



# Mní Wičóni: High Pressure Injection (ISL) Alteration of the Cheyenne River

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## Research Question

How has high pressure injection (ISL) altered the concentration of heavy metals in the Cheyenne River of South Dakota?

## Mní Wičóni

The expression, “Mní Wičóni”, meaning Water is Life, represents the Lakota understanding of kinship with water. Lakota understand water as a living being and relative (Valandra 2016). The Cheyenne River Sioux Tribe (CRST) is located in central South Dakota, comprising of over 3 million acres with 3 major waterways including the Missouri, Cheyenne, and Moreau rivers. The CRST consists of four bands of the Lakota people: the “Mnicoujou” Planters by the Water; the “Oohenumpa” Two Kettle; the “Itazipco” Without Bows; and “Siha Sapa” Black Foot. Bob Walters, CRST councilperson, stated: “There’s been a lot of battle over our water, our river, and you know, water is life. We all need it. Water’s sacred. Water has a spirit, just like everything else that the creator has made. Everything has a spirit. Everything is sacred” (Walters, Coombs, and Zoe 2021).

## What is In Situ Leaching (ISL)?

In Situ Leaching (ISL) is also known as solution mining or In Situ Recovery (ISR). ISL is a process of uranium mining that is similar to fracking. During the ISL process, hundreds of wells are drilled in a “grid pattern” over an ore body that is situated on a groundwater aquifer. A solution of water and sodium bicarbonate concentrate to dissolve the uranium is pumped down the aquifer. Afterwards, the dissolved uranium is pumped back up to the surface, out of other wells. The uranium is then separated from the residual radioactive waste solution and reinjected into the aquifer posterior to being held in waste ponds on the surface (Pierce, 2007; See Figure 1).

## Literature Review

Researchers are studying the mobility of heavy metals and radionuclides throughout water sources near abandoned uranium mines near the Black Hills and its influences on the quality of water. Studies show abandoned uranium mines have a degrading impact on the quality of water sources proximate to the Black Hills. A study by Sharma, Putrika, and Stone (2016) shows sediments in the Angostura reservoir ultimately being caused by anthropogenic activities such as historical uranium mining that took place near reservoirs. Using field work and laboratory analysis, other studies found that the Cheyenne River fluvial systems have been heavily impacted by historical uranium mining activities, resulting in elevated heavy metal concentrations (Pfieffe and Stone 2011).

