# Humates Used as a Filtering Medium for Uranium

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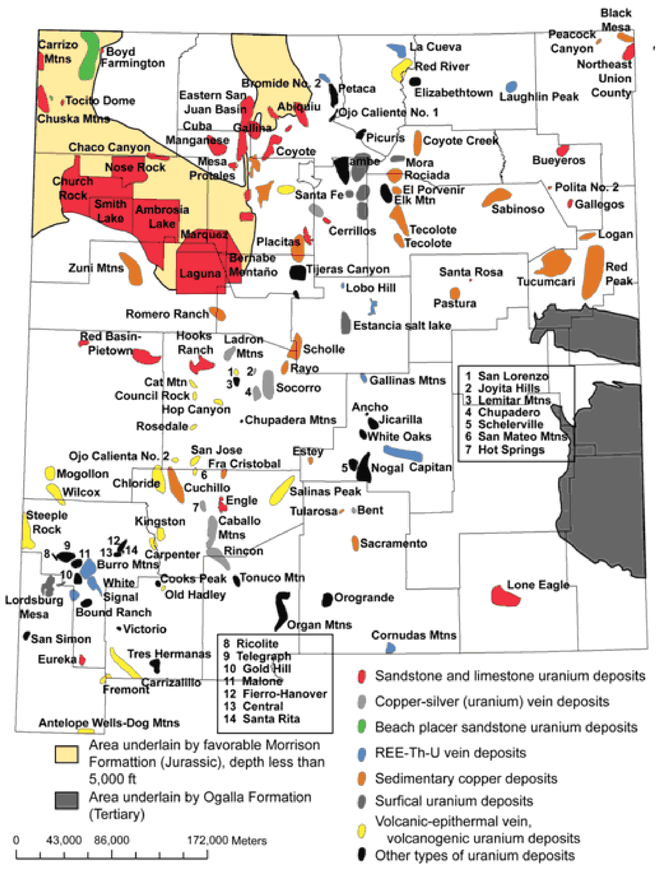
## Abstract

In New Mexico, there were as many as 28 uranium mining districts that were active from 1951-1980 (McLemore, 2020). In these mining districts, there were many sites and areas that have been contaminated with uranium. Contamination at mine sites extends to soils, sediments, and water. The cost of remediation is well into the millions of dollars and can be a burden on the nearby communities. In this project we will be exploring the possibility of using a resource for filtration that is readily available around the world- humates. Humates are a byproduct of coal that is mostly comprised of plant material that is rich in minerals; commonly used in agriculture. Humates are abundant in coal mines around the world, and when not used in coal mines around the world, they tend to be cast aside for later.




***(Fig. 1)***
*The uranium mining districts throughout New Mexico (New Mexico Bureau of Geology and Mineral Resources)*

## Objectives

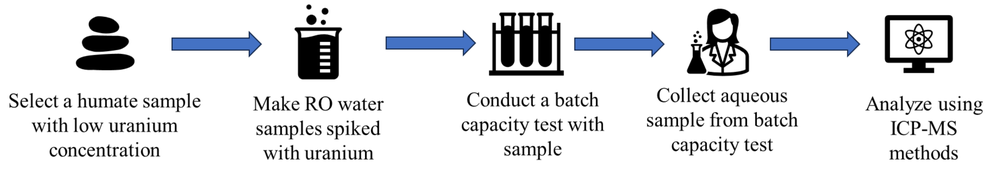
### Objective 1

- Using the Bureau coal database, find a humate sample with low uranium content
- Using RO water and a concentrate of uranium, make spiked solutions at 50ppb, 30ppb and 15ppb
- Conduct a batch capacity test to observe the absorbance of the uranium
- Analyze results using the ICP-MS

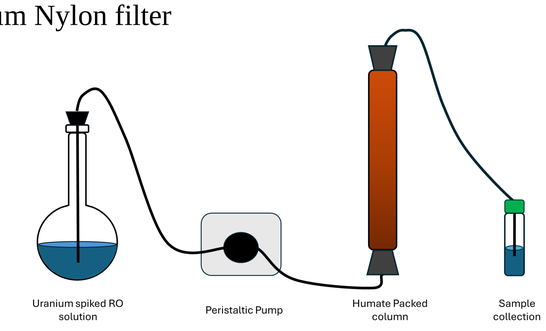
### Objective 2

- After initial testing, use humate sample as a filtrate medium and run spiked RO samples through the column
- Collect the samples from the column
- Analyze the ICP-MS and observe the data collected

