

Selected Defense Nuclear Facilities Safety Board (DNFSB) Background Regarding Criticality Safety at Los Alamos National Laboratory (LANL)

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There are three parts to this memo:

- A. Introduction and informal remarks
- B. Excerpts from DNFSB Weekly Site Reports (WSRs) bearing on LANL criticality safety or TA-55 vault issues
- C. Other important DNFSB references bearing on criticality safety at LANL

This memo is *not* meant to showcase the most salient issues concerning, or even provide a summary of, the current criticality concerns at LANL's TA-55 main plutonium facility. These concerns have temporarily halted nearly all fissile material operations at the facility. For a summary of these current concerns, please see today's press release.

A. Introduction and informal remarks

- DNFSB is a highly-professional advisory board, but has only about 60 technical staff available to review the work being done at all the nuclear facilities operated by the Department of Energy (DOE). Just two of these people work in Los Alamos. It is an advisory, not a regulatory, body. Therefore despite the generally outstanding work by DNFSB, there is only so much of the agency to go around and therefore its oversight is rather incomplete. Its review cannot be comprehensive.
- Reading the official DNFSB record, it appears that criticality safety at LANL became a greater concern to DNFSB beginning in late 2005 than it had ever been before. We don't know all the reasons for this, but they could include an unfavorable 10/05 audit by the National Nuclear Security Administration (NNSA), noted below, and subsequently audits by NNSA and LANL itself, or problems uncovered prior to or during the 2004 LANL-wide stand-down, or simply a renewed emphasis within the DNFB itself.
- We don't know how many criticality-related incidents have been formally logged at LANL by month or by year, and of course we do not know how many have not been reported, which is likely greater. We do not know the potential severity of those incidents. Some activities capable of generating criticality events under some scenarios have lacked criticality evaluations or guidelines altogether. Thus more incidents reported might show greater awareness, more thorough self-reporting, and better management overall.

- NNSA management attention and oversight to any given issue, including criticality safety, wax and wane in part because NNSA, like DNFSB, has too few staff, especially at the NNSA Los Alamos Site Office (LASO). LASO staffing levels and qualifications are of particular concern, as is its precise role or lack thereof in oversight.
- NNSA as a whole is deeply privatized; over 96% of its funding is paid to contractors. LANL is operated by Los Alamos National Security, LLC, which holds a contract that can be extended for a total of 20 years, which can generate up to \$79 million (M) in fees annually, and which DOE contracting office has assigned a book value of \$36 billion (B). The partners in LANS are Bechtel National, BWXT, Washington Group, and the University of California (UC). This is a very large no-bid contract. These same corporations are involved in managing other DOE sites and projects, and as subcontractors to one another. Bechtel, now DOE's largest contractor having displaced UC from this position, is a partner in prime DOE contracts worth \$100 B, for example.¹
- It is impossible to say what the most significant safety issue is for LANL as a whole or for any of its facilities. Criticality safety probably isn't the worst safety problem at TA-55. However, should a criticality event occur it would be seen in hindsight to be just that. Criticality safety, in addition to being a problem on its own, it is also an indicator of a broader range of institutional hazards.
- Within the criticality issue, two problems with quality assurance in vault criticality evaluations, issues reported by DNFSB in late August and early September of this year, caused reviews which led to the suspension of vault operations in four vaults and to suspension of fissile material handling in TA-55 as a whole.
- It is not criticality *per se* which most worries us. It is the system-wide pervasiveness, continuing and recurrent nature, and diversity of problems that are troubling, as well as the appearance after many years, of latent problems about which no one previously knew (e.g. sprinklers, vault criticality margin). Many of these safety problems have underlying roots in objective, hard-to-correct deficiencies in infrastructure; others have stubborn roots elsewhere.
- Safety issues are closely connected and are best viewed holistically. Overall LANL safety issues closely interacting with LANL criticality safety at TA-55 include:
 - Lack of adequate training and certification for fissile materials operators, criticality safety engineers, and in management. Upon information and belief, hundreds of Bechtel employees have been brought to LANL; their level of experience and competence is unknown.

¹ Damon Hill and Greg Mello, "Competition - or Collusion? Privatization and Crony Capitalism in the Nuclear Weapons Complex: Some Questions from New Mexico," Los Alamos Study Group, May 30, 2006, at <http://www.lasg.org/NNSAPrivatization.pdf>.

- Pressure to meet production milestones, first and foremost in pit production, and related long-term multi-shift operations at TA-55
- Limitations on vault space at TA-55
- Failure to complete “good housekeeping” projects at TA-55 such as stabilizing unstable forms of plutonium. In one case cleaning up after a significant accident took at least two years, with the materials involved comprising a major addition to overall facility risk over this entire time.
- Lack of “as-built” documentation at TA-55 and elsewhere, e.g. uncertainty about boration levels in vault fixtures, creating uncertainty about criticality safety limits
- Lack of a sound quality assurance (QA) program lab-wide
- The long-standing informality of operations throughout LANL
- Lack of revised seismic analysis and completed corrective actions to provide for stabilization of TA-55 in the event of a major earthquake
- Lack of NNSA oversight and inadequate numbers of qualified personnel at LASO
- A general lack of formal, stipulated contractor accountability via actual contract provisions (check in particular cases), including prior blanket indemnification for accidents involving nuclear materials and nuclear waste
- Failure to include personal responsibility for accidents in the contracts of key senior management personnel
- Near-complete opacity of information regarding all pertinent safety matters from the public and news media
- Lack of any relevant external regulation (as opposed to advice via DNFSB) for NNSA and LANL
- Antiquated infrastructure at LANL in selected areas, e.g. liquid radioactive waste management
- Lack of consistent LANL and NNSA management attention, interest or funding to follow through with safety assessments or corrective actions to correct problems found
- The “hands-off” oversight pilot program begun in 2006, entirely inappropriate for this site and these missions
- NNSA’s inappropriate attempt to initiate multiple major new missions and projects simultaneously at TA-55, which also are concurrent with infrastructure upgrades
- Lack of a fully-approved, up-to-date safety basis document for TA-55, which would require technical and institutional resolution of the issues underlying it

- An ill-conceived attempt to initiate pit production at TA-55 without compliance with DOE's project management order (Order 413.3), which is the primary way DOE manages such initiatives.
- Specialization, "stove-piping," and separation of safety responsibility from line management and staff, e.g. via subcontracting
- Lack of sufficient qualified facility engineers
- NNSA's ill-conceived attempt to pursue controversial projects (e.g. CMRR, pit production upgrades, NMSSUP) without congressional approval or any significant social consensus. This has a number of indirect, ramifying impacts on program quality and planning, which ramify broadly and deeply.
- An internal LANL culture that has largely replaced public service with opportunism and greed both on the part of the for-profit contractor and the staff
- Intentional cultivation of a less risk-averse culture at senior-most levels of NNSA and DOE, called the "managed risk" approach (a kind of oxymoron).
- Broader social decline in the region and nation: regional crime and drug abuse, lack of education, low aspirations as to discipline and reliability.

B. Excerpts from DNFSB Weekly Site Reports (WSRs) bearing closely on criticality safety at LANL and on TA-55 vault issues, by year

(informal comments by gm in italics)

2001

8/10

This was the first year in which LANL had a DNFSB Site Representative and hence is the beginning of the WSR series.

TA-55 Emergency Exercise: On Tuesday, the site rep observed the annual emergency evacuation exercise in the Plutonium Handling and Processing Facility (TA-55). The exercise was also observed by LANL senior management at the Division and the Deputy Associate Laboratory Director levels and by two DOE facility reps. The scenario involved a recurring criticality due to simulated SNM rearrangement and sprinkler activation (controls exist to prevent this accident).

Controls exist to prevent all accidents, but they don't always work. If not believed credible, then why do it?

2002

3/8

Recommendations 94-1 /2000-1: LANL discussed with the staff a new draft stabilization and packaging baseline sent to DOE last week. By the draft, LANL would qualify workers during the next 2 years, process most materials between 2004 and 2008, and complete processing in 2009. After rampup (2004), the processing schedule appears aggressive. Key assumptions are not yet documented.

LANL also indicated that safe, secure vault storage on site is near capacity and needs to be carefully managed and improved on to support current operations. Shipments off site are limited by restrictions on shipping containers and receiver sites. On-site storage demands will likely increase to support future missions and other needs. ...Progress on 94-1 (e.g., Pu stabilization and packaging, residue disposition) would permit more efficient storage and free up vault space. Therefore, DOE and LANL would likely benefit from both a safety and a mission perspective if 94-1 objectives were vigorously pursued.

These issues (Pu stabilization and packaging, residue disposition, vault capacity) recur again and again in the years to come.

3/15/02

Dynamic Experimentation: This week, the site rep toured a TA-16 assembly building that used to be a HC-2 facility (2000), was derated, and is expected to be declared a “temporary nuclear facility” intermittently, beginning several years from now. The facility is structurally robust. Equipment appears well-grounded. Housekeeping and combustible control look good, but fire protection (e.g., sprinkler head type) and seismic support of overhead appurtenances may warrant examination. It would be worthwhile to resolve these issues and put in place appropriate configuration management and maintenance well in advance of any future readiness assessment for nuclear operations.

[This is included for other reasons: it is a relatively recent, open admission of plans to conduct above-ground, contained, explosions using Pu at LANL.]

5/3/02

Recommendations 94-1/2000-1: The site rep understands that DOE and LANL are considering a flat out-year budget that does not support the draft stabilization schedule discussed with the staff in March (i.e., ramping up, processing most of the material between 2004 and 2008, and completing processing in 2009).

Such a budget would likely extend the schedule for stabilizing legacy materials into the next decade. Without stabilization and packaging or disposition, the risks associated with these materials can only be expected to increase with time.

Applying full resources to LANL 94-1 activities would reduce longer-term costs and permit more efficient material storage, freeing up vault space (site rep weekly 3/8/02). The latter improves not only safety but also LANL’s ability to support high-priority national security missions. The resources required at LANL to achieve timely

stabilization appear to be an order of magnitude less than required for 94-1 activities at some other DOE sites (e.g., Savannah River Site, Hanford). DOE and LANL would likely benefit in multiple ways if 94-1 objectives were vigorously pursued.

2003

2/21/03

Recommendations 94-1/2000-1: LANL has begun to systematically sort and package unneeded lower-risk residues for disposal at WIPP. This will reduce inventory and handling risks, improving safety, as well as lower costs, permit more efficient storage, and free up vault space, improving LANL's ability to support high-priority national security missions (site rep weekly 5/3/02).

12/12/03

Recommendations 94-1/00-1: It's been nearly 10 years since the Board's initial recommendations on nuclear material stabilization. LANL is the last remaining DOE site without an implementation plan accepted by the Board. Since 1995, LANL has stabilized about two-thirds of the excess and programmatic inventory identified by LANL as 94-1. LANL has also made progress this year in processing and in designating more material for WIPP; however, a sense of urgency has been lacking – from both NNSA and LANL. Due to the Type B and increased recognition of worker safety issues, LANL is now engaged in a comprehensive evaluation of the inventory, packaging, storage, and management of nuclear materials. Three example areas that could accelerate progress are: (1) reevaluation of the economic discard limit (EDL) - currently residues with little value are being processed to meet an outdated EDL; (2) expediting design, installation, and startup of a dedicated line for processing non-weapons grade plutonium (i.e., the exposure reduction line) – while the gloveboxes are there, the line is not scheduled to startup until the 2007 time-frame; (3) development and application of institutional standards. Considering both safety and mission implications (i.e., vault space, Type Bs), higher priority on closely managing, stabilizing, and disposing of residues is overdue.

2004

4/30/04

Plutonium Facility (TA-55): TA-55 went into standby mode and suspended operations intermittently this week in order to troubleshoot the Uninterruptible Power Supply (UPS). The UPS failed last Friday during restoration from maintenance, raising reliability concerns, but the failure has not been repeatable. The system has since operated normally. UPS is safety-significant. When off-site power is lost, it provides power to select safety systems, including criticality alarms, the paging/general announcement system, and the facility control system. Compensatory measures are in place...