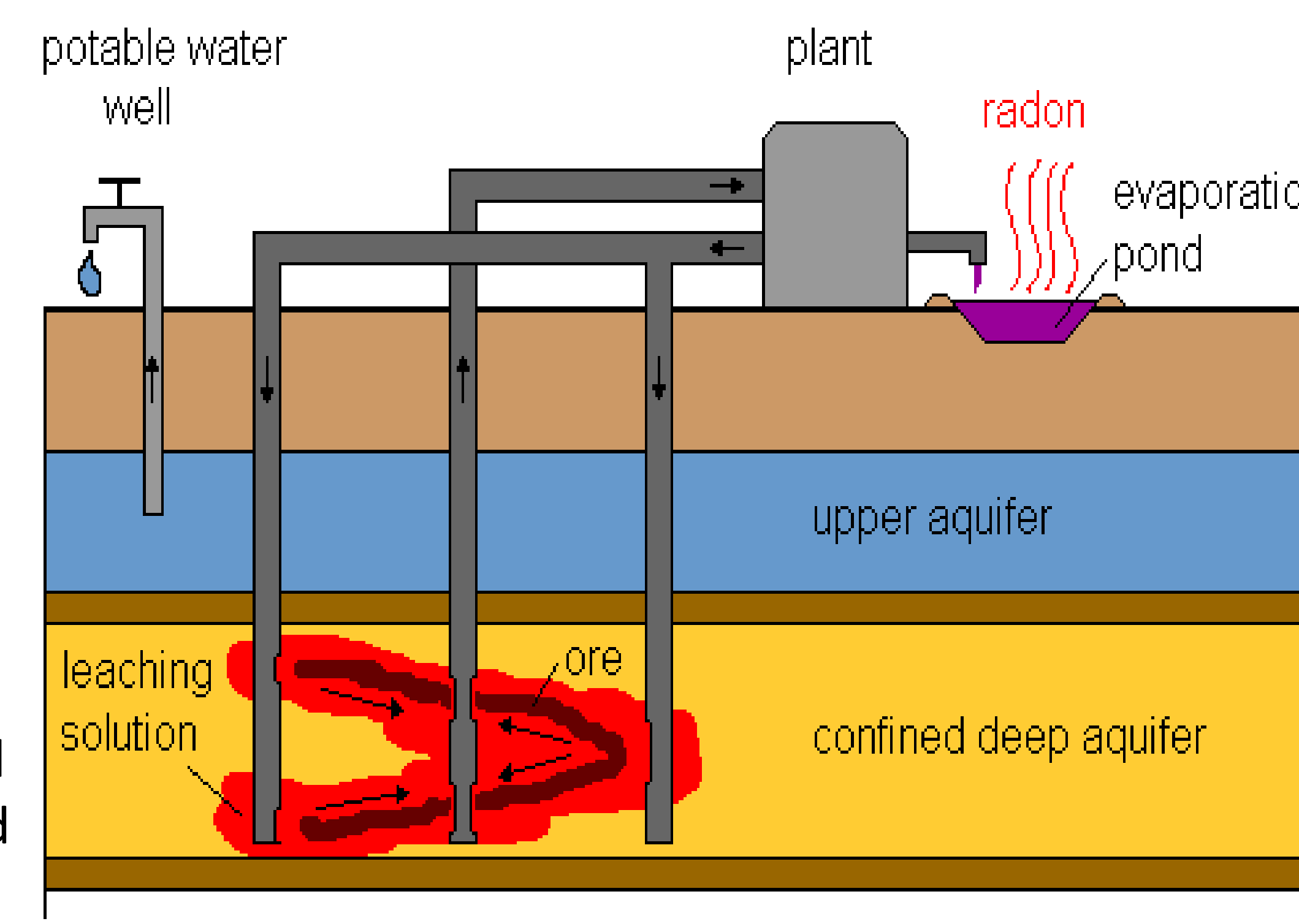


Figure 1 Normal ISL operation (Pierce, 2007).

## Methodology

To investigate the potential of heavy metal contamination in Cheyenne River due to ISL, I will use the quantitative methods including T-tests using two dependent (paired) samples. I will employ this method to gather water samples on the Cheyenne River to compare it prior to the Powertech Dewey-Burdock project and succeeding the project. In addition to water quality tests, I will also test for heavy metals such as radon, arsenic, and mercury. The samples will be sent to a lab for analysis. I will utilize previous records of water quality of Cheyenne River, as well as previous studies research metrics. A study by Heakin (1988), used the Kendall Test, a nonparametric statistical test, to analyze long-term and seasonal trends to remove the variability in water-quality data caused by seasonality. I will pair this with a flow adjusted concentration (FAC) model.

## Who is Powertech?

Powertech, also known as ‘Azarga’ or ‘Azarga Resources Limited’, is a Chinese company that has no experience mined uranium before. Since 2013, has merged with Powertech company to form Azarga Uranium or Powertech Uranium Corporation. They first began applying for permits and licensing for its Dewey-Burdock project in 2013. They plan on not only using ISL but using 9,051 total gallons per minute of water from two underground aquifers as well. The project they are planning is supposed to last 16 years and will use over 52 million gallons of water and produce over 14 million pounds of uranium. The first permit they received was in April of 2014 for source and by-product materials by the Nuclear Regulatory Commission despite a lawsuit from the Oglala Sioux tribe regarding the preservation of historical and cultural resources. Powertech also issued two permits by the Environmental Protection Agency in November 2020, which appealed to the Environmental Appeals Board. The Board meeting took place on May 5th, 2021, ending in a final approval (“WHO IS AZARGA?” 2017; See Figure 2).

## Future Directions

The results of this research would contribute to the investigation of In Situ Leaching on heavy metal concentration throughout Lakota Nation, more specifically the Cheyenne River.

Ultimately, these results would aid in finding ways to reclamation projects in the case of contamination (See Figure 3).

