This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-96SR18500 with the U. S. Department of Energy.

WSRC-TR-98-00420

Thermal Analysis of the 9975 Package with the 3013 Configuration During Normal Conditions of Transportation

by

S. Hensel

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

DOE Contract No. **DE-AC09-96SR18500**

WSRC-TR-98-00420

Thermal Analyses Of The 9975 Package With The 3013 Configuration During Normal Conditions Of Transport

S. J. Hensel

February 22, 1999

Westinghouse Savannah River Company
Savannah River Technology Center
Aiken, SC 29808

Prepared for the U. S. Department of Energy under Contract DE-AC09-96SR18500

DISCLAIMER

DOCUMENT: WSRC-TR-98-00420

TITLE: Thermal Analyses Of The 9975 Package With The 3013 Configuration During Normal Conditions Of Transport

APPROVALS

DATE: 2/23/99

P. K. Paul, Reviewer
SRTC/EESD/EDS, Engineering Modeling and Simulation Group

DATE: 2/25/99

R. J. Gromada, Reviewer
SRTC/EESD/EDS, Packaging and Transportation Group

DATE: 2-23-99

S. J. Hensel, Author
SRTC/EESD/EDS, Engineering Modeling and Simulation Group

DATE: 3/1/99

B. Seward, Customer
NMSS/Programs

DATE: 3/11/99

C. P. Holding-Smith, Group Manager
SRTC/EESD/EDS, Engineering Modeling and Simulation Group

DATE: 3/16/99

M. A. Ebra, Section Manager
SRTC/EESD/EDS

WSRC-TR-98-00420

KEY WORDS: Thermal Analysis
Plutonium
Packaging

RETENTION PERIOD: Permanent

Thermal Analyses Of The 9975 Package With The 3013 Configuration During Normal Conditions Of Transport

By

S. J. Hensel

ISSUED: February 22, 1999

SRTC SAVANNAH RIVER TECHNOLOGY CENTER, AIKEN, SC, 29808
Westinghouse Savannah River Company

Prepared for the U. S. Department of Energy under Contract DE-AC09-96SR18500

Table Of Contents

Abstract

Thermal analysis of the 9975 package with three configurations of the BNFL 3013 outer container (with Rocky Flats, SRS, and BNFL inner containers) have been performed for Normal Conditions of Transport (NCT) of plutonium oxide and metal. The NCT is defined in 10 CFR 71.71(c)(1) as an ambient of 100°F (38 °C) in still air with 800 W/m^2 and 400 W/m^2 of solar heating on the drum top and sides, respectively. The 9975 drum package is considered to be in an upright position, and the drum bottom is adiabatic.

The Rocky and SRS 3013 configurations with Pu metal contents (19 watts) result in acceptable (similar) packaging temperatures, however the plutonium metal temperatures are lower for the SRS design (SRS has helium fill gas whereas Rocky is essentially air filled). The BNFL configuration for Pu oxide contents (19 watts) result in acceptable temperatures and pressures based on limits in the 9975 Safety Analysis Report (SARP). However, for 30 watts of Pu oxide, the fiberboard peak temperatures are very near the SARP allowable. The pressure in the 3013 container is 688.4 psig for the 30 watt Pu oxide content and 569.5 psig for the 19 watt Pu oxide content.

Gas species in the pressure computations include air, helium and hydrogen from complete radiolysis of the moisture. The oxygen generated from the radiolysis of the water is not included as a pressure contributor. The gas temperature in the pressure computations was very conservatively assumed to be the maximum plutonium temperature.

1.0 Introduction

Plutonium storage is currently being planned for K-reactor and in a new Actinide Package Storage Facility (APSF) at SRS. The present work considers Normal Conditions of Transport (NCT) (solar radiation in an ambient of 100°F) and builds upon previous steady-state thermal analyses of the 9975 package when used as a storage container [1]. The previous work did not consider solar radiation and the drums were considered to be stacked two high and bundled while in storage (drum top and bottom surfaces were considered to be adiabatic and no radiation heat transfer from the outer drum to the ambient). This work does not explicitly evaluate the computed temperatures or pressures in terms of their impact on safety.

Several BNFL 3013 container storage configurations utilizing the 9975 package are contemplated. A schematic of the storage configurations with the BNFL 3013 container is presented in Figure 1. Table 1 identifies all of the 3013 configurations currently considered and the respective contents. The BNFL and Rocky configurations consist of three nested containers/cans within the primary containment vessel of the 9975. The SRS configuration is the only double nested configuration. Dimensions of the containers/cans are provided in Table 2. Although the 9975 package is currently certified for plutonium oxide at 19 watts, 30 watts was evaluated for comparison purposes.