Interactive failures – criticality alarms were unavailable in this power failure due to failure of the UPS.

12/31/04

LANL was closed this week, providing an opportunity for reflection on the year.

On July 16th, the LANL Director suspended all but essential operations, and LANL began a self-examination and resumption process. As of last week, the Director had approved resuming 77 % of the moderate and higher risk activity groups. Nuclear operations not yet approved to resume include TA-50/54 waste operations, the site services contractor, on-site transportation, TA-18 critical experiments facility, and TA-21 tritium facility (TSFF).

LANL reports they have examined more than 3,000 operations and identified more than 2,000 safety-related corrective actions from this process.

A major challenge for LANL in the coming year will be to ensure that these corrective actions are consistent, complete, sustainable, and effective. Over the years, LANL has often identified valid issues, prepared corrective action plans that appeared credible, and then failed to execute. A recent example is the stalled TA-55 Type B corrective action plan, which began early this year. LANL studies of corrective actions from reportable occurrences illustrate the problem: most corrective actions are reactive, one-time, facility-specific responses; most target procedural changes or equivalent; few eliminate or substitute for the hazard; few specify new or modified engineered barriers; and few opt for institutional solutions. The level of sustained management commitment required to reverse this trend should not be underestimated.

Worker safety and work control issues contributed to the decision to suspend operations. In September, LANL issued a Conduct of Operations Manual, an updated integrated work management process, and a schedule to implement the latter by June 2005. In October, LANL corrected span-of-control problems by splitting the Operations Directorate and increased visibility and independence of key institutional functions including engineering, fire protection, and emergency management; however, NNSA and LANL continue to be reactive on emergent safety issues, such as TA-18's operational issues during the last year.

While the resumption reviews provided a shot-in-time perspective, the conditions that led to suspension could recur unless NNSA and LANL improve their assessment processes – including improving management's timely and accurate awareness of emergent operational issues. LANL assessment processes are not robust. The LANL Director has stated that he suspended operations because of a pattern of near misses in safety and security that created a fundamental lack of confidence in the lab's ability to conduct work without a major mishap. At the time of suspension, NNSA had an effective operational oversight process, but its effectiveness has sharply eroded due to resumption demands on staffing and to shifts in assignments and responsibilities. Most NNSA Site Office

reporting of emergent safety issues now is informal and not amenable to systematic review. NNSA is currently attempting to rebuild its oversight processes, as well as verify corrective action closures. This will likely require increased staffing.

Regarding safety bases, within the last 2 weeks, NNSA has approved a LANL strategy for determining which proposed activities constitute a major modification requiring a Preliminary Documented Safety Analysis (PDSA). NNSA also clarified that interim safety bases employing safe harbor methodologies may be appropriate when the unreviewed safety question process is insufficient but a PDSA would be excessive. These are the most positive steps regarding safety bases taken this year. In most other areas, the safety basis issues discussed in the Board's letter of May 27th persist. Little progress is apparent on centralizing the safety basis function, improving quality of NNSA and LANL work, capturing a verified list of the safety bases, and updating aging safety bases (e.g., for plutonium operations – TA-55, CMR).

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NNSA appears here to be dividing its dwindling resources between multiple major oversight projects, all needed and for some reason all needed now. Neither LANL nor NNSA self-assess well. The complexity of LANL operations is contributing to defeating sound management – as are unstated political considerations.

2005

1/14

Plutonium Facility (TA-55): TA-55 appears to be under increasing operational stress as a result of vault space limitations, waste-pathway constraints, the expected influx from TA-18 to support the Early Move Project, the current 1996-era inadequate safety basis, and now the emergent leak path factor issue (site rep weekly 12/24/04). The situation will be aggravated if, in the interest of time, TA-18 ships material to TA-55 in packaging that does not meet TA-55 packaging standards.

Last Friday, LANL proposed and NNSA approved a set of interim compensatory measures to address the leak path factor issue and directed LANL to aggressively begin identifying potential solutions using a cost-benefit approach. The risks associated with continued operation, however, need to be better understood. The approved compensatory measures focus on mitigating the consequences of a Pu-238 lab room fire, which was the single accident that LANL evaluated. While this addressed one accident scenario, it did

not address other known scenarios with potentially significant consequences (e.g., basement waste fire, vault fire). Consequently, the approved controls are probably necessary but may be insufficient to address the full spectrum of potential accidents that could occur in TA-55.

NNSA and LANL have options that could aggressively reduce those risks. For example, the poorly containerized Pu-238 combustible residues in the room that was contaminated in August 2003 may now constitute a more significant risk than NNSA and LANL previously recognized; in fact, they may dominate the risk among main-floor operations. Deliberately but expeditiously cleaning up this room, packaging the residues, and pyrolyzing them would reduce risk. On the current course, starting up additional pyrolysis capability and disposing of these residues could be a year away (site rep weekly 12/3/04). Similarly, TA-55 is nearly waste-logged (site rep weeklies 12/17/04, 12/24/04). Addressing the obstacles to TA-55 transferring waste, including resuming WIPP shipments from TA-54, would also reduce risk.

Finally, TA-55 continues to operate under a safety basis that has been increasingly shown to be outdated. The safety basis support for TA-18 Early Move and for TA-55 resuming pyrolysis operations will compete for resources required to fully update the TA-55 safety basis. It may be advisable for NNSA and LANL to consider a partial update, together with an interim safety basis that specifically addresses the leak path factor issue.

LANL evaluates just one accident scenario; later they evaluate more but still not a vault fire scenario. Vault space is needlessly; TA-55 is choked with waste; lack of an approved safety basis continues; failure to even clean up from a spill for almost two years.

2/25

Waste Operations: During the last two months, TA-54 Area G has received transuranic waste drums from TA-55 (~1,400 Ci), temporarily alleviating TA-55 solid waste inventory issues (site rep weekly 1/14/05). LANL also appears on track to resume WIPP shipments in mid-April. One constraint may be NNSA and LANL achieving timely resolution of open safety basis issues involving the seismic capacity of the TA-54 RANT facility, which is used for loading TRUPACT shipping containers.

During the next seven months, TA-55 would like to ship another roughly 4,000 Ci to TA-54 to make vault space for TA-18 Early Move and to meet Secretarial commitments to the Board under Recommendations 94-1/00-1 (i.e., for direct discard of excess material). The constraint here was the TA-54 safety basis material-at-risk limit. NNSA has approved changes to the Technical Safety Requirements (TSRs) that credit robust packaging of sealed sources from the Off-site Source Recovery Program; these changes may provide sufficient operating margin for TA-54 to receive these shipments. This risk-balancing between TA-54 and TA-55 warrants continued close monitoring through this fiscal year and beyond.

LANL is choking on waste, in this case solid waste but liquid waste is also a theme.

7/1

Plutonium Facility: NNSA has completed their Operational Readiness Review (ORR) for the TA-55 safeguarded trailer pad. The final ORR report is in preparation and will not be issued until next week. Numerous pre-start findings were identified, including: inadequate review of industrial hazards, shortcomings in emergency management, insufficient basis for excluding criticality accident alarms, and an unresolved fire protection exemption. Resolution of these issues will delay start-up of the pad beyond NNSA's July 1 startup goal (site rep weekly, 6/24/05). NNSA HQ has indicated they intend to verify closure of select pre-start issues prior to authorizing operations to commence.

Shortcomings in jerry-rigged Pu storage including omitting criticality alarms; the process appears to be driven by political urgency involving the new pit mission

7/8

Plutonium Facility (TA-55): The NNSA Site Office believes that preparation of the new safeguarded trailer pad needs to be further along and that another readiness review cycle is needed before startup; this appears appropriate. While the NNSA operational readiness review (ORR) discussed last week was thorough, the facility was clearly not ready, and the nature and number of pre-start findings for what ought to be a straight-forward activity are a major concern.

For example, the NNSA team observed that program drivers and schedule pressure completely dominated safety oversight; NNSA operational oversight was particularly not evident; criticality safety issues exist, such as lack of justification for not having criticality alarms; emergency response personnel left a mock injured person unattended in a mock contamination area for 25 minutes while responding to a simulated spill; and construction and installation of additional trailers was incomplete at the time of the ORR and represents an unanalyzed hazard outside the safety envelope. By any standard, these findings constitute an unacceptable condition for starting operations and possible indicators of other undiscovered significant issues. NNSA and LANL appear to have rushed to declare readiness and push through the verification process. It's clear that the readiness verification process was used as an assist in getting ready, which is counter to applicable DOE requirements. There were indicators of this evolving condition (site rep weekly 6/17/05).

This is a not atypical NNSA and DOE rush-to-fail project. It is revealing that mission dominates safety.

7/29

Critical Experiments Facility (TA-18): Also on Monday, LANL determined that the fissile content of four recently re-packed 110 gal drums had not been reviewed by the

criticality safety group and that these drums exceeded the criticality limit by factors of up to 2.25. This was discovered during a criticality review to support shipping the drums. Local posting refers to guidance given elsewhere for the type of material involved. There are similarities between this event and problems observed during simulated fissile material handling for the TA-55 pad ORR (site rep weekly 7/8/05); together, they indicate issues with procedure clarity, training, supervision, and oversight of fissile material handling.

This appears to be a dangerous criticality violation: roots are said to be “clarity, training, supervision, oversight” – recurrent themes.

8/26

Plutonium Facility (TA-55): On Thursday, TA-55 had a criticality safety limit violation involving a 2% exceedance of fissile material passing through a glovebox; the problem was found and reported by those involved, which is positive. Line management has suspended TA-55 and TA-18 special nuclear material movements and is implementing a corrective action plan with clear resumption criteria.

A criticality violation.

9/23

Waste Operations: ...This Wednesday (9/21/05), LASO provided LANL its recent “for-cause” assessment of safety systems supporting waste operations. It concludes that safety basis requirements generally are inadequately identified, implemented, and fulfilled; specific findings are sweeping and involve safety bases, USQ process, requirement flow-down, fire protection, configuration management, and safety system surveillance, testing, and maintenance.

Many of the issues from the LASO assessment were previously recognized (e.g., site rep weekly 8/5/05) and could be addressed within the LANL plan. One course would be for LANL to evolve the plan based on review of specific LASO findings, establish clear metrics and milestones, and, with full LASO support, expeditiously execute the plan and reduce risk in a timely and balanced manner.

It looks like real oversight from NNSA, but it isn’t enough as later reports show – major problems remain. Configuration management” – does this include critical safety?

12/16

This is the first time “criticality safety” appears as a topic of its own in DNFSB site reports at LANL.

Criticality Safety: Per LANL request, NNSA (NA-117) recently performed at LANL one of its first formal criticality safety program reviews in the complex (site rep weekly 10/28/05). The NNSA team's report states that they observed no ongoing unsafe operations from a criticality safety perspective; however, their observations indicate that the LANL program is expert-based, under-staffed, incompletely documented, infrequently assessed, and managed informally and at too low a level; overall, the program is not demonstrably compliant with applicable national consensus standards.

The NNSA team made several specific recommendations that it suggested should be implemented within 3 months to provide a formal basis for continuing operations. These recommendations center on reviewing all ongoing fissile material operations and ensuring that an explicit criticality safety analysis exists for each, that the controls developed are implemented in postings and procedures, and that appropriate configuration management is in place for all explicit and assumed engineered controls. The team asserted that, while it seems unlikely that an undiscovered hazard exists, these recommendations should be implemented expeditiously. LANL is evaluating the team's report and recommendations.

This appears to be the initiation of greater emphasis on criticality safety at LANL, possibly in preparation for increased Pu pit manufacturing. NNSA's evaluation is not pretty.