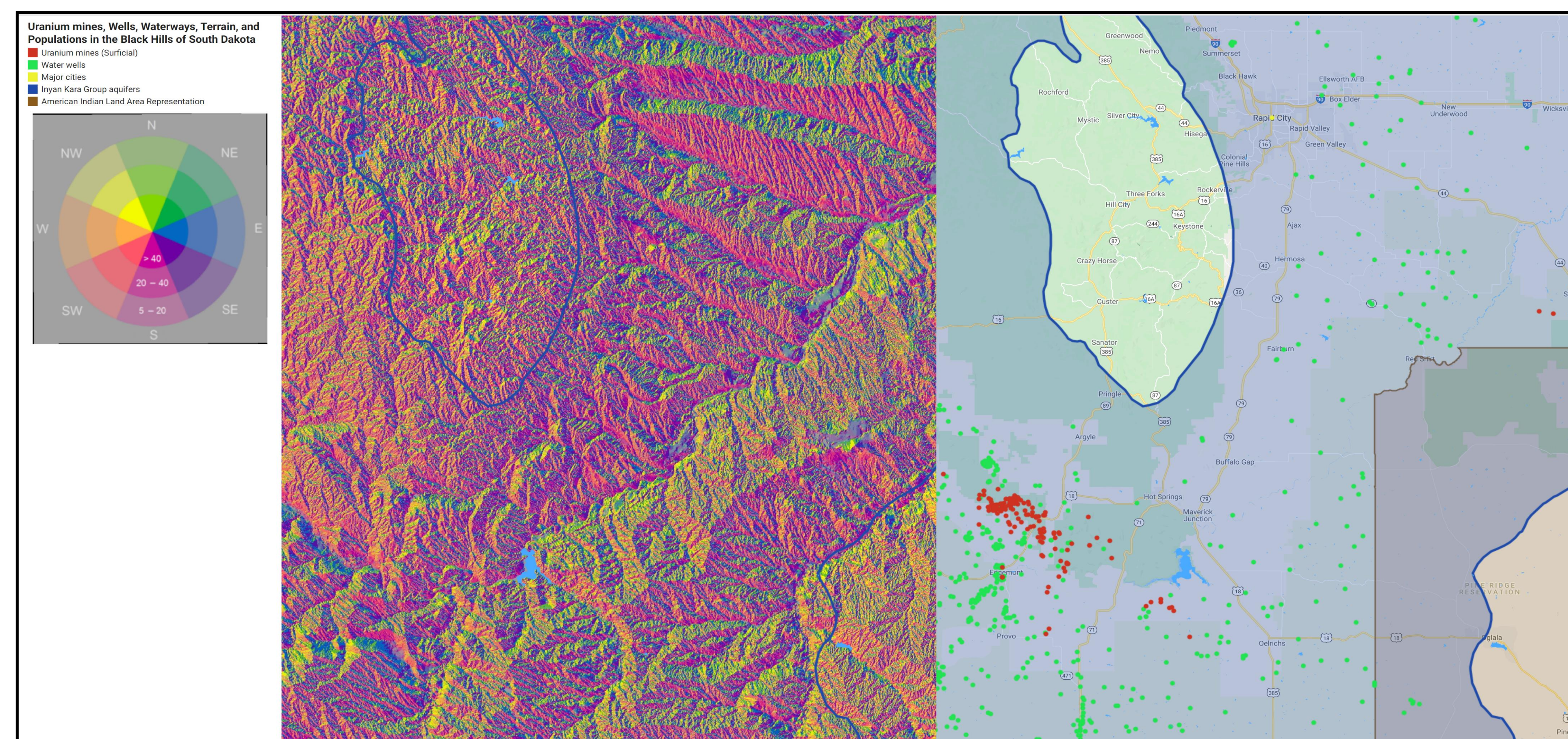


Figure 2 Terrain and Hydrography of Dewey-Burdock project.

