National Nuclear Security Administration

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

JAN 16 2013

The Honorable Peter S. Winokur
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue NW, Suite 700
Washington, D.C. 20004

Dear Mr. Chairman:

This letter is in response to your November 19, 2012, letter concerning the approved but not yet implemented 2012 upgrade to the nuclear facility safety basis for Area G at Los Alamos National Laboratory. Specifically, the Board's letter stated that the Area G safety basis approved in March 2012, included inconsistencies with Department of Energy (DOE) Standard 3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*. Three specific inconsistencies were cited in the Board's letter with additional issues described in an enclosed report.

NNSA has carefully evaluated the issues you have raised, including your proposed resolutions, and is taking actions in keeping with your suggestions to address these issues. The enclosed NNSA report describes the actions that we will take to address the issues in the next update of the Area G safety basis, currently scheduled for submittal to NNSA in April 2013. The one exception is the deposition velocity issue, which will be addressed in future annual updates in a manner that is coordinated with actions taken across the national security complex.

If you have any questions concerning this response, please contact Dr. Jerry McKamy at (301) 903-7980.

Sincerely,

James J. McConnell
Deputy Associate Administrator
for Infrastructure and Operations

Enclosure

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M. Campagnone, HS-1.1
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J. Griego, NA-00-LA

Enclosure: Detailed Response to DNFSB letter of November 19, 2012

In a letter dated November 19, 2012 to the National Nuclear Security Administration (NNSA), the Defense Nuclear Facility Safety Board (DNFSB) identified eight concerns with the Area G safety basis at Los Alamos National Laboratory (LANL). The DNFSB requested a report identifying actions taken or planned by NNSA to resolve these safety issues.

Section I below provides background on Area G and its safety basis. Section II cites each issue and discusses NNSA's analysis of the issue and planned action. Section III has conclusions.

I. BACKGROUND

LANL has used Technical Area (TA)-54 Area G for radiological waste disposal and storage since 1957. Area G receives, processes, stores, ships, and disposes of LANL's newly generated low-level waste, mixed low-level waste, hazardous waste, tritium contaminated waste, and transuranic (TRU) waste. Area G also prepares legacy waste items for shipment to offsite treatment, storage, and disposal facilities.

Area G is a limited-life facility. LANL shipments of TRU waste to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico are critical to Area G closure within the next few years and the associated risk reduction.

