Independent Assessment of Specific Administrative Controls for Nuclear Safety of Existing U.S. Department of Energy Facilities

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Office of Enterprise Assessments
U.S. Department of Energy

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Acronyms

AC	Administrative Control
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
DSA	Documented Safety Analysis
EA	Office of Enterprise Assessments
EHSS	DOE Office of Environment, Health, Safety and Security
EM	Office of Environmental Management
NE	Office of Nuclear Energy
NNSA	National Nuclear Security Administration
SAC	Specific Administrative Control
SC	Safety Class
SRFO	Savannah River Field Office
SRNS	Savannah River Nuclear Solutions, LLC
SRTE	Savannah River Tritium Enterprise
SS	Safety Significant
SSCs	Structures, Systems, and Components
TSR	Technical Safety Requirement

INDEPENDENT ASSESSMENT OF SPECIFIC ADMINISTRATIVE CONTROLS FOR NUCLEAR SAFETY OF EXISTING U.S. DEPARTMENT OF ENERGY FACILITIES

Executive Summary

The U.S. Department of Energy (DOE) Office of Nuclear Engineering and Safety Basis Assessments, within the independent Office of Enterprise Assessments (EA), assessed the identification, development, and implementation of specific administrative controls (SACs) to determine whether credited nuclear safety functions are reliably fulfilled. EA also assessed contractor and DOE line management programs for assessment and oversight of SACs. The EA assessment was conducted from fiscal year 2020 through 2023 and included 8 onsite assessments at locations supporting operations of existing DOE nuclear facilities managed by contractors of the National Nuclear Security Administration (NNSA) and the Office of Environmental Management (EM). The specific program results for NNSA and EM can be found in appendices D and E, respectively. As part of the onsite assessment activities, EA reviewed 91 (72%) of the SACs and 61 (over half) of the administrative controls (ACs) cited in the safety bases of the selected nuclear facilities. This report identifies common strengths and weaknesses, a best practice, and recommendations to help ensure that credited safety functions are reliably fulfilled.

Overall, NNSA and EM contractors demonstrated adequate knowledge and proficiency in the implementation of all assessed SACs. EA identified one best practice and several strengths. For example:

- The Savannah River Field Office triennially assesses a sample of SACs, similar to assessments of credited engineered controls by safety system experts, to ensure that credited safety functions are reliably fulfilled. (**Best Practice**)
- Contractors followed the hierarchy of controls in DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses* (DSAs), preferentially crediting available engineered controls over SACs for nearly all the assessed SACs.
- Contractors adequately derived nearly all the SAC safety functions from the hazard and accident analyses in the safety bases.
- Contractors have sufficiently trained and qualified workers to support SAC implementation.

However, EA identified extensive weaknesses in the contractors' development, and DOE line management's oversight, of SACs and other ACs, resulting in use of less-reliable controls for nuclear safety at all the assessed locations. For example:

- About half of the reviewed SACs did not comply with the systematic format and content required by DOE-STD-3009-94 to ensure a reliable set of nuclear safety controls.
- About half of the general or programmatic ACs that were reviewed were incorrectly credited in the safety bases with reducing the risk of hazards.
- About a quarter of the reviewed SACs rely on structures, systems, and components that have not been identified or evaluated for classification as credited engineered controls to ensure their reliability.

These onsite assessment results are consistent with technical concerns noted during reviews of safety basis documents for existing nuclear facilities at eight other locations, including sites managed by contractors of the Offices of Science and Nuclear Energy, indicating that the development of SACs for other operations at existing facilities that were not assessed may also be susceptible to these weaknesses. Therefore, the weaknesses identified during EA's onsite assessments provide opportunities to continue to improve the development and maintenance of SACs across the Department to ensure their reliability.

Additionally, EA identified a few weaknesses in the alignment and flowdown of SAC-related performance criteria and parameters of DSAs and technical safety requirement documents to the implementing documents. Inadequate use of elements of DOE-STD-1186-2004 and -2016, *Specific Administrative Controls*, in the safety bases for nuclear facilities contributed to these weaknesses.

Per the DOE implementation plan for Defense Nuclear Facilities Safety Board Recommendation 2020-1, *Nuclear Safety Requirements*, DOE is consolidating "any existing safety basis requirements that are currently embedded in separate directives and standards, such as in DOE O[rder] 420.1C, [*Facility Safety*,] with new nuclear safety basis requirements" in the new DOE order (DOE Order 421.1) being developed for nuclear safety bases. The EA-identified weaknesses support including requirements in DOE Order 421.1 to help ensure that SACs reliably fulfill their credited safety functions, especially SACs credited in safety bases for existing nuclear facilities.

Overall, NNSA and EM contractors demonstrated adequate knowledge and proficiency in the implementation of all assessed SACs as developed, and only a few weaknesses were identified in the alignment and flowdown of SAC-related requirements from safety basis documents to implementing documents. However, EA identified extensive weaknesses in the contractor development and DOE line management oversight of SACs and other ACs, resulting in use of less-reliable controls for nuclear safety at all the assessed locations. Although EA did not identify any imminent safety concerns related to the identified weaknesses, they result in an underestimate of mitigated risks of several accident scenarios in DOE-approved DSAs.

Recommendations

This report provides the following recommendations to help ensure that credited safety functions are reliably fulfilled across the Department.

- The DOE Office of Environment, Health, Safety and Security should consider incorporating the requirements recommended in appendix C into DOE Order 421.1.
- DOE field/site offices, in coordination with their respective contractors, should:
  - Revise DSAs to no longer give risk-reduction credit to ACs that are not SACs.
  - Review SACs in each DSA to assess compliance with the format and content requirements of the DOE-approved methodology for developing the DSA.
- Contractors and DOE field/site offices should improve their quality assurance/oversight of SACs by periodically assessing SAC implementation, including reviews of SAC-related condition reports, engineering operability evaluations, and observations of the execution of SACs.
- DOE line management should more frequently assess and have independent teams assess nuclear safety bases' compliance with 10 CFR 830, *Nuclear Safety Management*; DOE directives; and the DOE-approved methodology for developing the DSA in order to identify any warranted improvements.

INDEPENDENT ASSESSMENT OF SPECIFIC ADMINISTRATIVE CONTROLS FOR NUCLEAR SAFETY OF EXISTING U.S. DEPARTMENT OF ENERGY FACILITIES

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Engineering and Safety Basis Assessments, within the independent Office of Enterprise Assessments (EA), assessed the identification, development, and implementation of specific administrative controls (SACs) to determine whether credited nuclear safety functions are reliably fulfilled. EA also assessed contractor and DOE line management programs for assessment and oversight of SACs. The EA assessment was conducted from fiscal year 2020 through 2023 and included 8 onsite assessments at locations supporting operations within existing nuclear facilities managed by contractors of the National Nuclear Security Administration (NNSA) and the Office of Environmental Management (EM).

The safety basis for a nuclear facility governs operations with hazardous materials. A safety basis includes a documented safety analysis (DSA), the technical safety requirement (TSR) document, and the DOE safety evaluation report approving the safety basis, as well as other DOE-approved documents related to nuclear safety. A DSA includes the descriptions and evaluations of the hazards, potential accident scenarios, and TSRs, including SACs and engineered controls – i.e., controls using structures, systems, and components (SSCs) – that are credited with reducing risk to workers and the public.

Per part B of 10 CFR 830, *Nuclear Safety Management*, "[t]he contractor responsible for a Hazard Category 1, 2, or 3 DOE nuclear facility must obtain approval from DOE for the methodology used to prepare the documented safety analysis for the facility unless the contractor uses a methodology set forth in Table 1 of Appendix A to this part." DOE-STD-3009-94, *Preparation Guide for U. S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, or successor document, is listed as a source of acceptable methodology in table 1 of appendix A of part B of 10 CFR 830. DOE-STD-3009-94 states that the purpose of chapter 4 of a DSA "is to provide information necessary to support the safety basis requirements of 10 CFR 830 for derivation of hazard controls," including SACs. Accordingly, DOE-STD-3009-94 identifies the format and content needed in chapter 4 and the other DSA chapters.

