May 27, 2004

The Honorable Linton Brooks
Administrator
National Nuclear Security Administration
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0701

Dear Ambassador Brooks:

The staff of the Defense Nuclear Facilities Safety Board (Board) has reviewed the status of safety bases at the National Nuclear Security Administration's (NNSA) Los Alamos National Laboratory (LANL). The enclosed report prepared by the Board's staff identifies a number of related issues for your information.

LANL currently has 26 nuclear facilities. NNSA has focused mainly on accident analysis and risk reduction for the one facility with the highest predicted accident consequence—Technical Area (TA)-54 Area G—and has paid much less attention to other facilities and activities. More-balanced priorities appear warranted based on a comparison of predicted accident consequences in all the facilities.

The annual update requirements for safety bases at LANL are not being enforced. Several nuclear facilities are operating with older safety bases; these include four Hazard Category 2 facilities with safety bases that are 5 to 8 years old. An example is the 7-year-old safety basis for the TA-55 Plutonium Facility. Its proposed update has been awaiting NNSA approval for more than 2 years. NNSA's recent Type B investigation found that the lack of current container requirements in the TA-55 safety basis contributed to the plutonium-238 uptake event that occurred in August 2003.

As discussed in the enclosed report, the operational safety of many nuclear facilities at LANL would benefit from more-balanced priorities in maintaining and improving the facilities'

safety bases. The Board believes that prioritization of the safety bases at LANL may deserve your attention, and will continue to follow closely the efforts of NNSA and LANL to improve in this area.

Sincerely,

John T. Conway
Chairman

c: The Honorable Everet H. Beckner
Mr. Edwin L. Wilmot
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

May 3, 2004

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: C. H. Keilers, Jr.

SUBJECT: Status of Safety Bases at Los Alamos National Laboratory

This report documents a review by the staff of the Defense Nuclear Facilities Safety Board (Board) of the safety bases for nuclear facilities at the Department of Energy's (DOE) Los Alamos National Laboratory (LANL). LANL is administered by the National Nuclear Security Administration's (NNSA) Los Alamos Site Office (LASO). The review was conducted by staff members F. Bamdad, A. Jordan, and C. Keilers.

Background. The *Nuclear Safety Management Rule*, Title10, U.S. Code of Federal Regulations (CFR) Part 830, (10 CFR Part 830), states that by April 10, 2003, a contractor responsible for a Hazard Category (HC)-1, -2, or -3 existing nuclear facility must submit for approval a safety basis that meets Subpart B, "*Safety Basis Requirements*" (10 CFR Part 830 § 207).

LANL currently has 26 nuclear facilities. They are listed in Table 1 by Technical Area (TA), common acronym, and name. LANL had submitted 10 safety bases for approval by April 10, 2003, and obtained prior federal agreement that 5 other safety bases were compliant with 10 CFR Part 830. These 15 safety bases covered all the nuclear facilities that had been identified at that time. NNSA has approved 6 of the 10 updated safety bases and disapproved one. LANL has withdrawn three. In November 2003, 11 environmental sites were added to the nuclear facility list. Their safety bases are in preparation. The staff understands that the Decontamination and Volume Reduction System (DVRS) in TA-54 is being designated an interim HC-2 nuclear facility to supplement visual examination and repackaging activities now being conducted in the Waste Characterization, Reduction, and Repackaging Facility (WCRRF).

Hazard Category-2 Nuclear Facilities. LANL now has 17 HC-2 nuclear facilities. They are ranked in Table 2 in order of decreasing predicted unmitigated consequences to the maximally exposed offsite individual.

The Table 2 ranking excludes the environmental remediation (ER) sites, which do not yet have safety bases, and the Transuranic Waste Inspectable Storage Project, which has been completed. The information in the table on inventory and consequences is from the best sources available at this time, including proposed but unapproved safety bases. The ages of the safety bases shown in column 4 are the period since the last NNSA/LANL survey leading to a complete update. Minor Technical Safety Requirement (TSR) revisions have occurred, such as changes reflecting the facility management realignment.

