Uranium Contamination on the Navajo Nation

New Mexico Supercomputing Challenge

April 02, 2003

Team #: 064

Shiprock High School

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Executive Summary

Our project is to discover radioactive materials such as uranium that might be contaminating the San Juan River and the community of Shiprock. We obtained significant information about the landscape and the history of uranium contamination on the Navajo Nation. By researching these areas, we began to acquire water samples in various regions of the S.J. River to record our data and results. Therefore, if the river is contaminated, then we plan to take action.

Introduction

Our team (064) prepared a project on Uranium Contamination on the Navajo Nation to discover if the San Juan River is contaminated with uranium and where it might also be spreading. Water samples will be tested and recorded in our data.

In the beginning Shiprock was not yet a community but a small place where people could extract uranium from the mined rocks. From 1953 to 1963 a Uranium extraction factory was functioning in Shiprock. During those years, only the uranium ore was mined, but it was later extracted with other radioactive materials. The Factory staff also used dangerous chemicals just to extract the ore. So not only were they endangering themselves with dangerous chemicals but also their neighbors, and surroundings. After they finished extracting the ore, they abandoned their factory.

This is where the problem is. The factory was neglected for ten years; this gave enough time for the uranium to spread throughout the foundation, and to wherever the weather carried it. We predict that most of it reached down the floodplain near the river.

It was not until 1973 the DOE cleaned up the area and sealed it off. But they did not consider the fact that the uranium had spread out through the floodplain, and it was seeping through the Mancos Shale under the foundation and into the groundwater. Living in the desert had limited our water sources, and the groundwater was one of which we used in earlier years when the factory was in function. Now the uranium has become infected with radiation and that restricts us to use it.

The contamination of the water is a health risk to the community. Uranium can harm us, whether it is natural, depleted, or enriched because they all have the same

chemical effect on your body. High exposure to uranium can harm the tissue in your body and damage your kidneys.

In our opinion they should have taken action immediately after the factory was inactive. Perhaps the radiation problem would have been averted.

There are ways of cleaning up these contaminations by using a simple method called Bio-decontamination. This includes using plants to suck up the radiation, where you'll only destroy the plants itself.

Hypothesis

Our theory had us question the consequences we would face in the project, and our task was to discover if the San Juan River was contaminated with uranium. We want to prove that there is uranium seeping from seepages from the foundation. This is causing contamination to the San Juan River and our groundwater. If the river is contaminated with large amounts of radioactive material, then we plan to take action with the help of an organization. If this dilemma continues, it will only build up and worsen over the years. This is why we should take care of it now so that the next generation will not have to carry this burden.

When radiation was detected in our experiment survey, it could not have been just uranium because it was a mill tailing site behind the present day NECA office of Shiprock. The huge mound that is present now is a huge cover up, leaving all the radioactive materials beneath it. To this day there are seepages that are slowly releasing radiation into the San Juan River. It is also contaminating other water source like ground water. The radiation has reached a thick slab of clay about 75' below the tailings called

the Mancos Shale. Since it couldn't penetrate, the radioactive deposits are slowly being washed away and contaminating other water sources. Uranium is not the only harmful poison out there, but there have also been traces of ammonia, cesium, nitrate, and thorium. Most of these elements are formed by the half lives (radioactive decay) of uranium.

Model

The amount of radiation was tested through water samples that were taken from the wells, which are monitored every three months. There are water meters that are located throughout the south side community of Shiprock, NM. Not only does radiation float through the air to expose the citizens, but it is also in the groundwater. Since uranium has an atomic weight of 238.036, it is the heaviest metal in nature that just flows through seepages in the mound and into the San Juan River. Other radioactive materials are light elements that will flow northwest towards Shiprock High School.

The testing site is along the San Juan River bank under the Shiprock Bridge, where we collected water samples for radiation testing with the Geiger counter. A total of 19 samples were tested and recorded in our data. The Geiger counter measured the amount of radiation in the water samples in rads. Our first test concluded about 100 feet from the river, demonstrated 0.12, which indicates radiation occurred near and within the river. Our second test, water that is in the beaker, was about 0.05. The average of the readings is 0.059211. Appendix B shows a graph on the amount of radiation that is around the riverbank.

