

Joyce L. Connery, Chair
Thomas A. Summers, Vice Chair
Jessie H. Roberson

**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**

Washington, DC 20004-2901



August 17, 2022

The Honorable Jennifer Granholm
Secretary of Energy
US Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

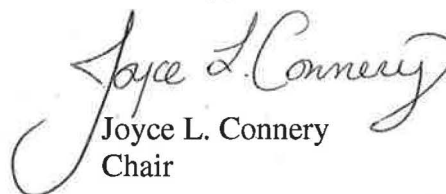
Dear Secretary Granholm:

Since January 2020, the Los Alamos National Laboratory Area G contractor, Newport News Nuclear BWXT-Los Alamos, LLC (N3B), has declared 24 potential inadequacies of the safety analysis against the Area G safety basis. To address these issues, N3B developed, and the Department of Energy (DOE) Office of Environmental Management approved, six justifications for continued operation (JCO).

The Defense Nuclear Facilities Safety Board (Board) recently completed a review of the JCOs and interim control strategy. While DOE is accepting high mitigated offsite dose consequences (about 10–18 rem total effective dose) for several accident scenarios, N3B will only be authorized to perform a limited set of operations in the near term. Further, N3B is working to develop a new Area G safety basis that is compliant with DOE Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, and DOE Standard 5506-2021, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*.

The Board encourages DOE to expeditiously complete and implement the modern Area G safety basis and identify controls consistent with the hierarchy of controls detailed in DOE Standard 3009-2014. The enclosed staff report provides additional information for DOE to use going forward.

Sincerely,


Joyce L. Connery
Chair

Enclosure

c: Mr. Michael Mikolanis
Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Report

May 20, 2022

LANL Area G Safety Posture and Justifications for Continued Operation

Background. Technical Area 54, Area G at Los Alamos National Laboratory (LANL) is a hazard category 2 nuclear facility primarily used to store, repackage, remediate, characterize, certify, and ship transuranic and low-level waste. Area G is operated by Newport News Nuclear BWXT-Los Alamos, LLC (N3B), for the Department of Energy's (DOE) Office of Environmental Management (DOE-EM) under the Los Alamos Legacy Cleanup Contract.

Since January 2020, N3B has declared 24 potential inadequacies of the safety analysis (PISA) and positive unreviewed safety question determinations (USQD) related to the Area G safety basis, which is a basis for interim operation (BIO)¹ [1]. To address these PISAs, N3B submitted, and DOE-EM Headquarters and the DOE-EM Los Alamos Field Office (EM-LA) approved, six justifications for continued operation (JCO) that derived 49 new safety controls (most of which are administrative in nature). Appendix A provides additional information on the PISAs, USQDs, and JCOs. The BIO and some of the JCOs will remain in effect until DOE-EM approves and N3B implements the new safety basis for Area G that N3B is currently developing and that will be compliant with DOE Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis* [3], and DOE Standard 5506-2021, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities* [4].

N3B plans to continue and start up a limited set of operations under the JCOs, most of which will continue under the new safety basis:

- Mining (i.e., retrieving above-ground containers from storage arrays), characterizing, certifying, and loading transuranic waste containers for shipment to the Waste Isolation Pilot Plant. N3B is currently authorized to perform these operations.
- Retrieving, size-reducing, and packaging corrugated metal pipes filled with cemented waste that are buried at Area G. N3B is currently working through readiness activities to support starting these operations in 2022.
- Draining and repackaging transuranic waste containers that include free liquids. DOE-EM has recently completed a federal readiness assessment and N3B is working to address pre-start findings. N3B plans to restart these operations in June 2022.
- Venting the four flanged tritium waste containers with potentially flammable headspaces currently stored in sheds near Dome 48. Before being authorized to start up, N3B will have to perform additional demonstrations of the operation for the federal readiness assessment team due to the gap in time between when the original

¹ According to DOE Standard 3011-2002, *Guidance for Preparation of Basis for Interim Operation (BIO) Documents* [2], a BIO is a type of documented safety analysis that allows for an abbreviated and graded approach to developing a safety basis. A BIO can be used for limited-life facilities that are expected to be operational for a short period of time (i.e., less than five years).

assessment was performed and when startup is projected. N3B plans to vent the containers in the summer of 2022.

Discussion. The staff performed a review of the JCOs and met with personnel from EM headquarters, EM-LA, and N3B in March 2022 to discuss the interim safety control strategy for Area G, planned near-term operations, and path forward for developing a modern Area G safety basis. Given the limited near-term operations, the staff team considers the safety posture of Area G to be adequate in the interim until a new safety basis is approved and implemented. N3B plans to submit the new safety basis in early calendar year 2023. DOE-EM has committed to a 120-day federal review [5]. Following approval, it may take N3B several months to implement the new safety basis, depending on the complexity of the new safety control strategy.

