

NRC INSPECTION MANUAL

NMSS/DFM

INSPECTION MANUAL CHAPTER 1247 APPENDIX C6

FUEL FACILITY CRITICALITY SAFETY INSPECTOR TECHNICAL PROFICIENCY TRAINING AND QUALIFICATION

Effective Date: 07/24/2024

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INTRODUCTION

Consult with your supervisor prior to beginning the activities or completing the courses in this qualification journal. You will need to complete the Basic Inspector Certification Journal prior to beginning the activities in this Appendix. You may complete the General Proficiency requirements contained in Appendix B together with the Technical Proficiency requirements outlined in this journal.

Several of the topics have both an individual study guide and on-the-job training. You must complete the individual study guide before beginning the corresponding on-the-job training.

Before signing up for any course, be sure that you have checked and have met any prerequisites.

REQUIRED FUEL FACILITY CRITICALITY SAFETY INSPECTOR TRAINING COURSES

- F-101S, Nuclear Criticality Safety Study Guide
- F-201 or 201S, Fuel Cycle Processes
- F-206S, Fire Protection for Fuel Cycle Facilities Self Study
- SCALE Criticality Safety Calculations (Calculations of K_{eff} using KENO offered at Oak Ridge National Laboratory)
- Department of Energy Nuclear Criticality Safety Program Hands-On Criticality Safety Evaluation (CSE) Course (2 weeks)

REQUIRED REFRESHER TRAINING:

(To be completed every 3 years)

- (16 Hours) Refresher Technical Training Seminar as approved by supervisor
- (8 hours) OSHA HAZWOPER Refresher Course or TMS "Health and Safety Suite (HAZWOPER)" as identified in Memorandum dated May 7, 2010, from Catherine Haney to NMSS Branch Chiefs (See ADAMS Accession No. ML100200563 for details of equivalent TMS training modules).

CONTINUING TRAINING:

These classes are suggested for continuing training for inspectors. You may propose alternate courses in additional topic areas to your supervisor.

- MCNP – Los Alamos National Laboratory
- SCALE Sensitivity and Uncertainty Analysis for Criticality Assessment and Validation (Variance Reduction Techniques and Tsunami)
- SCALE Criticality Safety and Radiation Shielding
- University of New Mexico Assessments and Criticality Safety Evaluations
- University of New Mexico – Nuclear Criticality Short Course
- University of Tennessee Monte Carlo Analysis (NE 483)
- University of Tennessee Selected Topics in Nuclear Criticality (NE 582)

STRONGLY ENCOURAGED PARTICIPATION:

Participation in the development and maintenance of American Nuclear Society (ANS) Chapter 8 standards as a member of an ANS-8 standards committee is strongly encouraged. Frequent attendance of ANS-8 meetings is also strongly encouraged. This is a strong recommendation, not a requirement. However, NRC staff participation in the development and maintenance of ANS-8 standards is important as NRC endorses many of the ANS-8 standards in Regulatory Guide 3.71. NRC generally maintains one voting member for each ANS standard; however, NRC staff may also participate in ANS-8 standards as non-voting associate members or non-voting observers. You should consult with your branch chief and the NMSS Standards Coordinator to discuss interests in standards participation.

REQUIRED INSPECTION ACCOMPANIMENTS:

You are required to accompany inspectors on a minimum of four criticality safety inspections. You should consult with your branch chief and regional staff to plan accompaniments at the following types of facilities:

- Category I fuel fabrication facility
- Category III fuel fabrication facility – dry process
- Category III fuel fabrication facility – wet process
- Enrichment facility

Fuel Facility Criticality Safety Inspector **Individual Study Activities**

(ISA-NCS-1) Regulatory Framework

PURPOSE:

The purpose of this activity is to acquaint you with the regulations that specify the requirements for all aspects of Domestic Licensing of Special Nuclear Material. This **individual study activities (ISA)** will help you to understand the content of criticality safety portions of the regulations.

COMPETENCY AREAS: REGULATORY FRAMEWORK

LEVEL OF EFFORT: **20-80** hours

REFERENCES:

- **10 CFR Part 70**
- Safety Evaluation Report (SER) for your reference facility
- License Application for your reference facility
- ISA summary for your reference facility

EVALUATION CRITERIA:

Upon completion of this activity, you should be able to do the following:

- Describe the criticality safety portions of 10 CFR Part 70.
- Describe the purpose of SERs.
- Describe the interaction between criticality safety licensing and inspection.

