U.S. DEPARTMENT OF ENERGY

EA Enterprise Assessments

Office of Enterprise Assessments

Office of Environment, Safety and Health Assessments

Independent Assessment of DOE Contractors' Management of Safety Issues

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Purpose

EA assessed DOE contractors' management of safety issues, including nuclear safety issues, to ensure that they are adequately resolved. This included assessing the management of nearly 4,000 issues by nine contractors managing nuclear facilities across the Department from fiscal year 2019 through 2023.

Additionally, EA met with representatives of the Naval Nuclear Propulsion Program, the Nuclear Regulatory Commission, the National Aeronautics and Space Administration, the Nuclear Energy Institute, Institute of Nuclear Operations, and Entergy to compare, and identify for consideration within DOE, practices for resolving issues and maintaining protections (safety) for workers, the public, and the environment.

The goals of this briefing are to present:

- The overall results of this assessment
- The methodology being used for these assessments
- Best practices and common weaknesses identified

Executive Summary

DOE contractors corrected 88% of the deficient conditions of the issues reviewed. However, inadequacies were identified in one of four issues reviewed; most of which were due to significant and extensive noncompliances with DOE policy and directives concerning the identification of issues and the timely resolution of the causes of issues. In many cases, these noncompliances allowed causes to persist and compromised nuclear and worker safety. For example:

- Six of nine assessed contractors had not determined the causes to prevent recurrence of 90 structures, systems, and components (SSCs) not being able to perform their function credited in the nuclear facility safety bases.
- Six contractors had not identified 25 adverse trends in nuclear safety programs.
- A near-miss to a fatality due to a worker being struck by a falling object was not resolved in a timely manner and two additional near-misses occurred before the causal analysis was completed for the first near-miss.

Due to the extent of these noncompliances and vague DOE requirements that contributed to them, other contractors are also likely noncompliant.

Executive Summary (continued)

Over a third of the issues concerning hazardous energy control and the conduct of operations were inadequately managed.

Additionally, from fiscal years 2019 through 2022, over 7% and 10% of the events reported to DOE are attributed to hazardous energy control issues and conduct of operations issues, respectively.

Methodology

For this assessment, EA teams used Criteria and Review Approach Document (CRAD) 30-01, Revision 1, *Contractor Assurance System* to review:

- The incorporation of issues management requirements into contractor procedures from DOE directives and consensus standards as specified in contractors' quality assurance program descriptions
- A representative sample of nuclear and worker safety issues (~400/contractor) managed over two years for specific functional areas or facilities, including:
  - Issues categorized at each level of risk/significance
  - Issues and potential improvements screened to other management systems
  - Condition reports, causal analyses, extent-of-condition reviews, corrective actions, effectiveness reviews, and closure documentation for each issue
- Procedures and meetings used to manage (categorize issues and review causal analyses, corrective actions, and closure documentation) issues
- Field office and contractor assessments and metrics of' issues management

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EA Enterprise Assessments

Assessments of Specific DOE Contractors Management of Safety Issues

EA Assessment Report	Program Office
Assessment of the Management of Nuclear Safety Issues at the Los Alamos National Laboratory - April 2019	National Nuclear Security Administration
Assessment of Mission Support and Test Services, LLC Issues Management at the Nevada National Security Site - December 2020	
Independent Assessment of the Consolidated Nuclear Security, LLC Management of Safety Issues at the Y-12 National Security Complex - December 2022	
Independent Assessment of the Management of Safety Issues at the Lawrence Livermore National Laboratory - April 2023	
Assessment of Issues Management at the Hanford Site Waste Treatment and Immobilization Plant - November 2019	Office of Environmental Management
Assessment of Issues Management at the Savannah River Site SRNS Facilities - November 2020	
Independent Assessment of the Washington River Protection Solutions, LLC Management of Safety Issues at the Hanford Site - December 2021	
Independent Assessment of the Battelle Energy Alliance, LLC Management of Safety Issues at the Idaho National Laboratory Materials and Fuel Complex - May 2022	Office of Nuclear Energy
Independent Assessment of the UT-Battelle, LLC Management of Safety Issues at the Oak Ridge National Laboratory - September 2022	Office of Science

