# Effects of Mineralogy and Lixiviant Composition on Uranium Leaching

**Alexandra Rose Pearce[1], Kierran C Maher[2] and Karissa G Rosenberger[2]**

[1]New Mexico Institute of Mining and Technology, EES Department, 801 Leroy Place, Socorro, NM, 87801, alexandra.pearce@student.nmt.edu
[2]New Mexico Institute of Mining and Technology, EES Department, 801 Leroy Place, Socorro, NM, 87801, US

Northwestern New Mexico holds one of the world's largest reserves of uranium in an approximately 100-mile-long belt of sandstone-hosted deposits in the Jurassic Morrison Formation. Some of these have been identified as amenable for alkaline in-situ recovery (ISR) in terms of geologic setting. Alkaline ISR is a widely-used form of 'solution mining', where an array of injection and extraction wells circulate chemical lixiviants to mobilize (via oxidation) and complex (via carbonate ions) uranium from a water-saturated ore body.

We investigated the behavior of primary- and redistributed-type ores (1% and 0.17% uranium, respectively) from this region when leached with a typical lixiviant (hydrogen peroxide + sodium bicarbonate) of industry-standard specifications and ambient groundwater. Preliminary results from 48-hour batch leaching tests of samples show that samples leached with groundwater (sourced from the Westwater Canyon Fm aquifer, host formation of many of the deposits) liberated approximately half the uranium that industry standard lixiviant leaching did. In addition, contrary to expectations, a less oxidizing lixiviant (i.e., containing an order-of-magnitude less hydrogen peroxide) liberated as much or more uranium relative to the industry-standard solution, not less. This implies that understanding the mineralogy of the system may be more important on predicting yield than the lixiviant concentration.

Ores from primary-type deposits associated with more organic carbon appeared to liberate a smaller fraction of their bulk uranium than redistributed-type ores (7 % uranium in samples with 3.5 % organic carbon content, versus 49 % released in those containing 0.03 % organic carbon). Lixiviant leaching also released non-target metals arsenic and selenium, which may have implications for groundwater quality and pregnant leach solution processing.

Much of the depositional porosity in the host sandstones of primary-type ores was subsequently reduced by deposition of organic matter and/or calcite, which may render them physically unsuitable for ISR depending on the lixiviant used. Preliminary results from electron microprobe analyses show the uranium mineralogy of primary-type ores to be overwhelmingly carbonaceous, with carnotite-group and pitchblende minerals present in much lower volume. Redistributed-type ores are dominated by pitchblende and carnotite group minerals. Carbonaceous uranium ores may be more resistant to alkaline ISR, but the higher amounts of uranium in them imply a longer mine life.

---

2019 New Mexico Geological Society Annual Spring Meeting
April 12, 2019, Macey Center, New Mexico Tech campus, Socorro, NM