Assessment of the Triad National Security, LLC Nuclear Criticality Safety Program at the Los Alamos National Laboratory

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Office of Enterprise Assessments
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Acronyms

ANS	American Nuclear Society
ANSI	American National Standards Institute
CMR	Chemistry and Metallurgy Research
COVID-19	Coronavirus Disease of 2019
CRAD	Criteria and Review Approach Document
CSA	Criticality Safety Analyst
CSE	Criticality Safety Evaluation
CSED	Criticality Safety Evaluation Document
DOE	U.S. Department of Energy
DPO	Differing Professional Opinion
EA	Office of Enterprise Assessments
FMO	Fissionable Material Operation
FOD	Facility Operations Director
FY	Fiscal Year
IMT	Issues Management Tool
LANL	Los Alamos National Laboratory
NA-LA	National Nuclear Security Administration Los Alamos Field Office
NCSD	Nuclear Criticality Safety Division
NCSP	Nuclear Criticality Safety Program
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
PF	Plutonium Facility
RANT	Radioactive Assay Nondestructive Testing
TA	Technical Area
Triad	Triad National Security, LLC

Assessment of the Triad National Security, LLC
Nuclear Criticality Safety Program
at the Los Alamos National Laboratory
November 2020 – January 2021

Summary

Scope

This remote assessment evaluated the effectiveness of the Triad National Security, LLC (Triad) nuclear criticality safety program and Federal office oversight of this program in advance of increased production rates of plutonium pits projected for the Plutonium Facility after 2023.

Significant Results for Key Areas of Interest

Triad's nuclear criticality safety program has significantly improved, addressing weaknesses that contributed to the shutdown of fissionable material operations in the Plutonium Facility from 2013 to 2017. Criticality safety analyst staffing supports mission needs, and the development and revision of criticality safety evaluations is on schedule to support increased pit production. Still, this assessment identified weaknesses in the rigor of evaluations, the safety culture of the Nuclear Criticality Safety Division, and Triad's management of its staffing.

Criticality Safety Evaluations

Most of the reviewed criticality safety evaluations are compliant, and the derived criticality safety controls are robust. However, approximately one-third of the reviewed evaluations include instances that do not comply with analysis and documentation requirements. None of the identified deficiencies pose a credible risk for a criticality accident due to independent, robust controls and additional margin in the evaluations. Nonetheless, Triad is required to resolve the identified deficiencies, the weaknesses causing these deficiencies, and deficiencies caused by these weaknesses in evaluations that were not part of the assessed sample.

Staffing

Triad has adequately managed the training and qualification of additional analysts and has the 27 analysts identified by Triad as needed to support increased pit production rates. However, future attrition may exceed Triad's current hiring plan.

Safety Culture

Overall, analysts enjoy their work and appreciate initiatives taken to improve retention and working relationships. However, several analysts expressed concerns with how differing professional opinions are resolved and believe that requesting formal arbitration could cause them to receive poor performance reviews. Several believe that some analysts have difficulty conveying their ideas and being heard based on gender, personality type, and level of experience. Several analysts also stated that Triad management does not reliably respond to their feedback.

Performance Assurance

Triad uses comprehensive, properly weighted metrics to track and improve performance. Further, Triad comprehensively assesses implementation of its nuclear criticality safety program; however, violations identified during these assessments are often not adequately managed or resolved. In several cases, required actions to prevent recurrence of criticality safety infractions have not been taken.

Federal Oversight

The National Nuclear Security Administration Los Alamos Field Office (NA-LA) adequately oversees Triad's nuclear criticality safety program, identifying issues for resolution and areas warranting improvement.

Best Practices and Findings

The assessment team identified the following as best practices:

- Triad and NA-LA have developed a more comprehensive set of metrics for monitoring the performance of Triad's nuclear criticality safety program than used by other divisions and organizations supporting nuclear safety (e.g., engineering divisions) across the Department of Energy and continue to refine the metrics to ensure that they are focused on areas warranting improvement.
- Triad maintains a listing of recent issues that is used during the annual review of each fissionable material operation to verify that those issues are not applicable to that operation.

The assessment team identified one finding for senior management attention, involving the systemic weakness(es) in the authoring and reviewing of evaluations by analysts that cause a third of the evaluations reviewed by the assessment team to not meet analysis and documentation requirements.

Follow-up Action

The assessment team could not evaluate implementation of criticality safety controls remotely. The Office of Enterprise Assessments is planning a separate, onsite assessment of Triad's conduct of operations (including its implementation of criticality safety controls) within a year.

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1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Nuclear Engineering and Safety Basis Analysis Assessments, an Environment, Safety and Health Assessments office within the Office of Enterprise Assessments (EA), assessed the effectiveness of the Triad National Security, LLC (Triad) nuclear criticality safety program (NCSP) at the Los Alamos National Laboratory (LANL). This assessment was conducted remotely, with interviews occurring November 16 – 20, 2020, and January 25 – 29, 2021.

Weaknesses in the NCSP and the conduct of operations led to the shutdown of fissionable material operations (FMOs) in the Plutonium Facility (PF)-4 from 2013 to 2017. The NCSP weaknesses included processes and practices allowing deficient criticality safety evaluations (CSEs) (e.g., CSEs lacking detailed information and analyses) and the departure of nearly all critical safety analysts (CSAs) from LANL.

The Fiscal Year (FY) 2015 National Defense Authorization Act established a requirement to produce 80 war reserve plutonium pits per year by 2030. To fulfill its role in meeting this requirement, LANL plans to begin production in FY 2023, with a production goal of 10 pits per year by FY 2024 and 30 pits per year by FY 2026. In addition to correcting the backlog of deficient CSEs, LANL has been increasing the fissionable material limits for specific locations to support increased pit production rates.

In October 2017, executives from the DOE Criticality Safety Support Group assessed the NCSP at LANL as "on the right track, but fragile" due to inexperienced staff, high workload, and restrictive operational limits. The 2019 DOE NCSP performance metrics reported to the Defense Nuclear Facilities Safety Board stated "improvements continue and the program is approaching full compliance. Deficiencies in legacy evaluations and program implementation remain a continuing challenge. The program is addressing these issues at an accelerated rate."

