# Enhanced Plant Health and Asset Management

## Value Proposition and Research Plan

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| **Context** | Industry Equipment Reliability (ER) and Asset Management (AM) Programs are essential elements that help ensure the safe and economical operation of nuclear power plants (NPPs). The effectiveness of these programs is addressed in several industry developed and regulatory programs. For example, all US NPPs have implemented the ER process defined in INPO AP-913 "Equipment Reliability Process Description". Additionally, performance of plant structures, systems, and components (SSCs) is monitored within a regulatory context in the Maintenance Rule 10CFR50.65 and the Mitigating Systems Performance Index (MSPI) programs. However, these programs have proven to be labor intensive and expensive. There is an opportunity to significantly enhance the collection, analysis, and use of this information to provide more cost-effective plant operation. Additionally, there is an acute industry need to leverage advanced technology to reduce costs and improve operational effectiveness. |
| **Why** | Although the use of advance monitoring has been successfully implemented to assess equipment and system performance in a number of industries (e.g. commercial and military aviation, transportation, gas turbine electrical generation), these technologies have not penetrated extensively into the commercial nuclear power sector. As a result, deployment of these technologies has the potential to provide significant improvements in the performance of critical SSCs (e.g. via detection and diagnosis of degraded performance at an incipient stage) and reduce costs associated with monitoring and regulatory compliance. In addition, NPPs have implemented long-term asset management programs to ensure safe and economic plant operation over the remaining useful life of the asset. With the advent of plant license renewal in the US (with a number of plants also actively seeking approval for a second 20-year license extension), these programs have become the focus of additional scrutiny from external organizations (e.g. US NRC and INPO). |
| **Our Work** | The Risk-Informed Systems Analysis (RISA) Pathway of the Light Water Reactor Sustainability (LWRS) Program is working with operating NPPs to develop more effective and efficient analytical methods and tools to support risk-informed decisions related to NPP equipment reliability and asset management programs. The objective of this collaborative research is to develop data analytics tools coupled with risk-informed methods to manage plant assets over the remaining years of plant operation (including periods of license renewal and second license renewal). The research is developing advanced computational capabilities to support enhanced system performance and health management in a manner that is significantly less labor intensive than currently performed. The approach has been designed to possess the following characteristics and capabilities:<br><br>• Integrated evaluation of safety, production, and economic risk;<br>• Use of advanced data analytics methods such as data mining, machine learning, and artificial intelligence;<br>• Enable maximum deployment and maximum benefits from risk-informed applications (e.g. 10CRF50.69 Alternative Treatments, Risk-Managed Technical Specifications, Surveillance Frequency Control);<br>• Permit efficient and economical adoption of new technologies, such as Accident Tolerant Fuel (ATF), as they become available. |
| **Deployment** | The methods and tools in the research will be developed via collaboration with sponsoring host NPPs. This collaboration will ensure that the research will be targeted to address issues that are relevant and significant to the long-term operation of the current fleet of operating NPPs and permit the participating sponsoring NPP to play an active role in the development and initial deployment. Collaboration with host NPPs also will provide a test bed platform to ensure the methods and tools achieve near-term deployment within the industry and from which scale-up for widespread dissemination across the industry can be achieved at the earliest possible date. |

Website: https://lwrs.inl.gov/SitePages/Risk-Informed%20Systems%20Analysis.aspx