

**Table of TS-R-1 2005 General Requirements for Packages**

Number	Summary of Requirement	Staff Evaluation
606	<i>Package</i> mass, volume and shape shall be such that it can be easily and safely transported. In addition, the <i>package</i> needs to be properly secured in or on the <i>conveyance</i> during transport.	Satisfied. This package is of a size and shape that it can readily be positioned and secured on a conveyance.
607	Any lifting attachments on the <i>package</i> will not fail when used in the intended manner and that, if failure of the attachments should occur, the ability of the <i>package</i> to meet other requirements of these Regulations would not be impaired. Take account of appropriate safety factors to cover snatch lifting.	Satisfied. Lifting attachments are trunnions welded to the package body, which will not render the package inoperable upon failure of those components.
608	Attachments and any other features on the outer surface of the <i>package</i> which could be used to lift it shall be designed either to support its mass in accordance with the requirements of Para. 607 or shall be removable or otherwise rendered incapable of being used during transport.	Two additional handling lugs on impact limiters are rendered inoperable
609	As far as practicable, the <i>packaging</i> shall be so designed and finished that the external surfaces are free from protruding features and can be easily decontaminated.	Satisfied. There are minimal protruding features on external surfaces.
610	As far as practicable, the outer layer of the <i>package</i> shall be so designed as to prevent the collection and the retention of water.	Satisfied. This package is a right circular cylinder with no obvious cavities which would retain water.
612	The <i>package</i> shall withstand the effects of any acceleration, vibration or vibration resonance which may arise under routine conditions of transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the <i>package</i> as a whole. In particular, nuts, bolts and other securing devices shall be so designed as to prevent them from becoming loose or being released unintentionally, even after repeated use.	Satisfied. Demonstrated by analysis and reasoned conclusions drawn from scaled physical tests.

614	All valves through which the <i>radioactive contents</i> could otherwise escape shall be protected against unauthorized operation.	Satisfied. Access to containment boundary is limited by methods of construction and the need for specialized tools.
615	The design of the <i>package</i> shall take into account ambient temperatures and pressures that are likely to be encountered in routine conditions of transport.	Satisfied.
617	For <i>packages</i> to be transported by air, the temperature of the accessible surfaces shall not exceed 50°C at an ambient temperature of 38°C, with no account taken for insolation.	Not Applicable.
618	<i>Packages</i> to be transported by air shall be so designed that, if they were exposed to ambient temperatures ranging from –40°C to +55°C, the integrity of containment would not be impaired.	Not Applicable.
619	<i>Packages</i> containing <i>radioactive material</i> , to be transported by air, shall be capable of withstanding, without leakage, an internal pressure that produces a pressure differential of not less than the <i>maximum normal operating pressure</i> plus 95 kPa.	Not Applicable.
629 thru 632	<b><i>Applicable to Fissile UF<sub>6</sub> only. For Details see TS-R-1</i></b>	Not Applicable.
650	<i>Type B(U) packages</i> shall be designed to meet the requirements specified in Paras 606–616, the requirements of Paras 617–619 if carried by air, and of Paras 634–647, except as specified in Para. 646(a), and, in addition, the requirements specified in Paras. 651–664.	Satisfied. See findings in Section 2.0.
651	For <i>package</i> designed under the ambient conditions specified in Paras. 653 and 654. For details see TS-R-1.	Satisfied. See section 2.0.
653	The ambient temperature shall be assumed to be 38°C.	Satisfied. See section 2.0.
660	A <i>package</i> shall be so designed that if it were at the <i>maximum normal operating pressure</i> and it were subjected to the tests specified in Paras 719–724 and 726–729, the level of strains in the <i>containment system</i> would not attain values which would adversely affect the <i>package</i> in such a way that it would fail to meet the applicable requirements.	Satisfied. Requisite margins of safety are demonstrated by tests and analysis.
661	A <i>package</i> shall not have a <i>maximum normal operating pressure</i> in excess of a gauge pressure of 700 kPa.	Satisfied. See section 2.0.
663	A <i>package</i> containing <i>low dispersible radioactive material</i> shall be so designed that any features added to the <i>low dispersible radioactive material</i> that are not part of it, or any internal components of the <i>packaging</i> shall not adversely affect the performance of the <i>low dispersible radioactive material</i> .	Not Applicable.

664	A <i>package</i> shall be designed for an ambient temperature range from $-40^{\circ}\text{C}$ to $+38^{\circ}\text{C}$ .	Satisfied. See section 2.0.
665	<b>For detailed requirements for Type B(M) packages</b> see TS-R-1.	Not Applicable.
667	<b>For detailed requirements for Type C packages</b> see TS-R-1.	Not Applicable.
670	For detailed requirements for Type C packages see TS-R-1.	Not Applicable.
675	<b>For Fissile materials packages:</b> The <i>package</i> , after being subjected to the tests specified in Paras. 719–724, must prevent the entry of a 10 cm cube.	Satisfied. No punctures or penetrations were observed during testing.
676	For Fissile materials packages: The <i>package</i> shall be designed for an ambient temperature range of $-40^{\circ}\text{C}$ to $+38^{\circ}\text{C}$ unless the <i>competent authority</i> specifies otherwise in the certificate of approval for the <i>package design</i> .	Satisfied. See section 2.0.
701	Demonstration of compliance with the performance standards required in Section VI shall be accomplished by any of the methods listed below or by a combination thereof. For details see TS-R-1.	Satisfied. See section 2.0.
702	After the specimen, prototype or sample has been subjected to the tests, appropriate methods of assessment shall be used to ensure that the requirements of this section have been fulfilled in compliance with the performance and acceptance standards prescribed in Section VI.	Satisfied. Compared with pretest analytical results based on energy methods.
704	Specimens that comprise or simulate <i>special form radioactive material</i> shall be subjected to the impact test, the percussion test, the bending test, and the heat test specified in Paras. 705–709. A different specimen may be used for each of the tests. For further details see TS-R-1.	Not Applicable.
705	Impact test: The specimen shall drop onto the target from a height of 9 m. The target shall be as defined in Para. 717.	Not Applicable.
706	Percussion test: <i>For details see TS-R-1.</i>	Not Applicable.
707	Bending test: The test shall apply only to long, slender sources with both a minimum length of 10 cm and a length to minimum width ratio of not less than 10. <i>For details see TS-R-1.</i>	Not Applicable.
708	Heat test: The specimen shall be heated in air to a temperature of $800^{\circ}\text{C}$ and held at that temperature for a period of 10 minutes and shall then be allowed to cool.	Not Applicable.
709	Specimens that comprise or simulate <i>radioactive material</i> enclosed in a sealed capsule may be excepted from: see TS-R-1 for details.	Not Applicable.

