Department of Energy
Washington, DC 20585

April 24, 2024

MEMORANDUM FOR DISTRIBUTION

FROM: JOHN E. DUPUY
DIRECTOR
OFFICE OF ENTERPRISE ASSESSMENTS

SUBJECT: *Independent Assessment of U.S. Department of Energy Contractors' Management of Safety Issues – April 2024*

The U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments, within the independent Office of Enterprise Assessments (EA), assessed DOE contractors' management of safety issues, including nuclear safety issues, to ensure that they are adequately resolved. The assessment was conducted fiscal year 2019 through 2023, and included 9 onsite assessments at locations supporting operations within existing nuclear facilities. A total of nearly 4,000 issues from contractors of the DOE Offices of Environmental Management, Science, and Nuclear Energy, and the National Nuclear Security Administration were evaluated. EA also met with representatives of several Federal agencies to compare, and identify for consideration within DOE, other practices for resolving safety issues.

Although the assessed contractors adequately managed three of every four reviewed issues, they demonstrated significant weaknesses impeding the identification of precursors to systematic issues, the identification and resolution of causes of issues, and the timely resolution of issues, especially of more complex or near misses to significant safety issues. In many cases these weaknesses led to compromises in hazard controls for worker safety and the defense-in-depth approach for nuclear safety, and represented missed opportunities to strengthen the Department's safety performance.

In the five years since EA began this targeted assessment campaign, the Department has taken significant steps to improve performance in the management of issues. Each of the nine sites assessed has implemented corrective actions in response to weaknesses identified. It is also important to note, while all DOE/NNSA sites must comply with applicable requirements, each program office may use a tailored approach for the management of issues.

The attached report provides recommendations to resolve the likely causes of the observed weaknesses based on the strengths and best practices demonstrated by assessed contractors and a few practices used by benchmarked Federal agencies. These recommendations are provided to assist the department in enabling its mission through

continuous improvement. A robust issues management program that consistently identifies and corrects the causes of issues will assist in preventing unnecessary rework and delays in critical mission-related work.

Further details on individual site/facility reports are available at the following link: https://www.energy.gov/ea/listings/assessment-documents

If you have any questions, comments, or feedback, please contact Kevin Kilp, Director, Office of Environment, Safety and Health Assessments, at (301) 903-5392. Alternatively, your staff may contact David Young, Deputy Director, Office of Environment, Safety and Health Assessments, at (202) 365-6682.

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Independent Assessment of U.S. Department of Energy Contractors' Management of Safety Issues

April 2024

Office of Enterprise Assessments
U.S. Department of Energy

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Acronyms

BEA	Battelle Energy Alliance, LLC
BNI	Bechtel National, Inc.
CFR	Code of Federal Regulations
CNS	Consolidated Nuclear Security, LLC
CRAD	Criteria and Review Approach Document
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
EHSS	Office of Environment, Health, Safety, and Security
GAO	Government Accountability Office
INPO	Institute of Nuclear Power Operations
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LLNS	Lawrence Livermore National Security, LLC
MSTS	Mission Support and Test Services, LLC
NASA	National Aeronautics and Space Administration
NNPP	Naval Nuclear Propulsion Program
NNSA	National Nuclear Security Administration
NQA	Nuclear Quality Assurance
NRC	Nuclear Regulatory Commission
OIG	Office of the Inspector General
SRNS	Savannah River Nuclear Solutions, LLC
SSCs	Structures, Systems, and Components
UT-Battelle	University of Tennessee and Battelle, LLC
WRPS	Washington River Protection Solutions, LLC

INDEPENDENT ASSESSMENT OF U.S. DEPARTMENT OF ENERGY CONTRACTORS' MANAGEMENT OF SAFETY ISSUES

Executive Summary

The U.S. Department of Energy (DOE) Office of Environment, Safety, and Health Assessments, within the independent Office of Enterprise Assessments (EA), assessed from fiscal year 2019 to 2023 DOE contractors' management of safety issues, including nuclear safety issues, to ensure that they are adequately resolved. Accordingly, EA assessed the management of safety issues by contractors of the DOE Offices of Environmental Management, Science, and Nuclear Energy, and the National Nuclear Security Administration. This included assessing the management of nearly 4,000 issues by 9 contractors managing nuclear facilities. Additionally, EA met with representatives of several Federal agencies to compare, and identify for consideration within DOE, other practices for resolving safety issues.

Overall, the assessed contractors adequately managed approximately three of every four reviewed issues but less than two thirds of the hazardous energy control and conduct of operations issues. Issues that were inadequately managed tended to be more complex or near misses to significant safety issues. The following significant and extensive weaknesses allowed, in many cases, compromises in hazard controls for worker safety and nuclear safety, as well as the "defense-in-depth" approach for nuclear safety, to develop and to persist unnecessarily for extended periods:

- **Inadequate Involvement in Issue Identification**: Working-level (non-supervisory) personnel of five contractors identified no or only a small portion of the issues, and most functional area experts of six contractors were not looking for adverse trends in issues as expected by DOE policy.
- **Infrequent Identification and Correction of the Causes of Issues**: Eight of the 9 assessed contractors determined the causes of only 1 to 23% of their reviewed issues. Most contractors rarely used their most rigorous and effective tools to resolve issues.
- **Untimely Issue Resolution**: Six contractors did not resolve up to 14% of their safety issues in a timely manner. Issues with fire protection systems at two sites were not resolved for over 10 years.

Several other weaknesses also impeded the resolution of safety issues, including:

- Common misunderstandings of vague requirements in DOE directives
- Contractor personnel identifying hundreds of noncompliances as optional opportunities for improvement, lessons learned, or suggestions, instead of issues requiring resolution
- Contractors typically documenting apparent cause and root cause analyses months to more than a year after the issues were identified, delaying corrective actions
- Five contractors inadequately monitoring the age of open issues.

The assessed contractors demonstrated many strengths and 18 best practices that can be the basis for improving the management of safety issues across the Department, including the following:

- The contractors self-identified approximately 80% or more of their issues, demonstrating their willingness to identify issues. A few contractors demonstrated practices that significantly increased the identification of issues by working-level personnel and their identification of adverse trends.
- A few contractors demonstrated that determining the causes of more issues leads to more effective corrective actions, preventing recurrence and reducing the significance of subsequent safety issues.
- Four contractors demonstrated best practices for monitoring and/or self-assessing the implementation of their issues management processes, resulting in improved performance.

Many similarities exist in the management of safety issues by DOE and the benchmarked Federal agencies. A few practices used by these Federal agencies may significantly improve DOE's performance:

- Other Federal agencies have a much lower threshold for entries into issues management systems, resulting in substantially more issues being identified, corrected and/or trended.
- Other Federal agencies perform significantly more causal analyses and typically complete them within a day to two months after issue identification.
- Other Federal agencies set more aggressive goals for the completion of corrective actions (e.g., within six months of identifying the issue), and due date extensions are escalated to higher levels of management for approval.
- Naval Nuclear Propulsion Program executives periodically review the significance of identified issues and revise, as necessary, criteria for headquarters' review of specific issues or events to ensure that weaknesses are resolved before more significant events occur.

In summary, although the assessed contractors adequately managed three of every four reviewed issues, they demonstrated significant weaknesses impeding the identification of precursors to systematic issues, the identification and resolution of causes of issues, and the timely resolution of issues, especially of more complex or near misses to significant safety issues. These weaknesses allowed, in many cases, compromises in hazard controls for worker safety and nuclear safety, as well as the "defense-in-depth" approach for nuclear safety, to develop and to persist unnecessarily for extended periods. Given the broad extent of these weaknesses amongst the assessed contractors, as well as common misunderstandings of vague requirements in DOE directives that contributed to them, contractors that were not assessed may also be susceptible to these weaknesses. Unresolved, the weaknesses increase the likelihood of safety issues with more significant consequences.

Recommendations

As summarized below and detailed in this report, EA identified recommendations to resolve the likely causes of the observed weaknesses. Many of these recommendations would also help to correct the causes of issues in other areas across DOE to prevent rework and delays due to recurring issues that can impact missions.

- The DOE Office of Environment, Health, Safety, and Security, as the lead for developing and maintaining DOE safety related directives, should ensure that DOE policy directives and orders adequately "[e]stablish high level expectations" and "clearly and concisely specify the goals and requirements that must be met" for the timely identification and correction of issues, adverse trends, and their causes using a graded approach considering the risk of safety issues.
- DOE contractors should share detailed information on practices that encourage and facilitate the earlier identification of issues by more working-level personnel and of adverse trends during outreach activities such as Energy Facility Contractors Group meetings.
- Contractors, in consultation with their DOE line management, should establish performance objectives for achieving yearly improvements in their timely identification and correction of issues, adverse trends, and their causes, and for increasing their use of simple, informal causal analysis techniques and more rigorous issues management tools. Detailed recommendations to achieve these objectives are included in this report.
- Contractors and DOE field/site offices should assess the contractor's issues management, especially the contractor's management of conduct of operations and hazardous energy control issues, by periodically reviewing representative samples of issues in high-risk areas to ensure that the required rigor is used to manage (resolve) issues and their causes in a timely manner.

INDEPENDENT ASSESSMENT OF U.S. DEPARTMENT OF ENERGY CONTRACTORS' MANAGEMENT OF SAFETY ISSUES

1.0 INTRODUCTION

From fiscal year 2019 through 2023, the U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments, within the independent Office of Enterprise Assessments (EA), assessed the DOE requirements for issues management and the corresponding processes and practices used by DOE contractors to manage (correct) safety issues, including nuclear safety issues. Accordingly, EA assessed the management of safety issues by contractors of the DOE Offices of Environmental Management, Science, and Nuclear Energy, and the National Nuclear Security Administration (NNSA). EA also met with representatives of the Naval Nuclear Propulsion Program (NNPP), the Nuclear Regulatory Commission (NRC), and the National Aeronautics and Space Administration (NASA) to discuss their processes and practices for resolving issues and maintaining protections (safety) for workers, the public, and the environment. Representatives of the Nuclear Energy Institute (NEI), the Institute of Nuclear Power Operations (INPO), and Entergy Corporation also elected to participate in this meeting because they actively support the development and maintenance of corrective action programs for nuclear power plants and utilities. Based on an analysis of the results of these activities, this report identifies overall strengths and weaknesses, best practices, and recommendations to improve performance throughout the Department.

2.0 METHODOLOGY

EA manages the DOE's independent oversight program. This program is designed to enhance DOE safety and security programs by providing the Secretary and Deputy Secretary of Energy, Under Secretaries of Energy, DOE managers, senior contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements, as well as the effectiveness of DOE and contractor line management performance, risk management in safety and security, and other critical functions as directed by the Secretary. DOE Order 227.1A, *Independent Oversight Program*, describes and governs the DOE independent oversight program. EA implements the program through a comprehensive set of internal protocols and assessment guides.

EA assessed the management of safety issues by nine contractors responsible for managing high hazard nuclear facilities to obtain a representative sample of how safety issues, including nuclear safety issues, are resolved. The EA assessment teams were comprised of experts that assessed the management of a representative sample of issues within their functional area of expertise that are key to nuclear and worker safety. In total, EA teams reviewed 3,898 issues. The findings and deficiencies that EA identified during these assessments were documented in separate reports for resolution per DOE Order 227.1A, along with best practices demonstrated by the contractors.

Appendix A lists the contributors to this assessment, the members of the Quality Review Board, and the responsible EA management. Appendix B details the scope of this review; the policies, requirements, and guidance applicable to issues management; the analysis methodology; and a comparison with other reviews of DOE's issues management performance. Appendix B also includes a table of the nine assessed contractors as well as the associated EA assessment reports. Appendix C provides a detailed analysis of the management of safety issues within specific functional areas reviewed.

