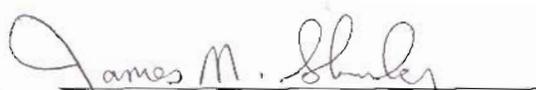


**Safety Evaluation Report for the  
Justification for Use of the Radio Frequency  
Identification (RFID) System  
Safety Analysis Report for Packaging  
Model 9975  
Addendum  
S-SARA-G-00008, Revision 0  
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## OVERVIEW

The Department of Energy (DOE) plans to incorporate a Radio Frequency Identification (RFID) system tag on Model 9975-85 Package. This action requires a review of each chapter of the Safety Analysis Report for Packaging (SARP) to ensure the RFID tag hardware is within the existing safety basis. The RFID tag will be incorporated on a Model 9975 Package to monitor parameters to be defined at a later date but could include temperature, tamper seal, shock, humidity, alarms, etc. The RFID hardware is identified as the DOE MK-II RFID tag as described in the Argonne National Laboratory (ANL) *Guide to the Radio Frequency Identification Monitoring System (Models 9975, 9977, and 9978 Packages)*. The DOE MK-II RFID tag is attached to the Model 9975 Package using two adjacent lid closure bolts that are longer than the standard closure bolt by 0.25 inches (1.50 versus 1.25 inches).

Once it is authorized by the DOE-Headquarters Certifying Official, this submittal is considered an Addendum to WSRC-SA-2002-00008, Revision 0, Safety Analysis Report for Packaging, Model 9975-85 Package, S-SARA-G-00001, Addendum 1, Revision 0, *Justification for Modified Contents Parameters*, Safety Analysis Report for Packaging, Model 9975-85 Package, S-SARA-G-00002, Addendum 2, Revision 1, *Justification for <sup>233</sup>U Content Envelope*, Safety Analysis Report for Packaging, Model 9975-85 Package, and S-SARA-G-00007, Addendum, Revision 1, *Justification for 9975 Gram Based Content Envelopes, C.10 and C.11*, Safety Analysis Report for Packaging, Model 9975-85.

## Chapter 1: General Information

This Safety Evaluation Report (SER) documents the DOE PCP staff review of S-SARA-G-00008, Addendum, Revision 0, *Justification for Use of the Radio Frequency Identification (RFID) System*, Safety Analysis Report for Packaging, Model 9975<sup>[1]</sup>— the Submittal — prepared for the Department of Energy (DOE) by Savannah River Packaging Technology, Savannah River National Laboratory, Savannah River Nuclear Solutions, Savannah River Site, to support incorporation of an DOE MK-II RFID tag onto the exterior of the Model 9975-85 Package. This section of the SER covers the review of the General Information provided in Chapter 1 of the Submittal.

It should be noted that this review does not cover any application of the DOE MK-II RFID tag to monitoring parameters such as temperature, tamper seal, shock, humidity, alarms, etc. These will be addressed in a later Addendum.

Once it is authorized by the DOE-Headquarters Certifying Official, this submittal is considered an Addendum to WSRC-SA-2002-00008, Revision 0, Safety Analysis Report for Packaging, Model 9975-85 Package,<sup>[2]</sup> S-SARA-G-00001, Addendum 1, Revision 0, *Justification for Modified Contents Parameters*, Safety Analysis Report for Packaging, Model 9975-85 Package,<sup>[3]</sup> S-SARA-G-00002, Addendum 2, Revision 1, *Justification for <sup>233</sup>U Content Envelope*, Safety Analysis Report for Packaging, Model 9975-85 Package,<sup>[4]</sup> and S-SARA-G-00007, Addendum, Revision 1, *Justification for 9975 Gram Based Content Envelopes, C.10 and C.11*, Safety Analysis Report for Packaging, Model 9975-85.<sup>[5]</sup>

The Model 9975-85 Package is currently certified by the DOE under Revision 22 to the Certificate of Compliance (CoC).<sup>[6]</sup>

