

Enclosure 12 to E-51306

Certificate of Compliance No. 1004

Proposed ASME Code Alternatives

AMENDMENT NUMBER 16 TO COC 1004

APPENDIX C

ASME CODE ALTERNATIVES FOR THE STANDARDIZED NUHOMS® HORIZONTAL
MODULAR STORAGE SYSTEM

DOCKET 72-1004

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C. ASME Code Alternatives

Approved ASME Code Alternatives can be found in the following tables.

DSC or TC Model(s)	ASME Code Alternative Topic	Reference Table
24P, 24PHB and 52B DSC	Pressure Boundary Components	Table C-1
24P, 24PHB and 52B DSC	Basket Assembly	Table C-2
61BT DSC	Confinement Boundary	Table C-3
61BT DSC	Basket	Table C-4
32PT DSC	Confinement Boundary	Table C-5
32PT DSC	Basket Assembly	Table C-6
24PTH DSC	Confinement Boundary	Table C-7
24PTH DSC	Basket Assembly	Table C-8
32PTH1 DSC	Confinement Boundary	Table C-9
32PTH1 DSC	Basket Assembly	Table C-10
61BTH DSC	Confinement Boundary	Table C-11
61BTH DSC	Basket	Table C-12
37PTH DSC	Confinement Boundary	Table C-13
37PTH DSC	Basket Assembly	Table C-14
69BTH DSC	Confinement Boundary	Table C-15
69BTH DSC	Basket	Table C-16
All CoC 1004 TCs Except for the OS200 and OS200FC TCs	TC structural components	Table C-17
OS200 and OS200FC TCs	TC structural components	Table C-18

NOTE: See the CoC Section II.1 Design Features for the applicable ASME code edition and years for each of these tables.

**Table C-1
ASME Code Alternatives for NUHOMS®-24P, 24PHB
and 52B DSC Pressure Boundary Components**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification and Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NB-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NB-1132	Attachments with a pressure retaining function, including stiffeners, shall be considered part of the component.	Bottom shield plug and outer bottom cover plate are outside code jurisdiction; these components together are much larger than required to provide stiffening for the inner bottom cover plate; the weld that retains the outer bottom cover plate and with it the bottom shield plug is subject to root and final PT examination.
NB-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NB-4121	Material Certification by Certificate Holder	
NB-4240 NB-5230	Full penetration welds are required for pressure boundary closure joints. Weld examination shall be UT or RT with surface PT.	<u>DSC Pressure Boundary Welds:</u> The joint details at the top and bottom end of the DSCs are not full penetration welds and thus do not comply with the requirements of figure NB-4243-1 for Category C flat head closure pressure and containment boundary welds. Volumetric weld inspection (RT or UT) is not practical due to the DSC geometry at the top and bottom closures and due to high radiation at the top closure after fuel loading (ALARA consideration). The inner and outer cover plate closure welds provide redundant closure welds, which are required by the 10 CFR Part 72 license. These welds are partial penetration welds that have been designed using a conservative "weld efficiency" factor of 0.6. Breach of the DSC confinement barriers due to an undetected flaw in any single weld layer is implausible due to the requirement for multi-layer welds. The top and bottom outer cover plate to shell welds and the inner bottom cover plate to shell weld receive a root and final PT. The top inner cover plate to shell weld, which is leak tested, has a final PT only.

**Table C-1
ASME Code Alternatives for NUHOMS®-24P, 24PHB
and 52B DSC Pressure Boundary Components**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification and Compensatory Measures
NB-6111	All completed pressure retaining systems shall be pressure tested.	<p>The pressure retaining system of the DSC consists of the following components: shell, bottom inner cover plate, siphon and vent block siphon and vent port covers, and top inner cover plates. The bottom cover plates are welded to the shell at the fabricator shop, whereas the top cover plates are field-welded to the shell at the nuclear power plant, following the loading of irradiated nuclear fuel. All other welds made to the pressure boundary, such as the support ring to shell weld, are not part of the pressure boundary and, thus, are not pressure tested.</p> <p><u>DSC Shell and Bottom Cover Plate Welds:</u> The DSC Shell and inner bottom cover plate are pressure tested during fabrication to the requirements of NB-6000. A helium leak test is performed to demonstrate leakage integrity of this boundary. Since the outer bottom cover plate is installed after the inner bottom cover plate is installed, it cannot be pressure tested.</p> <p><u>DSC Top Cover Plates Closure Welds:</u> The top closure welds are not completed until the DSC is loaded with irradiated nuclear fuel; therefore, a pressure test is not performed. Multi-layer welds are used for these joints to eliminate potential leakage paths. The inner and outer top closure welds are tested as follows:</p> <p><u>Inner Top Confinement Boundary Welds:</u> The inner top confinement boundary welds include the following: (1) field weld of inner cover plate to shell weld (including inner top cover plate to vent and siphon block), (2) top of siphon and vent block to shell weld, and (3) field weld of siphon and vent port cover plates to vent and siphon block ports. Weld (1) is helium leak tested in the field. Weld (2) is made in the fabricator shop under controlled conditions and receives a final PT. A pressure test and helium leak test are not practical because of its location. A field leak test of weld (2) is not performed because the current 10 CFR Part 72 license does not require it. Weld (3) is performed in the field with a final PT and without a leak test. A helium leak test cannot be performed on these welds because the vent and siphon ports are covered by the plates. Pressurization would require cutting a hole in the DSC creating a potential leakage point for the long-term storage canister.</p> <p><u>Outer Top Cover Plate Weld:</u> The outer top cover plate to shell weld receives a root and final PT. It is not leak tested because it is installed following the inner top cover plate.</p>
NB-7000	Overpressure Protection	No overpressure protection is provided for the NUHOMS® DSCs. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The DSC is designed to withstand the maximum possible internal pressure considering 100% fuel rod failure at maximum accident temperature.
NB-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.

