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DEVELOPING A STREAMLINED APPROACH TO CRITICALITY SAFETY ANALYST TRAINING/QUALIFICATION

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ABSTRACT

The Los Alamos National Laboratory (LANL) Criticality Safety Analyst (CSA) Qualification Standard was a multidivisional effort forged in late 2012. The result of the effort is a well-documented and efficient approach to training, encompassing local and national Nuclear Criticality Safety (NCS) training courses for incoming criticality safety staff, as well as a model for professional development of qualified CSAs at LANL. Five years later, the approach to training and qualification for CSAs has evolved into a streamlined safety management function, integrated in all phases of employee recruitment, development, deployment, and management.

Key Words: **criticality safety, training, qualification**

1. INTRODUCTION

Building a quality, compliant, and sustainable training and qualification program for criticality safety engineers is no easy feat in the nuclear industry. Taking into account additional requirements such as time-intensive demands, practicality, and flexibility, we began this monumental task at LANL's Nuclear Criticality Safety (NCS) organization under these circumstances. In autumn 2012, the organization was faced with leveraging decades of innovative and expert-based knowledge and practices, and developing and standardizing new approaches that needed to align with professional standards for instructional design, human resources, and the nuclear industry. Further, the program had to provide a mechanism for attracting, promoting, and retaining talent in this competitive field. Finally, we had to deliver the program's initial blueprint—the "qualification standard"— within 4 weeks. This summary describes LANL's accelerated development of a CSA training and qualification program and its results.

2. DESCRIPTION OF THE ACTUAL WORK

A team of training professionals and criticality safety subject matter experts was tasked with determining the construct of the new program, and recommending an implementation plan for its immediate- and long-term use. Using the Department of Energy (DOE) Order 426.2, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities* [1], the team commenced training analysis with a thorough review of these guidelines:

- American National Standards Institute/American Nuclear Society (ANSI/ANS) 8.26-2007, *Criticality Safety Engineer Training and Qualification Program* [2];
- DOE-STD-1135-99, *Guidance for Nuclear Criticality Safety Engineer Training and Qualification* [3]; and
- file drawers full of records and notes at organizational and individual levels.

The team interviewed criticality safety analysts and other subject matter experts, criticality safety managers, and associated stakeholders to determine the specific needs of the target program. LANL's *Nuclear Criticality Safety Program* [4] and *Conduct of Training Manual* [5], among others, further defined site and facility criteria, such as operations, equipment, material processes, physical plant/systems, and the safety authorization bases. Performance demonstrations, observations, and facility walk-downs were used to validate the analysis results.

Cognizant managers, from first-line to senior management, immediately set the pace for the expedited approach by articulating mission and operational priority, providing direction and resources, and navigating and negotiating inter- and intra-organizational expectations and collaborations. Data calls and benchmarking visits to other sites in the DOE complex [DOE Los Alamos Field Office, Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories (SNL), Oak Ridge National Laboratory (ORNL), Pacific Northwest National Laboratory (PNNL), and the University of New Mexico (UNM)] significantly contributed to the program.

3. RESULTS

At the highest level, the program was modeled on ANSI/ANS-8.26-2007 [2] and DOE-STD-1135-99 [3], using a three-phase approach and the ten competencies therein. The three levels of qualification are:

- CSA In Training (CSA-IT),
- CSA Qualified (CSA-Q), and
- CSA Senior Qualified (CSA-SQ).

The ten competencies are: Nuclear Theory; Criticality Safety Calculation Methods; Critical Experiments and Data; Hands-on Experimental Training; Rules, Standards, and Guides; Nuclear Criticality Safety Evaluations; Safety Analysis and Control; Criticality Accident Alarm System (CAAS) and Criticality Detection Systems (CDS); Accountability Practices; and Facility Knowledge.

Each competency was then developed into an instructional module made up of standard academic instruction and local requirements. We selected instructional methods based on several considerations: 1) the target population included both new and existing staff with unique learning styles and preferences; 2) the design and methods had to be flexible; and 3) renowned industry experts were available to serve as subject matter experts and instructors. The training program rolled out in early 2013 as "CSA Boot Camp" and included lectures, independent study, performance demonstrations, and examinations, and a final oral board examination as the capstone.

Within the first two 2 years of the initial implementation, other needs emerged. Formal mentoring—an expert- and experience-based instructional method—was added to the program to augment and

enhance the formal training by providing guided practice on any program-related topic. Another priority was developing a way to qualify analysts to independently perform work for which he/she had completed training, while still working towards full qualification. Further analysis concluded that the program could be subdivided into working units that supported safe and reliable performance of a specific task/function. The result was four “task qualifications” (or TQs):

- Calculation Specialist (TQ/CS),
- Facility Specialist (TQ/FS),
- Independent Review (TQ/IR), and most recently,
- Criticality Accident Alarm System Specialist (TQ/CAASS).

Figure 1 maps the structure a CSA would eventually take to achieve the milestones of this program. The requirements of the program vary based on education and experience of each individual. For example, a CSA with a bachelor’s degree in nuclear engineering specifically may satisfy core theory requirements that others might need to fulfill. CSAs with relevant work experience may satisfy further requirements such as criticality safety evaluation document (CSED) development performance requirements. In most cases, qualification time for a CSA-IT to achieve CSA-Q status was 18 to 24 months. Qualification time to achieve CSA-SQ status was experience-based, including a minimum of 10 years as a CSA-Q, with at least 5 years in the LANL CSA program. These time estimates are valid today.

