SARP Completeness Checklist for EM-60, Revision 1

Docket Number: _____

Package Model Number: _____

SARP Document Number: _____ Revision: _____ Date: _____

Checklist Preparers

Chapter	Name of Primary Reviewer	Signature	Date
1			
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Revision History

Revision	Date	Description of Changes	Issued
0	1/16/2007	Initial Issue.	1/16/2007
1	3/14/2007	1. To eliminate redundancy and reduce the length of the checklist, the verbatim text of the regulations (i.e., 10CFR71) was deleted from the Requirements row/column; however, a reference to the §71 regulation, or other requirement, is listed in the Requirement or Requirement Basis column. 2. Since the checklist is based on the NRC Regulatory Guidance documents, the Requirement Basis column entries were reordered for consistency, with the Reg Guide reference listed first, unless the requirement is not in the Reg Guide (e.g., Doe Order). 3. Tables cells were lightly shaded (20% gray) to delineate major sections for readability, and darkly shaded (50% gray) when data entry is not required. 4. Revision History page added. 5. Footer revised so that the pages are numbered per the Chapter, and dynamically change as required. 6. Since this revision was substantial, Rev bars were not used to indiate changes.	3/15/2007

INSTRUCTIONS

The SARP Completeness Checklist is a tool to assist applicants and reviewers in determining whether a SARP is complete and contains all required information to perform a thorough review. It does not ensure that the SARP documentation is accurate, nor does it obviate the need for a thorough, independent technical review and/or confirmatory analysis.

This checklist is a fill-in type form, which also includes drop down menus where applicable. Use the Tab key to navigate between the fill-in form-fields. This form does not validate data entries; consequently, it's incumbent on the preparer to verify that the form is completed properly.

1. The person having lead responsibility for reviewing the SARP must sign and date the cover sheet of this Checklist.

2. The person(s) primarily responsible for reviewing each Chapter of the SARP must sign and date the cover sheet of this Checklist.

3. The "Satisfactory" column is for simple yes, no, or not applicable (N/A) answers only.

4. If an answer requires elaboration, add a sequential number in the Comment Reference Number column and use a separate continuation sheet for your comment. Attach the continuation sheet to the checklist.

5. The "SARP Location" column requires the specific location, within the SARP, where the requirement is addressed. (e.g., Page 22, 2.3.1, 3rd para.).

6. The basis for the SARP/checklist requirement is referenced in the "Requirement Basis" column. References to 10 CFR, Part 71 will be noted as §71.

7. RG references in the "Requirement Basis" column refers to the NRC Regulatory Guide 7.9, *STANDARD FORMAT AND CONTENT OF PART 71 APPLICATIONS FOR APPROVAL OF PACKAGES FOR RADIOACTIVE MATERIAL*, Revision 2, March, 2005, or NRC Regulatory Guide 7.10, *ESTABLISHING QUALITY ASSURANCE PROGRAMS FOR PACKAGING USED IN TRANSPORT OF RADIOACTIVE MATERIAL*, Revision 2, March, 2005

8. A cell shaded in its entirety requires no data entry

9. The Docket Number and Package Model Number (Page 1) are obtained from the EM-60 Docket Manager (see www.rampac.com).

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Chapter 1 – General Information

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
1.0	**GENERAL INFORMATION** This chapter of the SARP should present an introduction and a general description of the package.	RG 7.9, 1.			
1.1	**Introduction** This section should identify the following:	RG 7.9, 1.1			
	Proposed use(s) of the package				
	Model number	RG 7.9, 1.1 §71.33(a)(3)			
	Classification as Type B(U), B(M), or fissile material packaging	§71.33(a)(1)			
	In the case of fissile packages, the proposed Criticality Safety Index (CSI)	RG 7.9, 1.1			
1.2	**Package Description**	RG 7.9, 1.2			
1.2.1	**Packaging** The general packaging description should include the following information:	RG 7.9, 1.2.1 §71.33(a)			
	Overall dimensions, maximum (fully loaded) weight, minimum (empty) weight (if appropriate).				
	Containment features (identification of the containment system)				
	Neutron and gamma shielding features, including personnel barriers				
	Criticality control features, including neutron poisons, moderators, and spacers				
	Structural features, including lifting and tie-down devices, impact limiters or other energy-absorbing features, internal supporting or positioning features, outer shell or outer packaging, and packaging closure devices				
	Heat transfer features				
	Packaging markings				
	Identification and volumes of any coolants	§71.33(a)(6)			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
1.2.2	**Contents** This section should state the quantity of radionuclides to be transported. The description should include the following, if appropriate:	RG 7.9, 1.2.2 §71.33(b)			
	Identification and maximum quantity (radioactivity or mass) of the radioactive material	RG 7.9, 1.2.2 §71.33(b)(1)			
	Identification and maximum quantities of fissile constituents	RG 7.9, 1.2.2 §71.33(b)(2)			
	Chemical and physical form, including the density and moisture content, and the presence of any moderating constituents	RG 7.9, 1.2.2 §71.33(b)(3)			
	Location and configuration of contents within the packaging, including secondary containers, wrapping, shoring, and other material not defined as part of the packaging	RG 7.9, 1.2.2			
	Identification and quantity of nonfissile materials used as neutron absorbers or moderators. Extent of reflection and the atomic ratio of moderator to fissile constituents	RG 7.9, 1.2.2 §71.33(b)(4)			
	Any material subject to chemical, galvanic, or other reaction, including the generation of gases	RG 7.9, 1.2.2			
	Maximum weight of radioactive contents, and maximum weight of payload including secondary containers and packaging, if applicable	RG 7.9, 1.2.2 §71.33(b)(6)			
	Maximum decay heat	RG 7.9, 1.2.2 §71.33(b)(7)			
	Any loading restrictions	RG 7.9, 1.2.2			
	Maximum normal operating pressure	§71.33(b)(5)			
	Identification and volumes of any coolants	§71.33(b)(8)			
	Location and configuration of contents within the packaging, including secondary containers, wrapping, shoring, and other material not defined as part of the packaging	RG 7.9, 1.2.2			
	Description of the contents that is suitable for inclusion into the Certificate of Compliance (CoC), including the type and form of material and maximum quantity of material per package.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
1.2.3	**Special Requirements for Plutonium** This section should show that plutonium contents in quantities greater than 0.74 TBq (20 Ci) must be in solid form.	RG 7.9, 1.2.3 §71.63			
1.2.4	**Operational Features** In the case of complex package systems, this section should describe the operational features of the package, and include a schematic diagram showing all valves, connections, piping, openings, seals, containment boundaries, etc.	RG 7.9, 1.2.4			
1.3	**Appendix** The appendix should include engineering drawings for the packaging. The drawings should:	RG 7.9, 1.3			
	Clearly detail the safety features (*Q-features*) considered in the package evaluation.				
	Include a materials list, dimensions, valves, fasteners, and welder and welding procedure qualification requirements.				
	Specify, by appropriate weld symbol, the specifications for all packaging weld joints, including the nondestructive examination (NDE) method and the acceptance standard				
	Show gasketed joints in the containment system in sufficient detail to, as a minimum, show the surface finish and flatness requirements of the closure surfaces, the gasket or O-ring specification and, if appropriate, the method of gasket or O-ring retention.				
	The appendix should not include detailed construction drawings of large, complex packages.				
	Packages authorized for shipment must conform to the approved design; that is, each package must be fabricated in conformance to the engineering drawings.				
	The appendix should also include a list of references, applicable pages from referenced documents that are not generally available, supporting information on special fabrication procedures, determination of the package category, and other appropriate supplemental information.				

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Chapter 2 – Structural Evaluation

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
2.0	**STRUCTURAL EVALUATION** This chapter of the SARP should identify, describe, discuss, and analyze the principal structural design of the packaging, components, and systems important to safety. This chapter should also describe how the package complies with the performance requirements of 10 CFR 71	RG 7.9, 2.			
2.1	**Description of Structural Design**	RG 7.9, 2.1			
2.1.1	**Discussion** This section should identify the principal structural members and systems (such as the containment vessel, impact limiters, radiation shielding, closure devices, and ports) that are important to the safe operation of the package. The discussion should reference the locations of these items on the drawings and discuss their structural design and performance.	RG 7.9, 2.1.1			
2.1.2	**Design Criteria** This section should describe and reference load combinations and factors that serve as design criteria.	RG 7.9, 2.1.2			
	For each criterion, state the maximum allowable stresses and strains (as a percentage of the yield or ultimate values for ductile failure), and describe how the other structural failure modes (e.g., brittle fracture, fatigue, buckling) are considered.				
	If different design criteria are to be allowed in various parts of the packaging or for different conditions, this section should indicate the appropriate values for reach case.				
	Identify the criteria used for the impact evaluation.				
	Identify codes and standards that are used to determine material properties, design limits, or methods of combining loads and stresses.				
	In the event that the design criteria deviate from those specified by standard codes, or if such codes do not cover certain components, this section should provide a detailed description of the design criteria used as substitutes.				
2.1.3	**Weights and Centers of Gravity**	RG 7.9, 2.1.3			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	This section should list the total weight of the packaging and contents, and tabulate the weights of major individual subassemblies such that the sum of the parts equals the total of the package.				
	Identify the location of the package's center of gravity and any other centers of gravity referred to in the SARP.				
	Include a sketch or drawing that clearly shows the individual subassembly referred to and the reference point for locating its center of gravity.				
2.1.4	**Identification of Codes and Standards for Package Design** The section should identify established codes and standards proposed for use in package design, fabrication, assembly, testing, maintenance, and use.	RG 7.9, 2.1.4			
	Include an assessment of the applicability of the codes and standards.				
	Show that the proposed codes or standards are appropriate for the package category. The package categories are identified in RG 7.9, Table 2-1 (from RG 7.11) and NUREG/CR-3854. The structural design criteria based on the ASME BPVC should be addressed (i.e., the appropriate ASME BPVC section should be selected based on the number of A_2's of the proposed contents). Other codes and/or standards can be used as design criteria provided they can be justified to be as conservative as the ASME BPVC; however, justification for deviations from the ASME BPVC must be extremely comprehensive and detailed. Therefore, compliance with the ASME BPVC is strongly recommended.	RG 7.9, 2.1.4 RG 7.11 NUREG/CR-3854			
2.2	**Materials**	RG 7.9, 2.2			
2.2.1	**Material Properties and Specifications** The source of information in this section should by identified by publication and page number.	RG 7.9, 2.2.1			
	List the material mechanical properties used in the structural evaluation. These may include yield stress, ultimate stress, modulus of elasticity, ultimate strain, Poisson's ratio, density, and coefficient of thermal expansion.				
	If impact limiters are used, include either a compression stress-strain curve for the material or the force-deformation relationship for the impact limiter, as appropriate.				

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	For materials that are subjected to elevated temperatures, the appropriate mechanical properties under those conditions should be specified.				
	Where material properties are determined by testing, describe the test procedures, conditions, and measurements in sufficient detail to enable the reviewer to evaluate the validity of the results.				
2.2.2	**Chemical, Galvanic, or Other Reactions**	RG 7.9, 2.2.2 §71.43(d)			
	Describe the possible chemical, galvanic, or other reactions in the packaging or between the packaging and the package contents, as well as methods used to prevent significant reactions.				
	For each component material of the packaging, this section should list all chemically or galvanically dissimilar materials in contact with the component material.				
	Coatings used on internal or external package surfaces, any reactions resulting from water inleakage or cask flooding, and the possible generation of hydrogen or other gases from chemical or radiolytic interactions should be considered.				
	Galvanic interactions and the formation of a eutectic for components that are, or may be, in physical contact should also be considered.				
2.2.3	**Effects of Radiation on Materials** This section should describe any aging or damaging effects of radiation on the packaging materials. These effects may include degradation of seals, sealing materials, coatings, adhesives, and structural materials.	RG 7.9, 2.2.3 §71.43(d)			
2.3	**Fabrication and Examination**	RG 7.9, 2.3			
2.3.1	**Fabrication** This section should describe the fabrication processes used for the package, such as fitting, aligning, welding and brazing, heat treatment, and foam and lead pouring.	RG 7.9, 2.3.1			
	For fabrication specifications prescribed by an acceptable code or standard (e.g., those promulgated by the ASME or the AWS), the code or standard, including the code edition and addenda years, should be clearly specified on the engineering drawings. Unless the SARP justifies otherwise, specifications of the same code or standard used for design should be used for fabrication.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	For components for which no code or standard is applicable, the SARP should identify the specifications on which the evaluation depends, and describe the method of control to ensure that these specifications are achieved. This description may reference QA or other appropriate specification documents, which should also be identified on the engineering drawings.				
2.3.2	**Examination** This section should describe the methods and criteria by which the fabrication is determined to be acceptable. Unless the SARP justifies otherwise, specifications of the same code or standard used for fabrication should also be used for examination.	RG 7.9, 2.3.2			
	For components that have no applicable fabrication code or standard, this section should summarize the examination methods and acceptance criteria contained in Chapter 8 (Acceptance Tests and Maintenance Program).				
2.4	**General Requirements for All Packages**	RG 7.9, 2.4			
	This section should address the following requirements of 10CFR71.43, "General Standards for All Packages" **Note:** The requirements of §71.43(d) (chemical and galvanic reactions) were addressed in Section 2.2.2 of this checklist, and the requirements of §71.43(e) (package valve or other device) and §71.43(h) (venting during transport) are addressed in Section 4.1.	RG 7.9, 2.4 §71.43			
2.4.1	**Minimum Package Size** The smallest overall dimension of a package may not be less than 10 cm (4 in).	RG 7.9, 2.4.1, §71.43(a)			
2.4.2	**Tamper-Indicating Feature** This section should describe the package closure system in sufficient detail to show that it incorporates a protective feature that, while intact, is evidence that unauthorized persons have not tampered with the package.	RG 7.9, 2.4.2 §71.43(b)			
	The description should include covers, ports, or other access that must be closed during normal transportation. Tamper indicators and their locations should be described.				
2.4.3	**Positive Closure** This section should describe the package closure system in sufficient detail to show that it cannot be inadvertently opened, either unintentionally or by	RG 7.9, 2.4.3 §71.43(c)			