Table C-1
ASME Code Alternatives for NUHOMS®-24P, 24PHB
and 52B DSC Pressure Boundary Components

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification and Compensatory Measures
NB-5520	NDE personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-2
ASME Code Alternatives for NUHOMS®-24P, 24PHB,
and 52B DSC Basket Assembly**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification and Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NF-2130	Material must be supplied by ASME approved material suppliers.	All DSC Basket Assembly sub-components designated as ASME on the DSC drawings are obtained from TN approved suppliers with Certified Material Test Reports (CMTR's). The DSC basket subcomponents listed below have been designated as non-Code. <ul style="list-style-type: none"> • Guide Sleeves, Oversleeves, and extraction stops (PWR only) • Neutron Absorber Plates and misc. hardware, such as anti-rotation pin, screws and locknuts, (BWR Only) • Coating for Spacer Discs
NF-4121	Material Certification by Certificate Holder	Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NF-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NF-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-3
ASME Code Alternatives for the NUHOMS®-61BT DSC Confinement
Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NB-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NB-1132	Attachments with a pressure retaining function, including stiffeners, shall be considered part of the component.	Bottom shield plug and outer bottom cover plate are outside code jurisdiction; these components together are much larger than required to provide stiffening for the inner bottom cover plate; the weld that retains the outer bottom cover plate and with it the bottom shield plug is subject to root and final PT examination.
NB-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NB-4121	Material Certification by Certificate Holder	
NB-4243 and NB-5230	Category C weld joints in vessels and similar weld joints in other components shall be full penetration joints. These welds shall be examined by UT or RT and either PT or MT.	The joints between the top outer and inner cover plates and containment shell are designed and fabricated per ASME Code Case N-595-1. This includes the inner top cover plate weld around the vent and siphon block. The welds are partial penetration welds and the root and final layer are PT examined. The weld between the vent and siphon block and the shell is made at the fabricator's shop and receives a final PT examination.
NB-6100 and 6200	All completed pressure retaining systems shall be pressure tested.	The vent and siphon block is not pressure tested due to the manufacturing sequence. The siphon block weld is helium leak tested when fuel is loaded and then covered with the outer top closure plate.
NB-7000	Overpressure Protection	No overpressure protection is provided for the NUHOMS® DSCs. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The DSC is designed to withstand the maximum possible internal pressure considering 100% fuel rod failure at maximum accident temperature.

Table C-3
ASME Code Alternatives for the NUHOMS®-61BT DSC Confinement Boundary

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NB-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NB-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-4
ASME Code Alternatives for the NUHOMS®-61BT DSC Basket**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NG/NF-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NG/NF-2000	Use of ASME Code Material	Some baskets include neutron absorber and aluminum plates that are not ASME Code Class 1 material. They are used for criticality safety and heat transfer, and are only credited in the structural analysis with supporting their own weight and transmitting bearing loads through their thickness.
NG/NF-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.
NG/NF-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NG/NF-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NG/NF-4121	Material Certification by Certificate Holder	
NG/NF-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.

**Table C-5
 Alternatives to the ASME Code for the NUHOMS®-32PT DSC Confinement
 Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NB-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME “N” or “NPT” stamp, or to be ASME Certified.
NB-1132	Attachments with a pressure retaining function, including stiffeners, shall be considered part of the component.	Bottom shield plug and outer bottom cover plate are outside code jurisdiction; these components together are much larger than required to provide stiffening for the inner bottom cover plate; the weld that retains the outer bottom cover plate and with it the bottom shield plug is subject to root and final PT examination.
NB-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability and certification are maintained in accordance with TN’s NRC approved QA program.
NB-4121	Material Certification by Certificate Holder	
NB-4243 and NB-5230	Category C weld joints in vessels and similar weld joints in other components shall be full penetration joints. These welds shall be examined by UT or RT and either PT or MT.	The joints between the top outer and inner cover plates and containment shell are designed and fabricated per ASME Code Case N-595-2, which provides alternative requirements for the design and examination of spent fuel canister closures. This includes the inner top cover plate weld around the vent & siphon block and the vent and siphon block welds to the shell. The closure welds are partial penetration welds and the root and final layer are subject to PT examination (in lieu of volumetric examination) in accordance with the provisions of ASME Code Case N-595-2. The 32PT closure system employs austenitic stainless steel shell, lid materials, and welds. Because austenitic stainless steels are not subject to brittle failure at the operating temperatures of the DSC, crack propagation is not a concern. Thus, multi-level PT examination provides reasonable assurance that flaws of interest will be identified. The PT examination is done by qualified personnel, in accordance with Section V and the acceptance standards of Section III, Subsection NB-5000. This alternative does not apply to other shell confinement welds, i.e., the longitudinal and circumferential welds applied to the DSC shell, and the inner bottom cover plate-to-shell weld which comply with NB-4243 and NB-5230.