3.0 RESULTS

Overall, the assessed contractors adequately managed approximately three of every four reviewed issues but less than two thirds of the hazardous energy control and conduct of operations issues. Issues inadequately managed tended to be more complex or near misses to significant safety issues. EA identified 21 findings, and 79 deficiencies that revealed, as discussed in detail in the following subsections, significant and extensive weaknesses in the involvement of some contractor personnel in issue identification, the identification and correction of the causes of issues, and the timely resolution of issues. In many cases, these weaknesses allowed compromises in hazard controls for worker safety and nuclear safety, as well as the "defense-in-depth" approach to hazard control required by DOE Policy 420.1, *Department of Energy Nuclear Safety Policy*, to develop and to persist unresolved for extended periods. For example:

- A DOE contractor categorized the significance of a near miss to fatal injury from a falling object lower than required by the contractor's procedures to preclude recurrence, resulting in less rigorous and less effective tools being used to identify and ensure that the causes were corrected. Subsequently, two additional near misses to fatalities from falling objects occurred in the next three months, while contractor personnel performed only an apparent cause analysis rather than a root cause analysis, which is required for a near miss to fatality. The contractor similarly categorized the significance of the two additional near misses lower than required by the contractor's procedure. The two additional near misses could have been precluded by appropriately categorizing the first near miss and performing timely causal analysis and corrective actions.
- Six contractors had not identified or resolved 25 adverse trends in nuclear safety management programs. These adverse trends indicate potential systemic weaknesses or extensive degradations in the implementation of safety management programs cited in the nuclear facility safety bases. Undetected, and therefore unresolved, systemic weaknesses and degradations in safety management programs reduce the layers of defense that ensure nuclear safety.
- Four contractors incorrectly identified hundreds of noncompliances and deficiencies in meeting nuclear safety requirements as optional opportunities for improvement, lessons learned, or suggestions rather than issues that are required to be resolved. In many cases, no action or untimely action was taken for these issues. In two cases, extensive noncompliances and broad performance issues with the contractors' nuclear qualification programs remained unresolved for years without the contractors determining whether work performed by potentially unqualified workers had impacted nuclear safety or determining and correcting the causes of the noncompliances and performance issues.
- Six 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. DOE requires the causes of credited SSC failures to be corrected so the safety functions will be fulfilled as needed for the safety of operations in the nuclear facilities.

Given the broad extent of the significant weaknesses identified, as well as common misunderstandings of the vague requirements in DOE directives that contributed to them, other contractors which were not assessed may also be susceptible to these weaknesses.

Sections 3.1 through 3.7 of this report discuss the common strengths and weaknesses and best practices that EA identified, grouped into the following functions for issues management: the flowdown of issues management requirements, identification of issues, categorization of issue significance, resolution of issues using a graded approach, timely resolution of issues, closure documentation, and monitoring of issues management performance. Although similarities exist in the management of safety issues by DOE

and other Federal agencies, these sections also summarize, for consideration across DOE, different approaches and practices for managing safety issues identified via a benchmarking study. Section 3.8 summarizes the results of the analysis in appendix C of the management of a representative sample of safety issues within different functional areas. This analysis is provided to help DOE organizations prioritize additional actions to improve the management of safety issues as needed.

Recommendations to resolve the likely causes of the significant weaknesses in the involvement in issue identification, the identification and correction of the causes of issues, and the timely resolution of issues are grouped in section 4.1. These include specific recommendations for DOE contractors, field offices, program offices, and the office responsible for DOE safety-related directives (i.e., the DOE Office of Environment, Health, Safety, and Security (EHSS)). Other recommendations to further improve the management of safety issues based on more efficient practices and common weaknesses are in section 4.2. Based on the analysis in section 3.8 and appendix C, recommendations to improve the management of conduct of operations and hazardous energy control issues are in section 4.3.

3.1 Flowdown of Issues Management Requirements and Expectations

This portion of the assessment evaluates how the nine assessed contractors invoked requirements from applicable consensus standards and DOE directives in their issues management processes. This portion of the assessment also evaluates the adequacy of DOE directives and policies.

In general, DOE appropriately invokes applicable directives via contracts, and the DOE program offices or field/site offices approve each contractors' quality assurance program describing, albeit sometimes inadequately as discussed below, how DOE requirements are flowed down into contractor procedures.

Strengths

All assessed DOE contracts invoked applicable directives for issues management. The DOE Office of Science invoked its clause for contractor assurance systems in the University of Tennessee and Battelle, LLC (UT-Battelle) contract rather than DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*.

Eight contractors used appropriate consensus standards for issues management. For example, these contractors invoked the requirements of the American Society of Mechanical Engineers consensus standard Nuclear Quality Assurance (NQA)-1-2008, *Quality Assurance Requirements for Nuclear Facility Applications*, with the NQA-1a-2009 addenda, or subsequent revisions of NQA-1 (hereafter referred to as NQA-1) for nuclear safety issues. Use of appropriate consensus standards incorporates requirements considered vital by consensus committees in specific fields of work or research.

Weaknesses

Although DOE Policy 450.4A, *Integrated Safety Management Policy*, provides expectations on the "involvement of workers in all aspects of work performance," the expectation in DOE Policy 450.4A "[t]o achieve this Policy, effective safety requirements and goals are established" has not been met because, as discussed in more detail in section 3.2, a requirement for employee involvement in issue identification has not been established in DOE directives.

Neither DOE Policy 450.4A nor DOE Policy 226.2, *Policy for Federal Oversight and Contractor Assurance Systems*, clearly "[e]stablish high level expectations" and "direction for Orders, Guides, and Technical Standards," as discussed in DOE Order 251.1D, *Departmental Directives Program*, for ensuring safety by resolving safety issues and their causes before weaknesses build or accumulate and increase the

likelihood of more significant consequences to safety and the Department's mission. This likely contributed to the misunderstandings in requirements of DOE directives concerning the identification of the causes of issues and recurrence control discussed below and to the weaknesses in the implementation of requirements concerning the timely resolution of issues discussed in section 3.5. As discussed in sections 3.3 and 3.4, a few DOE contractors and other Federal agencies more frequently use more rigorous issues management tools, such as causal analyses, to resolve issues of lower significance and to prevent more significant safety issues or events from occurring.

The requirements of criterion 3 of DOE Order 414.1D, *Quality Assurance*, to "[i]dentify the causes of problems, and include prevention of recurrence as a part of corrective action planning" are commonly misunderstood and inconsistently flowed down into programs and procedures by DOE contractors. Eight contractors graded out these requirements for 77% to 99% of their issues. Only Consolidated Nuclear Security, LLC requires all its issue owners to at least use their judgment to determine "what the causes are (not the problem, but the causes of the problem)" and to develop an action plan to "rectify the issue and significantly reduce the likelihood of recurrence." The following contributed to the misunderstandings of the requirements of this criterion:

- DOE Guide 414.1-2B, *Quality Assurance Program Guide*, states that the graded approach cannot be used to "grade quality assurance criterion to zero," and "[e]ven in the least stringent application, compliance with applicable portions of stated requirements is mandatory unless an exemption is approved through an appropriate process." However, DOE Guide 414.1-2B only contains guidance, not requirements, and eight contractors implement a graded approach that only requires formal, documented causal analyses for more significant issues. These contractors allow but do not require or explicitly expect issue owners to determine the causes of less significant problems.
- DOE Order 414.1D does not preclude grading a quality assurance criterion to zero (grading it out), but directs the use of NQA-1 or an equivalent consensus standard for nuclear facilities. Requirement 16 of NQA-1 states that "[i]n the case of a significant condition adverse to quality, the cause shall be determined and corrective action taken to preclude recurrence" but does not require the cause of a condition adverse to quality to be determined. However, guidance in table 400, part IV, subpart 4.5 of NQA-1 states that the requirements in NQA-1 only partially meet the requirements of DOE Order 414.1D and that a DOE quality assurance program "will need to extend the requirements of NQA-1 to [determine causes for] ALL conditions adverse to quality not just significant conditions adverse to quality."
- Nearly all the DOE program offices and field offices approved quality assurance programs proposed by their respective contractors that graded out requirements of criterion 3 of DOE Order 414.1D, demonstrating that the guidance in DOE Guide 414.1-2B and part IV of NQA-1 is insufficient to ensure that the criteria in DOE Order 414.1D are not graded out.
- DOE Order 226.1B requires a "thorough analysis of the underlying causal factors" only for higher significance findings (issues). Although DOE Order 226.1B does not preclude determining causes for less significant issues using a graded approach, discussing the requirement to determine causes only of higher significance issues is not consistent with DOE quality assurance requirements and can be misleading to DOE contractors.

Similarly, the requirements and responsibilities in DOE Order 232.2A, *Occurrence Reporting and Processing of Operations Information*, for issues resulting in reportable occurrences, are commonly misunderstood. As confirmed with EHSS, DOE contractors often misinterpret the requirement in the reporting model in DOE Order 232.2A, attachment 4 that "[a]ny identified causes and corrective actions must be included in the final report" sent to DOE for high level occurrences as an allowance to not determine causes for other occurrences for which a final report is not sent to DOE. As a result, six contractors did not adequately flow down the responsibility in DOE Order 232.2A that facility managers

"[d]etermine causes and generic implications … for reportable occurrences." Approximately 99% of the occurrences reported by the assessed DOE contractors were low or informational level reports. The causes for many of these occurrences were not identified or corrected, resulting in repeat occurrences such as recurring failures of SSCs credited in the safety bases for nuclear facilities. Additionally, the term "generic implications" is not defined in DOE Order 232.2A, and its relationship with the extent of a condition is unclear.

EA also identified the following weaknesses in the flowdown of requirements from the contractor-developed, DOE-approved quality assurance programs to the contractors' implementing procedures. These weaknesses can impede DOE oversight of issues management and other aspects of quality assurance.

- DOE Order 414.1D, attachment 1, paragraphs 1.a and 1.b, state, respectively, that the DOE-approved quality assurance program must "[d]escribe the graded approach used in the [quality assurance program]" and must "[i]mplement [quality assurance] criteria as defined in Attachment 2, … and describe how the criteria/requirements are met, using the documented graded approach." However, contrary to these requirements, four of the nine contractor-developed, DOE-approved quality assurance programs:
    - Referenced a graded approach from a document not approved by DOE.
    - Inadequately described how the criteria were to be met by the contractor. For example, some contractors repeated the definition of a graded approach in DOE Order 414.1D without specifying how the risk-based criteria would be applied or related to items, services, or processes managed by the contractor.

  Inadequately establishing the graded approach or key requirements in the quality assurance program document for how the criteria in DOE Order 414.1D will be implemented inappropriately bypasses DOE approval of requirements that contractors must flow down, maintain, and implement via their procedures.
- In general, DOE Order 414.1D requires DOE contractors to "include prevention of recurrence as part of corrective action planning." However, DOE Order 414.1D also requires the use of NQA-1 for nuclear facilities. Requirement 16 of NQA-1 states that "[i]n the case of a significant condition adverse to quality, the cause shall be determined and corrective action taken to preclude recurrence." Despite invoking NQA-1 for nuclear facilities, nearly all the assessed DOE contractors state in their quality assurance programs that they will take corrective actions to prevent recurrence of nuclear safety issues rather than preclude recurrence. In some cases, this allowed issue owners to take less enduring actions that do not correct the cause to preclude the recurrence of significant conditions adverse to quality (e.g., briefing personnel on recent lessons learned rather than making necessary changes to training provided to personnel).
- Additionally, EA identified inconsistencies between the approved quality assurance program and implementing procedures of six contractors that had not been identified by contractor or field/site office assessments. For example, the quality assurance program stated that causes would be determined for issues, but the contractor's issues management procedure did not require causes to be determined or corrected for less significant issues.