2.0 METHODOLOGY

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

The assessment team used the criteria of Objectives CS.1 and CS.2 of the EA Criteria and Review Approach Document (CRAD) 31-30, *Criticality Safety Program and Criticality Safety Controls Implementation*, Revision 3, to assess the compliance of Triad's NCSP and the adequacy of CSEs and controls. Additionally, criteria three and four of Objective CS.3 were used to assess how non-adherences to criticality safety controls are resolved and how operations are reviewed to ensure their implementation and process conditions remain within the assumptions of their CSE. The assessment team also used elements of the Office of Health, Safety and Security (HSS, the predecessor of EA) CRAD 45-21, *Feedback and Continuous Improvement Assessment Criteria and Approach – DOE Field Element*, Revision 1, to collect and analyze data on the oversight of criticality safety by the National Nuclear Security Administration (NNSA) Los Alamos Field Office (NA-LA).

The assessment team examined key documents, such as Triad system description SD130, *Nuclear Criticality Safety Program* (Revision 7); Triad's Nuclear Criticality Safety Division (NCSD) procedures; and facility-specific administrative procedures flowing down the requirements of SD130 to PF-4, the Chemistry and Metallurgy Research (CMR) facility, and the Radioactive Assay Nondestructive Testing (RANT) facility. The team reviewed NCSP improvement plans, staffing plans, plans for issuing and revising CSEs, CSEs, and training and qualification records. The team also conducted interviews of key personnel responsible for developing and executing these elements of the NCSP. The team also reviewed NCSP metrics, assessments, records of FMO reviews, and criticality safety infractions since Triad became the management and operating contractor for NNSA at LANL on November 1, 2018.

The Triad NCSP manages approximately 900 active CSEs. During this assessment, 35 CSEs that were developed or revised since November 1, 2018, were reviewed in detail, which is over 10% of the 260 CSEs developed or revised over this period. CSEs selected for review were the more complex CSEs supporting operations with significant amounts of fissionable material and potential process changes important to criticality safety. Selections also focused on FMOs important to pit production, with consultation and recommendations from the NCSD and operations management and NA-LA subject matter experts. The review of each CSE included the following:

- Review of the process description, including fissionable material handling activities.
- Review of the assumptions, including their bases and applicability to the FMO
- Review of the adequacy of the analysis to represent normal conditions
- Review of the postulated abnormal conditions, including credibility, comprehensiveness, sufficiency of conservatism (to ensure they are bounding), and adequacy of models and analyses
- Review of supporting (referenced) CSEs and technical documents
- Review of derived controls, including their adequacy to ensure subcriticality for normal conditions and postulated credible abnormal conditions, consideration of the safety margin, and compliance with the Double Contingency Principle
- Evaluation of the ability to implement the derived controls, including consideration of human factors, and the selection of controls credited in the safety basis for the facility.

The team interviewed 13 out of 26 CSAs in three groups (analysts who qualified since 2018, analysts who qualified between 2013 and 2018, and subcontracted analysts designated as senior qualified CSAs) to assess CSAs' job satisfaction, aspects affecting retention, and NCSD's safety culture. None of the NCSD CSAs are designated as senior qualified CSAs.

The members of the assessment team, the Quality Review Board, and management responsible for this assessment are listed in Appendix A. Weaknesses on specific CSEs and other technical documents identified by the assessment team are summarized in Appendix B.

The previous EA assessment of the LANL NCSP, documented in *Review of the Los Alamos National Laboratory Plutonium Facility Restart of Fissile Material Operations – January 2016*, did not identify any findings. Therefore, there were no items for follow-up during this assessment.

3.0 RESULTS

This section presents the results on the overall adequacy of Triad's NCSP, followed by assessments of elements/aspects of the NCSP that contributed to the shutdown of FMOs in PF-4 in 2013 and/or are key to supporting increased plutonium pit production rates. Specifically, assessments of CSEs, CSA staffing, NCSD safety culture, performance assurance, and NA-LA oversight of the NCSP are presented.

3.1 Nuclear Criticality Safety Program

The objective of this portion of the assessment was to assess whether Triad's NCSP meets the requirements of DOE Order 420.1C, *Facility Safety*, including invoked standards, and whether improvements were made to address inadequacies that contributed to the shutdown of FMOs in PF-4.

SD130 commits to the requirements in DOE Order 420.1C, Change 1 and its invoked standards for criticality safety (i.e., the American National Standards Institute and the American Nuclear Society Subcommittee 8 National Standards [ANSI/ANS-8 series] and DOE-STD-3007-2017, *Preparing Criticality Safety Evaluations at Department of Energy Nonreactor Nuclear Facilities*). These commitments are adequately flowed down into NCSD procedures and facility-specific NCSP administrative procedures with one exception. As discussed in Section 3.5, reviewed facility-specific procedures do not flow down the requirement to take action(s) to prevent recurrence of criticality safety infractions.

SD130, NCSD procedures, and facility-specific NCSP administrative procedures have been revised several times since 2013 to address inadequacies that contributed to the shutdown of FMOs in PF-4, significantly improving Triad's NCSP. For example, revisions clarified operations responsible supervisor, operations responsible manager, and NCSD responsibilities for procedure reviews; improved the requirements for the flow down of controls into procedures; and clarified guidance on which procedures require criticality safety review. However, only a few personnel in NCSD participated in the evolution of these improvements. Only one LANL CSA qualified before the shutdown occurred, and approximately 75% of the NCSD staff qualified or began their CSA qualification since the last group of FMOs in PF-4 restarted in 2017. Most of the NCSD staff interviewed could only provide vague descriptions of the lessons learned and NCSP improvements implemented since the shutdown of FMOs in PF-4. (See **OFI-Triad-1**.)

Although SD130, NCSD procedures, and facility-specific NCSP administrative procedures are adequately maintained overall, 6 out of 41 NCSD procedures exceeded their scheduled "Next Review Date" and 5 (13% of 41) of these were not verified and validated within the three-year periodicity required by P315, *Conduct of Operations*. NCS-AP-010, *Potential Process Deviation Response*, is the most overdue, with its last revision issued on August 23, 2016, and its scheduled review due July 18, 2018. (See **Deficiency D-Triad-1**.)

Nuclear Criticality Safety Program Conclusions

Triad's NCSP commits to the requirements in DOE Order 420.1C, Change 1 and its invoked standards, and has significantly improved since the shutdown of FMOs in PF-4 in 2013. However, only a few personnel in NCSD supported or witnessed its evolution, and most of the NCSD staff interviewed could only provide vague descriptions of the lessons learned and NCSP improvements implemented since the shutdown of FMOs in PF-4. NCSD has not reviewed or updated 13% of its procedures within the required three-year periodicity.

3.2 Criticality Safety Evaluations

The objective of this portion of the assessment was to assess CSEs for technical adequacy and compliance with applicable NCSP requirements.

