

Influence of Geology on Concentrations and Distribution of Dissolved Radon-222 in Private Drinking Water Wells in North Carolina, 2007

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Data from 553 private bedrock wells in the Piedmont-Mountain (P-M) region of NC were analyzed to evaluate the occurrence and distribution of radon-222 (Rn) in ground water drinking supplies. Results plotted on the State geologic map indicate that elevated concentrations of Rn are widespread in wells located in metaigneous rocks generally, and, more specifically, in granitic rock formations of Paleozoic age (~250 - 600 M yrs old) rather than Proterozoic age (~600 M - 2.5 B yrs old). Paleozoic granitic rock (PGR) formations make up about 17% of the P-M region. Other rock types also are associated with elevated levels of dissolved Rn in local areas. Numerous counties may be susceptible to elevated Rn, and statewide evaluation is underway. These findings are significant because Rn is a known human carcinogen and about half the NC population uses ground water for its potable supply. Analysis suggests that the primary controls on dissolved Rn levels and distribution are rock type and age (as rendered on the State geologic map). Wells in PGR contained significantly higher Rn (median = 7020 pCi/L, n = 148) than wells in Proterozoic granitic rocks (PrGR) (median = 1110 pCi/L, n = 29) and wells in all non-PGR rocks (median = 1590 pCi/L, n = 387). More broadly, wells in meta-igneous rocks contained higher Rn (median = 5530 pCi/L, n = 201) than wells in meta-sedimentary rocks (median = 1620 pCi/L, n = 339). Radon exceeded EPA's proposed MCL of 300 pCi/L in 98, 78, and 91% of PGR, PrGR, and all wells, respectively, and exceeded EPA's proposed alternate MCL of 4000 pCi/L in 75, 11, and 35% of PGR, PrGR, and all wells, respectively. Additional mineralogic/age analysis is planned. Other controls on Rn concentrations, considered secondary, also are presented. These include factors such as parent radionuclide (uranium and radium-226), redox chemistry, and hydrologic setting. Because dissolved Rn is widely occurring, carries a higher health risk than most other EPA-regulated natural and anthropogenic compounds, and continues to lack a promulgated standard, policy makers have begun to re-evaluate their radon in water policies and risk communication strategies. These strategies generally have been effective for indoor air radon but, to date, have been limited for radon in water. Challenges and controversies to radon in water policy are presented.