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	a pressure that may arise within the package.				
	This description should include covers, valves, or any other access that must be closed during normal transportation.				
2.5	**Lifting and Tiedown Standards for All Packages**	RG 7.9, 2.5			
2.5.1	**Lifting Devices** This section should identify all devices and attachments that could be used to lift the package or its lid, and show by testing or analysis that the devices comply with §71.45(a) requirements.	RG 7.9, 2.5.1 §71.45(a)			
	Include drawings or sketches that show the location and construction of these devices.				
	Show the effects of forces imposed by the lifting devices on other packaging surfaces.				
	Show that the documented values of the yield stresses of the materials were used as the criteria to demonstrate compliance with §71.45(a), including failure under excessive load.				
2.5.2	**Tie-down Devices** Describe the overall tie-down system for the package. Identify any device that is a structural part of the package and can be used for tie-down.	RG 7.9, 2.5.2 §71.45(b)			
	Include drawings or sketches that show the location and construction of the overall tie-down system and individual devices.				
	Discuss the testing or analysis that show these devices comply with the requirements of §71.45(b), and show the effect of imposed forces of vital package components, including the interfaces between the tiedown devices and other packaging surfaces.				
	Show that documented values of the yield stresses of the materials were used as the criteria for demonstrating compliance with §71.45(b), including failure under excessive load.				
2.6	**Normal Conditions of Transport**	RG 7.9, 2.6			
	This section should describe the evaluation that shows the package meets the standards specified in §71.43 and §71.51 when it is subjected to the tests and conditions specified in §71.71. The package should be evaluated against each condition individually. The evaluation should show that the	RG 7.9, 2.6 §71.71			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	package satisfies the applicable performance requirement specified in the regulations.				
	Structural evaluation of the package under NCT may be performed by analysis or test or a combination of both. This section should clearly show that the most limiting initial test conditions and most damaging orientations have been considered, and that the evaluation methods are appropriate and properly applied.				
	The following general information should be considered and included, as appropriate:				
	For evaluation by test, the test method, procedures, equipment, and facilities that were used should be described.				
	Package orientations that were evaluated for the tests should be clearly identified and justified as being the most damaging, if applicable.				
	If the package tested was not identical in all respects to the package described in the SARP, the differences should be identified and a justification given to show that the differences will not affect the test results.				
	Materials used as substitutes for the radioactive contents during the tests should be described and a justification showing that this substitution would not affect the results should be provided. The justification should include an assessment of the effects of internal decay heat and pressure buildup, if appropriate.				
	A detailed and quantitative description of the damage caused by the tests should be provided, along with the results of any measurements that were made, including both interior and exterior damage, as well as photographs of the damaged packaging.				
	For prototype and model testing, this section should provide a complete description of the test specimen, including detailed drawings that show its dimensions and materials of construction and dimensional tolerances to which the prototype or model was fabricated. Fabrication tolerances of the test specimen should be compared to those that will be used for the package.				
	For scale models, this section should identify the scale factor that was				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	used, and provide a detailed description of the laws of similitude that were used for testing, considering time scale, material density, velocity at impact, and kinetic energy. Information should be provided to show that the model test would give conservative results for peak g-force, maximum deformation, and dissipated energy. In addition, the damage done to the model should be correlated to damage that could occur to the package had the package undergone the same test(s).				
	For evaluation by analysis, this section should describe the methods and calculations used in the package evaluation in sufficient detail to enable the reviewer to verify the results. This section should clearly describe and justify all assumptions used in the analysis, and include adequate narration, sketches, and free body force diagrams. In addition, for equations that were used in the analysis, this section should either cite the source or include the derivation.				
	Computer programs should be identified and described, and should be shown to be well benchmarked, widely used for structural analysis, and applicable to the evaluation.				
	Computer models and related details should be well described and justified. For example, the number of discrete finite elements used in the model should reflect the type of analysis performed and should be appropriate considering such factors as stress or displacement.				
	Sensitivity studies used to determine the appropriate number of nodes or elements for a particular model should be provided.				
	A detailed description of the modeling of the bolted connections, including element types, modeling technique, and material properties should be included.				
	For impact analysis, information should be provided that shows how all of the kinetic energy would be dissipated, and what local deformation and dynamic forces would occur during impact, the package response in terms of stress and strain to components and structural members, the structural stability of individual members, stresses attributable to impact combined with those stresses caused by temperature gradients, differential thermal expansions, pressure, and other loads.				
	Analytical results should be directly compared with the acceptance criteria.				

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	An assessment showing that the NCT does not reduce the effectiveness of the packaging should be included.				
2.6.1	**Heat** The thermal evaluation for the heat test should be described and reported in Chapter 3 (Thermal Evaluation) of the SARP. The results of the Thermal Evaluation should be used as input to the following sections:	RG 7.9, 2.6.1 §71.71(c)(1)			
2.6.1.1	**Summary of Pressures and Temperatures** This section should summarize all of the temperatures and pressures, as determined in the Thermal Evaluation (Chapter 3.0), that will be used to perform calculations in SARP Section 2.6.1.2 through Section 2.6.1.4.	RG 7.9, 2.6.1.1			
2.6.1.2	**Differential Thermal Expansion** This section should present calculations of the circumferential and axial deformations and stresses (if any) that result from differential thermal expansion. Steady state and transient conditions should be considered. The calculations should be sufficiently comprehensive to demonstrate package integrity under NCT.	RG 7.9, 2.6.1.2			
2.6.1.3	**Stress Calculations** This section should present calculations of the stresses that are attributable to the combined effects of thermal gradients, pressure, and mechanical loads (including fabrication stresses from lead pour and lead cool down, if applicable), sketches that show the configuration and dimensions of the members or systems being analyzed and the points at which stresses are calculated should be provided. The analysis should consider whether repeated cycles of thermal loadings, together with other loadings, would cause fatigue failure or extensive accumulations of deformation.	RG 7.9, 2.6.1.3			
2.6.1.4	**Comparison with Allowable Stresses** This section should present the appropriate stress combinations and compare the resulting stresses with the design criteria specified in the SARP, and should show that all the relevant performance requirements have been satisfied as specified in the regulations.	RG 7.9, 2.6.1.4			
2.6.2	**Cold** The thermal evaluation for the cold test should be described and reported in Chapter 3 (Thermal Evaluation) of the SARP.	RG 7.9, 2.6.2 §71.71(c)(2)			
	Using the results from Chapter 3 of the SARP, this section should assess				

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	the effects that the cold condition has on the package, including material properties and possible liquid freezing and lead (Pb) shrinkage.				
	The resulting temperatures and their effects on package components and operation of the package should be reported.				
	Brittle fracture should be evaluated.				
	Stresses should be within the limits for normal condition loads.				
	For the sequential hypothetical accident test series, -29 °C (-20 °F) is the lowest service temperature that needs to be considered as specified in §71.73(b).				
2.6.3	**Reduced External Pressure** This section should describe the evaluation of the package for the effects of reduced external pressure as described in §71.71(c)(3). The evaluation should include the greatest pressure difference between the inside and outside of the package, as well as the inside and outside of the containment system, and evaluate this condition in combination with the maximum normal operating pressure.	RG 7.9, 2.6.3 §71.71(c)(3)			
2.6.4	**Increased External Pressure** This section should describe the evaluation of the package and show that it meets the requirements for the effects of increased external pressure as specified in §71.71(c)(4).	RG 7.9, 2.6.4 §71.71(c)(4)			
	The evaluation should include the greatest pressure difference between the inside and outside of the package, as well as the inside and outside of the containment system, and evaluate this condition in combination with the minimum internal pressure.				
	A buckling evaluation should be included.				
2.6.5	**Vibration** This section should describe the evaluation of the package for the effects of vibrations that are normally incident to transport. The combined stresses attributable to vibration, temperature, and pressure loads should be considered and a fatigue analysis should be included, if applicable.	RG 7.9, 2.6.5 §71.71(c)(5)			
	If closure bolts are reused, the bolt preload should be considered in the fatigue evaluation.				

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	Packaging components, including internals, should be evaluated for resonant vibration conditions that could cause rapid fatigue damage.				
2.6.6	**Water Spray** This section should show that the water spray test has no significant effect on the package.	RG 7.9, 2.6.6 §71.71(c)(6)			
2.6.7	**Free Drop** This section should describe the package evaluation for the effects of a free drop. The general comments of Section 2.7.1 (HAC Free Drop) may also apply to this section.	RG 7.9, 2.6.7 §71.71(c)(7)			
	The free drop test follows the water spray test.				
	This section should also address such factors as drop orientation, effects of free drop in combination with pressure, heat, and cold temperatures and other factors discussed in Section 2.6.				
2.6.8	**Corner Drop** If applicable, this section should describe the effects of the corner drop test on the package.	RG 7.9, 2.6.8 §71.71(c)(8)			
2.6.9	**Compression** For packages weighing up to 5,000 kg (11,000 lbs), this section should describe the effects of compression on the package.	RG 7.9, 2.6.9 §71.71(c)(9)			
2.6.10	**Penetration** This section should describe the effects of penetration on the package and should identify the most vulnerable location on the package surface.	RG 7.9, 2.6.10 §71.71(c)(10)			
2.7	**Hypothetical Accident Conditions**	RG 7.9, 2.7			
	This section should describe the evaluation that shows the package meets the standards specified in §71.51, §71.55(e), and §71.59(a)(2), when subjected to the tests specified in §71.73.	RG 7.9, 2.7 §71.73			
	The structural evaluation should consider the hypothetical accident conditions specified in 10 CFR 71.73, in the indicated sequence, to determine their cumulative effect on a package. Damage caused by each test is cumulative, and the evaluation of the ability of a package to withstand any one test must consider the damage that resulted from the previous tests. This section should confirm that the package effectiveness has not been reduced as a result of the normal conditions of transport, as				

