Sharing of Good Industry Practices:
NCS Engineer Training Qualification Program

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Nuclear Criticality Safety Engineer
Presentation Summary

Overview of training program

• Description of qualification process
• Highlight strengths and best practices
• Discussion questions
Training Program Overview

NCS Engineer Classifications

• EIT – Engineer-In-Training
  • BS in Engineering
  • Nuclear Engineering
  • Understanding of reactor physics

• NCSE – Nuclear Criticality Safety Engineer – Fully Qualified
  • Two years experience at a nuclear site, includes one year at Y-12
  • Completion of Y-12 Specific Tasks
  • Hands-on DOE criticality safety course

• Sr. NCSE – Senior Nuclear Criticality Safety Engineer
  • Ten years NCS experience, includes five years at Y-12
Training Program Overview

NCS Engineer Training Requirements

- Solid boxes contain minimum requirements
- Dashed boxes contain additional tasks they may work toward qualifying in

Good Practices

- Requirements met primarily through completion of work supporting production operations
- EiT rotating shadows are assigned to the NCSE leads and receive exposure to multiple facilities
Basic Theory & Practice Knowledge, Basic Document Knowledge

Hand calculation problems
• Reading critical mass/volume charts
• Single unit
• Arrays

Review DOE Orders/ANSI-ANS Standards
• Plant level procedures
• Operating level procedures
Basic Facility Knowledge

Complete facility tours supported by respective NCS group

With a mentor

- Review NCS requirements in each building
- Read and review TSR/SAR

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<th>Manufacturing Facilities</th>
<th>EUO Facilities</th>
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<td>QP 50401696</td>
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Task 1

Process Reviews

- Review processes approved by CSEs to ensure requirements are being met and are consistent with current process conditions
  - Conduct and document three operational reviews
- Reviews inventory control procedures
- Other reviews according to Y70-164
Task 2

NCS Evaluation and Documentation

- Review DOE standards & Y-12 procedures
- Discuss multiple specified topics with a mentor
  - CAAS, NCS controls, margins of safety, critical experiments, normal conditions, contingencies, NDA, etc..
- CSA, CSR suspensions, reactivations, cancellations
- Revise three CSEs
  - Major revisions and updates
- Review site SAR and TSR
Task 3

Implementing Document Approval

- Operating procedures
  - Minimum three procedures
- Design drawings
  - Minimum two drawings
- Passive design features subject to degradation
- Postings
- SSC grading worksheets
- Surveillance data sheets

Example Fissile Storage Array Posting
Task 4

Computations

• Perform NCS calculations with computer codes

• Review current validation documents

• Discuss with a mentor:
  • Cross sections, validations, monte carlo methods, monte carlo pitfalls, margins of subcriticality and upper subcritical limits, area of applicability

• Attend training course for either MCNP or SCALE

• Complete three calculations using the same code
NCSE Oral Board

Practical Examination

• Assess depth and breadth of NCS knowledge
• QVO (Qualification Verification Official) and two qualified NCSEs
• Questions from all areas of qualification process
Task 13

Field Response to Abnormal Conditions

- Response to NCS occurrence deficiency or minor non-compliance
- Minimum of three documented field responses
- Qualification allows NCSE to be on-call

Abnormal Response Simulator

- Training area – NCS fissile containers
- QVO conducts back-off scenarios
- NCSE volunteers
Additional Tasks for NCSEs

• Experienced Personnel Evaluation Board
  • Expedited qualification process for those with prior NCS experience outside of Y-12

• Two-Year Requalification
  • Requires documentation of completed NCS works and professional development

• Task 5 – Computation Review

• Task 6 – NCS Evaluation/Criticality Safety Process Study Review

• Task 9 – Order Compliance and NCS Procedures
NCS New Hires – Classroom Training

Y-12 onboarding 15+ new NCS engineers

• New hires start no later than July 2019
• Streamline time with mentors
• Presenters scheduled weekly through next year
Discussion Questions

• Are there additional NCS training practices not yet discussed other sites find beneficial?
• Is there a topical area in the scope of NCS training that is particularly difficult to develop?
• How is the NCS mentor/mentee relationship fostered?
• What challenges are anticipated training the next generation of NCSEs?
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