Issue Management Requirements

10 CFR 830, *Nuclear Safety Management*, and DOE Order 414.1D, *Quality Assurance*, provide general requirements for managing issues within DOE. For example, DOE Order 414.1D requires:

- DOE contractors "Use appropriate national or international consensus standards consistent with contractual and regulatory requirements, and Secretarial Officer direction" along with requirements in the order. Accordingly, eight contractors invoked ASME consensus standard Nuclear Quality Assurance (NQA)-1, *Quality Assurance Requirements for Nuclear Facility Applications.*
- DOE approval of each contractor's graded approach "ensuring that the levels of analyses, documentation, and actions used to comply with requirements are commensurate with" relevant risk-based factors.
- Issue owners "Identify the causes of problems, and include prevention of recurrence as a part of corrective action planning."

Issue Management Requirements (continued)

DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*, provides requirements for systems that contractors use to manage issues and requires "A thorough analysis of the underlying causal factors" for higher significance findings (issues).

DOE Order 232.2A, *Occurrence Reporting and Processing of Operations Information*, provides specific requirements for managing issues resulting in an occurrence warranting reporting to DOE per criteria in DOE Order 232.2A. For example, DOE Order 232.2A states that facility managers "Determine causes and generic implications, implement corrective actions and closeout activities for reportable occurrences."

DOE Contractors Weaknesses in Flowing down Requirements

Eight of nine contractors do not require issue owners "Identify the causes of problems, and include prevention of recurrence as a part of corrective action planning" for all issues. Instead, eight contractors incorrectly graded out, or did not comply with, this requirement for approximately 77% to 99% of their issues.

Similarly, six contractors did not adequately flow down the responsibility that facility managers "Determine causes and generic implications … for reportable occurrences."

EA also identified weaknesses in the flow down of requirements from the DOE-approved quality assurance programs to the contractors' implementing procedures.

Issue Identification

DOE Policy 450.4A, *Integrated Safety Management Policy*, expects "all organizations to embrace a strong safety culture where safe performance of work and involvement of workers in all aspects of work performance are core values that are deeply, strongly, and consistently held by managers and workers."

However, working-level personnel of five contractors were not given adequate tools or training to identify issues.

Additionally, functional area experts of six contractors were not adequately looking for adverse trends in issues.

Overall, DOE contractors had an issue identified every 2 – 3 years per full-time equivalent employee.

DOE Contractor Approaches for Identifying (Tracking) Issues

DOE contractors use three basic approaches to enter issues into their management systems. Specifically, contractor personnel:

- Enter all items (e.g., observations, issues, and opportunities for improvement) into the same system and then the items are screened to the appropriate subsystem for managing the item,
- Enter items into the appropriate management system and only enter issues exceeding a threshold into the contractor's issues management system, or
- Report issues to personnel trained to enter issues into tracking systems.

Issue Identification – DOE Best Practices

A DOE contractor:

- Rewards employees identifying "Good Catches." Additionally, this contractor requires issue owners to contact employees identifying issues within seven days, if requested.
- Distributed guidance to engineers on human performance tools promoting the identification and correction of errors prior to issuance of a finished product and preventing recurrence.
- Enhanced its trending with well-defined event codes consisting of "function and process" codes that are combined with "nature of issue" codes.

Graded Approaches for Resolving Problems

DOE contractors categorize issues in four to six significance levels.

Issues are assigned to a category by: (1) the issue owner, (2) a board of functional area experts (including performance assurance personnel with expertise on the contractor's issues management processes), or (3) a performance assurance expert with oversight provided by a board.

The contractors' issues management procedures grade the rigor of the issues management tools required for issues based on the significance level selected (e.g., a root cause, apparent cause, or no causal analysis may be required).