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	included in Section 2.6. Brittle fracture should also be considered. This section should include applicable information regarding tests and analyses, as described in Section 2.6, above.				
2.7.1	**Free Drop** This section should evaluate the package under the free drop test. The performance and structural integrity of the package should be evaluated for the drop orientation that causes the most severe damage, including center-of-gravity-over-corner, oblique orientation with secondary impact (slap down), side drop, and drop onto the closure. Orientations for which the center of gravity is directly over the point of impact should also be considered. An orientation that results in the most damage to one system or component may not be the most damaging for other systems and components. If a feature such as a tie-down component is a structural part of the package, it should be considered in selecting the drop test configurations and drop orientation. For these reasons, it is usually necessary to consider several drop orientations. The following items should be addressed, if applicable:	RG 7.9, 2.7.1 §71.73(c) §71.73(c)(1)			
	For packages with lead shielding, the package should be evaluated for the effects of lead slump. This evaluation of lead slump should be consistent with that used in the shielding evaluation.				
	The closure lid bolt design (or closure system for designs using something other than closure lid bolts) should be assessed for the combined effects of free drop impact force, internal pressures, thermal stress, O-ring compression force, and bolt preload.				
	Buckling of package components should be evaluated.				
	Other package components, such as port covers, port cover plates, and shield enclosures should be evaluated for the combined effects of the package drop impact force, puncture, internal pressures, and thermal stress.				
2.7.1.1	**End Drop** This section should describe the effects of the end drop test on the package.	RG 7.9, 2.7.1.1			
2.7.1.2	**Side Drop** This section should describe the effects of the side drop test on the package.	RG 7.9, 2.7.1.2			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
2.7.1.3	**Corner Drop** This section should describe the effects of the corner drop test on the package.	RG 7.9, 2.7.1.3			
2.7.1.4	**Oblique Drops** This section should describe the effects of oblique drops or provide information that shows that the end, side, and corner drops are more damaging to all systems and components that are vital to safety.	RG 7.9, 2.7.1.4			
2.7.1.5	**Summary of Results** This section should describe the condition of the package after each drop test, and describe the damage for each orientation.	RG 7.9, 2.7.1.5			
2.7.2	**Crush** If applicable, this section should describe the effects of the dynamic crush test on the package.	RG 7.9, 2.7.2 §71.73(c)(2)			
2.7.3	**Puncture** This section should describe the effects of puncture on the package, and identify and justify that the orientations for which maximum damage would be expected have been evaluated.	RG 7.9, 2.7.3 §71.73(c)(3)			
	The description should consider any damage resulting from the free drop and crush tests, as well as both local damage near the point of impact of the puncture bar and the overall effect on the package.				
	Containment system valves and fittings should be addressed. Punctures at oblique angles, near a support valve, at the package closure, and at a penetration should be considered, as appropriate.				
	General comments provided in Sections 2.6 (NCT) and 2.7.1 (Free Drop) may also apply to this test condition.				
	Although analytical methods are available for predicting puncture, empirical formulas derived from puncture test results of laminated panels are usually used for package design. The Nelm's formula developed specifically for package design provides the minimum thickness needed for preventing the puncture of the steel surface layer of a typical steel-lead-steel laminated cask wall.				
2.7.4	**Thermal** The thermal test should follow the free drop, crush and puncture tests.	RG 7.9, 2.7.4 §71.73(c)(4)			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	This section should evaluate the structural design for the effects of a fully engulfing fire as specified in §71.73(c)(4). Any damage resulting from the free drop, crush, and puncture conditions should be incorporated into the initial condition of the package for the fire test. The temperatures resulting from the fire and any increase in gas inventory caused by combustion or decomposition processes should be considered when determining the maximum pressure in the package during or after the test. The maximum thermal stresses, which can occur during or after the fire, should be assessed.				
	Except as noted in Section 2.7.4.1 through Section 2.7.4.4, detailed results of the thermal test should be reported in Chapter 3 (Thermal Evaluation) of the SARP.				
2.7.4.1	**Summary of Pressures and Temperatures** This section should provide a summary of all the temperatures and pressures, as determined in Chapter 3 of the SARP.	RG 7.9, 2.7.4.1			
2.7.4.2	**Differential Thermal Expansion** This section should include calculations for the circumferential and axial deformations and stresses (if any) that result from differential thermal expansion. Peak conditions, post-fire steady-state conditions, and all transient conditions should be considered.	RG 7.9, 2.7.4.2			
2.7.4.3	**Stress Calculations** This section should include calculations of the stresses caused by thermal gradients, differential expansion, pressure, and other mechanical loads.	RG 7.9, 2.7.4.3			
	Sketches showing the configuration and dimensions of the members of systems under investigation, and locations of the points at which the stresses are being calculated, should be included.				
2.7.4.4	**Comparison with Allowable Stresses** This section should make the appropriate stress combinations and compare the resulting stresses with the design criteria in Section 2.1.2. This section should demonstrate that the performance requirements specified in the regulations have been satisfied.	RG 7.9, 2.7.4.4			
2.7.5	**Immersion -- Fissile Material** If the contents include fissile material subject to the requirements of §71.55, and if water leakage has not been assumed for the criticality	RG 7.9, 2.7.5 §71.73(c)(5)			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	analysis, this section should assess the effects and consequences of the water immersion test condition. The test should consider immersion of a damaged specimen under a head of water of at least 0.9 m (3 ft) in the orientation for which maximum leakage is expected.				
2.7.6	**Immersion -- All Packages** This section should evaluate the undamaged package for water pressure equivalent to immersion under a head of water of at least 15 m (50 ft) for 8 hours. For test purposes, an external water pressure of 150 kPa (21.7 psi) gauge is considered to meet these conditions.	RG 7.9, 2.7.6 §71.73(c)(6)			
2.7.7	**Deep Water Immersion Test (for Type B Packages Containing More than 10^5 A_2)** If applicable, this section should evaluate the package for an external water pressure of 2 MPa (290 psi) for a period of not less than 1 hour, as specified in §71.61. Note: The pressure should be assumed to be gauge, and the internal pressure should be assumed to be 0 atm. Although §71.61 is silent on this issue, this guidance is consistent with the pressure requirement specified in §71.73(c)(6).	RG 7.9, 2.7.7 §71.61			
2.7.8	**Summary of Damage** This section should describe the condition of the package after the accident test sequence. The description should address the extent to which safety systems and components have been damaged, and relate the package condition to the acceptance standards.	RG 7.9, 2.7.8			
2.8	**Accident Conditions for Air Transport of Plutonium**	RG 7.9, 2.8			
	If applicable, this section should address the accident conditions in §71.74. Note: The SARP should provide an explanation of why the requirement does not apply.	RG 7.9, 2.8 §71.74			
2.9	**Accident Conditions for Fissile Material Packages for Air Transport**	RG 7.9, 2.9			
	If applicable, this section should address the accident conditions in §71.55(f).	RG 7.9, 2.9 §71.55(f)			
2.10	**Special Form**	RG 7.9, 2.10			
	For packages designed to transport radioactive material only in special	RG 7.9, 2.10			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	form, this section should state that the contents meet the requirements specified in §71.75 when subjected to the applicable test conditions specified in §71.77.	§71.75			
	The chemical and physical form should be specified.				
	If the source is not a doubly encapsulated right circular cylinder of welded construction, this section should include a detailed drawing of the encapsulation showing its dimensions, materials, manner of construction, and method of nondestructive examination.				
2.11	**Fuel Rods**	RG 7.9, 2.11			
	In Section 4, Containment, where fuel rod cladding is considered to provide containment of radioactive material under NCT or HAC conditions, this section should provide an analysis or test results showing that the cladding will maintain sufficient mechanical integrity to provide the degree of containment claimed.				
2.12	**Appendix**	RG 7.9, 2.12			
	The appendix should include a list of references, copies of applicable references if not generally available, computer code descriptions, input and output files, test results, test reports, and other appropriate supplemental information. The appendix should also include materials and manufacturing specifications for items that are significant with respect to safety, but are not produced to generally recognized standards.				

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Chapter 3 – Thermal Evaluation

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
3.0	**THERMAL EVALUATION** This chapter of the SARP should identify, describe, discuss, and analyze the principal thermal engineering design of the packaging, components, and systems that are important to safety, and describe how the package complies with the performance requirements of §71.	RG 7.9, 3.			
3.1	**Description of Thermal Design**	RG 7.9, 3.1			
	This section should describe the significant thermal design features and operating characteristics of the package, and discuss the operation of all subsystems.	RG 7.9, 3.1 §71.33(a)(5)(v)			
	The thermal criteria that will be applied directly to thermal results (e.g., maximum fuel temperature, shield temperature not to exceed melt) should be identified.				
	Properties evaluated in Chapter 3 of the SARP that are used to support other evaluations (e.g., pressure, temperature, distributions relative to thermal stress) should also be identified.				
	The significant results of the thermal analysis or tests and the implication of these results on the overall package should be summarized.				
	The minimum and maximum decay heat loads assumed in the thermal evaluation should be specified. The maximum decay heat load assumed should be consistent with the source terms assumed in the shielding and containment analyses.				
	This section should identify any coolants and their volumes with respect to the package and should document the evaluation of their effects on the packaging's performance.	§71.33(b)(8)			
3.1.1	**Design Features** This section should describe design features important to thermal performance, including the following:	RG 7.9, 3.1.1			
	Package geometry and materials of construction.				
	Structural and mechanical features that may affect heat transfer, such as cooling fins, insulating materials, surface conditions of the package				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	components, and gaps or physical contacts between internal components.				
3.1.2	**Content's Decay Heat** The maximum decay heat and radioactivity of the contents should be specified. This section should show the derivation of decay heat and that it is consistent with the maximum quantity of radioactive contents.	RG 7.9, 3.1.2			
3.1.3	**Summary Tables of Temperatures** This section should present summary tables of the maximum or minimum temperatures that affect structural integrity, containment, shielding, and criticality under both NCT and HAC.	RG 7.9, 3.1.3			
	For the thermal test condition, the tables should also include: The maximum temperatures of various package components and the time that they occur after fire initiation.				
	The maximum temperatures of the post-fire steady-state condition.				
3.1.4	**Summary Tables of Maximum Pressures** The summary tables should include the maximum normal operating pressure and the maximum pressure under HAC.	RG 7.9, 3.1.4			
3.2	**Material Properties and Component Specifications**	RG 7.9, 3.2			
3.2.1	**Material Properties** This section should specify the appropriate thermal properties for materials that affect heat transfer both within the package and from the package to the environment.	RG 7.9, 3.2.1			
	Liquids or gases within the package and gases external to the package for HAC should be included.				
	Thermal absorptivities and emissivities should be appropriate for the package surface conditions and each thermal condition.				
	When reporting a property as a single value, the evaluation should show that this value bounds the equivalent temperature-dependent property.				
	This section should also include references for the data cited.				
3.2.2	**Component Specifications** This section should include the technical specifications of components that are important to the thermal performance of the package, as illustrated by the following examples:	RG 7.9, 3.2.2			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	In the case of valves or seals, the operating pressure range and temperature limits.				
	Properties of fabricated insulation and coatings, including a summary of test data that supports their performance specifications.				
	The maximum allowable service temperatures or pressures for each package component.				
	The minimum allowable service temperature of all components, which should be less than or equal to -40 °C (-40 F).				
3.3	**Thermal Evaluation Under Normal Conditions of Transport**	RG 7.9, 3.3			
	This section should describe the thermal evaluation of the system and subsystem operation under NCT.				
	The temperature ranges bounded by the minimum and maximum ambient temperatures and the minimum and maximum decay heat loads should be considered. The results should be compared with allowable limits of temperature, pressure, etc., for the package components.				
	The information should be presented in summary tables, along with statements and appropriate comments. Information that is to be used in other sections of the SARP should be identified.				
	The margins of safety for package temperatures, pressures, and thermal stresses, including the effects of uncertainties in thermal properties, test conditions and diagnostics, and analytical methods, should be addressed.				
	The analysis or test results should be shown to be reliable and repeatable.				
	The following general information should be considered and included, as appropriate, when addressing this section:	RG 7.9, 3.3			
	For thermal evaluation by analyses, the methods and calculations used in the package thermal evaluation should be described in sufficient detail to enable the reviewer to verify the results.				
	Assumptions used in the analysis should be clearly described and justified.				
	For computer analyses that include finite element analyses, the computer program should be described and shown to be well benchmarked and widely used for thermal analyses and applicable to the evaluation.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	The models and modeling details should be clearly described.				
	For thermal evaluation by test, the test method, procedures, equipment, and facilities that were used should be described.				
	If the specimen tested is not identical in all respects to the package described in the SARP, the differences should be described and justification given that these differences will not affect the test results.				
	Temperature data should be reported at gaskets, valves, and other containment boundaries, particularly for temperature-sensitive materials, as well as for the overall package.				
	Some conditions, such as ambient temperature, decay heat of contents, or package emissivity or absorptivity, may not be exactly represented in a thermal test. Appropriate corrections or evaluations that account for these differences should be fully described.				
	Both interior and exterior temperatures should be included.				
	The damage caused by the tests and the results of any measurements that were made should be reported in detail, including photographs of the testing and the test specimen.				
3.3.1	**Heat and Cold** This section should demonstrate that the tests for NCT do not result in significant reduction in packaging effectiveness. The following items should be considered and addressed:	RG 7.9, 3.3.1			
	Degradation of the heat-transfer capability of the packaging (such as creation of new gaps between components).				
	Changes in material conditions or properties (e.g., expansion, contraction, gas generation, and thermal stresses) that affect the structural performance.				
	Changes in the packaging that affect containment, shielding, or criticality (such as thermal decomposition or melting of materials).				
	Ability of the packaging to withstand the tests under HAC.				
	The component temperatures and pressures should be compared with their allowable values.				
	This section should explicitly show that the package meets the maximum surface temperature requirements specified in §71.43(g).				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
3.3.2	**Maximum Normal Operating Pressure** This section should report the maximum normal operating pressure and show how it was calculated, assuming the package has been subjected to the heat condition for one year. The calculation should consider all possible sources of gases, including the following:	RG 7.9, 3.3.2			
	Gases initially present in the package.				
	Saturated vapor, including water vapor from the contents or packaging.				
	Helium from the radioactive decay of the contents.				
	Hydrogen or other gases resulting from thermal- or radiation-induced decomposition of materials such as water or plastics.				
	Fuel rod failure.				
	It should be demonstrated that hydrogen and other flammable gases would not result in a flammable mixture within any confined volume of the package.				
3.4	**Thermal Evaluation Under Hypothetical Accident Conditions**	RG 7.9, 3.4			
	This section should describe the thermal evaluation of the package under HAC. The HAC conditions in §71.73 should be applied sequentially. For the accident condition thermal evaluation, general comments in Section 3.3, above, should be considered and addressed, as appropriate.	RG 7.9, 3.4 §71.73(c)(4)			
3.4.1	**Initial Conditions** The thermal evaluation should consider the effects of the drop, crush (if applicable), and puncture tests. This section should identify the initial conditions and justify that they are the most unfavorable, including initial ambient temperature, insolation, internal pressure, decay heat, etc.	RG 7.9, 3.4.1			
3.4.2	**Fire Test Conditions** The test or analysis used to evaluate the package under the thermal (fire) test conditions should be described in detail. The evaluation should address the requirements in §71.73(c).	RG 7.9, 3.4.2			
3.4.3	**Maximum Temperatures and Pressure** This section should report the transient peak temperatures of the package components as a function of time both during and after the thermal test, as well as the maximum temperatures from the post-thermal test, steady-state	RG 7.9, 3.4.3			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	condition. This section should include those temperatures at locations in the package that are significant to the safety analysis and review. In particular, the temperatures for items such as the contents, gaskets, valves, and shielding should be reported. The calculations of the transient temperatures should trace the temperature-time history up to and past the time at which maximum temperatures are achieved and begin to fall.				
	The evaluation of the maximum pressure in the package should be based on the maximum normal operating pressure, and should consider fire-induced increases in package temperatures, thermal combustion or decomposition processes, fuel rod failure, phase changes, etc.				
	This section should provide a general description of the package performance and should compare the results of the thermal test with allowable limits of temperature, pressure, etc., for the package components. Damage to the package from either the interpretation of the analysis or from test observation should be considered and described. The assessment should include structural damage, breach of containment, and loss of shielding.				
3.4.4	**Maximum Thermal Stresses** This section should evaluate the most severe thermal stress conditions that result during the fire test and subsequent cool-down. The temperatures corresponding to the maximum thermal stresses should be reported.	RG 7.9, 3.4.4			
3.4.5	**Accident Conditions for Fissile Material Packages for Air Transport** If applicable, address the expanded fire tests conditions specified in §71.55(f).	RG 7.9, 3.4.5			
3.5	**Appendix**	RG 7.9, 3.5			
	The appendix should include a list of references, applicable pages from referenced documents, justification of assumptions or analytical procedures, test results, photographs, computer program descriptions and input and output files, specifications of O-rings and other components, detailed materials test data, and other supplemental information.				

