GNEP Coupled End-to-End Demonstration Project
Head-End Processing and Tritium Removal Using Voloxidation

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Abstract: Advanced nuclear fuel processing methodologies are being demonstrated as part of the Global Nuclear Energy Partnership (GNEP) program at ORNL. A coupled end-to-end (CETE) demonstration of all primary processing operations, ranging from spent fuel receipt to production of products and waste forms, will be conducted at small-scale (e.g., in the range of 20 kg spent fuel per year). The head-end processing segment includes single-pin shearing, voloxidation to remove tritium from the fuel before it enters the aqueous based separations systems, cleanup of the cladding hulls for disposition, and transfer of the fuel powder to the dissolution process.

A voloxidation system has been designed and built. The voloxidizer itself is a rotary calciner designed to process a batch of chopped fuel pins while the oxidizing gas flows through the retort tube. To simplify operations (particularly since this is a small scale demonstration), the voloxidizer is equipped with an inner basket into which the chopped fuel segments are placed. After processing is complete, the unit is up-ended from the horizontal retort tube position to the vertical retort tube position. This permits withdrawal of the basket containing the empty cladding hulls while the powdered fuel product transfers to a transportable container. Oxidation of the fuel in the presence of various gases (e.g., air, pure oxygen, etc.) is facilitated by a flexible gas supply system. Off-gases are routed to an off-gas treatment system (described in a separate paper in this conference). The voloxidation system provides an opportunity to evaluate the effects of operating parameters on removal of volatile fission and activation products. In addition, data from downstream processes (e.g., dissolution) will provide feedback on how voloxidation affects subsequent operations.

This paper will describe the voloxidation system and present preliminary results from the initial processing campaigns.

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