

Agenda: SARP Shielding/Criticality Safety Generalist's Course

Course Duration: Approximately 4.5 Days

- **Course Introduction**
 - Introduction
 - Course overview – applicability and scope
 - Course overview – Skill development
 - Course overview by day
 - Shielding course overview
 - NCS course overview
 - Overview of SARP Development
 - Hierarchy of Transportation Regulations
 - Applicable DOE and NNSA Requirements and Guidance
 - Applicable DOE requirements
 - Applicable Regulatory Documents
 - Applicable DOE Guidance
 - Applicable NNSA Guidance
 - Applicable Guidance Documents
 - Applicable NRC Guidance
 - Applicable Guidance Documents
 - Applicable Regulatory Documents
 - IAEA Regulatory Documents
 - Packaging Selection Relates to the Type of Material and Activity
 - Type A Packaging
 - Type B Packaging
- **Radioactive Material Package Shielding Evaluation Training**
 - Background
 - Why is there a need for shielding analysis?
 - Ionizing radiation
 - Typical sources of photons
 - Typical sources of neutrons
 - Chapter-to-chapter dependencies
 - Shielding Regulations
 - Regulatory dose rate limits
 - Rules and Regulations
 - SARP Ch. 5 shielding evaluation overview – per RG 7.9
 - Summary of methods/computer codes/nuclear data
 - Summary of Methods
 - Source Generation Methods
 - Radiation Transport Methods
 - Source Generation
 - Nuclear Data Sources for ORIGEN-S
 - ORIGEN-S Neutron Source Calculations
 - Radiation Transport Computational Methods
 - Monte Carlo Methods
 - Codes and Data Libraries
 - Source Generation Considerations
 - Individual components of radioactive sources

- Radioactive Sources
 - Radioactive Sources – Pu
 - Specific Power and Spontaneous Fission Yield of Pu Isotopes
 - Radioactive Sources – Uranium, U-233, Thorium
 - Radioactive Sources – Maximum Source Strength as a Function of Time
 - Shielding Design Considerations
 - Gamma Shielding
 - Neutron Shielding
 - General SARP Considerations
 - Shielding Review Considerations (several slides)
 - Steps for Reviewing a SARP
 - Tips for Source Term Review
 - Tips for Shielding Review
 - General SARP Comments
 - Review Requirements from the NNSA Safety Guide, SG 200
 - Safety Analysis Report for Packaging (SARP) Fundamentals
 - Safety Analysis Report for Packaging (SARP) Fundamentals – Conservative shielding analysis
 - Safety Analysis Report for Packaging (SARP) Fundamentals – Tips on modeling package
 - Safety Analysis Report for Packaging (SARP) Fundamentals – Tips on modeling payload
 - General SARP Content Strategies
 - SARP Shielding Example 3
 - Summary/Lessons Learned
 - Recommendations Summary (5 slides)
- **Radioactive Material Package Criticality Evaluation Training**
 - Chapter to chapter dependencies
 - Regulations governing NCS requirements for the packaging and shipment of fissile material
 - Introduction
 - Applicable Department of Energy (DOE) Requirements
 - Applicable Regulatory Documents – 10 CFR Part 71 – Packaging and Transportation of Radioactive Material
 - §71.55(b), (c), (d), (e), (f) General Requirements for Fissile Material Packages
 - §71.64 Special Requirements for Plutonium Air Shipments
 - §71.59 Standards for Arrays of Fissile Material Packages
 - Parameters Affecting Criticality Safety
 - Definition of exclusive use
 - Meaning of the Criticality Safety Index
 - Exclusive and non-exclusive use conveyances and the criticality safety index
 - SARP Chapter 6 Overview
 - SARP Overview – Criticality Evaluation (as per SG 200 and NRC Reg. Guide 7.9, R2)
 - Package description for Nuclear Criticality Safety
 - Introduction
 - Package Description

- Package Contents, e.g., Materials, Form, Quantity
 - Materials of construction and packaging, dimensions and volumes, limits on design features that contribute to Nuclear Criticality Safety
 - Packaging contents and configuration for HAC
 - Damaged package configuration for HAC
- Summary tables of criticality evaluation
 - Summary Tables of Criticality Evaluation (Introduction slide)
 - Summary Table of Criticality Evaluation (Single package results)
 - Summary Table of Criticality Evaluation (Array results)
 - Summary Table of Criticality Evaluation – Actual SARP Example (1)
 - Summary Table of Criticality Evaluation- Special requirements for Pu air shipments
 - Summary Table Example of Results (1)
 - Summary Table Example – Calculating the Criticality Safety Index
 - Summary Table Exercise – Calculating the Criticality Safety Index and Answer
 - Criticality Content in Other Chapters
 - Chapter to Chapter Dependencies
- Nuclear criticality safety analysis models
 - NCS Analysis Models – General
 - NCS Analysis Models – Sketches
 - NCS Analysis Models – Example of a Sketch for NCS Analysis
 - NCS Analysis Models – Model/Package Difference
 - NCS Analysis Models – Materials
 - NCS Analysis Models – Package Contents
 - NCS Analysis Models – Arrays
- Method of analysis
 - Calculational Methods
 - SARP Content
- Validation of Calculation Methods
 - Nuclear Data Bias
 - Validation of Calculation Methods (Introduction)
 - Limits, Biases & Uncertainties
- NCS Calculations and Results
 - Criticality Calculations and Results
 - Criticality Calculations and Results – Examples (1)
 - Criticality Calculations and Results – Examples (2)
- SARP Chapter 6 Summary
 - Summary of Key Points in Ch. 6
 - SARP Ch. 6 – Review Considerations
 - Review Considerations – SARP Completeness Review Checklist – SG 200
 - Resources (1), (2)
- NCS Analysis Overview
 - Performing Criticality Analysis
 - Analysis objectives
 - Single Undamaged Package
 - Single Undamaged Package (Real SARP Example)
 - Single Damaged Package

- Single Undamaged Package (Real SARP Example)
 - Analysis of Arrays of Packages – General
 - NCT Model Example
 - HAC Model Example
 - Calculating the Criticality Safety Index
 - Modeling Arrays of Undamaged Packages
 - Modeling Arrays of Damaged Packages
 - Discussion of Damaged Package Analysis
- Class Exercises
 - Compare an actual SARP Ch. 5 to NNSA SG 200 Ch. 5 Checklist
 - Discussion
 - Compare an actual SARP Ch. 6 to NNSA SG 200 Ch. 6 Checklist
 - Discussion
- Questions and Close-out Discussions