Chapter 4 – Containment

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
4.0	**CONTAINMENT** This chapter of the SARP should identify the package containment system and describe how the package complies with the containment requirements of §71.	RG 7.9, 4.			
4.1	**Description of the Containment System**	RG 7.9, 4.1			
	This section should define and describe the containment system, including components such as the containment vessel, welds, seals, lids, cover plates, valves, and other closure devices. The description should include materials of construction and applicable codes and standards. The containment boundary of the package should be explicitly identified, including the containment vessel, welds, drain or fill ports, valves, seals, test ports, pressure relief devices, lids, cover plates, and other closure devices. If multiple seals are used for a single closure, this section should identify the seal defined as the containment system seal. This section should also include a sketch of the containment system. **Note:** If a sketch of the containment system is provided elsewhere in the SARP, this section may simply state the following: "The sketch of the containment system is located in Section X.X."	RG 7.9, 4.1 §71.33(a)(4)			
	This section should address the following items:				
	Containment system penetrations and their method of closure.				
	Performance specifications for components such as valves and pressure relief devices.				
	The method used to protect any valve or similar device on the package against unauthorized operation, and the enclosure used to retain any leakage (except for a pressure relief valve)	RG 7.9, 4.1 §71.43(e)			
	How the containment system is securely closed with a positive fastening device that cannot be opened unintentionally or by a pressure that may arise within the package.	RG 7.9, 4.1 §71.43(c)			
	The features that ensure continuous venting is precluded.	RG 7.9, 4.1 §71.43(h)			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
4.2	**Containment Under Normal Conditions of Transport**	RG 7.9, 4.2			
	This section should include the evaluation of the containment system under NCT. The evaluation should be performed for the most limiting chemical and physical forms of the contents. Significant daughter products should be included. The constituents of the releasable source term, including radioactive gases, liquids, and powder aerosols, should be identified. The evaluation should address the following:				
	The maximum internal pressures.				
	The structural performance of the containment system, including seals, closure bolts, and penetrations.				
	The leakage rate testing of the containment system.				
	For Type A fissile packages, the evaluation should show that there is no loss or dispersal of radioactive material under NCT. .				
	For Type B packages, the evaluation should show that there is no release under NCT to the required sensitivity.				
4.3	**Containment Under Hypothetical Accident Conditions**	RG 7.9, 4.3			
	This section should include the evaluation of the containment system under HAC, considering factors given in Section 4.2 above.				
	This section should demonstrate that the package meets the containment requirements of §71.51(a)(2) under HAC. In particular, the structural performance of the containment system should be addressed, including seals, closure bolts, and penetrations, as well as leakage rate testing of the containment system.				
4.4	**Leakage Rate Tests for Type B Packages**	RG 7.9, 4.4			
	This section should describe leakage rate tests that are used to show the package meets the containment requirements of §71.51. This may include leakage rate tests of test units, newly fabricated packagings, periodic tests, and pre-shipment tests.				
4.5	**Appendix**	RG 7.9, 4.5			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	The appendix should include a list of references, applicable pages from referenced documents, supporting information and analysis, test results, and other appropriate supplemental information.				

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Chapter 5 – Shielding Evaluation

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
5.0	**SHIELDING EVALUATION** This chapter of the SARP should identify, describe, discuss, and analyze the principal radiation shielding design of the packaging, components, and systems that are important to safety.	RG 7.9, 5.			
5.1	**Description of Shielding Design**	RG 7.9, 5.1			
5.1.1	**Design Features** This section should describe the radiation shielding design features of the package, including dimensions, tolerances, materials of construction, and densities of material for neutron and gamma shielding.	RG 7.9, 5.1.1			
5.1.2	**Summary Table of Maximum Radiation Levels** This section should present the maximum dose rates for both NCT and HAC at the appropriate locations for non-exclusive and exclusive use shipments, as applicable. Table 5-1, *Example for Summary Table of External Radiation Levels (Non-Exclusive Use)* of RG 7.9, Revision 2, provides an example of the information that should be provided. The Transport Index should also be calculated and included in the summary table.	RG 7.9, 5.1.2			
5.2	**Source Specification**	RG 7.9, 5.2			
	This section should describe the contents, as well as the gamma and neutron source terms used in the shielding analysis. Any increase in source terms over time should be addressed.				
	For packages designed for spent fuel transport, this section should also state the assumed fuel burnup, power density, and cooling times.				
5.2.1	**Gamma Source** This section should specify the quantity of radioactive material included as contents and tabulate the gamma decay source strength (MeV/sec and photons/sec) as a function of photon energy.	RG 7.9, 5.2.1			
	A detailed description of the method used to determine the gamma source strength and distribution should be provided.				
5.2.2	**Neutron Source**	RG 7.9, 5.2.2			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	This section should specify the quantity of radioactive material included as contents and tabulate the neutron source strength (neutron/sec) as a function of energy.				
	A detailed description of the method used to determine the neutron source strength and distribution should be provided.				
5.3	**Shielding Model**	RG 7.9, 5.3			
5.3.1	**Configuration of Source and Shielding** This section should provide a detailed description of the model used in the shielding evaluation. The effects of the tests on the packaging and its contents under NCT and HAC should be evaluated. The models used in the shielding calculation should be consistent with these effects.	RG 7.9, 5.3.1			
	This section should include sketches (to scale) and dimensions of the radial and axial shielding materials. The dimensions of the transport vehicle and package location for exclusive-use shipments for which the analysis is based on the radiation levels in §71.47(b) should be included, as appropriate.				
	The dose point locations in the shielding model, including all locations prescribed in §71.47(a) or 71.47(b) and §71.51(a)(2) should be identified. These points should be chosen to identify the locations of maximum radiation levels. Voids, streaming paths, and irregular geometries in the model should be included or otherwise treated in an adequate manner.				
5.3.2	**Material Properties** This section should describe the material properties (e.g., mass densities and atom densities) in the shielding models of the packaging and contents. Changes resulting under NCT or HAC should be included, as appropriate.	RG 7.9, 5.3.2			
	The sources of data should be referenced for uncommon materials.				
5.4	**Shielding Evaluation**	RG 7.9, 5.4			
5.4.1	**Methods** This section should provide a general description of the basic method used to determine the gamma and neutron dose rates at the selected points outside the package for NCT and HAC.	RG 7.9, 5.4.1			
	Include a description of the spatial source distribution and any computer				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	program used, with its referenced documentation.				
	The shielding evaluation should include a detailed description of the basic input parameters, as well as the bases for selecting the program, attenuation and removal cross-sections, and buildup factors.				
5.4.2	**Input and Output Data** This section should identify key input data for the shielding calculations and show that information from the shielding models is properly input into the code.	RG 7.9, 5.4.2			
	At least one representative input file and output file (or key sections of those files) should be included.				
	This section should show that the code achieved proper convergence.				
5.4.3	**Flux-to-Dose-Rate Conversion** This section should include a tabulation of the flux-to-dose-rate conversion factors as a function of energy and should cite the appropriate references to support the data.	RG 7.9, 5.4.3			
5.4.4	**External Radiation Levels** This section should describe the results of the radiation analysis in detail. These results should agree with the summary tables. The locations of maximum dose rates for the analysis should be identified and sufficient data provided to show that the radiation levels are reasonable and their variations with location are consistent with the geometry and shielding characteristics of the package.	RG 7.9, 5.4.4			
	Calculation of Transport Index (TI) should be presented.	§71.4			
	The results should address NCT and HAC.	RG 7.9, 5.4.4			
5.5	**Appendix**	RG 7.9, 5.5			
	The appendix should include a list of references, applicable pages from referenced documents, justification of assumptions or analytical procedures, test results, photographs, computer program descriptions, input and output files, and other supplemental information.				

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Chapter 6 – Criticality Evaluation

