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Natural Radionuclide Contamination of Potable Groundwater Supplies

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Federal law limits the maximum drinking water concentrations of several radionuclides, including gross alpha (including uranium and radon) and beta particle activities. As a result, numerous wells have been abandoned and re-drilled or chemically treated to avoid areas of high radionuclide concentration.

It is advantageous to predict where unacceptable levels of radionuclides will occur prior to drilling. Many areas of the United States, primarily in the Northeast, are known to have high concentrations of radionuclides in groundwater associated with granites. Other areas, such as the Texas Gulf Coast and mid-continent, also have anomalous radionuclide concentrations; however the sources have not been fully identified.

Radionuclides found in fresh-water, alluvial aquifers located at some distance from a granitic source typically occur in a "scattered" pattern. One well may contain anomalously high amounts of radionuclides, while a nearby one may not. Also, the radionuclides may vary in concentration from well to well. This scattered pattern is typical of "roll-front" type uranium mineralization.

"Roll-front" type uranium mineralization is typically sinuous and narrow and results from geochemical reactions. Uranium is leached from source rocks (granite, ashfall tuffs, shales, etc.) by oxygen-rich groundwater and meteoric waters. Once leached, the soluble oxidized uranium migrates down-gradient until it reaches a reducing environment, which may be natural gas, oil, or coal. Uranium is insoluble under reducing conditions. If the oxidation-reduction (redox) boundary remains in place for any significant length of time, "roll-front" mineralization will form. If a water-supply well were to penetrate this deposit, a significant amount of radionuclides would be found in the groundwater supply. It is therefore important to understand how and why these deposits occur so that they may be avoided.

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