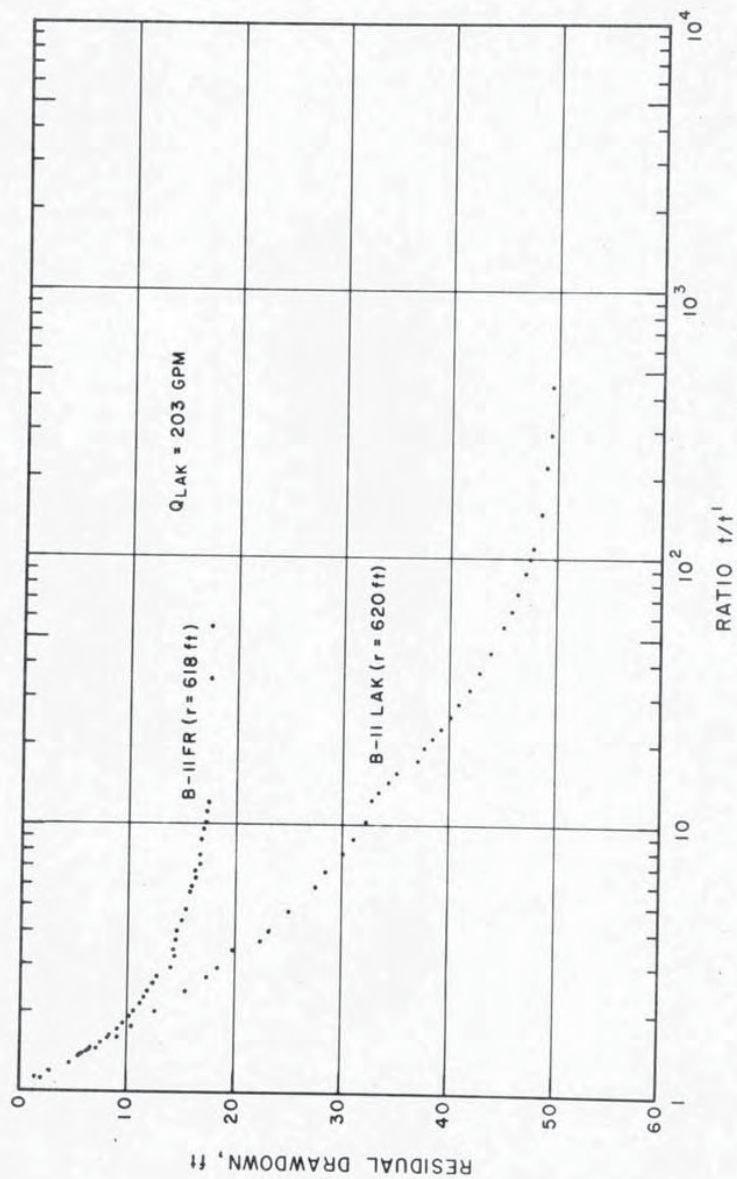


Figure 23: Recovery Graphs for B-II Observation Well Group, Lakota Aquifer Test



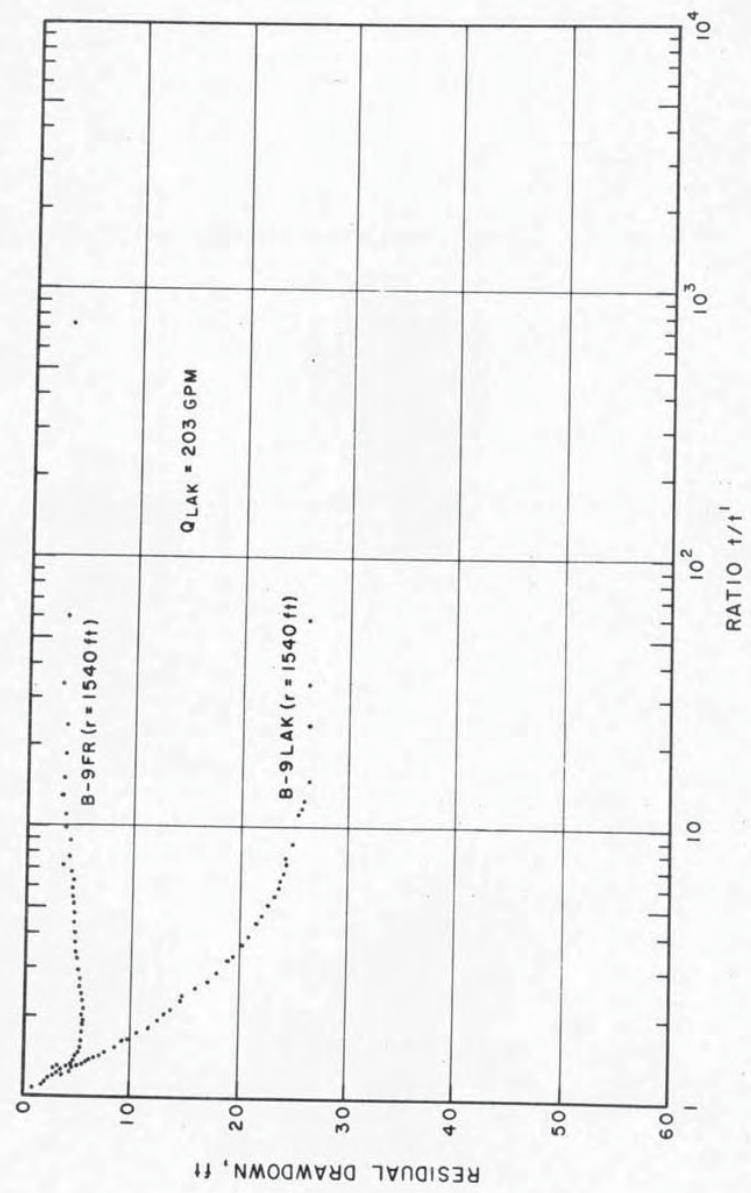


Figure 24: Recovery Graphs for B-9 Observation Well Group, Lakota Aquifer Test

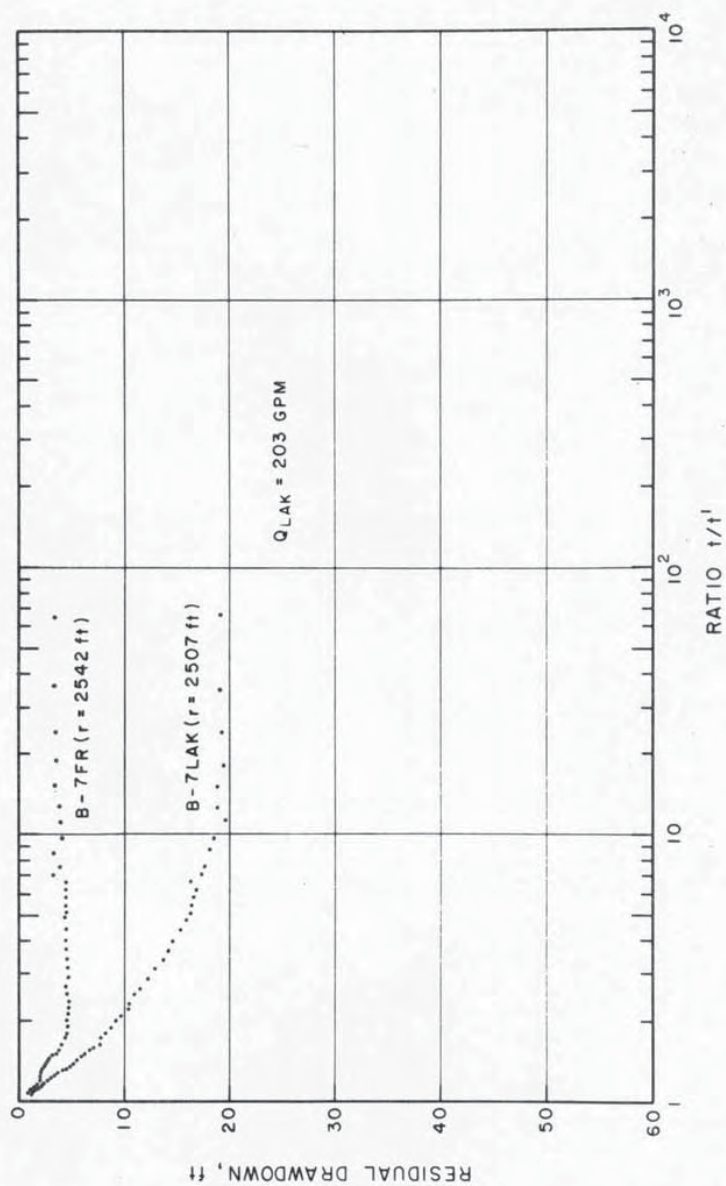


Figure 25: Recovery Graphs for B-7 Observation Well Group, Lakota Aquifer Test

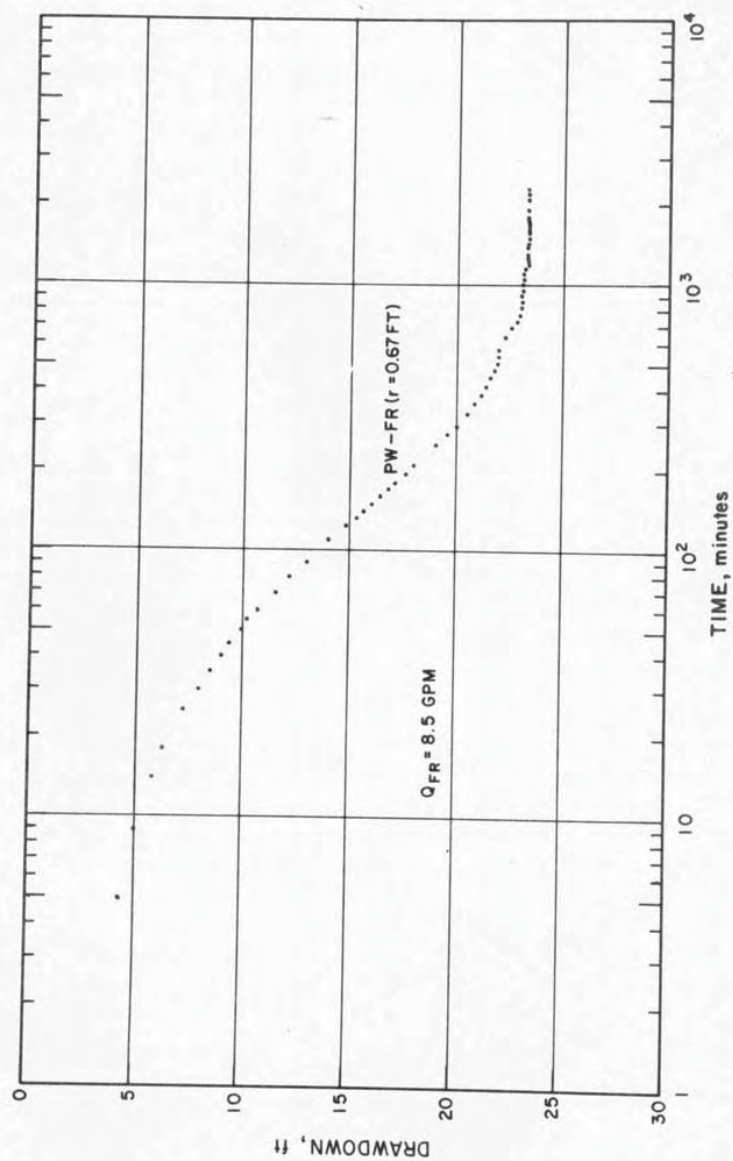


Figure 26: Semilogarithmic Graph of Drawdown for the Pumped Well,  
Fall River Aquifer Test

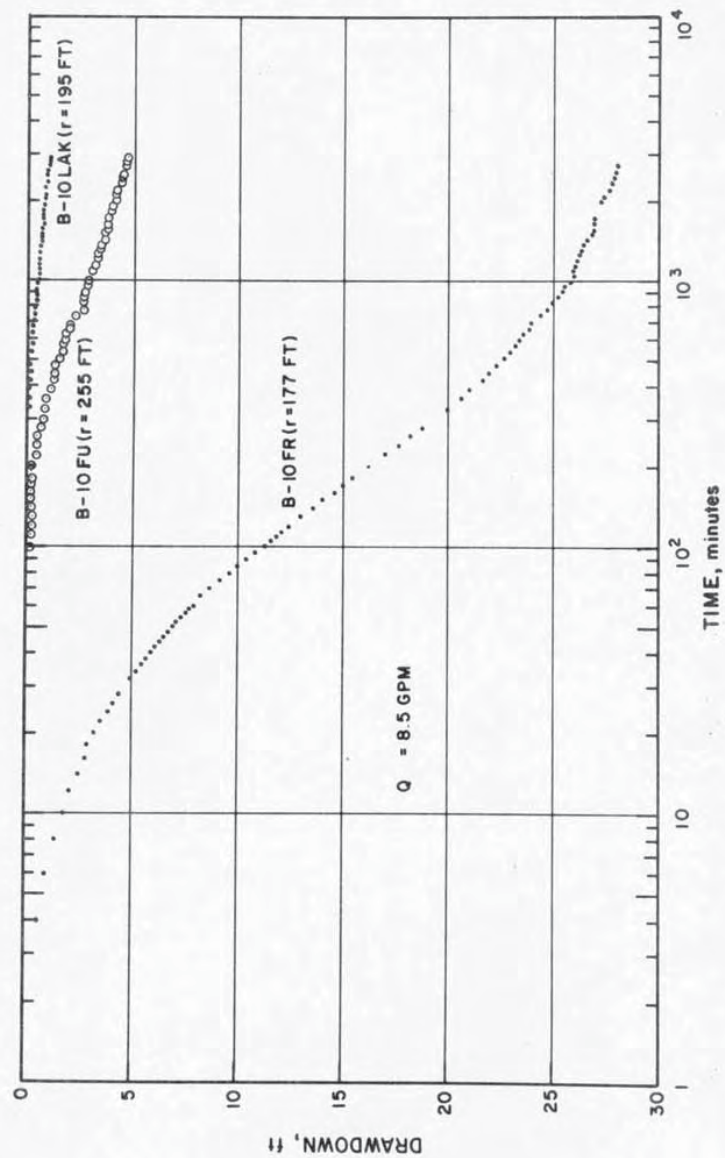


Figure 27 : Semilogarithmic Graphs of Drawdown for B-10 Observation Well Group,  
Fall River Aquifer Test



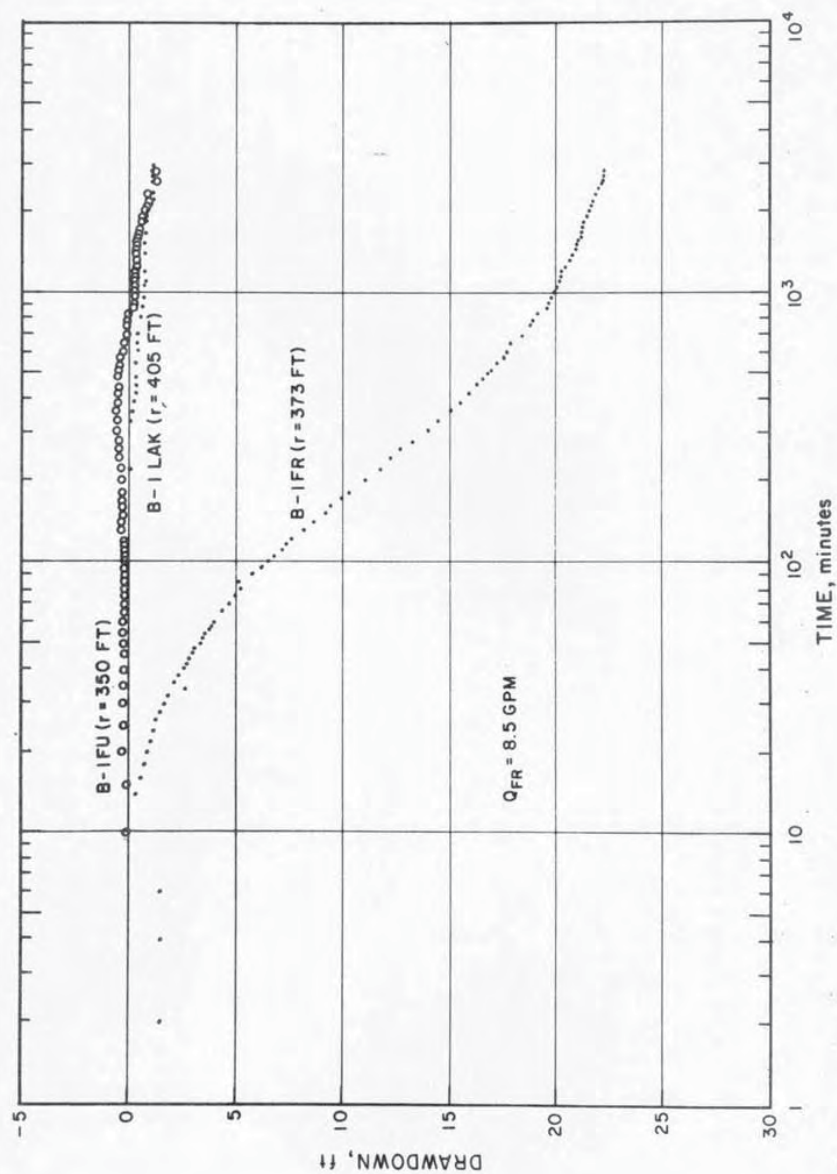


Figure 28 : Semilogarithmic Graphs of Drawdown for B-1 Observation Well Group,  
Fall River Aquifer Test

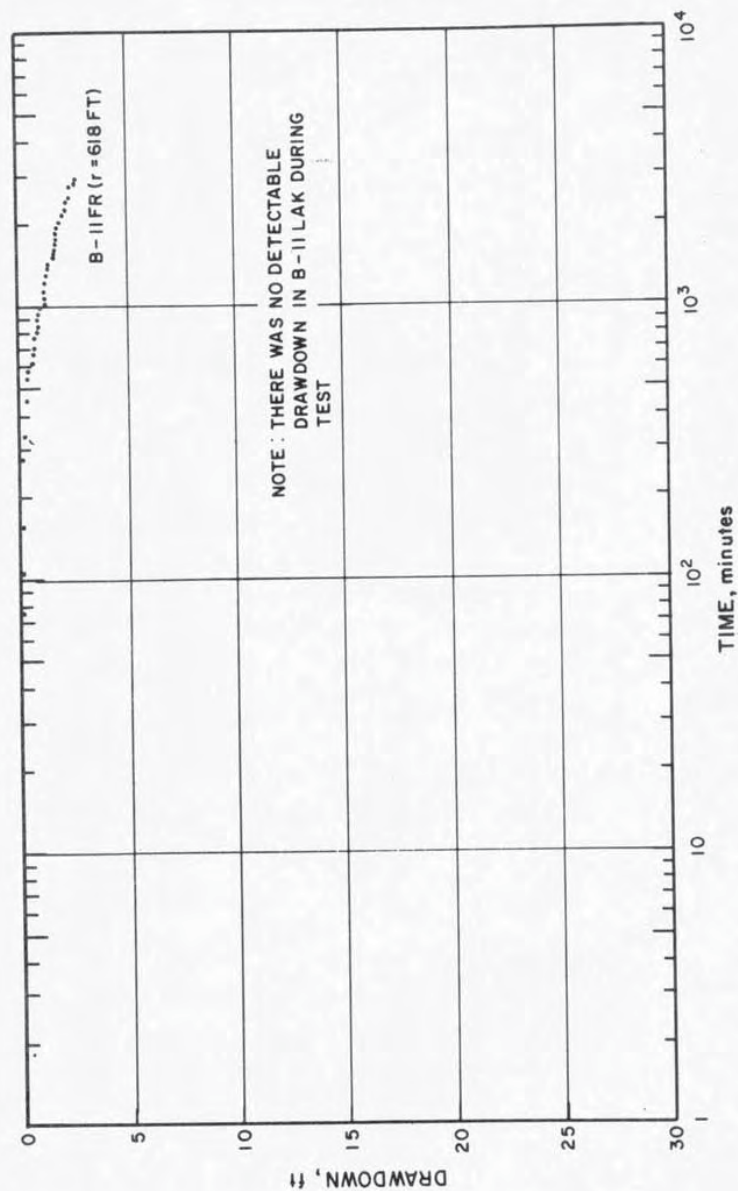


Figure 29: Semilogarithmic Graph of Drawdown for B-11 Observation Well Group, Fall River Aquifer Test

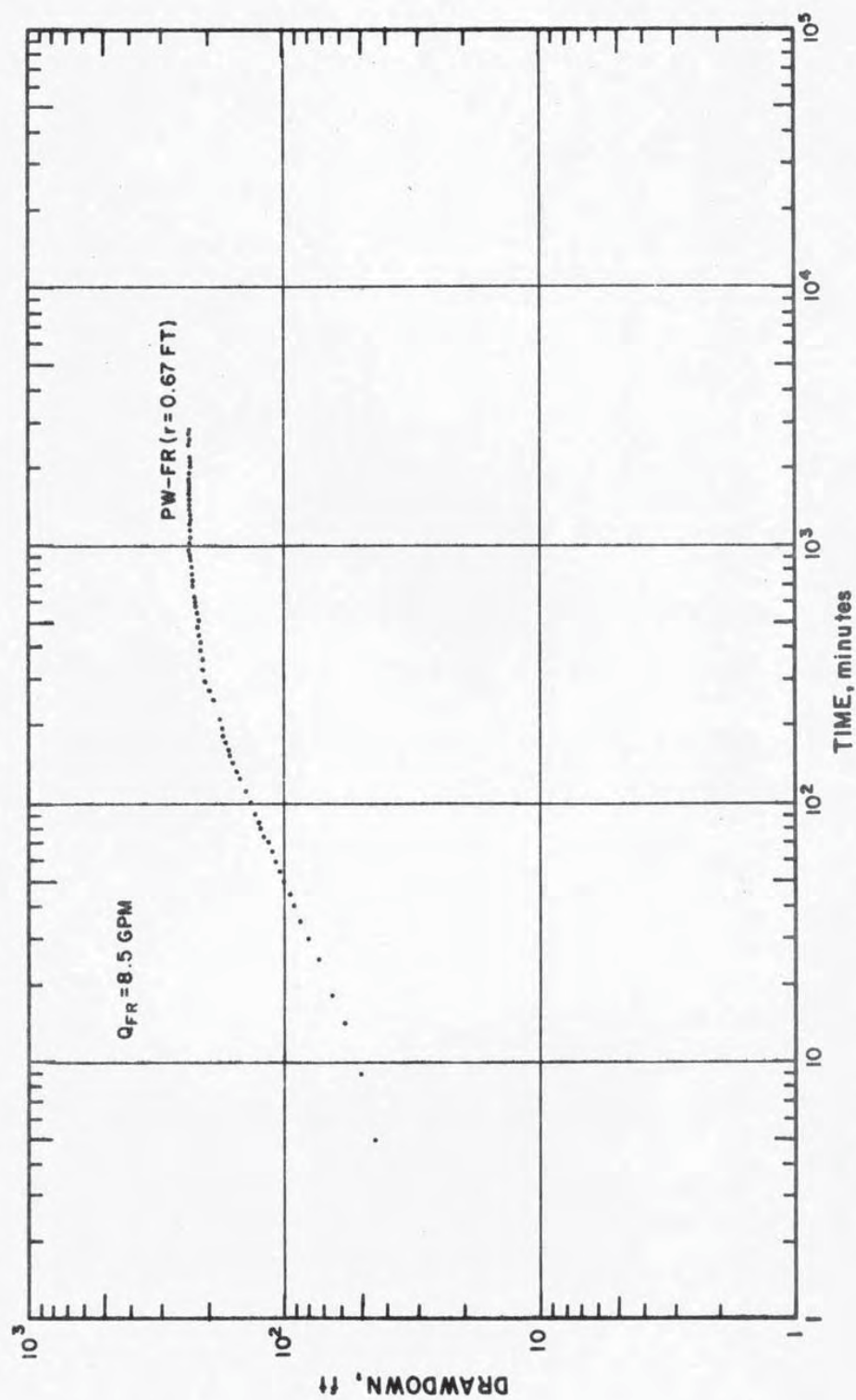


Figure 30: Logarithmic Graph of Drawdown for Pumped Well, Fall River Aquifer Test

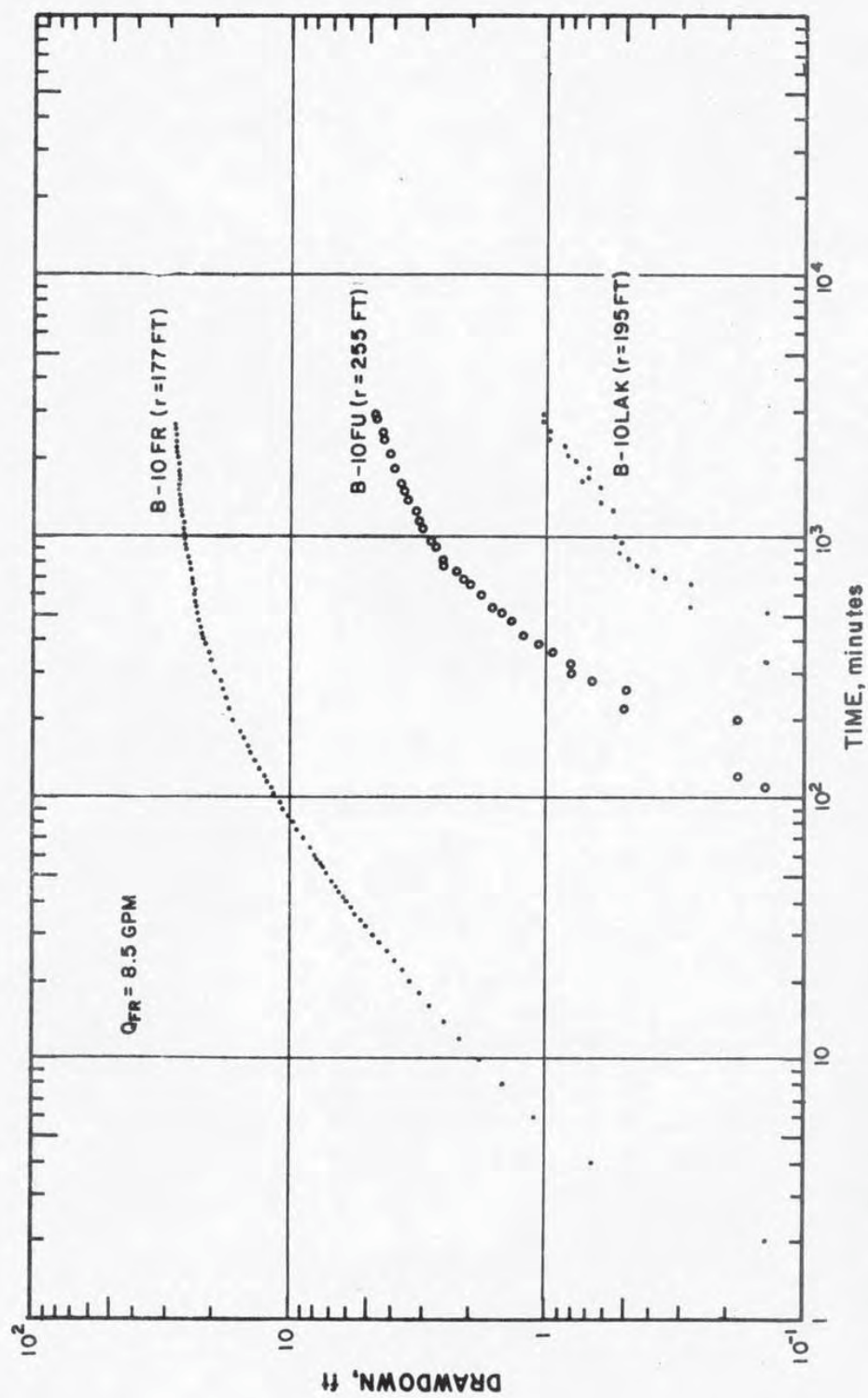


Figure 31: Logarithmic Graphs of Drawdown for B-10 Observation Well Group, Fall River Aquifer Test



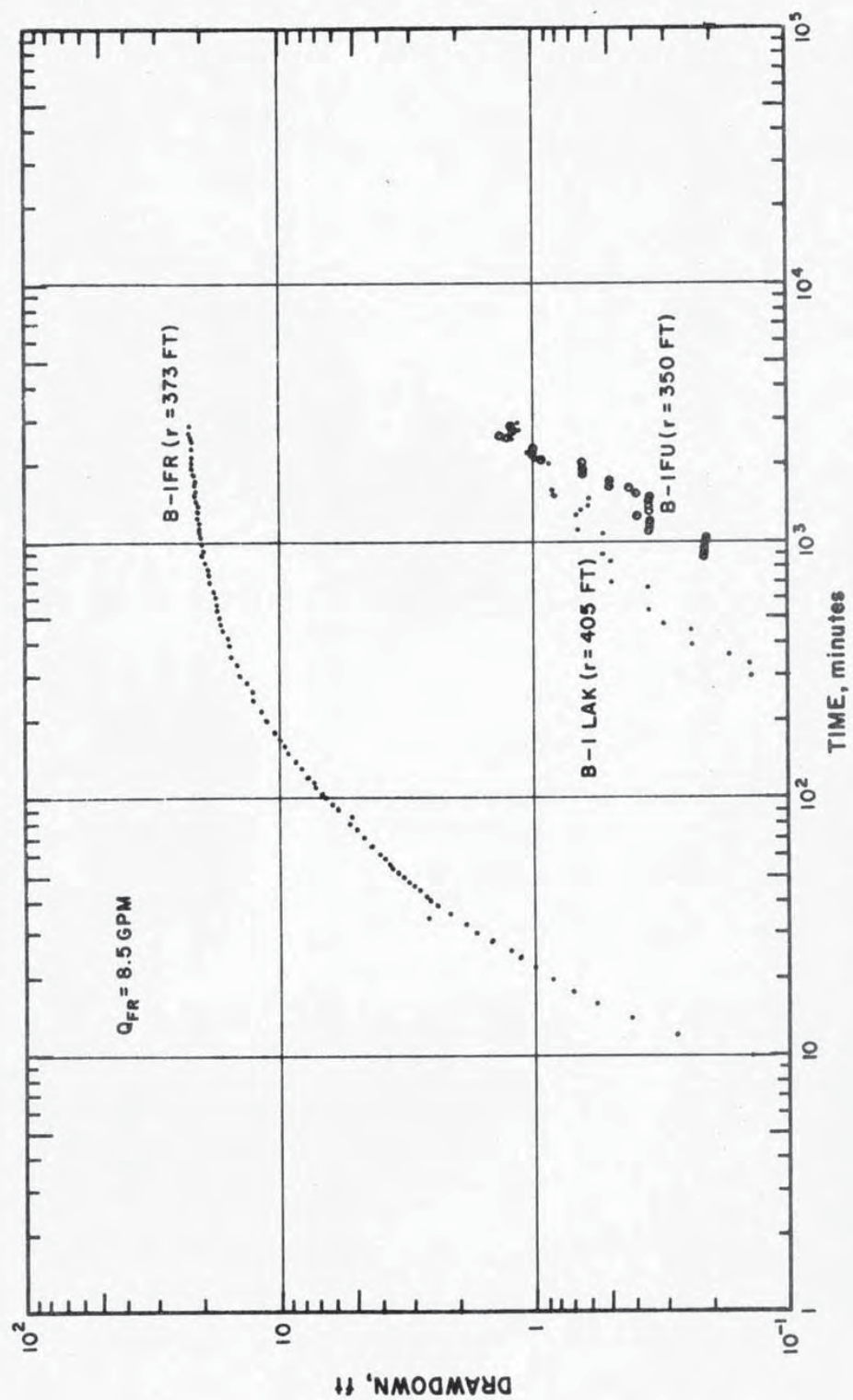


Figure 32: Logarithmic Graphs of Drawdown for B-1 Observation Well Group, Fall River Aquifer Test

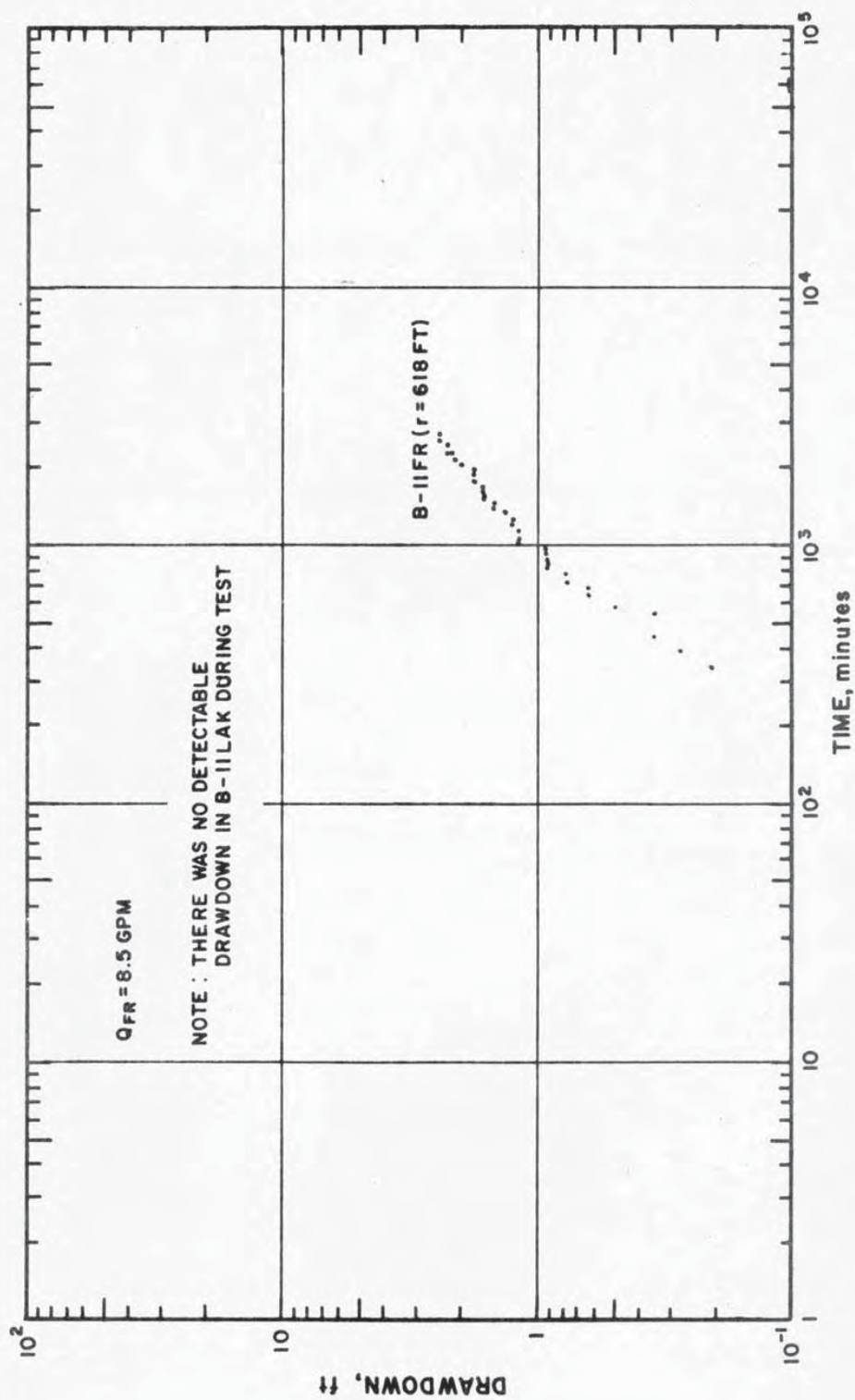


Figure 33: Logarithmic Graphs of Drawdown for B-II Observation Well Group, Fall River Aquifer Test

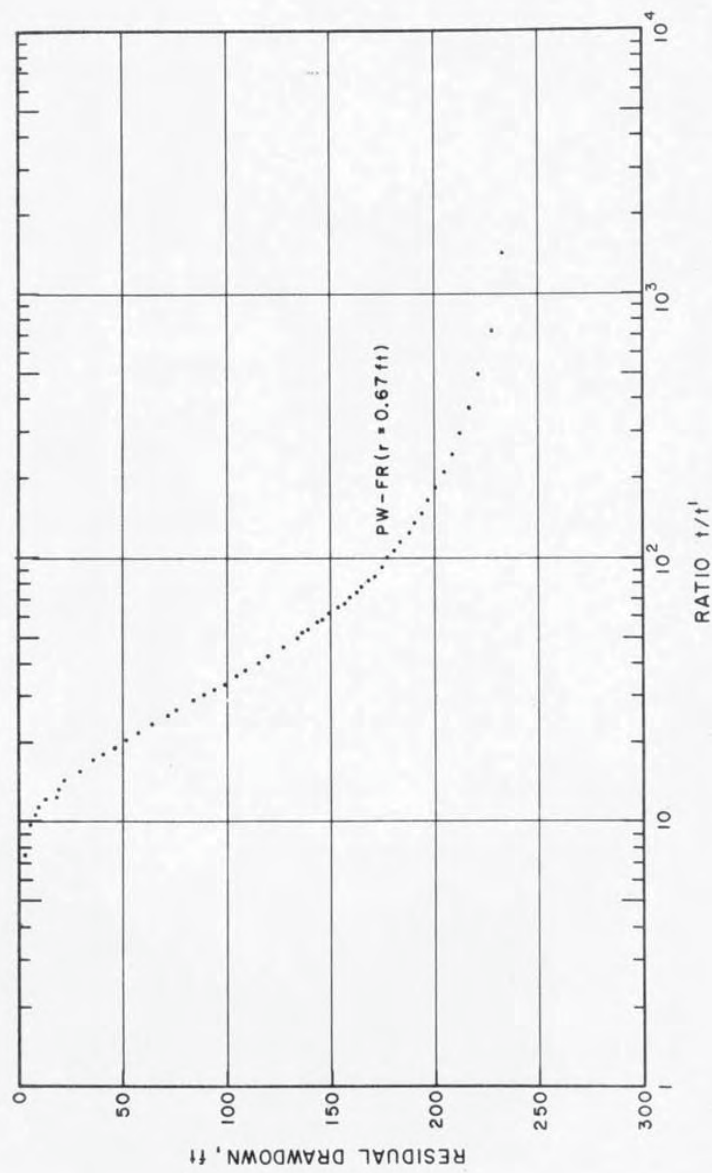


Figure 34: Recovery Graph for Pumped Well, Fall River Aquifer Test

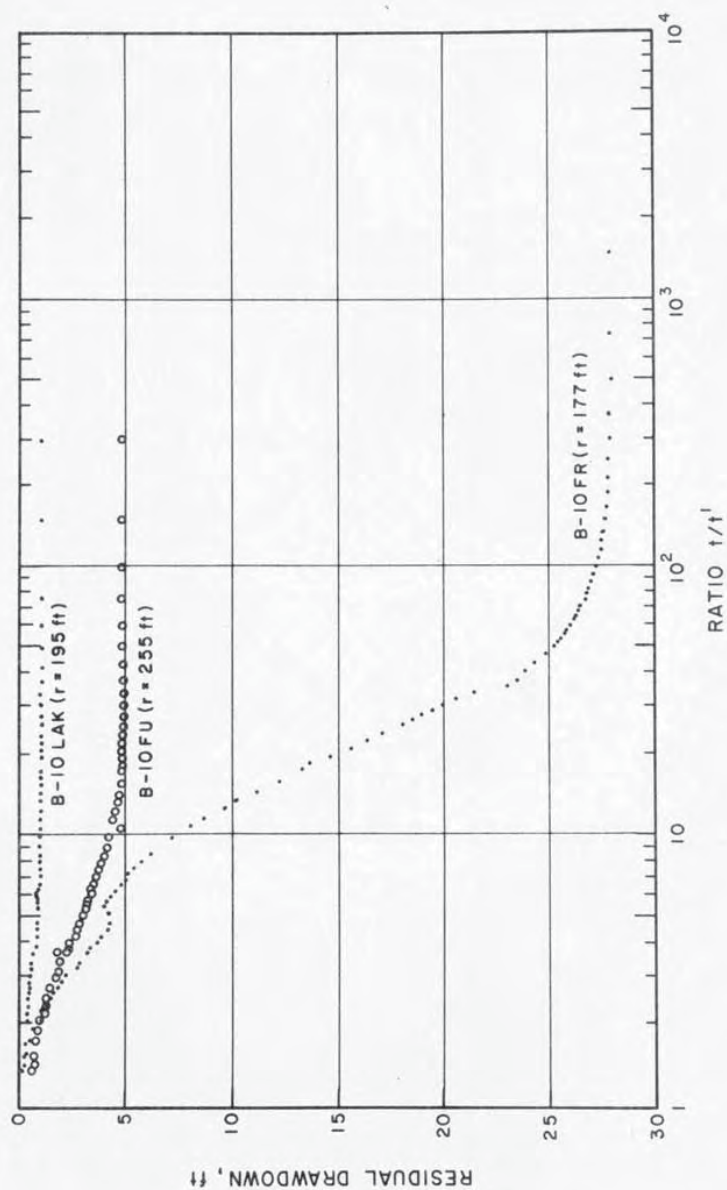


Figure 35: Recovery Graphs for B-10 Observation Well Group, Fall River Aquifer Test



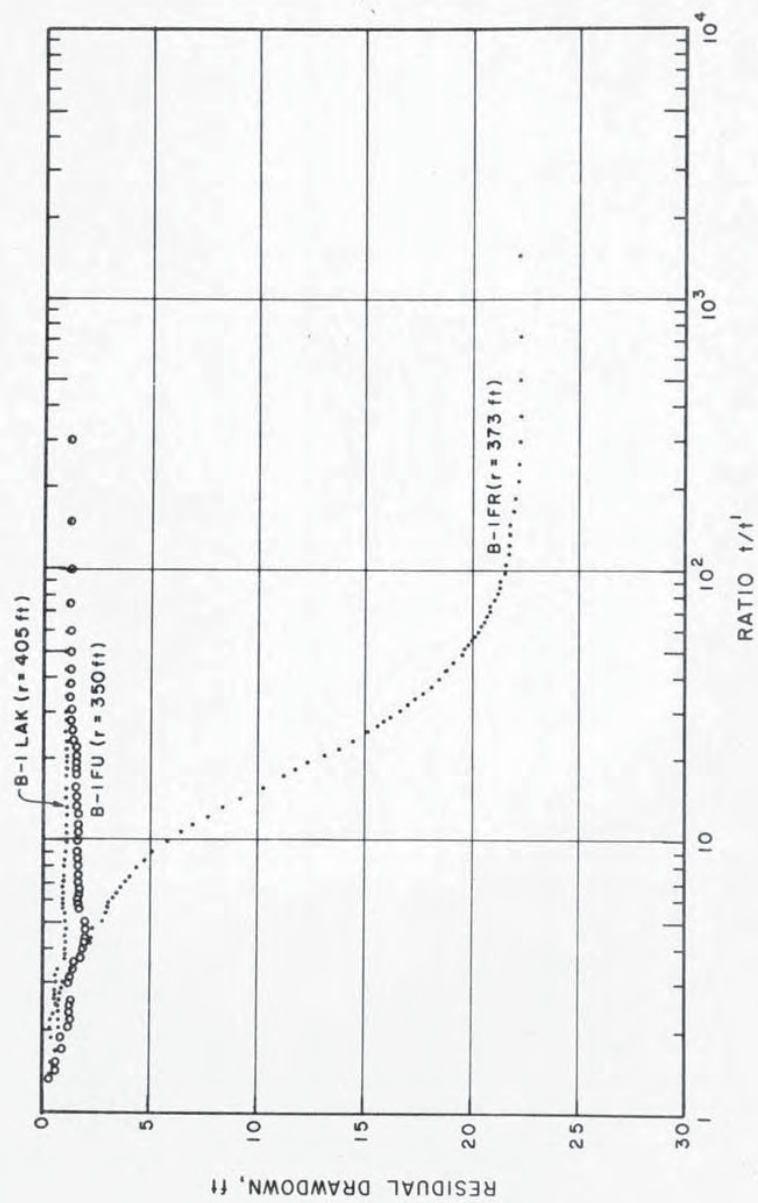


Figure 36: Recovery Graphs for B-1 Observation Well Group, Fall River Aquifer Test

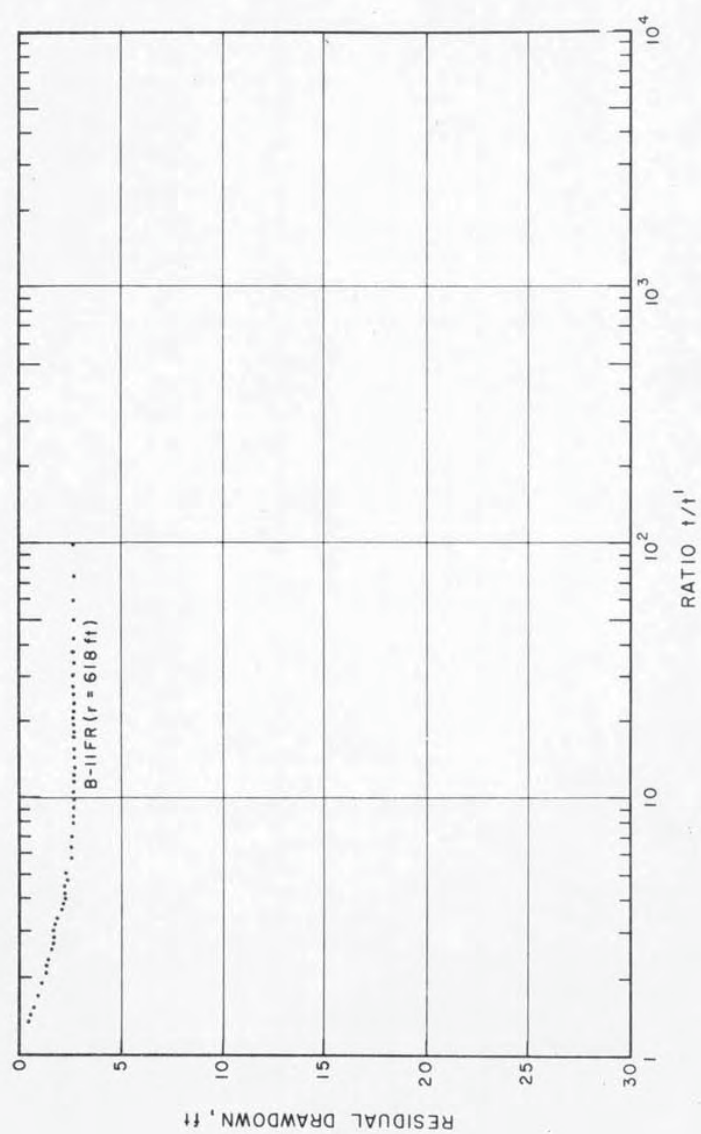


Figure 37: Recovery Graph for B-11 Observation Well Group, Fall River Aquifer Test

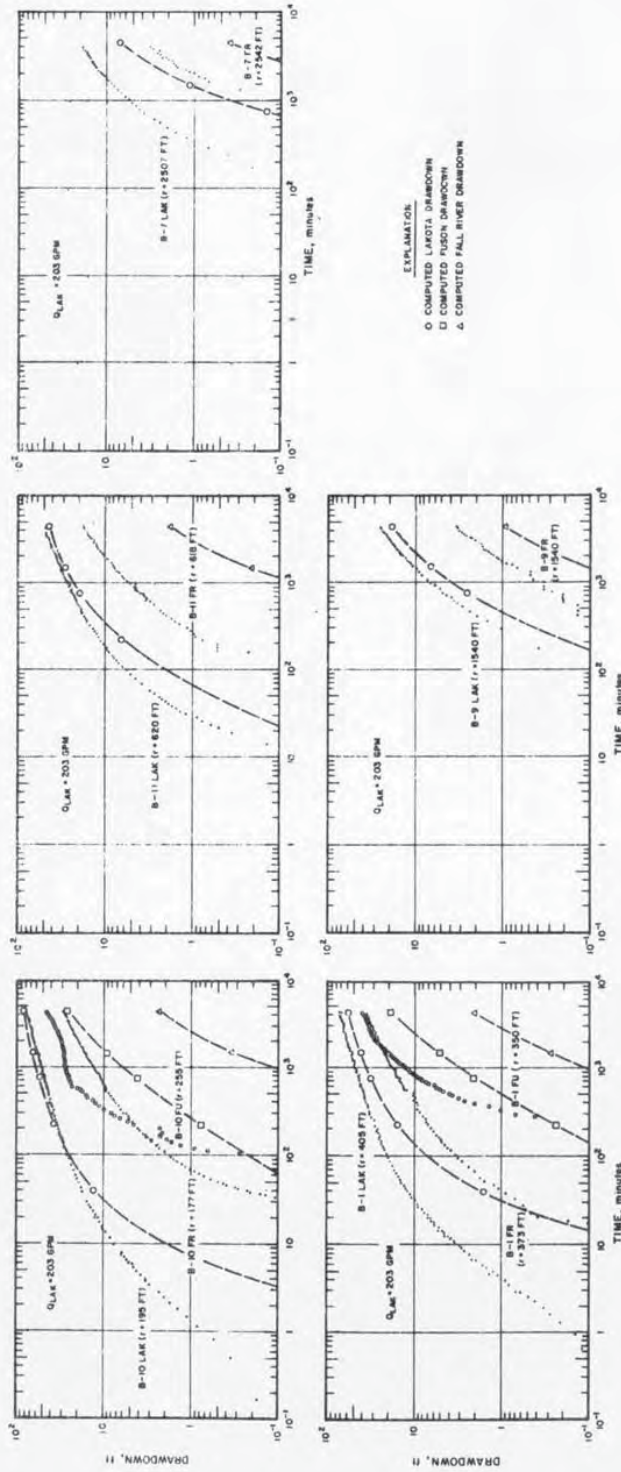


Figure 38 : Results of Initial Lakota Aquifer Test Simulation

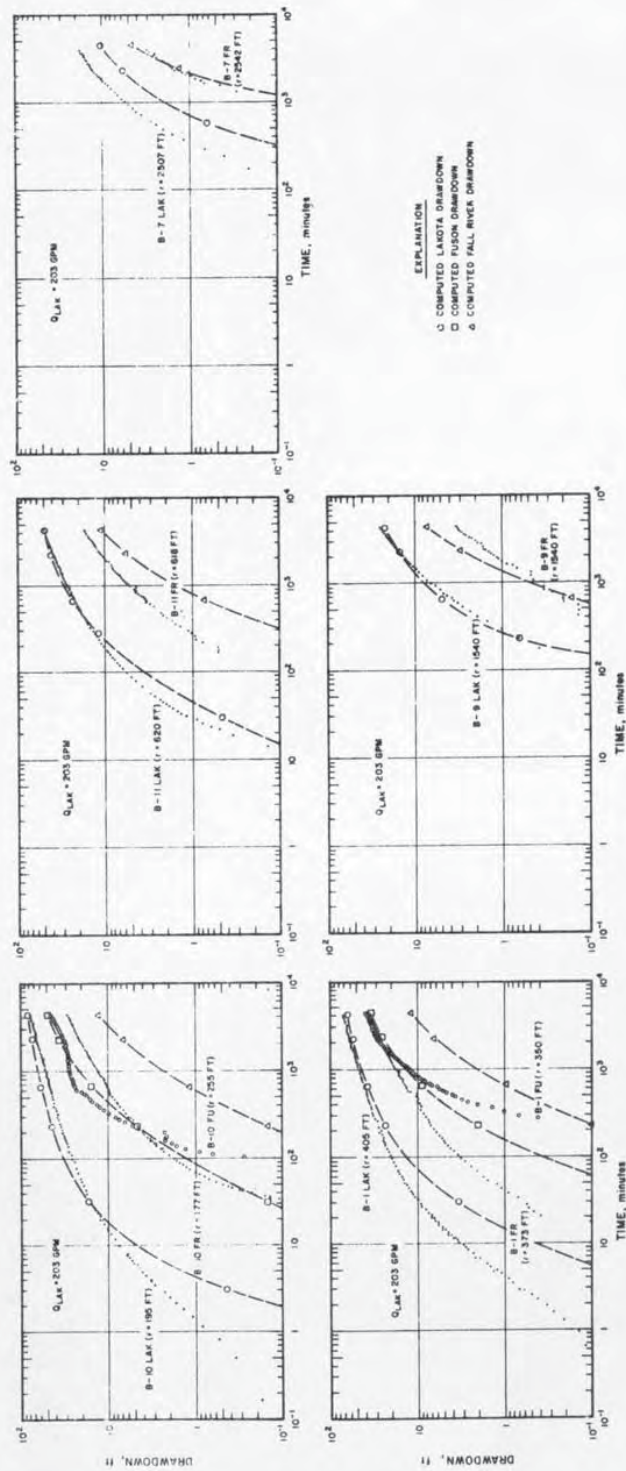


Figure 39 : Results of Final Lakota Aquifer Test Simulation



## **Groundwater Restoration at Uranium In-Situ Recovery Mines, South Texas Coastal Plain**



Open-File Report 2009–1143



# **Groundwater Restoration at Uranium In-Situ Recovery Mines, South Texas Coastal Plain**

By Susan Hall

Open-File Report 2009–1143

**U.S. Department of the Interior  
U.S. Geological Survey**

**U.S. Department of the Interior**  
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Texas coastal plain: U.S. Geological Survey Open-File Report 2009–1143, 32 p.



# Groundwater Restoration at Uranium In-Situ Recovery Mines, South Texas Coastal Plain



Susan Hall

U.S. Geological Survey

Central Energy Resources Science Center

Denver, CO



*Photo Courtesy Uranium Energy Corporation*

## Introduction

This talk was presented by U.S. Geological Survey (USGS) geologist Susan Hall on May 11, 2009, at the Uranium 2009 conference in Keystone, Colorado, and on May 12, 2009, as part of an underground injection control track presentation at the Texas Commission on Environmental Quality (TCEQ) Environmental Trade Fair and Conference in Austin, Texas.

Texas has been the location of the greatest number of uranium in-situ recovery (ISR) mines in the United States and was the incubator for the development of alkaline leach technology in this country. For that reason, the author chose to focus on the effectiveness of restoration at ISR mines by examining legacy mines developed in Texas. The best source for accurate information about restoration at Texas ISR mines is housed at the TCEQ offices in Austin. The bulk of this research is an analysis of those records.