TASKS:

- Read and discuss with a qualified Nuclear Criticality Safety (NCS) inspector or reviewer the criticality safety portions of 10 CFR Part 70.
- Discuss the SER for your reference facility with a qualified NCS inspector or reviewer.
- Discuss with a qualified NCS inspector or reviewer the difference between inspection and licensing.

DOCUMENTATION: Fuel Facility Operations Inspector Technical Proficiency-Level Qualification Signature Card, Item **ISA- ~~SG~~-NCS-1**

(ISA-NCS-2) Regulatory Guidance

PURPOSE:

The purpose of this is to familiarize you with the regulatory guidance available for NCS inspectors for fuel cycle facilities.

COMPETENCY AREAS: REGULATORY FRAMEWORK

LEVEL OF EFFORT: 60 hours

REFERENCES:

- NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," Chapters 2, 3, 5, and 11
- NUREG-1513, "Integrated Safety Analysis Guidance Document." (ML011440260)
- NUREG-1537, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors"
- LA-13638, "A Review of Criticality Accidents."
- NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculational Methodology" (ML050250061)
- LA-10860-MS, "Critical Dimensions of systems Containing ^{235}U , ^{239}Pu , and ^{233}U ."
- LA-12808, "Nuclear Criticality Safety Guide."
- ARH-600, "Criticality Handbook," W.A. Blyckert, Atlantic Richfield Hanford Company
- TID-7016, "The Nuclear Safety Guide"
- R. A. Knief, "Nuclear Criticality Safety – Theory and Practice," American Nuclear Society
- RG-3.71, "Nuclear Criticality Safety Standards for Nuclear Materials Outside Reactor Cores"
- ANSI/ANS-8 Standards

EVALUATION CRITERIA:

Upon completion of this activity, you should be able to do the following:

- Understand the guidance that the NRC has for criticality safety in fuel cycle facilities.

- Demonstrate a high level of proficiency in discussing the physics of criticality and criticality safety parameters.
- Demonstrate a high level of proficiency in discussing the concepts of Tasks 3 – 13.

TASKS:

- Read LA-13638, NUREG/CR-6698, and “Nuclear Criticality Safety – Theory and Practice.”
- Discuss the physics of criticality with a qualified criticality safety specialist. Discuss the non-linear effects of changes in NCS parameters on k_{eff} .
- Read Chapters 3 and 5 of NUREG-1520, with specific focus on the appendices to Chapter 5.
- Familiarize yourself with RG-3.71, LA-10860-MS, and the ANSI/ANS-8 standards. Discuss how LA-10860-MS and the ANSI/ANS-8 standards are used in licensing review with a qualified criticality specialist.
- Discuss with a qualified criticality specialist the concept of risk as it relates to 10 CFR 70.61(b), and whether likelihood should be assessed instantaneously or as a long-term average.
- Discuss with a qualified criticality specialist the common inappropriate use of k_{eff} as a risk assessment tool.
- Discuss with a qualified criticality specialist the requirements of 10 CFR 70.61(d). Discuss the concept of the approved margin of subcriticality (MoS) as it is stated in 10 CFR 70.61(d).
- Discuss with a qualified criticality specialist the similarities/differences between the requirements of 10 CFR 70.61(b) and 10 CFR 70.61(d). Discuss the significance of these being two separate requirements.
- Discuss with a qualified criticality specialist the concepts of the Double Contingency Principle and Process Analysis requirement (ANSI/ANS-8.1) and their relationship with the requirements of 10 CFR 70.61(d) and 10 CFR 70.61(b).
- Discuss with a qualified criticality specialist common differences in interpretation of the Double Contingency Principle (DCP). Discuss the meaning of the term “unlikely” and how its interpretation can vary. Discuss the meaning of the term “independent” and how its interpretation can vary with respect to whether a single criticality safety parameter can be controlled or if multiple parameters must be controlled. Discuss whether the DCP represents a design criterion or defines a state of existence, and how this interpretation can vary.
- Discuss with a qualified criticality specialist the use of the terms “credible” and “not credible” and their significance. Discuss the criteria used to assess whether an upset should be considered “not credible.”