12/23

Plutonium Facility (TA-55): Monday morning, nine workers promptly evacuated the TA-55 vault following a continuous air monitor (CAM) alarm; appropriate immediate actions were taken, including securing the scene. The release was predominantly Pu-239. Five workers had positive nasal smears (~90 dpm max); three workers had contamination on gloves or booties consistent with later floor surveys (20k dpm max). Initial dose estimates should be available in January.

The workers were inventorying containers. Due to this event, TA-55 has secured material movements outside glove-boxes, and LANL has started an investigation, which is proceeding deliberately. TA-55 identified and triple-bagged a suspect container and another nearby similar container on Wednesday and radiographed these containers on Thursday. Further investigation and recovery will occur after Jan 1st.

12/30

The laboratory was closed this week, providing an opportunity for reflection.

LANL is in a transformation. In the long term, the contract decision last week will eventually reshape the lab and conceivably the entire nuclear weapons complex. In the short-term, this decision ended one period of uncertainty for the workforce while ushering in another. The safety implications of personnel distraction during this period have LANL management's attention.

There has been tremendous activity since the lab-wide stand-down of July 2004 and throughout this year. Indicators of LANL progress included:

- resuming nuclear operations safely and deliberately within 6 months;
- identifying several thousand issues during resumption and quickly addressing about 400 such issues that were deemed an unanalyzed risk or imminent danger;
- establishing the Corrective Action Review Board (CARB) as an independent quality check on actions taken on the approximately 2,000 non-institutional issues found during resumption;
- consolidating line responsibility for most nuclear operations at the associate director level, and consolidating operations authority with a few key individuals – the RDLs;
- making substantial progress on the Operational Efficiency (OE) Project, which is intended to address weaknesses in key institutional functions, such as training and quality assurance;
- resuming transuranic waste shipments to WIPP after an 18-month hiatus, and by year's end shipping about one-fifth of the roughly 2,000 higher activity drums that constitute the Quick-to-WIPP set – these shipments are key to addressing the lab's postulated highest consequence nuclear accident;
- developing and starting implementation of interim technical safety requirements (iTSRs) for the Plutonium Facility (TA-55) – these are key to continuing safe operation of TA-55 under the 9-year old safety basis and to compensating for the still-open confinement strategy question, which is TA-55's dominant nuclear safety issue;
- recognizing emergent safety concerns and briefly suspending nuclear operations on at least four occasions in four separate nuclear facilities.

The key criticism may be the slow pace. The DOE Office of Independent Oversight (DOE-OA) recently summed this up well: to paraphrase – resumption-related corrective actions in general and integrated work management (IWM) implementation in particular are lagging from where they ought to be; also, both federal and contractor assessment systems, including issue management, warrant improvement (site rep weeklies 11/4/05, 10/21/05, 12/31/04). The contract competition likely hindered progress, since the commitment needed to some long-term fixes will also require long-term ownership.

On the federal side, NNSA oversight of LANL was reactionary and steadily deteriorated this year. DOE-OA also summed this up well: NNSA is not always performing effective oversight that drives continuous improvement in integrated safety management, in the contractor assessment system, and in other areas; recent efforts have focused on NNSA Site Office internal organizational matters and would benefit from management and organizational stability and increased headquarters support. The issues with NNSA oversight were best-illustrated by some of the problems that arose during the TA-18 Early Move Project, particularly with the TA-55 pad startup process (e.g., site rep weekly 7/8/05). While the Early Move Project achieved its FY-05 objectives, it adversely impacted many safety initiatives, such as nuclear material stabilization, criticality safety improvements, and TA-55 confinement strategy resolution. In the case of the TA-55 pad, programmatic priorities dominated startup to the point that restoring balanced priorities nearly derailed the Early Move Project. While LANL has taken some actions, NNSA has apparently done little to study and avail itself of lessons learned from this project.

“NNSA oversight of LANL was reactionary and steadily deteriorated this year.” Morale deteriorates, too; 400 unanalyzed or serious safety issues found; confinement strategy named TA-55’s #1 problem as of this date. There is continued slow corrective action and likely lack of long-term “ownership” of those fixes.

2006

1/6

Plutonium Facility (TA-55): TA-55 continues to radiologically characterize and to plan recovery from the Pu-239 contamination released into the vault on Dec 19th (site rep weekly 12/23/05)....Material movements outside glove-boxes remain restricted...the source appears to be an archival oxide sample from the early 1980s; the sample was packaged in a plastic screw-lid jar within a plastic bag, both within a taped, slip-lid can; the inner jar and bag failed, releasing powder into the can; the vinyl tape around the lid circumference then possibly failed, causing the release. TA-55 has triple-bagged this container and another similar container, but records indicate that there could be several dozen similar containers in the vault, including about a dozen that are near-identical. Some of these containers were on a list to be repackaged near-term as part of LANL response to Board Recommendations 94-1/00-1, but clearly this effort needs higher priority. A recovery plan is expected to be available next week.

TA-55 Confinement Strategy: This week, NNSA disapproved LANL-proposed performance criteria for safety-class plutonium containers because the criteria did not account for a eutectic-induced failure mode for plutonium metal in stainless steel packaging at above 400 C. NNSA had requested the criteria last September as part of developing a path-forward for the TA-55 confinement strategy issue (site rep weekly 9/23/05). The LANL proposed criteria are based on 10 accident scenarios, mostly involving Pu-238 containers. It's not clear that LANL considered all applicable Pu-239-related scenarios (e.g., vault fire) or whether these criteria will contribute in a readily justifiable manner to addressing the confinement strategy question; the picture is incomplete, particularly due to questions on pedigree of current Pu-238 and Pu-239 packaging. LANL owes refined accident analyses to NNSA this month that hopefully will focus future actions for the confinement issue (site rep weekly 9/16/05).

Failure to foresee some of the worst possible scenarios; lack of documentation of packaging; pushback against DNFSB on active vs. passive confinement issues

1/13

Criticality Safety: The site rep understands that a LANL plan to respond to last month's NNSA criticality safety assessment report is imminent (site rep weekly 12/16/05). The NNSA team recommended that LANL within 3 month review all ongoing fissile material operations and provide a formal basis for continuing these operations, with emphasis on ensuring that an explicit criticality safety analysis exists for each, that the controls developed are

implemented in postings and procedures, and that appropriate configuration management is in place for all explicit and assumed engineered controls. Due to the extensive number of such operations (~700 in TA-55 alone), LANL plans to focus efforts before March 8th on reviewing documentation with assistance from outside experts and on correcting identified deficiencies; on-the-floor reviews would follow. While concerned about the completeness of this effort, NNSA has indicated that this is an acceptable path-forward.

3 months to fix everything!

NNSA approves effort despite concerns about completeness

1/27

Plutonium Facility (TA-55): TA-55 has visually inspected and taken swipes on the exterior of the approximately 100 containers in the vault with characteristics most like the one that leaked on Dec 19th; they have found no indications of other failed packaging, including no discernable increase in contamination levels (e.g., CAMs). The plan for these containers during the next few weeks is to introduce them in small groups into a glovebox line for repackaging. Subject to the results of comprehensive surveys, limited vault operations with compensatory measures may resume next week.

Vault issues again

2/10

Plutonium Facility (TA-55): Vault recovery from the Dec 19th contamination event continues (site rep weekly 1/13/06). TA-55 is moving suspect containers out of the vault and into glovebox lines for inspection and repackaging. This week, work slowed when one bulged inner can and one rusted-to failure inner can were discovered and when concerns were raised on potentially pyrophoric contents in other cans; these represent abnormal conditions that warrant special attention....

More vault issues

2/17

Criticality Safety: By March 8th, LANL expects to finish the documentation review of its on-going fissile material operations and to finalize a criticality safety improvement plan that addresses issues identified in NNSA's Dec 2005 criticality safety assessment report (site rep weekly 1/13/06). LANL reported this week that they are about 80 % complete reviewing analyses and procedures for about 600 operations; of those completed, about 10 % (44 operations) have warranted a walk-down for further evaluation and about 5 % (22 operations) have warranted putting compensatory measures in place.

Plutonium Facility (TA-55): Pu-238 bench-scale aqueous recovery operations resumed this week. Separately, the vault recovery operation has been curtailed in order to ensure

that hazard identification and controls are adequate for addressing abnormal containers; recovery should resume next week. Overall, vault decontamination appears essentially done, except perhaps for the shelf that held the container that failed on Dec 19th. The key steps now are to address suspect containers and to establish confidence that controls will be adequate for future handling and storage operations based on current knowledge of containers and their contents. Longer term, increased emphasis on stabilization and packaging (i.e., Recommendations 94-1/00-1/05-1) appears warranted to prevent recurrence.

*LANL review appears nearly done but will be found inadequate later.
Lack of knowledge about what is actually in inventory; unstable storage forms.*

2/24

Plutonium Facility (TA-55): LANL has placed TA-55 in standby (Mode 2) and established a continuous fire watch due to an emergent concern over operability of sprinkler heads. Extent of condition and path-forward are still being determined; initial projections are that programmatic operations may remain suspended for several weeks. The facility has begun to containerize material that is now in glove-boxes and thereby increase the margin-of-safety during a possible extended suspension. LANL is also considering whether similar concerns may apply to other LANL facilities. The concern arose when engineering personnel were walking down the system and found that up to about half of the sprinkler heads in some rooms have paint or corrosion, which could compromise functionality of fire suppression. TA-55 fire suppression is designated safety-significant now and is being considered for re-designation as safety-class in response to the building confinement strategy issue. During this suspension, TA-55 intends to also pursue resolution of other issues, such as those identified in last year's NNSA criticality safety assessment and the DOE-SP review.

Major stand-down lasting many weeks over shocking discovery of inadequacy in major safety system.

3/3

Pu Containers: It is unclear how LANL's confinement analyses address scenarios with Pu outside glove-boxes. TA-55 has about 10,000 items; 60 % are in standard cans that may be thermally limited; 40 % are in weaker non-standard cans; 9 % have additional risk attributes; and 1% are an elevated risk and have been moved to a glove-box or over-packed. Relatedly, TA-55 has deconned and down-posted the vault from a contamination area; respirators are still required when handling non-standard cans.

Substandard storage containers and risky storage forms

3/10

Criticality Safety: On Wednesday (3/8), LANL submitted results of its documentation review of 564 fissile material operations, as well as its criticality safety improvement plan that is intended to address issues from a recent NNSA NA-117 assessment (site rep weekly 2/17/06). During its review, LANL identified 64 operations (i.e., 11 %) that warranted a high-priority walk-down; of these, LANL considered 24 (4 %) warranted immediate action: 19 involved TA-55 transfer (i.e., drop) boxes where the justification for limits was not immediately apparent; 4 involved machining or sample-prep boxes where the operation had been slightly altered without a criticality review; 1 involved ensuring backflow prevention in an acid feed line. While the remaining operations were considered acceptable, LANL raised lower-tier issues with more than half the contractor evaluations and approval actions; nearly all these cases were from documentation generated prior to mid-2003. LANL's improvement plan includes detailed walk-downs of the remaining 500 operations this year; the plan is under formal change control, and any changes are subject to concurrence of the LASO senior safety advisor.

Federal Oversight: LASO has exited its 14-week stand-down preparing for contract transition (site rep weeklies 2/17/06, 11/25/05). While some improvements were made, such as establishing a records control center, many prior problems persist, such as ineffective processes to address differing opinions, to find balanced perspective, and to achieve unity-of-purpose before decisions are made; the problems are particularly acute at the organizational interface between safety-basis and operations. Based on its own staffing analyses, LASO suffers from an insufficient number of technically-qualified staff to perform nuclear safety oversight: only 4 of 8 LASO managers in senior technical safety manager (STSM) positions have STSM qualification; 3 of the 5 safety analysts are fully qualified, compared to about 15 needed per responsible LASO management; 3 of 16 facility reps (FRs) are fully qualified - they are deployed at 3 of the 27 LANL nuclear facilities (TA-55, CMR, and LANSCE) – it is not apparent when and how LASO plans to establish qualified FR coverage for the remainder; 6 of 7 safety and health experts appear fully qualified for their positions, compared to about 30 needed to support nuclear and non-nuclear oversight. LASO has no full-time criticality safety expertise on site, which seems inconsistent with the scale of LANL fissile material operations. LASO has essentially no funding available this year for hiring or training staff and thereby beginning to alleviate this condition.