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
6.0	**CRITICALITY EVALUATION** This chapter of the SARP should identify, describe, discuss, and analyze the principal criticality safety design of the package, components, and systems important to safety, and describe how the package complies with the requirements of §71.55 and 71.59.	RG 7.9, 6.			
6.1	**Description of Criticality Design**	RG 7.9, 6.1			
6.1.1	**Design Features** This section should describe the design features of the package that are important for criticality control. This should include such information as the confinement system for fissile material, neutron absorbing and moderating materials, flux traps, spacers, etc.	RG 7.9, 6.1.1			
6.1.2	**Summary Table of Criticality Evaluation** This section should provide a summary table of criticality analysis results for the package for the following cases, as described in Section 6.4 through Section 6.6:	RG 7.9, 6.1.2			
	A single package, under the conditions of §71.55(b), (d), and (e).				
	An array of damaged packages, under the conditions of §71.59(a)(1).				
	An array of damaged packages, under the conditions of §71.59(a)(2).				
	The maximum value of the effective neutron multiplication factor (k_{eff}), the uncertainty, the bias, and the number of packages evaluated in the arrays should be specified in the table.				
6.1.3	**Criticality Safety Index** This section should provide the Criticality Safety Index (CSI) based on the number of packages evaluated in the arrays and show how it was calculated.	RG 7.9, 6.1.3			
6.2	**Fissile Material Contents**	RG 7.9, 6.2			
	This section should describe in detail the fissile materials in the package. The mass, dimensions, enrichment, physical and chemical composition, density, moisture, and other characteristics should be defined.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
6.3	**General Considerations**	RG 7.9, 6.3			
	This section should address the general considerations used to evaluate criticality of the package. These may apply to the criticality evaluations of a single package and arrays of packages under both NCT and HAC.				
6.3.1	**Model Configuration** This section should describe and provide sketches of the analytical model used in the calculations. The sketches should identify the materials used in all regions of the model.	RG 7.9, 6.3.1			
	Any differences between the actual package configuration and the model should be identified, and justification given that the model is conservative				
	Differences between the models for NCT and HAC should be clearly identified				
6.3.2	**Material Properties** This section should provide the appropriate mass densities and atomic number densities for materials used in the models of the packaging and contents. Material properties should be consistent with the condition of the package under the tests specified in §71.71 and 71.73.	RG 7.9, 6.3.2			
	All material property differences between NCT and HAC should be clearly identified. Materials relevant to the criticality design such as poisons, foams, plastics, and other hydrocarbons should specifically be addressed.				
6.3.3	**Computer Codes and Cross-Section Libraries** This section should describe the basic methods used to calculate the effective neutron multiplication constant of the package to demonstrate compliance with the fissile material package standards. This section should address the following:	RG 7.9, 6.3.3			
	A description of the computer program and neutron cross-sections used.				
	The bases for selecting the specific program and cross-sections.				
	Key input data for the criticality calculations, such as neutrons per generation, number of generations, convergence criteria, mesh selection, etc.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
6.3.4	**Demonstration of Maximum Reactivity** This section should include a demonstration that the most reactive configuration of each case listed in Sections 6.4 through 6.6 (single package, arrays of undamaged packages, and arrays of damaged packages, respectively) have been evaluated. All assumptions and approximations should be clearly identified and justified. This section should identify the optimum combination of internal moderation (within the package) and interspersed moderation (between packages), as applicable. The following should be considered:	RG 7.9, 6.3.4			
	Moderation by water and any hydrogen-containing packaging materials, such as polyethylene.				
	Preferential flooding of different regions within the package.				
	Partial loadings (i.e., fissile masses less than the maximum allowable mass).				
6.4	**Single Package Evaluation**	RG 7.9, 6.4			
6.4.1	**Configuration** This section should demonstrate that a single package is subcritical under NCT and HAC. The evaluation should consider the following factors:	RG 7.9, 6.4.1			
	Fissile material in its most reactive credible configuration consistent with the condition of the package and the chemical and physical form of the contents.				
	Water moderation to the most reactive credible extent, including water inleakage to the containment system as specified in §71.55(b).	RG 7.9, 6.4.1			
	Full water reflection on all sides of the containment system as specified in §71.55(b)(3), or reflection by the package materials, whichever results in the maximum reactivity.	RG 7.9, 6.4.1			
6.4.2	**Results** The results of the single package evaluation should be presented. The additional specifications of §71.55(d)(2) through 71.55(d)(4) under NCT should also be addressed.	RG 7.9, 6.4.2			
6.5	**Evaluation of Package Arrays Under Normal Conditions of Transport**	RG 7.9, 6.5			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
6.5.1	**Configuration** This section should evaluate an array of 5N packages under NCT.	RG 7.9, 6.5.1			
	The evaluation should consider the following factors:				
	The most reactive configuration of the array (e.g., pitch and package orientation) with nothing between the packages.				
	The most reactive credible configuration of the packaging and its contents under NCT. If the water spray test has demonstrated that water would not leak into the package, water inleakage need not be assumed.				
	Full water reflection on all sides of a finite array.				
6.5.2	**Results** This section should present the results of the analyses for arrays and identify the most reactive array conditions.	RG 7.9, 6.5.2			
6.6	**Package Arrays Under Hypothetical Accident Conditions**	RG 7.9, 6.6			
6.6.1	**Configuration** This section should evaluate an array of 2N packages under HAC. The evaluation should consider the following factors:	RG 7.9, 6.6.1			
	The most reactive configuration of the array (e.g., pitch, package orientation, and internal moderation).				
	Optimum interspersed hydrogenous moderation.				
	The most reactive credible configuration of the packaging and its contents under HAC, including inleakage of water.				
	Full water reflection on all sides of a finite array.				
6.6.2	**Results** This section should present the results of the analyses for arrays and identify the most reactive array conditions.	RG 7.9, 6.6.2			
6.7	**Fissile Material Packages for Air Transport**	RG 7.9, 6.7			
6.7.1	**Configuration** This section should evaluate a single package under the expanded accident conditions specified in §71.55(f). The evaluation should consider the following factors:	RG 7.9, 6.7.1			
	The most reactive configuration of the contents and packaging under the				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	expanded accident conditions.				
	Full water reflection				
	No water inleakage				
6.7.2	**Results** This section should present the results of the analyses for the single package, and identify the most reactive contents and packaging conditions.	RG 6.7.2			
6.8	**Benchmark Evaluations**	RG 7.9, 6.8			
	This section should include a description of the methods used to benchmark the criticality calculations. The computer codes for criticality evaluations should be benchmarked against critical experiments.				
	The same computer code, hardware, and cross-section library used to calculate the effective multiplication factor values for the package should be used in the benchmark experiments. This section should present the results of the calculations for selected critical benchmark experiments to justify the validity of the calculational method and neutron cross-section values used in the analysis, and to demonstrate that the hardware and software used were appropriate for the application.				
6.8.1	**Applicability of Benchmark Experiments** This section should describe selected critical benchmark experiments that are to be analyzed using the method and cross-sections given in Section 6.3. This section should show the applicability of the benchmarks in relation to the package and its contents, noting all similarities and resolving all differences. References that give full documentation on these experiments should be provided. The overall quality of the benchmark experiments and any uncertainties in experimental data should be addressed. Results of the benchmark calculations, as well as the actual nuclear and geometric input parameters used for those calculations, should be provided.	RG 7.9, 6.8.1			
6.8.2	**Bias Determination** This section should present the results of the benchmark calculations and the method used to account for biases, including the contribution from uncertainties in the experimental data.	RG 7.9, 6.8.2			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	This section should show a sufficient number of appropriate benchmark experiments and that the results of the benchmark calculations were appropriate to determine the bias for the package calculations. Parameters such as pitch-to-rod diameter, assembly separation, neutron absorber material performance, etc., should be considered. Statistical and convergence uncertainties should be addressed.				
6.9	**Appendix**	RG 7.9, 6.9			
	The appendix should include a list of references, applicable pages from referenced documents (if not generally available), justification of assumptions or analytical procedures, test results, photographs, computer code descriptions, input and output files, and other supplemental information. Input files for representative or "most limiting" cases for a single package and arrays of damaged and undamaged packages should specifically be included.				

Chapter 7 – Package Operations

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
7.0	**PACKAGE OPERATIONS** This chapter of the SARP should describe the operations used to load a package and prepare it for transport, presenting the steps sequentially in the actual order in which they are performed. The operations should describe the fundamental steps needed to ensure that the package is properly prepared for transport consistent with the package evaluation in Chapters 2 through 6 of the SARP.	RG 7.9, 7. §71.Subpart G			
	The package should be operated in accordance with detailed written procedures that are based on and consistent with the operations described in this chapter.				
	Package operations should be consistent with maintaining occupational radiation exposures as low as reasonably achievable (ALARA) as required by 10 CFR 20.1101(b) of 10 CFR 20, *Standards for Protection Against Radiation*.				
7.1	**Package Loading**	RG 7.9, 7.1			
	This section should describe the loading-related preparations, tests, and inspections of the package, including the inspections made before loading the package to determine that the package is not damaged and radiation and surface contamination levels are within allowable limits of the regulations.				
7.1.1	**Preparation for Loading** At a minimum, the operations for preparing the package for loading should specify:	RG 7.9, 7.1.1			
	The package is loaded and closed in accordance with detailed written procedures.				
	The contents are authorized in the package approval.				
	The package is in unimpaired physical condition.				
	Any required moderator or neutron absorber is present and in proper condition.				
	Any special controls and precautions for handling.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	Inspection of gaskets, criteria for replacement, and repair processes, if applicable, as well as the inspection of each closure device and criteria for replacement.				
7.1.2	**Loading of Contents** At a minimum, the operations for loading the contents should describe how the contents are loaded and how the package is closed.	RG 7.9, 7.1.2			
7.1.3	**Preparation for Transport** The operations for preparing the package for transport should address the radiation and contamination surveys of the package, leakage rate testing of the package, measurement of the package surface temperature, package tiedown, and the application of tamper-indicating devices.	RG 7.9, 7.1.3			
7.2	**Package Unloading**	RG 7.9, 7.2			
	This section should include inspections, tests, and special preparations of the package for unloading. As applicable, this section should also describe the operations used to ensure safe removal of fission gases, contaminated coolant, and solid contaminants.				
7.2.1	**Receipt of Package from Carrier** The process for receiving the package should address radiation and contamination surveys and inspection of the tamper-indicating device(s). Any proposed special controls and precautions for handling and unloading should be described. The appropriate requirements of 10 CFR 20.1906, *Procedures For Receiving And Opening Packages* should be addressed.	RG 7.9, 7.2.1			
7.2.2	**Removal of Contents** This section should describe the appropriate operations and method for opening and removing contents from the package.	RG 7.9, 7.2.2			
7.3	**Preparation of Empty Package for Transport**	RG 7.9, 7.3			
	This section should describe the inspections, tests, and special preparations needed to ensure that the packaging is verified to be empty and is properly closed, and that the radiation and contamination levels are within allowable limits. This section should address the appropriate requirements of 49 CFR 173.428, *Empty Class 7 (Radioactive) Materials Packaging*.				
7.4	**Other Operations**	RG 7.9, 7.4			
	This section should include the provisions for any special operational				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	controls (e.g., route, weather, shipping time restrictions, etc.).				
7.5	**Appendix**	RG 7.9, 7.5			
	This appendix should include a list of references, copies of applicable references (if not generally available), detailed descriptions and analysis of processes or protocols, graphic presentations, test results, and other appropriate supplemental information.				

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Chapter 8 – Acceptance Tests and Maintenance Program

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
8.0	**ACCEPTANCE TESTS AND MAINTENANCE PROGRAM** This chapter of the SARP should describe the acceptance tests and maintenance program to be used for the packaging in compliance with 10 CFR 71, Subpart G.	RG 7.9, 8.			
8.1	**Acceptance Tests**	RG 7.9. 8.1			
	This section should describe the tests to be performed before the first use of each packaging. Each test and its acceptance criteria should be described. The acceptance tests should confirm that each packaging is fabricated in accordance with the drawings referenced in the package approval.				
8.1.1	**Visual Inspections and Measurements** This section should describe the visual inspections to be performed and the intended purpose of each inspection.	RG 7.9, 8.1.1			
	The criteria for acceptance of each inspection, as well as the action to be taken if noncompliance is encountered, should be described.				
	The inspections should verify that the packaging has been fabricated and assembled in accordance with the drawings, and that all dimensions and tolerances specified on the drawings are confirmed by measurement.				
8.1.2	**Weld Examinations** This section should describe welding examinations used to verify fabrication in accordance with the drawings, codes and standards specified in the SARP. The location, type, and size of the welds should be confirmed by measurement. Other applicable specifications for weld performance, NDE, and acceptance should be identified.	RG 7.9, 8.1.2			
8.1.3	**Structural and Pressure Tests** This section should identify and describe the structural and pressure tests. Such tests should comply with §71.85(b), as well as applicable codes or standards specified. The sensitivity of the tests, and the actions taken when the prescribed criteria are not met, should be specified.	RG 7.9, 8.1.3			
8.1.4	**Leakage Tests** This section should describe the leakage rate tests to be performed on the	RG 7.9, 8.1.4			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	containment vessel, as well as auxiliary equipment.				
	The sensitivity of the tests should be specified, including the basis of this value, the criteria for acceptance, and the action to be taken if the criteria are not met.				
8.1.5	**Component and Material Tests** This section should specify the appropriate tests and acceptance criteria for components that affect package performance. In addition, this section should specify test sensitivity (if applicable), provide acceptance criteria, and describe the action to be taken if those criteria are not met.	RG 7.9, 8.1.5			
	This section should specify the appropriate tests and acceptance criteria for packaging materials. Tests should include those components, such as gaskets, under conditions that simulate the most severe service conditions under which they are to perform, including performance at pressure and under high and low temperatures.				
	Tests for neutron absorbers (e.g., boron) and insulating materials (e.g., foams, fiberboard) should ensure that minimum specifications for density and isotopic content are achieved.				
	Tests that demonstrate the ability of the materials to meet the performance specifications shown on the engineering drawings should be described.				
8.1.6	**Shielding Tests** This section should specify the appropriate shielding tests for both gamma and neutron radiation. These tests and acceptance criteria should be sufficient to ensure that no defects, voids, or streaming paths exist in the shielding.	RG 7.9, 8.1.6			
8.1.7	**Thermal Tests** This section should specify the appropriate tests to demonstrate the heat transfer capability of the packaging. These tests should confirm that the heat transfer performance determined in Chapter 3 of the SARP is achieved in the fabrication process.	RG 7.9, 8.1.7			
8.1.8	**Miscellaneous Tests** This section should describe any additional tests to be performed prior to use of the packaging.	RG 7.9, 8.1.8			
8.2	**Maintenance Program**	RG 7.9, 8.2			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	This section should describe the maintenance program used to ensure continued performance of the packaging. This program should include periodic testing, inspection, and replacement schedules, as well as criteria for replacement and repair of components and subsystems on an as-needed basis.				
8.2.1	**Structural and Pressure Tests** This section should identify and describe any periodic structural or pressure tests. Such tests would generally be applicable to codes, standards, or other procedures specified in the application.	RG 7.9, 8.2.1			
8.2.2	**Leakage Tests** This section should describe the tests to be performed, the frequency with which those tests are performed, and the sensitivity of each test. For most systems, this description should include a test of the package before each shipment and annually. In general, this section should specify that elastomeric seals should be replaced and leakage rate tested within the 12-month period before shipment, and that metallic seals should also be replaced and tested before each shipment.	RG 7.9, 8.2.2			
8.2.3	**Component and Material Tests** This section should describe the periodic tests and replacement schedules for components. Any process that could result in the deterioration of packaging materials, including loss of neutron absorbers, reduction in hydrogen content of shields, and density changes of insulating materials, should be addressed. Replacement intervals for components, such as bolts, that are susceptible to fatigue should be specified.	RG 7.9, 8.2.3			
8.2.4	**Thermal Tests** This section should describe the periodic tests used to ensure heat-transfer capability during the service life of the packaging. This section should describe periodic thermal tests, similar to the acceptance tests discussed in Section 8.1.7, and the interval for the tests, which is typically 5 years.	RG 7.9, 8.2.4			
8.2.5	**Miscellaneous Tests** Any additional tests to be performed periodically on the package or its components should be described.	RG 7.9, 8.2.5			
8.3	**Appendix**	RG 7.9, 8.3			
	The appendix should include a list of references, copies of applicable				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	references (if not generally available), test data and reports, and other appropriate supplemental information.				

