



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

Presented at American Nuclear Society Annual Meeting in San Francisco, CA

June 13, 2017

Andrew Wysong

LANL NCS Division Leader

Patrick Moss

NA-LA NCS Subject Matter Expert



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