



Lessons Learned in the Nuclear Criticality Safety Program at the LANL Plutonium Facility

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Nuclear Criticality Safety (NCS) Program: Enabling mission execution while strengthening performance

Today's discussion

- **LANL Nuclear Criticality Safety Program – Background and Timeline of Issues/Activities**
- **Lessons Learned**
 - NNSA/DNFSB Reviews (2005-2008)
 - Augmented Limit Review
 - Specific Vault Issues
 - Staff Attrition (2008-2012)
 - PF-4 Resumption
- **Conclusion**

NCS Program Background/Timeline 1

■ Timeline of Issues/Activities

- » Oct 2005: NNSA Comprehensive Audit of LANL NCS program
 - » Tabletop review of all evaluation results in some limit modifications.
 - » Program Improvement Plan Developed and Execution Begun
- » Jun 2007: DNFSB Finds Significant NCS Issues in Vault Rooms
- » Oct 2007: Plutonium Facility Management Initiate Augmented Limit Reviews
 - » 529 Fissionable Material Operations reviewed by Nuclear Criticality Safety Staff
 - » Direct and integrated Federal staff review.
 - » Floor-level review. Each operation reviewed in the facility and field verification of changes to the criticality safety basis.
- » 2007-2011: Program improvements
 - » Significant number of evaluations upgraded.
 - » Facility implementation lags core program improvements. This varies based on facility.
- » 2012-2013: Significant staff attrition.
 - » Lack of confidence in management results in ~100% loss of the NCS group.

NCS Program Background/Timeline 2

■ Timeline of Issues/Activities

- » Early 2013: Series of Low Level Criticality Infractions identified by federal staff.
- » May 2013: ADPSM Pauses Operations in one room and Initiates Reviews
- » Jun 2013: Director Pauses PF-4 Programmatic Operations – begins 1-year clock for requiring federal RAs for restart.
- » Mar 2014: PISA on Fire Water Entry into Glovebox Causing Criticality
 - » Subsequently led to TA55-ESS-14-002
- » Sep 2014 – Sep 2016: PF-4 Resumption Process
 - » Completed 6 Readiness Projects: T Base II, Pit Flow Sheet, IFIT, Balance of Machining, Furnace/ARIES/Casting, and Pyrochemistry Operations Resumed
- » Sep 2016 – Present: Supporting New Readiness Activities & Working Backlog
 - » Aqueous Chloride Readiness, Precision Machining Line Readiness, Infraction Resolution, Removal of ESS application to fissionable material operations

Lessons Learned – Big Picture

» CRITICALITY SAFETY IS HARD



Directions:

1. Place kit on FIRM surface.
2. Follow directions in circle of kit.
3. Repeat step 2 as necessary, or until unconscious.
4. If unconscious, cease stress reduction activity.

Lessons Learned – NNSA/DNFSB Reviews (2005-2008)

- » **Augmented Limit Review Lessons Learned**
 - » Operations/Program did not “own” safety
 - » Over reliance on NCS evidenced by:
 - » “I just need a mass limit from the crit guys so I can start work again”
 - » “We don’t have any crit issues, ‘so and so’ said so just five years ago”
 - » “We’re safe because we’ve been doing it this way for 20 years”
 - » Trend promulgated by NCS staff unavailability to spend time on floor while fixing compliance issues identified by NNSA/DNFSB
- » **BOTTOM LINE: Operations must own criticality safety and routinely engage with NCS personnel to achieve a strong program**

Lessons Learned – NNSA/DNFSB Reviews (2005-2008)

- » **Specific Vault Issues Lessons Learned**
 - » No standard of NCS evaluation documentation
 - » Difficult to ascertain what process upsets were analyzed
 - » Impossible to determine parametric dependencies
 - » No standard for technical review
 - » Unknown what type/depth of independent review was undertaken
 - » No standard for retention of computational models or description
 - » Not possible to independently evaluate model adequacy

- » **BOTTOM LINE: Standardization of evaluations, documentation, and record keeping is crucial to successful long-term NCS organization**

Lessons Learned – Staff Attrition (2008-2012)