As discussed in appendix B of this report, for over 20 years DOE directives and technical standards applicable to administrative controls (ACs) evolved from predominantly providing guiding principles to establishing more specific requirements and guidance. Nonreactor nuclear facilities being constructed use DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, which includes "clearer criteria and guidance to support effective and consistent DSAs based upon lessons learned in implementing DOE-STD-3009-94." Most contractors of existing nuclear facilities continue to maintain their safety basis, using DOE-STD-3009-94, as allowed by 10 CFR 830.

For this report, EA assessed the identification, development, and implementation of SACs for existing nuclear facilities that continue to use DOE-STD-3009-94. Per DOE-STD-3009-94, "SACs provide preventive and/or mitigative functions for specific potential accident scenarios, which also have safety importance equivalent to engineered controls that would be classified as safety-class [SC] or safety-significant [SS] if the engineered controls were available and selected." This report identifies common strengths and weaknesses, best practices, and recommendations to help ensure that credited safety functions are reliably fulfilled.

2.0 METHODOLOGY

EA implements 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 identification, development, and implementation of SACs at existing nuclear facilities using DOE-STD-3009-94. Based on 16 site-specific, remote reviews (hereafter referred to as scoping studies) of facility safety bases across DOE, SAC implementing procedures, supporting calculations, safety evaluation reports, occurrence reports, and training program records, EA selected 8 locations for onsite assessments to determine whether credited nuclear safety functions are reliably fulfilled. All the locations selected for the onsite assessments are managed by NNSA and EM contractors. The onsite assessments included additional document reviews (e.g., of training materials, qualification records, records of completed SAC implementing procedures, and SAC-related condition reports); onsite tours; observations of SAC training and implementation; and interviews. As part of the onsite assessments, EA reviewed 91 (72%) of the SACs (31 SC and 60 SS) and 61 (over half) of the ACs cited in the safety bases of the selected nuclear facilities. The finding and deficiencies that EA identified during these onsite assessments were documented in separate reports for resolution per DOE Order 227.1A, along with strengths demonstrated by the contractors and field/site offices.

Appendix A of this report lists the contributors to this assessment, the members of the Quality Review Board, and the responsible EA management. Appendix B details the scope, relevant requirements and guidance, and methodology of the review. Appendix B also includes a table of assessed locations and facilities, DOE Headquarters program offices and field/site offices, and links to the individual EA assessment reports used for this overall assessment, as well as a table showing the extent of SAC and AC weaknesses identified during the onsite assessments at NNSA and EM locations. Based on this assessment, appendix C provides EA's recommendations for requirements for SACs to be included in the new order being developed for nuclear safety bases (i.e., DOE Order 421.1). Appendices D and E summarize the onsite assessment results at NNSA and EM locations, respectively.

3.0 RESULTS

Overall, NNSA and EM contractors demonstrated adequate knowledge and proficiency in the implementation of all assessed SACs as developed, and only a few weaknesses were identified in the alignment and flowdown of SAC-related requirements from safety basis documents to implementing documents. However, EA identified extensive weaknesses in the contractors' development, and DOE line management's oversight, of SACs and other ACs, resulting in use of less-reliable controls for nuclear safety at all the assessed locations.

Although EA did not identify any imminent safety concerns related to these weaknesses, they result in an underestimate of mitigated risks of several accident scenarios in DOE-approved safety analyses. In the most extreme case observed, no longer crediting a programmatic AC as a preventive control for exposures from a release due to a design-basis earthquake would result in analyzed exposures to the public close to the Evaluation Guideline and would exceed the consequence threshold for workers by thousands of rem.

The onsite assessment results are consistent with technical concerns noted during the scoping studies at eight other locations, including sites managed by contractors of the Offices of Science and Nuclear Energy, indicating that the development of SACs for other operations at existing nuclear facilities that were not assessed may also be susceptible to these weaknesses. Therefore, the weaknesses identified during EA's onsite assessments provide opportunities to continue to improve the development and maintenance of SACs across the Department to ensure their reliability.

Sections 3.1 through 3.4 of this report discuss in more detail the common strengths and weaknesses and the best practice that EA identified, grouped into the following SAC functional areas: identification and development, implementation, contractor self-assessment, and DOE field/site office oversight. No trends were identified in controls for specific safety functions (e.g., controls credited with reducing the risks from fires). Recommendations to resolve factors contributing to the identified weaknesses are provided in section 4.0 and in appendix C. These include specific recommendations for DOE contractors, line management (i.e., field/site offices and program offices), and the DOE Office of Environment, Health, Safety and Security (EHSS).

3.1 SAC Identification and Development

This portion of the assessment evaluated the identification and development of SACs in the safety analyses supporting operation of nuclear facilities.

The DSAs for most existing nuclear facilities and all the assessed nuclear facilities continue to use DOE-STD-3009-94. Most of the assessed contractors expressed intentions to transition to DOE-STD-3009-2014, but these efforts have commonly been delayed for years. Consolidated Nuclear Security, LLC (CNS) has established dedicated funding and resources and is making considerable progress in aligning the format, content, and evaluations of the credited safety controls at the Pantex Plant with DOE-STD-3009-2014, with a goal to complete this effort by the end of calendar year 2024; however, CNS does not plan to transition its safety analyses to meet all the requirements in DOE-STD-3009-2014. At the Hanford Site, Central Plateau Cleanup Company is developing a DSA for the Solid Waste Operations Complex that complies with all the DOE-STD-3009-2014 requirements. This effort at the Hanford Site is taking more time and resources to complete because it goes beyond just aligning the format, content, and evaluations of controls, as is being done by CNS.

Strengths

The assessed contractors have identified and developed nearly all the reviewed SACs following the hierarchy of controls in DOE-STD-3009-94 (e.g., readily available SSCs were credited with performing safety functions instead of SACs).

Nearly all the SAC safety functions were adequately derived from the hazard and accident analyses in the safety bases.

At the Pantex Plant, CNS effectively uses a team approach with members from engineering, operations, and nuclear safety to formally perform and document the human factors evaluations. CNS uses these evaluations to ensure that SC SACs can be reliably performed by the required individuals.

Weaknesses

Of the 23 deficiencies identified during the assessments, 16 (70%) of them and the one finding identified for senior management attention were associated with the inadequate identification and development of SACs and the attributes of ACs, that are not SACs, being credited with reducing risk. The common

deficiencies identified during the onsite assessments were consistent with the technical concerns from the scoping studies. Specifically, in the assessed DSAs developed and maintained by the contractors and approved by DOE:

- The descriptions and evaluations for 43 (47%) of the 91 reviewed SACs did not comply with the systematic format and content requirements of DOE-STD-3009-94, sections 4.5.X.2, 4.5.X.3, and 4.5.X.4 to ensure that credited safety functions are reliably fulfilled and maintained. In many cases, the necessary information was provided elsewhere in the safety analyses, but 16 (18%) of the reviewed SACs had inadequate evaluations or performance criteria, and 9 (10%) had inadequate descriptions.

  These inconsistencies between the DSAs' format and content and the requirements in DOE-STD-3009-94 were identified at each of the eight assessed locations. Table B-2 in appendix B shows some variation in the extent of these inconsistencies; for example, 52% of the reviewed SACs at NNSA locations and 41% at EM locations did not comply with DOE-STD-3009-94 format and content, and 23% of the reviewed SACs at EM locations and 13% at NNSA locations had inadequate evaluations or performance criteria. However, the extent of these inconsistencies is significant at the assessed NNSA and EM locations.

- Attributes of 29 (48%) of the 61 reviewed ACs were incorrectly used to provide credited risk reduction. The credited elements were implemented via programmatic ACs and safety management programs rather than SACs per the definition of SACs in DOE-STD-3009-94. DOE-STD-3009-94 requires formal evaluation of SACs in the DSAs to demonstrate that the controls can perform their safety functions; there are no similar requirements for ACs. Additionally, ACs are not implemented as rigorously as SACs and thus cannot ensure the credited risk reduction.

  ACs were incorrectly credited at six of the eight assessed locations and resulted in five deficiencies and the one identified finding. Per table B-2, the extent of this weakness is similar between NNSA and EM locations: 50% of the reviewed ACs at NNSA locations and 45% at EM locations were incorrectly used to provide credited risk reduction.