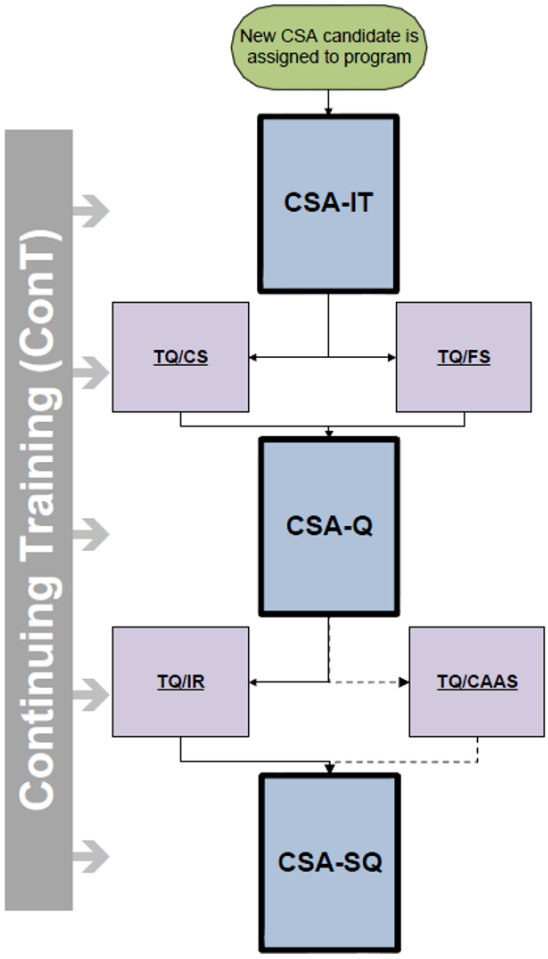

Figure 1. CSA Qualification Structure

Continuing training and biannual requalification modules, using multiple training methods such as required reading, briefings, attendance at seminars and lectures, etc., were incorporated early in the program implementation and were designed to address topics related to significant facility system and component changes; procedure changes; selected fundamentals; and applicable industry operating experience.

The program underwent a major curriculum change in November 2016. The boot camp model, while comprehensive and unique in design, was also costly and time consuming. A detailed analysis was performed again on the competency criteria vs course curricula for the DOE Nuclear Criticality Safety (NCSP) Hands-On Course [6], and the University of New Mexico's Nuclear Criticality Safety (NCS) Short Course and Assessments & Criticality Safety Evaluations Course, and Manager's Workshop [7–9]. The analysis concluded that these courses satisfied the criteria of ANSI/ANS-8.26-2007 [2] and could serve as a suitable replacement for the CSA Boot Camp's core academic requirements. LANL site requirements would still need to be addressed via local instruction and performance requirements.

4. CONCLUSIONS

This section describes the benefits of the streamlined approach of the CSA Program.

1. The Program demonstrates valid and reliable implementation.
    a. The program curricula were developed to meet specific industry criteria and unique site/facility needs.
    b. The program may be consistently and repeatedly implemented.

2. The Program augments staffing requirements.
    a. It enhances recruiting because it is self-driven, giving much control to the CSA-IT.
    b. It enables more working resources earlier on. For example, by qualifying at the task level, the CSA in training can independently perform a predefined work scope.
    c. It offers progressive growth opportunities, such as:
        i. CSA-IT introduces entry-level requirements, including DOE Nuclear Criticality Safety Engineer Training (NCSET) training modules [10]— available complex-wide—and LANL requirements;
        ii. CSA-Q consists of site-level competency requirements categorized as core and facility specific; and
        iii. CSA-SQ includes expanded and applicable site-wide requirements.
    d. It provides a robust continuing training program with weekly and monthly sessions.

3. The Program has operational impact.
    a. It is agile, flexible, and dynamic. Site, facility, programmatic, and personal needs and changes are easily addressed. For example, performance requirements are assigned by NCS management based on need and may include individual professional goals, such as the CAASS. It may also incorporate background, i.e., chemical engineering or operations experience.
    b. Previous training and qualification records from other sites/organizations can satisfy LANL requirements.

4. The Program shares and takes advantage of all resources.
    a. Existing industry training is used where appropriate.
    b. NCS management can assign the CSA to areas based on organizational need, CSA expertise, or growth opportunity.
    c. It provides breadth and depth.
    d. Colleagues from Sandia and National Security Technologies (NSTec), LLC, attended 2016 courses.

REFERENCES

[1] DOE-O-426.2, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*
[2] ANSI/ANS-8.26-2007, *Criticality Safety Engineer Training and Qualification Program*

[3] DOE-STD-1135-99, *Guidance for Nuclear Criticality Safety Engineer Training and Qualification*
[4] LANL System Description (SD)130, *Nuclear Criticality Safety Program*
[5] ITS-FSD-001, *LANL Conduct of Training Manual*
[6] DOE NCSP Hands-On Course. URL https://ncsp.llnl.gov/classMain.html
[7] UNM NCS Short Course, available online. URL http://ne.unm.edu/events/nuclear-criticality-safety/index.html
[8] UNM Assessments Course, available online. URL http://ne.unm.edu/events/nuclear-criticality-safety/index.html
[9] UNM Manager's Workshop, available online. URL http://ne.unm.edu/events/nuclear-criticality-safety/index.html
[10] DOE NCSET Training Modules, available online. URL https://ncsp.llnl.gov/trainingMain.html