Conclusions for the Flowdown of Issues Management Requirements and Expectations

Eight of the nine assessed contractors invoked appropriate consensus standards via their approved quality assurance programs to supplement DOE requirements for managing issues. However, requirements of criterion 3 of DOE Order 414.1D to "[i]dentify the causes of problems, and include prevention of recurrence as a part of corrective action planning" are commonly misunderstood and inconsistently flowed down by DOE contractors. Eight contractors graded out these requirements for 77% to 99% of

their issues. Similarly, the requirements and responsibilities in DOE Order 232.2A for issues resulting in reportable occurrences are commonly misunderstood. Six contractors did not require facility managers to determine causes for reportable occurrences as required by DOE Order 232.2A. Insufficient expectations in DOE Policy 450.4A and DOE Policy 226.2 and vague requirements in DOE Orders 226.1A, 232.2A, and 414.1D are likely contributing to these misunderstandings and the untimely resolution of issues. EA also identified several weaknesses in the DOE-approved quality assurance programs and the flowdown of requirements from the contractor-developed, DOE-approved quality assurance program to the implementing procedures of six contractors.

Different Approaches and Practices Identified During the Benchmarking Study

The NNPP and the NRC allow some issues (e.g., conditions adverse to quality that are not significant) to be corrected and/or trended without determining the causes or actions to preclude recurrence.

Personnel at nuclear power plants and utilities develop corrective actions per NQA-1 to preclude recurrence of issues.

Consistent with the responsibilities in DOE Order 232.2A that are applicable to DOE, the NNPP and the NRC both require the causes and their corresponding corrective actions to be determined for all events (a.k.a., occurrences or incidents) that are required to be reported to NNPP and NRC headquarters.

3.2 Identification of Issues

This portion of the assessment examined whether issues and trends are identified as required.

Overall, DOE contractors use three basic approaches to identify issues: (1) 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, (2) contractor personnel are expected to enter items into the appropriate management system and only enter issues exceeding a threshold into the contractor's issues management system, or (3) contractor personnel are expected to report issues to personnel trained to enter new issues into tracking systems.

Strengths

The nine assessed contractors each entered 1,000 – 2,100 issues per year and self-identified approximately 80% or more of these issues, demonstrating their willingness to identify issues.

For seven contractors, their computer system or database for managing issues is a module in the computer system used for other contractor assurance activities such as assessments, inspections, audits, management observations of ongoing operations, and event/occurrence notifications. This integration facilitates entering and/or linking issues (e.g., findings and noncompliances) identified during these activities into the contractor's issues management system.

Quality assurance personnel of six contractors developed processes and have capabilities in their issues management systems that facilitate analyzing issues for trends, which provides the opportunity to identify corrective actions for trends in a timely manner and prevent additional safety issues from developing.

Savannah River Nuclear Solutions, LLC (SRNS) and Washington River Protection Solutions, LLC (WRPS) have functional area experts and line managers periodically assess the performance of the processes and work under their areas of cognizance to identify trends.

WRPS and Mission Support and Test Services, LLC (MSTS) have working-level (non-supervisory) personnel identifying a larger percentage of issues than at other sites. This results in the identification of a broader set of issues for resolution before they can manifest into more severe consequences.

Weaknesses

For five contractors, only a small portion of their issues were identified by working-level personnel, allowing precursors to persist undetected and develop into more significant issues (e.g., reportable occurrences with more significant consequences, like personnel injuries). This weakness may be attributed to the following:

- DOE Order 414.1D does not include an explicit requirement for all contractor personnel to enter or identify issues.
- Three contractors provided little or no training or procedural direction to working-level personnel on how to enter issues into the contractor's issues management system; less than 5% of their issues are being identified by working-level personnel.
- Some contractors had not established methods for working-level personnel to easily enter issues into their issues management system. For example, at one site, personnel could only enter issues after taking detailed training over several days on how to use all the functionality in the issues management system. At other sites, contractors had not developed a method for working-level personnel who did not commonly access the contractor's intranet to enter issues into the issues management system. Three contractors only allowed designated personnel to make new entries, which can deter working-level personnel from identifying safety issues and concerns. Additionally, the designated personnel can filter issues and concerns that working-level personnel identify, without the appropriate review and oversight.

Personnel of four contractors incorrectly identified hundreds of noncompliances and deficiencies found during self-assessments, exercises, and reviews of emergency response actions as optional opportunities for improvement, lessons learned, or suggestions rather than issues that are required to be resolved. In many cases, no action or untimely action was taken for these issues. Similarly, five contractors did not require issues identified during human performance reviews, field observations, and periodic monitoring (via metrics) of performance within contractor organizations (e.g., divisions) or functional areas to be consistently entered into their issues management system.

Contractors did not identify 25 adverse trends of issues in their areas of cognizance that were identified by EA during its assessments. This can be attributed to functional area experts being inadequately involved in the identification of trends in issues. Instead, the functional area experts relied on performance assurance personnel to identify statistically significant increases in the number of issues. However, performance assurance personnel often lack the expertise to identify precursors, indirectly related issues, and indications of systemic weaknesses before they accumulate into statistically significant numbers of issues or self-revealing events with more significant consequences.

Best Practices

- WRPS recognizes and rewards employees who identify issues considered to be a "Good Catch." WRPS also requires the manager responsible for the issue to contact the employee identifying the issue within seven days, if requested by the employee. Both practices led to working-level personnel identifying more issues than at other sites.

- A WRPS Engineering Survival Guide distributed to its engineers provides a comprehensive collection of human performance enhancement tools promoting the identification and correction of errors prior to issuance of a finished product to enhance their ability to prevent error reoccurrence.
- Bechtel National, Inc. (BNI) trending of issues at the Waste Treatment and Immobilization Plant is enhanced through the use of well-defined event codes consisting of "function and process" codes that are combined with "nature of issue" codes for more effective binning of issues. The BNI Contractor Assurance Group has dedicated resources that proactively identify trends in issues monthly using event and cause codes and keyword searches.

Conclusions for Identification of Issues

The nine assessed contractors demonstrated a willingness to identify issues, and some contractors have issues being identified by all personnel. However, working-level personnel of five contractors only identified a small portion of the issues, and functional area experts of six contractors are inadequately involved in identification of trends, allowing precursors to remain unresolved until more statistically significant trends developed or until the weaknesses became self-revealing events with more significant consequences. A few contractors demonstrated strengths and best practices that improved their ability to identify issues, including adverse trends.

Different Approaches and Practices Identified During the Benchmarking Study

The threshold for entries in the issues management systems used by the NNPP, NRC, NASA, NEI, INPO, and Entergy are much lower than that of DOE contractors. For example, administrative (pen-and-ink) changes to work instructions and single instances of noncompliances with procedures are entered into issues management systems of the other organizations and Federal agencies. The lower thresholds significantly increase the number of issues entered into issues management systems for correction and/or trending. For example, a typical nuclear power plant staffed by 600 to 1,000 personnel would identify approximately 12,000 issues per year. Participants in the benchmarking study stated that the lower threshold and higher number of issues managed can significantly increase the engagement, familiarity, and comfort of working-level personnel with issues management systems. The NNPP, NEI, and Entergy also provide all employees training beyond issue identification (e.g., basic elements of causal analyses and attributes of effective corrective actions) to improve their engagement in the resolution of issues.

NASA includes adverse trends in issues in its risk management strategy by evaluating the potential consequences (risk) of recurring or repetitive issues on mission objectives, whereas programmatic risks are commonly managed separately from issues. Annually, NASA also identifies and publishes the top human factors that led to problems in the previous year to improve performance.

3.3 Categorization of Issue Significance

This portion of the assessment examined whether issue significance is adequately categorized to invoke the applicable issues management requirements per each contractor's DOE-approved graded approach.

In general, the nine assessed contractors established four to six categories for issues. Issues are assigned to a category based on significance 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 of functional area experts. The contractors' issues management procedures vary the rigor (e.g., the extent and formality of the analysis) of the issues management tools (e.g., root cause, apparent cause analysis, or no causal

analysis; the approval of a corrective action plan; and evaluations of the extent of condition and effectiveness) required for issues based on the assigned category.

Strengths

Most of the identified issues were of lower significance, and over 90% of the reviewed issues were categorized per each contractor's issues management procedure.

Most contractors have a board of functional area experts assign or review the assigned significance level to ensure consistency. BNI and CNS also developed very detailed criteria and/or examples to aid in the categorization of issues.

Weaknesses

Six contractors miscategorized up to 17% of the reviewed safety issues or some issues with the potential for significant consequences as lower in significance than required by their procedures. Consequently, the issues management tools for ensuring that these more significant issues are resolved were not always invoked, and some significant issues persisted unnecessarily. A common weakness is that contractors have not categorized issues at the highest significance level for several years despite having issues that met their established criteria, and the use of less rigorous issues management tools did not prevent recurrence of highly significant issues in some cases.

Additionally, the criteria for categorizing the issue significance used by seven contractors do not proactively require use of the contractors' more rigorous issues management tools to ensure that issues are resolved before more significant issues occur. For example, some contractors' most rigorous issues management tools were only required for issues resulting in a fatality or frequent personnel injuries requiring prolonged hospitalization rather than issues that had the potential for a single severe injury. Additionally, several of the contractors' procedures require use of the most rigorous issues management tools only for high level occurrences of DOE Order 232.2A rather than using these tools to solve issues at lower reporting levels or issues that are precursors to reportable occurrences.

Both of these weaknesses may be attributed to the following:

- Assessed contractors often categorized issues based on actual consequences rather than potential consequences even though some of their procedures required issues to be categorized considering potential consequences. For example:
    - A worker struck by a falling object was categorized as an "adverse condition" rather than a "serious adverse condition" because the worker was not seriously injured. However, this issue was required to be categorized as a "serious adverse condition" because there were no controls or measures precluding the worker from being where the impact would have likely been fatal (e.g., standing a few inches closer to where the object landed).
    - Indications of systemic weaknesses in safety management programs and degradations of SSCs in nuclear facilities that did not result in serious consequences were categorized as minor issues (or conditions adverse to quality) by several contractors despite these programs and SSCs being credited in safety bases for providing nuclear safety via the defense-in-depth approach. As minor issues, formal causal analyses and actions to prevent recurrence were not required by the contractor's issues management procedures or implemented by the contractors.
- Contractors typically take months (e.g., for an apparent cause analysis) or more than a year (e.g., for a root cause analysis) to document formal causal analyses for significant issues.

- The "[e]xamples of conditions that may be considered significant under certain conditions" provided in DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*, are limited to repeated instances of procedural noncompliance, adverse trends of near misses and in the formality of operations, and widespread training weaknesses or operator knowledge gaps. Limiting the examples provided to repeated issues, adverse trends, and widespread weaknesses omits significant issues, such as a single issue or near miss that is significant (e.g., an indication of a systemic weakness in a safety program or requirement and a degradation in a credited SSC).
- DOE field/site office personnel rarely identified that contractors were categorizing issues lower than required by the approved graded approach and often agreed with categorizing significant issues lower than required by the contractors' procedures.