713	All specimens shall be inspected before testing in order to identify and record faults or damage including the following: (a) divergence from the <i>design</i> ; (b) defects in manufacture; (c) corrosion or other deterioration; and (d) distortion of features.	Satisfied. See section 2.0.
714	The <i>containment system</i> of the <i>package</i> shall be clearly specified.	Satisfied. Identified by the German competent authority in the design certificate.
715	The external features of the specimen shall be clearly identified so that reference may be made simply and clearly to any part of such specimen.	Satisfied. See section 2.0.
716	After each of the applicable tests specified in Paras. 718–737: (a) Faults and damage shall be identified and recorded; (b) It shall be determined whether the integrity of the <i>containment system</i> and shielding has been retained to the extent required in Section VI for the <i>package</i> under test; and (c) For <i>packages</i> containing <i>fissile material</i> , it shall be determined whether the assumptions and conditions used in the assessments required by Paras. 671–682 for one or more <i>packages</i> are valid.	Satisfied. See section 2.0.
717	The target for the drop test specified in Paras. 705, 722, 725(a), 727 and 735 shall be a flat, horizontal surface of such a character that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase damage to the specimen.	Satisfied. See section 2.0.
718	Specimens that comprise or simulate <i>packagings</i> designed to contain 0.1 kg or more of uranium hexafluoride shall be tested hydraulically at an internal pressure of at least 1.38 MPa but, when the test pressure is less than 2.76 MPa, the <i>design</i> shall require <i>multilateral approval</i> . For retesting <i>packagings</i> , any other equivalent nondestructive testing may be applied subject to <i>multilateral approval</i> .	Not Applicable. No reference was made to UF6 as an approved content.
719	The tests are: the water spray test, the free drop test, the stacking test, and the penetration test. Specimens of the <i>package</i> shall be subjected to the free drop test, the stacking test and the penetration test, preceded in each case by the water spray test. One specimen may be used for all the tests, provided that the requirements of Para. 720 are fulfilled.	Satisfied. Water spray test was not performed because water in leakage is not credible due to methods of construction and surface treatments. Stacking test not performed because stacking of right circular cylinder is not a credible event.
720	The time interval between the conclusion of the water spray test and the succeeding test: <i>For details see TS-R-1</i> .	Satisfied. Water spray test not performed. See findings for Para. 719.

721	Water spray test: The specimen shall be subjected to a water spray test that simulates exposure to rainfall of approximately 5 cm per hour for at least one hour.	Staff reviewed and agrees that water intrusion due to water spray test is not credible.
722 (a), (b), (c)	Free drop test: The specimen shall drop onto the target so as to suffer maximum damage in respect of the safety features to be tested. <i>For details see TS-R-1.</i>	Test results and analytical calculations support the conclusion that no damage will occur for 0.3 m drop tests.
723	Stacking test: <i>For details see TS-R-1.</i>	Stacking is not credible due to cylindrical geometry.
724	Penetration test: <i>For details see TS-R-1.</i>	Penetration test is bounded by puncture test required by para. 735.
725	Additional tests for Type A packages designed for liquids and gases: (a) Free drop test, (b) Penetration test: <i>For details see TS-R-1.</i>	Not Applicable.
726	The specimen shall be subjected to the cumulative effects of the tests specified in Para. 727 and Para. 728, in that order. Following these tests, either this specimen or a separate specimen shall be subjected to the effect(s) of the water immersion test(s) as specified in Para. 729 and, if applicable, Para. 730.	Satisfied by test and verified by analytical solution.
727	Mechanical test: The mechanical test consists of three different drop tests. Each specimen shall be subjected to the applicable drops as specified in Para. 656 or Para. 682. For details of Drop I, II, and III see TS-R-1.	Satisfied by test and verified by analytical solution.
728	Thermal test.	Results by analysis, results satisfactory.
729	Water immersion test: The specimen shall be immersed under a head of water of at least 15 m for a period of not less than eight hours in the attitude which will lead to maximum damage. For demonstration purposes, an external gauge pressure of at least 150 kPa shall be considered to meet these conditions.	Pressure strength demonstrated at 9.6 MPa.
730	Enhanced water immersion test for Type B(U) and Type B(M) packages containing more than 105 A2 and Type C packages: Enhanced water immersion test: The specimen shall be immersed under a head of water of at least 200 m for a period of not less than one hour. For demonstration purposes, an external gauge pressure of at least 2 MPa shall be considered to meet these conditions.	Pressure strength demonstrated at 9.6 MPa.
731	Water leakage test for packages containing fissile material. <i>For details see TS-R-1.</i>	Pressure strength demonstrated at 9.6 MPa.

