NEUP Nuclear Energy University Program
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Beryllium Safety: Characterization of Beryllium Samples from High-Temperature Salt Systems to Support Improved Industrial Hygiene and Occupational Safety for Advanced Reactors that Employ Fluoroberyllate Salts

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Program: Reactor Development and Plant Optimization

ABSTRACT:

To accelerate the development and deployment of advanced reactors, this project will generate data for improving beryllium industrial hygiene tools tailored to high temperature molten salt operations. We postulate that in high temperature FLiBe systems beryllium takes much different physical and chemical forms, and transports differently, compared to the forms for which current industrial hygiene practices have been optimized.

Task 1 will create samples for surface and airborne contamination from controlled experiments with high-temperature beryllium-containing fluoride salts, such as FLiBe, BeF_2, NaF-BeF_2 and fuel salts, and investigate the chemical composition, particle size distribution, and other physical and chemical characteristics of the surface and airborne beryllium contamination.

Tas 2 will obtain representative samples from industrial processes and beryllium laboratories, and characterization of their chemical and physical characteristics and when relevant characterize the surface and airborne contamination that can be dispersed from them. Examples of such samples include FLiBe-exposed materials such as graphite and metal, samples of cover gas space deposits, samples from filter media, filter media aerosol samples, swipe samples.

Task 3 will investigate transport and uptake of Be from different types of samples generated by salt operations, into skin and lung tissue, and explore the effectiveness of barriers to exposure under engineering-relevant conditions and explore applicability of currently available topical skin lotions for decontamination and treatment of beryllium exposure.

Task 4 will develop recommendations and a sustained path forward, with input from technical advisory committee (TAC). The TAC will include expertise on beryllium occupational health, industrial hygiene, and experience with large-scale industrial handling of beryllium fluoride materials, and experience with operation of laboratories that employ beryllium-containing high temperature molten salts. Task 4 will integrate the findings from Task 1-3, solicit input from the TAC, and address the following deliverables, aimed at enabling growth of the research activities in the areas of beryllium safety that are of particular importance to high temperature molten salt operations: (a) industrial hygiene, (b) engineering, (c) sample library, and (d) specifications for future standard reference materials.