

# CROW BUTTE RESOURCES, INC.



## SUA – 1534 License Renewal Application

The cell dimensions vary depending on the formation and the characteristics of the ore body. The injection wells in a normal pattern are expected to be between 65 feet and 150 feet apart. A typical wellfield layout is shown in **Figure 3.1-5**. The wellfield is a repeated seven spot design, with the spacing between production wells ranging from 65 to 150 feet. Other wellfield designs include alternating single line drives.

All wells are completed so they can be used as either injection or recovery wells, so that wellfield flow patterns can be changed as needed to improve uranium recovery and restore the groundwater in the most efficient manner. During operations, leaching solution enters the formations through the injection wells and flows to the recovery wells.

Within the perimeter monitor well ring, prior to stability monitoring, more water is produced than injected to create an overall hydraulic cone of depression in the production/restoration zone. Under this pressure gradient the natural groundwater movement from the surrounding area is toward the wellfield providing additional control of the leaching solution movement. The difference between the amount of water produced and injected is the wellfield “bleed.” The minimum bleed rate will be a nominal 0.5 percent of the total wellfield production rate and the maximum bleed rate typically approaches 1.5 percent. Bleed is adjusted as necessary to ensure that the perimeter ore zone monitor wells are influenced by the cone of depression until stability monitoring described in Section 6.1.5 begins.

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Monitor wells will be placed in the Chadron Formation and in the first significant water-bearing Brule sand above the Chadron Formation. All monitor wells will be completed by one of the three methods discussed above and developed prior to leach solution injection. The development process for monitor wells includes establishing baseline water quality before the initiation of mining operations.

Injection of solutions for mining will be at a rate of 9,000 gpm with a 0.5 percent to 1.0 percent production bleed stream. Production solutions returning from the wells to the production manifold will be monitored with a totalizing flowmeter. All pipelines and trunklines will be leak tested and buried prior to production operations.

A water balance for the current CBR Facility is shown on **Figure 3.1-6**. The liquid waste generated at the plant site will be primarily the production bleed which, at a maximum scenario, is estimated at 1.0 percent of the production flow. At 9,000 gpm, the volume of liquid waste would be 47,304,000 gallons per year. CBR adequately handles the liquid waste through the combination of deep disposal well injection and evaporation ponds.

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1994. Mine Unit 1 was successfully restored to the approved primary or secondary restoration standards for all parameters.

The commercial groundwater restoration program consists of two stages, the restoration stage and the stabilization stage. The restoration stage consists of four activities:

- Groundwater transfer
- Groundwater sweep
- Groundwater treatment
- Wellfield recirculation

A reductant may be added at anytime during the restoration stage to lower the oxidation potential of the mining zone. A sulfide or sulfite compound will be added to the injection stream in concentrations sufficient to reduce the mobilized species.

The stabilization stage consists of monitoring the restoration wells following successful completion of the restoration stage. Stabilization begins once restoration activities have returned the average concentration of restoration parameters to acceptable levels. Following the stabilization phase, CBR provides a restoration report to the appropriate regulatory agencies. A cone of depression (inward hydraulic gradient) is not maintained during stabilization.

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During mining until the start of stabilization, a hydrologic bleed will be maintained within the perimeter monitor well ring to prevent lateral migration of mining lixiviant. If a proper hydrologic bleed is not maintained, it is possible for water with chemistry similar to that in Table 2.7-18 column “Typical Water Quality During Mining at CSA” to begin migrating toward the monitor well ring. If mobile ions such as chloride and carbonate are detected at the monitor well ring, adjustments will be made to reverse the trend.

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The maintenance of a hydrologic bleed and the close proximity of the monitor well ring, less than 300 feet from the mining patterns, will ensure there is negligible migration of mining fluid. Vertical migration of fluids is less of a concern than lateral migration due to the underlying and overlying aquitards. The ubiquitous Chadron Formation clays, which cap the Lower Chadron Formation ore body, have hydraulic conductivities on the order of  $10^{-11}$  cm/sec as outlined in Section 2.7.2.2 of this application. Likewise, the underlying Pierre Shale is over 1,200 feet thick and acts as a significant aquitard. The vastly different piezometric heads between the Lower and Middle Chadron as well as the results of the pumping test support the conclusion that the Lower Chadron is vertically isolated.

#### 6.1.4.2 Restoration Process

Restoration activities include four steps that are designed to optimize restoration equipment used in treating groundwater and to minimize the number of pore volumes

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Upon completion of restoration activities and before stabilization, all designated restoration wells in the mine unit will be sampled for the constituents listed in **Table 6.1-1**. If restoration activities have returned the wellfield average of restoration parameters to concentrations at or below those approved by the USNRC and the NDEQ, CBR will proceed with the stabilization phase of restoration.

During stabilization, all designated restoration wells will be sampled in accordance with the respective agencies' sampling requirements for the constituents listed in **Table 6.1-1**. At the end of each agency's stabilization period, CBR will compile all water quality data obtained during restoration and stabilization and submit a final report. If the analytical results continue to meet the appropriate standards for the mine unit and do not exhibit significant increasing trends, CBR would request the mine unit be declared restored. Following agency approval, wellfield reclamation and plugging and abandonment of wells will be performed as described in Section 6.2.

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