Chapter 9 – Quality Assurance

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
9.0	**QUALITY ASSURANCE** This chapter of the SARP should describe the QAP and demonstrate that it meets the requirements of §71, Subpart H.	DOE Order 460.1B §71.37 §71, Subpart H 10 CFR 830			
	DOE contractors are required to develop and implement a Quality Assurance Program (QAP) that meets the requirements of §71, Subpart H for package design through certification and use.				
	This section should include a statement that the QAP meets the requirements of §71, Subpart H.				
	This section should report the status of the approval of the QAP by the DOE-EM, Headquarters Certifying Official.	DOE Order 460.1B Sec 5(1)(f)			
9.1	**Quality Assurance Organization**	RG 7.10, 1. §71.103			
9.1.1	**Structure and Authority** This section should describe for each function, the structure of the organization and the assignment of responsibility should ensure that the following requirements are fulfilled:	RG 7.10, 1.1			
	The formal structure of the organization is documented by organization charts that identify each organizational element that functions under the QAP.				
	The discussion specifies the required authority and organizational freedom, including sufficient independence from the influence of cost and schedule.				
	The specified quality requirements are achieved and maintained by those who have been assigned the responsibility for perform the work.				
	The QAP user established measures to provide adequate control over activities important to safety (e.g., inspecting, cleaning, purchasing, and preparing the package for delivery).				
	Conformance to established requirements is verified by individuals and groups that are not directly responsible for performing the work.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	Established and document the required duties and qualifications for:				
	(1) The individual who has overall authority and responsibility for the QAP,				
	(2) Other personnel performing QA and QC functions, and those individuals should have the written endorsement of top management.				
9.1.2	**Top Management Endorsement of a QA Program** This section should describe top management's endorsement of the QAP.	RG 7.10, 1.2			
	Top management should maintain a continuing involvement in QA matters in order to ensure that the QAP is effective. To ensure the commitment of top management, the company/corporate president or chief executive officer should establish a written policy stating that it is the company/corporate policy to perform work on items important to safety in accordance with the requirements of Subpart H, as described in the QAP plan and implemented in the QAP implementing documents.				
	The policy statement should also identify the functions and positions who have delegated authority for the following task:				
	Implement and revise the provisions of the described QAP				
	Regularly assess the scope, status, implementation and effectiveness of the QAP				
9.2	**Quality Assurance Program**	RG 7.10, 2.0 §71.105			
9.2.1	**General Guidance on QA Program** The program description should describe how each of the regulations in Subpart H of §71 applies to your particular situation and how it will be satisfied (see Reg Guide 7.10, Section 2.1 for examples). Elements common to all QAP descriptions include the quality organization and program, corrective action, QA records, and audits.	RG 7.10, 2.1			
	This section should describe the application of the graded approach with respect to each of the applicable Subpart H regulations (i.e., to an extent that is consistent with its importance to safety). Note: NUREG/CR-6407 and Appendix A to RG 7.10 provide guidance on graded QA.	§71.105(b) RG 7.10, 2.1			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
9.2.2	**Scope of the QA Program** This section should describe measures for identifying: (1) the components, structures, and systems to be covered by the QAP, and (2) the approach for verifying that the applicable components, structures, and systems meet design objectives.	RG 7.10, 2.2			
	In particular, the QAP should establish measures to ensure that the following requirements are fulfilled:				
	Activities important to safety are performed using specified equipment and under suitable environmental conditions.	RG 7.10, 2.2 §71.105(b)			
	QA/QC manuals specify the designated QA and QC responsibilities for implementation of activities important to safety.	RG 7.10, 2.2 §71.105(a)			
	The QAP user has established indoctrination and training programs to ensure that personnel performing activities important to safety are trained and qualified to perform those activities.	RG 7.10, 2.2 §71.105(d)			
9.2.3	**Applicability of QA Program** Measures covered by the QAP should be compatible with and emphasize characteristics identified in the user's QAP. This section should discuss the rationale to identify items that are classified as important to safety and subject to the users QAP.	RG 7.10, 2.3			
9.2.4	**Documentation** The QAP user should assure that:	RG 7.10, 2.4			
	Written procedures (or manuals) and instructions describe all activities that are important to safety and applicable to the design, procurement, fabrication, and testing of packaging,				
	Those procedures and instructions will be in place before the QAP user engages in those activities.				
	To demonstrate that written procedures fully implement and reflect the current status of the documented QAP, this section should include a master index of QA procedures (or manual) related to all activities important to safety, as well as a matrix of the QA procedures that implement each section of Subpart H. These written procedures should also address the use, management, and storage of electronic records and data.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
9.2.5	**Controlled Conditions and Assignment of Responsibilities** This section should discuss the measures to ensure that activities important to safety are accomplished using appropriate production and test equipment, suitable environmental conditions, applicable codes and standards, and proper work instructions. The QAP user should document the assignment of responsibility for each task and method used to verify conformance to these quality requirements.	RG 7.10, 2.5 §71.105(b)			
9.3	**Package Design Control**	RG 7.10, 3. §71.107			
	This section should describe the control of the design process, control of design input, and control of design verification, as defined in Sections 9.3.1 through 9.3.3				
	This section should also describe QA procedures that address software verification/validation, management of electronic records, and quality control of electronic data to address the control of electronic data in design applications to ensure authenticity and technical accuracy.				
9.3.1	**Control of the Design Process** This section should describe measures such as "classification of characteristics" to ensure that packaging designs are reviewed to emphasize critical parameters that can be controlled by inspections or tests and to identify test and inspection criteria and quality standards.	RG 7.10, 3.1			
	This section should discuss the measures to control the preparation of drawings and specifications, the establish recognized engineering practices, such as prescribing drafting room standards, checking methods, establishing review/approval and issuance/distribution requirements (including revisions to them), maintaining current "as-built" configurations, and storing and controlling original and master copies.				
9.3.2	**Control of Design Input** This section should describe the measures to ensure that appropriate codes and standards are used in the design of packages. In the absence of such codes and standards for the formulation of the design activities, the applicant should identify alternative approaches. This section should discuss measures to ensure:	RG 7.10, 3.2 §71.107(a)			
	The responsible design organization has properly considered, reviewed,	RG 7.10, 3.2			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	and approved all design parameters (e.g., criticality physics, cooling, and decontamination of an item)	§71.107(b)			
	The parameters are in accordance with the applicable performance codes, standards, and regulatory requirements	RG 7.10, 3.2 §71.107(a)			
	Design documents specify the related maintenance, repair, in-service inspection, handling, storage, and cleaning requirements	RG 7.10, 3.2 §71.107(b)			
9.3.3	**Control of Design Verification** This section should describe methods for verifying the adequacy of the design (e.g., qualification testing, design review, or alternative calculations, including use of computer programs).	RG 7.10, 3.3 §71.107(b)			
	Technically qualified individuals or groups responsible for design verification should not be in the administrative line of authority of the original designer, with the exception that the designer's immediate supervisor may perform the verification, provided that The supervisor is the only technically qualified individual. The supervisor's management documents and approves the need in advance. QA audits cover the effectiveness of the use of supervisors as design verifiers to guard against abuse of this practice.	RG 7.10, 3.3 §71.107(b)			
	This section should discuss measures to ensure that drawing and specification changes are reviewed and approved by the same individuals or organizations which reviewed and approved the original documents. Changes in design that could result in conditions different from those prescribed on the CoC should be approved by EM-60 prior to implementation.	RG 7.10, 3.3 §71.107(c)			
	Design verification, if other than by qualification testing of a prototype or lead production unit, should be satisfactorily completed prior to:				
	(1) release for procurement or fabrication and				
	2) Release to other organizations for use in other design activities except when this timing cannot be met.				
	In such cases, design verification may be deferred, provided that the justification for this action is documented and the unverified portion of the design output documents are appropriately identified and controlled.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	When a test program is used to verify the adequacy of a design, the prototype should be subjected to the most adverse design conditions.				
9.4	**Procurement Document Control**	RG 7.10, 4. §71.109			
	This section should describe the measures to control the preparation, review, concurrence, and approval of all procurement documents.				
9.4.1	**Content of Procurement Documents** This section should describe the measures to ensure that procurement documents include the following information (as applicable):	RG 7.10, 4.1			
	The scope of work to be performed by the prospective supplier				
	The design-basis technical requirements (or references thereto), including applicable regulatory requirements, material and component identification requirements, drawings, specifications, codes and standards, special process instructions, and test and inspection requirements				
	Applicable Subpart H requirements that should be complied with and described in the supplier's QAP (Qualified QA personnel from the purchaser's organization should review and concur in the supplier's QAP or portions thereof before the purchaser initiates activities affected by the program. Also, if sub-tier suppliers are involved, the QAP user should specify the QA provisions appropriate to those procurements. The extent of the supplier's and sub-tier supplier's QAPs will depend on the particular item or service being procured.)				
	Permission to gain access to the supplier's and sub-tier supplier's plant facilities and records for inspection and audit purposes, (Procurement documents should identify the type of verification activities required of any sub-tier suppliers for supplied materials, as well for any design, fabrication, assembly, testing, maintenance, and repair services supplied.)				
	Identification of the documentation(e.g., drawings, specifications, procedures, inspection and fabrication plans, inspection and test records, personnel and procedure qualifications, results of chemical and physical tests on material) that the supplier(s) must prepare, maintain, and submit to the purchaser for approval.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	Requirements for reporting and approving disposition of non-conformances				
	Identification of records that the supplier must retain, control, and maintain, as well as those records that the supplier must deliver to the purchaser prior to installation of hardware. [These records should include the pertinent documentation to be furnished with the procured materials or services (e.g., CoC, as-built drawings, photographs, sketches, use, and maintenance manuals). If the pertinent documentation is in an electronic format, the QAP user should specify the software system that must be used to prepare and deliver the documentation.]				
9.4.2	**Replacement Part Procurement** This section should describe the measures established to require that procurement of replacement parts important to safety be reviewed by QA personnel to ensure that appropriate technical and QA requirements are included in purchase orders and that the purchase orders are placed with suppliers previously qualified during fabrication of the packaging. If replacement parts are purchased from suppliers not previously identified as qualified sources, the QAP user must assure that the replacement parts meet the requirements at least as stringent as the original criteria.	RG 7.10, 4.2			
9.4.3	**Review and Changes to Procurement Documents** This section should describe the measures to ensure review and approval of procurement documents are recorded prior to release, and those changes and revisions to those documents are subject to at the least the same review and approval as the original documents.	RG 7.10, 4.3			
9.5	**Instructions, Procedures, and Drawings**	RG 7.10, 5. §71.111			
9.5.1	**Quality Assurance Program Procedures** This section should describe the measures to ensure that the following requirements are fulfilled:	RG 7.10, 5.1			
	Activities important to safety are prescribed and accomplished in accordance with current documented instructions, procedures, or drawings that have been approved by appropriate levels of management.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	Instructions, procedures, and drawings specify the methods for complying with each of the applicable sections of Subpart H of §71.				
	All work activities are coordinated with QA personnel to ensure that the work controlling documents incorporate appropriate inspection and hold points to verify that initial work, planned work, effective repairs, or rework have been performed satisfactorily.				
	Instructions, procedures, and drawings include quantitative acceptance criteria (e.g., dimensions, tolerances, and operating limits) and qualitative acceptance criteria (e.g., workmanship samples) to verify that activities important to safety have been satisfactorily accomplished.				
	Written procedures address the use, management, storage, and protection of electronic records and data. The QAP user should also maintain information on the specific software applications and storage or computing hardware.				
9.5.2	**QA Review and Concurrence** This section should describe the measures to ensure that the QA organization reviews and concurs in inspection plans; test, calibration, and special process procedures; and specifications as well as any changes thereto. Prior to fabrication of an item, the QA organization should review and concur in the related manufacturing plans, as they relate to scheduled witness and hold points during fabrication.	RG 7.10, 5.2			
9.6	**Document Control**	RG 7.10, 6. §71.113			
9.6.1	**Controlled Documents** This section should discuss the maintenance of each of the documents under the control of the QAP to reflect the current status. As a minimum, the QAP user should exercise control over the following:	RG 7.10, 6.1			
	Design documents (e.g., drawings, specifications, and computer codes)				
	Procurement documents				
	QA and QC manuals				
	Operating, maintenance, and modification procedures				
	Inspection and test procedures				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	Nonconformance reports				
	Design change requests				
	Corrective action reports				
9.6.2	**Control of Document Generation and Issuance** This section should describe the controls to ensure that all documents and changes thereto are adequately reviewed and approved prior to their issuance. These controls should include measures (e.g., the use of a master document list) to ensure that current issues of applicable documents are available at the location where the activity is being performed to preclude use of obsolete or superseded documents.	RG 7.10, 6.2			
	Describe the method or process used to check all packaging affected by design changes to verify that it is in accordance with the appropriate revision.				
	Identify (by function or position) the individuals or groups responsible for reviewing, approving, and issuing documents and revisions thereto.				
9.6.3	**Control of Document Changes** This section should describe the measures to ensure that changes to documents are reviewed and approved by the same organization that performed the original review and approval and the changes are in accordance with established configuration control procedures.	RG 7.10, 6.3			
9.6.4	**Control of Electronic Documents** This section should describe the controls over access to the documents to ensure that the latest versions of the documents are available and changes to the documents are properly authorized and implemented. The software and hardware systems used to store electronic information should be reliable to avoid alteration or corruption of the information.	RG 7.10, 6.4			
9.7	**Control of Purchased Material, Equipment, and Services**	RG 7.10, 7. §71.115			
	This section should describe the measures identified in Sections 9.7.1 thru 9.7.7 to ensure that materials, equipment, and services conform to procurement documents.				
9.7.1	**Procurement Document Planning** This section should establish procurement planning procedures that describe each procurement step leading to contract award for items and	RG 7.10, 7.1			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	services. These procedures should identify the organizations responsible for each procurement step.				
9.7.2	**Selection of Procurement Sources** This section should establish measures for evaluating and selecting procurement sources, including the extent of QA and engineering involvement. Specifically, the QAP user should consider establishing the following provisions (if applicable):	RG 7.10, 7.2			
	The supplier's capability to comply with applicable sections of Subpart H.				
	Results of the survey of the supplier's facility and QAP.				
	Review of the supplier's previous records and performance.				
9.7.3	**Bid Evaluation and Award** This section should describe the measures to ensure that designated individuals or organizations evaluate proposed suppliers, as applicable to the type of procurement, based on technical considerations, conformance to QA requirements, production capability, and past performance.	RG 7.10, 7.3			
	Prior to contract award, the QAP user should resolve (if possible) all unacceptable conditions identified during the bid evaluation. If any unacceptable conditions cannot be resolved prior to contract award, the QAP user should obtain the supplier's commitment that the conditions will be resolved at a mutually agreeable date during the contract period.				
9.7.4	**Supplier Performance Control** This section should describe pre- and post-award activities, such as meetings and other communications, to ensure that the supplier understands procurement requirements, including, if applicable, "hold points" (i.e., pre-established inspection points in the manufacturing process that require inspection approval and release by the QA organization prior to further processing) during manufacturing and testing and before shipment.	RG 7.10, 7.4			
9.7.5	**Verification Activities** This section should describe the extent to which source surveillance will be performed during fabrication, assembly, maintenance, modification, repair, inspection, testing, and shipment to ensure conformance with the	RG 7.10, 7.5			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	purchase order requirements. The source surveillance should cover the following aspects:				
	Instructions specifying characteristics or processes to be witnessed, inspected, or verified				
	The documentation required.				
	Identification of those responsible for implementing source surveillance.				
	This section should describe the extent to which inspection will be performed upon receipt of supplier-furnished hardware to ensure that items are properly identified and correspond with procurement documentation. When acceptance of an item is contingent on tests after installation in the package, the QAP user and item supplier should mutually establish the relevant acceptance documentation prior to its use.				
	This section should describe the appropriate measures (such source surveillance and audits of records) to ensure that the supplier performed the design and fabrication of packaging under the control of an approved QAP.				
9.7.6	**Controlling Non-conformances** This section should describe the measures to ensure the proper disposition of items or services that do not meet procurement requirements. These measures should include evaluation of nonconforming items categorized by the supplier, along with technical justification and recommended disposition (e.g., "use as is" or "repair").	RG 7.10, 7.6			
9.7.7	**Records** This section should describe the measure to ensure that the supplier furnishes to the purchaser the following records (as a minimum):	RG 7.10, 7.7			
	Documentation that identifies material or equipment and the specific procurement requirements (e.g., codes, standards, and specifications met by the items).				
	Documentation that identifies any procurement requirements that have not been met, along with a description of those non-conformances designated "use as is" or "repair".				
