

## In-Situ Solution Mining of Uranium: Mining's Panacea or Pandora's Box

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**Abstract.** Powertech Uranium Corporation (Powertech) has proposed an *in-situ* solution mining of uranium project occupying 9 square miles in Weld County, Colorado (Centennial Project). The southern extent of the project is located near the town of Nunn. This project has received a lot of public attention and Powertech's homepage indicates that the Centennial Project is one of their major holdings and is scheduled for near term production. Solution mining is not a new technology and was first tried in the 1960s and 70s primarily in Wyoming and south Texas. A pilot scale solution mining operation was also conducted in the late seventies near Grover Colorado. In March 1979, the Three Mile Island accident occurred and uranium prices dropped drastically with the result that very limited uranium mining has occurred in the United States for the past almost thirty years. Recently uranium prices have increased and future demand for uranium appears to be strong. Uranium located in roll front deposits in tertiary age sandstones that are amenable to solution mining are located extensively over the western United States, Canada and in many other parts of the world. Sandstone formations are considered as a major aquifer type and contain large quantities of groundwater that is commonly a primary source of drinking water. The proposed Centennial Project is just the tip of the iceberg. The large number of potential solution mining projects represents a major threat to our groundwater resources. In the case of the Centennial Project the nearby proximity to population centers and surface water bodies represents an even greater threat. *In-situ* solution mining has relatively minor surface impacts as compared to open-pit mining. However at the conclusion of mining operations, the aquifer is contaminated with mobile radioactive uranium and other radioactive elements. The chemical equilibrium that existed prior to mining is now disrupted. Prior to mining the uranium ore was primarily uranium (IV) and afterwards it is uranium (VI). Uranium (IV) is relatively immobile whereas uranium (VI) is highly mobile in the groundwater. The rhetoric from the mining industry is the same heard thirty years ago. It is mindful of the Rip Van Winkle story. However knowledge by groundwater professionals of the problem of groundwater contamination and aquifer restoration has grown tremendously during this time period. It only takes a small quantity of contaminants to pollute large quantities of groundwater. Groundwater does not magically clean itself. Groundwater moves very slowly and the impact of groundwater contamination on the surrounding environment (wells and/or nearby surface water bodies) may not occur for many years or decades after the original contamination occurred. Once contaminated, groundwater is very difficult, time consuming and expensive to clean. The mining industry argues that the groundwater only be returned to pre-mining use, and use water samples taken directly from the roll front uranium ore deposit to be indicative of pre-mining use.

Mining proponents argue that *in-situ* solution mining is a panacea with minimal environmental impacts. Mining opponents argue it is a Pandora's box (once open the problems continue and cannot be put back into the box). Powertech owns the mineral rights in the sections to be mined and should have the opportunity to document that *in-situ* solution mining is environmentally safe. The citizens of northern Colorado have the right to know that they will not be left with a potential superfund site in their back yard. The following is proposed to aid in answering the question as to who is right and how to proceed. Prior to any full-scale mining operation, a pilot-scale system is installed using the same well spacing and lixivants as will be used in the full-scale mining operation. A dense network of monitoring wells is to be installed to detect horizontal and/or vertical excursions and residual groundwater contamination after restoration activities are completed. The monitoring well network would be separate from wells used by Powertech during mining or groundwater restoration. The details of this pilot-scale system are provided in the paper.