



SPEAKER: M.A. Williamson (Chemical Sciences and Engineering Division, Argonne National Laboratory)

TITLE: **Towards a Sustainable Nuclear Energy System**

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ABSTRACT

Electrochemical processing of used fuel provides a robust path for the transition from the once-through to a closed nuclear fuel cycle thereby increasing resource utilization and allowing fission product waste to be encapsulated in engineered waste forms designed for geologic storage. Selective combination of electrochemical processing technologies including a front-end oxide to metal conversion process enables the recovery of actinides from light water reactor fuel for use in fast reactor systems as well as the recycle of actinides from short-cooled fuel discharged from fast reactors.

Close-coupling of the fuel treatment and fabrication facility with the nuclear system reduces the storage requirements for the used and fresh fuel, eliminates the transportation of the radioactive materials between sites and potentially yields cost savings. This presentation will provide a summary of the technology development activities at Argonne from the unit operation level to full process flowsheet using examples from systems designed to treat used oxide and metal fuel. In addition, technologies used for process monitoring and their potential to supplement materials accountancy measurements will be described.