Sandia National Laboratories

Energy, Climate, & Infrastructure Security

Fuel Cycle Systems Engineering

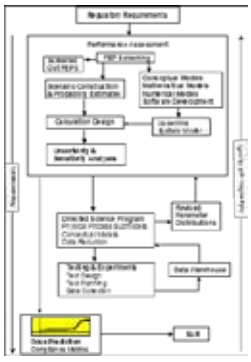
Complex programs have a higher probability of success if they are managed and developed with a top-down, goal oriented approach that ensures integration of all activities and aligns them with the highest goals and objectives. Systems Engineering (SE) is an established approach that achieves integration by combining the concurrent activities of engineering management and technology development in a common process. This process is based on a top-down, hierarchical decomposition of system requirements to component specifications, and is supported by system studies that record the options considered, their performance, and the basis for significant decisions.

Vision

To enhance the nation's security and prosperity through sustainable, transformative approaches to our most challenging energy, climate, and infrastructure problems.

Applications to Systems Assessment

Over the last three decades, SNL has developed and applied a Systems Engineering (SE) approach that includes performance assessment (PA) expertise to inform key decisions concerning radioactive waste management both in the US and internationally. The result of these efforts is a PA-based SE methodology for development and assessment of waste management systems that has wide acceptance within the international community (see figure below). This methodology has been used as an effective management and assessment tool to evaluate different disposal designs and sites; inform the development of regulatory requirements; identify, prioritize and guide research aimed at reducing uncertainties for objective estimations of risk; and support safety assessments. I



Applications to Decision Making

SNL has also applied systems engineering to develop a structured, open, and objective decision-making framework to help the DOE-NE focus R&D on high-potential opportunities and help better explain decision-making to stakeholders. This framework employs a "screening" methodology that rates the potential ability of alternative fuel cycle options to achieve desired characteristics, measured as objectively as possible using approved evaluation criteria and metrics. As shown in the figure below, the decision-making framework has two major components that are iterative in time: a policy component (outer loop) and an FCT program R&D component (inner loop). The inner R&D loop represents both (1) the key elements of the screening methodology (in green) and (2) the use of the screening results to inform R&D planning and data and knowledge management (in yellow). Data and knowledge management is an essential element of any long-term RD&D program and SNL also uses SE principles to develop and implement management information systems.

For more information, contact

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U.S. DEPARTMENT OF ENERGY

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