Inadequacy of oversight staff; low priority to safety oversight by NNSA management

3/31

Criticality Safety: Last week, LANL organizations reported two separate criticality infractions: one involved an 11 % mass and volume exceedance for an archival solution sample; the other involved an unevaluated geometry for a set of metal items that were within mass limits. Both reports resulted from heightened sensitivity of workers to criticality safety. As part of its criticality safety improvement plan, LANL plans to complete walk-downs of medium-priority processes, as well as drafts of new institutional criticality safety policies and procedures in May (site rep weekly 3/10/06).

Criticality violation

Work up to now had not been as carefully conducted

Work promised early in year still in planning stages

5/26

Criticality Safety: LANL determined this week that a nuclear facility was staging liquid plutonium residues for shipment at a location with posting that prohibited storage of hydrogenous fissile material. The event serves to re-emphasize the importance of LANL following up on its commitments in the recent criticality safety improvement plan (site rep weekly 3/31/06).

Criticality violation; lack of follow-up to be sure plans were implemented

6/2

Legacy Nuclear Materials: LANL has a substantial legacy inventory throughout, particularly in TA-18, the plutonium facilities (TA-55, CMR), and waste storage (TA-54 Area G). This inventory drives the public and worker risks from LANL nuclear operations; it has nearly saturated storage for some facilities; its timely disposition affects not only safety but the lab's national security mission.

Several of LANL's highest-consequence postulated nuclear accident scenarios involve transuranic waste stored at Area G, which is near capacity. For example, the safety analysis approved in 2003 assumes that, without mitigation, a large earthquake would cause drums containing about 24% of the Area G radioactivity to rupture without fire, leading to calculated off-site doses warranting about 2 to 3 orders of magnitude of mitigation. This week's drum-drop event illustrates that the drums are generally robust and that the safety analysis is conservative; however, the degree of conservatism is uncertain – particularly whether it constitutes 2 to 3 orders of magnitude. Updated analyses are due this month but are unlikely to improve the risk picture. Shipments to WIPP remain the primary mechanism for risk reduction.

TA-55 appears near capacity, pending more trailer startups on the safeguarded trailer pad, a temporary solution. It has unmitigated scenarios with calculated off-site consequences similar to Area G's. The highest involve Pu-238 lab room fires, exacerbated by an uncertain degree of building confinement. TA-55 has hundreds of grams of Pu-238 residues, some intermixed with combustibles in poor containers within gradually degrading plastic bags, stored in the room that was contaminated in Aug 2003; these conditions are similar to those assumed going into the worst-case accident scenarios.

TA-55 also has roughly 4,000 items in non-robust containers; these constitute a handling risk for the worker (e.g., the Dec 2005 vault contamination), and they could fail during a major accident. While TA-55 is pursuing more robust packaging, radiochemical stability is an issue, and processing has been postponed due to TA-50's transuranic liquid waste

treatment problems. TA-55 would like to dispose of more residues, including the Pu-238 residues, with minimum handling and processing. This would likely require an unprecedented degree of coordination between NNSA, DOE-EM, LANL, and the WIPP contractor to establish optimum waste acceptance criteria, and a safe and efficient program.

LANL is choking in waste at TA-50, -55, and -54 for starters, without proper handling facilities, adequate shipments.

Unstable waste forms

Dangerous stopgap solutions

Inadequate containers

*LANL maintaining these conditions even though they impede operations, are unsafe to workers, and are believed to cause *most* site hazard to the general public – evidence that production pressures are more important to management than a high-reliability safety culture, setting the stage for “normal accidents”*

6/9

Federal Oversight: The NNSA Site Office (LASO) continues to struggle with ensuring adequate oversight of nuclear operations (site rep weeklies 4/21/06, 3/10/06). The safety system oversight (SSO) program, which was viable before the LASO stand-down last November, now appears defunct. The facility rep (FR) program is down to 2 of 12 FRs being fully qualified, with a third nearly qualified; they are deployed at LANSCE, CMR, and RLWTF; LASO is again reviewing its FR staffing needs against DOE STD-1063 criteria. LASO still has no apparent plans to bring a criticality safety expert on site full-time, which is illogical given the scale of LANL fissile material operations.

Intentionally poor oversight, we must conclude. No federal criticality safety person – how can effective oversight occur?

7/7

Feedback and Improvement: While the new LANL management has done well at issue discovery and rediscovery (e.g., critiques), they have yet to substantively improve issue management, operations, and safety. Some examples are: • last week's suspension and partial resumption of hoisting and rigging operations were informally promulgated and controlled, causing some confusion; lessons learned from prior LANL suspensions remain unaddressed (e.g., site rep weekly 8/26/05); • on Thursday (7/6), TA-55 personnel self-reported a criticality safety infraction, which led to a brief suspension of operations on Friday; such infractions are a recurring issue and the subject of a lab corrective action plan (site rep weekly 3/10/06); • last Tuesday (6/27), the Sigma Complex (TA-3-66) received a potential internally contaminated package from TA-55 that was not what was expected; there are parallels to the Am-241 contamination event of a year ago, also the subject of a corrective action plan (site rep weeklies 2/3/06, 5/31/06); • LANL has postponed their readiness assessment for starting up more trailers on the TA-55 safeguarded trailer pad because findings from the startup of the first trailer a year ago

remain open (site rep weeklies 7/8/05,10/7/05). A common theme here, which applies lab-wide, is the continuing need for followup on known issues and corrective actions.

Criticality violation and suspension of ops

Inadequate followup on known issues

7/21

Plutonium Facility (TA-55): TA-55 has concluded that they need to improve their glove-box glove program, based on the rate of glove failures and the informality of current glove change-out criteria. TA-55 is also close to full implementation of the interim technical safety requirements (iTSRs), with a few exceptions that will require NNSA approval; lab verification is scheduled for early August. The key exceptions involve longstanding issues: (1) highly loaded cans of Pu-238 non-hydrogenous residues are still in the room that was contaminated in Aug 2003; (2) non-robust containers are still in use in the vault. TA-55 recently moved their higher-loaded cans of Pu-238 hydrogenous residues into a glove-box line and is still requiring respirators for vault work. Full resolution warrants priority.

Vault issues again

8/4

Institutional Safety Programs: LANL management has acknowledged a \$200M shortfall in its FY-07 budget (i.e., -10 %); the impact on necessary improvements to safety programs is uncertain. For example, the Operational Efficiency (OE) Project, which ends Oct 1st, identified that \$7.4M over 3 to 5 years is required to execute the OE-generated plan for technical baseline reconstitution of vital safety systems in nuclear facilities; FY-06 funding for this was \$0.2M. Similarly, the OE-related plan to systematically address about 600 institutional training issues identified during the last 3 years is estimated to cost \$44M and take 4 years; resolving these training issues appears fundamental to LANL improving other safety programs, such as work control, conduct of operations, and criticality safety. Currently, neither LANL's priorities for these improvements nor NNSA's intentions to contractually incentivize the improvements is clear; their overall priority may be decreasing.

Criticality Safety: Criticality safety is one of the LANL safety programs for which NNSA and LANL's intentions are unclear and the priority may be falling. The DOE Facility Safety Order 420.1 requires that nuclear operations satisfy the requirements of the ANSFANS nuclear criticality safety consensus standards, unless otherwise approved by DOE. NNSA's on-site review last Oct reported that the program was not demonstrably compliant with these standards (site rep weekly 12/16/05). While LANL has completed high and moderate priority walk-downs of fissile material operations, LANL is falling behind on its criticality safety improvement plan, intended to bring the LANL program into compliance with the standards; the schedule is undefined now due to budget issues.

For example, it's unlikely that LANL has sufficient criticality safety staff to complete the walk-downs, resolve issues, and implement the other ANSFANS program elements, including conducting annual oversight reviews of several hundred fissile material operations; on-site criticality staff is about half that estimated just to sustain the status quo and a quarter of that estimated to drive the improvement plan to completion in FY-07. The NNSA Site Office still lacks full-time federal expertise to provide oversight of the program. While these issues persist, NNSA and LANL are accepting higher risk than would be accepted in nuclear industry practice (site rep weeklies 3/31/06, 3/10/06, 2/17/06, 1/13/06).

Commitments to safety unclear, maybe falling

LANL not compliant with nuclear industry standards in criticality safety, willing to expose workers and public to higher risk than industry norms

LANL criticality staff inadequate in number

LANL falling behind in commitments in criticality safety

Still no full-time LASO expertise

8/18

Pajarito Laboratory (TA-18): TA-18 has curtailed nuclear operations because a procedural change last April specifying criticality safety limits was never finalized; LANL asserts that operations have been within the limits, which have not changed recently. Operations should resume next week.

Failure to complete criticality safety work

9/8

Criticality Safety: An NNSA Service Center review of several of LANL's recent criticality safety evaluations has raised questions, particularly on their completeness as justification for the control set for fissile material operations. One root cause may be insufficient qualified staff to systematically accomplish the growing workload and drive the LANL criticality safety program to a state that meets DOE requirements and applicable national consensus standards (site rep weekly 8/4/06).

NNSA finally provides some oversight, but what does "raising questions" do?

9/22

Recommendation 04-2: The on-site team has transmitted its preliminary evaluation of TA-55's confinement ventilation to the Independent Review Panel (IRP) Chairman. The team considered 24 accident scenarios and explored five in detail that seem to benefit most from active ventilation: a seismically-induced multi-room fire, two Pu-238 room fires, a vault fire, and an ion exchanger thermal excursion. Preliminarily, the team concludes that one particular ventilation subsystem by itself might be capable of maintaining building negativity during an upset and be a worthy candidate for safety-

class; the subsystem's functionality depends on avoiding smoke plugging HEPA filters; seismically upgrading glove-boxes is also key, particularly those with furnaces or other fire initiators. The team has scheduled 2 weeks for IRP review and intends to complete its evaluation by mid-November.

LANL's confinement philosophy, at odds with DNFSB, does not adequately protect against vault fires, a possible result of any criticality there.

10/20

Plutonium Facility (TA-55): NNSA has not acted on LANL's proposed resolution of discrepancies in the interim technical safety requirements, which LANL declared implemented -in August; the key issues involve: • non-robust nuclear material containers used in the vault, which was contaminated in Dec 2005; • Pu-238 residues still stored in the room that was contaminated in Aug 2003. Both of these are linked to still-open NNSA and LANL corrective actions in response to the Aug 2003 Pu-238 uptakes. Particularly, while WIPP recently approved new TRUCON codes and while LANL has disposed of some Pu-238 residues, NNSA and LANL have made little progress in developing packaging standards and addressing the remaining Pu-238 residues, some of which are intermixed with combustibles in poor containers within gradually degrading plastic bags (site rep weekly 6/2/06).

Vault issues again: inadequate containers; dangerous forms

10/27

Criticality Safety: NNSA's team of criticality safety experts was on site this week to determine the status of the LANL criticality safety program. As of Oct 1st, LANL has walked down and triaged about half the lab's 564 fissile material operations, including all those considered to be high or moderate risk; while walk-downs of the remaining ~300 lower risk operations have slowed, LANL considers that they constitute no serious safety issues. Separately, the NNSA Site Office has assigned a competent individual responsibility for the LANL program and hopes to accelerate his qualification.

