DOC.20090323.0030

BSC

Design Calculation or Analysis Cover Sheet

Complete only applicable items.

1. QA: QA

2. Page 1

3. System	4. Document Identifier
Naval Spent Nuclear Fuel Waste Package	51A-00C-DN00-00100-000-00A

5. Title

Three Dimensional Evaluation of Naval Canister Temperatures in the IHF

6. Group

Thermal Structural Analysis

7. Document Status Designation

☐ Preliminary ☒ Committed ☐ Confirmed ☐ Cancelled ☐ Superseded

8. Notes/Comments

This calculation supersedes *Canister Temperatures in IHF*, 51A-00C-IH00-00200-000-00A.

Condition Report 12493 was initiated to track issues identified in this calculation.

Condition Report 13450 was initiated to track the error found in Naples 1999 that is discussed in Section 6.2 of the calculation.

Attachments	Total Number of Pages
See Section 5	

RECORD OF REVISIONS

9. No.	10. Reason For Revision	11. Total # of Pgs.	12. Last Pg. #	13. Originator (Print/Sign/Date)	14. Checker (Print/Sign/Date)	15. EGS (Print/Sign/Date)	16. Approved/Accepted (Print/Sign/Date)
00A	Initial issue.	135	135	Tim deBues [signature] 3/17/09	Helen Marr [signature] 3/17/09	Del Mecham [signature] 3/17/09	Michael J. Anderson [signature] 3/25/09

ENCLOSURE 2

DISCLAIMER

The calculations contained in this document were developed by Bechtel SAIC Company, LLC (BSC) and are intended solely for the use of BSC in its work for the Yucca Mountain Project.

CONTENTS

FIGURES

Page

TABLES

ACRONYMS

2D	two-dimensional
3D	three-dimensional
BSC	Bechtel SAIC Company, LLC
CPU	central processing unit
CRWMS M & O	Civilian Radioactive Waste Management System Management and Operating Contractor
CFM	cubic feet per minute
CRCF	Canister Receipt and Closure Facility
DVD	digital versatile disc
FEA	finite element analysis
IED	information exchange drawing
IHF	Initial Handling Facility
ITS	important to safety
ITWI	important to waste isolation
IV	inner vessel
OCB	outer corrosion barrier
SNF	spent nuclear fuel
WP	waste package
WPTT	waste package transfer trolley

1 PURPOSE

The objective of this calculation is to determine the naval long and short SNF canister surface temperatures while in the Initial Handling Facility (IHF), as well as the waste package temperatures in Rooms 1006 and 1007 of the IHF, and concrete temperatures in Rooms 1006, 1007, and 1008 of the IHF. Waste package and concrete temperatures are evaluated under normal operating conditions and off-normal conditions (i.e., loss-of-ventilation). This calculation incorporates naval SNF heat generation rates with up to 5.0 kW/m axial peaking.

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2.3 DESIGN CONSTRAINTS

None.

2.4 DESIGN OUTPUTS

This calculation is performed to support information in the License Application.

3 ASSUMPTIONS

3.1 ASSUMPTIONS REQUIRING VERIFICATION

3.1.1 IHF Room Dimensions, Names, and Numbers

The IHF room dimensions, names, and numbers modeled are assumed to be the same as those indicated in References 2.2.14, 2.2.15, 2.2.16, 2.2.17, 2.2.18, and 2.2.19, and are assumed to be the same as the final definitive design.

Rationale: The design is preliminary, and will require verification at the completion of the final definitive design.

This assumption is used in Sections 6.1 and 6.1.1.

3.1.2 Dimensions and Materials of the Naval Waste Packages

Dimensions and materials of the Naval Waste Packages are assumed to be the same as those indicated in References 2.2.20, 2.2.21, 2.2.22, 2.2.23, 2.2.24, and 2.2.25 and are assumed to be the same as the final definitive design.

Rationale: The design is preliminary, and will require verification at the completion of the final definitive design.

This assumption is used in Section 6.1.1.

3.1.3 Dimensions and Material of M-290 Shipping Cask

The M-290 shipping cask is assumed to be made of 304 Stainless Steel, with dimensions assumed to be the same as those indicated in Table 5, and are assumed to be the same as the final definitive design.

Rationale: Attachment II indicates that the M-290 shipping cask is made of 304 Stainless Steel. The dimensions of M-290 cask were taken from a source that is not referenceable. This is the best information currently available. The design is preliminary, and will require verification at the completion of the final definitive design.

This assumption is used in Sections 6.1.1 and 6.2.

3.1.4 Dimensions and Materials of the Shield Doors

The shield doors are assumed to have the same dimensions as those indicated in References 2.2.26 and 2.2.27 and are assumed to be made of 316 Stainless Steel. Furthermore, it is assumed that dimensions and materials are the same as the final definitive design.

Rationale: The design is preliminary, and will require verification at the completion of the final definitive design.

This assumption is used in Sections 6.1.1 and 6.2.

3.1.5 Dimensions and Materials of the Slide Gates

The slide gates are assumed to have the same dimensions as those indicated in Reference 2.2.11 and are assumed to be made of 316 Stainless Steel. Furthermore, it is assumed that dimensions and materials are the same as the final definitive design.

Rationale: The design is preliminary, and will require verification at the completion of the final definitive design.

This assumption is used in Sections 6.1.1 and 6.2.

3.1.6 Shielding Thickness and Material of the Waste Package Transfer Trolley Shielded Enclosure

It is assumed that the Waste Package Transfer Trolley shielded enclosure is composed of 516 CS and is 9 in thick.

Rationale: Table 64 of Reference 2.2.30 identifies that the Waste Package Transfer Trolley shielded enclosure in the Canister Receipt and Closure Facility is composed a 9-in thick layer of stainless steel and a 7.5-in thick layer of borated polyethylene. The Waste Package Transfer Trolley in the IHF is expected to be similar to that in the Canister Receipt and Closure Facility, with the exception of the borated polyethylene layer, since the neutron source terms of the naval canisters are low enough that a shielding component specifically for neutrons is not needed. 516 CS is used in this calculation since it has a higher thermal conductivity than stainless steel.

This assumption is used in Sections 6.1.1, 6.2, 7.3.1, and Attachment I.

3.1.7 Thickness and Material of Ceiling Plate of Room 1006

It is assumed that the ceiling plate of Room 1006 (separating Rooms 1006 and 2004) is made of solid 316 Stainless Steel and is 6 in thick.

Rationale: The material and thickness are chosen for convenience in creating the computational model. The design is preliminary, and will require verification at the completion of the final definitive design.

This assumption is used in Sections 6.1.1 and 6.2.

3.1.8 Location of Shipping Cask in Room 1008

The location of the shipping cask in Room 1008 is assumed to be approximately in the center of the room at an elevation such that the top of the cask is approximately 8.5 in from the bottom of the ceiling.

Rationale: Locations of the waste forms are not represented in References 2.2.14, 2.2.15, 2.2.16, 2.2.17, 2.2.18, and 2.2.19. The design is preliminary, and will require verification at the completion of the final definitive design.

This Assumption is used in Section 6.1.1.

3.1.9 Location of Waste Package Transfer Trolley Shielded Enclosure in Room 1006

The location of the waste package transfer trolley shielded enclosure in Room 1006 is assumed to be approximately in the center of the room.

Rationale: Locations of the waste forms are not represented in References 2.2.14, 2.2.15, 2.2.16, 2.2.17, 2.2.18, and 2.2.19. The design is preliminary, and will require verification at the completion of the final definitive design.

This Assumption is used in Section 6.1.1.

3.1.10 Thickness of Concrete Walls, Ceilings, and Floors

The concrete walls and ceilings of the rooms in the IHF are assumed to have a thickness of 4 ft, and the concrete floor of the rooms in the IHF are assumed to have a thickness of 7 ft.

Rationale: These values were chosen for convenience in setting up the computational model. The design is preliminary, and will require verification at the completion of the final definitive design.

This Assumption is used in Section 6.1.1.

3.1.11 Temperature Boundary Conditions

The temperatures of the rooms surrounding those represented in the computational models, as indicated in Reference 2.2.13, are assumed to be the same as the final definitive design.

Rationale: Reference 2.2.13 is the best information currently available. Although Reference 2.2.13 is a QA: N/A calculation, it is suitable for use in this calculation, because boundary conditions are established for a non-ITS portion of the system (Reference 2.2.13, Section 4.1).

This assumption is used in Section 6.3.2.

3.1.12 Weld Heat

It is assumed that there are two weld torches, each operating at 12.5 volts and 275 amps, and that each weld pass takes 864.4 seconds with an average interpass delay time of 1178 seconds.

Rationale: These values are based upon Reference 2.2.35, which is QA: N/A. The information in Reference 2.2.35 is the best information currently available and will require verification at the completion of the final definitive design.

This Assumption is used in Attachment V.

3.1.13 Emissivity of the Waste Package Transfer Trolley Shielded Enclosure

It is assumed that the Waste Package Transfer Trolley shielded enclosure has an emissivity of 0.95.

Rationale: The surface emissivity of the Waste Package Transfer Trolley shielded enclosure is not certain at this time and depends on surface conditions (roughness and oxidation) induced by the final fabrication method(s).

This assumption is used in Sections 6.2 and 7.3.1.

3.2 ASSUMPTIONS NOT REQUIRING VERIFICATION

3.2.1 Representation of the Waste Package Transfer Trolley Shielded Enclosure in Room 1006

Only the waste package transfer trolley shielded enclosure (containing the waste package) is represented in the computational models of Room 1006. The waste package transfer trolley chassis beams, tilting mechanisms, driving mechanisms, and any associated hardware and enclosures are not modeled. Thus, the waste package transfer trolley shielded enclosure is assumed to be "floating" in air.

Rationale: This is a simplifying assumption necessary to keep the computational model to a reasonable size. The waste package transfer trolley chassis beams, tilting mechanisms, driving mechanisms, and associated hardware and enclosures will provide additional heat conduction paths from the shielding surface, and will also provide greater surface area for convection and radiation heat transfer to the environment. Therefore, modeling only the waste package transfer trolley shielded enclosure is conservative.

This assumption is used in Section 6.1.1.

3.2.2 Representation of the Shipping Cask in Room 1008

Only the shipping cask (containing the naval SNF canister) is represented in the computational models of Room 1008. The cask transfer trolley is not modeled. Thus, the waste shipping cask is assumed to be "floating" in air.

Rationale: This is a simplifying assumption necessary to keep the computational model to a reasonable size. The cask transfer trolley will provide additional heat conduction paths from the cask surface, and will also provide greater surface area for convection and radiation heat transfer to the environment. Therefore, modeling only the shipping cask is conservative.

This assumption is used in Section 6.1.1.

3.2.3 Representation of Naval SNF Canister within Shipping Cask

Canister support structures within the shipping cask are not modeled. Thus, the naval SNF canister is assumed to be "floating" inside the shipping cask, such that there is no contact between the shipping cask and the naval SNF canister.

Rationale: This is a simplifying assumption necessary to keep the computational model to a reasonable size. Canister support structures within the shipping cask will provide additional heat conduction paths from the canister surface; therefore, not modeling them is conservative.

This assumption is used in Section 6.1.1.

3.2.4 Representation of Waste Package within WPTT Shielded Enclosure

The waste package is modeled such that there is no contact between the outer corrosion barrier (OCB) and inner vessel (IV), as well as no contact between the inner vessel and the naval SNF canister. Thus, the naval SNF canister is assumed to be "floating" inside the inner vessel, and the inner vessel is assumed to be "floating" inside the outer corrosion barrier.

Rationale: This is a simplifying assumption necessary to keep the computational model to a reasonable size. Contact points between the outer corrosion barrier, inner vessel, and naval SNF canister will provide additional heat conduction paths from the canister surface; therefore, not modeling them is conservative.

This assumption is used in Section 6.1.1.

3.2.5 Heat Transfer Modeling Within the Waste Package/Shipping Cask

Modeling of only conduction and radiation heat transfer inside the waste package is assumed to provide conservative results for this calculation.

Rationale: Some convective heat transfer will occur in the waste package fill gas. However, convection within the waste package represents a very small part of the overall heat transfer.

Neglecting this mode of heat transfer will result in slightly higher temperatures within the waste package and, therefore, is conservative.

This assumption is used in Section 6.3.

3.2.6 Pressure of Helium in the Waste Package

The thermal conductivity of helium at atmospheric pressure is assumed to be representative of the conditions which helium in the waste package will experience.

Rationale: According to p. 255 of Reference 2.2.9, the thermal conductivity of most gasses is pressure independent. Thus, using the thermal conductivity at atmospheric pressure is reasonable. The impact of this assumption is anticipated to be negligible.

This assumption is used in Section 6.2.

3.2.7 Representation of Shield Doors to Room 1006

The shield doors to Room 1006 are represented in the ANSYS model as being 28.0833 ft high.

Rationale: Reference 2.2.27 indicates the shield doors are 28.5 ft tall. For convenience in setting up the computational model of Room 1006, the shield doors are not represented above the height of the concrete ceiling, which is 28.0833 ft. Reducing the modeled height of the doors by only 5 inches is expected to have a negligible impact on thermal results, since the omitted material is small and far from the region of interest.

This assumption is used in Section 6.1.1.

4 METHODOLOGY

4.1 QUALITY ASSURANCE

This calculation was prepared in accordance with EG-PRO-3DP-G04B-00037, *Calculations and Analyses* (Reference 2.1.1). The Naval Waste Packages are classified as ITS (important to safety) and ITWI (important to waste isolation) in the *Basis of Design for the TAD Canister-Based Repository Design Concept* (Reference 2.2.10, Section 12.1.2). Therefore, the approved version of this document designated as QA: QA.

4.2 USE OF SOFTWARE

The finite element computer code used for this calculation is ANSYS V8.0 (Reference 2.2.2), which is identified by the Software Tracking number 10364-8.0-00. Usage of ANSYS V8.0 in this calculation constitutes Level 1 software usage, as defined in IT-PRO-0011 (Reference 2.1.2, Attachment 4). ANSYS V8.0 is qualified, baselined, and listed in the *Repository Project Management Automation Plan* (Reference 2.1.3, Table 6-1).

Calculations using the ANSYS V8.0 software were executed on Hewlett-Packard (HP) 9000 Series workstations running operating system HP-UX 11.00. The ANSYS V8.0 evaluations performed in this calculation are fully within the range of the validation performed for ANSYS V8.0 (Reference 2.2.32). Therefore, ANSYS V8.0 is appropriate for the thermal analysis as performed in this calculation. Access to, and use of, the code for this calculation was granted by Software Configuration Management in accordance with the appropriate procedures. The details of the ANSYS analyses are described in Section 6 and the results are presented in Section 7 of this calculation.

ICEM CFD 11.0 is used for creating the computational meshes used in the ANSYS representations. Usage of ICEM CFD 11.0 in this calculation constitutes Level 2 software usage, as defined in IT-PRO-0011 (Reference 2.1.2, Attachment 4). ICEM CFD 11.0 is listed in the *Repository Project Management Automation Plan* (Reference 2.1.3, Table 6-1).

ICEM CFD 11.0 was executed on Hewlett-Packard (HP) 9000 Series workstations running operating system HP-UX 11.00. The meshes are verified by visual inspection.

Microsoft Excel 2003 SP-3, which is a component of Microsoft Office 2003, is used for performing simple calculations and plotting results in Section 7. Usage of Microsoft Office in this calculation constitutes Level 2 software usage, as defined in IT-PRO-0011 (Reference 2.1.2, Attachment 4). Microsoft Office 2003 is listed in the *Repository Project Management Automation Plan* (Reference 2.1.3, Table 6-1).

Microsoft Excel 2003 SP-3 was executed on a PC running the Microsoft Windows XP SP-3 operating system. The calculations are confirmed by hand calculations, and the plots are confirmed by visual inspection.

Mathcad version 13.0 is used for the calculation of thermal properties in Attachment VIII. Usage of Mathcad version 13.0 in this calculation constitutes Level 2 software usage, as defined in IT-PRO-0011 (Reference 2.1.2, Attachment 4). Mathcad version 13.0 is listed in the *Repository Project Management Automation Plan* (Reference 2.1.3, Table 6-1).

Mathcad version 13.0 was executed on a PC running the Microsoft Windows XP SP-3 operating system. The results are confirmed by hand calculation.

All inputs and outputs are located in Attachment VIII. Some calculations are performed by hand.

4.3 METHOD

The solution method employed involves three-dimensional (3D) analyses using the commercially available code ANSYS to determine the naval SNF canister surface temperatures, waste package temperatures, and temperatures in associated rooms of the IHF for both the normal and the off-normal conditions.

5 LIST OF ATTACHMENTS

Table 1. List of Attachments

Attachment	Description	Number of Pages
I	Calculation of WPTT Shielded Enclosure Dimensions	3
II	Email Regarding M-290 Cask Material Information	2
III	Emissivity Sensitivity	3
IV	Waste Package Fill Gas Comparison	1
V	Weld Heat Analysis	1
VI	Naval Canister Heat Generation Profiles	6
VII	File Listing for Attachment VIII	24
VIII	One (1) Digital Versatile Disc (DVD)	N/A

6 BODY OF CALCULATION

6.1 MODEL GEOMETRY

For this calculation, the thermal performance of the waste package, SNF canister, and concrete walls in the IHF are evaluated by modeling the most thermally bounding rooms. The room dimensions, names, and numbers are indicated in References 2.2.14, 2.2.15, 2.2.16, 2.2.17, 2.2.18, and 2.2.19 (Assumption 3.1.1).

Figure 1 illustrates the positions of the rooms considered in this calculation, relative to each other. Room 1008 contains a naval SNF canister in a shipping cask. Room 1006 and 1007 each contain a naval SNF canister placed inside a waste package, which resides in the waste package transfer trolley shielded enclosure. The waste package in Room 1006 is modeled with both lids in place. It is anticipated that the waste form will occupy only one room at a time; therefore, each room is modeled separately. Since Room 1006 is smaller than Room 1007, thermal results for Room 1006 are expected to be bounding for Room 1007; hence, Room 1007 is not modeled in this calculation.

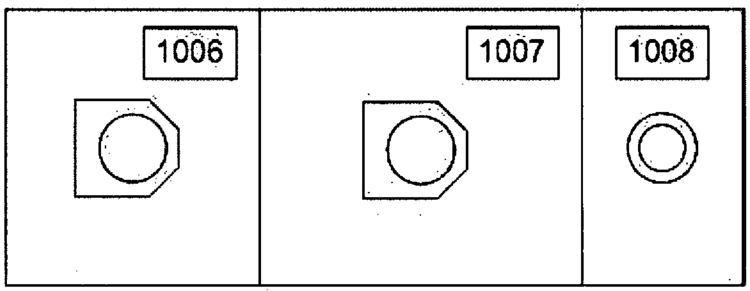

Figure 1. Room Locations in the IHF Relative to Each Other (not to scale)

There are two scenarios considered in this calculation: a normal operating condition (normal HVAC operations) and an off-normal condition with no air flow.

ANSYS is used to obtain steady-state, finite element, numerical solutions using three-dimensional representations of the naval SNF canister inside either a shipping cask or a waste package held in the waste package transfer trolley shielded enclosure, for both normal and off-normal conditions.

The following sections describe the details of the ANSYS representations, boundary conditions, and parameters used in the calculation.

6.1.1 ANSYS Representations

The dimensions used in ANSYS representation of the rooms are listed in Table 2 (see Assumption 3.1.1).

Table 2. Dimensions Used in ANSYS Model of the Rooms

Item	Dimension (ft)	Reference
Concrete Walls	4	Assumption 3.1.10
Concrete Floor	7	Assumption 3.1.10
Inside Width of Room 1006 (excluding door openings)	36	Reference 2.2.15
Inside Length of Room 1006	33	Reference 2.2.15
Inside Height of Room 1006 (up to concrete)	24.0833	Reference 2.2.19 and Assumption 3.1.10
Inside Height of Room 1006 (up to steel ceiling plate)	27.5833	Reference 2.2.19 and Assumption 3.1.7
Inside Width of Room 1008	21	Reference 2.2.15
Inside Length of Room 1008	37	Reference 2.2.15
Inside Height of Room 1008	33	Reference 2.2.17 and Assumption 3.1.10
Diameter of Top Opening of Room 1008	7.1667	Reference 2.2.11

The dimensions used in ANSYS representation of the shield doors are listed in Table 3 (see Assumption 3.1.4 and Assumption 3.2.7).

Table 3. Dimensions Used in ANSYS Model of the Shield Doors

Item	Dimension
Height of Shield Doors Between Rooms 1005 and 1006	28.0833 ft
Width of Shield Doors Between Rooms 1005 and 1006	23 ft
Thickness of Shield Doors Between Rooms 1005 and 1006	16 in
Height of Shield Doors Between Rooms 1006 and 1007	28.0833 ft
Width of Shield Doors Between Rooms 1006 and 1007	23 ft
Thickness of Shield Doors Between Rooms 1006 and 1007	16 in
Height of Shield Door to Room 1008	34 ft
Width of Shield Door to Room 1008	23 ft
Thickness of Shield Door to Room 1008	16 in

The dimensions used in ANSYS representation of the slide gate of Room 1008 are listed in Table 4 (see Assumption 3.1.5).

Table 4. Dimensions Used in ANSYS Model of the Slide Gate

Item	Dimension
Length of Slide Gate	116 in
Width of Slide Gate	116 in
Thickness of Slide Gate	9 in

The dimensions used in ANSYS representation of the M-290 shipping cask are listed in Table 5 (see Assumption 3.1.3). The location of the shipping cask in Room 1008 is assumed to be approximately in the center of the room at an elevation such that the top of the cask is approximately 8.5 in from the bottom of the ceiling (see Assumption 3.1.8). The waste shipping cask is assumed to be "floating" in air (see Assumption 3.2.2).

Table 5. Dimensions Used in ANSYS Model of M-290 Cask

Item	Dimension (in)
Cask Exterior Height	274.28
Cask Bottom Thickness	11.5
Cask Wall Thickness	10.5
Inner Diameter	71.15
Outer Diameter	92.15
Distance Between Top of Cask and Top of Naval Long or Short SNF Canister	21

Figure 2 shows a geometric cross-section of the waste package in the WPTT Shielded Enclosure indicating dimensions relevant to this calculation, which are listed in Table 6 along with other relevant dimensions. The location of the waste package transfer trolley shielded enclosure in Room 1006 is assumed to be approximately in the center of the room (see Assumption 3.1.9). The elevation of the waste package transfer trolley shielded enclosure is such that the distance from the top of the waste package to the top of the ceiling of Room 1006 (i.e. the floor of Room 2004) is 10 in (Reference 2.2.12). The waste package transfer trolley shielded enclosure is assumed to be "floating" in air (see Assumption 3.2.1).

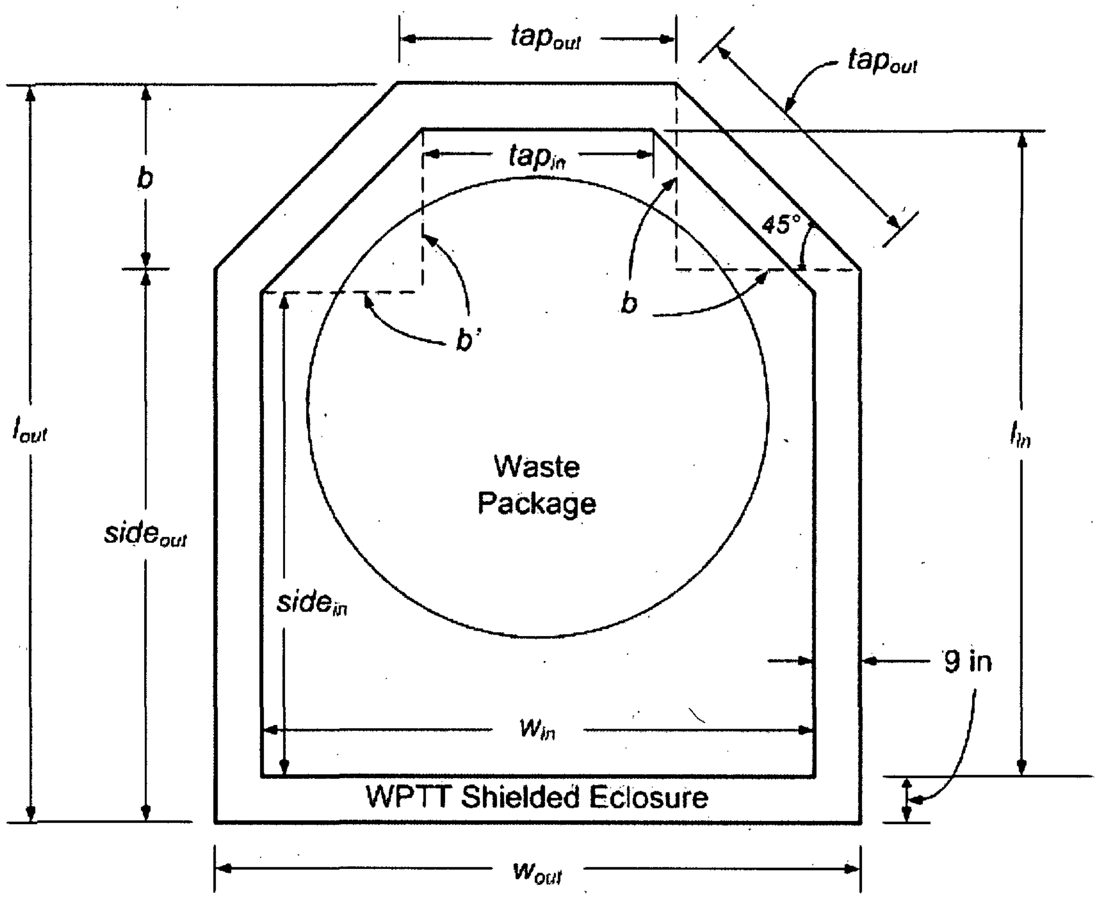

Figure 2. Cross-Section of Waste Package in the WPTT Shielded Enclosure

Table 6. Dimensions Used in Representation of WPTT Shielded Enclosure

Item	Dimension (in)	Reference
inside width, w_{in}	97.7	Attachment I
outside width, w_{out}	115.7	Attachment I
inside length, l_{in}	111.01	Attachment I
outside length, l_{out}	129.01	Attachment I
width of the outside tapered section, tap_{out}	47.92	Attachment I
width of the inside tapered section, tap_{in}	40.47	Attachment I
b	33.88	Attachment I
b'	28.62	Attachment I
outside length of the side, $side_{out}$	95.13	Attachment I
inside length of the side, $side_{in}$	82.39	Attachment I
Total Height of WPTT Shielded Enclosure	261	Reference 2.2.31, Figure 7
Waste package protrusion above shield ring	3	Reference 2.2.31, Figure 7
Clearance between WP and WPTT	6	Reference 2.2.31, Figure 8
Shielding Thickness	9	Assumption 3.1.6

The naval SNF canister is assumed to be "floating" inside the inner vessel, and the inner vessel is assumed to be "floating" inside the outer corrosion barrier (see Assumption 3.2.4).

The naval SNF canister is assumed to be "floating" inside the shipping cask, such that there is no contact between the shipping cask and the naval SNF canister (see Assumption 3.2.3).

The dimensions used in representation of the waste packages are listed in Table 7 (see Assumption 3.1.2).

Table 7. Dimensions Used in Representation of the Waste Package

Item	Dimension (in)	Reference
Naval Long Waste Package Outer Corrosion Barrier Outer Length (not including lifting feature and skirt)	225.07	References 2.2.21 and 2.2.22
Naval Short Waste Package Outer Corrosion Barrier Outer Length (not including lifting feature and skirt)	200.07	References 2.2.24 and 2.2.25
Outer Corrosion Barrier Lid Thickness	1.0	References 2.2.22 and 2.2.25
Outer Corrosion Barrier Bottom Thickness	1.0	References 2.2.22 and 2.2.25
Outer Corrosion Barrier Outer Diameter	74.08	References 2.2.21 and 2.2.24
Outer Corrosion Barrier Inner Diameter	72.08	References 2.2.21 and 2.2.24
Naval Long Waste Package Inner Vessel Outer Length (not including lip above top lid)	217	References 2.2.21 and 2.2.22
Naval Short Waste Package Inner Vessel Outer Length (not including lip above top lid)	192	References 2.2.24 and 2.2.25
Naval Long Waste Package Inner Vessel Cavity Length	213	Reference 2.2.21
Naval Short Waste Package Inner Vessel Cavity Length	188	Reference 2.2.24
Inner Vessel Lid Thickness	2.0	References 2.2.22 and 2.2.25
Inner Vessel Bottom Thickness	2.0	References 2.2.22 and 2.2.25
Inner Vessel Outer Diameter	71.70	References 2.2.21 and 2.2.24
Inner Vessel Inner Diameter	67.70	References 2.2.21 and 2.2.24
Naval SNF Canister Outer Diameter (Long and Short)	66.5	Reference 2.2.40, Enclosure 3, p. 2
Naval SNF Canister Wall Thickness (Long and Short)	1.0	Reference 2.2.8
Naval SNF Canister Lid Thickness (Long and Short)	15	Reference 2.2.7
Naval SNF Canister Bottom Thickness (Long and Short)	3.5	Reference 2.2.7
Naval Long SNF Canister Active Fuel Length	192.13 (4.88 m)	Reference 2.2.33, Attachment 1, Table 1
Naval Short SNF Canister Active Fuel Length	166.93 (4.24 m)	Reference 2.2.33, Attachment 1, Table 1

Note: Reference 2.2.7 and Reference 2.2.8 are drawings from the supplier of the Naval SNF Canisters and, therefore, are considered appropriate for use in this calculation.

6.2 THERMAL PROPERTIES

Table 8 summarizes the materials used in the 3D representations.

Table 8. Materials Used in the 3D Representations

Component	Material	Reference
Walls	Concrete	References 2.2.14, 2.2.15, 2.2.16, 2.2.17, 2.2.18, and 2.2.19
Shield Doors	316 Stainless Steel	Assumption 3.1.4
Top Slide Gate	316 Stainless Steel	Assumption 3.1.5
WPTT Shielded Enclosure	516 Carbon Steel	Assumption 3.1.6
Steel Ceiling Plate	316 Stainless Steel	Assumption 3.1.7
M-290 Cask	304 Stainless Steel	Assumption 3.1.3 and Attachment II
WP Outer Corrosion Barrier	Alloy 22	References 2.2.20 and 2.2.23
WP Inner Vessel	316 Stainless Steel	References 2.2.20 and 2.2.23
Naval SNF Canister	316 L Stainless Steel	Reference 2.2.8
Naval SNF	Homogeneous Material	Reference 2.2.40, Enclosure 1
Waste Package Inner Vessel Fill Gas (Before Inerting)	Air	No fill gas is specified. Since this area is allowed to communicate with the environment, it is air.
Waste Package Inner Vessel Fill Gas (After Inerting)	Helium	Reference 2.2.28, Section 4.9.5.4.2
Gap Between Inner Vessel and Outer Corrosion Barrier	Air	No fill gas is specified. Since this area is allowed to communicate with the environment, it is air.

Note: Reference 2.2.8 is a drawing from the supplier of the Naval SNF Canisters and, therefore, is considered appropriate for use in this calculation.

Table 9 lists the thermal properties of the concrete. The value of emissivity is taken from Table A.9 of Reference 2.2.36 at a temperature of approximately 300 K. The density, thermal conductivity, and specific heat are taken from Table A.3 of Reference 2.2.36 at temperature of 300 K.

Table 9. Thermal Properties of Concrete

Density (kg/m^3)	Thermal Conductivity (W/m-K)	Specific Heat (J/kg·K)	Emissivity
2300	1.4	880	0.88

Table 10 lists the density and emissivity of 316 SS and 316L SS. The density is taken from Reference 2.2.5, Table X1.1. The emissivity is taken from Reference 2.2.6, Table 4.3.2 (median value).

Table 11 lists values of thermal conductivity, thermal diffusivity, and specific heat of 316 SS and 316L SS. Values for thermal conductivity and thermal diffusivity are taken from Reference 2.2.3, Section II, Part D, Table TCD, p. 663 (material group K). The derivation of specific heat is defined in Equation (1). The specific heat of 316 SS and 316L SS is calculated using Equation (1), using the density in Table 10.

$$\mathit{Specific\ Heat}\left(\frac{\mathrm{J}}{\mathrm{kg}\cdot\mathrm{K}}\right) = \frac{\mathit{Thermal\ Conductivity}\left(\frac{\mathrm{W}}{\mathrm{m}\cdot\mathrm{K}}\right)}{\mathit{Density}\left(\frac{\mathrm{kg}}{\mathrm{m}^3}\right)\cdot \mathit{Thermal\ Diffusivity}\left(\frac{\mathrm{m}^2}{\mathrm{s}}\right)} \tag{1}$$

Table 10. Density and Emissivity of 316 SS and 316L SS

Density (kg/m^3)	Emissivity
7980	0.62

Table 11. Thermal Conductivity, Thermal Diffusivity, and Specific Heat of 316 SS and 316L SS

Temperature (°C)	Thermal Conductivity (W/m-K)	Thermal Diffusivity (m^2/s)	Specific Heat (J/kg·K)
21.11	14.18	3.587E-06	495.4
37.78	14.35	3.613E-06	497.9
65.56	14.87	3.665E-06	508.6
93.33	15.22	3.742E-06	509.7
121.11	15.74	3.794E-06	519.9
148.89	16.08	3.871E-06	520.7
176.67	16.43	3.923E-06	524.9
204.44	16.95	4.000E-06	531.0
232.22	17.30	4.052E-06	534.9
260.00	17.64	4.129E-06	535.4
287.78	18.16	4.181E-06	544.3
315.56	18.51	4.258E-06	544.6
343.33	18.85	4.310E-06	548.2
371.11	19.37	4.387E-06	553.3
398.89	19.72	4.439E-06	556.6
426.67	20.06	4.516E-06	556.7
454.44	20.58	4.568E-06	564.6
482.22	20.93	4.619E-06	567.7
510.00	21.27	4.697E-06	567.6
537.78	21.62	4.748E-06	570.5
565.56	22.14	4.826E-06	574.9
593.33	22.48	4.877E-06	577.7
621.11	22.83	4.929E-06	580.4

Table 12 lists the density and emissivity of 516 CS. The density is taken from Reference 2.2.3, Section II, Part A, SA-20, 14.1. The emissivity is taken as the median of the values given in Reference 2.2.6, Table 4.3.2.

Table 13 lists values of thermal conductivity, thermal diffusivity, and specific heat of 516 CS. Values for thermal conductivity and thermal diffusivity are taken from Reference 2.2.3, Section II, Part D, Table TCD (p.662, Material Group B). The specific heat of 516 CS is calculated using Equation 1, using the density in Table 12.

The emissivity of used for 516 CS (WPTT shielded enclosure) is 0.95 (see Assumption 3.1.13).

