Active Water Treatment Team

May 20, 2018: AIChE Projects – Prototype Showcase

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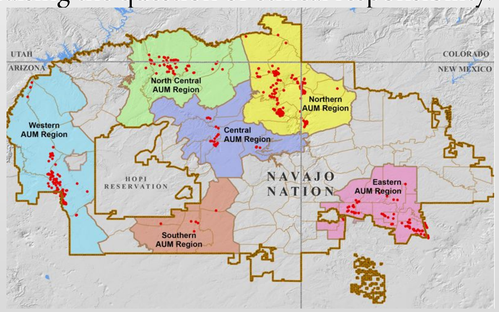
Background

From the 1940s to 1980s, to stockpile for the Cold War, the U.S. mined the uranium-rich land of the Navajo Nation, overlapping parts of Arizona, Colorado, Utah, and New Mexico. The excess mining caused natural uranium-containing minerals to pollute major water sources and air quality, both containing uranium levels high above the standard set by the EPA. No effective solution has been found to counter the source of the problem, posing not only a critical health issue, but also raising the question of ethical responsibility.



The Environmental Protection Agency (EPA) has promised to clean up the land for the past 20 years, but has only since installed cautionary signs and continued to transport inadequate shipments of water to the Navajo Nation.

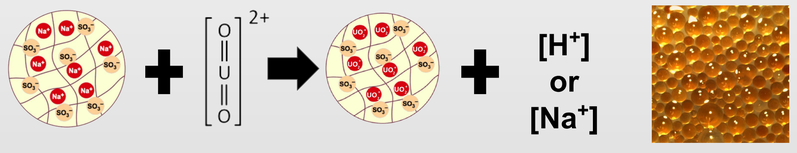
225+ contaminated sites are in need of treatment.

Goal

Active Water Treatment's mission in the Navajo Nation is to alleviate substandard living conditions by removing the radioactive heavy metal contaminants from local sources of water.

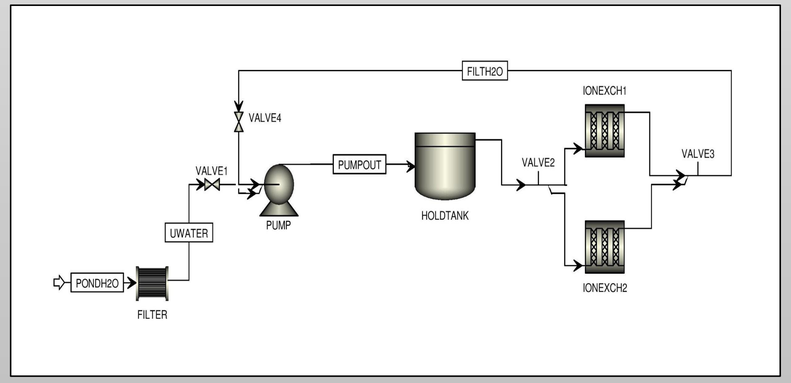
Current Design & Results

This project works on the principles of **ion exchange** occurring on small plastic beads called ion exchange resins. Typically, a harmful ion like the uranyl cation is exchanged for harmless ions like hydrogen or sodium cations. Special resins have been engineered to have greater affinity for specific target ions. Some resins can be regenerated using an acid or saline wash.



Contaminated water is pumped through a packed column filled with beads that adsorb uranyl and other contaminant ions.

Our ion exchange column will be filled with Amberlite XAD-4 resin beads, which we have hypothesized to be most suitable for adsorption of uranium and other heavy metal ions.

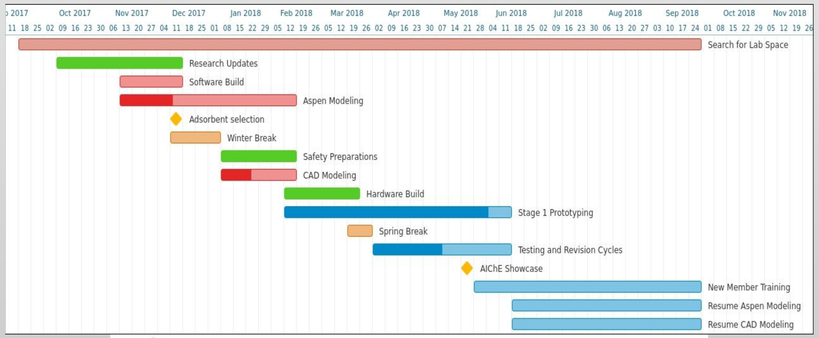


Our final system, diagrammed in the Aspen model above, will first flow the contaminated water through a filter to rid the water of relatively larger debris. The water will then flow water through two exchange columns, which after several cycles, will store purified water in the holding tank.

Path Forward

Our next goal is to pump heavy metal contaminated water through our prototype and measure the effective uptake of the resin. To do so, we will continue to actively search for lab space and for a professor to serve as a mentor for our project. After doing so, we will be able to conduct more in-depth testing to refine the efficiency and scale of our design. Eventually, we plan to run the system with uranium contaminated water and conduct subsequent testing.

Once that has been determined, we will work towards building an actual model that is capable of treating **20 gallons per minute**. Ideally, such a system would fit in the back of a truck. This model will be delivered to the Navajo EPA and they will be trained on how to operate and maintain the device.



Recently it has come to our attention that there is evidence of uranium contamination in water sources in the San Diego area. We are looking into locally accessible contaminated sites to test and secure our proof of concept before taking the device to the Navajo Nation and beyond.