- Of the reviewed SACs, 21 (23%) rely on SSCs that have not been identified or evaluated for functional classification as SS or SC SSCs per DOE-STD-3009-94, section 4.5.X.2, and the guidance in DOE-STD-1186-2004, *Specific Administrative Controls*, section 1.6.1 to ensure their current and future reliability.

  This issue was identified at five of the assessed locations and resulted in five deficiencies. As shown in appendix B, table B-2, this weakness was more prevalent at EM locations; 28% of the reviewed SACs at EM locations and 19% at NNSA locations rely on SSCs that have not been identified or evaluated for functional classification. However, the extent of this weakness is significant at NNSA and EM locations because unreliable SSCs can prevent SACs from fulfilling their safety functions.

Factors contributing to many of the identified weaknesses in SAC identification and development are inadequate implementation of the DOE-STD-3009-94 methodology at the assessed locations; insufficient requirements in DOE directives to help ensure adequate, consistent development of SACs in safety bases; and inadequate use of elements of DOE-STD-1186-2004 and DOE-STD-1186-2016, *Specific Administrative Controls*. For example, DOE-STD-3009-94 provides the format and content for chapter 4 of DSAs (i.e., where SACs are described and evaluated) to implement its methodology, but DOE directives do not include sufficient requirements on safety basis content for SACs or explicitly preclude the use of ACs, other than SACs, for risk reduction.

Per the DOE implementation plan for Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2020-1, *Nuclear Safety Requirements*, DOE "determined that new requirements at the Order level are appropriate for each of these safety basis topical areas [i.e., unreviewed safety questions, justifications for continued operations, TSRs, and SACs] to enhance the nuclear safety framework… The

intent of the [new nuclear safety Order] would be to consolidate any existing safety basis requirements that are currently embedded in separate directives and standards, such as in DOE O[rder] 420.1C, [*Facility Safety*,] with new nuclear safety basis requirements." Accordingly, DOE is evaluating whether elements of DOE-STD-1186-2016 should be included in the new DOE Order 421.1 being developed for nuclear safety bases. The EA-identified weaknesses support including elements of DOE-STD-1186-2016 for SACs in DOE Order 421.1. However, the EA-identified weaknesses also support including other requirements to help ensure that SACs reliably fulfill their credited safety functions across DOE, especially SACs credited in safety bases for existing nuclear facilities.

Conclusions for SAC Identification and Development

The assessed contractors identified and developed nearly all the reviewed SACs following the hierarchy of controls in DOE-STD-3009-94, and nearly all the SAC safety functions were adequately derived and classified based on the significance of their safety function. However, 70% of the deficiencies at the assessed locations were associated with inadequate identification and development of SACs and the attributes of ACs credited with reducing risk not being SACs. These deficiencies were common to many of the reviewed SACs and ACs: 47% of the reviewed SACs do not comply with the systematic format and content requirements of DOE-STD-3009-94, 48% of the reviewed ACs were incorrectly used to provide credited risk reduction, and 23% of the reviewed SACs rely on SSCs that have not been identified or evaluated for functional classification as credited SSCs per DOE-STD-3009-94, DOE-STD-1186-2004, or DOE-STD-1186-2016. Although the extent of these weaknesses varies somewhat between NNSA and EM locations, their scope was extensive at all the assessed locations. Factors contributing to many of the identified weaknesses are inadequate implementation of the DOE-STD-3009-94 methodology, insufficient requirements in DOE directives for SACs, and inadequate use of elements of DOE-STD-1186-2004 and DOE-STD-1186-2016.

Per the DOE implementation plan for DNFSB Recommendation 2020-1, DOE is evaluating whether elements of DOE-STD-1186-2016 should be included in DOE Order 421.1. The EA-identified weaknesses support including elements of DOE-STD-1186-2016 for SACs in DOE Order 421.1, along with other requirements to help ensure that SACs in all DOE-approved nuclear safety bases reliably fulfill their credited safety functions.

3.2 SAC Implementation

This portion of the assessment evaluated the alignment and flowdown of SAC-related performance criteria and parameters of the DSAs and TSR documents to the documents implementing the derived TSRs in the nuclear facilities. This portion also assessed the resultant implementation of SACs to determine whether they are fulfilling their credited safety function.

The DSAs of the assessed locations use DOE-STD-3009-94 for the derivation of TSRs for SACs, including the required performance criteria and implementation parameters. DOE-STD-1186-2004 provides guidance on "how SACs are formulated, implemented, and maintained;" "to improve the dependability of SACs;" and on the "treatment of SACs in TSRs." Neither DOE-STD-1186-2004 nor DOE-STD-1186-2016 is an invoked technical standard, allowing DOE contractors and line management to use them at their discretion. Seven of the eight assessed locations use these standards as unrequired guidance or selectively use elements of these standards.

Strengths

The contractors managing the assessed locations adequately trained and qualified workers for SAC implementation. Additionally, contractors at two assessed locations are taking actions to further improve operator training and proficiency. Specifically:

- Savannah River Nuclear Solutions, LLC (SRNS) is improving its training in support of SACs for the Savannah River Tritium Enterprise by using mockups and cross-training instructors and experienced operators.
- At the Los Alamos National Laboratory, Triad National Security, LLC used thorough and extensive planning and rehearsal, which included the use of mockups, before performing a high hazard container venting activity.

Further, two assessed contractors are developing approaches for managing SACs based on approaches for engineered controls using SSCs to fulfill credited safety functions. Specifically:

- For the Savannah River Tritium Enterprise, SRNS documented the basis used to develop specific SACs and details on their implementation in program description documents, similar to system description documents maintained for SSCs.
- At the Pantex Plant, CNS designated control owners to oversee the development and implementation of specific SACs, similar to cognizant system engineers for credited SSCs.

Contractor personnel demonstrated adequate knowledge and proficiency in the implementation of all assessed SACs during evolutions, field walkdowns, tabletop presentations, and interviews.

Weaknesses

Of the 23 deficiencies identified during the assessments, 6 (26%) involved SAC implementation. These deficiencies were identified at 6 of the 8 assessed locations. These results were consistent with the scoping studies. These six deficiencies were associated with the following SAC weaknesses:

- For 4 (4%) of the 91 reviewed SACs, at 3 of the assessed EM locations, the parameters for SAC implementation from the DSAs were not adequately incorporated in the contractor-maintained, DOE-approved TSR documents. Specifically:
  - For one SAC, the DSA and the TSR document differ on the frequency of the surveillance requirement confirming that the safety function is being met, potentially allowing the surveillance to be performed less frequently than analyzed.
  - For three SACs at two assessed locations, the TSRs did not include "the limits, controls, and related actions that establish the specific parameters and requisite actions for the safe operation of a nuclear facility" per the definition of TSRs in 10 CFR 830. Instead, the TSR documents referenced the sections in the DSA that contained the required parameters. Contractors can change the parameters listed in these sections without DOE approval if those changes are within the bounds of the existing analysis in the approved safety basis. However, 10 CFR 830.205(a)(2) requires DOE approval of all TSR changes. Not providing the parameters in the TSR documents increases the risk of changing the parameters without the required DOE approval.

  Per table B-2 in appendix B, for 10% of the reviewed SACs at EM locations, the parameters for SAC implementation were not adequately incorporated in the TSR documents. This weakness was not identified at the assessed NNSA locations. Only one SAC had inconsistent parameters between the DSA and TSR document.
- For 6 (7%) of the reviewed SACs, at 3 of the 8 assessed locations, TSR parameters were not adequately incorporated into facility implementing documents to ensure that the safety functions are

fulfilled per DOE-STD-3009-94, section 4.5.X.4; 10 CFR 830.122(e)(1); and the 10 CFR 830.3 definition of a TSR. Five of these SACs did not include adequate details to ensure that the safety functions would continue to be reliably fulfilled, and the remaining SAC did not have an implementing document.

Per table B-2, this weakness was more prevalent at NNSA locations (i.e., for 10% of the reviewed SACs at NNSA locations and 3% at EM locations). The adequate flowdown of TSR parameters to implementing procedures is a key component in ensuring that credited safety functions of SACs are fulfilled.

- One contractor incorrectly classified software supporting SS and SC functions of two SACs as non-safety software. EA is performing a more comprehensive assessment of software quality assurance requirements and their implementation across the DOE complex, which will be documented in a separate report.