	Documentation that the supplied material and equipment meets the				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	applicable procurement requirements prior to installation or use.				
	Appropriate documentation, as identified in the purchase order, which will accompany the packaging during transport and be received at the destination by the user.				
	Above documents should (1) be referenced in the CoC, (2) relate to the use and maintenance of the packaging, and (3) identify necessary actions to be taken prior to delivery of the licensed material to a carrier for transport.				
	If the pertinent documentation is in an electronic format, the QAP user should specify the software system that must be used to prepare and deliver the documentation.				
	Retention of the documentation at the facility or site of package use.				
9.8	**Identification and Control of Materials, Parts, and Components**	RG 7.10, 8. §71.117			
	This section should describe the measures to ensure that materials, parts, and components, including partially fabricated assemblies, are adequately identified to preclude the use of incorrect or defective items. The measures should provide the means for physical identification (e.g., stamping, tags, labels, or lot-follower cards) and traceability to appropriate documentation (e.g., mill reports, drawings, or specifications) throughout fabrication, installation, and use.	RG 7.10, 8			
	When replacement of limited-life items is specified, this section should establish measures to preclude use of items for which the shelf life or prescribed operation time has expired.				
	This section should establish measures to facilitate continued processing when required inspection or tests have not been completed in order to maintain physical identity and control over affected materials.				
9.9	**Control of Special Processes**	§71.119 RG 7.10, 9.			
	Special processes are not normally performed by the user of packaging. However, if packaging maintenance requires the use of special processes (e.g., welding or heat treating) or nondestructive testing, or if special processes are required to meet CoC requirements, this section should describe the measures to ensure that the special processes are controlled				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	in accordance with the following requirements				
	Procedures, equipment, and personnel are qualified in accordance with applicable codes, standards, and specifications.				
	The operations are performed by qualified personnel and accomplished in accordance with written process or procedure sheets that direct the recording of evidence of verification.				
	Qualification records of procedures, equipment, and personnel are established, filed, and kept current.				
9.10	**Internal Inspection**	RG 7.10, 10. §71.121			
9.10.1	This section should establish measures to ensure that the following requirements are fulfilled:	RG 7.10, 10.1			
	Inspection procedures, instructions, or checklists are available for each work operation, where necessary to ensure quality.				
	Documents developed include methods for identifying characteristics and activities to be inspected, acceptance and rejection criteria, and the individuals or groups responsible for performing the inspection.				
	Objective evidence of inspection results is recorded.				
	Hold or witness points are identified.				
	The appropriate personnel approve data to ensure that all inspection requirements have been satisfied.				
	The prerequisites to be satisfied prior to inspection are identified, including operator qualification and equipment calibration. Where sampling is used to verify acceptability of a group of items, the standard used as the basis for acceptance should be identified.				
9.10.2	**Inspections**	RG 7.10, 10.2			
9.10.2.1	**Receiving Inspections** This section should describe the measures to ensure that items are important to safety (i.e., the features of a structure, component, or system under control of the QAP and necessary to ensure the integrity of the packaging and its capability to prevent or mitigate the consequences that result from release of radioactive material) meet the requirements	RG 7.10, 10.2.1			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	specified on the purchase order when the items are received at the plant.				
	This section should describe criteria for acceptance of each of these inspections, as well as the action to be taken if noncompliance is encountered. These visual inspections should include the following aspects:				
	Surface conditions				
	Weld and structural integrity				
	The condition of flange faces or sealing areas, gaskets, seals, gauges, rupture disk, valves, and pressure relief devices				
	The condition of tie-down members (if applicable)				
	Labeling and Marking				
	Leak-tightness of the packaging				
	This section should establish provisions to control accepted items until they are placed in stock or released for use, as well as provisions for the proper disposition of rejected items.				
9.10.2.2	**In-Process Inspections** This section should describe the measures to ensure that process specifications and their supporting documentation provide for indirect control by monitoring processing methods, equipment, and personnel if direct inspection is impractical.	RG 7.10, 10.2.2			
9.10.2.3	**Final Inspections** This section should describe the measures to ensure that:	RG 7.10, 10.2.3			
	Final inspections provide for resolution of non-conformances identified in earlier inspections				
	The inspected item is identifiable and traceable to specific records and is adequately protected from physical or environmental damage				
	Supervisors review inspection records to verify that all inspection requirements have been satisfied.				
	This section should also describe checklists/procedures to ensure that inspections are performed to verify the following:				
	Packages are properly assembled				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	Moderators and neutron absorbers are present, if applicable.				
	Valves through which primary coolant flows are protected against tampering.				
	Valves are set to specifications.				
	All shipping papers are properly completed.				
	Packages are conspicuously and durably marked as required by the regulations set forth by the U.S. Department of Transportation (DOT).				
	Measures are established to ensure that appropriate personnel designated by the package user sign the shipping tags or indicators prior to authorization for shipping.				
9.10.2.4	**Maintenance Inspections** This section should describe the inspection program to ensure adequate maintenance of packaging. This inspection program should identify the items to be maintained, criteria for acceptability or replacement, and the frequencies of inspection assigned to each item.	RG 7.10, 10.2.4			
9.10.2.5	**Inspectors** This section should describe the measures to ensure that:	RG 7.10, 10.2.5			
	Inspectors are qualified in accordance with applicable codes, standards, and company training programs				
	Qualifications and certifications are kept current				
	Inspection personnel are independent from all individuals performing the activity being inspected.				
9.10.2.6	**Inspection Documentation** This section should describe how inspection records are maintained as QA records to document performance of inspection activities.	RG 7.10, 10.2.6			
9.11	**Test Control**	RG 7.10, 11. §71.123			
9.11.1	**Requirements** This section should describe the measures to ensure that applicable test programs, including prototype qualification tests, production tests, proof tests, and operational tests, are accomplished in accordance with written procedures.	RG 7.10, 11.1			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	This section should describe the measures to ensure that modifications, repairs, and replacements are tested in accordance with original design and testing requirements.				
9.11.2	**Procedures** This section should describe the measures to ensure that test prerequisites identified in the appropriate design disclosures (e.g., instrument calibrations, monitoring to be performed, mandatory hold points, suitable environmental conditions to be maintained, condition of the test equipment, methods for physical identification of test specimen, methods for documenting or recording test data, and criteria for acceptance) are properly translated into test procedures.	RG 7.10, 11.2			
9.11.3	**Acceptance Tests** This section should describe the measures, as appropriate; to ensure that acceptance tests are conducted prior to delivering packages for transport to a carrier. These measures should identify the basis for acceptance criteria (e.g., CoC, maintenance and operational manuals furnished by the packaging manufacturers). Tests should typically include the following considerations:	RG 7.10, 11.3			
	Structural integrity				
	Leak-tightness (on containment vessel as well as auxiliary equipment and shield tanks)				
	Component performance for valves, gaskets, and fluid transport devices				
	Shielding integrity				
	Thermal integrity				
9.11.4	**Maintenance Tests** This section should describe the maintenance test programs to ensure that packages remain usable and free of excessive radiation and contamination. These test programs should include measures to ensure that qualified and responsible individuals document, evaluate, and assess the acceptability of all test results.	RG 7.10, 11.4			
9.11. 5	**Results** This section should describe the measures to ensure that test results are documented, evaluated, and maintained as QA records. These records	RG 7.10, 11.5			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	should be readily available if questions arise concerning the operational aspects of the packages. In addition, a qualified individual or group should determine the acceptability of the records.				
9.12	**Control of Measuring and Test Equipment**	RG 7.10, 12. §71.125			
9.12.1	**Calibration Control** This section should describe the measures to ensure that measurement and test equipment (e.g., gauges, fixtures, reference standards, and devices used to measure product characteristics) is calibrated, adjusted, and maintained at prescribed intervals or prior to use.	RG 7.10, 12.1			
	Equipment should be labeled or tagged to indicate the planned date of its next calibration, and the calibration records should be identified, traceable, and maintained as QA records.				
	This section should describe the measures to ensure that in-house reference or transfer standards used in calibrating measuring and test equipment are traceable to nationally recognized standards. Calibrating standards should have known valid relationships to nationally recognized standards.				
	If no known recognized standard exists, the QAP user should document the basis for calibration.				
9.12.2	**Out-of-Calibration Equipment** This section should describe the measures to validate previous inspection and test results up to the time of previous calibration, when test and measuring equipment is found to be out of calibration.	RG 7.10, 12.2			
	Any measuring equipment that is consistently out of calibration should be repaired or replaced.				
9.13	**Handling, Storage, and Shipping Control**	RG 7.10, 13. §71.127			
9.13.1	**Preservation** This section should describe the measures to ensure that cleaning, handling, storage, and shipping are accomplished in accordance with design requirements to preclude damage or deterioration by environmental conditions such as temperature and humidity.	RG 7.10, 13.1			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	This section should describe the provisions for the use of special handling, lifting, or storage devices (e.g., cranes, shock absorbers, or special markings) to adequately identify and preserve packaging components or assemblies.				
	This section should ensure that conditions identified in the CoC are adhered to when unloading packaging.				
9.13.2	**Preparation, Release, and Delivery to Purchaser** This section should establish the measures to ensure that a final pre-release review has been completed. This review should ensure that packaging:	RG 7.10, 13.2			
	Is prepared for delivery to the purchaser in accordance with approved drawings, specifications, and government regulations,				
	Has passed all applicable inspections and tests,				
	Is properly identified by physical markings or tags,				
	Contains operating manuals, maintenance manuals, and generic procedures relating to its use.				
	This section should establish measures to ensure that the following requirements are fulfilled:				
	Cavities within gas-cooled package containments have been adequately dried, and cavities within liquid-cooled packages have been drained to allow adequate void space.				
	All conditions (including specified operations, inspections, and tests) have been completed prior to delivery to a carrier.				
	All DOE and DOT requirements have been satisfied prior to delivery to a carrier.				
	All necessary shipping papers have been prepared as required and reviewed by qualified personnel to verify completeness and accuracy.				
9.14	**Inspection, Test and Operating Status**	RG 7.10, 14. §71.129			
	This section should describe the measures to ensure that the status of inspections, tests, and operating conditions (including maintenance of items) is known by organizations responsible for ensuring quality.	RG 7.10, 14.			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	This section should describe the measures to control the application and removal of status indicators (e.g., tags, markings, stamps) and to ensure that bypassing a required inspection or test or any other required operation is procedurally controlled under the cognizance of the QA organization.				
9.15	**Nonconforming Materials, Parts, or Components**	RG 7.10, 15. §71.131			
	This section should describe the program for controlling nonconforming items and should include the following principal elements:	RG 7.10, 15.			
	Proper identification				
	Segregation of discrepant or nonconforming items				
	Disposition of the nonconforming items				
	Evaluation of the nonconforming items				
9.16	**Corrective Action**	RG 7.10, 16. §71.133			
9.16.1	**Reporting** This section should describe the measures to ensure that the causes of conditions detrimental to quality (e.g., those resulting from failures, malfunctions, deficiencies, deviations, or defective material and equipment) are promptly identified and reported to appropriate levels of management.	RG 7.10, 16.1			
	This section should describe the measures to obtain corrective actions from suppliers and ensure that follow-up actions are documented to verify that the corrective actions were implemented and effective.				
9.16.2	**Closeout, Retrieval, and Disposition of Records** This section should describe the measures to ensure that corrective actions designated by cognizant individuals have been implemented to preclude recurrence.	RG 7.10, 16.2			
	This section should identify (by function or position) the individuals or organizations responsible for closing out corrective actions and documenting their resolution.	RG 7.10, 16.2			
9.17	**Quality Assurance Records**	RG 7.10, 17.			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
		§71.135			
9.17.1	**General** This section should describe the QA records that furnish documentary evidence of the activities that affect quality and should provide sufficient information to allow each record to be identified with the items or activities to which it applies. As a minimum, QA records should include the following information:	RG 7.10, 17.1			
	Design, procurement manufacturing, and installation records				
	Supplier evaluations				
	Nonconformance reports				
	Results of inspections and tests				
	Failure analyses				
	As-built drawings and specifications				
	Qualification of personnel, procedures, and equipment				
	Calibration procedures				
	Training and retraining records				
	Corrective action reports				
	Records demonstrating evidence of operational capability				
	Records verifying repair, rework, and replacement				
	Audit plans, audit reports, and corrective actions				
	Records that are used as a baseline for maintenance				
	This section should describe the retention of records that show evidence of package delivery to a carrier and proof that all DOE and DOT requirements have been satisfied (with their retention times identified).				
	Where applicable, inspection and test records should contain the following information:				
	A description of the observation				
	Evidence of completion of the inspection or test operation				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	Results of inspections or tests with appropriate data				
	Conditions that are detrimental to quality				
	Names of inspectors, testers, or data recorders				
	Evidence of acceptability				
9.17.2	**Generating Records** This section should describe the measures to ensure that methods employed to generate and manage documents that are designated as QA records result in information that is retrievable, intelligible, and reliable.	RG 7.10, 17.2			
	Records should reflect the work accomplished and should be stored in a manner that avoids unnecessary delay when the record is needed.				
	Procedures for generating QA records should address both hard copy records and electronic information.				
9.17.3	**Indexing and Classification Records** This section should describe the classification of QA records as either "lifetime" or "nonpermanent".	RG 7.10, 17.3			
	Lifetime records include those pertaining to package fabrication and those associated with a particular item while it is installed in the packaging or stored for future use. These records should:				
	Demonstrate the capability for safe operation				
	Provide evidence of repair, rework, replacement, or modification				
	Aid in determining the cause of an accident or malfunction of an item				
	Provide a baseline for inservice inspection				
	Nonpermanent records are those that show evidence that an activity has been performed but do not meet the criteria for lifetime records. Records pertaining to use of a package should be retained for a period of three (3) years after the shipment.				
9.17.4	**Receipt, Retrieval, and Disposition of Records** This section should describe the measures to provide a receipt control system, including identification of functions or positions in each organization responsible for receiving records and assessing the current status of records in their possession.	RG 7.10, 17.4			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	This section should describes the measures to ensure records that are maintained in-house or at other locations are identifiable and retrievable, and are not disposed of until prescribed conditions are satisfied.				
	For electronic records, the software systems employed to image and store information should be compatible with new hardware as current technologies are implemented.				
	Before installing any new hardware systems, the QAP user should have a procedure in place to ensure that the new systems can reliable store and retrieve information form existing software systems.				
9.17.5	**Storage, Preservation, and Safekeeping** This section should describe the measures to ensure that the following requirements are fulfilled:	RG 7.10, 17.5			
	Facilities used to store records should be constructed to minimize the risk from damage or destruction by severe national conditions, such as wind, flood, fire, temperature, humidity, mold, or infestation by insects or rodents.				
	Records should be firmly attached in binders or placed in folders or envelopes for storage in steel file cabinets.				
	Electronic records should be maintained in facilities that minimize or eliminate the potential for destruction of information as a result of demagnetization.				
	Electronic records should be backed-up daily to eliminate the potential for loss of information as a result of equipment failure or human error.				
	If dual storage facilities are used to ensure the record integrity, the storage facilities should be sufficiently remote from each other to preclude a single event (such as a fire or flood) from damaging both facilities.				
	The QAP user should take measures to protect special records (e.g., radiographs and microfilm) from excessive light, electromagnetic fields, and temperature.				
	The QAP user should take measures to prevent unauthorized personnel from entering record storage areas.				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	Electronic information storage systems should be accessible only through security measures such as passwords, and the number of personnel who have authorized access should be limited. In addition, personnel who have authorized access should have identified privileges, such as "read only" or "read and add only".				
	The QAP user should describe the measures to ensure prompt replacement of a record that is lost or damaged.				
9.18	**Audits**	RG 7.10, 18. §71.137			
9.18.1	**Elements of an Audit Program** A comprehensive audit program should include the following elements:	RG 7.10, 18.1			
	Assurance of the authority and organizational independence of the auditors				
	A commitment to adequate manpower, funding, and facilities to implement the audit				
	Identification of audit personnel and their qualifications				
	Provisions for reasonable and timely access of audit personnel to facilities, documents, and qualified personnel necessary for performing audits				
	Use of established procedures and checklists				
	Methods for reporting audit findings to responsible management of both the audited and auditing organizations				
	Provisions for the audit team to gain access to levels of management that have responsibility and authority for corrective action				
	Methods for verifying that effective corrective action has been accomplished on a timely basis				
9.18.2	**Scheduling of Audits** The QAP user should establish schedules for internal audits, external audits, and audits performed by management. These schedules should ensure that key activities of the QAP (e.g., design, fabrication) receive priority consideration.	RG 7.10, 18.1			
	For audits performed by management, the schedules should identify the				