Table 12. Density and Emissivity of 516 CS

Density (kg/m^3)	Emissivity
7850	0.80

Table 13. Thermal Conductivity, Thermal Diffusivity, and Specific Heat of 516 CS

Temperature		Thermal Conductivity		Thermal Diffusivity		Specific Heat (J/kg·K)
(°F)	(°C)	(Btu/hr-ft-F)	(W/m-K)	(ft^2/hr)	(m^2/s)	
70	21.11	27.5	47.56	0.529	1.365E-05	443.8
100	37.78	27.6	47.73	0.512	1.321E-05	460.2
150	65.56	27.6	47.73	0.496	1.280E-05	475.1
200	93.33	27.6	47.73	0.486	1.254E-05	484.8
250	121.11	27.4	47.39	0.467	1.205E-05	500.9
300	148.89	27.2	47.04	0.453	1.169E-05	512.6
350	176.67	27.0	46.70	0.440	1.135E-05	523.9
400	204.44	26.7	46.18	0.428	1.105E-05	532.6
450	232.22	26.3	45.49	0.413	1.066E-05	543.7
500	260.00	25.9	44.79	0.398	1.027E-05	555.6
550	287.78	25.5	44.10	0.387	9.987E-06	562.5
600	315.56	25.0	43.24	0.374	9.652E-06	570.7
650	343.33	24.5	42.37	0.360	9.290E-06	581.0
700	371.11	24.0	41.51	0.346	8.929E-06	592.2
750	398.89	23.5	40.64	0.332	8.568E-06	604.3
800	426.67	23.0	39.78	0.318	8.206E-06	617.5
850	454.44	22.6	39.09	0.305	7.871E-06	632.6
900	482.22	22.1	38.22	0.291	7.510E-06	648.4
950	510.00	21.5	37.18	0.277	7.148E-06	662.6
1000	537.78	21.0	36.32	0.263	6.787E-06	681.7
1050	565.56	20.5	35.45	0.249	6.426E-06	702.9
1100	593.33	19.9	34.42	0.237	6.116E-06	716.8
1150	621.11	19.3	33.38	0.219	5.652E-06	752.4

Table 14 lists the density and emissivity of 304 SS. The density is taken from Reference 2.2.5, Table X1.1. The emissivity is taken from Reference 2.2.6, Table 4.3.2.

Table 15 lists values of thermal conductivity, thermal diffusivity, and specific heat of 304 SS. Values for thermal conductivity and thermal diffusivity are taken from the Reference 2.2.3, Section II, Part D, Table TCD, p. 663 (material group J). The specific heat of 304 SS is calculated using Equation (1), using the density in Table 14.

Table 14. Density and Emissivity of 304 SS

Density (kg/m^3)	Emissivity
7940	0.62

Table 15. Thermal Conductivity, Thermal Diffusivity, and Specific Heat of 304 SS

Temperature (°C)	Thermal Conductivity (W/m-K)	Thermal Diffusivity (m^2/s)	Specific Heat (J/kg·K)
21.11	14.87	3.897E-06	480.7
37.78	15.05	3.923E-06	483.1
65.56	15.57	3.974E-06	493.3
93.33	16.08	4.026E-06	503.2
121.11	16.60	4.077E-06	512.8
148.89	16.95	4.129E-06	517.0
176.67	17.47	4.181E-06	526.2
204.44	17.99	4.258E-06	532.0
232.22	18.33	4.310E-06	535.7
260.00	18.85	4.387E-06	541.2
287.78	19.20	4.439E-06	544.7
315.56	19.54	4.490E-06	548.2
343.33	20.06	4.568E-06	553.2
371.11	20.41	4.619E-06	556.4
398.89	20.75	4.671E-06	559.6
426.67	21.10	4.748E-06	559.6
454.44	21.62	4.800E-06	567.2
482.22	21.96	4.877E-06	567.2
510.00	22.31	4.929E-06	570.1
537.78	22.83	5.006E-06	574.3
565.56	23.18	5.058E-06	577.1
593.33	23.52	5.110E-06	579.8
621.11	23.87	5.187E-06	579.5

Table 16 lists the density and emissivity of Alloy 22. The density is taken from Reference 2.2.3, Section II, Part B, SB-575, Section 7.1. The emissivity is taken from Reference 2.2.37, p. 10-297. Table 17 lists the thermal conductivity of Alloy 22. Table 18 lists the specific heat of Alloy 22. The values of thermal conductivity and specific heat are taken from Reference 2.2.34, p. 13. The information cited in Reference 2.2.34 is data from the vendor of Alloy 22, and, therefore, is suitable for use in this calculation.

Table 16. Density and Emissivity of Alloy 22

Density (kg/m^3)	Emissivity
8690	0.87

Table 17. Thermal Conductivity of Alloy 22

Temperature (°C)	Thermal Conductivity (W/m·K)
48	10.1
100	11.1
200	13.4
300	15.5
400	17.5
500	19.5
600	21.3

Table 18. Specific Heat of Alloy 22

Temperature (°C)	Specific Heat (J/kg·K)
52	414
100	423
200	444
300	460
400	476
500	485
600	514

Table 19 lists the density and surface emissivity of the naval SNF canisters. The density of the naval SNF canisters is taken from Reference 2.2.40, Enclosure 1, p. 3 (maximum value). The emissivity is taken from Reference 2.2.40, Enclosure 1, p. 4. Table 20 and Table 21 list the effective thermal conductivity of the naval long and short SNF canisters, respectively, taken from Reference 2.2.40, Enclosure 1, p. 11. Table 22 lists the lumped specific heat of the naval SNF canisters, taken from Reference 2.2.40, Enclosure 1, p. 12. (Note that the units of the lumped specific heat shown on p. 12 of Reference 2.2.40 are in error. They should be kcal/kg·°C).

Table 19. Density and Surface Emissivity of Naval SNF Canisters

Density (kg/m^3)	Emissivity
4485	0.6

Table 20. Thermal Conductivity of Naval Long SNF Canister

Temperature (°C)	Thermal Conductivity (W/m·K)	Temperature (°C)	Thermal Conductivity (W/m·K)
77.78	2.45	189.14	3.39
89.61	2.62	193.11	3.38
109.98	2.71	195.20	3.37
129.11	2.90	203.17	3.44
135.20	2.87	204.59	3.46
142.72	2.00	204.97	3.49
155.84	3.12	207.36	3.49
159.20	3.06	219.36	3.58
167.42	3.18	228.56	3.66
167.84	3.26	236.22	3.72
178.75	3.23	239.03	3.74
181.64	3.27	242.72	3.76
184.95	3.28	244.75	3.78
188.03	3.35	279.34	4.00

Table 21. Thermal Conductivity of Naval Short SNF Canister

Temperature (°C)	Thermal Conductivity (W/m·K)	Temperature (°C)	Thermal Conductivity (W/m·K)
77.78	2.74	189.14	3.81
89.61	2.94	193.11	3.79
109.98	3.04	195.20	3.78
129.11	3.26	203.17	3.86
135.20	3.21	204.59	3.88
142.72	3.36	204.97	3.91
155.84	3.51	207.36	3.92
159.20	3.43	219.36	4.02
167.42	3.56	228.56	4.10
167.84	3.65	236.22	4.17
178.75	3.62	239.03	4.19
181.64	3.66	242.72	4.22
184.95	3.67	244.75	4.23
188.03	3.76	279.34	4.51

Table 22. Specific Heat of Naval SNF Canisters

Temperature (°C)	Specific Heat (J/kg·K)
0	397.48
38	418.40
93	435.14
148	451.87
204	472.79
260	481.16
316	493.71
371	502.08
400	506.26

The atmospheric pressure of air used in calculations is 88558 Pa. This pressure is obtained by taking the pressure at one atmosphere at sea level (101325 Pa) and multiplying it by the appropriate pressure ratio, 0.874, which is interpolated from Table 11.4.1 of Reference 2.2.6, at an elevation of 3750 ft. Reference 2.2.38, file: *As-Built Met. Sites Spreadsheet.xls*, indicates that the elevation of Site 1 (NTS-60) is approximately 3750 ft. (Note that DTN: MO0708ABS14MSP.000 (Reference 2.2.38) is cited in *IED Surface Facility and Environment* (Reference 2.2.29), and, therefore, is approved and appropriate for the intended use in this calculation).

Table 23 lists the thermal properties of air used in the ANSYS calculations. Values for specific heat and thermal conductivity are taken from Reference 2.2.4, p. 20.63, at standard atmospheric pressure. The density of air at a pressure of 88558 Pa and at the listed temperatures is calculated using the ideal gas law. See Attachment VIII, file: *density_of_air_at_elevation.xmcd* for detailed calculations of air density.

Table 23. Thermal Properties of Air

Temperature (°C)	Density (kg/m^3)	Thermal Conductivity (W/m-K)	Specific Heat (J/kg-K)
-17.78	1.208	0.0229	1006.4
-6.67	1.158	0.0238	1006.4
4.44	1.112	0.0246	1006.4
15.56	1.069	0.0255	1006.9
26.67	1.029	0.0263	1007.3
37.78	0.992	0.0271	1007.7
48.89	0.958	0.0279	1008.1
60.00	0.926	0.0287	1009.0
71.11	0.896	0.0295	1009.8
82.22	0.868	0.0302	1010.6
93.33	0.842	0.0310	1011.5
104.44	0.817	0.0317	1012.7
115.56	0.794	0.0325	1013.6
126.67	0.772	0.0332	1014.8
137.78	0.751	0.0340	1016.5
148.89	0.731	0.0347	1017.8
160.00	0.712	0.0354	1019.4
171.11	0.695	0.0361	1021.1
182.22	0.678	0.0368	1022.8
204.44	0.646	0.0382	1026.5
226.67	0.617	0.0396	1030.7
248.89	0.591	0.0410	1034.9
271.11	0.567	0.0423	1039.5
293.33	0.545	0.0436	1044.5
315.56	0.524	0.0449	1049.6
337.78	0.505	0.0462	1054.6
360.00	0.487	0.0475	1060.0
382.22	0.471	0.0487	1065.1
404.44	0.455	0.0499	1070.5
426.67	0.441	0.0512	1075.9

Table 24 lists values of density, thermal conductivity, and specific heat of helium used in the ANSYS calculations, taken from Reference 2.2.4, p. 20.59 (Assumption 3.2.6), at standard atmospheric pressure.

Table 24. Thermal Properties of Helium

Temperature (°C)	Density (kg/m^3)	Thermal Conductivity (W/m-K)	Specific Heat (J/kg-K)
-17.78	0.19094	0.1396	5196.3
-6.67	0.18293	0.1437	5196.3
4.44	0.17556	0.1478	5196.3
15.56	0.16883	0.1519	5196.3
26.67	0.16259	0.1559	5195.9
37.78	0.15682	0.1599	5195.9
48.89	0.15137	0.1638	5195.9
60.00	0.14641	0.1677	5195.9
71.11	0.14160	0.1715	5195.9
82.22	0.13728	0.1754	5195.9
93.33	0.13311	0.1791	5195.9
115.56	0.12542	0.1866	5195.9
137.78	0.11870	0.1940	5195.9
160.00	0.11261	0.2012	5195.9
182.22	0.10716	0.2083	5195.9
204.44	0.10204	0.2153	5195.9
226.67	0.09755	0.2222	5195.9
248.89	0.09339	0.2291	5195.9
271.11	0.08954	0.2358	5195.9
293.33	0.08602	0.2425	5195.9
315.56	0.08282	0.2491	5195.9
337.78	0.07977	0.2556	5196.3
360.00	0.07705	0.2620	5196.3
382.22	0.07449	0.2684	5196.3
404.44	0.07192	0.2747	5196.3
426.67	0.06968	0.2810	5196.3

6.3 BOUNDARY CONDITIONS

Modeling of only conduction and radiation heat transfer inside the waste package/shipping cask is assumed to provide conservative results for this calculation (see Assumption 3.2.5).

6.3.1 ANSYS Calculations, Off-Normal Operations

For the off-normal condition, the room wall exterior surface temperatures are set equal to the maximum ambient outdoor temperature of 116°F (46.7°C) (Reference 2.2.28, Section 6.1.6). Also, for added conservatism, adiabatic boundary conditions are applied to the exterior surface beneath the concrete floors.

6.3.2 ANSYS Calculations, Normal Operations

For the normal condition, the room wall exterior surface temperatures are set equal to the summer design room temperature of the adjacent rooms. Table 25 lists the summer design room temperatures in the IHF for rooms adjacent to those modeled in this calculation (Assumption 3.1.11). In order to be conservative, the maximum value of 90°F (32.2°C) is used on all modeled room wall exterior surfaces. Also, for added conservatism, adiabatic boundary conditions are applied to the exterior surface beneath the concrete floors.

Table 25. Summer Design Room Temperatures for Selected Rooms in IHF

Model Boundary (Room, Wall)	Room Adjacent to Model Boundary	Temperature	Reference
1006, North	1001	32.2°C (90°F)	Reference 2.2.13, p. 42
1006, East	1007	32.2°C (90°F)	Reference 2.2.13, p. 47
1006, South	1012	26.1°C (79°F)	Reference 2.2.13, p. 50
1006, West	1005	32.2°C (90°F)	Reference 2.2.13, p. 45
1006, Ceiling	2004	32.2°C (90°F)	Reference 2.2.13, p. 67
1008, North	1002	26.1°C (79°F)	Reference 2.2.13, p. 43
1008, East	1009	26.1°C (79°F)	Reference 2.2.13, p. 49
1008, South	1012	26.1°C (79°F)	Reference 2.2.13, p. 50
1008, West	1007	32.2°C (90°F)	Reference 2.2.13, p. 47
1008, Ceiling	2005	26.1°C (79°F)	Reference 2.2.13, p. 68

To simulate the effects of forced convection provided by the HVAC system, a convective boundary condition is applied to the exposed surfaces of the walls/ceiling, WPTT, and WP inside the room.

For air at room temperature and atmospheric pressure, the average value of the natural convection heat transfer coefficient, h, for flow over a vertical flat plate is correlated by the following equation (Reference 2.2.6, p. 4-88) (heat transfer coefficients based on natural convection are typically lower than heat transfer coefficients based on forced convection; therefore, using heat transfer coefficients based on natural convection will provide conservative results for forced convection):

$$h = 0.19\left(\Delta T\right)^{1/3} \tag{2}$$

which has units of Btu/hr·ft^2·°F, with ΔT in degrees Fahrenheit, for $L^3 \Delta T > 1000$ ft^3·°F.

The heat transfer coefficients used are listed in Table 26. They are calculated using Equation (2) and temperatures in degrees Fahrenheit, and the results are expressed in SI units using the conversion factor for Btu/hr·ft^2·°F to W/m^2·K (located inside the back cover of Reference 2.2.36):

$$1\,\frac{\mathrm{W}}{\mathrm{m}^2 \cdot \mathrm{K}} = 0.17612\,\frac{\mathrm{Btu}}{\mathrm{hr} \cdot \mathrm{ft}^2 \cdot {}^\circ\mathrm{F}} \tag{3}$$

Details of the heat transfer coefficient calculations can be seen in Attachment VIII, file: *calculate_h.xls*.

Table 26. Calculated Heat Transfer Coefficients (Ambient Temperature = 32.2°C)

Surface Temperature (°C)	Heat Transfer Coefficient ($W/m^2 \cdot K$)
32.2	0.0
32.3	0.4
32.5	0.9
33.0	1.2
33.5	1.4
35.0	1.8
37.0	2.2
40.0	2.6
45.0	3.1
50.0	3.4
55.0	3.7
60.0	4.0
65.0	4.2
70.0	4.4
80.0	4.8
90.0	5.1
100.0	5.4
110.0	5.6
120.0	5.8
140.0	6.2
160.0	6.6
180.0	6.9
200.0	7.2

6.4 HEAT LOADS

In the ANSYS representations, the naval long SNF canister is axially divided into 51 sections, and the naval short SNF canister is axially divided into 45 sections. For both canisters, the top and bottom sections represent the lid and bottom of the naval SNF canister, and as such, generate no heat. The remaining sections represent the naval SNF. There are eight heat generation profiles for the naval short SNF canister and eight heat generation profiles for the naval long SNF canister. All naval SNF canister heat generation profiles used in this calculation are listed in Table 51 through Table 54 in Attachment VI.

6.5 CALCULATION CASES

The ANSYS cases considered in this calculation are summarized in Table 27. All cases listed are analyzed under normal and off-normal conditions with air as the inner vessel fill gas. Figure 3 through Figure 10 show the ANSYS models used in the calculation.

Table 27. ANSYS Calculation Cases (Normal and Off-Normal Conditions)

Naval Heat Generation Profile Case	Room	Naval SNF Canister Type
2.3_5	1008	Long
		Short
	1006	Long
		Short
2.2_3	1008	Long
		Short
	1006	Long
		Short
2.1_3	1008	Long
		Short
	1006	Long
		Short
2.2_1	1008	Long
		Short
	1006	Long
		Short
3.3_5	1008	Long
		Short
	1006	Long
		Short
3.2_3	1008	Long
		Short
	1006	Long
		Short
3.1_3	1008	Long
		Short
	1006	Long
		Short
3.2_1	1008	Long
		Short
	1006	Short
		Short

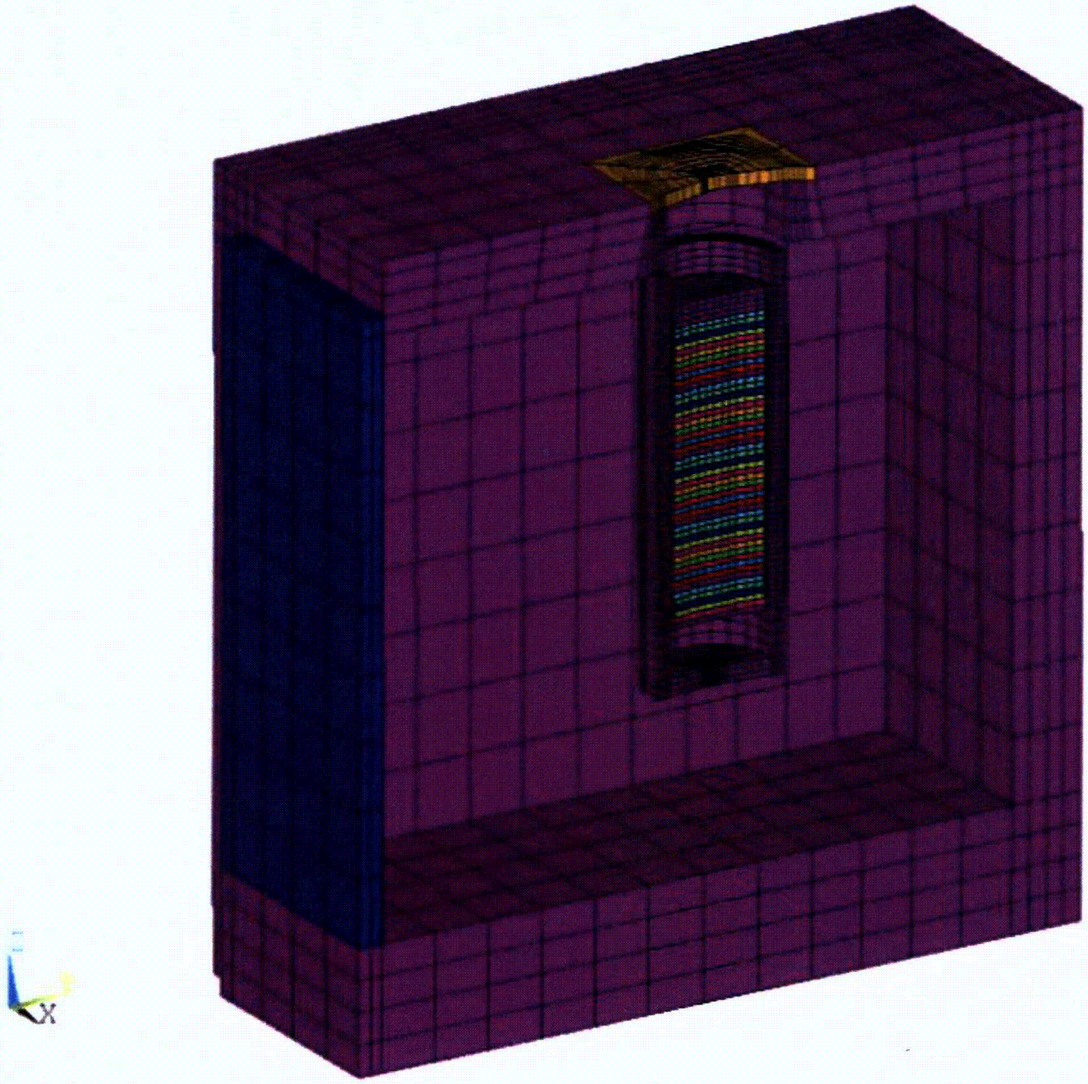

Figure 3. ANSYS Representation of Naval Long SNF Canister in Shipping Cask in Room1008 (Cut-away View)

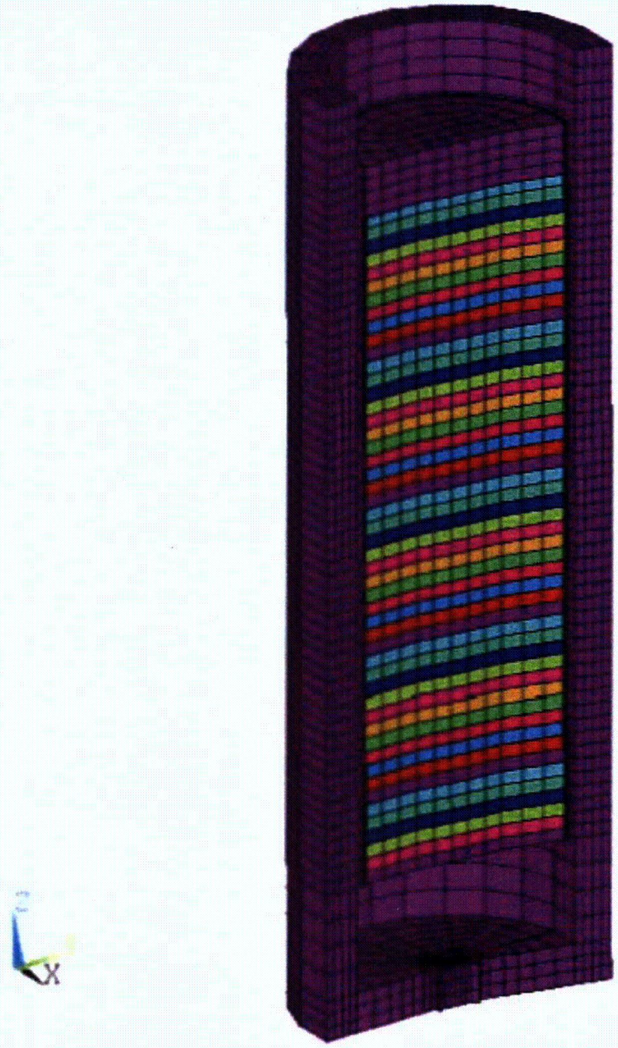

Figure 4. ANSYS Representation of Naval Long SNF Canister in Shipping Cask in Room1008 (Close-up, Cut-away View, Room Not Shown)

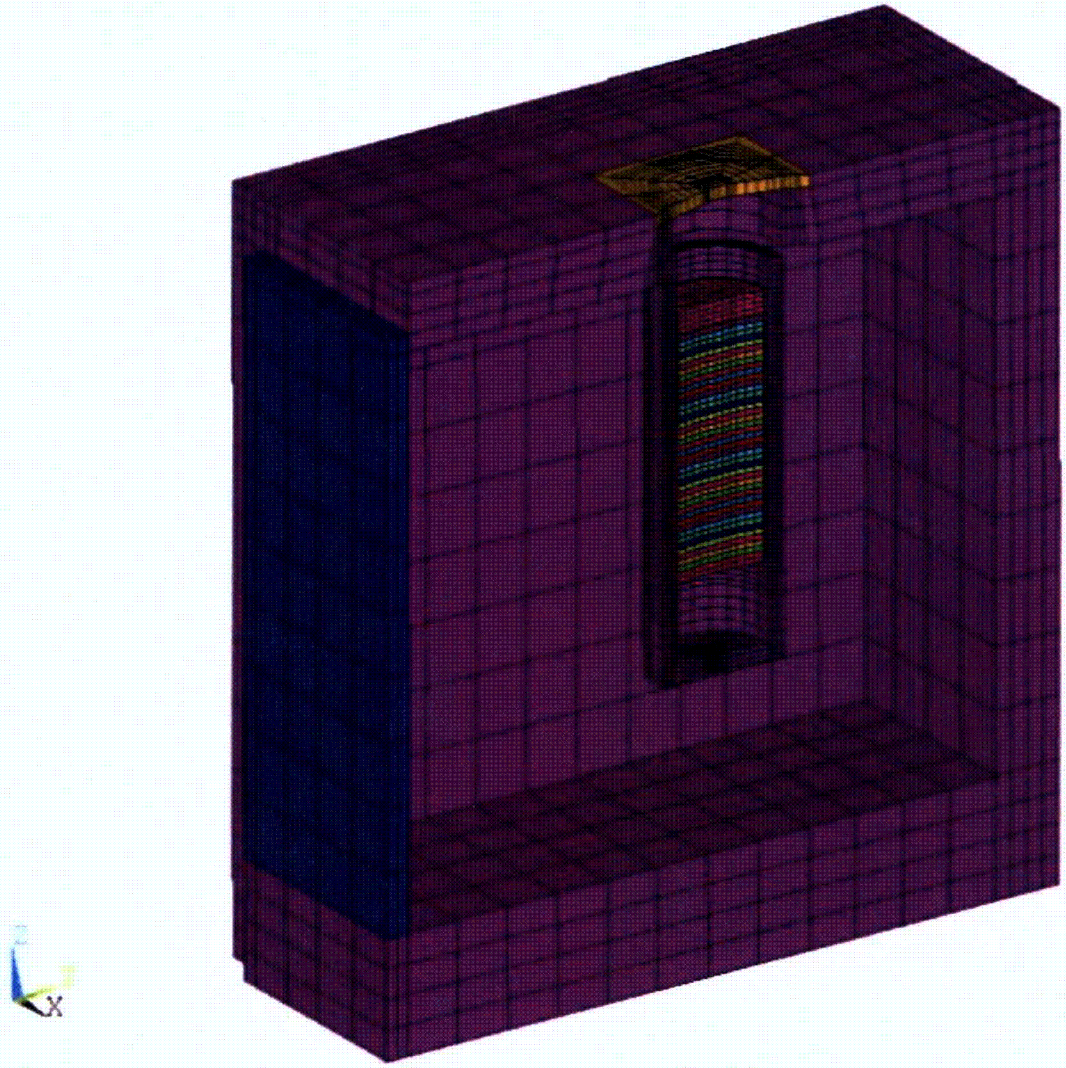

Figure 5. ANSYS Representation of Naval Short SNF Canister in Shipping Cask in Room1008 (Cut-away View)

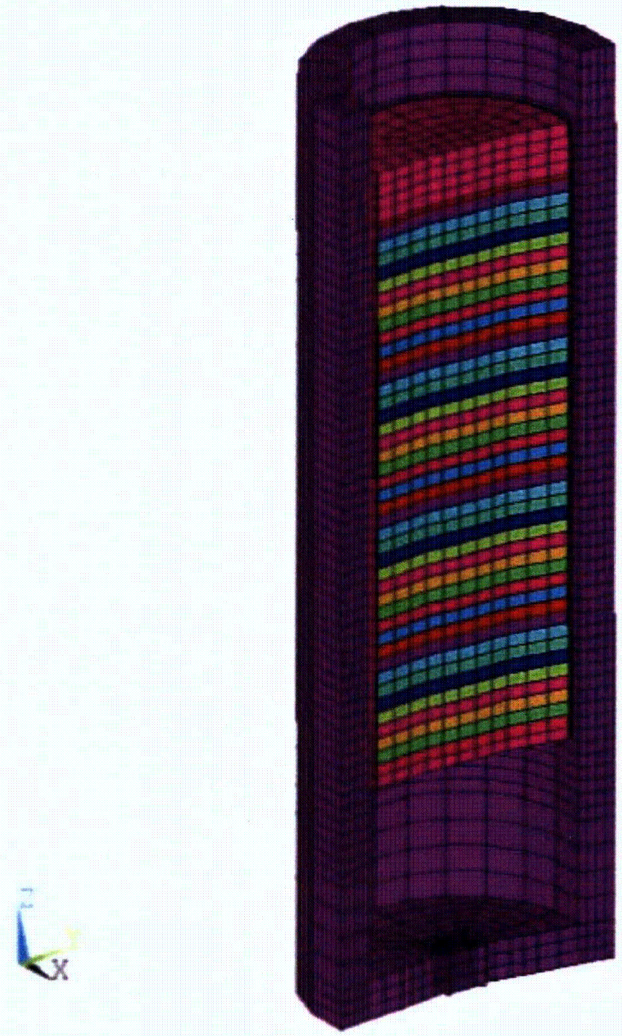

Figure 6. ANSYS Representation of Naval Short SNF Canister in Shipping Cask in Room1008 (Close-up, Cut-away View, Room Not Shown)

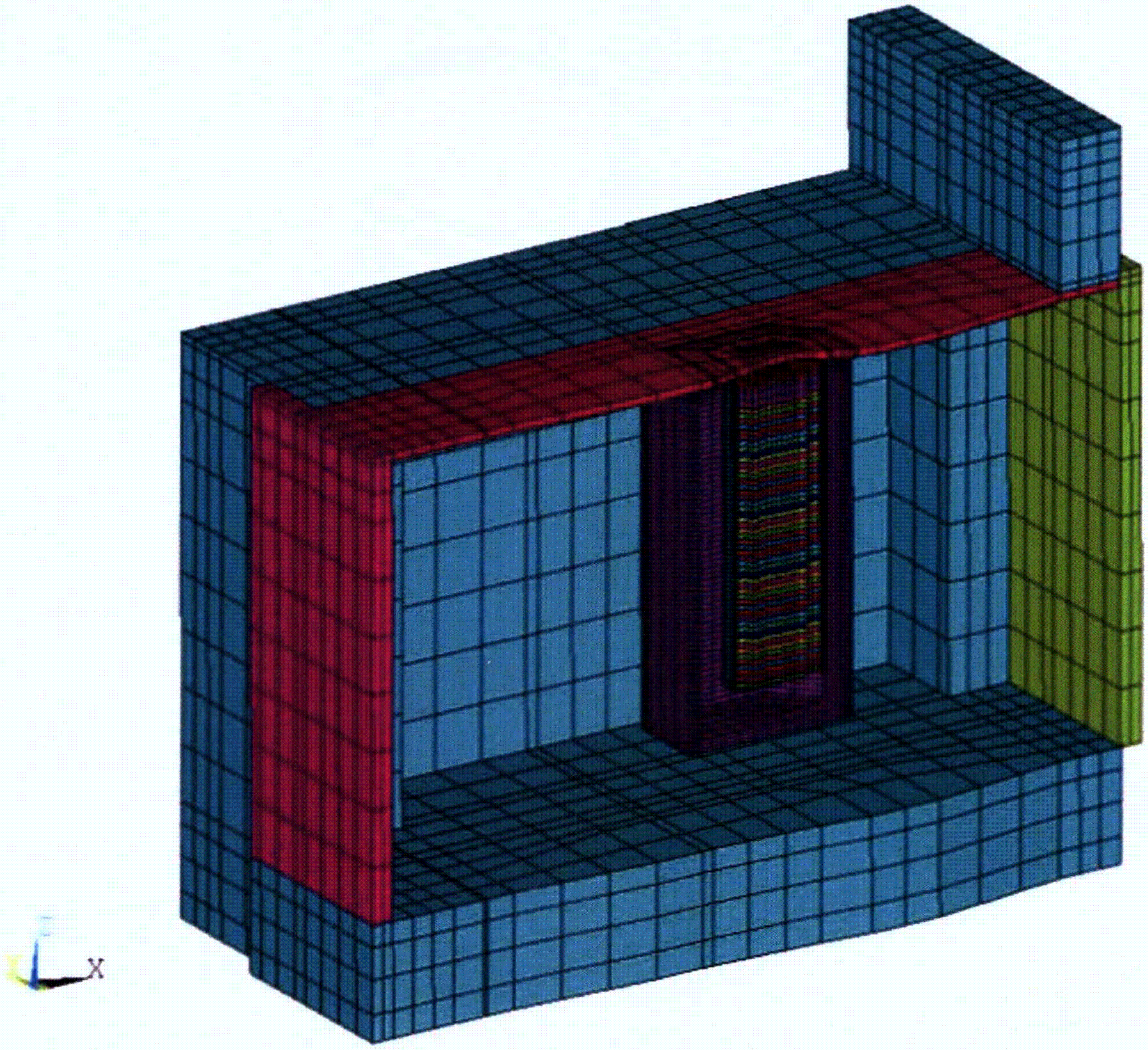

Figure 7. ANSYS Representation of Naval Long Waste Package in Waste Package Transfer Trolley Shielded Enclosure in Room 1006 (Cut-away View)

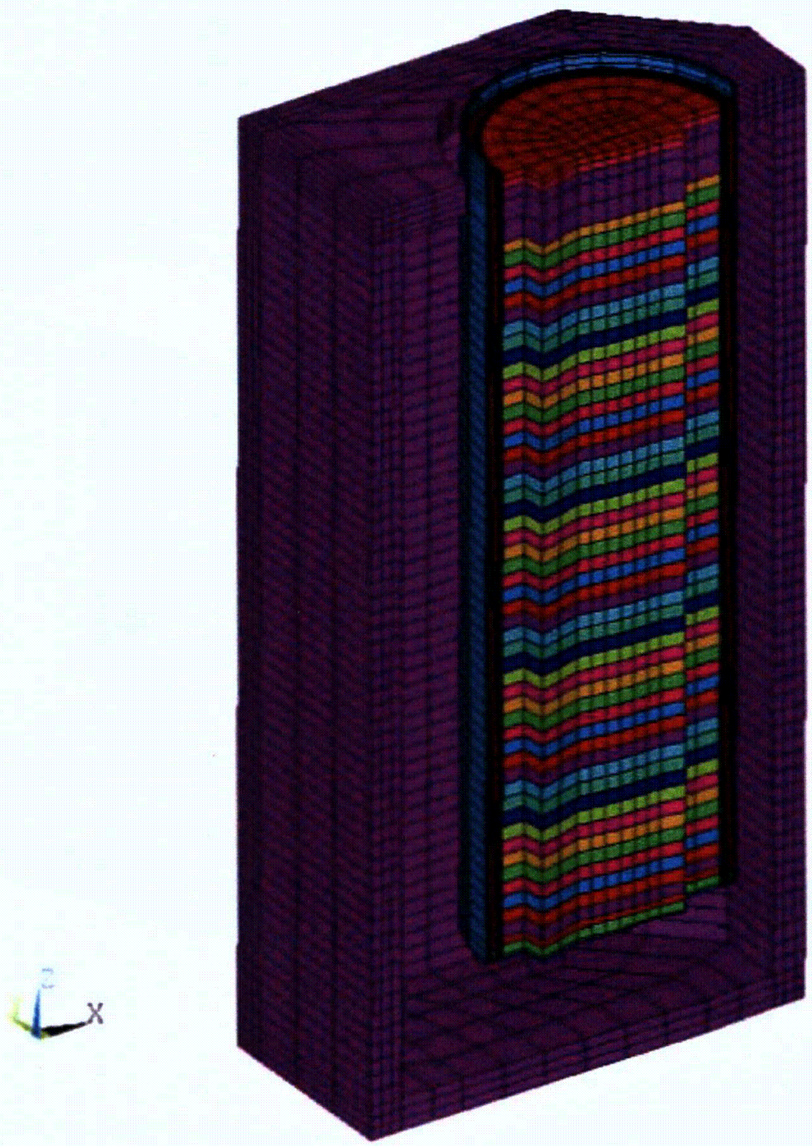

Figure 8. ANSYS Representation of Naval Long Waste Package in Waste Package Transfer Trolley Shielded Enclosure in Room 1006 (Close-up, Cut-away View, Room Not Shown)

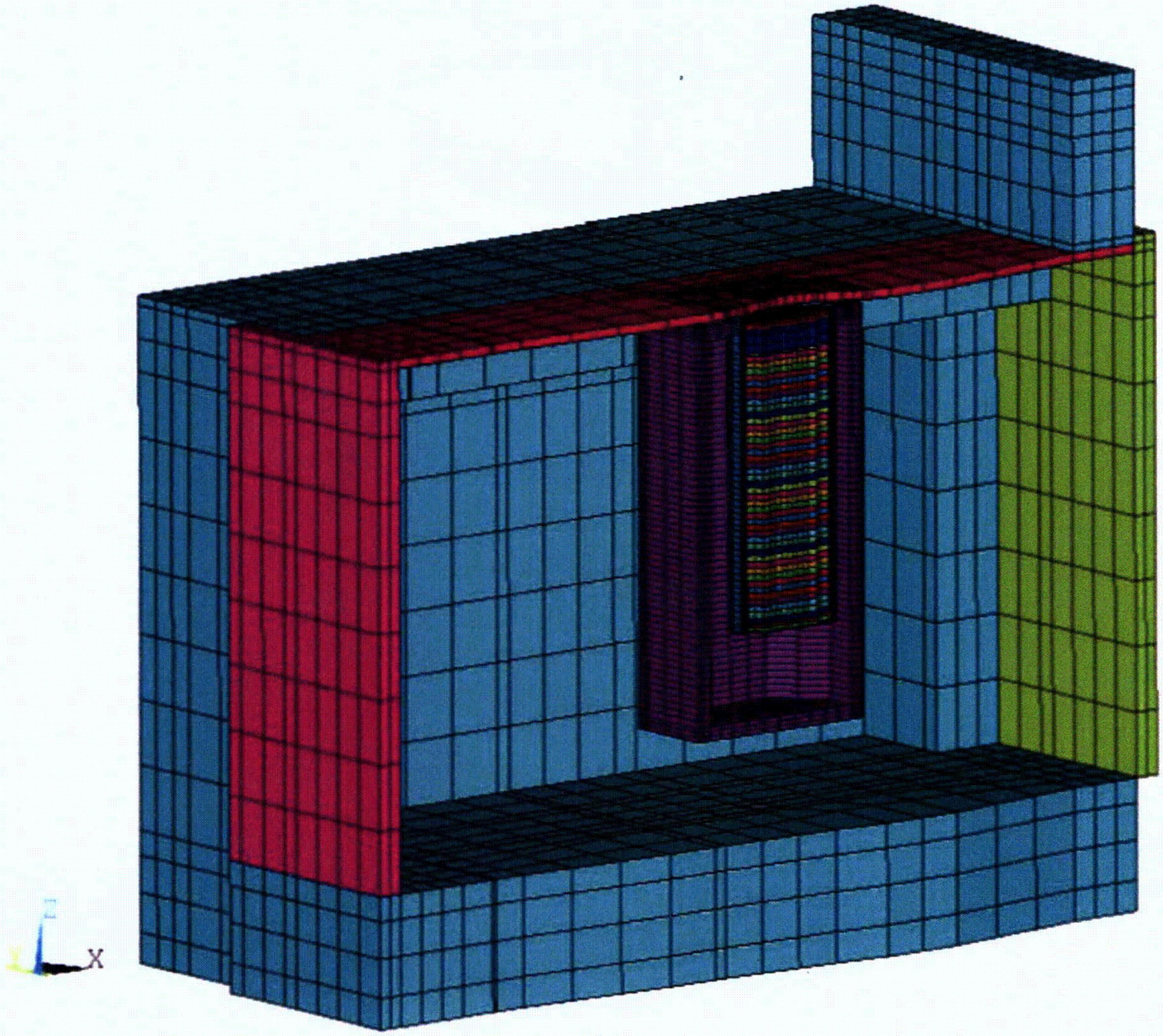

Figure 9. ANSYS Representation of Naval Short Waste Package in Waste Package Transfer Trolley Shielded Enclosure in Room 1006 (Cut-away View)

Figure 10. ANSYS Representation of Naval Short Waste Package in Waste Package Transfer Trolley Shielded Enclosure in Room 1006 (Close-up, Cut-away View, Room Not Shown)

7 RESULTS AND CONCLUSIONS

The outputs of this calculation are reasonable compared to the inputs, and the results are suitable for the intended use.