The NCT thermal analysis is steady-state with an ambient of 100°F (38°C). The cylindrical drum is upright with the bottom surface adiabatic. Solar heating on the drum top and sides are 800 W/m^2 and 400 W/m^2, respectively. The drum dissipates heat to the ambient via natural convection and radiation.

Schematic Of 3013 Configurations

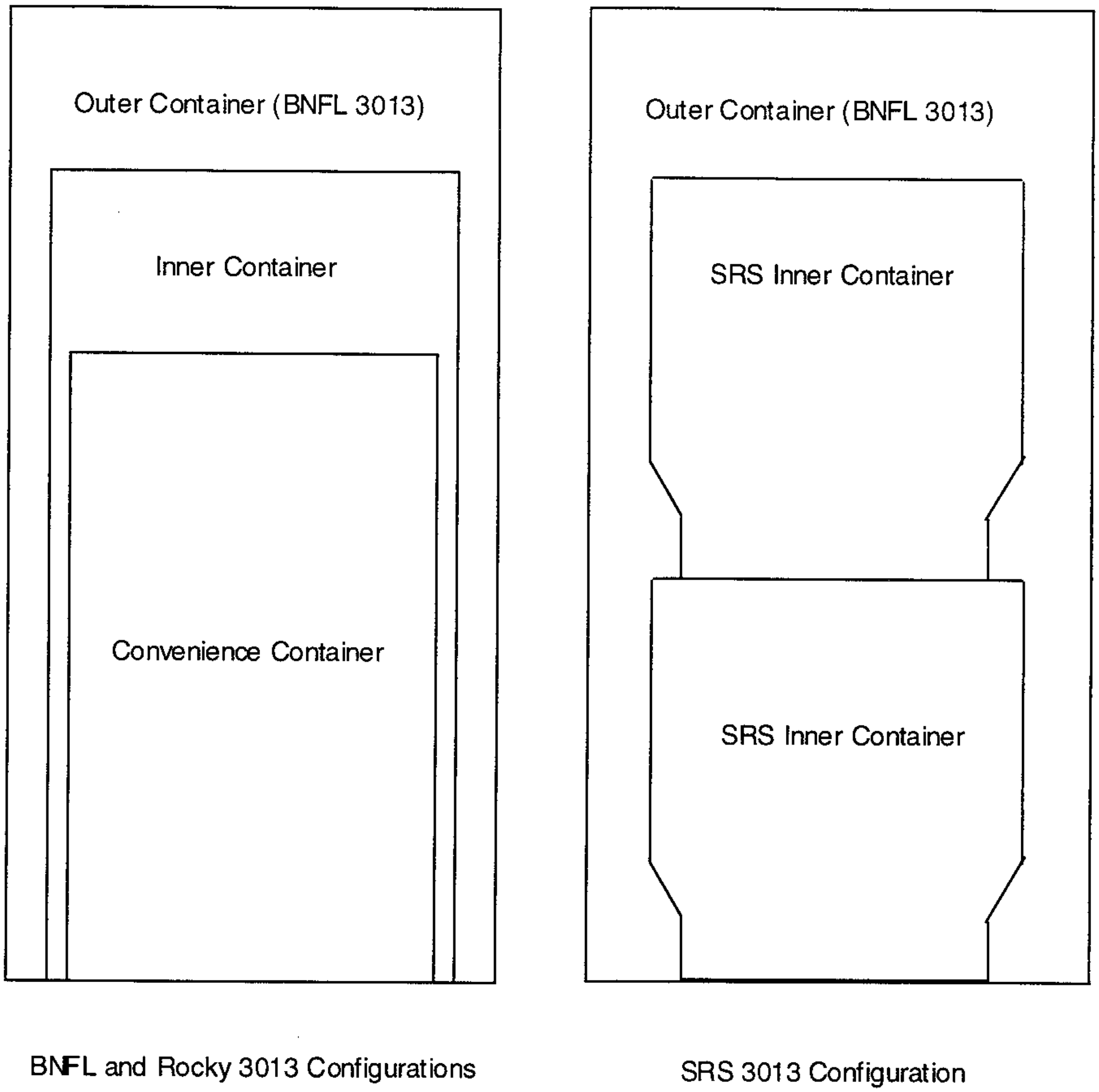

Figure 1

Table 1: Storage Configurations

Name	Outer Container	Inner Container	Convenience Container	Fill Gasses	Contents
BNFL	Yes BNFL 3013	Yes BNFL	Yes BNFL	Helium between Inner container and 3013, all other is air	low density Pu Oxide (19 W or 30 W)
Rocky	Yes BNFL 3013	Yes BNFL	Yes Rocky Flats	Helium between Inner container and 3013, all other is air	2 Pu metal buttons stacked directly on top of each other (19 W total)
SRS	Yes BNFL 3013	Yes SRS cans stacked two high	No	Helium within 3013 container and Inner container	2 Pu metal buttons (19 W total divided between 2 containers)

Table 2: External Dimensions Of Containers (in.)

Container	Diameter X Height (in.)	Drawing Number
BNFL 3013	4.92 X 10.0	BNFL Drawing M-4-20-1-245 Mod C
BNFL Inner Container	4.61 X 9.45	BNFL Drawing M-4-20-1-244 Mod D
BNFL Convenience Container	4.29 X 8.91	BNFL Drawing M-4-20-1-243 Mod C
Rocky Convenience Container	4.11 X 5.96	Dynamic Machine Works 1509-02
SRS Inner Container	4.6 X 4.625	WSRC Drawing R-R1-F-0039 rev. 2

The general purpose conduction-radiation computer code MSC/Thermal (also known as P/Thermal) was used to perform the computations [2]. This computer code meets site nuclear safety QA requirements [3], and work was performed in accordance with the WSRC E-7 manual [4].