While a facility's rank in Table 2 is an important criterion for setting safety basis priorities, it should not be the only one, for at least two reasons. First, the age of each safety basis may indicate whether hazards have been reviewed in detail against current requirements and whether the control set has been updated. Seven of the 17 HC-2 facilities are now operating under older safety bases, and the 5 new ER sites have safety bases under preparation. Section 202 of 10 CFR Part 830 requires that safety bases be reviewed and that any required updates be proposed and approved once per year; however, this has rarely occurred for LANL nuclear facilities.

Second, Table 2 does not reflect lower-tier postulated accidents. For example, the highest-consequence accident postulated at LANL is an airplane crash into the highest-source-term drums in TA-54 Area G, should these drums be collocated. LANL conservatively predicts that the maximally exposed off-site individual would receive 1800 rem (Committed Effective Dose Equivalent) from this accident. If this postulated airplane crash involves typical-source-term drums, the predicted consequences drop by a factor of 6, to 300 rem. The next-highest-consequence accident postulated in Area G is the toppling of all of the above-ground drums during an earthquake, should they not be banded together on pallets (900 rem). This consequence is comparable to the worst accident consequences predicted for TA-18 and TA-55.

The staff observes that, since April 2003, LASO's safety basis staff has focused on accident analysis and risk reduction for TA-54 Area G—ranked #1 in Table 2—and paid much less attention to other activities. While risk reduction in Area G is important, more-balanced priorities appear warranted. Senior management at LANL recently established an executive committee to track the progress of LASO and LANL on safety basis issues and reprioritize efforts as appropriate. While this is a positive step, the LANL committee appeared to be ramping up and not to be fully effective as of April 2004.

More-specific observations related to the information in Table 2 follow.

HC-2 Nuclear Facilities with Newer Safety Bases. Five HC-2 facilities have had their safety bases updated within the last 2 years—Area G, TA-18, Radioactive Nondestructive Testing Facility (TA-54 RANT), Weapons Engineering Tritium Facility (WETF), and on-site transportation. These updates covered the higher-risk facilities—specifically, #1, #2, #4, #6, and #11 in Table 2— but issues remain, briefly summarized below.

Waste Storage and Disposal Facility (TA-54 Area G)—Risk reduction in Area G depends on the success of the Quick-to-WIPP Program, which involves shipping about 2,000 drums with the highest, most dispersable inventory to the Waste Isolation Pilot Plant (WIPP) by the end of fiscal year 2004. LANL's WIPP shipments were suspended last October. NNSA expects LANL to resume shipments in June 2004, at the earliest, and then to achieve one shipment per day. This is an aggressive pace and will require vigilance to prevent safety or compliance issues from arising. During a briefing to the Board in March 2004, LANL provided a revised schedule indicating that shipments under the Quick-to-WIPP Program will resume in July 2004 and be completed in March 2005.

Critical Experiments Facility (TA-18)—The higher-consequence accidents for TA-18 are different from those for other facilities and involve uncontrolled reactivity excursions leading to melting and partial vaporization of plutonium cores or samples. The TA-18 laboratories containing critical assemblies were built in the 1950s and offer no confinement. Risk mitigation now depends

highly on administrative controls to prevent uncontrolled excursions during both burst and delayed critical operations. For the latter, NNSA approved new safety-class temperature scram systems, already installed in two of the five assemblies. There are open questions, however, as to whether these systems can perform their safety function. In March 2004, NNSA announced an accelerated relocation of the TA-18 mission to the Nevada Test Site. Few details are available now on how this relocation will be accomplished and how NNSA and LANL intend to manage the risk of current TA-18 operations during the transition. The extensive use of administrative controls to address TA-18's unique scenarios warrants close scrutiny. A TSR revision was approved last summer to address implementation issues.