Per 10 CFR 830, "[a] contractor must perform work in accordance with the DOE-approved safety basis …and, in particular, with the hazard controls that ensure adequate protection of workers, the public, and the environment." DOE-STD-3009-94, section 4.5.X.4, states that "performance criteria characterize the specific operational responses and capabilities necessary to meet functional requirements." However, neither 10 CFR 830, DOE Order 420.1C, *Facility Safety*, nor DOE-STD-3009-94 provides more detailed requirements to ensure that SACs are adequately implemented. Per the guidance of DOE-STD-1186-2004, section 2.3, these implementing documents "should include specifications for implementation such as qualifications of involved personnel, steps involved, verification of identified limits, frequency of verification, requirements for any independent verifications, interfaces with measuring equipment, and the required accuracy of the equipment." However, neither DOE-STD-1186-2004 nor -2016 is listed as an invoked technical standard in DOE Order 420.1C, allowing DOE contractors and line management to implement them at their discretion. Per the DOE implementation plan for DNFSB Recommendation 2020-1, DOE is evaluating whether elements of DOE-STD-1186-2016 should be included in DOE Order 421.1. The EA-identified weaknesses support including elements of DOE-STD-1186-2016 and other requirements in DOE Order 421.1.

Conclusions for SAC Implementation

The NNSA and EM contractors managing the assessed locations have adequately trained and qualified workers for SAC implementation. Contractors at two sites are taking actions to further improve operator training and proficiency. Contractor personnel demonstrated adequate knowledge and proficiency in the performance of all assessed SACs during evolutions, field walkdowns, tabletop presentations, and interviews. At two sites, contractors are developing approaches for managing SACs based on approaches successfully used for engineered controls. A few weaknesses were identified in the alignment and flowdown of performance criteria and parameters of the DSAs and TSR documents to documents implementing the TSRs in the nuclear facilities. These weaknesses were not as extensive as those discussed in section 3.1. However, the EA-identified weaknesses support including more detailed requirements in DOE Order 421.1 to help ensure consistent, reliable implementation of SACs across DOE.

3.3 Contractor Self-assessment

This portion of the assessment evaluated contractors' assessments of their SAC implementation.

Per 10 CFR 830, subpart A, *Quality Assurance Requirements*, contractors are to develop, maintain, and conduct work in accordance with the DOE-approved quality assurance program. Contractor quality assurance programs are required to describe how the quality assurance criteria of 10 CFR 830.122,

Quality assurance criteria, including management and independent assessments, are satisfied for "items or services that affect, or may affect, nuclear safety of DOE nuclear facilities." Additionally, DOE-STD-1186-2004 and DOE-STD-1186-2016 state that "SACs identified in TSRs shall be initially (prior to operation) and periodically verified to be capable of performing their intended safety function." However, neither version of DOE-STD-1186 is an invoked technical standard of DOE Order 420.1C.

Strengths

Contractors at seven of the assessed locations periodically reviewed the flowdown of SAC requirements in the safety bases to the documents implementing them. At three locations (two at NNSA locations and one at an EM location), contractors also periodically verified (e.g., with work observations, procedure walkdowns, tabletop exercises, or hazard or casualty exercises) that the implementation of SACs fulfilled the credited safety functions. At the Savannah River Site, an SRNS independent evaluation board conducts performance-based reviews of the implementation of a sample of SACs.

Weaknesses

Contrary to the graded approach and quality assurance criteria for assessments set out in 10 CFR 830 and the guidance in DOE-STD-1186-2004, section 2.2, contractors at five of the assessed locations (two at NNSA locations and three at EM locations) did not periodically verify that SACs perform their safety functions with work observations, procedure walkdowns, tabletop exercises, or hazard or casualty exercises.

Conclusions for Contractor Self-assessment

Contractors at seven assessed locations periodically reviewed the flowdown of SAC requirements in the safety bases to the documents implementing them. Contractors at five assessed locations (two at NNSA locations and three at EM locations) did not periodically verify that SACs perform their safety functions with work observations, procedure walkdowns, tabletop exercises, or hazard or casualty exercises. The lack of performance-based periodic reviews or assessments by contractors to verify that SACs fulfill their credited safety functions can allow discrepant conditions to go undetected and thus remain unresolved.

3.4 DOE Field/Site Office Oversight

This portion of the assessment evaluated DOE field/site office oversight of SAC identification, development, and implementation.

Per 10 CFR 830, subpart B, *Safety Basis Requirements*, DOE approves the contractor-developed and contractor-maintained DSA as well as the TSR documents and the changes to them. Typically, field/site office managers are delegated the authority to approve the safety basis and establish a safety basis review team of qualified field office personnel to independently review the safety basis.

Per DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*, field/site office managers are to implement line management oversight programs and processes "tailored according to the effectiveness of contractor assurance systems, the hazards at the site/activity, and the degree of risk, giving additional emphasis to potentially high consequence activities." DOE Order 226.1B also states that DOE line management organizations must include "DOE Headquarters line organizations' conduct of oversight processes that are focused primarily on their DOE Field Elements, including reviewing contractor activities to the extent necessary to evaluate the implementation and effectiveness of the Field Element's oversight of its contractors."

Strengths

Field/site office Facility Representatives at each assessed location oversee the implementation of SACs as part of their routine surveillance activities. Because issues in SAC implementation would be identified during routine TSR operational awareness activities, this SAC oversight approach is considered effective. Notably, the NNSA's Livermore Field Office, Los Alamos Field Office, and Savannah River Field Office (SRFO) also use safety system experts and/or nuclear safety specialists to assess SAC implementation.

Uniquely, SRFO assesses the flowdown of controls from the DSA to implementation for a sample of SACs on a triennial basis, similar to assessments of credited SSCs regularly performed by safety system experts at SRFO and other field offices to ensure that credited safety functions are reliably fulfilled. EA cites the performance of formal, periodic assessments of SAC implementation as a **Best Practice** for consideration by other field/site offices because SACs perform hazard control functions of equal importance to those performed by credited SSCs, which are regularly assessed by field/site office safety system experts.

Weaknesses

Insufficient assessment and oversight of safety bases by DOE line management to confirm compliance with 10 CFR 830 and DOE-STD-3009-94 allowed the weaknesses in SAC development discussed in section 3.1 to persist. None of the reviewed field/site office oversight activities periodically assesses the flowdown of or compliance with the requirements in DOE-STD-3009-94.

Conclusions for DOE Field/Site Office Oversight

DOE field/site office Facility Representatives at each assessed location adequately oversee the implementation of SACs as part of their routine surveillance activities. EA cited the SRFO performance of formal, periodic assessments of SAC implementation as a **Best Practice** because SACs perform hazard control functions of equal importance to those performed by credited SSCs, which are regularly assessed by field/site office safety system experts. Insufficient assessment and oversight of safety bases by DOE line management to confirm compliance with 10 CFR 830 and DOE-STD-3009-94 allowed the extensive weaknesses in SAC development discussed in section 3.1 to persist.

4.0 RECOMMENDATIONS

The following recommendations are based on the analysis of assessment results as summarized in section 3.0 of this report. While the underlying deficiencies from the individual assessments did not apply to every reviewed site, the recommended actions are intended to provide insights for potential improvements at all DOE nuclear sites. Consequently, DOE organizations and site contractors should evaluate the applicability of the following recommended actions to their respective facilities and/or organizations and consider their use as appropriate, in accordance with Headquarters and/or site-specific program objectives.

To help ensure the reliability of SACs in all DOE-approved nuclear safety bases and consolidate nuclear safety requirements for SACs in a DOE order as stated in the DOE implementation plan for DNFSB Recommendation 2020-1:	
EHSS	• Consider adding requirements in appendix C to the new DOE order being developed for nuclear safety bases, DOE Order 421.1.
To improve the effectiveness of contractor self-assessments of SAC implementation:	
Site Contractors	• Modify the periodic SAC assessments to include performance-based criteria, such as reviews of SAC-related condition reports, reviews of engineering operability evaluations, and observations of the execution of SACs or walkdowns of SAC-implementing procedures with the contractor personnel responsible for executing them.
To improve the effectiveness of Federal oversight and assessment of SAC implementation:	
DOE Field/Site Element Managers	• In coordination with respective contractors: o Revise DSAs to no longer give risk-reduction credit to ACs that are not SACs. o Review SACs in each DSA to assess compliance with the format and content requirements of the DOE-approved methodology for developing the DSA, considering the weaknesses identified in this report. • Implement the best practice demonstrated by SRFO by triennially assessing the flowdown of requirements and parameters for SAC implementation from the DSAs to implementation for a sample of SACs, similar to assessments of credited SSCs that are typically performed by safety system experts.
DOE Line Management (Field/sites and Program Offices)	• More frequently assess and have independent teams assess nuclear safety bases' compliance with 10 CFR 830, DOE directives, and the DOE-approved methodology for developing the DSA in order to identify any warranted improvements.