Triad has issued or revised 260 CSEs since November 1, 2018 and is on schedule to support planned increases in pit production in PF-4. Development of CSEs is adequately prioritized and tracked during weekly meetings between NCSD and operations management, appropriately considering resolution of identified deficiencies and mission needs.

Many of the reviewed CSEs demonstrate thorough and systematic evaluations that are supported by well-developed parametric analyses, and the derived criticality safety controls are robust. Documentation of analyses and supporting bases shows progressive improvement. However, approximately one-third of the reviewed CSEs include instances that do not comply with the analysis and documentation requirements of Section 3.4.1 of DOE-STD-3007-2017. Together, the deficiencies below demonstrate systemic weakness(es) in the authoring and reviewing of CSEs by CSAs. (See **Finding F-Triad-1**.) The assessment team reviewed only a sample of CSEs. Per the American Society of Mechanical Engineers consensus standard Nuclear Quality Assurance (NQA)-1-2008, with the NQA-1a 2009 addenda, *Quality Assurance Requirements for Nuclear Facility Applications*, as Triad committed to in its quality assurance program, "the cause of the condition [Finding F-Triad-1] shall be determined and corrective action taken to preclude recurrence." Other CSEs impacted by the cause(s) of Finding F-Triad-1 "shall be identified promptly and corrected as soon as practicable."

None of the identified deficiencies pose a credible risk for a criticality accident due to independent, robust controls and additional margin in the evaluations. However, per the requirement in Section 4.1.2 of ANSI/ANS 8.1-2014, Triad is responsible for confirming that the FMOs covered by these non-compliant CSEs "will be subcritical under both normal and credible abnormal conditions" before the operation begins (or is allowed to resume).

The identified deficiencies are listed below and discussed in Appendix B:

- As described in Item 1 of Appendix B, assumptions in models and analyses used to determine the separation distance for neutronic decoupling are not clearly aligned with (applicable to) conditions of FMOs. (See **Deficiency D-Triad-2**.)

- As described in Item 2 of Appendix B, the assumed position of a deformed/missing spacer does not result in a sufficiently conservative model. (See **Deficiency D-Triad-3**.)

- As described in Item 3 of Appendix B, guidance for over-mass abnormal conditions is used from a memorandum without the required justification, as specified in the referenced guidance, for the specific FMOs covered by several CSEs. (See **Deficiency D-Triad-4**.)

- As described in Item 4 of Appendix B, a stainless-steel container thickness is considered bounding and a water box was assumed to bound a glovebox based on undocumented scoping studies and calculations. (See **Deficiency D-Triad-5**.)

Further, the assessment team identified the following during their review of CSEs:

- CSAs cite various technical documents, CSEs, and memoranda or develop their own duplicate analyses (e.g., using the Monte Carlo N-Particle code) for common geometries, materials, and operations to support CSEs for specific FMOs, often with varying or inconsistent modeling assumptions. (See **OFI-Triad-2**.)

- Although NCS-AP-004, *Criticality Safety Evaluations*, notes that "Daisy-chaining technical bases from different evaluations is a poor practice, and is to be avoided," several CSEs have continued to cite CSEs that reference other documents for their technical bases. (See **OFI-Triad-3**.)

- CSEs and other technical documents often reference an entire document without specifically indicating the relevant sections, tables, and figures, potentially resulting in a lack of alignment between the author and independent reviewers. (See **OFI-Triad-4**.)

- Although all reviewed CSEs meet the Double Contingency Principle, compliance with this principle is not clearly documented in the CSEs. (See **OFI-Triad-5**.)

- Several CSEs (e.g., NCS-CSED-19-064, NCS-CSED-20-034, NCS-CSED-15-018, NCS-CSED-19-008, NCS-CSED-15-137, NCS-CSED-18-052) rely on the lessons learned from the fire at the Rocky Flats Plant regarding the credibility and/or subcriticality of fire-related conditions for potential fire events of FMOs at LANL; however, they use inconsistent approaches and levels of rigor. (See **OFI-Triad-6**.)

Criticality Safety Evaluations Conclusions

Development of CSEs is adequately prioritized and on track to meet mission needs, including increased pit production in PF-4. The reviewed CSEs are generally technically adequate and comply with NCSP requirements, and derived criticality safety controls are robust and meet the Double Contingency Principle. However, approximately one-third of the reviewed CSEs include instances that do not meet the analysis and documentation requirements of Section 3.4.1 of DOE-STD-3007-2017, demonstrating systemic weakness(es) in the authoring and reviewing of CSEs by the CSAs.

3.3 Criticality Safety Analyst Staffing

The objective of this portion of the assessment was to review the CSA staffing and training plans for the influx of CSAs needed per LA-CP-19-20624, *Plan to Produce 30 Pits per Year at Los Alamos National Laboratory*.

Triad has the 27 fully qualified CSAs that LA-CP-19-20624 states are required to support LANL missions. However, the projected attrition rate used to forecast hiring needs is less than the average attrition rate since FY 2015, and several incentives for qualified CSAs are about to expire, potentially impacting the number of CSAs who will be retained.

- NCSD has18 qualified CSAs, 8 in training, and 7 full-time and 1 part-time experienced subcontractors who were qualified as CSAs at LANL. Another Triad division has a fully qualified CSA for a total of 27 fully qualified CSAs.

- Although NCSD only achieved a net increase of three fully qualified CSAs in FY 2020, instead of the goal of five in NCS-PLAN-20-001, *Nuclear Criticality Safety Program Improvement Plan*, NCSD hired six, rather than five, analysts in FY 2020. Training and qualification as a CSA typically ranges from six months to two years, depending on the CSA trainee's previous experience.

- Per NCS-PLAN-20-001, NCSD plans to hire four or five CSAs in FY 2021 and in FY 2022 to continue to reduce the need for subcontracted CSAs and to account for the NCSD-assumed attrition rate of 10%. However, the average annual attrition since FY 2015 has been approximately 16%. (See **OFI-Triad-7**.)

NCS-PLAN-17-001, *Retention Plan for Nuclear Criticality Safety (NCS)*, extended benefits to retain qualified CSAs, including adding an annual financial benefit for CSAs up to five years after qualification. During interviews, several CSAs stated appreciation for aspects of the plan, including the annual financial benefits for qualified CSAs, flexible work schedules, tuition for work-relevant advanced degrees, and participation in professional organizations (e.g., ANS conferences). By the end of FY 2021, the annual financial benefit of the plan will expire for 5 out of the 16 qualified CSAs in NCSD and then for another 5 CSAs by the end of FY 2023 (approximately when pit production is expected to increase). (See **OFI-Triad-8**.)

