What Is the Quality of Groundwater Within the Uranium-Mineralized Zone?

Pre-mining historical data are site-specific groundwater quality data that were collected at each permitted site to establish pre-mining groundwater quality, or what is referred to as baseline groundwater quality.

Pre-mining historical data indicate that uranium-mineralized zones at all in-situ mining sites, also known as in-situ leaching (ISL) sites, in South Texas meet the definition of an Underground Source of Drinking Water (USDW – a water-bearing geologic unit that contains groundwater with less than 10,000 milligrams per liter of total dissolved solids). However, these data also indicate that the groundwater in the uranium-mineralized zones at these sites does not meet primary drinking water standards for a variety of groundwater constituents, particularly for radioactive radium-226. Uranium mineralization affects only the localized groundwater in contact with the mineralized zone. Away from the uranium-mineralized zone, the groundwater quality is not affected by the mineralization.

The in-situ uranium leaching process further affects the quality of groundwater within the uranium-mineralized zone. About 75 to 80 percent of the uranium in the mineralized zone is dissolved and removed using in-situ techniques. In addition to dissolving uranium from the mineralized zone, injected mining solutions dissolve other constituents from the aquifer material, including arsenic, molybdenum, cadmium, calcium, and radium-226. Normally, groundwater is under chemically-reducing conditions (i.e., low oxygen levels). Under such conditions, uranium solubility is greatly decreased. During ISL, the oxygen in the mining fluids reacts with the uranium minerals, dissolving the uranium and other constituents into the mining fluid. This dissolved uranium then reacts with the bicarbonate ions to form a chemical complex, which keeps the uranium in solution. Radium-226 dissolution into the mining fluid results from increased chloride ion concentrations in the mining fluid.

Resources and Useful Links

- Texas Commission on Environmental Quality (TCEQ) Source Material Recovery and By-Product Material Disposal, https://www.tceq.texas.gov/permitting/radmat/uranium/uranium.html
- TCEQ In Situ Leach and Conventional Uranium-Recovery Methods, https://www.tceq.texas.gov/permitting/radmat/uranium/process.html
- TCEQ Regulations for Class III Wells, https://www.tceq.texas.gov/permitting/radmat/uic_permits/UIC_Guidance_Class_3.html
- U.S. Environmental Protection Agency Class III Injection Wells for Solution Mining, https://www.epa.gov/uic/class-iii-injection-wells-solution-mining

- U.S. Nuclear Regulatory Commission (NRC) *NUREG 1569: Standard Review Plan for In Situ Leach Uranium Extraction License Applications,* https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1569/sr1569.pdf

- U.S. NRC *NUREG 6870: Consideration of Geochemical Issues in Groundwater Restoration at Uranium In-Situ Leach Mining Facilities,* https://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr6870/index.html

- Texas A&M AgriLife Extension Service (TAES) *Drinking Water Problems: Radionuclides (B-6192),* https://twon.tamu.edu/wp-content/uploads/sites/3/2021/06/drinking-water-problems-radionuclides.pdf

Other Frequently Asked Questions (FAQs)

To find additional FAQs visit the Texas Groundwater Protection Committee's FAQ webpage at https://tgpc.texas.gov/frequently-asked-questions-faqs.