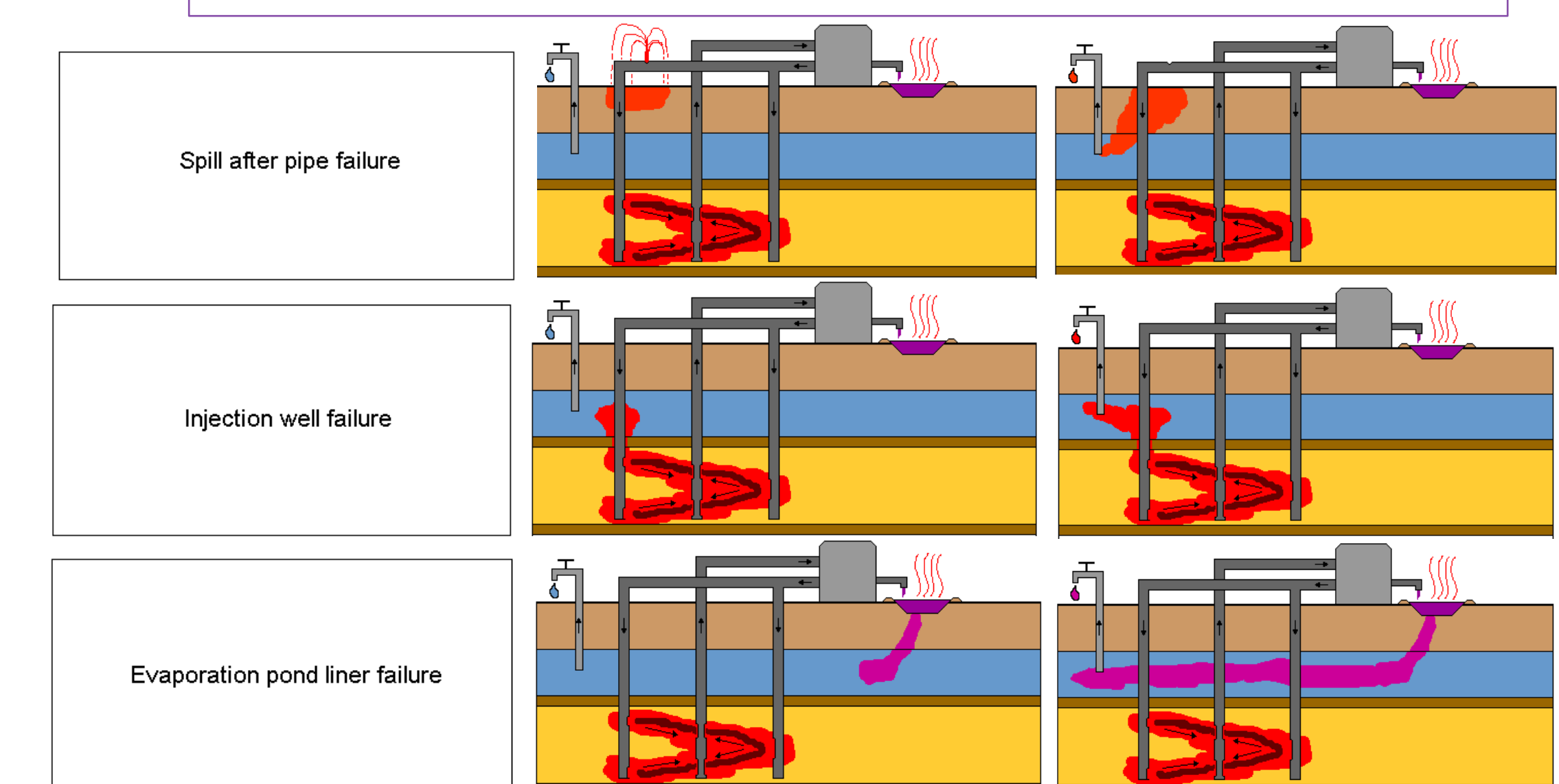


Figure 3 Potential failure modes of ISL (Pierce 2007).

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## Acknowledgements

I would like to thank the Haskell Environmental Research Studies Institute, EPSCoR, the National Science Foundation (NSF), Haskell Indian Nations University, and the University of Kansas. I would also like to acknowledge Trina McClure, Josh Meisel, and Dr. Jay Johnson, Cody Marshall, Katie Grote, Mandy Frank, Dr. Daniel Wildcat, and Jim “Jim Jam”. This project was supported by NSF Grant #1656006.