7.1 THERMAL LIMITS

The following thermal limits apply to this calculation:

The naval SNF canister external surface temperature will not exceed 400°F (204.4°C) from the time of detensioning the transportation cask closure until completion of emplacement of the naval waste package in the emplacement drift. The overall duration of these handling operations shall not exceed 30 days (Reference 2.2.39, Section 10.3.2.2).

The waste package surface temperature must not exceed 300°C (572°F) Reference 2.2.10, Section 12.2.2.5). This limit applies to both normal and off-normal conditions.

Section A.4.1 of Reference 2.2.1 indicates that for normal operations or any other long term period, "the temperature of the concrete shall not exceed 150°F (65.6°C), except for local areas, such as around penetrations, which are allowed to have increased temperatures not to exceed 200°F (93.3°C)." Section A.4.2 of Reference 2.2.1 indicates that for accident or any other short term period, the concrete surface temperature shall not exceed 350°F (176.7°C).

7.2 RESULTS

7.2.1 Naval Canister Temperatures in Waste Package in WPTT in Room 1006

Table 28 and Table 29 list the peak temperatures of the naval long SNF canister and naval short SNF canister, respectively, in a waste package in the WPTT shielded enclosure in Room 1006 of the IHF, for both normal and off-normal conditions.

For both normal and off-normal conditions, the naval long SNF canister surface temperatures are below the 204.4°C (400°F) limit for all cases considered. For both normal and off-normal conditions, the naval short SNF canister surface temperatures are below the 204.4°C (400°F) limit for all cases, except the two naval short SNF canisters with the 5 kW/m peaking.

The worst off-normal case (naval short SNF canister case 2.3_5) was reanalyzed in ANSYS with the addition of a convective heat transfer condition applied to the interior of the WPTT shielded enclosure and the exterior of the waste package in order to simulate ventilation through the WPTT shielded enclosure. These cases used a very low value of heat transfer coefficient (on the order of 1 W/m^2-K) together with an air temperature of 68.8°C (155.8°F). The air temperature was calculated as the mean of the peak exterior WPTT shielded enclosure temperature for this case (79.5°C or 175.0°F, see Table 34) and the peak concrete wall temperature (not including the ceiling) in Room 1006, which for this case was 58°C or 136.4°F. The results of these cases are presented in Table 30, where it can be seen that the inclusion of the convective effects through the WPTT bring the naval short SNF canister surface temperatures below the 204.4°C (400°F) limit.

Table 28. Peak Naval Long Canister Surface Temperatures in Waste Package in Room 1006

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5 *	192.9	379.3	203.9	399.1
2.2_3	158.9	318.1	170.0	338.0
2.1_3 *	177.9	352.2	189.4	373.0
2.2_1	84.1	183.3	96.4	205.6
3.3_5 *	190.7	375.2	201.7	395.1
3.2_3	160.3	320.5	171.5	340.7
3.1_3 *	175.5	347.9	187.2	369.0
3.2_1	85.2	185.3	97.5	207.5

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 29. Peak Naval Short Canister Surface Temperatures in Waste Package in Room 1006

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5	196.5	385.8	207.4	405.4
2.2_3	155.5	311.9	166.7	332.1
2.1_3	179.5	355.1	190.7	375.3
2.2_1	82.5	180.5	94.9	202.7
3.3_5 *	195.9	384.7	206.7	404.1
3.2_3	158.3	316.9	169.4	336.8
3.1_3	179.6	355.3	190.8	375.5
3.2_1	84.2	183.6	96.5	205.6

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 30. Peak Off-Normal Naval Short Canister Surface Temperatures in Waste Package in Room 1006 with Convection through WPTT

Naval Heat Generation Profile Case	**h (W/m^2-K)**	**T_∞**		**Peak Canister Surface Temperature**	
		°C	°F	°C	°F
2.3_5	1	68.8	155.8	203.5	398.3
2.3_5	1.5	68.8	155.8	201.9	395.4

Figure 11 through Figure 26 show the temperature contours (°C) obtained from the ANSYS solutions of the naval SNF canister in the waste package in the WPTT shielded enclosure in Room 1006. Since all cases of the heat generation profiles produce similarly shaped contours (with differing magnitudes), only the results from the case with the most thermally limiting heat generation profile (Case 2-3_5) are shown.

Figure 11 through Figure 14 show the temperature contours (°C) obtained from the ANSYS solution of the naval long SNF canister in the waste package in the WPTT shielded enclosure in Room 1006 under the normal operating condition.

Figure 15 through Figure 18 show the temperature contours (°C) obtained from the ANSYS solution of the naval long SNF canister in the waste package in the WPTT shielded enclosure in Room 1006 under the off-normal condition.

Figure 19 through Figure 22 show the temperature contours (°C) obtained from the ANSYS solution of the naval short SNF canister in the waste package in the WPTT shielded enclosure in Room 1006 under the normal operating condition.

Figure 23 through Figure 26 show the temperature contours (°C) obtained from the ANSYS solution of the naval short SNF canister in the waste package in the WPTT shielded enclosure in Room 1006 under the off-normal condition.

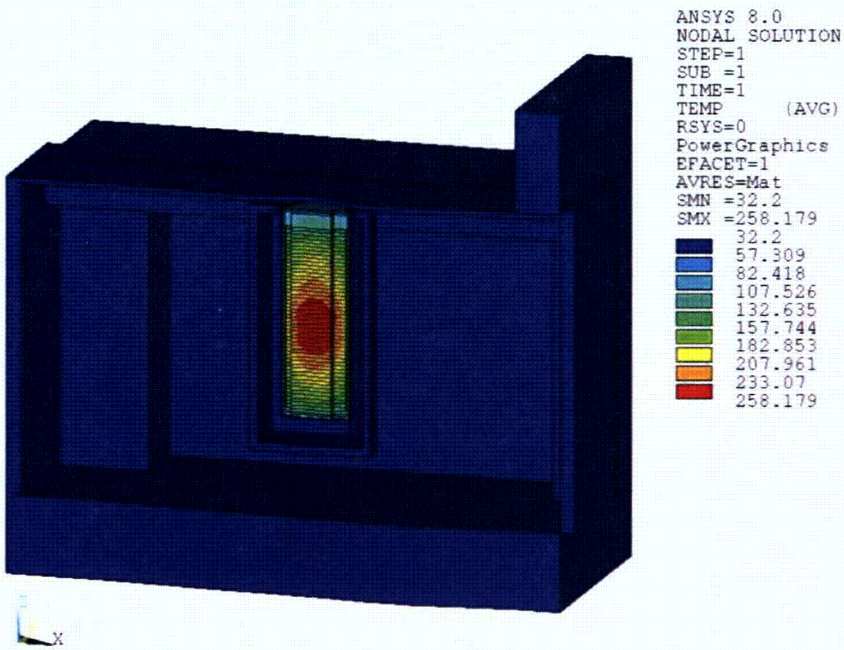

Figure 11. Temperature Contours (°C), Naval Long SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Normal Condition (Cut-away View)

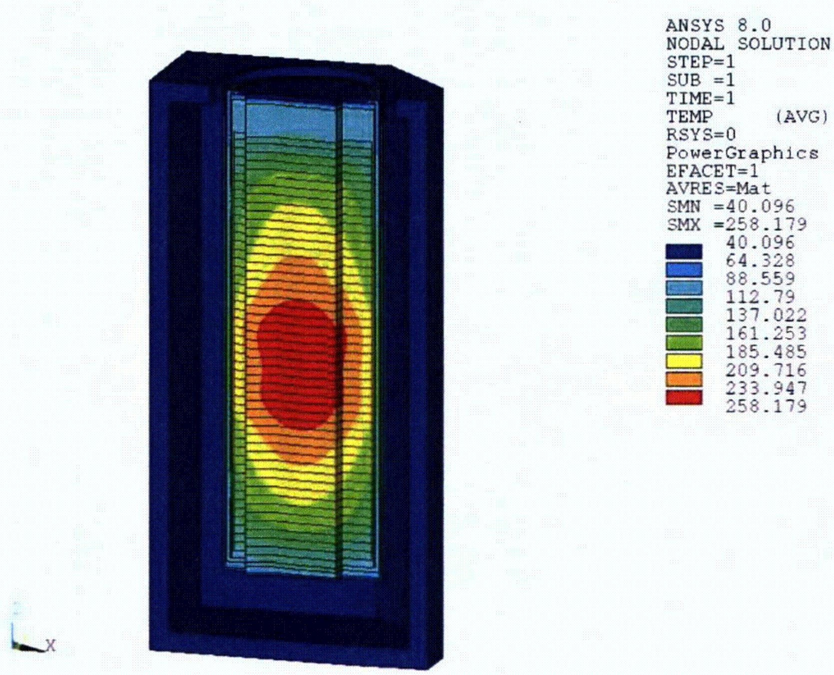

Figure 12. Temperature Contours (°C), Naval Long SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Normal Condition (Cut-away View of Waste Package)

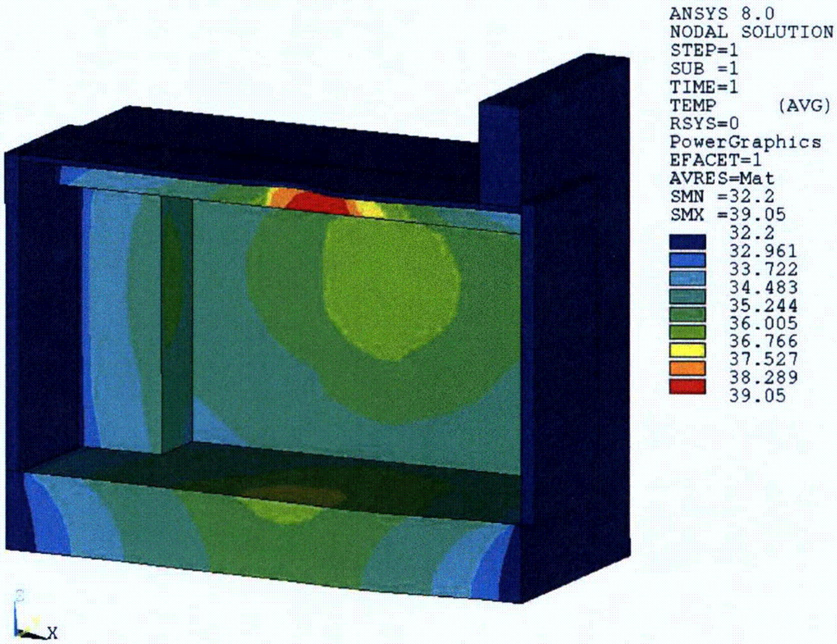

Figure 13. Temperature Contours (°C), Naval Long SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Normal Condition (Cut-away View of Room)

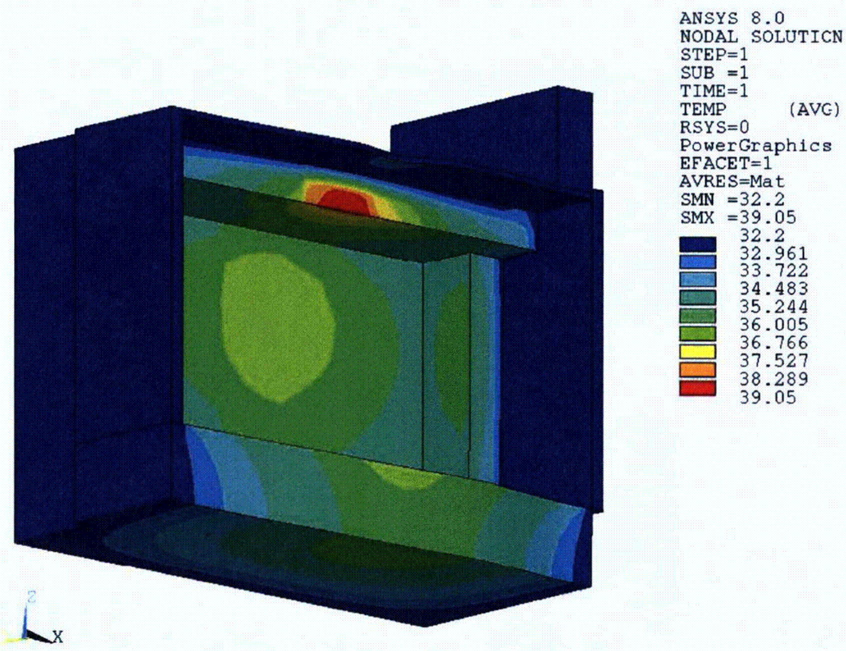

Figure 14. Temperature Contours (°C), Naval Long SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Normal Condition (Cut-away View of Room)

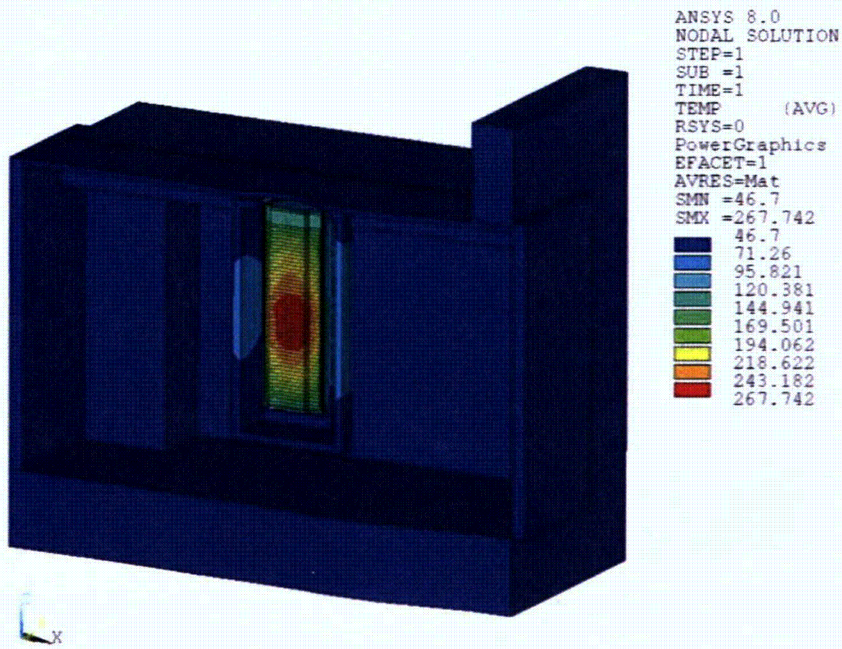

Figure 15. Temperature Contours (°C), Naval Long SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Off-normal Condition (Cut-away View)

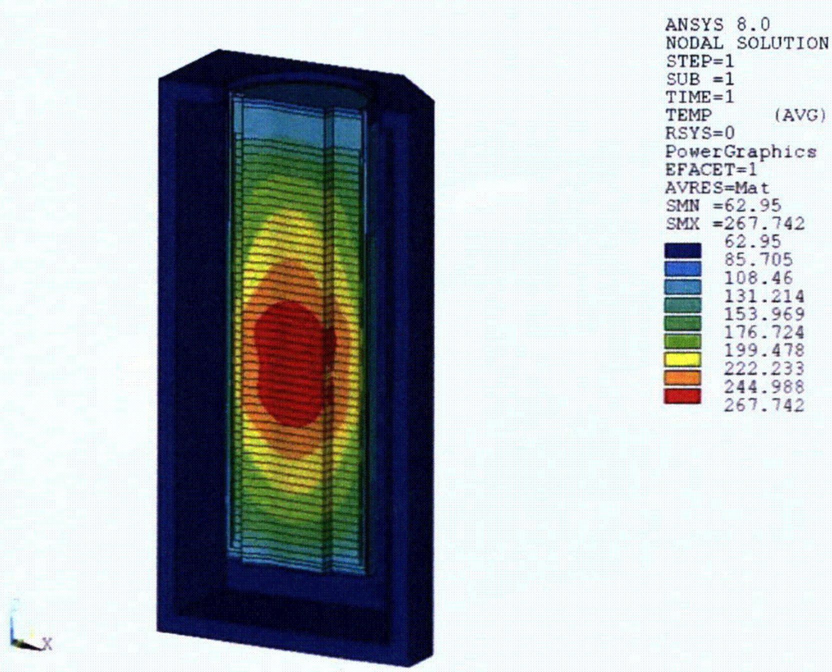

Figure 16. Temperature Contours (°C), Naval Long SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Off-normal Condition (Cut-away View of Waste Package)

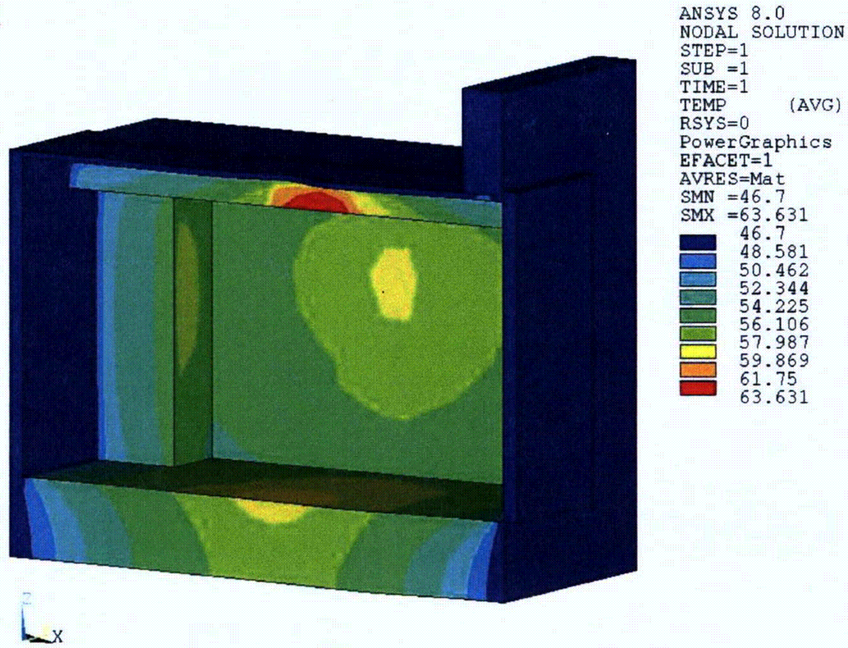

Figure 17. Temperature Contours (°C), Naval Long SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Off-normal Condition (Cut-away View of Room)

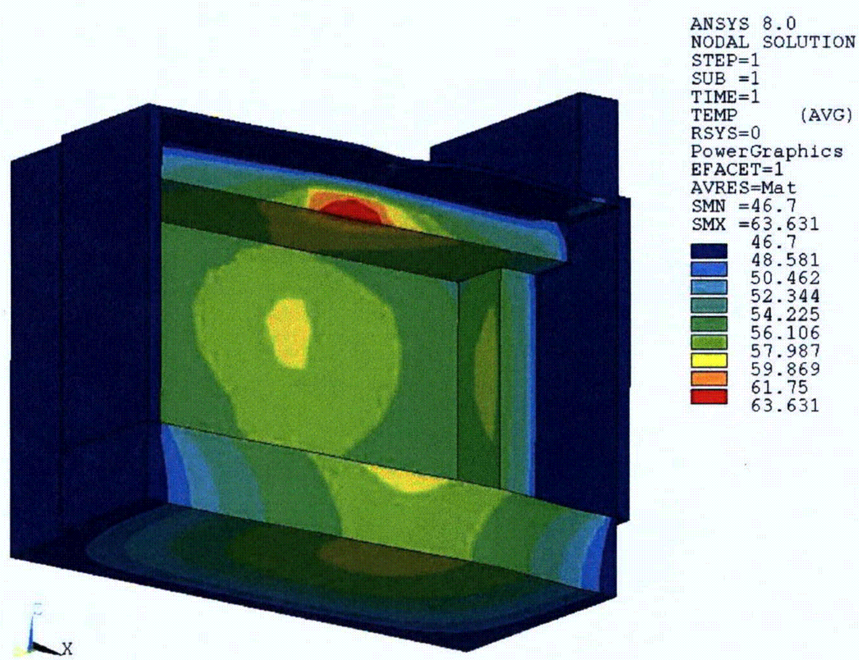

Figure 18. Temperature Contours (°C), Naval Long SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Off-normal Condition (Cut-away View of Room)

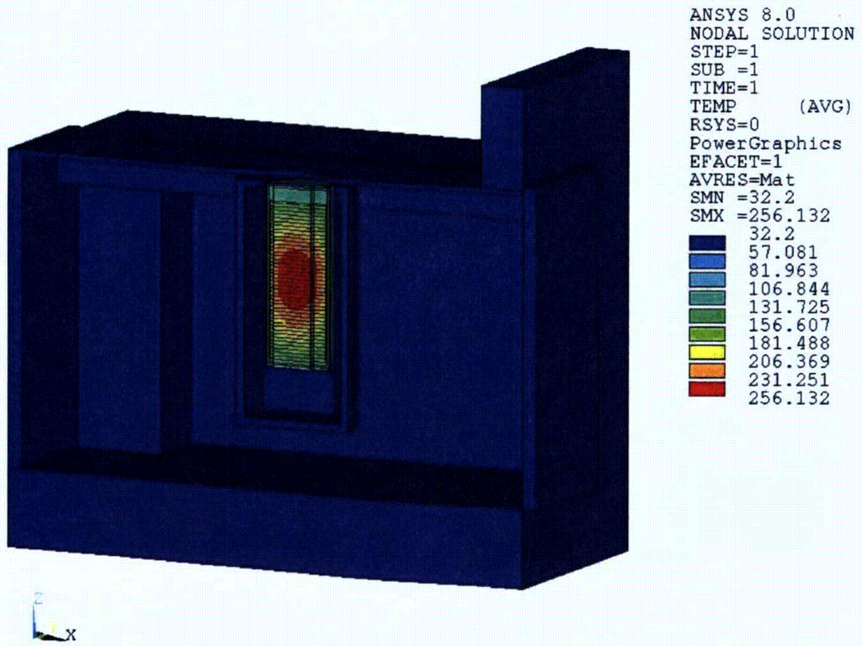

Figure 19. Temperature Contours (°C), Naval Short SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Normal Condition (Cut-away View)

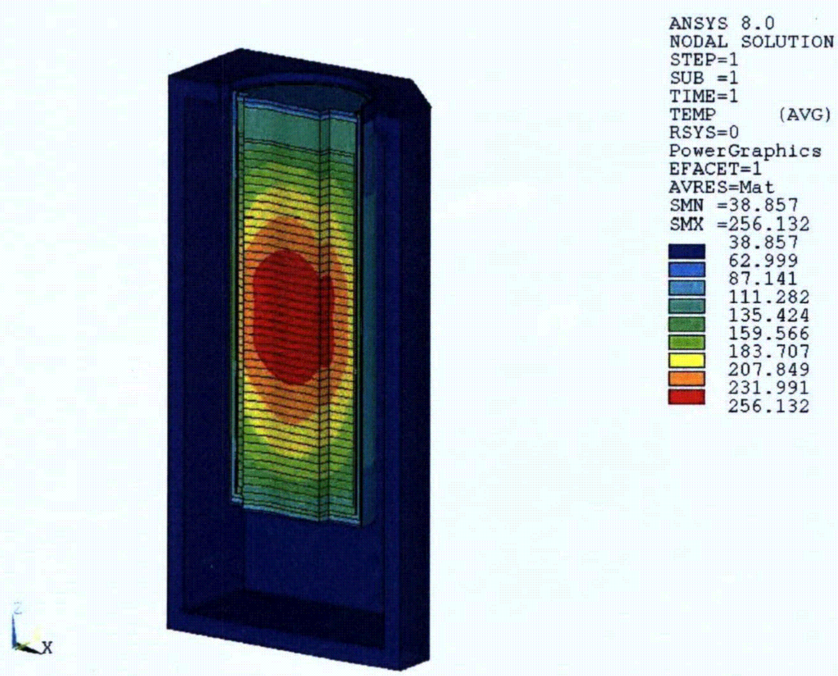

Figure 20. Temperature Contours (°C), Naval Short SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Normal Condition (Cut-away View of Waste Package)

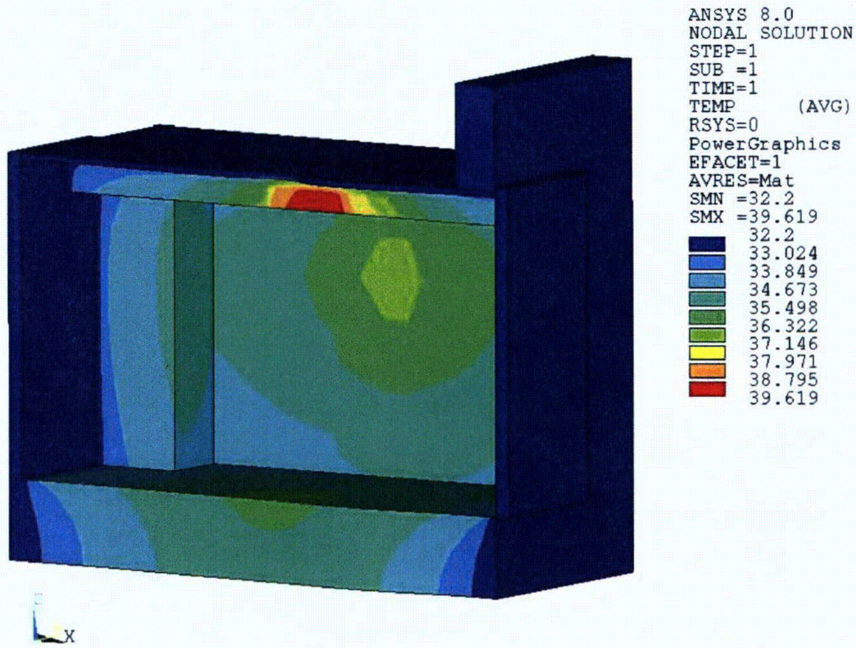

Figure 21. Temperature Contours (°C), Naval Short SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Normal Condition (Cut-away View of Room)

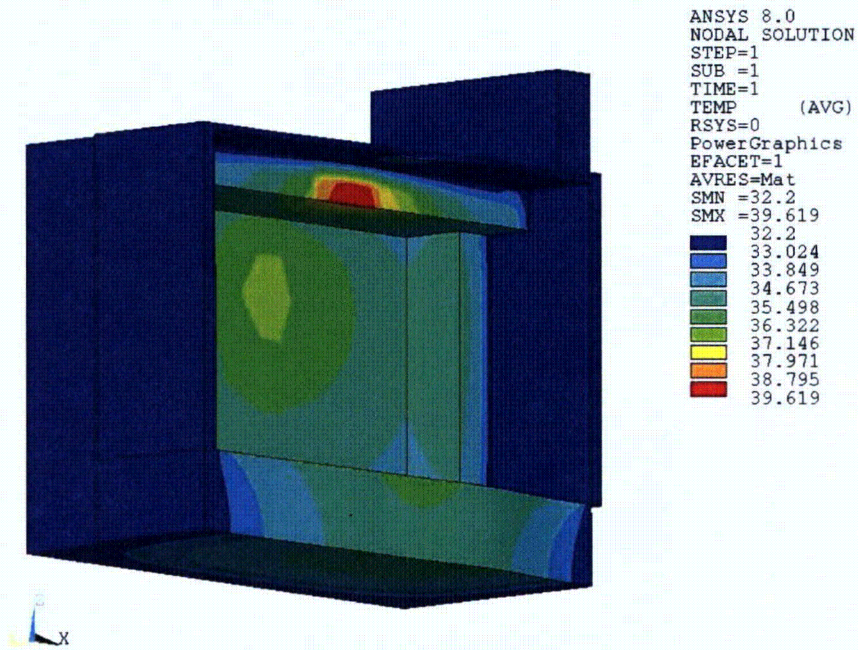

Figure 22. Temperature Contours (°C), Naval Short SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Normal Condition (Cut-away View of Room)

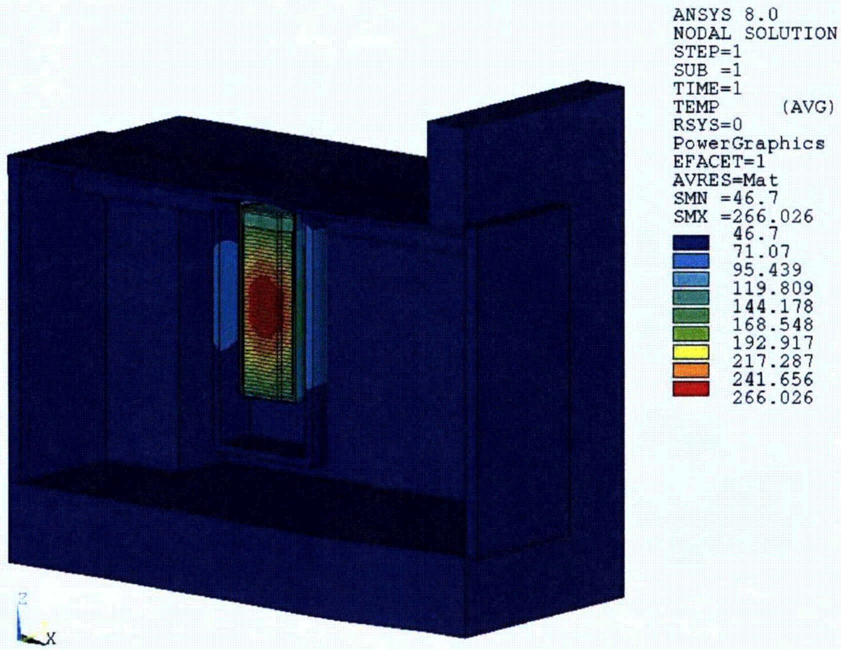

Figure 23. Temperature Contours (°C), Naval Short SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Off-normal Condition (Cut-away View)