## USGS Uranium ISR Research

**Phase 1: Forensic Chemistry (Nearing Completion)**

- Compile historic chemistry of ISR operations throughout the United States
- Characterize groundwater chemistry in past ISR operations
- Compare effectiveness of restoration techniques (monitor ongoing studies)

**Phase 2: Long-term Monitoring (Site and Funding Search Underway)**

- Resample old well fields to test for long-term aquifer contamination
- Measure capacity of host formations to naturally attenuate ISR well field waters
- Resample around well fields to determine if contamination has moved outside original monitor wells
- Determination of mineralogic transformations through mining and reclamation

**Phase 3: Improved Restoration Techniques (Preliminary Testing Initiated)**

- Bench scale testing to try to develop more effective geochemical techniques for groundwater restoration in ISR mines
- Pilot studies implementing new techniques



### USGS Uranium ISR Studies

The USGS initiated a study of the effects on groundwater by ISR mining in 2008 in response to increased activity in uranium exploration and mining and the increasing number of applications for ISR mines to the U.S. Nuclear Regulatory Commission. USGS geologists were particularly intrigued with the widespread assertion that “Groundwater has never been returned to baseline at any ISR mine.”

USGS ISR studies are broken down into three phases:

1. Compilation of forensic chemistry: the examination of legacy projects.
2. Investigations of groundwater chemistry over time.
3. Development of improved restoration techniques.

The USGS is nearing completion of Phase 1, the forensic chemistry portion of our project, and these are some of the interim results of this work. The search for a suitable field site and funding to evaluate long-term impacts and natural attenuation of groundwater in ISR well fields (Phase 2) is underway, and preliminary testing of new restoration technologies for ISR well fields (Phase 3) has begun.



### **Outline of Presentation**

To determine the effectiveness of groundwater restoration at ISR mines, the following topics will be addressed:

1. The establishment of baseline and restoration goals.
2. Effectiveness of groundwater restoration.
3. Long-term stability of well fields.
4. An evaluation of best restoration technologies, including:
  - (a) Pump and treat techniques (Texas),
  - (b) The addition of reductants (Wyoming and New Mexico), and
  - (c) Bioremediation (Nebraska and Wyoming).



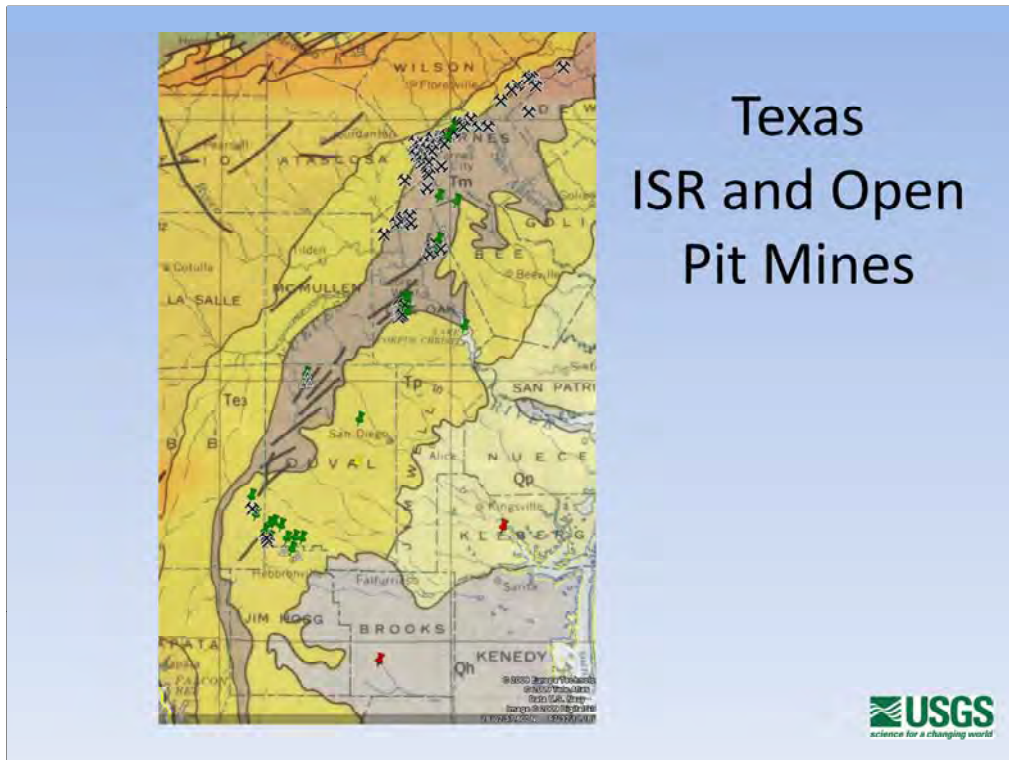
### Background

The United States has been steadily producing uranium using ISR mining since the mid-1970s. In April 2009 there were four active mines in the United States (red markers): Cameco's Smith Ranch/Highland property in Wyoming and Crow Butte mine in Nebraska, and Mestena Uranium's Alta Mesa mine and URI's Kingsville Dome mine, both located in Texas.

Most uranium production from ISR mines has come from mines in Wyoming and Texas (green markers), with only pilot projects testing mining and restoration techniques developed in New Mexico (Crown Point, Mobil) and Colorado (Grover, Wyoming Minerals). More than 20 ISR mines anticipate or have begun the process of applying for licensing (yellow markers).

According to the Energy Information Agency, the United States imported 82 percent of its uranium in 2007 (Energy Information Agency, 2009) and 38 percent of U.S. uranium reserves are classified as ISR amenable (Nuclear Energy Agency, 2008). Thus, the safe and effective use of ISR technology in mining uranium deposits is a potentially critical element in the movement towards energy independence in the United States

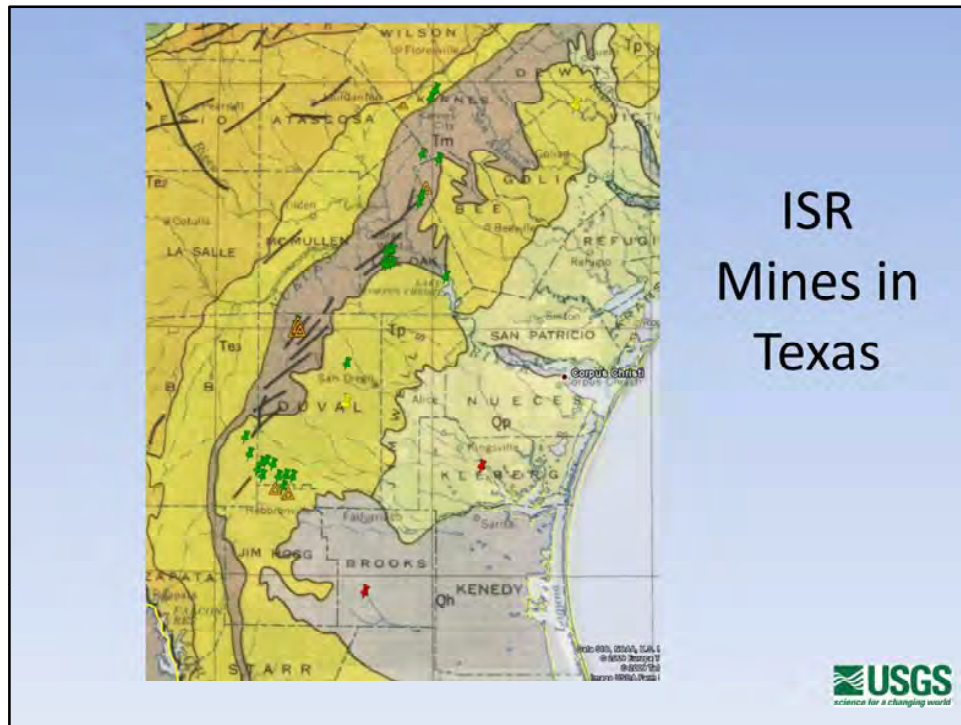




### Texas Coastal Plain Uranium District

Historically, uranium in Texas has been produced from Tertiary units along the southwest coastal plain. Uranium was first mined from a series of open-pit deposits developed in the Whitsett Formation (Jackson Group) and Catahoula Formation, starting in the late 1950s, when uranium was discovered during radiometric surveys in support of oil and gas exploration in Texas.

Black crossed mine symbols are uranium properties identified by the USGS Mineral Resources Data System database (<http://tin.er.usgs.gov/>) and show mostly historical open-pit mines located near Karnes City, Texas. The green markers represent closed ISR mines, and the red markers indicate operating ISR mines as of April 2009.



Along the southwest Texas coastal plain, uranium is mined, using ISR techniques, from the:

- Goliad Formation (Tp); a series of Miocene mudstone, conglomerates, and limestones, which is host to seven ISR mines
- Oakville Sandstone and Catahoula Formation (Tm); Miocene and Oligocene sandstone, clays, mudstones and Catahoula tuffs hosting 27 mines; 15 mines in the Oakville Sandstone and 13 mines in the Catahoula Formation
- Whitsett Formation (Te, Jackson Group); Oligocene mudstones, sandstones and tuffs which host two mines.

Thirty-six sites were authorized in Texas; seven were never mined (orange triangles), one was a tailings project (white square), and one was combined with another property. This leaves 27 mines (green markers) that were developed by construction of 77 well fields, termed Production Authorization Areas (PAAs) in Texas. The term “well field” and “PAA” will be used interchangeably throughout this presentation. Baseline and “amended restoration” values are available for all 27 mines/ 77 PAAs in TCEQ records.

Currently two mines are active in Texas: the Kingsville Dome mine in Kleberg County, operated by Uranium Resources International (URI), and the Alta Mesa mine in Brooks County, operated by Mestena Uranium (red markers). Two mines are in standby or shut down (green markers): the Vasquez and Rosita mines, both URI properties in Duval County. Two ISR mines are in the process of being permitted (yellow markers): Goliad in Goliad County (Uranium Energy Corporation) and La Palangana, a South Texas Mining Ventures property in Duval County.

Table 1: Baseline Water Quality for Zamzow PAA-1

ATTACHMENT G

BASELINE WATER QUALITY TABLE

TEXAS WATER COMMISSION

GROUNDWATER ANALYSIS REPORT SUMMARY

BASELINE WATER QUALITY - Solution Mining

Company: JTC Form

Date: 10/10/2012

Mine Area: PAA-1 (New and Existing Data)

Data Source: October 31, 1998

BASELINE WATER QUALITY TABLE

| PARAMETER       | UNIT      | NON-PRODUCTION ZONE** |         |      | PRODUCTION ZONE |         |        | WELL ID, BY AREA* |            |        |
|-----------------|-----------|-----------------------|---------|------|-----------------|---------|--------|-------------------|------------|--------|
|                 |           | Low                   | Average | High | Low             | Average | High   | NON-PROD. ZONE    | PROD. ZONE | WELL   |
| 1 Calcium       | mg/l      |                       |         |      | 132             | 317     | 552    | 196               | 288        | 300    |
| 2 Magnesium     | mg/l      |                       |         |      | 15              | 38.4    | 84.7   | 0.0               | 71.1       | 56     |
| 3 Sodium        | mg/l      |                       |         |      | 739             | 362     | 760    | 829               | 382        | 446    |
| 4 Potassium     | mg/l      |                       |         |      | 19              | 30.3    | 49     | 18.9              | 26.7       | 50     |
| 5 Carbonate     | mg/l      |                       |         |      | 0               | 0       | 0      | 0                 | 0          | 0      |
| 6 Bicarbonate   | mg/l      |                       |         |      | 128             | 297     | 400    | 157               | 269        | 344    |
| 7 Sulfate       | mg/l      |                       |         |      | 454             | 793     | 1,520  | 441               | 601        | 940    |
| 8 Chloride      | mg/l      |                       |         |      | 350             | 503     | 936    | 304               | 538        | 662    |
| 9 Fluoride      | mg/l      |                       |         |      | 0.16            | 0.54    | 1.19   | 0.01              | 0.36       | 0.50   |
| 10 Nitrate-N    | mg/l      |                       |         |      | <0.01           | 0.16    | 0.9    | <0.01             | 0.14       | 0.49   |
| 11 Silica       | mg/l      |                       |         |      | 31              | 51.6    | 85     | 11                | 43.8       | 74     |
| 12 pH           | Std. unit |                       |         |      | 6.6             | 7.0     | 7.66   | 6.68              | 7.0        | 7.45   |
| 13 TDS          | mg/l      |                       |         |      | 1,697           | 2,289   | 3,220  | 1,810             | 2,037      | 2,360  |
| 14 Conductivity | umhos     |                       |         |      | 2,720           | 3,204   | 4,300  | 2,680             | 3,049      | 3,430  |
| 15 Alkalinity   | Std. unit |                       |         |      | 105             | 238     | 400    | 206               | 238        | 284    |
| 16 Ammonia      | mg/l      |                       |         |      | <0.001          | 0.009   | 0.03   | <0.001            | 0.006      | 0.044  |
| 17 Cadmium      | mg/l      |                       |         |      | <0.0001         | 0.0001  | 0.002  | <0.0001           | 0.0001     | 0.0013 |
| 18 Lead         | mg/l      |                       |         |      | 0.01            | 0.019   | 0.3    | 0.02              | 0.075      | 0.28   |
| 19 Zinc         | mg/l      |                       |         |      | <0.001          | 0.001   | 0.005  | <0.001            | 0.004      | 0.02   |
| 20 Manganese    | mg/l      |                       |         |      | 0.002           | 0.024   | 0.42   | 0.01              | 0.110      | 0.16   |
| 21 Mercury      | mg/l      |                       |         |      | <0.00001        | 0.0001  | 0.0018 | <0.00001          | 0.0005     | 0.001  |
| 22 Selenium     | mg/l      |                       |         |      | <0.001          | 0.01    | 0.01   | <0.001            | 0.04       | 0.01   |
| 23 Arsenic      | mg/l      |                       |         |      | <0.0001         | 0.0001  | 0.001  | <0.0001           | 0.0001     | 0.001  |
| 24 Uranium      | mg/l      |                       |         |      | <0.001          | 0.111   | 1.7    | <0.001            | 0.078      | 0.432  |
| 25 Molybdenum   | mg/l      |                       |         |      | <0.001          | 0.03    | 0.65   | <0.001            | 0.225      | 0.1    |
| 26 Radium-226   | pCi/L     |                       |         |      | 1.0             | 1.155   | 1.953  | 1.63              | 1.152      | 1.748  |

\* LIST THE IDENTIFICATION NUMBERS OF WELLS USED TO OBTAIN THE LOW, AVERAGE AND HIGH VALUES.

\*\* MONITOR WELLS



## TCEQ ISR Restoration Database

The ISR restoration database is housed in the TCEQ offices in Austin, Texas. The database consists of binders for each mine in a data room adjacent to regulator offices. TCEQ does not represent these data as validated. Official data are on microfiche in an adjacent building, but the data are poorly organized and difficult to search. A digital database, compiled by a retired TCEQ employee, was also made available to the USGS. This digital database was cross-checked against original data sheets from the TCEQ data room, which forms the basis of this research.

TCEQ employees were extremely helpful in allowing the USGS full access to their data and copying facilities and were always available to answer questions about the database or permitting process.

This table is a typical data sheet summarizing pre-mining groundwater baseline data for a Texas PAA. In Texas, 26 chemical constituents are measured before mining to establish a baseline, as shown in Table 1. Restoration values are initially set as baseline, with operators selecting the highest average concentration from either the production or mine area as their restoration goal. At this Zamzow well field, PAA-1, 0.171 milligram per liter uranium was the highest average value from the mine or production area for uranium, as highlighted in Table 1.

Table 2 : Initial Restoration Table for Zamzow PAA-1

Production Area Authorization  
Permit No. UR02108-011

Page 3

ATTACHMENT A  
RESTORATION TABLE

| Parameter    | Unit      | Concentration |
|--------------|-----------|---------------|
| Calcium      | mg/l      | 317           |
| Magnesium    | mg/l      | 38.4          |
| Sodium       | mg/l      | 387           |
| Potassium    | mg/l      | 30.3          |
| Carbonate    | mg/l      | 0             |
| Bicarbonate  | mg/l      | 297           |
| Sulfate      | mg/l      | 793           |
| Chloride     | mg/l      | 538           |
| Fluoride     | mg/l      | 0.54          |
| Nitrate-N    | mg/l      | 0.16          |
| Silica       | mg/l      | 61.6          |
| pH           | Std. Unit | 7             |
| TDS          | mg/l      | 2,289         |
| Conductivity | µmhos     | 3,204         |
| Alkalinity   | Std. Unit | 275           |
| Arsenic      | mg/l      | 0.009         |
| Cadmium      | mg/l      | 0.001         |
| Iron         | mg/l      | 0.913         |
| Lead         | mg/l      | 0.004         |
| Manganese    | mg/l      | 0.224         |
| Mercury      | mg/l      | 0.0006        |
| Selenium     | mg/l      | 0.01          |
| Ammonia      | mg/l      | 0.374         |
| Molybdenum   | mg/l      | 0.226         |
| Radium-226   | pCi/l     | 166           |
| Uranium      | mg/l      | 0.171         |



Table 2 is a copy of the initial restoration table for Zamzow PAA-1. Note that the restoration goal for uranium in groundwater is set as 0.171 milligram per liter, as highlighted on the table, which was the highest average uranium content from the PAA mine area, as shown on Table 1.



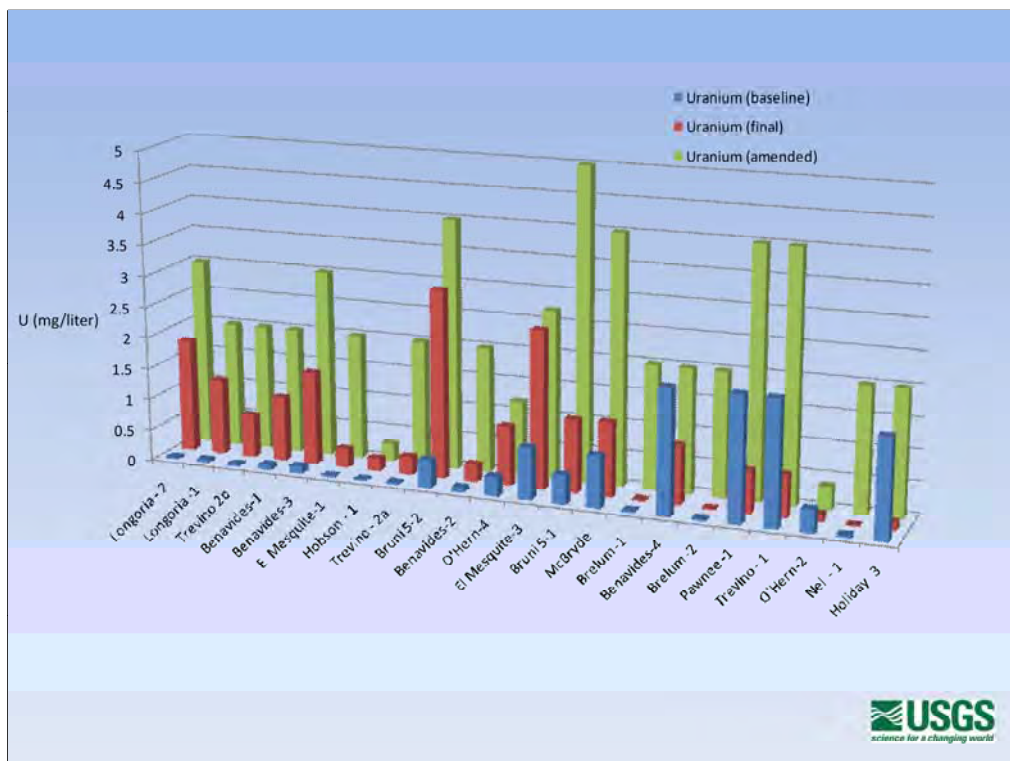
Table 3: Amended Restoration Table for Zamzow PAA-1

ATTACHMENT A  
RESTORATION TABLE  
(Amended)

| Parameter    | Unit       | Concentration |
|--------------|------------|---------------|
| Calcium      | mg/l       | 317.          |
| Magnesium    | mg/l       | 38.4          |
| Sodium       | mg/l       | 450.          |
| Potassium    | mg/l       | 30.3          |
| Carbonate    | mg/l       | 0             |
| Bicarbonate  | mg/l       | 760.          |
| Sulfate      | mg/l       | 793.          |
| Chloride     | mg/l       | 538.          |
| Fluoride     | mg/l       | 0.54          |
| Nitrate-N    | mg/l       | 0.16          |
| Silica       | mg/l       | 51.6          |
| pH           | std. units | 6.5 - 8.5     |
| TDS          | mg/l       | 2289.         |
| Conductivity | umhos      | 3204.         |
| Alkalinity   | std. units | 500.          |
| Arsenic      | mg/l       | 0.2           |
| Cadmium      | mg/l       | 0.001         |
| Iron         | mg/l       | 0.915         |
| Lead         | mg/l       | 0.004         |
| Manganese    | mg/l       | 0.224         |
| Mercury      | mg/l       | 0.0006        |
| Molybdenum   | mg/l       | 5.            |
| Selenium     | mg/l       | 0.01          |
| Uranium      | mg/l       | 3.            |
| Ammonia-N    | mg/l       | 200.          |
| Radium-226   | pCi/l      | 200.          |



All PAAs in Texas have received amended restoration goals for at least one element after operators have expended a reasonable degree of effort to restore groundwater, as determined by TCEQ regulators, following established guidelines. The final restoration table for Zamzow PAA-1 shows an amended limit of 3.00 milligrams per liter for uranium. This amended restoration value is believed to be a relatively arbitrary value set by the regulators, as illustrated by the number of PAAs that set amended values at rounded whole numbers that were unrelated to any restoration level actually achieved in the PAAs. As there are no “final sample” data for Zamzow PAA-1, no information is available to describe the degree to which this well field was restored.



This graph of uranium concentration for various Texas PAAs illustrates the relationship between baseline, final values, and amended restoration goals in the PAAs where final values were available. The blue bars represent baseline restoration goals for uranium as set by the highest average uranium concentration in baseline samples from either the mine or the production area. Well-field designations are shown on the X-axis of this chart. Red bars represent “final values” for uranium prior to release of the PAAs, and green bars represent amended restoration goals for uranium. There is no clear relationship between the final value achieved for uranium in groundwater at the PAAs, and the amended restoration goals. Amended restoration goals do not reflect the degree of restoration achieved at the PAAs in Texas for which final values are available. Therefore, only those fields for which final values were available were chosen for this analysis.

Only 22 PAAs from 13 mines have final sample values. These 22 PAAs form the basis of the study of restoration at these well fields.

**Table 4: Baseline Groundwater in United States  
ISR Mines – Constituents with EPA MCLs**

| Baseline Groundwater Characteristics of U.S. Uranium ISL Projects |         |                                       |                                                                                                 |                                        |                              |                                                         |                                                  |  |
|-------------------------------------------------------------------|---------|---------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------|---------------------------------------------------------|--------------------------------------------------|--|
| Chemical Constituent<br>(mg/L unless stated<br>otherwise)         | EPA MCL | Texas Baseline Range (71-<br>77 PAAs) | Texas - Number of PAAs<br>Where Average Baseline<br>Exceeds MCL/total # of<br>PAAs & percentage | New Mexico<br>Crown Point ISL<br>Pilot | Colorado<br>Grover ISL Pilot | Wyoming<br>(SR WF1, CR<br>MU2-6,<br>Irigaray MU1-<br>5) | Nebraska<br>Crow Butte<br>(MU 1-5 &<br>R&D Site) |  |
| <i>USEPA Primary Maximum Contaminant Levels (MCLs):</i>           |         |                                       |                                                                                                 |                                        |                              |                                                         |                                                  |  |
| Arsenic                                                           | 0.010   | 0.0010 - 0.2000                       | 45/73 62 %                                                                                      | 0.004                                  | 0.01                         | 0.006                                                   | 0.001                                            |  |
| Barium                                                            | 2       | -                                     | -                                                                                               | 0.1                                    | 0.03                         | 0.073                                                   | 0.10                                             |  |
| Cadmium                                                           | 0.005   | 0.0001 - 0.126                        | 21/73 29%                                                                                       | 0.006                                  | 0.002                        | 0.016                                                   | 0.006                                            |  |
| Chromium                                                          | 0.1     | -                                     | -                                                                                               | 0.007                                  | 0.003                        | 0.259                                                   | 0.01                                             |  |
| Copper                                                            | 1.3     | -                                     | -                                                                                               | 0.01                                   | 0.06                         | 0.043                                                   | 0.012                                            |  |
| Cyanide                                                           | 0.2     | -                                     | -                                                                                               | 0.088                                  | -                            | -                                                       | -                                                |  |
| Fluoride                                                          | 4       | 0.2 - 2.0                             | 0/73 0%                                                                                         | 0.39                                   | 0.7                          | 0.307                                                   | 0.69                                             |  |
| Gross Alpha (pCi/L)                                               | 15      | -                                     | -                                                                                               | -                                      | 87.67                        | -                                                       | -                                                |  |
| Gross Beta (millirems/year)                                       | 4       | -                                     | -                                                                                               | -                                      | 15.23                        | -                                                       | -                                                |  |
| Lead                                                              | 0.015   | 0.001 - 1.970                         | 35/73 48%                                                                                       | 0.003                                  | 0.02                         | 0.038                                                   | 0.032                                            |  |
| Mercury                                                           | 0.002   | 0.00003 - 0.44500                     | 6/73 8%                                                                                         | 0.00024                                | 0.0002                       | 0.001                                                   | 0.0007                                           |  |
| Nitrate                                                           | 10      | 0.01 - 12.0                           | 1/77 1%                                                                                         | 0.09                                   | 1.4                          | 3.01                                                    | 0.07                                             |  |
| Nitrite                                                           | 1       | -                                     | -                                                                                               | -                                      | -                            | 0.168                                                   | 0.004                                            |  |
| Radium ( <sup>226 &amp; 228</sup> Ra: pCi/L)                      | 5       | 5.45 - 1536.5                         | 71/71 100%                                                                                      | <14.1                                  | 13.4                         | 293.15                                                  | 405.4                                            |  |
| Selenium                                                          | 0.05    | 0.001 - 0.600                         | 7/73 10%                                                                                        | 0.01                                   | 0.01                         | 0.015                                                   | 0.002                                            |  |
| Uranium                                                           | 0.03    | 0.002 - 2.913                         | 66/73 90%                                                                                       | 0.01                                   | 0.086                        | 0.193                                                   | 0.103                                            |  |

#### Baseline Characterization of Groundwater in U.S. ISR Well Fields

Baseline standards for all 77 Texas PAAs can be used to characterize Texas ISR well fields that serve as a basis of comparison with baseline values determined for other ISR well fields in the United States. The argument is commonly made that before mining, groundwater in ISR well fields is so contaminated that it should not be used for human consumption. Before mining, these aquifers are typically granted exemptions from the Clean Water Act, termed aquifer exemptions, by the U.S. Environmental Protection Agency (USEPA).

In Texas, more than 25 percent of PAAs are characterized by baseline groundwater above the maximum contaminant level (MCL) for arsenic, cadmium, lead, radium, and uranium (shown highlighted on Table 4). MCL is set by the U.S. Environmental Protection Agency (USEPA; <http://www.epa.gov/safewater/contaminants/index.html>) for those elements with well-established links to negative human health effects. All PAAs contain radium above MCL, and 90 percent contain uranium above MCL. Although baseline is artificially elevated in this database because the operator is selecting the highest average value within the production or mine area, this value does serve to identify elements of concern in these well fields.

In the Crown Point pilot project in New Mexico, only cadmium was elevated above MCL. At the Grover pilot project in Colorado, baseline water showed gross alpha, gross beta, radium, and uranium above MCL. In Wyoming, averaged values for the Smith Ranch 1, Christensen Ranch 2-6, and Irigaray 1-5 mine units were elevated above MCL for cadmium, chromium, lead, radium, and uranium. In Nebraska (Crow Butte mine units 1-5 and the Crow Butte R & D site), average cadmium, lead, radium, and uranium were elevated above MCL. Elements above MCL are highlighted in the table.

With the exception of the New Mexico deposit (Crown Point), these well fields are characterized by groundwater elevated in multiple MCLs prior to mining. Radium is almost always elevated above MCL while uranium is typically elevated and cadmium and lead commonly elevated. These well fields would require pretreatment to be used as a source for drinking water.

**Table 5: Baseline Groundwater in U.S. ISR Mines – Constituents with EPA Secondary (recommended) Standards**

| Baseline Groundwater Characteristics of U.S. Uranium ISL Projects |                              |                                       |                                                                                                                                                                                    |       |                                        |                              |                                                         |                                                  |
|-------------------------------------------------------------------|------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------|------------------------------|---------------------------------------------------------|--------------------------------------------------|
| Chemical Constituent<br>(mg/L unless stated<br>otherwise)         | EPA<br>Secondary<br>Standard | Texas Baseline Range (71-<br>77 PAAs) | Texas - Number of PAAs<br>Where Average Baseline<br>Exceeds Secondary<br>Standards/total # of PAAs &<br>Percentage (Highlighted If ><br>75% of PAAs Exceed Secondary<br>Standards) |       | New Mexico<br>Crown Point ISL<br>Pilot | Colorado<br>Grover ISL Pilot | Wyoming<br>(SR WFT, CR<br>MUZ-6,<br>Hagerman MU1-<br>9) | Nebraska<br>Crow Butte<br>(MU 1-5 &<br>R&D Site) |
| EPA Secondary Recommended Standards:                              |                              |                                       |                                                                                                                                                                                    |       |                                        |                              |                                                         |                                                  |
| Aluminum                                                          | 0.200                        | -                                     | -                                                                                                                                                                                  | -     | 0.02                                   | 0.537                        | 0.117                                                   | -                                                |
| Chloride                                                          | 250                          | 122.5 - 3505.0                        | 64/77                                                                                                                                                                              | 83 %  | 20.3                                   | 7                            | 9.8                                                     | 202.6                                            |
| Iron                                                              | 0.30                         | 0.01 - 6.3                            | 32/72                                                                                                                                                                              | 44 %  | 0.67                                   | 0.7                          | 0.648                                                   | 0.04                                             |
| Manganese                                                         | 0.05                         | 0.01 - 5.06                           | 37/73                                                                                                                                                                              | 51 %  | 0.05                                   | 0.02                         | 0.018                                                   | 0.03                                             |
| Silver                                                            | 0.10                         | -                                     | -                                                                                                                                                                                  | -     | <0.01                                  | 0.003                        | -                                                       | -                                                |
| Sulfate                                                           | 250                          | 10.3 - 1197                           | 10/77                                                                                                                                                                              | 13 %  | 38                                     | 38.3                         | 300                                                     | 353                                              |
| Total Dissolved Solids                                            | 500                          | 628 - 6349                            | 73/73                                                                                                                                                                              | 100 % | 357                                    | 295                          | 616                                                     | 1177                                             |
| Zinc                                                              | 5                            | -                                     | -                                                                                                                                                                                  | -     | 0.01                                   | 0.04                         | 0.073                                                   | 0.017                                            |

Recommended secondary standards are set by the USEPA for constituents that, in high enough concentrations, negatively affect the esthetic quality of groundwater, but are not conclusively linked to any negative human health effect. Of those elements for which secondary standards are set by the USEPA, iron, sulfate, and total dissolved solids (TDS) are commonly elevated above recommended levels in pre-mining water at ISR facilities. Chloride and manganese are commonly high in Texas PAAs before mining, while TDS is elevated above the recommended standard in all pre-mining Texas PAAs. Elements elevated above secondary standards are highlighted in Table 5.



**Table 6: Baseline Groundwater in U.S. ISR Mines – Constituents with no MCL or Secondary Standard**

| Baseline Groundwater Characteristics of U.S. Uranium ISR Projects |           |                                       |                                        |                                 |                                                 |                                               |
|-------------------------------------------------------------------|-----------|---------------------------------------|----------------------------------------|---------------------------------|-------------------------------------------------|-----------------------------------------------|
| Chemical Constituent<br>(mg/L unless stated<br>otherwise)         | USEPA MCL | Texas Baseline Range (71-<br>77 PAAs) | New Mexico<br>Crown Point<br>ISR Pilot | Colorado<br>Grover ISR<br>Pilot | Wyoming (SR<br>Wf1, CR MU2-6,<br>Ingarav MU1-5) | Nebraska Crow<br>Butte (MU 1-5<br>& R&D Site) |
| <i>No Established MCL or Recommended Secondary Standard:</i>      |           |                                       |                                        |                                 |                                                 |                                               |
| Alkalinity (as CaCO <sub>3</sub> )                                | -         | 24 - 349                              | -                                      | 154.7                           | 116.1                                           | -                                             |
| Ammonia-N                                                         | -         | 0.01 - 7.49                           | 0.47                                   | 0.25                            | 0.344                                           | 0.26                                          |
| Bicarbonate                                                       | -         | 125 - 500                             | 228                                    | 220.1                           | 171.6                                           | 344                                           |
| Boron                                                             | -         | -                                     | 0.1                                    | 0.1                             | 0.1                                             | 0.93                                          |
| Calcium                                                           | -         | 0.2 - 395                             | 5.8                                    | 9.1                             | 29.4                                            | 12.97                                         |
| Carbonate                                                         | -         | 0.10 - 38                             | -                                      | 4.31                            | 22.4                                            | 369                                           |
| Cobalt                                                            | -         | -                                     | <0.05                                  | -                               | -                                               | -                                             |
| Conductivity (umhos/cm)                                           | -         | 1,110 - 11,160                        | -                                      | 380.7                           | 1051                                            | 1947                                          |
| Magnesium                                                         | -         | 0.48 - 150.0                          | -                                      | 1.1                             | 5.324                                           | 3.27                                          |
| Molybdenum                                                        | -         | 0.01 - 2.53                           | 0.172                                  | 0.02                            | 0.100                                           | 0.05                                          |
| Nickel                                                            | -         | -                                     | 0.02                                   | 0.2                             | 0.093                                           | 0.03                                          |
| Phosphorous                                                       | -         | -                                     | -                                      | 0.05                            | -                                               | -                                             |
| Potassium                                                         | -         | 6.38 - 101.1                          | -                                      | 4.43                            | 9.810                                           | 13.10                                         |
| Silica                                                            | -         | 15 - 98                               | -                                      | 5.45                            | 10.496                                          | 16.7                                          |
| Sodium                                                            | -         | 174 - 2,356                           | 114                                    | 85.2                            | 155                                             | 410                                           |
| Thorium                                                           | -         | -                                     | -                                      | 0.7417                          | -                                               | -                                             |

Table 6 shows average concentrations and a range of concentrations in Texas PAAs, within pre-mining baseline groundwater for those analytes for which no primary or secondary standards have been set by the USEPA.

| Table 7: Groundwater Chemistry of Texas In-situ Uranium Production Authorization Areas                                                                                                |                                                |                 |                        |                                                       |                                                                     |                                                      |                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------|------------------------|-------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------|
| (22 PAAs where final analyses are available)                                                                                                                                          |                                                |                 |                        |                                                       |                                                                     |                                                      |                                                         |
| Analyte                                                                                                                                                                               | USEPA and TCEQ Drinking Water Standards (mg/l) | Baseline Range  | Post-Restoration Range | PAAs with Baseline Above MCL or Recommended Standards | PAAs with Post-Restoration Water Above MCL or Recommended Standards | PAAs Where Post-Restoration Analyses Exceed Baseline | PAAs Where Post-Restoration Analyses are Below Baseline |
| USEPA and TCEQ Primary Maximum Contaminant Levels (MCLs):                                                                                                                             |                                                |                 |                        |                                                       |                                                                     |                                                      |                                                         |
| Arsenic                                                                                                                                                                               | 0.01                                           | 0.04 - 0.23     | 0.02 - .323            | 77%                                                   | 55%                                                                 | 18%                                                  | 82%                                                     |
| Cadmium                                                                                                                                                                               | 0.005                                          | 0.0001 - 0.0126 | 0.0001 - 0.01          | 45%                                                   | 23%                                                                 | 27%                                                  | 73%                                                     |
| Fluoride                                                                                                                                                                              | 4                                              | 0.21 - 1.8      | 0.29 - 1.6             | 0%                                                    | 0%                                                                  | 31%                                                  | 69%                                                     |
| Lead                                                                                                                                                                                  | 0.02                                           | 0.003 - 1.97    | 0.001 - 0.05           | 81%                                                   | 18%                                                                 | 9%                                                   | 91%                                                     |
| Mercury                                                                                                                                                                               | 0.002                                          | 0.0001 - 0.445  | 0.0001 - 0.01          | 9%                                                    | 0%                                                                  | 22%                                                  | 64%                                                     |
| Nitrate                                                                                                                                                                               | 10                                             | 0.031 - 10.0    | 0.001 - 2.8            | 0%                                                    | 0%                                                                  | 4%                                                   | 96%                                                     |
| Selenium                                                                                                                                                                              | 0.05                                           | 0.001 - 0.049   | 0.001 - 0.102          | 18%                                                   | 4%                                                                  | 54%                                                  | 45%                                                     |
| Radium (226 & 228 Ra: Pci/l)                                                                                                                                                          | 5 pCi/l                                        | 0.36 - 420.8    | 5.2 - 149              | 100%                                                  | 100%                                                                | 4%                                                   | 96%                                                     |
| Uranium                                                                                                                                                                               | 0.03                                           | 0.025 - 2.0     | 0.013 - 3.02           | 95%                                                   | 86%                                                                 | 68%                                                  | 32%                                                     |
| TCEQ Secondary Recommended Standards:                                                                                                                                                 |                                                |                 |                        |                                                       |                                                                     |                                                      |                                                         |
| Sulfate                                                                                                                                                                               | 300                                            | 15.8 - 250      | 78 - 3881              | 0%                                                    | 18%                                                                 | 86%                                                  | 14%                                                     |
| Chloride                                                                                                                                                                              | 300                                            | 196.9 - 3505    | 138 - 3326             | 86%                                                   | 86%                                                                 | 22%                                                  | 78%                                                     |
| Total Dissolved Solids                                                                                                                                                                | 1000                                           | 785.7 - 6349    | 706.3 - 6155           | 81%                                                   | 77%                                                                 | 31%                                                  | 55%                                                     |
| Iron                                                                                                                                                                                  | 0.3                                            | 0.04 - 5.49     | 0.01 - 2.7             | 54%                                                   | 9%                                                                  | 4%                                                   | 96%                                                     |
| Manganese                                                                                                                                                                             | 0.05                                           | 0.01 - 0.41     | 0.01 - 0.84            | 77%                                                   | 50%                                                                 | 40%                                                  | 60%                                                     |
| No Established MCL or Secondary Standards                                                                                                                                             |                                                |                 |                        |                                                       |                                                                     |                                                      |                                                         |
| Calcium                                                                                                                                                                               | -                                              | 4.13 - 241      | 14.7 - 191             |                                                       |                                                                     | 77%                                                  | 23%                                                     |
| Magnesium                                                                                                                                                                             | -                                              | 0.477 - 125     | 2.27 - 53              |                                                       |                                                                     | 72%                                                  | 28%                                                     |
| Sodium                                                                                                                                                                                | -                                              | 200 - 2356      | 169 - 2247             |                                                       |                                                                     | 31%                                                  | 65%                                                     |
| Potassium                                                                                                                                                                             | -                                              | 6.38 - 101      | 6.1 - 70               |                                                       |                                                                     | 14%                                                  | 86%                                                     |
| Carbonate                                                                                                                                                                             | -                                              | 0.1 - 17.9      | 0 - 14.6               |                                                       |                                                                     | 50%                                                  | 30%                                                     |
| Bicarbonate                                                                                                                                                                           | -                                              | 160 - 500       | 160 - 500              |                                                       |                                                                     | 66%                                                  | 25%                                                     |
| Silica                                                                                                                                                                                | -                                              | 16.3 - 76       | 13.4 - 77.6            |                                                       |                                                                     | 19%                                                  | 81%                                                     |
| Conductivity (umhos/cm)                                                                                                                                                               | -                                              | 1310 - 11160    | 1429 - 3697            |                                                       |                                                                     | 76%                                                  | 24%                                                     |
| Alkalinity (as CaCO3)                                                                                                                                                                 | -                                              | 134 - 349       | 145 - 408              |                                                       |                                                                     | 81%                                                  | 10%                                                     |
| Molybdenum                                                                                                                                                                            | -                                              | 0.01 - 0.2      | 0.0001 - 3.38          |                                                       |                                                                     | 42%                                                  | 54%                                                     |
| Ammonia-N                                                                                                                                                                             | -                                              | 0.01 - 7.49     | 0.04 - 120             |                                                       |                                                                     | 76%                                                  | 24%                                                     |
| Baseline and post-restoration data was available for all 22 PAAs with the exception of: Ra, Mo, K, Si, Bicarbonate, Ammonia (21), Conductivity (14), Alkalinity (11) & Carbonate (10) |                                                |                 |                        |                                                       |                                                                     |                                                      |                                                         |

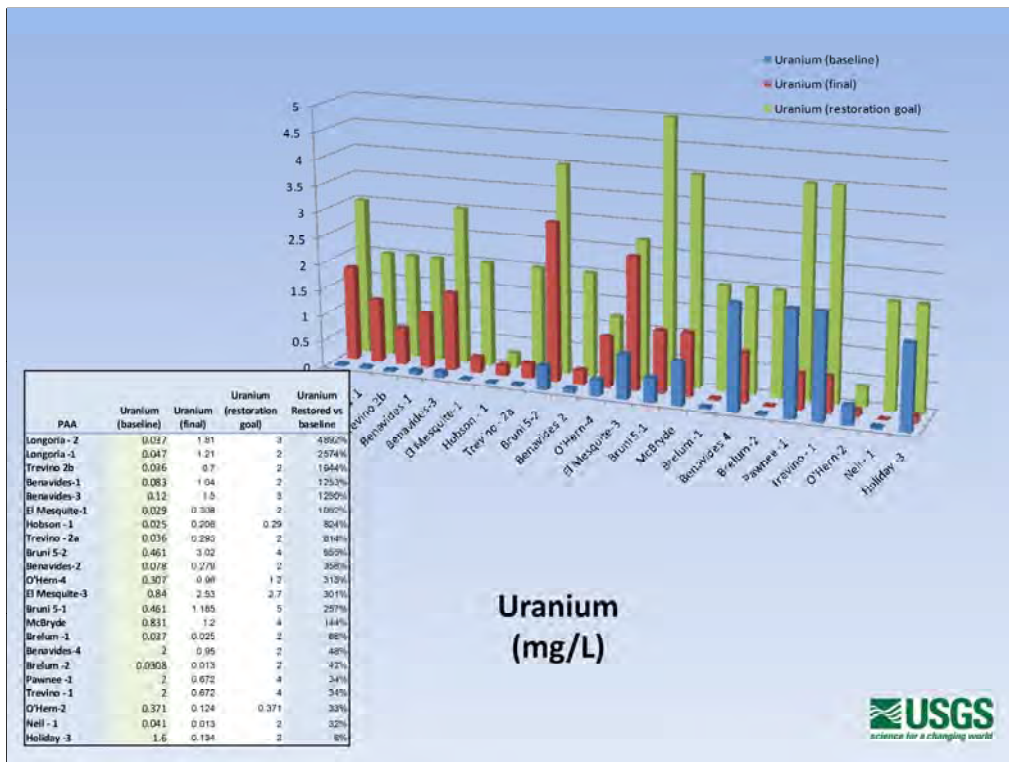
## Restoration Results for Texas PAAs

Table 7 shows the average value, post-restoration, and baseline ranges of chemical constituents for all 22 well fields that have post-restoration analyses in the TCEQ records.

In general, at PAAs where post-restoration values exceed MCL, the elements elevated in baseline values (As, Cd, Pb, Se, Ra, and U) continue to be elevated after mining.

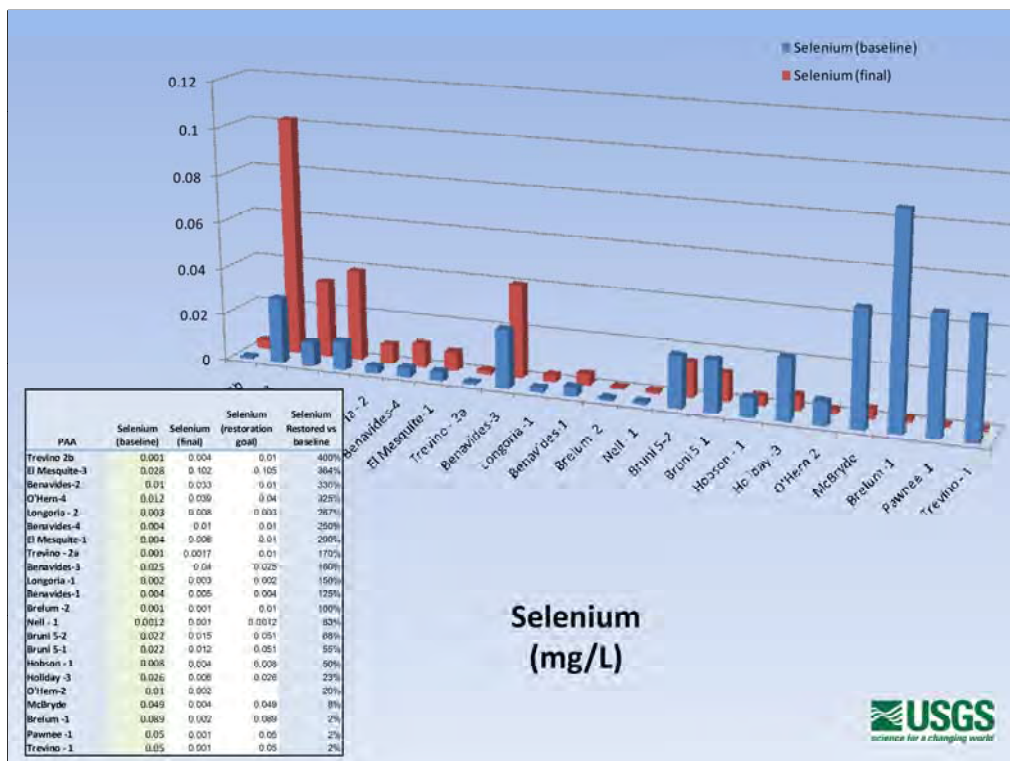
As compared to baseline values for the PAAs, uranium and selenium are elevated in the majority of PAAs. More than half of PAAs show a decrease in As, Cd, Fl, Pb, Hg, nitrate, and Ra after mining.

The following slides examine these trends in detail.



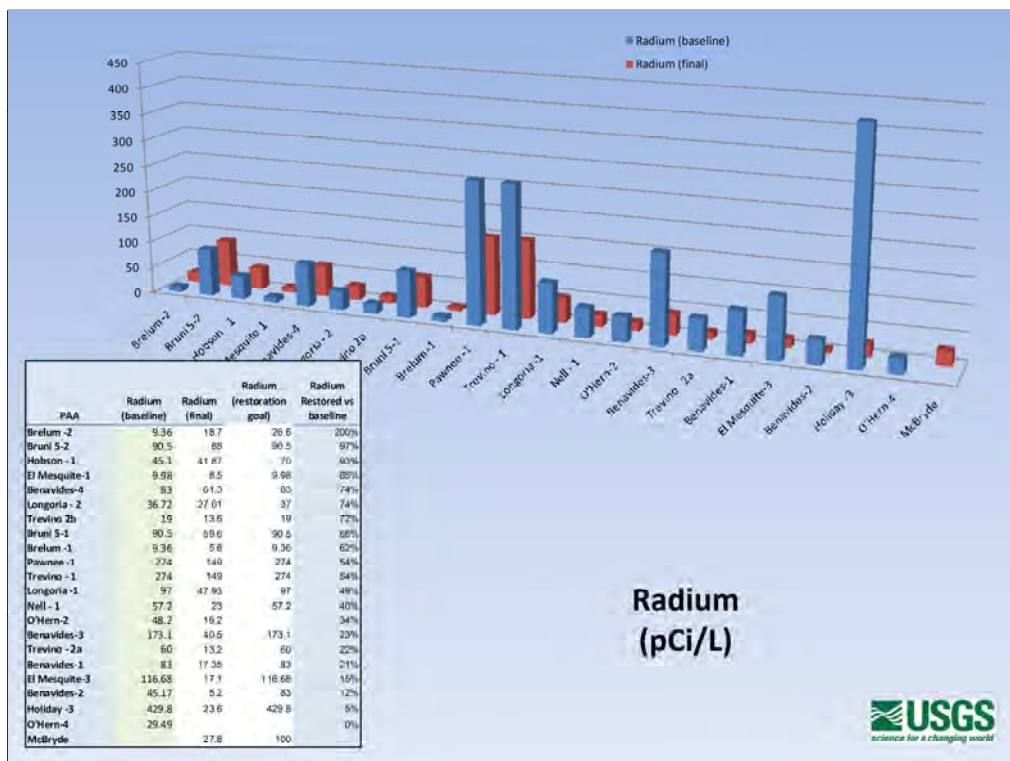
The USEPA-established MCL for uranium in drinking water is 0.03 milligram per liter. Ninety-five percent of Texas PAAs have a baseline value above MCL. Only the Hobson-1 and El Mesquite-1 PAAs were below the MCL for uranium and El Mesquite “rounded out” to equal MCL.

Eighty-six percent of Texas PAAs show a final restoration above MCL. In 68 percent of PAAs, final value exceeded baseline, and in 32 percent of PAAs, restoration was below baseline for uranium.

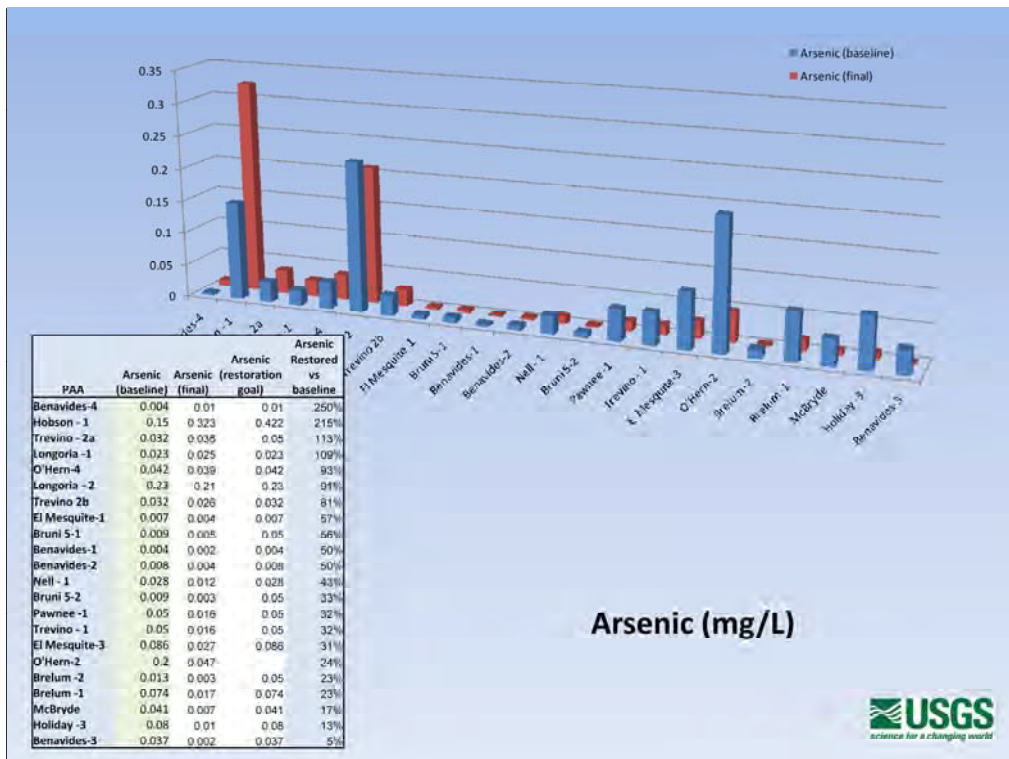


The MCL for selenium is 0.05 milligram per liter in drinking water. In 18 percent of PAAs, baseline of groundwater was above MCL, and in 24 percent of PAAs, the final restoration value was above MCL. After mining and restoration, 55 percent of PAAs exceeded baseline and 45 percent of PAAs were below baseline.



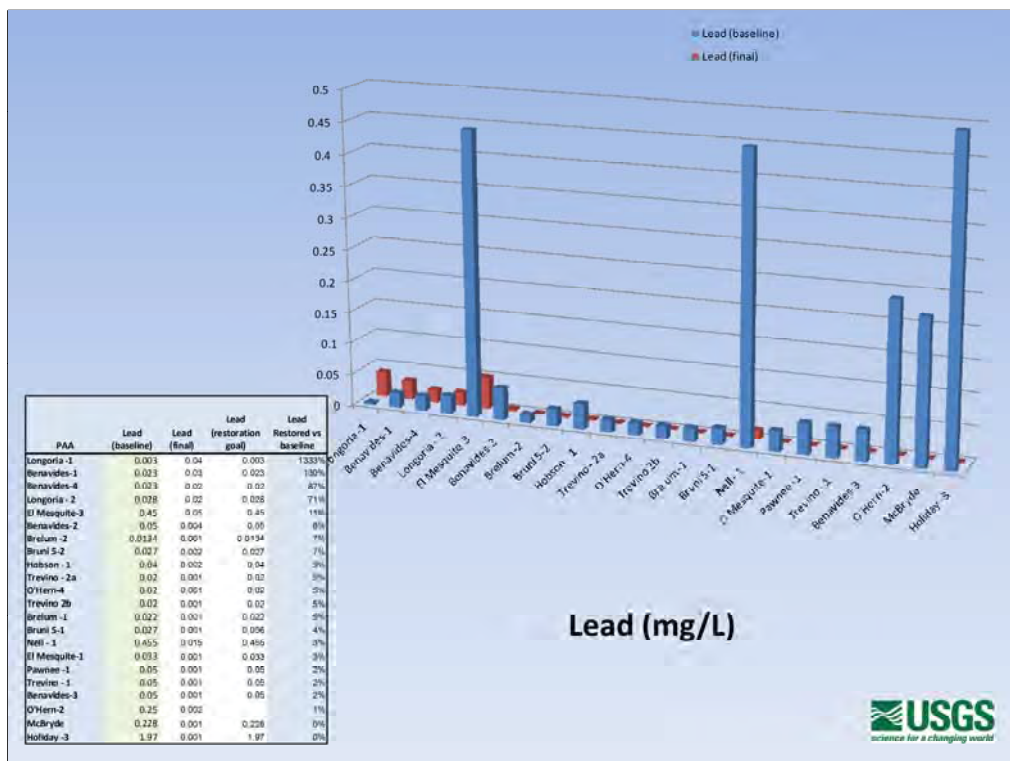


The MCL for radium ( $^{226}\text{Ra}$  and  $^{228}\text{Ra}$ ) is 5 pCi/L in drinking water. All PAAs are characterized by baseline and post-restoration radium concentrations above MCL. After mining and restoration, 4 percent of PAAs were above baseline, and 96 percent of PAAs were below baseline.