The NNSA team's preliminary conclusions are that criticality safety risks here are now well understood and are being well controlled using interim processes, as opposed to the situation a year ago; the strong field presence of LANL experts and the new database of interim criticality safety documentation appear noteworthy; LANL has much to do to establish a compliant program, which could take 2 to 3 years; that said, budgetary decisions made within the last week increase the lab's criticality safety program funding by about 20% for FY-07, which is encouraging. The NNSA team expects to issue a report in November, and LANL expects to issue an updated schedule for corrective actions in December (site rep weeklies 9/8/06, 8/4/06, 3/10/06, 1/13/06, 12/16/05).

*Still no qualified full-time LASO oversight, though approaching it
Still 2-3 years away from a compliant program*

NNSA's conclusion about risks being well understood was wrong.

11/3

Management: NNSA and LANL have agreed upon and issued a performance evaluation plan, which includes performance based incentives (PBIs) for implementing conduct of operations, engineering, and maintenance, as well as improving the safety bases, criticality safety, and readiness reviews.

Institutional Safety Programs: Last Friday (10/27), LANL forwarded to NNSA new institutional manuals for conduct of operations, maintenance, and engineering in accordance with the PBIs. Implementation plans are expected in January. NNSA intends to review performance quarterly. LANL has also established a conduct of operations performance index, based on occurrence reports and criticality safety infractions, that will serve as a metric for measuring improvement.

*Unclear how safety performance was ranked among other incentives.
None of this information is public – need criticality safety infractions and occurrence reports*

11/17

Parajito Laboratory (TA-18): LANL has shipped the remaining TA-18 fissile solutions to CMR for disposition. NNSA has also approved a safety basis for storage of Off-site Source Recovery Program (OSRP) sources in a TA-55 transportainer and has approved startup of 3 more trailers (4 total) at the TA-55 secure trailer pad; these actions open the pathway for removing the remaining TA-18 nuclear materials and provide relief to the TA-55 vault, which has been storing TA-18 materials.

The TA-55 transportainer is limited to -250 Ci, consisting of OSRP sealed sources in pipe-overpack containers meeting WIPP requirements. The trailers are limited to 3,100 Ci and rely on the trailers, the pads, and external anchorage as safety-class features; containers, shelving, internal anchorage, and the pad slope are safety-significant; material-at-risk and combustible inventory limits are the key admin controls; dispersible Pu (e.g., powders, liquids) is prohibited. Both the transportainer and the trailers will likely be in use for several years (site rep weeklies 10/13/06, 9/22/06, 8/11/06, 7/7/06).

LANL is storing large amounts of metallic Pu in an interim, jerry-rigged set-up rather than shipping these materials to the DAF at NTS apparently because LANL is counting on building the CMRR vault and pursuing a career in pit manufacturing.

12/22

Criticality Safety: On Thursday (12/21), NNSA approved LANL's proposed updated criticality safety program improvement plan, which is intended to address issues from NNSA's Oct 2005 assessment during the next 3 years. LANL asserts that the 3 year time

frame is acceptable because the laboratory has established that adequate safety margin exists and that an interim configuration management protocol is in place. NNSA is also still finalizing a report from their Oct 2006 assessment, which preliminarily concluded that criticality safety risks here are now well understood and are being well controlled using interim processes, as opposed to the situation a year ago (site rep weekly 10/27/06).

The LANL plan discusses accomplishments to date, including issuing an institutional policy and manual, reviewing 564 fissile material operations, and walking down most of the operations; the remaining 'low risk' operations are scheduled to be walked down by Mar 2007, about 3 months later than the original schedule. The next phase focuses on bringing practices and documentation into compliance with the new policy and manual. The scope is large but risk-prioritized; the largest part involves generating more than 110 new criticality safety evaluations (CSEs) for current operations that are missing CSEs, upgrading more than 50 technically deficient CSEs, and correcting roughly 170 CSEs that have other issues. LANL is planning staff augmentation in FY-07 to support this.

Note lapse of time from 10/05 assessment. LANL falsely asserts everything is safe now (so why is the plan needed in the first place). Unsure if Keilers got these dates right. 330 CSEs in all need writing/improving.

2007

1/12

Criticality Safety: There are inconsistencies between the LANL institutional criticality safety manual (ISD 130), issued last July, and a general TA-55 administrative procedure for nuclear criticality safety, revised last October; LASO and LANL acknowledge the latter needs to be improved. In a larger sense, LASO and LANL have agreed upon a plan to improve LANL's criticality safety program during the next 3 years (site rep weekly 12/22/06). Accelerating reestablishment of an active Nuclear Criticality Safety Committee to provide semi-independent institutional oversight would be helpful.

Inconsistencies, implying lack of management attention; failure to deliver on promised response

1/19

Criticality Safety: On Wednesday, a TA-55 worker reported a 20 % over-mass condition on a shelf of a cart. The room was secured; the condition was evaluated and corrected per LANL procedures. LANL's review of the event found problems with postings and with operator interpretation of which had over-riding precedent: the room posting or the cart posting. Underlying these problems are weaknesses in operator training and in implementing the Criticality Safety Officer program; these are focus areas for the criticality safety program improvement efforts (site rep weekly 12/22/06).

Criticality violation

Operator training, lack of implementation of procedure; failure to implement CSO program

3/2

Price Anderson Enforcement Letter: NNSA has sent the former LANL contractor (UC) a preliminary notice of violation... In May 2006, LANL (UC) issued an integrated corrective action plan (ICAP) to address related needs...The new LANL contractor (LANS) updated and committed to the ICAP in Sep 2006...LANL has embedded the ICAP corrective actions in the new issue management system (LIMTS), which is part of the contractor assurance system (CAS); however, LANL management does not appear to have an explicit mechanism in place for closely monitoring ICAP progress and quickly focusing attention on lagging elements of the ICAP when they arise.

Failure to implement corrective actions

4/13

Plutonium Facility (TA-55): Weaknesses in first-line supervision contributed to the above [contamination] incidents (site rep weekly 3/9/07). TA-55 is improving first-line management and span of control, including posting about 50 to 60 new management positions that will replace current non-managerial team leader positions. Also, as part of the response to the above incidents, TA-55 management is conducting a glovebox-by-glovebox inspection; the LANL criticality safety group recently joined the inspection team and is simultaneously conducting the annual review of fissile material operations.

On Monday, this joint team discovered two staging gloveboxes in an aqueous processing room that had liquid lines that were valved-out but not disconnected or locked-out, as required by the criticality safety posting; the lines were subsequently locked-out. This was a good catch and illustrates the value of such periodic reviews for continuously improving facility safety.

*Inadequate management structures
Criticality violation*

4/20

Plutonium Facility (TA-55): TA-55's proactive glove-box inspections, reported last week, are continuing to find discrepancies between operations and their criticality safety postings, such as: • lean solutions in bottles in a glove-box with posting indicating solutions should be in the columns (i.e., tanks) except when filling or emptying, which was done -2 weeks ago; • a practice of staging small transuranic waste containers (e.g., Hagan cans) on the floor while the posting indicates only 15, 30, or 55 gal drums are permitted on the floor. The latter has led management to curtail transuranic waste packaging until procedures are implemented consistent with the posting, expected next week.

Criticality Safety: These events are similar to the case reported last week and will probably not be the last found by TA-55's ongoing glove-box inspections, which is commendable. Upon review, LANL is also finding that many of these discrepancies (including last week's) were already recognized and documented during last year's criticality safety walk-downs; corrective actions for these typically were assigned a low priority in LANL's extensive multi-year criticality safety improvement plan (site rep weekly 12/22/06). However, operating contrary to criticality safety postings may desensitize operators to the postings - an important element of criticality safety and conduct of operations; TA-55 is working on an interim solution. In some cases, such as the TA-55 waste packaging operation, the LANL criticality safety group is reassessing the priority assigned to addressing the issues.

Informality and scofflaw practices, heretofore passively or actively supported by management

Corrective actions given low priority by management

Operating contrary to criticality postings!

4/27

Criticality Safety: In response to the issues reported last week, the Plutonium Facility (TA-55) intends to work with the LANL criticality safety group and reconcile known discrepancies between operations and their criticality safety postings before the criticality safety evaluations are updated, which is scheduled during the next three years; this is positive (site rep weekly 12/22/06).

Nuclear Material Stabilization: Last Friday, LANL management approved a comprehensive nuclear material packaging and storage plan for TA-55 that is intended to address a series of related corrective actions dating from the December 2005 vault contamination and the August 2003 Pu-238 uptakes. The objective is to repack all non-standard items by the end of 2010, eliminating associated risks....

There should not be "known discrepancies" between operations and rules and they should not take three years to fix

Corrective actions take too long and both the problems and the corrective actions interfere with other operations

6/8

Davis, Elliott, Goff, Plaue, and Moury were here this week reviewing criticality safety and TA-55 vault operations....

Criticality Safety: LANL has near term plans to reestablish the Nuclear Criticality Safety Committee (NCSC) and to augment the cadre of full-time criticality safety officers (CSO). These are positive steps in that the NCSC provides independent institutional

oversight to help ensure the criticality safety program is robust and adding well trained CSOs helps ensure the program is implemented effectively.

Other opportunities for improving the effectiveness of the criticality safety program may be gained by strengthening the interfaces with other institutional programs. For example, until planned enhancements to the configuration management system are enacted, changes to processes, procedures, and equipment that could affect assumptions or controls important for criticality safety may not receive appropriate review; compensatory measures may be warranted in the interim. Also, the antiquated security-related MASS software program plays a role in maintaining criticality safety, although it was not designed for this function. MASS modernization and functionality improvements are being planned, but funding for much needed upgrades to this critical system is uncertain.

As program is strengthened as it should have been, problems are discovered which have been there all along.

DNFSB applies more attention (symbolized by 5 staff from DC) and more things happen.

Antiquated software, not applicable to job, evidently no QA for it.

6/22

Plutonium Facility (TA-55): This week, LANL completed the Director's Assessment of the TA-55 Plutonium Facility; the report is in preparation. The assessment included more than 200 interviews, 100 document reviews, and 50 observed evolutions. Some of the team's preliminary observations included:

- PF-4 is LANL's signature nuclear facility and should be held to the highest level of asset management, commensurate with its value to LANL's continuing role;
- work at TA-55 is performed safely overall, primarily because of the experienced personnel (many approaching retirement); implementing institutional improvements (e.g. in operations, engineering, maintenance, and configuration management) warrants priority;
- slow progress on work control corrective actions is a continuing risk;
- there are vulnerabilities in relying on LANL's existing waste facilities (i.e., RLWTF, Area G) but no implementation plan for addressing newly generated transuranic or liquid waste for the next two decades.

Pattern of meaningless assurances

Major disconnects between program plans, infrastructure, funding, staffing, and so on.

7/20

Nuclear Facility Infrastructure: Recent events illustrate continuing challenges, particularly for staffing and for safety system configuration management and maintenance. The Plutonium Facility (TA-55) has been in extended-hour operations for several months. This week, a wing (Zone 2) ventilation system fan failed impacting operations; the shaft and bearing were replaced that night. Personnel working the

switchgear upgrade project plugged an electric lift unknowingly into the uninterrupted power supply (UPS) system, impacting the facility control system, which impacted ventilation. An instrument air leak caused ventilation cycling, also impacting operations. Breaker inspections found a degraded (partially welded) chilled water system breaker, which was repaired. Acidic solution leaked from pipe onto a glovebox and the floor, forcing a lab room evacuation; the facility appropriately responded. Acidic waste transfers to the Radioactive Liquid Waste Treatment Facility are suspended while that facility investigates anomalous tank-level increases.

Additionally, LANL has completed a staffing analysis evaluating cognizant system engineer (CSE) support for vital safety systems (VSS) at 6 operating nuclear facilities. The analysis showed that CSEs are performing numerous ancillary functions including maintenance, design, and plant engineering tasks, leaving the average VSS with only about one-third of the institutionally recommended minimum level of effort for system engineering.