732	Water leakage test for packages containing fissile material. Test must occur after mechanical tests (727) and thermal test (728).	Satisfied. This condition is not explicitly stated, however, mechanical and thermal tests do not change the condition of the containment boundary. Furthermore, maximum reactivity occurs with the absence of water, and water in leakage reduces reactivity of the contents.
733	Water leakage test for packages containing fissile material. Submerged under a head of water of 0.9 m for eight hours.	Satisfied. See findings for Para. 732.
734	Specimens shall be subjected to the effects of each of the following test sequences in the orders specified: (a) the tests specified in Paras. 727(a), 727(c), 735 and 736; and (b) the test specified in Para. 737. Separate specimens are allowed to be used for each of the sequences (a) and (b).	Satisfied. See previous findings.
735	Puncture/tearing test: The specimen shall be subjected to the damaging effects of a solid probe made of mild steel. The orientation of the probe to the surface of the specimen shall be such as to cause maximum damage at the conclusion of the test sequence specified in Para. 734(a). See TS-R-1 for details.	Satisfied with several drop sequences.
737	Impact test: The specimen shall be subject to an impact on a target at a velocity of not less than 90 m/s, at such an orientation as to suffer maximum damage. The target shall be as defined in Para. 717, except that the target surface may be at any orientation as long as the surface is normal to the specimen path.	Not Applicable. Package not transported by air.

807	<p>An application for approval shall include:</p> <p>(a) a detailed description of the proposed <i>radioactive contents</i> with reference to their physical and chemical states and the nature of the radiation emitted;</p> <p>(b) a detailed statement of the <i>design</i>, including complete engineering drawings and schedules of materials and methods of manufacture;</p> <p>(c) a statement of the tests which have been done and their results, or evidence based on calculative methods or other evidence that the <i>design</i> is adequate to meet the applicable requirements;</p> <p>(d) the proposed operating and maintenance instructions for the use of the <i>packaging</i>; e) if the <i>package</i> is designed to have a <i>maximum normal operating pressure</i> in excess of 100 kPa gauge, a specification of the materials of manufacture of the <i>containment system</i>, the samples to be taken, and the tests to be made; (g) any special stowage provisions necessary to ensure the safe dissipation of heat from the <i>package</i> considering the various modes of transport to be used and type of <i>conveyance</i> or <i>freight container</i>.</p>	Satisfied. Inspection of the Safety Evaluation Report and the documentation of the German competent authority show these requirements to be satisfied.
810	<p>An application for approval of a <i>Type B(M) package design</i> shall include, in addition to the information required in Para. 807 for <i>Type B(U) packages</i>: See TS- R-1 for range of ambient conditions requirements.</p>	Not Applicable.
813	<p>An application for approval shall include all information necessary to satisfy the <i>competent authority</i> that the <i>design</i> meets the requirements of Para. 671, and a specification of the applicable <i>quality assurance</i> program as required in Para. 310.</p>	Satisfied. See section 2.0.
501 (b)	<p>Shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design.</p>	<p>The mechanical properties of the cask materials (M7,M8) were given in various tables in the SAR and checked against independent sources, such as the ASME code Part D, and the Parker handbook. The heat transfer characteristics of the cement isolation and the range of operation of the polymer seal material where confirmed.</p>

501 (c)	Requirement before 1 <sup>st</sup> shipment: For packages containing fissile material, where, in order to comply with the requirements of para. 671, neutron poisons are specifically included as components of the package, checks shall be performed to confirm the presence and distribution of those neutron poisons.	This package includes no neutron poisons.
507, 613, 642	Materials of the packaging and any components or structures shall be physically and chemically compatible with each other and with the radioactive contents. Account shall be taken of their behavior under irradiation. The design of any component of the containment system shall take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.	There are no explosive, flammable, pyrophoric, chemically toxic or corrosive materials in this cask that is mainly constructed out of austenitic stainless steel. There is no potential for the galvanic production of hydrogen, or chemical decomposition generating gases. Air may be used as a cover gas if the power is less than 750 W. In all cases except content 1.3, any exposed fuel pellets will be in welded containers so oxidation is not an issue. For content 1.3, pellets and pellet scrap is only permitted in welded containers.
607	Specifies that the design shall be such that any lifting attachment on the package will not fall when used in the intended manner and that, if failure of the attachments should occur, the ability of the package to meet other requirements of these Regulations would not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting.	The materials properties for the trunnions and the trunnion support plates are given in SAR Tables 4-5 and 4-6. The properties were checked against the ASME code Part D.

615, 618, 637, 653, 664, 651	The design of the package shall take into account temperatures ranging from -40°C to +70°C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.	The maximum allowable temperatures for all the materials are listed in Table 5-1 of SAR NCS 0017 Rev. 3. All the maximum temperatures are justifiable and above 70°C. In addition the minimum temperature for long and short term use was checked against a variety of references. The minimum useful temperature for all materials was below -40°C. All the materials stay within these acceptable ranges.
638	The design and manufacturing techniques shall be in accordance with national or international standards, or other requirements, acceptable to the competent authority.	International, DIN, or ISO standards are provided for all materials used.
651(a)	Ensure heat does not alter the arrangement, the geometrical form, or the physical state of the radioactive contents or, if the radioactive material is enclosed in a can or receptacle (for example, clad fuel elements), cause the can, receptacle, or radioactive material to deform or melt.	All fuel with burnup above 45 GWd/MTU must be enclosed in a welded canister. The materials for these cans, and methods and drawings of construction are not given. Due to the unknown properties of the Zircaloy cladding above 45 GWd/MTU, any fuel rods with burnup higher than 45 GWd/MTU, not 62 GWd/MTU, should be placed in welded cans and treated as damaged fuel. The thermal properties of the materials provided in the SAR and supplemental test reports were independently checked, and were found to be acceptable to the Staff.