The MCL for arsenic is 0.01 milligram per liter in drinking water. Before mining, 77 percent of PAAs showed arsenic above the MCL, and after restoration 55 percent of PAAs were above the MCL.

After restoration, 18 percent of PAAs exceeded baseline and 82 percent of PAAs were below baseline.



The MCL for lead is 0.02 milligram per liter in drinking water. Eighty-one percent of PAAs have baseline levels above MCL, and 18 percent of PAAs are characterized by final restoration values above MCL.

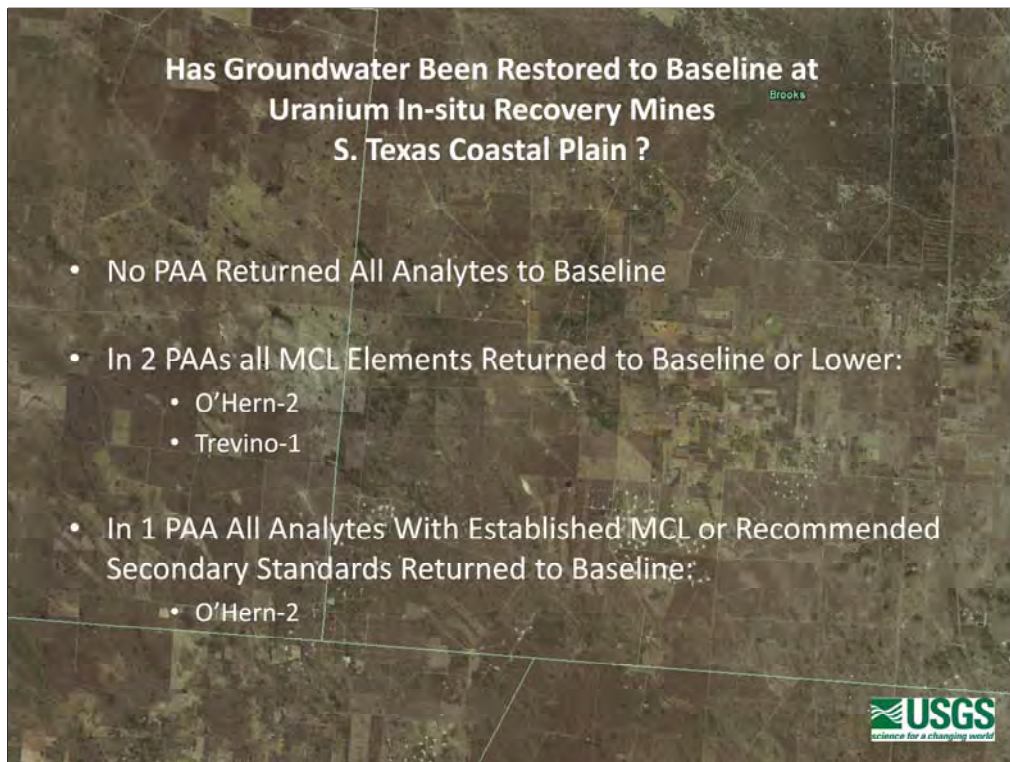
After mining and reclamation, 9 percent of PAAs were above baseline and 91 percent of PAAs were below baseline.

| Table 7: Ground-water Chemistry of Texas In-situ Uranium Production Authorization Areas<br>(22 PAAs where final analyses are available)                                                |                                              |                 |                        |                                                       |                                                                     |                                                      |                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-----------------|------------------------|-------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------|
| Analyte                                                                                                                                                                                | USEPA & TCEQ Drinking Water Standards (mg/L) | Baseline Range  | Post-Restoration Range | PAAs with Baseline Above MCL or Recommended Standards | PAAs with Post-Restoration Water Above MCL or Recommended Standards | PAAs Where Post-Restoration Analyses Exceed Baseline | PAAs Where Post-Restoration Analyses are Below Baseline |
| USEPA & TCEQ Primary Maximum Contaminant Levels (MCLs):                                                                                                                                |                                              |                 |                        |                                                       |                                                                     |                                                      |                                                         |
| Arsenic                                                                                                                                                                                | 0.01                                         | 0.04 - 0.23     | 0.02 - 323             | 77%                                                   | 55%                                                                 | 18%                                                  | 82%                                                     |
| Cadmium                                                                                                                                                                                | 0.005                                        | 0.0001 - 0.0126 | 0.0001 - 0.01          | 45%                                                   | 23%                                                                 | 27%                                                  | 73%                                                     |
| Fluoride                                                                                                                                                                               | 4                                            | 0.21 - 1.8      | 0.29 - 1.6             | 0%                                                    | 0%                                                                  | 31%                                                  | 89%                                                     |
| Lead                                                                                                                                                                                   | 0.02                                         | 0.003 - 1.97    | 0.001 - 0.05           | 81%                                                   | 18%                                                                 | 9%                                                   | 91%                                                     |
| Mercury                                                                                                                                                                                | 0.002                                        | 0.0001 - 0.445  | 0.0001 - 0.01          | 9%                                                    | 0%                                                                  | 22%                                                  | 64%                                                     |
| Nitrate                                                                                                                                                                                | 10                                           | 0.031 - 10.0    | 0.001 - 2.8            | 0%                                                    | 0%                                                                  | 4%                                                   | 96%                                                     |
| Selenium                                                                                                                                                                               | 0.05                                         | 0.001 - 0.049   | 0.001 - 0.102          | 18%                                                   | 4%                                                                  | 54%                                                  | 45%                                                     |
| Radium (226 & 228 Ra: Pci/L)                                                                                                                                                           | 5 Pci/L                                      | 9.38 - 429.8    | 5.2 - 149              | 100%                                                  | 100%                                                                | 4%                                                   | 96%                                                     |
| Uranium                                                                                                                                                                                | 0.03                                         | 0.025 - 2.0     | 0.013 - 3.02           | 95%                                                   | 86%                                                                 | 68%                                                  | 32%                                                     |
| TCEQ Secondary Recommended Standards:                                                                                                                                                  |                                              |                 |                        |                                                       |                                                                     |                                                      |                                                         |
| Sulfate                                                                                                                                                                                | 300                                          | 15.8 - 250      | 78 - 3881              | 0%                                                    | 18%                                                                 | 86%                                                  | 14%                                                     |
| Chloride                                                                                                                                                                               | 300                                          | 196.9 - 3505    | 138 - 3326             | 86%                                                   | 86%                                                                 | 22%                                                  | 78%                                                     |
| Total Dissolved Solids                                                                                                                                                                 | 1000                                         | 785.7 - 6349    | 706.3 - 6155           | 81%                                                   | 77%                                                                 | 31%                                                  | 55%                                                     |
| Iron                                                                                                                                                                                   | 0.3                                          | 0.04 - 5.49     | 0.01 - 2.7             | 54%                                                   | 9%                                                                  | 4%                                                   | 96%                                                     |
| Manganese                                                                                                                                                                              | 0.05                                         | 0.01 - 0.41     | 0.01 - 0.84            | 77%                                                   | 50%                                                                 | 40%                                                  | 60%                                                     |
| No Established MCL or Recommended/Secondary Standard:                                                                                                                                  |                                              |                 |                        |                                                       |                                                                     |                                                      |                                                         |
| Calcium                                                                                                                                                                                | -                                            | 4.13 - 241      | 14.7 - 191             |                                                       |                                                                     | 77%                                                  | 23%                                                     |
| Magnesium                                                                                                                                                                              | -                                            | 0.477 - 125     | 2.27 - 53              |                                                       |                                                                     | 72%                                                  | 28%                                                     |
| Sodium                                                                                                                                                                                 | -                                            | 200 - 2356      | 189 - 2247             |                                                       |                                                                     | 31%                                                  | 65%                                                     |
| Potassium                                                                                                                                                                              | -                                            | 6.38 - 101      | 6.1 - 70               |                                                       |                                                                     | 14%                                                  | 86%                                                     |
| Carbonate                                                                                                                                                                              | -                                            | 0.1 - 17.9      | 0 - 14.6               |                                                       |                                                                     | 50%                                                  | 30%                                                     |
| Bicarbonate                                                                                                                                                                            | -                                            | 160 - 500       | 160 - 500              |                                                       |                                                                     | 66%                                                  | 25%                                                     |
| Silica                                                                                                                                                                                 | -                                            | 16.3 - 76       | 13.4 - 77.6            |                                                       |                                                                     | 19%                                                  | 81%                                                     |
| Conductivity (umhos/cm)                                                                                                                                                                | -                                            | 1310 - 11160    | 1429 - 3697            |                                                       |                                                                     | 76%                                                  | 24%                                                     |
| Alkalinity (as CaCO3)                                                                                                                                                                  | -                                            | 134 - 349       | 145 - 408              |                                                       |                                                                     | 81%                                                  | 10%                                                     |
| Molybdenum                                                                                                                                                                             | -                                            | 0.01 - 0.2      | 0.0001 - 3.38          |                                                       |                                                                     | 42%                                                  | 54%                                                     |
| Ammonia-N                                                                                                                                                                              | -                                            | 0.01 - 7.49     | 0.04 - 120             |                                                       |                                                                     | 76%                                                  | 24%                                                     |
| Baseline and post-restoration data was available for all 22 PAAs with the exception of: Ra, Mo, K, Si, Bicarbonate, Ammonia (21), Conductivity (14), Alkalinity (11) & Carbonate (10). |                                              |                 |                        |                                                       |                                                                     |                                                      |                                                         |

Although restoration results vary widely for individual well fields, among the elements with an MCL, only selenium and uranium show overall increases in post-restoration groundwater in more than 50 percent of PAAs (Table 7). Of constituents for which secondary standards are established by the USEPA, sulfate increased in the majority of well fields after mining and restoration, whereas chloride, TDS, iron, and manganese decreased in the majority of well fields.

Of those chemical constituents for which there are no established MCLs or secondary standards, calcium, magnesium, bicarbonate, conductivity, carbonate, alkalinity and ammonia increased; sodium, potassium and silica decreased in the majority of well fields after mining and restoration. Statistically, molybdenum decreased in the small majority of well fields after mining.





Regarding the original question of whether or not groundwater has been restored to baseline in Texas uranium ISR well fields, it was observed that no well field for which final sample results were found in TCEQ records returned every element to baseline. However, two PAAs returned all elements for which USEPA has established MCLs to baseline: the O'Hern-2 and Trevino-1 PAAs.

Trevino-1, which was mined from the Oakville Sandstone and restored using electrodialysis, shows restored sulfate to 164 percent of baseline. Reclamation at O'Hern-2 returned constituents with secondary standards or MCLs to baseline values or below.

**Table 8: Baseline and Final Chemistry of Groundwater at the O'Hern PAA-2 Well Field**

| O'Hern-2<br>Groundwater Sweep and<br>Reverse Osmosis                              | Analyte      | Baseline | Final  |
|-----------------------------------------------------------------------------------|--------------|----------|--------|
| Analytes for which EPA and TCEQ<br>have set Maximum Contaminant<br>Levels         | Arsenic      | 0.2      | 0.047  |
|                                                                                   | Cadmium      | 0.01     | 0.0005 |
|                                                                                   | Fluoride     | 1.37     | 0.73   |
|                                                                                   | Lead         | 0.25     | 0.002  |
|                                                                                   | Mercury      | 0.445    | 0.0001 |
|                                                                                   | Nitrate-N    | 0.86     | 0.47   |
|                                                                                   | Selenium     | 0.01     | 0.002  |
|                                                                                   | Radium       | 48.2     | 16.2   |
|                                                                                   | Uranium      | 0.371    | 0.124  |
| Analytes for which<br>TCEQ has set<br>Secondary<br>Recommendation<br>Upper Limits | Sulfate      | 129      | 102    |
|                                                                                   | Chloride     | 254      | 220    |
|                                                                                   | TDS          | 979      | 890    |
|                                                                                   | Iron         | 3.52     | 0.02   |
|                                                                                   | Manganese    | 0.124    | 0.03   |
|                                                                                   | Ca           | 13.7     | 14.7   |
|                                                                                   | Mg           | 2.7      | 2.27   |
|                                                                                   | Na           | 310      | 289    |
|                                                                                   | K            | 9.7      | 6.6    |
|                                                                                   | Carbonate    | 1.78     | 2.6    |
|                                                                                   | Bicarbonate  | 347      |        |
|                                                                                   | Silica       | 43.7     | 35     |
|                                                                                   | Conductivity | 1626     | 1429   |
|                                                                                   | Alkalinity   |          |        |
|                                                                                   | Ammonia-N    | 0.77     | 0.3    |
|                                                                                   | Molybdenum   | 1.1      | 0.24   |



Specifically looking at restoration details from the O'Hern PAA-2 , this well field was developed by Cogema from 1979 to 1982 in the Catahoula Formation. Groundwater sweep and reverse osmosis were both used to restore groundwater after mining. Calcium and carbonate were both slightly elevated above baseline following mining and reclamation, as shown in Table 8 above.

The aquifer overlying O'Hern-2 is characterized by an average calcium of 27 milligrams per liter and carbonate of 10.1 milligrams per liter, so post-restoration elevation of these elements in the O'Hern-2 PAA seems inconsequential in the scheme of local hydrochemistry. No final values for bicarbonate or alkalinity were reported, so the specific degree to which this PAA was restored is unknown.

There is a notation in the TCEQ database that O'Hern PAA-3 did not receive any amendments. However, this could not be corroborated by TCEQ records.



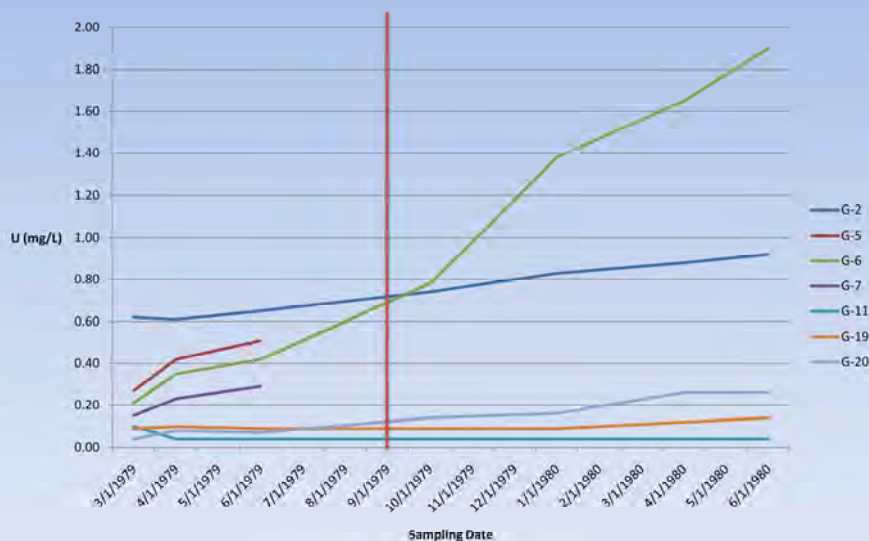
### Long-Term Stability and Natural Attenuation

In Texas, after ISR mining ceased and restoration of the well fields was completed, PAAs were monitored for a minimum of 6 months. This period of monitoring has recently been increased to one year if no amendments to the restoration table are requested, and to two years if the operator requests an amendment to the restoration table.

Some well fields monitored for longer periods of time during the post-mining and remediation stability period show trends of increasing analyte concentration, as noted by USGS geologists while examining records at pilot projects in Colorado (Grover), New Mexico (Crown Point), and throughout Wyoming.

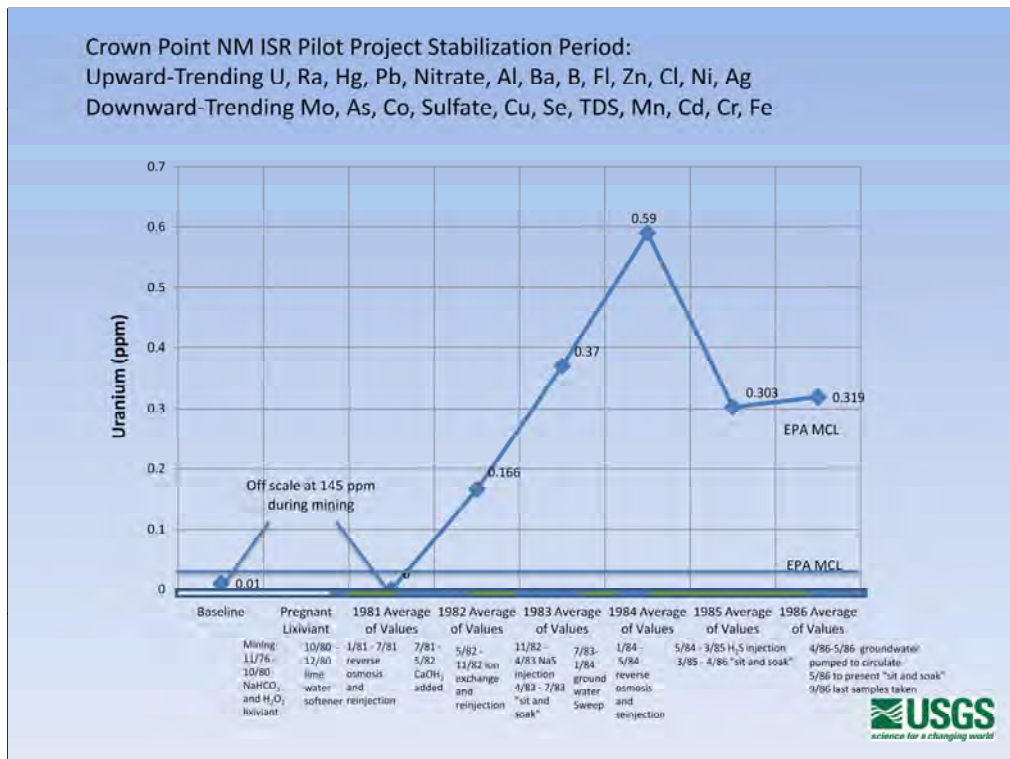
## Grover, CO -Trends Through Time:

Groundwater Not Stabilized - Increasing **Uranium**, Beta Activity, Radium, TDS, Ca, Mg, Specific Conductivity, Total Hardness, Gross Alpha, and Ammonia



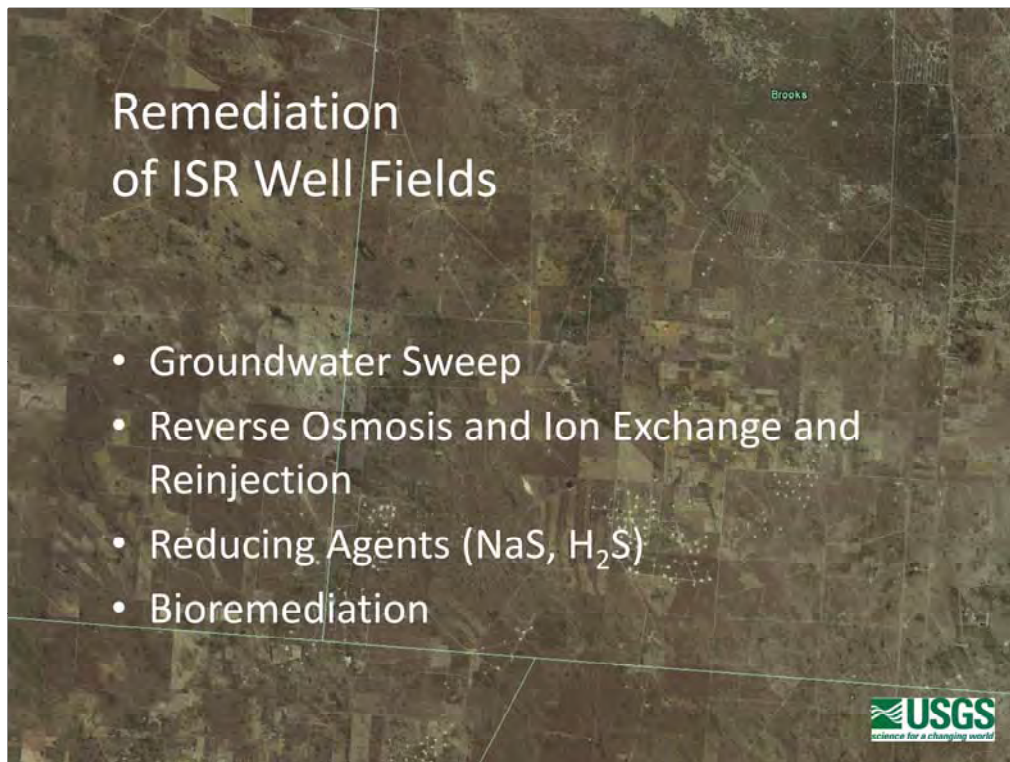
At the Grover, Colorado, pilot test site, pump and treat technologies did not return groundwater to baseline. Analysis of data collected by Colorado State regulators showed upward-trending uranium, beta activity, radium, TDS, calcium, magnesium, specific conductivity, total hardness, gross alpha, and ammonia. Results from individual wells differentiated using solid colored lines are shown above in the time series plot of uranium concentration. Note that the vertical red line indicates the end of the 6-month stabilization period required for Texas PAAs. These increasing concentrations of analytes indicate groundwater may not have stabilized when the Grover well field was released.





During the one-year stabilization period that followed restoration at Mobil's Crown Point, New Mexico ISR pilot project, both upward and downward trends in various chemical constituents were noted (Mobil, 1981). The Crown Point data are not detailed enough to analyze these trends, but the data indicate that groundwater may not have stabilized when the final samples were collected, similar to the Grover, Colorado, project.

Examples from Grover, Colorado, Crown Point, New Mexico, and ISR pilot projects in Wyoming indicate that the 6-month stability period mandated by Texas ISR rules may not have been long enough to adequately determine if groundwater in well fields had stabilized. Recent rule changes in Texas allow for longer term monitoring and could yield valuable data about the chemical stability of groundwater after ISR mining.



### Effectiveness of Restoration Techniques

After mining has ceased, a restoration method called groundwater sweep can be used whereby groundwater in a mined aquifer is pumped from the well field either to a deeper aquifer, an adjacent well field where mining is being initiated, or to surface ponds where it is allowed to evaporate. Local groundwater then “sweeps in” to replace the displaced water. This is typically the first method of restoration applied to a well field (Mays, 1994).

Reverse osmosis and ion exchange are methods of removing contaminants from groundwater in well fields. The cleaned water is then reinjected into the well fields (Mays, 1994).

Reducing agents (H, NaS and H<sub>2</sub>S) have been added to well-field groundwater in an attempt to return groundwater and host rocks to reducing conditions, thereby reversing the effects of oxidizing mining solutions (lixiviants) within the aquifer.

Bioremediation, the stimulation of native bacteria within the aquifer whose life processes fix metals from solution, is another remediation technique currently receiving much attention (Long and others, 2008).

| Table 9: Elements with USEPA and TECQ Primary Maximum Contaminant Levels Restored vs. Baseline for Texas Well Fields With Known Restoration Methods |                     |         |         |          |       |         |           |          |        |         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------|---------|----------|-------|---------|-----------|----------|--------|---------|
| PAA                                                                                                                                                 | Restoration Method  | Arsenic | Cadmium | Fluoride | Lead  | Mercury | Nitrate-N | Selenium | Radium | Uranium |
| Hobson - 1                                                                                                                                          | GW Sweep Only       | 215%    | 1%      | 134%     | 5%    | 16%     | 9%        | 50%      | 93%    | 824%    |
| Longoria - 1                                                                                                                                        | GW Sweep Only       | 109%    | 10000%  | 98%      | 1333% | 333%    | 34%       | 150%     | 49%    | 2574%   |
| Longoria - 2                                                                                                                                        | GW Sweep Only       | 91%     | 10000%  | 82%      | 71%   | 333%    | 22%       | 267%     | 74%    | 4892%   |
| McBryde                                                                                                                                             | GW Sweep Only       | 17%     | 6%      | 50%      | 0%    | 10%     | 56%       | 8%       |        | 144%    |
| Average for GW Sweep Only                                                                                                                           |                     | 108%    | 5002%   | 91%      | 353%  | 173%    | 30%       | 119%     | 72%    | 2109%   |
| Benavides-4                                                                                                                                         | RO                  | 250%    | 3333%   | 77%      | 87%   | 100%    | 3%        | 250%     | 74%    | 48%     |
| Bruni 5-1                                                                                                                                           | RO                  | 56%     | 2%      | 143%     | 4%    | 11%     | 15%       | 55%      | 66%    | 257%    |
| Bruni 5-2                                                                                                                                           | RO                  | 33%     | 4%      | 155%     | 7%    | 11%     | 22%       | 68%      | 97%    | 655%    |
| O'Hern-4                                                                                                                                            | RO                  | 93%     | 91%     | 63%      | 5%    | 13%     | NR        | 325%     | NR     | 313%    |
| Average for RO only                                                                                                                                 |                     | 108%    | 858%    | 110%     | 26%   | 34%     | 13%       | 175%     | 79%    | 318%    |
| El Mesquite-1                                                                                                                                       | RO and Ion Exchange | 57%     | 17%     | 117%     | 3%    | 50%     | 22%       | 200%     | 85%    | 1062%   |
| El Mesquite-3                                                                                                                                       | RO and Ion Exchange | 31%     | 83%     | 74%      | 11%   | 40%     | 19%       | 364%     | 15%    | 301%    |
| Holiday -3                                                                                                                                          | RO and Ion Exchange | 13%     | 200%    | 94%      | 0%    | 100%    | 53%       | 23%      | 5%     | 8%      |
| Average for RO and ion exchange                                                                                                                     |                     | 34%     | 100%    | 95%      | 5%    | 63%     | 31%       | 196%     | 35%    | 457%    |
| Brelum -1                                                                                                                                           | GW Sweep and RO     | 23%     | 6%      | 107%     | 5%    | 10%     | 3%        | 2%       | 62%    | 68%     |
| Brelum -2                                                                                                                                           | GW Sweep and RO     | 23%     | 1%      | 97%      | 7%    | 11%     | 5%        | 100%     | 200%   | 42%     |
| O'Hern-2                                                                                                                                            | GW Sweep and RO     | 24%     | 5%      | 53%      | 1%    | 0%      | 55%       | 20%      | 34%    | 33%     |
| Average for GW Sweep and RO                                                                                                                         |                     | 23%     | 4%      | 86%      | 4%    | 7%      | 21%       | 41%      | 99%    | 48%     |
| Trevino - 1                                                                                                                                         | Electrodialysis     | 32%     | 1%      | 82%      | 2%    | 5%      | 5%        | 2%       | 54%    | 34%     |
| Trevino - 2a                                                                                                                                        | Electrodialysis     | 113%    | 1%      | 83%      | 5%    | 33%     | 6%        | 170%     | 22%    | 814%    |
| Trevino 2b                                                                                                                                          | Electrodialysis     | 81%     | 1%      | 81%      | 5%    | 33%     | 19%       | 400%     | 72%    | 1944%   |
| Average for Electrodialysis                                                                                                                         |                     | 75%     | 1%      | 82%      | 4%    | 24%     | 10%       | 191%     | 49%    | 931%    |

## Pump and Treat Technology

Texas provides a database that can be used to examine the effectiveness of the “pump and treat” technologies of groundwater sweep, reverse osmosis, ion exchange, and electrodialysis. Historically, pump and treat techniques were the only restoration techniques used in ISR mines developed in Texas.

Uranium in groundwater is 2,109 percent of baseline in well fields using groundwater sweep only, yet is 48 percent of baseline when groundwater sweep is combined with reverse osmosis (Table 9). Similar trends are shown for arsenic, cadmium, lead, mercury, and selenium. Trends for fluoride and nitrate are not as clear.

Analysis of patterns in Texas PAAs show restoration using groundwater sweep coupled with reverse osmosis results in the greatest decrease in concentration of chemical constituents. These coupled techniques are commonly used in many well-field restoration projects nationwide.



**Table 10: Summary of ISR Mines Where Chemical Reduction Was Used to Remediate Groundwater**

| Type of Reductant | Sites                                                       | Pros                               | Cons                                                                                                                                                               |
|-------------------|-------------------------------------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| H <sub>2</sub> S  | Smith Ranch, Irigaray and Collins Draw, WY; Crown Point, NM | Good Reducer                       | Volatile, difficult to use, mixed results, well clogging                                                                                                           |
| Na <sub>2</sub> S | Crown Point, NM; Highland, WY                               | Less expensive than bioremediation | Overall mixed results, likely doesn't have reducing capacity necessary to effect any noticeable improvement in groundwater quality, may produce transitory effects |
| H <sub>2</sub>    | Kingsville Dome, TX                                         | Good Reducer                       | 2009 pilot project, results not yet available                                                                                                                      |



## Chemical Reduction

Inorganic chemical reductants are designed to reverse the effects of oxidizing lixiviant solutions on host rock and groundwater. Overall, these techniques when used in remediation of U.S. ISR mines, show mixed results (Table 10). Crown Point and Irigaray did not appear to significantly benefit from the addition of reductants into groundwater at the levels applied (LQD/DEQ Response Document, 2005; Mobil, 1981). Uranium Resources International is completing a pilot project in Texas to test the restoration effectiveness of hydrogen gas in removing analytes from groundwater (M. Pelliza, oral commun., May 2009). Results of this study are not yet available.



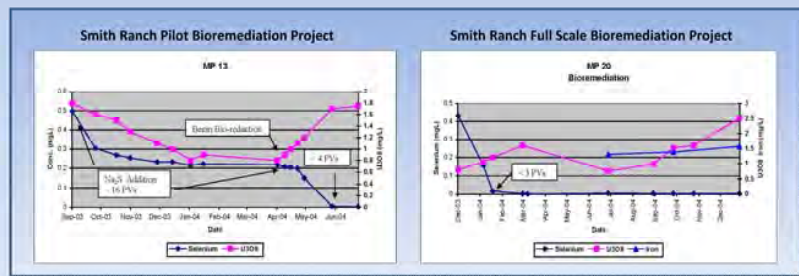
# Bioremediation

## Crow Butte, NE

- Jan. 2009: Emulsified oil substrate added to six production wells in Mine Unit 4 after groundwater sweep, ion exchange

## Smith Ranch, WY

- 2003 – Methanol and molasses (Highland Well field B)
- Selenium rapidly to non-detection levels, uranium shows upward trend

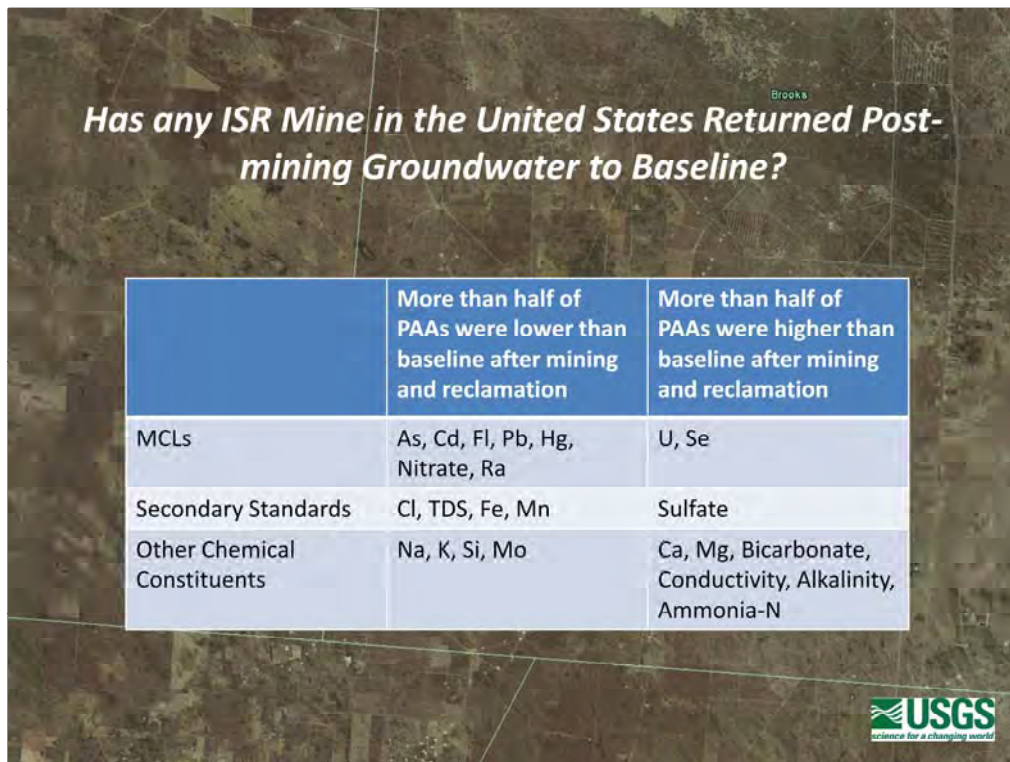


## Bioremediation

Nutrients, such as acetate, methanol, and molasses, can be added to groundwater as a food source to stimulate native bacteria populations. As bacteria populations rise in response to increased food, metal concentrations decrease in groundwater; however the exact mechanism is uncertain.

In January 2009, an emulsified oil substrate was added to 6 production wells at the Crow Butte ISR mine as part of remediation of groundwater in Mine Unit 4 (NDEQ, 2009). The first 4 months of preliminary results do not show a significant reduction in uranium. At a Smith Ranch/Highland ISR remediation project in 2003, methanol and molasses were added to wells in the Highland B well field, first as a pilot project following chemical reduction ( $\text{Na}_2\text{S}$ ) and then in a full-scale remediation project without prior chemical reduction (Reimann and Huffman, 2005). Selenium in groundwater was rapidly reduced in both the pilot (MP13) and full-scale (MP20) fields, although uranium concentration initially increased (see graphs above). Uranium increases noted in groundwater after bioremediation had been initiated may be attributable to the dissolution of iron oxyhydroxides and the concomitant release of their contained uranium in response to increasingly reducing conditions created during bioremediation (Reimann and Huffman, 2005). In subsequent bioremediation projects at Smith Ranch, cheese whey coupled with methanol has been used as a biostimulant.

The USGS continues to gather and process records from State agencies to track the effectiveness of these bioremediation methods.



## Conclusions

Can we answer the question: “Has any ISR mine in the United States returned post-mining groundwater to baseline?”

Answer: Not based upon analysis of the Texas database because “final value” records were found for only 22 of 77 PAAs (13 of 36 mines).

We can conclude that in Texas, ISR mines are characterized by high baseline arsenic, cadmium, lead, selenium, radium, and uranium. After mining and restoration, for those well fields that reported “final values” in TCEQ records, more than half of the PAAs had lowered levels of many elements, including some that dropped below MCL.

Of those elements for which MCL is established, the majority of PAAs showed increases in uranium and selenium after mining and restoration and decreases in arsenic, cadmium, fluoride, lead, mercury, nitrate, and radium to below baseline for the majority of well fields.

Analytes for which secondary standards have been established show that sulfate is the only constituent that increased in the majority of well fields after mining and remediation, whereas chloride, TDS, iron, and manganese decreased. Chemical constituents for which no MCL or secondary standards were set are higher than baseline for calcium, magnesium, bicarbonate, conductivity, alkalinity, and ammonia. Sodium, potassium, silica, and molybdenum were lower than baseline in the majority of well fields after mining and remediation.

For More Information Contact:

Susan Hall  
U.S. Geological Survey  
Central Energy Resources Science Center  
Box 25046, MS 939  
Denver, CO 80225

[susanhall@usgs.gov](mailto:susanhall@usgs.gov)  
303-236-1656

## References Cited

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**From:** [Jeffery C. Parsons](#)  
**To:** [Shea, Valois](#)  
**Cc:** ["Roger Flynn"](#)  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments#8  
**Date:** Monday, June 19, 2017 5:39:24 PM  
**Attachments:** [AE Evaluation Form.doc](#)  
[AOR ZOI Aq Ex Drawing.pdf](#)  
[AOR ZOI Definitions changes in version 4.doc](#)  
[AOR ZOI Definitions changes.doc](#)  
[AOR ZOI Definitions v2 6 10 2008.doc](#)  
[AOR ZOI Definitions v3 6 20 2008.doc](#)  
[AOR ZOI Definitions v4 7 8 2008.doc](#)  
[AOR ZOI Definitions.doc](#)  
[AOR ZOI Dfns\\_edgar's comments.doc](#)  
[AORZOIDefinitions26112008.doc](#)

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Email #8

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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**From:** Jeffery C. Parsons [mailto:[wmap@igc.org](mailto:wmap@igc.org)]  
**Sent:** Monday, June 19, 2017 3:47 PM  
**To:** [shea.valois@epa.gov](mailto:shea.valois@epa.gov)  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #7

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:45 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>

**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #6

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:43 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #5

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:39 PM  
**To:** [shea.valois@epa.gov](mailto:shea.valois@epa.gov)  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #4

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project

P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738  
\*\*\*\*\*

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:38 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

\*\*\*\*\*  
Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738  
\*\*\*\*\*

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:37 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #2

\*\*\*\*\*  
Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738  
\*\*\*\*\*

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:36 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>

**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>

**Subject:** Oglala Sioux Tribe Comment Attachments

Ms. Shea – in support of the comments submitted this day (June 19, 2017) by the Oglala Sioux Tribe, attached are supplemental documents. As there are several such documents, there are likely to be a series of emails to follow. Thank you.

\*\*\*\*\*

Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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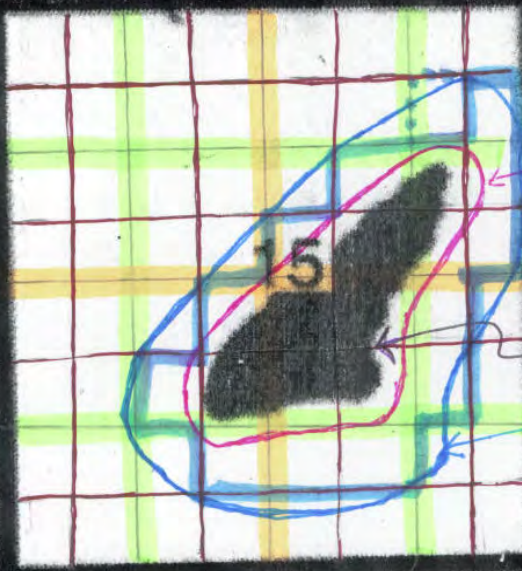


3

- $\frac{1}{4}$   $\frac{1}{4}$   $\frac{1}{4}$  section (660)
- $\frac{1}{4}$   $\frac{1}{4}$  section (1320)
- $\frac{1}{4}$  section (2640)

9

10



— aquifer exemption boundary

— monitor well ring

14

— zone of influence

— 120 day time of travel boundary

22

## **Discussion of Zone of Influence, Area of Review, and the Aquifer Exemption Boundary for Class III Injection Wells used for the In-Situ Leaching (ISL) of Uranium**

**Introduction:** The purpose of this discussion is to provide information about the proposed criteria the EPA Region 8 UIC program will use to evaluate acceptable locations for the Area of Review and an aquifer exemption boundary ~~proposed~~requested by the permit applicant in UIC Class III injection well permit applications for in-situ mining of uranium. This document also explains how the concepts of the Area of Review and zone of endangering influence will be applied to Class III injection well permit applications.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a ~~location~~line circumscribing the minimum area that allows full extraction of the ore proposed in the mining plan and restoration of the area affected by lixiviant flow within the subsurface, without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. The criteria EPA Region 8 will use for evaluating the placement of the aquifer exemption boundary will be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the ~~monitor~~monitoring well ring.

The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

This document also includes proposed permit requirements, including response actions, when excursions occur.

**Background Information:** The method for determining Area of Review around an injection well or injection project area is defined in 40 CFR 146.3 as "the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06." Regulation 146.06 states that the "Area of Review for each injection well or each field, project or area ...shall be determined..." using the zone of endangering influence calculation in 146.06(a) or a fixed radius according to 146.06(b). (Specific regulations are located at the end of this document for reference.)

In the regulations, the zone of endangering influence for a single injection well is the radius encompassing the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water. For an area permit, the zone of endangering influence includes the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

Regulation 40 CFR 146.4 states that criteria for EPA to use in determining the aquifer exemption area for an ISL mining project is the portion of the aquifer that is mineral producing, or can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that are expected to be commercially producible based on quantity and location.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a location that allows the mining operation to fully extract the ore and restore the area affected by the flow of lixiviant within the subsurface without having the chemical effects of

the lixiviant reach beyond the aquifer exemption boundary. Hydrologic modeling should be used to demonstrate that the entire area within the aquifer exemption boundary is required to meet these criteria. The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

For the purposes of this discussion, the term "project area" used in reference to the Area of Review above, is considered to be equivalent to the area where lixiviant is moving within the subsurface. The project area contains the wellfields and the surrounding "flare" of lixiviant around the wellfields. The project area will be delineated in the permit application with reference to the commercially producible portion of the ore body. Justification should be based on reasonable market projections of uranium price fluctuations over the life of the mine. In the following discussion, the aquifer exemption boundary will be determined based on a distance relative to the project area and the ~~monitor~~ monitoring well ring around the project area.

**Discussion:** The intent of the Area of Review in the regulations is to set a boundary around an area that will be thoroughly investigated to locate any potential breaches in the confining zones above and below the proposed injection interval, and to perform corrective action, if needed, to mitigate those breaches so injectate cannot move up or down into another aquifer.

The intent of the zone of endangering influence in the regulations is to determine the farthest distance away from the injection well or project area that the pressure effect of injection activity is anticipated to reach over the life of the injection well or project area. In the case of ISL injection wells, the overall effect of injection and recovery in ISL well fields is a groundwater flow gradient directed toward the project area. The zone of endangering influence calculation in the regulations is not appropriate for an in-situ mining project, because the formula applies to injection wells that only inject, with no extraction taken into account.

For this reason, the Area of Review boundary for an ISL project should not be equivalent to the zone of endangering influence. Instead of a zone of endangering influence, the concept of importance for Class III injection wells used for in-situ mining is the area chemically affected by injection. The term "project area" described above will be applied to the area within the subsurface where lixiviant is causing chemical changing within the subsurface. The project area is limited to the area of lixiviant flow under normal operating conditions, i.e. where lixiviant flow is being controlled by proper balancing of injection rates and recovery rates within the wellfields. (The project area does not include excursions, where the flow of lixiviant is not considered to be under direct control.)

The aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and the area around the ore body where the lixiviant is expected to travel during mining of the ore deposits and post-mining aquifer restoration. It is important to minimize the extent of the area inside the aquifer exemption boundary, because it is forever exempted from protection under the UIC Program, specifically the provisions of 144.12.

**Proposal:** In the permit application and aquifer exemption request, the permittee identifies the location of the monitoring well ring around the project area, and proposes an Area of Review boundary and an aquifer exemption boundary. The aquifer exemption boundary may be located at some distance outside the monitoring well ring, but no further out than the Area of Review boundary. Because the aquifer exemption boundary is the area within

which mining-related contaminants are allowed to move, the area should be subject to Area of Review requirements.

Monitoring well Ring: The ~~location of the~~ monitoring well ring should be placed at some distance beyond the project area to detect any excursions of lixiviant outside the project area and allow recovery of excursions within a reasonable amount of time. The ~~monitor~~ monitoring well ring location may be set a fixed distance beyond the project area. The permit application should include ~~a discussion of estimations of~~

- ☐ how long it will take an excursion to reach the ~~monitor~~ monitoring well ring ~~and,~~
- ☐ ~~based on sampling frequency,~~ how far an excursion could potentially flow before it is detected at the monitoring well ring, and
- ☐ ~~how~~ long it will take to recover an excursion detected at the ~~monitor~~ monitoring well ring.

This information will be considered in evaluating the proposed location of the aquifer exemption boundary.

~~The Area of Review should be set at least as far away from the project area as the proposed aquifer exemption boundary.~~ Within the Area of Review, the permittee will investigate the need for corrective action and perform corrective action as needed. The Area of Review boundary may be set at the aquifer exemption boundary or at some distance beyond the aquifer exemption boundary. The location of the boundary should be justified using hydrologic modeling of worse case scenario excursions, taking into account these factors stated in the regulations:

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*...the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.*

The permit application should include a discussion of how the Area of Review was determined, including pertinent hydrologic modeling results that support the proposed boundary locations. The discussion should also include how applicable factors in the paragraph above were taken into consideration.

#### **Concept for locating the Aquifer Exemption boundary**

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The aquifer exemption request is included as part of the permit application. The permittee submits a proposed aquifer exemption boundary that is placed at some distance outside the project area ~~based on the following considerations:~~

Excursion recovery. Because the ~~monitor~~ monitoring well ring is the first place where the presence of an excursion is detected, the aquifer exemption boundary should be placed at some distance beyond the ~~monitor~~ monitoring well ring that will allow a reasonable time for an excursion detected at the ~~monitor~~ monitoring well ring to be recovered before it crosses the aquifer exemption boundary. ~~The determination should be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitoring well ring.~~

Hydrologic modeling. Hydrologic modeling should be used to verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent ~~and for groundwater restoration within the affected are after completion of mining.~~

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Justification for the position of the aquifer exemption boundary should be included in the aquifer exemption request. The justification should include hydrologic modeling results,

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information on variability of flow rates in different directions within the aquifer, and an estimation of how long it would take an excursion to reach the aquifer exemption boundary.

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#### **Permit Requirements for Delineating Extent of Excursion**

When an excursion is detected at the monitoring well ring, the permit will require the permittee to verify that the excursion has not reached the aquifer exemption boundary. Upon detecting an excursion at the monitoring well ring, the permit will require the installation of excursion response wells that would intercept the excursion plume before it reaches the aquifer exemption boundary. The placement of the response wells will be based on hydrologic modeling and at a location far enough ahead of the excursion front, that the excursion plume will not have reached the excursion response well locations by the time the wells are installed, sampled, and analytical results received. - Sampling of the excursion response wells will continue for a long enough period of time after the excursion is controlled to verify that the plume never reaches them based on hydrologic modeling. Duration and frequency for sampling the response wells will be based on the travel time of the excursion. If the excursion goes beyond the aquifer exemption boundary, the permit will require verification that the plume has been pulled back within the aquifer exemption boundary. More frequent sampling of the monitoring ring wells will be required until the excursion has been pulled back in.

**Definitions in regulations for reference:**

**144.3 and 146.3 Definitions**

**Area of Review** means the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.

**Contaminant** means any physical, chemical, biological, or radiological substance or matter in water.

**Underground source of drinking water (USDW)** means an aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
- (A) Currently supplies drinking water for human consumption; or
- (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

**§ 146.6 Area of Review.**

The Area of Review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section.

(a) Zone of endangering influence.

(1) The zone of endangering influence shall be:

- (i) In the case of application(s) for well permit(s) under §144.31 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or
- (ii) In the case of an application for an area permit under §144.33, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. *[equation and parameter list not included here]*

(b) Fixed radius. (1) In the case of application(s) for well permit(s) under §144.31 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §144.31 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.

In determining the fixed radius, the following factors shall be taken into consideration:

Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the Area of Review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1/4) mile.

#### **146.4 Criteria for exempted aquifers.**

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in §146.3 may be determined under 40 CFR 144.8 to be an "exempted aquifer" if it meets the following criteria:

- (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 can be demonstrated by a permit applicant as 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.

#### **144.12 Prohibition of movement of fluid into underground sources of drinking water.**

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146 [*I take that to mean aquifer exemption under 146.4*], the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated.

## Discussion of Zone of Influence, Area of Review, and the Aquifer Exemption Boundary for Class III Injection Wells used for the In-Situ Leaching (ISL) of Uranium

**Introduction:** The purpose of this discussion is to provide information about the proposed criteria the EPA Region 8 UIC program will use to evaluate acceptable locations for the Area of Review and an aquifer exemption boundary proposed in UIC Class III injection well permit applications for in-situ mining of uranium. This document also explains how the concepts of the Area of Review and zone of endangering influence will be applied to Class III injection well permit applications.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a location that allows full extraction of the ore proposed in the mining plan and restoration of the area affected by lixiviant flow within the subsurface, without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. The criteria EPA Region 8 will use for evaluating the placement of the aquifer exemption boundary will be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitor well ring.

The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

**Background Information:** The method for determining Area of Review around an injection well or injection project area is defined in 40 CFR 146.3 as "the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06." Regulation 146.06 states that the "Area of Review for each injection well or each field, project or area ...shall be determined..." using the zone of endangering influence calculation in 146.06(a) or a fixed radius according to 146.06(b). (Specific regulations are located at the end of this document for reference.)

In the regulations, the zone of endangering influence for a single injection well is the radius encompassing the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water. For an area permit, the zone of endangering influence includes the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

Regulation 40 CFR 146.4 states that criteria for EPA to use in determining the aquifer exemption area for an ISL mining project is the portion of the aquifer that is mineral producing, or can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that are expected to be commercially producible based on quantity and location.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a location that allows the mining operation to fully extract the ore and restore the area affected by the flow of lixiviant within the subsurface without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. Hydrologic modeling should be used to demonstrate that the entire area within the aquifer exemption boundary is required to meet these criteria. The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically



possible, and to minimize the area that will need to be restored upon the completion of mining.

For the purposes of this discussion, the term "project area" used in reference to the Area of Review above is defined as the wellfield locations considered to be equivalent to the area where injection is occurring, lixiviant is moving within the subsurface. The project area contains the wellfields and the surrounding "flare" of lixiviant around the wellfields. The project area will be delineated in the permit application with reference to the commercially producible portion of the ore body. Justification should be based on reasonable market projections of uranium price fluctuations over the life of the mine. In the following discussion, the aquifer exemption boundary will be determined based on a distance relative to the project area and the monitor well ring around the project area.

**Discussion:** The intent of the Area of Review in the regulations is to set a boundary around an area that will be thoroughly investigated to locate any potential breaches in the confining zones above and below the proposed injection interval, and to perform corrective action, if needed, to mitigate those breaches so injectate cannot move up or down into another aquifer.

The intent of the zone of endangering influence in the regulations is to determine the farthest distance away from the injection well or project area that injectate the pressure effect of injection activity is anticipated to reach over the life of the injection well or project area. In the case of ISL injection wells, the overall effect of injection and recovery in ISL well fields is a groundwater flow gradient directed toward the project area. The zone of endangering influence calculation in the regulations is not appropriate for an in-situ mining project, because the formula applies to injection wells that only inject, with no extraction taken into account.

For an ISL project this reason, the Area of Review boundary for an ISL project should not be equivalent to the zone of endangering influence. For Class III injection wells used for in-situ mining, the zone of endangering influence is equivalent to the project area, the injection and recovery wells within the wellfields where the lixiviant is moving within the aquifer. Instead of a zone of endangering influence, the concept of importance for Class III injection wells used for in-situ mining is the area chemically affected by injection. The term "project area" described above will be applied to the area within the subsurface where lixiviant is causing chemical changing within the subsurface. The project area is limited to the area of lixiviant flow under normal operating conditions, i.e. where lixiviant flow is being controlled by proper balancing of injection rates and recovery rates within the wellfields. (The project area does not include excursions, where the flow of lixiviant is not considered to be under direct control.)

The aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and the area around the ore body where the lixiviant is expected to travel during mining of the ore deposits and post-mining aquifer restoration. It is important to minimize the extent of the area inside the aquifer exemption boundary, because it is forever exempted from protection under the UIC Program, specifically the provisions of 144.12.

**Proposal:** In the permit application and aquifer exemption request, the permittee identifies the location of the monitoring well ring around the project area, and proposes an Area of Review boundary and an aquifer exemption boundary. The aquifer exemption boundary may be located at some distance outside the monitoring well ring, but no further out than the Area of Review boundary. Because the aquifer exemption boundary is the area within

which mining-related contaminants are allowed to move, the area should be subject to Area of Review requirements.

The location of the monitoring well ring should be placed at some distance beyond the project area to detect any excursions of leachate outside the project area and allow recovery of excursions within a reasonable amount of time. The monitor well ring location may be set a fixed distance beyond the project area. The permit application should include a discussion of how long it will take an excursion to reach the monitor well ring and how long it will take to recover an excursion detected at the monitor well ring. This information will be considered in evaluating the proposed location of the aquifer exemption boundary.

The Area of Review should be set at least as far away from the project area as the proposed aquifer exemption boundary. Within the Area of Review, the permittee will investigate the need for corrective action and perform corrective action as needed. The Area of Review boundary may be set at the aquifer exemption boundary or at some distance beyond the aquifer exemption boundary. The location of the boundary should be justified using hydrologic modeling of worst case scenario excursions, taking into account these factors stated in the regulations:

*...the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.*

The permit application should include a discussion of how the Area of Review was determined, including pertinent hydrologic modeling results that support the proposed boundary locations. The discussion should also include how applicable factors in the paragraph above were taken into consideration.

#### **Concept for locating the Aquifer Exemption boundary**

The aquifer exemption request is included as part of the permit application. The permittee submits a proposed aquifer exemption boundary that is placed at some distance outside the project area. Because the monitor well ring is the first place where the presence of an excursion is detected, the aquifer exemption boundary should be placed at some distance beyond the monitor well ring that will allow a reasonable time for an excursion detected at the monitor well ring to be recovered before it crosses the aquifer exemption boundary. Hydrologic modeling should be used to verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent.

Calculation for the distance from the project area that the aquifer exemption boundary should be placed is based on the rate of flow of the aquifer in any given direction under natural conditions. The aquifer exemption boundary should be placed at a distance from the project area that an excursion would reach within 90 days of being detected at the monitoring well ring. The 90-day time of travel should be calculated using the rate of flow of the aquifer under natural conditions in the direction the excursion is traveling. The justification for placement of the aquifer exemption boundary should also include an estimate of how many days it would take an excursion to move outside of the project area before it is detected at the monitoring well ring. In approving the proposed aquifer exemption boundary, EPA will take into consideration the distance the monitoring well ring is located outside the project area and the rate of groundwater flow as it varies with direction within the aquifer. The each aquifer exemption boundary will be approved on a case-by-case basis, with the preferred boundary location being no greater than 120 days of travel time from the project area request. The justification should include hydrologic modeling results, information on variability of flow rates in different directions

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within the aquifer, and how long it would take an excursion to reach the aquifer exemption boundary.

