

**SRNL Training Courses for Packaging, Transportation, and Storage of  
Radioactive Material-17597**

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**Abstract**

The U.S. Department of Energy (DOE) Packaging Certification Program (PCP), Office of Packaging and Transportation has sponsored a suite of training courses that have been conducted since the early 1990s. Of these training courses, the Savannah River National Laboratory (SRNL) is currently leading the effort for two courses: (1) *Management of SARP Preparation*, and (2) *Nuclear and Other Radioactive Materials Transport Security and Leak Testing*. This paper provides an overview of both courses.

**Introduction and Objectives**

A burgeoning relationship between DOE and the University of Nevada, Reno (UNR)<sup>1</sup> continues to breath new depth and breadth to the PCP Packaging University program training students and nuclear industry professionals in packing and transporting radioactive material. For years DOE has been a primary source of safety education in the specialized field of radioactive material packaging, providing training to hundreds of government and industry professionals from the United States and overseas.

The Savannah River National Laboratory began leading two courses to support Packaging and transportation in the early 2000s. Each course is one week in duration and includes lectures, in-class exercises and discussions, homework assignments and a final exam. The two courses are: 1) *Management of Safety Analyses Report in Packaging (SARP) Preparation*; and, 2) *Radioactive Material Package Operations and Leak Testing*.

The objective of the *Management of SARP Preparation* course is to provide a basic understanding of the steps necessary to manage the development, submission, and utilization of a nuclear package Safety Analysis Report (SARP). The primary audience for this course is DOE and its contractors and other agency and industry personnel who are responsible for SARP management; SARP leads, writers, and developers; engineers and package designers; and others who support Type B and fissile radioactive material packaging and transportation operations.

The objective of the *Radioactive Material Package Operations and Leak Testing* course is two-fold. First to inform radioactive material package users of the requirements associated with the closing, opening, testing, and handling of packages containing Class 7 hazardous materials. Second, to provide an introduction to basic leak testing methods for packages containing Type A, AF and B quantities of Radioactive Material (RAM). The primary audience for this course is individuals that prepare, load/unload, operate (open/close), and maintain Type B, Type AF, and Type A packages for shipment of radioactive materials, those that prepare procedures and documentation related to these activities, as well as supervisors and managers of these individuals.

## **Discussion**

### ***Management of SARP Preparation***

The *Management of SARP Preparation* is split into a five-day course. The first day of the course focusses on enabling the students to contribute to improving the quality of the SARPs submitted to DOE, including a review of current and recent DOE specific guidance, the guides used for SARP format, and the content that is expected to be in each of the SARP chapters<sup>2</sup>. Key definitions discussed include: 1) defining what is in a SARP; 2) explaining why SARPS exist; and, 3) what is the basis for issuing a Certificate of Compliance (COC). Roles and responsibilities of the applicant, SARP Manager, SARP team as well as the review team during the SARP development and approval process are detailed. Day one also includes:

- Introduction to SARPs
- DOE Packaging Program PCP Requirements and Guidance
- Overview of the RAMPAC Website<sup>3</sup>
- Key Regulatory Requirements, Guidance, Codes & Standards
- Role of the ASME Code in RAM Packaging

Day two focusses on: 1) Forming and Managing the SARP Team; 2) Managing SARP Scope, Schedule and Cost; 3) Packaging Contents; 4) Package Evaluation by Analysis; and ,5) Package Evaluation by Testing.

Day three details: 1) SARP Production – Part 1 Format References and Application Packaging Quality Assurance Appendices; 2) SARP Production – Part 2 Technical Writing, Review and Assembly; 3) Reviews; 4) Package Evaluation by Analysis; and, 5) Package Evaluation by Testing.

Day four provides: 1) Discussions with the DOE Packaging Certification Program (PCP) Team; 2) Post Submittal Events, DOEs writing the Safety Evaluation Report and the CoC development; 3) Management of the Certified Package and the SARP; and, 4) Packaging Operations.

Day five focusses on a comprehensive review and time for answering questions, a test review and the exam.

### ***Radioactive Material Package Operations and Leak Testing***

The *Radioactive Material Package Operations and Leak Testing* is also split into a five-day course, but organized into seven half day sessions, and a half day for the final exam.

The courses first session - *Package Operation & Maintenance Requirements* – provided basic information that most package users are not aware of concerning Type B radioactive material packaging. The session started off explaining that radioactive material (RAM) packaging must ensure containment of radioactive material, maintain sub-criticality during normal and accident conditions, and

provide shielding to workers and public. Next students learned that safe radioactive material packaging is documented in a SARP for DOE package applications and in a Safety Analysis Report (SAR) for Nuclear Regulatory Commission (NRC) package applications. It was explained that a SARP or a SAR provides a comprehensive technical evaluation of the packaging that covers design, testing, operational and maintenance procedures, and quality assurance program and upon approval of a SARP by DOE or SAR by NRC a Certificate of Compliance (CoC) is issued which allows the package to be used to ship radioactive material. The differences between a SARP and facility safety basis are covered too. Since the course is primarily targeted to DOE users it focused on the use of SARPs to ship radioactive material. As such this session summarizes the purpose and contents of a SARP and identifies the SARP chapters important to package operation and maintenance which are Chapter 1 - *General Information*, Chapter 7 - *Package Operations*, and Chapter 8 - *Acceptance Tests & Maintenance Program*.