**Table C-5
 Alternatives to the ASME Code for the NUHOMS®-32PT DSC Confinement
 Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NB-6100 and 6200	All pressure retaining components and completed systems shall be pressure tested. The preferred method shall be hydrostatic test.	The NUHOMS®-32PT DSC is pressure tested in accordance with ASME Code Case N-595-2. The shield plug support ring and the vent and siphon block are not pressure tested due to the manufacturing sequence. The support ring is not a pressure-retaining item and the vent and siphon block weld is helium leak tested after fuel is loaded to the same criteria as the inner top closure plate-to-shell weld (ANSI N14.5-1997 leaktight criteria).
NB-7000	Overpressure Protection	No overpressure protection is provided for the NUHOMS® DSCs. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The DSC is designed to withstand the maximum possible internal pressure considering 100% fuel rod failure at maximum accident temperature.
NB-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NB-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-6
Alternatives to the ASME Code for the NUHOMS® -32PT DSC Basket
Assembly**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NG-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NG-2000	Use of ASME Material	Some baskets include neutron absorber and aluminum plates that are not ASME Code Class 1 material. They are used for criticality safety and heat transfer, and are only credited in the structural analysis with supporting their own weight and transmitting bearing loads through their thickness. Material properties in the ASME Code for Type 6061 aluminum are limited to 400 °F to preclude the potential for annealing out the hardening properties. Annealed properties (as published by the Aluminum Association and the American Society of Metals) are conservatively assumed for the solid aluminum rails for use above the Code temperature limits.
NG-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NG-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NG-4121	Material Certification by Certificate Holder	
NG-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NG-3000/ Section II, Part D, Table 2A	Maximum temperature limit for XM-19 plate material is 800 °F.	Not compliant with ASME Section II Part D Table 2A material temperature limit for XM-19 steel for the postulated transfer accident case (117 °F, loss of sunshade, loss of neutron shield). This is a post-drop accident scenario, where the calculated maximum steady state temperature is 852 °F, the expected reduction in material strength is small (less than 1 ksi by extrapolation), and the only primary stresses in the basket grid are deadweight stresses. The recovery actions following the postulated drop accident are as described in Section 8.2.5 of the UFSAR.
NG-5520	NDE personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-7
 Alternatives to the ASME Code for the NUHOMS®-24PTH DSC Confinement
 Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NB-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NB-1132	Attachments with a pressure retaining function, including stiffeners, shall be considered part of the component.	Bottom shield plug assembly, outer bottom cover plate, lifting posts, grapple ring, grapple ring support are outside code jurisdiction; these components together are much larger than required to provide stiffening for the inner bottom cover plate; the weld that retains the outer bottom cover plate and with it the bottom shield plug is subject to root and final PT examination.
NB-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NB-4121	Material Certification by Certificate Holder	
NB-4243 and NB-5230	Category C weld joints in vessels and similar weld joints in other components shall be full penetration joints. These welds shall be examined by UT or RT and either PT or MT.	The joints between the top outer and inner cover plates (or top forging assembly for the 24PTH-S-LC) and containment shell are designed and fabricated per ASME Code Case N-595-2, which provides alternative requirements for the design and examination of spent fuel canister closures. This includes the inner top cover plate weld around the vent & siphon block and the vent and siphon block welds to the shell. The closure welds are partial penetration welds and the root and final layer are subject to PT examination (in lieu of volumetric examination) in accordance with the provisions of ASME Code Case N-595-2. The 24PTH closure system employs austenitic stainless steel shell, lid materials, and welds. Because austenitic stainless steels are not subject to brittle failure at the operating temperatures of the DSC, crack propagation is not a concern. Thus, multi-level PT examination provides reasonable assurance that flaws of interest will be identified. The PT examination is done by qualified personnel, in accordance with Section V and the acceptance standards of Section III, Subsection NB-5000. This alternative does not apply to other shell confinement welds, i.e., the longitudinal and circumferential welds of the DSC shell, and the inner bottom cover plate-to-shell weld (or bottom forging to shell weld, as applicable) which comply with NB-4243 and NB-5230.

**Table C-7
 Alternatives to the ASME Code for the NUHOMS®-24PTH DSC Confinement
 Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NB-6100 and 6200	All pressure retaining components and completed systems shall be pressure tested. The preferred method shall be hydrostatic test.	The NUHOMS®-24PTH DSC is pressure tested in accordance with ASME Code Case N-595-2. The shield plug support ring and the vent and siphon block are not pressure tested due to the manufacturing sequence. The support ring is not a pressure-retaining item and the vent and siphon block weld is helium leak tested after fuel is loaded to the same criteria as the inner top closure plate-to-shell weld (ANSI N14.5-1997 leaktight criteria).
NB-7000	Overpressure Protection	No overpressure protection is provided for the NUHOMS® DSCs. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The DSC is designed to withstand the maximum possible internal pressure considering 100% fuel rod failure at maximum accident temperature.
NB-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NB-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-8
 Alternatives to the ASME Code for the NUHOMS®-24PTH DSC Basket
 Assembly**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NG-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NG-2000	Use of ASME Material	Some baskets include neutron absorber and aluminum plates that are not ASME Code Class 1 material. They are used for criticality safety and heat transfer, and are only credited in the structural analysis with supporting their own weight and transmitting bearing loads through their thickness. Material properties in the ASME Code for Type 6061 aluminum are limited to 400 °F to preclude the potential for annealing out the hardening properties. Annealed properties (as published by the Aluminum Association and the American Society of Metals) are conservatively assumed for the aluminum transition rails for use above the Code temperature limits.
NG-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NG-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NG-4121	Material Certification by Certificate Holder	
NG-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NG-3000/ Section II, Part D, Table 2A	Maximum temperature limit for Type 304 plate material is 800 °F.	Not compliant with ASME Section II Part D Table 2A material temperature limit for Type 304 steel for the postulated transfer accident case (117 °F, loss of sunshade, loss of neutron shield). This is a post-drop accident scenario, where the calculated maximum steady state temperature is 862 °F, the expected reduction in material strength is small (less than 1 ksi by extrapolation), and the only primary stresses in the basket grid are deadweight stresses. The recovery actions following the postulated drop accident are as described in Section 8.2.5 of the UFSAR.