Project Description

Our team (064) came together and set off to the river located under the bridge of Shiprock, N.M. We had ropes, life jackets, and all of our materials and tools for the study of radiation and contamination. We had to investigate the history of the area where the landscape was formed.

Next, our group expressed what our environmental concerns would be, that was where our scientific problem occurred. The abandoned uranium mill tailing that is located beside the river was where the main problem was established. What we imagine is an environmental runoff such as rain, snow, and wind very probably carried radioactive materials into the river.

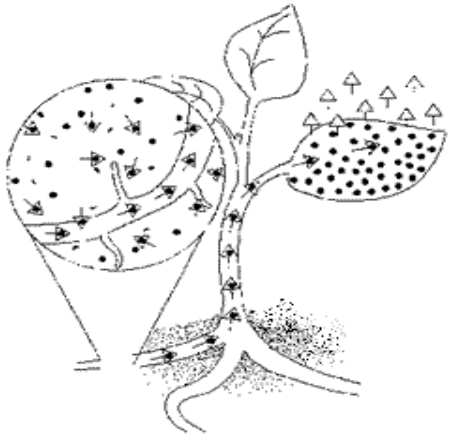
We tested the water in a minor area about of 200 feet in radius along the river. This is located on the north side of the bridge. First, we collected water samples along the riverbank, and afterward we began collecting water from the middle of our tiny area of the river. The one-gallon jug came into use to tie the jug to a long piece of rope. By doing this, we accumulated our water samples by throwing the jug into the river. After that, we poured the water sample into a beaker, used the Geiger counter, and measured the amount of radiation exposure.

Method

The DOE cleanup crew figured that it would be best if nature would take its course and wash the uranium further down the river, called Natural Flushing. However, we believe that Natural Flushing is not a good idea, because it will affect our community and environment.

Bioremediation is a process in which:

1. The plant will absorb the contaminates from the ground into its roots,
2. Then the Uranium is taken up by the roots and transported to the shoots,
3. Then the water will evaporate from the plant and leave the concentrated uranium in the plant, causing it to die.
4. That is when the waste can be transported to a more secure area where the radiation will not cause any harm to the community and the environment.



In this case the different types of plants we thought might be useful are cellulose, sawdust, alfalfa hay, wheat straw, and soluble starch. These were tested to determine which one would work. Cellulose reduced the solubility of U (VI) with time in batch reactors. See Appendix C to show the outcome.

Implementation

Java enabled us to have a program that would transfer our data and results into an informational system. Our data illustrates only the water samples we obtained from the San Juan River.

Software used are Microsoft Word, Excel, PowerPoint, Internet Explorer, Netscape, Java, and Telnet.

Results

According to the data it proved that our hypothesis is accurate, uranium is seeping through seepages from the disposal site, and flowing into the San Juan River. Not only uranium but other radioactive materials such as sulfate, nitrate, arsenic, uranium and traces of ammonia, cesium, and thorium were elements in the runoff from the site. The Geiger counter was the only radiation sensor or indicator used, but does not completely designate what the radioactive source is since the sensor is not calibrated to identify the main source.

Conclusion

In conclusion, a small amount of radiation is present in the river and in the water. But there is only about 1% of radiation in the samples we tested. The percentage of radiation is not enough to overexpose us, reconstruct our genetic structure, or cause us to glow at night. There are an abandoned 71 acres of radioactive mill tailings on the banks of the San Juan River, the only major waterway in the arid region, causing radioactive contamination downstream.

Recommendations

There is enough information to report to the EPA because “The EPA requires that spills or accidental releases of uranium waste into the environment containing 0.1 curies or more of radioactivity must be reported to the EPA”

“The EPA is currently working to develop an appropriate drinking water limit for uranium based on a board range of human and animal health studies.”

“The Occupational Safety and Health Administration have set occupational exposure limits for uranium in breathing air over an 8-hour work-day, 40-hour workweek. The limits are 0.05 milligrams per cubic meter (0.05 mg/m3) for soluble uranium dust and 0.25 mg/m3 for insoluble uranium dust.”

Acknowledgements

Team 064 would like to thank the following people who took time and consideration for assisting us in our Supercomputing project: Mrs. Noble, Mrs. Hines, Mrs. Johnson, Joaquin Cooley, Erick Ovaska, James Taylor, and Levi Valdez.