Radioactive Nondestructive Testing Facility—TA-54 RANT is the LANL facility for loading shipping containers for WIPP shipments. In 1999, LANL considered TA-54 RANT to be the only nuclear facility, of nine reviewed, to have an acceptable safety basis. In a safety basis revision last year, NNSA increased TA-54 RANT's rating from HC-3 to HC-2 with no physical modifications. Although built in the late 1980s, TA-54 RANT does not meet Performance Category 2 seismic requirements. In January 2004, NNSA directed that the TA-54 RANT safety basis expire in 5 years and that cost-benefit analyses be performed on the facility's seismic vulnerabilities. NNSA also questioned the adequacy of the fire suppression system to activate during small to medium fires. Long-term risk reduction through the Quick-to-WIPP Program may warrant accepting a short-term increased risk from TA-54 RANT operations with well-justified interim controls.

Weapons Engineering Tritium Facility—Risk mitigation for WETF depends on safety-class containers, fire barriers, lightning protection, and radioactive and combustible inventory controls. In September 2003, NNSA approved a reduced tritium inventory limit and a schedule for shifting about half of the inventory to more thermally robust containers during fiscal year 2004. In February 2004, NNSA directed WETF to pursue improved fire barriers and improved maintenance, operability, and configuration management for the safety-class lightning protection system. A minor TSR revision was approved last summer to address issues identified during TSR verification.

On-Site Transportation—In contrast with other nuclear operations, risk mitigation during on-site transportation depends on a general control set developed on the basis of barrier analyses instead of accident analyses. This safety basis provides a general framework for developing controls. The specific controls are supposed to be captured in transportation plans, for which development and implementation have been problematic during the last year. The transportation plans may need to be considered, in whole or in part, as TSRs for specific shipments.

Other HC-2 Nuclear Facilities. The remaining 12 HC-2 facilities also have safety basis issues. Four have safety bases that are 5 to 8 years old—TA-55, Chemistry and Metallurgy Research (CMR) Facility, TA-21, and the Radioactive Liquid Waste Treatment Facility—ranked #3, #5, #9, and #10 respectively in Table 2. Also, the Radiography Facility is operating under a 2-year-old Justification for Continued Operation (JCO), and the WCRRF is operating under a 3-year-old combined hazard analysis and TSRs. The five ER sites were just added to the list, and their safety bases are in preparation. Specific issues are highlighted below.

Plutonium Facility (TA-55)—The TA-55 safety basis is about 7 years old and has had no annual updates approved in that period. NNSA has yet to act on a safety basis update proposed 2

years ago, in April 2002. That update itself likely now needs updating. NNSA did prepare a draft Safety Evaluation Report in the summer of 2002. LANL resubmitted draft TSRs in early 2003.

This delay may impact safety in TA-55. For example, a recent Type B investigation found that the lack of current container requirements in the safety basis contributed to the plutonium-238 (Pu-238) uptake event in August 2003. Also, the current TSRs do not specify periodic inspections of design features to ensure that they perform their safety functions. Such inspections would include confirming seismic restraints on Pu-238 storage cages—probably equivalent to a safety-class control. NNSA has approved two minor TSR revisions since last November but has not yet included requirements for the new Pu-238 scrap recovery line. Overall, the April 2002 update may not reflect the latest DOE requirements on worker safety (DOE Standard-3009, Change Notice 2, also dated April 2002). NNSA has linked resolution of several issues raised by the Board to this safety basis upgrade, such as the reliance on passive ventilation during an accident—an issue raised in 1996.

Chemistry and Metallurgy Research Facility—The CMR safety basis is 5 years old. LANL expects to submit a major upgrade shortly, which ought to address functional classification questions raised by the Board. The current safety basis has some design features not designated as safety-class that may be playing a safety-class role. For example, CMR has a containerization program intended to ensure that material not in active use is placed inside robust safes so it will be protected during catastrophic events, such as a major fire or earthquake. This storage system appears to serve a safety-class function. Last fall, items within safes were found not to be packaged consistently with the packaging used for surrogate items during qualification tests of the safes. This issue had not been recognized for an extended period because the tested package configurations were not clearly documented in the current interim TSRs, procedures, or the qualification report, and there appeared to have been no standard packaging procedure in use by the CMR programmatic groups. Also, the CMR replacement facility is now not expected to be ready until well past 2010. It may be worthwhile for NNSA to periodically review previous assumptions and conclusions (e.g., from cost-benefit analyses) in light of the replacement facility's progress and assess the merit of potential improvements versus the continued risk of operating without them.