Based on criteria such as expertise, level of effort, and system condition, the evaluation concluded that 9 of the 43 active systems studied had inadequate system engineering coverage and 27 were receiving marginally adequate coverage. Staffing recommendations included adding 26 engineers at TA-55 (29 existing), 5 at CMR (9 existing), 4 at WETF (8 existing), 3 at WCRR (3 existing), and 3 at RANT and Area G (3 existing) for a total recommended increase of 41 engineers to the existing pool of 52. This analysis focused primarily on CSE coverage for active systems; the staffing recommendations will not necessarily be sufficient to ensure system engineering expectations are adequately met for passive safety systems. LANL intends to begin addressing the identified needs by hiring 9 new engineers.

*Inadequate staffing
Hardware breakdowns from heavy use*

7/27

Engineered Controls: LANL nuclear facilities have 46 active and 47 passive safety systems. A January 27th, 2004 Board letter identified weaknesses in LANL engineering practices for determining that such systems will adequately perform their intended safety functions; a contributing factor is that the safety functions are often not clearly defined in the safety bases, which generally have not been updated....

Based on the staff's detailed review of 6 active systems, these issues persist: LANL still does not have the configuration management, maintenance, and engineering elements in place to demonstrably assure these systems will adequately perform their credited safety functions. For several years, LANL has been developing a conduct of engineering program to address such issues, but this effort is insufficiently supported, it's understaffed, it's under-assessed, and it has yet to increase confidence in these systems.

Plutonium Facility (TA-55): On Monday, TA-55 workers found a component cleaning glovebox had spent cleaning solution in excess of posted criticality safety limits (i.e., moderator/reflector); the safety margin was not impacted. Workers had intended to sample and remove the spent solution last week, which requires suspending room operations, but did not do so because of production schedule pressure.

Inadequate safety bases, maintenance, facility engineering, problems not fully assessed, production pressure

Criticality violation occurred

8/3

Criticality Safety: After a significant hiatus, the Nuclear Criticality Safety Committee has been formally re-chartered and held their first meeting this week. This is a positive development that could help strengthen lab-wide criticality safety by providing independent institutional oversight.

Failure to implement NCSC announced with fanfare many months earlier; “hiatus” occurred

8/10

Federal Oversight: Field activities for the Chief of Defense Nuclear Safety biennial review of the NNSA site office were largely completed this week. Oversight objectives were deemed to be met in 4 functional areas (quality assurance, criticality safety, radiation protection, and packaging and transportation). The balance of roughly 10 functional areas did not meet objectives. The review team noted significant issues associated with site office oversight of contractor training and qualification, maintenance, and safety system engineering. Other concerns identified during the review were weaknesses in site office training and qualification and inconsistent oversight of compensatory measures and corrective actions stemming from contractor gap analyses against DOE requirements.

What capabilities exist at LASO now in criticality safety?

8/17

Criticality Safety: While walking down TA-55 pit casting operations on Wednesday, an NNSA facility rep and a criticality safety subject matter expert discovered a discrepancy in criticality safety posting, which led to discovery of staged plutonium metal in excess of the workstation limit. Personnel evacuated the room; the LANL criticality safety group evaluated the situation; the overmass condition was appropriately corrected; TA-55 pit operations are curtailed pending further review. This single failure appears to have had little effect on the margin of safety of this operation.

The over-mass condition arose as follows. For several years, the casting group has used a glovebox for staging that was divided into two workstations. In May, the casting group began to bring an inactive furnace in this glovebox on-line. Working with the criticality safety group, they reassigned it as a single workstation, consistent with other casting boxes, and assigned new limits. Operators were trained on the change; however, only one of the two glovebox postings was changed, and the MASS database was not updated. Recently, operators began casting in this glove-box. Per procedure, they checked MASS, the postings, the other indicators, all of which incorrectly reflected two workstations; they staged items in the glovebox consistent with those indicators and with the glovebox's prior use.

Updating workstation postings and MASS is expert-based; the site reps believe that informal change control and startup review, coupled with distraction due to production pressure, led to this workstation being incompletely updated. When checking extent of condition, TA-55 identified about two-dozen transfer (i.e., drop) boxes that are properly posted but may be susceptible to similar problems; these boxes as a class were reassigned last year as single locations but MASS still reflects two locations (site rep weekly 3/10/06). TA-55 is working toward correcting these conditions and establishing more formal protocols for declaring operability of gloveboxes and for updating criticality safety postings.

Criticality violation

Informal change control and review, production pressure.

8/31

Criticality Safety: The roughly 20 existing criticality safety evaluations (CSEs) for the TA-55 vault are convoluted, occasionally contradictory, and heavily reliant on expert judgment; these are among about 300 CSEs that LANL has identified as missing, technically deficient, or having some other problem that LANL has committed to address during the next few years (site rep weekly 12/22/06).

The vault CSEs require that two vault rooms have 5% borated-polyethylene in the shelving unit doors, but LANL cannot conclusively assure that the installed material has this level of boration – an ANSFANS 8.21 requirement. The poly was intended only as radiation shielding. A 2002 CSE credits the boron, as well as fissile mass, spacing, shape, and reflection; a related 2001 CSE states that boron is required to keep the array sub-critical provided each storage location is loaded to the upper limits; current expert judgment is that boron is not required, but that judgment is not backed by analysis.

Based on photographs, procurement requests, and catalog data, TA-55 has no reason to believe that the configuration is other than the one analyzed; however, there is no material certification, and there are other instances where LANL procurement processes have allowed incorrect materials to be installed. LANL should consider (1) if a criticality infraction exists, in accordance with LANL ISD 130-1; (2) if a sensitivity analyses on

boron's effect on safety margin is warranted, including double-batching not covered in the 2002 CSE; and (3) if compensatory measures are needed, as indicated by analysis.

Contradictory safety documentation; reliant on expert judgment rather than formality of operations and engineered safety features.

Lack of documentation and QA.

9/7

Plutonium Facility (TA-55): TA-55 is planning an outage from Nov 5th through the end of the year, focused on formality of operations, configuration management, condition assessments, procedure standardization, system improvements, etc.; some limited operations would continue (Pu-238, MOX).

Criticality Safety: TA-55 is declaring a potential inadequacy of the safety analysis (PISA) and is suspending fissile material moves into two vault rooms unless the moves are reviewed by the LANL criticality safety group; material moves out of the rooms are unrestricted. While related, this is a different problem and affects different rooms than those reported last week. In this week's case, BISCO neutron shielding with 2 % boron carbide was installed in 1986; material certification was provided but has been lost; it's unclear whether or not the 1986 criticality safety evaluations credited boron. Given the uncertainty, the facility chose to enter the PISA process for these two rooms. LANL expects to have an analysis in about a week on whether the boron is required.

More lack of documentation, leading toward possible shutdown.

C. Other important DNFSB references bearing on criticality safety at LANL

1. DNFSB Eighth Annual Report to Congress – February 1998

3.10 Los Alamos National Laboratory, p. 3-22

.... At a facility level, the Plutonium Facility (TA-55), currently the location of most plutonium processing at LANL has made significant progress in formalizing operational safety. In its evolution toward better safety management, laboratory management at TA-55 suspended operations for nearly 3 months at one point while improved safety management procedures were developed. In response to the Board's focused attention, operations and maintenance at TA-55 have been improved, to help ensure that work is performed in a safe and controlled manner that is tailored to the hazards and importance of the operation. These hazards are identified by using a methodical process that comprehensively considers the risks to workers, collocated workers, and the public; TA-55 now has a workable safety management program. The director of LANL recently stated that productivity at TA-55 has increased dramatically in the last 2 years. He also noted that experience at TA-55 has shown that working in a formal, deliberate fashion

and following reviewed and approved procedures that are tailored to the hazards led to improved efficiency, productivity, and safety.

2. Presentation by John T. Conway, Chairman, DNFSB, at the DOE Nuclear Criticality Safety Conference held in conjunction with the American Nuclear Society 2002 Winter Meeting, November 22, 2002

“Criticality Safety” (quoted in full)

Of all the safety issues that the Defense Nuclear Facilities Safety Board has addressed in carrying out its statutory oversight function, none is more important or challenging than criticality safety. I welcome and appreciate the opportunity to meet with you today to convey the Board’s concerns regarding this issue and its dedication to the pursuit of a zero-tolerance mentality in the conduct of any program in the Department of Energy where the possibility of a criticality accident exists.

Why the emphasis on criticality accidents? Obviously, a criticality accident would endanger the lives of facility workers as well as present a potential risk to the public through exposure to radiation from any radioactive release. Almost as important is the fact that a criticality accident constitutes, in the mind of the public, confirmation of the fears generated by critics who have attacked anything related to “nuclear.”

A number of commendable criticality safety initiatives have been conducted by DOE, and have contributed directly to a continuing upgrade of criticality safety throughout the DOE complex. These initiatives include implementation of the Board’s Recommendation 97-2, the Secretary’s requirement that criticality specialists spend more time on the floor where operations with fissile material are conducted, and the completion of individual self-assessments and associated improvements in sites’ criticality safety programs. Later in the program, Dr. Burns of the Board’s staff will discuss some additional initiatives that may be explored in the future.

Before discussing recent incidents or threats to criticality safety, I would like to note two of the Board’s concerns that prompted the issuance of Recommendation 97-2. The first is the continuing threat to stable funding of criticality programs, while the second is the result of the movement within DOE to close experimental criticality facilities. I understand that commendable progress has been made by Dr. Crandall on ensuring stabilized funding in the future. On the second issue, I simply wish to reinforce the Board’s position that any impact on or delay in the training of criticality engineers and experimental test programs that might be associated with the relocation of the Los Alamos criticality facilities should be identified and minimized. This is a difficult problem that the Board is following closely.

I would like to share with you additional thoughts that may be helpful in your commitment to criticality safety. Lest we forget, much of what we know today of criticality safety requirements is due to extensive experiments conducted in the early years at Los Alamos National Laboratory, sometimes with tragic results. Dr. Otto

Frisch's early experiments with special nuclear material to confirm theoretical calculations were referred to as "tickling the Dragon's tail" in recognition of the danger involved.

One of the early experimenters, Dr. Harry Daughlian, died in August 1945, within 10 days of an accidental exposure from working on a critical assembly. Months later, Dr. Louis Slotin, who was one of the investigators assigned to look into that accident, was fatally involved in another criticality accident at Los Alamos.

As a young staffer on the Joint Committee on Atomic Energy in 1957, my very first visit to Los Alamos was to investigate a criticality accident that, while causing a great deal of property damage, fortunately, did not involve any personal injuries.

We must not forget what can occur if strict attention is not given to criticality safety. Three individuals died at the SL-1 reactor experiment in Idaho, a death occurred in Rhode Island at a processing plant, and, of course, there were two deaths associated with the recent Japanese criticality experience.

From a historical perspective, I recall that in the early stages of the Navy nuclear program, some 40 or more years ago, there were no formal requirements similar to 10 CFR 830, there were no consensus standards, there weren't even any computers or pertinent benchmarked criticality data.

What was it that enabled the success of this program? A major contributor was the acceptance of personal responsibility for safety by the people involved in criticality safety programs, i.e., "a criticality safety culture." Ensuring this "criticality safety culture" in the DOE complex is a continuing challenge, especially given that the program is constantly being pressured by financial and schedule concerns. There are several other areas that are potential threats to "a criticality safety culture."

- The first potential threat is human errors associated with the implementation of complex criticality controls and laxity in the conduct of operations.

The Board is aware of several recent incidents involving Building 9212 at Y-12 and the removal of raschig rings in tanks at Rocky Flats. I would like to re-emphasize the importance of the proper development and execution of procedures, postings, and requirements involving the handling of fissile material. It is important that the criticality safety community work closely with the relevant line organizations to develop criticality controls that are concise and easily implemented. If a criticality accident should occur, I am convinced it will not be caused by an unanalyzed criticality situation. It will be due to an operator making a mistake in trying to follow a complex, confusing criticality safety control.

- The second potential threat is the proliferation of risk acceptance.