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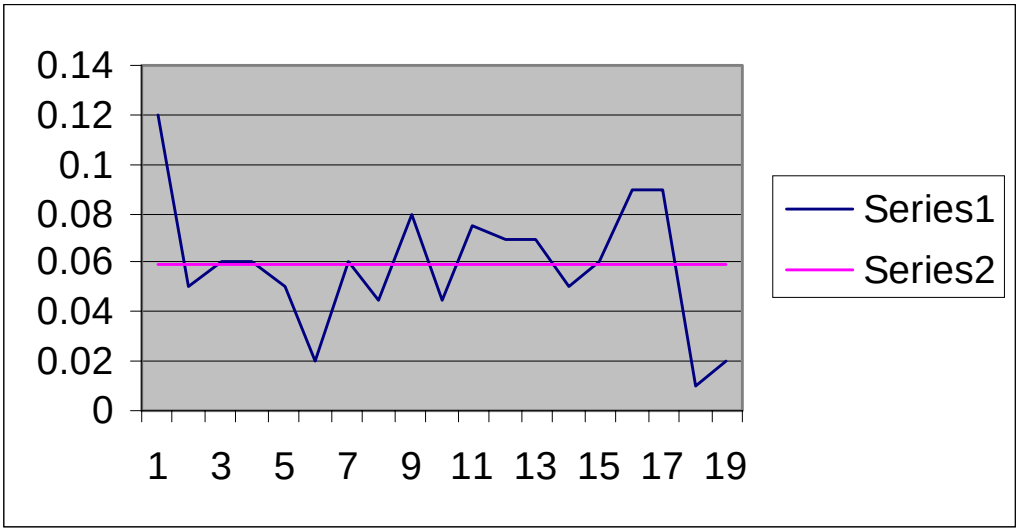
Appendix A – Code

Appendix B – Water Sample Radiation Reading



Appendix C – Cellulose

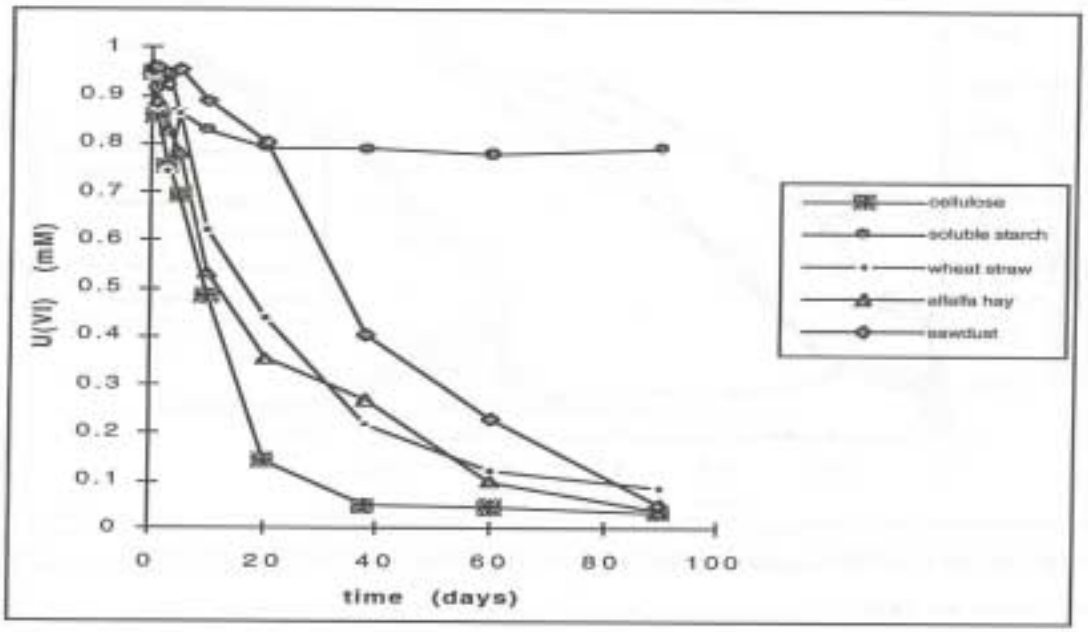


Figure 11. Reduction of soluble U(VI) with time in batch reactors