Radiography Facility (TA-8-23)—TA-8-23 was built in 1948, was designated as HC-2 in 2000, and has operated under a JCO since late 2001. It resembles a TA-18 laboratory building and offers no confinement. It is used to radiograph specimens, including assemblies and components with high explosives and/or nuclear material. TA-8-23 has administrative controls limiting overnight storage and prohibiting concurrent operations involving high explosives and radioactive material exceeding the HC-3 threshold. Last year, the natural gas heat in TA-8-23 was replaced with electric heat, eliminating one dominant hazard. In August 2003, NNSA approved continuing operations in TA-8-23 under the JCO until NNSA took action on a proposed safety basis submitted in March 2003. In March 2004, LANL withdrew the proposed safety basis. In April 2004, NNSA suspended radiography of tritium and explosive items because of identified lightning protection deficiencies. Subsequently, LANL suspended operations because the fire alarm system does not comply with code requirements. In the longer term, NNSA and LANL are considering shifting nonexplosive radiography operations to the former Nuclear Material Storage Facility (TA-55 PF-41).

Waste Characterization, Reduction, and Repackaging Facility (TA-50 WCRRF)—TA-50 WCRRF was built in 1979 and then expanded in the mid-1980s. It is used mainly for visual examination and repackaging to support certification of WIPP packages. It is a bottleneck for the

Quick-to-WIPP Program (e.g., it cannot inspect 85-gallon drum overpacks). In October 2003, NNSA disapproved the proposed safety basis update. In November 2003, LANL submitted a corrective action plan. Key elements of this plan are a fire hazard analysis update, a seismic upgrade feasibility study, a criticality safety update, a natural gas removal study, and comment resolution meetings with NNSA—all leading to a resubmitted safety basis. In the meantime, LANL is complying with restrictive inventory limits in the current safety basis (i.e., HC-3 inside the building, HC-2 storage outside the building). LANL believes that TA-50 WCRRF has 5 years of remaining service life and anticipates a replacement facility. Risk reduction in Area G may warrant accepting a short-term increased risk from TA-50 WCRRF operations with well-justified interim controls.

Tritium Science and Fabrication Facility (TA-21 TSFF)—TA-21 TSFF was built in 1964 as a radio-chemistry laboratory. Between 1974 and 1993, it was called the Tritium Salt Facility and supported nuclear testing. It is now used for neutron tube target loading. LANL is transferring that mission to WETF after closure of items from a DOE Operational Readiness Review. WETF is expected to be fully functional by November 2004. TA-21 TSFF will then be deinventoried and removed from the nuclear facility list. TA-21 TSFF now operates under a 7-year-old Basis for Interim Operation and 4-year-old Operational Safety Requirements. Last fall, LANL withdrew its proposed safety basis upgrade for TA-21 TSFF because of document quality issues.

Radioactive Liquid Waste Treatment Facility (TA-50 RLWTF)—TA-50 RLWTF has collected, treated, and disposed of LANL's radioactive and other liquid wastes since 1963. The facility currently operates as HC-3. NNSA and LANL are taking less credit for segmentation in the new safety basis and are pursuing a HC-2 designation. LANL anticipates adding a new pump house and influent storage facility within the next few years; receiving congressional approval for a replacement facility in fiscal year 2006; and decommissioning the current facility, tentatively in 2010. The facility has issues resulting from aging infrastructure. Last year, it began to limit use of the receipt tank for TA-55 transuranic caustic waste because that tank had developed a leak. Tank replacement is expected in the next year. TA-50 RLWTF currently operates under an 8-year-old safety basis and 5-year-old TSRs. Last November, LANL withdrew its proposed safety basis upgrade because of document quality issues, evident from NNSA's review of the new tank addition.