The staff found that under the JCO interim control strategy, EM is accepting high mitigated offsite dose consequences (approximately 10–18 rem total effective dose [TED]) for three accident scenarios: a pressurized release of powder from sealed sources during a fire at the super high efficiency neutron counter, fuel pool fire accidents involving transuranic waste containers, and TRUPACT payload drops. The JCOs credit several administrative controls to reduce the frequency of these events to “extremely unlikely” (10^{-4} to 10^{-6} /year) or “beyond extremely unlikely” (below 10^{-6} /year). Appendix B provides additional detail on these accident scenarios.

N3B stated that its focus when addressing the safety basis issues was on returning the Area G safety posture to a risk level that was previously approved by DOE. DOE Standard 3009-2014 establishes a safety control selection strategy (i.e., hierarchy of controls) that places emphasis on engineered controls over administrative controls. During the new Area G safety basis development, N3B should consider crediting engineered safety controls to prevent or mitigate these high mitigated dose consequence events. For example, N3B indicated that it was considering whether to install a fire suppression system in the super high efficiency neutron counter trailers. This engineered safety control would provide more reliability than the existing administrative control (i.e., a fire watch).

Conclusion. DOE-EM has approved and N3B has implemented six JCOs to address 24 PISAs and positive USQDs against the Area G BIO. The JCOs derive 49 safety controls, which are mostly administrative. In approving the interim safety control strategy, DOE-EM is accepting high mitigated offsite dose consequences (approximately 10–18 rem TED) for three accident scenarios. Given the limited near-term operations, the staff team considers the safety posture of Area G to be adequate in the interim until a new safety basis is approved and implemented in calendar year 2023.

Appendix A—Area G Safety Basis Issues and Path Forward

Since January 2020, Newport News Nuclear BWXT-Los Alamos, LLC (N3B), has declared 24 potential inadequacies of the safety analysis (PISA) and positive unreviewed safety question determinations (USQD) against the Area G Basis for Interim Operation (BIO) Revision 5.0 [1]. This revision of the BIO is the 2017 annual update and was inherited from the previous Area G contractor, Los Alamos National Security, LLC, when N3B took over operation of Area G in April 2018. In December 2021, Department of Energy’s (DOE) Office of Environmental Management (DOE-EM) Los Alamos Field Office (EM-LA) approved Revision 8.0 of the BIO [6], which is the currently implemented revision. N3B earlier had submitted two other revisions of the BIO that were rejected by DOE-EM [7].

In January 2020, N3B declared a PISA related to the assumed spacing between waste container arrays in a calculation used to determine the number of waste containers that would be involved in a fuel pool fire. In June 2020, personnel from DOE-EM Headquarters communicated to N3B concerns about the assumed fuel depth in the same fuel pool fire calculation. In July 2020, N3B declared a PISA on the assumed fuel depth.

Following these two PISAs, EM directed N3B to perform an extent of condition review to evaluate the BIO for additional errors. N3B performed the extent of condition review in two parts, one for fire accidents [8] and the second for spill and impact accidents [9]. N3B completed the fire accident review in November 2020, resulting in seven additional PISAs, and the spill/impact accident review in March 2021, resulting in four additional PISAs. During this timeframe, N3B declared several other PISAs (e.g., those stemming from issues related to the flammable gas sampling of transuranic waste containers and energetic reaction concerns identified in DNFSB Technical Report 46 [10]).

In some cases, DOE-EM and N3B’s implementation of the PISA process was not timely. For example, on February 4, 2020, N3B staff declared a PISA related to flammable gas sampling of transuranic waste containers. N3B staff submitted an evaluation of the safety of the situation (ESS) on March 27, 2020. EM-LA staff responded to the ESS submittal 167 days later with a rejection letter. N3B staff submitted a revision on October 6, 2020, based on EM-LA’s comments. EM-LA staff approved this revision 125 days later. EM-LA staff pointed to limited staffing as a reason for the delays. EM headquarters personnel stated that they were not aware of the review delays at the time and committed to completing reviews within two weeks going forward.