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#### **Permit Requirements for Delineating Extent of Excursion**

When an excursion is detected at the monitoring well ring, the permit will require the permittee to verify that the excursion has not reached the aquifer exemption boundary. Upon detecting an excursion at the monitoring well ring, the permit will require the installation of response wells that would intercept the excursion plume before it reaches the aquifer exemption boundary. The placement of the response wells will be based on hydrologic modeling and at a location far enough ahead of the excursion front, that the excursion plume will not have reached the response well locations by the time the wells are installed, sampled, and analytical results received. ~~The 120-day travel time has been established to allow the permittee enough time to mobilize a drill rig, install, develop, and sample the response wells, and to obtain analytical results of the well samples before the excursion passes out of the aquifer exemption area.~~

Duration and frequency for sampling the response wells will be based on the travel time of the excursion.

**Definitions in regulations for reference:**

**144.3 and 146.3 Definitions**

**Area of Review** means the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.

**Contaminant** means any physical, chemical, biological, or radiological substance or matter in water.

**Underground source of drinking water (USDW)** means an aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
- (A) Currently supplies drinking water for human consumption; or
- (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

**§ 146.6 Area of Review.**

The Area of Review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section.

(a) Zone of endangering influence.

(1) The zone of endangering influence shall be:

- (i) In the case of application(s) for well permit(s) under §144.31 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or
- (ii) In the case of an application for an area permit under §144.33, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. *[equation and parameter list not included here]*

(b) Fixed radius. (1) In the case of application(s) for well permit(s) under §144.31 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §144.31 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.

In determining the fixed radius, the following factors shall be taken into consideration:

Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the Area of Review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1/4) mile.



#### **146.4 Criteria for exempted aquifers.**

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in §146.3 may be determined under 40 CFR 144.8 to be an "exempted aquifer" if it meets the following criteria:

- (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 can be demonstrated by a permit applicant as 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.

#### **144.12 Prohibition of movement of fluid into underground sources of drinking water.**

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146 [*I take that to mean aquifer exemption under 146.4*], the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated.

## **Discussion of Zone of Influence, Area of Review, and the Aquifer Exemption Boundary for Class III Injection Wells used for the In-Situ Leaching (ISL) of Uranium**

**Introduction:** The method for determining Area of Review around an injection well or injection project area is defined in 40 CFR 146.3 as “the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.” Regulation 146.06 states that the “Area of Review for each injection well or each field, project or area ...shall be determined...” using the zone of endangering influence calculation in 146.06(a) or a fixed radius according to 146.06(b). (Specific regulations are located at the end of this document for reference.)

In the regulations, the zone of endangering influence for a single injection well is the radius encompassing the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water. For an area permit, the zone of endangering influence includes the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

Regulation 40 CFR 146.4 states that criteria for EPA to use in determining the aquifer exemption area for an ISL mining project is the portion of the aquifer that is mineral producing, or can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that are expected to be commercially producible based on quantity and location.

For the purposes of this discussion, the term “project area” used in reference to the Area of Review above is defined as the wellfield locations where injection is occurring. The project area will be delineated in the permit application with reference to the commercially producible portion of the ore body. Justification should be based on reasonable market projections of uranium price fluctuations over the life of the mine. In the following discussion, the aquifer exemption boundary will be determined based on a distance relative to the project area.

**Discussion:** The intent of the Area of Review in the regulations is to set a boundary around an area that will be thoroughly investigated to locate any potential breaches in the confining zones above and below the proposed injection interval, and to perform corrective action, if needed, to mitigate those breaches so injectate cannot move up or down into another aquifer.

The intent of the zone of endangering influence in the regulations is to determine the farthest distance away from the injection well or project area that injectate is anticipated to reach over the life of the injection well or project area. In the case of ISL injection wells, the overall effect of injection and recovery in ISL well fields is a groundwater flow gradient directed toward the mining area. The zone of endangering influence calculation in the regulations is not appropriate for an in-situ mining project, because the formula applies to injection wells that only inject, with no extraction taken into account. For an ISL project, the Area of Review boundary should not be equivalent to the zone of endangering influence. For Class III injection

wells used for in-situ mining, the zone of endangering influence is equivalent to the injection/recovery wellfields where the lixiviant is moving within the aquifer under normal operating conditions when the lixiviant is being controlled by proper balancing of injection rates and recovery rates within the wellfields. (This zone does not include excursions, where the flow of lixiviant is not considered to be under direct control.)

The aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and the area around the ore body where the lixiviant is expected to travel during mining of the ore deposits and post-mining aquifer restoration. The area inside the aquifer exemption boundary is forever exempted from protection under the UIC Program, specifically the provisions of 144.12.

**Proposal:** In the permit application and aquifer exemption request, the permittee identifies the location of the monitoring well ring around the wellfields, and proposes an Area of Review boundary and an aquifer exemption boundary. The aquifer exemption boundary may be located at a some distance outside the monitoring well ring, but no further out than the Area of Review boundary. Because the aquifer exemption boundary is the area within which mining-related contaminants are allowed to move, the area should be subject to Area of Review requirements.

The location of the monitoring well ring should be placed at some distance beyond the project area to detect any excursions of lixiviant outside the project area within a reasonable amount of time.

The Area of Review should be set at least as far away from the project area as the proposed aquifer exemption boundary. Within the Area of Review, the permittee will investigate the need for corrective action and perform corrective action as needed. The Area of Review boundary may be set at the aquifer exemption boundary or at some distance beyond the aquifer exemption boundary. The location of the boundary should be justified using hydrologic modeling of worse case scenario excursions, taking into account these factors stated in the regulations:

*...the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.*

The permit application should include a discussion of how the Area of Review was determined, including pertinent hydrologic modeling results that support the proposed boundary locations and contain a discussion of how applicable factors in the paragraph above were taken into consideration.

#### **Concept for locating the Aquifer Exemption boundary**

The aquifer exemption request is included as part of the permit application. The permittee submits a proposed aquifer exemption boundary that is placed at some distance outside the project area. Hydrologic modeling should verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent.

Calculation for the distance from the project area that the aquifer exemption boundary should be placed is based on the rate of flow of the aquifer in any given

direction under natural conditions. The aquifer exemption boundary should be placed at a distance from the project area that an excursion would reach in 120 days at the rate of flow of the aquifer under natural conditions in the direction the excursion is traveling.

**Permit Requirements for Delineating Extent of Excursion**

When an excursion is detected at the monitoring well ring, the permit will require the permittee to verify that the excursion has not reached the aquifer exemption boundary. Upon detecting an excursion at the monitoring well ring, the permit will require the installation of response wells that would intercept the excursion plume before it reaches the aquifer exemption boundary. The placement of the response wells will be based on hydrologic modeling at a location far enough ahead of the excursion front that the excursion plume will not have reached the response well locations by the time the wells are installed, sampled, and analytical results received. The 120 day travel time has been established to allow the permittee enough time to mobilize a drill rig, install, develop, and sample the response wells, and to obtain analytical results of the well samples before the excursion passes out of the aquifer exemption area.

More frequent sampling of the response wells may be required for a period of time based on the travel time of the excursion at sampling intervals set commensurate with the rate the excursion is traveling.

## Definitions in regulations for reference:

### 144.3 and 146.3 Definitions

**Area of Review** means the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.

**Contaminant** means any physical, chemical, biological, or radiological substance or matter in water.

**Underground source of drinking water (USDW)** means an aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
- (A) Currently supplies drinking water for human consumption; or
- (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

### § 146.6 Area of Review.

The Area of Review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section.

(a) Zone of endangering influence.

(1) The zone of endangering influence shall be:

- (i) In the case of application(s) for well permit(s) under §144.31 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or
- (ii) In the case of an application for an area permit under §144.33, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. *[equation and parameter list not included here]*

(b) Fixed radius. (1) In the case of application(s) for well permit(s) under §144.31 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §144.31 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.

In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the Area of Review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1/4) mile.



**146.10 Plugging and abandoning Class I, II, III, IV, and V wells.**

(a)(4) The plugging and abandonment plan required in 40 CFR 144.51(o) and 144.52(a)(6) shall, in the case of a Class III project which underlies or is in an aquifer which has been exempted under §146.04, also demonstrate adequate protection of USDWs. The Director shall prescribe aquifer cleanup and monitoring where he deems it necessary and feasible to insure adequate protection of USDWs.

**144.12 Prohibition of movement of fluid into underground sources of drinking water.**

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146 [*I take that to mean aquifer exemption under 146.4*], the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated.

## **Discussion of Zone of Influence, Area of Review, and the Aquifer Exemption Boundary for Class III Injection Wells used for the In-Situ Leaching (ISL) of Uranium**

**Introduction:** The purpose of this discussion is to provide information about the proposed criteria the EPA Region 8 UIC program will use to evaluate acceptable locations for the Area of Review and an aquifer exemption boundary proposed in UIC Class III injection well permit applications for in-situ mining of uranium. This document also explains how the concepts of the Area of Review and zone of endangering influence will be applied to Class III injection well permit applications.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a location that allows full extraction of the ore proposed in the mining plan and restoration of the area affected by lixiviant flow within the subsurface, without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. The criteria EPA Region 8 will use for evaluating the placement of the aquifer exemption boundary will be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitor well ring.

The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

**Background Information:** The method for determining Area of Review around an injection well or injection project area is defined in 40 CFR 146.3 as “the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.” Regulation 146.06 states that the “Area of Review for each injection well or each field, project or area ...shall be determined...” using the zone of endangering influence calculation in 146.06(a) or a fixed radius according to 146.06(b). (Specific regulations are located at the end of this document for reference.)

In the regulations, the zone of endangering influence for a single injection well is the radius encompassing the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water. For an area permit, the zone of endangering influence includes the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

Regulation 40 CFR 146.4 states that criteria for EPA to use in determining the aquifer exemption area for an ISL mining project is the portion of the aquifer that is mineral producing, or can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that are expected to be commercially producible based on quantity and location.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a location that allows the mining operation to fully extract the ore and restore the area affected by the flow of lixiviant within the subsurface without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. Hydrologic modeling should be used to demonstrate that the entire area within the aquifer exemption boundary is required to meet these criteria. The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically

possible, and to minimize the area that will need to be restored upon the completion of mining.

For the purposes of this discussion, the term “project area” used in reference to the Area of Review above is considered to be equivalent to the area where lixiviant is moving within the subsurface. The project area contains the wellfields and the surrounding “flare” of lixiviant around the wellfields. The project area will be delineated in the permit application with reference to the commercially producible portion of the ore body. Justification should be based on reasonable market projections of uranium price fluctuations over the life of the mine. In the following discussion, the aquifer exemption boundary will be determined based on a distance relative to the project area and the monitor well ring around the project area.

**Discussion:** The intent of the Area of Review in the regulations is to set a boundary around an area that will be thoroughly investigated to locate any potential breaches in the confining zones above and below the proposed injection interval, and to perform corrective action, if needed, to mitigate those breaches so injectate cannot move up or down into another aquifer.

The intent of the zone of endangering influence in the regulations is to determine the farthest distance away from the injection well or project area that the pressure effect of injection activity is anticipated to reach over the life of the injection well or project area. In the case of ISL injection wells, the overall effect of injection and recovery in ISL well fields is a groundwater flow gradient directed toward the project area. The zone of endangering influence calculation in the regulations is not appropriate for an in-situ mining project, because the formula applies to injection wells that only inject, with no extraction taken into account.

For this reason, the Area of Review boundary for an ISL project should not be equivalent to the zone of endangering influence. Instead of a zone of endangering influence, the concept of importance for Class III injection wells used for in-situ mining is the area chemically affected by injection. The term “project area” described above will be applied to the area within the subsurface where lixiviant is causing chemical changing within the subsurface. The project area is limited to the area of lixiviant flow under normal operating conditions, i.e. where lixiviant flow is being controlled by proper balancing of injection rates and recovery rates within the wellfields. (The project area does not include excursions, where the flow of lixiviant is not considered to be under direct control.)

The aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and the area around the ore body where the lixiviant is expected to travel during mining of the ore deposits and post-mining aquifer restoration. It is important to minimize the extent of the area inside the aquifer exemption boundary, because it is forever exempted from protection under the UIC Program, specifically the provisions of 144.12.

**Proposal:** In the permit application and aquifer exemption request, the permittee identifies the location of the monitoring well ring around the project area, and proposes an Area of Review boundary and an aquifer exemption boundary. The aquifer exemption boundary may be located at some distance outside the monitoring well ring, but no further out than the Area of Review boundary. Because the aquifer exemption boundary is the area within which mining-related contaminants are allowed to move, the area should be subject to Area of Review requirements.

The location of the monitoring well ring should be placed at some distance beyond the project area to detect any excursions of lixiviant outside the project area and allow recovery

of excursions within a reasonable amount of time. The monitor well ring location may be set a fixed distance beyond the project area. The permit application should include a discussion of how long it will take an excursion to reach the monitor well ring and how long it will take to recover an excursion detected at the monitor well ring. This information will be considered in evaluating the proposed location of the aquifer exemption boundary.

The Area of Review should be set at least as far away from the project area as the proposed aquifer exemption boundary. Within the Area of Review, the permittee will investigate the need for corrective action and perform corrective action as needed. The Area of Review boundary may be set at the aquifer exemption boundary or at some distance beyond the aquifer exemption boundary. The location of the boundary should be justified using hydrologic modeling of worse case scenario excursions, taking into account these factors stated in the regulations:

*...the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.*

The permit application should include a discussion of how the Area of Review was determined, including pertinent hydrologic modeling results that support the proposed boundary locations. The discussion should also include how applicable factors in the paragraph above were taken into consideration.

#### **Concept for locating the Aquifer Exemption boundary**

The aquifer exemption request is included as part of the permit application. The permittee submits a proposed aquifer exemption boundary that is placed at some distance outside the project area. Because the monitor well ring is the first place where the presence of an excursion is detected, the aquifer exemption boundary should be placed at some distance beyond the monitor well ring that will allow a reasonable time for an excursion detected at the monitor well ring to be recovered before it crosses the aquifer exemption boundary. Hydrologic modeling should be used to verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent. Justification for the position of the aquifer exemption boundary should be included in the aquifer exemption request. The justification should include hydrologic modeling results, information on variability of flow rates in different directions within the aquifer, and how long it would take an excursion to reach the aquifer exemption boundary.

#### **Permit Requirements for Delineating Extent of Excursion**

When an excursion is detected at the monitoring well ring, the permit will require the permittee to verify that the excursion has not reached the aquifer exemption boundary. Upon detecting an excursion at the monitoring well ring, the permit will require the installation of response wells that would intercept the excursion plume before it reaches the aquifer exemption boundary. The placement of the response wells will be based on hydrologic modeling and at a location far enough ahead of the excursion front, that the excursion plume will not have reached the response well locations by the time the wells are installed, sampled, and analytical results received. Duration and frequency for sampling the response wells will be based on the travel time of the excursion.

## Definitions in regulations for reference:

### 144.3 and 146.3 Definitions

**Area of Review** means the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.

**Contaminant** means any physical, chemical, biological, or radiological substance or matter in water.

**Underground source of drinking water (USDW)** means an aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
- (A) Currently supplies drinking water for human consumption; or
- (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

### § 146.6 Area of Review.

The Area of Review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section.

(a) Zone of endangering influence.

(1) The zone of endangering influence shall be:

- (i) In the case of application(s) for well permit(s) under §144.31 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or
- (ii) In the case of an application for an area permit under §144.33, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. *[equation and parameter list not included here]*

(b) Fixed radius. (1) In the case of application(s) for well permit(s) under §144.31 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §144.31 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.

In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the Area of Review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1/4) mile.



#### **146.4 Criteria for exempted aquifers.**

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in §146.3 may be determined under 40 CFR 144.8 to be an "exempted aquifer" if it meets the following criteria:

- (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 can be demonstrated by a permit applicant as 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.

#### **144.12 Prohibition of movement of fluid into underground sources of drinking water.**

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146 [*I take that to mean aquifer exemption under 146.4*], the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated.

## **Discussion of Zone of Influence, Area of Review, and the Aquifer Exemption Boundary for Class III Injection Wells used for the In-Situ Leaching (ISL) of Uranium**

**Introduction:** The purpose of this discussion is to provide information about the proposed criteria the EPA Region 8 UIC program will use to evaluate acceptable locations for the Area of Review and an aquifer exemption boundary requested by the permit applicant in UIC Class III injection well permit applications for in-situ mining of uranium. This document also explains how the concepts of the Area of Review and zone of endangering influence will be applied to Class III injection well permit applications.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a line circumscribing the minimum area that allows full extraction of the ore proposed in the mining plan and restoration of the area affected by lixiviant flow within the subsurface, without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. The criteria EPA Region 8 will use for evaluating the placement of the aquifer exemption boundary will be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitoring well ring.

The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

This document also includes proposed permit requirements, including response actions, when excursions occur.

**Background Information:** The method for determining Area of Review around an injection well or injection project area is defined in 40 CFR 146.3 as “the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.” Regulation 146.06 states that the “Area of Review for each injection well or each field, project or area ...shall be determined...” using the zone of endangering influence calculation in 146.06(a) or a fixed radius according to 146.06(b). (Specific regulations are located at the end of this document for reference.)

In the regulations, the zone of endangering influence for a single injection well is the radius encompassing the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water. For an area permit, the zone of endangering influence includes the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

Regulation 40 CFR 146.4 states that criteria for EPA to use in determining the aquifer exemption area for an ISL mining project is the portion of the aquifer that is mineral producing, or can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that are expected to be commercially producible based on quantity and location.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a location large enough to allow the mining operation to fully extract the ore and restore the area affected by the flow of lixiviant without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. Hydrologic modeling should be used to

demonstrate that the entire area within the aquifer exemption boundary is required to meet these criteria. The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

For the purposes of this discussion, the term “project area” used in reference to the Area of Review above, is considered to be equivalent to the area where lixiviant is moving within the subsurface. The project area contains the wellfields and the surrounding “flare” of lixiviant around the wellfields. The project area will be delineated in the permit application with reference to the commercially producible portion of the ore body. Justification should be based on reasonable market projections of uranium price fluctuations over the life of the mine. In the following discussion, the aquifer exemption boundary will be determined based on a distance relative to the project area and the monitoring well ring around the project area.

**Discussion:** The intent of the Area of Review in the regulations is to set a boundary around an area that will be thoroughly investigated to locate any potential breaches in the confining zones above and below the proposed injection interval, and to perform corrective action, if needed, to mitigate those breaches so injectate cannot move up or down into another aquifer.

The intent of the zone of endangering influence in the regulations is to determine the farthest distance away from the injection well or project area that the pressure effect of injection activity is anticipated to reach over the life of the injection well or project area. In the case of ISL injection wells, the overall effect of injection and recovery in ISL well fields is a groundwater flow gradient directed toward the project area. The zone of endangering influence calculation in the regulations is not appropriate for an in-situ mining project, because the formula applies to injection wells that only inject, with no extraction taken into account.

For this reason, the Area of Review boundary for an ISL project should not be equivalent to the zone of endangering influence. Instead of a zone of endangering influence, the concept of importance for Class III injection wells used for in-situ mining is the area chemically affected by injection. The term “project area” described above will be applied to the area within the subsurface where lixiviant is causing chemical changes. The project area is limited to the area of lixiviant flow under normal operating conditions, i.e. where lixiviant flow is being controlled by proper balancing of injection rates and recovery rates within the wellfields. (The project area does not include excursions, where the flow of lixiviant is not considered to be under direct control.)

The aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and the area around the ore body where the lixiviant is expected to travel during mining of the ore deposits and post-mining aquifer restoration. It is important to minimize the extent of the area inside the aquifer exemption boundary, because it is forever exempted from protection under the UIC Program, specifically the provisions of 144.12.

**Proposal:** In the permit application and aquifer exemption request, the permittee identifies the location of the monitoring well ring around the project area, and proposes an Area of Review boundary and an aquifer exemption boundary. The aquifer exemption boundary may be located at some distance outside the monitoring well ring, but no further out than the Area of Review boundary. Because the aquifer exemption boundary is the area within which mining-related contaminants are allowed to move, the area should be subject to Area of Review requirements.

Monitoring well Ring: The monitoring well ring should be placed at some distance beyond the project area to detect excursions of lixiviant outside the project area within a reasonable amount of time. The monitoring well ring location may be set a fixed distance beyond the project area. The permit application should include estimations of

- ☐ how long it will take an excursion to reach the monitoring well ring,
- ☐ based on sampling frequency, how far an excursion could potentially flow before it is detected at the monitoring well ring, and
- ☐ how long it will take to recover an excursion detected at the monitoring well ring.

This information will be considered in evaluating the proposed location of the aquifer exemption boundary.

Area of Review: Within the Area of Review, the permittee will investigate the need for corrective action and perform corrective action as needed. The Area of Review boundary may be set at the aquifer exemption boundary or at some distance beyond the aquifer exemption boundary. The location of the boundary should be justified using well constrained hydrologic modeling of worse case scenario excursions, taking into account these factors stated in the regulations:

*...the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.*

The permit application should include a discussion of how the Area of Review was determined, including pertinent hydrologic modeling results that support the proposed boundary locations. The discussion should also include how applicable factors in the paragraph above were taken into consideration.

Aquifer Exemption boundary: The aquifer exemption request is included as part of the permit application. The permittee submits a proposed aquifer exemption boundary that is placed at some distance outside the project area based on the following considerations:

*Excursion recovery.* Because the monitoring well ring is the first place where the presence of an excursion is detected, the aquifer exemption boundary should be placed at some distance beyond the monitoring well ring that will allow a reasonable time for an excursion detected at the monitoring well ring to be recovered before it crosses the aquifer exemption boundary. The aquifer exemption boundary is considered a Point of Compliance. The determination should be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitoring well ring.

*Hydrologic modeling.* Hydrologic modeling should be used to verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent and for groundwater restoration within the affected are after completion of mining.

Justification for the position of the aquifer exemption boundary should be included in the aquifer exemption request. The justification should include hydrologic modeling results, aquifer data and measurements, information on variability of flow rates in different directions within the aquifer, and an estimation of how long it would take an excursion to reach the aquifer exemption boundary.

**Permit Requirements for Delineating Extent of Excursion**

When an excursion is detected at the monitoring well ring, the permit will require the permittee to verify that the excursion has not reached the aquifer exemption boundary. Upon detecting an excursion at the monitoring well ring, the permit will require action to intercept the excursion plume before it reaches the aquifer exemption boundary. The effectiveness of the remedial action must be physically demonstrated. Duration and frequency for sampling the response wells will be based on the travel time of the excursion. If the excursion goes beyond the aquifer exemption boundary, the permit will require verification that the plume has been pulled back within the aquifer exemption boundary. More frequent sampling of the monitoring ring wells will be required until the excursion has been pulled back in.

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## 40 Code of Federal Regulations (CFR)

### §§144.3 and 146.3 Definitions

**Area of Review** means the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.

**Contaminant** means any physical, chemical, biological, or radiological substance or matter in water.

**Underground source of drinking water (USDW)** means an aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
- (A) Currently supplies drinking water for human consumption; or
- (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

### § 146.6 Area of Review.

The Area of Review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section.

(a) Zone of endangering influence.

(1) The zone of endangering influence shall be:

- (i) In the case of application(s) for well permit(s) under §144.31 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or
- (ii) In the case of an application for an area permit under §144.33, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. *[equation and parameter list not included here]*

(b) Fixed radius. (1) In the case of application(s) for well permit(s) under §144.31 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §144.31 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.

In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the Area of Review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1/4) mile.

#### **§146.4 Criteria for exempted aquifers.**

An aquifer or a portion thereof which meets the criteria for an “underground source of drinking water” in §146.3 may be determined under 40 CFR 144.8 to be an “exempted aquifer” if it meets the following criteria:

- (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 can be demonstrated by a permit applicant as 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.

#### **§144.12 Prohibition of movement of fluid into underground sources of drinking water.**

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146 [*I take that to mean aquifer exemption under 146.4*], the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated.

## **Discussion of Zone of Influence, Area of Review, and the Aquifer Exemption Boundary for Class III Injection Wells used for the In-Situ Leaching of Uranium**

**Introduction:** The method for determining Area of Review around an injection well or injection project area is defined in 40 CFR 146.3 as “the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.” Subpart 146.06 states that the “Area of Review for each injection well or each field, project or area ...shall be determined...” using the Zone of Influence calculation in 146.06(a) or a fixed radius according to 146.06(b). (Specific regulations are located at the end of this document for reference.)

**Discussion:** The intent of the Area of Review in the regulations is to set a boundary around an area that will be thoroughly investigated to locate any potential breaches in the confining zones above and below the proposed injection interval, and to perform corrective action, if needed, to mitigate those breaches so injectate cannot move up or down into another aquifer.

The intent of the Zone of Influence in the regulations is to determine the farthest distance away from the injection well or project area that injectate is anticipated to reach over the life of the injection well or project area. In the case of ISL injection wells, the overall effect of injection and recovery in ISL well fields is a groundwater flow gradient directed toward the mining area. The Zone of Influence calculation in the regulations is not appropriate for an in-situ mining project, because the formula applies to injection wells that only inject, with no extraction taken into account. For an ISL project, the Area of Review boundary should not equivalent to the Zone of Influence. For Class III injection wells used for in-situ mining, the Zone of Influence is equivalent to the injection/recovery wellfields where the lixiviant is moving within the aquifer.

The aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and how much area may be subject to loss of hydraulic control of mining-related contaminants during mining of the ore deposits and post-mining aquifer restoration. The area inside the aquifer exemption boundary is forever exempted from protection under the UIC Program, specifically the provisions of 144.12.

**Proposal:** In the permit application and aquifer exemption request, the permittee identifies the location of the monitoring well ring around the wellfields, and proposes an Area of Review boundary, and an aquifer exemption boundary. The aquifer exemption boundary may be located at a some distance outside the monitor well ring, but no further out than the Area of Review boundary. Because the aquifer exemption boundary is the area within which mining-related contaminants are allowed to move, the area should be subject to Area of Review requirements.

Hydrologic modeling should support the anticipation that mining solutions will be contained inside the Zone of Influence under normal operating conditions.

The location of the monitoring well ring should be placed to detect any excursions beyond the Zone of Influence. The criteria for placement of the monitoring well ring

should be explained in the permit application, e.g. a location within X number of days of ground water flow travel time in order to allow recovery or reversal of any excursions to be accomplished within Y number of days. Other placement criteria may be used and explained in the permit application. Hydrologic modeling should verify the criteria used for the placement of the monitoring well ring.

The Area of Review should be separate from the Zone of Influence line, and set at least as far away from the wellfields as the proposed aquifer exemption boundary. Within the Area of Review, the permittee will investigate the need for corrective action and perform corrective action as needed. The Area of Review boundary may be set at a fixed radius around the monitoring well ring, but the location of the boundary should be justified using hydrologic modeling of worse case scenario excursions, taking in to account these factors stated in the regulations:

*In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.*

In summary, the permit application should include the rationale for placement of the Zone of Influence boundary, the distance the monitor well ring is placed outside the Zone of Influence, and the location of the Area of Review boundary. The rationale should also contain pertinent hydrologic modeling results that support the proposed boundary locations. The rationale for the location of the Area of Review should contain a discussion of how applicable factors in the paragraph above were taken into consideration.

#### **Concept for locating the Aquifer Exemption boundary**

The aquifer exemption request is included as part of the permit application. The permittee submits a proposed aquifer exemption boundary that is placed along the nearest  $\frac{1}{4}$   $\frac{1}{4}$   $\frac{1}{4}$  section lines at some distance outside the monitoring well ring. Hydrologic modeling should verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent. Justification should be based on reasonable market projections of uranium price fluctuations over the life of the mine.

Calculation for the distance from the monitor well ring that the aquifer exemption boundary should be placed is based on the rate of flow of the aquifer in any given direction under natural conditions. The aquifer exemption boundary should be placed at a distance from the Zone of Influence that an excursion would reach in 120 days at the rate of flow of the aquifer under natural conditions in the direction the excursion is traveling. The boundary will be drawn on a map to the nearest  $\frac{1}{4}$   $\frac{1}{4}$   $\frac{1}{4}$  section that does not extend beyond the 120 day travel time boundary. (See Figure 1.)

When an excursion is detected at the monitor well ring, the permit will require the permittee to verify the excursion has not reached the aquifer exemption boundary. Upon detecting an excursion at the monitor well ring, the permit will require the installation of monitor wells that would intercept the excursion plume before it reached the aquifer exemption boundary. The placement of the monitor wells will be based on hydrologic modeling at a location far enough ahead of the excursion front that the excursion plume will not have reached the well locations by the time the wells are installed, sampled, and analytical results received. The 120 day travel time

has been established to allow the permittee enough time to mobilize a drill rig, install, develop, and sample the monitor wells, and to obtain analytical results of the well samples before the excursion passes out of the aquifer exemption area.

More frequent sampling of the monitor wells will be required for a period of time based on the travel time of the excursion at sampling intervals set commensurate with the rate the excursion is traveling.

#### **Definitions in regulations for reference:**

##### **144.3 and 146.3 Definitions**

**Area of Review** means the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.

**Contaminant** means any physical, chemical, biological, or radiological substance or matter in water.

**Underground source of drinking water (USDW)** means an aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
- (A) Currently supplies drinking water for human consumption; or
- (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

##### **§ 146.6 Area of Review.**

The Area of Review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section.

(a) Zone of endangering influence.

(1) The zone of endangering influence shall be:

- (i) In the case of application(s) for well permit(s) under §144.31 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or
- (ii) In the case of an application for an area permit under §144.33, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. *[equation and parameter list not included here]*

(b) Fixed radius. (1) In the case of application(s) for well permit(s) under §144.31 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §144.31 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.



In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the Area of Review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1/4) mile.

**146.10 Plugging and abandoning Class I, II, III, IV, and V wells.**

(a)(4) The plugging and abandonment plan required in 40 CFR 144.51(o) and 144.52(a)(6) shall, in the case of a Class III project which underlies or is in an aquifer which has been exempted under §146.04, also demonstrate adequate protection of USDWs. The Director shall prescribe aquifer cleanup and monitoring where he deems it necessary and feasible to insure adequate protection of USDWs.

**144.12 Prohibition of movement of fluid into underground sources of drinking water.**

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146 [*I take that to mean aquifer exemption under 146.4*], the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated.

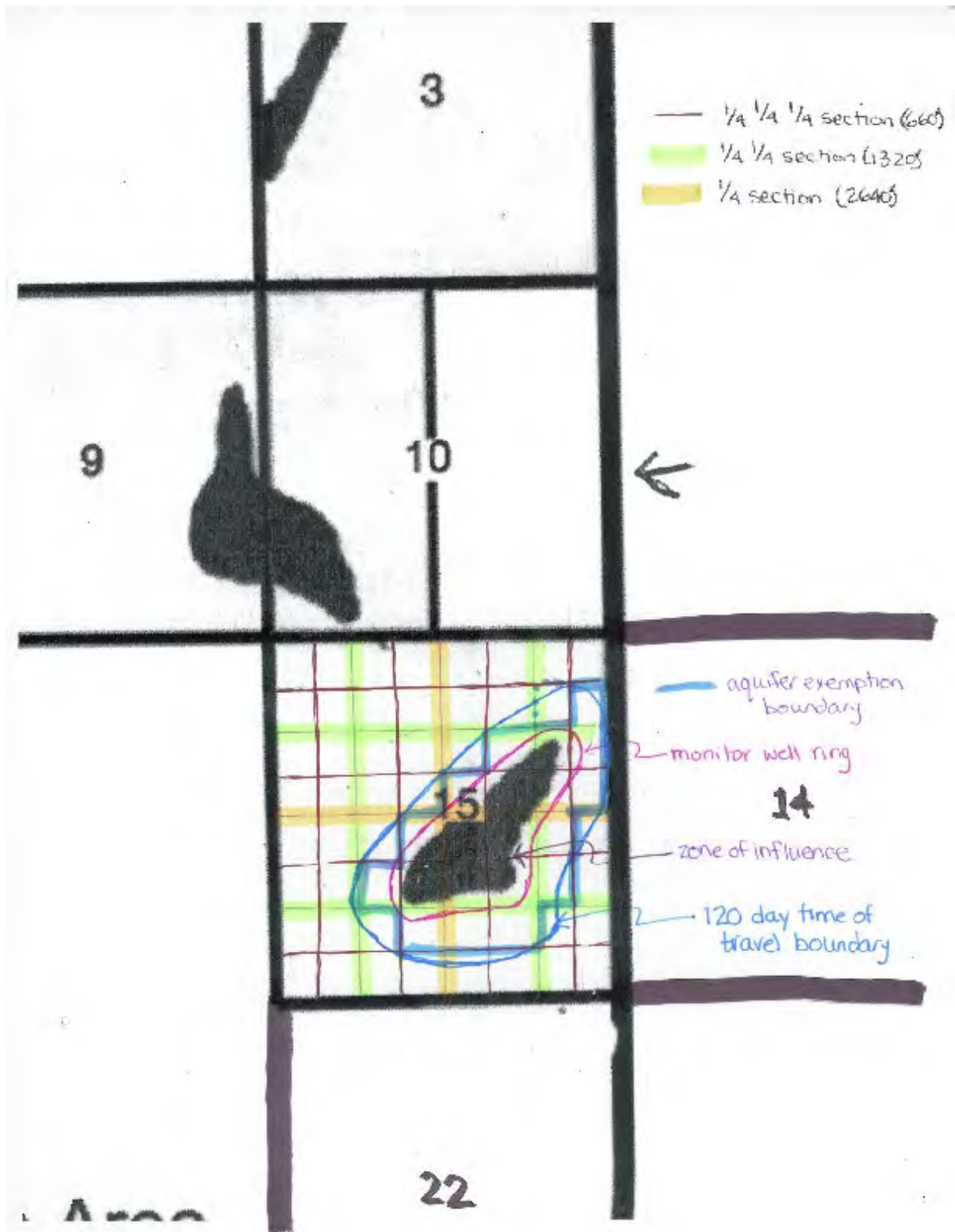


Figure 1

## Discussion of Zone of Influence, Area of Review, and the Aquifer Exemption Boundary for Class III Injection Wells used for the In-Situ Leaching (ISL) of Uranium

**Introduction:** The purpose of this discussion is to provide information about the proposed criteria the EPA Region 8 UIC program will use to evaluate acceptable locations for the Area of Review and an aquifer exemption boundary requested by the permit applicant in UIC Class III injection well permit applications for in-situ mining of uranium. This document also explains how the concepts of the Area of Review and zone of endangering influence will be applied to Class III injection well permit applications.

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The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a line circumscribing the minimum area that allows full extraction of the ore proposed in the mining plan and restoration of the area affected by lixiviant flow within the subsurface, without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. The criteria EPA Region 8 will use for evaluating the placement of the aquifer exemption boundary will be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitoring well ring.

The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

This document also includes proposed permit requirements, including response actions, when excursions occur.

**Background Information:** The method for determining Area of Review around an injection well or injection project area is defined in 40 CFR 146.3 as "the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06." Regulation 146.06 states that the "Area of Review for each injection well or each field, project or area ...shall be determined..." using the zone of endangering influence calculation in 146.06(a) or a fixed radius according to 146.06(b). (Specific regulations are located at the end of this document for reference.)

In the regulations, the zone of endangering influence for a single injection well is the radius encompassing the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water. For an area permit, the zone of endangering influence includes the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

Regulation 40 CFR 146.4 states that criteria for EPA to use in determining the aquifer exemption area for an ISL mining project is the portion of the aquifer that is mineral producing, or can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that are expected to be commercially producible based on quantity and location.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a location that allows the mining operation to fully extract the ore and restore the area affected by the flow of lixiviant within the subsurface without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. Hydrologic modeling ~~should~~

~~may~~ be used to demonstrate that the entire area within the aquifer exemption boundary ~~is required to meet~~ these criteria. The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

For the purposes of this discussion, the term "project area" used in reference to the Area of Review above, is considered to be equivalent to the area where lixiviant is moving within the subsurface. The project area contains the wellfields and the surrounding "flare" of lixiviant around the wellfields. The project area will be delineated in the permit application with reference to the commercially producible portion of the ore body. Justification should be based on reasonable market projections of uranium price fluctuations over the life of the mine. In the following discussion, the aquifer exemption boundary will be determined based on a distance relative to the project area and the monitoring well ring around the project area.

**Discussion:** The intent of the Area of Review in the regulations is to set a boundary around an area that will be thoroughly investigated to locate any potential breaches in the confining zones above and below the proposed injection interval, and to perform corrective action, if needed, to mitigate those breaches so injectate cannot move up or down into another aquifer.

The intent of the zone of endangering influence in the regulations is to determine the farthest distance away from the injection well or project area that the pressure effect of injection activity is anticipated to reach over the life of the injection well or project area. In the case of ISL injection wells, the overall effect of injection and recovery in ISL well fields is a groundwater flow gradient directed toward the project area. The zone of endangering influence calculation in the regulations is not appropriate for an in-situ mining project, because the formula applies to injection wells that only inject, with no extraction taken into account.

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For this reason, the Area of Review boundary for an ISL project should not be equivalent to the zone of endangering influence. Instead of a zone of endangering influence, the concept of importance for Class III injection wells used for in-situ mining is the area chemically affected by injection. The term "project area" described above will be applied to the area within the subsurface where lixiviant is causing chemical changes ~~within the subsurface~~. The project area is limited to the area of lixiviant flow under normal operating conditions, i.e. where lixiviant flow is being controlled by proper balancing of injection rates and recovery rates within the wellfields. (The project area does not include excursions, where the flow of lixiviant is not considered to be under direct control.)

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The aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and the area around the ore body where the lixiviant is expected to travel during mining of the ore deposits and post-mining aquifer restoration. It is important to minimize the extent of the area inside the aquifer exemption boundary, because it is forever exempted from protection under the UIC Program, specifically the provisions of 144.12.

**Proposal:** In the permit application and aquifer exemption request, the permittee identifies the location of the monitoring well ring around the project area, and proposes an Area of Review boundary and an aquifer exemption boundary. The aquifer exemption boundary may be located at some distance outside the monitoring well ring, but no further out than the Area of Review boundary. Because the aquifer exemption boundary is the area within

which mining-related contaminants are allowed to move, the area should be subject to Area of Review requirements.

Monitoring well Ring: The monitoring well ring should be placed at some distance beyond the project area to detect ~~any~~ excursions of lixiviant outside the project area ~~and allow recovery of excursions within a reasonable amount of time~~. The monitoring well ring location may be set a fixed distance beyond the project area. The permit application should include estimations of

- how long it will take an excursion to reach the monitoring well ring,
- based on sampling frequency, how far an excursion could potentially flow before it is detected at the monitoring well ring, and
- how long it will take to recover an excursion detected at the monitoring well ring.

This information will be considered in evaluating the proposed location of the aquifer exemption boundary.

Area of Review: Within the Area of Review, the permittee will investigate the need for corrective action and perform corrective action as needed. The Area of Review boundary may be set at the aquifer exemption boundary or at some distance beyond the aquifer exemption boundary. The location of the boundary should be justified using well constrained hydrologic modeling of worse case scenario excursions, taking into account these factors stated in the regulations:

*...the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.*

The permit application should include a discussion of how the Area of Review was determined, including pertinent hydrologic modeling results that support the proposed boundary locations. The discussion should also include how applicable factors in the paragraph above were taken into consideration.

Aquifer Exemption boundary: The aquifer exemption request is included as part of the permit application. The permittee submits a proposed aquifer exemption boundary that is placed at some distance outside the project area based on the following considerations:

Excursion recovery. Because the monitoring well ring is the first place where the presence of an excursion is detected, the aquifer exemption boundary should be placed at some distance beyond the monitoring well ring that will allow a reasonable time for an excursion detected at the monitoring well ring to be recovered before it crosses the aquifer exemption boundary. The aquifer exemption boundary is considered a Point of Compliance. The determination should be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitoring well ring.

Hydrologic modeling. Hydrologic modeling ~~may should~~ be used to verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent and for groundwater restoration within the affected area after completion of mining.

Justification for the position of the aquifer exemption boundary should be included in the aquifer exemption request. The justification should include hydrologic modeling results, aquifer data and measurements, information on variability of flow rates in different directions within the aquifer, and an estimation of how long it would take an excursion to reach the aquifer exemption boundary.



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### Permit Requirements for Delineating Extent of Excursion

When an excursion is detected at the monitoring well ring, the permit will require the permittee to verify that the excursion has not reached the aquifer exemption boundary. Upon detecting an excursion at the monitoring well ring, the permit will require action to the installation of excursion response wells that would intercept the excursion plume before it reaches the aquifer exemption boundary. The effectiveness of the remedial action must be physically demonstrated. ~~The placement of the response wells will be based on hydrologic modeling and at a location far enough ahead of the excursion front, that the excursion plume will not have reached the excursion response well locations by the time the wells are installed, sampled, and analytical results received. Sampling of the excursion response wells will continue for a long enough period of time after the excursion is controlled to verify that the plume never reaches them based on hydrologic modeling.~~ Duration and frequency for sampling ~~the response~~ wells will be based on the travel time of the excursion. If the excursion goes beyond the aquifer exemption boundary, the permit will require verification that the plume has been pulled back within the aquifer exemption boundary. More frequent sampling of the monitoring ring wells will be required until the excursion has been pulled back in.

**Definitions in regulations for reference:**

**144.3 and 146.3 Definitions**

**Area of Review** means the area surrounding an injection well described according to the criteria set forth in 40 C.F.R. §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.

**Contaminant** means any physical, chemical, biological, or radiological substance or matter in water.

**Underground source of drinking water (USDW)** means an aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
- (A) Currently supplies drinking water for human consumption; or
- (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

**§ 146.6 Area of Review.**

The Area of Review for each injection well or each field, project or area ~~of the State~~ shall be determined according to either paragraph (a) or (b) of this section.

(a) Zone of endangering influence.

(1) The zone of endangering influence shall be:

- (i) In the case of application(s) for well permit(s) under §144.31 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or
- (ii) In the case of an application for an area permit under §144.33, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. *[equation and parameter list not included here]*

(b) Fixed radius. (1) In the case of application(s) for well permit(s) under §144.31 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §144.31 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.

In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the Area of Review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1/4) mile.

#### **146.4 Criteria for exempted aquifers.**

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in §146.3 may be determined under 40 CFR 144.8 to be an "exempted aquifer" if it meets the following criteria:

- (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 can be demonstrated by a permit applicant as 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.

#### **144.12 Prohibition of movement of fluid into underground sources of drinking water.**

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146 [*I take that to mean aquifer exemption under 146.4*], the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated.

## **Discussion of Zone of Influence, Area of Review, and the Aquifer Exemption Boundary for Class III Injection Wells used for the In-Situ Leaching (ISL) of Uranium**

**Introduction:** The method for determining Area of Review around an injection well or injection project area is defined in 40 CFR 146.3 as “the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.” Regulation 146.06 states that the “Area of Review for each injection well or each field, project or area ...shall be determined...” using the zone of endangering influence calculation in 146.06(a) or a fixed radius according to 146.06(b). (Specific regulations are located at the end of this document for reference.)

In the regulations, the zone of endangering influence for a single injection well is the radius encompassing the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water. For an area permit, the zone of endangering influence includes the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

Regulation 40 CFR 146.4 states that criteria for EPA to use in determining the aquifer exemption area for an ISL mining project is the portion of the aquifer that is mineral producing, or can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that are expected to be commercially producible based on quantity and location.

For the purposes of this discussion, the term “project area” used in reference to the Area of Review above is defined as the wellfield locations where injection is occurring. The project area will be delineated in the permit application with reference to the commercially producible portion of the ore body. Justification should be based on reasonable market projections of uranium price fluctuations over the life of the mine. In the following discussion, the aquifer exemption boundary will be determined based on a distance relative to the project area.

**Discussion:** The intent of the Area of Review in the regulations is to set a boundary around an area that will be thoroughly investigated to locate any potential breaches in the confining zones above and below the proposed injection interval, and to perform corrective action, if needed, to mitigate those breaches so injectate cannot move up or down into another aquifer.

The intent of the zone of endangering influence in the regulations is to determine the farthest distance away from the injection well or project area that injectate is anticipated to reach over the life of the injection well or project area. In the case of ISL injection wells, the overall effect of injection and recovery in ISL well fields is a groundwater flow gradient directed toward the project area. The zone of endangering influence calculation in the regulations is not appropriate for an in-situ mining project, because the formula applies to injection wells that only inject, with no extraction taken into account. For an ISL project, the Area of Review boundary should not be equivalent to the zone of endangering influence. For Class III injection



wells used for in-situ mining, the zone of endangering influence is equivalent to the project area, the injection and recovery wells within the wellfields where the lixiviant is moving within the aquifer. The project area is limited to the area of lixiviant flow under normal operating conditions, i.e. where lixiviant flow is being controlled by proper balancing of injection rates and recovery rates within the wellfields. (The project area does not include excursions, where the flow of lixiviant is not considered to be under direct control.)

The aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and the area around the ore body where the lixiviant is expected to travel during mining of the ore deposits and post-mining aquifer restoration. It is important to minimize the extent of the area inside the aquifer exemption boundary, because it is forever exempted from protection under the UIC Program, specifically the provisions of 144.12.

**Proposal:** In the permit application and aquifer exemption request, the permittee identifies the location of the monitoring well ring around the project area, and proposes an Area of Review boundary and an aquifer exemption boundary. The aquifer exemption boundary may be located at some distance outside the monitoring well ring, but no further out than the Area of Review boundary. Because the aquifer exemption boundary is the area within which mining-related contaminants are allowed to move, the area should be subject to Area of Review requirements.

The location of the monitoring well ring should be placed at some distance beyond the project area to detect any excursions of lixiviant outside the project area within a reasonable amount of time.

The Area of Review should be set at least as far away from the project area as the proposed aquifer exemption boundary. Within the Area of Review, the permittee will investigate the need for corrective action and perform corrective action as needed. The Area of Review boundary may be set at the aquifer exemption boundary or at some distance beyond the aquifer exemption boundary. The location of the boundary should be justified using hydrologic modeling of worse case scenario excursions, taking into account these factors stated in the regulations:

*...the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.*

The permit application should include a discussion of how the Area of Review was determined, including pertinent hydrologic modeling results that support the proposed boundary locations. The discussion should also include how applicable factors in the paragraph above were taken into consideration.

#### **Concept for locating the Aquifer Exemption boundary**

The aquifer exemption request is included as part of the permit application. The permittee submits a proposed aquifer exemption boundary that is placed at some distance outside the project area. Hydrologic modeling should verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent.

Calculation for the distance from the project area that the aquifer exemption boundary should be placed is based on the rate of flow of the aquifer in any given direction under natural conditions. The aquifer exemption boundary should be placed at a distance from the project area that an excursion would reach within 90 days of being detected at the monitoring well ring. The 90-day time of travel should be calculated using the rate of flow of the aquifer under natural conditions in the direction the excursion is traveling. The justification for placement of the aquifer exemption boundary should also include an estimate of how many days it would take an excursion to move outside of the project area before it is detected at the monitoring well ring. In approving the proposed aquifer exemption boundary, EPA will take into consideration the distance the monitoring well ring is located outside the project area and the rate of groundwater flow as it varies with direction within the aquifer. The each aquifer exemption boundary will be approved on a case-by-case basis, with the preferred boundary location being no greater than 120 days of travel time from the project area boundary.

#### **Permit Requirements for Delineating Extent of Excursion**

When an excursion is detected at the monitoring well ring, the permit will require the permittee to verify that the excursion has not reached the aquifer exemption boundary. Upon detecting an excursion at the monitoring well ring, the permit will require the installation of response wells that would intercept the excursion plume before it reaches the aquifer exemption boundary. The placement of the response wells will be based on hydrologic modeling and at a location far enough ahead of the excursion front, that the excursion plume will not have reached the response well locations by the time the wells are installed, sampled, and analytical results received. The 120 day travel time has been established to allow the permittee enough time to mobilize a drill rig, install, develop, and sample the response wells, and to obtain analytical results of the well samples before the excursion passes out of the aquifer exemption area.

Duration and frequency for sampling the response wells will be based on the travel time of the excursion.

## Definitions in regulations for reference:

### 144.3 and 146.3 Definitions

**Area of Review** means the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.

**Contaminant** means any physical, chemical, biological, or radiological substance or matter in water.

**Underground source of drinking water (USDW)** means an aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
- (A) Currently supplies drinking water for human consumption; or
- (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

### § 146.6 Area of Review.

The Area of Review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section.

(a) Zone of endangering influence.

(1) The zone of endangering influence shall be:

- (i) In the case of application(s) for well permit(s) under §144.31 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or
- (ii) In the case of an application for an area permit under §144.33, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. *[equation and parameter list not included here]*

(b) Fixed radius. (1) In the case of application(s) for well permit(s) under §144.31 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §144.31 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.

In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the Area of Review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1/4) mile.

#### **146.4 Criteria for exempted aquifers.**

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in §146.3 may be determined under 40 CFR 144.8 to be an "exempted aquifer" if it meets the following criteria:

- (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 can be demonstrated by a permit applicant as 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.

#### **144.12 Prohibition of movement of fluid into underground sources of drinking water.**

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146 [*I take that to mean aquifer exemption under 146.4*], the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated.

**From:** [Jeffery C. Parsons](#)  
**To:** [Shea, Valois](#)  
**Cc:** ["Roger Flynn"](#)  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments  
**Date:** Monday, June 19, 2017 5:43:47 PM  
**Attachments:** [Aquifer Exemption Guidance.pdf](#)  
[Aquifer Modeling Contract emails.doc](#)  
[Confidential info concerning production potential.doc](#)  
[Criteria for Class III AQ Exemption Review.doc](#)  
[Data Needs and Work Tasks.doc](#)  
[Edgars\\_email\\_dated\\_7.doc](#)  
[EPA FOIA\\_email\\_response\\_cover\\_letter.pdf](#)  
[FY08 OPRA ISL Uranium activities - VS2 Oct28-08.doc](#)  
[Guidance 34 Attachment 3.pdf](#)  
[Leissner comments.doc](#)  
[Powertech Dewey Burdock emails.doc](#)  
[Powertech emails.doc](#)  
[Questions from Patsy to Answer.doc](#)  
[R8 ISL AqExmpt considerations Sep9-08.doc](#)  
[Tent Agenda\\_080605.doc](#)  
[UIC Permit Agenda.doc](#)  
[Wendy AE.docx](#)

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Email #9

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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**From:** Jeffery C. Parsons [mailto:wmap@igc.org]  
**Sent:** Monday, June 19, 2017 5:38 PM  
**To:** shea.valois@epa.gov  
**Cc:** 'Roger Flynn' <wmap@igc.org>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #8

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*



**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:47 PM  
**To:** [shea.valois@epa.gov](mailto:shea.valois@epa.gov)  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #7

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:45 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #6

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:43 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #5

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:39 PM  
**To:** [shea.valois@epa.gov](mailto:shea.valois@epa.gov)  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #4

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:38 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:37 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** RE: Oglala Sioux Tribe Comment Attachments

Email #2

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Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

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**From:** Jeffery C. Parsons [<mailto:wmap@igc.org>]  
**Sent:** Monday, June 19, 2017 3:36 PM  
**To:** 'shea.valois@epa.gov' <[shea.valois@epa.gov](mailto:shea.valois@epa.gov)>  
**Cc:** 'Roger Flynn' <[wmap@igc.org](mailto:wmap@igc.org)>  
**Subject:** Oglala Sioux Tribe Comment Attachments

Ms. Shea – in support of the comments submitted this day (June 19, 2017) by the Oglala Sioux Tribe, attached are supplemental documents. As there are several such documents, there are likely to be a series of emails to follow. Thank you.

\*\*\*\*\*

Jeffrey C. Parsons  
Senior Attorney  
Western Mining Action Project  
P.O. Box 349  
Lyons, CO 80540  
(303) 823-5738

\*\*\*\*\*

GUIDELINES FOR REVIEWING  
AQUIFER EXEMPTION REQUESTS

**BACKGROUND**

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:

1. It does not currently serve as a source of drinking water and;
2. It cannot now and will not in the future serve as a source of drinking water because:
  - (a) 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;
  - (b) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;
  - (c) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or
  - (d) It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or
3. 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.

Regulations at 40 CFR §144.7(b)(1) state that "The Director may identify (by narrative description, illustrations, maps or other means) and describe in geographic and/or geometric terms (such as vertical and lateral limits and gradient) which are clear and definite all aquifers or parts thereof which the Director preposes to designate as exempted aquifers. . . ." If an exemption is proposed under 40 CFR §146.04(b)(1), the applicant for a Class II or III injection well permit must submit information to demonstrate "commercial producibility." To

demonstrate producibility the applicant for a Class III injection well permit may provide a map and general description of the mining zone, analysis of the amenability of the mining zone to the proposed mining method, and a production timetable. Applicants for an exemption for a Class II injection well may demonstrate producibility by providing information such as logs, core data, drill stem test information, a formation description, and oil data for the well in question or surrounding wells.

Except as listed above, the regulations do not specify technical criteria for the EPA to judge aquifer exemption requests. The EPA therefore developed the following technical criteria. These criteria include general information requirements common to all aquifer exemption requests. These are followed by specific criteria to evaluate each type of exemption request listed above.

EPA will approve aquifer exemptions for only specific purposes. All exemption request approvals will include a description of injection activities allowed and a statement that additional approvals would be needed for other injection activities (e.g., hazardous waste disposal into an aquifer exempted for mineral production).

#### EVALUATION CRITERIA

##### General

Applicants requesting exemptions must provide the following general information:

1. A topographic map of the proposed exempted area. The map must show the boundaries of the area to be exempted. Any map which precisely delineates the proposed exempted area is acceptable.
2. A written description of the proposed exempted aquifer including:
  - (a) Name of formation of aquifer.
  - (b) Subsurface depth or elevation of zone.
  - (c) Vertical confinement from other underground sources of drinking water.
  - (d) Thickness of proposed exempted aquifer.
  - (e) Area of exemption (e.g., acres, square miles, etc.).
  - (f) A water quality analysis of the horizon to be exempted.