Best Practices

- UT-Battelle often categorizes issues as "serious" and "important," and its issue owners often choose to use discretionary critiques, causal analyses, and informal effectiveness reviews when not required by the UT-Battelle procedures to ensure that issues are resolved. Similarly, MSTS intentionally increased the number of issues categorized as more significant issues such that its more rigorous issues management tools (e.g., causal analyses) are used to resolve more safety issues. These practices of UT-Battelle and MSTS significantly contributed to these contractors resolving issues before they degrade or remove layers of defense (barriers), preventing significant safety related consequences.
- As discussed in section 3.7 of this report, UT-Battelle, CNS, and Lawrence Livermore National Security, LLC (LLNS) monitor their categorization processes, enabling them to detect and correct negative trends to ensure that issues are categorized per their procedures.

Conclusions for the Categorization of Issue Significance

Most of the identified issues were of lower significance and over 90% of the reviewed issues were categorized per each contractor's issues management procedure by boards of functional area experts. However, six of the nine assessed contractors did not correctly categorize more significant issues as required by their procedures. Consequently, the issues management tools for ensuring resolution of these more significant issues were not invoked, and significant issues, including nuclear safety issues, persisted unnecessarily. UT-Battelle and MSTS demonstrated that increasing the number of issues managed with more rigorous tools (e.g., causal analyses) enabled them to proactively resolve safety issues while other layers of defense continued to prevent significant consequences.

Different Approaches and Practices Identified During the Benchmarking Study

Personnel at nuclear power plants and utilities categorize many issues as significant conditions adverse to quality per NQA-1. For example, these plants and utilities categorize issues potentially degrading a barrier (layer of defense) that provides safety as significant conditions adverse to quality, while DOE contractors categorized many instances of SSCs not being able to perform their function credited in nuclear safety bases as less significant conditions adverse to quality, contrary to NQA-1. Nuclear power plants and utilities similarly categorize significant non-nuclear issues (i.e., issues not within the scope of NQA-1, such as industrial safety issues) in order to use the same tools and procedures used to resolve nuclear safety issues.

At their respective sites, the NNPP, the NRC, and INPO periodically review the significance of issues at NNPP sites and nuclear power plants and utilities to ensure a healthy distribution of issues at all levels, resembling a triangle or a pyramid. Additionally, NNPP executives proactively manage the number and significance of their "pinnacle" (most significant) events by revising, as needed, the threshold of

significance levels and criteria for NNPP headquarters' review of specific issues or events. These lower thresholds cause more rigorous issues management tools and management engagement and oversight to be used for issues of lower significance, so the issues are resolved rather than allowing them to develop into more significant pinnacle events. For example, the NNPP requires events resulting in personnel contamination to be reported to NNPP headquarters even if the exposure is below Federal limits. Consequently, the NNPP has more rigorously resolved contamination issues that are well below Federal limits.

3.4 Graded Resolution of Issues

This portion of the assessment evaluated the structured processes and graded approaches used for identifying the causes, extent, and corrective actions for issues and for reviewing the effectiveness of actions taken to ensure that issues are resolved.

Overall, the nine assessed contractors have developed structured processes that grade the analysis and corrective actions taken for issues based on their significance. For example, formal reviews determining the extent of conditions (issues) and evaluating the effectiveness of corrective actions are required by these contractors for more significant issues.

Strengths

All nine contractors require more rigorous techniques, or tools, to be used to determine the causes of significant issues and require qualified or specifically trained personnel to perform these formal causal analyses.

UT-Battelle, CNS, and MSTS demonstrated that determining the causes of more issues leads to more effective corrective actions, preventing recurrence and reducing the significance or consequences of subsequent safety issues.

Most extent-of-condition and effectiveness reviews performed for significant issues adequately ensured that issues were resolved. SRNS managers and functional area experts discuss new issues during periodic meetings at different levels of management to ensure that the extent of less significant issues is regularly assessed. Additionally, SRNS often includes measures to assess the effectiveness of actions taken to resolve less significant issues.

Weaknesses

Most contractors rarely use the procedures and resources (e.g., personnel qualified in advanced causal analysis techniques) they developed for determining and resolving the causes of significant and/or complex issues. For example, six contractors have not used a root cause analysis in the past five years to ensure that issues are resolved, despite having significant and/or complex issues.

Most actions taken by contractors are only to correct a specific condition, with no action taken to resolve the cause of the condition to prevent recurrence. Contractors also often take actions that have only a temporary, non-enduring effect (e.g., conduct a briefing to improve performance rather than revising continuing training programs to provide an enduring correction to prevent recurrence).

Most contractors allowed a small percentage (e.g., approximately 7%) of issues to be closed without corrective action. Some of these were nuclear safety issues (conditions adverse to quality), which NQA-1 requires to be corrected.

Unactionable causal statements were identified by issue owners for some contractors. For example, some statements of cause just repeat the problem without identifying why it occurred or provide vague, unactionable descriptions of the cause(s), including just listing the cause codes of DOE Order 232.2A, which are intended to be used to facilitate trending of issues.

Three contractors require formal, detailed extent-of-condition and effectiveness reviews only for the most significant issues and have not developed structured processes for evaluating the extent of conditions and corrective action effectiveness for less significant issues via a graded approach. Often, effectiveness reviews only ensured that actions were completed or that similar events (e.g., in the same system and facility) had not recurred, rather than determining whether the causes of the issues were resolved.

Effectiveness reviews are typically only performed six months after all the corrective actions are complete, which could be over two years since the issue was identified. This allows weaknesses to persist unabated if actions taken early in the management of the issue are ineffective.

EA also identified the following ways that issues were not effectively managed, allowing them to persist:

- Inadequate or no compensatory actions were documented to ensure that similar issues did not occur while the causes of issues and their corrective actions were identified and implemented.
- Unexplained differences and conflicts existed between event reports (with their possible causes and proposed corrective actions), formal causal analyses (and their proposed corrective actions), and corrective action plans managed via the issues management system.
- Frequently, the sole action assigned for an issue was to perform an evaluation (e.g., to evaluate the adequacy of a procedure or training) without subsequent action taken either to implement recommendations from the evaluation or to take some other corrective action(s) to resolve the issue if the evaluation did not recommend any action.
- Issues were assumed to be resolved by actions taken for other issues without ensuring the causes of the issues were the same. EA identified several cases where the causes of similar issues differed, and the actions taken to resolve one issue did not prevent recurrence of others.
- The oversight provided by managers of several contractors was limited to ensuring that corrective actions were completed when scheduled rather than ensuring that the weaknesses were corrected.

Best Practices

- Even if a causal analysis is not required, CNS issue owners are expected to use, and are held accountable for using, their judgment to determine "what the causes are (not the problem, but the causes of the problem)" and to develop an action plan to "rectify the issue and significantly reduce the likelihood of recurrence."
- Battelle Energy Alliance, LLC (BEA) managers (other than the condition owners) verify the adequacy and continued implementation of compensatory actions for issues when corrective actions are significantly delayed.
- WRPS allows the issue investigation, causal analysis, and corrective action development to be integrated into one report, avoiding inconsistency between the investigations, analyses, and corrective action plans, a situation identified at other sites.
- As part of its review of corrective action plans, the UT-Battelle Corrective Action Institutional Review Board coordinates actions within the corrective action plan with lessons-learned and ongoing initiatives across DOE (e.g., actions being taken by other DOE contractors shared within the Battelle communities of practice) to improve performance.

- WRPS causal analysis teams develop success criteria for effectiveness reviews to show that actions taken adequately resolve the identified causes.

Conclusions on the Graded Resolution of Issues

A few DOE contractors demonstrated that determining the causes of more issues leads to more effective corrective actions, preventing recurrence and reducing the significance of subsequent safety issues. However, most contractors rarely use the procedures and resources for determining and resolving causes. Instead, most of their corrective actions correct the specific issue or condition without preventing recurrence. Additionally, a few contractors only require the extent of conditions and the effectiveness of corrective actions to be determined for issues categorized at the contractor's highest level of significance (which is rarely used), and they have not developed a structured approach for performing these reviews for less significant issues. Effectiveness reviews are typically performed over two years after issues are identified, allowing weaknesses to persist unabated if actions taken early in the management of issues are ineffective. EA also identified several ways that issues are not effectively managed (e.g., inadequate or no compensatory actions were documented), allowing them to persist unnecessarily.

Different Approaches and Practices Identified During the Benchmarking Study

Personnel at nuclear power plants and utilities and NNPP sites perform causal analyses to resolve many issues. For example, these plants and utilities perform one to two root cause analyses per year and three to four apparent cause or common cause analyses each month. NNPP sites perform causal analyses for approximately a third to a half of their issues.

INPO identified that the differences between an apparent cause and a root cause analysis at nuclear power plants and utilities is in the scope of the review (e.g., an apparent cause is not required to include safety culture assessment) and that outside experts are sometimes used to facilitate root cause analyses. However, the same analytical techniques are used in root and apparent cause analyses, so the rigor of these analysis techniques is not graded.

Causal analyses performed at nuclear power plants and utilities and NNPP sites also include a comparison between what occurred and what should have happened based on existing procedures and practices to identify gaps for additional analysis. The NNPP has also found that this activity helps get workers more involved in issue resolution and helps prevent the layering of corrective actions (e.g., developing unnecessary corrective actions to require processes or practices that already exist).

3.5 Timely Resolution of Issues

This portion of the assessment examined whether issues are reported and resolved in a timely manner.

EA assessed 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 reviewed issues were reported and actions were taken in a timely manner. However, as discussed below, 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.

Strengths

Contractors reported and took corrective actions for approximately 90% of the reviewed issues in a timely manner.

Weaknesses

Contrary to DOE Order 226.1B, attachment 1, requirement 2.b.(3)(a), that contractors capture deficiencies (issues) in issues management systems "that provide for timely reporting" and requirement 16 of NQA-1 that "conditions adverse to quality [(including nuclear safety issues)] shall be identified promptly," EA identified that contractors have allowed some issues to be entered into their issues management systems in an untimely manner, which impacted the timely resolution of these issues. For example:

- 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 their issues management system for resolution.
- Six of the contractors' issues management procedures did not include expectations or requirements for prompt entry of issues into their issues management systems. This likely contributed to the untimely entry of issues by contractor personnel.

Contrary to DOE Order 226.1B, attachment 1, requirement 2.b.(3)(b), that contractors "ensure that problems are evaluated and corrected on a timely basis," 6 of 9 assessed contractors did not develop or implement corrective actions in a timely manner for up to 14% of their safety issues or allowed some issues with the potential for significant consequences to remain unresolved for extended periods. For example, two contractors allowed issues with fire protection systems to remain unresolved for over 10 years. Per NQA-1, conditions adverse to quality (issues) are required to be corrected "as soon as practicable." Untimely evaluation and resolution may be attributed to the following:

- Contractors commonly take months to document the results of formal apparent cause analyses and over a year for root cause analyses, delaying the development and implementation of corrective actions that would resolve these causes to prevent recurrence.
- Five contractors allow issue owners to extend corrective action due dates multiple times with inadequate or no justification or with no additional management oversight or approval.
- As discussed in section 3.7, five contractors also monitored the timeliness of their issues management by monitoring either the number of overdue commitments (e.g., corrective action completion dates) and how long they had been overdue (rather than age of open issues) or by monitoring the average age of issues. Both of these monitoring methods allowed issue resolutions to be delayed without adequate justification and without providing contractor and DOE field/site office management adequate visibility of aged issues. For example, averaging the age of all open issues can provide misleading indications of timeliness because the age of extremely old, unresolved safety issues is obscured by large quantities of more recently identified 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.

Although UT-Battelle resolved nearly all the issues reviewed in a timely manner, the contract clause invoked by the DOE Office of Science, instead of DOE Order 226.1B, does not require issues to be corrected in a timely manner. This increases DOE's vulnerability to untimely issue reporting and resolution by contractors of the Office of Science.