The DOE MK-II RFID tag uses primary (non-rechargeable) lithium thionyl chloride batteries. These are the same type of batteries used in remote monitoring technology, such as the Automatic Meter Reader (AMR) market. Over 40 million AMR devices have been installed.<sup>[7]</sup> The DOE MK-II RFID tag uses four (4) each of the batteries to power an electronic monitoring device, located in a plastic housing, mounted to a metal-backing plate that is connected to a set of washers (1.0-inch by 3.74-inch by 0.19-inch thick), which secure the seal sensor.<sup>[8]</sup> The tag is attached to two of the shipping package's 24 lid bolts, which have been lengthened to 1.5 inches and secured with a second DOE MK-II RFID tag fastening nut (the primary lid closure nut is welded to the Model 9975 Packaging drum flange and permanently remains in place). The extended length bolts may be reused for lid closure without re-installing the DOE MK-II RFID tag. The DOE MK-II RFID tag is about 8 inches in length, 7 inches tall, 1.5 inches thick, and weighs about 2 pounds. The tag is contoured to the Model 9975 drum curvature at about 36°.

### Findings

Based on the review of the statements and representations in the Submittal, DOE PCP has concluded that the packaging design has been adequately described to meet the requirements of 10 CFR 71.<sup>[9]</sup>

### Conditions of Approval

DOE PCP has concluded that no additional General Information-related conditions of approval need to be added to the existing CoC for the approval of this request.

## **Chapter 2: Structural Evaluation**

This section of the SER covers the review of the Structural Evaluation information provided in Chapter 2 of the Submittal.

Details of the items reviewed are noted above in Chapter 1. The results of the structural review are discussed below.

The addition of the DOE MK-II RFID to the package does not significantly increase total package mass. The maximum content weight and packaging configuration authorized is essentially the same as evaluated in the Model 9975 Package SARP. The package structural performance documented in the existing Model 9975 Package SARP is valid for the addition of an attached DOE MK-II RFID.

### **Findings**

DOE PCP has concluded that the lithium thionyl chloride battery contained in the DOE MK-II RFID will not detonate, and in the extreme case, it might deflagrate when subjected to an internal short. Deflagration will not significantly load the structure beyond what has already been analyzed.

Based on the review of the statements and representations in the Submittal, plus the above determination by the DOE PCP staff, DOE PCP has concluded that the packaging design has been adequately described to meet the structural requirements of 10 CFR 71.

### **Conditions of Approval**

DOE PCP has concluded that no additional structurally-related conditions of approval need to be added to the existing CoC for the approval of this request.

## **Chapter 3: Thermal Evaluation**

This section of the SER covers the review of the Thermal Evaluation information provided in Chapter 3 of the Submittal.

Details of the items reviewed are noted above in Chapter 1. The results of the thermal review are discussed below.

A DOE MK-II RFID tag could be permanently attached to the outside drum of a Model 9975 Package, which will make the DOE MK-II RFID tag a part of the packaging during the whole length of its usage. Due to the small size ratio of the DOE MK-II RFID tag to a Model 9975 Package and the small amount heat generation from the DOE MK-II RFID tag, the thermal performance of the Model 9975 Package should not be affected, compared with the case without a DOE MK-II RFID tag.

During the HAC fire, the DOE MK-II RFID tag batteries will fail because their 85°C temperature limit will be exceeded.

### **Findings**

DOE PCP has concluded that the DOE MK-II RFID tag batteries will fail during the HAC fire but will not detonate. The failure will have an insignificant effect on the package.

### **Conditions of Approval**

DOE PCP has concluded that no additional thermally-related conditions of approval need to be added to the existing CoC for the approval of this request.

## **Chapter 4: Containment**

This section of the SER covers the review of the Containment information provided in Chapter 4 of the Submittal.

Details of the items reviewed are noted above in Chapter 1. The results of the containment review are discussed below.

The DOE MK-II RFID tag does not change or affect the packaging content, content configuration, or the containment vessels. The DOE MK-II RFID tag does not increase the content within the containment vessels; does not increase the evaluated maximum temperature or pressure that must be contained. Therefore, package containment *leaktight* performance (in accordance with ANSI Standard N-14.5<sup>(10)</sup>) as documented in the existing Model 9975 Package SARP is still valid.

### **Findings**

Based on the review of the statements and representations in the Submittal, DOE PCP has concluded that the packaging design has been adequately described to meet the requirements of 10 CFR 71.