- Discuss with a qualified criticality specialist the methods for conducting criticality safety evaluations (CSEs).
- Discuss with a qualified criticality safety specialist the concept of validation. Discuss the concept and methods used in the determination of bias and bias uncertainty, the minimum subcritical margin (MMS), and overall margin of subcriticality (MoS). Discuss the considerations involved in evaluating the adequacy of the MMS and how these concepts relate to validation.
- Discuss the concept of positive bias with a qualified criticality safety specialist. Discuss agency position on the use of positive bias.
- Discuss with a qualified criticality safety specialist the methods for treating criticality safety parameters (mass, geometry, moderation, etc.). Discuss the concept of optimizing parameters unless specifically controlled or otherwise limited to a credible value less reactive than optimum.
- Discuss with a qualified criticality safety specialist the concepts of the criticality accident alarm system (CAAS).

DOCUMENTATION: Fuel Facility Operations Inspector Technical Proficiency-Level Qualification Signature Card, Item ISA-NCS-2.

(ISA-NCS-3) Generic Communications

PURPOSE:

The purpose of this is to familiarize you with the NRC generic communications that have been issued for fuel cycle facilities.

COMPETENCY AREAS: REGULATORY FRAMEWORK
INSPECTION

LEVEL OF EFFORT: 40 hours

REFERENCES:

- FCSS-ISG-12, "Reportable Safety Events per 10 CFR Part 70 Appendix A"
- IN-18-06, "Determination of Management Measures for Process Isolation Controls Designated as Items Relied on for Safety and Implementation of Adequate Quality Assurance Measures for Plant Features and Procedures"
- IN-18-05, "Long-Term Fissile Material Accumulation Due to Unanalyzed or Improperly Analyzed Conditions and Fuel Cycle Facilities"
- IN 16-13, Uranium Accumulation in Fuel Cycle Facility Ventilation and Scrubber Systems
- IN 15-08, "Criticality and Chemical Safety Events Involving Unanalyzed Conditions and Unanticipated Unavailability of IROFS at Fuel Cycle Facilities"
- IN 11-06, "Erroneous Criticality Alarm Monitoring Signal Caused by Incorrect Data Acquisition Module Configuration"
- IN 10-16, "Failure to Disable Unsafe Geometry Bandsaw Reservoir Results in Criticality Safety-Related Alert"
- IN 10-15, "Fuel Cycle Facility Configuration Management Errors"
- (IN) 08-14, "Criticality Safety-related Events Resulting from Fissile Material Operations under Procedures Not Reviewed by Criticality Safety Staff"
- IN 08-08, "Maintenance Procedures Compromise Double-Contingency of UO₂ Powder-Handling Equipment at Fuel Cycle Facility"
- IN 07-30, "Radiological Controls Create Criticality Safety Accident Scenario for Fissile Solution Container Transport at Fuel Cycle Facility"
- IN 07-13, "Use of As-found Conditions to Evaluate Criticality-related Process Upsets at Fuel Cycle Facilities"
- IN 06-10, "Use of Concentration Control for Criticality Safety"

- IN 06-07, “Inappropriate Use of a Single-Parameter Limit as a Nuclear Criticality Safety Limit”
- IN 05-31, “Potential Non-Conservative Error in Preparing Problem-Dependent Cross Sections for Use with the Keno V.A. or Keno-VI Criticality Code”
- IN 05-28, “Inadequate Test Procedures Fails to Detect Inoperable Criticality Accident Alarm Horns”
- IN 05-22, “Inadequate Criticality Safety Analysis of Ventilation Systems at Fuel Cycle Facilities”
- IN 05-13, “Potential Non-Conservative Error in Modeling Geometric Regions in the Keno-V.a Criticality Code”
- IN 05-12, “Excessively Large Criticality Safety Limits Fail to Provide Double Contingency at Fuel Cycle Facility”
- IN 05-05, “Improving Material Control and Accountability Interface with Criticality Safety Activities at Fuel Cycle Facilities”
- IN 04-14, “Use of less than Optimal Bounding Assumptions in Criticality Safety Analysis at Fuel Cycle Facilities”
- IN 94-73, “Clarification of Criticality Reporting Criteria”
- IN 93-60, “Reporting Fuel Cycle and Materials Events to the NRC Operations Center”
- IN 92-14, “Uranium Oxide Fires at Fuel Cycle Facilities”
- IN 91-84, “Problems with Criticality Alarm Components/Systems”
- IN 90-63, “Management Attention to the Establishment and Maintenance of a Nuclear Criticality Safety Program”
- IN 89-24, “Nuclear Criticality Safety”
- IN 82-21, “Buildup of Enriched Uranium in Effluent Treatment Tanks”

EVALUATION CRITERIA:

Upon completion of this activity, you should be able to do the following:

- Identify criticality safety problems that have occurred in fuel cycle facilities and be able to apply lessons learned to inspection activities.

