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**Subject:** [External\_Sender] Uranium Daughters in Cimarron Groundwater?  
**Date:** Wednesday, December 01, 2021 9:35:59 AM  
**Attachments:** [2021-11-11 Lab Report - SDG 559068 - U Daughters.pdf](#)  
[Uranium Daughters Evaluation.pdf](#)

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In the NRC's August 11 request for information, there were several requests to provide information on "all radionuclides". After some discussions with the NRC, we decided that although some of the requests only specifically mentioned Tc-99, it would be worth addressing both Tc-99 and the daughters of uranium that may be present at the Site in response to some of the requests for information that only specifically mentioned Tc-99.

Experience at other sites has taught me that as a rule thorium is substantially less soluble than uranium. The activity concentration of uranium in groundwater may be thousands of pCi/L, but its first decay products (Th-234 for U-238 and Th-231 for U-235) may not be detectable in groundwater. I wanted to try to answer the question, "Are there uranium daughters in the groundwater?"

When we conducted our fourth quarter redox sampling event in Burial Area #1, I included in the scope of work the collection of additional samples from the four monitor wells (which would already be sampled for redox evaluation) which in the past yielded the highest uranium concentrations. Those are Monitor Wells TMW-13, 02W02, 02W01, and TMW-09. Groundwater from those four wells were scheduled to be analyzed for uranium **mass** concentration, but I also wanted these samples to be analyzed for **activity** concentration to compare the activity concentration of the daughters to the activity concentration of the parents.

The detection limits for Th-234 and Th-231 were higher than the results for the parent radionuclide, so we can't definitively rule out the presence of thorium in groundwater; however, thorium was not detected in any sample. The detection limit for Pa-234 (2<sup>nd</sup> daughter of U-238) varied from 13% to 20% of the U-238 activity concentration results; however, Pa-234 was not detected in any sample.

I believe it's reasonable to conclude that although the analytical results cannot be considered definitive, the absence of Pa-234 provides a good indication that the thorium does not remain in solution in groundwater. Our effluent and dose calculations are based on the **extremely conservative** assumption that all three daughters (Th-234, Pa-234, and Th-231) are present (in groundwater, in the resin, and in the effluent) at the same activity concentrations as their parent uranium nuclide. But I believe it is likely that we will be receiving essentially no uranium daughters (above background concentrations) in the influent to the water treatment systems.

I've attached for your information the laboratory report as well as a table summarizing the laboratory results. I don't plan to change any of the assumptions made in the decommissioning plan, because there is essentially no dose or regulatory compliance impact even if the daughters **are** present in groundwater. This information only provides an **indication** that we will receive little if any uranium daughters in the influent, the spent resin, and the effluent from the treatment systems.

Please feel free to call if you have questions regarding this email, or to discuss implications relative to the decommissioning plan. Thanks.

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