CSAs supporting LANL missions are qualified to NCS-QS-001, *Criticality Safety Analyst (CSA) Qualification Standard*. Training and qualification records supporting NCS-QS-001 are adequately maintained. CSAs stated that the mentoring provided by senior qualified CSAs per NCS-QS-001 to supplement their training and qualification was effective. However, mentors were not officially assigned or the amount of mentorship provided drastically declined following qualification as a CSA; some recently qualified CSAs stated a desire for continued guidance to help them continue to develop. Several CSAs also expressed the belief that the documented expectations to attain higher CSA positions/paygrades (i.e., CSA-3 and CSA-4) were not clear or were outdated. For example, a few CSAs stated that they are expected to write approximately 50 CSEs or supporting technical documents to be promoted, even though CSE document length has increased from only a few pages to hundreds of pages. The perceived lack of promotion opportunities could impact the retention of several CSAs. (See **OFI-Triad-8**.)

Despite employing the most CSAs in LANL history and implementing plans for hiring and qualifying more, NCSD has only one supervisor (the NCSD division leader). The NCSD division leader and the NCSD executive advisor are extensively involved in resolving technical issues with deficient CSEs and prioritizing the development of new CSEs that support the projected increases in pit production. Neither the NCSD division leader nor the NCSD executive advisor are qualified CSAs, and efforts to hire a deputy division leader to help manage technical issues have not been successful. (See **OFI-Triad-9**.)

Criticality Safety Analyst Staffing Conclusions

Triad has adequately managed the training and qualification of additional CSAs and has the 27 fully qualified CSAs needed for increased pit production rates after FY 2023. However, the projected attrition rate used to forecast hiring needs is less than the average attrition rate since FY 2015, and several incentives for qualified CSAs are about to expire, potentially impacting the number of CSAs who will be retained. Despite having the most CSAs in LANL history, as well as plans for hiring and qualifying more, NCSD has only one supervisor, the division leader, to manage and improve a very technically complex NCSP and, with the NCSD executive advisor, to prioritize the revision/development of CSEs supporting increased pit production. Neither the NCSD division leader nor the executive advisor are qualified CSAs, and efforts to hire a deputy division leader to help manage technical issues have not been successful.

3.4 Nuclear Criticality Safety Division Safety Culture

The objective of this portion of the assessment was to assess CSA job satisfaction, aspects affecting retention of CSAs, and NCSD's safety culture.

Interviewed CSAs readily discussed their job satisfaction, aspects affecting their retention, and their perceptions of the NCSD safety culture. The assessment team shared their notes of CSA feedback with the CSAs interviewed, who verified that the feedback was accurately recorded. These notes were then presented and discussed in detail with the NCSD division leader, who appreciated this feedback. Key feedback expressed by the CSAs interviewed is summarized below.

Job Satisfaction and Aspects Affecting Retention

CSAs stated that they enjoyed their work due to its important role in national security and its diversity of tasks. They also appreciated the initiatives of NCSD management to improve retention (e.g., mentoring of new employees through their CSA qualification, attending conferences, and financial incentives) and that their working environment has improved over the past few years.

Environment for Raising Concerns

Some (mostly senior qualified) CSAs perceive the environment for raising concerns to be appropriate, with concerns being appropriately resolved via informal discussions. Conversely, other CSAs described instances of not being heard, being shut down by staff with more "clout," and being denied the opportunity for formal arbitration of their differing professional opinions (DPOs). A few CSAs expressed fears of retaliation if they pushed to have their opinion heard or if they continued to request formal arbitration of the DPOs, stating it would "sour" their work environment and they might receive poor performance reviews. (See **OFI-Triad-10**.)

Some CSAs stated that the technical challenges are not as difficult as the challenges associated with personal interactions and office politics. A few CSAs qualified since FY 2013 stated that they did not feel respected or heard. For example, a CSA stated that he/she proposed an idea or solution that was ignored, and then someone else proposed the same idea and it was accepted as a great idea. CSAs with more experience or CSAs who self-identified as being "loud" did not share the same experience. However, other CSAs acknowledge that they have seen CSAs ignored (not heard) and their perception was that some CSAs have difficulty being heard based on gender, personality type (e.g., quiet versus loud), level of experience, or some combination of these factors.

CSAs in all three groups noted that there is an NCSD arbitration process in NCS-AP-004 using a review panel of other CSAs. The senior qualified CSAs stated that they would be surprised to see the formal arbitration process used because issues are typically resolved informally between CSAs. They viewed this informal practice positively, noting that things are working the way they should.

CSAs qualified since FY 2013 expressed a very different perspective, stating that the NCS-AP-004 arbitration process is not used when it should be, and a few CSAs related instances where requests to use the process were denied by NCSD management. The perception of these CSAs is that NCSD management decides between the DPOs instead of using the NCS-AP-004 arbitration process. Many questioned the adequacy of this practice because current NCSD management are not qualified as CSAs. These CSAs stated that they wanted DPOs considered by the review panel of CSAs formed per NCS-AP-004.

NCSD management confirmed that they have not been using the NCS-AP-004 arbitration process. Instead, NCSD management has been facilitating discussions between CSAs authoring and reviewing CSEs, with the intent of building a more collegial work environment and avoiding adversarial interactions that NCSD management stated have happened in the past due to the use of the NCS-AP-004 arbitration process. (See **OFI-Triad-11**.)

Neither the CSAs nor NCSD management were fully aware of all avenues for raising concerns or DPOs that are available to them. Many referred to the NCSD division-level arbitration process per NCS-AP-004 and the Triad-wide DPO process interchangeably, as if they were the same process. No DPOs were entered into the Triad-wide DPO process concerning nuclear criticality safety during the period covered by this assessment (i.e., since November 1, 2018). The assessment team identified the following concerns that may contribute to this inaccurate perception that the NCSD and the Triad-wide DPO processes are the same (interchangeable).

- NCS-AP-004, Section 5.6.3, states that "Differing professional opinions may be documented as part of the Review Panel Form." While this statement offers the review panel as an example of one way to resolve a DPO, it may contribute to the inaccurate perceptions of the avenues for raising DPOs. If NCSD staff are not aware of the Triad-wide DPO process, or if they believe that the division-level review panel should be used prior to elevating to the Triad-wide process, then they are effectively discouraged ("chilled") from pursuing resolution through the Triad-wide DPO process when they are

denied the division-level process in NCS-AP-004. (See **OFI-Triad-12**.)