To address these PISAs, and subsequent positive USQDs, N3B developed, and EM approved, several evaluations of the safety of the situation and six justifications for continued operation (JCO). The JCOs were approved by the EM-LA Field Office manager with concurrence from the DOE-EM Deputy Assistant Secretary for Safety, Security, and Quality Assurance. Table A-1 contains a description of each PISA, the date it was declared, and the safety basis document that addressed the PISA. The six JCOs are:

- N3B-JCO-AREAG-20-002, R1, *Justification for Continued Operations, PISA: Headspace Gas Sampling in Support of Flammable Gas Analysis* (approved June 10, 2021) [11]. This JCO was incorporated into Revision 8.0 of the BIO.
- N3B-JCO-AREAG-21-001, R1, *Justification for Continued Operations, PISA: Pipe Overpack Containers Material-at-Risk / Expiration of Building 0412 JCO / Expiration of PDP and Calibration Sealed Sources ESS* (dated September 20, 2021, and incorporating directed changes from the safety evaluation report dated September 1, 2021) [12].
- N3B-JCO-AREAG-21-002, R0, *Justification for Continued Operations: Mobile Crane and Forklift Operations* (approved September 1, 2021) [13].
- N3B-JCO-AREAG-21-003, R1, *Justification for Continued Operations: PISA: New Information – DNFSB Technical Report 46* (dated September 20, 2021, and incorporating directed changes from the safety evaluation report dated September 1, 2021) [14].
- N3B-JCO-AREAG-21-004, R3, *Justification for Continued Operations for Design Basis Accident Potential Inadequacy in the Safety Analysis: Multiple Fire and Seismic Scenarios* (approved April 4, 2022) [15].
- N3B-JCO-AREAG-21-005, R0, *Justification for Continued Operations – PISA: DBA 4A Unvented TRU Waste Drum Movement and DBA 5A Horizontal Sympathetic Deflagration* (approved December 22, 2021) [16].

Table A-1. Area G PISAs and the safety basis document that addressed the issue

Date PISA Declared	PISA Description	Safety Basis Document
1/7/2020	Fuel Pool Fire Aisle Spacing Assumption	N3B-JCO-AREAG-21-004
2/4/2020	Flammable Gas Sample of TRU Drums	N3B-JCO-AREAG-20-002
7/7/2020	Fuel Pool Fire Geometry Assumptions	N3B-JCO-AREAG-21-004
7/8/2020	POCs ¹ Above MAR ² Assumptions for DBA ³ 1B	N3B-JCO-AREAG-21-001
9/1/2020	CCP ⁴ Characterization Results in POC MAR Change	N3B-JCO-AREAG-21-001
11/10/2020	ESS-113 Unmitigated 535 PE-Ci MAR Limit	N3B-JCO-AREAG-21-001
12/3/2020	DNFSB Technical Report 46	N3B-JCO-AREAG-21-003
12/21/2020	DBA 1A – Vehicle Impact with Pool Fire	N3B-JCO-AREAG-21-004
12/21/2020	DBA 1B – Fuel Pool Fire	N3B-JCO-AREAG-21-004
12/21/2020	DBA 1C – Vehicle Refueling with Pool Fire	N3B-JCO-AREAG-21-004
12/21/2020	DBA 2A – Vehicle Accident with Combustible Fire	N3B-JCO-AREAG-21-004
12/29/2020	Expiration of N3B-JCO-AREAG-19-001, R0	N3B-JCO-AREAG-21-001
12/29/2020	Expiration of ESS-AREAG-113-R1	N3B-JCO-AREAG-21-001
1/7/2021	DBA 3 – Large Combustible Fire	N3B-JCO-AREAG-21-004
1/7/2021	DBA 10 – Wildland Fire	N3B-JCO-AREAG-21-004
1/7/2021	DBA 12 – Post-seismic Fire	N3B-JCO-AREAG-21-004
2/12/2021	DBA 4A – Single Container Deflagration	N3B-JCO-AREAG-21-005
2/16/2021	DBA 8 – Crane Drops TRUPACT II Payload	N3B-JCO-AREAG-21-002

Date PISA Declared	PISA Description	Safety Basis Document
2/22/2021	DBA 7B – Crane Topple onto Waste	N3B-JCO-AREAG-21-002
2/22/2021	DBA 4F – Container Deflagration by Puncture	N3B-JCO-AREAG-21-002
3/23/2021	Helicopter Crash Frequency	BIO Revision 10
4/22/2021	Dome Construction Classification	N3B-JCO-AREAG-21-004
4/23/2021	Lateral Sympathetic Deflagration	N3B-JCO-AREAG-21-005
3/10/2022	Hydrogen Accumulation in Plastic Containers	BIO Revision 10

¹ POC: pipe overpack container

² MAR: material-at-risk

³ DBA: design basis accident

⁴ CCP: Central Characterization Program

In October 2020, N3B submitted a safety basis strategy to develop a DOE Standard 3009-2014 compliant safety basis [17], which it has since revised twice. N3B is currently planning to submit this modern safety basis in February 2023. In the interim, N3B plans to make several revisions to the BIO to address two PISAs (revision 10), incorporate changes that were determined to be negative USQDs (revision 11), and meet annual update requirements and incorporate two of the JCOs (revision 12).

