MACKINAWITE FOR RESTORATION OF GROUND WATER FOLLOWING IN-SITU RECOVERY MINING OF URANIUM

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In-situ recovery (ISR) is one of the current technologies used for uranium extraction in the United States. Most operations employ oxygenated, bicarbonate solutions to solubilize uranium ore by oxidative dissolution and complexation of uranium. Natural or introduced sulfides may facilitate the ground-water restoration processes by re-stabilizing uraninite and other mineral species through the re-establishment of reducing conditions. During this study, ground water quality was simulated in the laboratory to be consistent with concentrations following uranium ore leaching during ISR mining operations. Subsequently, mackinawite, a nanoparticulate, reduced iron monosulfide, was then added to the simulated contaminated groundwater in an effort to achieve maximum contaminant levels (MCLs). This study demonstrates that mackinawite removes dissolved uranium from solution by reductive precipitation of a U(IV) solid from pH 5 to pH 9. Additionally, mackinawite scavenged other redox-active metals often associated with uranium ore bodies (e.g. As and Se, etc.). This study demonstrates that mackinawite is also effective at lowering dissolved uranium in both the presence and absence of carbonate, a strong complexing agent for uranium. Furthermore, upon re-oxidation, the system still provides uptake capacity for U(VI). This research provides a basis for further examination of the feasibility of using mackinawite as a remediation medium for ground-water restoration following ISL mining and in-situ remediation of U(VI)-contaminated ground waters.