Overview of the Quality Assurance Program Applied to the Performance Assessment of the Waste Isolation Pilot Plant

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Abstract

The Waste Isolation Pilot Plant (WIPP) is the first deep geologic repository for radioactive waste disposal in the world to be certified by a regulator. Rigorous, nuclear-industry quality assurance (QA) requirements were imposed by the U. S. Environmental Protection Agency. As the Scientific Advisor to the U.S. Department of Energy, Sandia National Laboratories applied these standards to the experimental studies and performance assessment used in the certification process. The QA program ensured that activities conducted by SNL were traceable, transparent, reviewed, reproducible, and retrievable. As a result, regulators and stakeholders were able to evaluate and ultimately certify and accept the WIPP.

Introduction

The United States Department of Energy (DOE) received certification from the United States Environmental Protection Agency (EPA) for the first repository for defense-related, transuranic waste. The repository, the Waste Isolation Pilot Plant (WIPP), is located in southeastern New Mexico. The Sandia National Laboratories (SNL) is the Scientific Advisor to the DOE for WIPP activities. SNL is the lead organization for assessing the performance of the WIPP, with respect to federal, radioactive waste-disposal regulations. The demonstration of an adequate and well-implemented quality assurance (QA) program was a key component of these regulations. This paper provides an overview of the QA program that was applied to the SNL experimental studies and performance assessment (PA) of the WIPP.

The United States Congress passed the *Waste Isolation Pilot Plant Land Withdrawal Act* (1) in October of 1992 and directed the EPA to develop criteria for certifying the WIPP. The regulation which contains these criteria, 40 CFR Part 194, *Criteria for the Certification and Re-certification of the Waste Isolation Pilot Plant's Compliance With the 40 CFR Part 191 Disposal Regulations,* was issued in February of 1996 (2). The criteria specifically address the QA requirements to be applied to activities used to permit the WIPP for waste disposal. The QA requirements imposed by the EPA are ASME NQA-1-1989 edition (3); ASME NQA-2a-1990 addenda, part 2.7, to ASME NQA-2-1989 edition (4); and ASME NQA-3-1989 edition (5). These documents are considered to be American national standards and were developed to specify QA program requirements for nuclear facilities, nuclear facility applications, and the collection of scientific and technical information for site characterization of high-level nuclear waste repositories.

Historical Perspective

Site characterization for the WIPP began around 1975. At that time, petroleum industry drilling and good scientific practices controlled the work. As time progressed, industry standards and DOE Orders began to be incorporated into the WIPP QA program. In the early 1980's the WIPP moved towards a nuclear QA program and became increasingly more rigorous. The EPA formally imposed three nuclear-industry standards, NQA-1, NQA-2, and NQA-3, in early 1996. Prior to that, the Project had already begun to incorporate these standards into the program. They are the QA basis for the work used in certifying the WIPP.

The large span of time from first data collection to applying for the compliance certification caused not only the specific QA requirements to evolve, but also the interpretation of those requirements became more conservative. As a result, much of the early data had to go through a qualification process to meet the QA requirements stated in 40 CFR Part 194. The Project used two of the approaches described in NUREG-1298, *Qualification of Existing Data for High-Level Nuclear Waste Repositories* (6). This general technical position paper, produced by the U.S. Nuclear Regulatory Commission, provides for the qualification of data by four methods:

- Peer review,
- Corroborating data
- Confirmatory testing, and
- Demonstration of QA program equivalency.

Through the use of QA program equivalency and formal, external peer review, the Project was able to qualify all of the early data used for certification. The peer review process was based on NUREG-1297, *Peer Review for High-Level Nuclear Waste Repositories* (7).

Summary of QA Program

The SNL QA program is based on the 18 criteria found in NQA-1. These criteria address such areas as: organization, quality assurance program (including personnel training and qualification), design, procurement, document development and review, analyses and calculations, calibrations, sample management, corrective action, records, assessments, data collection, and software qualification. The most important procedures relative to the type of work performed by SNL are those that apply to data collection, analyses, and software.

Currently, the SNL QA program is described in 18 procedures and is based on the 18 criteria from NQA-1, as well as additional requirements. NQA-2 requirements for the development, procurement, maintenance, testing, and use of computer software; and NQA-3 requirements for scientific investigations, and data traceability and identification are also addressed.

QA Program Implementation

For successful implementation, strong commitment to the QA program must begin at the highest levels of management. The SNL WIPP Project Manager ensured that staff knew their responsibilities with respect to the QA program and held them accountable for fulfilling those responsibilities. Without strong leadership and management support, implementation would have been extremely difficult and may not have been successful.

In order to assist the technical staff with QA program implementation, several QA Coordinator positions were created. The Coordinators, QA professionals with technical backgrounds, were assigned to functional work groups (e.g., chemistry, hydrology, performance assessment). They assisted with the development of test and analysis plans, and reviewed many project documents such as contracts, procedures, scientific notebooks, analysis records packages, data record

packages, and reports. Dedicating these QA resources to the technical staff was a key success factor.

Another activity that contributed to successful QA implementation was a strong assessment program. Activities were independently reviewed for compliance with upper tier QA requirements. If a deficiency was found, corrective action was taken. Corrective action usually consisted of remediating the problem, conducting investigations to determine if similar instances of the deficiency had occurred, determining the impact from any deficiencies, and taking action to preclude recurrence of the deficiency. Additionally, an annual analysis was conducted on the deficiencies to uncover any trends.

Key Elements of a QA Program

During the certification process, much was learned about the benefits of an well-implemented QA program. Quality assurance practices and scientific studies support decision making in radioactive waste disposal, such as licensing or permitting. These decisions are open to public review and are largely based on documented evidence of the activities used to support the decisions.

In terms of providing defensible results, a QA program, regardless of upper-tier requirements should ensure that the activities used for decision making are:

- Traceable, i.e., the source and justification of data and other inputs can be understood.
- Transparent, i.e., the logic, calculations, and other actions can be followed.
- Reviewed, i.e., technical, QA, and managerial reviews are documented.
- Reproducible, i.e., the results can be duplicated.
- Retrievable, i.e., documentation attesting to the above four benefits can be retrieved.

Conclusion

In conclusion, SNL successfully developed and implemented a QA program that adequately met the requirements described in applicable federal regulations. Upper tier requirements were addressed in QA procedures, QA Coordinators were assigned to the technical work groups, and a rigorous, independent assessment program was deployed. These actions contributed to a QA program that ensured the activities conducted by SNL were traceable, transparent, reviewed, reproducible, and retrievable. As a result, regulators and stakeholders were able to evaluate and ultimately certify and accept the WIPP.

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Biographical sketch of author

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