- Contrary to SD100, *Integrated Safety Management System*, NCS-AP-004 Sections 5.7.1 and 5.7.3 and Section 6.6, Step [4] direct the CSAs authoring and providing the independent technical review of a CSE to accept the decision of the review panel without allowing recourse to the Triad-wide DPO process. SD100 states that employee "technical concerns related to the environment, safety, and health that cannot be resolved using routine processes … [are] transferred to LANL's internal DPO process for review and disposition. An employee always has the right to report a DPO directly to DOE in accordance with DOE O 442.2 Chg. 1," *Differing Professional Opinions for Technical Issues Involving Environmental, Safety, and Health Technical Concerns*. (See **Deficiency D-Triad-6**.)

Relationships and Communication with Management

CSAs stated that NCSD management are personable, approachable, and willing to hear from the criticality staff. However, several CSAs stated that NCSD management does not reliably respond to or act on CSA feedback. CSAs interviewed provided specific examples where they had been told that changes would be made, but ultimately the changes did not happen, and there had been no communications about the status of changes or reasons that they had not been implemented. (See **OFI-Triad-13**.)

Many staff members also voiced concerns that the current NCSD management are not qualified as CSAs, which makes it more difficult to resolve complex technical issues and address technical concerns. Several CSAs stated that suggestions have been made to fill a division-level deputy position with a qualified CSA; as noted in Section 3.3, efforts to hire a deputy division leader to help manage technical issues have not been successful. (See **OFI-Triad-9**.)

Nuclear Criticality Safety Division Safety Culture Conclusions

CSAs enjoy their work and appreciate the initiatives to improve retention and working relationships. However, several interviewed CSAs expressed concerns with how DPOs are resolved, including the lack of NCSD management's willingness to exercise its formal arbitration process. Overall, NCSD management's approach of facilitating discussions to resolve DPOs instead of using the NCSD arbitration process appears to have had unintended, negative effects on CSAs' perceptions of the environment in NCSD for resolving DPOs. Several CSAs also believe that there are biases in NCSD based on gender, personality type, and level of experience. Additionally, interviewed CSAs cited examples of NCSD management not reliably responding to CSA feedback.

3.5 Performance Assurance

The objective of this portion of the assessment was to review how Triad monitors, assesses, and improves NCSP performance; reviews operations to ensure that they remain within the bounds of the respective CSEs; and resolves non-adherences to criticality safety controls.

Metrics

NCSD developed comprehensive, properly weighted metrics that it has used to effectively identify areas of NCSP performance warranting improvement. Metrics reports are typically issued monthly (quarterly since March 2020 due to reduced operations in response to the COVID-19 pandemic) with an annual summary. These reports effectively characterize performance of key elements of the NCSP, including NCSD staff professional development; NCSP implementation; NCSD assessments, field time, and FMO reviews; CSE quality; criticality safety infraction severity, recurrence, and resolution time; and status of significant NCSP improvement initiatives (e.g., CSA staffing and progress on removing deficient CSEs

from the backlog). NCSD works with NA-LA to refine the metrics of NCSP performance and to identify other areas for improvement. NCSD presented its program metrics at the ANS Annual Conference in November 2020. (**Best Practice**)

Assessments

NCSD performs comprehensive vertical assessments of NCSP implementation in each facility every three years per NCS-AP-011, *Assessments*. However, violations with Triad's NCSP requirements and issues with specific CSEs identified during these assessments are often not adequately managed or resolved. Specifically, they are not resolved in a timely manner or are incorrectly categorized as opportunities for improvement instead of findings. No action is required for opportunities for improvement entered into Triad's Issues Management Tool (IMT), whereas efforts to resolve findings (issues) are based on the graded approach in P322-4, *Issues Management*. (See **Deficiency D-Triad-7**.) For example:

- NCS-RPT-18-2, *Final Report of the Independent Assessment of the LANL Nuclear Criticality Safety Program at the Nevada National Security Site*, dated October 22, 2018, documented concerns with CSEs for FMOs that had "subjective technically weak claims to justify arbitrarily small additional margins of subcriticality ...such that if they were mis-handled they would absolutely achieve the critical condition." These concerns were incorrectly categorized as an opportunity for improvement with action due May 31, 2021 (almost 2.5 years after the report was issued), without documenting justification for this delayed response.

- NCS-RPT-18-2 also stated that "NCS-CSED-17-065 does not document normal and credible abnormal conditions." NCS-AP-004 states that "Normal and credible abnormal conditions shall be identified," yet this non-compliance was noted in the discussion of noteworthy practice CS-NP-1 of NCS-RPT-18-2, but was not entered into IMT as an issue requiring correction.

- NCS-RPT-19-2, *Final Report of the Management Assessment of the LANL Nuclear Criticality Safety Program at TA [Technical Area]-55*, dated November 5, 2019, has eight non-compliances with SD130 or NCSD procedures categorized as opportunities for improvement. For example:

    - An issue with the adequacy of the argument or justification in NCS-CSED-18-052 used to conclude that "fire-fighting water provided by first responders would enter the glovebox in a non-disruptive manner" was incorrectly categorized as an opportunity for improvement and closed without documentation of any action.

    - An issue with the adequacy of the justification for the subcritical limits used in older CSE documents was incorrectly categorized as an opportunity for improvement and closed without documentation of any action.

    - The TA-55 facility-specific procedure to detect, characterize, and maintain records of fissionable material accumulations in non-process locations has either not been developed or has not received concurrence from the NCSD, as required by SD130. This issue was incorrectly categorized as an opportunity for improvement and closed without documentation of any action.

- NCT-RPT-20-1, *Final Report of the Management Self-Assessment of the LANL Nuclear Criticality Safety Program at [the Los Alamos Neutron Science Center]*, dated August 21, 2020, identified that the method used to validate the calculations in NCS-CSED-16-110 is not applicable to the mixed uranium and plutonium systems in this FMO. "[D]uring the most recent [FMO review], the CSA noted the [sic] an issue with the validation method used in the CSED," however, this was not entered into IMT as an issue requiring correction following the FMO review or NCS-RPT-20-1.