In addition to the above descriptive information concerning the aquifer, all exemption requests must demonstrate that the



aquifer " . . . does not currently serve as a source of drinking water." (40 CFR §146.04(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. Any water supply wells located should be identified on the map showing the proposed 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. If the exemption pertains to only a portion of an aquifer, a demonstration must be made that the waste will remain in the exempted portion. Such a demonstration should consider among other factors, the pressure in the injection zone, the waste volume, injected waste characteristics (i.e., specific gravity, persistence, etc.) in the life of the facility.

#### Specific Information

§146.04(b)(1) It cannot now and will not in the future serve as a source of drinking water because: it is mineral, hydrocarbon, or geothermal energy producing or can be demonstrated by a permit applicant as 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.

If the proposed exemption is to allow a Class II enhanced oil recovery well or an existing Class III injection well operation to continue, the fact that it has a history of hydrocarbon or mineral production will be sufficient proof that this standard is met. Many times it may be necessary to slightly expand an existing well field to recover minerals or hydrocarbons. In this case, the applicant must show only that the exemption request is for expanding the previously exempted aquifer and state his reasons for believing that there are commercially producible quantities of minerals within the expanded area.

Applicants for aquifer exemptions to allow new in-situ mining must demonstrate that the aquifer is expected to contain commercially producible quantities of minerals. Information to be provided may include: a summary of logging which indicates that commercially producible quantities of minerals 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. The applicant may also identify nearby projects which produce from the formation proposed for exemption. Many Class III injection well permit applicants may consider much information concerning production potential to be proprietary. As a matter of policy, some States do not allow any information submitted as part of a permit application to be confidential. In those cases where potential production information is not being submitted, it may be necessary for EPA to participate

with the State in discussions with the applicant to obtain sufficient evidence to indicate that the ore zone is commercially producible. The information to be discussed would include the results of any R & D pilot project.

Exemptions relating to any new Class II wells which will be injecting into a producing or previously produced horizon should include the following types of information.

- a. Production history of the well if it is a former production well which is being converted.
- b. Description of any drill stem tests run on the horizon in question. This should include information on the amount of oil and water produced during the test.
- c. Production history of other wells in the vicinity which produce from the horizon in question.
- d. Description of the project, if it is an enhanced recovery operation including the number of wells and their location.

§145.04(b)(2) It cannot now and will not in the future serve as a source of drinking water because: It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical:

EPA consideration of an aquifer exemption request under this provision would turn on: The availability of alternative supplies, the adequacy of alternatives to meet present and future needs, and a demonstration that there are major costs for treatment and or development associated with the use of the aquifer.

The economic evaluation, submitted by the applicant, should consider the above factors, and these that follow:

1. Distance from the proposed exempted aquifer to public water supplies.
2. Current sources of water supply for potential users of the proposed exempted aquifer.
3. Availability and quality of alternative water supply sources.
4. Analysis of future water supply needs within the general area.
5. Depth of proposed exempted aquifer.
6. Quality of the water in the proposed exempted aquifer.

7. Costs to develop the proposed exempted aquifer as a water supply source including any treatment costs and costs to develop alternative water supplies. This should include costs for well construction, transportation, water treatment, etc., for each source.

§146.04(b)93) It cannot now and will not in the future serve as a source of drinking water because: It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption.

Economic considerations would also weigh heavily in EPA's evaluation of aquifer exemption requests under this section. However, unlike the previous section, the economics involved would be controlled by the cost of technology to render water fit for human consumption. Treatment methods can usually be applied to render water potable. However, costs of that treatment may often be prohibitive either in absolute terms or when compared to cost to develop alternative water supplies. ]

EPA's evaluation of aquifer exemption request under this section will consider the following information submitted by the applicant:

1. Concentrations and types of contaminants in the aquifer.
2. Source of contamination.
3. Whether the contamination source has been abated.
4. Extent of contaminated area.
5. Probability that the contaminant plume will pass the proposed exempted area.
6. Availability of treatment to remove contaminants from water.
7. Chemical content of proposed injected fluids.
8. Current water supply in the area.
9. Alternative water supplies.
10. Costs to develop current and probable future water supplies, and cost to develop water supply from proposed exempted aquifer. This should include well construction costs, transportation costs, water treatment costs, etc.
11. Projections on future use of the proposed aquifer.

§146.04(b)(4) It cannot now and will not in the future serve as a source of drinking water because: It is located over a Class III mining area subject to subsidence or catastrophic collapse:

An aquifer exemption request under this section should discuss the proposed mining method and why that method necessarily causes subsidence or catastrophic collapse. The possibility that non-exempted underground sources of drinking water would be contaminated due to the collapse should also be addressed in the application.

§146.04(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.

An application under this provision must include information about the quality and availability of water from the aquifer proposed for exemption. Also, the exemption request must analyze the potential for public water supply use of the aquifer. This may include: a description of current sources of public water supply in the area, a discussion of the adequacy of current water supply sources to supply future needs, population projections, economy, future technology, and a discussion of other available water supply sources within the area.

JUL 8 1984

AQUIFER EXEMPTION  
SUMMARY SHEET

Date application received in Region: \_\_\_\_\_

Date application sent Headquarters: \_\_\_\_\_

Date action needed: \_\_\_\_\_

APPLICANT: \_\_\_\_\_

HEARING DATE: \_\_\_\_\_

I.D. NUMBER: \_\_\_\_\_

EXEMPTION DESCRIPTION (Township, Range, Section, Quarter section  
and affected area):

FIELD: \_\_\_\_\_

AQUIFER TO BE EXEMPTED: \_\_\_\_\_

JUSTIFICATION FOR EXEMPTION:

- ( ) Aquifer is not a source of drinking water and will not serve  
as a source of drinking water in the future because it:
- ( ) Has a TDS level above 3,000 and not reasonably expected  
to serve as a source of drinking water
  - ( ) Is producing or capable to produce hydrocarbons
  - ( ) Is producing or capable to produce minerals
  - ( ) Is too deep or too remote
  - ( ) Is above Class III area subject to subsidence
  - ( ) Is too contaminated (name contaminant(s)):
  - ( ) Other: \_\_\_\_\_

PURPOSE OF INJECTION: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_



APPLICANT: \_\_\_\_\_

HEARING DATE: \_\_\_\_\_

I.D. NUMBER: \_\_\_\_\_

INJECTED FLUID QUALITY: \_\_\_\_\_ INJECTION FLUID SOURCE: \_\_\_\_\_

FORMATION WATER QUALITY: \_\_\_\_\_

OIL OR MINERAL PRODUCTION HISTORY: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ACTIVE INJECTION WELLS INJECTING INTO SAME FORMATION

| <u>Field</u> | <u>Location</u> | <u>Injection Interval</u> | <u>Injection Source</u> | <u>Total Depth</u> |
|--------------|-----------------|---------------------------|-------------------------|--------------------|
|--------------|-----------------|---------------------------|-------------------------|--------------------|

WATER USE IN AREA: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

REMARKS: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Append to Aquifer Exemption Guidance for Class III well aquifer exemption  
Requirements for Aquifer Exemption for Class III Wells**

144.7(c)(1) Applicant must furnish data necessary to demonstrate that the aquifer es expected to be mineral or hydrocarbon producing. Info to include for Director's consideration:

- ☐ map
- ☐ general description of mining zone
- ☐ general info on the mineralogy & geochemistry of the mining zone
- ☐ analysis of amenability of mining zone to proposed mining method
- ☐ time table of planned developments of mining zone
- ☐ info required by 144.31(g) [Info for Class I Haz Waste Well Permits]

# Appendix to Aquifer Exemption Guidelines for Class III well aquifer exemption Requirements for Aquifer Exemption for Class III Wells

144. (b)(5) Applicant must furnish data necessary to demonstrate that the aquifer is expected to be subject to hydraulic pumping. Data to include for Director's consideration:

- (i) map
- (ii) general description of mining zone
- (iii) general info on the geology & geochronology of the mining zone
- (iv) analysis of availability of mining zone to proposed mining method
- (v) time table of planned development of mining zone
- (vi) info required by 144.3(a) [Info for Class I (ex Waste Well Permit)]

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Hi Rich, The confidentiality agreement from RMC is attached at the very bottom.

The contacts at RMC are  
Richard Valdez, President & CEO  
David Groy, Vice President  
Claude Murray, Senior Geologist/Hydrologist  
Robert Pruca, Senior Water Resource Engineer  
Walt McNab, Senior Geochemist

Brian Sweet, Staff Environmental Geologist

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

----- Forwarded by Valois Shea/P2/R8/USEPA/US on 04/08/2008 11:46 AM -----

"Richard Valdez" <rvaldez@rmc-consultants.com>  
04/08/2008 11:13 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
Jamie Harris/R8/USEPA/US@EPA, "David Groy" <dgroy@rmc-consultants.com>  
Subject  
NDA Template

Hi Valois, attached is a template we've used for non-disclosure of sensitive information between two parties. I hope we can use something like this to address any concerns. If this is going to Power Tech, I have no problems with them editing this to suit their needs.

Please don't hesitate to call or email with questions. Thanks, RV

Richard B. Valdez  
RMC Consultants Inc.  
12345 W. Alameda Parkway, Suite 205  
Lakewood, CO 80228  
richard.valdez@rmc-consultants.com  
303.980.4101  
303-881-2561 cell  
303.980.4107 facsimile  
<http://www.rmc-consultants.com/>

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unauthorized access or unauthorized amendment. This notice must not be removed. Thank you!

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Hi Kaci, I talked to the RMC guys & it turns out that they would like to see some information for the meeting, after all.

Here is the list:

Map of pump test locations showing pumped well and observation wells.

Any preliminary pump test data you have on hand

A geologic map & cross section of pump test locations

Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Hi Richard,  
I hope things are going well. Attached is the list of information RMC would like to obtain from Powertech. I send it only as a draft for discussion at this point. Would you mind reviewing it to identify the information that you would prefer to keep as CBI. I think that might help the confidentiality discussion deal with specific rather than general topics of info. Also, if you wouldn't mind also identifying what would be no longer need to be held as confidential after the permit application is submitted, that would be helpful, too. I can guess at these things, but it would be better to hear it from you.  
Thanks!

Just an update on the progress of finalizing the aquifer exemption paper we met about: We met with Petrotek and they offered to review it, too, and offer comments. We will meet with them again today to get their comments.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741





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Valois,

We are making good progress on several fronts. I am pleased to read that you have discussed the issue of the aquifer exemption boundary with Petrotek. They are experienced in this area of science and technology and should provide sound input.

Thanks for providing RMC's list of information needs and the offer to meet to further discuss the request and the related confidentiality concerns. We will quickly review the request internally and be prepared to meet with you and RMC very soon. I need to check with Wallace and others to coordinate schedules and will get back to you later today. I agree that we should focus on specific information that we would prefer to maintain as CBI.

I trust your time off was enjoyable and relaxing. I suspect you will be quite busy for the next several months.

Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Thursday, July 10, 2008 6:46 AM  
To: Richard Blubaugh  
Subject: Draft RMC wish list for you review of potential CBI

Hi Richard,

I hope things are going well. Attached is the list of information RMC would like to obtain from Powertech. I send it only as a draft for discussion at this point. Would you mind reviewing it to identify the information that you would prefer to keep as CBI. I think that might help the confidentiality discussion deal with specific rather than general topics of info. Also, if you wouldn't mind also identifying what would be no longer need to be held as confidential after the permit application is submitted, that would be helpful, too. I can guess at these things, but it would be better to hear it from you.  
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Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129

phone: 303-312-6276  
fax: 303-312-6741

- Data Needs and Work Tasks.doc

ATTACHMENT: Data Needs and Work Tasks.doc vrs



**Potentially Proprietary Information Related to Demonstration that Quantity and Location of Mineral Deposits Are Expected to be Commercially Producing.**

Title 40 Code of Federal Regulations (CFR) Section 146.4, Criteria for Exempted Aquifers, includes an opportunity to demonstrate that minerals in a proposed aquifer exemption area are commercially producible as a basis for exempting the proposed portion of the aquifer from status as an Underground Source of Drinking Water under Section 144.6(b)1. Many Class III injection well permit applicants may consider much information concerning production potential provided as support for 144.6(b)1 to be proprietary. Information submitted as part of a permit application is considered to be part of the Administrative Record and must be available for public review. However, the permittee may designate proprietary information to be “Confidential Business Information” per 40 CFR Section 144.5 below.

**§ 144.5 Confidentiality of information.**

(a) In accordance with 40 CFR part 2, any information submitted to EPA pursuant to these regulations may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission in the manner prescribed on the application form or instructions or, in the case of other submissions, by stamping the words “confidential business information” on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR part 2 (Public Information).

(b) Claims of confidentiality for the following information will be denied:

- (1) The name and address of any permit applicant or permittee;
- (2) Information which deals with the existence, absence, or level of contaminants in drinking water.



## **Criteria for EPA Review of Class III Aquifer Exemptions**

### **I. Regulations: Title 40 Code of Federal Regulations (CFR) Sections**

#### **146.4 Criteria for exempted aquifers.**

An aquifer or a portion thereof which meets the criteria for an “underground source of drinking water” in §146.3 may be determined under 40 CFR 144.8 to be an “exempted aquifer” if it meets the following criteria:

**(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 can be demonstrated by a permit applicant as 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.**

**Definition of USDW from 40 CFR 146.3**

Underground source of drinking water (USDW) means an aquifer or its portion:

(a) (1) Which supplies any public water system;

**or**

(2) Which contains a sufficient quantity of ground water to supply a public water system;

**and**

(i) Currently supplies drinking water for human consumption;

**or**

(ii) Contains fewer than 10,000 mg/l total dissolved solids;

**and**

(b) Which is not an exempted aquifer.

**144.7 Identification of underground sources of drinking water and exempted aquifers.**

(c)(1) For Class III wells, the Director shall require an applicant for a permit which necessitates an aquifer exemption under §146.04(b)(1) to furnish the data necessary to demonstrate that the aquifer is expected to be mineral or hydrocarbon producing. Information contained in the mining plan for the proposed project, such as:

- o a map
- o a general description of the mining zone,
- o general information on the mineralogy and geochemistry of the mining zone,
- o analysis of the amenability of the mining zone to the proposed mining method,  
and
- o a time-table of planned development of the mining zone,

shall be considered by the Director in addition to the information required by §144.31(g).

## II. Guidance: Guidance for Revisions to State Programs, Attachment 3 Guidelines for Reviewing Aquifer Exemptions.

EPA will approve aquifer exemptions for only specific purposes.

All exemption request approvals will include a description of injection activities allowed and a statement that additional approvals would be needed for other injection activities.

### Evaluation Criteria

#### General Information

Applicants requesting exemptions must provide the following general information:

1. A topographic map of the proposed exempted area. The map must show the boundaries of the area to be exempted. Any map which precisely delineates the proposed exempted area is acceptable.
2. A written description of the proposed exempted aquifer including:
  - a. Name of formation of aquifer.
  - b. Subsurface depth or elevation of zone.
  - c. Vertical confinement from other underground sources of drinking water (USDWs).
  - d. Thickness of proposed exempted aquifer.
  - e. Area of exemption (e.g., acres, square miles, etc.).
  - f. A water quality analysis of the horizon to be exempted.

In addition to the above descriptive information concerning the aquifer, all exemption requests must demonstrate that the aquifer "...does not currently serve as a source of drinking water." (40 CFR Section 146.04(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 ¼ mile from the boundary of the exempted area. Any water supply wells located should be identified on the map showing the proposed 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. **If the exemption pertains to only a portion of an aquifer, a demonstration must be made that the waste will remain in the exempted portion. Such a demonstration should consider among other factors, the pressure in the injection zone, the waste volume, injected waste characteristics (i.e., specific gravity, persistence, etc.) in the life of the facility.**

#### Specific Information

146.04(b) (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 can be demonstrated by a permit applicant as 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.

Applicants for aquifer exemptions to allow new in-situ mining must demonstrate that the aquifer is expected to contain commercially producible quantities of minerals.

Information to be provided may include:

- A summary of logging which indicates that commercially producible quantities of minerals 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.

The applicant may also identify nearby projects which produce from the formation proposed for exemption.

**Date:** June 13, 2008

**Subject:** Preliminary Data Needs and Expected Work Tasks, Centennial Well Field Aquifer Modeling, Weld County, Colorado

~~Conference Date: November 7 & 8, 2005~~

~~Conference Location: Wyoming Department of Environmental Quality, Cheyenne, Wyoming~~

~~Conference Notes Provided By: David Groy, RMC Consultants, Inc.~~

~~Conference Participants\*:~~

~~See attached participant list.~~

The following items will be acquired to initiate and proceed with the Centennial Aquifer Modeling program. Proposed work tasks are offered as well.

1. Obtain, if possible, an existing large-scale flow model of the basin (state engineer, or other party),
2. Anticipated number, location, and flow rates of in situ uranium extraction and operation wells. Obtain Powertech's proposed ISL mining plan as soon as possible (i.e., which sections they'll start with first Section 33 in T10N/R67W, how many injection wells, how many production wells, how many ISL areas within just Section 33?).
3. Geologic information to include:
  - a. Summary of all geologic interpretations (state engineer) or from Powertech.
  - b. Approximate range of aquifer thickness from ISL areas and average thickness of hydraulic conductivities of the A and B aquifers and aquitard.
  - c. Powertech's raw borehole data for developing our own isopachs and aquifer zone interpretations. This will be a fundamental dataset in our assessment for EPA.
4. Hydrologic information to include:
  - a. All active/proposed wells from state engineer.
  - b. Preliminary groundwater level data for wells in the area (state, or Powertech) to establish average regional hydraulic gradient, gradient magnitudes, and flow direction for key A-zone aquifer
  - c. Obtain previous pump test information as soon as possible.
5. Geochemical information to include:
  - a. Major and trace element aquifer chemistry, preferably for both A and B aquifers at multiple locations
  - b. Mineralogical descriptions of affected lithologies.

Following data collection and review, work will begin on assessing the geologic and hydrogeologic characterization, protection of potable groundwater from contamination by



uranium as well as other trace elements (e.g., arsenic, selenium, vanadium) that could be potentially mobilized as a result of proposed *in situ* uranium mining operations, extraction and injection well configuration which will determine the completeness of capture protection, mobility of the trace elements of concern in groundwater with respect to a conservative tracer such as chloride.

Additionally, an initial screening hydrogeologic model will be developed that addresses an idealized representation of the hydrogeologic system. Modeling may include an infinite 2- or 3-layer aquifer system of uniform thickness, pumping configuration, groundwater quality, and aquifer mineralogy, including host rock composition, will be applied to identify the extent and rate of groundwater quality impact beyond the monitoring well network given a range of assumed hydrogeologic and geochemical properties.

To accomplish these objectives, specific work task will likely include:

1. Prepare a brief Work Plan outlining hydrogeologic modeling work to be performed.
2. Develop working GIS database to include:
  - a. hydrography (I already got this from state water GIS webpage),
  - b. Topo-dem (10 meter preferred – even if we have to purchase).
  - c. Major aquifer surfaces/isopachs (Denver-Julesburg aquifer system).
  - d. Surface geology
  - e. Soils map
  - f. all user wells in area
  - g. all boreholes
  - h. all geophysical log locations
  - i. Land ownership
  - j. Obtain data and reports (whatever is available now).
2. Attempt to obtain all well/geology information for the area from State Engineer's Office – Ms. Elizabeth Pottorff.
3. Determine what information EPA, CDPHE, and other regulatory agencies currently have.
4. Pull together readily available GIS information in Arcview from EPA or CDPHE or even BLM/USDA.
5. Develop preliminary conceptual-level hydrogeologic model (i.e., area of review) for Powertech's L-shaped area with many sections. Describe all components, uncertainty, flow directions, discharge/recharge areas/mechanisms etc. Try to develop understanding of regional flow controls/trend over proposed mining area – based on conceptual flow model. A simple 'area of review' model (for at least 46 sq. mi. permit area) could be developed to help define regional boundary conditions for more localized modeling.

6. Given geologic complexity and spatial extent of planned ISL activity, assess where pump tests would be most beneficial. Considering the areal extent of proposed mining and the critical nature of pump test data, one pump test may not be adequate for EPA purposes.
7. Conduct pump test oversight during Powertech proposed pump test to confirm flow rates, aquifer response, locations etc. Following the pump test, assess and analyze pump test results.
8. Base on all available data, develop a hydrogeologic and geochemical model. Assess geochemical 'worst-case' migration scenario from any of the ore-bodies in their sections (i.e., 46 sq. miles).
9. Following model development and simulation, prepare a methodology document for EPA as guidance for future similar projects. The document will follow ASTM standards to the extent possible.

Edgars email dated 7/18/2008

At the edge of the aquifer exemption state water jurisdiction comes back into force. The edge of the facility is, de facto, a point of compliance under state law. Is the monitoring well ring a POC under your jurisdiction? There can be a difference between wells used to monitor performance and wells used for compliance determination. The former is the way you are proposing to use the monitor well ring. Will EPA required wells be used for the latter, or will you leave that to the state?

How will EPA determine if a violation has occurred? What is a violation? What is the consequence of a violation?

I think your discussion document has some good information, and well reasoned decisions. Sometimes the document is a little wordy and prescriptive. (That's just my opinion as I write tersely.)

Thanks for letting me comment.

best regards,  
Edgar Ethington  
CDPHE  
(303) 692-3438

## Roger Flynn

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**From:** Shea.Valois@epamail.epa.gov  
**Sent:** Monday, March 23, 2009 11:18 AM  
**To:** wmap@igc.org  
**Subject:** the email part of your FOIA request



Powertech Dewey \_AVG  
Burdock emails... tification\_.txt (275 KB)

Hi Jeff,

I have exported the emails & created a Word document including all the emails in each of the 5 email folders I created to organize the emails:

Aquifer Modeling Contract  
Dewey Burdock Permit Application  
Powertech  
Powertech Centennial  
Powertech Dewey Burdock

The Powertech Dewey Burdock document is attached to this email.

Each document is a direct export from our Lotus Notes email system & it is not pretty. I am really disappointed that I could not just send you the extracted database from Lotus Notes so you could have easier, more organized access to each email. It would have been slick.

Rather than edit the document to take out all the extraneous stuff, I thought I should leave it intact. So I am sorry it is so unwieldy. If an email has attachments, I added the name of the attached file in red & initialed it so you know it was something I added to the information that is otherwise directly as it came from Lotus Notes. I will send each compressed zip folder containing the attachments for each email folder separately.

(See attached file: Powertech Dewey Burdock emails.doc)

Valois Shea US EPA Region 8 8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

## **In-Situ Uranium Leaching-Related Activities by OPRA's Underground Injection Control Program**

The Region 8 UIC Program is preparing to receive Class III UIC permit applications at two ISL uranium sites. Injection wells at both sites will be regulated by EPA Region 8. These UIC Class III ISL Permits will be the first nationally that EPA would issue and directly regulate under a direct implementation program. Powertech (USA) Inc. (Powertech) is proposing to submit permits for the Centennial Site in Weld County, CO, and the Dewey-Burdock site south of Rapid City, SD. The target receipt date for the Dewey-Burdock permit application is December 31, 2008. No target date has been set for the Centennial permit application.

Region 8 UIC program staff are engaging in the following activities to prepare for handling the permit applications in an efficient and informed manner.

**I.** Meetings and conference calls with the co-regulating agencies in Colorado and South Dakota to initiate an informal coordinated effort for permit application review and permit issuance for the ISL sites. These agencies include:

1. Colorado Department of Natural Resources (CDNR)  
Division of Reclamation, Mining, and Safety  
State Engineer's Office under the Division of Water Resources
2. Colorado Department of Public Health and Environment (CDPHE)  
Hazardous Materials & Waste Management Division Radiation Program, which issues the radioactive materials license under agreement with the Nuclear Regulatory Commission.
3. Weld County Commissioners, who requested a presentation on EPA's UIC program and its role in regulating ISL mining. Weld County will issue a land use permit.
4. South Dakota Department of the Environment and Natural Resources (SD DENR)  
Minerals and Mining Program  
Ground Water Quality Program

**II.** Review of amended state ISL injection well regulations proposed by SD DENR<sup>1</sup> agencies. These amended state regulations are at least equivalent to federal UIC regulations, and will allow for increased ground water protection and restoration requirements to be applied to in-situ uranium operations. These more detailed amended state regulations will facilitate easier (smoother?) coordination between the Region 8 UIC Program and the DENR programs that regulate ISL injection wells in South Dakota.

**III.** Establishing a contract with an independent, third party contractor. The contractor will observe aquifer tests at the Centennial project site in Colorado, review the aquifer test data, and perform hydrologic and geochemical models simulating active mining and

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<sup>1</sup> The CDRMS is currently updating state regulations related to ISL mining.



restoration in the project area. One reason the Centennial project is receiving ~~a much higher level of~~ **this level of** technical scrutiny is because many residences located near the proposed Centennial project rely on private wells for their drinking water, and many of those drinking water wells are completed in the same Fox Hills Formation aquifer as the mining zone aquifer. The data and models provided by the contractor will provide information how water withdrawal from those drinking water wells could affect and complicate ground water flow patterns in the project area, thus helping EPA develop permit requirements that better protect underground sources of drinking water (USDWs) in the Centennial project area. In contrast, the Dewey Burdock site in SD is mainly ranch land, with far fewer private drinking wells. At Dewey-Burdock, the private residences that did have drinking water wells completed in the mining zone aquifer agreed to have Powertech replace their drinking water wells with new, deeper wells that are not in hydrologic connection with the mining zone aquifer.

**IV.** The Region 8 UIC Program met with Powertech early on. Region 8 has developed permit application guidance documents and policy statements regarding criteria and processes used for permit application review, developing permit requirements, and for evaluating and approving exemption of a USDW aquifer for ISL mining. Federal regulations for UIC Class III facilities tend to be very general and do not provide detailed information helpful to companies developing permit applications and aquifer exemption requests.

**V.** In developing permit application guidance documents and policy statements, UIC staff also consulted or met with a number of mining companies with interests in Region 8, with consultants and experts on ISL mining, aquifer characterization and modeling, and with staff from state UIC programs and other EPA Regions.

**VI.** Coordination with WY DEQ Land Quality Division (LQD). In 2005, the LQD, the Division responsible for the delegated UIC Class III program, passed regulations governing noncoal rules (ISL regulations). At that time, Region 8 identified and commented to LQD regarding several issues that needed to be addressed prior to approving their regulations. One outstanding issue concerns the language used to describe the boundary of an exempted aquifer. EPA must approve any exemption of a USDW aquifer at an ISL project before injection is allowed. Region 8 EPA and LQD have met twice this year to discuss resolution of this issue. LQD intends to modify their regulations such that their aquifer exemption language is as strict as EPA regulations. At the request of LQD, EPA provided LQD with a formal letter denying approval of the already-passed noncoal ISL rules to provide to the Wyoming Environmental Quality Council (EQC). The LQD is expecting an ISL permit application with aquifer exemption in the near future which likely will need to be issued before any new noncoal rules become final.

Valois,

I like the report. Here are my comments.

**Regarding the statement:**

"The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a line circumscribing the minimum area that allows full extraction of the ore proposed in the mining plan and restoration of the area affected by lixiviant flow within the subsurface, without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary."

**Comment:**

You may want to define at what concentration(s) the chemical effects to which the statement refers are considered benign.

**Regarding the statement:**

"It is important to minimize the extent of the area inside the aquifer exemption boundary, because it is forever exempted from protection under the UIC Program, specifically the provisions of 144.12."

**Comment:**

Forever is a long time. This Region has toyed with the idea, as has the State of Texas, to re-apply to remove the exemption for restored aquifers. I see no prohibition in the rules on the matter and if the State want to amend their program to re-include the exempted aquifer I guess they could. This has not happened yet.

**Regarding the statement:**

"The aquifer exemption boundary may be located at some distance outside the monitoring well ring, but no further out than the Area of Review boundary."

**Comment:**

This does not correctly place the exemption boundary. The monitoring well ring's purpose is to ensure no contact between lixiviant and USDW occurs. So the monitoring wells MUST be placed within the exempted aquifer. The AOR, by guidance, extends out beyond the exemption boundary by at least 1/4 mile. The monitoring well ring, if placed in the AOR, will not be able to detect an excursion before the excursion makes contact with a non-exempted USDW. The ring has to be placed outside of the area to be mined, but far enough inside the exempted boundary to detect an excursion before it reaches a non-exempted USDW. The AOR should be large enough to subsume the ring and the exempted aquifer plus at least 1/4 mile.

In this Region we use the Area of Review to determine the extent of GW usage near the area to be mined. Initially, it will be no less than 1/4 mile surrounding the facility boundary. We would increase the AOR beyond the 1/4 mile if the modeling suggested. At the very least the final AOR will extend beyond the boundaries of the

exemption to the extent necessary to include all water wells whose draw would have an impact on the migration of a restored plume.

**Regarding the statement:**

Monitoring well Ring: The monitoring well ring should be placed at some distance beyond the project area to detect any excursions of lixiviant outside the project area and allow recovery of excursions within a reasonable amount of time. The monitoring well ring location may be set a fixed distance beyond the project area. The permit application should include estimations of

- ☐ how long it will take an excursion to reach the monitoring well ring,
- ☐ based on sampling frequency, how far an excursion could potentially flow before it is detected at the monitoring well ring, and
- ☐ how long it will take to recover an excursion detected at the monitoring well ring.

This information will be considered in evaluating the proposed location of the aquifer exemption boundary.

**Comment:**

I suggest some discussion of monitoring well spacing. Texas requires no greater than 400' apart. This may be stretching it depending on the geology.

**Regarding the statement:**

Upon detecting an excursion at the monitoring well ring, the permit will require the installation of excursion response wells that would intercept the excursion plume before it reaches the aquifer exemption boundary.

**Comment:**

Excursion response wells seem like a good idea, When they detect an excursion down here they must notify the State and change withdrawal and injection patterns immediately to draw the excursion back inside the ring. This includes producing the monitoring well(s) wherein the excursion was detected. This is done until the excursion is no longer detected. The whole episode is documented and reported and might result in an enforcement action.

Thanks for letting me look at your product.

Ray Leissner, Env. Eng.  
Ground Water / UIC Section (6WQ-SG)  
(214) 665 - 7183  
USEPA, Region 6

----- Forwarded by Ray Leissner/R6/USEPA/US on 08/04/2008 07:33 AM -----

**Ray**  
**Leissner/R6/USEPA/US** To Valois Shea/P2/R8/USEPA/US@EPA  
07/23/2008 02:58 PM cc leissner.ray@epa.gov, Nathan  
Wiser/ENF/R8/USEPA/US@EPA  
Subj Re: Fw: Exemption question - a partial answer [Notes](#)  
ect [Link](#)

Valois

That is a very stringent interpretation of 144.12 you've posed. We do not hold with that interpretation. We just read the rule at face value. What is up for interpretation in this Region is:

What can constitute a violation of the primary drinking water regulations?

and

What can be considered when determining what is harmful to human health?

These questions are actually much more involved than is evident in their simplistic appearance. If you want to discuss call me.

I'll be out of the office for the next week or so but I'll try to provide comment when I return.  
Thanks

Ray Leissner, Env. Eng.  
Ground Water / UIC Section (6WQ-SG)  
(214) 665 - 7183  
USEPA, Region 6

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Hi Patsy, I appreciate your help in taking on those boxes of old files last Friday. You also inspired me to start looking up references. I was looking in our EPA library to see if we had 2 TVA reports about hydrology



at the D-B sites. They don't but will ask for them on inter-library loan. It will take a couple of weeks. Just because I am so eager to read them - I'd thought I would ask... Would you happen to have them in an electronic format?

1980, Analysis of aquifer tests conducted at the proposed Burdock uranium mine site Burdock, SD: Report No. WR28-8-520-109

1983, Hydrologic investigations at proposed uranium mine near Dewey SD: Report No. WR28-2-520-128

Thanks!

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Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Thanks so much! I tried to find reports on the USGS website but it looked like I had to purchase the ones I would have liked, so I really appreciate

you sending this info. Nov 28th works for me. I can come to the KP office, since there is only 1 of me and many of you with large maps. What time would work for you all? I can be there around 8:30 to 9:00, I think.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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I have it on my calendar! A geologic map of the proposed mine sites and a couple of cross sections through the ore zones would be helpful. If there are any domestic wells around the orebodies, a map showing their locations

would be good. Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
11/20/2007 12:27 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
  
Subject  
Meeting Wednesday Dec 28th at 9 am

Hello Valois,  
I'd like to confirm the meeting set for Wednesday, December 28th at 9 am in the Denver Knight Piesold office. I will put together a draft agenda and participant list as soon as possible. Please let me know if you have specific material that you would like to see/discuss so that we can accommodate you as best as possible. My understanding is that much of the technical information will be presented in the form of a power point presentation. Please let me know if you want to view paper copies of maps so that we can make sure they are available.  
Thank you,  
Patsy

---

Patsy B. Moran, Ph.D.  
Chemist

Knight Piesold and Co.  
1580 Lincoln Street, Suite 1000  
Denver, CO 80203-1512

Direct Dial: 303 867 2201  
Tel: 303 629 8788  
Fax: 303 629 8789

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PostedDate: 11/26/2007 09:56:02 AM  
Recipients:  
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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

Thanks for all the information! I look forward to the meeting on Wednesday.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
11/21/2007 11:16 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
"Daniel P. Hoyer" <Daniel.Hoyer@respec.com>, "Paul Bergstrom"  
<pbergstrom@knightpiesold.com>  
Subject  
Contact information and draft participant list

Hi Valois,

Tom Brandner is the UIC contact at SD DENR. I believe he is located in the Pierre office and the main number is (605) 773-3151.

Mike Cepak is the contact for the Large Mine Permit contact at SD DENR and he can be reached through the same number.

The SD DENR will not be present at the upcoming meeting. A list of the likely participants follows:

Valois Shea (EPA)  
Rich Blubaugh (PowerTech)  
Mark Hollenbeck (PowerTech)  
Dan Hoyer (Respec)  
Paul Bergstrom (Knight Piésold)  
Cory Conrad (Knight Piésold)  
Patsy Moran (Knight Piésold)

Please let me know if this attendee list isn't consistent with your understanding.

Dan Hoyer recommended that you contact Mark Anderson at USGS (Rapid City) regarding the aquifer pump tests and parallel modeling that EPA plans to do for the Dewey-Burdock site. His email is manders@usgs.gov and phone number is 605-394-3220. I got this information directly from the internet

so I cannot be certain it is current.

I'm working on a draft agenda and will get it to you as soon as possible.

I hope this proves helpful.

Patsy

---

Patsy B. Moran, Ph.D.  
Chemist

Knight Piésold and Co.  
1580 Lincoln Street, Suite 1000  
Denver, CO 80203-1512

Direct Dial: 303 867 2201  
Tel: 303 629 8788  
Fax: 303 629 8789

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PostedDate: 11/26/2007 12:18:12 PM  
Recipients: <pmoran@knightpiesold.com>  
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Looks fine to me! Could you explain a little more about what "regulatory status" would cover?

I hope to have finished reading the info you sent me by the time we meet.  
Would it be helpful for me to have contacted the SD people before the meeting?  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
11/26/2007 11:44 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
Meeting Agenda

Hi Valois,  
Can you please look this agenda over and see if you'd like to add anything?  
I'd like to send it out to everyone attending later today, if possible.  
Thank you,  
Patsy

---

Patsy B. Moran, Ph.D.  
Chemist

Knight Piésold and Co.  
1580 Lincoln Street, Suite 1000  
Denver, CO 80203-1512

Direct Dial: 303 867 2201  
Tel: 303 629 8788  
Fax: 303 629 8789

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ATTACHMENT: UIC Permit Agenda vrs

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Hi Paul, Thanks for setting up something so quickly! But I just spoke with Kaci Walker from R Squared to confirm a trip that Patsy, Kaci, and I will take to Cheyenne on December 19 to review files and meet with staff

at WDEQ Land Quality Division. I'll leave it up to Patsy as to which trip we should do! I do have a meeting I must make on Tuesday morning, so I wouldn't be able to leave until Tuesday afternoon. Frankly, it would be easier for me to go after Christmas, giving me time to get my travel approved & plane ticket purchased, etc. But I don't want to delay the meeting with USGS just to fit my schedule. Just let me know & I will submit my travel request. Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Paul Bergstrom" <pbergstrom@knightpiesold.com>  
12/04/2007 02:17 PM

To  
"Patsy Moran" <pmoran@knightpiesold.com>, Valois Shea/P2/R8/USEPA/US@EPA  
cc  
"Daniel P. Hoyer" <Daniel.Hoyer@respec.com>, "Mark Hollenbeck"  
<mhollenbeck@powertechuranium.com>  
Subject  
FW: USGS Meeting on Inyan Kara

Hello Patsy and Valois:

Will this schedule work for you? Please let me know ASAP. Thanks. Paul

Paul D. Bergstrom, C.E.P.  
Senior Associate  
Knight Piésold and Co.  
1580 Lincoln Street, Suite 1000      New Address!  
Denver, CO 80203-1512  
USA  
Phone: (303) 629-8788  
Direct: (303) 867-2270  
Fax: (303) 629-8789  
Web Site: <http://www.knightpiesold.com>

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From: Daniel P. Hoyer [mailto:Daniel.Hoyer@respec.com]  
Sent: Tuesday, December 04, 2007 11:57 AM  
To: Paul Bergstrom  
Cc: mhollenbeck@powertechuranium.com; rblubaugh@powertechuranium.com  
Subject: USGS Meeting on Inyan Kara

Mark just confirmed the meeting. His office in Rapid City, 9 am Wednesday December 19. I suggest Valois and Patsy fly in Tuesday morning, make a field visit and plan to fly out Wednesday afternoon after lunch. We could visit the site Wednesday pm if that works better in there schedule.

Dan

Dan Hoyer, Ph.D., PE  
Vice President, RESPEC  
3824 Jet Drive  
Rapid City, SD 57709-0725  
dan.hoyer@respec.com  
<http://www.respec.com/>  
Phone  
Office: 605 394 6512  
Fax: 605 394 6456  
Cell: 605 381 0043

From: Daniel P. Hoyer  
Sent: Monday, December 03, 2007 8:24 AM  
To: 'Mark T Anderson'  
Cc: 'Mark Hollenbeck'; Paul Bergstrom  
Subject: Meeting on Inyan Kara

Mark

I would like to follow up on the idea of coming into your office and discuss the work we are doing on the Dewey Burdock In-Situ Uranium project near Edgemont, SD. As we discussed, RESPEC is responsible for characterizing the aquifer in this area. There was a lot of data from the late 70 and early 80s when TVA was planning a shaft type mine in the resource. The objective of the meeting is to provide information and to solicit wisdom. The proposed agenda is;

- § Introductions
- § Project History
- § Project Description
- § Regulatory Status
- § Regional Geology
- § Groundwater Hydrology
- § Water Use
- § Dewey-Burdock Pump Tests
- § USGS related work

I plan to invite Arden Davis, Larry Steler (they are working with us on this project) Perry Rohn, Valois Shea EPA Region VIII, and a SD DENR representative. I suggest we allow for a 60 minute presentation and another 60 minutes for discussion. I can provide our analysis to date and key literature such as the two USGS studies of the area prior to the meeting.

I am thinking we should schedule this December 18, 19 or 20th. Would any of those dates work for you?

Dan

Dan Hoyer, Ph.D., PE  
Vice President, RESPEC  
3824 Jet Drive  
Rapid City, SD 57709-0725  
dan.hoyer@respec.com  
<http://www.respec.com/>  
Phone  
Office: 605 394 6512  
Fax: 605 394 6456  
Cell: 605 381 0043

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Patsy,

I am sending this email as follow-up to your November 16th visit to the EPA Region 8 office to review files related to Underground Injection Control Class I and Class III permit applications and aquifer exemptions. This email also serves as documentation of closure on your FOIA request dated November 5. Please feel free to contact me if there is any other



information that might be helpful to you.

Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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 <KaciWalker@R2Incorporated.com>, pbergstom@knightpiesold.com  
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 \$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

I think Patsy's task was to call Steve Engle to set up a meeting. I will be glad to do that.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
12/07/2007 09:35 AM

To  
"Kaci Walker" <KaciWalker@R2Incorporated.com>, Valois  
Shea/P2/R8/USEPA/US@EPA  
cc  
<pbergstom@knightpiesold.com>  
Subject  
RE: Visit to Wyoming DEQ

Hi Valois and Kaci,  
I cannot remember if I confirmed with you folks about the trip to WDEQ? If possible can you make the arrangements since I'll be in Peru and I'm having spotty email contact? I will be wherever you need me on any day/time. I can drive if needed. Just let me know. I hope I haven't inconvenienced you too much.  
Thank you,  
Patsy

---

From: Kaci Walker [mailto:KaciWalker@R2Incorporated.com]  
Sent: Mon 12/3/2007 3:55 PM  
To: shea.valois@epa.gov; Patsy Moran  
Subject: Visit to Wyoming DEQ

Valois,

Patsy Moran and I are trying to line up a trip to WDEQ to view UIC files. We are looking at the week of December 17th. I am available the 17th through the 20th and Patsy is also available then. However, we are targeting the 19th in particular. Is there a day that week that might

work for you?

Also, I am currently compiling the documents you requested from Richard and will have them to you by COB tomorrow (Dec. 4th).

Kaci Walker

Permit Coordinator

R Squared, Inc.

303-832-7664 (office)

303-378-1146 (cell)

\$AutoSpell: 1  
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In\_Reply\_To: <9544D5A542136C49ACC1C118202AAA5501E3A2@DVEX1.knightpiesold.local>  
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PostedDate: 12/21/2007 01:28:44 PM  
Recipients: <pmoran@knightpiesold.com>  
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InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
  
Wed night Jan 9  
\$70 dollars

505 North Fifth Street, Rapid City

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by  
 epahub12.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
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 SendTo: "Daniel P. Hoyer" <Daniel.Hoyer@respec.com>, "Paul Bergstrom"  
 <pbergstrom@knightpiesold.com>  
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\$MiniView:  
\$PaperColor: 1

Hi Dan,

Just to confirm, are you going to make the reservations for Paul, Valois and me in Rapid City the night of January 15th?

We appreciate the help!

Patsy

---

Patsy B. Moran, Ph.D.

Chemist

Knight Piésold and Co.

1580 Lincoln Street, Suite 1000

Denver, CO 80203-1512

Direct Dial: 303 867 2201

Tel: 303 629 8788

Fax: 303 629 8789

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Here is the list I promised you long ago:

Here is the page I got from the MCL document so you can see how the radon standards are listed:

Here is the whole document:

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

3 ATTACHMENTS: Total Metals.doc, Radionuclides.doc, dwstandards.doc vrs

Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
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 \$MiniView:  
 \$RespondedTo: 1



\$PaperColor: 1

Hi Valois,

We are going to head out around noon. I just wanted to let you know that nothing else is in the works prior so getting here at noon should be sufficient. I'm going to grab lunch at Heidi's just before and eat it in the car. Let me know if you want me to pick something up for you.

Thanks!

Patsy

---

Patsy B. Moran, Ph.D.

Chemist

Knight Piésold and Co.

1580 Lincoln Street, Suite 1000

Denver, CO 80203-1512

Direct Dial: 303 867 2201

Tel: 303 629 8788

Fax: 303 629 8789

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INetBlindCopyTo:  
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InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

Thanks for keeping me up to date. I brought my lunch but thanks for asking!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by  
 epahub11.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
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 <Shea.Valois@epamail.epa.gov>; Fri, 18 Jan 2008 13:56:55 -0500 (EST)  
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 Thread\_Index: AchaA+QLXUxZrZaaRpaHIUVevSU6Tg==  
 From: "Patsy Moran" <pmoran@knightpiesold.com>  
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 DeliveredDate: 01/18/2008 11:56:57 AM  
 \$MiniView:  
 \$RespondedTo: 1

\$PaperColor: 1

Hi Valois,

Are you familiar with this letter issued to a UIC permit applicant from the EPA...

<http://www.epa.gov/Region8/water/uic/dwletter.pdf>

and its contents?

I'm hoping you have a paper or electronic copy of some of the attachments that are referenced but not included. I'm primarily interested in a few specific items from pg 5 of the letter since I believe I have everything else. Specifically:

- UIC Permitting Process Flowchart & "Issuing a UIC Permit"
- Checklist for Administrative Review
- Information to Be Submitted with Application Attachments
- Financial Responsibility (Bonding) Guidance Booklet
- Example Forms for Financial Responsibility Demonstration:

Irrevocable Standby Letter of Credit

Standby Trust Agreement with Schedule "A"

Surety Performance Bond

Trust Agreement with Schedule "B"

Chief Financial Officer's Letter

This document keeps grabbing my attention and I figured it couldn't hurt to ask.

Thanks!

Have a great weekend,

Patsy

---

Patsy B. Moran, Ph.D.

Chemist



Knight Piésold and Co.

1580 Lincoln Street, Suite 1000

Denver, CO 80203-1512

Direct Dial: 303 867 2201

Tel: 303 629 8788

Fax: 303 629 8789

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Thanks very much for sending this! The visit to the Centennial site was interesting. The geology there is so much simpler than at Dewey Burdock,

so the aquifer test is simpler, too, but interesting to see first hand. I look forward to seeing the Dewey Burdock test in March!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Here is the information that I sent to Kaci about UIC requirements related to aquifer restoration. I mentioned it while we were driving up to South Dakota, but couldn't remember the regulation.

---

Valois Shea  
US EPA Region 8

8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

----- Forwarded by Valois Shea/P2/R8/USEPA/US on 01/18/2008 01:58 PM -----

Valois Shea/P2/R8/USEPA/US  
12/11/2007 11:35 AM

To  
"Kaci Walker" <KaciWalker@R2Incorporated.com>  
cc

Subject  
Re: Aquifer Exemption Question

I think it might just be an imprecise statement. I think the intent of the statement is correct - the water quality of the mined zone is exempt from the protection offered to underground sources of drinking water under the UIC program up until mining has been completed. Then the authority of either the NRC, and, in the case of Colorado, the DRMS kicks in requiring groundwater restoration.

The wording of the UIC regulation that mentions aquifer cleanup under the closure requirements for Class III wells is not very clear, so it could easily be misinterpreted by someone who hasn't obsessed about it. The reg is 40 CFR 146.10 Plugging and Abandonment of Class III wells, (4)" The Director shall prescribe aquifer cleanup and monitoring where he deems it necessary and feasible to insure adequate protection of USDWs." The UIC program has authority to prevent any contaminant with an MCL from moving beyond aquifer exemption boundary into the un-exempted part of the aquifer. This means it can require a certain level of restoration within the aquifer exemption area if it is necessary to prevent any regulated contaminants from moving out of the exempted area into the un-exempted part of the aquifer.

I think leaving as early as possible for Cheyenne next Wednesday is a good idea. Patsy is driving in from Bailey. I'm coming from Lakewood. So if you would like to choose a spot convenient for you where we can meet and park, maybe somewhere not far from I-25, I can be there at any time. Do you need transportation to pick up the rental car?

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Kaci Walker" <KaciWalker@R2Incorporated.com>  
12/11/2007 10:29 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
Aquifer Exemption Question

Valois,

I am reviewing an NRC workshop on UIC and it mentions several times that some aquifer exemptions are "temporary and require aquifer restoration." When is this applicable and where could I find an example?

Also, as to our trip to WDEQ, what time do you think we should leave? I think the earlier, the better.

Kaci Walker  
Permit Coordinator  
R Squared, Inc.  
303-832-7664 (office)  
303-378-1146 (cell)



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Hi Valois,

Thanks for all the documents. I'm looking them over now. I appreciate the help.  
Patsy

---

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Fri 1/18/2008 1:56 PM  
To: Patsy Moran  
Subject: Re: Documents that you might have easy access to...

Hi Patsy, That "Dear Applicant" letter is an old letter, so not all the documents are used anymore. I couldn't find the flow chart. It was basically a flowchart drawing of the permitting process described in the Dear Applicant Letter. (It wasn't that great - I thought it complicated things. Maybe that is why it disappeared!)

The one called "Information to be submitted with Application Attachments" was just a reformatted list of attachments with the permit application (pages 3-6 of the 7520-6 pdf)

(See attached file: Admin Review Checklist.pdf)(See attached file: ADMINCHKLST-ClassIapp.doc)(See attached file: TechReview Checklist.doc)  
(See attached file: 7520-6.pdf)

Here are all the financial responsibility documents I could find. I included the request form we submit internally the financial responsibility reviewer, so you can see the kinds of things that cause it to be rejected.

(See attached file: UIC Financial Responsibility Review Request.doc)(See attached file: Class II Financial Responsibility documents.pdf)(See attached file: Federal Financial Responsibility for Class II Wells.pdf)  
(See attached file: Financial Responsibility instrument examples.doc)  
(See attached file: Standby Trust example.pdf)

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
01/18/2008 11:55  
AM  
Subject  
Documents that you might have  
easy access to...

To  
  
cc

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<http://www.epa.gov/Region8/water/uic/dwletter.pdf>

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- \* Checklist for Administrative Review
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- \* Example Forms for Financial Responsibility Demonstration:

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Standby Trust Agreement with Schedule "A"

Surety Performance Bond

Trust Agreement with Schedule "B"

Chief Financial Officer's Letter

This document keeps grabbing my attention and I figured it couldn't hurt to ask.

Thanks!

Have a great weekend,

Patsy

---

Patsy B. Moran, Ph.D.  
Chemist

Knight Piésold and Co.  
1580 Lincoln Street, Suite 1000  
Denver, CO 80203-1512

Direct Dial: 303 867 2201  
Tel: 303 629 8788  
Fax: 303 629 8789

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From: NMA Legal 2 [mailto:nmalegal2@nma.org]  
Sent: Wednesday, January 02, 2008 7:33 AM  
To: Patsy Moran  
Subject: 2008 Uranium Recovery Workshop NMAID=107550

SAVE THE DATE

The 2008 NMA/NRC Uranium Recovery Workshop  
will be held  
April 29-30  
at the CurtisHotelin Denver  
(Sidebar meetings will be held on April 28 and May 1)

We will forward additional information on hotel reservations and registration in the near future. In the meantime, if you have suggestions for speakers or presentations, please contact Katie Sweeney at ksweeney@nma.org or (202) 463-2627.

To schedule a sidebar meeting, contact Steve Cohen of NRC at SJC7@nrc.gov or (301) 415-7182.

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From: Selkirk, Linda [mailto:lselkirk@learn.colostate.edu]  
Sent: Wednesday, January 09, 2008 2:59 PM  
To: Patsy Moran  
Subject: uranium\_020208.pdf

Hello,

Here is all the information you should need in order to register for the Uranium Symposium and Workshop on Feb. 2. Online registration is now available at the website given in the brochure. If you have any question regarding registration, please don't hesitate to contact me.

Thank you.

Linda Selkirk

Academic Officer  
Division of Continuing Education  
Colorado State University  
1040 Campus Delivery  
Fort Collins, CO 80523-1040  
Phone: 970.491.2527  
Fax: 970.491.7886 - uranium\_020208.pdf

ATTACHMENT: uranium\_020208.pdf vrs

\$AutoSpell: 1  
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not the Health Physics one. I have been wondering...how is it going with  
your new house?  
Are you moved in?

---

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8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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\$MiniView:  
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Hi Valois,  
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Thanks!  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, January 28, 2008 8:42 AM  
To: Patsy Moran  
Subject: Re: FW: uranium\_020208.pdf

Hi Patsy,  
Thanks for forwarding me the info. I will attend the one in April, but not the Health Physics one. I have been wondering...how is it going with your new house?  
Are you moved in?

---

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8P-W-GW  
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fax: 303-312-6741



\$AutoSpell: 1  
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InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
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We don't require the 5 quarters of background data, so total metals results from the next groundwater sampling event would cover it.

---

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Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
01/28/2008 08:59 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
  
Subject  
RE: FW: uranium\_020208.pdf

Hi Valois,  
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From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, January 28, 2008 8:42 AM  
To: Patsy Moran  
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US EPA Region 8

8P-W-GW  
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Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
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\$MiniView:

Hi Valois,  
For my clarity...  
EPA only requires a single quarter of background ground water monitoring  
or several rounds?

After re-reading your comments about EPA authority over restoration I'm  
worried I don't have a solid grasp of the EPA requirements for  
restoration. I'm told we are following NUREG 1569 and USNRC Reg guide  
4.14 but could we be missing something? Does EPA have any guidance  
beyond what we have already discussed?

Thanks!  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, January 28, 2008 9:39 AM  
To: Patsy Moran  
Subject: RE: FW: uranium\_020208.pdf

We don't require the 5 quarters of background data, so total metals  
results from the next groundwater sampling event would cover it.

---

Valois Shea  
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8P-W-GW  
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phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
01/28/2008 08:59  
AM  
Subject  
RE: FW: uranium\_020208.pdf

To

cc

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Hi Valois,

I keep forgetting to ask you about the Region 6 UIC information you obtained from your colleague. Is it ready for public consumption?

Thanks!

Patsy

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I forgot to say that I will review the DQOs in our regional & program QAPPs & get back to you.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Hi Valois,  
I'm glad the input was useful.  
Folks have been asking about the Moore Ranch Large Mine Permit. Can you still check into this? I'd primarily like to know if it is hugely in error or if it has minor problems.  
Thanks!  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Wednesday, January 30, 2008 4:14 PM  
To: Patsy Moran  
Subject: QAPP

I forgot to say that I will review the DQOs in our regional & program QAPPs & get back to you.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



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Hi Valois,

This could be an interesting collaboration opportunity (see below). I forwarded it to the client but they have a lot on their plate. I'm not sure if anything will pan out. I wonder if EPA Region 8 could find any way to collaborate with Jim. Regardless, he is a great resource for us all.

Thanks,

Patsy

From: James A Davis [mailto:jadavis@usgs.gov]  
Sent: Wednesday, January 30, 2008 11:08 AM  
To: Patsy Moran  
Subject: ISL uranium

Hey Patsy,  
How are you?

I am trying to get some funding from the Nuclear Regulatory Commission to study biogeochemistry of ISL mine systems before, during, and after bioremediation is used as a groundwater remediation strategy. Are you aware of any specific companies that might welcome USGS working with them to study what happens during bioremediation?