**Table C-8
 Alternatives to the ASME Code for the NUHOMS®-24PTH DSC Basket
 Assembly**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NG-3352	Table NG-3352-1 lists the permissible welded joints.	<p>The fusion (spot) type welds between the stainless steel insert plates (straps) and the stainless steel fuel compartment tube are not permissible welds per Table NG-3352-1. These welds are qualified by testing. The required minimum tested capacity of the welded connection (at each side of the tube) shall be 36 Kips (at room temperature). This value is based on a margin of safety (test-to-design) of 1.6, which is larger than the Code-implied margin of safety for Level D loads. The minimum capacity shall be determined by shear tests of individual specimens made from production material. The tests shall be corrected for temperature differences (test-to-design) and for material properties (actual-to-ASME Code minimum values) to demonstrate that the capacity of the welded connection with ASME minimum properties, tested at design temperatures, will meet the 36 Kips test requirement. The capacity of the welded connection is determined from the test of the weld pattern of a typical insert plate to the tube connection. The welds will be visually inspected to confirm that they are located over the insert plates, in lieu of the visual acceptance criteria of NG-5260 which are not appropriate for this type of weld. A joint efficiency (quality) factor of 1.0 is utilized for the fuel compartment longitudinal seam welds. Table NG-3352-1 permits a joint efficiency (quality) factor of 0.5 to be used for full penetration weld examined by ASME Section V visual examination (VT). For the 24PTH DSC, the compartment seam weld is thin and the weld will be made in one pass. Both surfaces of weld (inside and outside) will be fully examined by VT and therefore a factor of $2 \times 0.5 = 1.0$, will be used in the analysis. This is justified as both surfaces of the single weld pass/layer will be fully examined, and the stainless steel material that comprises the fuel compartment tubes is very ductile.</p>
NG-5520	NDE personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-9
 Alternatives to the ASME Code for the NUHOMS® 32PTH1 DSC
 Confinement Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NB-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME “N” or “NPT” stamp, or to be ASME Certified.
NB-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability and certification are maintained in accordance with TN’s NRC approved QA program.
NB-4121	Material Certification by Certificate Holder	
NB-4243 and NB-5230	Category C weld joints in vessels and similar weld joints in other components shall be full penetration joints. These welds shall be examined by UT or RT and either PT or MT.	The shell to the outer top cover weld, the shell to the inner top cover/shield plug weld (including optional design configurations for the inner top cover as described in the 32PTH1 DSC drawings), the siphon/vent cover welds, and the vent and siphon block welds to the shell are all partial penetration welds. As an alternative to the NDE requirements of NB-5230, for Category C welds, all of these closure welds are multi-layer welds and receive a root and final PT examination, except for the shell to the outer top cover weld. The shell to the outer top cover weld will be a multi-layer weld and receive multi-level PT examination in accordance with the guidance provided in ISG-15 for NDE. The multi-level PT examination provides reasonable assurance that flaws of interest will be identified. The PT examination is done by qualified personnel, in accordance with Section V and the acceptance standards of Section III, Subsection NB-5000. All of these welds are designed to meet the guidance provided in ISG-15 for stress reduction factor.
NB-1132	Attachments with a pressure retaining function, including stiffeners, shall be considered part of the component.	Bottom shield plug and outer bottom cover plate are outside code jurisdiction; these components together are much larger than required to provide stiffening for the inner bottom cover plate; the weld that retains the outer bottom cover plate and with it the bottom shield plug is subject to root and final PT examination.

**Table C-9
 Alternatives to the ASME Code for the NUHOMS® 32PTH1 DSC
 Confinement Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NB-6100 and 6200	All pressure retaining components and completed systems shall be pressure tested. The preferred method shall be hydrostatic test.	<p>The NUHOMS® 32PTH1 DSC is not a complete vessel until the top closure is welded following placement of fuel assemblies within the DSC. Due to the inaccessibility of the shell and lower end closure welds following fuel loading and top closure welding, as an alternative, the pressure testing of the DSC is performed in two parts. The DSC shell and inner bottom plate/forging (including all longitudinal and circumferential welds), are pressure tested and examined at the fabrication facility.</p> <p>The shell to the inner top cover/shield plug closure weld (including optional design configurations for the inner top cover as described in the 32PTH1 DSC drawings) is pressure tested and examined for leakage in accordance with NB-6300 in the field.</p> <p>The siphon/vent cover welds are not pressure tested; these welds and the shell to the inner top cover/shield plug closure weld (including Optional design configurations for the inner top cover as described in the 32PTH1 DSC drawings) are helium leak tested after the pressure test.</p> <p>Per NB-6324 the examination for leakage shall be done at a pressure equal to the greater of the design pressure or three-fourths of the test pressure. As an alternative, if the examination for leakage of these field welds, following the pressure test, is performed using helium leak detection techniques, the examination pressure may be reduced to ≥ 1.5 psig. This is acceptable given the significantly greater sensitivity of the helium leak detection method.</p>
NB-7000	Overpressure Protection	No overpressure protection is provided for the NUHOMS® DSCs. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The DSC is designed to withstand the maximum possible internal pressure considering 100% fuel rod failure at maximum accident temperature.
NB-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NB-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

Table C-10
Alternatives to the ASME Code for the NUHOMS® 32PTH1 DSC Basket
Assembly

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NG-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME “N” or “NPT” stamp, or to be ASME Certified.
NG-2000	Use of ASME Material	Some baskets include neutron absorber and aluminum plates that are not ASME Code Class 1 material. They are used for criticality safety and heat transfer, and are only credited in the structural analysis with supporting their own weight and transmitting bearing loads through their thickness. Material properties in the ASME Code for Type 6061 aluminum are limited to 400 °F to preclude the potential for annealing out the hardening properties. Annealed properties (as published by the Aluminum Association and the American Society of Metals) are conservatively assumed for the aluminum transition rails for use above the Code temperature limits.
NG-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NG-2130 is not possible. Material traceability and certification are maintained in accordance with TN’s NRC approved QA program.
NG-4121	Material Certification by Certificate Holder	
NG-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN’s approved QA program.
NG-3000/ Section II, Part D, Table 2A	Maximum temperature limit for Type 304 plate material is 800 °F.	Not compliant with ASME Section II Part D Table 2A material temperature limit for Type 304 steel for the postulated transfer accident case (117 °F, loss of sunshade, loss of neutron shield) and blocked vent accident (117 °F, 40 hr). The calculated maximum steady state temperatures for transfer accident case and blocked vent accident case are less than 1000 °F. The only primary stresses in the basket grid are deadweight stresses. The ASME Code allows use of SA240 Type 304 stainless steel to temperatures up to 1000 °F, as shown in ASME Code, Section II, Part D, Table 1A. In the temperature range of interest (near 800 °F), the S _m values for SA240 Type 304 shown in ASME Code, Section II Part D, Table 2A are identical to the allowable S values for the same material shown in Section B, Part D, Table 1A. The recovery actions following these accident scenarios are as described in the UFSAR.