Where criticality issues are involved in a process, the objective should be prevention, not mitigation, of an accident. The extreme cost of failure, from both a safety and a public perception standpoint, is unacceptable. In the words of a noted expert in this area, Victor Stello, “In the mind of the public, risk is a clever way that the nukes have to package danger.”

- A finally potential threat is retirement of experienced criticality specialists and the general demise of nuclear programs in the academic community.
- Attracting and retaining criticality safety experts is a significant problem that appears only to be getting worse.

As a final thought, keep in mind that *you* have responsibility for criticality safety. If a criticality incident occurs at your site, you will find yourself in the position of having to justify not having taken every possible step to avoid it.

The Board encourages DOE and its contractors to redouble their efforts in the development and implementation of clear criticality safety requirements and adherence to sound conduct-of-operations practices to ensure continued success in achieving their mission objectives. I know the challenge I am presenting — that of overcoming the obstacles to achieving the needed “criticality safety culture” — may be difficult to accept without losing a lot of sleep, but we must strive to meet it. In the words of Robert Browning, “. . . a man’s reach should exceed his grasp, or what’s a heaven for?”

3. DNFSB Fourteenth Annual Report to Congress – February 2004

Recommendations 94-1 and 2000-1. In these related Recommendations, the Board encouraged DOE to stabilize and safely store nuclear materials. LANL has been the least responsive site with regard to this important task, due in part to inadequate funding by DOE. On August 5, 2003, a serious incident occurred that could have been prevented had DOE and LANL been more responsive to these two Recommendations.

4. “Safety Management of Complex, High-Hazard Organizations,” DNFSB Technical Report – December 2004

a. Executive Summary

The Department of Energy (DOE) is implementing or contemplating a variety of changes in the management and contract processes that define, govern, and oversee the operations of DOE contractors performing defense nuclear activities. These well-intended changes, designed to improve productivity and efficiency, have the potential to lessen safety and to make a high-consequence, low-probability accident more likely. This report summarizes academic research on organizations involved in high-consequence operations, as well as lessons learned from major accidents and near-misses. Organizational attributes are identified that should benefit the safe management of nuclear operations. Corrective actions have been recommended to DOE as part of the Defense Nuclear Facilities Safety

Board's (Board) Recommendation 2004-1, Oversight of Complex, High-Hazard Nuclear Operations.

Many of DOE's national security and environmental management programs are complex, tightly coupled systems with high-consequence safety hazards. Mishandling of actinide materials and radiotoxic wastes can result in catastrophic events such as uncontrolled criticality, nuclear materials dispersal, and even an inadvertent nuclear detonation. Simply stated, high-consequence nuclear accidents are not acceptable. Fortunately, major high-consequence accidents in the nuclear weapons complex are rare and have not occurred for decades. Notwithstanding that good performance, DOE needs to continuously strive for (1) excellence in nuclear safety standards, (2) a proactive safety attitude, (3) world-class science and technology, (4) reliable operations of defense nuclear facilities, (5) adequate resources to support nuclear safety, (6) rigorous performance assurance, and (7) public trust and confidence. Safely managing the enduring nuclear weapon stockpile, fulfilling nuclear material stewardship responsibilities, and disposing of nuclear waste are missions with a horizon far beyond current experience and therefore demand a unique management structure. It is not clear that DOE is thinking in these terms.

This report synthesizes suggestions for provoking innovations and new solutions that should satisfy the Board's Recommendation 2004-1 and can help DOE improve the safe management of nuclear programs. For example, a separation of responsibility is suggested to clearly define and fulfill DOE's role as federal nuclear safety governance authority and its programmatic role to execute mission functions. Creation of a centralized nuclear safety function with well-defined authorities and experienced technical capabilities may resolve many of the issues identified by the Board. The ideas in this report are intended to promote a sustained organizational shift that should provide better balance between productivity and safety.

b. APPENDIX: CHRONOLOGY OF KEY EVENTS IN DOE NUCLEAR SAFETY¹

A chronology of key events leading to the current state of DOE's ES&H program follows.

1942-1946: The development of nuclear weapons during World War II was performed in secrecy under the Manhattan Engineering District. The deadly effects of massive doses of radiation, as evidenced in the people of Hiroshima and Nagasaki, led to expanded research into radiation effects on people and the environment.

1946-1960: In 1946, Congress established the Atomic Energy Commission (AEC) to manage the nuclear weapons program. The AEC formed a Safety and Industrial Health Advisory Board to survey health, safety, and fire protection practices throughout the complex. In 1954, Congress changed the Atomic Energy Act to encompass peaceful uses of nuclear materials. Under the new Atomic Energy Act of 1954, Section 161, the AEC was authorized to "establish by rule, regulation, or order such standards and instructions to govern the possession and use of special nuclear material and by-product material as

¹ This appendix is a synopsis of work done by Joseph DiNunno.

the Commission may deem necessary or desirable to promote the common defense, to protect or to minimize danger to life or property."

In 1959, subject matter experts in applied health physics, fire protection, and industrial health and safety standards were consolidated into an Operational Safety Division. Independent AEC reviews and critiques of safety practices at weapon production facilities marked the first forceful federal insertion of nuclear safety expectations into the workplace. However, expert consensus-rather than demonstrated compliance with formalized safety requirements-was the basis for authorization. In effect, the 1946-1960 period was marked by a continuation of expert-based safety practices learned during the Manhattan Project, and subsequently augmented by the safety systems of the industrial firms with which the government contracted to run the weapons production facilities. The AEC relied upon its contractors to apply the results of the weapons laboratories' research on the biological effects of radiation on people and the environment, as well as of basic research in chemistry, physics, and metallurgy.

1960-1980: In 1961, the AEC's Director of Regulation was assigned authority to establish nuclear safety requirements. Commercial applications of nuclear energy were licensed through the formal rule-making process; however, the weapons establishment was not subject to formal licensing. New environmental protection statutes enacted during the 1970s forced major changes to the AEC's environmental program, and in 1973, the AEC created an Assistant General Manager for ES&H. The biology, medicine, and reactor research programs continued to provide basic safety-related data to support both the weapons program and the commercial regulatory program.

The Energy Reorganization Act of 1974 abolished the AEC and established the Energy Research and Development Administration (ERDA) and the independent NRC. ERDA and subsequently DOE assumed responsibility for the weapons program, including the legacy wastes of the early weapons production era; coordinated biomedical and environmental research; oversight of a health and safety laboratory; development of environmental control technologies; development of safety standards; compliance oversight; coordination of reactor safety research; and waste management and transportation.

1980-1990: The 1980s were marked by intensified public interest and involvement of activists in nuclear safety, triggered in part by the Three Mile Island reactor accident. Both the nation's weapons and commercial nuclear power programs were the focus of the activists' attention and growing concern about nuclear-related issues. Confidence in DOE's safety programs eroded, and residual radioactive wastes emerged as the major point of controversy. DOE's struggle with remedial actions was met with lawsuits and court actions, leading to the opening of DOE defense nuclear sites to access and scrutiny by the Environmental Protection Agency and state authorities. An Assistant Secretary position for ES&H with enhanced responsibilities and authority for safety in mission-oriented environmental cleanup and weapons program activities was created in 1985. In 1988, Congress established the Board to provide independent external oversight for defense nuclear facilities.²

That same year, the Secretary of Energy undertook a major restructuring of DOE's approach to safety management. Line managers were made primarily responsible for safety management, oversight increased, and stringent technical safety standards for operating nuclear facilities were issued. The Price Anderson Amendments Act of 1988 authorized DOE to impose civil penalties on indemnified contractors to ensure compliance with nuclear safety requirements. DOE's Office of Price Anderson Enforcement was subsequently formed to investigate potential violations of enforceable requirements and initiate enforcement actions.

1990-2000: During the 1990s, DOE's ES&H program continued to experience shifts in direction as both Congress and the Administration worked to solve the problems of nuclear waste and surplus nuclear materials resulting from the shutdown of weapons production lines. In 1992, Congress passed the Federal Facility Compliance Act, requiring federal agencies to bring their facilities into compliance with federal environmental protection requirements.

During the mid-1990s, DOE orders and manuals were reduced to contain only high-level safety expectations, which are generally applicable to most of DOE's defense nuclear work. More explicit "how-to" or process-related direction was extracted and placed in guides and standards. The structure of DOE's directives system implied that most of the safety expectations set forth in orders and manuals should be included as safety requirements in contracts. As before, none of the direction from DOE (other than requirements in rules) is binding on contractors unless it is included in their contract. The intent under this system is for DOE's contractors and the contracting officers to use a standards and requirements identification process to select a set of binding safety requirements that is graded to the work at contract sites. Those safety expectations, regardless of their original source, then become contractually binding safety requirements. This list is referred to as "List B" in Section 970 .5204-2 of the Department of Energy Acquisition Regulations. List B is used in conjunction with 10 CFR Part 830 to form the nuclear safety requirements for the contractor.

² The Board began operations in October 1989.

5. DNFSB Fifteenth Annual Report to Congress – February 2005

5.4.7 Criticality Safety

When closing Recommendation 97-2 in August 2003, the Board stressed the need for aggressive self-assessment programs and expanded use of operational facility reviews and independent oversight. The Board also requested an annual report from DOE on the status of this program. Unfortunately, DOE's performance to date has been unsatisfactory. DOE has failed to review effectively each site's nuclear criticality safety programs using knowledgeable professionals; has not provided adequate staff for criticality safety work; and has not conducted trending and analysis of performance indicators with sufficient rigor. In a letter dated May 21, 2004, the Board again cautioned DOE to proceed with care in the plan to relocate the Critical Experiment Facility from the Los Alamos National Laboratory to Nevada Test Site. This relocation could damage criticality safety programs at Los Alamos and undermine coordination of criticality work among the Test Site, Los Alamos, and Lawrence Livermore. To highlight the Board's emphasis

on criticality safety, a member of the Board provided the keynote presentation on this topic at both the 2004 summer and winter meetings of the American Nuclear Society.

6. Testimony Of A.J. Eggenberger, Acting Chairman, DNFSB, "A Review Of Ongoing Management Concerns At Los Alamos National Laboratory," Subcommittee On Oversight And Investigations, House Committee On Energy and Commerce, May 5, 2005

The board's statutory oversight mission (pg 2)

...Congress created the Defense Nuclear Facilities Safety Board (Board) as an independent technical agency within the Executive Branch, external to DOE, to identify the nature and consequences of potential threats to public health and safety at the Department of Energy's defense nuclear facilities, to elevate such issues to the highest levels of authority, and to inform the public. The Board is not a regulator, but a small advisory agency with approximately 60 technical staff.

The Board's approach to conducting its nuclear safety oversight mission is to identify conditions or deficiencies to DOE. The Board provides advice and recommendations to DOE primarily by way of letters, reporting requirements, and formal Recommendations to the Secretary of Energy. DOE can accept or reject the Board's advice and recommendations. Although DOE's contractors take most of the actions in response to the Board, the Board works primarily through DOE - both headquarters and site office staff.

.....
(pg 5) The greatest hazard at LANL, hence the area of greatest interest to the Board, is plutonium in all forms, including metals, powders, solutions, and wastes.

7. DNFSB Sixteenth Annual Report to Congress – February 2006

2.2.1 Los Alamos National Laboratory

Los Alamos National Laboratory, located in New Mexico, is the DOE weapons laboratory with the largest number of defense nuclear facilities and weapons-related activities. In 2005, the Board focused its attention on resumption of operations, active confinement ventilation, work planning, conduct of engineering, fire protection, and oversight by the Los Alamos Site Office.

....

Strategic Pause in Federal Oversight.