Jim

Dr. James A. Davis  
U. S. Geological Survey  
Mail Stop 465  
345 Middlefield Rd.  
Menlo Park, CA 94025  
tel: 650-329-4484  
fax: 650-329-4545  
email: jadavis@usgs.gov

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Hi Valois,

The NRC has a fairly defined approach (NUREG 1569) to setting restoration standards at ISR sites. For example,

(a) Primary Restoration Standards—The primary goal of a restoration program is to return the water quality within the exploited production zone and any affected aquifers to pre-operational (baseline) water quality conditions.

(b) Secondary Restoration Standards—In situ leach operations may cause permanent changes in water quality within the exploited production zone, because the in situ leach extraction process relies on changing the chemistry in the production zone to remove the uranium. The applicant may therefore propose returning the water quality to its pre-operational class of use (e.g., drinking water, livestock, agricultural, or limited use) as a secondary restoration standard.

Does EPA have a similar approach? In my searches I have not been able to find significant guidance material related to this subject. It would be a huge help if I could better understand the approach EPA will take with regard to restoration standards.

Thanks!

Patsy

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The regulation that gives us the very nebulous authority over restoration is 40 CFR 146.10 (a)(4)

(4) The plugging and abandonment plan required in 40 CFR 144.51(o) and 144.52(a)(6) shall, in the case of a Class III project which underlies or is in an aquifer which has been exempted under §146.04, also demonstrate adequate protection of USDWs. The Director shall prescribe aquifer cleanup and monitoring where he deems it necessary and feasible to insure adequate protection of USDWs.

I take this to mean that the permit will require restoration inside the aquifer exemption boundary to the point that no regulated contaminants are moving outside the aquifer exemption boundary into the unexempted USDW. The regulated contaminants in this case would be the list of Total Metals I sent you.

This brings us to a related subject of importance.

We had a meeting with WY DEQ Land Quality Division about their regulation covering the aquifer exemption boundary. We came to the conclusion that we will accept the boundary proposed in the permit application if it is supported with enough information to justify its location. Steve Pratt, my supervisor, stated that his interpretation of the "commercially producible" criteria means establishing a boundary for the aquifer exemption area where the commercially producible ore zone can be mined to the fullest extent and restored without having any contamination passing out of the aquifer exemption boundary into the unexempted USDW.

I do have to tell you that to our shock & horror we found that our regulation 144.12 (b) states

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146, the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated. For EPA administered programs, such enforcement action shall be taken in accordance with appropriate sections of the SDWA. The definition of contaminant is very broad: Contaminant means any physical, chemical, biological, or radiological substance or matter in water.

It does not seem to be restricted to just regulated contaminants. So this has very big implications for where to establish the proposed aquifer exemption boundary. We should have a big meeting to discuss what this means.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



"Patsy Moran" <pmoran@knightpiesold.com>  
01/31/2008 03:56 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
NRC Restoration

Hi Valois,  
The NRC has a fairly defined approach (NUREG 1569) to setting restoration standards at ISR sites. For example,

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Does EPA have a similar approach? In my searches I have not been able to find significant guidance material related to this subject. It would be a huge help if I could better understand the approach EPA will take with regard to restoration standards.

Thanks!

Patsy

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I talked to Carol Bilbrough during the WY DEQ LQD meeting I mentioned in my previous email & she said that she would have a copy of the WY comments on the application sent to me. I will share them with you & Kaci.

It is usually an iterative process where the permit applicant responds to the WY DEQ LQD comments by fixing the problems or providing justification for why they do not believe they need to address a particular comment. This goes back & forth until they reach a compromise that they each can live with.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
01/30/2008 04:33 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
RE: QAPP

Hi Valois,  
I'm glad the input was useful.  
Folks have been asking about the Moore Ranch Large Mine Permit. Can you still check into this? I'd primarily like to know if it is hugely in error or if it has minor problems.  
Thanks!  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Wednesday, January 30, 2008 4:14 PM  
To: Patsy Moran  
Subject: QAPP

I forgot to say that I will review the DQOs in our regional & program QAPPs & get back to you.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276

fax: 303-312-6741

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\$MiniView:

Hi Valois,

Yes... this is useful and it sounds like we should talk soon. I will forward your email to Paul and Cory and get their take on this as well.

My original concern was how EPA will deal with constituents that are already above the MCL, HA, or Region 8 permit limits (baseline Radium for example) when it comes time for restoration. Will ACLs be used? If a constituent is below the MCL now but is slightly elevated as a result of the oxidation of the ore body, will the company be held to MCLs as a clean up standard?

I'll read the email again and make sure I absorb it. I'll probably have a few more questions.

Thank you for all the help!  
Have a great weekend,  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Friday, February 01, 2008 2:26 PM  
To: Patsy Moran  
Subject: Re: NRC Restoration

The regulation that gives us the very nebulous authority over restoration is 40 CFR 146.10 (a)(4)

(4) The plugging and abandonment plan required in 40 CFR 144.51(o) and 144.52(a)(6) shall, in the case of a Class III project which underlies or is in an aquifer which has been exempted under §146.04, also demonstrate adequate protection of USDWs. The Director shall prescribe aquifer cleanup and monitoring where he deems it necessary and feasible to insure adequate protection of USDWs.

I take this to mean that the permit will require restoration inside the aquifer exemption boundary to the point that no regulated contaminants are moving outside the aquifer exemption boundary into the unexempted USDW. The regulated contaminants in this case would be the list of Total Metals I sent you.

This brings us to a related subject of importance.

We had a meeting with WY DEQ Land Quality Division about their regulation covering the aquifer exemption boundary. We came to the conclusion that we will accept the boundary proposed in the permit application if it is supported with enough information to justify its location. Steve Pratt, my supervisor, stated that his interpretation of the "commercially producible" criteria means establishing a boundary for the aquifer exemption area where the commercially producible ore zone can be mined to the fullest extent and restored without having any contamination passing out of the aquifer exemption boundary into the unexempted USDW.

I do have to tell you that to our shock & horror we found that our

regulation 144.12 (b) states

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146, the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated. For EPA administered programs, such enforcement action shall be taken in accordance with appropriate sections of the SDWA.

The definition of contaminant is very broad: Contaminant means any physical, chemical, biological, or radiological substance or matter in water.

It does not seem to be restricted to just regulated contaminants. So this has very big implications for where to establish the proposed aquifer exemption boundary. We should have a big meeting to discuss what this means.

---

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Denver, CO 80202-1129  
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"Patsy Moran"  
<pmoran@knightrpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
01/31/2008 03:56  
PM  
Subject  
NRC Restoration

To

cc



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(a) Primary Restoration Standards-The primary goal of a restoration program is to return the water quality within the exploited production zone and any affected aquifers to pre-operational (baseline) water quality conditions.

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Does EPA have a similar approach? In my searches I have not been able to find significant guidance material related to this subject. It would be a huge help if I could better understand the approach EPA will take with regard to restoration standards.

Thanks!

Patsy

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Hi Valois,  
This topic came up in conversation at the Uranium Symposium. I forwarded your comments below to Powertech since it sounded like you would be discussing this topic on Wednesday.  
Hope you are doing well.  
Patsy

-----Original Message-----

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Sent: Friday, February 01, 2008 2:26 PM  
To: Patsy Moran  
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Denver, CO 80202-1129  
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"Patsy Moran"  
<pmoran@knightpi  
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Valois Shea/P2/R8/USEPA/US@EPA  
01/31/2008 03:56  
PM  
Subject  
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Patsy

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Hi Valois,

From talking to Paul the intent is to have the pump test in March. However, the date is still not firm. As soon as I know the exact schedule I'll let you know. We'll have some documentation on the pump test in the near future.

We do not have a map copier here but we can have full size copies made. How many are there? Perhaps you can bring them Thursday morning?

Thanks!

Patsy



Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by  
 epahub11.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
 2008021818282378-4947040 ; Mon, 18 Feb 2008 18:28:23 -0500  
 Received: by mintra01.rtp.epa.gov (Postfix) id C7FE644365; Mon, 18 Feb 2008  
 18:28:23 -0500 (EST)  
 Delivered\_to: shea.valois@epamail.epa.gov  
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 <Shea.Valois@epamail.epa.gov>; Mon, 18 Feb 2008 18:28:23 -0500 (EST)  
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 [206.168.230.10]) by mseive02.rtp.epa.gov (Postfix) with ESMTP id 726395D401C  
 for <Shea.Valois@epamail.epa.gov>; Mon, 18 Feb 2008 18:28:21 -0500 (EST)  
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 Subject: Thursday morning meeting problem  
 PostedDate: 02/18/2008 04:28:16 PM  
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 872573E2.0076EF08@epamail.epa.gov>  
 X\_MS\_Has\_Attach:  
 X\_MS\_TNEF\_Correlator:  
 Thread\_Topic: Thursday morning meeting problem  
 Thread\_Index: AchlGxIJ0dmWwV3aRamBtM1btqzVggNaohuQ  
 References: <9544D5A542136C49ACC1C118202AAA5506BBF4@DVEX1.knightpiesold.local>  
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 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 X\_PMX\_Version: 5.3.3.310218, Antispam-Engine: 2.5.2.311128, Antispam-Data:  
 2008.2.18.151252  
 X\_PerlMx\_Spam: Gauge=IIIIIII, Probability=7%, Report='BODY\_SIZE\_200\_299 0, \_\_CT  
 0, \_\_CTE 0, \_\_CT\_TEXT\_PLAIN 0, \_\_HAS\_MSGID 0, \_\_IMS\_MSGID 0, \_\_MIME\_TEXT\_ONLY 0,  
 \_\_MIME\_VERSION 0, \_\_SANE\_MSGID 0'  
 \$MIMETrack: Itemize by SMTP Server on EPAHUB11/USEPA/US(Release 7.0.3|September  
 26, 2007) at 02/18/2008 06:28:23 PM,MIME-CD by Notes Client on Valois  
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 INetSendTo: Shea.Valois@epamail.epa.gov  
 INetFrom: .  
 SMTPOriginator: pmoran@knightpiesold.com  
 RouteServers: CN=EPAHUB11/0=USEPA/C=US,CN=R8MAIL2/OU=R8/0=USEPA/C=US  
 RouteTimes: 02/18/2008 04:28:23 PM-02/18/2008 04:28:25 PM,02/18/2008 04:28:25  
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 RoutingState:  
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 Categories:  
 \$Revisions: 02/18/2008 04:28:26 PM  
 DeliveredDate: 02/18/2008 04:28:27 PM  
 \$MiniView:  
 \$RespondedTo: 1

Hi Valois,

I have a conflict on Thursday morning and I'm hoping we can make an adjustment. I'm sorry; my boss scheduled a multiple person meeting right on top of ours (he forgot). Any chance we can change to the afternoon? If not, I'll see what I can do.

Thanks,

Patsy

\$AutoSpell: 1  
OriginalModTime: 02/19/2008 01:25:56 PM  
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\$MessageID: <0FD0A3CE46.6D03DDE2-0N872573F4.00703288-872573F4.00703DB9@LocalDomain>  
INetFrom: Shea.Valois@epamail.epa.gov  
PostedDate: 02/19/2008 01:25:58 PM  
Recipients: <pmoran@knightpiesold.com>  
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AltCopyTo:  
INetBlindCopyTo:  
InheritedReplyTo:  
InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedFromDomain:  
From: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
AltFrom: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
Logo: StdNotesLtr32  
tmpImp2:  
DefaultMailSaveOptions: 1  
Query\_String:  
PRINCIPAL: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
SentToDocu: False  
SendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
CopyTo:  
BlindCopyTo:  
Subject: Re: Thursday morning meeting problem  
ldf\_locale: en-US  
Encrypt: 0  
Sign: 0  
ReturnReceipt: 0  
delTmpEncrypt:  
delTmpImportance:  
delTmpReturnReceipt:  
delTmpSign:  
EnterSendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
EnterCopyTo:  
EnterBlindCopyTo:  
\$RFSaveInfo: B6C526E7781FD92B852573F30080F14A  
\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

afternoon is fine. Would about 1:00 work?

---

Valois Shea

US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
02/18/2008 04:28 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
Thursday morning meeting problem

Hi Valois,  
I have a conflict on Thursday morning and I'm hoping we can make an adjustment. I'm sorry; my boss scheduled a multiple person meeting right on top of ours (he forgot). Any chance we can change to the afternoon? If not, I'll see what I can do.  
Thanks,  
Patsy

Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
 epahub11.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
 2008021915285414-5102947 ; Tue, 19 Feb 2008 15:28:54 -0500  
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 15:28:54 -0500 (EST)  
 Delivered\_to: shea.valois@epamail.epa.gov  
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 [206.168.230.10]) by mseive02.rtp.epa.gov (Postfix) with ESMTP id 916AC5D401F  
 for <Shea.Valois@epamail.epa.gov>; Tue, 19 Feb 2008 15:28:53 -0500 (EST)  
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 MIME\_Version: 1.0  
 Subject: RE: Thursday morning meeting problem  
 PostedDate: 02/19/2008 01:28:51 PM  
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 872573F4.00703DB9@epamail.epa.gov>  
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 X\_MS\_TNEF\_Correlator:  
 Thread\_Topic: Thursday morning meeting problem  
 Thread\_Index: AchzNX045UcsyMj7RAiYtF38MkZPTgAAE9Kg  
 References: <9544D5A542136C49ACC1C118202AAA550DD5A8@DVEX1.knightpiesold.local>  
 <0FD0A3CE46.6D03DDE2-0N872573F4.00703288-872573F4.00703DB9@epamail.epa.gov>  
 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 X\_PMX\_Version: 5.3.3.310218, Antispam-Engine: 2.5.2.311128, Antispam-Data:  
 2008.2.19.121459  
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 26, 2007) at 02/19/2008 03:28:54 PM,MIME-CD by Notes Client on Valois  
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 AM,MIME-CD complete at 03/23/2009 08:42:24 AM  
 INetSendTo: Shea.Valois@epamail.epa.gov  
 INetFrom: .  
 SMTPOriginator: pmoran@knightpiesold.com  
 RouteServers: CN=EPAHUB11/0=USEPA/C=US,CN=R8MAIL2/OU=R8/0=USEPA/C=US  
 RouteTimes: 02/19/2008 01:28:54 PM-02/19/2008 01:28:55 PM,02/19/2008 01:28:55  
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 Categories:  
 \$Revisions: 02/19/2008 01:28:55 PM  
 DeliveredDate: 02/19/2008 01:28:56 PM  
 \$MiniView:  
 \$RespondedTo: 1

Hi Valois,  
That sounds perfect. Thanks! I assume you will be coming here? If not,  
I'm fine heading over your direction.  
Hope you are doing well,  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Tuesday, February 19, 2008 1:26 PM  
To: Patsy Moran  
Subject: Re: Thursday morning meeting problem

afternoon is fine. Would about 1:00 work?

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
02/18/2008 04:28  
PM  
Subject  
Thursday morning meeting problem

To

cc

Hi Valois,  
I have a conflict on Thursday morning and I'm hoping we can make an  
adjustment. I'm sorry; my boss scheduled a multiple person meeting right  
on top of ours (he forgot). Any chance we can change to the afternoon?  
If not, I'll see what I can do.  
Thanks,  
Patsy

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PostedDate: 02/22/2008 09:55:20 AM  
Recipients: <pmoran@knightpiesold.com>  
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INetSendTo: .  
AltCopyTo:  
INetBlindCopyTo:  
InheritedReplyTo:  
InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedFromDomain:  
From: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
AltFrom: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
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useApplet: True  
tmpImp2:  
DefaultMailSaveOptions: 1  
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PRINCIPAL: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
SentToDocu: False  
SendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
CopyTo:  
BlindCopyTo:  
Subject: SD in-situ mining regs  
ldf\_locale: en-US  
Encrypt: 0  
Sign: 0  
ReturnReceipt: 0  
delTmpEncrypt:  
delTmpImportance:  
delTmpReturnReceipt:  
delTmpSign:  
EnterSendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
EnterCopyTo:



EnterBlindCopyTo:

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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

Hi Patsy, I created the attached file comparing the SD in-situ mining regs with the in-situ water quality regs. There are some differences with monitoring frequency that I highlighted. For the other 2 (restoration & excursions), EPA has no corresponding regs, but I just wanted to check out the requirements.

These files are application requirements from the ISL mining regs. I highlighted the ones that I would like to see in the EPA UIC permit application. I figured since you (or someone else?) are already preparing them for the large mine permit, maybe I could get that info, too.

I will email you the side by side comparison of SD mining & WQ regs compared with EPA regs when I get that finished up.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

\$AutoSpell: 1  
\$FILE:  
OriginalModTime: 02/22/2008 10:01:27 AM  
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\$MessageID: <0F7070A20F.8933D31A-ON872573F7.005D5279-872573F7.005D8638@LocalDomain>  
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PostedDate: 02/22/2008 10:01:32 AM  
Recipients: <pmoran@knightpiesold.com>  
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INetSendTo: .  
AltCopyTo:  
INetBlindCopyTo:  
InheritedReplyTo:  
InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedFromDomain:  
From: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
AltFrom: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
Logo: StdNotesLtr32  
useApplet: True  
tmpImp2:  
DefaultMailSaveOptions: 1  
Query\_String:  
PRINCIPAL: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
SentToDocu: False  
SendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
CopyTo:  
BlindCopyTo:  
Subject: copy of the SD In-Situ mining regs  
ldf\_locale: en-US  
Encrypt: 0  
Sign: 0  
ReturnReceipt: 0  
delTmpEncrypt:  
delTmpImportance:  
delTmpReturnReceipt:  
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EnterBlindCopyTo:  
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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

It occurred to me that you might not have a copy of the mining regs:

This copy you can click on the blue links to see the references regs.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

ATTACHMENT: linked SD ISL mining regs.doc vrs

\$AutoSpell: 1  
 OriginalModTime: 02/22/2008 10:23:43 AM  
 In\_Reply\_To: <9544D5A542136C49ACC1C118202AAA550DD644@DVEX1.knightpiesold.local>  
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 PostedDate: 02/22/2008 10:23:51 AM  
 Recipients: <pmoran@knightpiesold.com>  
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 INetSendTo: .  
 AltCopyTo:  
 INetBlindCopyTo:  
 InheritedReplyTo:  
 InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
 InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
 InheritedFromDomain:  
 From: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
 AltFrom: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
 Logo: StdNotesLtr32  
 useApplet: True  
 tmpImp2:  
 DefaultMailSaveOptions: 1  
 Query\_String:  
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 SentToDocu: False  
 SendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
 CopyTo:  
 BlindCopyTo:  
 Subject: link to SD rules  
 ldf\_locale: en-US  
 Encrypt: 0  
 Sign: 0  
 ReturnReceipt: 0  
 delTmpEncrypt:  
 delTmpImportance:  
 delTmpReturnReceipt:  
 delTmpSign:  
 EnterSendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
 EnterCopyTo:  
 EnterBlindCopyTo:  
 \$RFSaveInfo: EF749AB0582F457C852573F400708266  
 \$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

Hi again. I found this website to help locate the many rule references imbedded in the regs:

<http://legis.state.sd.us/rules/>

Once you bring up the first rule, you can just edit the end of the URL line & type in the next rule you want to see.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by  
 epahub11.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
 2008022214034849-5603816 ; Fri, 22 Feb 2008 14:03:48 -0500  
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 14:03:48 -0500 (EST)  
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 for <Shea.Valois@epamail.epa.gov>; Fri, 22 Feb 2008 14:03:47 -0500 (EST)  
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 PostedDate: 02/22/2008 12:03:45 PM  
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 Thread\_Topic: SD in-situ mining regs  
 Thread\_Index: Ach1dCBc0zFEftVNReWkeG1J0eA0CQAEXQYQ  
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 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
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 \$MiniView:  
 \$RespondedTo: 1

WOW! Valois, this is awesome. I had no idea what you were doing. Thank you so much! See you in an hour, here?  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Friday, February 22, 2008 9:55 AM  
To: Patsy Moran  
Subject: SD in-situ mining regs

Hi Patsy, I created the attached file comparing the SD in-situ mining regs with the in-situ water quality regs. There are some differences with monitoring frequency that I highlighted. For the other 2 (restoration & excursions), EPA has no corresponding regs, but I just wanted to check out the requirements.

(See attached file: Comparison of Restoration requirements.doc)(See attached file: Comparison of Monitoring requirements.doc)(See attached file: Comparison of Excursion Regs.doc)

These files are application requirements from the ISL mining regs. I highlighted the ones that I would like to see in the EPA UIC permit application. I figured since you (or someone else?) are already preparing them for the large mine permit, maybe I could get that info, too.

(See attached file: Application content requirements Reclamation plan.doc)(See attached file: Application content requirements additional baseline.doc)(See attached file: Application content requirements Mine operations plan.doc)

I will email you the side by side comparison of SD mining & WQ regs compared with EPA regs when I get that finished up.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

6 ATTACHMENTS: 1) Comparison of Restoration requirements.doc  
2) Comparison of Monitoring requirements.doc  
3) Comparison of Excursion Regs.doc  
4) Application content requirements Reclamation plan.doc  
5) Application content requirements additional baseline.doc  
6) Application content requirements Mine operations plan.doc  
vrs



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\$MessageID: <0F8C85EE85.190B27F3-ON872573F7.006B77D2-872573F7.006BBA4F@LocalDomain>  
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PostedDate: 02/22/2008 12:36:41 PM  
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AltCopyTo:  
INetBlindCopyTo:  
InheritedReplyTo:  
InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
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SentToDocu: False  
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CopyTo:  
BlindCopyTo:  
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Sign: 0  
ReturnReceipt: 0  
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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

other related SD regs

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

3 ATTACHMENTS:

- 1) Plugging Requirements.doc
  - 2) 74 29 11 02 refs.doc
  - 3) 74 29 11 03 1 refs.doc
- vrs

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AltCopyTo:  
INetBlindCopyTo:  
InheritedReplyTo:  
InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedFromDomain:  
From: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
AltFrom: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
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useApplet: True  
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DefaultMailSaveOptions: 1  
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SentToDocu: False  
SendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
CopyTo:  
BlindCopyTo:  
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Sign: 0  
ReturnReceipt: 0  
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EnterSendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
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---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

ATTACHMENT: 29 well construction.doc vrs

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 12:17:14 -0500 (EST)  
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 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
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 INetSendTo: Shea.Valois@epamail.epa.gov  
 INetFrom: .  
 SMTPOriginator: pmoran@knightpiesold.com  
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 \$MiniView:

\$RespondedTo: 1

Hi Valois,  
I cannot find the SD UIC regs (74:55 etc) that you put together. Can you resend those regs? It would be a huge help.

Thanks!  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Friday, February 22, 2008 12:46 PM  
To: Patsy Moran  
Subject: well construction requirements

(See attached file: 29 well construction.doc)

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Recipients: <pmoran@knightpiesold.com>  
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AltCopyTo:  
INetBlindCopyTo:  
InheritedReplyTo:  
InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedFromDomain:  
From: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
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CopyTo:  
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ldf\_locale: en-US  
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Sign: 0  
ReturnReceipt: 0  
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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US



Actually I was going to send you all this anyway - the SD regs had been revised & I did not have the latest version. These all have the latest version of the regs:

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
03/04/2008 10:17 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
  
Subject  
RE: well construction requirements

Hi Valois,  
I cannot find the SD UIC regs (74:55 etc) that you put together. Can you resend those regs? It would be a huge help.

Thanks!  
Patsy

-----Original Message-----  
From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Friday, February 22, 2008 12:46 PM  
To: Patsy Moran  
Subject: well construction requirements

(See attached file: 29 well construction.doc)

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
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 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
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 26, 2007) at 03/04/2008 02:25:59 PM,MIME-CD by Notes Client on Valois  
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 INetSendTo: Shea.Valois@epamail.epa.gov  
 INetFrom: .  
 SMTPOriginator: pmoran@knightpiesold.com  
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 \$MiniView:

Hi Valois,  
Did you read my mind?  
Thanks!  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Tuesday, March 04, 2008 12:19 PM  
To: Patsy Moran  
Subject: RE: well construction requirements

Actually I was going to send you all this anyway - the SD regs had been revised & I did not have the latest version. These all have the latest version of the regs:

(See attached file: 55 SD ISL WQ rules working copy.doc)(See attached file: 40 CFR side by side.doc)(See attached file: Comparing 55 and 29.doc)(See attached file: Comparison of Info Required in Permit App.doc)

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
03/04/2008 10:17  
AM  
Subject  
RE: well construction  
requirements

To

cc

Hi Valois,  
I cannot find the SD UIC regs (74:55 etc) that you put together. Can you resend those regs? It would be a huge help.

Thanks!  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]

Sent: Friday, February 22, 2008 12:46 PM

To: Patsy Moran

Subject: well construction requirements

(See attached file: 29 well construction.doc)

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

4 ATTACHEMENTS:

- 1) 55 SD ISL WQ rules working copy.doc
  - 2) 40 CFR side by side.doc
  - 3) Comparing 55 and 29.doc
  - 4) Comparison of Info Required in Permit App.doc
- vrs

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X\_MS\_TNEF\_Correlator:  
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From: "Patsy Moran" <pmoran@knightpiesold.com>  
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Hi Valois,  
I just found out that there is a meeting regarding the UIC regulations happening today in Pierre, SD. I'm assuming it is for the WQ regs. Can you briefly remind me of the key inconsistencies you found in the mining and WQ UIC and EPA regs? I believe the two main differences are the location of the monitoring wells relative to the ore body and the concern that the "pilot" study required by SD will need a UIC permit before any injection can take place.  
I'll work on answering this question myself now.  
Thanks!  
Pasy

-----Original Message-----  
From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Tuesday, February 19, 2008 1:26 PM  
To: Patsy Moran  
Subject: Re: Thursday morning meeting problem

afternoon is fine. Would about 1:00 work?

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
02/18/2008 04:28  
PM  
Subject  
Thursday morning meeting problem

To

cc

Hi Valois,  
I have a conflict on Thursday morning and I'm hoping we can make an adjustment. I'm sorry; my boss scheduled a multiple person meeting right on top of ours (he forgot). Any chance we can change to the afternoon? If not, I'll see what I can do.  
Thanks,  
Patsy





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Hi Valois,  
As I dig in more I realize that you already did the work for me. Sorry  
to bug you. I'm summarizing the key differences now. Did you get a  
chance to talk with SD about these inconsistencies?  
Thanks!  
Patsy

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Hi Valois,

The working copy of the SD water quality regs shows that 74:55:01:45-Restoration demonstration required was repealed. However, the rules on the SD legislative site do not show this to be the case. It might help to know where you obtained the information from 55 SD ISL WQ rules working copy.doc. I'm also having trouble finding the information we discussed about monitoring within 50 feet of the ore body, do you remember this section and where it is located?

I appreciate your help.

Thanks!

Patsy

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Hi Patsy, The link below is where I found the new version of the water quality regs. They are more consistent with the mining regs, so that should make life easier!  
"74:55:01:42. Nonproduction zone monitoring" is where the 50 feet was included, but it got taken out & made to match 74:29:11:32 of the mining regs.

I had a conference call last week with Gary Haag and Tom Brandner of the DENR water quality group about these new regs. They will coordinate a

meeting with the mining folks (Mike Cepak) and me, so we can all sit down in one place & talk about our permit requirements to try to make our requirements consistent with each other as much as possible and minimize things you will have to do different for each of us. That may not happen until May, which is kind of late in your time frame. But I will let you know as I find out more.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

----- Forwarded by Valois Shea/P2/R8/USEPA/US on 03/13/2008 09:20 AM -----

<Gary.Haag@state.sd.us>  
02/28/2008 05:24 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
RE: comments and questions about the UIC Class III regs

Valois:

After reading your comments I am a little concerned that you were not looking at a copy of the revised rules.  
The revised rules are at the website listed below at the bottom of the page where it says new:

<http://www.state.sd.us/denr/DES/Ground/groundprg.htm>

Thanks,  
Gary Haag, Hydrologist  
DENR, Ground Water Quality  
523 East Capitol  
Pierre, SD 57501  
Phone: 605-773-5855  
Fax: 605-773-6035  
E-mail: [gary.haag@state.sd.us](mailto:gary.haag@state.sd.us)

-----Original Message-----

From: [Shea.Valois@epamail.epa.gov](mailto:Shea.Valois@epamail.epa.gov) [mailto:[Shea.Valois@epamail.epa.gov](mailto:Shea.Valois@epamail.epa.gov)]  
Sent: Tuesday, February 26, 2008 4:55 PM  
To: Haag, Gary  
Subject: RE: comments and questions about the UIC Class III regs



Great! Thanks very much. My home phone number is 303-232-2329.  
Valois Shea US EPA Region 8 8P-W-GW 1595  
Wynkoop Street Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

<Gary.Haag@state  
.sd.us>

02/26/2008 03:13  
PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
<Tom.Brandner@state.sd.us>  
Subject  
RE: comments and questions about  
the UIC Class III regs

Valois:

How about if we call you at 1:30 central time.

Thanks,  
Gary Haag, Hydrologist  
DENR, Ground Water Quality  
523 East Capitol  
Pierre, SD 57501  
Phone: 605-773-5855  
Fax: 605-773-6035  
E-mail: gary.haag@state.sd.us

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Tuesday, February 26, 2008 2:21 PM  
To: Haag, Gary  
Subject: RE: comments and questions about the UIC Class III regs

That would be great. I usually work at home on Wednesdays, so that would be a good day. Anytime during the time frame you suggested would work for me. Would you call me, or should I call you? Thanks!

Valois Shea US EPA Region 8 8P-W-GW 1595  
Wynkoop Street Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

<Gary.Haag@state  
.sd.us>

02/26/2008 01:02  
PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
CC  
<Tom.Brandner@state.sd.us>,  
<Gary.Haag@state.sd.us>  
Subject  
RE: comments and questions about  
the UIC Class III regs

Valois:

Would you have some time on Wednesday March 5 to discuss your comments with Tom Brandner and I.

Between 1:00 and 4:00 pm central time would be best for us.

Thanks,  
Gary Haag, Hydrologist  
DENR, Ground Water Quality  
523 East Capitol  
Pierre, SD 57501  
Phone: 605-773-5855  
Fax: 605-773-6035  
E-mail: gary.haag@state.sd.us

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Tuesday, February 26, 2008 11:40 AM  
To: Brandner, Tom; Haag, Gary  
Subject: comments and questions about the UIC Class III regs

(See attached file: Comments and Questions.doc)  
Comments and Questions on  
CHAPTER 74:55:01 UNDERGROUND INJECTION CONTROL  
CLASS III WELLS

The 74:55:01 regulations include more specific information than the federal regulations. This specificity is going to be more helpful to permit applicants than the federal regulations for determining what to put into a permit application. The federal regulations are more

general because they set minimum standards for all possible state programs under Section 1422 of the Safe Drinking Water Act, plus they need to be applicable to the whole US. The level of specific detail in the 74:55:01 and 74:29:11 regulations, together with the other 74:29 regulations and the imbedded references to other South Dakota regulations such as 74:02:04, will also be very helpful in designing a federal UIC permit that will mesh well with the South Dakota UIC permit.

Only 2 comments that might lead to changes:

It would be good to include a requirement equivalent to 146.34 Information to be considered by the Director.

a) Prior to the issuance of a permit  
(14) Contingency plans to cope with all shut-ins or well failures so as to prevent the migration of contaminating fluids into underground sources of drinking water;

74:55:01:46. Minimum monitoring requirements. Monitoring requirements shall include, but not be limited to, the following:

(2) Installation and use of continuous recording devices to monitor the injection pressure, flow rate, volume, and annular pressure;

I am not sure that monitoring of annular pressure is appropriate for Class III wells. I have not seen a design for a Class III well that has an open annulus filled with fluid that must be pressurized.

Questions:

There are some inconsistencies between monitoring requirements in the 74:29:11 regs and the 74:55:01 regs. Will the more protective 74:55:01 regs have precedent over the 74:29:11 regs?

The regulations for monitoring requirements are both as protective as the equivalent federal regs except for

74:29:11:30. Production area operational monitoring requirements. (4) Monitoring ground water quality, including the control parameters, and fluid levels in monitoring wells completed above and below the production zone a minimum of every month;

But the equivalent 74:55:01 reg has a 2 week interval: 74:55:01:46. Minimum monitoring requirements. (4) Monitoring once every two weeks of wells completed above or below the injection zone;

[The equivalent federal reg is

40 CFR 146. 146.33 Operating, monitoring, and reporting requirements.

(b) Monitoring requirements.

(4) Monitoring of the parameters chosen to measure water quality in the monitoring wells required by §146.32(e)[into and above injection zone], semi-monthly.]

There is another inconsistency between

74:55:01:42. Nonproduction zone monitoring These monitor wells shall be located not more than 50 feet on either side of a line through the center of the production area,

74:29:11:32. Nonproduction zone monitoring. These monitor wells shall be located within the production area and up to 200 feet

outside of the production area.

74:55:01:45. Restoration demonstration required

The demonstration of restoration regulation was really intriguing.

The first part:

74:55:01:45. Restoration demonstration required. The secretary shall do a preliminary review of the permit application and technical report after submission by the applicant. After the review the secretary shall determine if mining appears feasible or infeasible

nicely addresses the requirement for "analysis of the amenability of the mining zone to the proposed mining method" in 144.7

Identification of underground sources of drinking water and exempted aquifers.

(c)(1).

[That whole regulation is

144.7 Identification of underground sources of drinking water and exempted aquifers.

(c)(1) For Class III wells, the Director shall require an applicant for a permit which necessitates an aquifer exemption under §146.04(b)(1) to furnish the data necessary to demonstrate that the aquifer is expected to be mineral or hydrocarbon producing. Information contained in the mining plan for the proposed project, such as a map and general description of the mining zone, general information on the mineralogy and geochemistry of the mining zone, analysis of the amenability of the mining zone to the proposed mining method, and a time-table of planned development of the mining zone shall be considered by the Director in addition to the information required by §144.31(g).]

First the mining zone is determined to be amenable and mining appears to be feasible based on the data review. The follow up steps for EPA would be to issue the aquifer exemption and draft permit. After public hearing and public comment period, issue the final permit. Then well construction and testing would begin, and the information submitted to EPA to obtain the Authorization to Inject.

Let's talk about how this process would fit with the restoration demonstration procedures.

Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



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PostedDate: 03/13/2008 09:33:33 AM  
Recipients: <pmoran@knightpiesold.com>  
MAILOPTIONS: 0  
SaveOptions: 1  
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Logo: StdNotesLtr32  
useApplet: True  
tmpImp2:  
DefaultMailSaveOptions: 1  
Query\_String:  
SentToDocu: False  
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Subject: Fw: Powertech Aquifer Test  
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Hi it's me again. I meant to ask you if you had heard anything about the aquifer test. Gary Haag copied me on the reply below from Mike Cepak of the mining group, who thinks it will be in a few months. Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129

phone: 303-312-6276

fax: 303-312-6741

----- Forwarded by Valois Shea/P2/R8/USEPA/US on 03/13/2008 09:31 AM -----

<Gary.Haag@state.sd.us>

03/12/2008 06:59 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
FW: Powertech Aquifer Test

Valois:

FYI on aquifer test.

Thanks,  
Gary Haag, Hydrologist  
DENR, Ground Water Quality  
523 East Capitol  
Pierre, SD 57501  
Phone: 605-773-5855  
Fax: 605-773-6035  
E-mail: gary.haag@state.sd.us

-----Original Message-----

From: Cepak, Mike  
Sent: Wednesday, March 12, 2008 7:56 AM  
To: Haag, Gary  
Subject: RE: Powertech Aquifer Test

They haven't said anything definite yet. Probably will conduct one in a few months though.

-----Original Message-----

From: Haag, Gary  
Sent: Tuesday, March 11, 2008 8:11 AM  
To: Cepak, Mike  
Cc: Keenihan, Mark; Valois R. Shea (shea.valois@epa.gov)  
Subject: Powertech Aquifer Test

Mike:

Do you know when Powertech will be conducting the aquifer test?

Thanks,  
Gary Haag, Hydrologist  
DENR, Ground Water Quality  
523 East Capitol  
Pierre, SD 57501



Phone: 605-773-5855  
Fax: 605-773-6035  
E-mail: [gary.haag@state.sd.us](mailto:gary.haag@state.sd.us)

Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
 epahub11.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
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 Thread\_Index: AciFH9yb0QwNVhGPQG+Y7HU6Z1I4KwAK06Uw  
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 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 X\_PMX\_Version: 5.3.3.310218, Antispam-Engine: 2.5.2.311128, Antispam-Data:  
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 \$MiniView:

\$RespondedTo: 2

Hi Valois,

I believe Paul forwarded your email to Mark Hollenbeck so perhaps we'll have an answer regarding the pump test ETA soon. My understanding was that it was going to happen in April but perhaps that was optimistic. Thank you for the link; that will minimize my confusion.

I have another subject that we need to move forward on, drill holes/wells, and could use your guidance:

Reading 40 CFR 146.34 I see that it requires "a tabulation of data reasonably available from public records or otherwise known to the applicant on wells within the area of review included on the map required under paragraph (a)(2) of this section which penetrate the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and completion, and any additional information the Director may require. In cases where the information would be repetitive and the wells are of similar age, type, and construction the Director may elect to only require data on a representative number of wells."

The Dewey-Burdock has approximately 4000 bore holes from historic drilling activities (i.e. TVA). These holes do not have plugging/abandonment records, the TVA coordinates do not currently line up with the real world coordinates, and only about half have logs/depths.

I'm hoping this site would be eligible for tabulating only a representative number of wells since these holes are likely to have many similarities (e.g. depth, age, type etc).

Any help you can offer as to what EPA will expect would be extremely useful in the near future. I imagine we will need to obtain the required information (description of each well's type, construction, date drilled, location, depth, record of plugging and completion) for, at minimum, "representative" wells, which will be a difficult task but to obtain this information for all holes would be a substantial task. Looking at Moore Ranch (NRC license application) I see that they only show bore hole IDs and locations. Is this sufficient information?

Did you know the Lost Creek application to the NRC was recalled?

I appreciate your help.

Thanks!

Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]

Sent: Thursday, March 13, 2008 9:34 AM

To: Patsy Moran

Subject: Fw: Powertech Aquifer Test

Hi it's me again. I meant to ask you if you had heard anything about the aquifer test. Gary Haag copied me on the reply below from Mike Cepak of the mining group, who thinks it will be in a few months. Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741  
----- Forwarded by Valois Shea/P2/R8/USEPA/US on 03/13/2008 09:31 AM  
-----

<Gary.Haag@state  
.sd.us>  
To  
03/12/2008 06:59 Valois Shea/P2/R8/USEPA/US@EPA  
AM CC

Subject  
FW: Powertech Aquifer Test

Valois:

FYI on aquifer test.

Thanks,  
Gary Haag, Hydrologist  
DENR, Ground Water Quality  
523 East Capitol  
Pierre, SD 57501  
Phone: 605-773-5855  
Fax: 605-773-6035  
E-mail: gary.haag@state.sd.us

-----Original Message-----  
From: Cepak, Mike  
Sent: Wednesday, March 12, 2008 7:56 AM  
To: Haag, Gary  
Subject: RE: Powertech Aquifer Test

They haven't said anything definite yet. Probably will conduct one in a few months though.

-----Original Message-----  
From: Haag, Gary  
Sent: Tuesday, March 11, 2008 8:11 AM

To: Cepak, Mike  
Cc: Keenihan, Mark; Valois R. Shea (shea.valois@epa.gov)  
Subject: Powertech Aquifer Test

Mike:

Do you know when Powertech will be conducting the aquifer test?

Thanks,  
Gary Haag, Hydrologist  
DENR, Ground Water Quality  
523 East Capitol  
Pierre, SD 57501  
Phone: 605-773-5855  
Fax: 605-773-6035  
E-mail: gary.haag@state.sd.us

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 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 CopyTo: "Paul Bergstrom" <pbergstrom@knightpiesold.com>  
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Hi Valois,

Based on the drilling schedule, we are looking at mid to late April for the pump test. We will try to give you as much lead time as possible. How is your communication with USGS regarding third party review progressing?

Thanks,

Patsy



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Hi Valois,

Are you in this office this week or next? We are moving forward fairly quickly and would like to touch base as soon as possible.

Thanks!

Patsy

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Recipients: <pmoran@knightpiesold.com>  
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Yes I am in! I have been working on the reply to your question about the thousands of boreholes, but I haven't quite finished it yet.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
03/18/2008 02:00 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
In the office this week?

Hi Valois,  
Are you in this office this week or next? We are moving forward fairly quickly and would like to touch base as soon as possible.  
Thanks!  
Patsy

Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
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 localhost (Postfix) with SMTP id 80A059D400E for  
 <Shea.Valois@epamail.epa.gov>; Tue, 18 Mar 2008 16:19:59 -0400 (EDT)  
 Received: from DVEX1.knightpiesold.local (dvmmail.knightpiesold.com  
 [206.168.230.10]) by mseive02.rtp.epa.gov (Postfix) with ESMTP id 955989D4011  
 for <Shea.Valois@epamail.epa.gov>; Tue, 18 Mar 2008 16:19:58 -0400 (EDT)  
 X\_MIMEOLE: Produced By Microsoft Exchange V6.5  
 MIME\_Version: 1.0  
 Subject: RE: In the office this week?  
 PostedDate: 03/18/2008 02:18:09 PM  
 \$MessageID: <9544D5A542136C49ACC1C118202AAA550DE073@DVEX1.knightpiesold.local>  
 In\_Reply\_To: <0FF849CB6B.40940217-ON87257410.006F0242-  
 87257410.006F26CA@epamail.epa.gov>  
 X\_MS\_Has\_Attach:  
 X\_MS\_TNEF\_Correlator:  
 Thread\_Topic: In the office this week?  
 Thread\_Index: AciJNPiajArmfbfQEwbo22v8B8tdgAACh0g  
 References: <9544D5A542136C49ACC1C118202AAA550DE067@DVEX1.knightpiesold.local>  
 <0FF849CB6B.40940217-ON87257410.006F0242-87257410.006F26CA@epamail.epa.gov>  
 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 X\_PMX\_Version: 5.3.3.310218, Antispam-Engine: 2.5.2.311128, Antispam-Data:  
 2008.3.18.130808  
 X\_PerlMx\_Spam: Gauge=IIIIIII, Probability=7%, Report='\_\_C230066\_P5 0, \_\_CT 0,  
 \_\_CTE 0, \_\_CT\_TEXT\_PLAIN 0, \_\_FRAUD\_419\_CONTACT\_NUM 0, \_\_HAS\_MSGID 0,  
 \_\_IMS\_MSGID 0, \_\_MIME\_TEXT\_ONLY 0, \_\_MIME\_VERSION 0, \_\_SANE\_MSGID 0'  
 \$MIMETrack: Itemize by SMTP Server on EPAHUB12/USEPA/US(Release 7.0.3|September  
 26, 2007) at 03/18/2008 04:19:59 PM,MIME-CD by Notes Client on Valois  
 Shea/R8/USEPA/US(Release 7.0.3|September 26, 2007) at 03/23/2009 08:42:25  
 AM,MIME-CD complete at 03/23/2009 08:42:25 AM  
 INetSendTo: Shea.Valois@epamail.epa.gov  
 INetFrom: .  
 SMTPOriginator: pmoran@knightpiesold.com  
 RouteServers: CN=EPAHUB12/0=USEPA/C=US,CN=R8MAIL2/OU=R8/0=USEPA/C=US  
 RouteTimes: 03/18/2008 02:20:00 PM-03/18/2008 02:21:10 PM,03/18/2008 02:21:11  
 PM-03/18/2008 02:21:12 PM  
 \$Orig: DECF96AF52B7333285257410006FB1A3  
 RoutingState:  
 \$UpdatedBy: ,CN=EPAHUB12/0=USEPA/C=US,CN=R8MAIL2/OU=R8/0=USEPA/C=US  
 Categories:  
 \$Revisions:  
 DeliveredDate: 03/18/2008 02:21:12 PM  
 \$MiniView:

Cool! I look forward to hearing more.  
Thanks,  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Tuesday, March 18, 2008 2:14 PM  
To: Patsy Moran  
Subject: Re: In the office this week?

Yes I am in! I have been working on the reply to your question about the thousands of boreholes, but I haven't quite finished it yet.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
03/18/2008 02:00  
PM  
Subject  
In the office this week?

To

cc

Hi Valois,  
Are you in this office this week or next? We are moving forward fairly quickly and would like to touch base as soon as possible.  
Thanks!  
Patsy

Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by  
 epahub12.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
 2008032619111502-2423546 ; Wed, 26 Mar 2008 19:11:15 -0400  
 Received: by mintra01.rtp.epa.gov (Postfix) id 606E944502; Wed, 26 Mar 2008  
 19:11:15 -0400 (EDT)  
 Delivered\_to: shea.valois@epamail.epa.gov  
 Received: from mintra01.rtp.epa.gov (localhost.localdomain [127.0.0.1]) by  
 localhost (Postfix) with SMTP id 55B9344509 for  
 <Shea.Valois@epamail.epa.gov>; Wed, 26 Mar 2008 19:11:15 -0400 (EDT)  
 Received: from mseive01.rtp.epa.gov (mseive01.rtp.epa.gov [134.67.221.149]) by  
 mintra01.rtp.epa.gov (Postfix) with ESMTP id 3A29944502 for  
 <Shea.Valois@epamail.epa.gov>; Wed, 26 Mar 2008 19:11:15 -0400 (EDT)  
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 localhost (Postfix) with SMTP id 2E35044459 for  
 <Shea.Valois@epamail.epa.gov>; Wed, 26 Mar 2008 19:11:15 -0400 (EDT)  
 Received: from DVEX1.knightpiesold.local (dvmmail.knightpiesold.com  
 [206.168.230.10]) by mseive01.rtp.epa.gov (Postfix) with ESMTP id D93EA44479  
 for <Shea.Valois@epamail.epa.gov>; Wed, 26 Mar 2008 19:11:14 -0400 (EDT)  
 X\_MIMEOLE: Produced By Microsoft Exchange V6.5  
 MIME\_Version: 1.0  
 Subject: Possible call tomorrow morning?  
 PostedDate: 03/26/2008 05:09:51 PM  
 \$MessageID: <9544D5A542136C49ACC1C118202AAA5514BF19@DVEX1.knightpiesold.local>  
 X\_MS\_Has\_Attach:  
 X\_MS\_TNEF\_Correlator:  
 Thread\_Topic: Possible call tomorrow morning?  
 Thread\_Index: AciPln5++QVT9vsnsZKJmG3LeHCKPA==  
 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 CopyTo: "Byron Boyle" <bboyle@knightpiesold.com>  
 X\_PMX\_Version: 5.3.3.310218, Antispam-Engine: 2.5.2.311128, Antispam-Data:  
 2008.3.26.160048  
 X\_PerlMx\_Spam: Gauge=IIIIIII, Probability=7%, Report='HTML\_70\_90 0.1, \_\_CT 0,  
 \_\_CTYPE\_HAS\_BOUNDARY 0, \_\_CTYPE\_MULTIPART 0, \_\_CTYPE\_MULTIPART\_ALT 0,  
 \_\_HAS\_MSGID 0, \_\_HTML\_FONT\_BLUE 0, \_\_HTML\_MSWORD 0, \_\_IMS\_MSGID 0, \_\_MIME\_HTML  
 0, \_\_MIME\_VERSION 0, \_\_SANE\_MSGID 0, \_\_STYLE\_RATWARE\_2 0, \_\_TAG\_EXISTS\_HTML 0'  
 \$MIMETrack: Itemize by SMTP Server on EPAHUB12/USEPA/US(Release 7.0.3|September  
 26, 2007) at 03/26/2008 07:11:15 PM,MIME-CD by Notes Client on Valois  
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 AM,MIME-CD complete at 03/23/2009 08:42:25 AM  
 INetSendTo: Shea.Valois@epamail.epa.gov  
 INetCopyTo: .  
 INetFrom: .  
 SMTPOriginator: pmoran@knightpiesold.com  
 RouteServers: CN=EPAHUB12/O=USEPA/C=US,CN=R8MAIL2/OU=R8/O=USEPA/C=US  
 RouteTimes: 03/26/2008 05:11:15 PM-03/26/2008 05:13:22 PM,03/26/2008 05:13:22  
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 RoutingState:  
 \$UpdatedBy: ,CN=EPAHUB12/O=USEPA/C=US,CN=R8MAIL2/OU=R8/O=USEPA/C=US  
 Categories:  
 \$Revisions: 03/26/2008 05:13:23 PM  
 DeliveredDate: 03/26/2008 05:13:25 PM  
 \$MiniView:  
 \$RespondedTo: 1  
 \$PaperColor: 1



Hi Valois,

I was planning to call you in the morning around 830 am just to ask a few (hopefully) easy questions. Also, I'd like to introduce you to Byron Boyle; he has been helping to get the UIC permit up to speed. Will you have 30-45 minutes to talk? If not, can we schedule a phone call for the near future?

I hope you are doing well.

Thanks!

Patsy

\$AutoSpell: 1  
OriginalModTime: 03/27/2008 06:40:40 AM  
In\_Reply\_To: <9544D5A542136C49ACC1C118202AAA5514BF19@DVEX1.knightpiesold.local>  
\$NameLanguageTags: en  
AltSendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
AltBlindCopyTo:  
\$Mailer: Lotus Notes Release 7.0.3 September 26, 2007  
\$MessageID: <0F859B77FC.3F825C1E-ON87257419.004599C7-87257419.0045A460@LocalDomain>  
INetFrom: Shea.Valois@epamail.epa.gov  
PostedDate: 03/27/2008 06:40:40 AM  
Recipients: <pmoran@knightpiesold.com>  
MAILOPTIONS: 0  
SaveOptions: 1  
ldf\_createddate: null  
ldf\_from: null  
ldf\_archive: null  
ldf\_temp: null  
\$AltNameLanguageTags:  
\$StorageCc:  
\$StorageTo: .  
\$StorageBcc:  
INetCopyTo:  
INetSendTo: .  
AltCopyTo:  
INetBlindCopyTo:  
InheritedReplyTo:  
InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedFromDomain:  
From: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
AltFrom: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
Logo: StdNotesLtr32  
tmpImp2:  
DefaultMailSaveOptions: 1  
Query\_String:  
PRINCIPAL: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
SentToDocu: False  
SendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
CopyTo:  
BlindCopyTo:  
Subject: Re: Possible call tomorrow morning?  
ldf\_locale: en-US  
Encrypt: 0  
Sign: 0  
ReturnReceipt: 0  
delTmpEncrypt:  
delTmpImportance:  
delTmpReturnReceipt:  
delTmpSign:  
EnterSendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
EnterCopyTo:  
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\$RFSaveInfo: 4BFACDED6F5316AF85257418007F5F6E  
\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

That sounds fine. I will be sure to be at my desk & off the phone at 8:30.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
03/26/2008 05:09 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
"Byron Boyle" <bboyle@knightpiesold.com>  
Subject  
Possible call tomorrow morning?

Hi Valois,  
I was planning to call you in the morning around 830 am just to ask a few (hopefully) easy questions. Also, I'd like to introduce you to Byron Boyle; he has been helping to get the UIC permit up to speed. Will you have 30-45 minutes to talk? If not, can we schedule a phone call for the near future?  
I hope you are doing well.  
Thanks!  
Patsy

Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
 epahub11.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
 2008032710322439-3477012 ; Thu, 27 Mar 2008 10:32:24 -0400  
 Received: by mintra02.rtp.epa.gov (Postfix) id 851E24450A; Thu, 27 Mar 2008  
 10:32:24 -0400 (EDT)  
 Delivered\_to: shea.valois@epamail.epa.gov  
 Received: from mintra02.rtp.epa.gov (localhost.localdomain [127.0.0.1]) by  
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 <Shea.Valois@epamail.epa.gov>; Thu, 27 Mar 2008 10:32:24 -0400 (EDT)  
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 <Shea.Valois@epamail.epa.gov>; Thu, 27 Mar 2008 10:32:24 -0400 (EDT)  
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 [206.168.230.10]) by mseive02.rtp.epa.gov (Postfix) with ESMTP id E95A25D4072  
 for <Shea.Valois@epamail.epa.gov>; Thu, 27 Mar 2008 10:32:21 -0400 (EDT)  
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 MIME\_Version: 1.0  
 Subject: RE: Possible call tomorrow morning?  
 PostedDate: 03/27/2008 08:30:31 AM  
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 X\_MS\_Has\_Attach:  
 X\_MS\_TNEF\_Correlator:  
 Thread\_Topic: Possible call tomorrow morning?  
 Thread\_Index: AciQB4cz00nTR9vqTIyuA6FWoEWtrwAD4JVA  
 References: <9544D5A542136C49ACC1C118202AAA5514BF19@DVEX1.knightpiesold.local>  
 <0F859B77FC.3F825C1E-0N87257419.004599C7-87257419.0045A460@epamail.epa.gov>  
 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 X\_PMX\_Version: 5.3.3.310218, Antispam-Engine: 2.5.2.311128, Antispam-Data:  
 2008.3.27.71744  
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 \$MIMETrack: Itemize by SMTP Server on EPAHUB11/USEPA/US(Release 7.0.3|September  
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 INetFrom: .  
 SMTPOriginator: pmoran@knightpiesold.com  
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 RouteTimes: 03/27/2008 08:32:24 AM-03/27/2008 08:32:25 AM,03/27/2008 08:32:25  
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 Categories:  
 \$Revisions:  
 DeliveredDate: 03/27/2008 08:32:26 AM  
 \$MiniView:

Hi Valois,  
Byron and I will call in about two minutes.  
Thanks,  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Thursday, March 27, 2008 6:41 AM  
To: Patsy Moran  
Subject: Re: Possible call tomorrow morning?

That sounds fine. I will be sure to be at my desk & off the phone at 8:30.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com> To  
Valois Shea/P2/R8/USEPA/US@EPA  
03/26/2008 05:09 cc  
PM "Byron Boyle"  
<bboyle@knightpiesold.com>  
Subject  
Possible call tomorrow morning?