Section 5.5.2 of NCS-AP-011 may be contributing to the incorrect categorization of violations and issues identified in the NCSD assessments discussed above. This section states that "Findings **shall** be referenced to an ANSI/ANS standard, or DOE directive not being met. Opportunities for Improvements (OFIs) **should** be referenced to a requirement … (e.g., approved criticality program or facility procedures)" which incorrectly implies that issues and violations associated with Triad requirements are not findings. Per the definitions in NCS-AP-011 and P322-3, *Management Assessments*, a finding is "A validated violation of a documented or codified requirement regardless of the source" (i.e., including NCSP requirements in NCSD procedures or facility-specific procedures).

NCSD management stated that some, but not all, potential errors or inadequacies in CSEs have been managed using NCS-AP-010 due to their potential significance to criticality safety. However, NCS-AP-010 provides NCSD requirements for responding to suspected deviations and alterations made by operators, not suspected errors or inadequacies in CSEs that could potentially impact criticality safety limits or require different controls in multiple, ongoing FMOs to ensure safety. Per DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*, Triad is required to establish an issues management system to "provide for timely reporting, and taking compensatory corrective actions when needed." (See **OFI-Triad-14**.)

NCSD assessment reports were unnecessarily long, and the significant results were obscured. For example, findings, opportunities for improvement, and detailed criteria used for these assessments were repeated verbatim, three times in some cases. Executive summaries often listed the findings and opportunities for improvement without further discussion of their significance. (See **OFI-Triad-15**.)

FMO Reviews

NCS-AP-009, *Fissionable Material Operational Reviews*, requires each active FMO to be reviewed annually to ensure that FMOs "are adhering to their approved procedures, criticality safety requirements (consisting of both administrative controls and engineered controls), and the process conditions remain within the envelope considered by the operation's criticality safety evaluation." Per NCS-AP-009, CSAs performing these reviews use NCS-MEMO-19-029, *Emergent Issues*, dated August 30, 2019, or successor documents, to verify that emergent issues (e.g., those identified during other reviews, walkdowns, assessments, and fact-finding meetings) are not applicable to the FMO being reviewed. (**Best Practice**) NCS-MEMO-20-039, *Nuclear Criticality Safety Program Performance FY 20 Metrics Report*, dated November 9, 2020, indicates that all FMO reviews were performed on schedule and that over 97% of them found no issues. The assessment team's review of approximately 30 checklists documenting these reviews identified that the checklists adequately document completion of these reviews.

Criticality Safety Infractions

Triad's NCSP, through SD130, incorporates ANSI/ANS 8-series consensus standard requirements for managing (resolving) criticality safety infractions due to deviations from procedures and unintended alterations in process conditions that affect nuclear criticality safety. Overall, these requirements are adequately flowed down and implemented via NCSD procedures and facility-specific administrative procedures for criticality safety; however, the facility-specific processes reviewed (i.e., those for PF-4, CMR, and RANT) do not flow down the requirement to take actions to prevent recurrence for infractions impacting criticality safety. (See **Deficiency D-Triad-8**.)

The cognizant Facility Operations Director (FOD) assigns a criticality safety infraction severity index based on the recommendation from NCSD per NCS-AP-011 and the criteria in SD130. The index can be zero through five, with five for cases that do not adversely impact criticality safety and zero for cases of

inadvertent criticality. The assessment team's review of criticality safety infractions since November 1, 2018, identified the following:

- The ten infractions reviewed with a severity index of four were categorized as low risk/significance or as a potential risk in IMT; therefore, no causal analysis was required or performed per P322-4 to determine corrective action(s) to prevent recurrence of the causes. For six of these infractions (i.e., events 18-044, 18-054, 18-057, 19-068, 20-018, and 20-044), the FOD did not develop actions to prevent recurrence. Instead, actions were taken to perform a brief on lessons learned (which does not have a sustained effect to prevent recurrence) and/or to perform various evaluations (e.g., to determine whether procedures should be modified) that determined that no action beyond the evaluation was necessary. Three other more severe criticality safety infractions had causal analyses performed and actions taken to prevent recurrence.

- NCSD CSAs did not include recommendations for actions to preclude recurrence, as required by Section 4.5 of NCS-AP-010, for the 13 records reviewed. The "NCSD Recommendation" field was typically left blank or provided the recommended severity index for the infraction. (See **Deficiency D-Triad-9**.) However, actions preventing recurrence address the cause(s) of an infraction; therefore, CSAs' recommendations for actions to prevent recurrence before, or outside, the P322-4 issues management process would be premature or inappropriate. Per SD130, the FOD is responsible "to ensure each reported procedure deviation and alteration in process conditions is investigated promptly, corrected as appropriate—including action to prevent recurrence—and documented," however, as "the [Responsible Manager] of the NCSP," the NCSD leader's role is to ensure actions are taken to prevent recurrence of criticality safety infractions. (See **OFI-Triad-16** and **OFI-Triad-17**.)

- Operations personnel in PF-4 are the predominant source for reported criticality safety infractions. Since November 1, 2018, 107 out of the 120 (90%) infractions were for FMOs in PF-4, and metrics in NCS-MEMO-20-039 indicate that operations personnel self-identified approximately 80% of the infractions in FY 2020, while NCSD identified the remaining.

- There are several themes in the 120 reported infractions:

    - 27 (22%) are for differences between the inventory slip (printout) and the material present.

    - 17 (14%) are for inaccuracies in the Criticality Safety Posting (CSP) identifying the criticality safety limits and controls for a location (e.g., outdated CSPs, missing CSPs, and the wrong CSP for a location).

    - 18 (15%) are for unanalyzed conditions (e.g., material in a safe that was not part of the analysis).

NCS-MEMO-19-049, *Analysis of NCS Events from October 2017 through December 2019*, dated March 5, 2020, also identified themes in infractions related to the communication of criticality safety controls and human performance issues and management of FMOs. However, analysis of human performance issues and management of FMOs was limited because operations personnel did not participate. Instead, NCS-MEMO-19-049 stated that further evaluation "could yield corrective actions to strengthen the overall Conduct of Operations practices of personnel." However, this recommendation and others in NCS-MEMO-19-049 were not entered into IMT like findings and opportunities for improvement for an assessment would be, per NCS-AP-011 or P322-3, and no action was taken on the recommendations. (See **OFI-Triad-18**.)

Performance Assurance Conclusions

NCSD developed comprehensive, properly weighted metrics that it has used to effectively identify areas of NCSP performance warranting improvement. NCSD also performs comprehensive vertical assessments of NCSP implementation; however, violations of Triad's NCSP requirements and issues with specific CSEs identified during these assessments are often not adequately managed or resolved. There is no NCSD procedure for responding to potential errors or inadequacies in CSEs. NCSD has managed some, but not all, potential errors or inadequacies in CSEs using its procedure for responding to potential process deviations by operators. CSAs adequately review each active FMO annually. Administrative procedures for implementing the NCSP in PF-4, CMR, and RANT do not flow down the requirement to take actions to prevent recurrence for infractions impacting criticality safety. In several cases, required action to prevent recurrence of criticality safety infractions has not been taken.