651(b)	Ensure heat does not lessen the efficiency of the packaging through differential thermal expansion or cracking or melting of the radiation shielding material.	Coefficients of thermal expansion for all materials were listed in Table 4-5 thru 4-12 of SAR NCS 0017, Rev. 4, and checked against independent sources, usually the ASME handbook Part D. Using these values, potential interference due to thermal expansion was evaluated in SAR Sec. 4.2.4 and found to be inconsequential (M6). Temperatures of the lead radiation shield (SAR table 5-10) are expected to be below the melting point of lead (M3).
655	Requires that for a package which includes thermal protection in order to satisfy the 30 minute thermal test, the protection on the exterior of the package shall not be rendered ineffective by ripping, cutting, skidding, abrasion, or rough handling.	The thermal protection is provided by a cement insulating material contained outside of the lead shield but inside the stainless steel annulus of the cask body. It is protected by the outer wall of the cask.
656	Sets requirements indicating that a package shall be so designed that if it were subjected to certain tests it could meet given requirements.	The cask has shock absorbers made of Balsa, and spruce. The mechanical properties of these materials are given in SAR Figure 6 and 7, and Table 4-31. These have been independently checked for correctness. (M1-M2)
807 (a), 807 (f)	A detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted.	Detailed descriptions of the allowable contents and limitations on the contents are included in the CoC.
807 (b)	A detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture.	The SAR contains complete engineering drawings of the cask components. The drawings include weld specifications and materials of construction (807b).

807 (d)	The proposed operating and maintenance instructions for the use of the packaging.	The procedure for drying the cavity of the cask and the fuel after loading was checked and found to be acceptable.
501	<b>REQUIREMENTS BEFORE THE FIRST SHIPMENT (501)</b> Sets requirements that must be fulfilled before the first shipment of any package.	Satisfied. See Section 3.0.
501 (b)	For each Type B(U), Type B(M), and Type C package and for each package containing fissile material, it shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design.	Satisfied. See Section 3.0.
502	<b>REQUIREMENTS BEFORE EACH SHIPMENT (502)</b> Sets requirements that must be fulfilled prior to each shipment of any package.	Satisfied. See Section 3.0.
502(a)	For any package it shall be ensured that all the requirements specified in the relevant provisions of these Regulations have been satisfied.	Satisfied. See Section 3.0.
502(c)	For each Type B(U), Type B(M) and Type C package and for each package containing fissile material, it shall be ensured that all the requirements specified in the approval certificates have been satisfied.	Satisfied. See Section 3.0.
502(d)	Each Type B(U), Type B(M) and Type C package shall be held until equilibrium conditions have been approached closely enough to demonstrate compliance with the requirements for temperature and pressure unless an exemption from these requirements has received unilateral approval.	Satisfied. See Section 3.0.
507	<b>OTHER DANGEROUS PROPERTIES OF CONTENTS (507)</b> Sets the requirements of other dangerous properties of the package contents, such as explosiveness, flammability, pyrophoricity, chemical toxicity, and corrosiveness that should be taken into account in the packing, labeling, marking, placarding, storage, and transport in order to be in compliance with the transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.	Satisfied. See Section 3.0.

637	The design of the package shall take into account temperatures ranging from -40 degrees C to +70 degrees C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.	Satisfied. See Section 3.0.
642	The design of any component of the containment system shall take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.	Satisfied. See Section 3.0.
643	The containment system shall retain its radioactive contents under a reduction of ambient pressure to 60 kPa.	Satisfied. See Section 3.0.
644	All valves, other than pressure relief valves, shall be provided with an enclosure to retain any leakage from the valve.	Satisfied. See Section 3.0.
651(a)	Ensure heat does not alter the arrangement, the geometrical form or the physical state of the radioactive contents or, if the radioactive material is enclosed in a can or receptacle (for example, clad fuel elements), cause the can, receptacle or radioactive material to deform or melt.	Satisfied. See Section 3.0.
651(b)	Ensure heat does not lessen the efficiency of the packaging through differential thermal expansion or cracking or melting of the radiation shielding material.	Satisfied. See Section 3.0.
651(c)	In combination with moisture, accelerate corrosion.	Satisfied. See Section 3.0.
652	A package shall be so designed that the temperature of the accessible surfaces of a package shall not exceed 50 degrees C, unless the package is transported under <u>exclusive use</u>	Satisfied. See Section 3.0.
653	The ambient temperature shall be assumed to be 38 degrees C.	Satisfied. See Section 3.0.
654	The solar insulation conditions shall be assumed to be as specified in Table XI.	Satisfied. See Section 3.0.
655	Requires that for a package which includes thermal protection in order to satisfy the 30 minute thermal test, the protection on the exterior of the package shall not be rendered ineffective by ripping, cutting, skidding, abrasion, or rough handling.	Satisfied. See Section 3.0.
676	A package for fissile material shall be designed for an ambient temp. range of -40 degrees C to +38 degrees.	Satisfied. See Section 3.0.