Hi Valois,  
I was planning to call you in the morning around 830 am just to ask a few (hopefully) easy questions. Also, I'd like to introduce you to Byron Boyle; he has been helping to get the UIC permit up to speed. Will you have 30-45 minutes to talk? If not, can we schedule a phone call for the near future?  
I hope you are doing well.  
Thanks!  
Patsy

Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
 epahub11.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
 2008032711263780-3491123 ; Thu, 27 Mar 2008 11:26:37 -0400  
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 11:26:37 -0400 (EDT)  
 Delivered\_to: shea.valois@epamail.epa.gov  
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 <Shea.Valois@epamail.epa.gov>; Thu, 27 Mar 2008 11:26:37 -0400 (EDT)  
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 [206.168.230.10]) by mseive02.rtp.epa.gov (Postfix) with ESMTP id 11D4A5D4077  
 for <Shea.Valois@epamail.epa.gov>; Thu, 27 Mar 2008 11:26:07 -0400 (EDT)  
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 MIME\_Version: 1.0  
 Subject: CSC permit application  
 PostedDate: 03/27/2008 09:24:20 AM  
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 X\_MS\_TNEF\_Correlator:  
 Thread\_Topic: CSC permit application  
 Thread\_Index: AciQHqExaQE6o21TIamUKVjuDAMjg==  
 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
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 INetFrom: .  
 SMTPOriginator: pmoran@knightpiesold.com  
 RouteServers: CN=EPAHUB11/0=USEPA/C=US, CN=R8MAIL2/OU=R8/0=USEPA/C=US  
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 RoutingState:  
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 DeliveredDate: 03/27/2008 09:27:04 AM  
 \$MiniView:  
 \$RespondedTo: 1  
 \$FILE:  
 \$PaperColor: 1

In case you haven't seen this.

Patsy - csc-uic-permit-application.pdf

ATTACHMENT: csc-uic-permit-application.pdf vrs



PRINCIPAL: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
ForwardedFrom: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
ForwardedDate: 03/27/2008 09:50:03 AM  
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OriginalModTime: 03/27/2008 09:51:17 AM  
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INetCopyTo:  
INetBlindCopyTo:  
\$StorageTo: .  
\$Mailer: Lotus Notes Release 7.0.3 September 26, 2007  
\$MessageID: <0F5D83FF09.A628775E-0N87257419.0056FA8A-87257419.0057190C@LocalDomain>  
INetFrom: Shea.Valois@epamail.epa.gov  
PostedDate: 03/27/2008 09:51:19 AM  
Recipients: <pmoran@knightpiesold.com>  
MAILOPTIONS: 0  
SaveOptions: 1  
ldf\_createddate: null  
ldf\_from: null  
ldf\_archive: null  
ldf\_temp: null  
From: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
AltFrom: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
Logo: StdNotesLtr32  
useApplet: True  
tmpImp2:  
DefaultMailSaveOptions: 1  
Query\_String:  
SentToDocu: False  
SendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
CopyTo:  
BlindCopyTo:  
Subject: Fw: WY COGEMA Excursion/monitor well location  
ldf\_locale: en-US  
Encrypt: 0  
Sign: 0  
ReturnReceipt: 0  
delTmpEncrypt:  
delTmpImportance:  
delTmpReturnReceipt:  
delTmpSign:  
EnterSendTo: "Patsy Moran" <pmoran@knightpiesold.com>  
EnterCopyTo:  
EnterBlindCopyTo:  
\$RFSaveInfo: 0394A416C0CBB7718525740B0077F794  
\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

----- Forwarded by Valois Shea/P2/R8/USEPA/US on 03/27/2008 09:50 AM -----

"Steve Ingle" <SINGLE@state.wy.us>  
03/13/2008 03:50 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
Excursion/monitor well location

Valois,

I've attached a wellfield simulation that shows a simulated excursion and retrieval within the 60 day criteria we use. I hope this helps.

Steve

ATTACHMENT: Mine\_Unit\_7\_Pump\_Test\_Results\_&\_Analysis.pdf vrs

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PostedDate: 03/27/2008 10:43:55 AM  
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InheritedFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
InheritedAltFrom: "Patsy Moran" <pmoran@knightpiesold.com>  
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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

ATTACHMENT: 7520-13 Plugging Record.snp vrs

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 X\_MS\_TNEF\_Correlator:  
 Thread\_Topic: Mine Unit 7 Pump Test Document  
 Thread\_Index: AciQ5jdAu37ALHanS3010wo1kaaKsQ==  
 From: "Patsy Moran" <pmoran@knightpiesold.com>  
 SendTo: <SINGLE@state.wy.us>  
 CopyTo: "Cory Conrad" <cconrad@knightpiesold.com>, Valois  
 Shea/P2/R8/USEPA/US@EPA  
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 \$PaperColor: 1

Hi Steve,

Valois gave use the Mine Unit 7 Pump Test wellfield simulation document. Cory Conrad read through it last night and said it was a HUGE help. We are hoping to obtain the figures/tables maps etc. Is this possible? I'm keeping my fingers crossed that the requested information is already electronic.

I really appreciate the help!

Thank you,

Patsy

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Hi Patsy, I have finally finished obsessing about this checklist for figure in the permit application. It is still in DRAFT form, so please let me know if it coincides with what you were thinking or if there is a way to make it more helpful for permit applicants.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

ATTACHMENT: Class III Permit App Figure Checklist.doc vrs



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Hi Valois,

If you have time now can you give Cory a call at 303 867 2208. It should be quick.

Thanks,

Patsy

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Hi Patsy, I just wanted to let you know I checked the regs & both the mining regs 74:29:11:07 & the WQ regs 74:55:01:35 say a minimum of 6 months of monthly sampling. Maybe they are extending it to a year to match NRC. I'll ask about that & let you know.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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 SendTo: Valois Shea/P2/R8/USEPA/US/EPA  
 CopyTo: "'Mark Hollenbeck'" <mhollenbeck@powertechuranium.com>  
 References: <005401c8a3ec\$b5187f30\$6a32a8c0@powertech.local>  
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 INetFrom: .  
 SMTPOriginator: rblubaugh@powertechuranium.com  
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Valois,  
Would you be able to attend a project update meeting in Rapid City next Friday? We are thinking that we need to have it fairly soon if we are to have such a meeting prior to the pump tests which we plan on conducting in May.

Richard Blubaugh  
Powertech (USA) Inc.  
303-790-7528

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, April 21, 2008 3:52 PM  
To: Richard Blubaugh  
Subject: RE: Days I am out in May & June

Yes I have all day open.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard  
Blubaugh"  
<rblubaugh@power  
techuranium.com>

To  
Valois Shea/P2/R8/USEPA/US@EPA

cc  
04/21/2008 02:17  
PM

Subject

RE: Days I am out in May & June

Valois,  
Are you available next Friday, May 2nd?  
Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, April 21, 2008 10:15 AM  
To: Kaci Walker; rblubaugh@powertechuranium.com;  
twalsh@powertechuranium.com  
Subject: Days I am out in May & June

May

Mon 5 - Wed 7

Wed 14 - Fri 16

Mon 19 - Fri 23

Mon 26

Thur 29 - Mon June 2

June

Tues 10 - Wed 18 (or something like that)

Mon 23 - Fri 27

---

Valois Shea

US EPA Region 8

8P-W-GW

1595 Wynkoop Street

Denver, CO 80202-1129

phone: 303-312-6276

fax: 303-312-6741

Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
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Hi Valois,

Here is the Dewey-Burdock pump test work plan.

Patsy - Pump Test Workplan\_Rev2.pdf

ATTACHMENT: Pump Test Workplan\_Rev2.pdf vrs

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 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 CopyTo:  
 <rblubaugh@powertechuranium.com>, <mhollenbeck@powertechuranium.com>, "Paul  
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Hi Valois,  
I need to make sure that Powertech is okay with giving the additional  
cross sections out seeing as they need some reviews/edits. I'm cc'ing  
Rich and Mark on this email so that Powertech can make that decision.  
Sorry for the delay.  
Patsy

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 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 CopyTo: <KaciWalker@R2Incorporated.com>, "Paul Bergstrom"  
 <pbergstrom@knightpiesold.com>  
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Hi Valois,

I had a great conversation with Kaci Walker today regarding our individual approaches to the monitoring program and aquifer exemption boundaries, etc. We both agree that it would be useful to meet with you and the operations folks (perhaps John and/or Wallace Mays) to discuss these items. I expressed that you were concerned over lack of continuous monitoring and we believe there may be some confusion about where continuous monitoring applies. The Dewey-Burdock Site monitoring program has continuously monitoring for the following parameters:

Parameter

Monitoring Frequency

Monitoring Instrument

injection rate (gpm)

Continuous

Digital Recorder

injection total volume (gallons)

Continuous

Digital Totalizer

injection pressure (psig)

Continuous

Digital Recorder

annular pressure (psig)

Continuous

Digital Recorder

injection fluid temperature (°F)

Continuous

Digital Recorder

quartz capillary pressure (psig)

Continuous

Digital Recorder

Fluid level and control parameters (other parameters I'm forgetting right now?) will not be continuously monitored. I hope this is in-line with your thinking. Please let me know if this is not how you interpret the rules.

I didn't see anything from Rich about the cross sections; he probably got overwhelmed with other beginning of the week items. However, once the minor changes are made I will get you new copies. I have not looked over the cross sections in enough detail to say if I believe they fulfill the permit application requirements yet. Once I've gone through that iteration and you have updated copies, I'm hoping you and I can sit down and discuss your take on the completeness of the cross sections. Would you be interested in sitting down (another meeting-sorry) sometime in the next few weeks?

I hope your week is going well so far.

Thanks,

Patsy

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PostedDate: 05/08/2008 07:36:09 AM

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From: "Paul Bergstrom" <pbergstrom@knightpiesold.com>

SendTo: Valois Shea/P2/R8/USEPA/US@EPA

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\$Revisions:

DeliveredDate: 05/08/2008 07:36:13 AM

\$MiniView:

\$PaperColor: 1

Paul D. Bergstrom, C.E.P.

Senior Associate

Knight Piésold and Co.

1580 Lincoln Street, Suite 1000      New Address!

Denver, CO80203-1512

USA

Phone: (303) 629-8788

Direct: (303) 867-2270

Fax: (303) 629-8789

Web Site: <http://www.knightpiesold.com>

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From: Michael Beshore [mailto:[mbeshore@powertechuranium.com](mailto:mbeshore@powertechuranium.com)]  
Sent: Wednesday, May 07, 2008 4:50 PM  
To: DENRINTERNET@state.sd.us  
Cc: 'Mark Hollenbeck'; 'Richard Blubaugh'; 'John Mays';  
[flichnovsky@powertechuranium.com](mailto:flichnovsky@powertechuranium.com); Cory Conrad; 'Cory S. Foreman'; Paul Bergstrom  
Subject: Atten: Bobbie Fivecoate

Hi Bobbie, Below is a schedule of pumping test activities at the Dewey-Burdock site for next week. I think I said last week that I would forward you this.



Monday, May 12: Conduct Step Drawdown Tests at Burdock.

Tuesday, May 13: Conduct Step Drawdown Tests at Dewey.

Wednesday, May 14: Possibly begin/continue pump test at the Burdock site. This depends on if the aquifer has stabilized following step drawdown test.

\*If aquifer has not yet stabilized at Burdock, take day off and wait another day.

Thursday, May 15: Possibly begin/continue pump test at the Burdock site. This depends on if the aquifer has stabilized following step drawdown test.

\*If aquifer has not yet stabilized at Burdock, take day off and wait another day.

Friday, May 16: Definitely begin conducting 72 hour pump test at the Burdock site.

Saturday, May 17: Continue Burdock pump test. Possibly begin Dewey pump test.

Sunday, May 18: Continue Burdock pump test. Possibly begin Dewey pump test.

Monday, May 19: Definitely begin conducting 72 hour pump test at the Dewey site.

Tuesday, May 20: Continue Dewey pump test.

Wednesday, May 21: Continue and Complete Dewey pump test.

Hope this is fairly clear. The day we begin the Burdock pump test will be determined how quickly the aquifer stabilizes following the step drawdown test on Monday at Burdock. If stabilization takes place by Wednesday we will begin the pump test. But we would like to at the most give the aquifer 3 days to reach static. However, regardless we will begin the Burdock pump test by Friday. We will stay in touch with you by phone (forward me a phone number) so we can tell you when we are beginning the Burdock pump test. Either way, you are welcome to come out to oversee some

step drawdown activities on Monday and Tuesday if you would like. Tuesday we should have a better feel for when pumping will begin at Burdock.

Thanks, Mike

Michael D. Beshore, P.G.

Senior Environmental Coordinator

Powertech (USA) Inc.

P.O. Box 1066

8305 6th Street

Wellington, CO80549

(970) 282-7777 office

(970) 556-5988 cell

(970) 568-3423 fax

Email: [mbeshore@powertechuranium.com](mailto:mbeshore@powertechuranium.com)

Website: [www.powertechuranium.com](http://www.powertechuranium.com)

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Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
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 (SMTPD32-8.15) id A220785008E; Thu, 08 May 2008 07:45:52 -0700  
 From: "Michael Beshore" <mbeshore@powertechuranium.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US/EPA  
 CopyTo: "'Mark Hollenbeck'" <mhollenbeck@powertechuranium.com>,"'Richard  
 Blubaugh'" <rblubaugh@powertechuranium.com>  
 Subject: Dewey Burdock Pump Test  
 PostedDate: 05/08/2008 08:46:18 AM  
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 20.hlrn.qwest.net to mhollenbeck@powertechuranium.com,  
 rblubaugh@powertechuranium.com, shea.valois@epa.gov, 08 May 2008 07:46:00 PT,  
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\$PaperColor: 1

Hi Valois, I almost forgot to send you the schedule. Hope to see you up there if you get a chance to get to the field.

Mike

From: Michael Beshore [mailto:mbeshore@powertechuranium.com]  
Sent: Wednesday, May 07, 2008 4:50 PM  
To: 'DENRINTERNET@state.sd.us'  
Cc: 'Mark Hollenbeck'; 'Richard Blubaugh'; 'John Mays';  
'flichnovsky@powertechuranium.com'; 'Cory Conrad'; 'Cory S. Foreman';  
'Paul Bergstrom'  
Subject: Atten: Bobbie Fivecoate

Hi Bobbie, Below is a schedule of pumping test activities at the Dewey-Burdock site for next week. I think I said last week that I would forward you this.

Monday, May 12: Conduct Step Drawdown Tests at Burdock.

Tuesday, May 13: Conduct Step Drawdown Tests at Dewey.

Wednesday, May 14: Possibly begin/continue pump test at the Burdock site. This depends on if the aquifer has stabilized following step drawdown test.

\*If aquifer has not yet stabilized at Burdock, take day off and wait another day.

Thursday, May 15: Possibly begin/continue pump test at the Burdock site. This depends on if the aquifer has stabilized following step drawdown test.

\*If aquifer has not yet stabilized at Burdock, take day off and wait another day.

Friday, May 16: Definitely begin conducting 72 hour pump test at the Burdock site.

Saturday, May 17: Continue Burdock pump test. Possibly begin Dewey pump test.

Sunday, May 18: Continue Burdock pump test. Possibly begin Dewey pump test.

Monday, May 19: Definitely begin conducting 72 hour pump test at the Dewey site.

Tuesday, May 20: Continue Dewey pump test.

Wednesday, May 21: Continue and Complete Dewey pump test.

Hope this is fairly clear. The day we begin the Burdock pump test will be determined how quickly the aquifer stabilizes following the step drawdown test on Monday at Burdock. If stabilization takes place by Wednesday we will begin the pump test. But we would like to at the most give the aquifer 3 days to reach static. However, regardless we will begin the Burdock pump test by Friday. We will stay in touch with you by phone (forward me a phone number) so we can tell you when we are beginning the Burdock pump test. Either way, you are welcome to come out to oversee some step drawdown activities on Monday and Tuesday if you would like. Tuesday we should have a better feel for when pumping will begin at Burdock.

Thanks, Mike

Michael D. Beshore, P.G.

Senior Environmental Coordinator

Powertech (USA) Inc.

P.O. Box 1066

8305 6th Street

Wellington, CO 80549

(970) 282-7777 office

(970) 556-5988 cell

(970) 568-3423 fax

Email: [mbeshore@powertechuranium.com](mailto:mbeshore@powertechuranium.com)

Website: [www.powertechuranium.com](http://www.powertechuranium.com)

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Hi Valois,

I noticed that the UIC program is looking for a GS-12/13. Are you aware of this and if so is this person going to be assisting you with Class III permitting?

We are still working towards a meeting regarding the monitoring programs for Centennial and Dewey-Burdock. I'm a bit overloaded at the moment but would like to talk about scheduling a meeting next week.

I hope all is well.

Thanks,

Patsy



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I am going to be out of the office until May 23. I will try to give you a call while I am out on travel to catch up!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
05/13/2008 09:17 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
UIC program

Hi Valois,  
I noticed that the UIC program is looking for a GS-12/13. Are you aware of this and if so is this person going to be assisting you with Class III permitting?  
We are still working towards a meeting regarding the monitoring programs for Centennial and Dewey-Burdock. I'm a bit overloaded at the moment but would like to talk about scheduling a meeting next week.  
I hope all is well.  
Thanks,  
Patsy

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Hi Valois,  
I'll be out May 22, 23 and 26th. Otherwise I should be fairly easy to reach. I'll talk with you soon.  
Thanks,  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Tuesday, May 13, 2008 2:22 PM  
To: Patsy Moran  
Subject: Re: UIC program

I am going to be out of the office until May 23. I will try to give you a call while I am out on travel to catch up!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
05/13/2008 09:17  
AM  
Subject  
UIC program

To  
cc

Hi Valois,  
I noticed that the UIC program is looking for a GS-12/13. Are you aware of this and if so is this person going to be assisting you with Class III permitting?  
We are still working towards a meeting regarding the monitoring programs for Centennial and Dewey-Burdock. I'm a bit overloaded at the moment but would like to talk about scheduling a meeting next week.  
I hope all is well.  
Thanks,  
Patsy

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Hi Patsy, I have a meeting this morning, but I can give you a call after lunch. Would 1:00 work? Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

ATTACHMENT: AOR ZOI Definitions v3 6 20 2008.doc vrs



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---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

----- Forwarded by Valois Shea/P2/R8/USEPA/US on 06/20/2008 09:51 AM -----

"Steve Ingle" <SINGLE@state.wy.us>  
06/11/2008 09:49 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
Re: Fw: Question back for you

Valois,

Here are the Moore Ranch comments. As I mentioned in my email yesterday, when they get into technical review there will be many more comments.

I hope this helps.

Steve

ATTACHMENT: EMapCrv1.7gm.doc vrs

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---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

----- Forwarded by Valois Shea/P2/R8/USEPA/US on 06/20/2008 09:52 AM -----

"Steve Ingle" <SINGLE@state.wy.us>  
06/10/2008 09:40 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
Re: Fw: Question back for you

Valois,

The permit coordinator has the comments electronically and is out of the office today. I'll try to get them to you tomorrow. Our review consists of 2 parts, the first is completeness, where we determine if all the component parts are addressed and then after the application is declared complete (or substantially complete), then we begin our technical review. For example, doing a pump test would be completeness, doing it right would be technical.

Right now they are marginally complete, but from the preliminary technical issues they are very deficient. They are a long ways from getting their permit.

Steve

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Hi Valois,

Currently the draft permit application states that no stimulation program is planned for the Dewey-Burdock Project. Do you believe well stimulation should be proposed even if it is not necessarily used? I've researched the topic and discussed it with people with a bit more technical expertise and don't believe well stimulation is a common practice for uranium UIC. Am I way off base?

I appreciate your assistance.

Thank you,

Patsy

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I agree that well stimulation is not common practice for uranium mining injection wells & should not be needed, so no proposed plan is necessary for the permit app.

Just to let you know, Wendy & I are still working on that aquifer exemption boundary document. We got input from Petrotek, too. I think we would also like to talk to the WY LQD staff before we finalize it. Hope it was not too rude an awakening to return to CO from Hawaii!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
07/10/2008 03:35 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
Quick question....

Hi Valois,  
Currently the draft permit application states that no stimulation program is planned for the Dewey-Burdock Project. Do you believe well stimulation should be proposed even if it is not necessarily used? I've researched the topic and discussed it with people with a bit more technical expertise and don't believe well stimulation is a common practice for uranium UIC. Am I way off base?

I appreciate your assistance.  
Thank you,  
Patsy



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Hi Valois,  
Thanks! One less thing to worry about today. Of course, I'll put the attachment in the application and just have a short statement saying that no stimulation program is being proposed at this time.

I'm sure I'll have a ton of questions for you in the near future... what is your schedule like over the next few weeks?

I hope you are doing well.  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, July 14, 2008 11:15 AM  
To: Patsy Moran  
Subject: Re: Quick question....

I agree that well stimulation is not common practice for uranium mining injection wells & should not be needed, so no proposed plan is necessary for the permit app.

Just to let you know, Wendy & I are still working on that aquifer exemption boundary document. We got input from Petrotek, too. I think we would also like to talk to the WY LQD staff before we finalize it. Hope it was not too rude an awakening to return to CO from Hawaii!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
07/10/2008 03:35  
PM  
Subject  
Quick question....

To

cc

Hi Valois,  
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program is planned for the Dewey-Burdock Project. Do you believe well stimulation should be proposed even if it is not necessarily used? I've researched the topic and discussed it with people with a bit more technical expertise and don't believe well stimulation is a common practice for uranium UIC. Am I way off base?  
I appreciate your assistance.  
Thank you,  
Patsy

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Hi Valois,

The information I have suggests that verification of financial resources for the UIC permit (Attachment R-Necessary Resources) is for well plugging and abandonment only. Therefore, I am putting together a range of costs which will depend on the number of wells, diameter and depth (and cement vs bentonite grout). Is my interpretation consistent with your understanding?

Thanks!

Patsy

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Yes that sounds good. When I talked with Britta Copt, our Financial Responsibility person, she said a bid from a contractor on how much it would cost to close an example well is needed. I think your company does that sort of work? So if you could document the info you described below as a proposed bid or estimate from Knight Piesold to include in the permit app, that would be good. Would that cause a problem (either with Powertech or KP) for you to do that?

I am telecommuting Tues & Wed this week and I hope 3 days next week to catch up on stuff. I hope to take off the week of July 28, but that week off can be moved around - it is basically for home projects. So let me know how that week off works for your schedule. Any estimated date for delivery of the permit app?

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
07/14/2008 11:36 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
Necessary Resources

Hi Valois,  
The information I have suggests that verification of financial resources for the UIC permit (Attachment R-Necessary Resources) is for well plugging and abandonment only. Therefore, I am putting together a range of costs which will depend on the number of wells, diameter and depth (and cement vs bentonite grout). Is my interpretation consistent with your understanding?  
Thanks!  
Patsy

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Hi Valois,  
Thanks! Very helpful. I need to find out about the bid because we generally use sub-contractors to do that sort of work but a bid seems like a reasonable expectation.

I'm still on schedule for the August 1st submission of the draft permit application to Powertech. They have two weeks of review in their schedule and two weeks for us to make the changes. So September 1st is the big day. If things look like they are changing I'll let you know asap. The next week or so will be key.

I have a question about isopach map requirements. I need to talk to Cory a bit first. I just wanted to give you a heads up.

I appreciate your help.  
Patsy

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, July 14, 2008 12:04 PM  
To: Patsy Moran  
Subject: Re: Necessary Resources

Yes that sounds good. When I talked with Britta Copt, our Financial Responsibility person, she said a bid from a contractor on how much it would cost to close an example well is needed. I think your company does that sort of work? So if you could document the info you described below as a proposed bid or estimate from Knight Piesold to include in the permit app, that would be good. Would that cause a problem (either with Powertech or KP) for you to do that?

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---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran"  
<pmoran@knightpi  
esold.com>  
Valois Shea/P2/R8/USEPA/US@EPA  
07/14/2008 11:36  
AM  
Subject  
Necessary Resources

To  
  
cc

Hi Valois,

The information I have suggests that verification of financial resources for the UIC permit (Attachment R-Necessary Resources) is for well plugging and abandonment only. Therefore, I am putting together a range of costs which will depend on the number of wells, diameter and depth (and cement vs bentonite grout). Is my interpretation consistent with your understanding?

Thanks!

Patsy

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Hi Valois,

I'm sorry to ask such a basic question but here it goes:

The actual permit application (1 page) asks for the number of wells (this information is required elsewhere also). I'm hoping an approximate number is acceptable, is this your understanding? Is this number for all wells including injection, production and monitoring wells or does it exclude monitoring wells?

I appreciate your help.

Thank you,

Patsy

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\$PaperColor: 1

I don't see how anyone could really know how many wells will be needed for

sure until the wells are actually being installed. So for the form on page 1, if you would like put a page number in that space referring to the page in the application where that topic is discussed, that would be more helpful than an estimated number of wells. Where it asks for the number of wells elsewhere in the application, the # wellfields with # patterns that are anticipated would be more helpful information & even that is probably an estimate at the time of the application.

I figure each well pattern will be a 5-spot. Even though the center well would actually be a recovery well, we will permit each well as an injection well, to give the operator the flexibility of using any of the recovery wells for injection when needed.

It is helpful to get these questions for when it is time for us to put together better permit app instructions.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

-----"Patsy Moran" <pmoran@knightpiesold.com> wrote: -----

To: Valois Shea/P2/R8/USEPA/US@EPA  
From: "Patsy Moran" <pmoran@knightpiesold.com>  
Date: 07/14/2008 05:38PM  
Subject: UIC application

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I'm sorry to ask such a basic question but here it goes:

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Hi Valois,

Once again you have been very helpful. I will do what you've suggested below. I'm sure more questions will follow soon.

I hope your day is going well.

Thanks,

Patsy

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Tuesday, July 15, 2008 9:25 AM  
To: Patsy Moran  
Subject: Re: UIC application

I don't see how anyone could really know how many wells will be needed for sure until the wells are actually being installed. So for the form on page 1, if you would like put a page number in that space referring to the page in the application where that topic is discussed, that would be more helpful than an estimated number of wells. Where it asks for the number of wells elsewhere in the application, the # wellfields with # patterns that are anticipated would be more helpful information & even that is probably an estimate at the time of the application.

I figure each well pattern will be a 5-spot. Even though the center well would actually be a recovery well, we will permit each well as an injection well, to give the operator the flexibility of using any of the recovery wells for injection when needed.

It is helpful to get these questions for when it is time for us to put together better permit app instructions.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



-----"Patsy Moran" <pmoran@knightpiesold.com> wrote: -----

To: Valois Shea/P2/R8/USEPA/US@EPA  
From: "Patsy Moran" <pmoran@knightpiesold.com>  
Date: 07/14/2008 05:38PM  
Subject: UIC application

Hi Valois,

I'm sorry to ask such a basic question but here it goes:

The actual permit application (1 page) asks for the number of wells (this information is required elsewhere also). I'm hoping an approximate number is acceptable, is this your understanding? Is this number for all wells including injection, production and monitoring wells or does it exclude monitoring wells?

I appreciate your help.

Thank you,

Patsy

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Hi Valois,

Is the plugging and abandonment bond for all mine units or for the first only? I just noticed Lost Creek and Moore Ranch only have estimates for the first mine unit.

Thanks!

Patsy

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I don't know. I think we just need enough to close any active wells as mining is done incrementally.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Patsy Moran" <pmoran@knightpiesold.com>  
07/17/2008 05:07 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
Plugging and Abandonment

Hi Valois,  
Is the plugging and abandonment bond for all mine units or for the first only? I just noticed Lost Creek and Moore Ranch only have estimates for the first mine unit.  
Thanks!  
Patsy

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Hi Valois,

We're working on the figures now and inevitably some questions have come up. The NRC has a number of different buffer zones (1/4 mile, 1 mile, 2 mile etc). When you refer to the buffer zone for the Site Plan Map and Monitoring Program Maps are you referring to the 2 mile criteria (2 miles from the site boundary) used for Site Characterization as discussed in NUREG 1569? I can see this being the case for the Site Plan map but I believe it would take away from the Monitoring Program Maps. Do I understand what you are requesting?

Thanks!

Patsy

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Hi Valois,

For Attachment P-Monitoring Program we will provide map(s) with the information as detailed in your List of Figures but I need to make sure my approach isn't inconsistent with your vision.

We currently plan to use a figure similar to the attached Moore Ranch Figure to illustrate the monitoring plan (with production zone monitoring wells 400 ft part and 400 ft from the well field, a single mine unit and color coded designation for the screened interval (i.e., production, underlying, overlying). Is this Figure in line with what you were hoping to see?

Figure (as described above): wells in wellfields-  
TYPICAL MINE UNIT?

location of monitoring wells as appropriate

labeled with well numbers/names

designate screened or open interval for each well. (e.g. color-coded according to mining zones, aquifers above, and aquifers below)

and...

Large Map: large mine permit boundary

area of review

zone of influence-NO LONGER ON MAP

buffer zone (as defined by NCR permit requirements) NEED CLARITY

monitor well ring wells

aquifer exemption boundary

Do you want the wells in all wellfields illustrated and all monitoring wells?

Would it be a problem if I put the isopachs and potentiometric maps in with the cross sections rather than in the monitoring program attachment?

I hope this is fairly clear? If not, we can talk on the phone. I'm in the office all week.

Thanks,

Patsy

- Moore Ranch Mine unit Monitoring.pdf

ATTACHMENT: Moore Ranch Mine unit Monitoring.pdf vrs

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I don't know if I even understand what I am asking! I'll ponder that

question & get back to you.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

-----"Patsy Moran" <pmoran@knightpiesold.com> wrote: -----

To: Valois Shea/P2/R8/USEPA/US@EPA  
From: "Patsy Moran" <pmoran@knightpiesold.com>  
Date: 07/21/2008 10:53AM  
Subject: NRC buffer zone question?

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Thanks!

Patsy

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Hi Valois,

Thanks!

Sorry about the barrage of questions. I should have asked these before but I had more pressing issues that were occupying my time.

Patsy

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, July 21, 2008 6:00 PM  
To: Patsy Moran  
Subject: Re: NRC buffer zone question?

I don't know if I even understand what I am asking! I'll ponder that question & get back to you.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

-----"Patsy Moran" <pmoran@knightpiesold.com> wrote: -----

To: Valois Shea/P2/R8/USEPA/US@EPA  
From: "Patsy Moran" <pmoran@knightpiesold.com>  
Date: 07/21/2008 10:53AM  
Subject: NRC buffer zone question?

Hi Valois,

We're working on the figures now and inevitably some questions have come up. The NRC has a number of different buffer zones (1/4 mile, 1 mile, 2 mile etc). When you refer to the buffer zone for the Site Plan Map and Monitoring Program Maps are you referring to the 2 mile criteria (2 miles from the site boundary) used for Site Characterization as discussed in NUREG 1569? I can see this being the case for the Site Plan map but I believe it would take away from the Monitoring Program Maps. Do I understand what you are requesting?

Thanks!

Patsy

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Hi Valois,



Does Powertech need to have the financial responsibility demonstration completed at the time the permit application is submitted or do they just need to specify which instrument they plan to use? Looking at the information you sent me on 1/18/2008 (specifically the review form) implies that the documentation should be in place.

Thanks,  
Patsy

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Hi Valois,

Another question....

The necessary resources information implies that only injection wells (i.e., injection and production) need to be taken into consideration. If that is the case, monitoring wells don't need to be included. This may be a moot point since it appears that NRC requires an estimate for all wells in the first mine unit. However, I just want to make sure I'm properly informing Powertech.

Let me know if the barrage of questions is overwhelming and I'll start saving them up.

Thank you,  
Patsy

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Hi Patsy, I have been besieged with deadlines & have been working at home this week to catch up. I will give you better answers to all your questions, but it will probably be next week. Will that be OK? Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Hi Valois,  
I understand; I'm in the same boat. I'll consolidate any other questions for now. I'm talking with Kaci today; perhaps she already asked some of these questions. If so, I'll let you know.  
Good luck!  
Thanks,  
Patsy

---

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Wed 7/23/2008 10:03 AM  
To: Patsy Moran  
Subject: Re: Another financial question-injection wells

Hi Patsy, I have been besieged with deadlines & have been working at home this week to catch up. I will give you better answers to all your questions, but it will probably be next week. Will that be OK? Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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 <pbergstrom@knightpiesold.com>  
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Hi Valois,

I'm glad to hear you'll be calling Rich by the end of the week. Here are the P&A cost estimates from Moore Ranch and Lost Creek that we discussed. I look forward to seeing the updated permit application checklist and AEB/AOR guidance document.

Thank you,

Patsy - Lost Creek P&A cost.pdf - Moore Ranch P&A cost.pdf

2 ATTACHMENTS:

1)Lost Creek P&A cost.pdf

2)Moore Ranch P&A cost.pdf

vrs

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Hi Patsy, Please do not be dismayed if the permit application you have prepared does not look exactly like the descriptions for attachments and checklist for figures. I consider review of your permit application to be a test for these draft documents to see how they hold up in reference to reality. Also I included the answers to your questions that we discussed over the phone. Please let me know if there is any discrepancy. Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741 - Class III Permit App Checklist.doc - Class III Permit App Attachments.doc - Questions from Patsy to Answer.doc

3 ATTACHMENTS:

- 1) Class III Permit App Checklist.doc
- 2) Class III Permit App Attachments.doc
- 3) Questions from Patsy to Answer.doc

vrs

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I had meant to fix this part, too. I thought I had, but it was the stimulation program I was thinking of. How does this sound? I didn't want to get too specific about what the tests should be - is that OK?

I. FORMATION TESTING PROGRAM - For the purpose of a Class III ISL operation, formation testing should be designed to provide information about geohydrologic properties of the mining zone and the confining zones pertinent to the mining operation and physical and chemical characteristics of the formation fluids. Describe the proposed formation testing program, including aquifer pump tests and any other types of tests conducted. Include calculations for fracture pressures of the mining zone and confining zones. A calculated value will be adequate in this case, because injection pressure during mining or restoration should never be near fracture pressure of the mining zone or the confining zones.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Amy, Thanks very much for the update!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Amy Thurlkill" <athurlkill@powertechuranium.com>  
09/16/2008 05:15 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
<rblubaugh@powertechuranium.com>  
Subject  
Re: phone discussion on Geology and Pump Test

Valois,

We have a narrative draft under in-house review; we are waiting on some figures from our geologist.  
We will send you a copy of the geology report as soon as it is complete.

The pump test has not been scheduled. We will know more about the scheduling in a couple of weeks.  
We do realize you need to schedule your availability and we will let you know the date and time as soon as we know.

Thank you for your patients concerning these matters,  
Amy

Amy L. Thurlkill  
E.H.S. Manager; RSO - Corporate  
Powertech (USA) Inc.  
PWE:TSX  
5575 DTC Parkway Suite #140  
Greenwood Village, CO 80111  
www.powertechuranium.com  
Tel:303.790.7528  
Cell: 361.318.1622  
Fax:303.790.3885  
E-mail: athurlkill@powertechuranium.com





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Sorry I could not be of more help,  
Items are moving through the checks and balances here as soon as Richard or  
myself have the information we will be sharing.  
Amy

Amy L. Thurlkill  
E.H.S. Manager; RSO - Corporate  
Powertech (USA) Inc.  
PWE:TSX  
5575 DTC Parkway Suite #140  
Greenwood Village, CO 80111  
www.powertechuranium.com  
Tel:303.790.7528  
Cell: 361.318.1622  
Fax:303.790.3885  
E-mail: athurlkill@powertechuranium.com

-----Original Message-----

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Sent: Wednesday, September 17, 2008 8:43 AM  
To: Amy Thurlkill  
Subject: Re: phone discussion on Geology and Pump Test

Amy, Thanks very much for the update!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Amy Thurlkill"  
<athurlkill@powe  
rtechuranium.com

>

Valois Shea/P2/R8/USEPA/US@EPA

To

cc

09/16/2008 05:15

<rblubaugh@powertechuranium.com>

PM

Subject

Re: phone discussion on Geology  
and Pump Test

(Embedded image moved to file: pic12382.jpg) Valois,

We have a narrative draft under in-house review; we are waiting on some figures from our geologist.  
We will send you a copy of the geology report as soon as it is complete.

The pump test has not been scheduled. We will know more about the scheduling in a couple of weeks..  
We do realize you need to schedule your availability and we will let you know the date and time as soon as we know.

Thank you for your patients concerning these matters, Amy

Amy L. Thurlkill  
E.H.S. Manager; RSO - Corporate  
Powertech (USA) Inc.  
PWE:TSX  
5575 DTC Parkway Suite #140  
Greenwood Village, CO 80111  
[www.powertechuranium.com](http://www.powertechuranium.com)  
Tel:303.790.7528  
Cell: 361.318.1622  
Fax:303.790.3885  
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\$PaperColor: 1

Hi Valois,  
Do you every get costs for actually installing a Class I deep well injection well (for example at a uranium ISR site)?

Is that information publically available?

Is there any chance you can send me some permit applications/permits that are publicly available or point me in the right direction?

I'm looking at Region 9 documents now.

I appreciate your help.

Thank you,  
Patsy

Patsy Moran, Ph.D. | Geochemist  
Main: 303.217.5700 | Direct: 720.881.5815 | Fax: 303.217.5705  
Patsy.Moran@tetrattech.com

Tetra Tech | Complex World, Clear Solutions™  
350 Indiana Street, Suite 500 | Golden, CO 80401 | [www.tetrattech.com](http://www.tetrattech.com)

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 From: "Moran, Patsy" <Patsy.Moran@tetratech.com>  
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Hi Valois,  
It might be more useful to have a conversation with you about Class 1 wells, well testing etc. What are the chances you can make time for this is the next few business days?  
Sorry, perhaps you thought you got rid of me?  
Thanks!  
Patsy

Patsy Moran, Ph.D. | Geochemist  
Main: 303.217.5700 | Direct: 720.881.5815 | Fax: 303.217.5705  
Patsy.Moran@tetrattech.com

Tetra Tech | Complex World, Clear Solutions™  
350 Indiana Street, Suite 500 | Golden, CO 80401 | [www.tetrattech.com](http://www.tetrattech.com)

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 CopyTo: "'John Mays'" <jmays@powertechuranium.com>  
 References: <69FE65937617459CBA2AD54DACFD0E15@powertech.local>  
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\$RespondedTo: 1

Hello Valois,

Yes, thank you. I will suggest 2:00p.m., but you can let me know what time works best for you and we will be there. Powertech will be represented by John Mays and myself.

Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Thursday, October 16, 2008 10:25 AM  
To: Richard Blubaugh  
Subject: RE Dewey Burdock meeting

Would some time tomorrow afternoon work for you?

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard  
Blubaugh"  
<rblubaugh@power  
techuranium.com>  
cc  
10/16/2008 09:25  
AM

To  
Valois Shea/P2/R8/USEPA/US@EPA

RE: presentation for GWPC meeting

Subject

Hello Valois,

I would prefer to meet with you while you are in town, between Oct. 16 and Oct 23. It would not take long, nor would there be a lot of people, probably just two of us. We are close to finishing up the Dewey-Burdock UIC application but would prefer to discuss a couple of items related to the AEB prior to submitting. Let me know.

Best regards,  
Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Thursday, October 09, 2008 9:32 AM  
To: Richard Blubaugh  
Subject: RE: presentation for GWPC meeting

OK Thanks! I will be out till Oct 16, then out again until Oct 23. Would the week of Oct 27 be too long to wait to get together to talk about Dewey Burdock?

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard  
Blubaugh"

<rblubaugh@power  
techuranium.com>  
cc

10/09/2008 08:07  
AM

RE: presentation for GWPC meeting

To  
Valois Shea/P2/R8/USEPA/US@EPA  
<athurlkill@powertechuranium.com>  
Subject

Valois,

I am in SD today and will be back in office tomorrow. I will see that we make arrangements to get the geology to you asap. Also, I would like to get together with you to review our thoughts on the Dewey-Burdock AEB. It shouldn't take but about 30 minutes. You are welcome to visit our office, or I will gladly meet at yours?

Actually, I thought Cincinnati was a nice place. The hotel was near downtown and the river. Unfortunately, I had little time to enjoy it. It was my first exposure to the GWPC and I thought it was an organization we should participate in on a regular basis, particularly if they increase focus on ISL.

Richard

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Wednesday, October 08, 2008 9:15 AM:  
To: Richard Blubaugh  
Subject: RE: presentation for GWPC meeting

Hi Richard,

Thanks for copying me on your message. I didn't realize you went to GWPC. That's great, although it is a bummer that it wasn't held some place cool this time like San Diego or Annapolis, like it usually is! May I get an estimated time of arrival for the preview of geology info for the permit application & the aquifer test at Centennial when you have a moment, please?

Our very persistent consultant on the hydrologic modeling contract thoughtfully checks in with me every week, so I thought I would ask this in anticipation of his call!  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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InheritedReplyTo:  
InheritedFrom: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
InheritedAltFrom: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
InheritedFromDomain:  
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That sounds great! Thanks for offering to come here. I will set up a conference room for 2:00 & meet you & John down in the lobby. See you tomorrow!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard Blubaugh" <rblubaugh@powertechuranium.com>  
10/16/2008 10:52 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
"John Mays" <jmays@powertechuranium.com>  
Subject  
RE: RE Dewey Burdock meeting

Hello Valois,

Yes, thank you. I will suggest 2:00p.m., but you can let me know what time works best for you and we will be there. Powertech will be represented by John Mays and myself.

Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Thursday, October 16, 2008 10:25 AM  
To: Richard Blubaugh  
Subject: RE Dewey Burdock meeting

Would some time tomorrow afternoon work for you?

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard

Blubaugh"  
<rblubaugh@power  
techuranium.com>

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

10/16/2008 09:25  
AM

Subject  
RE: presentation for GWPC meeting

Hello Valois,

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Best regards,  
Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Thursday, October 09, 2008 9:32 AM  
To: Richard Blubaugh  
Subject: RE: presentation for GWPC meeting

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Valois Shea  
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8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard  
Blubaugh"  
<rblubaugh@power  
techuranium.com>

To  
Valois Shea/P2/R8/USEPA/US@EPA

10/09/2008 08:07  
AM

cc  
<athurlkill@powertechuranium.com>  
Subject  
RE: presentation for GWPC meeting

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Richard

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Sent: Wednesday, October 08, 2008 9:15 AM:  
To: Richard Blubaugh  
Subject: RE: presentation for GWPC meeting

Hi Richard,

Thanks for copying me on your message. I didn't realize you went to GWPC. That's great, although it is a bummer that it wasn't held some place cool this time like San Diego or Annapolis, like it usually is! May I get an estimated time of arrival for the preview of geology info for the permit application & the aquifer test at Centennial when you have a moment, please?

Our very persistent consultant on the hydrologic modeling contract thoughtfully checks in with me every week, so I thought I would ask this in anticipation of his call!  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741





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 jbonner@powertechuranium.com, jmays@powertechuranium.com,  
 mhollenbeck@powertechuranium.com, pbergstrom@knightpiesold.com,  
 rblubaugh@powertechuranium.com, rforclement@powertechuranium.com,  
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Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Thursday, October 16, 2008 11:25 AM  
To: Richard Blubaugh  
Subject: RE: RE Dewey Burdock meeting

That sounds great! Thanks for offering to come here. I will set up a conference room for 2:00 & meet you & John down in the lobby. See you tomorrow!

---

Valois Shea

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Denver, CO 80202-1129  
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"Richard  
Blubaugh"  
<rblubaugh@power  
techuranium.com> To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
10/16/2008 10:52 "'John Mays'"  
AM <jmays@powertechuranium.com>  
Subject  
RE: RE Dewey Burdock meeting

Hello Valois,

Yes, thank you. I will suggest 2:00p.m., but you can let me know what  
time  
works best for you and we will be there. Powertech will be represented  
by  
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Blubaugh"  
<rblubaugh@power  
techuranium.com> To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
10/16/2008 09:25  
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"Richard  
Blubaugh"  
<rblubaugh@power  
techuranium.com> To  
Valois Shea/P2/R8/USEPA/US@EPA

CC

10/09/2008 08:07

<athurlkill@powertechuranium.com>

AM

Subject

RE: presentation for GWPC meeting

Valois,

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Actually, I thought Cincinnati was a nice place. The hotel was near downtown and the river. Unfortunately, I had little time to enjoy it. It was my first exposure to the GWPC and I thought it was an organization we should participate in on a regular basis, particularly if they increase focus on ISL.

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From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]

Sent: Wednesday, October 08, 2008 9:15 AM:

To: Richard Blubaugh

Subject: RE: presentation for GWPC meeting

Hi Richard,

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Thanks!

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Hi Richard,

I just wanted to clarify what I meant related to the integrity of wells penetrating the Inyan Kara. It is only the water wells inside the Area of Review that I wanted to call to your attention. I know that the injection, extraction, and the monitoring wells will be addressed in the permit application, and that you have a plan for them. Part of the Area of Review process is to identify any pre-existing penetrations through the confinement zones that might be possible breaches of confinement. John mentioned that the wells Powertech constructed in the deeper aquifer to replace the private wells in the uranium-bearing aquifer were pressure tested to be sure the casing had integrity - so that is good. You mentioned that the deeper Sundance aquifer is artesian - I had forgotten that, so if there are any breaches in the confinement zones along outside the well casing, the flow gradient would be out of the aquifer anyway. That information also addresses the Area of Review process, especially if the Sundance hydraulic head is greater than that of the Inyan Kara aquifers. John also mentioned, too, that the clay-bearing nature of confinement zones will act to seal off any open channels along well casing. So all that is good info to include in the Area of Review section of the permit application. I wasn't sure I explained that very well at the meeting, so I wanted to give it another try!

Also, could I have a copy of the excursion control procedure, once you have it ready, for my team leaders and supervisor to review in advance of the permit application, so I can give them a pre-briefing, please? That may be what you were going to do anyway, but with all the sirens & fire alarms & emergency vehicles, I was a little distracted and couldn't remember for sure.

Thanks!

---

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"Richard Blubaugh" <rblubaugh@powertechuranium.com>  
10/17/2008 04:03 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

"John Mays" <jmays@powertechuranium.com>, "Amy Thurlkill"  
<Amy.Thurlkill@cotterusa.com>, "Richard Clement"  
<rfclement@powertechuranium.com>, <mhollenbeck@powertechuranium.com>,  
<jbonner@powertechuranium.com>, <flichnovsky@powertechuranium.com>,  
<wmmi@aol.com>, "Paul Bergstrom" <pbergstrom@knightpiesold.com>

Subject

RE: RE Dewey Burdock meeting



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<rblubaugh@power  
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10/16/2008 10:52  
AM

To  
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cc  
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<jmays@powertechuranium.com>  
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Hi Valois,  
I'm almost done with this cost estimate for a class I well (perhaps more of a class V well since all casings are cemented) but I'm a bit confused about wellheads and blowout protectors. Do you or your colleague that works on class 1 wells have time to briefly talk with me on this subject. If not, can you recommend someone that might have familiarity with this topic. I don't need to tell them you sent me their way.  
Thank you,  
Patsy

Patsy Moran, Ph.D. | Geochemist  
Main: 303.217.5700 | Direct: 720.881.5815 | Fax: 303.217.5705  
Patsy.Moran@tetrattech.com

Tetra Tech | Complex World, Clear Solutions™  
350 Indiana Street, Suite 500 | Golden, CO 80401 | [www.tetrattech.com](http://www.tetrattech.com)

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Good Morning Valois,

Hope all is well with you and yours and hope that your Thanksgiving Holiday was a great one.

We are getting really close to submittal of our application and need to know how many copies to print up for the EPA administrative review. If you could send me this number sometime today, It will help me prepare the printing job.

Thank you so much,

Amy

Amy L. Thurlkill

E.H.S. Manager; RSO - Corporate

Powertech (USA) Inc.

PWE:TSX

5575 DTC Parkway Suite #140

Greenwood Village, CO 80111

[www.powertechuranium.com](http://www.powertechuranium.com)

Tel:303.790.7528

Cell: 361.318.1622

Fax:303.790.3885

E-mail: [athurlkill@powertechuranium.com](mailto:athurlkill@powertechuranium.com)



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Hi Amy,

I have been thinking about the answer, but no one else is around today for me to consult. But just now talking to Richard on the phone I think I arrived at an answer. We would like 1 hard copy with all the confidential business information excluded. This will be for public review. Then 1 hard copy with the CBI included for our review. We can all share that copy. Then one electronic copy of the complete application. I did not request an electronic copy without the CBI when I talked with Richard, but can we get that, too? Then we can have it available for public review.

Just to clarify: The applications will not be available for public review until the Draft Permit is completed and sent out for public review & comment. So the permit application will not be available for public review before that time unless we get a Freedom of Information Act request.  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Amy Thurlkill" <athurlkill@powertechuranium.com>  
12/05/2008 08:00 AM

To  
Valois Shea/R8/USEPA/US@EPA  
cc  
<rblubaugh@powertechuranium.com>  
Subject  
Number of UIC Class III Application copies for EPA

Good Morning Valois,  
Hope all is well with you and yours and hope that your Thanksgiving Holiday was a great one.

We are getting really close to submittal of our application and need to know how many copies to print up for the EPA administrative review. If you could send me this number sometime today, It will help me prepare the printing job.  
Thank you so much,  
Amy

Amy L. Thurlkill  
E.H.S. Manager; RSO - Corporate

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Cell: 361.318.1622  
Fax:303.790.3885  
E-mail: [athurlkill@powertechuranium.com](mailto:athurlkill@powertechuranium.com)

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Hi Amy & Richard,

I just sent a meeting notice to the people involved here for 9:30 - 11:00 Wednesday morning Dec 17th. The back-up would be that afternoon from 1:30 to 3:00. I will let you know as soon as I hear back from everyone. Have a nice weekend!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Thank you for your suggestions about the meeting and the quick response to our inquiries.

Have a great weekend!

Amy

Amy L. Thurlkill  
E.H.S. Manager; RSO - Corporate  
Powertech (USA) Inc.  
PWE:TSX  
5575 DTC Parkway Suite #140  
Greenwood Village, CO 80111  
[www.powertechuranium.com](http://www.powertechuranium.com)  
Tel:303.790.7528  
Cell: 361.318.1622  
Fax:303.790.3885  
E-mail: [athurlkill@powertechuranium.com](mailto:athurlkill@powertechuranium.com)

-----Original Message-----

From: [Shea.Valois@epamail.epa.gov](mailto:Shea.Valois@epamail.epa.gov) [mailto:[Shea.Valois@epamail.epa.gov](mailto:Shea.Valois@epamail.epa.gov)]  
Sent: Friday, December 05, 2008 3:57 PM  
To: Amy Thurlkill; [rblubaugh@powertechuranium.com](mailto:rblubaugh@powertechuranium.com)  
Subject: possible meeting date/time

Hi Amy & Richard,

I just sent a meeting notice to the people involved here for 9:30 - 11:00 Wednesday morning Dec 17th. The back-up would be that afternoon from 1:30 to 3:00. I will let you know as soon as I hear back from everyone. Have a nice weekend!

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Valois Shea  
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8P-W-GW  
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Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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 <Shea.Valois@epamail.epa.gov>; Fri, 5 Dec 2008 18:11:49 -0500 (EST)  
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 CopyTo: <rblubaugh@powertechuranium.com>  
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\$MiniView:  
\$RespondedTo: 1

Valois,  
Here is my understanding of what EPA needs in regards to UIC Application  
submittal copies.  
Please verify so I know we are sending correct number.

1 Hard Copy with Confidential Business Information Excluded  
1 Hard Copy with Confidential Business Information Included  
1 CD with Confidential Business Information Excluded  
1 CD with Confidential Business Information Included  
Thank you so much,  
Amy

Amy L. Thurlkill  
E.H.S. Manager; RSO - Corporate  
Powertech (USA) Inc.  
PWE:TSX  
5575 DTC Parkway Suite #140  
Greenwood Village, CO 80111  
www.powertechuranium.com  
Tel:303.790.7528  
Cell: 361.318.1622  
Fax:303.790.3885  
E-mail: athurlkill@powertechuranium.com

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Friday, December 05, 2008 3:49 PM  
To: Amy Thurlkill  
Cc: rblubaugh@powertechuranium.com  
Subject: Re: Number of UIC Class III Application copies for EPA

Hi Amy,  
I have been thinking about the answer, but no one else is around today for  
me to consult. But just now talking to Richard on the phone I think I  
arrived at an answer. We would like 1 hard copy with all the confidential  
business information excluded. This will be for public review. Then 1 hard  
copy with the CBI included for our review. We can all share that copy.  
Then  
one electronic copy of the complete application. I did not request an  
electronic copy without the CBI when I talked with Richard, but can we get  
that, too? Then we can have it available for public review.

Just to clarify: The applications will not be available for public review  
until the Draft Permit is completed and sent out for public review &  
comment. So the permit application will not be available for public review  
before that time unless we get a Freedom of Information Act request.

Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Amy Thurlkill"  
<athurlkill@powertechuranium.com>  
> To  
Valois Shea/R8/USEPA/US@EPA  
cc  
12/05/2008 08:00 <rblubaugh@powertechuranium.com>  
AM Subject  
Number of UIC Class III  
Application copies for EPA

(Embedded image moved to file: pic20609.jpg) Good Morning Valois, Hope all is well with you and yours and hope that your Thanksgiving Holiday was a great one.

We are getting really close to submittal of our application and need to know how many copies to print up for the EPA administrative review. If you could send me this number sometime today, It will help me prepare the printing job.  
Thank you so much,  
Amy

Amy L. Thurlkill  
E.H.S. Manager; RSO - Corporate  
Powertech (USA) Inc.  
PWE:TSX  
5575 DTC Parkway Suite #140  
Greenwood Village, CO 80111  
www.powertechuranium.com  
Tel:303.790.7528  
Cell: 361.318.1622  
Fax:303.790.3885  
E-mail: . athurlkill@powertechuranium.com (Embedded image moved to file: pic24740.jpg)MPj04372190000[1]



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PostedDate: 12/05/2008 04:40:47 PM  
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InheritedReplyTo:  
InheritedFrom: "Amy Thurlkill" <athurlkill@powertechuranium.com>  
InheritedAltFrom: "Amy Thurlkill" <athurlkill@powertechuranium.com>  
InheritedFromDomain:  
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Yes. That is it.

Just FYI, I just got a call from a guy named Ray Johnson with USGS who works with the energy resources (or something like that) group in Denver that is interested in doing some modeling of restoration at uranium ISL sites. I am going to meet with him on Wed Dec 10 to find out more about what they want to do. They seem to have their own funding & would be looking for a field site & data sharing. They have a PhD student lined up. I am pretty excited about it! It is still in the preliminary stages at this point, but the timing sounds like it might be good for Centennial.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Amy Thurlkill" <athurlkill@powertechuranium.com>  
12/05/2008 04:10 PM

To  
Valois Shea/R8/USEPA/US@EPA  
cc  
<rblubaugh@powertechuranium.com>  
Subject  
RE: Number of UIC Class III Application copies for EPA

Valois,  
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Please verify so I know we are sending correct number.