Table C-10
Alternatives to the ASME Code for the NUHOMS® 32PTH1 DSC Basket
Assembly

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NG-3352	Table NG-3352-1 lists the permissible welded joints.	<p>The fusion welds between the stainless steel insert plates and the stainless fuel compartment tube are not included in Table NG-3352-1. These welds are qualified by testing. The required minimum tested capacity of the welded connection (at each side of the tube) shall be 45 kips (at room temperature). The capacity shall be demonstrated by qualification and production testing. Testing shall be performed using, or corrected to, the lowest tensile strength of material used in the basket assembly or to minimum specified tensile strength. Testing may be performed on individual welds, or on weld patterns representative of one wall of the tube.</p> <p>ASME Code Section IX does not provide tests for qualification of these type of welds. Therefore, these welds are qualified using Section IX to the degree applicable together with the testing described here.</p> <p>The welds will be visually inspected to confirm that they are located over the insert plates, in lieu of the visual acceptance criteria of NG-5260 which are not appropriate for this type of weld.</p> <p>A joint efficiency (quality) factor of 1.0 is utilized for the fuel compartment longitudinal seam welds. Table NG-3352-1 permits a joint efficiency (quality) factor of 0.5 to be used for full penetration weld examined by ASME Section V visual examination (VT). For the 32PTH1 DSC, the compartment seam weld is thin and the weld will be made in one pass. Both surfaces of weld (inside and outside) will be fully examined by VT and therefore a factor of $2 \times 0.5 = 1.0$, will be used in the analysis. This is justified as both surfaces of the single weld pass/layer will be fully examined, and the stainless steel material that comprises the fuel compartment tubes is very ductile.</p>
NG-5520	NDE personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-11
ASME Code Alternatives for the NUHOMS®-61BTH DSC Confinement
Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NB-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME “N” or “NPT” stamp, or to be ASME Certified.
NB-1132	Attachments with a pressure retaining function, including stiffeners, shall be considered part of the component.	Bottom shield plug and outer bottom cover plate are outside code jurisdiction; these components together are much larger than required to provide stiffening for the inner bottom cover plate; the weld that retains the outer bottom cover plate and with it the bottom shield plug is subject to root and final PT examination.
NB-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability and certification are maintained in accordance with TN’s NRC approved QA program.
NB-4121	Material Certification by Certificate Holder	
NB-4243 and NB-5230	Category C weld joints in vessels and similar weld joints in other components shall be full penetration joints. These welds shall be examined by UT or RT and either PT or MT.	The shell to the outer top cover weld, the shell to the inner top cover/weld, the siphon/vent cover welds and the vent and siphon block welds to the shell are all partial penetration welds. As an alternative to the NDE requirements of NB-5230 for Category C welds, all of these closure welds will be multi-layer welds and receive a root and final PT examination, except for the shell to the outer top cover weld. The shell to the outer top cover weld will be a multi-layer weld and receive multi-level PT examination in accordance with the guidance provided in ISG-15 for NDE. The multi-level PT Examination provides reasonable assurance that flaws of interest will be identified. The PT examination is done by qualified personnel, in accordance with Section V and the acceptance standards of Section III, Subsection NB-5000. All of these welds will be designed to meet the guidance provided in ISG-15 for stress reduction factor.

**Table C-11
ASME Code Alternatives for the NUHOMS®-61BTH DSC Confinement
Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NB-6100 and 6200	All completed pressure retaining systems shall be pressure tested.	<p>The 61BTH is not a complete or "installed" pressure vessel until the top closure is welded following placement of Fuel Assemblies with the DSC. Due to the inaccessibility of the shell and lower end closure welds following fuel loading and top closure welding, as an alternative, the pressure testing of the DSC is performed in two parts. The DSC shell (including all longitudinal and circumferential welds) is pressure tested and examined at the fabrication facility.</p> <p>The shell to the inner top cover closure weld are pressure tested and examined for leakage in accordance with NB-6300 in the field.</p> <p>The siphon/vent cover welds are not pressure tested; these welds and the shell to the inner top cover closure weld are helium leak tested after the pressure test.</p> <p>Per NB-6324 the examination for leakage shall be done at a pressure equal to the greater of the design pressure or three-fourths of the test pressure. As an alternative, if the examination for leakage of these field welds, following the pressure test, is performed using helium leak detection techniques, the examination pressure may be reduced to ≥ 1.5 psig. This is acceptable given the significantly greater sensitivity of the helium leak detection method.</p>
NB-7000	Overpressure Protection	No overpressure protection is provided for the NUHOMS® DSCs. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The DSC is designed to withstand the maximum possible internal pressure considering 100% fuel rod failure at maximum accident temperature.
NB-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NB-5520	NDE personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-12
ASME Code Alternatives for the NUHOMS®-61BTH DSC Basket**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NG/NF-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NG/NF-2000	Use of ASME Material	Some baskets include neutron absorber and aluminum plates that are not ASME Code Class 1 material. They are used for criticality safety and heat transfer, and are only credited in the structural analysis with supporting their own weight and transmitting bearing loads through their thickness. Material properties in the ASME Code for Type 6061 aluminum are limited to 400 °F to preclude the potential for annealing out the hardening properties. Annealed properties (as published by the Aluminum Association and the American Society of Metals) are conservatively assumed for the aluminum transition rails for use above the Code temperature limits.
NG/NF-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NG/NF-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NG/NF-4121	Material Certification by Certificate Holder	
NG-3352	Table NG-3352-1 lists the permissible welded joints and quality factors.	The fuel compartment tubes may be fabricated from sheet with full penetration seam weldments. Per Table NG-3352-1 a joint efficiency (quality) factor of 0.5 is to be used for full penetration weldments examined in accordance with ASME Section V visual examination (VT). A joint efficiency (quality) factor of 1.0 is utilized for the fuel compartment longitudinal seam welds (if present) with VT examination. This is justified because the compartment seam weld is thin and the weldment is made in one pass; and both surfaces of the weldment (inside and outside) receive 100% VT examination. The 0.5 quality factor, applicable to each surface of the weldment, results in a quality factor of 1.0 since both surfaces are 100% examined. In addition, the fuel compartments have no pressure retaining function and the stainless steel material that comprises the fuel compartment tubes is very ductile.
NG/NF-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.