728(a)	Exposure of a specimen for a period 30 minutes to a thermal environment which provides a heat flux at least equivalent to that of a hydrocarbon fuel/air fire in sufficiently quiescent ambient conditions to give a minimum average flame emissivity coefficient of 0.9 and an average temperature of at least 800 degrees C, fully engulfing the specimen, with a surface absorptivity coefficient of 0.8 or that value which the package may be demonstrated to possess if exposed to the fire specified.	Satisfied. See Section 3.0.
728(b)	Exposure of the specimen to an ambient temperature of 38 degrees C, subject to the solar insolation conditions specified in Table XI and subject to the design maximum rate of internal heat generation within the package by the radioactive contents for a sufficient period to ensure that temperatures in the specimen are everywhere decreasing and/or are approaching initial steady state conditions.	Satisfied. See Section 3.0.
807 (a)	A detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted.	Satisfied. See Section 3.0.
807 (b)	A detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture.	Satisfied. See Section 3.0.
807 (c)	A statement of the tests which have been done and their results, or evidence based on calculative methods or other evidence that the design is adequate to meet the applicable requirements.	Satisfied. See Section 3.0.
807 (d)	The proposed operating and maintenance instructions for the use of the packaging.	Satisfied. See Section 3.0.
807 (e)	If the package is designed to have a maximum normal operating pressure in excess of 100 kPa gauge, a specification of the materials of manufacture of the containment system, the samples to be taken, and the tests to be made.	Satisfied. See Section 3.0.
807 (g)	Any special stowage provisions necessary to ensure the safe dissipation of heat from the package considering the various modes of transport to be used and type of conveyance or freight container.	Satisfied. See Section 3.0.
810 (d)	The range of ambient conditions (temperature, solar radiation) which are expected to be encountered during transport and which have been taken into account in the design.	Satisfied. See Section 3.0.
813	An application for approval shall include all information necessary to satisfy the competent authority that the design meets the requirements of para. 671, and a specification of the applicable quality assurance program as required in para. 310.	Satisfied. See Section 3.0.

501	Sets requirements that must be fulfilled before the first shipment of any package.	Satisfied. See Section 4.0.
501 (b)	For each Type B(U), Type B(M), and Type C package and for each package containing fissile material, it shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design.	Satisfied. See Section 4.0.
502	Sets requirements that must be fulfilled prior to each shipment of any package.	Satisfied. See Section 4.0.
502(a)	For any package it shall be ensured that all the requirements specified in the relevant provisions of these Regulations have been satisfied.	Satisfied. See Section 4.0.
502(c)	For each Type B(U), Type B(M), and Type C package and for each package containing fissile material, it shall be ensured that all the requirements specified in the approval certificates have been satisfied.	Satisfied. See Section 4.0.
502(e)	For each Type B and Type C package, inspections or tests are required to ensure that all closures, valves and other openings of the containment system are properly closed and sealed.	Satisfied. See Section 4.0.
502(g)	For packages containing fissile material, measurements of isotopic composition (if burnup credit is allowed) and tests of the closure of the package (if special features are used to avoid in-leakage of water) shall be performed.	Satisfied. See Section 4.0.
502(h)	For low dispersible material, the requirements in the approval certificate and the relevant provisions of the regulations must be met.	Satisfied. See Section 4.0.
507	Sets the requirements of other dangerous properties of the package contents, such as explosiveness, flammability, pyrophoricity, chemical toxicity, and corrosiveness that should be taken into account in the packing, labeling, marking, placarding, storage, and transport in order to be in compliance with the transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.	Satisfied. See Section 4.0.
520(c)	The level of internal non-fixed contamination does not exceed one hundred times the levels specified in para. 508.	Satisfied. See Section 4.0.

614	All valves through which the radioactive contents could otherwise escape shall be protected against unauthorized operation.	Satisfied. See Section 4.0.
637	The design of the package shall take into account temperatures ranging from -40 degrees C to +70 degrees C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.	Satisfied. See Section 4.0.
639	The design shall include a containment system securely closed by a positive fastening device which cannot be opened unintentionally or by a pressure which may arise within the package.	Satisfied. See Section 4.0.
642	The design of any component of the containment system shall take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.	Satisfied. See Section 4.0.
643	The containment system shall retain its radioactive contents under a reduction of ambient pressure to 60 kPa.	Satisfied. See Section 4.0.
644	All valves, other than pressure relief valves, shall be provided with an enclosure to retain any leakage from the valve.	Satisfied. See Section 4.0.
646	A package shall be so designed that if it were subjected to the tests specified in paras. 719-724 [Type A package tests].	Satisfied. See Section 4.0.
647	The design of a package intended for liquid radioactive material shall make provision for ullage to accommodate variations in the temperature of the contents, dynamic effects and filling dynamics.	Satisfied. See Section 4.0.
651	A package shall be so designed that, under the ambient conditions specified in paras. 653 and 654, heat generated within the package by the radioactive contents shall not, under normal conditions of transport, as demonstrated by the tests in paras. 719-724, adversely affect the package in such a way that it would fail to meet the applicable requirements for containment and shielding if left unattended for period of one week. Particular attention shall be paid to the effects of heat.	Satisfied. See Section 4.0.
651(a)	Alter the arrangement, the geometrical form or the physical state of the radioactive contents or, if the radioactive material is enclosed in a can or receptacle (for example, clad fuel elements), cause the can, receptacle or radioactive material to deform or melt.	Satisfied. See Section 4.0.