### **Conditions of Approval**

DOE PCP has concluded that no additional containment-related conditions of approval need to be added to the existing CoC for the approval of this request.

## **Chapter 5: Shielding Evaluation**

This section of the SER covers the review of the Shielding Evaluation information provided in Chapter 5 of the Submittal.

Details of the items reviewed are noted above in Chapter 1. The results of the shielding review are discussed below.

### **Findings**

The DOE MK-II RFID tag does not change or affect the packaging content, content configuration, or shielding. Therefore, package shielding performance as documented in the existing Model 9975 Package SARP is still valid.

Based on the review of the statements and representations in the Submittal, DOE PCP has concluded that the packaging design has been adequately described to meet the requirements of 10 CFR 71.

### **Conditions of Approval**

DOE PCP has concluded that no additional shielding-related conditions of approval need to be added to the existing CoC for the approval of this request.

## Chapter 6: Criticality Evaluation

This section of the SER covers the review of the Criticality Evaluation information provided in Chapter 6 of the Submittal.

Details of the items reviewed are listed above in Chapter 1. The results of the criticality review are discussed below.

### Criticality Evaluation

The DOE MK-II RFID tag is located outside the drum. Therefore, it will increase the separation between the drums in the drum array and consequently reduces the reactivity of the drum array. The effect of DOE MK-II RFID material (mostly plastic and stainless steel) in the interstitial space in the drum array is to increase the isolation and reduce the interaction among the drum array, (as shown in the original analysis). However, this effect will be very small as the DOE MK-II RFID tags occupy a small portion in the interstitial space. Therefore, it is concluded that the Model 9975 Package with the DOE MK-II RFID is bounded by the original criticality evaluations.

### Findings

Based on the review of the statements and representations in the Submittal, DOE PCP has concluded that the packaging design has been adequately described to meet the requirements of 10 CFR 71.

### Conditions of Approval

The DOE PCP has concluded that no additional criticality-related conditions of approval need to be added to the existing CoC for the approval of this request.

## Chapter 7: Operating Procedures

This section of the SER covers the review of the Operating Procedures information provided in Chapter 7 of the Submittal.

Details of the items reviewed are noted above in Chapter 1. The results of the operating procedures review are discussed below.

### Findings

As part of the review, the DOE PCP staff has noted that the procedural steps for using the longer bolts for the DOE MK-II RFIDs have been included. The DOE PCP staff noted that there is no mention of the potential hazardous nature of the DOE MK-II RFID batteries, particularly if the batteries have been damaged. A condition should be added to the CoC, related to the use of the DOE MK-II RFID, that the RFID guidance<sup>[8]</sup> contains a copy of the Product Sheet/Material Safety Data Sheet, which provides information on the safe use of the batteries.

### Conditions of Approval

Because the requirements specified in the Operating Procedures Chapter of the SARP are normally incorporated, in their entirety, as Conditions of Approval in the CoC, DOE PCP has concluded that the new procedural steps specified in Chapter 7 of the Submittal, must be included as new Conditions of Approval in the CoC for the approval of this request. DOE PCP

will also add a condition to the CoC, related to the use of the DOE MK-II RFID, that the RFID guidance<sup>[8]</sup> contains a copy of the Product Sheet/Material Safety Data Sheet, which provides information on the safe use of the batteries.

## **Chapter 8: Acceptance Tests and Maintenance Program**

This section of the SER covers the review of the Acceptance Tests and Maintenance Program information provided in Chapter 8 of the Submittal.

Details of the items reviewed are noted above in Chapter 1. The results of the acceptance tests and maintenance review are discussed below.

### **Findings**

The applicant has concluded that, “The DOE MK-II RFID does not affect or change the package acceptance or maintenance requirements and therefore the package acceptance testing and maintenance program documented in the existing Model 9975 Package SARP remains valid.” With respect to the Maintenance Program, however, the DOE PCP recommends a condition be added to the CoC, related to the use of the DOE MK-II RFID, that the RFID guidance<sup>[8]</sup> contains a copy of the Product Sheet/Material Safety Data Sheet, which provides information on the safe use of the batteries.

