Safety Analysis Report for Packaging Shielding and Nuclear Criticality Safety Courses Developed and Conducted by Oak Ridge National Laboratory

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Agenda

- Introduce the US Department of Energy (DOE) Packaging Certification Program, Office of Packaging and Transportation, Safety Analysis Report for Packaging (SARP) Shielding and Nuclear Criticality Safety (NCS) courses for SARP generalists and analysts
- Course background
- Courses offered
  - Generalist Course
  - Analyst Course
- Course registration options

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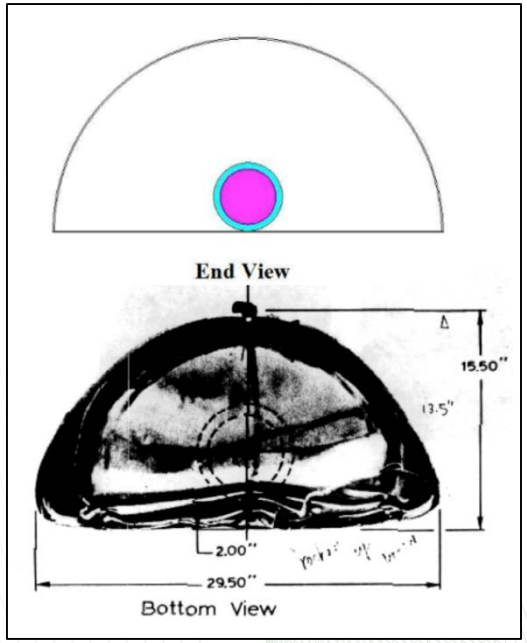
SARP course background

- **The SARP Generalist Course**
  - Designed for project managers, supervisors, NCS/shielding subject matter experts (SMEs), and SMEs in non-NCS/shielding technical areas (e.g., structural, thermal, package design)
  - Developed to improve the understanding of how NCS/shielding analyses fit into the broader body of SARP documentation
- **The SARP Analyst Course**
  - Provides detailed instruction on the radioactive material package shielding analyses and NCS evaluation fundamentals needed by analysts/practitioners
  - Designed to help prepare and/or review technical analyses for the SARP documentation



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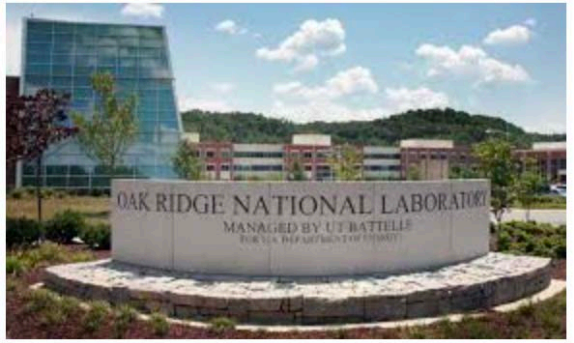
SARP course background

- The courses were originally developed for the National Nuclear Security Administration (NNSA) in 2013
- A pilot SARP Generalist Course was offered for NNSA staff members for the first time in September 2013 in Albuquerque, New Mexico
- The updated courses are now conducted for the DOE Packaging Certification Program's Office of Packaging and Transportation
- The goal is to offer each course once per year at the National Transportation Research Center (NTRC) at Oak Ridge National Laboratory (ORNL)

