

**SURFACE DISPOSAL OF PRODUCED WATERS IN WESTERN AND CENTRAL PENNSYLVANIA:
POTENTIAL FOR ACCUMULATION OF ALKALI-EARTH ELEMENTS IN SEDIMENTS**

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Waters co-produced with hydrocarbons in the Appalachian Basin are of notably poor quality (TDS and total radium up to and exceeding 300,000 mg/L and 10,000 pCi/L, respectively). Since 2008, a rapid increase in Marcellus Shale gas production has led to a commensurate rise in associated wastewater in addition to continued generation of produced water from conventional oil and gas activities. In this study, we focus on treatment of produced waters from both shale gas and conventional operations in Pennsylvania in order to assess whether disposal practices could result in the accumulation of associated alkali earth elements. Our results indicate that water treatment in publicly owned treatment works (POTWs) and centralized waste treatment facilities (CWTs) did not result in elevated concentrations of Ba, Ca, Na, Ra, or Sr in fluvial sediments downstream of the discharge outfalls ($p > 0.05$). However, the use of roadspreading of brines from conventional oil and gas wells for deicing resulted in accumulation of Ra (1.3x), Sr (3.0x), Ca (5.3x), and Na (6.2x) in sediments proximal to roads ($p < 0.05$). Although this study is an important initial assessment of the impacts of these disposal practices, more work is needed to consider the unintended consequences of produced waters management.

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