Appendix B—Accidents with High Mitigated Offsite Dose Consequences

The staff found that the Department of Energy’s (DOE) Office of Environmental Management (DOE-EM) is accepting high mitigated offsite dose consequences (i.e., between about 10–18 rem total effective dose [TED]) for three accident scenarios analyzed in the justifications for continued operation (JCO) that Newport News Nuclear BWXT-Los Alamos, LLC (N3B), developed to address 24 potential inadequacies of the safety analysis (PISA) for Area G. N3B’s focus in addressing the issues was to return the risk ranking to a level that was previously approved by EM. In Revision 5 of the Area G Basis for Interim Operation (BIO) [1], DOE-EM previously approved a control strategy that mitigated or prevented to a level equivalent to risk ranks III or IV. Table B-1 shows the combinations of dose consequences and accident frequencies that result in the four risk bins. The Area G BIO defines the offsite dose consequence levels as high (greater than 10 rem TED), moderate (greater than 1 rem TED but less than 10 rem TED), and low (less than 1 rem TED).

Table B-1. *Qualitative risk ranking bins from the Area G BIO [1]*

Consequence Level	Beyond Extremely Unlikely (BEU) Below $10^{-6}/\text{yr}$	Extremely Unlikely (EU) 10^{-4} to $10^{-6}/\text{yr}$	Unlikely (U) 10^{-2} to $10^{-4}/\text{yr}$	Anticipated (A) 10^{-1} to $10^{-2}/\text{yr}$
High Consequence	III	II	I	I
Moderate Consequence	IV	III	II	II
Low Consequence	IV	IV	III	III

The following three accident scenarios, while risk ranked III or IV, result in mitigated offsite dose consequences that are approximately 10–18 rem and rely solely on administrative controls to reduce the frequency of the accident.

Pressurized Release of Powder from Sealed Sources During a Fire. N3B-JCO-AREAG-21-001, *Justification for Continued Operations, PISA: Pipe Overpack Containers Materials-at-Risk/Expiration of Building 0412 JCO/Expiration of PDP and Calibration Sealed Sources ESS* [12], allows four sealed sources (totaling 14.6 PE-Ci) to be used during calibration of the super high efficiency neutron counter (HENC). The JCO calculates that a fire involving all the sealed sources would result in mitigated offsite dose consequences of 18.1 rem TED.

Further, the JCO uses an airborne release fraction and a respirable fraction (ARFxRF) for pressurized releases of powders based on a correlation that is not recommended by the currently approved DOE Handbook 3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities* [18]. The correlation is included in DOE Standard 5506-2021, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities* [4], and the RevCom version of DOE Handbook 3010. The staff has concerns with the correlation and underlying ARFxRF values and has provided comments during the RevCom process for the new DOE Handbook 3010. For example, DOE derived the ARFxRF values from an experiment that was conducted in a chamber and measurements did not include material that deposited on the

chamber ceiling and walls, which in an external environment would have aerosolized. If N3B had used the bounding ARFxRF from DOE Handbook 3010, the mitigated offsite dose consequences for a pressurized release involving the sealed sources would have challenged or exceeded the DOE Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis* [3], Evaluation Guideline of 25 rem TED, and may have required additional safety class controls.

N3B stated it only needs all four sources for initial calibration or when addressing an equipment malfunction. These operations are estimated to require minimal duration (i.e., on the order of five hours per year). N3B plans to consider the operational need in the new Area G safety basis and is evaluating whether to install a fire suppression system in the HENC/Super HENC.

Fuel Pool Fires Involving Transuranic Waste Containers. N3B-JCO-AREAG-21-004, *Justification for Continued Operations: Design Basis Accident Potential Inadequacy in the Safety Analysis: Multiple Fire and Seismic Scenarios* [15], allows up to 23 gallons of flammable liquid in a defined area. Based on a revised fuel pool fire calculation (that addressed PISAs related to the fuel pool depth and aisle spacing), an accident with this much fuel would result in an offsite dose consequence of 9.6 rem TED. N3B has an operational need for this much fuel (e.g., asphalt repair, vegetation mitigation, and snow removal) but plans to re-evaluate fuel pool fire accidents and corresponding controls in the new documented safety analysis. N3B also indicated that it was considering the use of electric forklifts for some operations, which would help reduce the risk of fuel pool fires.