DOE Contractor Weaknesses with Categorizing Issue Significance

Six contractors categorized up to 17% of safety issues lower in significance than required by their procedures. For several years, several of these contractors have not categorized issues at the highest significance level despite having issues that met the established criteria.

Some contractors' most rigorous (most effective or best) issues management tools were only required for issues resulting in a fatality or frequent personnel injuries.

DOE contractors often categorized issues only based on actual consequences rather potential consequences (e.g., indications of systemic weaknesses and degradations of credited controls that did not have actual consequences were categorized lower than required to prevent recurrence).

DOE Contractor Weaknesses with Issue Resolution

Inadequate or no compensatory actions were documented.

Eight contractors only required causes to be determined for 1 - 13% of their issues resulting in causes persisting and recurring safety issues.

Issue owners identified unactionable causal statements (e.g., listed cause codes) or repeated the problem statement.

Issues were assumed to be resolved by actions taken for other issues without ensuring the causes of the issues were the same.

DOE Contractor Weaknesses with Issue Resolution (continued)

DOE contractors closed some issues without taking corrective actions. For example, frequently the sole action was to perform an evaluation but with no subsequent action to implement its recommendations.

Effectiveness reviews are typically performed six months after all the corrective actions are complete which can allow weaknesses to persist unabated if actions taken early in the management of the issue are ineffective.

Often effectiveness reviews only ensure actions were completed or that similar events (e.g., in the same system and facility) have not recurred rather than determining if the causes of the issues were resolved.

DOE Contractor Best Practices for Resolving Issue Causes

Managers (other than the issue owner) verified the adequacy and continued implementation of compensatory measures for issues when corrective actions are significantly delayed.

A few DOE contractors performed more causal analyses to resolve issues while other layers of defense maintain safety.

A DOE contractor integrated the investigation, causal analysis, and corrective action development for each issue into one report. The report also identified criteria to evaluate success during an effectiveness review.

Timeliness of Issue Resolution

EA qualitatively reviewed the timeliness of the resolution of specific issues considering the significance and complexity of each issue and its corrective actions.

Overall, approximately 90% of the issues reviewed were reported and resolved in a timely manner.

However, the identification of some issues in the contractor's issues management system and the implementation of some corrective actions were delayed without justification or due to inefficient processes. A few contractors allowed some issues, including nuclear safety issues, to remain unresolved for over 10 years.

Factors Leading to Untimely Issue Identification

Six of the contractors' issues management procedures did not include expectations or requirements for prompt entry of issues into their issues management systems.

Several contractors did not enter issues identified from fact-finding activities for operational events until the fact-finding report was issued typically a month after the event occurred.

Two contractors allowed draft issues to exist for up to a year before entering them into the contractors' issues management system.

Factors Leading to Untimely Corrective Actions

Six DOE contractors did not implement corrective actions in a timely manner for up to 14% of their safety issues or allowed some with the potential for significant consequences to remain unresolved for extended periods. These delays may be attributed to the following:

- Contractors commonly take months to document the results of apparent cause analyses and over a year for root cause analyses.
- Five contractors allow issue owners to extend corrective action due dates multiple times with inadequate or no justification or additional management oversight or approval.
- Five contractors monitored the number of overdue commitments and how long they had been overdue (rather than age of open issues) or monitored the average age of issues.
- DOE Order 414.1D does not include a requirement to resolve issues in a timely manner despite inherent risk of unresolved issues on quality assurance, safety, and mission accomplishment.

DOE Best Practices for Timely Issue Resolution

A DOE contractor has information used to report and manage the recovery from an event (including the specific gaps in the implementation of requirements that led to the event) simultaneously available to use to identify and categorize the associated issues.

This contractor also provides an expected time commitment for a causal analysis of an issue based on its significance level (e.g., a one-to-two-hour analysis for minor issues and one-to-two-week or more analysis for significant or complex issues).

Documentation Retained

The issues management procedures of eight contractors require documentation supporting closure to include the problem statement; results of extent-of-condition, causal analyses, and effectiveness evaluations (if performed); and objective evidence of corrective actions taken.