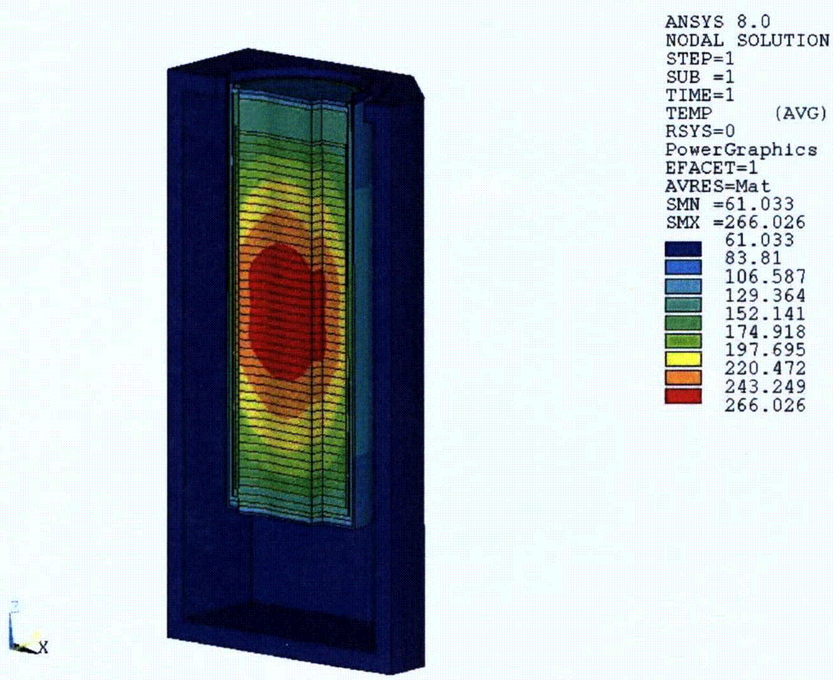

Figure 24. Temperature Contours (°C), Naval Short SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Off-normal Condition (Cut-away View of Waste Package)

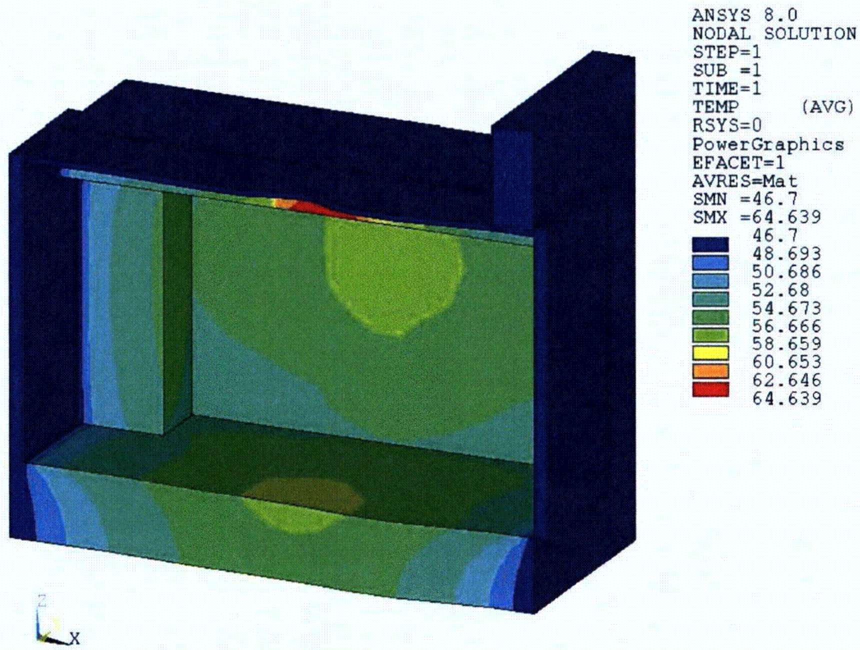

Figure 25. Temperature Contours (°C), Naval Short SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Off-normal Condition (Cut-away View of Room)

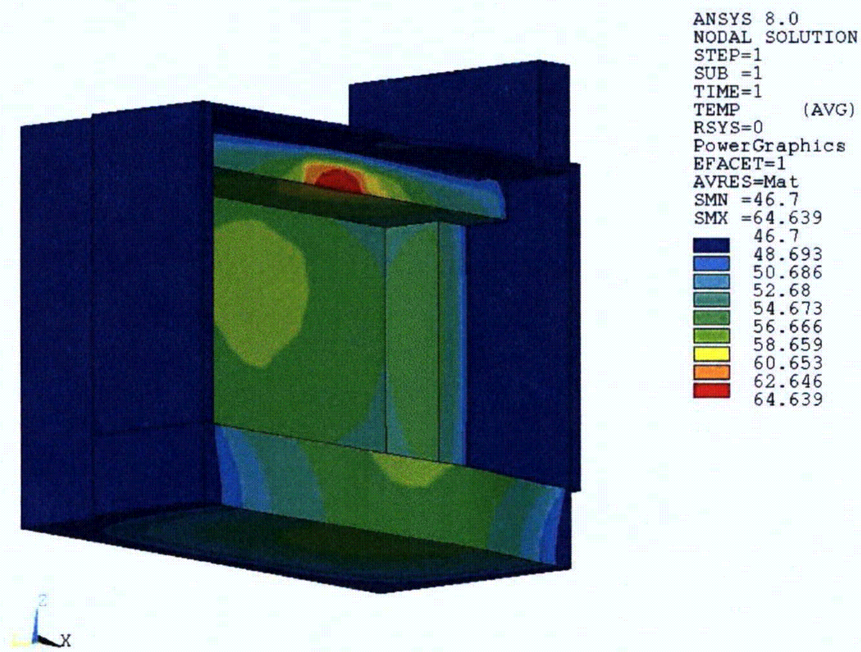

Figure 26. Temperature Contours (°C), Naval Short SNF Canister in Waste Package in WPTT Shielded Enclosure in Room 1006, Case 2-3_5, Off-normal Condition (Cut-away View of Room)

Peak surface temperature profiles of the naval SNF canisters for all cases in Room 1006 are shown in Figure 27 through Figure 34.

Figure 27 and Figure 28 show the peak surface temperature profiles along the length of the naval long SNF canister in degrees C and degrees F, respectively, for all cases under the normal operating condition in Room 1006.

Figure 29 and Figure 30 show the peak surface temperature profiles along the length of the naval long SNF canister in degrees C and degrees F, respectively, for all cases under the off-normal condition in Room 1006.

Figure 31 and Figure 32 show the peak surface temperature profiles along the length of the naval short SNF canister in degrees C and degrees F, respectively, for all cases under the normal operating condition in Room 1006.

Figure 33 and Figure 34 show the peak surface temperature profiles along the length of the naval short SNF canister in degrees C and degrees F, respectively, for all cases under the off-normal condition in Room 1006.

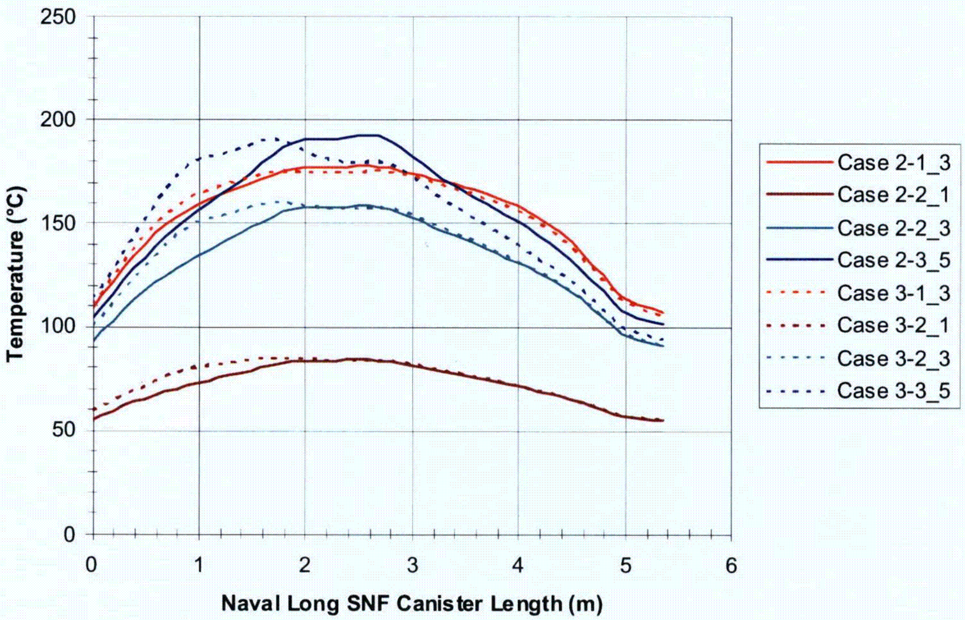

Figure 27. Naval Long SNF Canister Peak Surface Temperature Profiles (°C), Room 1006, Normal Condition

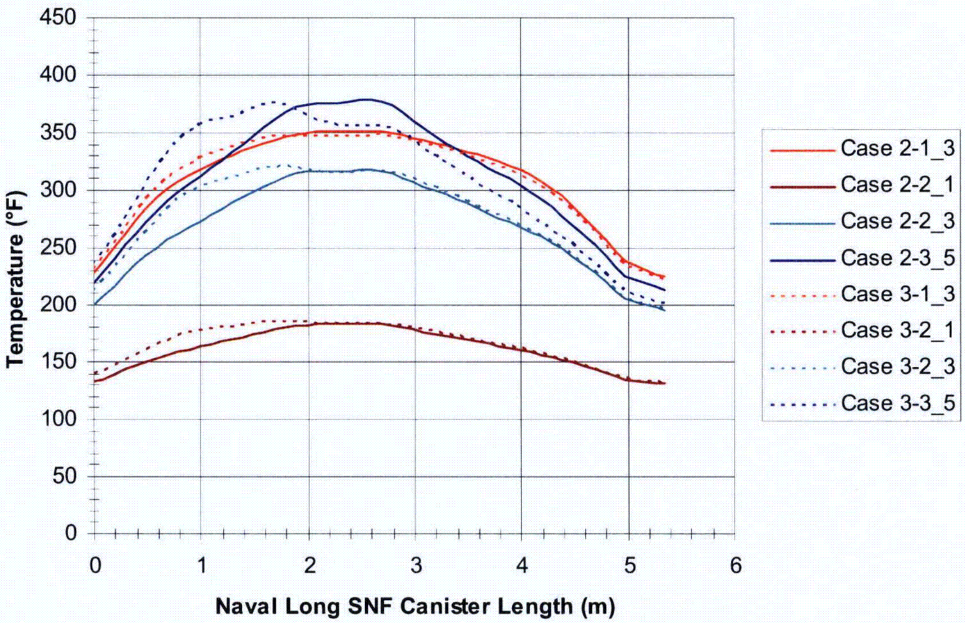

Figure 28. Naval Long SNF Canister Peak Surface Temperature Profiles (°F), Room 1006, Normal Condition

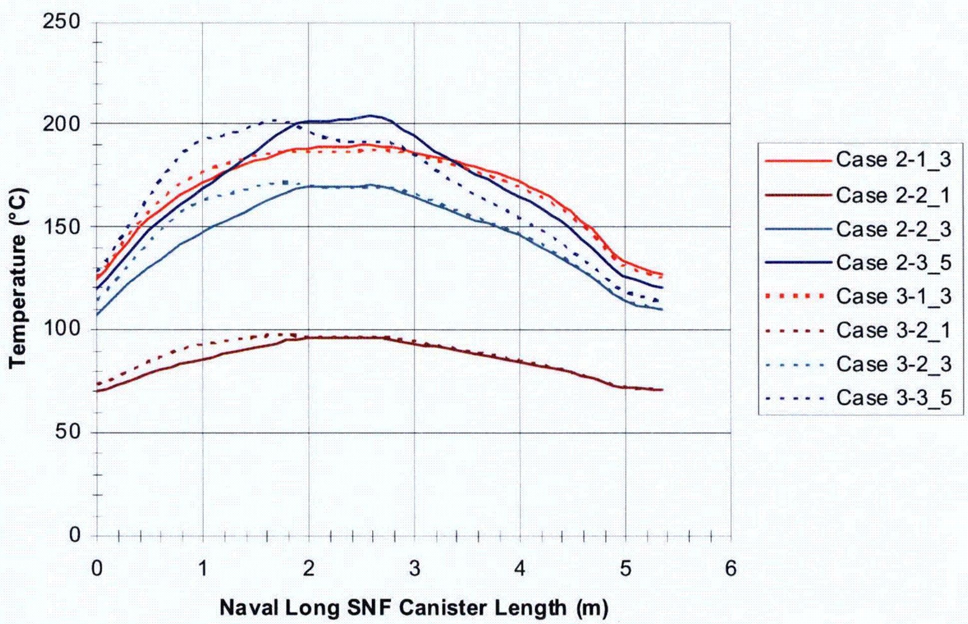

Figure 29. Naval Long SNF Canister Peak Surface Temperature Profiles (°C), Room 1006, Off-normal Condition

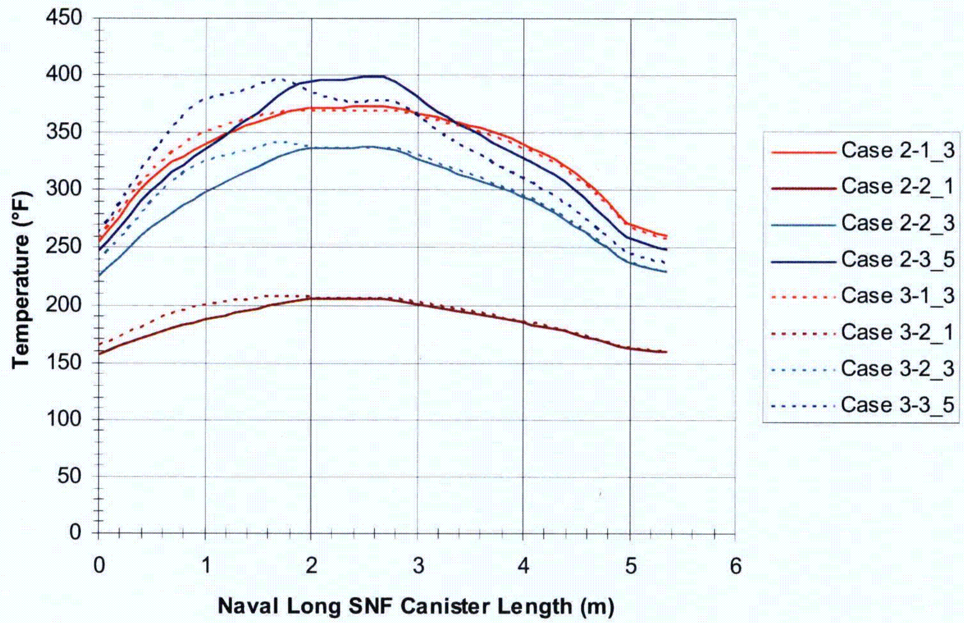

Figure 30. Naval Long SNF Canister Peak Surface Temperature Profiles (°F), Room 1006, Off-normal Condition

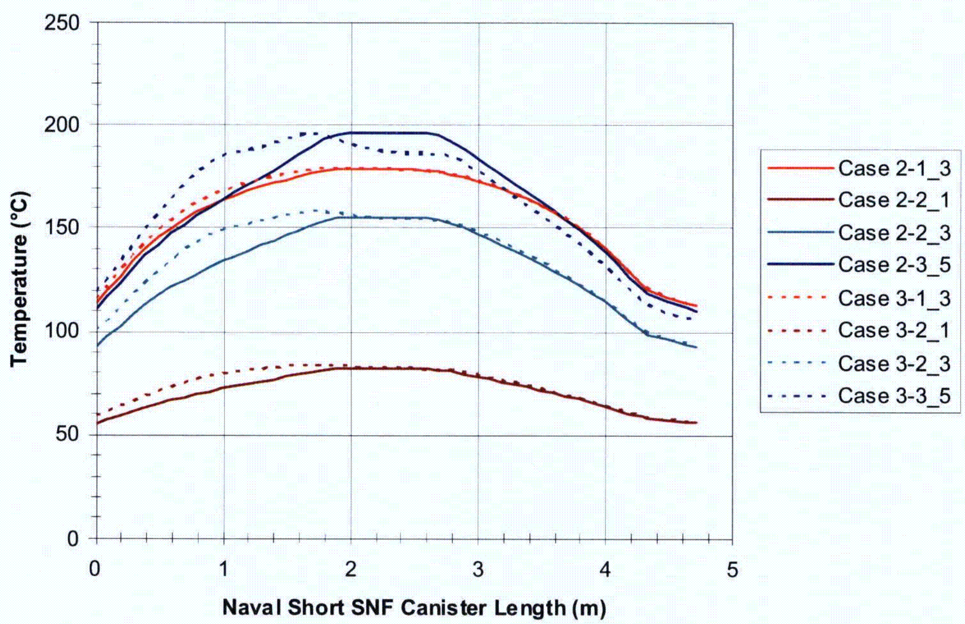

Figure 31. Naval Short SNF Canister Peak Surface Temperature Profiles (°C), Room 1006, Normal Condition

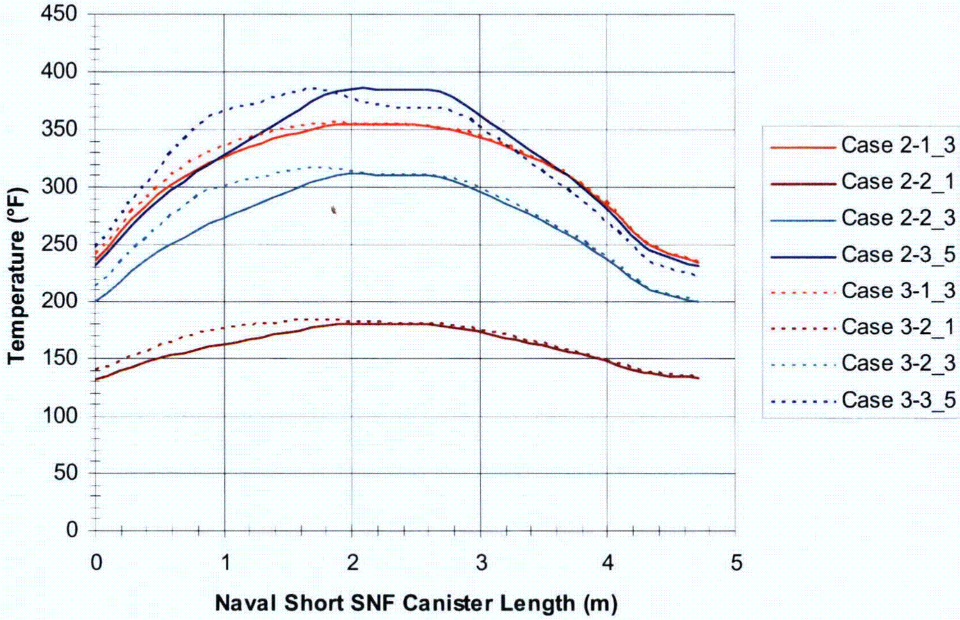

Figure 32. Naval Short SNF Canister Peak Surface Temperature Profiles (°F), Room 1006, Normal Condition

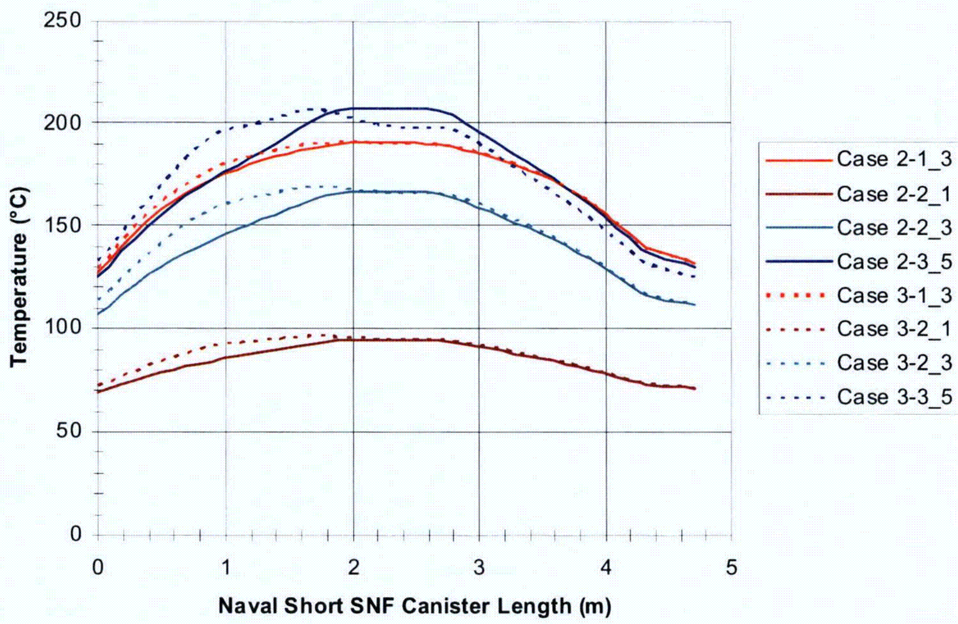

Figure 33. Naval Short SNF Canister Peak Surface Temperature Profiles (°C), Room 1006, Off-normal Condition

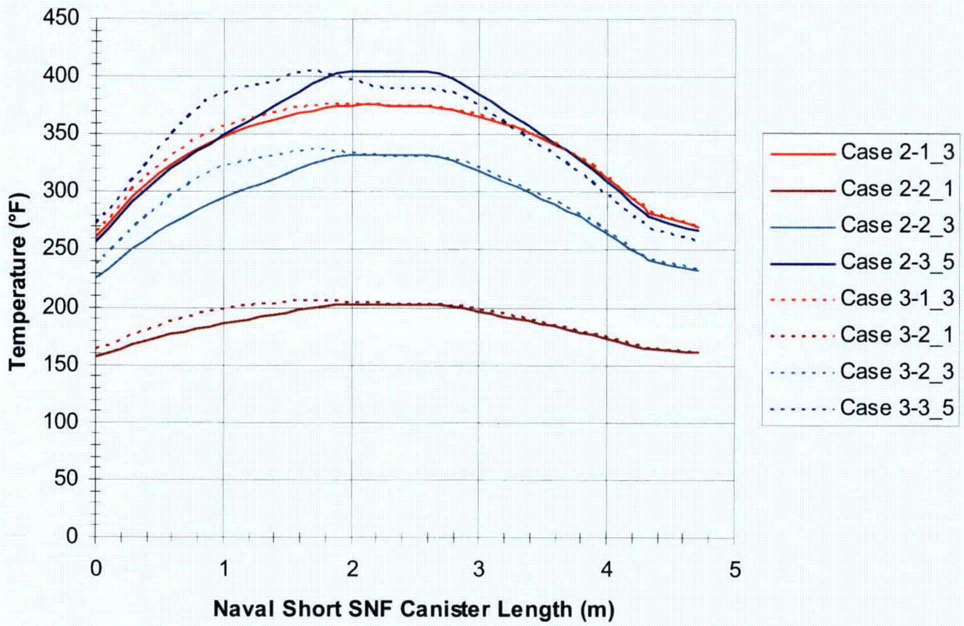

Figure 34. Naval Short SNF Canister Peak Surface Temperature Profiles (°F), Room 1006, Off-normal Condition

7.2.2 Waste Package, WPTT, and Room Wall Temperatures in Room 1006

Table 31 and Table 32 list the peak outer corrosion barrier surface temperatures of a naval long waste package and a naval short waste package, respectively, in Room 1006 of the IHF for both normal and off-normal conditions.

For all cases, both normal and off-normal conditions, the waste package outer corrosion barrier peak surface temperatures are below the 300°C (572°F) limit.

Table 31. Peak Naval Long Waste Package OCB Surface Temperatures in Room 1006

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5 *	108.1	226.5	124.7	256.4
2.2_3	90.9	195.7	106.9	224.4
2.1_3 *	101.8	215.2	118.8	245.8
2.2_1	54.4	129.9	68.9	156.1
3.3_5 *	106.5	223.6	123.2	253.7
3.2_3	91.8	197.3	108.1	226.5
3.1_3 *	100.9	213.7	118.0	244.4
3.2_1	55.0	131.0	69.6	157.3

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 32. Peak Naval Short Waste Package OCB Surface Temperatures in Room 1006

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5	110.4	230.7	126.9	260.4
2.2_3	88.9	192.0	104.6	220.3
2.1_3	102.3	216.2	119.0	246.1
2.2_1	53.5	128.4	68.0	154.4
3.3_5 *	109.4	229.0	126.0	258.8
3.2_3	90.4	194.7	106.2	223.2
3.1_3	102.7	216.8	119.4	246.8
3.2_1	54.4	129.9	68.9	155.9

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 33 and Table 34 list the peak exterior surface temperatures of the waste package transfer trolley shielded enclosure containing a naval long waste package and a naval short waste package, respectively, in Room 1006 of the IHF for both normal and off-normal conditions.

Table 33. Peak WPTT (with Naval Long Waste Package) Outer Surface Temperatures in Room 1006

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5 *	54.5	130.1	79.0	174.2
2.2_3	49.3	120.7	71.2	160.2
2.1_3 *	53.4	128.2	77.7	171.9
2.2_1	38.4	101.0	54.9	130.8
3.3_5 *	54.3	129.7	78.8	173.8
3.2_3	50.0	121.9	72.4	162.3
3.1_3 *	53.3	128.0	77.6	171.7
3.2_1	38.7	101.6	55.4	131.7

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 34. Peak WPTT (with Naval Short Waste Package) Outer Surface Temperatures in Room 1006

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5	55.0	131.0	79.5	175.0
2.2_3	48.3	118.9	69.5	157.1
2.1_3	53.1	127.6	77.0	170.6
2.2_1	38.0	100.4	54.3	129.8
3.3_5 *	55.1	131.1	79.7	175.4
3.2_3	49.0	120.3	70.7	159.3
3.1_3	53.4	128.1	77.4	171.3
3.2_1	38.3	101.0	54.8	130.7

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 35 and Table 36 list the peak concrete surface temperatures in Room 1006 with the naval long SNF waste package and the naval short SNF waste package, respectively, for both normal and off-normal conditions. In all cases, for the off-normal condition, the concrete temperatures are below the 176.7°C (350°F) limit. In all cases, for the normal condition, the concrete temperatures are below the 65.6°C (150°F) limit.

Table 35. Peak Concrete Surface Temperatures in Room 1006 (with Naval Long WP)

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5 *	39.1	102.3	63.6	146.5
2.2_3	37.7	99.9	59.8	139.6
2.1_3 *	39.2	102.5	63.9	147.0
2.2_1	34.4	93.9	51.0	123.8
3.3_5 *	38.6	101.6	62.8	145.1
3.2_3	37.8	100.1	60.3	140.5
3.1_3 *	39.1	102.3	63.7	146.7
3.2_1	34.5	94.0	51.2	124.1

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 36. Peak Concrete Surface Temperatures in Room 1006 (with Naval Short WP)

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5	39.6	103.3	64.6	148.4
2.2_3	37.6	99.8	59.2	138.5
2.1_3	39.3	102.7	63.8	146.8
2.2_1	34.4	93.8	50.8	123.4
3.3_5 *	39.4	102.9	64.3	147.8
3.2_3	37.8	100.1	59.7	139.5
3.1_3	39.3	102.8	63.9	147.1
3.2_1	34.4	94.0	51.0	123.8

* Total heat is scaled down to 11.8 kW while holding the peaks constant

7.2.3 Naval Canister Surface Temperatures in Shipping Cask in Room 1008

Table 37 and Table 38 list the peak temperatures of the naval long SNF canister and naval short SNF canister, respectively, in a shipping cask in Room 1008 of the IHF for both normal and off-normal conditions. For all cases, the naval SNF canister surface temperatures are below the 204.4°C (400°F) limit.

Table 37. Peak Naval Long Canister Surface Temperatures Shipping Cask in Room 1008

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5 *	163.2	325.8	184.9	364.8
2.2_3	134.6	274.2	155.5	311.9
2.1_3 *	149.4	300.9	171.7	341.0
2.2_1	75.3	167.5	91.3	196.4
3.3_5 *	161.6	322.8	183.1	361.5
3.2_3	136.4	277.5	156.8	314.2
3.1_3 *	147.7	297.9	169.8	337.6
3.2_1	76.2	169.2	92.3	198.2

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 38. Peak Naval Short Canister Surface Temperatures Shipping Cask in Room 1008

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5	165.6	330.1	187.2	369.0
2.2_3	132.5	270.6	152.1	305.8
2.1_3	150.5	302.8	172.3	342.2
2.2_1	74.2	165.6	89.8	193.7
3.3_5 *	165.1	329.2	186.8	368.2
3.2_3	134.7	274.4	154.5	310.0
3.1_3	150.6	303.1	172.5	342.5
3.2_1	75.4	167.8	91.2	196.2

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Figure 35 through Figure 50 show the temperature contours (°C) obtained from the ANSYS solutions of the naval SNF canister in the waste package in the shipping cask in Room 1008. Since all cases of the heat generation profiles produce similarly shaped contours (with differing magnitudes), only the results from the case with the most thermally limiting heat generation profile (Case 2-3_5) are shown.

Figure 35 through Figure 38 show the temperature contours (°C) obtained from the ANSYS solution of the naval long SNF canister in the shipping cask in Room 1008 under the normal operating condition.

Figure 39 through Figure 42 show the temperature contours (°C) obtained from the ANSYS solution of the naval long SNF canister in the shipping cask in Room 1008 under the off-normal condition.

Figure 43 through Figure 46 show the temperature contours (°C) obtained from the ANSYS solution of the naval short SNF canister in the shipping cask in Room 1008 under the normal operating condition.

Figure 47 through Figure 50 show the temperature contours (°C) obtained from the ANSYS solution of the naval short SNF canister in the shipping cask in Room 1008 under the off-normal condition.

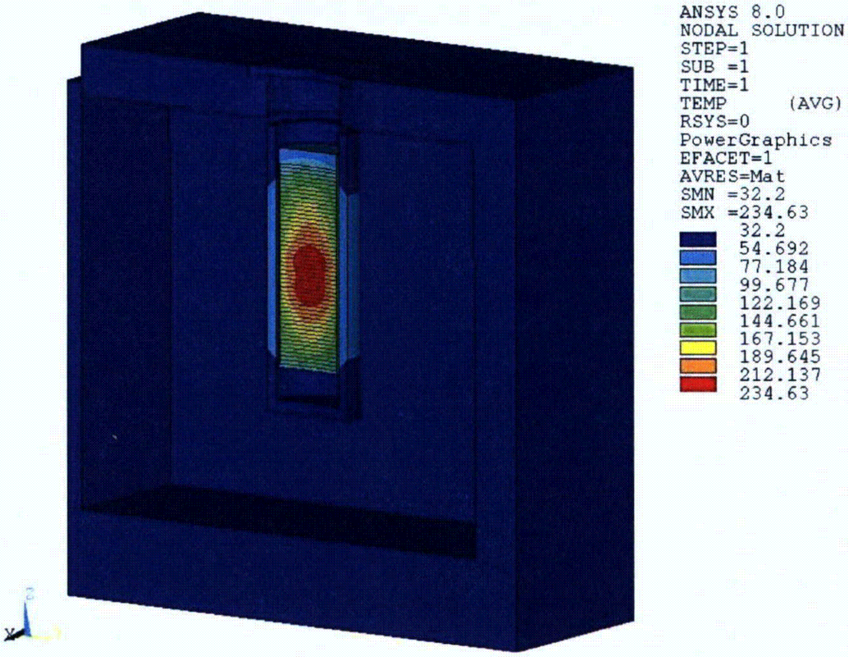

Figure 35. Temperature Contours (°C), Naval Long SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Normal Condition (Cut-away View)

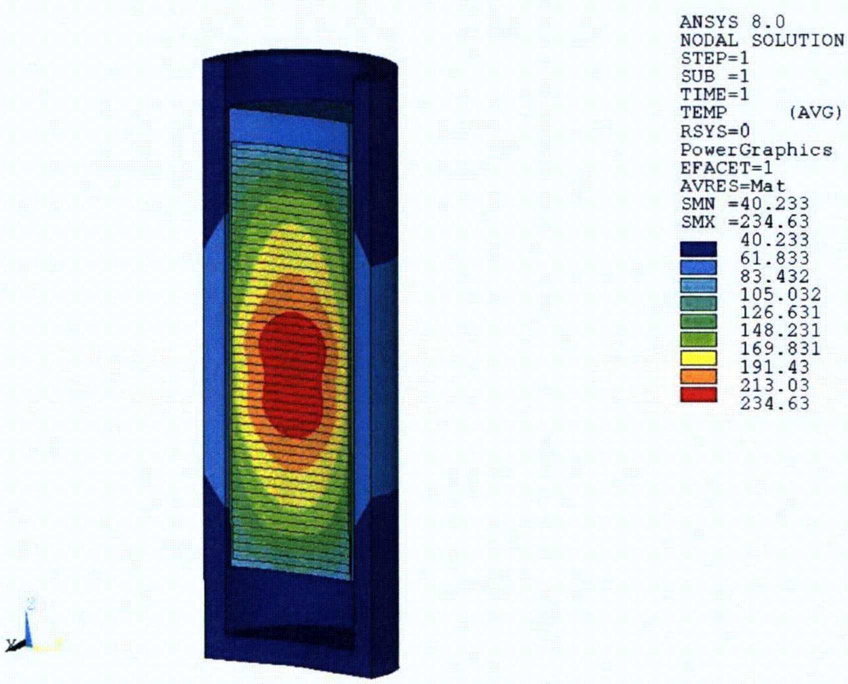

Figure 36. Temperature Contours (°C), Naval Long SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Normal Condition (Cut-away View of Shipping Cask)

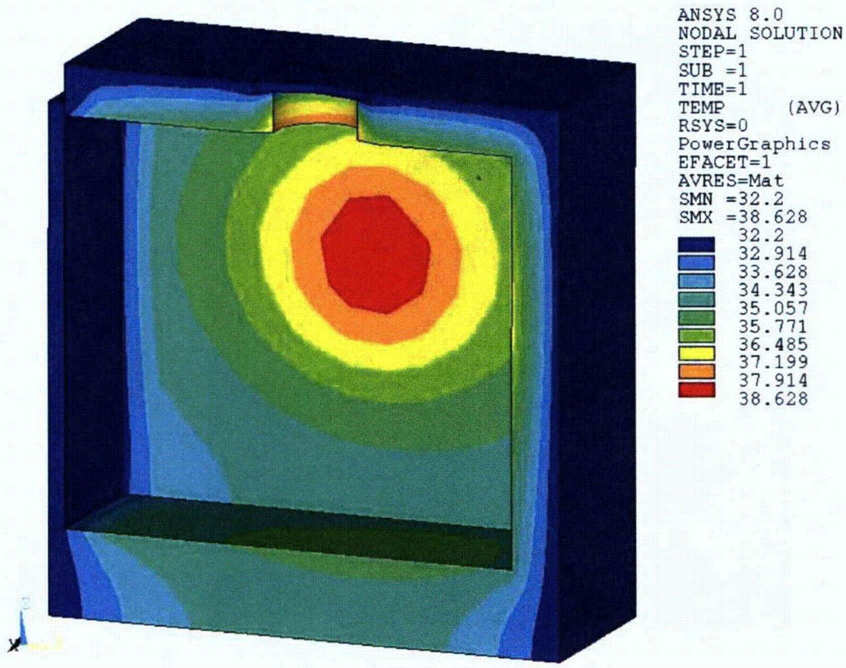

Figure 37. Temperature Contours (°C), Naval Long SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Normal Condition (Cut-away View of Room)