In November 2005, the Board was briefed by DOE on a planned 3-month "strategic pause" at the Los Alamos Site Office. The purpose of the strategic pause was to reassign personnel in the site office to preparations for the transition to a new prime contractor. Approximately two-thirds of the site office's workforce was assigned to the transition effort, leaving the remaining third to perform essential functions and oversee laboratory operations. As a compensatory measure, the site office requested that the laboratory contractor increase its internal self-assessment activities for an indefinite period of time. In a letter to DOE dated November 29, 2005, the Board challenged this retreat from federal oversight responsibility. The Board stated that executing a

substantial reduction in federal oversight concurrent with a number of higher-risk laboratory activities was not consistent with ensuring safe operations. This is of particular concern as it is occurring during the first contractor transition period in Los Alamos's history-a period when oversight by the site office is most needed.

8. Letter from DNFSB Chair Eggenburger to NNSA Administrator Brooks, September 22, 2006, re criticality safety at LANL, enclosing staff issue report

a. Letter

Dear Ambassador Brooks:

The Defense Nuclear Facilities Safety Board (Board) has completed a review of the Nuclear Criticality Safety (NCS) program at Los Alamos National Laboratory (LANL). The enclosed report prepared by the Board's staff provides detailed discussion of the results of this review.

As discussed in a Board letter dated June 28, 2006, the Board has been encouraged by the increased influence being exerted by the Criticality Safety Support Group and the increased frequency of reviews under the Criticality Safety Monitoring Program. The Board has followed closely the NCS Improvement Plan developed by LANL in response to the findings of an October 2005 review performed under the auspices of the Department of Energy Criticality Safety Monitoring Program. The review team concluded that LANL's NCS program was noncompliant with several requirements of the American National Standards Institute (ANSI)/American Nuclear Society (ANS) Series 8 standards on nuclear criticality safety. The actions in the Improvement Plan initially scheduled for completion by the end of 2006 are being delayed. Additionally, it is not clear that the incremental risk of an inadvertent criticality incurred as a result of a deficient NCS program is fully understood and formally accepted by federal site management. Thus, the actions identified in the NCS Improvement Plan to address the LANL criticality safety deficiencies are not receiving appropriate attention and priority from National Nuclear Security Administration (NNSA) management.

The Board has three observations regarding this situation. First, compensatory measures beyond acting on the immediate safety recommendation have not been, but should be, implemented to minimize risk until the NCS program is brought into compliance. Second, it is imperative that the risk of an inadvertent criticality be minimized through completion of the actions in the NCS Improvement Plan and by compliance with the ANSI/ANS Series 8 standards. Plans to increase significantly the fissile material throughput at the LANL Plutonium Facility increase the importance of achieving a compliant NCS program. Third, although the Criticality Safety Monitoring Program assessment was effective in identifying criticality safety deficiencies at LANL, there should be a definitive mechanism to ensure that identified criticality deficiencies are quickly and effectively resolved.

Therefore, pursuant to 42 U.S.C. §2286b(d), the Board requests a report within 45 days of receipt of this letter, addressing the following:

- Interim compensatory measures being employed to reduce the risk of inadvertent criticality prior to achieving compliance with the ANSI/ANS Series 8 standards, or justification for accepting the incremental risk of an inadvertent criticality.
- A description of the management approach being used to ensure that the NCS Improvement Plan milestones are completed in a timely manner, including (1) the resources being applied to this effort, (2) when a full-time qualified federal NCS engineer will be added to the NNSA site office, and (3) how NCS program performance is monitored to prevent a recurrence of this situation.
- A description of the mechanism NNSA is using to ensure that findings resulting from Criticality Safety Monitoring Program assessments are promptly addressed.

Sincerely,

A. J. Eggenberger
Chairman

c: Mr. Thomas P . D'Agostino
Mr. Edwin L. Wilmot
Mr. Mark B . Whitaker, Jr.

Enclosure: DNFSB Staff Issue Report

b. DNFSB Staff Issue Report

September 6, 2006

MEMORANDUM FOR: J. K. Fortenberry, Technical Director
COPIES: Board Members
FROM: E. Elliott
SUBJECT: Nuclear Criticality Safety at Los Alamos National Laboratory

This report documents results of a review conducted by the staff of the Defense Nuclear Facilities Safety Board (Board) at Los Alamos National Laboratory (LANL) of the Nuclear Criticality Safety (NCS) Program Improvement Plan. The review was conducted on August 1, 2006, by staff members B. Broderick, E. Elliott, C. Keilers, and J. Plaue.

LANL NCS Program Improvement Plan. The National Nuclear Security Administration (NNSA) performed a review of LANL's NCS program in October 2005 using a team composed of members of the Criticality Safety Support Group and Criticality Safety Core Team. The review was conducted using Department of Energy (DOE) Standard 1158 (DOESTD-1158), Self-Assessment Standard for DOE Contractor Criticality Safety Programs, and the results were documented in a report issued on December 8, 2005, titled Technical Evaluation of the Los Alamos National Laboratory Nuclear Criticality Safety Program . The review team concluded

that LANL's NCS program was noncompliant with several requirements of the American National Standards Institute (ANSI)/American Nuclear Society (ANS) Series 8 standards. The report identified 14 findings (considered noncompliances with requirements) and numerous recommendations (considered opportunities for improvement). Three safety recommendations requiring immediate action to assess and minimize the risk of an inadvertent criticality were also provided. LANL developed an NCS Improvement Plan to address the findings and recommendations from this review, a previous DOE review,³ and a LANL self-assessment done by the NCS organization in 2004. The status of these efforts and of the resources necessary to support them is given below.

Safety Recommendations — The NNSA review required that the three safety recommendations be addressed within 90 days of the report's issuance. They are summarized as follows: (1) a documented review of all ongoing fissile material operations should be performed to ensure that they are in compliance with NCS requirements and that the posted limits, NCS evaluations, and operating procedures exist and are consistent with each other; (2) all passive and active engineered controls relied upon for criticality safety should be evaluated for formal configuration control ; and (3) inadequacies documented in the review called for by the first recommendation should be incorporated into a formal corrective action plan, with priorities based on potential criticality risks.

LANL developed a triage process using NCS experts from other sites within the DOE complex and has completed the safety recommendations for the highest-risk operations. Lower risk operations were scheduled to be evaluated by December 19, 2006, but a lack of resources has placed this date in jeopardy.

Improvement Plan – Completion of the Improvement Plan is essential to bring LANL's NCS program into compliance with requirements of the ANS/ANS Series 8 standards, which is required by DOE Order 420 .1A, Facility Safety. Some of the actions in the Improvement Plan have been completed, but many depend on sufficient resources for completion by the target date. One essential action-developing NCS evaluations and limits for fissile operations currently lacking such evaluations-does not have a target date since it is strictly dependent on staff resources for completion (see below) . If priority is not placed on increasing resources to address the findings from the NNSA report, it is unclear when compliance will be achieved.

Technical Staff Resources – LANL currently has 10 staff NCS engineers. The latest staffing plan indicated that a total of 15 engineers were needed to support ongoing operations, and an additional 18 would be needed to complete the actions in the Improvement Plan within a year. Further NCS-qualified staff will likely be needed to support increases in the scope and tempo of operations in the Plutonium Facility that are planned for the next few years. Apart from the possibility of obtaining a few engineers from corporate partners of Los Alamos National Security, efforts to obtain additional resources are lacking. Lack of sufficient staff will further delay -bringing the NCS program into compliance with requirements of DOE Order 420.1A and may lead to adverse schedule impacts on current or planned fissile material operations.

¹ Office of Environment, Safety and Health, Report to the Secretary of Energy on the Review of Nuclear Criticality Safety at Key Department of Energy Facilities, March 2000.

Federal NCS Oversight. According to an October 2005 briefing to the Board on the proposed DOE NCS Oversight Program, findings and/or recommendations were to be addressed under the auspices of the Chief of Defense Nuclear Safety and the Central Technical Authority, an arrangement that has not been effective in this case. The Los Alamos Site Office still does not have a full-time, qualified federal NCS engineer to provide day-to-day oversight as noted by the DOE reviews conducted in 2000 and 2005 . It is not clear that the incremental risk incurred as the result of a deficient NCS program is fully understood and has been formally accepted by federal site management, nor have any compensatory measures been identified to minimize that risk.

9. DNFSB Seventeenth Annual Report to Congress – February 2007

2.2.1 Los Alamos National Laboratory

Los Alamos National Laboratory, located in New Mexico, is the DOE weapons laboratory with the largest number of defense nuclear facilities and weapons-related activities. In 2006, a new contracting structure was put in place for management of the laboratory. The Board focused its attention on institutional corrective actions, federal oversight, active confinement ventilation, nuclear criticality safety, fire protection, and transuranic waste operations

.....

Federal Oversight

On October 1, 2006, DOE began a two-year pilot of a new federal oversight model at the Los Alamos Site Office. The pilot increases the federal presence in nuclear and high hazard facilities and relies on the contractor's assurance systems to monitor less hazardous operations. The Board objected to the concept of the pilot and raised specific concerns including the lack of compensatory measures in oversight for the period of time it takes for the contractor's assurance system to reach full effectiveness and maturity; the absence of federal oversight of radiological facilities under the pilot; and significant weaknesses in the technical capability of the federal workforce.

5.3.6 Criticality Safety

The Board continued to monitor DOE's progress in improving nuclear criticality safety programs. The Board reviewed a DOE report entitled Status of the Department of Energy Nuclear Criticality Safety Program for Calendar Year 2005 (February 8, 2006), and in a letter dated June 28, 2006, noted favorably the positive influence of the Criticality Safety Support Group, the improved stability of funding for the criticality program, and the increased frequency of reviews under the Criticality Safety Monitoring Program. However, the Board was concerned about several items that are fundamental to the health of DOE's nuclear criticality safety program and requested that DOE provide an estimate of when critical experiments would be started at Nevada Test Site and a status report on staffing and training. In October 2006, DOE responded to the Board that critical experiment operations at Nevada Test Site are planned to resume in late 2009, and the experimenters will undergo requalification in accordance with a training plan to be finalized in 2007. DOE also identified sites that require additional criticality safety resources to provide effective oversight and has taken action to acquire and qualify these resources. Finally, a number of engineer training courses devoted to criticality matters were held at Lawrence

Livermore National Laboratory this past summer, after a nearly two-year hiatus throughout the complex.

The Board has also closely followed efforts by Los Alamos National Laboratory to correct program deficiencies identified during an October 2005 review. A review in early August found that progress in completing the corrective actions had stalled. Subsequently, the Board issued a letter on September 22, 2006, asking DOE what compensatory measures would be put in place until the laboratory's program deficiencies could be corrected. DOE responded in a letter dated November 2, 2006, stating that it has increased oversight of the laboratory's program and assigned a full-time individual to oversight. A limited review of compensatory measures taken for current operations determined that there were no immediate criticality safety concerns. DOE will meet periodically with contractor management to monitor progress on corrective actions. The Board will continue to monitor progress and oversight effectiveness.

5.4.2 Criticality Safety Engineers

In 2006, the Board assessed the nuclear criticality training and staffing at several DOE site offices in the area of nuclear criticality safety oversight. The Board found that several DOE site offices continue to be either understaffed or not staffed at all in the area of oversight. Some of the problems with contractor programs can be traced to ineffective oversight by DOE site offices. By October 2006, DOE was actively seeking to fill criticality safety positions at the Nevada Site Office, Los Alamos Site Office, and Savannah River Operations Office. In the meantime, technical support in the criticality safety area is being provided to these sites through DOE's Albuquerque Service Center. At the Los Alamos Site Office, a general engineer has also been assigned as a full-time criticality safety engineer. He is required to complete qualification as an expert by April 2008, but DOE is exploring mechanisms to accelerate his qualification progress.

5.4.3 Federal Facility Representatives

The Board conducted on-site reviews of the staffing levels and training of DOE's facility representatives at the Pantex, Sandia, and Los Alamos Site Offices. The Board found that both staffing and training were inadequate in all three offices. DOE agreed and took steps to improve its activity-specific hazard training and to develop a more rigorous means of establishing a minimum staffing level at each office. However, DOE continues to experience difficulty maintaining the desired number of qualified facility representatives at too many sites.