DEFENSE NUCLEAR FACILITIES SAFETY BOARD
Washington, DC 20004-2901

November 19, 2012

Mr. Kevin W. Smith
Manager, Los Alamos Site Office
U.S. Department of Energy
747 West Jemez Road
TA-3 Building 1410, Mail Stop-A316
Los Alamos, New Mexico 87544

Dear Mr. Smith:

The Defense Nuclear Facilities Safety Board (Board) has reviewed the approved safety basis for Area G at Los Alamos National Laboratory (LANL). This review revealed multiple inconsistencies between the hazard and accident analyses and the objectives outlined in Department of Energy Standard 3009-94, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*. These inconsistencies include:

- A non-conservative damage ratio that is not technically justified or based on a formally credited safety control
- Exclusion of sealed sources from the quantity of material-at-risk with no analysis to show that they would survive design basis accident conditions
- An unanalyzed hazard in the safety basis involving a forklift puncturing a propane tank

The Board believes the above inconsistencies and deficiencies result in a significant underestimation of the potential radiological dose consequence to the public and, consequently, an inadequate control set to protect the public. Further, the Board believes that the overall safety posture of Area G could be improved if other observations noted in the enclosed report are addressed in the next annual update of the safety basis. Therefore, pursuant to 42 U.S.C. § 2286b(d), the Board requests a report within 60 days of the receipt of this letter describing plans to address the issues noted above and in the enclosed report.

Sincerely,

Peter S. Winokur, Ph.D.
Chairman

Enclosure

c: Mrs. Mari-Jo Campagnone

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

September 25, 2012

MEMORANDUM FOR: T. J. Dwyer, Technical Director

COPIES: Board Members

FROM: M. Dunlevy

SUBJECT: Basis for Interim Operation, Area G, Los Alamos National Laboratory

This report documents a review conducted by the staff of the Defense Nuclear Facilities Safety Board (Board) during June 19–21, 2012, of the Basis for Interim Operation (BIO) at Los Alamos National Laboratory's (LANL) Area G. The staff met with personnel from Los Alamos National Security, LLC (LANS) and the National Nuclear Security Administration's (NNSA) Los Alamos Site Office (LASO) to discuss the details of the updated BIO for Area G. The staff also conducted walkdowns of Area G facilities and observed workers opening and processing the contents of a standard waste box. Following the onsite portion of the review, the staff requested and reviewed documents in July, August, and September. Staff members participating in this review included B. Broderick, T. Davis, M. Dunlevy, W. Futrell, C. Johnson, J. Pasko, and B. Sharpless.

Background. During March 2012, the LASO manager approved the first major update to the Area G safety basis since April 2003. Currently, Area G is scheduled for closure by 2015 (Order of Consent, 2005) and therefore qualifies as a limited-life facility consistent with Department of Energy (DOE) Standard 3011-02, *Guidance for Preparation of Basis for Interim Operation (BIO) Documents.* As a result, only a BIO (rather than a Documented Safety Analysis [DSA]) is required to meet safe harbor expectations consistent with Title 10 of the Code of Federal Regulations, Part 830, *Nuclear Safety Management.* However, according to DOE Standard 3011-02, Chapters 2–6 of the BIO should still be compliant with DOE Standard 3009-94, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses* (DOE Standard 3009).

Hazard and Accident Analyses. The Board's staff reviewed the Area G BIO and noted the following concerns regarding the hazard and accident analyses.

Damage Ratio—LANS safety analysts use a damage ratio of 0.01 in the Area G BIO 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 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 personnel should either technically justify a damage ratio less than 1.0 or formally credit the container as a safety control.

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.

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.

Particulate Deposition Velocity—DOE's Office of Health, Safety and Security 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 2 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 2 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.

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.

Fire Protection. The Board's staff noted the following concerns during its review of the Area G facilities and associated fire protection program.

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.

Dome 231 & 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.

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 firefighting 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.

References

Murphy, C., P. Lee, B. Viner, and C. Hunter, 2012, *Recommended Tritium Oxide Deposition Velocity for Use in Savannah River Site Safety Analyses*, SRNL-STI-2012-00128, Rev. 0, Aiken, SC: Savannah River National Laboratory.

Napier, B. 2011, *Dry Deposition Velocity Estimation for the Los Alamos Site*, PNNL-20440, Battelle, Pacific Northwest National Laboratory.

Taschner, M., C. Bunnerberg, and W. Raskob, 1997, "Measurements and Modeling of Tritium Reemission Rates after HTO Depositions at Sunrise and at Sunset," Journal of Environmental Radioactivity, 32, pp. 219–235.

State of New Mexico Environment Department, March 1, 2005, *Compliance Order on Consent.*

U.S. Department of Energy, 2004, *MACCS2 Computer Code Application Guidance for Documented Safety Analysis Final Report*, DOE-EH-4.2.1.4-MACCS2-Code Guidance, Washington, DC.