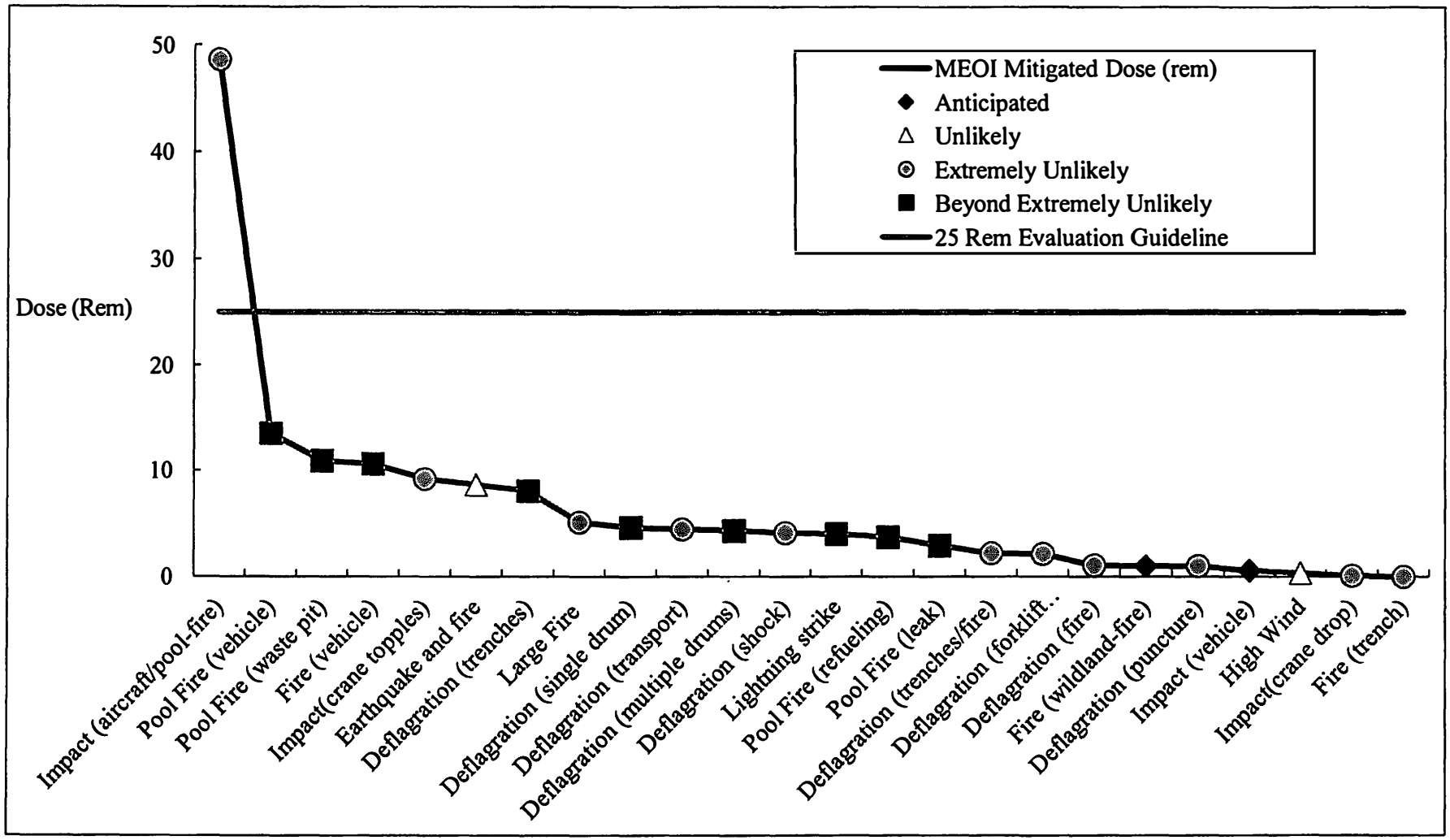
Area G currently operates to a Documented Safety Analysis (DSA) and set of Technical Safety Requirements (TSRs) originally developed in 2003 that have seen 8 and 33 revisions, respectively. During 2012, Los Alamos National Security, LLC (LANS) proposed and NNSA approved a new DSA and TSRs that are not yet implemented. The not-yet-implemented 2012 DSA was the subject of the DNFSB review.

While the 2003 DSA is more conservative in a few areas, the 2012 DSA provides clearer connections between the hazard analyses, the detailed accident analyses, and the control selection, facilitating the change control (USQ) process. It also has defined operating modes, improved surveillances of engineered safety systems, improved safety administrative controls, and improved safety controls to prevent fuel pool fires.

For perspective, Figure 1 presents the calculated mitigated accident frequencies and mitigated doses to the maximally exposed off-site individual (MEOI) for the two dozen detailed accident analyses in the 2012 DSA. The frequency bins (e.g., Anticipated, Unlikely, etc.) correspond to those identified in Department of Energy (DOE) Standard 3009. One accident scenario, the aircraft crash and fire, had calculated consequences exceeding the DOE 25 rem Evaluation Guideline. NNSA accepted this result based on:

- Area G is a limited life facility (i.e., closure anticipated within a few years);
- The mission (i.e., shipping off TRU waste) is essential and results in long-term risk reduction
- The accident frequency is on the order of 10^{-6} per year
- The consequence calculation is conservative

None of the DNFSB issues applied to this decision.


50
40
30
20
10
0
Dose (Rem)
MEOI Mitigated Dose (rem)
Anticipated
Unlikely
Extremely Unlikely
Beyond Extremely Unlikely
25 Rem Evaluation Guideline
Impact (aircraft/pool-fire)
Pool Fire (vehicle)
Pool Fire (waste pit)
Fire (vehicle)
Impact(crane topples)
Earthquake and fire
Deflagration (trenches)
Large Fire
Deflagration (single drum)
Deflagration (transport)
Deflagration (multiple drums)
Deflagration (shock)
Lightning strike
Pool Fire (refueling)
Pool Fire (leak)
Deflagration (trenches/fire)
Deflagration (forklift..
Deflagration (fire)
Fire (wildland-fire)
Deflagration (puncture)
Impact (vehicle)
High Wind
Impact(crane drop)
Fire (trench)

II. ISSUE ANALYSIS AND PLANNED ACTIONS

The DNFSB issue description, the NNSA analysis, and the NNSA planned actions for each issue are provided below.