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
	level of management designated to assess the overall effectiveness of the implementation of the described in-house QAP. The QAP user should also identify the activities important to safety (e.g., procurement, training of personnel) that should be included in the audit program. Management audits should be conducted at least once every 12 months.				
	For internal audits, the schedules should ensure that applicable elements of the QA program are audited annually or at least once within the life of the activity, whichever is shorter.				
	For external audits, the schedules should ensure that all elements of a major supplier's (or major contractor's) QAP are audited on a triennial basis. The 3-year period should begin with performance of an audit when sufficient work is in progress to demonstrate implementation of a QAP that has the required scope for purchases placed during the 3-year period.				
9.18.3	**Team Selection** The QAP user should establish the qualifications of the lead auditor and audit team members and specify their respective responsibilities with respect to evaluating and issuing audit reports. Specific guidance for determining qualifications for the lead auditor and individual audit team members may be obtained from ANSI/ASME NQA-1983	RG 7.10, 18.3			
	The auditing organizations should have the responsibility to establish qualifications for prospective audit personnel and the requirements for use of technical specialists to accomplish auditing activities that are important to safety.				
	The QAP user should select the lead auditor and audit team members from personnel who do not have direct responsibility in the areas being audited.				
9.18.4	**Pre-audit Conference** Prior to an audit, the QAP user should specify the nature and scope of the pre-audit conference between management of the organizations being audited and the team conducting the audit. The purpose of the pre-audit conference should be to meet counterparts, confirm the audit scope and dates, establish channels of communication, discuss the sequence and duration of the audit, prepare an agreed-upon agenda for the audit, and set the time for the post-audit conference.	RG 7.10, 18.4			

Section	Requirement	Requirement Basis	SARP Location	Satisfactory? Y/N/NA	Comment Ref. No.
9.18.5	**Post-Audit Conference** The QAP user should describe the measures to conduct a post-audit conference between management of the organizations being audited and the team conducting the audit to present the results and clarify any misunderstandings that may arise.	RG 7.10, 18.5			
9.18.6	**Reporting and Response** The QA program user should describe the measures to identify time constraints imposed for issuing audit reports and the requested date for a corrective action response by the audited organization.	RG 7.10, 18.6			
	The response should clearly state the corrective action taken to prevent recurrence of nonconformances.				
	If corrective action cannot be taken immediately, the response of the audited organization should include scheduled dates for initiation and completion of the corrective action.				
9.18.7	**Followup Action** The audit team leader should verify that	RG 7.10, 18.7			
	The audited organization provides a timely response to the audit report,				
	the response is adequate, and				
	the corrective action has been accomplished within the prescribed schedule.				

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