2.0 Thermal Models And Analysis

The thermal models of the storage configurations were created using the general purpose finite element pre and post processor Patran [5].

2.1 Models

Axisymmetric models of the 9975 drum package used in the preparation of the 9975 SARP were modified to accommodate the proposed configurations [6]. A schematic of the axisymmetric model of the 9975 packaging with the BNFL configuration for Pu oxide contents is shown in Figure 2. Models for the Pu metal button configurations are very similar. Metal buttons are modeled as disks 0.75 in. thick with flat tops and 5.125 in. radius of curvature bottoms (curved side down) as shown in Figure 3 [7]. The contact between the metal button and the container is at a point. The axisymmetric models contain roughly 5500 nodes. Heat is transferred to the ambient by conduction through the 9975 components and radiation and conduction across the air gaps. Within the primary containment vessel conduction heat transfer is modeled, but natural convection is neglected. Radiation within the primary containment vessel is considered as listed in Table 3. The contribution of radiation heat transfer between the inner and outer containers for the BNFL and Rocky configurations is relatively small and therefore neglected. Natural convection within the packaging is also conservatively neglected.

Fringe plots of the axisymmetric models used to analyze the Rocky, SRS and BNFL configurations are presented in Figures 4 through 6. The package materials are represented by the fringe colors.