1. *Issue – Damage Ratio:* LANS safety analysts use a damage ratio of 0.01 in the Area G BIO [Basis for Interim Operation] when calculating the release of tritium in waste containers via a fire without justifying that assumption or crediting the containers as a safety control. This approach is inconsistent with DOE [Department of Energy] Standard 3009, which states, "Exclusion of MAR [Material-at-Risk] from the source term may be based on qualified containers (which may then be designated as SC [safety-class] design features), consideration regarding the specifics of the accident scenario through the definition of the damage ratio or other appropriate means."

   Accordingly, LANS [Los Alamos National Security, LLC] personnel should either technically justify a damage ratio less than 1.0 or formally credit the container as a safety control.

   NNSA Analysis: The currently implemented Area G DSA assumes the Damage Ratio (DR) to be 1.0 and is not an issue. The approved but not yet implemented DSA revision 1.1 assumed a DR of 0.01 for tritium containers in three of the two-dozen detailed accident analyses. The high-activity tritium containers are robust, welded stainless-steel containers or stainless steel containers with machined metal flanges and metal gaskets, with a high-density polyethylene or stainless steel over-pack over the inner container. The tritium is also typically in a chemical form that is not releasable except in a high-temperature fire event. That said, NNSA agrees that the Area G DSA dose consequences should be recalculated for tritium releases due to fire.

   Action: In the next safety basis annual update, the damage ratio (DR) will be changed from 0.01 to 1.0, increasing the tritium source term accordingly, unless the high-activity tritium containers can be shown to survive fire accident conditions and be credited as a safety control.

2. *Issue – Sealed Sources:* LANS safety analysts assign a damage ratio of zero to sealed radioactive sources that are certified as American National Standards Institute (ANSI) N.43.6/ISO 2919 Class 4 for temperature performance (the container is rated to survive a fire not exceeding a temperature of 400°C and lasting 1 hour) thereby excluding these sources from the MAR in the Area G BIO. However, the BIO does not analyze whether a temperature exceeding 400°C is credible under accident conditions. This approach is inconsistent with DOE Standard 3009, which states, "While [DOE Standard 1027] excludes material in qualified containers [containers that comply with ANSI N.43.6] from consideration for the purposes of hazard classification, the existence of such material should be acknowledged in a DSA. Such material should later be excluded from the source term for the applicable accident scenarios if the containers can be shown to perform their functions under the accident environments." Accordingly, LANS personnel should either include sealed sources in the quantity of MAR analyzed in the safety basis or technically justify excluding them.

NNSA Analysis: The currently implemented Area G safety basis includes dose calculations for direct radiation exposure to the radioactive sources used in the non-destructive evaluation (NDE) systems. The technical justification for Technical Safety Requirements (TSR) Rev 0.7 included spill and fire accident analyses for the stored waste Off-Site Source Recovery Program (OSRP) sealed sources, with justification of the damage ratio of 0.0 to 0.05. OSRP sealed source packaging has also been tested and shown to meet the special form requirements in 49 Code of Federal Regulations 173.469, which includes impact (9 m drop), percussion, bending, and heat (800°C for 10 minutes). Further information on the OSRP encapsulation and packaging can be found at: http://osrp.lanl.gov/.

Action: In the next safety basis annual update, a calculation will be developed to show the maximum temperature of a projected fire in the facility. The DSA will also be revised to justify excluding those sealed NDE sources that meet the requirements specified in DOE-STD-3009, and to include within the analyzed MAR any sealed sources which do not meet the exclusion criteria.

3. *Issue – Unanalyzed Hazards:* The Area G BIO does not analyze the puncture of a propane tank or damage to the fuel line on a forklift whereby the escaping gas immediately ignites, resulting in a "blowtorch" effect. This postulated accident could impact both the facility workers and the MAR. This event is credible whenever a forklift is operating within a facility, and it becomes more likely when multiple forklifts are operating simultaneously in the same facility.

   NNSA Analysis: The hazard analyses in both the currently implemented and the new but not yet implemented DSA also include deflagration/fire scenarios that are caused by accumulation of flammable airborne concentrations above the lower flammability limit following a gasoline or propane fuel leak or spill. Figure 1 indicates that the 2012 DSA accident analyses included 9 deflagration scenarios and 8 other fire scenarios. The scenarios already covered in the hazard and accident analyses may bound the scenario posed by the DNFSB and its staff.

