

Salinization and Radium Accumulation Assessment of Produced Water Beneficial Use in Western US Streams

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Eighty percent of the United States' produced water, saline water from oil and gas (O&G) formations brought to the surface during extraction processes, often containing elevated radioactivity, is generated in states west of the 98th meridian and frequently discharged to surface waters. Beneficial use of this wastewater for agriculture is encouraged in arid western states with minimal treatment prior to disposal. Collaborative sampling occurred in a major Wyoming river basin from 2013-2016 at 26 sites along two perennial rivers and one ephemeral tributary.

Salinity increases were observed in the two perennial rivers with time. Traditional elemental fingerprints (e.g., Br/Cl, Sr/Ca) failed to identify a definitive salinity source and instead revealed a combination of mechanisms and potential sources. Thus, strontium, boron, sulfur and lithium isotopes (⁸⁷Sr/⁸⁶Sr, ¹¹B/¹⁰B, ³⁴S/³²S, ⁷Li/⁶Li) were analyzed on surface water samples. Based on preliminary results ⁸⁷Sr/⁸⁶Sr and ³⁴S/³²S, O&G produced water is not the source of increasing salinity in two of the rivers. Sediment samples at points of discharge were elevated in total radium, with one facility as high as 3600 Bq/kg. X-Ray Diffraction paired with sequential leaching indicated ~75% of the sample radium was incorporated in sediment with >97% calcium carbonate composition. Wetland sites downstream are being studied for radium sequestration from easily leachable carbonate minerals.