Best Practices

- Information used to report and manage the recovery from an event by CNS (including the specific gaps in the implementation of requirements that led to the event) is simultaneously available for CNS

personnel to use to identify and categorize the associated issues for resolution per CNS's issues management process.

- CNS 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). These expected time commitments ensure the efficient use of resources and help prevent prolonged causal analyses.

Conclusions on the Timely Resolution of Issues

Overall, approximately 90% of the reviewed issues were reported and resolved in a timely manner. However, the identification of some issues in the contractors' issues management systems and the implementation of some corrective actions were delayed without justification and due to inefficient processes of six of the nine assessed contractors. A few contractors allowed some issues, including nuclear safety issues, to remain unresolved for over 10 years.

Different Approaches and Practices Identified During the Benchmarking Study

Personnel at nuclear power plants and utilities and NNPP sites are expected to enter each issue into their issues management systems within a day of identifying or discovering it. Causal analyses at nuclear power plants and utilities and NNPP sites are also completed sooner. For example:

- At NNPP sites, 80% of causal analyses are completed within a day of issue identification.
- The NNPP expects an initial report be issued within 10 days for all issues required to be reported to NNPP headquarters. This initial report includes causes and corrective actions, even if the causal analysis is incomplete. The initial report may just have short-term "bridging actions," which establish safe conditions and enable work or operations to resume. If needed, a supplemental report is issued with a more in-depth, complete analysis and more actions to correct the causes of the issues. The short-term bridging actions are removed as actions to correct the causes are implemented.
- For NRC regulated nuclear power plants and utilities, root cause analyses typically take 30 to 60 days and apparent cause analyses typically take 30 days.

The goal at nuclear power plants and utilities is to complete corrective actions within six months of identifying the issue or during the next refueling outage if justified. Extensions to corrective action due dates are escalated to higher levels of management for approval, and additional metrics and management oversight are used to monitor actions that extend past six months or the next refueling outage. NASA stands up an independent review team or board that does periodic reviews of each project, including the resolution of issues related to safety. These NASA teams or board report their results to the next level of authority for disposition.

3.6 Documentation Supporting Closure

This portion of the assessment examined whether documentation supporting closure of issues is adequate.

The issues management procedures of eight of the nine assessed 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.

Strengths

The contractors retained evidence supporting closure of over 87% of their reviewed issues.

Eight contractors hold their assigned issue owners responsible for reviewing documentation used to close their issue to ensure that the actions taken resolved the issue. Six contractors have personnel independently review at least a sample of the closure documentation to ensure adequacy.

Weaknesses

EA identified the following common weaknesses in documentation used to support closing issues:

- A few significant issues were closed with no, incomplete, or irrelevant evidence.
- A few issues were closed when corrective actions were transferred into another tracking system (e.g., into systems tracking document change requests) before the action was completed (e.g., issues were closed to a promise of future action).

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. This extensive documentation for issues with low risk reduces available resources for resolving more significant issues. These contractor-generated requirements are inefficient and exceed the requirements of DOE Order 226.1 and NQA-1, which include the following:

- DOE Order 226.1B, attachment 1, section 2.b, requires documentation of corrective actions only for "higher significance findings." Similarly, requirement 16 of NQA-1 states that "[t]he identification, cause, and corrective action for significant conditions adverse to quality shall be documented."
- For less significant issues (conditions adverse to quality), documentation showing the implementation of corrective actions (e.g., a copy of a procedure with changes marked on it) is not required by DOE. Instead, SRNS, BEA, and UT-Battelle allow issue owners to "provide clear description of the action taken" to meet the requirement of NQA-1 to verify completion of corrective actions.

Best Practice

- Reviews of closure documentation by performance assurance personnel of BNI, MSTS, and WRPS led to additional actions resulting in more effective corrective actions and the closure of more issues with supporting documentation. As a result, over 97% of their reviewed issues were adequately documented.

Conclusions on Documentation Supporting Closure

Contractors adequately documented evidence supporting the closure of over 87% of the reviewed issues. Contractors that have performance assurance personnel review at least a sample of the documentation used to support closing issues had better performance in this area. Rather than grading the level of documentation used to support closing issues, most contractors require the same level of documentation for each corrective action irrespective of significance, which is inefficient and exceeds the DOE and NQA-1 requirements for closure of less significant issues.

Different Approaches and Practices Identified During the Benchmarking Study

Consistent with NQA-1, documentation retained for issues at nuclear power plants and utilities and NNPP and NASA sites is based on a graded approach considering the significance of the issue. For example:

- For very simple issues (e.g., personnel not wearing safety glasses), the issue or condition report has the description of the issue and a description of the action taken (e.g., coaching was provided and the worker donned their safety glasses).
- For other issues, there needs to be enough documentation to accurately describe the action taken (e.g., an action to revise a procedure could reference the revision that included the change).
- For more significant issues (including significant conditions adverse to quality), detailed problem statements; results of extent-of-condition, causal analyses, and effectiveness evaluations (if performed); and objective evidence of corrective action completion is warranted to, for example, determine what needs to be done if the issue recurs. For more significant issues, the documentation is also retained longer.

3.7 Monitoring Issues Management Performance

This portion of the assessment examined how contractors monitor and assess the management of issues and take action to improve 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 assessed contractors have assurance personnel monitor issues management performance, including the management of safety issues. The directorates of the other assessed contractor inadequately monitored and oversaw their issues management performance.

Strengths

Three contractors improved their issues management performance by self-assessing elements of their issues management processes.

Several contractors appropriately developed processes to separately track actions that require a long time to implement and exclude them, as outliers, from metrics monitoring their typical management of issues.

Weaknesses

Six of the nine assessed contractors did not monitor or assess the implementation of their categorization processes, allowing more significant issues to be repeatedly categorized below that required by their issues management procedures.

The following weaknesses in the monitoring of issues management performance contributed to the untimely resolution of issues:

- Only a few contractors monitored the time between events or when issues were identified until when the issues were entered into their issues management system for resolution. EA identified nuclear safety issues that had been in a draft status (i.e., not entered into the issues management system for resolution) for up to a year.
- Metrics and management oversight of several contractors was focused on completing actions as scheduled, or rescheduled, and did not adequately monitor how long issues had remained unresolved.
- A few contractors had metrics repeatedly not meeting performance goals for the timely resolution of issues but took inadequate action to improve performance (e.g., divisions not meeting performance goals were notified, but the cause of the delay or systematic changes needed to improve performance were not identified or corrected).

- Metrics were based on averages which could obscure cases of poor performance and allow them to persist without being specifically reported to contractor and DOE field/site office senior management for resolution.

Best Practices

- SRNS, LLNS, and UT-Battelle's periodic self-assessments of the implementation of their issues management procedures improved their performance. Specifically:
  - The SRNS contractor assurance group performs quarterly assessments of the implementation of its procedure by reviewing 5% of the facility and functional area program issues closed each quarter. The DOE Savannah River field office additionally independently assesses the results of the SRNS assessments.
  - LLNS assesses the implementation of its categorization process approximately every two years, and appropriately responds to emerging trends to ensure that issues are appropriately categorized based on significance. As a result, LLNS performance in this area exceeds that of other assessed contractors.
  - UT-Battelle biennially assesses the implementation of its issues management procedures by reviewing the management of a representative sample of issues in certain areas (e.g., nuclear safety). UT-Battelle also incorporates lessons learned from similar assessments across DOE into its assessments (e.g., adopting the methods EA used for the assessment of specific contractor's management of safety issues and looking for weaknesses that EA identified for other contractors). UT-Battelle takes action based on its assessments to improve its issues management. Subsequently, EA identified that UT-Battelle resolved and adequately documented nearly all the reviewed issues in a timely manner.
- SRNS 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.
- CNS and LLNS readily display and monitor the distribution of issue significance levels to detect changes in their issues management implementation. As a result, CNS and LLNS categorize issue significance more accurately than most other assessed contractors.

Conclusions on Monitoring Issues Management Performance

Nearly all of the assessed contractors monitored the performance of their issues management processes, and several developed measures to separately track actions that require a long time to implement. However, several metrics and contractor management oversight practices focused on completing actions as scheduled, or rescheduled, and did not adequately monitor how long issues had persisted unreported and/or unresolved. A few contractors improved their performance by monitoring and self-assessing elements of their issues management processes and incorporating relevant lessons learned (e.g., adopting the methods EA used and looking for weaknesses EA identified for other contractors).

Different Approaches and Practices Identified During the Benchmarking Study

As discussed in section 3.5, personnel at nuclear power plants and utilities set aggressive goals for the completion of corrective actions (i.e., within six months of identifying the issue or during the next refueling outage, but only if justified). Extensions to corrective action due dates are escalated to higher levels of management for approval and additional metrics and management oversight are used to monitor

actions that extend past six months or the next refueling outage. Independent review teams or boards at NASA periodically review resolution of issues related to safety within projects and report their results to the next level of authority for disposition.

3.8 Contractors' Issues Management Performance by Functional Area

To aid in the prioritization of actions to improve the management of safety issues, this portion of the assessment summarizes the contractors' management of safety issues within functional areas where a representative sample of issues was reviewed. In general, there was not sufficient data to assess issues management performance between DOE program offices.

Based on the analysis in appendix C the percentage of emergency management, fire protection, conduct of operations, and hazardous energy control issues inadequately managed was considerably higher than the overall average. EA previously recommended actions to improve emergency management and fire protection programs based on more comprehensive assessments of these functional areas, so no new recommendations other than those in section 4.0 are recommended for these areas. Analyses of the management of conduct of operations and hazardous energy control issues indicate that contractor safety culture assessments and actions focused on organizational behaviors supporting issues management are key to improving the resolution of safety issues attributable to these functional areas. Also, until these assessments and actions are implemented, additional oversight of issue categorization and resolution processes for these areas, especially for conduct of operations issues, is warranted. The percentage of issues in the other assessed functional areas was considerably lower than the average, so no recommendations other than those in section 4.0 are recommended for these areas.

4.0 RECOMMENDATIONS

The following recommendations are based on the analysis in section 3.0 of this report. The recommendations in section 4.1 are intended to resolve the likely causes of the significant weaknesses in the involvement of some contractor personnel in issue identification, identification and correction of the causes of issues, and the timely resolution of issues across DOE. These include recommendations specifically for DOE contractors, field offices, program offices, and EHSS. Other recommendations to further improve the management of safety issues based on more efficient practices and common weaknesses identified are in section 4.2. Based on the analysis in section 3.8 and appendix C, additional recommendations to improve the management of conduct of operations and hazardous energy control issues are in section 4.3.

4.1 Recommendations to Increase the Involvement in Issue Identification, Correct the Causes of More Issues, and Improve the Timeliness of Issue Resolution

EA-recommended actions to resolve the likely causes of the significant weaknesses in the involvement of some contractor personnel in issue identification, the identification and correction of the causes of issues, and the timeliness of issue resolution are in tables 1, 2, and 3, respectively.

Table 1. Recommendations to Increase the Involvement in Issue Identification

To have working-level personnel proactively identify more issues or concerns and to remove obstacles hindering them from entering issues into their contractors' issues management system:	
Contractors	During outreach activities such as Energy Facility Contractors Group (EFCOG) meetings: • Share practices for encouraging and facilitating more proactive issue identification by working-level personnel to improve the engagement of working-level personnel in the identification and resolution of issues. During these discussions, contractors should also consider the practices that improved the engagement of working-level personnel of other Federal agencies (i.e., lower thresholds for entries into the issues management systems and training on basic elements of causal analyses and attributes of effective corrective actions, in addition to training of how to make entries into their issues management systems). • Share practices and tools facilitating issue identification by working-level personnel, including those workers who do not frequently access computer systems. • Share practices used to measure whether working-level personnel have embraced "a strong safety culture" by identifying issues.
To facilitate functional area experts' identification of adverse trends and indications of system weaknesses within their area of cognizance:	
Contractors	• During outreach activities such as EFCOG meetings, benchmark and advocate for practices similar to those used by SRNS and WRPS.
DOE Field/Site Offices	• During DOE Nuclear and Facility Safety Program Workshops, share practices for independently identifying adverse trends and precursors of systemic weaknesses in contractors' programs and management systems.