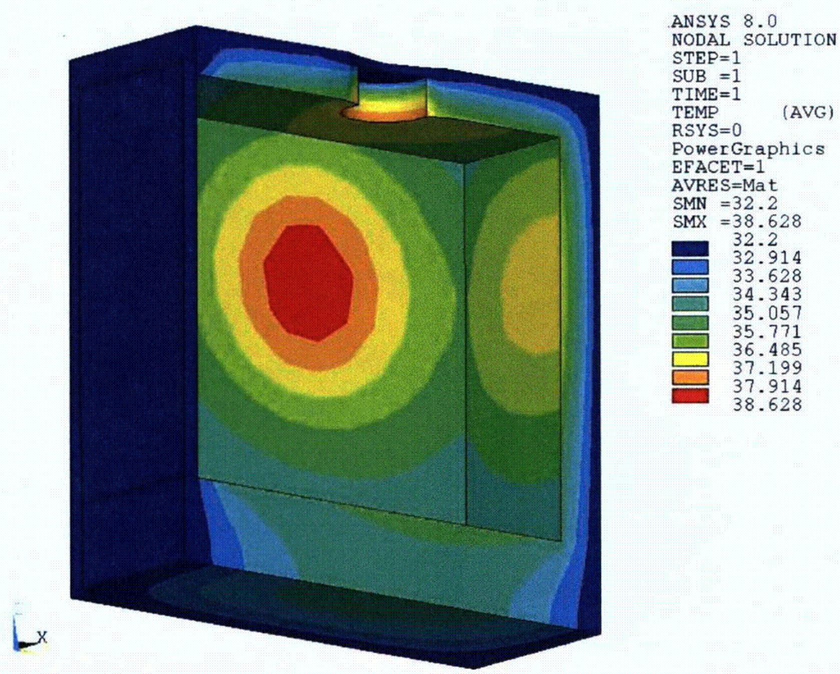

Figure 38. Temperature Contours (°C), Naval Long SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Normal Condition (Cut-away View of Room)

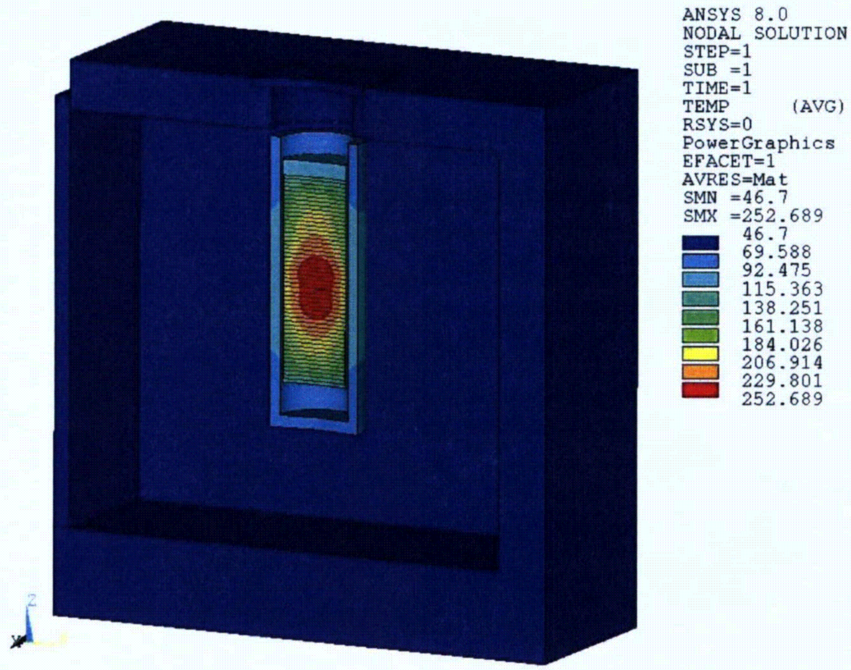

Figure 39. Temperature Contours (°C), Naval Long SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Off-normal Condition (Cut-away View)

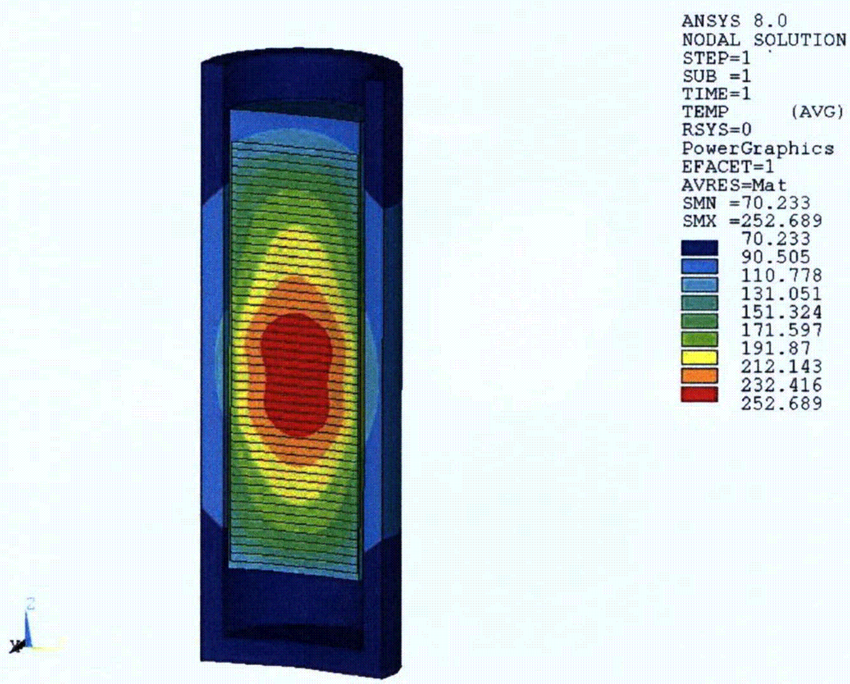

Figure 40. Temperature Contours (°C), Naval Long SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Off-normal Condition (Cut-away View of Shipping Cask)

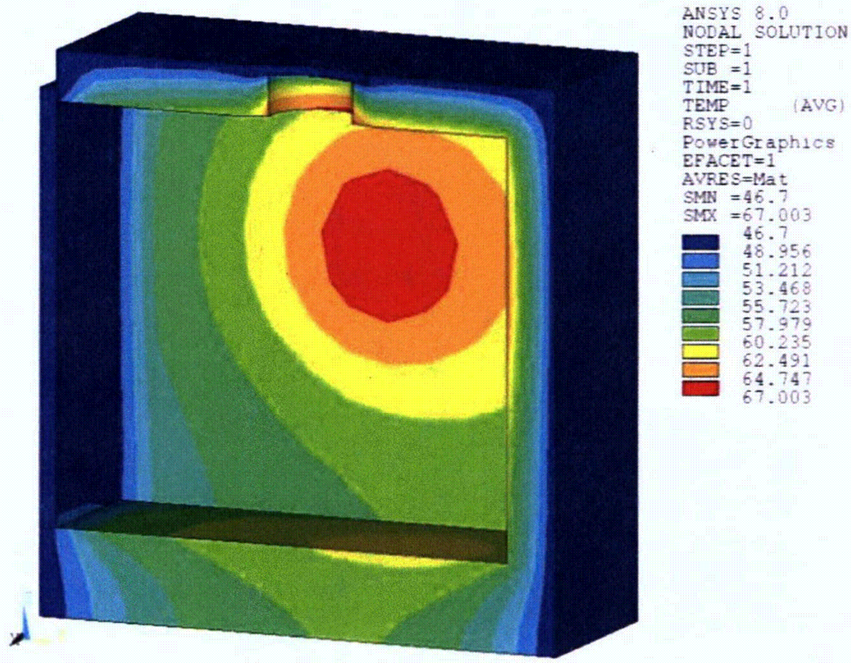

Figure 41. Temperature Contours (°C), Naval Long SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Off-normal Condition (Cut-away View of Room)

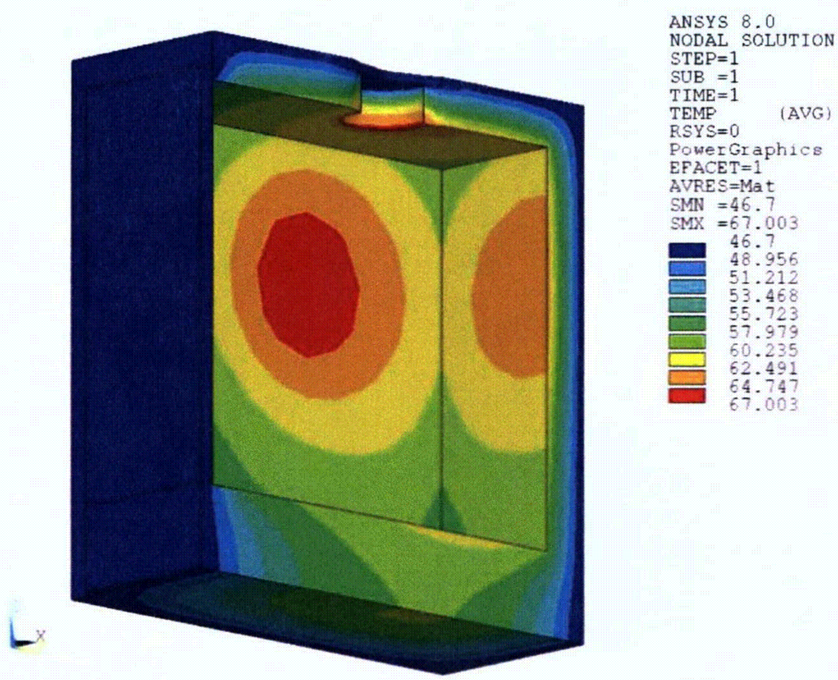

Figure 42. Temperature Contours (°C), Naval Long SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Off-normal Condition (Cut-away View of Room)

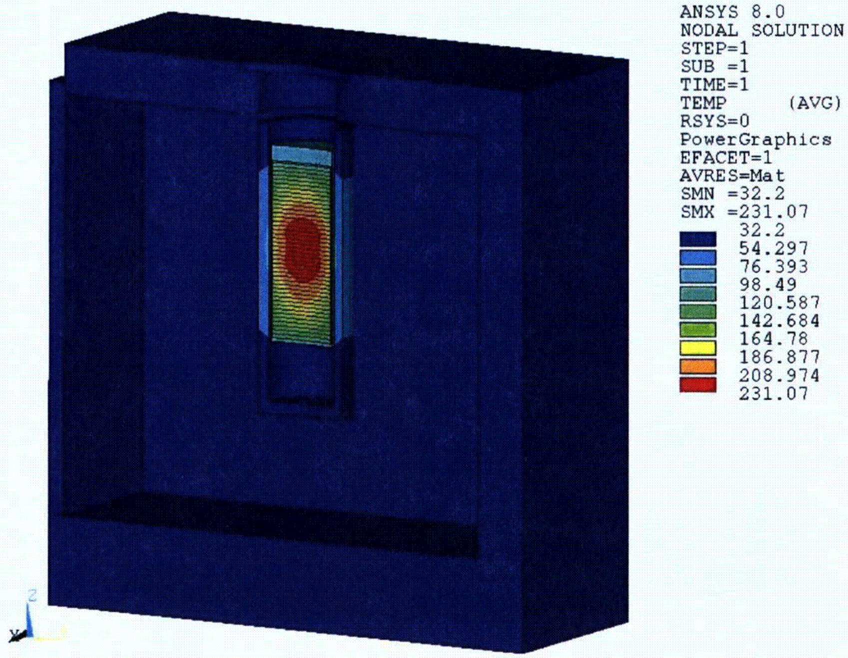

Figure 43. Temperature Contours (°C), Naval Short SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Normal Condition (Cut-away View)

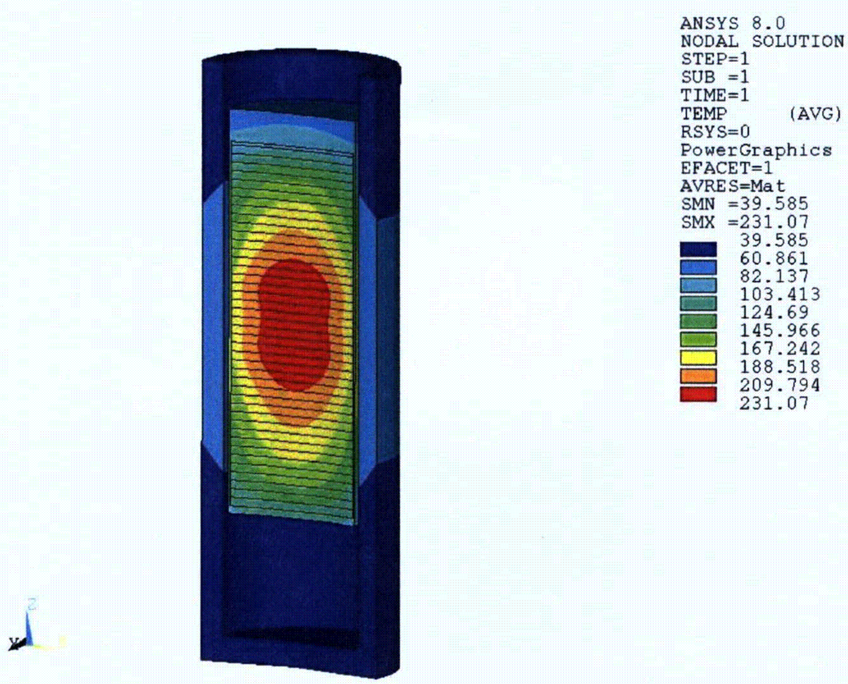

Figure 44. Temperature Contours (°C), Naval Short SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Normal Condition (Cut-away View of Shipping Cask)

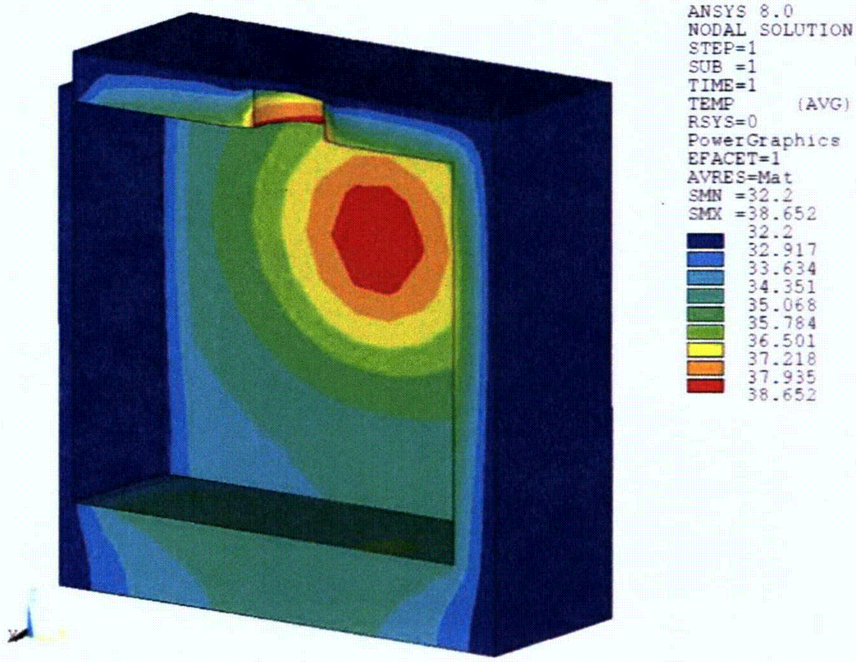

Figure 45. Temperature Contours (°C), Naval Short SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Normal Condition (Cut-away View of Room)

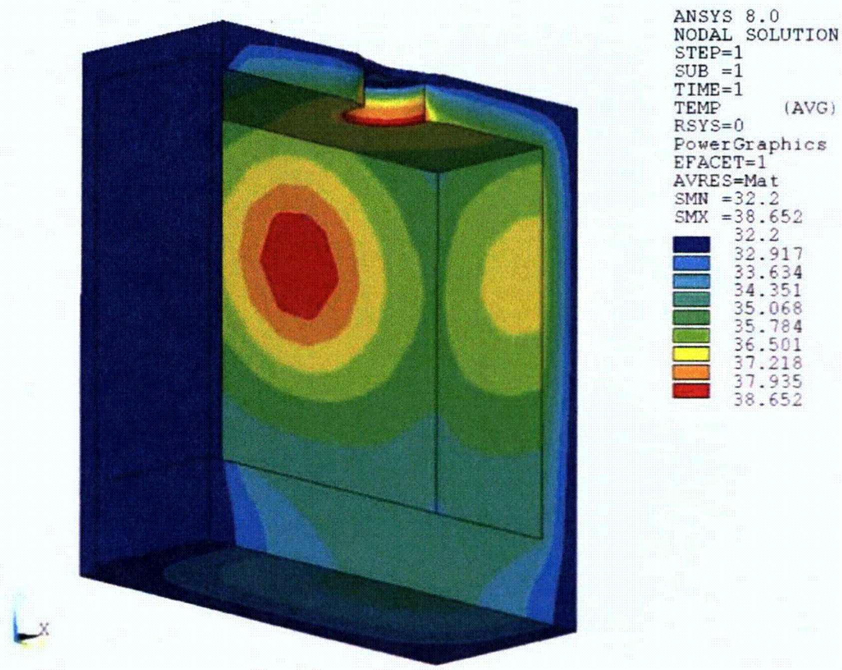

Figure 46. Temperature Contours (°C), Naval Short SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Normal Condition (Cut-away View of Room)

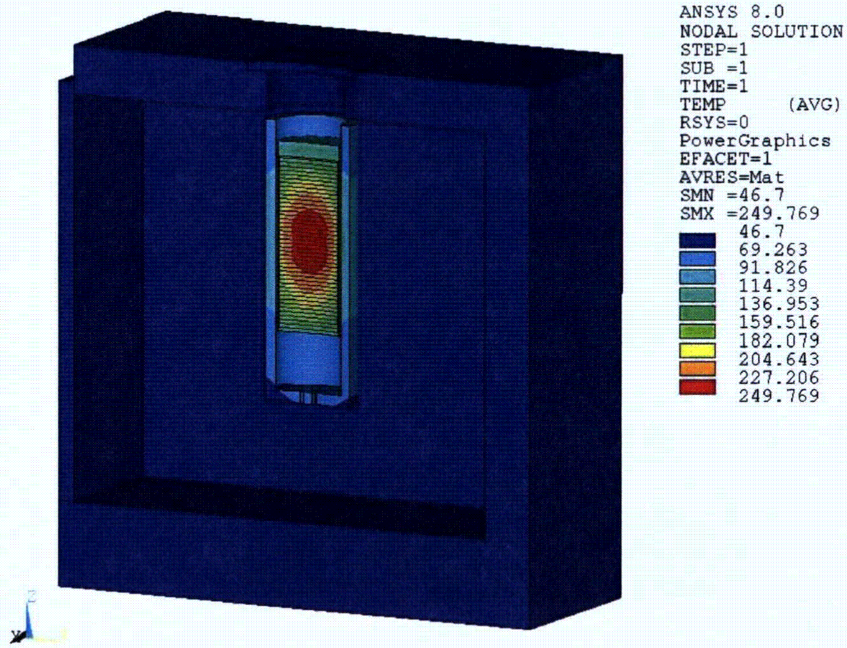

Figure 47. Temperature Contours (°C), Naval Short SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Off-normal Condition (Cut-away View)

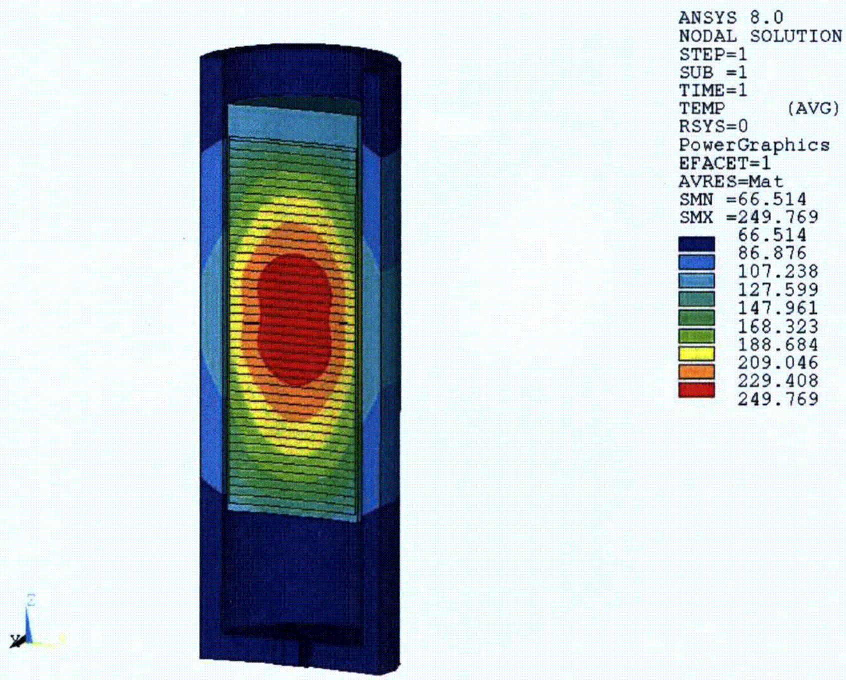

Figure 48. Temperature Contours (°C), Naval Short SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Off-normal Condition (Cut-away View of Shipping Cask)

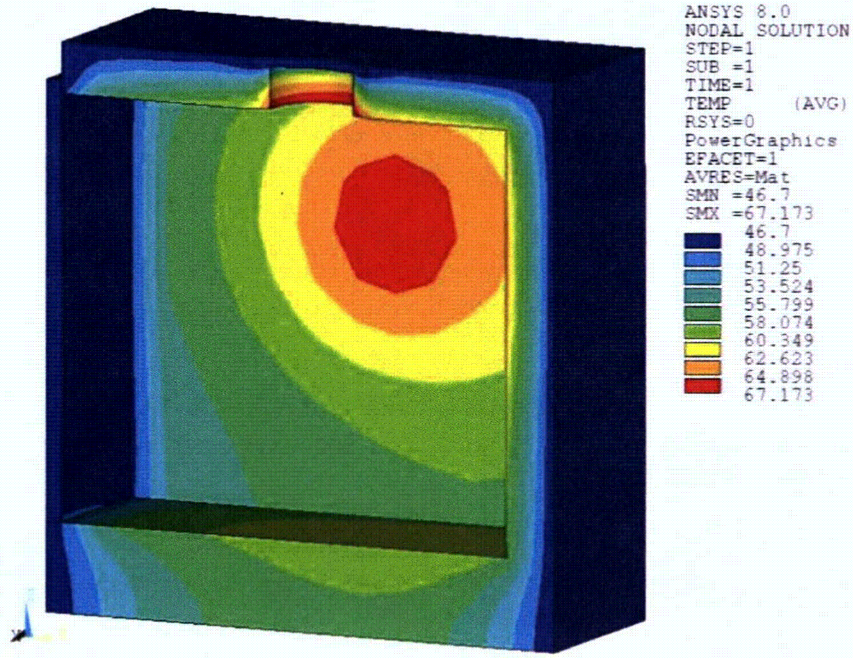

Figure 49. Temperature Contours (°C), Naval Short SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Off-normal Condition (Cut-away View of Room)

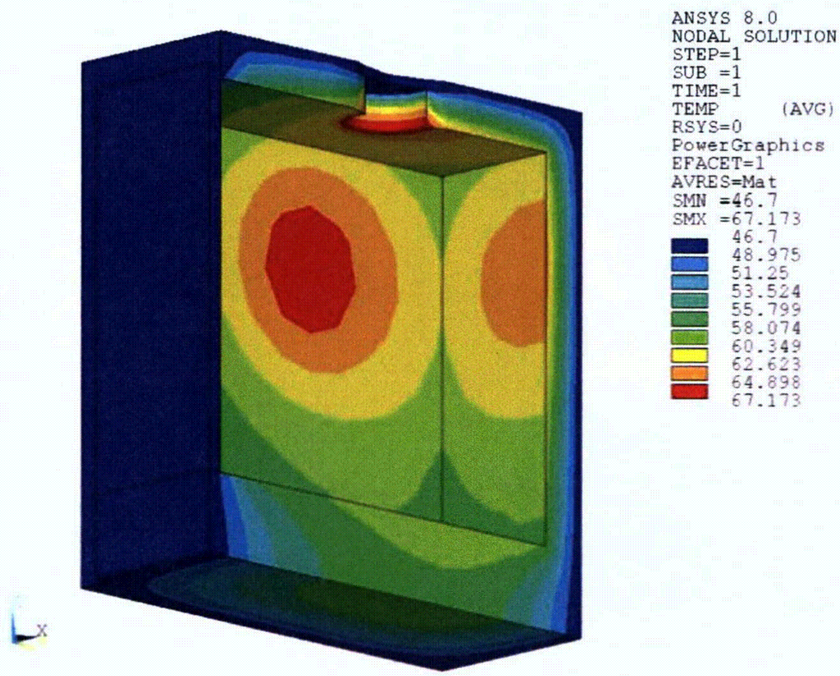

Figure 50. Temperature Contours (°C), Naval Short SNF Canister in Shipping Cask in Room 1008, Case 2-3_5, Off-normal Condition (Cut-away View of Room)

Peak surface temperature profiles of the naval SNF canisters for all cases in Room 1008 are shown in Figure 51 through Figure 58.

Figure 51 and Figure 52 show the peak surface temperature profiles along the length of the naval long SNF canister in degrees C and degrees F, respectively, for all cases under the normal operating condition in Room 1008.

Figure 53 and Figure 54 show the peak surface temperature profiles along the length of the naval long SNF canister in degrees C and degrees F, respectively, for all cases under the off-normal condition in Room 1008.

Figure 55 and Figure 56 show the peak surface temperature profiles along the length of the naval short SNF canister in degrees C and degrees F, respectively, for all cases under the normal operating condition in Room 1008.

Figure 57 and Figure 58 show the peak surface temperature profiles along the length of the naval short SNF canister in degrees C and degrees F, respectively, for all cases under the off-normal condition in Room 1008.

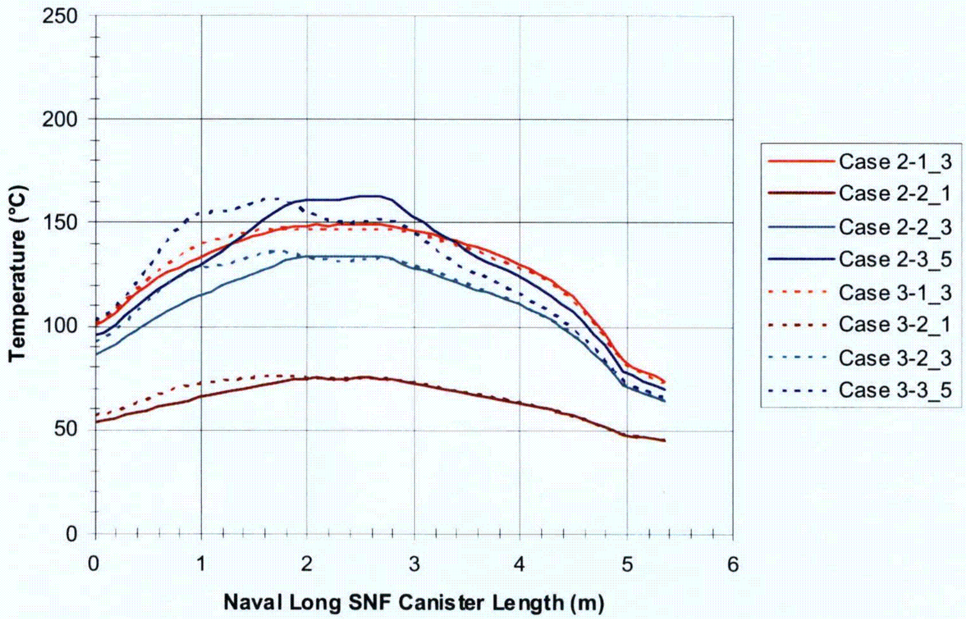

Figure 51. Naval Long SNF Canister Peak Surface Temperature Profiles (°C), Room 1008, Normal Condition

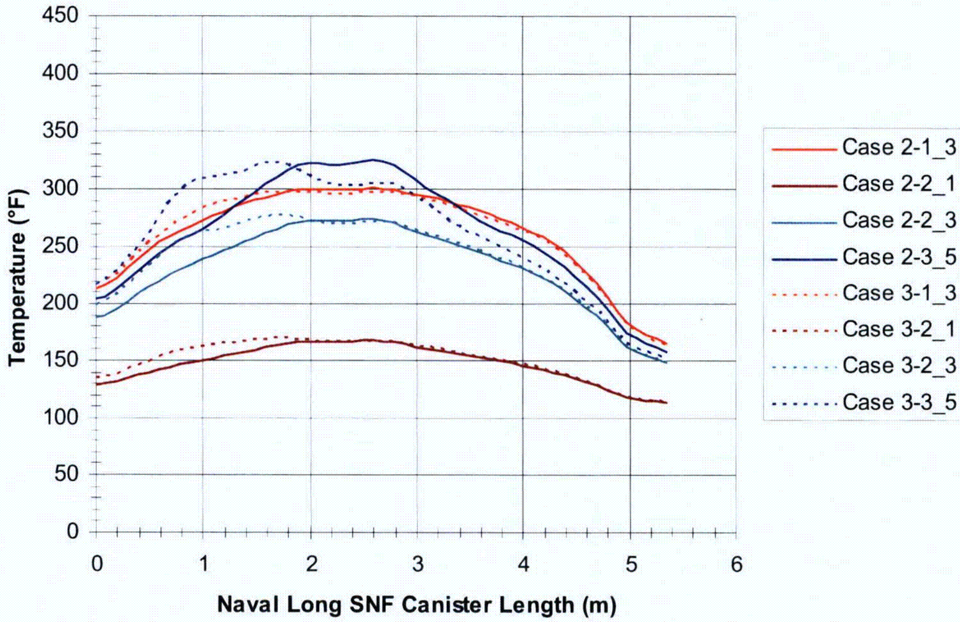

Figure 52. Naval Long SNF Canister Peak Surface Temperature Profiles (°F), Room 1008, Normal Condition

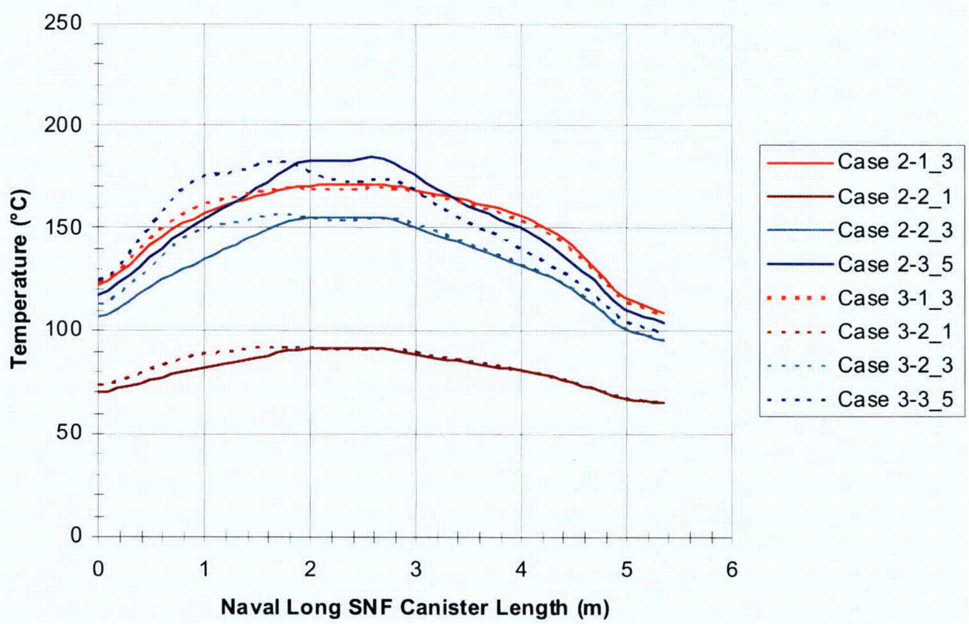

Figure 53. Naval Long SNF Canister Peak Surface Temperature Profiles (°C), Room 1008, Off-normal Condition

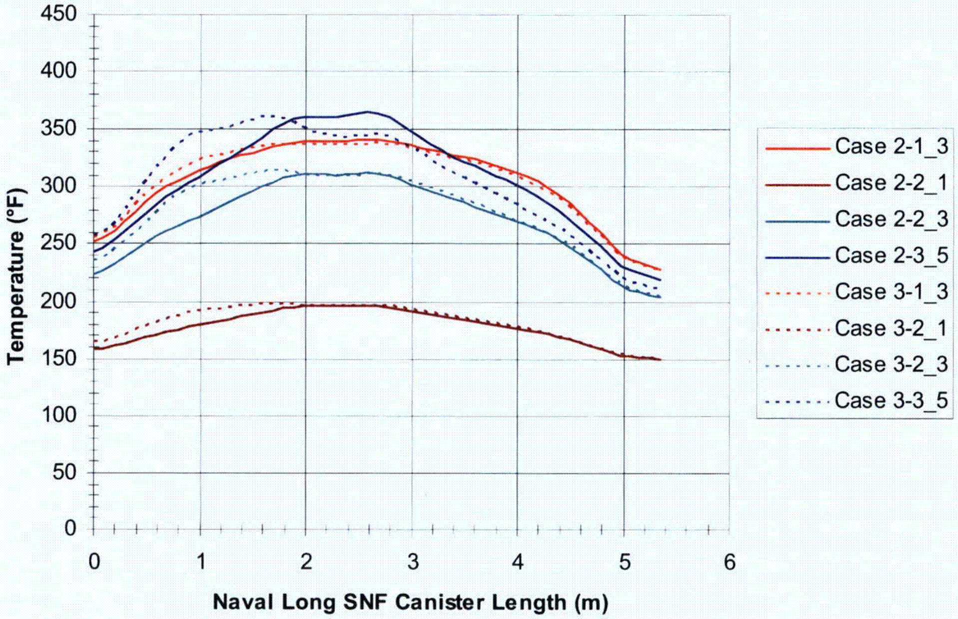

Figure 54. Naval Long SNF Canister Peak Surface Temperature Profiles (°F), Room 1008, Off-normal Condition

