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PROLIFERATION RESISTANCE OF ADVANCED SPENT FUEL CONDITIONING PROCESS

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ABSTRACT

The Advanced Spent Fuel Conditioning Process (ACP) is a pyro-metallurgical spent fuel conditioning technology that is under development by the Korea Atomic Energy Research Institute (KAERI). KAERI has been developing this technology to resolve the high-level waste (HLW) disposition problem since 1997 and is planning to perform a lab-scale demonstration in 2008. The proposed concept is an electrometallurgical treatment technique that converts spent nuclear fuels into a single set of disposal metal forms to reduce the volume and simplify the qualification process. The goal of the project is to recover more than 99% of the actinides in metallic form from oxide spent fuel in a proliferation-resistant manner. With this technology, a significant reduction of the volume and heat load of spent fuel is expected, decreasing the burden of the final disposal in terms of size, safety, and cost. The success of the ACP will depend on a number of factors. One key factor is "proliferation resistance," and it should be judged by the manner in which it addresses issues of proliferation concern. In this paper, the proliferation resistance of the ACP technology has been analyzed. The intrinsic and extrinsic proliferation resistance features of the ACP technology were examined for the pilot-scale ACP facility based on the Nuclear Energy Research Advisory Committee's TOPS (Task Force on Technology Opportunities for Increasing the Proliferation Resistance of Global Civilian Nuclear Power System) metrics. It was found that the ACP system was more proliferation-resistant than aqueous technologies. The ACP as envisioned in current process flow is not capable of separating plutonium, and significant additional steps would be required to create a pathway to produce plutonium. However, like other processes, it could be modified to directly obtain weapon-usable materials. In this paper, several options are suggested for modification of the process or facility design in order to reduce the capability of the facility and its materials for overt weapons materials production. Further research topics for nuclear materials accounting and process monitoring are also discussed.

BIOGRAPHICAL SKETCH

Johnna B. Marlow

Johnna B. Marlow received her B.A. in Environmental Conservation in 1988 and her B.S. In Chemical Engineering in 1994, both from the University of Colorado at Boulder. She joined Los Alamos National Laboratory as a Technical Staff Member in the Safeguards Science and Technology Group in 2003. Prior to that, she had served as the Technical Manager at BNFL Instrument Incorporated, a post she assumed after a ten year career at the Rocky Flats Environmental Technology Site. Her recent work has been in the areas of nondestructive assay system design for international safeguards applications.