Sandia National Laboratories

Energy, Climate, & Infrastructure Security

Quality Assurance and Configuration Management

Sandia National Laboratories implements quality assurance and configuration systems essential to the control and traceability of modeling used to demonstrate regulatory compliance.

Introduction

Sandia National Laboratories has a long history of involvement in significant national programs directed at solving the national problem of managing the disposal of various forms of nuclear wastes. These involvements include significant responsibility on the Waste Isolation Pilot Plant (WIPP), the Yucca Mountain Site Characterization Project (YMP), the Hanford Tank Waste Remediation System (TWRS), and the Greater Confinement Disposal (GCD) programs. In addition, Sandia has also played major roles in nuclear waste transportation, and in several environmental remediation and restoration programs, including those at Fernald, Ohio, and Hanford, Washington.

A key to the success of our activities on these programs, particularly for WIPP, YMP, TWRS, and GCD, was the development and application of quality assurance for program activities. Another important aspect of our success was the implementation of configuration management systems essential to the control and traceability of modeling codes, databases, and analyses used to demonstrate regulatory compliance.

Quality Assurance

Over nearly four decades, Sandia has developed an extensive experience base in the development and application of quality assurance to scientific and engineering activities in the regulatory environment of major nuclear waste programs. This development has involved interaction with and acceptance of the programs by several regulatory agencies, including, most significantly, the U.S. Nuclear Regulatory Commission and the U.S. Environmental Protection Agency, as well as various federal, state, and other organizations. Among more notable successes of this work has been the adaptation of quality assurance to activities sponsored largely by the U.S. Department of Energy involved in the characterization, selection, and performance analyses associated with programs involving nuclear waste management. Quality assurance requirements originated from a need to control and assure the quality of nuclear power plant design, construction, and operations; modifying these concepts for application to scientific investigation and characterization activities was a necessary and beneficial effort that has proven successful for nuclear waste management.

Decades of experience under the scrutiny of independent audits, identifying quality deficiencies, and taking effective corrective action have resulted in a number of valuable lessons learned. The application of quality assurance to the conduct of scientific investigation in a regulatory environment has been continuously improved. Everyone at Sandia involved in scientific investigations, including field engineers, laboratory scientists, software developers and modelers, QA specialists, and members of management have important responsibilities in developing and ensuring quality products throughout the program. Using a hierarchy of procedures, these QA programs lead to full, verifiable compliance with regulatory and customer requirements as a result of

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the improvements Sandia pioneered. These improvements have resulted in cost-efficient and streamlined programs that also benefit from customer scrutiny and acceptance. Approaching the implementation of quality assurance as a system, rather than a set of unrelated and poorly integrated processes also has provided additional benefits in areas such as the associated infrastructure support systems for training, document control, and records and data management.

Configuration Management

The need to efficiently manage and tightly control the information used to demonstrate regulatory compliance and the scientific basis underlying program positions was recognized and addressed by Sandia as a major component in the success of the WIPP Compliance Certification Application process. Navigation of legal and regulatory barriers resulted in the approval and initiation of operations for the nation's first licensed underground nuclear waste repository. A fundamental challenge of this information management process was developing consensus on the modeling parameters used for the analysis of the expected performance of the disposal system. This requirement involved interactions between those responsible for collecting and interpreting site characterization data and those using the data to perform predictive analyses. A formal program to control and document these interactions and manage the subset of data and parameters selected for use in licensing was developed and implemented by Sandia. It proved essential in maintaining traceability, consistency, and reproducibility of modeling results and conclusions. In addition to the formal control of parameters selected for licensing analyses, this system also maintained full traceability to supporting documentation. This traceability allowed the ready retrieval of associated records, provided a transparent means to evaluate the process by which conclusions were developed, and allowed regulatory judgments to be made about the adequacy of program positions.

In combination with this process of reaching consensus and managing parametric information, Sandia developed a system to manage the software codes and input datasets used to execute licensing analyses. This system was extremely valuable in providing the capability to reproduce analysis results consistently and with minimal resource expenditure, to address regulatory concerns, and to ensure stringent control of the compliance analyses. Another component of the configuration management system, which proved essential to the success of WIPP, was the development of a system to identify, prioritize, and allocate resources to critical licensing issues. Under tight deadline and budget constraints, it became critically important to focus project resources on the most important questions for which greater confidence could be established. Based on results of sensitivity and uncertainty analyses of conceptual models, areas in which uncertainty could be reduced within the boundaries of these constraints were identified and resources allocated accordingly. The resulting confidence in the system performance results paved the way for regulatory and stakeholder acceptance and for eventual approval of the proposed disposal system.

While these QA and configuration management accomplishments led to the initial certification of the WIPP repository, Sandia continues to maintain, improve, and streamline its approach to applying quality assurance to scientific endeavor within a regulatory environment and to exercise appropriate configuration management across multiple operating systems in promoting traceability, reproducibility, and retrievability of our repository science work. Taken together these approaches and disciplines provide assurance to stakeholders and regulators about the integrity of the scientific foundation on which judgments about compliance are based.

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