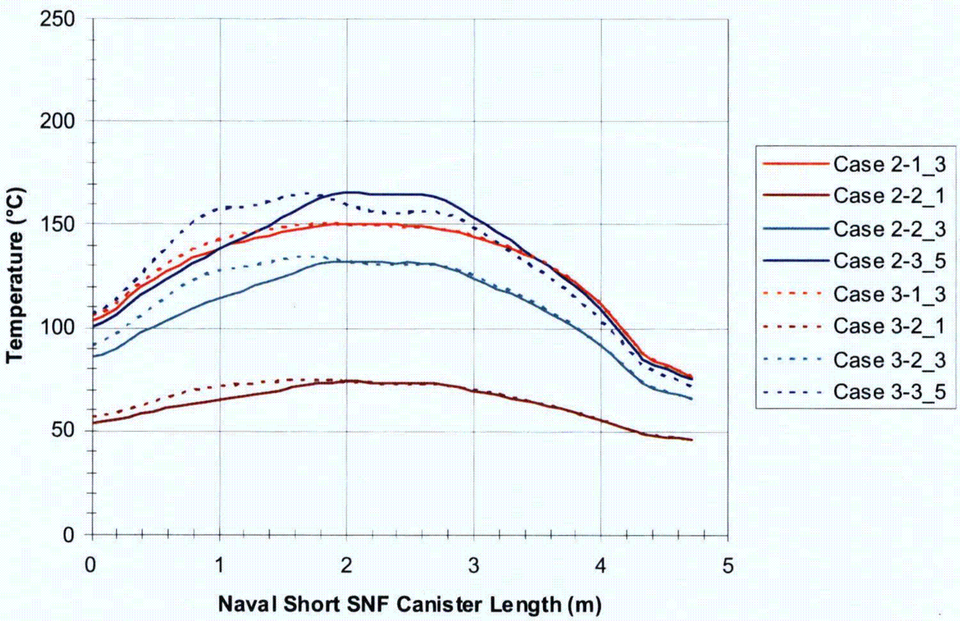

Figure 55. Naval Short SNF Canister Peak Surface Temperature Profiles (°C), Room 1008, Normal Condition

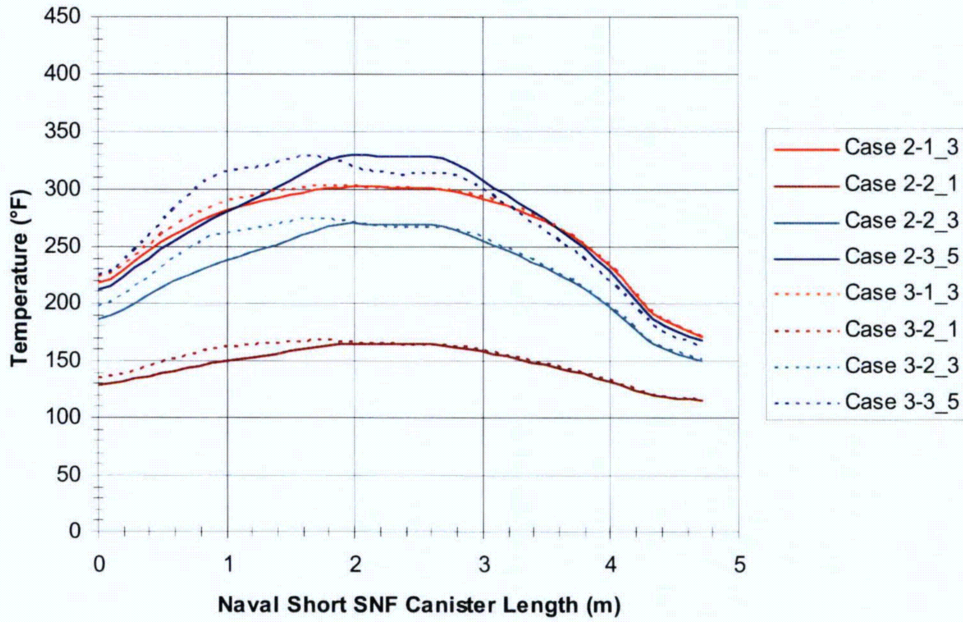

Figure 56. Naval Short SNF Canister Peak Surface Temperature Profiles (°F), Room 1008, Normal Condition

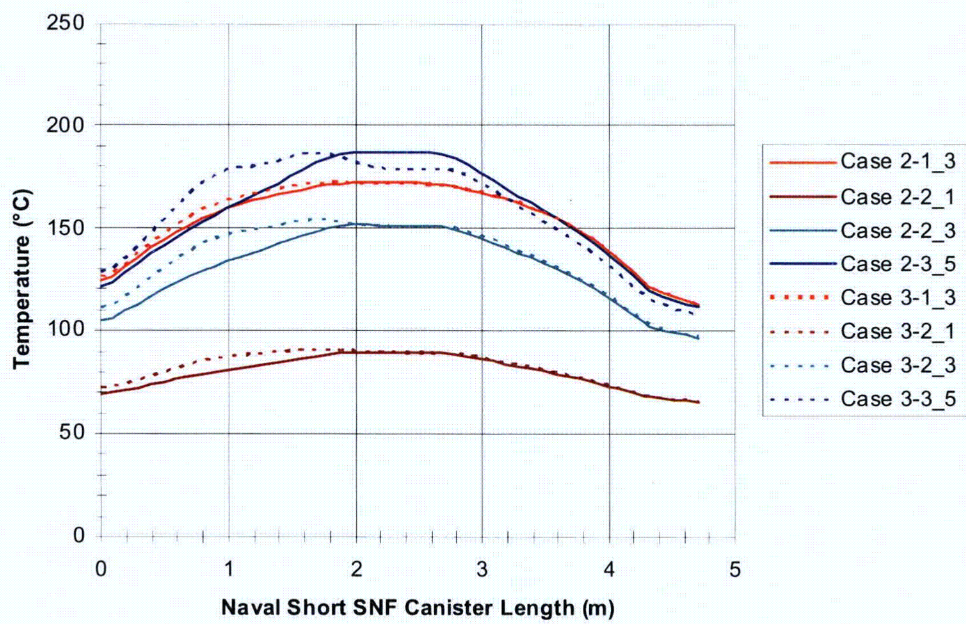

Figure 57. Naval Short SNF Canister Peak Surface Temperature Profiles (°C), Room 1008, Off-normal Condition

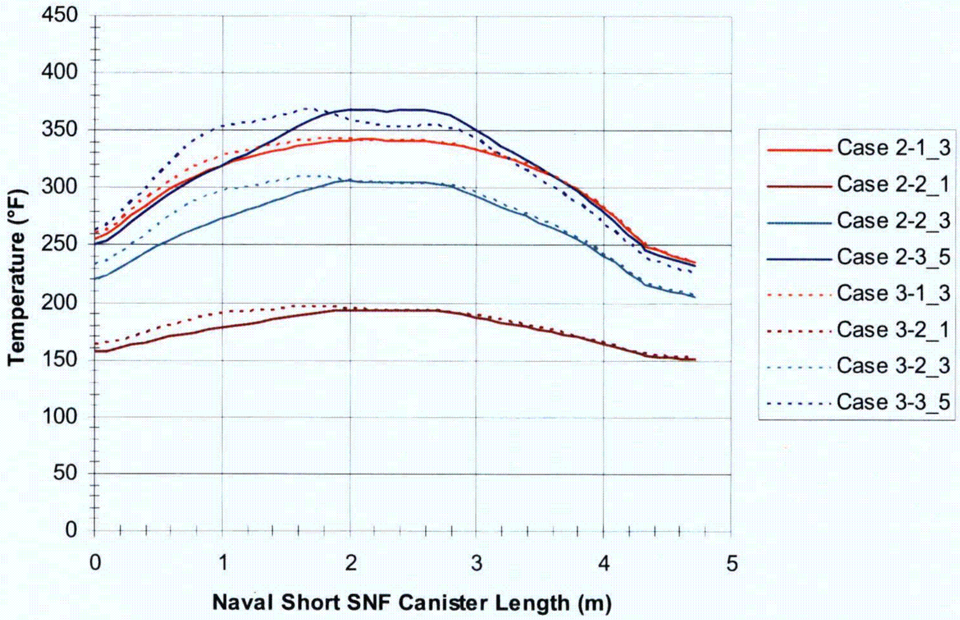

Figure 58. Naval Short SNF Canister Peak Surface Temperature Profiles (°F), Room 1008, Off-normal Condition

7.2.4 Shipping Cask and Room Wall Temperatures in Room 1008

Table 39 and Table 40 list the peak surface temperatures of the shipping cask holding a naval long SNF canister and a naval short SNF canister, respectively, in Room 1008 of the IHF for both normal and off-normal conditions.

Table 39. Peak Shipping Cask (with Naval Long Canister) Surface Temperatures in Room 1008

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5 *	70.9	159.6	109.9	229.8
2.2_3	61.5	142.7	95.2	203.4
2.1_3 *	67.6	153.7	105.7	222.3
2.2_1	43.3	110.0	63.9	147.1
3.3_5 *	70.1	158.2	108.8	227.8
3.2_3	62.1	143.8	96.7	206.1
3.1_3 *	67.2	153.0	105.3	221.6
3.2_1	43.7	110.6	64.7	148.4

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 40. Peak Shipping Cask (with Naval Short Canister) Surface Temperatures in Room 1008

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5	71.9	161.4	111.1	232.0
2.2_3	60.4	140.7	92.6	198.6
2.1_3	67.6	153.6	105.1	221.2
2.2_1	42.9	109.2	62.9	145.3
3.3_5 *	71.5	160.8	110.8	231.5
3.2_3	61.3	142.4	94.3	201.8
3.1_3	67.8	154.1	105.6	222.1
3.2_1	43.3	109.9	63.8	146.8

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 41 and Table 42 list the peak concrete surface temperatures in Room 1008 with the naval long SNF canister and the naval short SNF canister, respectively, for both normal and off-normal conditions. In all cases, for the off-normal condition, the concrete temperatures are below the 176.7°C (350°F) limit. In all cases, for the normal condition, the concrete temperatures are below the 65.6°C (150°F) limit.

Table 41. Peak Concrete Surface Temperatures in Room 1008 (with Naval Long Canister)

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5 *	38.6	101.5	67.0	152.6
2.2_3	37.2	99.0	62.1	143.8
2.1_3 *	38.5	101.3	66.7	152.0
2.2_1	34.2	93.6	51.7	125.1
3.3_5 *	38.6	101.4	66.8	152.2
3.2_3	37.5	99.4	62.9	145.2
3.1_3 *	38.5	101.2	66.6	151.9
3.2_1	34.3	93.7	52.0	125.6

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 42. Peak Concrete Surface Temperatures in Room 1008 (with Naval Short Canister)

Naval Heat Generation Profile Case	Normal Condition		Off-Normal Condition	
	°C	°F	°C	°F
2.3_5	38.7	101.6	66.9	152.4
2.2_3	36.9	98.4	60.6	141.1
2.1_3	38.3	100.9	65.7	150.2
2.2_1	34.1	93.3	51.2	124.2
3.3_5 *	38.8	101.8	67.3	153.1
3.2_3	37.1	98.8	61.5	142.8
3.1_3	38.3	101.0	66.0	150.8
3.2_1	34.2	93.5	51.6	124.8

* Total heat is scaled down to 11.8 kW while holding the peaks constant

7.3 SUMMARY AND CONCLUSIONS

7.3.1 Naval Canister Surface Temperatures in Waste Package in WPTT in Room 1006 of the IHF

In Room 1006 of the IHF, for all cases considered, for both normal and off-normal conditions, the naval long SNF canister surface temperatures are below the 204.4°C (400°F) limit (see Table 28).

In Room 1006 of the IHF, For both normal and off-normal conditions, the naval short SNF canister surface temperatures are below the 204.4°C (400°F) limit for all cases, except the two naval short SNF canisters with the 5 kW/m peaking (see Table 29). However, when convective effects through the WPTT are considered for the most thermally limiting heat generation profile, the naval short SNF canister surface temperature is brought below the 204.4°C (400°F) limit (see Table 30).

It should be noted that calculated naval SNF canister surface temperatures are dependent the Waste Package Transfer Trolley shielded enclosure having an emissivity value of 0.95 (see Assumption 3.1.13) and being constructed of 516 CS (see Assumption 3.1.6). Therefore, it is recommended that the emissivity (0.95) and material (516 CS) be made requirements in the design of the Waste Package Transfer Trolley shielded enclosure.

It should also be noted that the naval SNF canister bounding outer diameter of 66.5 in was used throughout this calculation. The nominal outer diameter is 66.0 in. Such a small difference in diameters has a negligible effect on naval canister surface temperatures. To illustrate this point, consider radiant heat transfer from the naval SNF canister and to a surrounding environment (black body) at a constant temperature, given by the equation for radiant heat flux:

$$q = \frac{Q}{A} = \sigma \varepsilon_{canister} \left(T_{canister}^4 - T_{\infty}^4 \right) \tag{4}$$

where:

Q is the heat output of the naval SNF canister (11.8 kW)
σ is the Stefan-Boltzmann constant ($5.67 \cdot 10^{-8}$ W/(m^{2}K^4))
$\varepsilon_{canister}$ is the emissivity of the naval SNF canister (0.6)
$T_{canster}$ is the surface temperature of the naval SNF canister
T_{∞} is the temperature of the surroundings
A is the surface area of the naval SNF canister which is calculated as:

$$A = 2\left(\pi r^2\right) + 2\pi r l \tag{5}$$

where r is the radius of the canister and l is the length of the canister.

If the temperature of the surroundings is held constant at 300 K, solving equation (4) for the canister surface temperature yields the following results:

Table 43. Naval Canister Surface Temperature Sensitivity to Change in Diameter (Radiating to Environment at 300 K)

	Diameter = 66.5 in	Diameter = 66.0 in	% Difference
Naval Long SNF canister	369.56	370.01	0.12
Naval Short SNF Canister	375.44	375.92	0.13

As seen in Table 43, the reduced diameter results in an increase in temperature of only 0.13%. If this temperature increase is applied to the results for the canister with the most limiting heat generation profile (naval short SNF canister case 2.3_5, as given in Table 30, h = 1 W/m^2-K) the peak canister surface temperature would be 203.8°C (398.8°F) which is still below the 204.4°C (400°F) limit. Therefore, using the bounding diameter of 66.5 in is acceptable.

7.3.2 Naval SNF Canister Surface Temperatures in Room 1007 of the IHF

Room 1007 of the IHF was not analyzed in this calculation. Since Room 1006 is smaller than Room 1007, thermal results for Room 1006 are expected to be bounding for Room 1007.

7.3.3 Naval Canister Surface Temperatures in Shipping Cask in Room 1008 of the IHF

In Room 1008 of the IHF, for all cases considered, for both normal and off-normal conditions, the naval long SNF canister and the naval short SNF canister surface temperatures are below the 204.4°C (400°F) limit (see Table 37 and Table 38).

7.3.4 Concrete Temperatures in Rooms 1006, 1007, and 1008 of the IHF

In Room 1008 of the IHF, for all cases considered under the off-normal condition, the concrete temperatures are below the 176.7°C (350°F) limit. For all cases considered under the normal condition, the concrete temperatures are below the 65.6°C (150°F) limit (see Table 41 and Table 42).

In Room 1006 of the IHF, for all cases considered under the off-normal condition, the concrete temperatures are below the 176.7°C (350°F) limit. For all cases considered under the normal condition, the concrete temperatures are below the 65.6°C (150°F) limit (see Table 35 and Table 36).

Room 1007 of the IHF was not analyzed in this calculation. Since Room 1006 is smaller than Room 1007, thermal results for Room 1006 are expected to be bounding for Room 1007.

7.3.5 Waste Package Outer Corrosion Barrier Temperatures in the IHF

In Room 1006 of the IHF, for all cases considered, for both normal and off-normal conditions, the waste package outer corrosion barrier peak surface temperatures are below the 300°C (572°F) limit (see Table 31 and Table 32).

Room 1007 of the IHF was not analyzed in this calculation. Since Room 1006 is smaller than Room 1007, thermal results for Room 1006 are expected to be bounding for Room 1007.

ATTACHMENT I

CALCULATION OF WPTT SHIELDED ENCLOSURE DIMENSIONS

Reference 2.2.31 provides dimensions for the waste package transfer trolley shielded enclosure, as it is expected in the Canister Receipt and Closure Facility. Figure 8 of Reference 2.2.31 indicates a shielding thickness of 16 in. The waste package transfer trolley in the IHF is expected to be similar, except that it is assumed that the shielding of waste package transfer trolley shielded enclosure is 9 in thick (Assumption 3.1.6). Therefore, to calculate the shielding dimensions for model development, the shielding thickness given in Reference 2.2.31 is reduced by 7 in, without moving the inner shielding surface (i.e. the 6 in clearance between the waste package and the interior of the waste package transfer trolley is unchanged in this calculation).

Figure 59 shows a geometric cross-section of the waste package in the WPTT Shielded Enclosure indicating dimensions relevant to this calculation.

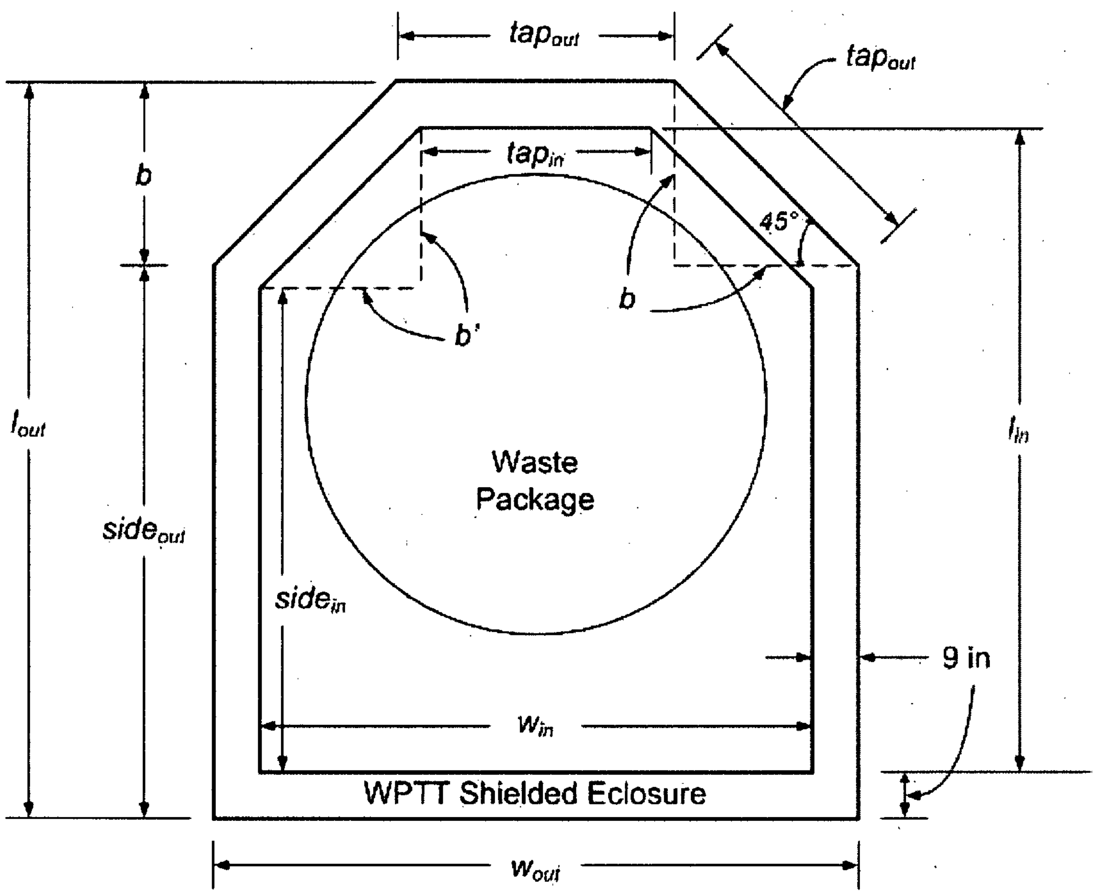

Figure 59. Cross-Section of Waste Package in the WPTT Shielded Enclosure

Figure 8 of Reference 2.2.31 gives the total outside width of the shielded enclosure (with 16-in thick shielding) as 129.70 in. Subtracting the shielding thickness from both sides gives the inside width, w_{in}:

$$w_{in} = 129.70\text{ in} - 2(16\text{ in}) = 97.7\text{ in} \tag{6}$$

The outside width, w_{out}, is determined by adding the 9-in shielding thickness to both sides of the inside width:

$$w_{out} = 97.70\text{ in} + 2(9\text{ in}) = 115.7\text{ in} \tag{7}$$

Figure 8 of Reference 2.2.31 gives the total outside height of the shielded enclosure (with 16-in thick shielding) as 143.01 in.

Subtracting the 16-in shielding thickness from both sides gives the inside length, l_{in}:

$$l_{in} = 143.01\text{ in} - 2(16\text{ in}) = 111.01\text{ in} \tag{8}$$

Adding the 9-in shielding thickness to both sides of h_{in} gives the outside length, l_{out}:

$$l_{out} = 111.01\text{ in} + 2(9\text{ in}) = 129.01\text{ in} \tag{9}$$

Pages 29-30 of Reference 2.2.31 indicate that the tapered sections of the shielded enclosure can be represented as a half-octagon. Page 2-8 of Reference 2.2.6 gives the side length of a regular polygon, a, as:

$$a = 2r\tan\left(\frac{v}{2}\right) \tag{10}$$

where

$$v = \frac{360°}{n} = \frac{2\pi}{n} \tag{11}$$

In Equations (10) and (11), n is the number of sides (in this case, 8 for an octagon), and r is the radius of a circle inscribed in the polygon (i.e., half the width of the shielded enclosure). Combining Equations (10) and (11) yields:

$$a = 2r\tan\left(\frac{\pi}{n}\right) \tag{12}$$

Setting $r = w_{out} / 2$, Equation (12) gives the width of the outside tapered section, tap_{out}:

$$tap_{out} = 2\left(\frac{w_{out}}{2}\right)\tan\left(\frac{\pi}{n}\right) = (115.7\text{ in})\tan\left(\frac{\pi}{8}\right) = 47.92\text{ in} \tag{13}$$

Likewise, setting $r = w_{in} / 2$, Equation (12) gives the width of the inside tapered section, tap_{in}:

$$tap_{in} = 2\left(\frac{w_{in}}{2}\right)\tan\left(\frac{\pi}{n}\right) = (97.7 \text{ in})\tan\left(\frac{\pi}{8}\right) = 40.47 \text{ in} \tag{14}$$

Using the Pythagorean Theorem the lengths b and b' can be calculated:

$$2b^2 = tap_{out}^{\ 2} = (47.92 \text{ in})^2 \tag{15}$$

$$b = 33.88 \text{ in} \tag{16}$$

$$2b'^2 = tap_{in}^{\ 2} = (40.47 \text{ in})^2 \tag{17}$$

$$b' = 28.62 \text{ in} \tag{18}$$

The outside length of the side, $side_{out}$, can be calculated by subtracting b from l_{out}:

$$side_{out} = l_{out} - b = 129.01 \text{ in} - 33.88 \text{ in} = 95.13 \text{ in} \tag{19}$$

Similarly, the inside length of the side, $side_{in}$, can be calculated by subtracting b' from l_{in}:

$$side_{in} = l_{in} - b' = 111.01 \text{ in} - 28.62 \text{ in} = 82.39 \text{ in} \tag{20}$$

ATTACHMENT II

EMAIL REGARDING M-290 CASK MATERIAL INFORMATION

(2 pages)

This email is from Charles Ejzak of Bechtel Bettis Atomic Power Laboratory dated 6/28/07 to Delwin Mecham of BSC Thermal Analysis Group regarding the materials used in the M-290 shipping cask.

"Ejzak, Charles" <ejzakcw@bettis.gov> on 06/28/2007 04:33:24 AM

To: "Delwin Mecham/YM/RWDOE" <Delwin_Mecham@ymp.gov>
cc: "Willis, Clarence" <williscr@bettis.gov>, "Daniel Wang/YM/RWDOE" <Daniel_Wang@ymp.gov>, "Timothy deBues/YM/RWDOE" <Timothy_deBues@ymp.gov>, "Steven Clark/YM/RWDOE" <Steven_Clark@ymp.gov>
Subject: RE: Final Meeting Minutes

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Del

The material is 304 stainless steel. The upper region is a nitronic that has thermal properties for 304 as well.

Chuck

-----Original Message-----
From: Delwin Mecham/YM/RWDOE [mailto:Delwin_Mecham@ymp.gov]
Sent: Wednesday, June 20, 2007 5:45 PM
To: Ejzak, Charles
Cc: Delwin Mecham/YM/RWDOE; Willis, Clarence; Daniel Wang/YM/RWDOE; Timothy deBues/YM/RWDOE; Steven Clark/YM/RWDOE
Subject: RE: Final Meeting Minutes

Chuck,

We looked through the information Dave Tooker has and found dimensions, but
no materials listed. So I guess we still need some more info from you on
this.

Thanks, Del

"Ejzak, Charles" <ejzakcw@bettis.gov> on 06/05/2007 06:05:43 AM

To: "Delwin Mecham/YM/RWDOE" <Delwin_Mecham@ymp.gov>
cc: "Willis, Clarence" <williscr@bettis.gov>, "Daniel Wang/YM/RWDOE" <Daniel_Wang@ymp.gov>, "Timothy deBues/YM/RWDOE" <Timothy_deBues@ymp.gov>
Subject: RE: Final Meeting Minutes
LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

Del

I checked on the M-290 cask. I was told that Dave Tooker is the contact at your end who should have that information.

Please let us know whether this will work for you.

Thanks

Chuck Ejzak

-----Original Message-----
From: Delwin Mecham/YM/RWDOE [mailto:Delwin_Mecham@ymp.gov]
Sent: Thursday, May 31, 2007 2:16 PM
To: Ejzak, Charles
Cc: Willis, Clarence; Delwin Mecham/YM/RWDOE; Daniel Wang/YM/RWDOE; Timothy deBues/YM/RWDOE
Subject: RE: Final Meeting Minutes

Thanks.

When you send material and dimensional info on the M-290 cask, please copy Daniel Wang and Tim deBues. They will be the author and checker respectively on the calculation we will be doing for IHF.

Del

ATTACHMENT III

EMISSIVITY SENSITIVITY

This attachment is not meant to calculate all possible temperatures based on every combination of emissivity values for every material used in this calculation. It is merely meant to obtain an estimate of temperature ranges for a few cases and limits the changes in emissivity to a few materials.

The actual values for emissivity of waste package materials are not certain at this time and depend on surface conditions (roughness and oxidation) induced by the final fabrication method(s).

Emissivity is also dependent on temperature. While most emissivity values in this calculation are used within the temperature range indicated in their respective references, a few are not. For instance, the emissivity of 316 SS (shown in Table 10), taken from Reference 2.2.6, Table 4.3.2, is only valid in this calculation at temperatures above 230°C (446°F). Also, the emissivity of 304 SS (shown in Table 14), taken from Reference 2.2.6, Table 4.3.2, is only valid in this calculation at temperatures above 220°C (428°F).

The worst normal case (naval short SNF canister case 2.3_5) was used to gage the sensitivity of the results to changes in emissivity values. (The ANSYS models of Room 1006 do not use 304 SS; 304 SS is only used in the ANSYS models of Room 1008. However, 304 SS and 316 SS are similar in composition and have similar values of emissivity. Thus, it is expected that similar changes in emissivity values for 304 SS in the model of Room 1008 would change the results in Room 1008 by approximately the same degree.) This case was rerun several times, each time with various values of emissivity prescribed for different surfaces. The cases compared are shown in Table 44. Note that Case E1 in Table 44 is the worst normal case (naval short SNF canister case 2.3_5), identified in Section 7.2.3.

Table 44. Emissivity Sensitivity Cases (Room 1006, Normal Condition)

Case	Emissivity					
	Concrete	WP OCB (Alloy 22)	Naval Short SNF Canister Surface	WP IV (316 SS)	WPTT Shielded Enclosure (516 CS)	Shield Doors/ Ceiling Plate (316 SS)
E1	0.88	0.87	0.6	0.62	0.95	0.62
E2	0.88	0.87	0.6	0.62	0.6	0.62
E3	0.88	0.5	0.6	0.62	0.95	0.62
E4	0.88	0.87	0.6	0.4	0.95	0.62

Table 45 through Table 48 list the peak temperatures obtained from the ANSYS emissivity sensitivity cases.

III.1 WPTT SHIELDED ENCLOSURE EMISSIVITY

Comparing the results of Cases E1 and E2, indicates the effect of varying the emissivity of the WPTT shielded enclosure.

The results indicate that a decrease in the emissivity of the WPTT shielded enclosure from 0.95 to 0.6 results in a temperature increase of 8.7°C (an increase of 15.6°F) in the peak naval short SNF canister surface temperature.

III.2 OCB EMISSIVITY

Comparing the results of Cases E1 and E3 indicates the effect of varying the emissivity of the waste package outer corrosion barrier. The results indicate that a decrease in the emissivity of Alloy 22 from 0.87 to 0.5 results in a temperature increase of 20.9°C (an increase of 37.6°F) in the peak naval SNF canister surface temperature.

III.3 IV EMISSIVITY

Comparing the results of Cases E1 and E4 indicates the effect of varying the emissivity of the waste package inner vessel. The results indicate that a decrease in the emissivity of waste package inner vessel from 0.62 to 0.4 results in a temperature increase of 15.4°C (an increase of 27.6°F) in the peak naval SNF canister surface temperature.

Table 45. Peak Naval Short Canister Surface Temperatures in Waste Package in Room 1006 (Emissivity Sensitivity Cases)

Emissivity Case	Normal Condition	
	°C	°F
E1	196.5	385.8
E2	205.2	401.4
E3	217.4	423.4
E4	211.9	413.4

Table 46. Peak Naval Short Waste Package OCB Surface Temperatures in Room 1006 (Emissivity Sensitivity Cases)

Naval Heat Generation Profile Case	Normal Condition	
	°C	°F
E1	110.4	230.7
E2	125.0	256.9
E3	136.6	277.9
E4	109.7	229.4

Table 47. Peak WPTT (with Naval Short Waste Package) Outer Surface Temperatures in Room 1006 (Emissivity Sensitivity Cases)

Naval Heat Generation Profile Case	Normal Condition	
	°C	°F
E1	55.0	131.0
E2	58.0	136.4
E3	54.6	130.2
E4	54.9	130.8

Table 48. Peak Concrete Surface Temperatures in Room 1006 (with Naval Short WP) (Emissivity Sensitivity Cases)

Naval Heat Generation Profile Case	Normal Condition	
	°C	°F
E1	39.6	103.3
E2	38.6	101.4
E3	39.4	103.0
E4	39.6	103.4

ATTACHMENT IV

WASTE PACKAGE FILL GAS COMPARISON

Before the outer corrosion barrier lid is put in place, the waste package inner vessel is backfilled with helium. In the body of this calculation, all the cases of the waste package in the WPTT shielded enclosure in Room 1006 were analyzed with air as the waste package inner vessel fill gas, which is more thermally limiting that using helium as the fill gas.

A steady-state analysis was performed on the case with the most limiting heat generation profile (naval short waste package, case 2.3_5) under normal conditions with helium as the inner vessel fill gas. In this case, the waste package was modeled with the outer corrosion barrier lid in place.

The resulting peak temperatures of interest are reported in Table 49. As seen in Table 49, the peak naval short canister surface temperature with helium as the inner vessel fill gas is 184.3°C (363.8°F), which is 12.2°C cooler (22.0°F cooler) than the naval short canister surface temperature reported in Table 29 (case 2.3_5) with air as the inner vessel fill gas.

Table 49. Peak Surface Temperatures in Waste Package in Room 1006 (Backfilled with Helium, Normal Condition)

Surface of Interest	Peak Surface Temperature	
	°C	°F
Naval Canister	184.3	363.8
Outer Corrosion Barrier	109.5	229.1
WPTT Shielded Enclosure	53.0	127.3
Concrete in Room 1006	40.0	104.0

ATTACHMENT V

WELD HEAT ANALYSIS

A steady-state analysis was performed on the case with the most limiting heat generation profile (naval short waste package, case 2.3_5) under normal conditions with helium as the inner vessel fill gas. This case is identical to that analyzed in Attachment IV, except that heat generation was applied to a small ring around the top of the waste package at the lid. While this does not capture the transient nature of the welding process, it does provide an estimate on the sensitivity of the naval canister surface temperature to the welding process.

Page 13 of Reference 2.2.35 indicates that there are two weld torches, each operating at 12.5 volts and 275 amps. Each weld pass takes 864.4 s (Reference 2.2.35, Section 4.7.1). The average interpass delay time (1178 s) is calculated from the interpass delay times given in Table 8 of Reference 2.2.35 (see Assumption 3.1.12). The weld power used in the steady-state analysis (2909 W) is calculated as the total weld power of both torches expended over the time of one complete weld pass (weld time + interpass time) (see Attachment VIII, file: *calc_weld_heat.xmcd* for calculation).

The weld heat is applied in the ANSYS representation as a volumetric heat generation rate. The volume to which the heat generation rate is applied is a small ring-shaped section in the OCB lid with a thickness (in the radial direction) of 0.004865 m and a height of 0.0254 m (the same height of the OCB lid). The volume of this ring is $7.09 \cdot 10^{-4}$ m^3. Dividing the weld power by the volume to which it is applied results in a volumetric heat generation rate of $4.1 \cdot 10^6$ W/m^3 (see Attachment VIII, file: *calc_weld_heat.xmcd* for calculation).

The resulting peak temperatures of interest are reported in Table 50. As seen in Table 50, the peak naval short canister surface temperature with helium as the inner vessel fill gas and with simulated weld heat applied is 187.0°C (368.6°F), which is 2.7°C hotter (4.8°F hotter) than the naval short canister surface temperature reported in Table 49 for the same case without the weld heat.

Table 50. Peak Surface Temperatures in Waste Package in Room 1006 (Backfilled with Helium, Normal Condition, with Weld Heat)

Surface of Interest	Peak Surface Temperature	
	°C	°F
Naval Canister	187.0	368.6
Outer Corrosion Barrier	170.5	338.9
WPTT Shielded Enclosure	54.0	129.2
Concrete in Room 1006	41.3	106.3

ATTACHMENT VI

NAVAL CANISTER HEAT GENERATION PROFILES

The heat generation data shown in Table 51 through Table 54 were derived from the linear decay heat loads given in Table 1 and Table 2 in Attachment 1 of Reference 2.2.33.

The linear decay heat (kW/m) from each 0.1-meter segment of the naval SNF canisters was used to calculate the total heat for each segment (kW). In cases where the total heat of the naval SNF canister is greater than 11.8 kW (i.e., for Case 2.3_5 long, Case 2.1_3 long, Case 3.3_5 long, Case 3.1_3 long, and Case 3.3_5 short), the total heat is scaled down to 11.8 kW, while holding the peaks constant. The volumetric heat generation for each segment of the naval SNF canister (W/m^3) is calculated by dividing the total heat for each segment (W) by the volume of each segment (m^3, calculated by multiplying the length of each segment by the cross-sectional area of the naval canister minus the 1-inch canister wall thickness).

The details of the derivation of the volumetric heat generation rates can be seen in Attachment VIII, files: *naval_long_canister_heat_gen.xls* and *naval_short_canister_heat_gen.xls*.