Table 2. Recommendations to Correct the Causes of More Issues

To resolve the documented misunderstandings of DOE requirements and expectations for identifying and correcting issues and their causes:	
DOE EHSS	Ensure that DOE policy directives and orders adequately "[e]stablish high level expectations" and "clearly and concisely specify the goals and requirements that must be met" for the timely identification and correction of issues, adverse trends, and their causes using a graded approach considering the risk of safety issues. For example: As part of the ongoing development of DOE Order 414.1E: • Clarify whether elements of the quality assurance criterion in attachment 2 can be graded to zero (graded out). • Revise DOE Order 414.1D, attachment 2, criterion 3, to require contractors to establish and implement processes that ensure all levels of personnel identify quality problems (issues).

	• Revise the definition of the graded approach (specifically section 6.h(1)) to be based on the relative importance of improving and maintaining safety, for example, maintaining the defense-in-depth approach to hazard control required by DOE Policy 420.1. • Revise DOE Order 414.1D, attachment 2, criterion 3, to clarify for what issues actions to correct the causes of the issues are required (e.g., require actions that correct the causes of broad and systematic issues and issues indicating degradation in a control established to ensure safety and/or quality and require less significant safety and quality issues be corrected and monitored for trends). • Resolve issues (problems) in a timely manner consistent with the approved graded approach (e.g., commensurate with their relative importance to maintaining safety and the magnitude of any hazard involved). • Have senior contractor management annually review issues over two years old and, within areas of their authority or influence, remove barriers preventing resolution. Revise DOE Order 232.2A to: • Clarify for which reportable occurrences facility managers are required to determine the causes and generic implications of. • Require low and informational level occurrences be reported to DOE via a final report and remove the requirement for the initial notification reports for these occurrences. Requiring final reports for low and informational level occurrences would provide DOE contractors time to determine and report causes and corrective actions for these occurrences to headquarters personnel and enable EHSS to identify trends in the causes (via identified cause codes) of these lower reporting level occurrences. • Define "generic implications" and their relationship with the extent of condition of reportable occurrences. Revise DOE Order 226.1B to: • Require issue owners to identify and correct the causes of issues, consistent with DOE Order 414.1. • Define "high [or higher] significance findings" (issues) in DOE Order 226.1B to include significant conditions adverse to quality as defined in NQA-1 and potential indications of broad or systemic weaknesses in safety programs (unless the extent of the condition (issue) is verified to be isolated) and issues indicating degradation in a control established to ensure safety and/or quality.
To ensure that causes and their corrective actions are identified and implemented for more issues using a graded approach:	
Contractors	• Require personnel serving in the role of an issue owner to participate in annual training on: (1) techniques (e.g., the five-why method) and lessons learned that can be used to efficiently determine the causes of relatively simple issues, (2) when support by personnel qualified in more advanced causal analysis techniques would be appropriate, and (3) enduring actions that can prevent recurrence.

	• Require issue owners to document actionable (specific) statements of the cause(s) for their issues and take action(s) to correct the issues and their causes per the graded approach in the approved quality assurance program. • Provide working-level personnel training on basic principles and elements of issues management (e.g., causal analyses and corrective action development) to enable them to be more involved in the identification and resolution of issues. • In coordination with their DOE field/site offices, assess processes for categorizing issue significance, and their implementation for a representative sample of issues, to verify that DOE issues management requirements are met and issues are categorized per the graded approach in the approved quality assurance program.
DOE Line Management (Program Offices and/or Field/Site Offices)	• Establish an expectation for each contractor (e.g., in annual performance evaluation and monitoring plans) to use all their issues management tools with some nominal frequency to ensure that the tools maintained by the contractor are being used to resolve significant issues each year and to maintain contractor personnel's proficiency with each of these tools.
DOE Field/Site Offices	• In coordination with their contractors, assess the contractor's process for categorizing issue significance, and its implementation for a representative sample of issues, to verify that DOE issues management requirements are met and issues are categorized per the graded approach in the approved quality assurance program.

Table 3. Recommendations to Improve the Timeliness of Issue Resolution

To ensure that issues are entered into contractors' issues management systems in a timely manner:	
Contractors	• Require that issues be promptly entered into their issues management systems and categorized (e.g., within two working days of being identified) and monitor or assess compliance with this requirement as needed.
To ensure that causes and their corrective actions are identified in a timely manner:	
Contractors	• Improve processes for determining and documenting causes and corrective actions to prevent recurrence more rapidly and efficiently. For example, contractors could (1) use Lean process improvement techniques to focus processes on documenting causes and corrective actions and removing or reducing inefficiencies, such as steps documenting in detail the analysis techniques used and (2) assign individuals full-time to teams implementing the process for significant issues. • Document in their issues management procedures expected time commitments for causal analysis and corrective action development of issues based on their significance level (e.g., a one-to-two-hour analysis for minor issues and one-to-two-week or one-to-two-month analysis for significant or complex issues). Monitor performance of these expectations to ensure the efficient use of resources and help prevent prolonged causal analyses and corrective action development.

To ensure that issues and their causes are corrected in a timely manner:	
DOE Office of Science	• Modify the clause in Office of Science contracts invoking requirements for contractor assurance systems (instead of DOE Order 226.2A) to require that issues be resolved as soon as practicable and consistent with the approved graded approach.
Contractors	• Require that the issue owner's manager approve corrective action due dates (including extensions) greater than general timeliness goals established by contractor management and agreed to by the DOE field/site office manager (e.g., in each contractor's quality assurance program). • Monitor the age of issues and prioritize corrective actions using a graded approach to ensure that safety issues are resolved in a timely manner. • Annually require issue owners to present to senior contractor and DOE field/site office management barriers precluding resolution of any issue over two years old and to propose actions, as appropriate, to overcome these barriers.

4.2 Other Recommendations to Improve DOE Contractors' Issues Management

Other recommendations based on the more efficient practices and common weaknesses identified in section 3.0 are provided in table 4 to improve contractors' management of safety issues and other issues.

Table 4. Other Recommendations to Improve DOE Contractors' Issues Management

DOE Line Management*	• As part of the next annual review of quality assurance programs required by section 2.c. of attachment 1 of DOE Order 414.1D, ensure that contractors include the graded approach and adequately describe how the risk-based criteria of the quality assurance program are applied to items, services, or processes managed by the contractor for each criterion in attachment 2 of DOE Order 414.1D, considering the weaknesses discussed in section 3.1 of this report on the flowdown of requirements from the quality assurance program to contractors' implementing procedures.
DOE Field/Site Offices	• Verify that DOE field/site office oversight plans assess the flowdown of issues management requirements from DOE directives to the contractor's quality assurance program to the contractor's issues management procedures to ensure consistency. • In coordination with respective contractors, assess contractors' issues management programs using the methodology in appendix B (i.e., criterion 5 of objective 1 and the criteria of objective 3 of EA Criteria and Review Approach Document (CRAD) 30-01, Revision 1, *Contractor Assurance System*), or a similar methodology, to determine whether weaknesses and/or best practices identified in section 3 are relevant to the contractor's management of issues.

Contractors	• As part of the next annual review of each contractor's quality assurance program, ensure that it includes the graded approach and adequately describes how the risk-based criteria in the quality assurance program are applied to items, services, or processes managed by the contractor for each criterion in attachment 2 of DOE Order 414.1D, considering the weaknesses discussed in section 3.1 of this report on the flowdown of requirements from the quality assurance program to contractors' implementing procedures. • In consultation with the DOE line management overseeing their contract, establish performance objectives for improving each year their timely identification and correction of issues, adverse trends and their causes, and for increasing the use of simple, informal causal analysis techniques and more rigorous issues management tools. • Assess the flowdown of issues management requirements from DOE directives to the contractor's quality assurance program to the contractor's issues management procedures to ensure consistency. • Triennially assess the flowdown of issues management requirements from the DOE-approved quality assurance program and representative sample of issues in high-risk areas or functions using the methodology in appendix B (i.e., criterion 5 of objective 1 and the criteria of objective 3 of EA CRAD 30-01), or a similar methodology, to verify issues and their causes are resolved in a timely manner per the approved graded approach and contractor performance goals. • Revise issues management procedures to: o Require that issue owners evaluate the extent of a condition (issue) and effectiveness of corrective actions more often. For example, state that issue owners should consider whether specific actions to evaluate extent of condition and effectiveness of corrective actions are warranted, like the practice demonstrated by SRNS and discussed in section 3.4 of this report as a strength. o Require that issue owners consider performing one or more interim effectiveness reviews when corrective actions will take a long time to implement or are significantly delayed. o Implement a graded approach for closure documentation retained for issues. For example, provide issue owners the option of providing a clear description of action(s) taken to resolve less significant issues.

* - This recommendation is for DOE line management with the authority, per section 5.b.(2) and 5.c.(3) of DOE Order 414.1D, to approve a quality assurance program developed or updated by a contractor.

4.3 Recommendations to Improve DOE Contractors' Management of Conduct of Operations and Hazardous Energy Control Issues

Based on the analysis in section 3.8 and appendix C, recommendations to improve the management of conduct of operations and hazardous energy control issues are presented in table 5.

Table 5. Recommendations to Improve DOE Contractors' Management of Conduct of Operations and Hazardous Energy Control Issues

To improve the management of conduct of operations and hazardous energy control issues in the near-term (pending improvements to the organizational behaviors supporting the management of safety issues in these functional areas):	
DOE Field/Site Offices	• Provide additional oversight of their contractors' management of conduct of operations and hazardous energy control issues to ensure that these issues are categorized and resolved as required per the approved quality assurance program and the contractor's issues management procedures. For example, this oversight could include: (1) formal observations or surveillances of meetings used to categorize issue significance, and (2) reviews of closed issues to ensure that adequate compensatory measures were documented and extent-of-condition reviews, causal analyses, corrective actions, and effectiveness reviews were adequately performed when required by the graded approach in the contractor's quality assurance program.
Contractors	• Provide additional monitoring and assessment of the management of conduct of operations and hazardous energy control issues to ensure that these issues are categorized and resolved as required per the approved quality assurance program and the contractor's issues management procedures. For example, this could include management observations and independent surveillances of (1) meetings used to categorize issue significance, and (2) documentation used to close issues to ensure that adequate compensatory measures were documented and extent-of-condition reviews, causal analyses, corrective actions, and effectiveness reviews were adequately performed when required by the graded approach in the contractor's quality assurance program.
To improve the management of conduct of operations and hazardous energy control issues in the long-term:	
Contractors	• Assess organizational behaviors supporting issues management and take action to sustain behaviors that improve the resolution of conduct of operations and hazardous energy control issues considering the guidance in DOE Guide 450.4-1C, *Integrated Safety Management System Guide*, section 6.4 and attachment 10, and the assessment approach for objective SC.3 of EA CRAD 30-08, *Safety Culture Assessment*.