## Methods



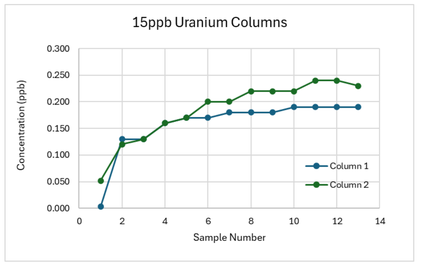

- During pre-preparation process, all coal samples were ground down and sifted through a No. 10 (2.0mm) sieve
- Coal 42 and Coal 289 were homogenized and stored at room temperature in the lab
- During the batch capacity test, the samples were placed in the shaker for 24hrs at 150rpm
- The samples were then centrifuged at 500rpm, decanted off and then filtered through a 45µm Nylon filter



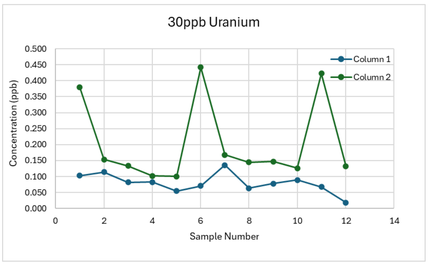

***(Fig. 2)***
*The column set up for the filtration system*

- For the column tests, I did a sample collection every hour for a 12 hour period followed by a 24 hour column rinse afterwards
- The peristaltic pump was ran at 155rpm for the 12 hour period
- Once the samples were collected, samples were acidified with 1% nitric acid overnight
- The samples were then centrifuged at 500rpm for 20 minutes and then decanted into a clean sample vial.

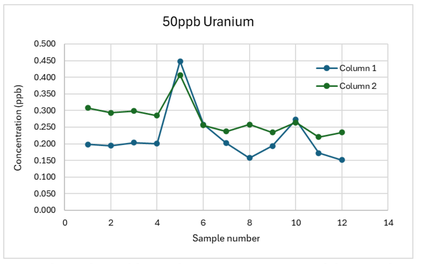
## Results



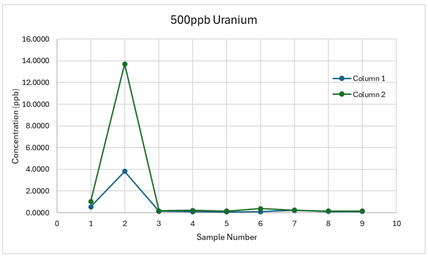

***(Graph 1)*** The concentration of uranium present in the collected solutions in parts per billion. This experiment required the use of both columns as a duplicate.




***(Graph 2)*** The second run using the 30 ppb uranium solution yielded data much more drastically different than the 15 ppb solution. However, this is happening only in one column.




***(Graph 3)*** The sudden spike in concentrations of the samples continue. The concentrations rising are not a concern though because this is all still under 1 ppb in the solution.




***(Graph 4)*** Since the last runs ran really well with a concentration of less than 1 ppb of uranium in the solution coming out of the column, we decided to try the 500 ppb solution to see how well it would filter the uranium.

- The columns were run together as duplicates to see how well the uranium was filtering out
- Through the testing, the concentrations of uranium may have fluxuated greatly over time, but the concentrations remained under 1 ppb which exceeded expectations.
- Column 2 fluxuated the most but still the concentration of uranium stayed below 1 ppb for the duration of the experiment
- Since the initial tests went so well, we took it a step further and tried seeing how well the columns would filter out 500 ppb uranium from the stock solution. The concentrations remained under the EPA limit of 15 ppb.

## Future Directions

- Seeing that the columns are being extremely effective on the initial testing using stock solutions, possibilities to using actual water samples is an option
- Vanadium levels in these solutions are also rising in the solution so using some of Dr. Tsosie's work to address that issue
- Move forward with testing other humate samples to see if it is possible to replicate the experiment using other humate samples from other mines.

### Acknowledgements

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**Any persons wishing to conduct geologic investigations on the Navajo Nation must first apply for and receive a permit from the Minerals Department, P.O. Box 1910, Window Rock, Arizona 6515 and telephone no. 928-871-6588**

- Special thank you to Dustin Baca who helped me in the testing of the samples on the ICP-MS, Quantitative Analysis and from committing crimes against the ICP-MS