### **Conditions of Approval**

DOE PCP will also add a condition to the CoC, related to the use of the DOE MK-II RFID, that the RFID guidance<sup>[8]</sup> contains a copy of the Product Sheet/Material Safety Data Sheet, which provides information on the safe use of the batteries.

## **Chapter 9: Quality Assurance**

This section of the SER covers the review of the Quality Assurance (QA) program description and packaging-specific QA requirements provided in Chapter 9 of the Submittal.

Details of the items reviewed are noted above in Chapter 1. The results of the quality assurance review are discussed below.

The Submittal describes that the QA Program for the Model 9975 Packaging is described in the *SARPs for the Model 9975 Packaging*. The Submittal also describes that the QA requirements for the DOE MK-II RFID tag are contained in the Argonne National Laboratory *Guide to the RFID Monitoring System (Models 9975, 9977, and 9978)*.<sup>[8]</sup> DOE PCP concurs that the addition of the DOE MK-II RFID tag to the package does not affect the QA program as stated in Chapter 9 of the existing SARP, and that Chapter 9 contain reasonably up-to-date descriptions of the applicant’s QA program and packaging-specific QA requirements. For purposes of this Submittal, DOE PCP agrees that the DOE MK-II RFID tag is a non-“Q” item.

### **Findings**

Based on review of the statements and representations in the Submittal, DOE PCP concludes that the QA program has been adequately described and meets the QA requirements of 10 CFR 71, Subpart H. Packaging-specific requirements are adequate to assure that the packaging is designed, fabricated, assembled, tested, used, maintained, modified, and repaired in a manner consistent with its evaluation.

## Conditions of Approval

DOE PCP has concluded that no additional QA-related conditions of approval need to be added to the existing CoC for the approval of this request.

## References

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- [1] *Justification for the Use of the Radio Frequency Identification (RFID) System*, Safety Analysis Report for Packaging, Model 9975, Addendum, S-SARA-G-00008, Revision 0, Savannah River Packaging Technology, Savannah River National Laboratory, Savannah River Nuclear Solutions, Savannah River Site, Aiken, SC (November 2009).
  - [2] Safety Analysis Report for Packaging, Model 9975-85, WSRC-SA-2002-00008, Revision 0, Radioactive Materials Packaging Technology, Savannah River Technology Center, Westinghouse Savannah River Company, Savannah River Site, Aiken, South Carolina (December 2003).
  - [3] *Justification for Modified Contents Parameters*, Safety Analysis Report for Packaging, Model 9975-85 Package, S-SARA-G-00001, Addendum 1, Revision 0 (April 2005).
  - [4] *Justification for <sup>233</sup>U Content Envelope*, Safety Analysis Report for Packaging, Model 9975-85 Package, S-SARA-G-00002, Addendum 2, Revision 1, Savannah River Packaging Technology, Savannah River National Laboratory, Washington Savannah River Company, Savannah River Site, Aiken, South Carolina (May 2008).
  - [5] *Justification for 9975 Gram Based Content Envelopes, C.10 and C.11*, Safety Analysis Report for Packaging, Model 9975-85, S-SARA-G-00007, Addendum, Revision 1, Savannah River Packaging Technology, Savannah River National Laboratory, Savannah River Nuclear Solutions, Savannah River Site, Aiken, South Carolina (August 2009).
  - [6] USA/9975/B(M)F-85 (DOE), *United States Department of Energy Certificate of Compliance for Radioactive Materials Packages, Model 9975*, Revision 22, United States Department of Energy, Washington, DC, expires March 31, 2011.
  - [7] *Advanced Lithium Battery Technology Key to AMR Market*, REMOTE Site & Equipment Magazine (April/May 2002.).
  - [8] *Guide to the RFID Monitoring System (Models 9975, 9977, and 9978 Packages)*, Argonne National Laboratory, ANL/DIS-09-5. December 3, 2009.
  - [9] Nuclear Regulatory Commission. 10 CFR Part 71, *Compatibility with IAEA Transportation Standards (TS-R-1) and Other Transportation Safety Amendments*; Final Rule, 69 F.R. 3698, pp. 3698–3814, January 26, 2004, as amended.
  - [10] American National Standards Institute, *American National Standard for Radioactive Materials-Leakage Tests on Packages for Shipment*, ANSI N14.5-1997, New York, New York, 10036.