They also hold their assigned issue owners responsible for reviewing documentation to ensure that the actions taken resolved the issue. For example, six contractors periodically review at least a sample of the closure documentation to ensure adequacy.

Documentation Retained

DOE Order 414.1D states that a graded approach ensures "that the level of analyses, documentation, and actions used to comply with requirements are commensurate" with several risk-based factors. However, most contractors required extensive documentation providing objective evidence of what was changed based on corrective actions for all issues irrespective of risk.

A few contractors allow issue owners to "provide clear description of the action taken" to meet the requirement of NQA-1 to verify completion of corrective actions.

Monitoring Issues Management Performance

DOE contractors use two different approaches for monitoring their performance for managing issues: (1) performance assurance divisions monitor the contractor's issues management performance, or (2) each directorate monitors its own issues management performance.

Eight of the nine contractors assessed have assurance personnel monitor issues management performance, including the management of safety issues.

DOE Contractor Strengths in Monitoring Performance

Three contractors improved their performance by self-assessing their issue management using the EA assessment methodology.

Several contractors developed processes to separately track actions that require a long time to implement and exclude them, as outliers, from overall performance metrics.

DOE Contractor Weaknesses in Monitoring Performance

Metrics and management oversight of several contractors was focused on completing actions as schedule, or rescheduled, and did not adequately monitor how long issues had remained unresolved.

A few contractors had metrics repeatedly not meeting performance goals but took inadequate action to improve performance.

Metrics were based on averages allowing cases of extremely poor performance (e.g., nuclear safety issues over 10 years old) to obscured and to persist.

DOE Contractor Best Practices for Monitoring Performance

A DOE contractor requires an independent team to review at least half of the causal analyses each month. This independent team scores the causal analyses for tracking and improving analyses and correcting low-scoring analyses. Each of the 12 sections of the causal analysis report is graded against a bulleted list of criteria, with the most weight given to the causal analysis results and the corrective actions plan.

A couple DOE contractors readily display and monitor the distribution of issue significance levels to detect changes in their issues management implementation.

Wrap-up

DOE contractors corrected 88% of the deficient conditions of the issues reviewed. However, significant and extensive noncompliances with DOE policy and directives allowed, in many cases, causes to persist and compromise nuclear and worker safety.

Due to the extent of these noncompliances and vague DOE requirements that contributed to them, other contractors are also likely noncompliant.

The results (meeting minutes) of a study benchmarking the management of safety issues are being documented.

EA's overall assessment of DOE contractors' management of safety issues will include:

- Common strengths and weaknesses and best practices demonstrated by DOE contractors
- Different approaches and practices identified during the benchmarking for consideration across DOE.
- Recommendations to improve the management of safety issues

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Backup Slides

Requirements

We assess implementation of issues management requirements contractors commit to in their quality assurance plans. These requirements include the following:

10 CFR 830 – *Nuclear Safety Management*:

§830.121 Quality Assurance Program (QAP).

(a) Contractors conducting activities, including providing items or services, that affect, or may affect, the nuclear safety of DOE nuclear facilities must conduct work in accordance with the Quality Assurance criteria in §830.122.

(b) ….

(c) The QAP must:

(1) Describe how the quality assurance criteria of §830.122 are satisfied.

(2) Integrate the quality assurance criteria with the Safety Management System, or describe how the quality assurance criteria apply to the Safety Management System.

(3) Use voluntary consensus standards in its development and implementation, where practicable and consistent with contractual and regulatory requirements, and identify the standards used.

Requirements (continued)

10 CFR 830 – *Nuclear Safety Management*:

§830.122 Quality assurance criteria. The QAP must address the following management, performance, and assessment criteria:

…

(c) Criterion 3—Management/Quality Improvement.

(1) Establish and implement processes to detect and prevent quality problems.

(2) Identify, control, and correct items, services, and processes that do not meet established requirements.