TRUPACT II Payload Drops. N3B-JCO-AREAG-21-002, *Justification for Continued Operations: Mobile Crane and Forklift Operations* [13], allows up to 880 PE-Ci for TRUPACT II payloads. If a payload is dropped, the resulting dose consequence is 9.85 rem TED. N3B indicated it could reduce the material-at-risk limit to 600 PE-Ci based on near term shipping plans, which would reduce the mitigated offsite dose consequences to 6.7 rem TED.

References

- [1] Los Alamos National Laboratory, *Basis for Interim Operation for Technical Area 54, Area G*, ABD-WFM-001, Rev. 5.0, September 27, 2017.
- [2] Department of Energy, *Guidance for Preparation of Basis for Interim Operation (BIO) Documents*, DOE Standard 2011-2002, December 2002.
- [3] Department of Energy, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, DOE Standard 3009-2014, November 2014.
- [4] Department of Energy, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, DOE Standard 5506-2021, August 2021.
- [5] Mikolanis, M.A., *Response to Submittal Date Extension Request for N3B-SBS-20-002-R2, TA-54 Area G Safety Basis Strategy (SBS): DOE Standard 3009-2014 Documented Safety Analysis (DSA) and Technical Safety Requirements (TSRs)*, EMLA-2022-0080-01-003, April 25, 2022.
- [6] N3B Los Alamos, *Basis for Interim Operation for Technical Area 54, Area G*, ABD-WFM-001, Rev. 8.0, September 15, 2021.
- [7] Hoffman, S.G., and G. Sosson, *Department of Energy Rejection of the ABD-WFM-001, Revision 7.0 and Revision 6.0, Basis for Interim Operation for Technical Area 54, Area G (AREA G BIO), and ABD-WFM-002, Revision 7.0 and Revision 6.0, Technical Safety Requirements (TSRs) for Technical Area 54, Area G (AREA G TSRs)*, EMLA-2021-0245-01-001, July 15, 2021.
- [8] N3B Los Alamos, *Extent of Condition review of potential errors in the Area G safety basis associated calculations, including the issue related to the fuel pool depth assumption*, IAS-2021-0056, November 30, 2020.
- [9] N3B Los Alamos, *Extent of Condition review of potential errors in the Area G safety basis Explosion/Deflagration and Spill/Impact Design Basis Accident (DBA) Scenarios and Calculations*, IAS-2021-0063, March 11, 2021.
- [10] Defense Nuclear Facilities Safety Board, *Potential Energetic Chemical Reaction Events Involving Transuranic Waste at Los Alamos National Laboratory*, DNFSB/TECH-46, September 2020.
- [11] N3B Los Alamos, *Justification for Continued Operations, PISA: Headspace Gas Sampling in Support of Flammable Gas Analysis*, N3B-JCO-AREAG-20-002, Rev. 1, May 27, 2021.
- [12] N3B Los Alamos, *Justification for Continued Operations, PISA: Pipe Overpack Containers Material-at-Risk / Expiration of Building 0412 JCO / Expiration of PDP and*

- Calibration Sealed Sources ESS*, N3B-JCO-AREAG-21-001, Rev. 1, September 20, 2021.
- [13] N3B Los Alamos, *Justification for Continued Operations: Mobile Crane and Forklift Operations*, N3B-JCO-AREAG-21-002, Rev. 0, July 8, 2021.
- [14] N3B Los Alamos, *Justification for Continued Operations: PISA: New Information – DNFSB Technical Report 46*, N3B-JCO-AREAG-21-003, Rev. 1, September 20, 2021.
- [15] N3B Los Alamos, *Justification for Continued Operations for Design Basis Accident Potential Inadequacy in the Safety Analysis: Multiple Fire and Seismic Scenarios*, N3B-JCO-AREAG-21-004, Rev. 3, February 7, 2022.
- [16] N3B Los Alamos, *Justification for Continued Operations – PISA: DBA 4A Unvented TRU Waste Drum Movement and DBA 5A Horizontal Sympathetic Deflagration*, N3B-JCO-AREAG-21-005, Rev. 0, October 13, 2021.
- [17] N3B Los Alamos, *TA-54 Area G Safety Basis Strategy, DOE Standard 3009-2014 Documented Safety Analysis (DSA) and Technical Safety Requirements (TSRs)*, N3B-SBS-20-002-Rev. 0, October 28, 2020.
- [18] Department of Energy, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, DOE Handbook 3010-94, December 1994.