Data-Driven Decision Making for Economic Nuclear Power Plant Operations and Maintenance

Abstract: Nuclear power plants are faced with a challenging economic reality, stemming largely from inexpensive natural gas, subsidized renewables, and the lack of a carbon tax for fossil fuels-based energy production. William Levis, President and Chief Operating Officer, PSEG Power, succinctly describes the current situation in the forward to NEI’s Delivering the Nuclear Promise®: Advancing Safety, Reliability and Economic Performance:

“Nuclear energy is carbon-free and large-scale, and our industry has delivered on its promise to generate energy safely and reliably. Yet nuclear energy still is not economically competitive in many electricity markets. That is our industry’s most significant challenge and the one promise that we have yet to deliver.”

Controlling the day-to-day operations and maintenance (O&M) costs associated with nuclear power is one of the primary avenues for improving the economic outlook for the nuclear industry. The current approach to O&M relies primarily on periodic inspection and maintenance activities scheduled to preclude in-service degradation and failure; however, this approach often leads to unnecessary work and wasted effort. Current trends in the nuclear industry are moving away from purely time-based inspection and maintenance toward risk-informed practices, based in part on online equipment condition assessment of key components. A wealth of data is already collected in the normal course of operating a nuclear power plant, including process data, inspection and testing data, maintenance logs, and plant performance indicators. Statistical analysis of these data can allow for automated early detection of degradation before any significant impact on plant performance. This seminar will overview research in online equipment condition assessment, fault detection and diagnostics, and failure prognostics for active equipment in nuclear power plants and methods to integrate this knowledge into robust decision making.

Biography: Dr. Jamie Baalis Coble is an Assistant Professor in the Nuclear Engineering department at the University of Tennessee, Knoxville where she has been since 2013. Dr. Coble’s expertise is primarily in statistical data analysis, empirical modeling, and advanced pattern recognition for equipment condition assessment, process and system monitoring, anomaly detection and diagnosis, failure prognosis, and integrated decision making. Her research interests expand on past work in nuclear system monitoring and prognostics to incorporate system monitoring and remaining useful life estimates into risk assessment, operations and maintenance planning, and optimal control algorithms. Prior to joining the UT faculty, she worked in the Applied Physics group at Pacific Northwest National Laboratory. Her work there focused primarily on data analysis and feature extraction for detecting anomalies and degradation in large passive components, advanced active components, and nuclear fuel reprocessing systems. Dr. Coble is currently pursuing research in prognostics and health management for active components and systems; advanced control strategies for integration of small modular reactors with deep renewable penetration; and process monitoring and accountancy for safeguards of nuclear fuel cycle facilities.