

# Uranium and Radon in Ground Water from Glacial and Bedrock Aquifers in the Northern United States

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## Abstract

Concentrations of uranium and radon in 1,400 monitoring, public, and domestic drinking-water wells in glacial aquifers throughout the northern United States; 117 domestic wells in crystalline bedrock aquifers in New England, New Jersey, and New York; and in 80 domestic wells in bedrock aquifers in Minnesota and Wisconsin were studied to determine regional occurrence and distribution patterns. These data, collected as part of the U.S. Geological Survey's National Water Quality Assessment Program, show that uranium and radon are above drinking-water standards in localized areas in the northern United States.

Uranium concentrations were measured in 36 percent of 1,100 ground-water samples at levels greater than 1 microgram per liter ( $\mu\text{g/L}$ ). Only 28 samples (2.5 percent) were above the U.S. Environmental Protection Agency's Maximum Contaminant Level of 30  $\mu\text{g/L}$ . Of these samples, 82 percent of these samples were in monitoring wells in glacial aquifers in the western part of the United States, and the remaining 18 percent were in domestic wells in the crystalline bedrock aquifers of New England and New Jersey. Uranium concentrations were highest in shallow monitoring wells in glacial aquifers underlying agricultural lands in Nebraska, Washington State, and North Dakota, and were the lowest in domestic wells in the Cambrian-Ordovician bedrock aquifers in Minnesota and Wisconsin. The high use of recycled irrigation waters and a local geology that contains leach-able uranium, are possible factors contributing to elevated uranium concentrations in glacial aquifers in the western United States. In wells in the crystalline bedrock aquifers of New England, New Jersey, and New York, uranium concentrations correlated with radon, gross alpha, and gross beta concentrations, indicating a geologic source of the uranium.

Radon was measured at a concentration above the proposed USEPA drinking-water standard of 300 picocuries per liter ( $\text{pCi/L}$ ) in 60 percent of nearly 1,200 ground-water samples. Only ground water in the crystalline bedrock and glacial aquifers in the New England and New York area had radon concentrations exceeding 4,000  $\text{pCi/L}$ . Radon correlated strongly and positively with uranium, gross alpha, and gross beta concentrations in wells in the crystalline bedrock aquifers, but not in the glacial or Cambrian-Ordovician bedrock aquifers. The relation between radon and uranium in crystalline bedrock aquifers of New England, New Jersey, and New York is likely associated with the large amounts of granite and high-grade metamorphic rocks that contain naturally occurring uranium and radium-226.

### *Biographical Sketches*

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