Appendix A
Supplemental Information

Office of Enterprise Assessments Management

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William F. West, Deputy Director, Office of Enterprise Assessments
Kevin G. Kilp, Director, Office of Environment, Safety and Health Assessments
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Appendix B
Scope, Relevant Requirements and Guidance, Methodology, and Extent Analysis

B.1 SCOPE

The U.S. Department of Energy (DOE) Office of Nuclear Engineering and Safety Basis Assessments, within the independent Office of Enterprise Assessments (EA), assessed the identification, development, and implementation of specific administrative controls (SACs) to determine whether credited nuclear safety functions are reliably fulfilled. EA also assessed contractor and DOE line management programs for assessment and oversight of SACs. The EA assessment was conducted from fiscal year 2020 through 2023 and included 16 site-specific scoping studies and 8 onsite assessments at locations supporting operations of existing DOE nuclear facilities. The scoping studies included nuclear facilities managed by contractors of the DOE Offices of Environmental Management (EM), Science, and Nuclear Energy (NE), and the National Nuclear Security Administration (NNSA). The onsite assessments were conducted at locations managed by contractors of EM and NNSA. Based on an analysis of the results of predominantly the onsite activities, this report identifies overall strengths and weaknesses, best practices, and recommendations to further increase the reliability of SACs in fulfilling their safety functions.

B.2 RELEVANT REQUIREMENTS AND GUIDANCE

The following Federal regulation and DOE order and technical standards address the identification of SACs, their development in documented safety analyses (DSAs) and technical safety requirement (TSR) documents, and their implementation:

- 10 CFR 830, *Nuclear Safety Management*
- DOE Order 420.1C, *Facility Safety*
- DOE-STD-3009-94, *Preparation Guide for U. S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports,* retitled *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses* via Change 2 in April 2002
- DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*
- DOE-STD-1186-2004, *Specific Administrative Controls*
- DOE-STD-1186-2016, *Specific Administrative Controls*.

The evolution and interface between the Federal regulation and the DOE directives and technical standards concerning SACs are summarized below.

Per part B of 10 CFR 830, "[t]he contractor responsible for a Hazard Category 1, 2, or 3 DOE nuclear facility must obtain approval from DOE for the methodology used to prepare the documented safety analysis for the facility unless the contractor uses a methodology set forth in Table 1 of Appendix A to this part." DOE-STD-3009-94, or successor document, is listed as a source of acceptable methodology in table 1 of appendix A of this part.

DOE-STD-3009-94 "incorporate[d] and integrate[d] many different approaches regarding DSA format and content. To ensure a consistent application of this Standard among users," it provided guiding principles and guidance on how requirements for DSAs and TSRs should be met.

Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2002-3, *Requirements for the Design, Implementation, and Maintenance of Administrative Controls*, stated "the Board has identified a number of administrative safety controls, proposed or in use, at various defense nuclear facilities that are

technically inadequate…[and] concluded that the DOE directives system does not contain adequate requirements for the design, implementation, and maintenance of important safety-related administrative controls to ensure that they will be effective and reliable." DOE agreed with DNFSB Recommendation 2002-3 and evaluated and improved its directives concerning administrative controls (ACs). For example:

- In August 2004, DOE issued DOE-STD-1186-2004 to provide, in one document, guidance "to enhance assurance of the effectiveness and dependability of these important administrative controls [i.e., SACs] beyond that which might be experienced if the specific action AC were simply to be implemented under the auspices of a Safety Management Program."
- In March 2006, DOE issued Change Notice 3 of DOE-STD-3009-94 to reflect that DOE Order 5480.23, *Nuclear Safety Analysis Reports*, was replaced by 10 CFR 830, with DOE-STD-3009-94 representing a "safe harbor" methodology to be used as a guide in conjunction with 10 CFR 830. Change Notice 3 also provided guidance on the identification, analysis, functional requirements, and parameters of SACs that should be in DSAs, because SACs "provide preventive and/or mitigative functions for specific potential accident scenarios, which also have safety importance equivalent to engineered controls that would be classified as safety-class or safety-significant if the engineered controls were available and selected." Change Notice 3 also added section 4.5 to provide the format and content of information on SACs to be included in chapter 4 of DSAs.

The DNFSB agreed that the actions taken were sufficient and closed Recommendation 2002-3 in October 2013.

In November 2014, DOE issued DOE-STD-3009-2014 "to clearly identify those portions of the Standard that are required to meet 10 C.F.R. Part 830 requirements if this methodology is used for DSA preparation…[and] to provide clearer criteria and guidance to support effective and consistent DSAs based upon lessons learned in implementing DOE-STD-3009-94. Individual facilities, sites, and program offices may choose or be directed to apply this revision for upgrading a facility or site DSA, if desired."

During the rollout of DOE-STD-3009-2014, DOE stated that existing facilities not undergoing a major modification should apply DOE-STD-3009-2014 over time. In June 2015, the DOE Office of Environment, Health, Safety and Security (EHSS) issued an operating experience level 1 document, OE-1: 2015-1, *Evaluation of Existing Facilities to DOE-STD-3009-2014*, signed by the DOE Deputy Secretary. This OE-1 states that "[t]o continue to benefit from the best practices and lessons learned incorporated into the new DOE-STD-3009-2014, DOE nuclear facilities are encouraged to move toward its use over time (i.e., 5-10 years). This action is not intended to revise any existing DOE requirements. Sites can evaluate whether DOE-STD-3009-2014 is appropriate for their facilities through the normal processes of evaluating new standards to determine applicability and benefit."

In December 2016, DOE issued DOE-STD-1186-2016. Whereas DOE-STD-1186-2004 provided guidance for SACs, DOE-STD-1186-2016 "provides requirements and guidance on acceptable methods for developing and implementing [SACs] at nuclear facilities."

Per DOE Order 420.1C, each DOE element is to "[d]irect its contractors to use DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, for preparing [DSAs], when the DOE-STD-3009 method is used to satisfy [10 CFR 830] requirements for new DOE non-reactor nuclear facilities and major modifications to existing DOE non-reactor nuclear facilities." However, "the appropriate Head of Department Element, or designee, with concurrence by the applicable Central Technical Authority, may approve use of DOE-STD-3009-94…for major modifications to existing nuclear facilities." Neither DOE-STD-1186-2004 nor -2016 is an invoked technical standard of DOE Order 420.1C. Therefore, contractors maintaining safety bases for existing nuclear facilities may

continue to use DOE-STD-3009-94 for DSAs and use DOE-STD-1186-2004 and -2016 as guidance for SACs.

In June 2021, the DNFSB revised and reaffirmed its Recommendation 2020-1, *Nuclear Safety Requirements*, to recommend "specific measures that DOE should adopt as requirements in its regulatory framework, including 10 CFR 830 and associated orders and standards, to include the implementation thereof, to ensure that public health and safety are adequately protected." These recommendations included specific measures to address aging infrastructure and DNFSB concerns related to the categorization of nuclear facilities, DSA preparation and review processes, processes and requirements for the safety basis (including those for unreviewed safety questions, TSRs, and SACs), and DOE approval of nuclear facility safety bases.

DOE agreed with the revised DNFSB Recommendation 2020-1 and developed a detailed implementation plan that was being executed at the time of this assessment. This implementation plan included the establishment of requirements for key safety basis concepts involving SACs, noting that "DOE has determined that new requirements at the Order level are appropriate for each of these safety basis topical areas to enhance the nuclear safety framework." Accordingly, DOE committed to address an "evaluation of DOE-STD-1186-2016, *Specific Administrative Controls*, and whether the requirements should be elevated to requirements in an Order, or whether the Standard should be invoked in the future." In a letter to the DNFSB from the Acting Deputy Director for EHSS issued on July 11, 2023, DOE revised deliverable 5.3.1, *New Nuclear Safety Order Authorization by Directives Review Board (DRB)* of the DOE implementation plan "to develop a new and separate DOE Order focused on nuclear safety basis requirements, along with any necessary revisions to [DOE Order] 420.1C." In this letter, DOE stated that it "anticipates the completion date for this effort to be December 27, 2024."