651(b)	Lessen the efficiency of the packaging through differential thermal expansion or cracking or melting of the radiation shielding material.	Satisfied. See Section 4.0.
657	A package for radioactive contents with activity greater than $10^5 A_2$ shall be so designed that if it were subject to the enhanced water immersion test specified in para. 730, there would be no rupture of the containment system.	Satisfied. See Section 4.0.
658	Compliance with the permitted activity release limits shall depend neither upon filters nor upon a mechanical cooling system.	Satisfied. See Section 4.0.
659	A package shall not include a pressure relief system from the containment system which would allow the release of radioactive material to the environment under the conditions of the tests specified in paras. 719-724 and 726-729.	Satisfied. See Section 4.0.
660	A package shall be so designed that if were at the maximum normal operating pressure and it were subjected to the tests specified in paras. 719-724 and 726-729 the level of strain in the containment system would not adversely affect the package.	Satisfied. See Section 4.0.
661	A package shall not have a maximum normal operating pressure in excess of a gauge pressure of 700 kPa.	Satisfied. See Section 4.0.
730	Enhanced water immersion test: The specimen shall be immersed under a head of water of at least 200 m for a period of not less than one hour. For demonstration purposes, an external gauge pressure of at least 2 Map shall be considered to meet these conditions.	See Paragraph 657.
807 (a)	A detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted.	Satisfied. See Section 4.0.
807 (b)	A detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture.	Satisfied. See Section 4.0.
807 (c)	A statement of the tests which have been done and their results, or evidence based on calculative methods or other evidence that the design is adequate to meet the applicable requirements.	Satisfied. See Section 4.0.
807 (d)	The proposed operating and maintenance instructions for the use of the packaging.	Satisfied. See Section 4.0.
807 (e)	If the package is designed to have a maximum normal operating pressure in excess of 100 kPa gauge, a specification of the materials of manufacture of the containment system, the samples to be taken, and the tests to be made.	Satisfied. See Section 4.0.

813	An application for approval shall include all information necessary to satisfy the competent authority that the design meets the requirements of para. 671, and a specification of the applicable quality assurance program as required in para. 310.	Satisfied. See Section 4.0.
501 (b) 502(a)	Shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design. For any package it shall be ensured that all the requirements specified in the relevant provisions of these Regulations have been satisfied.	The shielding properties of the cask materials were provided in Chapter 7 of the SAR and checked against independent sources, such as the Periodic Table of Elements, and the Radiological Health Handbook.
526 526(a)	Specifies that the TI for a package, overpack, or freight container, or for unpackaged LSA-I or SCO-I, shall be the number derived in accordance with the procedure in paras. 526 - 527. Determine the maximum radiation level in units of mSv/h at a distance of 1 m from the external surfaces of the package, overpack, freight container, or unpackaged LSA-I and SCO-I. The value determined is multiplied by 100 and the resulting number is the transport index. For uranium and thorium ores and their concentrates, the maximum radiation level at any point 1 m from the external surface of the load may be taken as: .4 mSv/h for ores and physical concentrates of uranium and thorium; 0.3 mSv/h for chemical concentrates of thorium; 0.02 mSv/h for chemical concentrates of uranium, other than uranium hexafluoride.	This is an exclusive use package. At 2 meters from the external surface of the cask, the dose rate is not to exceed 0.1 mSv/h (10 mrem/h).
526(c)	The value obtained in (a) and (b) shall be rounded up to the first decimal place (e.g., 1.13 becomes 1.2) except that a value of 0.05 or less may be considered as zero.	This is an exclusive use package.
530	The transport index of any package or overpack shall not exceed 10, nor shall the CSI of any package or overpack exceed 50 except for consignments under exclusive use.	This is an exclusive use package.  TI is determined by measurement prior to shipping.

531 532	Sets the maximum radiation level on external surfaces of packages or overpacks except for those: transported under exclusive use by rail and road under the conditions specified in subpara. 572(a); or, under exclusive use and special arrangement by vessel or by air under the conditions specified in paras. 574 or 578. The maximum radiation level at any point on any external surface of a package or overpack shall not exceed 2 mSv/h. The maximum radiation level at any point on any external surface of a package under exclusive use shall not exceed 10 mSv/h.	This is an exclusive use package. The dose rates meet the requirements.
601	Requirements for LSA-III material (601) LSA-III material shall be a solid of such a nature that if the entire contents of a package were subject to the test specified in para. 703 the activity in the water would not exceed 0.1 A2.	Part 71 does not include LSA packages, and does not recognize fissile LSA materials.
645	A radiation shield which encloses a component of the package specified as a part of the containment system shall be so designed as to prevent the unintentional release of that component from the shield. Where the radiation shield and such component within it form a separate unit, the radiation shield shall be capable of being securely closed by a positive fastening device which is independent of any other packaging structure.	Not applicable because containment and shielding form a single unit.
646 646(b)	A package shall be so designed that if it were subjected to the tests specified in paras. 719-724 [Type A package tests], it would prevent: Loss of shielding integrity which would result in more than a 20% increase in the radiation level at any external surface of the package.	The HAC dose rates are provided in Table 7-32 and 7-33.
651	A package shall be so designed that, under the ambient conditions specified in paras. 653 and 654, heat generated within the package by the radioactive contents shall not, under normal conditions of transport, as demonstrated by the tests in paras. 719-724, adversely affect the package in such a way that it would fail to meet the applicable requirements for containment and shielding if left unattended for period of one week. Particular attention shall be paid to the effects of heat.	Temperatures calculated in Chapter 5 at the package and inside the package are by far lower than the admissible temperature and melting temperatures of the packaging materials and of the radioactive contents (see Chapter 5). The package consists of austenitic stainless steel with outstanding corrosion resistance. Humidity inside the package will not lead to corrosion. Ambient conditions are considered.