   Action: In the next safety basis annual update, the hazard analysis will explicitly examine the immediate ignition and resulting "blowtorch" from the propane escaping a damaged tank or fuel supply line. If this hazard analysis scenario represents a bounding case, then it will be carried forward to a new accident scenario in accordance with DOE Standard 3009 requirements.

4. *Issue – Particulate Deposition Velocity:* DOE's Office of Health, Safety and Security [DOE-HS] issued Safety Bulletin 2011-02, Accident Analysis Parameter Update, which concludes that a dry deposition velocity value of 1 cm/s for unfiltered/unmitigated releases may not be reasonably conservative for all DOE sites and accident scenarios. As a result, the Safety Bulletin recommends using a default value of 0.1 cm/s or technically justifying the use of a site-specific value. LANS safety analysts use a dry deposition velocity value of 1 cm/s for particulates in the Area G BIO. However, a recent report (Napier, 2011) states, "For calculations at distances of less than about two miles [at LANL], deposition velocities as low

as 0.002 m/s (0.2 cm/s) for both particles and reactive gases could be appropriate." The distance between facilities at Area G and the maximally exposed offsite individual is less than two miles. A lower deposition velocity reduces the calculated plume depletion, resulting in a higher predicted dose consequence to the public.

LANS safety analysts justify using this non-conservative deposition velocity in SBTSWP-12-001, Rev. 0, Justification of the Use of 1 cm/s Deposition Velocity in MACCS2 for LANL Applications. This document states, "The results show that the non-conservative use of a 1 cm/sec DV [deposition velocity] value is offset by over-conservatism in the MACCS2 dispersion coefficients." The Board' s staff believes safety basis analysts should always use technically justified values for all input parameters in the radiological dose consequence, consistent with DOE Standard 3009.

NNSA Analysis: DOE Standard 3009 states that the intent is that calculations be based on reasonably conservative estimates of the various input parameters (Section A.3). A LANL-specific study using the methodology recommended by DOE-HS indicates that a reasonably conservative estimate for deposition velocity is within the range of 0.1 to 1 cm/sec, depending on several factors. Area G is closer to the site boundary than other LANL nuclear facilities (i.e., hundreds of yards). Given the proximity of the site boundary, the modeled plume depletion before the plume crosses the site boundary intuitively will be small, and its effect on calculated MEOI dose will also be small.

The analysis still needs to be updated. NNSA has directed LANS to review dispersion input parameters for all the site's nuclear facility safety bases and appropriately revise analyses as part of the safety basis annual update process during the next two years.

In parallel, DOE has initiated research to develop an approach for calculating the MEOI 95th percentile doses considering the key parameters used in dispersion models (particularly deposition velocity). Therefore, NNSA has directed LANS to conduct the site-specific effort in a manner that supports while not duplicating DOE research efforts in this area.

Action: The determination of the appropriately justified dispersion parameters, including deposition velocity, is being addressed by ongoing efforts by LANS and DOE. NNSA expects to reach resolution and to incorporate this effect in future annual updates.

5. *Issue – Tritium Oxide Deposition Velocity:* LANS safety analysts use a dry deposition velocity value of 0.5 cm/s for tritium oxide in the Area G BIO, citing the MACCS2 Computer Code Application Guidance for Documented Safety Analysis Final Report (MACCS2 Application Guidance) (U.S. Department of Energy, 2004) as the basis. Research has shown that this value is neither conservative nor appropriate for the time scale of most design basis accidents (see the Board's August 19, 2011 Letter to the NNSA Administrator). Further, it should be noted that the use of any non-zero dry deposition velocity value for tritium oxide is valid only if reemission (the release of tritium from vegetation and soil back into the atmosphere) is adequately accounted for. Reemission is rapid, and at least one study has shown that more than 50 percent of deposited tritium oxide can be reemitted during a 12-hour period (Taschner et al., 1997).

As a point of reference, safety analysts at the Tritium Facility at Lawrence Livermore National Laboratory use a dry deposition velocity value of 0.0 or 0.1 cm/s for tritium oxide in their accident analysis calculations. Further, Savannah River National Laboratory issued a report (Murphy et al., 2012) stating that, "an effective deposition velocity [for tritium oxide] of 0.0 cm/s is appropriate for safety analysis with the MACCS2 code" for the Savannah River Site. Although the specific conditions that affect the deposition velocity of tritium oxide may differ from site to site, the overall conclusion remains the same: the value recommended in the MACCS2 Application Guidance is not conservative.