TASKS:

- Review the listed references and discuss them and lessons learned with a qualified criticality safety inspector.

- Discuss recent problems experienced at fuel cycle facilities with a qualified criticality safety inspector.

DOCUMENTATION: Fuel Facility Operations Inspector Technical Proficiency-Level Qualification Signature Card, Item ISA-NCS-3.

(ISA-NCS-4) Industry Codes and Standards

PURPOSE:

The purpose of this is to familiarize you with **criticality safety** industry codes and standards that are used by the NRC and fuel cycle facilities.

COMPETENCY AREA: **INSPECTION
TECHNICAL AREA EXPERTISE**

LEVEL OF EFFORT: **40** hours

REFERENCES:

- RG-3.71, "Nuclear Criticality Safety Standards for Nuclear Materials Outside Reactor Cores" (ML18169A258)
- ANSI NQA-1 "Quality Assurance Requirements for Nuclear Facilities"
- ANS 8.1, "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors"
- ANS 8.3, "Criticality Accident Alarm System"
- ANS 8.5, "Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material"
- ANS 8.6, "Safety in Conducting Subcritical Neutron-Multiplication Measurements in Situ"
- ANS 8.7, "Nuclear Criticality Safety in the Storage of Fissile Materials"
- ANS 8.10, "Criteria for Nuclear Criticality Safety Controls in Operations with Shielding and Confinement"
- ANS 8.12, "Nuclear Criticality Control and Safety of Plutonium-Uranium Fuel Mixtures Outside Reactors"
- ANS 8.14, "Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors"
- ANS 8.15, "Nuclear Criticality Control of Special Actinide Elements"
- ANS 8.17, "Criticality Safety Criteria for the Handling, Storage, and Transportation of LWR Fuel Outside Reactors"
- ANS 8.19, "Administrative Practices for Nuclear Criticality Safety"
- ANS 8.20, "Nuclear Criticality Safety Training"
- ANS 8.21, "Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors"

- ANS 8.22, “Nuclear Criticality Safety Based on Limiting and Controlling Moderators”
- ANS 8.23, “Nuclear Criticality Accident Emergency Planning and Response”
- ANS 8.24, “Validation of Neutron Transport Methods for Nuclear Criticality Safety Calculations”
- ANS 8.26, “Criticality Safety Engineer Training and Qualification Program”
- ISO 7753, “Nuclear Energy – Performance and Testing Requirements for Criticality Detection and Alarm Systems First Edition”
- IAEA Specific Safety Guide (SSG-27), “Criticality Safety in the Handling of Fissile Material”

EVALUATION CRITERIA:

Upon completion of this activity, you should be able to do the following:

- Describe the significance of the ANSI/ANS 8 standards on the criticality safety community. Discuss the involvement of NRC staff on the ANS working groups.
- Describe how the fuel cycle licensees use and commit to the ANSI/ANS 8 standards.
- Discuss how quality assurance programs and management measures are used in criticality safety.

TASKS:

- Review Reg Guide 3.71 and the endorsed ANSI/ANS-8 Consensus Standards and discuss with a qualified criticality safety inspector.
- Discuss with a qualified criticality safety inspector or reviewer how licensees meet the double contingency principle. Discuss the history of the double contingency principle and how different organizations have different views on the implementation of the double contingency principle.
- Discuss the key differences of the criticality accident alarm system (CAAS) requirements between 10 CFR 70.24 and ANSI/ANS-8.3.
- Discuss with a qualified criticality safety inspector or reviewer how single parameter limits are used at facilities. Describe the conservatism that is established as part of the single parameter limit as compared to a calculated limit.

