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Molten Salt Reactors and Associated Safeguards Challenges and Opportunities

Molten Salt Reactors (MSRs) were first proposed at Oak Ridge National Laboratory (ORNL) shortly after World War II to power military aircraft and were followed by the development of civilian MSR programs also at ORNL from the mid-1950s to the mid-1970s. Although the development of the concepts ended in the late-1970s, a wide variety of new MSR technologies are now being developed and are gaining international interest and momentum toward deployment. ORNL continues to be actively engaged in the development of the underpinning science and technology of MSRs, including leading and managing the US national programs. The programs include the evaluation of the associated safeguards challenges and opportunities. As a follow on to our paper at the IAEA Emerging Technologies Workshop in 2016, here we present an update on the evaluation of the specific safeguards concepts and approaches, and potential promising safeguards technologies.

A number of previously reported technical factors impacting the safeguards of MSRs include (1) the homogeneous mixture of fuel, coolant, fission products, and actinides; (2) continuous variation of isotopic concentrations in the fuel salt, including removal (passive or active) of fission products, rare earth elements, and noble metals; (3) the potential for online reprocessing whereby some fraction of the inventory can be removed while the reactor is operational; and (4) unique refueling schemes including the ability to continuously feed the core with fresh fissile or fertile material. This necessitates the use of sophisticated modeling and simulation tools for tracking the isotopic masses and signatures throughout the reactor and associated auxiliary processing, and as a function of time as the fuel salt evolves. This paper presents the early results of that analysis and demonstrates how the data is used to underpin the assessment of the necessary safeguards approaches, and instrument and technology challenges presented by MSRs.

Which "Key Question" does your Abstract address?

NEW1.2

Which alternative "Key Question" does your Abstract address? (if any)

NEW1.1

Topics

NEW1

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