National Nuclear Security Administration

OFFICE OF ENVIRONMENTAL MANAGEMENT

OFFICE OF PACKAGING AND TRANSPORTATION



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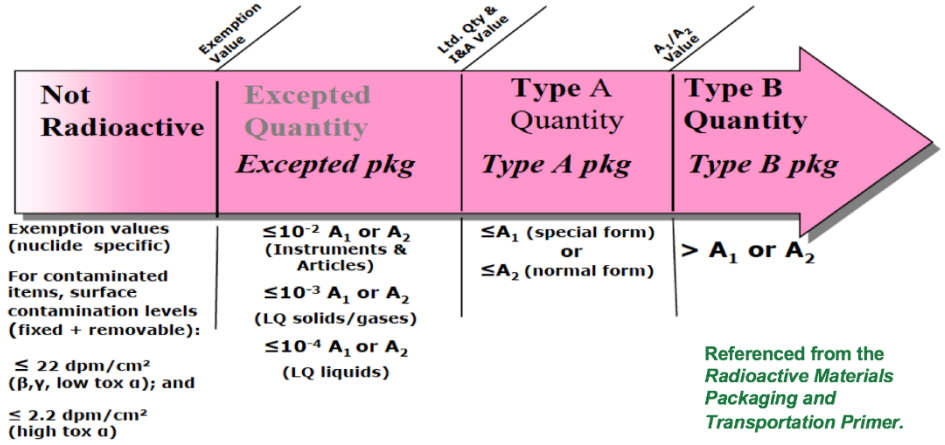
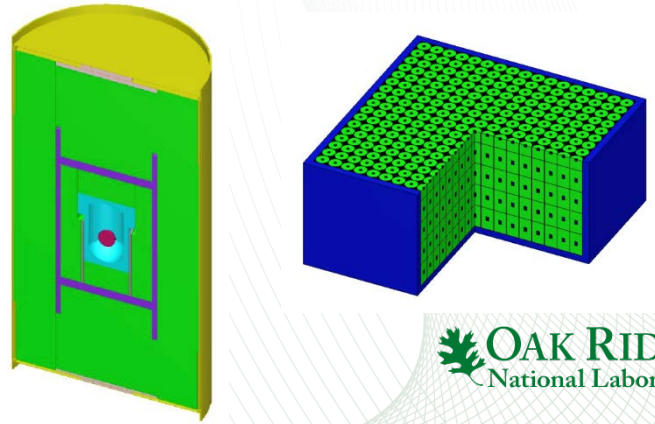
SARP Generalist Course

- The SARP Generalist Course provides an overview of the regulations and guidelines for criticality and shielding analyses for a SARP
  - Specifically, this course provides an overview of 49 CFR 171-178 and 10 CFR Part 71 regulations for designing and certifying type B packages for transporting fissionable materials safely
- Students are introduced to the content of a SARP document so they can understand how Chapter 5, “Shielding Evaluation,” and Chapter 6, “Criticality Safety,” relate to the other SARP chapters
- Students review an actual SARP document to examine key elements of the shielding and criticality analyses



Chapter 1 General Information	**Chapter 2** Structural Evaluation	**Chapter 3** Thermal Evaluation
Chapter 4 Containment	**Chapter 5** Shielding Evaluation	**Chapter 6** Criticality Evaluation
Chapter 7 Package Operations	**Chapter 8** Acceptance Tests & Maintenance Program	**Chapter 9** Quality Assurance



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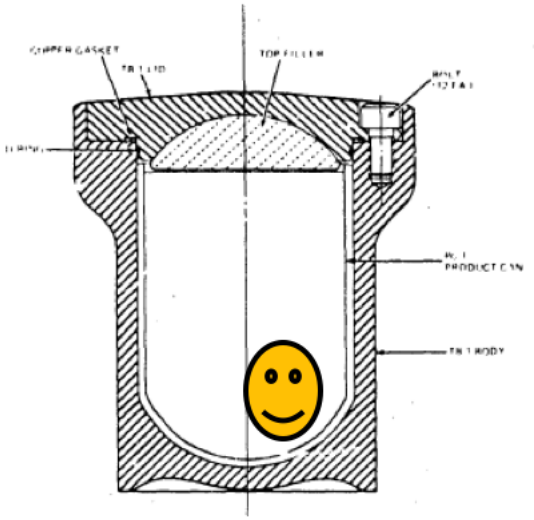
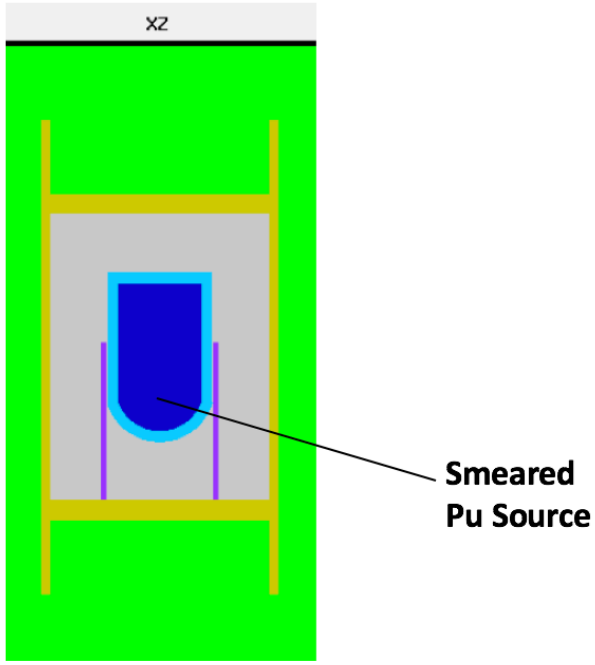
SARP Generalist Course