DOCUMENTATION: Fuel Facility Operations Inspector Technical Proficiency-Level Qualification Signature Card, Item ISA-NCS-4.

(ISA-NCS-5) Fuel Cycle Events

PURPOSE:

The purpose of this is to familiarize you with previous accidents in fuel cycle facilities and how these have impacted the regulatory framework and the criticality safety community.

COMPETENCY AREAS: INSPECTION

LEVEL OF EFFORT: 80 hours

REFERENCES:

- NUREG/CR-6410, "Nuclear Fuel Cycle Facility Accident Analysis Handbook."
- NUREG-1450, "Potential Criticality Accident at the GE Nuclear Fuel and Component Manufacturing Facility, May 29, 1991."
- NUREG-1198, "Release of UF₆ From a Ruptured Model 48Y cylinder at Sequoyah Fuels Corporation Facility: Lessons-Learned Report."
- NUREG-1189, "Assessment of the Public Health Impact from the Accidental Release of UF₆ at the Sequoyah Fuels Corporation Facility at Gore, Oklahoma."
- F-206S, "Fire Protection for Fuel Cycle Facilities Self-Study Course Manual."
- LA-13638, "A Review of Criticality Accidents."
- NRC INSPECTION REPORT (IR) NO. 70-1151/2004-001
- NRC IR 70-143/2006-006
- NRC IR 70-143/2006-011
- NRC IR 70-143/2006-012
- NRC IR 70-143/2006-019
- NRC IR 70-27/2009-006
- NRC IR 70-27/2015-006
- NRC IR 70-27/2015-008
- NRC IR 70-27/2017-007
- NRC IR 70-143/2015-002
- NRC IR 70-1151/2016-007

EVALUATION CRITERIA:

Upon completion of this activity, you should be able to do the following:

- Understand how previous accidents in fuel cycle facilities have impacted the regulatory framework and the criticality safety community.
- Understand how to apply lessons learned from previous criticality safety accidents to what to look for when inspecting.

TASKS:

- Read and discuss how NUREG/CR-6410 applies to criticality safety with a qualified **criticality safety** inspector or reviewer.
- Discuss the **Nuclear Fuel Services elevator pit** event in 2006 with a qualified **criticality safety** inspector or reviewer. Discuss the inspection reports (IR) IR 70-143/2006-006, IR 70-143/2006-011, IR 70-143/2006-012, and IR 70-143/2006-019, and enforcement actions that were taken.
- Discuss the Westinghouse Incinerator event in 2004 **and the Scrubber event in 2016** with a qualified **criticality safety** inspector or reviewer. Discuss IRs 70-1151/2004-001/**2016-007** and enforcement actions that were taken.
- Discuss the B&W bandsaw event in 2009 **and the desiccant filter event in 2017** with a qualified **criticality safety** inspector or reviewer. Discuss IRs 70-27/2009-006/**2017-007** and enforcement actions that were taken.
- Discuss with a qualified **criticality safety** inspector or reviewer the Sequoyah fuels accidents in 1986 and 1992 after reading NUREGs 1198 and 1189.
- Discuss with a qualified **criticality safety** inspector or reviewer the **General Electric (GE)** Near criticality event in 1991 after reading NUREG-1450.
- Read the UO₂ fires portion of the Fire Protection for Fuel Cycle Facilities Self-Study Course Manual (F-206S), and discuss with a fire safety inspector UO₂ fires, and then discuss with a **criticality safety** inspector or reviewer how fire safety and criticality safety interact.
- Review LA-13638 and discuss with a **criticality safety** inspector or reviewer the United Nuclear- Wood River Junction accident in 1964.
- Review LA-13638 and discuss with a **criticality safety** inspector or reviewer the Y-12 accident in 1958.
- Review LA-13638 and discuss with a **criticality safety** inspector or reviewer the fuel fabrication accident in Japan in 1999. Be able to discuss common failures that happen in all of the events.

DOCUMENTATION: Fuel Facility Operations Inspector Technical Proficiency-Level
Qualification Signature Card, Item ISA-NCS-5.

Fuel Facility Criticality Safety Inspector
On-the-Job Activities

(OJT-NCS-1) Criticality Safety Inspections

PURPOSE:

The purpose of this activity is to familiarize you with the proper method for inspecting criticality safety documents and organizations.