<p>651(a) 651(b)</p>	<p>Alter the arrangement, the geometrical form or the physical state of the radioactive contents or, if the radioactive material is enclosed in a can or receptacle (for example, clad fuel elements), cause the can, receptacle or radioactive material to deform or melt; or Lessen the efficiency of the packaging through differential thermal expansion or cracking or melting of the radiation shielding material.</p>	<p>All fuel with burnup above 62 GWd/MTU must be enclosed in a welded canister. The materials for these cans, and methods and drawings of construction are not given. Due to the unknown properties of the Zircaloy cladding above 45 GWd/MUT, any fuel rods with burnup higher than 45 GWd/MTU not 62 GWd/MUT should be placed in welded cans and treated as damaged fuel.</p>
<p>656(b)</p>	<p>The tests specified in paras. 726, 727(b), 728, and 729 and the tests in paras: (i) 727I, when the package has a mass not greater than 500 kg, an overall density not greater than 1000 kg/m<sup>3</sup> based on the external dimensions, and the radioactive contents greater than 1000 A<sub>2</sub> for not as special form radioactive material, or (ii) 727(a) for all other packages, it would: (i) retain sufficient shielding to ensure that the radiation level at 1 m from the surface of the package would not exceed 10 mSv/h with the maximum radioactive contents and (ii) restrict the accumulated loss of radioactive contents in a period of one week to not more than 20 A<sub>2</sub> for krypton-85 and not more than A<sub>2</sub> for all other radionuclides.</p>	<p>Thermal insulation is protected by 25 mm thick stainless steel outer shell of the package. Drop tests show that the thermal insulation remains undamaged under accident conditions of transport (see Chapter 4).</p>
<p>807 (a)</p>	<p>A detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted.</p>	<p>Detailed descriptions of the allowable contents and limitations on the contents are included in the Certificate of Approval. However, these permissible contents are reduced by the conditions specified in the CoC.</p>
<p>807 (b)</p>	<p>A detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture.</p>	<p>Design details are provided in Chapter 3 and 9 of the SAR.</p>
<p>807 (c)</p>	<p>A statement of the tests which have been done and their results, or evidence based on calculative methods or other evidence that the design is adequate to meet the applicable requirements.</p>	<p>Tests performed and results of the tests are described in Chapter 4 of the SAR.</p>

807 (d)	The proposed operating and maintenance instructions for the use of the packaging.	The procedure for drying the cavity of the cask and fuel after loading was checked and found to be acceptable.
807 (f)	Where the proposed radioactive contents are irradiated fuel, the applicant shall state and justify any assumption in the safety analysis relating to the characteristics of the fuel and describe any preshipment measurement required by para. 674(b).	The contents are limited to intact PWR fuel rods with burnup/enrichment combinations: burnup up to 120 GWd/MTU, U-235 enrichment not less than 5.3wt%, burnup at 10 GWd/MTU, enrichment must not less 1.0 wt%.
501 (c)	For packages containing fissile material, where, in order to comply with the requirements of para. 671, neutron poisons are specifically included as components of the package, checks shall be performed to confirm the presence and distribution of those neutron poisons.	This package includes no neutron poisons.
528, 529, 530	The CSI for packages containing fissile material shall be obtained by dividing the number 50 by the smaller of the two values of N derived in para 681 and 682. The value of the CSI may be zero, provided that an unlimited number of packages is subcritical. The CSI for each consignment shall be determined as the sum of the CSIs of all the packages contained in that consignment. The transport index of any package or overpack shall not exceed 10, nor shall the CSI of any package or overpack exceed 50 except for consignments under exclusive use.	An infinite array of dry packages with flooding between the packages and 20 cm reflection was evaluated. The assessment of package arrays for conditions of transport are discussed in Section 8.2.4. of the SAR.
601	Requirements for LSA-III material (601) LSA-III material shall be a solid of such a nature that if the entire contents of a package were subject to the test specified in para. 703 the activity in the water would not exceed 0.1 A2.	Part 71 does not include LSA packages, and does not recognize fissile LSA materials.

<p>671(a), 671 (b), 674</p>	<p>Maintain subcriticality during normal and accident conditions of transport; in particular, the following contingencies shall be considered: water leaking into or out of packages; the loss of efficiency of built-in neutron absorbers or moderators; rearrangement of the contents either within the package or as a result of loss from the package; reduction of spaces within or between packages; packages becoming immersed in water or buried in snow; and temperature changes; and meet the requirements of para. 634 for fissile material contained in packages; prescribed elsewhere in these Regulations which pertain to the radioactive properties of the material; and specified in paras. 673-682, unless excepted by para. 672. For irradiated nuclear fuel the assessment of paras. 677-682 shall be based on an isotopic composition demonstrated to provide (a) the maximum neutron multiplication during the irradiation history, or (b) a conservative estimate of the neutron multiplication for the package assessments. After irradiation but prior to shipment, a measurement shall be performed to confirm the conservatism of the isotopic composition.</p>	<p>The materials, assumptions, and analyses are shown in Chapter 8 of the SAR. Geometry, spacing of fissile content, water leakage, and water reflection were considered in the determination of the optimum configuration. Although NRC staff does not agree with the complete methodology used in the criticality analysis, given the approved fissile material content limit and conservatism used in the analyses there is substantial confidence that the contents identified in the SAR will remain subcritical under the conditions specified in this SER.</p>
<p>676</p>	<p>A package for fissile material shall be designed for an ambient temp. range of -40 degrees C to +38 degrees.</p>	<p>The limits in the materials review corresponding to TS-R-1 requirements determine that the materials are designed for temperatures ranging from -40 degrees C to +70 degrees C.</p>