3.6 NA-LA Oversight

The objective of this portion of the assessment was to assess the effectiveness of NA-LA oversight of Triad's NCSP.

NA-LA adequately oversees Triad's NCSP. NA-LA assessments of the NCSP are comprehensive, critical, and appropriately identify significant issues for Triad resolution. For example, the 2019 NA-LA assessment of the NCSP program improvement plan identified and documented the following:

- The Triad Nuclear Criticality Safety Committee (NCSC) was not adequately engaged and did not document its activities. The EA assessment team's review of NCSC documentation issued since the NA-LA assessment shows that the NCSC has improved its engagement.

- Improvements in NCSD safety culture had been made, but more work is still needed. The EA assessment team validated this issue, as discussed in Section 3.4 of this report.

- "There is no plan/procedure to identify and evaluate inadvertent holdup of fissionable materials with regards to criticality safety." NA-LA oversight is ensuring that Triad adequately resolves this issue.

NA-LA's periodic reviews of a sampling of CSEs are thorough, resulting in findings and observations provided to Triad for resolution. The NA-LA field office maintains operational awareness and discusses questions and concerns weekly with Triad NCSD management.

The only NA-LA qualified criticality safety expert is also the Assistant Manager of Field Operations; however, two members of NA-LA are actively pursuing qualification and supporting oversight of Triad's NCSP.

NA-LA Oversight Conclusions

NA-LA adequately oversees Triad's NCSP and contributes to its improvement with effective processes for assessing Triad's NCSD performance, including monitoring the scope and implementation of contractor activities, management programs, and assurance systems.

4.0 BEST PRACTICES

Best practices are safety-related practices, techniques, processes, or program attributes observed during an assessment that may merit consideration by other DOE and contractor organizations for implementation. The following best practices were identified as part of this assessment:

- NCSD maintains a more comprehensive set of properly weighted metrics than used by other divisions and organizations supporting nuclear safety (e.g., engineering divisions) across DOE, focused on key elements of the Triad NCSP performance and efforts vital to the NCSP improvement plan. Reports of these metrics are typically issued monthly with an annual summary. NCSD presents these metrics at conferences and regularly works with NA-LA to refine the metrics and identify other areas for improvement.

- NCSD maintains a listing of recent emergent issues that is used during annual FMO reviews to verify that these issues are not applicable to the FMO being reviewed.

5.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 226.1 to manage the corrective actions and track them to completion.

Triad National Security, LLC

Finding F-Triad-1: Triad CSAs authoring and providing independent technical and quality reviews of CSEs are not always ensuring that "CSE documentation … meet[s] the content guidance of DOE-STD-3007-2017, *Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities*." Approximately a third of the CSEs reviewed were not compliant. (SD130, Section 6.5.7.a)

6.0 DEFICIENCIES

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

Triad National Security, LLC

Deficiency D-Triad-1: NCSD has not reviewed or updated 13% of its procedures within the required three-year periodicity. (P315, Attachment 16, Section 16.7.1)

Deficiency D-Triad-2: For several CSEs, NCSD did not justify the applicability of models with assumed conditions that differ from those of the FMOs. (DOE-STD-3007-2017, Section 3.4.1)

Deficiency D-Triad-3: NCSD did not use a bounding or sufficiently conservative model to represent a postulated abnormal condition in a CSE. (DOE-STD-3007-2017, Section 3.4.1)

Deficiency D-Triad-4: For several CSEs, NCSD did not justify using guidance from supporting documents (e.g., memos) as the bases for limits. (DOE-STD-3007-2017, Section 3.4.1)

Deficiency D-Triad-5: NCSD did not document the bases supporting analysis parameters used in a CSE and in a technical document. (DOE-STD-3007-2017, Section 3.4.1)

Deficiency D-Triad-6: NCSD has not ensured that its procedures allow recourse to the Triad-wide DPO process as required by SD100. (SD100, Section 3.6.1)

Deficiency D-Triad-7: NCSD does not adequately categorize or manage many issues identified during its assessments to ensure resolution of violations of "documented or codified requirements regardless of the source." (Definitions for a finding in NCS-AP-011 and P322-3 and NCS-AP-011, Section 6.5, Step [1])

Deficiency D-Triad-8: FODs for CMR, PF-4, and RANT did not flow down the NCSP requirement to take action to prevent recurrence of issues impacting criticality safety into their facility-specific administrative procedures. For several issues affecting nuclear criticality safety, no action was taken to prevent recurrence. (SD100, Section 4.5)

Deficiency D-Triad-9: NCSD CSAs do not include recommendations for actions to preclude recurrence of infractions as required. (NCS-AP-010, Section 4.5)

7.0 OPPORTUNITIES FOR IMPROVEMENT

The assessment team identified 18 OFIs to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in assessment reports, they may also address other conditions observed during the assessment process. These OFIs are offered only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

Triad National Security, LLC

OFI-Triad-1: Consider providing comprehensive training on the lessons learned and NCSP improvements implemented since the shutdown of FMOs in PF-4.

OFI-Triad-2: Consider developing data books and/or trend books for common geometries, materials, and operations to support CSEs for specific FMOs. This would improve consistency in modeling and analysis assumptions and efficiency in the development of CSEs.

OFI-Triad-3: Consider developing additional guidance and/or training to continue to reduce layering of references (daisy-chaining of information) in supporting documents.

OFI-Triad-4: Consider referencing specific information (e.g., sections, tables, figures) in supporting technical documents as opposed to referencing the entire document.

OFI-Triad-5: Consider demonstrating compliance with the Double Contingency Principle more clearly by adopting a standard format to summarize the independent and unlikely contingencies for each potential normal and abnormal condition for an FMO.

OFI-Triad-6: Consider developing a document that analyzes the lessons learned from the fire at the Rocky Flats Plant to provide a single reference for fire analyses in the CSEs.

OFI-Triad-7: Consider increasing the hiring and qualification of new CSAs since the average attrition rate has been 16% instead of the 10% used in the current staffing plan.

OFI-Triad-8: Consider offering incentives (based on CSA feedback) to improve retention of high-performing CSAs beyond five years after qualification.

