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Evidence of Technetium and Iodine Release from a Sodalite-Bearing Ceramic Waste Form

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Abstract

Sodalites have been proposed as a possible host of certain radioactive species, specifically ⁹⁹Tc and ¹²⁹I, which may be encapsulated into the cage structure of the mineral. To demonstrate the ability of this framework silicate mineral to encapsulate and immobilize ⁹⁹Tc and ¹²⁹I, single-pass flow-through (SPFT) tests were conducted on a sodalite-bearing multi-phase ceramic waste form produced through a steam reforming process. Two samples made using a steam reformer samples were produced using non-radioactive I and Re (as a surrogate for Tc), while a third sample was produced using actual radioactive tank waste containing Tc and added Re. One of the non-radioactive samples was produced with an engineering-scale steam reformer while the other non-radioactive sample and the radioactive sample were produced using a bench-scale steam reformer. For all three steam reformer products, the similar steady-state dilute-solution release rates for Re, I, and Tc at pH (25 °C) = 9 and 40 °C were measured. However, it was found that the Re, I, and Tc releases were equal or up to 4.5x higher compared to the release rates of the network-forming elements, Na, Al, and Si. The similar releases of Re and Tc in the SPFT test, and the similar time-dependent shapes of the release curves for samples containing I, suggest that Re, Tc, and I partition to the sodalite minerals during the steam reforming process.

1. INTRODUCTION

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