<p>677, 677(a), 678, 679</p>	<p>For a package in isolation, it shall be assumed that water can leak into or out of all void spaces of the package, including those within the containment system. However, if the design incorporates, special features to prevent such leakage of water into or out of certain void spaces, even as a result of error, absence of leakage may be assumed in respect of those void spaces. Special features shall include the following: Multiple high standard water barriers, each of which would remain watertight if the package were subject to the tests prescribed in para. 682(b), a high degree of quality control in the manufacture, maintenance and repair of packagings and tests to demonstrate the closure of each package before each shipment. It shall be assumed that the confinement system shall be closely reflected by at least 20 cm of water or such greater reflection as may additionally be provided by the surrounding material of the packaging. However, when it can be demonstrated that the confinement system remains within the packaging following the tests prescribed in para. 682(b), close reflection of the package by at least 20 cm of water may be assumed in para 679(c). The package shall be subcritical under the conditions of paras. 677 and 678 with the package conditions that result in the maximum neutron multiplication consistent with: (a) routine conditions of transport (incident free); (b) the tests specified in para. 681(b); and (c), the test specified in para. 682(b).</p>	<p>The materials, assumptions, and analyses are shown in Chapter 8 of the SAR. Geometry, spacing of fissile content, water leakage, and water reflection were considered in the determination of the optimum configuration.</p>
<p>681, 681(a), 681(b), 682, 682(b)</p>	<p>A number "N" shall be derived, such that five times "N" shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following: There shall not be anything between the packages, and the package arrangement shall be reflected on all sides by at least 20 cm of water, and the state of the packages shall be their assessed or demonstrated condition if they had been subjected to the test specified in paras. 719-724. A number "N" shall be derived, such that two times "N" shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following: Hydrogenous moderation between packages, and the package arrangement reflected on all sides by at least 20 cm of water.</p>	<p>An infinite array of dry packages with flooding between the packages and 20 cm reflection was evaluated. The assessment of package arrays for conditions of transport are discussed in Section 8.2.4. of the SAR.</p>
<p>807 (a)</p>	<p>A detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted.</p>	<p>Detailed descriptions of the allowable contents and limitations on the contents are included in the CoC.</p>

807 (b)	A detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture.	Design details are provided in Chapter 3 and 9 of the SAR.
807 (c)	A statement of the tests which have been done and their results, or evidence based on calculative methods or other evidence that the design is adequate to meet the applicable requirements.	Tests performed and results of the tests are described in Chapter 4 of the SAR
807 (d)	The proposed operating and maintenance instructions for the use of the packaging.	The procedure for drying the cavity of the cask and fuel after loading was checked and found to be acceptable.
807 (f)	Where the proposed radioactive contents are irradiated fuel, the applicant shall state and justify any assumption in the safety analysis relating to the characteristics of the fuel and describe any preshipment measurement required by para. 674(b).	The fissile content was analyzed as being pre-irradiated as shown in Sections 2 and 8 of the SAR.
501 (a)	Before the first shipment, containment integrity shall be ensured.	Containment system of the package is identified by the German competent authority in the certificate. Leak testing of the containment boundary is required prior to shipment. After loading, the package must be leak tested according to procedure HA-02-06 Rev. 2 to have a leakage rate of less than $10E-5 \text{ Pa m}^3 / \text{s}$ .
502 (b)	Before each shipment, lifting attachments shall be ensured compliant w/ 607 and 608.	Lifting attachments are trunnions welded to the package body, which will not fail if used in the intended manner. If the trunnions were to fail due to improper use, the package still remains safe and meets the requirements of TS-R-1. Additionally, two additional handling lugs on impact limiters remain inoperable during transport.

502 (f)	Before each shipment, ensure special form requirements of TS-R-1 are met.	Not applicable to NCS 45.
503	Ensure the package does not contain any unnecessary items, which are not required for shipment of the radioactive material. Ensure interaction between contents do not reduce the safety of the package.	NCS 45 does not contain unnecessary items which reduce the safety of the package during transport.
520	Ensure empty packaging requirements of TS-R-1 are met.	HA-02-06 contains instructions on how to ship empty packages.
538 - 539	Ensure package is legibly and durably marked.	Drawings exist for name plates and radioactive signs - parts list 150-151.
554	Ensure consignor's declaration is made on the transport document pertaining to the consignment requirements of 550.	HA-02-06 contains instructions pointing to the proper shipping declaration.
611	Ensure non-package features will not reduce package safety during transport.	There are no non-package features which reduce package safety during transport.
616	Ensure package does not contain dangerous properties.	NCS-45 does not contain dangerous properties.
806	Ensure Type B(U) requires unilateral approval per TS-R-1 requirements.	The NCS-45 package is a Type B(U)F package and requires unilateral approval per TS-R-1 requirements.
807	Ensure package illustrations, quality assurance program, operating and maintenance instructions, proposed radioactive contents, and adequate package descriptions are provided in the application per TS-R-1.	See Section 1.0 and 7.0 of SER.
808	Ensure the application contains the appropriate certificate of approval per TS-R-1 requirements.	The application contains a certificate as appropriate.
809 - 811	Applicable only to B(M) packages.	Not applicable to NCS-45.
812-814	Ensure the package will remain subcritical during transport per 671 and the certificate of approval so indicates.	The application contains a certificate which indicates the package is critically safe as appropriate.