**Table C-12
ASME Code Alternatives for the NUHOMS®-61BTH DSC Basket**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NG/NF-5520	NDE personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-13
 Alternatives to the ASME Code for the NUHOMS® 37PTH DSC Confinement
 Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 71 Subpart H in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda.	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NB-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NB-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NB-4121	Material Certification by Certificate Holder.	
NB-4243 and NB-5230	Category C weld joints in vessels and similar weld joints in other components shall be full penetration joints. These welds shall be examined by UT or RT and either PT or MT.	The shell to the outer top cover weld, the shell to the inner top cover weld (including optional design configurations for the inner top cover as described in the 37PTH DSC drawings), the siphon/vent cover welds, and the vent and siphon block welds to the shell are all partial penetration welds. As an alternative to the NDE requirements of NB-5230, for Category C welds, all of these closure welds are multi-layer welds and receive a root and final PT examination, except for the shell to the outer top cover weld. The shell to the outer top cover weld will be a multi-layer weld and receive multi-level PT examination in accordance with the guidance provided in ISG-15 (which is incorporated in NUREG-1536, Revision 1) for NDE. The multi-level PT examination provides reasonable assurance that flaws of interest will be identified. The PT examination is done by qualified personnel, in accordance with Section V and the acceptance standards of Section III, Subsection NB-5000. All of these welds are designed to meet the guidance provided in ISG-15 (which is incorporated in NUREG-1536, Revision 1) for stress reduction factor.
NB-1132	Attachments with a pressure retaining function, including stiffeners, shall be considered part of the component.	Bottom shield plug and outer bottom cover plate are outside code jurisdiction; these components together are much larger than required to provide stiffening for the inner bottom cover plate; the weld that retains the outer bottom cover plate and with it the bottom shield plug is subject to root and final PT examination.

**Table C-13
 Alternatives to the ASME Code for the NUHOMS® 37PTH DSC Confinement
 Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NB-6100 and 6200	All pressure retaining components and completed systems shall be pressure tested. The preferred method shall be hydrostatic test.	<p>The NUHOMS® 37PTH DSC is not a complete vessel until the top closure is welded following placement of fuel assemblies within the DSC. Due to the inaccessibility of the shell and lower end closure welds following fuel loading and top closure welding, as an alternative, the pressure testing of the DSC is performed in two parts. The DSC shell and inner bottom plate/forging (including all longitudinal and circumferential welds), are pressure tested and examined at the fabrication facility.</p> <p>The shell to the inner top cover/shield plug closure weld (including optional design configurations for the inner top cover as described in the 37PTH DSC drawings) is pressure tested and examined for leakage in accordance with NB-6300 in the field.</p> <p>The siphon/vent cover welds are not pressure tested; these welds and the shell to the inner top cover/shield plug closure weld (including Optional design configurations for the inner top cover as described in the 37PTH DSC drawings) are helium leak tested after the pressure test.</p> <p>Per NB-6324 the examination for leakage shall be done at a pressure equal to the greater of the design pressure or three-fourths of the test pressure. As an alternative, if the examination for leakage of these field welds, following the pressure test, is performed using helium leak detection techniques, the examination pressure may be reduced to ≥ 1.5 psig. This is acceptable given the significantly greater sensitivity of the helium leak detection method.</p>
NB-7000	Overpressure Protection	No overpressure protection is provided for the NUHOMS® DSCs. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The DSC is designed to withstand the maximum possible internal pressure considering 100% fuel rod failure at maximum accident temperature.
NB-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NB-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

Table C-14
Alternatives to the ASME Code for the NUHOMS® 37PTH DSC Basket
Assembly

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 71 Subpart H in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda.	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NG-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NG-2000	Use of ASME Material.	Baskets include neutron absorber and aluminum plates that are not ASME Code Class 1 material. They are used for criticality safety and heat transfer, and are only credited in the structural analysis with supporting their own weight and transmitting bearing loads through their thickness. Material properties in the ASME Code for Type 6061 aluminum are limited to 400 °F to preclude the potential for annealing out the hardening properties. Annealed properties (as published by the Aluminum Association and the American Society of Metals) are conservatively assumed for the aluminum transition rails for use above the Code temperature limits.
NG-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NG-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NG-4121	Material Certification by Certificate Holder.	
NG-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.
NG-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-15
ASME Code Alternatives for the NUHOMS®-69BTH DSC Confinement
Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 71 Subpart H in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda.	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before those specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, as long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NB-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME “N” or “NPT” stamp, or to be ASME Certified.
NB-1132	Attachments with a pressure retaining function, including stiffeners, shall be considered part of the component.	Bottom shield plug and outer bottom cover plate are outside code jurisdiction; these components together are much larger than required to provide stiffening for the inner bottom cover plate; the weld that retains the outer bottom cover plate and with it the bottom shield plug is subject to root and final PT examination.
NB-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NB-2130 is not possible. Material traceability and certification are maintained in accordance with TN’s NRC approved QA program.
NB-4121	Material Certification by Certificate Holder.	
NB-4243 and NB-5230	Category C weld joints in vessels and similar weld joints in other components shall be full penetration joints. These welds shall be examined by UT or RT and either PT or MT.	The shell to the outer top cover weld, the shell to the inner top cover weld (including optional design configurations for the inner top cover as described in the 69BTH DSC drawings), the siphon/vent cover welds and the vent and siphon block welds to the shell are all partial penetration welds. As an alternative to the NDE requirements of NB-5230 for Category C welds, all of these closure welds will be multi-layer welds and receive a root and final PT examination, except for the shell to the outer top cover weld. The shell to the outer top cover weld will be a multi-layer weld and receive multi-level PT examination in accordance with the guidance provided in ISG-15 (which is incorporated in NUREG-1536, Revision 1) for NDE. The multi-level PT Examination provides reasonable assurance that flaws of interest will be identified. The PT examination is done by qualified personnel, in accordance with Section V and the acceptance standards of Section III, Subsection NB-5000. All of these welds will be designed to meet the guidance provided in ISG-15 (which is incorporated in NUREG-1536, Revision 1) for stress reduction factor.