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 the following CRADs during the scoping studies and onsite assessments to assess the identification, development, and implementation of SACs to ensure that they reliably fulfill their required safety functions:

- CRAD 34-02, *Specific Administrative Controls*
- CRAD 31-3, *Safety Basis Upgrade Review Criteria Review and Approach Document*
- CRAD EA-30-07, *Federal Line Management Oversight Processes*

EA performed the scoping studies and onsite assessments listed in table B-1 to get a representative sample of contractor identification, development, and implementation and field/site office oversight of SACs at existing nuclear facilities across the DOE program offices. Per EA's resource-loaded, multiyear assessment plan, many of the same EA personnel supporting the scoping studies also participated in the onsite assessments to facilitate consistency in the overall assessment approach and implementation of the plan. EA personnel who participated in several scoping studies and onsite assessments prepared this overall assessment of SACs.

For the scoping studies, EA focused its review on the elements of the safety bases for SACs and other ACs cited in the safety bases. EA also reviewed implementing procedures, supporting calculations, safety evaluation reports, occurrence reports, and training program records. If EA concluded that there were

sufficient technical concerns regarding SAC development or potential implementation issues involving the control of high-risk events, or a lack of clarity in the overall use of ACs (e.g., the crediting of ACs for risk reduction), EA selected that location for further onsite assessment. Per this methodology, all the locations selected for the onsite assessments are managed by NNSA and EM contractors.

The onsite assessments included additional document reviews (e.g., of training materials, qualification records, records of completed SAC implementing procedures, and SAC-related condition reports), onsite tours, observations of SAC training and implementation, and interviews. As part of the onsite assessments, EA reviewed 91 (72%) of the SACs (31 safety class and 60 safety significant). These SACs included the most significant SACs based on the hazards analyses, SACs that rely on hardware/software for their implementation, and SACs that may have been relied upon instead of safety structures, systems, or components (SSCs). EA also evaluated 61 (over half) of the ACs cited in the safety bases of the selected nuclear facilities to determine whether they were properly designated.

Findings and deficiencies that EA identified during the onsite assessments are documented in the separate EA assessment reports listed in table B-1; the assessments also identified a best practice demonstrated by a field office. 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.

By analyzing the identified strengths and weaknesses, EA assessed the adequacy of the requirements and guidance of 10 CFR 830 and DOE directives and technical standards listed in section B.2.

Table B-1. Assessed Locations and Associated Source Documents

Site	Facilities	DOE Field/Site Office (and Program Office)	EA Assessment Report
Hanford Site	Tank Farms 242-A Evaporator	Office of River Protection (EM)	*Independent Assessment of Specific Administrative Controls at the Hanford Site Tank Farms and 242-A Evaporator Facility - December 2021*
Lawrence Livermore National Laboratory	B332 (Plutonium Facility)	Livermore Field Office (NNSA)	*Independent Assessment of Specific Administrative Controls at the Lawrence Livermore National Laboratory Plutonium Facility-Building 332 - March 2022*
Savannah River Site	Defense Waste Processing Facility	Savannah River Operations Office (EM)	*Independent Assessment of Specific Administrative Controls at Savannah River Site Defense Waste Processing Facility - May 2022*
Hanford Site	Solid Waste Operations Complex	DOE Richland Operations Office and Office of River Protection (EM)	*Independent Assessment of Specific Administrative Controls at the Hanford Site Solid Waste Operations Complex - August 2022*
Los Alamos National Laboratory	Weapons Engineering Tritium Facility	Los Alamos Field Office (NNSA)	*Independent Assessment of Specific Administrative Controls at the Los Alamos National Laboratory Weapons Engineering Tritium Facility - November 2022*

Site	Facilities	DOE Field/Site Office (and Program Office)	EA Assessment Report
Savannah River Site	H-Canyon	Savannah River Operations Office (EM)	*Independent Assessment of Specific Administrative Controls at the Savannah River Site H-Canyon - May 2023*
Pantex Plant	Nuclear Material Operations	NNSA Production Office (NNSA)	*Independent Assessment of Specific Administrative Controls at the Pantex Plant - September 2023*
Savannah River Site	Tritium Facility and Tritium Extraction Facility	Savannah River Field Office (NNSA)	*Independent Assessment of Specific Administrative Controls for the Savannah River Tritium Enterprise - December 2023*
Nevada National Security Site	Device Assembly Facility	Nevada Field Office (NNSA)	None – scoping study performed January 2021
Idaho National Laboratory	Fuel Conditioning Facility	Idaho Operations Office (NE)	None – scoping study performed March 2021
Oak Ridge National Laboratory	High Flux Isotope Reactor	Oak Ridge National Laboratory Site Office (Office of Science)	None – scoping study performed March 2021
Waste Isolation Pilot Plant	Waste Isolation Pilot Plant	Carlsbad Field Office (EM)	None – scoping study performed April 2021
Idaho National Laboratory	Irradiated Fuel Storage Facility	Idaho Operations Office (NE)	None – scoping study performed November 2021
Oak Ridge National Laboratory	Liquid Low-Level Waste System	Oak Ridge Office of Environmental Management (EM)	None – scoping study performed February 2022
Y-12 National Security Complex	Building 9212	NNSA Production Office (NNSA)	None – scoping study performed September 2022
Pacific Northwest National Laboratory	Building 325 Radiochemical Processing Laboratory	Pacific Northwest Site Office (Office of Science)	None – scoping study performed October 2022

B.4 EXTENT ANALYSIS

Section 3 of this report provides the results of the overall EA assessment of SACs used in existing nuclear facilities based on the reports listed in table B-1. The type and extent of the SAC and AC weaknesses identified during the onsite assessments at NNSA and EM locations, supporting the overall assessment, are summarized in table B-2 and discussed in appendices D and E.

Table B-2. Extent of SAC and AC Weaknesses Identified during Onsite Assessments

	At NNSA Locations	At EM Locations	At NNSA and EM Locations
SACs assessed	63% (52 of 82)	87% (39 of 45)	72% (91 of 127)
SACs that did not comply with the format and content of the DOE-STD-3009-94	52% (27 of 52)	41% (16 of 39)	47% (43 of 91)
SACs with inadequate evaluations or performance criteria	13% (7 of 52)	23% (9 of 39)	18% (16 of 91)
SACs with inadequate descriptions	10% (5 of 52)	10% (4 of 39)	10% (9 of 91)
ACs that were incorrectly used to provide risk reduction	50% (14 of 28)	45% (15 of 33)	48% (29 of 61)
SACs relying on SSCs that have not been identified or evaluated for functional classification as safety significant or safety class SSCs	19% (10 of 52)	28% (11 of 39)	23% (21 of 91)
SAC implementation parameters were not adequately incorporated in TSR documents	None	10% (4 of 39)	4% (4 of 91)
TSR parameters were not adequately incorporated into implementing documents	10% (5 of 52)	3% (1 of 39)	7% (6 of 91)

Appendix C
Recommendations for DOE Order 421.1

Per the U.S, Department of Energy (DOE) implementation plan for Defense Nuclear Facilities Safety Board Recommendation 2020-1, *Nuclear Safety Requirements*, DOE "determined that new requirements at the Order level are appropriate for each of these safety basis topical areas [i.e., unreviewed safety questions, justifications for continued operations, technical safety requirements (TSRs), and specific administrative controls (SACs)] to enhance the nuclear safety framework… The intent of the [new nuclear safety Order] would be to consolidate any existing safety basis requirements that are currently embedded in separate directives and standards, such as in DOE O[rder] 420.1C, with new nuclear safety basis requirements." Accordingly, DOE is evaluating whether elements of DOE-STD-1186-2016 should be included in the new DOE order (DOE Order 421.1) being developed for nuclear safety bases.