Appendix A
Supplemental Information

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Appendix B
Scope, Relevant Requirements and Guidance, Methodology, and Other Reviews

B.1 SCOPE

From fiscal year 2019 through 2023, the U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments, within the independent Office of Enterprise Assessments (EA), assessed the processes and practices used by nine DOE and National Nuclear Security Administration (NNSA) (hereafter referred to as DOE unless a difference exists for NNSA) contractors to manage (correct) safety issues, especially nuclear safety issues, across DOE. EA also interviewed representatives of the Naval Nuclear Propulsion Program (NNPP), the Nuclear Regulatory Commission (NRC), and the National Aeronautics and Space Administration (NASA) to discuss processes and practices for resolving issues and maintaining protections (safety) of workers, the public, and the environment. Based on an analysis of the results of these activities, this report identifies overall strengths and weaknesses, best practices, and recommendations to improve performance throughout DOE.

B.2 RELEVANT FEDERAL REGULATION; DOE POLICIES, DIRECTIVES, AND GUIDES; AND CONSENSUS STANDARD

The following Federal regulation; DOE policies, directives, and guides; and consensus standard are for DOE contractors' management of safety issues, including nuclear safety issues:

- 10 CFR 830, *Nuclear Safety Management*
- DOE Policy 420.1, *Department of Energy Nuclear Safety Policy*
- DOE Policy 450.4A, *Integrated Safety Management Policy*
- DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*
- DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*
- DOE Order 232.2A, *Occurrence Reporting and Processing of Operations Information*
- DOE Order 414.1D, *Quality Assurance*
- DOE Guide 414.1-2B, *Quality Assurance Program Guide*
- Nuclear Quality Assurance (NQA)-1-2008, *Quality Assurance Requirements for Nuclear Facility Applications*, with the NQA-1a-2009 addenda

DOE Order 414.1D, attachment 2, criterion 3, and 10 CFR 830, subpart A, section 830.122, *Quality Assurance Criteria*, criterion 3, provide general requirements for managing issues within DOE. Per DOE Order 414.1D, DOE contractors "[u]se appropriate national or international consensus standards consistent with contractual and regulatory requirements, and Secretarial Officer direction" along with requirements in the order. DOE Order 414.1D requirements are implemented via a graded approach, "ensuring that the levels of analyses, documentation, and actions used to comply with requirements are commensurate with" relevant risk-based factors developed by contractors and approved by the DOE secretarial office or site office or the NNSA field office in each contractor's quality assurance program.

DOE Order 226.1B provides requirements for systems that contractors use to manage issues, as part of their contractor assurance system, for the NNSA and nearly all of DOE. The Office of Science invokes requirements for each contractor's assurance system, including its issues management system, via a contract clause rather than DOE Order 226.1B.

DOE Order 232.2A provides specific requirements for managing issues resulting in an occurrence warranting reporting to DOE per criteria in DOE Order 232.2A.

DOE Order 414.1D, attachment 2, criterion 2, requires contractors to "[t]rain … personnel to be capable of performing their assigned work," which for nearly all contractor personnel would entail training on the contractor's quality assurance program, which includes the contractor's issues management system and processes.

DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities,* attachment 1, provides more specific training requirements on quality assurance and issues management for personnel, including technical support staff, working in or supporting DOE nuclear facilities.

B.3 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which EA implements through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms "best practices, deficiencies, findings, and recommendations" as defined in the order.

EA used criterion 5 of objective 1 and the criteria of objective 3 of EA Criteria and Review Approach Document (CRAD) 30-01, Revision 1, *Contractor Assurance System* (February 15, 2018), to assess the DOE contractors' flowdown and implementation of issues management requirements from DOE directives and invoked consensus standards.

EA assessed the management of safety issues by the contractors listed in table B-1 using an overall resource-loaded, multiyear assessment plan to get a representative sample of the management of safety issues, including nuclear safety issues, across DOE program offices with nuclear facilities. The EA assessment teams were comprised of experts that assessed the management of a representative sample of issues within their functional areas of expertise that are key to nuclear and worker safety. The EA assessment teams also included a subset of team members defined as the core team. At least two members of this core team participated in the assessment of each contractor to facilitate maintaining consistency in the overall assessment approach and implementation of the plan for each contractor-specific assessment. In total, EA teams reviewed 3,898 issues. Findings and deficiencies that EA identified during the assessments of these contractors were documented in separate reports listed in table B-1 along with best practices demonstrated by the contractors. The reports were provided to the responsible DOE program office, field office and contractors, and may have resulted in corrective actions or enhancements that are not reflected in this report. Section 3 of this report is the overall EA assessment of DOE contractors' management of safety issues based on the reports in table B-1. Members of the core team used for the contractor-specific assessments also participated in the benchmarking study and prepared this overall assessment of DOE contractors' management of safety issues.

EA used the DOE directives and CRAD to assess whether the policies, directives, quality assurance programs, procedures, and practices resolved safety issues in a timely manner using an appropriate graded approach.

Table B-1. EA Assessments of Specific DOE Contractor's Management of Safety Issues

Contractor	Site	Areas Assessed	EA Assessment Report	Program Office
Los Alamos National Security, LLC (LANS)*	Los Alamos National Laboratory (LANL)	Nuclear Engineering (including criticality safety and safety bases) and the Conduct of Operations Supporting Nuclear Facilities and Plutonium Manufacturing	*Assessment of the Management of Nuclear Safety Issues at the Los Alamos National Laboratory* April 2019	National Nuclear Security Administration
Mission Support and Test Services, LLC (MSTS)	Nevada National Security Site	Nuclear Maintenance, the Conduct of Operations, and Industrial Hygiene	*Assessment of Mission Support and Test Services, LLC Issues Management at the Nevada National Security Site* December 2020	
Consolidated Nuclear Security, LLC (CNS)	Y-12 National Security Complex	Nuclear Engineering (including criticality safety and safety bases), Radioactive Waste, and the Conduct of Operations	*Independent Assessment of the Consolidated Nuclear Security, LLC Management of Safety Issues at the Y-12 National Security Complex* December 2022	
Lawrence Livermore National Security, LLC (LLNS)**	Lawrence Livermore National Laboratory	Nuclear Engineering (including criticality safety and safety bases), the Conduct of Operations, Hazardous Energy Control, and Fire Protection	*Independent Assessment of the Management of Safety Issues at the Lawrence Livermore National Laboratory* April 2023	
Bechtel National, Inc. (BNI)	Hanford Site Waste Treatment and Immobilization Plant	Nuclear Facility Engineering and Design, Procurement, Construction, Maintenance, Startup, and Commissioning and all Significant Conditions Adverse to Quality	*Assessment of Issues Management at the Hanford Site Waste Treatment and Immobilization Plant* November 2019	Office of Environmental Management

Contractor	Site	Areas Assessed	EA Assessment Report	Program Office
Savannah River Nuclear Solutions, LLC (SRNS)	Savannah River Site	F/H Laboratory, 235-F, H Canyon, K Area Complex, and L Area	*Assessment of Issues Management at the Savannah River Site SRNS Facilities* November 2020	
Washington River Protection Solutions, LLC (WRPS)	Hanford Site	Nuclear Engineering (including criticality safety and safety bases), the Conduct of Operations, and Industrial Hygiene	*Independent Assessment of the Washington River Protection Solutions, LLC Management of Safety Issues at the Hanford Site* December 2021	
Battelle Energy Alliance, LLC (BEA)	Idaho National Laboratory	Nuclear Engineering (including criticality safety, safety bases), the Conduct of Operations (including reactor operations), and Hazardous Energy Control at the Materials and Fuel Complex and Site-wide Emergency Management	*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
UT-Battelle, LLC	Oak Ridge National Laboratory	Radioactive Waste, Safety Basis Implementation, Radiological Controls, and the Conduct of Operations	*Independent Assessment of the UT-Battelle, LLC Management of Safety Issues at the Oak Ridge National Laboratory* September 2022	Office of Science

* The management and operations contract for LANL transitioned from LANS to Triad National Security, LLC (Triad) on November 1, 2018, so this assessment focused on issues managed by LANS personnel retained by Triad and processes implemented by Triad immediately following this transition.

** An assessment of LLNS management of safety issues was not in the resource-loaded plan for the assessment of issues management across DOE. However, the LLNS management of safety issues was assessed using the methodology and resources used for the other assessments, so the results were included in the overall assessment of issues management.

B.4 OTHER REVIEWS OF DOE'S ISSUES MANAGEMENT PERFORMANCE

This portion of the assessment compares the results of other assessments and audits of DOE's issues management performance issued since calendar year 2016 with the results of this overall assessment of DOE contractors' management of safety issues.

Since 2016, the DOE Office of the Inspector General (OIG) has issued three audit reports associated with contractors' management of issues at DOE sites. As discussed below, the scope of these audits was not as comprehensive as the EA reviews assessing the overall management of safety issues by DOE contractors.

- DOE-OIG-16-07, *Issues Management at the Los Alamos National Laboratory*, dated February 2016, identified systemic, significant weaknesses in the management of "high-significance issues" across LANL by LANS. Subsequently, EA's *Assessment of the Management of Nuclear Safety Issues at the Los Alamos National Laboratory – April 2019* identified that actions taken by LANS to improve its issues management "led to only limited improvement in addressing longstanding weaknesses" and identified "significant weaknesses in the LANS [issues management] process and institutional behaviors that have allowed identified problems to go uncorrected, problem recurrences to be routinely accepted, and corrective actions to often be delayed for years." In 2022, DOE-OIG-22-31, *Follow-up on Issues Management at the Los Alamos National Laboratory*, stated that the OIG team's review of "all 40 high-significance issues for fiscal year 2017 through March 8, 2021, and found, with few exceptions, that the documentation in LANL's Issues Management tool identified underlying causes and corrective actions that addressed the root causes, determined the extent of the issue, and evaluated the efficacy of completed corrective actions."

  However, this OIG audit team did not review issues not categorized as "high-significance issues." Reviews by the EA assessment team identified that LANS personnel incorrectly categorize less than 1% of their issues as "high-significance," including high-significance issues (findings) previously identified by EA. The more comprehensive reviews of safety issues by the EA assessment teams identified the common weaknesses discussed in this overall assessment of DOE contractors' management of safety issues.

- DOE-OIG-22-32, *Corrective Actions on the Office of Enterprise Assessments Findings and Deficiencies*, stated that based on reviews at SRS and LANL, "the Department did not always fully address findings and deficiencies identified by EA-30. Specifically, in the 18 reports we reviewed, we found that corrective actions taken by Department organizations did not fully address the findings and/or deficiencies for 9 reports (Finding 1) and were not documented in the [issues management system], as required, for 4 reports (Finding 2). In addition, we found corrective actions were incorrectly documented for two reports (Finding 3). Finally, [corrective action plans] were not developed for 6 of the 13 reports that contained findings, as required (Finding 4)."

  The EA-identified findings and deficiencies reviewed by the OIG audit team were not categorized as high-significance issues by personnel at SRS or LANL, so this audit identified inadequacies in the management of less significant issues consistent with this overall EA assessment of contractors' management of safety issues.

Other EA assessment reports issued since 2016 have also identified some of the inadequacies identified by this overall EA assessment of contractors' management of safety issues. For example, EA *Summary Report: Independent Focused Assessment of Emergency Management Corrective Actions at National Nuclear Security Administration and Office of Environmental Management Sites – March 2022* identified that only two of eight assessed sites had adequately resolved EA-identified findings and "[o]f the 59 findings reviewed, only 29 were adequately resolved, and multiple sites had four recurring issues" including inadequacies in the verification and validation of corrective actions (a.k.a., effectiveness reviews). "For these four issues in particular, sites repeatedly experienced challenges closing findings

with the level of effectiveness necessary to prevent recurrence." Inadequate effectiveness reviews were determined to be "a primary or contributing problem with the closure packages for 21 of the 30 findings still unresolved" and the other three recurring issues have been inadequately resolved by DOE contractors over the past eight to nine years, which is not timely.