**Table C-15
ASME Code Alternatives for the NUHOMS®-69BTH DSC Confinement
Boundary**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NB-6100 and 6200	All completed pressure retaining systems shall be pressure tested.	<p>The 69BTH is not a complete or “installed” pressure vessel until the top closure is welded following placement of Fuel Assemblies with the DSC. Due to the inaccessibility of the shell and lower end closure welds following fuel loading and top closure welding, as an alternative, the pressure testing of the DSC is performed in two parts. The DSC shell (including all longitudinal and circumferential welds) is pressure tested and examined at the fabrication facility.</p> <p>The shell to the inner top cover closure weld are pressure tested and examined for leakage in accordance with NB-6300 in the field.</p> <p>The siphon/vent cover welds are not pressure tested; these welds and the shell to the inner top cover closure weld are helium leak tested after the pressure test.</p> <p>Per NB-6324 the examination for leakage shall be done at a pressure equal to the greater of the design pressure or three-fourths of the test pressure. As an alternative, if the examination for leakage of these field welds, following the pressure test, is performed using helium leak detection techniques, the examination pressure may be reduced to ≥ 1.5 psig. This is acceptable given the significantly greater sensitivity of the helium leak detection method.</p>
NB-7000	Overpressure Protection.	No overpressure protection is provided for the NUHOMS® DSCs. The function of the DSC is to contain radioactive materials under normal, off-normal and hypothetical accident conditions postulated to occur during transportation and storage. The DSC is designed to withstand the maximum possible internal pressure considering 100% fuel rod failure at maximum accident temperature.
NB-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN’s approved QA program.
NB-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

**Table C-16
ASME Code Alternatives for the NUHOMS®-69BTH DSC Basket**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 71 Subpart H in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda.	Code edition and addenda other than those specified in Section 4.2.2 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.2 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.2 may be used, so long the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NG/NF-1100	Requirements for Code Stamping of Components, Code reports and certificates, etc.	Code Stamping is not required. As Code Stamping is not required, the fabricator is not required to hold an ASME "N" or "NPT" stamp, or to be ASME Certified.
NG/NF-2000	Use of ASME Material.	Some baskets include neutron absorber and aluminum plates that are not ASME Code Class 1 material. They are used for criticality safety and heat transfer, and are only credited in the structural analysis with supporting their own weight and transmitting bearing loads through their thickness. Material properties in the ASME Code for Type 6061 aluminum are limited to 400 °F to preclude the potential for annealing out the hardening properties. Annealed properties (as published by the Aluminum Association and the American Society of Metals) are conservatively assumed for the aluminum transition rails for use above the Code temperature limits.
NG/NF-2130	Material must be supplied by ASME approved material suppliers.	Material is certified to meet all ASME Code criteria but is not eligible for certification or Code Stamping if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NG/NF-2130 is not possible. Material traceability and certification are maintained in accordance with TN's NRC approved QA program.
NG/NF-4121	Material Certification by Certificate Holder.	
NG-3352	Table NG 3352-1 lists the permissible welded joints and quality factors.	The fuel compartment tubes may be fabricated from sheet with full penetration seam weldments. Per Table NG-3352-1 a joint efficiency (quality) factor of 0.5 is to be used for full penetration weldments examined in accordance with ASME Section V visual examination (VT). A joint efficiency (quality) factor of 1.0 is utilized for the fuel compartment longitudinal seam welds (if present) with VT examination. This is justified because the compartment seam weld is thin and the weldment is made in one pass; and both surfaces of the weldment (inside and outside) receive 100% VT examination. The 0.5 quality factor, applicable to each surface of the weldment, results in a quality factor of 1.0 since both surfaces are 100% examined. In addition, the fuel compartments have no pressure retaining function and the stainless steel material that comprises the fuel compartment tubes is very ductile.
NG/NF -8000	Requirements for nameplates, stamping & reports per NCA-8000.	The NUHOMS® DSC nameplate provides the information required by 10 CFR Part 71, 49 CFR Part 173 and 10 CFR Part 72 as appropriate. Code stamping is not required for the DSC. QA data packages are prepared in accordance with the requirements of TN's approved QA program.

**Table C-16
ASME Code Alternatives for the NUHOMS®-69BTH DSC Basket**

Reference ASME Code Section/Article	Code Requirement	Alternatives, Justification & Compensatory Measures
NG/NF-5520	NDE Personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

Table C-17
ASME Code Alternatives for the Standardized NUHOMS® System TCs
Except for the OS200 and OS200FC TCs

(Applies to TC structural components only; lead shielding, neutron shielding, and neutron shield jacket of the TC are not addressed by this table)