(3) Identify the causes of problems and work to prevent recurrence as a part of correcting the problem.

(4) Review item characteristics, process implementation, and other quality-related information to identify items, services, and processes needing improvement.

…

Requirements (continued)

DOE Order 414.1D, Attachment 1 – Contractor Requirements Document:

1. QUALITY ASSURANCE PROGRAM DEVELOPMENT AND IMPLEMENTATION. …The contractor, using a graded approach, must develop a QAP and conduct work in accordance with the approved QAP that meets the requirements of this CRD. The QAP must do the following:

   a. Describe the graded approach used in the QAP.

   b. Implement QA criteria as defined in Attachment 2, as well as the requirements in Attachment 3 for all facilities, and the requirements in Attachment 4 for nuclear facilities, and describe how the criteria/requirements are met, using the documented graded approach.

      Note: This requires that all software meet applicable QA requirements in Attachment 2, using a graded approach.

   c. Use appropriate national or international consensus standards consistent with contractual and regulatory requirements, and Secretarial Officer direction. Clearly identify which standards, or parts of the standards, are used. When standards do not fully address the CRD requirements, the gaps must be addressed in the QAP. Select and document the appropriate choice below.

Requirements (continued)

DOE Order 414.1D – *Quality Assurance*:

7.h. Graded Approach. The process of ensuring that the levels of analyses, documentation, and actions used to comply with requirements are commensurate with:

(1) the relative importance to safety, safeguards, and security;

(2) the magnitude of any hazard involved;

(3) the life-cycle stage of a facility or item;

(4) the programmatic mission of a facility;

(5) the particular characteristics of a facility or item;

(6) the relative importance to radiological and nonradiological hazards; and,

(7) any other relevant factors. (10 C.F.R. § 830.3)

Requirements (continued)

American Society of Mechanical Engineers (ASME) consensus standard Nuclear Quality Assurance (NQA)-1-2008, with the NQA-1a 2009 addenda, *Quality Assurance Requirements for Nuclear Facility Applications*:

> *condition adverse to quality*: an all-inclusive term used in reference to any of the following: failures, malfunctions, deficiencies, defective items, and nonconformances. A significant condition adverse to quality is one that, if uncorrected, could have a serious effect on safety or operability.
>
> **PART 1, REQUIREMENT 16. Corrective Action**
>
> **100 Basic**
>
> Conditions adverse to quality shall be identified promptly and corrected as soon as practicable. In the case of a significant condition adverse to quality, the cause of the condition shall be determined and corrective action taken to preclude recurrence. The identification, cause, and corrective action for significant conditions adverse to quality shall be documented and reported to appropriate levels of management. Completion of corrective actions shall be verified.

Requirements (continued)

American Society of Mechanical Engineers (ASME) consensus standard Nuclear Quality Assurance (NQA)-1-2008, with the NQA-1a 2009 addenda, *Quality Assurance Requirements for Nuclear Facility Applications*:

PART II, SUBPART 2.18. Quality Assurance Requirements for Maintenance of Nuclear Facilities

400 CORRECTIVE MAINTENANCE

403.2 Engineering Evaluation. For failures identified that could have serious effect on safety or operability, an engineering evaluation shall be performed and documented to substantiate or revise the failure assessment and corrective action planning.

Requirements (continued)

DOE Order 232.2A – *Occurrence Reporting and Processing of Operations Information*, Attachment 1 – *Contractor Requirements Document*:

4. RESPONSIBILITIES.

   Facility Managers (as defined in this Order; see definition in Attachment 5). In addition to other requirements prescribed in this Order, Facility Managers are responsible for the following:

   a. Ensure that procedures implemented for notification and reporting meet the requirements of this Order.

   b. Determine causes and generic implications, and implement corrective actions and closeout activities for reportable occurrences.

   c. Review and assess reportable occurrence information for their facilities to assess generic implications and corrective action implementation, closeout, and effectiveness, as required; and to ensure that facility personnel involved in these operations perform the related functions.