COMPETENCY AREA: INSPECTION
REGULATORY FRAMEWORK

LEVEL OF EFFORT: 120 hours

REFERENCES:

- IP 88003, "Reactive Inspection for Events at Fuel Cycle Facilities Program."
- IP 88015, "Nuclear Criticality Safety"
- IP 88020, "Operational Safety"
- IP 88070, "Plant Modifications (Annual)"
- IP 88072, "Plant Modifications (Triennial)"
- IP 93800, "Augmented Inspection Team"
- IP 98312, "Special Inspection"
- ISA summary for designated facility

EVALUATION CRITERIA:

Upon completion of the tasks, you should be able to do the following:

- Identify the hazards (nuclear criticality safety, radiation protection, chemical safety, and fire protection) associated with your designated fuel cycle facility.
- Identify the IROFS and management measures for a designated operation or process to ensure that process operations remain safe during normal and credible abnormal conditions.
- Identify the controlled parameters and controls, and safety limits for a specified process.
- Describe the differences between the general types of criticality safety controls used an LEU facility and an HEU facility.

TASKS:

- Perform the following tasks as part of the four (4) required OJT accompaniments:
- Review the licensee's ISA methodology for your assigned facility and select a risk significant area or process. Discuss with a qualified criticality safety inspector how the methodology applies to criticality safety. Discuss how the licensee identifies criticality safety hazards.
- Review the licensee's methodology for conducting criticality safety evaluations (CSEs). Review a sample of the licensee's CSEs. Discuss with a qualified criticality safety inspector the licensee's approach to meeting the Double Contingency Principle, the Process Analysis requirement (ANSI/ANS-8.1), and 10 CFR 70.61(d).
- Review the licensee's commitments related to the treatment of criticality safety parameters. Identify and discuss with a qualified criticality safety inspector which criticality safety parameters are controlled and how. Review a sample of the licensee's calculations and discuss how the models reflect the commitments related to the treatment of criticality safety parameters.
- Review the License Application and criticality safety procedures used by the licensee at your designated facility to implement the criticality safety program. Discuss the information with a qualified criticality safety inspector.
- Review the License Application and procedures used by the licensee at your designated facility to implement the Corrective Action Program (CAP). The License Application requirements for the CAP may vary between fuel facilities.
- Obtain a copy of an internal and external audit of criticality safety. Discuss the information with a qualified criticality safety inspector.
- Review the licensee's commitments related to the treatment of criticality safety parameters. Identify and discuss with a qualified criticality safety specialist which criticality safety parameters are controlled and how. Review a sample of the licensee's calculations and discuss how the models reflect the commitments related to the treatment of criticality safety parameters.
- Review the licensee's Validation Report, including the determination of bias and bias uncertainty, MMS, and MoS. Discuss the considerations involved in evaluating the adequacy of the licensee's proposed MMS with a qualified criticality safety inspector.
- Review the license application against the criteria in NUREG-1520. Discuss the review with a qualified criticality safety inspector and the specifics of how the licensee meets the requirements of 10 CFR Part 70. Document conclusions appropriately (e.g., SER, memo, etc.).
- Discuss the operation and maintenance of the safety controls with the workers. Discuss normal and emergency operational requirements.
- Discuss procedural compliance with the workers.

- Review the maintenance and surveillance requirements for the safety controls as listed in the Management Measures. Review a sampling of maintenance records for the maintenance and surveillance testing for specific controls.
- Discuss your evaluation of the operability of the safety controls with your supervisor or the qualified criticality safety inspector.

DOCUMENTATION: Fuel Facility Criticality Safety Inspector Proficiency-Level Qualification Signature Card, Item OJT-NCS-1.

(OJT-NCS-2) Criticality Safety Analytical Methods

PURPOSE:

The purpose of this activity is to familiarize you with the criticality safety codes that you may encounter at licensee's sites.

COMPETENCY AREA: INSPECTION

LEVEL OF EFFORT: 80 hours

REFERENCES:

- SCALE Criticality Safety Calculations Course (via ORNL)
- SCALE Sensitivity and Uncertainty Analysis for Criticality Safety Assessment and Validation (via ORNL)
- LA-UR-04-0294, "Criticality Calculations with MCNP5: A Primer."