Table 51. Represented Naval Long SNF Canister Heat Generation Rates with Two Peaks

SNF Segment Length (m)		Volumetric Heat Generation Rate (W/m^3)			
Begin	End	Case 2.3_5 *	Case 2.2_3	Case 2.1_3 *	Case 2.2_1
0.00	0.10	920.5	759.0	1093.4	237.2
0.10	0.20	920.5	759.0	1093.4	237.2
0.20	0.30	920.5	759.0	1093.4	237.2
0.30	0.40	920.5	759.0	1093.4	237.2
0.40	0.50	920.5	759.0	1093.4	237.2
0.50	0.60	920.5	759.0	1093.4	237.2
0.60	0.70	920.5	759.0	1093.4	237.2
0.70	0.80	920.5	759.0	1093.4	237.2
0.80	0.90	920.5	759.0	1093.4	237.2
0.90	1.00	920.5	759.0	1093.4	237.2
1.00	1.10	920.5	759.0	1093.4	237.2
1.10	1.20	920.5	759.0	1093.4	237.2
1.20	1.30	920.5	759.0	1093.4	237.2
1.30	1.40	920.5	759.0	1093.4	237.2
1.40	1.50	920.5	759.0	1093.4	237.2
1.50	1.60	1338.9	759.0	1093.4	237.2
1.60	1.70	1673.6	1423.1	1423.1	474.4
1.70	1.80	2371.9	1423.1	1423.1	474.4
1.80	1.90	2371.9	1423.1	1423.1	474.4

1.90	2.00	1673.6	1423.1	1423.1	474.4
2.00	2.10	1338.9	759.0	1093.4	237.2
2.10	2.20	920.5	759.0	1093.4	237.2
2.20	2.30	920.5	759.0	1093.4	237.2
2.30	2.40	920.5	759.0	1093.4	237.2
2.40	2.50	2371.9	1423.1	1423.1	474.4
2.50	2.60	2371.9	1423.1	1423.1	474.4
2.60	2.70	2371.9	1423.1	1423.1	474.4
2.70	2.80	2371.9	1423.1	1423.1	474.4
2.80	2.90	920.5	759.0	1093.4	237.2
2.90	3.00	920.5	759.0	1093.4	237.2
3.00	3.10	920.5	759.0	1093.4	237.2
3.10	3.20	920.5	759.0	1093.4	237.2
3.20	3.30	920.5	759.0	1093.4	237.2
3.30	3.40	920.5	759.0	1093.4	237.2
3.40	3.50	920.5	759.0	1093.4	237.2
3.50	3.60	920.5	759.0	1093.4	237.2
3.60	3.70	920.5	759.0	1093.4	237.2
3.70	3.80	920.5	759.0	1093.4	237.2
3.80	3.90	920.5	759.0	1093.4	237.2
3.90	4.00	920.5	759.0	1093.4	237.2
4.00	4.10	920.5	759.0	1093.4	237.2
4.10	4.20	920.5	759.0	1093.4	237.2
4.20	4.30	920.5	759.0	1093.4	237.2
4.30	4.40	920.5	759.0	1093.4	237.2
4.40	4.50	920.5	759.0	1093.4	237.2
4.50	4.60	920.5	759.0	1093.4	237.2
4.60	4.70	920.5	759.0	1093.4	237.2
4.70	4.80	920.5	759.0	1093.4	237.2
4.80	4.88	920.5	759.0	1093.4	237.2

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 52. Represented Naval Long SNF Canister Heat Generation Rates with Three Peaks

SNF Segment Length (m)		**Volumetric Heat Generation Rate (W/m^3)**			
Begin	**End**	**Case 3.3_5 ***	**Case 3.2_3**	**Case 3.1_3 ***	**Case 3.2_1**
0.00	0.10	780.6	759.0	1056.7	237.2
0.10	0.20	780.6	759.0	1056.7	237.2
0.20	0.30	780.6	759.0	1056.7	237.2
0.30	0.40	780.6	759.0	1056.7	237.2
0.40	0.50	780.6	759.0	1056.7	237.2
0.50	0.60	780.6	759.0	1056.7	237.2

0.60	0.70	2371.9	1423.1	1423.1	474.4
0.70	0.80	2371.9	1423.1	1423.1	474.4
0.80	0.90	2371.9	1423.1	1423.1	474.4
0.90	1.00	2371.9	1423.1	1423.1	474.4
1.00	1.10	780.6	759.0	1056.7	237.2
1.10	1.20	780.6	759.0	1056.7	237.2
1.20	1.30	780.6	759.0	1056.7	237.2
1.30	1.40	780.6	759.0	1056.7	237.2
1.40	1.50	2371.9	1423.1	1423.1	474.4
1.50	1.60	2371.9	1423.1	1423.1	474.4
1.60	1.70	2371.9	1423.1	1423.1	474.4
1.70	1.80	2371.9	1423.1	1423.1	474.4
1.80	1.90	780.6	759.0	1056.7	237.2
1.90	2.00	780.6	759.0	1056.7	237.2
2.00	2.10	780.6	759.0	1056.7	237.2
2.10	2.20	780.6	759.0	1056.7	237.2
2.20	2.30	780.6	759.0	1056.7	237.2
2.30	2.40	780.6	759.0	1056.7	237.2
2.40	2.50	1135.5	996.2	1056.7	332.1
2.50	2.60	1419.3	1185.9	1423.1	379.5
2.60	2.70	2371.9	1423.1	1423.1	474.4
2.70	2.80	2371.9	1423.1	1423.1	474.4
2.80	2.90	1419.3	1185.9	1423.1	379.5
2.90	3.00	1135.5	996.2	1056.7	332.1
3.00	3.10	780.6	759.0	1056.7	237.2
3.10	3.20	780.6	759.0	1056.7	237.2
3.20	3.30	780.6	759.0	1056.7	237.2
3.30	3.40	780.6	759.0	1056.7	237.2
3.40	3.50	780.6	759.0	1056.7	237.2
3.50	3.60	780.6	759.0	1056.7	237.2
3.60	3.70	780.6	759.0	1056.7	237.2
3.70	3.80	780.6	759.0	1056.7	237.2
3.80	3.90	780.6	759.0	1056.7	237.2
3.90	4.00	780.6	759.0	1056.7	237.2
4.00	4.10	780.6	759.0	1056.7	237.2
4.10	4.20	780.6	759.0	1056.7	237.2
4.20	4.30	780.6	759.0	1056.7	237.2
4.30	4.40	780.6	759.0	1056.7	237.2
4.40	4.50	780.6	759.0	1056.7	237.2
4.50	4.60	780.6	759.0	1056.7	237.2
4.60	4.70	780.6	759.0	1056.7	237.2
4.70	4.80	780.6	759.0	1056.7	237.2
4.80	4.88	780.6	759.0	1056.7	237.2

* Total heat is scaled down to 11.8 kW while holding the peaks constant

Table 53. Represented Naval Short SNF Canister Heat Generation Rates with Two Peaks

SNF Segment Length (m)		Volumetric Heat Generation Rate (W/m^3)			
Begin	**End**	**Case 2.3_5**	**Case 2.2_3**	**Case 2.1_3**	**Case 2.2_1**
0.00	0.10	1043.6	759.0	1185.9	237.2
0.10	0.20	1043.6	759.0	1185.9	237.2
0.20	0.30	1043.6	759.0	1185.9	237.2
0.30	0.40	1043.6	759.0	1185.9	237.2
0.40	0.50	1043.6	759.0	1185.9	237.2
0.50	0.60	1043.6	759.0	1185.9	237.2
0.60	0.70	1043.6	759.0	1185.9	237.2
0.70	0.80	1043.6	759.0	1185.9	237.2
0.80	0.90	1043.6	759.0	1185.9	237.2
0.90	1.00	1043.6	759.0	1185.9	237.2
1.00	1.10	1043.6	759.0	1185.9	237.2
1.10	1.20	1043.6	759.0	1185.9	237.2
1.20	1.30	1043.6	759.0	1185.9	237.2
1.30	1.40	1043.6	759.0	1185.9	237.2
1.40	1.50	1043.6	759.0	1185.9	237.2
1.50	1.60	1518.0	759.0	1185.9	237.2
1.60	1.70	1897.5	1423.1	1423.1	474.4
1.70	1.80	2371.9	1423.1	1423.1	474.4
1.80	1.90	2371.9	1423.1	1423.1	474.4
1.90	2.00	1897.5	1423.1	1423.1	474.4
2.00	2.10	1518.0	759.0	1185.9	237.2
2.10	2.20	1043.6	759.0	1185.9	237.2
2.20	2.30	1043.6	759.0	1185.9	237.2
2.30	2.40	1043.6	759.0	1185.9	237.2
2.40	2.50	2371.9	1423.1	1423.1	474.4
2.50	2.60	2371.9	1423.1	1423.1	474.4
2.60	2.70	2371.9	1423.1	1423.1	474.4
2.70	2.80	2371.9	1423.1	1423.1	474.4
2.80	2.90	1043.6	759.0	1185.9	237.2
2.90	3.00	1043.6	759.0	1185.9	237.2
3.00	3.10	1043.6	759.0	1185.9	237.2
3.10	3.20	1043.6	759.0	1185.9	237.2
3.20	3.30	1043.6	759.0	1185.9	237.2
3.30	3.40	1043.6	759.0	1185.9	237.2
3.40	3.50	1043.6	759.0	1185.9	237.2
3.50	3.60	1043.6	759.0	1185.9	237.2
3.60	3.70	1043.6	759.0	1185.9	237.2
3.70	3.80	1043.6	759.0	1185.9	237.2
3.80	3.90	1043.6	759.0	1185.9	237.2
3.90	4.00	1043.6	759.0	1185.9	237.2

4.00	4.10	1043.6	759.0	1185.9	237.2
4.10	4.20	1043.6	759.0	1185.9	237.2
4.20	4.24	1043.6	759.0	1185.9	237.2

Table 54. Represented Naval Short SNF Canister Heat Generation Rates with Three Peaks

SNF Segment Length (m)		**Volumetric Heat Generation Rate (W/m^3)**			
Begin	**End**	**Case 3.3_5 ***	**Case 3.2_3**	**Case 3.1_3**	**Case 3.2_1**
0.00	0.10	923.6	759.0	1185.9	237.2
0.10	0.20	923.6	759.0	1185.9	237.2
0.20	0.30	923.6	759.0	1185.9	237.2
0.30	0.40	923.6	759.0	1185.9	237.2
0.40	0.50	923.6	759.0	1185.9	237.2
0.50	0.60	923.6	759.0	1185.9	237.2
0.60	0.70	2371.9	1423.1	1423.1	474.4
0.70	0.80	2371.9	1423.1	1423.1	474.4
0.80	0.90	2371.9	1423.1	1423.1	474.4
0.90	1.00	2371.9	1423.1	1423.1	474.4
1.00	1.10	923.6	759.0	1185.9	237.2
1.10	1.20	923.6	759.0	1185.9	237.2
1.20	1.30	923.6	759.0	1185.9	237.2
1.30	1.40	923.6	759.0	1185.9	237.2
1.40	1.50	2371.9	1423.1	1423.1	474.4
1.50	1.60	2371.9	1423.1	1423.1	474.4
1.60	1.70	2371.9	1423.1	1423.1	474.4
1.70	1.80	2371.9	1423.1	1423.1	474.4
1.80	1.90	923.6	759.0	1185.9	237.2
1.90	2.00	923.6	759.0	1185.9	237.2
2.00	2.10	923.6	759.0	1185.9	237.2
2.10	2.20	923.6	759.0	1185.9	237.2
2.20	2.30	923.6	759.0	1185.9	237.2
2.30	2.40	923.6	759.0	1185.9	237.2
2.40	2.50	1343.4	996.2	1185.9	332.1
2.50	2.60	1679.3	1185.9	1423.1	379.5
2.60	2.70	2371.9	1423.1	1423.1	474.4
2.70	2.80	2371.9	1423.1	1423.1	474.4
2.80	2.90	1679.3	1185.9	1423.1	379.5
2.90	3.00	1343.4	996.2	1185.9	332.1
3.00	3.10	923.6	759.0	1185.9	237.2
3.10	3.20	923.6	759.0	1185.9	237.2
3.20	3.30	923.6	759.0	1185.9	237.2

3.30	3.40	923.6	759.0	1185.9	237.2
3.40	3.50	923.6	759.0	1185.9	237.2
3.50	3.60	923.6	759.0	1185.9	237.2
3.60	3.70	923.6	759.0	1185.9	237.2
3.70	3.80	923.6	759.0	1185.9	237.2
3.80	3.90	923.6	759.0	1185.9	237.2
3.90	4.00	923.6	759.0	1185.9	237.2
4.00	4.10	923.6	759.0	1185.9	237.2
4.10	4.20	923.6	759.0	1185.9	237.2
4.20	4.24	923.6	759.0	1185.9	237.2

* Total heat is scaled down to 11.8 kW while holding the peaks constant

ATTACHMENT VII

FILE LISTING FOR ATTACHMENT VIII

```
Volume in drive D is 090311_0931
 Volume Serial Number is 3EFD-8135

 Directory of D:\

02/23/2009  02:42 PM    <DIR>          ANSYS_RUNS
01/23/2009  02:07 PM            49,152 calculate_h.xls
02/03/2009  11:15 AM            55,127 calc_weld_heat.xmcd
03/10/2009  06:59 AM            92,554 canister_diameter_sensitivity.xmcd
06/24/2008  07:20 AM           118,662 density_of_air_at_elevation.xmcd
02/23/2009  02:39 PM    <DIR>          ICEM_MESHES
02/04/2009  09:49 AM           110,080 IHF_hybridmesh_elem-mat_types.xls
11/13/2008  03:31 PM           148,480 naval_long_canister_heat_gen.xls
11/05/2008  11:17 AM           128,000 naval_short_canister_heat_gen.xls
               7 File(s)        702,055 bytes

 Directory of D:\ANSYS_RUNS

02/23/2009  02:42 PM    <DIR>          .
03/11/2009  09:31 AM    <DIR>          ..
02/23/2009  02:40 PM    <DIR>          IHF1006L
02/23/2009  02:43 PM    <DIR>          IHF1006S
02/23/2009  02:42 PM    <DIR>          IHF1008L
02/23/2009  02:41 PM    <DIR>          IHF1008S
               0 File(s)              0 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
02/23/2009  02:15 PM           461,824 IHF1006L_ansys_results.xls
02/23/2009  02:40 PM    <DIR>          IHF1006L_NORM_SS_2-1_3
02/23/2009  02:40 PM    <DIR>          IHF1006L_NORM_SS_2-2_1
02/23/2009  02:40 PM    <DIR>          IHF1006L_NORM_SS_2-2_3
02/23/2009  02:40 PM    <DIR>          IHF1006L_NORM_SS_2-3_5
02/23/2009  02:40 PM    <DIR>          IHF1006L_NORM_SS_3-1_3
02/23/2009  02:40 PM    <DIR>          IHF1006L_NORM_SS_3-2_1
02/23/2009  02:40 PM    <DIR>          IHF1006L_NORM_SS_3-2_3
02/23/2009  02:40 PM    <DIR>          IHF1006L_NORM_SS_3-3_5
02/23/2009  02:40 PM    <DIR>          IHF1006L_OFFN_SS_2-1_3
02/23/2009  02:40 PM    <DIR>          IHF1006L_OFFN_SS_2-2_1
02/23/2009  02:40 PM    <DIR>          IHF1006L_OFFN_SS_2-2_3
02/23/2009  02:40 PM    <DIR>          IHF1006L_OFFN_SS_2-3_5
02/23/2009  02:40 PM    <DIR>          IHF1006L_OFFN_SS_3-1_3
02/23/2009  02:40 PM    <DIR>          IHF1006L_OFFN_SS_3-2_1
02/23/2009  02:40 PM    <DIR>          IHF1006L_OFFN_SS_3-2_3
02/23/2009  02:40 PM    <DIR>          IHF1006L_OFFN_SS_3-3_5
               1 File(s)        461,824 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_NORM_SS_2-1_3

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
01/18/2009  01:09 PM            34,634 ihf_1006L_norm_ss.inp
01/18/2009  04:27 PM        21,630,851 ihf_1006L_norm_ss.out
01/18/2009  04:27 PM             7,693 ihf_1006L_norm_ss.parm
01/18/2009  01:22 PM            17,495 matprops_navy_ihf_1006L.dat
```

```
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:10 PM             3,424 navy_long_heat_2-1_3.dat
12/09/2008  08:14 AM               184 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,702,266 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_NORM_SS_2-2_1

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:15 PM            34,691 ihf_1006L_norm_ss.inp
01/18/2009  04:57 PM        21,619,847 ihf_1006L_norm_ss.out
01/18/2009  04:57 PM             7,693 ihf_1006L_norm_ss.parm
01/18/2009  01:23 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:15 PM             3,424 navy_long_heat_2-2_1.dat
12/09/2008  08:14 AM               184 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,691,319 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_NORM_SS_2-2_3

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:05 PM            34,691 ihf_1006L_norm_ss.inp
01/18/2009  05:28 PM        21,619,989 ihf_1006L_norm_ss.out
01/18/2009  05:28 PM             7,693 ihf_1006L_norm_ss.parm
01/18/2009  01:23 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:02 PM             3,383 navy_long_heat_2-2_3.dat
12/09/2008  08:14 AM               184 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,691,420 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_NORM_SS_2-3_5

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
01/18/2009  01:27 PM            34,691 ihf_1006L_norm_ss.inp
01/18/2009  05:58 PM        21,619,989 ihf_1006L_norm_ss.out
01/18/2009  05:58 PM             7,693 ihf_1006L_norm_ss.parm
01/18/2009  01:24 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
11/25/2008  02:41 PM             3,375 navy_long_heat_2-3_5.dat
12/09/2008  08:14 AM               184 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,691,412 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_NORM_SS_3-1_3

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:32 PM            34,691 ihf_1006L_norm_ss.inp
01/18/2009  06:27 PM        21,619,989 ihf_1006L_norm_ss.out
01/18/2009  06:27 PM             7,693 ihf_1006L_norm_ss.parm
01/18/2009  01:28 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:32 PM             3,424 navy_long_heat_3-1_3.dat
12/09/2008  08:14 AM               184 runfile
```

```
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,691,461 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_NORM_SS_3-2_1

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:39 PM            34,691 ihf_1006L_norm_ss.inp
01/18/2009  06:52 PM        21,619,847 ihf_1006L_norm_ss.out
01/18/2009  06:52 PM             7,693 ihf_1006L_norm_ss.parm
01/18/2009  01:28 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:38 PM             3,375 navy_long_heat_3-2_1.dat
12/09/2008  08:14 AM               184 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,691,270 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_NORM_SS_3-2_3

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:27 PM            34,691 ihf_1006L_norm_ss.inp
01/18/2009  07:22 PM        21,619,989 ihf_1006L_norm_ss.out
01/18/2009  07:22 PM             7,693 ihf_1006L_norm_ss.parm
01/18/2009  01:30 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:27 PM             3,387 navy_long_heat_3-2_3.dat
12/09/2008  08:14 AM               184 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,691,424 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_NORM_SS_3-3_5

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:22 PM            34,691 ihf_1006L_norm_ss.inp
01/18/2009  07:51 PM        21,619,989 ihf_1006L_norm_ss.out
01/18/2009  07:51 PM             7,693 ihf_1006L_norm_ss.parm
01/18/2009  01:28 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:21 PM             3,389 navy_long_heat_3-3_5.dat
12/09/2008  08:14 AM               184 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,691,426 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_OFFN_SS_2-1_3

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02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:12 PM            34,986 ihf_1006L_offnorm_ss.inp
01/18/2009  08:29 PM        21,602,032 ihf_1006L_offnorm_ss.out
01/18/2009  08:28 PM             7,693 ihf_1006L_offnorm_ss.parm
01/18/2009  01:28 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:11 PM             3,424 navy_long_heat_2-1_3.dat
12/01/2008  04:47 PM               199 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,673,814 bytes
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 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_OFFN_SS_2-2_1

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
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01/18/2009  08:54 PM        21,602,044 ihf_1006L_offnorm_ss.out
01/18/2009  08:53 PM             7,693 ihf_1006L_offnorm_ss.parm
01/18/2009  01:28 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:16 PM             3,424 navy_long_heat_2-2_1.dat
12/01/2008  04:47 PM               199 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,673,826 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_OFFN_SS_2-2_3

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:06 PM            34,986 ihf_1006L_offnorm_ss.inp
01/18/2009  09:31 PM        21,602,032 ihf_1006L_offnorm_ss.out
01/18/2009  09:31 PM             7,693 ihf_1006L_offnorm_ss.parm
01/18/2009  01:28 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:03 PM             3,383 navy_long_heat_2-2_3.dat
12/01/2008  04:47 PM               199 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,673,773 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_OFFN_SS_2-3_5

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
01/18/2009  01:34 PM            34,986 ihf_1006L_offnorm_ss.inp
01/18/2009  10:09 PM        21,602,032 ihf_1006L_offnorm_ss.out
01/18/2009  10:09 PM             7,693 ihf_1006L_offnorm_ss.parm
01/18/2009  01:29 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
11/25/2008  02:41 PM             3,375 navy_long_heat_2-3_5.dat
12/09/2008  02:18 PM             4,081 nodelist_navcan_peak_temp_line.txt
12/01/2008  04:47 PM               199 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
              10 File(s)     29,677,846 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_OFFN_SS_3-1_3

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:34 PM            34,986 ihf_1006L_offnorm_ss.inp
01/18/2009  10:51 PM        21,602,032 ihf_1006L_offnorm_ss.out
01/18/2009  10:51 PM             7,693 ihf_1006L_offnorm_ss.parm
01/18/2009  01:29 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:32 PM             3,424 navy_long_heat_3-1_3.dat
12/01/2008  04:47 PM               199 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,673,814 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_OFFN_SS_3-2_1
```

```
02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:40 PM            34,986 ihf_1006L_offnorm_ss.inp
01/18/2009  11:17 PM        21,602,044 ihf_1006L_offnorm_ss.out
01/18/2009  11:17 PM             7,693 ihf_1006L_offnorm_ss.parm
01/18/2009  01:29 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:38 PM             3,375 navy_long_heat_3-2_1.dat
12/01/2008  04:47 PM               199 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,673,777 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_OFFN_SS_3-2_3

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:28 PM            34,986 ihf_1006L_offnorm_ss.inp
01/18/2009  11:54 PM        21,602,032 ihf_1006L_offnorm_ss.out
01/18/2009  11:54 PM             7,693 ihf_1006L_offnorm_ss.parm
01/18/2009  01:29 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:26 PM             3,387 navy_long_heat_3-2_3.dat
12/01/2008  04:47 PM               199 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,673,777 bytes

 Directory of D:\ANSYS_RUNS\IHF1006L\IHF1006L_OFFN_SS_3-3_5

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:40 PM    <DIR>          ..
12/29/2008  12:23 PM            34,986 ihf_1006L_offnorm_ss.inp
01/19/2009  12:31 AM        21,602,032 ihf_1006L_offnorm_ss.out
01/19/2009  12:31 AM             7,693 ihf_1006L_offnorm_ss.parm
01/18/2009  01:29 PM            17,495 matprops_navy_ihf_1006L.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/29/2008  12:21 PM             3,389 navy_long_heat_3-3_5.dat
12/01/2008  04:47 PM               199 runfile
12/04/2008  04:27 PM         5,547,319 zz_ihf_rm1006L_wptt_251.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     29,673,779 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S

02/23/2009  02:43 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
02/23/2009  02:42 PM    <DIR>          A_IHF1006S_NORM_EMIS_CASES
02/23/2009  02:42 PM    <DIR>          A_IHF1006S_NORM_WELD_CASES
02/23/2009  02:42 PM    <DIR>          A_IHF1006S_OFFN_CONV_CASES
02/23/2009  02:16 PM           472,576 IHF1006S_ansys_results.xls
02/23/2009  02:43 PM    <DIR>          IHF1006S_NORM_SS_2-1_3
02/23/2009  02:43 PM    <DIR>          IHF1006S_NORM_SS_2-2_1
02/23/2009  02:43 PM    <DIR>          IHF1006S_NORM_SS_2-2_3
02/23/2009  02:43 PM    <DIR>          IHF1006S_NORM_SS_2-3_5
02/23/2009  02:43 PM    <DIR>          IHF1006S_NORM_SS_3-1_3
02/23/2009  02:43 PM    <DIR>          IHF1006S_NORM_SS_3-2_1
02/23/2009  02:43 PM    <DIR>          IHF1006S_NORM_SS_3-2_3
02/23/2009  02:42 PM    <DIR>          IHF1006S_NORM_SS_3-3_5
02/23/2009  02:42 PM    <DIR>          IHF1006S_OFFN_SS_2-1_3
02/23/2009  02:42 PM    <DIR>          IHF1006S_OFFN_SS_2-2_1
02/23/2009  02:42 PM    <DIR>          IHF1006S_OFFN_SS_2-2_3
```

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02/23/2009  02:42 PM    <DIR>          IHF1006S_OFFN_SS_2-3_5
02/23/2009  02:42 PM    <DIR>          IHF1006S_OFFN_SS_3-1_3
02/23/2009  02:42 PM    <DIR>          IHF1006S_OFFN_SS_3-2_1
02/23/2009  02:42 PM    <DIR>          IHF1006S_OFFN_SS_3-2_3
02/23/2009  02:42 PM    <DIR>          IHF1006S_OFFN_SS_3-3_5
               1 File(s)        472,576 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_NORM_EMIS_CASES

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
02/23/2009  02:42 PM    <DIR>          IV_LOW_E_NORM_SS_2-3_5
02/23/2009  02:42 PM    <DIR>          OCB_LOW_E_NORM_SS_2-3_5
02/23/2009  02:42 PM    <DIR>          WPTT_LOW_E_NORM_SS_2-3_5
               0 File(s)              0 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_NORM_EMIS_CASES\IV_LOW_E_NORM_SS_2-3_5

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
01/23/2009  10:34 AM            34,016 ihf_1006S_norm_ss.inp
01/23/2009  01:19 PM        19,898,661 ihf_1006S_norm_ss.out
01/23/2009  01:19 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:40 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/01/2008  04:43 PM             3,095 navy_short_heat_2-3_5.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,492,869 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_NORM_EMIS_CASES\OCB_LOW_E_NORM_SS_2-
3_5

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
01/23/2009  10:32 AM            34,014 ihf_1006S_norm_ss.inp
01/23/2009  12:25 PM        19,898,659 ihf_1006S_norm_ss.out
01/23/2009  12:25 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:40 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/01/2008  04:43 PM             3,095 navy_short_heat_2-3_5.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,492,865 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_NORM_EMIS_CASES\WPTT_LOW_E_NORM_SS_2-
3_5

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
01/23/2009  10:33 AM            34,015 ihf_1006S_norm_ss.inp
01/23/2009  11:30 AM        19,898,659 ihf_1006S_norm_ss.out
01/23/2009  11:30 AM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:40 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/01/2008  04:43 PM             3,095 navy_short_heat_2-3_5.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,492,866 bytes
```

```
 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_NORM_WELD_CASES

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
02/23/2009  02:42 PM    <DIR>          NOWELD_HE_SS_2-3_5
02/23/2009  02:42 PM    <DIR>          WELD_HE_SS_2-3_5
               0 File(s)              0 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_NORM_WELD_CASES\NOWELD_HE_SS_2-3_5

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
01/22/2009  11:34 AM            35,153 ihf_1006S_norm_ss.inp
01/22/2009  12:10 PM        19,907,955 ihf_1006S_norm_ss.out
01/22/2009  12:10 PM             6,925 ihf_1006S_norm_ss.parm
01/21/2009  03:48 PM            17,169 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/01/2008  04:43 PM             3,095 navy_short_heat_2-3_5.dat
12/04/2008  02:19 PM             3,655 nodelist_navcan_peak_temp_line.txt
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
              10 File(s)     27,506,912 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_NORM_WELD_CASES\WELD_HE_SS_2-3_5

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
02/02/2009  05:12 PM            35,141 ihf_1006S_norm_ss.inp
02/02/2009  05:40 PM        19,909,385 ihf_1006S_norm_ss.out
02/02/2009  05:40 PM             6,925 ihf_1006S_norm_ss.parm
01/22/2009  03:24 PM            17,168 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/01/2008  04:43 PM             3,095 navy_short_heat_2-3_5.dat
12/04/2008  02:19 PM             3,655 nodelist_navcan_peak_temp_line.txt
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
              10 File(s)     27,508,329 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_OFFN_CONV_CASES

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
02/23/2009  02:42 PM    <DIR>          CONV_SS_2-3_5_H1
02/23/2009  02:42 PM    <DIR>          CONV_SS_2-3_5_H1p5
               0 File(s)              0 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_OFFN_CONV_CASES\CONV_SS_2-3_5_H1

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
01/18/2009  01:59 PM            30,517 ihf_1006S_offnorm_ss.inp
01/18/2009  03:00 PM        19,888,376 ihf_1006S_offnorm_ss.out
01/18/2009  03:00 PM             6,925 ihf_1006S_offnorm_ss.parm
01/18/2009  01:58 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/01/2008  04:43 PM             3,095 navy_short_heat_2-3_5.dat
12/01/2008  04:48 PM               199 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,479,100 bytes
```

```
 Directory of D:\ANSYS_RUNS\IHF1006S\A_IHF1006S_OFFN_CONV_CASES\CONV_SS_2-3_5_H1p5

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
01/18/2009  02:03 PM            30,574 ihf_1006S_offnorm_ss.inp
01/18/2009  03:28 PM        19,877,514 ihf_1006S_offnorm_ss.out
01/18/2009  03:28 PM             6,925 ihf_1006S_offnorm_ss.parm
01/18/2009  01:58 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/01/2008  04:43 PM             3,095 navy_short_heat_2-3_5.dat
12/01/2008  04:48 PM               199 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,468,295 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_NORM_SS_2-1_3

02/23/2009  02:43 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
01/16/2009  12:43 PM            34,018 ihf_1006S_norm_ss.inp
01/16/2009  04:23 PM        19,898,667 ihf_1006S_norm_ss.out
01/16/2009  04:23 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:39 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:46 PM             3,138 navy_short_heat_2-1_3.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,492,920 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_NORM_SS_2-2_1

02/23/2009  02:43 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  02:51 PM            34,075 ihf_1006S_norm_ss.inp
01/16/2009  04:51 PM        19,887,663 ihf_1006S_norm_ss.out
01/16/2009  04:51 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:40 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:50 PM             3,095 navy_short_heat_2-2_1.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,481,930 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_NORM_SS_2-2_3

02/23/2009  02:43 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  02:40 PM            34,075 ihf_1006S_norm_ss.inp
01/16/2009  05:21 PM        19,887,805 ihf_1006S_norm_ss.out
01/16/2009  05:20 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:40 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:39 PM             3,103 navy_short_heat_2-2_3.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,482,080 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_NORM_SS_2-3_5

02/23/2009  02:43 PM    <DIR>          .
```

```
02/23/2009  02:43 PM    <DIR>          ..
12/09/2008  12:55 PM            34,075 ihf_1006S_norm_ss.inp
01/16/2009  05:49 PM        19,887,805 ihf_1006S_norm_ss.out
01/16/2009  05:49 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:40 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/01/2008  04:43 PM             3,095 navy_short_heat_2-3_5.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,482,072 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_NORM_SS_3-1_3

02/23/2009  02:43 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  03:04 PM            34,075 ihf_1006S_norm_ss.inp
01/16/2009  06:17 PM        19,887,805 ihf_1006S_norm_ss.out
01/16/2009  06:17 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:40 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  03:03 PM             3,138 navy_short_heat_3-1_3.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,482,115 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_NORM_SS_3-2_1

02/23/2009  02:43 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  03:08 PM            34,075 ihf_1006S_norm_ss.inp
01/16/2009  06:41 PM        19,887,663 ihf_1006S_norm_ss.out
01/16/2009  06:41 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:40 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  03:07 PM             3,095 navy_short_heat_3-2_1.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,481,930 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_NORM_SS_3-2_3

02/23/2009  02:43 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  02:59 PM            34,075 ihf_1006S_norm_ss.inp
01/16/2009  07:10 PM        19,887,805 ihf_1006S_norm_ss.out
01/16/2009  07:10 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:40 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:59 PM             3,107 navy_short_heat_3-2_3.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,482,084 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_NORM_SS_3-3_5

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  02:55 PM            34,075 ihf_1006S_norm_ss.inp
01/16/2009  07:39 PM        19,887,805 ihf_1006S_norm_ss.out
```

```
01/16/2009  07:39 PM             6,925 ihf_1006S_norm_ss.parm
01/16/2009  01:47 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:55 PM             3,109 navy_short_heat_3-3_5.dat
12/09/2008  12:47 PM               184 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,482,086 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_OFFN_SS_2-1_3

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  02:47 PM            34,373 ihf_1006S_offnorm_ss.inp
01/16/2009  08:13 PM        19,869,839 ihf_1006S_offnorm_ss.out
01/16/2009  08:13 PM             6,925 ihf_1006S_offnorm_ss.parm
01/16/2009  01:41 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:46 PM             3,138 navy_short_heat_2-1_3.dat
12/01/2008  04:48 PM               199 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,464,462 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_OFFN_SS_2-2_1

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  02:52 PM            34,373 ihf_1006S_offnorm_ss.inp
01/16/2009  08:38 PM        19,869,851 ihf_1006S_offnorm_ss.out
01/16/2009  08:38 PM             6,925 ihf_1006S_offnorm_ss.parm
01/16/2009  01:41 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:50 PM             3,095 navy_short_heat_2-2_1.dat
12/01/2008  04:48 PM               199 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,464,431 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_OFFN_SS_2-2_3

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  02:42 PM            34,373 ihf_1006S_offnorm_ss.inp
01/16/2009  09:07 PM        19,869,697 ihf_1006S_offnorm_ss.out
01/16/2009  09:07 PM             6,925 ihf_1006S_offnorm_ss.parm
01/16/2009  01:41 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:39 PM             3,103 navy_short_heat_2-2_3.dat
12/01/2008  04:48 PM               199 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,464,285 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_OFFN_SS_2-3_5

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/05/2008  11:04 AM            34,373 ihf_1006S_offnorm_ss.inp
01/16/2009  09:43 PM        19,869,839 ihf_1006S_offnorm_ss.out
01/16/2009  09:42 PM             6,925 ihf_1006S_offnorm_ss.parm
01/16/2009  01:41 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
```

```
12/01/2008  04:43 PM             3,095 navy_short_heat_2-3_5.dat
12/04/2008  02:19 PM             3,655 nodelist_navcan_peak_temp_line.txt
12/01/2008  04:48 PM               199 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
              10 File(s)     27,468,074 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_OFFN_SS_3-1_3

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  03:05 PM            34,373 ihf_1006S_offnorm_ss.inp
01/16/2009  10:20 PM        19,869,839 ihf_1006S_offnorm_ss.out
01/16/2009  10:19 PM             6,925 ihf_1006S_offnorm_ss.parm
01/16/2009  01:42 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  03:03 PM             3,138 navy_short_heat_3-1_3.dat
12/01/2008  04:48 PM               199 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,464,462 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_OFFN_SS_3-2_1