- Shielding course modules
  - Students will better understand the analysis methods that are a part of the package shielding analysis in Chapter 5 of a SARP
  - Students will learn
    - Which radiation transport codes and nuclear data are used for this type of analysis
    - How the packaging characteristics and radiation source terms are defined and used, ensuring that a package's external radiation levels are acceptable for a given packaging configuration and fissionable payload
  - Exercises are provided throughout the course to solidify key points





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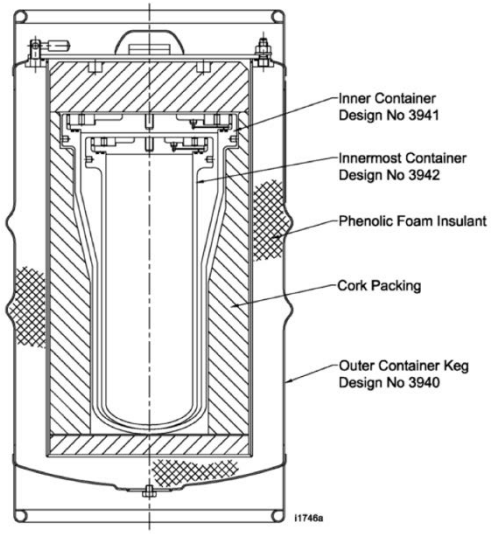
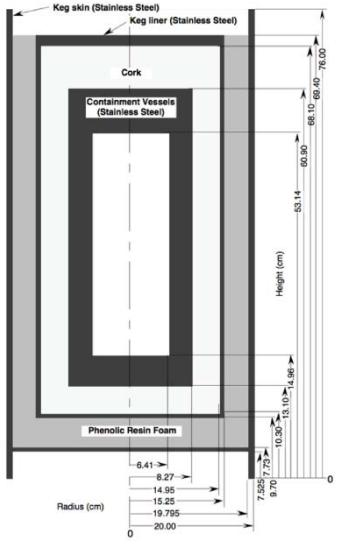
SARP Generalist Course

- Criticality course modules
  - Students will be provided with an overview of the regulations to perform single package and array of package criticality analysis; this analysis is used to derive a criticality safety index (CSI) for a certain package configurations and fissionable payload
  - Other topics covered at a high level include
    - The use of radiation transport codes
    - Neutron cross sections
    - Analysis methods
    - Validation
  - Exercises are also provided for students to gain an understanding of how to derive the CSI from analysis results
  - Students perform a mock review of SARP criticality analysis to become familiar with the content of Chapter 6 and to suggest opportunities for improvement based on the guidance and requirements