NNSA Analysis: In the currently implemented Area G safety basis, the MAACS analysis used 0.0 cm/s for tritium dry deposition and does not pose an issue. The approved but not yet implemented DSA assumed 0.5 cm/s deposition velocity for tritium or tritiated water vapor. Along with current assumptions such as no heat-induced plume buoyancy and no reduction due to the lighter-than-dry-air density of tritium gas or water vapor, assuming a deposition velocity of 0.0 cm/s would certainly result in the calculated doses meeting the "reasonably conservative" requirement of DOE Standard 3009.

Action: In the next safety basis annual update, the calculation of the downwind effluent concentration will be updated to reflect a dry deposition velocity of 0.0 cm/s for tritium or tritiated water vapor.

6. *Issue – Fire Suppression*: The fire suppression system for Dome 229, a hazard category 2 nuclear facility, has been shut down (impaired) and is no longer maintained. Although the fire suppression system is not a credited safety feature in the Area G BIO, DOE Order 420.1B, *Facility Safety*, requires that automatic fire suppression systems be provided in all significant facilities, including hazard category 2 nuclear facilities. LANL fire protection personnel recognized this deficiency and submitted an exemption request in September 2011 for Dome 229 and five other domes housing hazard category 2 quantities of MAR. NNSA has not yet acted upon this request. The Board's staff believes the delay in taking corrective action contributes to a degraded safety posture at Area G.

   NNSA Analysis: As stated by the DNFSB staff, the fire suppression system is not a credited safety feature for the Area G waste storage domes. NNSA is currently evaluating the exemption request to DOE O 420.1B requirements.

   Action: The next Area G safety basis update and fire hazard analysis update will include updated fire suppression system information, including NNSA action on the exemption request.

7. *Issue – Dome 231 and Dome 375 Fire Suppression*: At the time of the staff's visit, LANL was investigating the feasibility of installing a foam fire extinguishing system inside enclosures being erected in Domes 231 and 375 to support wooden waste box disposition efforts. LANL fire protection personnel have subsequently informed the staff that they will instead install a pre-action automatic sprinkler system in each enclosure. This action will

provide fire suppression capabilities, as required by DOE Order 420.1B, within the enclosures.

NNSA Analysis: As stated by the DNFSB staff, the planned actions will provide fire suppression within the Dome 231 and 375 enclosures.

Action: The next Area G safety basis update and fire hazard analysis update will include updated information on the fire suppression systems, including fire suppression attributes that are credited in the accident analysis.

8. *Issue – Wildland Fire Control Observation:* Currently, little mitigation effort has been undertaken to reduce the fuel (grasses, brush, and dead trees) for wildland fires along the primary access road, which fire fighting vehicles would use to respond to and defend Area G against a wildland fire. Given the Los Alamos region's susceptibility to wildland fires, the staff believes that fuel mitigation and reduction activities along the primary access road and in Area G should be given appropriately high priority to ensure that emergency responders can affect a timely response to protect the large quantity of above ground transuranic wastes at Area G. Accordingly, LANS management is considering fuel mitigation activity along the primary Area G access roadway during 2013 and the relocation of some personnel and removal of some combustible trailers that are located along the roadway.

   NNSA Analysis: This is an implementation issue and does not require any changes to the Area G safety basis. The current fuel inventory (grasses, brush, and dead trees) at Area G is compliant with the fire protection program. The fuel inventory is inspected as a scheduled preventive maintenance item, and identified deficiencies are corrected.

   Action: The next Area G fire hazard analysis update will include updated information on the wild-land fire fuel reduction program.

III. CONCLUSIONS

In general, NNSA agrees with each of the Area G safety basis issues identified in the report provided by the DNFSB letter dated November 19, 2012. These issues affect the 2012 DSA, which is not yet implemented and would need to be revised before it could be implemented. They do not affect the currently implemented safety basis, which was originally developed in 2003.

NNSA intends to address these issues in the next Area G safety basis annual update, with the exception of the more complicated issue involving deposition velocity. This issue will be addressed during the next two years in a manner that is coordinated with concurrent Department of Energy research efforts on improving dispersion analyses. The next annual update is currently scheduled for submittal in April 2013.