Reference ASME Code Section/Article	Code Requirement	Exception, Justification and Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.3 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.3 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.3 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NC-1100	Requirements for Code Stamping of Components.	The cask is designed and fabricated to the requirements of Subsection NC, to the maximum extent practical. However, the TC does not have a Code stamp. Code Stamping is not required by 10 CFR Part 72 regulation. Therefore, the fabricator is not required to be ASME Certified.
NC-2000	ASME Code Materials are to be used.	The Cask bottom ram access cover plate is made of ASTM A240, a non-ASME material. This cover plate is a water tight closure used during fuel LOADING/UNLOADING OPERATIONS in the fuel/reactor building only. This is not a pressure boundary component, and its failure does not result in any public safety concerns.
NC-2130	Material must be supplied by ASME approved material suppliers.	Materials designated as ASME on UFSAR Appendix E drawings are obtained by TN approved suppliers with Certified Material Test Reports (CMTR's). Material is certified to meet all ASME Code criteria but is not eligible for Certification or Code Stamping, if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NC-2130 is not possible.
NC-4120	Material Certification by Certificate Holder	Material traceability & certification are maintained in accordance with TN's NRC approved QA program.
NC-4240	Full penetration welds are required for pressure boundary closure joints.	The joint between the ram access penetration forging and the bottom end plate consists of partial penetration welds, while NC-3200 would require full penetration welds. This cover plate is a water tight closure used during fuel LOADING/UNLOADING OPERATIONS in the fuel/reactor building only. This is not a pressure boundary component, and its failure does not result in any public safety concerns.
NC-5250	Category A and B joints shall be fully radiographed.	UFSAR Appendix E drawing NUH-03-8001 permits weld examination of (a) the circumferential and longitudinal welds for the structural shell and (b) the weld between the bottom end plate and the bottom support ring to be done using radiography (RT) or ultrasound (UT) while NC-5250 allows full penetration welds to be examined by RT only. Since the structural shell is not a pressure boundary, this code exception is acceptable.
NC-6000	All completed pressure retaining systems shall be pressure tested.	With respect to pressure testing requirements, the TC is considered a non pressure retaining component. Therefore, no pressure testing is required. However, the liquid neutron shield cavity, cask bottom neutron shield cavity, and the bottom cover plate assembly are pressure and leak tested.

Table C-17
ASME Code Alternatives for the Standardized NUHOMS® System TCs
Except for the OS200 and OS200FC TCs

(Applies to TC structural components only; lead shielding, neutron shielding, and neutron shield jacket of the TC are not addressed by this table)

Reference ASME Code Section/Article	Code Requirement	Exception, Justification and Compensatory Measures
NC-7000	Overpressure Protection	The TC is considered a non pressure retaining component. Therefore, no overpressure protection is provided for the TC, except that a pressure relief valve is provided for the annular neutron shielding.
NC-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The TC nameplate provides the information required by 10 CFR Part 72. Code stamping is not required for the TC. QA Data packages are prepared in accordance with the requirements of 10 CFR Part 72 and TN's NRC approved QA program.
NC-5520	NDE personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.

Table C-18
ASME Code Alternatives for the Standardized NUHOMS® System OS200
and OS200FC TCs

(Applies to TC structural components only; lead shielding, neutron shielding, and neutron shield jacket of the TC are not addressed by this table.)

Reference ASME Code Section/Article	Code Requirement	Alternatives, Exception, Justification & Compensatory Measures
NCA	All	Not compliant with NCA. Quality Assurance is provided according to 10 CFR Part 72 Subpart G in lieu of NCA-4000.
NCA-1140	Use of Code editions and addenda	Code edition and addenda other than those specified in Section 4.2.3 may be used for construction, but in no case earlier than 3 years before that specified in the Section 4.2.3 table. Materials produced and certified in accordance with ASME Section II material specification from Code Editions and Addenda other than those specified in Section 4.2.3 may be used, so long as the materials meet all the requirements of Article 2000 of the applicable Subsection of the Section III Edition and Addenda used for construction.
NC-1100	Requirements for Code Stamping of Components	The OS200/OS200FC TC is designed and fabricated to the requirements of Subsection NC, to the maximum extent practical. However, the TC does not have a Code stamp. Code Stamping is not required by 10 CFR Part 72 regulation. Therefore, the fabricator is not required to be ASME Certified.
NC-2000	ASME Code Materials are to be used.	The TC bottom ram access cover plate is made of ASTM A240, a non-ASME material. This cover plate is a water tight closure used during fuel LOADING/UNLOADING OPERATIONS in the fuel/reactor building only. This is not a pressure boundary component, and its failure does not result in any public safety concerns.
NC-2130	Material must be supplied by ASME approved material suppliers.	Materials designated as ASME on the UFSAR Chapter U.1 drawings are obtained by TN approved suppliers with Certified Material Test Reports (CMTR's). Material is certified to meet all ASME Code criteria but is not eligible for Certification or Code Stamping, if a non-ASME fabricator is used. As the fabricator is not required to be ASME certified, material certification to NC-2130 is not possible.
NC-4120	Material Certification by Certificate Holder	Material traceability & certification are maintained in accordance with TN's NRC approved QA program.
NC-5254	Category D joints shall be RT or UT examined.	The trunnion-to-shell weld is a Category D joint which does not allow adequate UT or RT examination. This weld is not a pressure boundary but serves as lifting point for the TC. During fabrication, this weld is progressive PT examined and then load- tested to three times the design load. The weld between the ram access penetration forging and bottom end plate is a Category D joint which does not allow meaningful RT or UT examination. This weld is PT examined root and final layers. This is not a pressure boundary component and its failure does not result in any public safety concerns.
NC-6000	All completed pressure retaining systems shall be pressure tested.	With respect to pressure testing requirements, the TC is not a pressure retaining component. Therefore, no pressure testing is required. However, the liquid neutron shield cavity, cask bottom neutron shield cavity, and the bottom cover plate assembly are pressure and leak tested.
NC-7000	Overpressure Protection	The TC is not a pressure retaining component. Therefore, no overpressure protection is provided for the TC, except that a pressure relief valve is provided for the annular neutron shielding.

Table C-18
ASME Code Alternatives for the Standardized NUHOMS® System OS200
and OS200FC TCs

(Applies to TC structural components only; lead shielding, neutron shielding, and neutron shield jacket of the TC are not addressed by this table.)

Reference ASME Code Section/Article	Code Requirement	Alternatives, Exception, Justification & Compensatory Measures
NC-8000	Requirements for nameplates, stamping & reports per NCA-8000.	The TC nameplate provides the information required by 10 CFR Part 72. Code stamping is not required for the TC. QA data packages are prepared in accordance with the requirements of 10 CFR Part 72 and TN's NRC approved QA program.
NC-5520	NDE personnel must be qualified to a specific edition of SNT-TC-1A.	Permit use of the Recommended Practice SNT-TC-1A to include up to the most recent 2011 edition.