Schematic of 9975 With BNFL Containers And Pu Oxide Contents

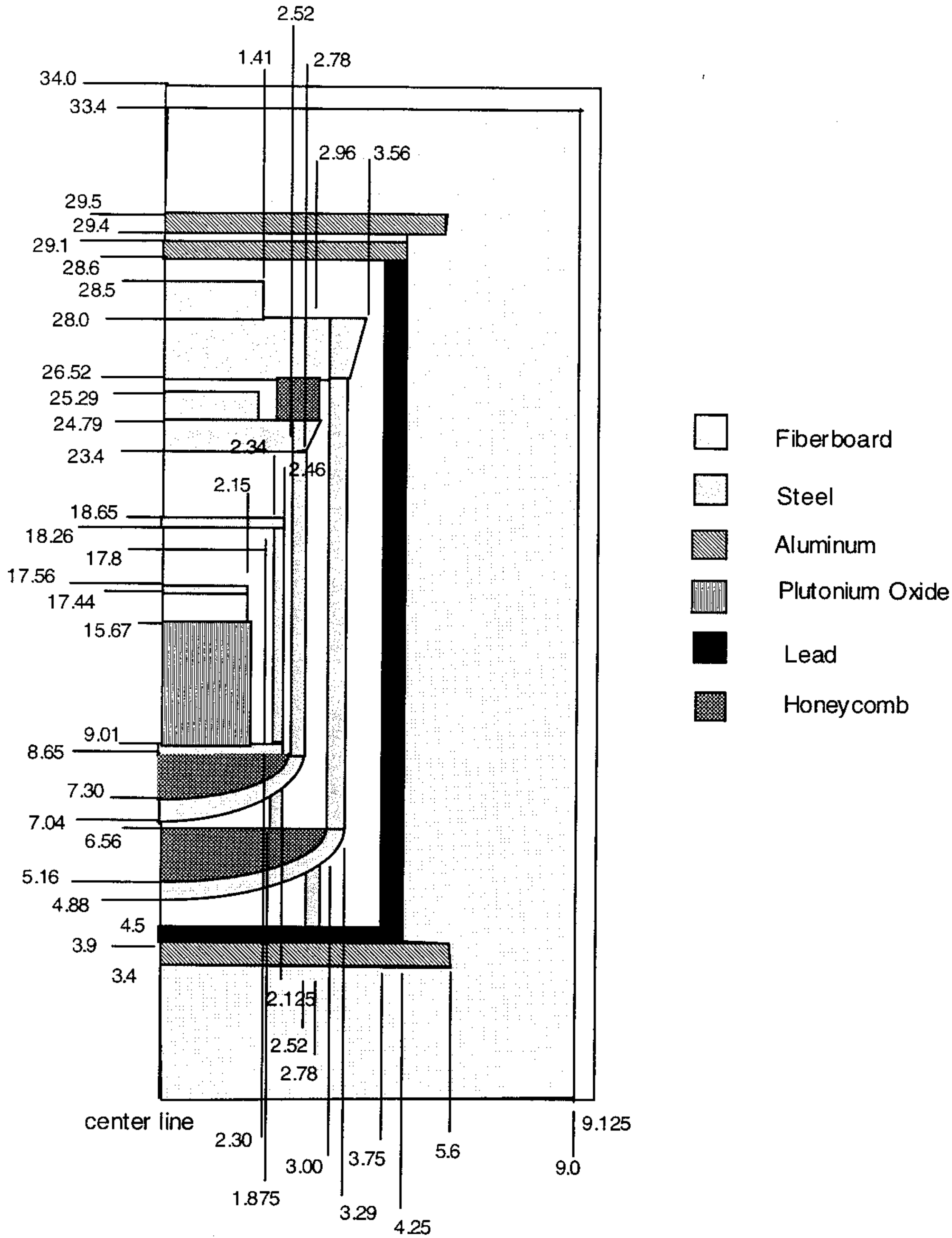

Figure 2

Schematic Of Pu Button

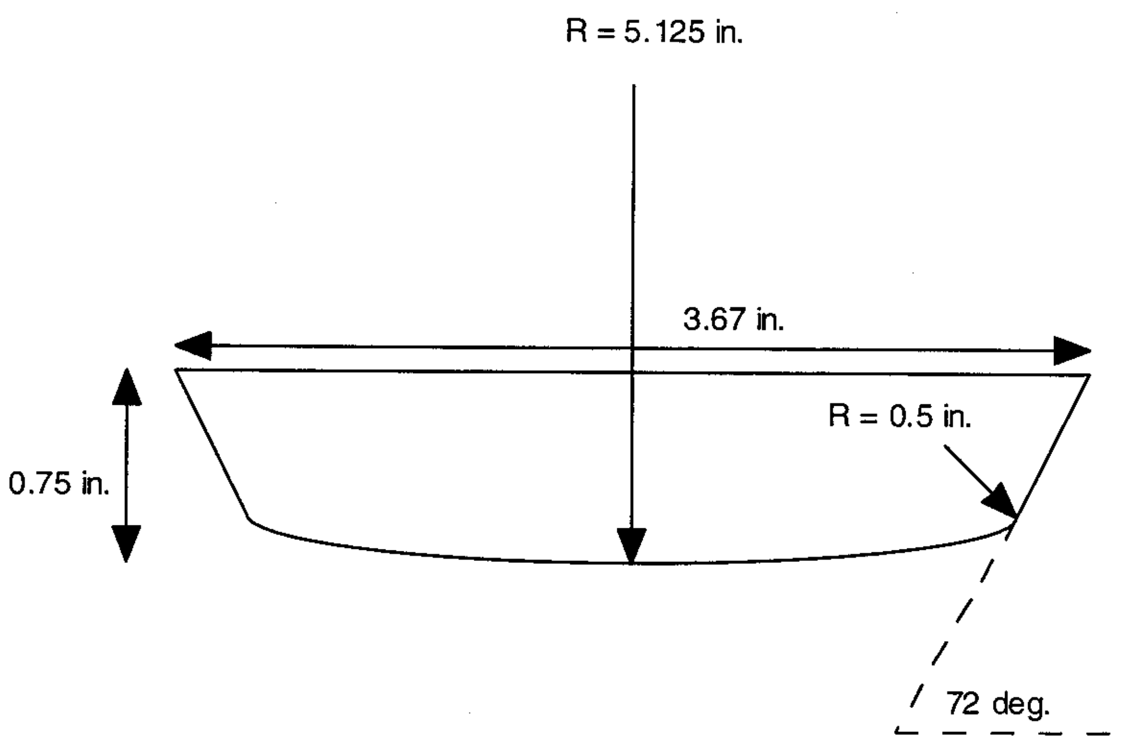

Figure 3

MSC/PATRAN Version 7.5 03-Aug-98 11:12:51
Fringe: Property Set Name