Actual Package Configuration



NCS Analysis Sketch

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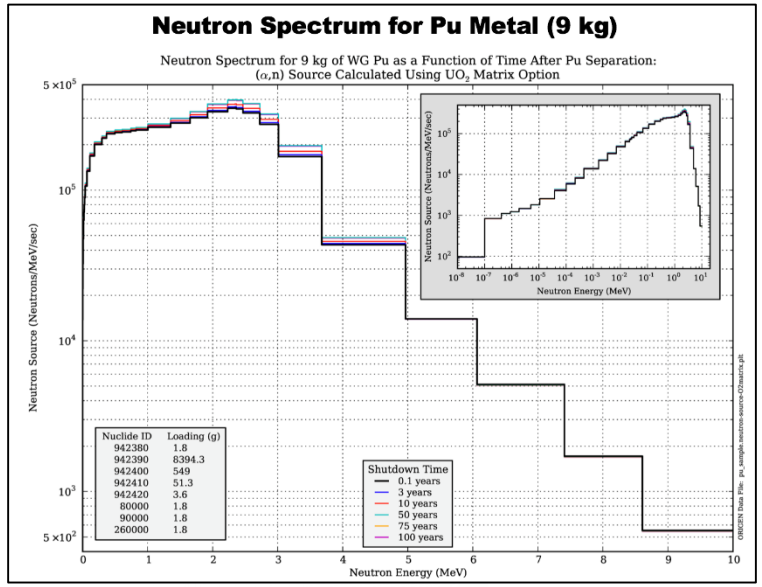
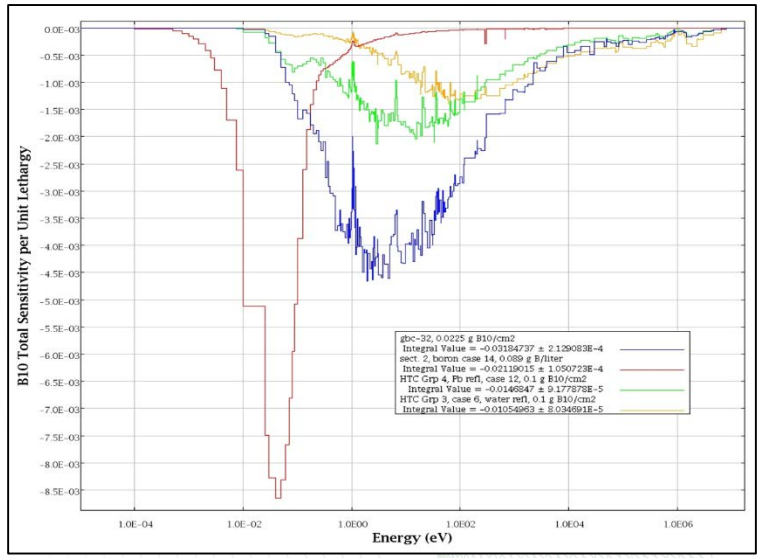
SARP Analyst Course

- The SARP analyst course provides
  - Detailed instructions on the radioactive material package shielding analyses and NCS evaluation fundamentals needed by analysts/practitioners to prepare and/or review technical analyses for the SARP documentation for a type B package for shipping fissionable materials
  - An overview of regulations and guidelines, in addition to detailed in-class exercises associated with package shielding and NCS analyses
  - An exercise setting up Monte Carlo N-Particle (MCNP) input files and interpreting results of shielding and criticality analyses
- Analysis teams will be presented with staged SARP examples in which several important decision processes required in the generation of a SARP will be demonstrated and discussed
  - For example, teams will learn how criticality analysis for a given payload mass may require either a mass reduction or package redesign