The second session of the course – *Package Contents* – highlights the importance of proper identification and characterization of the radioactive material contents that will be shipped in an approved radioactive material package. Students are presented with a variety of questions to consider when evaluating contents for SARP compliance. The various units used in content tables are covered along with explaining the potential consequences of mixing units or not recognizing the given units. Examples of both SARP and SAR approved content tables are presented and discussed showing the similarities and differences. Students learn the importance of accounting for measurement uncertainties when certifying SARP contents with specific examples presented. This session also outlines the process for adding new contents to a SARP.

The third session of the course – *Package Operations* – covered in detail the following elements of package operations and associated SARP requirements: package loading, package receipt, package unloading, preparation of empty package for transport, package storage, reporting incidents, and records maintenance. The purpose of SARP warnings, cautions, and notes are discussed. Information and

advice concerning required alpha, beta, and gamma radiological contamination surveys along with radiological dose rate measurements are presented. This session also addressed topics that need to be considered during package operations such as: Do site specific procedures need to match the SARP verbatim?; What level of verification to SARP requirements do site specific procedures need?; Should site specific procedures address unexpected conditions?; Should the package sealing surfaces be protected and how?; What qualifications are needed to perform a post load leak test?; and How much time should be allowed for adequate loading?

The fourth session of the course – *Packaging Equipment, Tools, & Purge Gases* – educated students on the types of equipment needed to support packaging operation and maintenance. Because most packages have torque requirements, a significant portion of this session deals with torque wrenches in terms of explaining the need for achieving torque compliance, discussing the different types of torque wrenches, and presenting examples of methodologies used to ensure SARP compliance with torque requirements. Examples of hoisting and rigging equipment typically used in package operations are also discussed and the importance of the equipment to be in good working condition in order to protect personnel safety and package compliance is addressed. Since some packages require purging with specified type and grade of gases, students are given examples of different purging requirements, explained why purge gases are needed for SARP compliance, shown how to ensure the SARP specified gas is procured, given suggestions on what to do if the SARP specified gas cannot be procured, and taught how to verify the SARP purge requirements are archived. This session stressed the importance of maintaining calibrated and controlled equipment that is often used during package operations to guard against reportable situations.

The fifth session of the course - *Package Maintenance & Leak Testing* – identified SARP required package inspections and the criteria to satisfy the inspections. The course explained how to handle the replacement of expendable parts, the need for part traceability, and the need for documentation of maintenance. Annual and post load (pre-shipment) leak test as defined by ANSI 14.5<sup>4</sup> were discussed. Post load

(pre-shipment leak test for two different packages with different type sealing surfaces is demonstrated to the students. This session included a package demonstration that followed SARP requirements for: package disassembly, loading of contents, package closure including bolt torque, post load (pre-shipment) leak test, radiation dose surveys and radiological contamination measurements.

The sixth session of the course - *Abnormal Conditions* – provided package users with information concerning how to handle abnormal conditions that are typically encountered during operations, such as damaged packages, noncompliant content, and procedure issues. The session discusses the requirements for notification, how to report an abnormal condition, how to document the condition, and how to document the resolution.

The 7<sup>th</sup> session of the course - *Lessons Learned from Package Operations* – explains lessons learned from examples of package operational issues. Most of the examples were related to the 9975 shipping container, but the lessons are applicable to any package. Topics covered during the lesson learned session are: content compliance, package closure, package inspections, records handling, and operational impacts from package fabrication. There is also an open student forum to discuss and capture lessons learned from course attendees.

Day five focusses on a comprehensive review and time for answering questions, a test review and the exam.

## **Conclusion**

Management of SARP Preparation focusses on: 1) the regulatory requirements, guidance, and applicable codes and standards used during the development of the SARP; 2) templates for the development of the SARP writing team and for estimating the scope, schedule, and cost associated with the development of the SARP; 3) Various ways to evaluate radioactive material packages as well as format

and write the SARP; and 4) The internal and external reviews associated with a SARP, as well as interaction with the regulatory organization that reviews the SARP for completeness and compliance with 10 CFR Part 71<sup>5</sup>. This course differs from the SARP Preparation course in that this the it focusses on managing the development of the SARP though the planning development and PCP review process versus the SARP modeling and mathematical expectations.

*Radioactive Material Package Operations and Leak Testing* course covers: 1) an overview of the regulatory aspects of a SARP, focusing on the requirements typically outlined in Chapters 1, 7, and 8; and, 2) A review of the basic elements required to establish a leak testing program at a facility, including an overview of regulatory and code requirements of leak testing while helping to understand the fundamentals and limitations of common leak testing methods. Hands-on leak testing using common methods as well as hands-on operations of select RAM packagings are performed in the class.

Almost anyone responsible for packaging and transportation of Type B quantities of radioactive material would greatly benefit from both classes. While those responsible for Type A quantities would also benefit most from attending the course entitled *Radioactive Material Package Operations and Leak Testing*.

## References

1. EM, University of Nevada, Reno Team on “Packaging University” at <https://energy.gov/em/articles/em-university-nevada-reno-team-packaging-university> (01/10/2017).
2. U.S. Nuclear Regulatory Commission, Regulatory Guide 7.9, *Standard Format and Content of Part 71 Applications for Approval of Packages for Radioactive Material*, Revision 2, March 2005.

3. RAMPAC, Radioactive Material Packaging at <https://rampac.energy.gov/> on (01/08/2017).
4. ANSI N 14.5 – 1997, "American National Standard for Radioactive Materials – Leakage Tests on Package for Shipment," ANSI, Inc., February 1998.
5. United States Code of Federal Regulations, 10 CFR Part 71, Packaging and Transportation of Radioactive Material.