Project Title

Advanced Online Monitoring and Diagnostic Technologies for Nuclear Plant Management, Operation, and Maintenance

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The goal of this proposal is to develop and demonstrate advanced online monitoring to better manage nuclear plant assets, operation, and maintenance.

For advanced nuclear reactors to be cost effective, we must take advantage of improvements in advanced instrumentation and big data analytics in order to operate plants more efficiently, streamline maintenance, and have minimal staffing levels. With the obvious need for advanced nuclear power to meet changing electricity and energy demands, we must now develop and demonstrate advanced online monitoring techniques and begin to learn now how such tools can be used to support and improve decision making.

In this research, we will develop a tool that will use condition monitoring and advanced analytics to manage plant assets and operation and maintenance costs. This tool will integrate the following: big data analytics, condition monitoring, and models of the supply chain and business process applications. Such a tool could be used by utilities for planning short and long-term asset management and for decision-making about plant operation.

If this research is successful, we should be able to do the following:

- perform a cost-benefit analysis for achieving reliability, availability, maintainability and security using advanced online monitoring technologies,
- conduct predictive analytics of operational and maintenance data,
- implement risk-informed condition monitoring technologies, and
- integrate of economics, big data, and predictive maintenance to enable a transformational approach to supply chain and asset management with business process applications.

To achieve these objectives, we will develop a framework that models the interaction between component reliability and condition monitoring, supply chain and resources availability, financial and business decision making, and asset management. The output of this model will be an estimate of the financial risk. In order to build this integrated model, we will perform the following tasks: First, we will generate a component reliability model using Bayesian networks. Using the plant data history, this model will generate statistical estimates of the condition of components. Second, we will develop a model of the supply chain. This will model the risk within the supply chain network, assess the resource availability and its effects on asset management, and measure the risk exposure caused by the supply chain. Third, we will build an asset management model for a plant that will integrate the condition determined by the component reliability model, the supply chain risk determined from the supply chain model; and, financial and business options determined from financial data and business models.