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  03:09 PM            34,373 ihf_1006S_offnorm_ss.inp
01/16/2009  10:47 PM        19,869,851 ihf_1006S_offnorm_ss.out
01/16/2009  10:47 PM             6,925 ihf_1006S_offnorm_ss.parm
01/16/2009  01:42 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  03:08 PM             3,095 navy_short_heat_3-2_1.dat
12/01/2008  04:48 PM               199 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,464,431 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_OFFN_SS_3-2_3

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  03:00 PM            34,373 ihf_1006S_offnorm_ss.inp
01/16/2009  11:16 PM        19,869,697 ihf_1006S_offnorm_ss.out
01/16/2009  11:16 PM             6,925 ihf_1006S_offnorm_ss.parm
01/16/2009  01:42 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:59 PM             3,107 navy_short_heat_3-2_3.dat
12/01/2008  04:48 PM               199 runfile
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,464,289 bytes

 Directory of D:\ANSYS_RUNS\IHF1006S\IHF1006S_OFFN_SS_3-3_5

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:43 PM    <DIR>          ..
12/30/2008  02:56 PM            34,373 ihf_1006S_offnorm_ss.inp
01/16/2009  11:51 PM        19,869,839 ihf_1006S_offnorm_ss.out
01/16/2009  11:51 PM             6,925 ihf_1006S_offnorm_ss.parm
01/16/2009  01:42 PM            17,212 matprops_navy_ihf_1006S.dat
11/26/2008  03:24 PM         1,230,513 mod_zz_ihf_rm1006_only_262.in
12/30/2008  02:54 PM             3,109 navy_short_heat_3-3_5.dat
12/01/2008  04:48 PM               199 runfile
```

```
12/02/2008  09:30 AM         5,072,110 zz_ihf_rm1006S_wptt_252.in
11/26/2008  03:24 PM         1,230,153 zz_ihf_rm1006_only_262.in
               9 File(s)     27,464,433 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
02/23/2009  02:17 PM           375,296 IHF1008L_ansys_results.xls
02/23/2009  02:42 PM    <DIR>          IHF1008L_NORM_SS_2-1_3
02/23/2009  02:42 PM    <DIR>          IHF1008L_NORM_SS_2-2_1
02/23/2009  02:41 PM    <DIR>          IHF1008L_NORM_SS_2-2_3
02/23/2009  02:41 PM    <DIR>          IHF1008L_NORM_SS_2-3_5
02/23/2009  02:41 PM    <DIR>          IHF1008L_NORM_SS_3-1_3
02/23/2009  02:41 PM    <DIR>          IHF1008L_NORM_SS_3-2_1
02/23/2009  02:41 PM    <DIR>          IHF1008L_NORM_SS_3-2_3
02/23/2009  02:41 PM    <DIR>          IHF1008L_NORM_SS_3-3_5
02/23/2009  02:41 PM    <DIR>          IHF1008L_OFFN_SS_2-1_3
02/23/2009  02:41 PM    <DIR>          IHF1008L_OFFN_SS_2-2_1
02/23/2009  02:41 PM    <DIR>          IHF1008L_OFFN_SS_2-2_3
02/23/2009  02:41 PM    <DIR>          IHF1008L_OFFN_SS_2-3_5
02/23/2009  02:41 PM    <DIR>          IHF1008L_OFFN_SS_3-1_3
02/23/2009  02:41 PM    <DIR>          IHF1008L_OFFN_SS_3-2_1
02/23/2009  02:41 PM    <DIR>          IHF1008L_OFFN_SS_3-2_3
02/23/2009  02:41 PM    <DIR>          IHF1008L_OFFN_SS_3-3_5
               1 File(s)        375,296 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_NORM_SS_2-1_3

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:10 PM            21,134 ihf_1008L_norm_ss.inp
12/31/2008  04:38 PM        10,523,192 ihf_1008L_norm_ss.out
12/31/2008  04:38 PM             7,463 ihf_1008L_norm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  02:58 PM             3,424 navy_long_heat_2-1_3.dat
12/22/2008  12:41 PM             4,152 nodelist_nav_can_peak_temp_line.txt
12/22/2008  02:38 PM               184 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
              10 File(s)     14,557,101 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_NORM_SS_2-2_1

02/23/2009  02:42 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:13 PM            21,134 ihf_1008L_norm_ss.inp
12/31/2008  04:43 PM        10,522,908 ihf_1008L_norm_ss.out
12/31/2008  04:43 PM             7,463 ihf_1008L_norm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:12 PM             3,424 navy_long_heat_2-2_1.dat
12/22/2008  02:38 PM               184 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,552,665 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_NORM_SS_2-2_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  02:55 PM            21,134 ihf_1008L_norm_ss.inp
```

```
12/31/2008  04:49 PM        10,523,050 ihf_1008L_norm_ss.out
12/31/2008  04:49 PM             7,463 ihf_1008L_norm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  02:53 PM             3,383 navy_long_heat_2-2_3.dat
12/22/2008  02:38 PM               184 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,552,766 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_NORM_SS_2-3_5

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/22/2008  02:46 PM            21,106 ihf_1008L_norm_ss.inp
12/22/2008  05:45 PM        10,528,507 ihf_1008L_norm_ss.out
12/22/2008  05:45 PM             7,463 ihf_1008L_norm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
11/13/2008  11:20 AM             3,375 navy_long_heat_2-3_5.dat
12/22/2008  12:41 PM             4,152 nodelist_nav_can_peak_temp_line.txt
12/22/2008  02:38 PM               184 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
              10 File(s)     14,562,339 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_NORM_SS_3-1_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:21 PM            21,134 ihf_1008L_norm_ss.inp
12/31/2008  04:56 PM        10,523,192 ihf_1008L_norm_ss.out
12/31/2008  04:56 PM             7,463 ihf_1008L_norm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:21 PM             3,424 navy_long_heat_3-1_3.dat
12/22/2008  02:38 PM               184 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,552,949 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_NORM_SS_3-2_1

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:28 PM            21,134 ihf_1008L_norm_ss.inp
12/31/2008  05:01 PM        10,522,908 ihf_1008L_norm_ss.out
12/31/2008  05:01 PM             7,463 ihf_1008L_norm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:27 PM             3,375 navy_long_heat_3-2_1.dat
12/22/2008  02:38 PM               184 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,552,616 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_NORM_SS_3-2_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:18 PM            21,134 ihf_1008L_norm_ss.inp
12/31/2008  05:07 PM        10,523,050 ihf_1008L_norm_ss.out
12/31/2008  05:07 PM             7,463 ihf_1008L_norm_ss.parm
```

```
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:18 PM             3,387 navy_long_heat_3-2_3.dat
12/22/2008  02:38 PM               184 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,552,770 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_NORM_SS_3-3_5

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:16 PM            21,134 ihf_1008L_norm_ss.inp
12/31/2008  05:13 PM        10,523,050 ihf_1008L_norm_ss.out
12/31/2008  05:13 PM             7,463 ihf_1008L_norm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:15 PM             3,389 navy_long_heat_3-3_5.dat
12/22/2008  02:38 PM               184 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,552,772 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_OFFN_SS_2-1_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:11 PM            21,289 ihf_1008L_offnorm_ss.inp
12/31/2008  05:20 PM        10,511,964 ihf_1008L_offnorm_ss.out
12/31/2008  05:20 PM             7,463 ihf_1008L_offnorm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  02:58 PM             3,424 navy_long_heat_2-1_3.dat
12/22/2008  02:38 PM               199 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,541,891 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_OFFN_SS_2-2_1

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:13 PM            21,289 ihf_1008L_offnorm_ss.inp
12/31/2008  05:25 PM        10,511,976 ihf_1008L_offnorm_ss.out
12/31/2008  05:25 PM             7,463 ihf_1008L_offnorm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:12 PM             3,424 navy_long_heat_2-2_1.dat
12/22/2008  02:38 PM               199 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,541,903 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_OFFN_SS_2-2_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  02:57 PM            21,289 ihf_1008L_offnorm_ss.inp
12/31/2008  05:33 PM        10,511,964 ihf_1008L_offnorm_ss.out
12/31/2008  05:33 PM             7,463 ihf_1008L_offnorm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  02:53 PM             3,383 navy_long_heat_2-2_3.dat
```

```
12/22/2008  02:38 PM                199 runfile
11/24/2008  12:14 PM          2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM            707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,541,850 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_OFFN_SS_2-3_5

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/22/2008  12:48 PM             21,260 ihf_1008L_offnorm_ss.inp
12/22/2008  05:57 PM         10,517,421 ihf_1008L_offnorm_ss.out
12/22/2008  05:57 PM              7,463 ihf_1008L_offnorm_ss.parm
11/24/2008  01:03 PM              8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM            707,459 mod_zz_ihf_rm1008_only_09.in
11/13/2008  11:20 AM              3,375 navy_long_heat_2-3_5.dat
12/22/2008  12:41 PM              4,152 nodelist_nav_can_peak_temp_line.txt
12/22/2008  02:38 PM                199 runfile
11/24/2008  12:14 PM          2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM            707,089 zz_ihf_rm1008_only_09.in
              10 File(s)     14,551,422 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_OFFN_SS_3-1_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:22 PM             21,289 ihf_1008L_offnorm_ss.inp
12/31/2008  05:40 PM         10,511,964 ihf_1008L_offnorm_ss.out
12/31/2008  05:40 PM              7,463 ihf_1008L_offnorm_ss.parm
11/24/2008  01:03 PM              8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM            707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:21 PM              3,424 navy_long_heat_3-1_3.dat
12/22/2008  02:38 PM                199 runfile
11/24/2008  12:14 PM          2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM            707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,541,891 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_OFFN_SS_3-2_1

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:29 PM             21,289 ihf_1008L_offnorm_ss.inp
12/31/2008  05:45 PM         10,511,976 ihf_1008L_offnorm_ss.out
12/31/2008  05:45 PM              7,463 ihf_1008L_offnorm_ss.parm
11/24/2008  01:03 PM              8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM            707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:27 PM              3,375 navy_long_heat_3-2_1.dat
12/22/2008  02:38 PM                199 runfile
11/24/2008  12:14 PM          2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM            707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,541,854 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_OFFN_SS_3-2_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:19 PM             21,289 ihf_1008L_offnorm_ss.inp
12/31/2008  05:52 PM         10,511,964 ihf_1008L_offnorm_ss.out
12/31/2008  05:52 PM              7,463 ihf_1008L_offnorm_ss.parm
11/24/2008  01:03 PM              8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM            707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:18 PM              3,387 navy_long_heat_3-2_3.dat
12/22/2008  02:38 PM                199 runfile
11/24/2008  12:14 PM          2,574,088 zz_ihf_rm1008L_cask_08.in
```

```
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,541,854 bytes

 Directory of D:\ANSYS_RUNS\IHF1008L\IHF1008L_OFFN_SS_3-3_5

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
12/31/2008  03:17 PM            21,289 ihf_1008L_offnorm_ss.inp
12/31/2008  05:59 PM        10,511,964 ihf_1008L_offnorm_ss.out
12/31/2008  05:59 PM             7,463 ihf_1008L_offnorm_ss.parm
11/24/2008  01:03 PM             8,916 matprops_navy_ihf_1008L.dat
11/24/2008  12:32 PM           707,459 mod_zz_ihf_rm1008_only_09.in
12/31/2008  03:15 PM             3,389 navy_long_heat_3-3_5.dat
12/22/2008  02:38 PM               199 runfile
11/24/2008  12:14 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  12:14 PM           707,089 zz_ihf_rm1008_only_09.in
               9 File(s)     14,541,856 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:42 PM    <DIR>          ..
02/23/2009  02:18 PM           363,520 IHF1008S_ansys_results.xls
02/23/2009  02:41 PM    <DIR>          IHF1008S_NORM_SS_2-1_3
02/23/2009  02:41 PM    <DIR>          IHF1008S_NORM_SS_2-2_1
02/23/2009  02:41 PM    <DIR>          IHF1008S_NORM_SS_2-2_3
02/23/2009  02:41 PM    <DIR>          IHF1008S_NORM_SS_2-3_5
02/23/2009  02:41 PM    <DIR>          IHF1008S_NORM_SS_3-1_3
02/23/2009  02:41 PM    <DIR>          IHF1008S_NORM_SS_3-2_1
02/23/2009  02:41 PM    <DIR>          IHF1008S_NORM_SS_3-2_3
02/23/2009  02:41 PM    <DIR>          IHF1008S_NORM_SS_3-3_5
02/23/2009  02:41 PM    <DIR>          IHF1008S_OFFN_SS_2-1_3
02/23/2009  02:41 PM    <DIR>          IHF1008S_OFFN_SS_2-2_1
02/23/2009  02:41 PM    <DIR>          IHF1008S_OFFN_SS_2-2_3
02/23/2009  02:41 PM    <DIR>          IHF1008S_OFFN_SS_2-3_5
02/23/2009  02:41 PM    <DIR>          IHF1008S_OFFN_SS_3-1_3
02/23/2009  02:41 PM    <DIR>          IHF1008S_OFFN_SS_3-2_1
02/23/2009  02:41 PM    <DIR>          IHF1008S_OFFN_SS_3-2_3
02/23/2009  02:40 PM    <DIR>          IHF1008S_OFFN_SS_3-3_5
               1 File(s)        363,520 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_NORM_SS_2-1_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/16/2009  02:03 PM            20,483 ihf_1008S_norm_ss.inp
01/17/2009  12:01 AM         9,891,064 ihf_1008S_norm_ss.out
01/17/2009  12:01 AM             6,695 ihf_1008S_norm_ss.parm
01/16/2009  02:06 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:00 AM             3,138 navy_short_heat_2-1_3.dat
12/22/2008  02:37 PM               184 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,738,678 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_NORM_SS_2-2_1

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:04 AM            20,512 ihf_1008S_norm_ss.inp
01/17/2009  12:05 AM         9,885,320 ihf_1008S_norm_ss.out
01/17/2009  12:05 AM             6,695 ihf_1008S_norm_ss.parm
```

```
01/16/2009  02:17 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:03 AM             3,095 navy_short_heat_2-2_1.dat
12/22/2008  02:37 PM               184 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,732,920 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_NORM_SS_2-2_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  10:58 AM            20,512 ihf_1008S_norm_ss.inp
01/17/2009  12:10 AM         9,885,462 ihf_1008S_norm_ss.out
01/17/2009  12:10 AM             6,695 ihf_1008S_norm_ss.parm
01/16/2009  02:17 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  10:57 AM             3,103 navy_short_heat_2-2_3.dat
12/22/2008  02:37 PM               184 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,733,070 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_NORM_SS_2-3_5

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
12/22/2008  02:36 PM            20,483 ihf_1008S_norm_ss.inp
01/17/2009  12:20 AM         9,891,064 ihf_1008S_norm_ss.out
01/17/2009  12:20 AM             6,695 ihf_1008S_norm_ss.parm
01/16/2009  02:18 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
11/20/2008  10:25 AM             3,095 navy_short_heat_2-3_5.dat
12/22/2008  02:37 PM               184 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,738,635 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_NORM_SS_3-1_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:16 AM            20,512 ihf_1008S_norm_ss.inp
01/17/2009  12:25 AM         9,885,604 ihf_1008S_norm_ss.out
01/17/2009  12:25 AM             6,695 ihf_1008S_norm_ss.parm
01/16/2009  02:18 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:15 AM             3,138 navy_short_heat_3-1_3.dat
12/22/2008  02:37 PM               184 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,733,247 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_NORM_SS_3-2_1

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:19 AM            20,512 ihf_1008S_norm_ss.inp
01/17/2009  12:30 AM         9,885,462 ihf_1008S_norm_ss.out
01/17/2009  12:30 AM             6,695 ihf_1008S_norm_ss.parm
01/16/2009  02:18 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:18 AM             3,095 navy_short_heat_3-2_1.dat
```

```
12/22/2008  02:37 PM                184 runfile
11/20/2008  11:12 AM          2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM            707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,733,062 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_NORM_SS_3-2_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:12 AM             20,512 ihf_1008S_norm_ss.inp
01/17/2009  12:35 AM          9,885,604 ihf_1008S_norm_ss.out
01/17/2009  12:35 AM              6,695 ihf_1008S_norm_ss.parm
01/16/2009  02:18 PM              8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM            707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:10 AM              3,107 navy_short_heat_3-2_3.dat
12/22/2008  02:37 PM                184 runfile
11/20/2008  11:12 AM          2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM            707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,733,216 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_NORM_SS_3-3_5

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:07 AM             20,512 ihf_1008S_norm_ss.inp
01/17/2009  12:41 AM          9,885,604 ihf_1008S_norm_ss.out
01/17/2009  12:41 AM              6,695 ihf_1008S_norm_ss.parm
01/16/2009  02:18 PM              8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM            707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:06 AM              3,109 navy_short_heat_3-3_5.dat
12/22/2008  02:37 PM                184 runfile
11/20/2008  11:12 AM          2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM            707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,733,218 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_OFFN_SS_2-1_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:02 AM             20,667 ihf_1008S_offnorm_ss.inp
01/17/2009  12:46 AM          9,874,376 ihf_1008S_offnorm_ss.out
01/17/2009  12:46 AM              6,695 ihf_1008S_offnorm_ss.parm
01/16/2009  02:18 PM              8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM            707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:00 AM              3,138 navy_short_heat_2-1_3.dat
11/20/2008  12:05 PM                199 runfile
11/20/2008  11:12 AM          2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM            707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,722,189 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_OFFN_SS_2-2_1

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:04 AM             20,667 ihf_1008S_offnorm_ss.inp
01/17/2009  12:51 AM          9,874,530 ihf_1008S_offnorm_ss.out
01/17/2009  12:51 AM              6,695 ihf_1008S_offnorm_ss.parm
01/16/2009  02:18 PM              8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM            707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:03 AM              3,095 navy_short_heat_2-2_1.dat
11/20/2008  12:05 PM                199 runfile
11/20/2008  11:12 AM          2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM            707,107 zz_ihf_rm1008_only_09.in
```

```
               9 File(s)     13,722,300 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_OFFN_SS_2-2_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  10:59 AM            20,667 ihf_1008S_offnorm_ss.inp
01/17/2009  12:57 AM         9,874,376 ihf_1008S_offnorm_ss.out
01/17/2009  12:57 AM             6,695 ihf_1008S_offnorm_ss.parm
01/16/2009  02:18 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  10:56 AM             3,103 navy_short_heat_2-2_3.dat
11/20/2008  12:05 PM               199 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,722,154 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_OFFN_SS_2-3_5

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
11/24/2008  04:31 PM            20,638 ihf_1008S_offnorm_ss.inp
01/17/2009  01:07 AM         9,879,836 ihf_1008S_offnorm_ss.out
01/17/2009  01:07 AM             6,695 ihf_1008S_offnorm_ss.parm
01/16/2009  02:18 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
11/20/2008  10:25 AM             3,095 navy_short_heat_2-3_5.dat
11/20/2008  04:15 PM             3,726 nodelist_can_peak_temp_line.txt
11/20/2008  12:05 PM               199 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
              10 File(s)     13,731,303 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_OFFN_SS_3-1_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:17 AM            20,667 ihf_1008S_offnorm_ss.inp
01/17/2009  01:13 AM         9,874,376 ihf_1008S_offnorm_ss.out
01/17/2009  01:13 AM             6,695 ihf_1008S_offnorm_ss.parm
01/16/2009  02:18 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:15 AM             3,138 navy_short_heat_3-1_3.dat
11/20/2008  12:05 PM               199 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,722,189 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_OFFN_SS_3-2_1

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:21 AM            20,667 ihf_1008S_offnorm_ss.inp
01/17/2009  01:18 AM         9,874,530 ihf_1008S_offnorm_ss.out
01/17/2009  01:18 AM             6,695 ihf_1008S_offnorm_ss.parm
01/16/2009  02:19 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:18 AM             3,095 navy_short_heat_3-2_1.dat
11/20/2008  12:05 PM               199 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,722,300 bytes
```

```
 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_OFFN_SS_3-2_3

02/23/2009  02:41 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:12 AM            20,667 ihf_1008S_offnorm_ss.inp
01/17/2009  01:23 AM         9,874,376 ihf_1008S_offnorm_ss.out
01/17/2009  01:23 AM             6,695 ihf_1008S_offnorm_ss.parm
01/16/2009  02:19 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:10 AM             3,107 navy_short_heat_3-2_3.dat
11/20/2008  12:05 PM               199 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,722,158 bytes

 Directory of D:\ANSYS_RUNS\IHF1008S\IHF1008S_OFFN_SS_3-3_5

02/23/2009  02:40 PM    <DIR>          .
02/23/2009  02:41 PM    <DIR>          ..
01/01/2009  11:09 AM            20,667 ihf_1008S_offnorm_ss.inp
01/17/2009  01:29 AM         9,874,376 ihf_1008S_offnorm_ss.out
01/17/2009  01:29 AM             6,695 ihf_1008S_offnorm_ss.parm
01/16/2009  02:19 PM             8,501 matprops_navy_ihf_1008S.dat
11/20/2008  09:35 AM           707,459 mod_zz_ihf_rm1008_only_09.in
01/01/2009  11:06 AM             3,109 navy_short_heat_3-3_5.dat
11/20/2008  12:05 PM               199 runfile
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  09:28 AM           707,107 zz_ihf_rm1008_only_09.in
               9 File(s)     13,722,160 bytes

 Directory of D:\ICEM_MESHES

02/23/2009  02:39 PM    <DIR>          .
03/11/2009  09:31 AM    <DIR>          ..
02/23/2009  02:39 PM    <DIR>          ICEM_IHF_NEW_MESH_1006L
02/23/2009  02:39 PM    <DIR>          ICEM_IHF_NEW_MESH_1006S
02/23/2009  02:39 PM    <DIR>          ICEM_IHF_NEW_MESH_1008L
02/23/2009  02:39 PM    <DIR>          ICEM_IHF_NEW_MESH_1008S
               0 File(s)              0 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1006L

02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/23/2009  02:39 PM    <DIR>          AUTOHEX_GEOM_1006L
12/04/2008  04:03 PM            45,159 boco
12/04/2008  04:03 PM            16,174 family_boco.fbc
12/04/2008  04:03 PM         2,950,810 hex.uns
12/04/2008  04:24 PM            35,529 zz_ihf_rm1006L_wptt_251.atr
12/04/2008  04:24 PM         3,701,755 zz_ihf_rm1006L_wptt_251.blk
12/04/2008  04:24 PM            16,240 zz_ihf_rm1006L_wptt_251.fbc
12/04/2008  04:24 PM            16,239 zz_ihf_rm1006L_wptt_251.fbc_old
12/04/2008  04:25 PM         5,547,301 zz_ihf_rm1006L_wptt_251.in
12/04/2008  04:25 PM               258 zz_ihf_rm1006L_wptt_251.in.log
12/04/2008  04:25 PM           284,707 zz_ihf_rm1006L_wptt_251.jrf
12/04/2008  04:24 PM               530 zz_ihf_rm1006L_wptt_251.par
12/04/2008  04:24 PM            38,192 zz_ihf_rm1006L_wptt_251.prj
12/04/2008  04:24 PM         3,800,317 zz_ihf_rm1006L_wptt_251.tin
12/04/2008  04:24 PM         2,950,722 zz_ihf_rm1006L_wptt_251.uns
12/04/2008  04:22 PM         2,950,722 zz_ihf_rm1006L_wptt_251.uns.bak
11/25/2008  03:17 PM            40,039 zz_ihf_rm1006_only_262.atr
11/25/2008  03:17 PM         2,134,683 zz_ihf_rm1006_only_262.blk
11/25/2008  03:17 PM            11,417 zz_ihf_rm1006_only_262.fbc
```

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11/25/2008  03:14 PM             8,197 zz_ihf_rm1006_only_262.fbc_dfupdate
11/25/2008  03:17 PM            11,416 zz_ihf_rm1006_only_262.fbc_old
11/25/2008  03:14 PM         1,230,135 zz_ihf_rm1006_only_262.in
11/25/2008  03:14 PM               255 zz_ihf_rm1006_only_262.in.log
11/25/2008  03:17 PM         1,511,340 zz_ihf_rm1006_only_262.jrf
11/25/2008  03:17 PM               530 zz_ihf_rm1006_only_262.par
11/25/2008  03:17 PM            30,882 zz_ihf_rm1006_only_262.prj
11/25/2008  03:17 PM           385,922 zz_ihf_rm1006_only_262.tin
11/25/2008  03:17 PM           678,246 zz_ihf_rm1006_only_262.uns
11/25/2008  03:14 PM           678,246 zz_ihf_rm1006_only_262.uns.bak
              28 File(s)     29,075,963 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1006L\AUTOHEX_GEOM_1006L

02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/13/2008  04:22 PM            19,572 autohex.prj
09/22/2008  04:12 PM         2,626,828 autohex.tin
09/22/2008  04:12 PM            30,094 boco
09/22/2008  04:12 PM             3,448 family_boco
09/22/2008  04:11 PM                34 job
11/05/2008  02:24 PM               227 messages.log
09/22/2008  04:11 PM            99,605 model
09/22/2008  04:11 PM                11 model_timestamp
09/22/2008  04:11 PM            20,372 problem
09/22/2008  02:12 PM                93 unnamed.jrf
02/21/2008  09:41 AM                16 unnamed.jrf.1
02/20/2008  04:32 PM                16 unnamed.jrf.2
              12 File(s)      2,800,316 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1006S

02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/23/2009  02:39 PM    <DIR>          AUTOHEX_GEOM_1006S
12/04/2008  10:49 AM            41,402 boco
12/04/2008  10:49 AM            24,783 family_boco.fbc
12/04/2008  10:49 AM         2,697,763 hex.uns
12/02/2008  09:28 AM            87,719 zz_ihf_rm1006S_wptt_252.atr
12/02/2008  09:28 AM         3,522,881 zz_ihf_rm1006S_wptt_252.blk
12/02/2008  09:28 AM            24,926 zz_ihf_rm1006S_wptt_252.fbc
12/01/2008  03:30 PM             9,018 zz_ihf_rm1006S_wptt_252.fbc_dfupdate
12/02/2008  09:28 AM            24,925 zz_ihf_rm1006S_wptt_252.fbc_old
12/02/2008  09:29 AM         5,072,092 zz_ihf_rm1006S_wptt_252.in
12/02/2008  09:29 AM               258 zz_ihf_rm1006S_wptt_252.in.log
12/02/2008  09:29 AM           186,402 zz_ihf_rm1006S_wptt_252.jrf
12/02/2008  09:28 AM               530 zz_ihf_rm1006S_wptt_252.par
12/02/2008  09:28 AM             7,145 zz_ihf_rm1006S_wptt_252.prj
12/02/2008  09:28 AM         3,371,922 zz_ihf_rm1006S_wptt_252.tin
12/02/2008  09:28 AM         2,697,364 zz_ihf_rm1006S_wptt_252.uns
12/02/2008  09:27 AM         2,697,364 zz_ihf_rm1006S_wptt_252.uns.bak
              16 File(s)     20,466,494 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1006S\AUTOHEX_GEOM_1006S

02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/13/2008  04:22 PM            19,572 autohex.prj
11/17/2008  11:11 AM         2,094,409 autohex.tin
11/17/2008  11:11 AM            22,165 boco
11/17/2008  11:11 AM             2,519 family_boco
11/17/2008  11:11 AM                34 job
11/18/2008  01:56 PM               227 messages.log
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11/17/2008  11:11 AM            99,885 model
11/17/2008  11:11 AM                11 model_timestamp
11/17/2008  11:11 AM            20,372 problem
09/22/2008  02:12 PM                93 unnamed.jrf
02/21/2008  09:41 AM                16 unnamed.jrf.1
02/20/2008  04:32 PM                16 unnamed.jrf.2
              12 File(s)      2,259,319 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1008L

02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/23/2009  02:39 PM    <DIR>          AUTOHEX_GEOM_1008L
02/23/2009  02:39 PM    <DIR>          AUTOHEX_GEOM_1008L_ONLY
11/24/2008  11:23 AM            39,358 boco
11/24/2008  11:23 AM            10,013 family_boco.fbc
11/24/2008  11:23 AM         1,427,802 hex.uns
11/24/2008  12:17 PM            10,710 zz_ihf_rm1008L_cask_08.atr
11/24/2008  12:17 PM           408,778 zz_ihf_rm1008L_cask_08.blk
11/24/2008  12:17 PM            10,079 zz_ihf_rm1008L_cask_08.fbc
11/24/2008  12:17 PM            10,078 zz_ihf_rm1008L_cask_08.fbc_old
11/24/2008  12:06 PM         2,574,088 zz_ihf_rm1008L_cask_08.in
11/24/2008  11:38 AM               258 zz_ihf_rm1008L_cask_08.in.log
11/24/2008  12:17 PM           356,099 zz_ihf_rm1008L_cask_08.jrf
11/24/2008  12:17 PM               674 zz_ihf_rm1008L_cask_08.par
11/24/2008  12:17 PM             7,212 zz_ihf_rm1008L_cask_08.prj
11/24/2008  12:17 PM         3,017,991 zz_ihf_rm1008L_cask_08.tin
11/24/2008  12:17 PM         1,427,714 zz_ihf_rm1008L_cask_08.uns
11/24/2008  11:38 AM         1,427,714 zz_ihf_rm1008L_cask_08.uns.bak
11/20/2008  09:26 AM             2,332 zz_ihf_rm1008_only_09.atr
11/20/2008  09:26 AM           154,915 zz_ihf_rm1008_only_09.blk
11/20/2008  09:26 AM             2,485 zz_ihf_rm1008_only_09.fbc
11/20/2008  09:27 AM             4,408 zz_ihf_rm1008_only_09.fbc_dfupdate
11/20/2008  09:26 AM             2,484 zz_ihf_rm1008_only_09.fbc_old
11/20/2008  09:27 AM           707,089 zz_ihf_rm1008_only_09.in
11/20/2008  09:27 AM               255 zz_ihf_rm1008_only_09.in.log
11/20/2008  09:27 AM           771,728 zz_ihf_rm1008_only_09.jrf
11/20/2008  09:26 AM               674 zz_ihf_rm1008_only_09.par
11/20/2008  09:26 AM            25,927 zz_ihf_rm1008_only_09.prj
11/20/2008  09:26 AM           167,241 zz_ihf_rm1008_only_09.tin
11/20/2008  09:26 AM           397,110 zz_ihf_rm1008_only_09.uns
11/20/2008  08:45 AM           421,181 zz_ihf_rm1008_only_09.uns.bak
              28 File(s)     13,386,397 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1008L\AUTOHEX_GEOM_1008L

02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/13/2008  04:22 PM            19,572 autohex.prj
11/05/2008  03:06 PM         2,472,385 autohex.tin
11/05/2008  03:06 PM            28,750 boco
11/05/2008  03:06 PM             3,229 family_boco
11/05/2008  03:06 PM                34 job
11/05/2008  03:06 PM             2,439 messages.log
11/05/2008  03:06 PM            95,899 model
11/05/2008  03:06 PM                11 model_timestamp
11/05/2008  03:06 PM            20,372 problem
02/21/2008  09:41 AM                16 unnamed.jrf
02/20/2008  04:32 PM                16 unnamed.jrf.1
              11 File(s)      2,642,723 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1008L\AUTOHEX_GEOM_1008L_ONLY
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02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/13/2008  04:22 PM            19,572 autohex.prj
11/05/2008  03:29 PM         1,883,054 autohex.tin
11/05/2008  03:29 PM            18,117 boco
11/05/2008  03:29 PM             1,971 family_boco
11/05/2008  03:29 PM                34 job
11/05/2008  03:29 PM               786 messages.log
11/05/2008  03:29 PM            60,465 model
11/05/2008  03:29 PM                11 model_timestamp
11/05/2008  03:29 PM            20,372 problem
02/20/2008  04:32 PM                16 unnamed.jrf.1
              10 File(s)      2,004,398 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1008S

02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/23/2009  02:39 PM    <DIR>          AUTOHEX_GEOM_1008L
02/23/2009  02:39 PM    <DIR>          AUTOHEX_GEOM_1008S_ONLY
11/20/2008  10:55 AM            30,957 boco
11/20/2008  11:11 AM             8,786 elements.dat
11/20/2008  10:55 AM             8,339 family_boco.fbc
11/20/2008  10:55 AM         1,325,996 hex.uns
11/20/2008  11:12 AM            10,314 zz_ihf_rm1008S_cask_10.atr
11/20/2008  11:12 AM           392,652 zz_ihf_rm1008S_cask_10.blk
11/20/2008  11:12 AM             8,405 zz_ihf_rm1008S_cask_10.fbc
11/20/2008  11:12 AM             8,404 zz_ihf_rm1008S_cask_10.fbc_old
11/20/2008  11:12 AM         2,394,047 zz_ihf_rm1008S_cask_10.in
11/20/2008  11:11 AM               258 zz_ihf_rm1008S_cask_10.in.log
11/20/2008  11:12 AM            95,773 zz_ihf_rm1008S_cask_10.jrf
11/20/2008  11:12 AM               798 zz_ihf_rm1008S_cask_10.par
11/20/2008  11:12 AM            28,313 zz_ihf_rm1008S_cask_10.prj
11/20/2008  11:12 AM         2,750,246 zz_ihf_rm1008S_cask_10.tin
11/20/2008  11:12 AM         1,325,908 zz_ihf_rm1008S_cask_10.uns
11/20/2008  11:11 AM         1,325,908 zz_ihf_rm1008S_cask_10.uns.bak
              16 File(s)      9,715,104 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1008S\AUTOHEX_GEOM_1008L

02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/13/2008  04:22 PM            19,572 autohex.prj
11/05/2008  03:06 PM         2,472,385 autohex.tin
11/05/2008  03:06 PM            28,750 boco
11/05/2008  03:06 PM             3,229 family_boco
11/05/2008  03:06 PM                34 job
11/05/2008  03:06 PM             2,439 messages.log
11/05/2008  03:06 PM            95,899 model
11/05/2008  03:06 PM                11 model_timestamp
11/05/2008  03:06 PM            20,372 problem
02/21/2008  09:41 AM                16 unnamed.jrf
02/20/2008  04:32 PM                16 unnamed.jrf.1
              11 File(s)      2,642,723 bytes

 Directory of D:\ICEM_MESHES\ICEM_IHF_NEW_MESH_1008S\AUTOHEX_GEOM_1008S_ONLY

02/23/2009  02:39 PM    <DIR>          .
02/23/2009  02:39 PM    <DIR>          ..
02/13/2008  04:22 PM            19,572 autohex.prj
11/13/2008  04:48 PM         1,683,743 autohex.tin
11/13/2008  04:48 PM            16,431 boco
11/13/2008  04:48 PM             1,785 family_boco
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11/13/2008  04:48 PM                34 job
11/13/2008  04:48 PM             1,351 messages.log
11/13/2008  04:48 PM            54,935 model
11/13/2008  04:48 PM                11 model_timestamp
11/13/2008  04:48 PM            20,372 problem
02/20/2008  04:32 PM                16 unnamed.jrf.1
              10 File(s)      1,798,250 bytes

     Total Files Listed:
             812 File(s)  1,648,573,980 bytes
             270 Dir(s)                0 bytes free
```