The weaknesses identified by the DOE Office of Enterprise Assessments (EA) support including the following for SACs in DOE Order 421.1. EA recommends that the format or methodology for presenting the information fulfilling the proposed requirements continue to be per the safe harbor methodology DOE approved per 10 CFR 830.

In DOE Order 421.1, Require:	Comments/Justification
The documented safety analysis (DSA) to justify use of SACs in lieu of structures, systems, and components (SSCs).	• Ten percent of the reviewed SACs had inadequate descriptions, including inadequate justifications for using SACs in lieu of available SSCs. • Insufficient requirements in DOE directives to help ensure adequate, consistent development of SACs in safety bases contributed to this weakness.
Administrative controls (ACs) that provide credited risk reduction, or protect analysis assumptions, to be SACs.	• About half of the reviewed ACs were incorrectly used to provide credited risk reduction. • DOE directives do not explicitly preclude the use of ACs, other than SACs, for risk reduction.
The DSA to identify the safety functions, functional requirements, and performance criteria of SACs and to evaluate how the performance criteria and supporting SSCs will ensure that safety functions are adequately and reliably fulfilled.	• Eighteen percent of the reviewed SACs had inadequate evaluations or performance criteria, and ten percent had inadequate descriptions. • Insufficient requirements in DOE directives to help ensure adequate, consistent development of SACs in safety bases contributed to this weakness.
The DSA to identify SSCs whose failure would result in losing the ability to complete an action required by a SAC and to functionally classify SSCs and software necessary for the performance of actions required by the SAC consistent with the safety function of the SAC or provide justification for not functionally classifying the SSCs as safety significant or safety class SSCs.	• Approximately a quarter of the reviewed SACs rely on SSCs that have not been identified or evaluated for functional classification. • Insufficient requirements in DOE directives to help ensure adequate, consistent development of SACs in safety bases contributed to this weakness.

In DOE Order 421.1, Require:	Comments/Justification
SAC performance criteria to be controlled via the TSR document.	• For approximately four percent of the reviewed SACs, the parameters for SAC implementation from the DSAs were not adequately incorporated in the contractor-maintained, DOE-approved TSR documents.
SACs to be implemented using formally controlled documents that: (1) are understandable, practical, usable, and adequate for meeting the functional requirements and expectations of the SAC TSR; (2) include the information needed to support implementation, including the identification of necessary support equipment and required personnel qualifications; (3) highlight the procedure steps applicable to implementing the SAC; and (4) include a mechanism and documentation for demonstrating reliable procedural compliance.	• For approximately seven percent of the reviewed SACs, TSR parameters were not adequately incorporated into facility implementing documents to ensure that the safety functions are fulfilled. • EA recommends designating the corresponding guidance in DOE-STD-1186-2016 as requirements because neither 10 CFR 830, DOE Order 420.1C, DOE-STD-3009-94, nor -2014 provide more detailed requirements to ensure that SACs are adequately implemented.
SACs to be initially (prior to operation) and periodically verified to be capable of performing their intended safety function. The periodic verifications shall be performance-based, including reviews of SAC-related condition reports, engineering operability evaluations, and observations of the execution of SACs.	• Contractor quality assurance programs are required to describe how the quality assurance criteria of 10 CFR 830.122, *Quality assurance criteria*, including management and independent assessments, are satisfied for "items or services that affect, or may affect, nuclear safety of DOE nuclear facilities." Additionally, contractors are required to develop and implement assurance systems and the approved graded approach, which would require rigorous assessments of SACs. However, contrary to these general requirements and the guidance in DOE-STD-1186-2004, section 2.2, contractors at five of the assessed locations did not periodically verify that SACs perform their safety functions with work observations, procedure walkdowns, tabletop exercises, or hazard or casualty exercises.
Periodic field/site office assessments of SAC implementation and performance to be conducted in accordance with DOE Order 226.1B.	• The Savannah River Field Office was the only assessed field office that periodically assesses the flowdown of controls from the DSA to implementation for a sample of SACs, similar to assessments of credited SSCs regularly performed by safety system experts. • SACs perform hazard control functions as important as those performed by credited SSCs, and therefore warrant the same rigor as credited SSCs based on the graded approach.

Appendix D
Assessment of Specific Administrative Controls at National Nuclear Security Administration Locations

D.1 INTRODUCTION

As part of its initial review, the U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) performed remote scoping studies of the identification, development, implementation, and oversight of specific administrative controls (SACs) at six National Nuclear Security Administration (NNSA) locations. Four of these locations were selected for onsite assessments. The NNSA locations where EA performed these scoping studies and onsite assessments are listed in table B-1 of appendix B. As part of the onsite assessments, EA reviewed 52 (63%) of the 82 SACs – 26 safety class (SC) and 26 safety significant (SS) – and 28 (over half) of the administrative controls (ACs) cited in the safety bases of the selected NNSA nuclear facilities. At the NNSA locations, EA identified 12 deficiencies, no findings, 11 strengths, and a best practice. The following sections discuss the common strengths and weaknesses and the best practice at the NNSA locations, grouped into the following SAC functional areas: identification and development, implementation, contractor self-assessment, and NNSA field office oversight. Recommendations for NNSA contractors and line management based on the results of the overall assessment of SACs are in section 4.0 of the report.

D.2 NNSA SAC IDENTIFICATION AND DEVELOPMENT

Strengths

The reviewed SACs followed the hierarchy of controls in DOE-STD-3009-94.

SAC safety functions were adequately derived from the hazard and accident analyses in the safety bases.

At the Pantex Plant, Consolidated Nuclear Security, LLC (CNS) effectively uses a team approach with members from engineering, operations, and nuclear safety to formally perform and document the human factors evaluations. CNS uses these evaluations to ensure that SC SACs can be reliably performed by the required individuals.

CNS has established dedicated funding and resources and is making considerable progress in aligning the format, content, and evaluations of the credited safety controls at the Pantex Plant with DOE-STD-3009-2014, with a goal to complete this effort by the end of calendar year 2024; however, CNS does not plan to transition its safety analyses to meet all the requirements in DOE-STD-3009-2014.

Weaknesses

Of the 12 deficiencies identified at NNSA locations, 9 (75%) of them were associated with inadequate identification and development of SACs and the attributes of ACs, that are not SACs, being credited with reducing risk. SAC identification and development issues were identified at the four assessed NNSA locations, as summarized below:

- The descriptions and evaluations for 27 (52%) of the 52 reviewed SACs did not comply with the systematic format and content requirements of DOE-STD-3009-94, sections 4.5.X.2, 4.5.X.3, and 4.5.X.4, to ensure that credited safety functions are reliably fulfilled and maintained. In many cases, the necessary information was provided elsewhere in the safety analyses, but 7 (13%) of the reviewed SACs had inadequate evaluations or performance criteria, and 5 (10%) had inadequate descriptions.

These inconsistencies between the format and content of the documented safety analyses (DSAs) and the requirements of DOE-STD-3009-94 were observed at the four assessed NNSA locations.

- Attributes of 14 (50%) of the 28 reviewed ACs were incorrectly used to provide credited risk reduction. The credited elements were implemented via programmatic ACs and safety management programs rather than SACs per the definition of SACs in DOE-STD-3009-94.
- Of the reviewed SACs, 10 (19%) rely on SSCs that have not been identified or evaluated for functional classification as SS or SC SSCs per DOE-STD-3009-94, section 4.5.X.2, and DOE-STD-1186-2004, section 1.6.1, to ensure their current and future reliability. This issue was identified at three of the NNSA locations and resulted in three deficiencies.

D.3 NNSA SAC IMPLEMENTATION

Strengths

The contractors managing the assessed locations have adequately trained and qualified workers for SAC implementation. Additionally, two NNSA contractors are taking actions to further improve operator training and proficiency. Specifically:

- Savannah River Nuclear Solutions, LLC (SRNS) is improving its training in support of SACs for the Savannah River Tritium Enterprise (SRTE) by using mockups and cross-training instructors and experienced operators.
- At the Los Alamos National Laboratory, Triad National Security, LLC used thorough and extensive planning and rehearsal, which included the use of mockups, before performing a high hazard container venting activity.