Reports and other correspondence from the Defense Nuclear Facilities Safety Board (DNFSB) often identify safety issues and recommend changes to corrective action plans to resolve these safety issues. DNFSB staff members expressed an interest in DOE's issues management performance and observed the EA team activities supporting EA's *Independent Assessment of the Consolidated Nuclear Security, LLC Management of Safety Issues at the Y-12 National Security Complex – November 2022*.

The Government Accountability Office (GAO) has not issued a report since 2016 assessing DOE's overall issues management performance.

Conclusions on Other Reviews of DOE's Issues Management Performance

Since 2016, OIG and other EA reports have assessed the management of a subset of the safety issues reviewed for this EA assessment of DOE contractors' management of safety issues. Due to their reduced scope, these OIG and other EA reports identified some of the inadequacies identified by the EA teams assessing the overall management of safety issues by DOE contractors. These OIG and other EA reports support, and do not conflict with, the results in this report. The GAO has not issued a report since 2016 assessing DOE's overall issues management performance.

Appendix C
Contractors' Issues Management Performance by Functional Area

This portion of the assessment summarizes the contractors' management of safety issues within functional areas where a representative sample of issues was reviewed. In general, there was not sufficient data to assess issues management performance between DOE program offices. The tables and analysis below are provided to aid in the prioritization of additional actions to improve the management of safety issues as needed.

Table C-1. EA-identified Issues Management Performance by Functional Area

Functional Area	Safety Issues Inadequately Managed [(1), (2), (3), (4)]	Notes
Emergency Management	71% (101 of 143)	- EA reviewed one contractor's management of issues related to emergency management. Deficient practices demonstrated by this contractor were specifically identified in the associated assessment report. - More comprehensive assessments of the management of emergency management issues and emergency management programs are in EA *Summary Report: Independent Focused Assessment of Emergency Management Corrective Actions at National Nuclear Security Administration and Office of Environmental Management Sites – March 2022* and *Lessons Learned from Assessments of Emergency Management Programs at U.S. Department of Energy Sites During Fiscal Year 2021 – May 2022*. These EA reports included recommendations and methods to improve emergency management within DOE. - Other than the recommendations in sections 4.1 and 4.2, EA does not have any new recommendations to improve emergency management based on the performance of the assessed contractor.
Fire Protection Program	65% (65 of 100)	- EA reviewed one contractor's management of issues related to its fire protection program. Deficient practices demonstrated by this contractor were specifically identified in the assessment report of that contractor for resolution. - A more comprehensive assessment of fire protection programs is in EA report *Lessons Learned from Assessment of Fire Protection at U.S. Department of Energy Sites – February 2023*.

Functional Area	Safety Issues Inadequately Managed [(1), (2), (3), (4)]	Notes
		- Other than the recommendations in sections 4.1 and 4.2, EA does not have any new recommendations to improve fire protection programs based on the performance of the assessed contractor.
Hazardous Energy Control	Average: 37% (73 of 195) Range: 29% - 45%	- EA reviewed two contractors' management of hazardous energy control issues for nuclear and non-nuclear work.
Conduct of Operations	Average: 36% (359 of 992) Range: 18% - 58%	- EA reviewed six contractors' management of issues related to the conduct of operations in nuclear facilities. Issues associated with hazardous energy control were part of these reviews for five contractors because one contractor's management of hazardous energy control issues was reviewed separately by the EA team from other issues related to the conduct of operations. - NNSA contractors adequately managed 64 to 82% of their issues associated with the conduct of operations while three other assessed contractors associated with other program offices adequately managed 42 to 70% of their issues.
Radioactive Waste	Average: 18% (43 of 235) Range: 15% - 24%	- EA reviewed two contractors' management of issues related to radioactive waste. - EA reviewed the management of issues that led to non-compliant waste shipments, as documented in the EA report *Enterprise-wide Assessment of the Department of Energy's Packaging and Shipping of Radioactive Waste – July 2020*. At CNS, completed actions adequately corrected the deficiencies previously identified by EA, and interviews and document reviews indicated that ongoing actions by UT-Battelle were significantly improving its management of radioactive waste.
Radiological Controls	17% (17 of 102)	- EA reviewed one contractor's management of issues related to its radiological controls program.
Conduct of Engineering	Average: 16% (144 of 920) Range: 5% - 41%	- EA reviewed six contractors' management of engineering issues related to nuclear safety, including nuclear criticality safety and safety bases used to authorize nuclear operations. - Deficient practices leading to the inadequate management of 41% of the issues by one contractor were identified in the assessment report of that contractor for resolution. The other contractors

Functional Area	Safety Issues Inadequately Managed [1], [2], [3], [4]	Notes
		adequately managed at least 82% of their reviewed engineering issues.
Conduct of Maintenance	Average: 11% (22 of 194) Range: 5% - 20%	- EA reviewed two contractors' management of issues related to the conduct of maintenance for SSCs credited in safety bases for nuclear operations.
Industrial Hygiene	Average: 11% (23 of 204) Range: 10% - 12%	- EA reviewed two contractors' management of issues related to industrial hygiene.
Overall	Average[3]: 26% (1,024 of 3,898) Range[3]: 7% - 56%	- Approximately one of every four reviewed issues was inadequately managed, impacting the timely identification and resolution of the causes of these issues.

(1) The averages, numbers of issues, and ranges in this table for the individual functional areas do not include issues managed by SRNS or BNI because the issues reviewed for these assessments was not grouped by these functional areas. Specifically, the EA team assessed the management of safety issues within specific SRNS facilities and areas and included reviews of BNI's management of all its more significant issues.

(2) Averages reported in this table are the total number of issues inadequately managed over the total number of issues reviewed in that functional area; while the ranges reported are the number of issues inadequately managed over the number of issues of specific contractors reviewed in that functional area.

(3) The overall average, number of issues, and range include data from all nine assessed contractors.

(4) Instances of safety issues inadequately managed did not meet requirements of DOE directives invoked by contract, the DOE-approved quality assurance program, consensus standards the contractor committed to in the DOE-approved quality assurance program, or an implementing procedure developed by the contractor.

Management of Emergency Management and Fire Protection Issues

The average percentage of inadequacies EA identified in the management of issues concerning emergency management and a fire protection program are considerably higher than the overall average of inadequacies identified (i.e., 71% and 65%, respectively, are considerably higher than the overall average of 26%). However, as noted in table C-1, EA only assessed one contractor's management of issues concerning emergency management and another contractor's management of fire protection issues as part of this assessment of DOE contractors' management of safety issues. The assessments of these contractors included three findings and five deficiencies based, in part, on one contractor's inadequate management of emergency management issues and four findings and four deficiencies based, in part, on the other contractor's inadequate management of fire protection issues. Per DOE Order 227.1A, these "[f]indings and other deficiencies … are managed in accordance with established issues management systems (DOE O 226.1, current version) and quality assurance programs (DOE O 414.1, current version, and 10 CFR Part 830)" to resolve them. As additionally noted in table C-1, EA recently provided recommendations for improving emergency management and fire protection based on more

comprehensive assessments of these functional areas. Therefore, other than the recommendations in section 4.0, EA does not have any new recommendations to improve emergency management or fire protection based on the issues management performance of the two assessed contractors.

Management of Hazardous Energy Control and Conduct of Operations Issues

The average percentage of inadequacies EA identified in the management of issues concerning hazardous energy control and the conduct of operations are also considerably higher than the overall average of inadequacies identified (i.e., 37% and 36%, respectively, are considerably higher than the overall average of 26%). Additionally, based on a review of data available in the DOE Corporate Safety Performance Dashboard, from fiscal years 2019 through 2022, over 7% and 10% of reportable events were, respectively, attributed to hazardous energy control issues and conduct of operations issues, with the most reportable events (12%) being due to equipment degradation or failure. More proactive and effective management of less significant issues reduces the number of significant (e.g., reportable) issues. The high percentages of issues inadequately managed in these areas and the high number of reportable events attributed to them are indicative of weaknesses in the organizational behaviors for identifying and correcting these safety issues. Table C-2 provides the results of additional analysis of the inadequacies in the management of these issues.

Table C-2. Common Inadequacies in the Management of Issues Concerning Hazardous Energy Control and the Conduct of Operations

Aspect of Issues Management	Hazardous Energy Control Issues Inadequately Managed [(1), (2), (3)]	Conduct of Operations Issues Inadequately Managed [(1), (2), (3)]	Notes
Issue Identification	Average: 7% Range: 6% - 8%	Average: 5% Range: 0% - 12%	- This data reflects inadequacies in the management of issues in the contractor's issues management system. These percentages do not include consideration of issues never entered into the issues management system, for example, by working-level personnel.
Issue Categorization	Average: 9% Range: 7% - 11%	Average: 17% Range: 4% - 38%	- This data indicates how many issues the contractors categorized lower than required by their procedures in these functional areas.
Issue Resolution	Average: 9% Range: 7% - 12%	Average: 30% Range: 14% - 53%	- The most common inadequacies were inadequate or no compensatory actions documented, causes were not

Aspect of Issues Management	Hazardous Energy Control Issues Inadequately Managed (1), (2), (3)	Conduct of Operations Issues Inadequately Managed (1), (2), (3)	Notes
			identified or resolved, and no action or inadequate action was taken based on evaluations performed to determine what corrective actions were warranted.
Timeliness	Average: 12% Range: 5% - 19%	Average: 6% Range: 3% - 10%	- EA subject matter experts determined that the corrective actions were delayed, and extensions were both extensive and not justified.
Closure Documentation	Average: 5% Range: 4.9% - 5.4%	Average: 6% Range: 0% - 17%	- Common inadequacies included closing issues with no or inadequate documentation, based on a promise of future action, or by transferring issues into other systems not approved for managing (resolving) issues.

(1) Averages reported in this table are the total number of issues with inadequacies identified for each aspect of issues management over the total number of issues reviewed in that functional area. The ranges reported are the range of averages for issues managed by specific contractors.

(2) EA often identified multiple inadequacies in the management of individual issues so the sum of the percentages for each functional area in table C-2 exceeds the percentage of issues inadequately managed for the same functional area listed in table C-1 (i.e., 37% for hazardous energy control and 36% for the conduct of operations).

(3) Instances of safety issues inadequately managed did not meet requirements of DOE directives invoked by contract, the DOE-approved quality assurance program, consensus standards the contractor committed to in the DOE-approved quality assurance program, or an implementing procedure developed by the contractor.

The results in table C-2 indicate that several organizational behaviors (e.g., attention to safety, organizational learning, problem identification and resolution, and time urgency) are likely negatively impacting the resolution of safety issues associated with the conduction of operations and hazardous energy control. Contractors appropriately assessing and accordingly improving organizational behaviors supporting issues management is key to improving the management of safety issues in these functional areas. Until these organizational behaviors are assessed and improved, additional oversight of the issue categorization and resolution processes (e.g., implementation of compensatory measures, extent-of-condition reviews, causal analyses, corrective action planning and tracking, and effectiveness reviews) is warranted for issues in these functional areas.

Management of Issues Concerning the Other Functional Areas

The average percentage of inadequacies that EA identified in the management of issues concerning radioactive waste, a radiological control program, the conduct of nuclear engineering, the conduct of nuclear maintenance, and industrial hygiene is considerably less than the overall average of inadequacies identified (i.e., 18%, 17%, 16%, 11%, and 11%, respectively, are considerably less than the overall average of 26%). Therefore, other than the recommendations in section 4.0, EA does not have any other recommendations to improve the management of issues within these functional areas.