EVALUATION CRITERIA:

Upon completion of the tasks, you should be able to do the following:

- Demonstrate a general knowledge of the mathematics and physics associated with criticality safety computer codes
- Demonstrate proficiency in using criticality safety computer codes such as SCALE or MCNP to calculate the k_{eff} of configurations.
- Demonstrate proficiency in using computer codes such as SCALE to conduct sensitivity and uncertainty analysis.
- Demonstrate an understanding of criticality accident alarm system (CAAS) detector placement techniques.

TASKS:

- Participate in one or more quarterly criticality safety community of practice (CoP) group exercises.
- In support of the tasks in OJT-NCS-1, generate a plot showing spherical critical mass as a function of concentration (i.e., critical mass curve) for a uranium compound and water mixture to evaluate the effects of varying degrees of moderation. The uranium compound used should be appropriate for the system(s) evaluated in OJT-NCS-1. Identify areas on the plot representing over-moderated, optimally-moderated, and under-moderated. Identify the relative minimum critical mass of the system.

- Repeat bullet 2 using a different enrichment to evaluate the effects of varying degrees of enrichment.
- Repeat bullet 2 using varying water-reflector thicknesses and varying reflector materials (i.e. reflectors other than water) to evaluate the effects of varying degrees of reflection.
- Have a criticality safety inspector or reviewer assign you a practice criticality safety evaluation to do based on a process in your reference facility. Your evaluation should include physically measuring your system, creating controls, and defending your evaluation to a criticality safety inspector.

DOCUMENTATION: Fuel Facility Criticality Safety Inspector Proficiency-Level Qualification
Signature Card, Item OJT-NCS-3.

Fuel Facility Criticality Safety Inspector Technical
Proficiency-Level Signature Card and Certification

Inspector Name:	Employee Initials/Date	Supervisor's Signature/Date
A. Training Courses		
SCALE training class		
Hands on Criticality Safety Course (DOE)		
F-101S, Nuclear Criticality Safety Self Study		
F-201 or 201S, Fuel Cycle Processes		
F-206S, Fire Protection for Fuel Cycle Facilities Self Study		
B. Individual Study Activities		
ISA-NCS-1 Regulatory Framework		
ISA-NCS-2 Regulatory Guidance		
ISA-NCS-3 Generic Communications		
ISA-NCS-4 Industry Codes and Standards		
ISA-NCS-5 Fuel Cycle Events		
C. On-the-Job Training Activities		
(OJT-NCS-1) Criticality Safety Inspections		
(OJT-NCS-2) Criticality Safety Analytical Methods		

Supervisor's signature indicates successful completion of all required courses and activities listed in this journal and readiness to appear before the Oral Board.

Supervisor's Signature: _____ Date: _____

The appropriate Form 1, Fuel Facility Operations Inspector Basic-Level Equivalency Justification, must accompany this signature card and certification, if applicable.

Form 1: Fuel Facility Criticality Safety Inspector Technical
Proficiency-Level Equivalency Justification

Inspector Name:	Identify equivalent training and experience for which the inspector is to be given credit.
A. Training Courses	
SCALE training class	
Hands on Criticality Safety Course	
F-101S, Nuclear Criticality Safety Self Study	
F-201 or 201S, Fuel Cycle Processes	
F-206S, Fire Protection for Fuel Cycle Facilities Self Study	
B. Individual Study Guides	
ISA-NCS-1 Regulatory Framework	
ISA-NSC-2 Regulatory Guidance	
ISA-NSC-3 Generic Communications	
ISA-NCS-4 Industry Codes and Standards	
ISA-SG-NCS-5 Fuel Cycle Events	
C. On-the-Job Training Activities	
OJT-NCS1 Criticality Safety Inspections	
OJT-NCS-2 Criticality Safety Analytical Methods	

Supervisor's Signature: _____ Date: _____

Attachment 1: Revision History for IMC 1247, Appendix C6

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Changes	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional Non-Public Information)
N/A	ML14051A526 06/11/14 CN 14-012	New inspection manual chapter appendix to specify qualification requirements for NRC criticality safety inspectors. Researched commitments for four years and found none.	None	ML14084A483
N/A	ML24082A163 07/24/24 CN 24-021	First revision of the IMC appendix for criticality safety inspectors. Revised evaluation criteria and tasks for training courses, individual study guides, and on-the-job training activities.	N/A	N/A