» Staff Attrition Lessons Learned

- » Management responsibilities are paramount to NCS sustainability.
- » Direct management engagement can be improved by ensuring NCS has a reporting function high enough in the organization.
- » Criticality safety professionals are in high demand. Almost the entire group left within a 1 year period and the lab has since struggled to hire experienced engineers.
- » **BOTTOM LINE: Management must be accessible to NCS staff when issues need to be reported up the chain AND support initiatives that engage and professionally develop NCS staff!**

Lessons Learned –PF4 Pause/Resumption (2013-2017)

- » **Importance of Being on Floor with Operations Personnel (Sounds Familiar)**
- » NCS personnel spending time on the floor fosters relationships with operators and operations management
 - » Routine small group interactions lead to better questions and improvements in process limits
 - » Reduces the stigma of “NCS Police”
- » Increase Understanding of Systems/Processes
 - » Allows NCS personnel to become more familiar with processes, systems, and their possible upsets
 - » Important for response to abnormal conditions (i.e. infractions, accident)
- » **BOTTOM LINE: Effective nuclear criticality safety is not achievable sitting down**

Lessons Learned –PF4 Pause/Resumption (2013-2017)

- » **Engagement/Ownership from Operations**
- » Operations personnel (including senior management) must take an active role in owning and implementing the NCS Program
 - » At LANL progress has been achieved via “beating into submission” :)
 - » Active engagement by federal oversight has been necessary to drive change in the operations organization.
- » Important for NCS organization to capitalize on engagement and show positive returns
 - » E.g. Streamlined limit set better tailored to operation
 - » Work WITH us and dealing with the feds is easier
- » **BOTTOM LINE: Criticality safety cannot be outsourced – must be owned and engaged in by operations personnel**

Lessons Learned –PF4 Pause/Resumption (2013-2017)

- » **Staffing & Retention (People, People, People)**
- » Training of a Criticality Safety Analyst (CSA) is not a trivial exercise
 - » LANL CSAs take an average of 18 months to achieve qualification
 - » CSAs take 3-5 years to hit their stride
- » Retention is Vital
 - » Engagement & Positive Accountability
 - » Financial Incentives
 - » Professional Development
- » Current Staffing
 - » Regular Employees (20 Analysts – 7 Qualified – 7 Task Qualified – 6 In Training)
 - » Subcontractors (4.5 FTE Analysts – 3 Qualified – 1.5 In Training)
- » **BOTTOM LINE: If you don't have people who want to stick around you have no chance of success**

Lessons Learned –PF4 Pause/Resumption (2013-2017)

- » **Manage Expectations & Communicate Clearly**
- » Ensure customer prioritizes work appropriately
 - » Each major customer must be clear on number and priority of requests
- » Communicate Early and Often
 - » Operations always wants it yesterday
 - » Rule of thumb – everything takes twice as long as new NCS analyst expects it to
 - » Sooner the communication around missed deadline comes the better
- » Protect your people
 - » Manager must shield analysts from demands (for productivity and sanity's sake)
- » **BOTTOM LINE: Managing expectations and clearly communicating is a necessity for survival**

Lessons Learned –PF4 Pause/Resumption (2013-2017)

- » **Align Stakeholders**
- » Oversight must be on the same page (even if one of you don't like the page)
 - » Spend time developing a trusting relationship. If things are working well there should be give-and take on the position both NCS and oversight are taking.
 - » Mixed messages always end badly
 - » We're doing great vs. They are doing terrible
- » Senior management must understand the current situation and plan
 - » Ensure you have effectively engaged senior decision makers and clearly laid out your vision
 - » Always Be Closing (Sell your vision)
 - » 39 Presentations on NCS Program Status in past 18 months
- » **BOTTOM LINE: Managing upwards is just as important as managing down**

NCS Program Conclusion (seen 39 times)

- **Our history**

- » The LANL NCS Program has been through rigorous efforts to self-identify compliance issues
- » Long list of improvements necessary for the LANL NCS Program to reach full compliance
- » Rigorous compensatory measures are in place that ensure safe operations

- **Our future**

- » Well defined NCS Program Improvement Plan that plots the course to stability and full compliance
- » LANL NCS Program is on a positive trend as it has been successfully executing this plan
- » There are several years of improvement left. Managing external factors requires coordination between NCS management and Oversight.

We recognize and acknowledge that we are on a multi-year journey to eliminate resource constraints and to become completely compliant with national standards