OFI-Triad-9: Consider delegating NCSD functions (e.g., supervisory, technical, and administrative) to additional personnel to better manage NCSP improvements, resolution of technical issues with CSEs, hiring and development of CSAs, and feedback from CSAs.

OFI-Triad-10: Consider developing and implementing processes for monitoring NCSD staff willingness to raise safety concerns to enhance organizational factors encouraging employees to raise safety concerns.

OFI-Triad-11: Consider updating NCSD procedures to reflect the process to be used to resolve DPOs between CSAs preparing and reviewing CSEs and other technical documents when routine work practices fail to resolve technical differences.

OFI-Triad-12: Consider using diverse, periodic methods of communication by NCSD management to remind employees of the avenues available to them for raising concerns and resolving DPOs.

OFI-Triad-13: Consider developing a mechanism(s) for NCSD management to provide periodic, timely updates on the status of management's response to concerns and suggestions raised by the NCSD staff, including those provided during the group interviews of this assessment.

OFI-Triad-14: Consider developing or expanding the scope of existing Triad processes for nuclear safety issues (e.g., the NCS-AP-010 or the Triad process for a potentially inadequate safety analysis) to supplement Triad's P322-4 issues management process to ensure timely reporting and compensatory actions for potential inadequacies or errors in CSEs.

OFI-Triad-15: Consider documenting the results of NCSD assessments more concisely by maintaining separate CRADs that are invoked and tailored, as needed, in a separately issued plan for each assessment. The EA website lists CRADs that could be useful examples.

OFI-Triad-16: Consider revising NCS-AP-010 to require, for infractions with severity indices of four and below, that NCSD CSAs participate (to provide guidance) in causal analysis meetings and corrective action development per P322-4, and that NCSD CSAs summarize key actions being taken to prevent recurrence (with references to the IMT number) in the NCSD record for the infraction.

OFI-Triad-17: Consider implementing Triad's graded approach by invoking more rigorous issues management tools of P322-4 (e.g., root or apparent cause analysis, extent-of-condition reviews, corrective action plans, and effectiveness reviews) for more severe issues based on the criticality safety infraction severity index. For example:

- For the criticality safety infraction severity indices four and below, consider requiring a causal analysis to identify actions that will prevent recurrence (i.e., by developing action(s) to prevent the cause(s) of the infraction identified via the analysis).

- For the criticality safety infraction severity indices three and below, consider requiring NCSD leader concurrence with the corrective action plan and closure of issues.

OFI-Triad-18: Consider revising NCS-AP-011 to include periodic (e.g., annual) assessments, performed with facility operations personnel, of criticality safety infractions to identify ongoing systemic weaknesses and trends warranting corrective actions (by either NCSD, operations, or both) broader than those taken following the individual infractions. These assessments could also include reviews of other operations, not involving criticality safety, to identify common weaknesses in the conduct of operations.

8.0 FOLLOW-UP ITEM

The assessment team could not evaluate implementation of criticality safety controls remotely. EA is planning a separate, onsite assessment of the conduct of operations (including the implementation of criticality safety controls) at LANL within a year.

Appendix A
Supplemental Information

Dates of Assessment

Remote Assessment: November 2020 – January 2021

Office of Enterprise Assessments (EA) Management

Nathan H. Martin, Director, Office of Enterprise Assessments
John E. Dupuy, Deputy Director, Office of Enterprise Assessments
Kevin G. Kilp, Director, Office of Environment, Safety and Health Assessments
Kevin M. Witt, Director, Office of Nuclear Safety and Environmental Assessments
Charles C. Kreager, Director, Office of Worker Safety and Health Assessments
Jack E. Winston, Director, Office of Emergency Management Assessments
Joseph J. Waring, Director, Office of Nuclear Engineering and Safety Basis Assessments

Quality Review Board

John E. Dupuy
James W. Lund
Matthew E. Bland
Michael A. Kilpatrick – Advisor to the QRB

EA Site Lead for LANL

Joseph E. Probst

EA Assessors

Joseph E. Probst – Lead
Laura H. Micewski
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William E. Carnes

Appendix B
Weaknesses in Specific Criticality Safety Evaluations and Technical Documents

1. NCS-CSED-18-018, NCS-CSED-20-020, and NCS-MEMO-16-014 (which is a common source of information, referenced in at least 11 other CSEs concerning interactions between fissionable units) rely on (i.e., reference) an analysis in NCS-TECH-15-018 for the minimum required separation between operations or locations to ensure neutronic decoupling. However, these CSEs do not justify the applicability of the NCS-TECH-15-018 analysis considering differences between the models used in NCS-TECH-15-018 and the conditions of the FMOs covered by these CSEDs (e.g., differences in material, size, number, and shape of fissionable units; differences in interstitial materials between the fissionable units). Therefore, relying on NCS-TECH-15-018 as the basis for demonstrating that interaction between the two operations or locations does not need to be considered in these CSEs is not appropriate.

2. NCS-CSED-19-048 inadequately evaluates the use of a non-compliant spacer. The analysis asserts that the credible use of a spacer that is not compliant with minimum requirements is bounded by the over-mass analysis (evaluated in a different section of NCS-CSED-19-04) because the worst manifestation of this event is no spacer at all. However, the over-mass analysis considers a less neutronically optimal, and thus not bounding, peripheral location of the non-compliant (modeled as missing) spacer as compared to a central location with lower neutron leakage.

3. NCS-CSED-20-043, NCS-CSED-20-034, NCS-CSED-18-107, NCS-CSED-18-047, and NCS-CSED-20-053 do not justify that guidance contained in memorandum NCS-MEMO-16-014 is applicable to and bounding for the FMOs being evaluated. The reviewed CSEs reference the memorandum for the analysis of a single item over-mass condition by increasing the item mass by 10%. The memorandum acknowledges that 10% over-mass is just guidance and specific operations could use different accounting error values based on the specifics of the material flow, form change, or characterization method. However, the reviewed CSEs use the 10% guidance from the memorandum without any further evaluation to justify applicability, asserting that it is the maximum credible or bounding over-mass condition.

4. NCS-CSED-19-048 and NCS-TECH-19-021 rely on undocumented information to support limiting analysis parameters. NCS-CSED-19-048 acknowledges that a stainless-steel container thickness can vary; however, the analysis limits this thickness to 0.75 inches based on “otherwise undocumented scoping studies.” NCS-TECH-19-021 states “Undocumented scoping calculations were used to demonstrate that a 1-inch water box conservatively bounds a 7-gauge stainless steel glovebox.”