Title: **Mineralogical and Geophysical Monitoring of Naturally Occurring Radioactive Elements in Selected Wisconsin Aquifers (Study No. 46)**

Investigators:

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Objectives: To determine whether observed radium distribution and levels are stratigraphically or structurally controlled. Other objectives included determining the mineralogy and geochemistry of the radioactively enriched zones within the aquifer and suggesting remedies for minimizing the concentration of radium in produced water.

Background/Need: The majority of the wells in Wisconsin which exhibit radioactivity levels in excess of the 5 picocuries per liter drinking water standard are located in the southeast portion of the state. The limited understanding of the identity, mineralogical form and spatial distribution of radioisotopes within the sandstone aquifer hinders the development of new techniques to minimize radioactive contamination of public water supplies.

Methods: Structure and shale content maps for formations within the sandstone aquifer were generated from an analyses of borehole cuttings and natural gamma-ray logs. These maps were then compared to published water supply data. For six wells which exhibited a wide range of radiometric water quality, complete geophysical logs including spectral gamma ray results were available. These six logs were analyzed in detail to determine the source of the radium contamination. The results of the spectral gamma logs were compared to the results of two analytical procedures applied directly to well-bore cuttings.

Results: The radium content of produced water is not related to the structure or stratigraphy of the Mt. Simon or Eau Claire sandstone formations. The radium-228 content of produced water is directly related to the thickness and thorium content of the carbonate section of the borehole, Platteville and Galena formations. The radium-226 content of the water is directly related to the thickness and uranium content of the St. Peter sandstone formation.

Conclusions: Increases in uranium and thorium concentrations were accompanied by increases in shale and decreases in quartz in the aquifer matrix.

Recommendations/ Implications: Several items were suggested to improve the validity of sample data. Future work should include a sample collection program which utilizes sample cores or well cuttings prepared by project personnel. Logging procedures for water-well surveys need to be developed to determine uranium and thorium concentrations in a consistent manner. Groundwater chemistry needs to be determined for the intervals of potential contamination. Iron oxide content should analytically be determined along with isotopic uranium, thorium and radium associated with surface grain coatings for each sample interval. Additional spectral gamma logs should be obtained to more fully establish the sources of radium contamination suggested by this study.

Availability of Report: This report is available for viewing and loan at:

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