1 Hard Copy with Confidential Business Information Excluded  
1 Hard Copy with Confidential Business Information Included  
1 CD with Confidential Business Information Excluded  
1 CD with Confidential Business Information Included  
Thank you so much,  
Amy

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www.powertechuranium.com  
Tel:303.790.7528

Cell: 361.318.1622  
Fax:303.790.3885  
E-mail: athurkill@powertechuranium.com

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Friday, December 05, 2008 3:49 PM  
To: Amy Thurkill  
Cc: rblubaugh@powertechuranium.com  
Subject: Re: Number of UIC Class III Application copies for EPA

Hi Amy,  
I have been thinking about the answer, but no one else is around today for me to consult. But just now talking to Richard on the phone I think I arrived at an answer. We would like 1 hard copy with all the confidential business information excluded. This will be for public review. Then 1 hard copy with the CBI included for our review. We can all share that copy. Then one electronic copy of the complete application. I did not request an electronic copy without the CBI when I talked with Richard, but can we get that, too? Then we can have it available for public review.

Just to clarify: The applications will not be available for public review until the Draft Permit is completed and sent out for public review & comment. So the permit application will not be available for public review before that time unless we get a Freedom of Information Act request.  
Thanks!

---

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US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Amy Thurkill"  
<athurkill@powertechuranium.com>

12/05/2008 08:00 AM

To  
Valois Shea/R8/USEPA/US@EPA  
cc  
<rblubaugh@powertechuranium.com>  
Subject  
Number of UIC Class III  
Application copies for EPA

(Embedded image moved to file: pic20609.jpg) Good Morning Valois, Hope all is well with you and yours and hope that your Thanksgiving Holiday was a great one.

We are getting really close to submittal of our application and need to know how many copies to print up for the EPA administrative review. If you could send me this number sometime today, It will help me prepare the printing job.  
Thank you so much,  
Amy

Amy L. Thurlkill  
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Powertech (USA) Inc.  
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Cell: 361.318.1622  
Fax:303.790.3885  
E-mail:. athurlkill@powertechuranium.com (Embedded image moved to file: pic24740.jpg)MPj04372190000[1]

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Hi Richard,

We have the Aspen Room in the 2nd floor conference center for our meeting on Wednesday, Dec 17 from 12:30 - 2:00. We will have Wendy Cheung, Douglas Minter (UIC teamleader), Steven Pratt (my supervisor) & me at the meeting. Douglas & Steve will have to leave at 2:00, but Wendy & I can stay longer if needed. Please let me know who will be attending from your side so I can let the front desk know. I think they like to have the list of names, as well as the number of people, if 5 or more people will be coming. Thanks very much! I look forward to hearing about the upcoming adventure!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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 <mhollenbeck@powertechuranium.com>, <athurkill@powertechuranium.com>  
 References: <299328DC47B0480CAB7FD50A25CF42DE@powertech.local>  
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 X\_Identity: 74.7.185.206 | [No Reverse DNS] | powertechuranium.com  
 X\_Note: incoming, from rblubaugh@powertechuranium.com via [No Reverse DNS] to  
 athurkill@powertechuranium.com, jmays@powertechuranium.com,  
 mhollenbeck@powertechuranium.com, rblubaugh@powertechuranium.com,  
 Shea.Valois@epamail.epa.gov, wmimi@aol.com, 12 Dec 2008 09:23:08 PT,  
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\$RespondedTo: 1

Valois,

Thank you so much for arranging the meeting next Wednesday. This confirms  
our intent to be at EPA's offices Dec. 17 at 12:30 p.m.

Those likely to attend include:

Wallace Mays  
John Mays  
Mark Hollenbeck  
Richard Blubaugh  
Amy Thurlkill

I will let you know by email next week if the names or number of attendees  
differ from that shown.

Again, thank you for your cooperation in providing us this opportunity to  
meet with you and discuss our Dewey-Burdock Project.

Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Friday, December 12, 2008 9:59 AM  
To: Richard Blubaugh  
Subject: Meeting to discuss Dewey Burdock permit application

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meeting on Wednesday, Dec 17 from 12:30 - 2:00. We will have Wendy  
Cheung, Douglas Minter (UIC teamleader), Steven Pratt (my supervisor) &  
me at the meeting. Douglas & Steve will have to leave at 2:00, but Wendy  
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from your side so I can let the front desk know. I think they like to have the list of names, as well as the number of people, if 5 or more people will be coming.  
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US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Sign:  
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Importance: 2  
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DeliveryPriority: N  
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CopyTo: cheung.wendy@epa.gov  
BlindCopyTo:  
AltSendTo: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
AltCopyTo: cheung.wendy@epa.gov  
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03/23/2009 08:42:26 AM

\$PaperColor: 1

Hello Richard,  
I looked over the table of contents for the permit application and compared it with my checklist - it looks very thorough.

Wendy mentioned one thing to ask of you - if you could make sure the wording in the permit application reflects that the estimated aquifer travel time of 10 feet per day is based on site-specific information taking into account the induced gradient created by the injection and recovery wells, that would be really helpful. When Wallace was talking about the aquifer travel time at the meeting, he described it in that context, and Wendy thought that was an important distinction to make. We are trying to keep the guidance from being based on arbitrary numbers. I will give you a call when I get in the office this afternoon to explain our reasoning better.  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by epahub12.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id 2008042116180084-438319 ; Mon, 21 Apr 2008 16:18:00 -0400  
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From: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
References:  
<CEF48648A9D3404E8622F000022C3E68053FAB@r2incorpex01.R2INCORPORATED.COM>  
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Thread\_Index: AcijyukgBYnuantoQheon9QFxEfMiwAIVzqA  
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INetSendTo: Shea.Valois@epamail.epa.gov  
INetFrom: .  
SMTPOriginator: rblubaugh@powertechuranium.com  
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Categories:  
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DeliveredDate: 04/21/2008 02:18:03 PM  
\$MiniView:  
\$PaperColor: 1

Valois,

Are you available next Friday, May 2nd?

Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, April 21, 2008 10:15 AM  
To: Kaci Walker; rblubaugh@powertechuranium.com;  
twalsh@powertechuranium.com  
Subject: Days I am out in May & June

May

Mon 5 - Wed 7

Wed 14 - Fri 16

Mon 19 - Fri 23

Mon 26

Thur 29 - Mon June 2

June

Tues 10 - Wed 18 (or something like that)

Mon 23 - Fri 27

---

Valois Shea

US EPA Region 8

8P-W-GW

1595 Wynkoop Street

Denver, CO 80202-1129

phone: 303-312-6276

fax: 303-312-6741

Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
 epahub12.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id  
 2008042116194263-438528 ; Mon, 21 Apr 2008 16:19:42 -0400  
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 Delivered\_to: shea.valois@epamail.epa.gov  
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 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 References:  
 <CEF48648A9D3404E8622F000022C3E68053FAB@r2incorpex01.R2INCORPORATED.COM>  
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 INetFrom: .  
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Valois,  
Are you available next Friday, May 2nd?  
Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, April 21, 2008 10:15 AM  
To: Kaci Walker; rblubaugh@powertechuranium.com;  
twalsh@powertechuranium.com  
Subject: Days I am out in May & June

May  
Mon 5 - Wed 7  
Wed 14 - Fri 16  
Mon 19 - Fri 23  
Mon 26  
Thur 29 - Mon June 2

June  
Tues 10 - Wed 18 (or something like that)  
Mon 23 - Fri 27

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

\$AutoSpell: 1  
OriginalModTime: 04/21/2008 03:51:38 PM  
In\_Reply\_To: <005401c8a3ec\$b5187f30\$6a32a8c0@powertech.local>  
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AltBlindCopyTo:  
\$Mailer: Lotus Notes Release 7.0.3 September 26, 2007  
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PostedDate: 04/21/2008 03:51:38 PM  
Recipients: <rblubaugh@powertechuranium.com>  
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ldf\_temp: null  
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INetSendTo: .  
AltCopyTo:  
INetBlindCopyTo:  
InheritedReplyTo:  
InheritedFrom: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
InheritedAltFrom: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
InheritedFromDomain:  
From: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
AltFrom: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
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PRINCIPAL: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US  
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SendTo: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
CopyTo:  
BlindCopyTo:  
Subject: RE: Days I am out in May & June  
ldf\_locale: en-US  
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Sign: 0  
ReturnReceipt: 0  
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delTmpImportance:  
delTmpReturnReceipt:  
delTmpSign:  
EnterSendTo: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
EnterCopyTo:  
EnterBlindCopyTo:  
\$RFSaveInfo: 718811BBDCEEADC285257432006FAAF7  
\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

Yes I have all day open.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard Blubaugh" <rblubaugh@powertechuranium.com>  
04/21/2008 02:17 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc

Subject  
RE: Days I am out in May & June

Valois,  
Are you available next Friday, May 2nd?  
Richard

-----Original Message-----  
From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, April 21, 2008 10:15 AM  
To: Kaci Walker; rblubaugh@powertechuranium.com;  
twalsh@powertechuranium.com  
Subject: Days I am out in May & June

May  
Mon 5 - Wed 7  
Wed 14 - Fri 16  
Mon 19 - Fri 23  
Mon 26  
Thur 29 - Mon June 2

June  
Tues 10 - Wed 18 (or something like that)  
Mon 23 - Fri 27

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



Received: from mintra02.rtp.epa.gov ([134.67.221.154]) by  
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 Received: from unknown (HELO richardlt) (74.7.185.206) by mpls-pop-  
 07.inet.qwest.net with SMTP; 22 Apr 2008 17:13:45 -0000  
 From: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
 SendTo: Valois Shea/P2/R8/USEPA/US/EPA  
 CopyTo: "'Mark Hollenbeck'" <mhollenbeck@powertechuranium.com>  
 References: <005401c8a3ec\$b5187f30\$6a32a8c0@powertech.local>  
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 In\_Reply\_To: <OFBCB3936D.0D69AA06-ON87257432.007809D1-  
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 2008.4.22.100050  
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 AM,MIME-CD complete at 03/23/2009 08:36:29 AM  
 INetSendTo: Shea.Valois@epamail.epa.gov  
 INetCopyTo: .  
 INetFrom: .  
 SMTPOriginator: rblubaugh@powertechuranium.com  
 RouteServers: CN=EPAHUB12/O=USEPA/C=US,CN=R8MAIL2/OU=R8/O=USEPA/C=US  
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RoutingState:  
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Categories:  
\$Revisions: 04/22/2008 11:13:49 AM  
DeliveredDate: 04/22/2008 11:13:50 AM  
\$MiniView:  
\$RespondedTo: 1

Valois,  
Would you be able to attend a project update meeting in Rapid City next Friday? We are thinking that we need to have it fairly soon if we are to have such a meeting prior to the pump tests which we plan on conducting in May.

Richard Blubaugh  
Powertech (USA) Inc.  
303-790-7528

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, April 21, 2008 3:52 PM  
To: Richard Blubaugh  
Subject: RE: Days I am out in May & June

Yes I have all day open.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard  
Blubaugh"  
<rblubaugh@power  
techuranium.com>

cc  
04/21/2008 02:17  
PM

RE: Days I am out in May & June

To  
Valois Shea/P2/R8/USEPA/US@EPA

Subject

Valois,  
Are you available next Friday, May 2nd?  
Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Monday, April 21, 2008 10:15 AM  
To: Kaci Walker; rblubaugh@powertechuranium.com;  
twalsh@powertechuranium.com  
Subject: Days I am out in May & June

May

Mon 5 - Wed 7

Wed 14 - Fri 16

Mon 19 - Fri 23

Mon 26

Thur 29 - Mon June 2

June

Tues 10 - Wed 18 (or something like that)

Mon 23 - Fri 27

---

Valois Shea

US EPA Region 8

8P-W-GW

1595 Wynkoop Street

Denver, CO 80202-1129

phone: 303-312-6276

fax: 303-312-6741

Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by  
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 14.inet.qwest.net with SMTP; 2 May 2008 15:19:46 -0000  
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 SendTo: Valois Shea/P2/R8/USEPA/US@EPA  
 CopyTo: <twalsh@powertechuranium.com>,"George M. L. Robinson"  
 <GEORGEROBINSON@R2INCORPORATED.COM>  
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 INetFrom: .  
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\$MiniView:

\$RespondedTo: 1

\$PaperColor: 1

Valois,

We discussed a meeting tentatively scheduled for May 13th. Unfortunately, a number of our folks will be busy in SD on that date. Would you possibly be able to reschedule for the following week?

Richard Blubaugh

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AltBlindCopyTo:  
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\$MessageID: <0FEC9DC7C3.E7CEA8B1-ON8725743D.00559FB1-8725743D.00560237@LocalDomain>  
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PostedDate: 05/02/2008 09:39:27 AM  
Recipients:  
<rblubaugh@powertechuranium.com>,<GEORGEROBINSON@R2INCORPORATED.COM>,<twalsh@pwer  
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<GEORGEROBINSON@R2INCORPORATED.COM>,twalsh@pwer  
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InheritedAltFrom: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
InheritedFromDomain:  
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That would be fine. I will be back in the office Friday, May 23. I will also be in May 27 & 28 & June 3-6. Would Monday, May 12 afternoon work? I could ask RMC to reschedule our meeting for that morning.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard Blubaugh" <rblubaugh@pwertechuranium.com>  
05/02/2008 09:17 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
<twalsh@pwertechuranium.com>, "'George M. L. Robinson'"  
<GEORGEROBINSON@R2INCORPORATED.COM>  
Subject  
Next Meeting

Valois,  
We discussed a meeting tentatively scheduled for May 13th. Unfortunately, a number of our folks will be busy in SD on that date. Would you possibly be able to reschedule for the following week?

Richard Blubaugh

Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by epahub12.rtp.epa.gov (Lotus Domino Release 7.0.3) with ESMTP id 2008052210363354-181077 ; Thu, 22 May 2008 10:36:33 -0400

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From: "Richard Blubaugh" <rblubaugh@powertechuranium.com>

SendTo: Valois Shea/P2/R8/USEPA/US@EPA

Subject: Meeting - May 23rd

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INetFrom: .

SMTPOriginator: rblubaugh@powertechuranium.com

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Valois,

I do not know if you have a tentative agenda for the meeting scheduled for 9:30 a.m. tomorrow, so I have tentatively penciled in the following -

I. Introductions

II. Purpose

III. Roles & Responsibilities

IV. Centennial Aquifer Tests

a. Prior Tests

b. Proposed Test(s)

i. Location

ii. Schedule

V. Other

Please edit as you think appropriate and advise of any changes.

Also, would you have time after meeting with RMC to spend a little time with us reviewing a few issues for which we would like clarification? These are concepts that have been discussed but still seem to be ambiguous, e.i., area of review, aquifer exemption boundary, monitor well ring, points of compliance and bonding. Alternatively, we can agree to a different date to get together to review these items.

Please advise. Thanks.

Richard Blubaugh



Powertech (USA) Inc.

303-790-7528

Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by  
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 SendTo: Valois Shea/P2/R8/USEPA/US@EPA, Steven Pratt/P2/R8/USEPA/US@EPA, Dan  
 Jackson/P2/R8/USEPA/US@EPA, Wendy Cheung/P2/R8/USEPA/US@EPA, "David Groy"  
 <dgroy@rmc-consultants.com>  
 CopyTo: Douglas  
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 @powertechuranium.com>, <twalsh@powertechuranium.com>, "Michael Beshore"  
 <mbeshore@powertechuranium.com>, <georgerobinson@R2INCORPORATED.COM>, "John D.  
 Fognani" <jfognani@fognanilaw.com>, <jbonner@powertechuranium.com>  
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Valois,

Thank you for sending the new write-up for the Area of Review, Zone of Influence and Aquifer Exemption Boundary determinations. When we agreed to meet Tuesday, I thought it might be a little ambitious. As it turns out, we would like to have a little more time to consider the new write-up, particularly with Wallace Mays, who is out of the country until next week. I would prefer to wait until I have met with Wallace on this matter before scheduling a meeting. I should be able to get back with you in this regard Monday afternoon.

Thank you in advance for your understanding and cooperation regarding this request for postponement of the Tuesday meeting.

Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Thursday, May 29, 2008 9:15 AM  
To: Pratt.Steven@epamail.epa.gov; Jackson.Dan@epamail.epa.gov; Cheung.Wendy@epamail.epa.gov; Richard Blubaugh; David Groy  
Cc: Minter.Douglas@epamail.epa.gov  
Subject: new write-up for Area of Review, Zone of Influence and Aquifer Exemption Boundary determinations

Please distribute to others as you deem appropriate: (yikes that sounds bureaucratic!)

(See attached file: AOR ZOI Aq Ex Drawing.pdf)(See attached file: AOR ZOI Definitions.doc)

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276

fax: 303-312-6741

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Hi Richard, That sounds fine to me to have the meeting on Thursday. That gives me some breathing room! I will check with Wendy Cheung and Dan Jackson (they are working on the aquifer exemption boundary definition with me) to see what times would work for them & get back to you. How many people from your office do you think will be at the meeting? Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Hi Valois,

I am assuming the time for the meeting will be 9:30 a.m., the same time as the previous meeting, at EPA's office. We are planning on bringing 5 people

(shown on attached meeting notice and tentative agenda). Please edit the agenda as appropriate for your needs. We are looking forward to discussing your proposed aquifer exemption determination proposal.

Richard Blubaugh

Powertech (USA) Inc.

Vice President - EH&S Resources

P: 303-790-7528

C: 720-935-1723

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]

Sent: Tuesday, June 03, 2008 8:45 AM

To: Richard Blubaugh

Subject: RE: new write-up for Area of Review, Zone of Influence and Aquifer Exemption Boundary determinations

Hi Richard, That sounds fine to me to have the meeting on Thursday. That gives me some breathing room! I will check with Wendy Cheung and Dan Jackson (they are working on the aquifer exemption boundary definition with me) to see what times would work for them & get back to you. How many people from your office do you think will be at the meeting? Thanks!

---

Valois Shea

US EPA Region 8

8P-W-GW

1595 Wynkoop Street

Denver, CO 80202-1129

phone: 303-312-6276

fax: 303-312-6741

- Tent Agenda\_080605.doc

ATTACHMENT: Tent Agenda\_080605.doc vrs



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I just wanted to thank you all for coming down for the meeting yesterday. Your expertise and knowledge helped us out tremendously. Thanks for taking the time to share it with us!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Hi Richard,  
Do have any insight into whether the requirement to shut-down mining in  
the event of an excursion will be tied at all to our aquifer exemption  
boundary?  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Valois,  
We very much appreciated the opportunity to meet with you and your colleagues to review your proposal regarding the Aquifer Exemption Boundary determination. I do not have any additional insight right now. However, I have asked our attorney to provide his interpretation. I should hear from him early next week.

I will contact you with additional information when I receive it.

Again, thanks for your attention and consideration.  
Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Friday, June 06, 2008 6:45 AM  
To: Richard Blubaugh  
Subject: question about your take on the new HB 1161

Hi Richard,  
Do have any insight into whether the requirement to shut-down mining in the event of an excursion will be tied at all to our aquifer exemption boundary?  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Richard,

I regret that it has taken so long to get comments from our counsel regarding the draft non-disclosure agreement you provided. However, attached for your review and comment is a marked up copy received from our attorney. Powertech does have some concerns regarding confidentiality that go beyond the NDA and RMC Consultants that we need to address with EPA. Dan Jackson was going to provide some guidance from their counsel. I have not yet seen the referenced guidance and will follow up with Valois regarding the guidance and our concerns.

I look forward to hearing from you after you have had an opportunity to review the attachment.

Richard Blubaugh

Powertech (USA) Inc.

303-790-7528



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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

If you would like to get together & discuss this, please let me know.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

ATTACHMENT: Data Needs and Work Tasks.doc vrs

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 <twalsh@powertechuranium.com>,"'John Mays'"  
 <jmays@powertechuranium.com>,"'Michael Beshore'"  
 <mbeshore@powertechuranium.com>,"'George Robinson'"  
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Valois,

Needless to say, I was unable to get back to you yesterday. We would like to schedule a meeting with you and RMC Consultants to finalize the NDA, review the data request and address your questions regarding confidentiality. Please select a couple of different times you and RMCC are available. I am not available Monday or Tuesday a.m. but am flexible for remainder of week.

Richard

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Hi Richard,

I just wanted to check with you to see if you would like to have a meeting or phone call to talk about CBI issues before our meeting with RMC. I am not sure EPA has adequately addressed the CBI concerns for Powertech. I am waiting to hear back from our ethics guy (Dave Schachterle - no one can remember his real title) to get his final comments on the language we need to be sure we have in the CA. I reminded him of that today, so I hope by the end of the week I can get that to you.

Just FYI, I heard from Edgar Ethington. It sounds like we are shooting for the first 2 weeks of August for that meeting.

Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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\$UpdatedBy: CN=Valois Shea/OU=P2/OU=R8/O=USEPA/C=US

Hi Richard,

I'm sorry I never got back to you about setting up a meeting with RMC. I wanted to follow up on that now. Would the purpose of the meeting be to hand over the requested information or to further discuss the CA or both? Is there any way the information could be handed over before a meeting? Thanks!

Also, for my own edification, I put together the attached table with the info RMC requests from Powertech and whether or not it could be handled as confidential, whether as CBI or as pre-decisional until the permit application is submitted, based on my take on the regulations and our usual policy. I thought I would share it in case it was helpful.

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Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

ATTACHMENT: Information Items requested.doc vrs



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Hi Richard, I hope you had a nice visit with your son and granddaughter. I will be home next week, cleaning house - yuk, so please feel free to call me at 303-232-2329. Here are the things on my list that I wanted to talk to you about with the attachments from previous emails all on one place:

1. The confidentiality agreement - are the changes I made OK with Powertech? Rich Valdez, RMC, said that he is willing to finalize it without his last two comments being addressed.

Here are his last 2 comments:

3) Applicable State Law - Section 4.0. If we can define what the effect of a breach is (and its consequence?), that would be beneficial to both parties as opposed to alluding to State Law. Associated with this is an interest in negotiating amicably among the parties how we settle any disputed breach. Binding arbitration by a sanctioned mediator is economically feasible and preferable.

4) Term. RMC would prefer a term limiting the duration of confidentiality be imposed. We discuss information emerging into the public domain and the limitation on that, but once we deliver our information to our client, and subsequently return all documents, I can't see any reason to continue with restrictions.

2. I also wanted to go over the list of information RMC is requesting to check on confidentiality concerns. I am not sure EPA has adequately addressed all of Powertech's CBI concerns. Here is the list of info RMC has requested with my unofficial confidentiality classifications:

3. Potential meetings: -Would you like to meet or do a conference call to discuss the information list before we all meet with RMC to hand the info over?

-A meeting with RMC to hand over requested info  
(or can it be done informally without a meeting?)

-Could I spend an afternoon down at KP to get a preview of the Dewey Burdock permit application before it is officially submitted to EPA? As you know, I have been working on creating permit application guidelines for Class III ISL wells over the last few months. The guideline have been taking shape as I talk with you all about different things, mainly while talking with Kaci and Patsy and addressing their questions. Between the two of them, there were a lot of really good questions! But I am just concerned that these guidelines-in-the-making were not as clear as they really needed to be for this first permit application.  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street

Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

ATTACHMENT: NDA\_Powertech-RMC\_7-17-08epa.doc vrs

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Valois,

I must confess that I misplaced your phone number. I would like to speak with you before the Aug. 15th meeting to address some questions we have regarding RMCC's effort and recent data request as well as a few questions concerning the UIC permit process. Hopefully you can get back to me before then. Thanks.

Richard

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Hi Richard,  
I can't remember if we ended our call with the understanding that you would email me, or vice versa, about the info to pass along to RMC. What I was hoping we could send them is the private well data, including any logs, and any non-confidential geologic data (not exploration logs) that you or RSquared has on hand. Will that work?  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

Received: from mintra01.rtp.epa.gov ([134.67.221.153]) by  
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Shea/OU=P2/OU=R8/O=USEPA/C=US

\$RespondedTo: 3

Valois,

I believe I am to send you the email. Thanks for gentle reminder. I have had R2 compile the domestic well reports and will provide them early next week. There will be two four inch binders and the domestic well map. Additionally, we are finishing our draft narrative of the project area geology and could probably make it available next week as well. It still needs internal review.

I hope this will help satisfy the needs of RMCC.

On another note, Hal Demuth and I would like to talk to you or someone you designate regarding Class I and Class V disposal wells, preferably September 2nd or 4th. Please let me know if either of these dates work for you, or if you have some other date available.

I regret the delay in getting back to you. It has been one of those weeks.

Enjoy the weekend.

Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]

Sent: Friday, August 22, 2008 11:07 AM

To: Richard Blubaugh

Subject: follow-up to our phone conversation

Hi Richard,

I can't remember if we ended our call with the understanding that you would email me, or vice versa, about the info to pass along to RMC. What I was hoping we could send them is the private well data, including any logs, and any non-confidential geologic data (not exploration logs) that you or RSquared has on hand. Will that work?  
Thanks!

---

Valois Shea

US EPA Region 8

8P-W-GW

1595 Wynkoop Street

Denver, CO 80202-1129

phone: 303-312-6276

fax: 303-312-6741



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Sign:  
MAILOPTIONS: 1  
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03/23/2009 08:36:30 AM

\$PaperColor: 1

The list of info you described sounds great.

I am working from home this week because of the Democrats convening down the street, so communication with co-workers is less direct & immediate. I have left messages about meeting with you and Hal on the 2nd or 4th to talk about a Class I or Class V well.

As for others who should attend, that depends on what you would like out of the meeting. I am eager to hear what you all would like to propose for a deep disposal well at either the Centennial or Dewey Burdock site, and that discussion could involve just Wendy Cheung & me. That could probably happen next week, once I hear back from Wendy. But if you would need a policy decision on whether or not EPA would accept a Class I vs Class V for deep disposal of ISL waste fluids, then my teamleader & Supervisor would need to be there to make the best use of your time. That would take more time to schedule. I will give you a call tomorrow to find out more about the content of the meeting you would like to have.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

-----"Richard Blubaugh" <rblubaugh@powertechuranium.com> wrote: -----

To: Valois Shea/P2/R8/USEPA/US@EPA  
From: "Richard Blubaugh" <rblubaugh@powertechuranium.com>  
Date: 08/22/2008 04:01PM  
Subject: RE: follow-up to our phone conversation

Valois,

I believe I am to send you the email. Thanks for gentle reminder. I have had R2 compile the domestic well reports and will provide them early next week. There will be two four inch binders and the domestic well map. Additionally, we are finishing our draft narrative of the project area geology and could probably make it available next week as well. It still needs internal review.

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I regret the delay in getting back to you. It has been one of those weeks.

Enjoy the weekend.

Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]

Sent: Friday, August 22, 2008 11:07 AM

To: Richard Blubaugh

Subject: follow-up to our phone conversation

Hi Richard,

I can't remember if we ended our call with the understanding that you would email me, or vise versa, about the info to pass along to RMC. What I was hoping we could send them is the private well data, including any logs, and any non-confidential geologic data (not exploration logs) that you or RSquared has on hand. Will that work?

Thanks!

---

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8P-W-GW

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Denver, CO 80202-1129

phone: 303-312-6276

fax: 303-312-6741

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It looks like Wendy, Dan & I are free Tuesday Sept 2nd in the morning after 9:00 and Tuesday afternoon after 3:00  
Thursday Sept 4th from 2 to 5.

Wendy & I were thinking that Tuesday morning might be a little scary since we are all working at home this week and Tuesday will be our first day back in the office. There is no telling what will be looming over us when we walk into our cubicles on Tuesday. But if Tuesday morning turns out to be the best time for you all, we will rise to the occasion!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
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fax: 303-312-6741

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\$PaperColor: 1

I'm sorry - I forgot about my daughter's orthodontist appointment on Tuesday morning. It's at 9 & will be long. (She's finally getting her braces off). Wendy & I have Wednesday morning free, but Dan doesn't.

---

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1595 Wynkoop Street  
Denver, CO 80202-1129  
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fax: 303-312-6741

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Valois,

Thanks for the follow up email...good luck with the orthodontist. I have checked with Hal and John Mays and they are both available for Tuesday at 3:00, or Wednesday or Thursday. I would prefer sooner over later but will defer to your schedule. We would ask that we have at least a full hour with you. Please advise.

Thanks.

Richard

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Tuesday, August 26, 2008 7:14 PM  
To: Richard Blubaugh  
Cc: cheung.wendy@epa.gov  
Subject: oops not Tuesday morning for me

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8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Dan is free until 10, but Wendy & I can stay past 10.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Valois,

Thank you for getting back to me on this meeting. We will likely go past  
10:00 as we have a few questions related to the UIC - Class III as well.

We will plan on seeing you Wednesday at 9:00.

Enjoy your Labor Day Holiday.

Richard

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Wednesday, August 27, 2008 11:49 AM  
To: Richard Blubaugh  
Cc: cheung.wendy@epa.gov  
Subject: how about Wednesday morning Sept 3 at 9:00

Dan is free until 10, but Wendy & I can stay past 10.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



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I have scheduled the Big Horn Room for our meeting tomorrow morning. It is the room to the right of the sign in desk, as you are facing the desk. After I scheduled the meeting, I found out that I need to get relatives to the airport, but I will be able to join the meeting at 9:30. I am sorry for that inconvenience, but I thought that would be better than trying to reschedule the meeting. See you tomorrow morning.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard Blubaugh" <rblubaugh@powertechuranium.com>  
08/29/2008 04:12 PM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
Wendy Cheung/P2/R8/USEPA/US@EPA  
Subject  
RE: how about Wednesday morning Sept 3 at 9:00

Valois,  
Thank you for getting back to me on this meeting. We will likely go past 10:00 as we have a few questions related to the UIC - Class III as well. We will plan on seeing you Wednesday at 9:00.

Enjoy your Labor Day Holiday.

Richard

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Wednesday, August 27, 2008 11:49 AM  
To: Richard Blubaugh  
Cc: cheung.wendy@epa.gov  
Subject: how about Wednesday morning Sept 3 at 9:00

Dan is free until 10, but Wendy & I can stay past 10.

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street

Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

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Dan,

I know I am getting back to you after the fact, but I wanted to let you know  
that I thought your presentation was an excellent addition to the  
presentations made at the GWPC. Your explanation of why uranium projects  
are being developed in the U.S. and around the world, as well as your  
description of the ISL (ISR) process was very well done. Powertech  
appreciates your reference to our projects and the particular focus on our  
Centennial Project.

The most relevant part of your paper to us, however, are the statements you  
made regarding EPA, Region 8's approach to permitting and monitoring  
relative to the proposed projects.

I regret that I did not have time to stay and visit with you after the  
session. However, I expect to see you again soon regarding one or both of  
our projects.

Respectfully,

Richard Blubaugh  
Powertech (USA) Inc.

-----Original Message-----

From: Jackson.Dan@epa.gov [mailto:Jackson.Dan@epa.gov]  
Sent: Friday, September 19, 2008 2:02 PM  
To: Richard Blubaugh  
Cc: Pratt.Steven@epamail.epa.gov; shea.valois@epamail.epa.gov  
Subject: presentation for GWPC meeting

Hello Richard:

At one of our recent meetings I mentioned to you that I am scheduled to give a presentation at the upcoming Ground Water Protection Council meeting next week in Cincinnati, and I promised to send you a copy of the planned presentation and narrative, which is attached. This presentation is scheduled for Tuesday morning, so if you manage to review this and have specific comments, suggestions or concerns, please email them to me. Cheers. -dan

Dan W. Jackson, UIC Program  
(303) 312-6155  
US EPA Region 8 Ground Water Unit  
1595 Wynkoop Street  
Denver, Colorado 80202-1129

(See attached file: GWPC Sep08 - Slides v6.ppt)(See attached file: GWPC Sep08 - Narrative v6.doc)

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Hi Richard,  
Thanks for copying me on your message. I didn't realize you went to GWPC. That's great, although it is a bummer that it wasn't held some place cool this time like San Diego or Annapolis, like it usually is! May I get an estimated time of arrival for the preview of geology info for the permit application & the aquifer test at Centennial when you have a moment, please?

Our very persistent consultant on the hydrologic modeling contract thoughtfully checks in with me every week, so I thought I would ask this in anticipation of his call!  
Thanks!

---

Valois Shea  
US EPA Region 8  
8P-W-GW  
1595 Wynkoop Street  
Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741



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Richard

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
Sent: Wednesday, October 08, 2008 9:15 AM  
To: Richard Blubaugh  
Subject: RE: presentation for GWPC meeting

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Thanks!

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Denver, CO 80202-1129  
phone: 303-312-6276  
fax: 303-312-6741

"Richard Blubaugh" <rblubaugh@powertechuranium.com>  
10/09/2008 08:07 AM

To  
Valois Shea/P2/R8/USEPA/US@EPA  
cc  
<athurlkill@powertechuranium.com>  
Subject  
RE: presentation for GWPC meeting

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Sent: Wednesday, October 08, 2008 9:15 AM  
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Thanks!

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Denver, CO 80202-1129  
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Hello Valois,

I would prefer to meet with you while you are in town, between Oct. 16 and Oct 23. It would not take long, nor would there be a lot of people, probably just two of us. We are close to finishing up the Dewey-Burdock UIC application but would prefer to discuss a couple of items related to the AEB prior to submitting.  
Let me know.

Best regards,  
Richard

-----Original Message-----

From: Shea.Valois@epamail.epa.gov [mailto:Shea.Valois@epamail.epa.gov]  
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"Richard  
Blubaugh"  
<rblubaugh@power

To



techuranium.com> Valois Shea/P2/R8/USEPA/US@EPA  
cc  
10/09/2008 08:07 <athurlkill@powertechuranium.com>  
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Patsy's emailed questions:

Tuesday July 22 Another financial question-injection wells

1. The necessary resources information implies that only injection wells (i.e., injection and production) need to be taken into consideration. If that is the case, monitoring wells don't need to be included. This may be a moot point since it appears that NRC requires an estimate for all wells in the first mine unit. However, I just want to make sure I'm properly informing Powertech. **I am pretty sure that we will only require a bond for the injection wells, since the state mining & NRC will have a bond for everything else. I'll check to be sure.**

2. Does Powertech need to have the financial responsibility demonstration completed at the time the permit application is submitted or do they just need to specify which instrument they plan to use? Looking at the information you sent me on 1/18/2008 (specifically the review form) implies that the documentation should be in place.

**The mechanism for financial assurance only needs to be identified at the time the permit application is submitted. By the time the Final Permit is issued, the financial assurance instrument needs to be in place. The Final Permit gives authorization for the wells to be constructed. Construction can't begin until the financial assurance is in place. An aside note: Well construction can't begin until the Final Permit is effective, which is 30 days after the issue date, to provide time for people who submitted public comments to appeal the Final Permit decision.**

Monday July 21

For **Attachment P-Monitoring Program** we will provide map(s) with the information as detailed in your List of Figures but I need to make sure my approach isn't inconsistent with your vision.

We currently plan to use a figure similar to the attached Moore Ranch Figure to illustrate the monitoring plan (with production zone monitoring wells 400 ft part and 400 ft from the well field, a single mine unit and color coded designation for the screened interval (i.e., production, underlying, overlying). Is this Figure in line with what you were hoping to see? **Yes, that looks fine. It shows the proposed injection wells and production wells in different colors, and , the monitor wells are color coded to distinguish whether they are in the overlying USDW, the underlying USDW, and the mining zone.**

**During our phone call July 30, we also talked about including the manifold system piping and associated bldgs. I am not sure how busy that would make the map. It might be OK if we could have a separate map for each wellfield. Would there be one manifold system for each separate wellfield, or would one system serve >1 wellfields? We should talk about that more, before we commit to that.**

Figure (as described above):

**Yes** wells in wellfields for a TYPICAL MINE UNIT for each well field?

Yes location of monitoring wells as appropriate

No labeled with well numbers/names – we can wait till the wells are in place. After the Final Permit is issued, then 30 days later the Final Permit becomes effective and well construction can begin. After the wells are all in place, aquifer testing has been completed, and mechanical integrity test results are done, all this information will be submitted to receive authorization to inject (see the list below of info needed to obtain authorization to inject) . That seems like a better time to provide a map will final well locations, well names/numbers.

Yes designate screened or open interval for each well. (e.g. color-coded according to mining zones, aquifers above, and aquifers below) and...

Large Map:

large mine permit boundary

area of review

zone of influence-the project area has replaced the zone of influence concept as explained in the latest version of the Area of Review/Aquifer Exemption boundary document. You had asked about the definition of Project Area in Area of Review regulation. After talking with Petrotek and hearing about the modeling to define the “flare” around the wellfields, I realized that it was the wellfields plus the flare zones what I was trying to arrive at with my discussion about defining the area where the lixiviant will be flowing around the wellfields under normal operating conditions. For the large scale map, just showing a color blob or outline for the wellfields will be good.

Yes on large scale map buffer zone (as defined by NCR permit requirements) NEED

CLARITY

monitor well ring wells

aquifer exemption boundary

Do you want the wells in all wellfields illustrated and all monitoring wells?

Not the individual wells in the wellfields, just show the color blob or outline for the wellfields/ore bodies, but the monitor well location will still be useful for the large scale map.

Would it be a problem if I put the isopachs and potentiometric maps in with the cross sections rather than in the monitoring program attachment? That is a good idea. It does seem more appropriate to have them there.

I hope this is fairly clear? If not, we can talk on the phone. I’m in the office all week.

Thanks,

See attachment “Moore”

Monday July 21

Hi Valois,

We're working on the figures now and inevitably some questions have come up. The NRC has a number of different buffer zones (1/4 mile, 1 mile, 2 mile etc). When you refer to the buffer zone for the Site Plan Map and Monitoring Program Maps are you referring to the 2 mile criteria (2 miles from the site boundary) used for Site Characterization as discussed in NUREG 1569? I can see this being the case for the Site Plan map but I believe it would take away from the Monitoring Program Maps. Do I understand what you are requesting?

Not having the 2 mile buffer zone boundary for the monitoring program maps sounds like a good idea. It would still be helpful to have the buffer zones for the large scale map. I need to read NUREG 1569 to understand those requirements better. That is on my list for working at home during the DNC.

Thanks!

Patsy

I should start putting together a list of the information needed to obtain authorization to inject for ore extraction. This is just a first attempt. So far I have:

- ☐ Map showing final well names/numbers/locations color coded according to screened interval e.g. aquifer above, below, Fall River, Lakota, different levels within ore body, if applicable.
- ☐ detailed geology information that was collected during well drilling.
- ☐ results of aquifer tests demonstrating that the injection wells, recovery wells, and monitor ring wells are all in hydraulic communication.
- ☐ mechanical integrity test results
- ☐ cement bond logs
- ☐ Well Completion Reports in the form of a spread sheet listing well name, latitude, longitude, well depth, top and bottom elevations for the screened intervals within the casing.
- ☐ Well construction diagrams only for those wells that do not match the construction specifications in the permit application for one reason or another.

## **Discussion of Zone of Influence, Area of Review, and the Aquifer Exemption Boundary for Class III Injection Wells used for the In-Situ Leaching (ISL) of Uranium**

**Introduction:** The purpose of this discussion is to provide information about the proposed criteria the EPA Region 8 UIC program will use to evaluate acceptable locations for the Area of Review and an aquifer exemption boundary requested by the permit applicant in UIC Class III injection well permit applications for in-situ mining of uranium. This document also explains how the concepts of the Area of Review and zone of endangering influence will be applied to Class III injection well permit applications.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a line circumscribing the minimum area that allows full extraction of the ore proposed in the mining plan and restoration of the area affected by lixiviant flow within the subsurface, without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. The criteria EPA Region 8 will use for evaluating the placement of the aquifer exemption boundary will be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitoring well ring.

The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

This document also includes proposed permit requirements, including response actions, when excursions occur.

**Background Information:** The method for determining Area of Review around an injection well or injection project area is defined in 40 CFR 146.3 as “the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.” Regulation 146.06 states that the “Area of Review for each injection well or each field, project or area ...shall be determined...” using the zone of endangering influence calculation in 146.06(a) or a fixed radius according to 146.06(b). (Specific regulations are located at the end of this document for reference.)

In the regulations, the zone of endangering influence for a single injection well is the radius encompassing the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water. For an area permit, the zone of endangering influence includes the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

Regulation 40 CFR 146.4 states that criteria for EPA to use in determining the aquifer exemption area for an ISL mining project is the portion of the aquifer that is mineral producing, or can be demonstrated by a permit applicant as part of a permit application for a Class III operation to contain minerals that are expected to be commercially producible based on quantity and location.

The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a location large enough to allow the mining operation to fully extract the ore and restore the area affected by the flow of lixiviant without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. Hydrologic modeling should be used to

demonstrate that the entire area within the aquifer exemption boundary is required to meet these criteria. The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining.

For the purposes of this discussion, the term “project area” used in reference to the Area of Review above, is considered to be equivalent to the area where lixiviant is moving within the subsurface. The project area contains the wellfields and the surrounding “flare” of lixiviant around the wellfields. The project area will be delineated in the permit application with reference to the commercially producible portion of the ore body. Justification should be based on reasonable market projections of uranium price fluctuations over the life of the mine. In the following discussion, the aquifer exemption boundary will be determined based on a distance relative to the project area and the monitoring well ring around the project area.

**Discussion:** The intent of the Area of Review in the regulations is to set a boundary around an area that will be thoroughly investigated to locate any potential breaches in the confining zones above and below the proposed injection interval, and to perform corrective action, if needed, to mitigate those breaches so injectate cannot move up or down into another aquifer.

The intent of the zone of endangering influence in the regulations is to determine the farthest distance away from the injection well or project area that the pressure effect of injection activity is anticipated to reach over the life of the injection well or project area. In the case of ISL injection wells, the overall effect of injection and recovery in ISL well fields is a groundwater flow gradient directed toward the project area. The zone of endangering influence calculation in the regulations is not appropriate for an in-situ mining project, because the formula applies to injection wells that only inject, with no extraction taken into account.

For this reason, the Area of Review boundary for an ISL project should not be equivalent to the zone of endangering influence. Instead of a zone of endangering influence, the concept of importance for Class III injection wells used for in-situ mining is the area chemically affected by injection. The term “project area” described above will be applied to the area within the subsurface where lixiviant is causing chemical changes. The project area is limited to the area of lixiviant flow under normal operating conditions, i.e. where lixiviant flow is being controlled by proper balancing of injection rates and recovery rates within the wellfields. (The project area does not include excursions, where the flow of lixiviant is not considered to be under direct control.)

The aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and the area around the ore body where the lixiviant is expected to travel during mining of the ore deposits and post-mining aquifer restoration. It is important to minimize the extent of the area inside the aquifer exemption boundary, because it becomes permanently exempted from protection under the UIC Program, specifically the provisions of 144.12.

**Proposal:** In the permit application and aquifer exemption request, the permittee identifies the location of the monitoring well ring around the project area, and proposes an Area of Review boundary and an aquifer exemption boundary. The aquifer exemption boundary may be located at some distance outside the monitoring well ring, but no further out than the Area of Review boundary. Because the aquifer exemption boundary is the area within which mining-related contaminants are allowed to move, the area should be subject to Area of Review requirements.



Monitoring well Ring: The monitoring well ring should be placed at some distance beyond the project area to detect excursions of lixiviant outside the project area within a reasonable amount of time. The monitoring well ring location may be set a fixed distance beyond the project area. The permit application should include estimations of

- ☐ how long it will take an excursion to reach the monitoring well ring,
- ☐ based on sampling frequency, how far an excursion could potentially flow before it is detected at the monitoring well ring, and
- ☐ how long it will take to recover an excursion detected at the monitoring well ring.

This information will be considered in evaluating the proposed location of the aquifer exemption boundary.

Area of Review: Within the Area of Review, the permittee will investigate the need for corrective action and perform corrective action as needed. The Area of Review boundary may be set at the aquifer exemption boundary or at some distance beyond the aquifer exemption boundary. The location of the boundary should be justified using well constrained hydrologic modeling of worse case scenario excursions, taking into account these factors stated in the regulations:

*...the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.*

The permit application should include a discussion of how the Area of Review was determined, including pertinent hydrologic modeling results that support the proposed boundary locations. The discussion should also include how applicable factors in the paragraph above were taken into consideration.

Aquifer Exemption boundary: The aquifer exemption request is included as part of the permit application. The permittee submits a proposed aquifer exemption boundary that is placed at some distance outside the project area based on the following considerations:

*Excursion recovery.* Because the monitoring well ring is the first place where the presence of an excursion is detected, the aquifer exemption boundary should be placed at some distance beyond the monitoring well ring that will allow a reasonable time for an excursion detected at the monitoring well ring to be remediated before it reaches the aquifer exemption boundary. The aquifer exemption boundary is considered a Point of Compliance. The determination should be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitoring well ring.

*Hydrologic modeling.* Hydrologic modeling should be used to verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent and for groundwater restoration within the affected are after completion of mining.

Justification for the position of the aquifer exemption boundary should be included in the aquifer exemption request. The justification should include hydrologic modeling results, aquifer data and measurements, information on variability of flow rates in different directions within the aquifer, and an estimation of how long it would take an excursion to reach the aquifer exemption boundary.

**Permit Requirements for Delineating Extent of Excursion**

When an excursion is detected at the monitoring well ring, the permit will require the permittee to verify that the excursion has not reached the aquifer exemption boundary. Upon detecting an excursion at the monitoring well ring, the permit will require action to intercept the excursion plume before it reaches the aquifer exemption boundary. The effectiveness of the remedial action must be physically demonstrated. Duration and frequency for sampling the response wells will be based on the travel time of the excursion. If the excursion goes beyond the aquifer exemption boundary, the permit will require verification that the plume has been pulled back within the aquifer exemption boundary. More frequent sampling of the monitoring ring wells will be required until the excursion has been pulled back in.

DRAFT

## 40 Code of Federal Regulations (CFR)

### §§144.3 and 146.3 Definitions

**Area of Review** means the area surrounding an injection well described according to the criteria set forth in §146.06 or in the case of an area permit, the project area plus a circumscribing area the width of which is either 1/4 of a mile or a number calculated according to the criteria set forth in §146.06.

**Contaminant** means any physical, chemical, biological, or radiological substance or matter in water.

**Underground source of drinking water (USDW)** means an aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
- (A) Currently supplies drinking water for human consumption; or
- (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

### § 146.6 Area of Review.

The Area of Review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section.

(a) Zone of endangering influence.

(1) The zone of endangering influence shall be:

- (i) In the case of application(s) for well permit(s) under §144.31 that area the radius of which is the lateral distance in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water; or
- (ii) In the case of an application for an area permit under §144.33, the project area plus a circumscribing area the width of which is the lateral distance from the perimeter of the project area, in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground source of drinking water.

(2) Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. *[equation and parameter list not included here]*

(b) Fixed radius. (1) In the case of application(s) for well permit(s) under §144.31 a fixed radius around the well of not less than one-fourth (1/4) mile may be used.

(2) In the case of an application for an area permit under §144.31 a fixed width of not less than one-fourth (1/4) mile for the circumscribing area may be used.

In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the Area of Review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth (1/4) mile.

#### **§146.4 Criteria for exempted aquifers.**

An aquifer or a portion thereof which meets the criteria for an “underground source of drinking water” in §146.3 may be determined under 40 CFR 144.8 to be an “exempted aquifer” if it meets the following criteria:

- (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 can be demonstrated by a permit applicant as 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.

#### **§144.12 Prohibition of movement of fluid into underground sources of drinking water.**

(b) For Class I, II and III wells, if any water quality monitoring of an underground source of drinking water indicates the movement of any contaminant into the underground source of drinking water, except as authorized under part 146 [*I take that to mean aquifer exemption under 146.4*], the Director shall prescribe such additional requirements for construction, corrective action, operation, monitoring, or reporting (including closure of the injection well) as are necessary to prevent such movement. In the case of wells authorized by permit, these additional requirements shall be imposed by modifying the permit in accordance with §144.39, or the permit may be terminated under §144.40 if cause exists, or appropriate enforcement action may be taken if the permit has been violated.

Meeting: Powertech (USA) Inc. and U.S. EPA, Region 8  
Subject: Revised Write-up regarding Determination of Aquifer Exemption Boundary  
Date: June 5, 2008  
Location: EPA Region 8 Office, Denver, CO  
Time: 9:30 a.m.

Powertech Participants:

Wallace Mays; Powertech Chairman and COO  
Richard Blubaugh; Powertech VP-EH&S Resources  
Paul Bergstrom; Knight Piesold, Project Manager for Dewey-Burdock Project  
Cory Conrad; Knight Piesold, Hydrologist  
Patsy Moran; Knight Piesold UIC Permit Coordinator

**Tentative Agenda**

- I. Introduction**
- II. Purpose of Meeting**
- III. Clarification Review of EPA Revised Guidance for Determination of Aquifer Exemption Boundary**
- IV. In Situ Industry Experience and Practice (W. Mays)**
- V. Critique and Discussion of EPA Proposal**
- VI. Path Forward**



Meeting Agenda  
Powertech (USA) Inc.  
Dewey-Burdock Project  
UIC Permit Application  
Wednesday, November 28, 2007  
Location: Knight Piésold Office, Denver CO  
9:00 am – 12:00 pm

- Introductions
- Project History
- Project Description
- Regulatory Status
- Regional Geology
- Groundwater Hydrology
- Water Use
- Dewey-Burdock Pump Tests
- Open Discussion on UIC / Aquifer Exemption Requirements
- EPA/DENR Coordination
- Communication Protocol

***Anticipated attendees:***

|                  |                                             |
|------------------|---------------------------------------------|
| KP:              | Paul Bergstrom, Cory Conrad and Patsy Moran |
| Respect:         | Dan Hoyer                                   |
| Powertech:       | Richard Blubaugh and Mark Hollenbeck        |
| EPA Region VIII: | Valois Shea                                 |

The below is a discussion of where we are with the aquifer exemption boundary. We are clear that the aquifer exemption boundary has to be placed some distance outside of the monitoring well ring (MWR). If placed at or near the ring, the operator would incur a violation when an excursion occurs.

Previously, we had discussed setting the distance from the MWR based on the amount of time the contaminant would travel in 90 days to allow for time to install excursion monitoring wells. However, during meetings with Petrotek, we discovered that typical travel times are < 1 ft/day, and the distance from MWR ring then could be as little as 10's of feet away. We have since been on a search for a hydrogeological, mineralogical, or historically-based rationale that could provide guidance to the operator on how to determine that distance away from the MWR. Here are some of the things we've discovered:

Modeling: modeling can help with planning and understanding the scope of the project. But due to the heterogeneity and other unknown features, such as fractures, that may not be accounted for, the model has is a degree of uncertainty. To account for the uncertainty, "worst case scenarios" are run to provide some understanding of what may happen, then the question that is posed is, what is realistic and would be accepted as a "worst case scenario"? It would be difficult to provide guidance in describing this worse case scenario.

Restoration: modeling could provide some additional distance outside of the MWR, but since this is the last part of the ISR process – the data to provide an accurate model will not be available until after the permit has been issued.

Mineable Ore Body: the operators do not necessarily have a complete picture of what the mine ore body looks like subsurface until they fully investigate. And often this is done in stages. The information that they provide their investors can somewhat increase their mining size by including postions that they have not fully explored. They have performed a simple exercise to show if they pursued 0.1 GT (grade thickness) ore body versus 0.3 GT, it wouldn't give them a large exemption area, it would fill rather fill in the existing area.

Historically based rationale: We had initially understood that the distance that the MWR is placed is based on hydrogeological calculations. We have since learned that in Wyoming, the industry standard is about 500' and in Texas, it is about 400'. No one quite knows how this came about, but it "works" and is used. Similarly, we could come up with some distance that is based on what operators have experienced in the field. At what the distance beyond the MWR, would groundwater be affected by production and restoration activities? However, there is very little monitoring activity outside of the MWR to answer this question and it does vary based on hydrogeology.

So, what we have concluded is that it would be difficult to provide the permittee with a simple formula or a set distance that would give clear direction, and yet would not be considered arbitrary. Below, is the latest and greatest aquifer exemption boundary piece that Valois has put together to require the permittee to provide justification on where the aquifer exemption boundary should be placed. We

receive the information, review and negotiate with the operator as necessary. We are continually learning more about the ISR process and some aspects are still being understood in the field, particularly the restoration phase. Perhaps after we see these permits come in, we can get a better grasp of what makes sense and what can provide clearer guidance to the operator.

**Aquifer Exemption Boundary** The EPA Region 8 will consider an acceptable location for the aquifer exemption boundary to be a location large enough to allow the mining operation to fully extract the ore and restore the area affected by the flow of lixiviant, without having the chemical effects of the lixiviant reach beyond the aquifer exemption boundary. EPA will use the aquifer exemption boundary as a compliance boundary. Any mining-related contaminants moving beyond the aquifer exemption boundary will be considered a permit violation.

The area within the aquifer exemption boundary has a horizontal and a vertical extent. The vertical extent is bounded by upper and lower confining zones. The horizontal extent is proposed by the permit applicant based on the extent of commercially producible ore deposits and the area around the ore body where the lixiviant is expected to travel during mining of the ore deposits and post-mining aquifer restoration. The area within the aquifer exemption boundary should be minimized to protect as much of the aquifer surrounding the mining project as is practically possible, and to minimize the area that will need to be restored upon the completion of mining. It is also important to minimize the extent of the area inside the aquifer exemption boundary, because it is forever exempted from protection under the UIC Program, specifically the provisions of 144.12.

Because the monitoring well ring is the first place where the presence of an excursion is detected, the aquifer exemption boundary should be placed at some distance beyond the monitoring well ring to allow a reasonable time for an excursion detected at the monitoring well ring to be recovered before it crosses the aquifer exemption boundary. The determination should be based on prudent operating procedures in which excursions are controlled within 90 days after they are detected at the monitoring well ring.

Justification for the position of the aquifer exemption boundary should be included in the aquifer exemption request. The justification should include hydrologic modeling results, aquifer data and measurements, information on variability of flow rates in different directions within the aquifer, and an estimation of how long it would take an excursion to reach the aquifer exemption boundary.

*Hydrologic modeling.* Well constrained hydrologic models should be used to verify that the extent of the aquifer exemption boundary is justified and the entire area is needed for uranium to be extracted to the fullest planned extent and for groundwater restoration within the affected area after completion of mining.