Decontamination and Volume Reduction System (TA-54 DVRS)—TA-54 DVRS is a Radiological Facility built to size-reduce gloveboxes and other large components currently stored in about 300 plywood boxes in TA-54 Area G. Since it is not HC-2 or HC-3, it is not listed in Tables 1 and 2; however, LASO is poised to approve interim operation of DVRS as HC-2 to support the Quick-to-WIPP Program. Specifically, a large glovebox line is to be installed in DVRS to supplement the visual examination and repackaging activities now conducted in WCRRF.

At some point, DVRS will likely need to become at least HC-3 to process the majority of the plywood boxes. Operations to process the crates have been curtailed because of a lack of funding. This is unfortunate for two reasons. First, DVRS provides a pathway for addressing concerns arising from the combustible nature and structural integrity of the crates (i.e., these plywood crates have failed). Second, DVRS requires manually intensive operations that would benefit from allowing an appropriate learning curve for the workforce—a benefit lost by curtailing operations. NNSA has directed that the plywood crates be stored in SeaLand containers. While these containers may be appropriate for crates that will not be processed for some time, that pathway increases crate-handling risks and may become an excuse to delay processing of the crate

contents into a form acceptable for WIPP. The new TRUPACT-III containers may also become an option not requiring size reduction. However, DVRS is the only viable disposition path for these crates at this time.

Authorization Agreements. Neither LANL nor LASO maintains a complete list of safety bases documents, which would include Safety Analysis Reports, TSRs, NNSA approval letters, etc. Some nuclear facilities maintain their own list. For example, TA-55's current list has 88 documents (some not yet approved by NNSA). The diffusion of the safety basis over numerous documents for some facilities has been problematic for NNSA and LANL operations personnel who need to understand what constitutes the safety bases. LASO relies on LANL to maintain a complete list in the authorization agreements, as required by applicable LANL Laboratory Implementation Requirements (LIRs). The LIRs require that LANL submit a revised authorization agreement to NNSA for approval within 15 working days of the approval of a newly revised documents, such as TSRs. Neither LANL nor NNSA has enforced this requirement, and most authorization agreements are out of date.

Conclusions. LANL currently has 26 nuclear facilities, including 17 that are HC-2 and that have a number of safety bases issues. Since April 2003, LASO has focused on risk reduction for TA-54 Area G and paid much less attention to other activities. While risk reduction in Area G is important, more-balanced priorities appear warranted.

For example, the higher-consequence accidents for TA-18 are different from those for other facilities; reevaluation of the controls, particularly the new temperature scram systems and the extensive use of administrative controls, is warranted. The safety basis for TA-55 is 7 years old, and a safety basis update has been awaiting NNSA approval for nearly 2 years. A recent Type B investigation found that lack of current container requirements in the safety basis contributed to a Pu-238 uptake event in TA-55. The safety basis for the CMR is 5 years old, and an update is due shortly. TA-8-23 is continuing to operate under a 2-year-old JCO. In two facilities with safety basis issues (TA-54 RANT and TA-50 WCRRF), acceptance of short-term increased risk with well-justified interim controls may be warranted to achieve longer-term risk reduction through the Quick-to-WIPP Program.

Technical Area	Acronym	17 Hazard Category 2 Nuclear Facilities
TA-3	CMR	Chemistry and Metallurgy Research Facility
TA-8	TA-8-23	Radiography Facility
TA-16	WETF	Weapons Engineering Tritium Facility
TA-18	TA-18	Los Alamos Critical Experiments Facility (LACEF)
TA-21	TSFF	Tritium Science and Fabrication Facility
TA-50	RLWTF	Radioactive Liquid Waste Treatment Facility
TA-50	WCRRF	Waste Characterization, Reduction, and Repackaging Facility
TA-54	Area G	Waste Storage and Disposal Facility
TA-54	TWISP	Transuranic Waste Inspectable Storage Project (completed)
TA-54	RANT	Radioactive Nondestructive Testing Facility
TA-55	TA-55	Plutonium Facility
		On-Site Transportation
		Five environmental sites (e.g., Material Disposal Areas): TA-21 (two), TA-49, TA-50, TA-53
		9 Hazard Category 3 Nuclear Facilities
TA-53	LANSCE	Los Alamos Neutron Science Center—1L Target
TA-53		LANSCE Lujan Center Experimental Rooms 1 and 2 Actinides
TA-53		LANSCE Activated Component and Target Storage (TA-53-3, Area A East, Sector M)
		Six environmental sites in TA-10, TA-21, TA-35 (three), and TA-54

Table 1. LANL Nuclear Facilities

Notes: TA-50 RLWTF is currently approved as HC-3, expected to be redesignated as HC-2. The TA-54 DVRS is expected to be added to the nuclear facility list shortly.

