TECHNICAL EVALUATION REPORT
TUBA CITY FINAL PHASE I GROUND-WATER COMPLIANCE ACTION PLAN

DATE: January 19, 2000

FACILITY: Tuba City Site

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SUMMARY:

The Phase I Ground-water Compliance Action Plan (GCAP) for the Tuba City, Arizona, Uranium Mill Tailings Remedial Action (UMTRA) Project site is the first phase in active ground-water remediation at the site, and is expected to last approximately 3 years. Phase I includes installation of additional recovery wells and Phase II will include expansion of remediation capacity and monitoring to ensure the aquifer restoration standards are met. Phases I and II of ground-water remediation are expected to last approximately 12 years.

DESCRIPTION OF THE REQUEST:

The U.S. Department of Energy (DOE) has requested concurrence from the U.S. Nuclear Regulatory Commission (NRC) on the Phase I GCAP for the Tuba City, Arizona, UMTRA site. In evaluating the request, the NRC prepared this Technical Evaluation Report. Additional information may become available during Phase I of the GCAP, which may lead to changes in the design of the Phase II GCAP. DOE will submit the final GCAP for Phase II at the time of implementation. This will enable DOE to include any new approaches indicated by new site data.

TECHNICAL EVALUATION:

Background:

The Tuba City UMTRA site is located in Coconino County, Arizona. The site is within the Navajo Nation and close to the Hopi Reservation, 5 miles east of Tuba City and 85 miles north of Flagstaff. Land in the vicinity of the site is used for occasional grazing, some farming, and residences. Surface water is limited, making ground water an important resource in the area.

The uranium mill at the Tuba City site operated from 1956 to 1966, processing 800,000 tons of ore during its operation. The plant used a sulfuric acid leach process until 1962, when it was reconfigured to use a sodium carbonate alkaline process. All tailings from mill processing were slurried into evaporation ponds which covered a total area of 33.5 acres at the site.

DOE began remedial activities at the site in 1988 and has stabilized the tailings and related materials on site, cleaned up windblown contamination, and placed the radon barrier and final cover on the disposal cell.

Technical Assessment:

Site characteristics:

The main aquifer near the Tuba City site is the N-multiple aquifer system. The aquifer is recharged from rainfall and snowmelt, with a small amount of leakage from overlying beds. Saturated thickness of the aquifer in the vicinity of the disposal cell is about 400 feet, but thins rapidly to the south. Approximately 4,000 feet south of the site, seeps can be found along cliff bands that border the Moenkopi Wash.

Background water quality in the N-aquifer has low concentrations of dissolved solids and metals, and is suitable for domestic use. Ground-water contamination at the Tuba City site resulted primarily from water drained from the tailings piles during operation of the mill. The rate of drainage from the evaporation ponds slowed significantly after the mill closing in 1966, and is now essentially complete.

Current conditions:

Contaminants that exceed standards in 40 CFR 192 are molybdenum, nitrate, selenium, and uranium. Elevated levels of sulfate are also present in the ground water, at high enough levels to cause a potential health risk. Thirteen other contaminants exceeded background levels but were below levels that pose a possible health risk. These constituents are: ammonium, cadmium, calcium, chloride, chromium, iron, magnesium, manganese, potassium, sodium, strontium, tin, and zinc. Lead is also above background but below the Maximum Contaminant Limits (MCLs), and is not attributable to milling activities.

The 13 contaminants that are above background but pose no health risk do not require active ground-water compliance. However, the remaining five contaminants (molybdenum, nitrate, selenium, uranium, and sulfate) require corrective action to achieve ground-water compliance. Sulfate is not regulated under 40 CFR 192, but it is present at concentrations that pose a potential health risk.

Remedial Alternatives:

Several compliance strategies were evaluated by DOE, including natural flushing. Ground-water models indicate natural flushing would require a minimum of 220 years, which is longer than DOE is willing to allow for natural flushing methods.

After considering all potential alternatives, DOE determined active remediation to be the best approach to return contaminants of concern to below aquifer restoration standards, as required by 40 CFR 192. Additional aquifer restoration goals not required by 40 CFR 192 requested by the Navajo Nation are: TDS, 500 mg/l; Sulfate, 250 mg/l; Sodium, 20 mg/l; Chloride, 250 mg/l; pH, 6.5 - 8.5; and Corrosivity, noncorrosive.

Several potential active remediation techniques were studied, including a combination approach of pumping affected ground water, injection of clean water, and an infiltration trench to help flush contamination under the disposal cell to the extraction wells. The selected remediation plan is the combination approach, allowing several technologies to be employed to solve the multifaceted challenge of containment, as well as remediation of the plume.

Containment of the contaminant plume can be achieved by injecting the treated ground water along the edges of the plume to control migration downgradient. This also aids in redirecting uncontaminated ground water around the plume. Twenty years will be required to extract two pore volumes on the uranium plume with a continuous extraction rate of 150 gallons per minute (gpm). The initial phase of pumping will require 50 to 70 extraction wells, 30 to 40 injection wells, an infiltration trench 2,400 feet in length along the north side of the disposal cell and the piping and other necessary infrastructure to operate the system. Final numbers for the injection and extraction wells will be determined as restoration progresses. The injection and extraction rates will be balanced.

Treatment of extracted ground water will take place by distillation which will meet or exceed treatment goals. Treated water from the distillation process will be injected back into the aquifer, which will help meet the standards specified in 40 CFR 192, and the additional goals requested by the Navajo Nation. Brine generated from the treatment process will be pumped to double lined evaporation ponds for final concentration of the solids. The ponds will have a leachate collection system in addition to the double liners to ensure the extracted contaminants do not leak back into the ground water. As the brine evaporates, additional water may be added to the residual solids in the evaporation ponds to eliminate the possibility of wind erosion.

RECOMMENDATION:

NRC staff considers DOE's planned activities for ground-water cleanup to be acceptable and protective of human health and the environment. Additional evaluation of the site activities by NRC staff will take place when the Phase II GCAP and Confirmation Reports are issued.

REFERENCES:

U.S. Department of Energy, 1999. Phase I Ground Water Compliance Action Plan for the Tuba City, Arizona UMTRA Site, U0027401, June.