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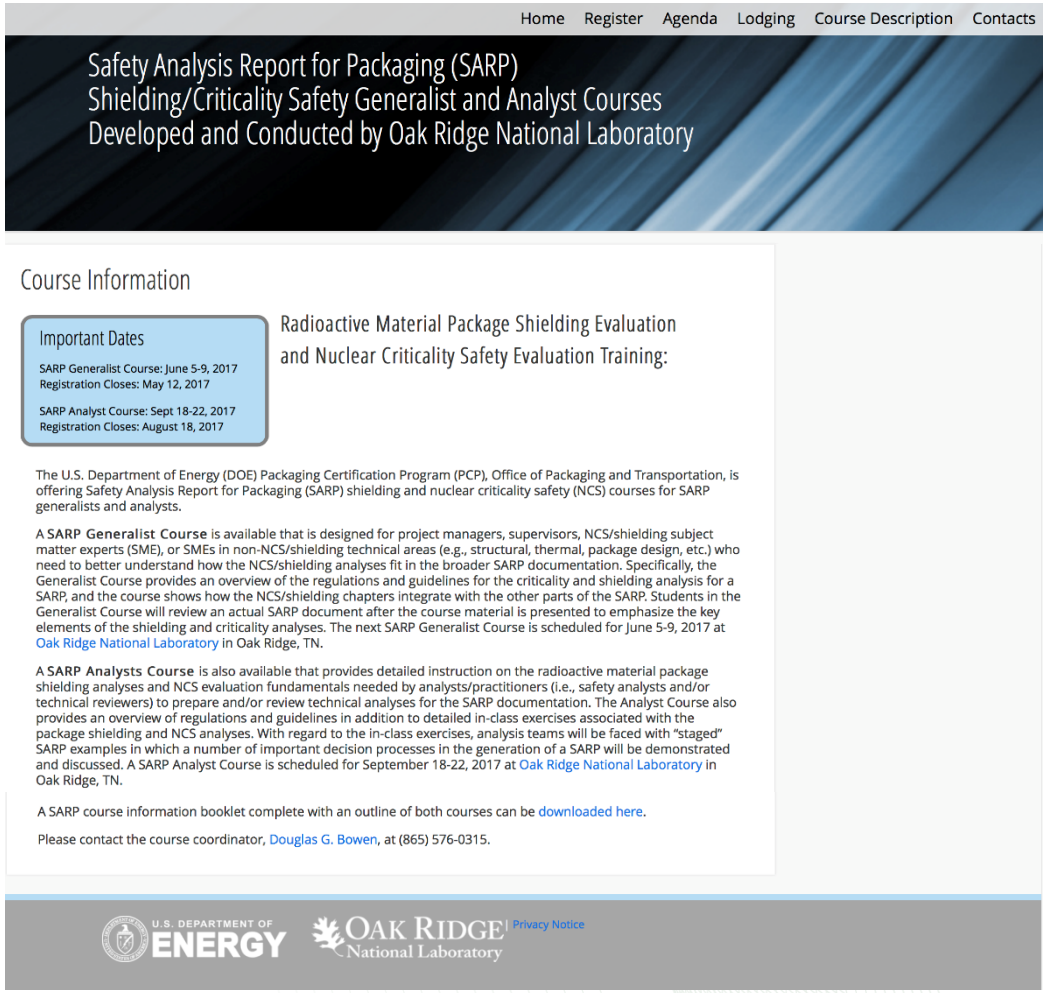
SARP Course Registration Options

- The DOE Packaging Certification Program's Office of Packaging and Transportation has collaborated with the University of Nevada, Reno (UNR) to establish a Nuclear Packaging Graduate Certificate Program
  - The UNR Department of Mechanical Engineering conducts this program for DOE and is currently the only university program for this purpose in the United States
  - The nine-credit-hour program consists of a combination of courses offered at UNR, as well as at three national laboratories, including ORNL
  - The SARP generalist and analyst courses will likely be part of this program starting in fiscal year 2018
  - Details about the certificate program can be found at the UNR Nuclear Packaging Certificate Program website: https://www.unr.edu/degrees/nuclear-packaging/certificate

SARP Course Registration Options

- Students interested in attending the SARP generalist and analyst courses but not the Nuclear Packaging Graduate Certificate program can register for the courses directly through the ORNL conference center
  - Registration links are provided at the Radioactive Material Packaging (RAMPAC) website (https://rampac.energy.gov) and announced throughout the year on the ORNL Radiation Safety Information Computational Center (RSICC) website (https://rsicc.ornl.gov) and in RSICC monthly newsletters
  - The SARP generalist course is offered each June, and the SARP analyst course is offered each September



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Are there any questions?

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