Further, two NNSA contractors are developing approaches for managing SACs based on approaches for engineered controls using SSCs to fulfill credited safety functions. Specifically:

- For the SRTE, SRNS documented the basis used to develop specific SACs and details of their implementation in program description documents, similar to system description documents maintained for SSCs.
- At the Pantex Plant, CNS designated control owners to oversee the development and implementation of specific SACs, similar to cognizant system engineers for credited SSCs.

Parameters in the DSA for SAC implementation were adequately incorporated in the contractor-maintained, NNSA-approved technical safety requirement (TSR) documents.

Contractor personnel demonstrated adequate knowledge and proficiency in the implementation of assessed SACs during evolutions, field walkdowns, tabletop presentations, and interviews.

Weaknesses

Of the 12 deficiencies identified at NNSA locations, 3 (25%) involved SAC implementation. SAC implementation issues were identified at three of the four assessed NNSA locations, as summarized below:

- For 5 (10%) of the 52 reviewed SACs, at 2 of the 4 NNSA locations, TSR parameters were not adequately incorporated into facility implementing documents to ensure that the safety functions are fulfilled.

- At one location, software supporting SS and SC functions of two SACs was classified as non-safety software.

D.4 NNSA CONTRACTOR SELF-ASSESSMENT

Strengths

Contractors at three of the four NNSA locations periodically reviewed the flowdown of SAC requirements in the safety bases to the documents implementing them. At SRTE and Lawerence Livermore National Laboratory, the contractors also periodically verified (e.g., with work observations, procedure walkdowns, tabletop exercises, or hazard or casualty exercises) that the implementation of SACs fulfilled the credited safety functions. For SRTE, SRNS assessments by personnel in the safety basis division are supplemented with periodic assessments performed by an independent evaluation board that reviews the implementation of a sample of SACs.

Weaknesses

Contrary to the guidance in DOE-STD-1186-2004, section 2.2, contractors at two of the four NNSA locations did not periodically verify that SACs perform their safety functions with work observations, procedure walkdowns, tabletop exercises, or hazard or casualty exercises.

D.5 NNSA FIELD OFFICE OVERSIGHT

Strengths

NNSA field office Facility Representatives at each assessed location oversee the implementation of SACs as part of their routine surveillance activities. The Livermore Field Office, Los Alamos Field Office and the Savannah River Field Office also use safety system experts and/or nuclear safety specialists to assess SAC implementation.

The Savannah River Field Office triennially assesses a sample of SACs, similar to assessments of credited engineered controls by safety system experts, to ensure that credited safety functions are reliably fulfilled. (Best Practice)

Weaknesses

Insufficient assessment and oversight of safety bases by NNSA line management to confirm compliance with 10 CFR 830 and DOE-STD-3009-94 allowed the weaknesses in SAC development discussed in section 3.1 to persist. None of the reviewed field office oversight activities assessed the flowdown of or compliance with the requirements of DOE-STD-3009-94.

Appendix E
Assessment of Specific Administrative Controls at Office of Environmental Management Locations

E.1 INTRODUCTION

As part of its initial review, the U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) performed remote scoping studies of the identification, development, implementation, and oversight of specific administrative controls (SACs) at six DOE Office of Environmental Management (EM) locations. Four of these locations were selected for onsite assessments. The EM locations where EA performed these scoping studies and onsite assessments are listed in table B-1 of appendix B. As part of the onsite assessments, EA reviewed 39 (87%) of the 45 SACs – 5 safety class (SC) and 34 safety significant (SS) – and 33 (over half) of the administrative controls (ACs) cited in the safety bases of the selected EM nuclear facilities. At the EM locations, EA identified 11 deficiencies, a finding, and 6 strengths. The following sections discuss the common strengths and weaknesses at the EM locations, grouped into the following SAC functional areas: identification and development, implementation, contractor self-assessment, and EM field/site office oversight. Recommendations for EM contractors and line management based on the results of the overall assessment of SACs are in section 4.0 of the report.

E.2 EM SAC IDENTIFICATION AND DEVELOPMENT

Strengths

The reviewed SACs followed the hierarchy of controls in DOE-STD-3009-94.

SAC safety functions were adequately derived from the hazard and accident analyses in the safety bases.

At the Hanford Site, Central Plateau Cleanup Company is developing a documented safety analysis (DSA) for the Solid Waste Operations Complex that complies with all the DOE-STD-3009-2014 requirements.

Weaknesses

Of the 11 deficiencies and 1 finding identified at EM locations, 7 (63%) of them were associated with the inadequate identification and development of SACs and the attributes of ACs, that are not SACs, being credited with reducing risk. SAC identification and development issues were observed at the four assessed EM locations, as summarized below:

- The descriptions and evaluations for 16 (41%) of the 39 reviewed SACs did not comply with the systematic format and content requirements of DOE-STD-3009-94, sections 4.5.X.2, 4.5.X.3, and 4.5.X.4 to ensure that credited safety functions are reliably fulfilled and maintained. In many cases, the necessary information was provided elsewhere in the safety analyses, but 9 (23%) of the reviewed SACs had inadequate evaluations or performance criteria, and 4 (10%) had inadequate descriptions. These inconsistencies between the DSAs' format and content and the requirements in DOE-STD-3009-94 were identified at the four assessed EM locations.
- Attributes of 15 (45%) of the 33 reviewed ACs were incorrectly used to provide credited risk reduction. The credited elements were implemented via programmatic ACs and safety management programs rather than SACs per the definition of SACs in DOE-STD-3009-94. ACs were incorrectly credited at the four EM locations and resulted in three deficiencies and the one identified finding.
- Of the 39 reviewed SACs, 11 (28%) rely on structures, systems, and components (SSCs) that have not been identified or evaluated for functional classification as SS or SC per DOE-STD-3009-94,

section 4.5.X.2, and DOE-STD-1186-2004, section 1.6.1 to ensure their current and future reliability. This issue was identified at two of the EM locations and resulted in two deficiencies.

E.3 EM SAC IMPLEMENTATION

Strengths

The contractors managing the assessed locations have adequately trained and qualified workers for SAC implementation.

Contractor personnel demonstrated adequate knowledge and proficiency in the implementation of assessed SACs during evolutions, field walkdowns, tabletop presentations, and interviews.

Weaknesses

Of the 11 deficiencies and 1 finding identified at EM locations, 3 (27%) of them involved SAC implementation. SAC implementation issues were identified at three of the four assessed EM locations assessed, as summarized below:

- For 4 (10%) of the 39 reviewed SACs, at 3 of the 4 EM locations, the parameters for SAC implementation from the DSAs were not adequately incorporated in the contractor-maintained, DOE-approved technical safety requirement (TSR) documents. Specifically:
  - For one SAC, the DSA and the TSR document differ on the frequency of the surveillance requirement confirming that the safety function is being met, potentially allowing the surveillance to be performed less frequently than analyzed.
  - For three SACs at two EM locations, the TSRs did not include "the limits, controls, and related actions that establish the specific parameters and requisite actions for the safe operation of a nuclear facility" per the definition of TSRs in 10 CFR 830. Instead, the TSR documents referenced the sections in the DSA that contained the required parameters.
- For 1 (3%) of the 39 reviewed SACs, TSR parameters were not adequately incorporated into facility implementing documents to ensure that the safety functions are fulfilled.

E.4 EM CONTRACTOR SELF-ASSESSMENT

Strengths

Contractors at the four EM locations periodically reviewed the flowdown of SAC requirements in the safety bases to the documents implementing them. Additionally, at the Savannah River Site, a Savannah River Nuclear Solutions, LLC independent evaluation board conducts performance-based reviews of the implementation of a sample of SACs.

Weaknesses

Contrary to the guidance in DOE-STD-1186-2004, section 2.2, contractors at three of the EM locations did not periodically verify that SACs perform their safety functions by means of work observations, procedure walkdowns, tabletop exercises, or hazard or casualty exercises.

E.5 EM FIELD/SITE OFFICE OVERSIGHT

Strengths

EM field/site office Facility Representatives at each assessed location oversee the implementation of SACs as part of their routine surveillance activities.

Weaknesses

Insufficient assessment and oversight of safety bases by DOE line management to confirm compliance with 10 CFR 830 and DOE-STD-3009-94 allowed the weaknesses in SAC development discussed in section 3.1 to persist. None of the reviewed field/site office oversight activities assessed the flowdown of or compliance with the requirements in DOE-STD-3009-94.