No[a]	LANL HC-2 Facilities [b]	Current Safety Basis (SB) Types [c]	SB/TSR Ages in Years [d]	Relative Inventory[e]	MEOI Dose (rem) [f]	Accident Description [g]
1	TA-54 Area G	DSA/TSR	1/0	3,000 [j]	1,800	crash high-activity drums
2	TA-18	BIO/TSR	2/0	900	1,100	$1 excursion—Pu core
3	TA-55	FSAR/TSR	7/4	6,000 [k]	800	Pu-238 room fire or beyond-EBA seismic [m]
4	TA-54 RANT	BIO/TSR	0/0	70	500	crash or seismic/fire
5	CMR CMR excluding hot cells, safes	BIO/ITSR	5/2	4,000 [l] 20 [l]	– 200	- 13 kg Pu-238 GPHS - seismic/collapse/fire
6	WETF-Tritium	DSA/TSR	2/2	70	100	full fire-100% oxidized
7	TA-8 Radiography	JCO	2	300	100	detonation-1 kg Pu-238[m,n]
8	TA-50 WCRRF	HA/TSR	3/3	50	70	wildfire/truck fuel fire [m,n]
9	TA-21-Tritium	BIO/OSR	7/4	2	8	full fire-100% oxidized [m,n]
10	TA-50 RLWTF [h]	SAR/ITSR	8/5	2	3	seismic/fire [m,n]
11	Transportation	DSA	1/1			barrier analysis controls [o]
---	TA-54 TWISP	BIO/TSR	4/4			project completed
---	Five ER Sites [i]					TA-21(2), 49, 50, 53

Table 2. LANL Hazard Category 2 Nuclear Facilities

Note: All numbers are rounded.

[a] First column is the facility ranking by decreasing unmitigated accident consequence.

[b] Second column is the facility's common acronym, as defined in Table 1.

[c] Third column lists safety basis type: DSA = Documented Safety Analysis; TSR = Technical Safety Requirement; BIO = Basis for Interim Operation; FSAR = Final Safety Analysis Report; ITSR = interim TSR; JCO = Justification for Continued Operation; HA = Hazard Analysis; OSR = Operational Safety Requirements.

Table 2 notes (continued)

[d] Fourth column is the period in years since the last safety basis revision and last major TSR revision.

[e] Fifth column is the maximum inventory in the safety basis, measured in units of the HC-2 threshold.

[f] Sixth column is the largest predicted unmitigated accident consequence to the maximally exposed off-site individual (MEOI).

[g] Seventh column is a brief accident description.

[h] TA-50 RLWTF is currently approved as HC-3, and is expected to be redesignated as a HC-2.

[i] Safety bases for environmental remediation (ER) sites are in preparation.

[j] This is the Area G above-ground inventory limit. There is also a below-ground limit.

[k] TA-55 has not proposed an inventory limit. This number is derived from inventory assumed in the seismic analysis for a beyond-evaluation-basis accident.

[l] For CMR, two inventories are given. The first is for the entire facility, including General Purpose Heat Sources (GPHS) in hot cells and other materials in safes. The second is for inventory outside of hot cells and safes. The predicted CMR accident consequence cited corresponds to an accident involving the latter.

[m] This data is from proposed but not yet approved safety analyses.

[n] LANL withdrew the TA-8, TA-21, and TA-50 RLWTF analyses. NNSA disapproved the TA-50 WCRRF analysis.

[o] The transportation safety basis uses barrier analyses instead of accident analyses.