Rocky Configuration With Pu Metal Contents

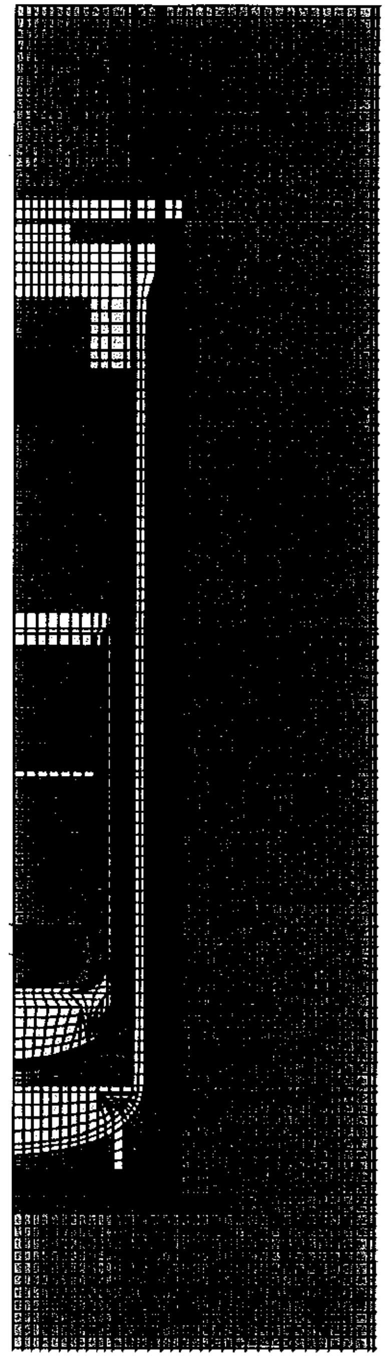

Figure 4

MSC/PATRAN Version 7.5 12-Nov-98 16:23:42
Fringe: Property Set Name

SRS Configuration With Pu Metal Contents

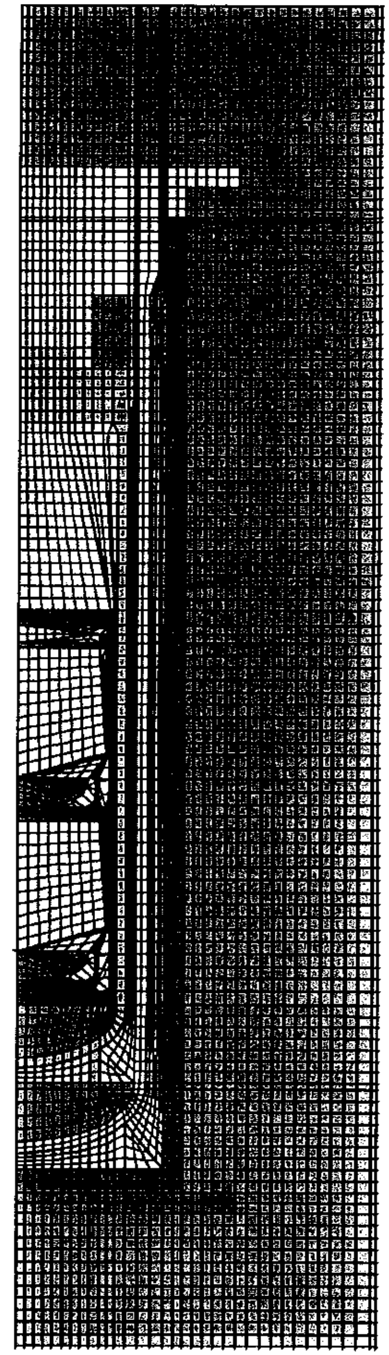

Figure 5

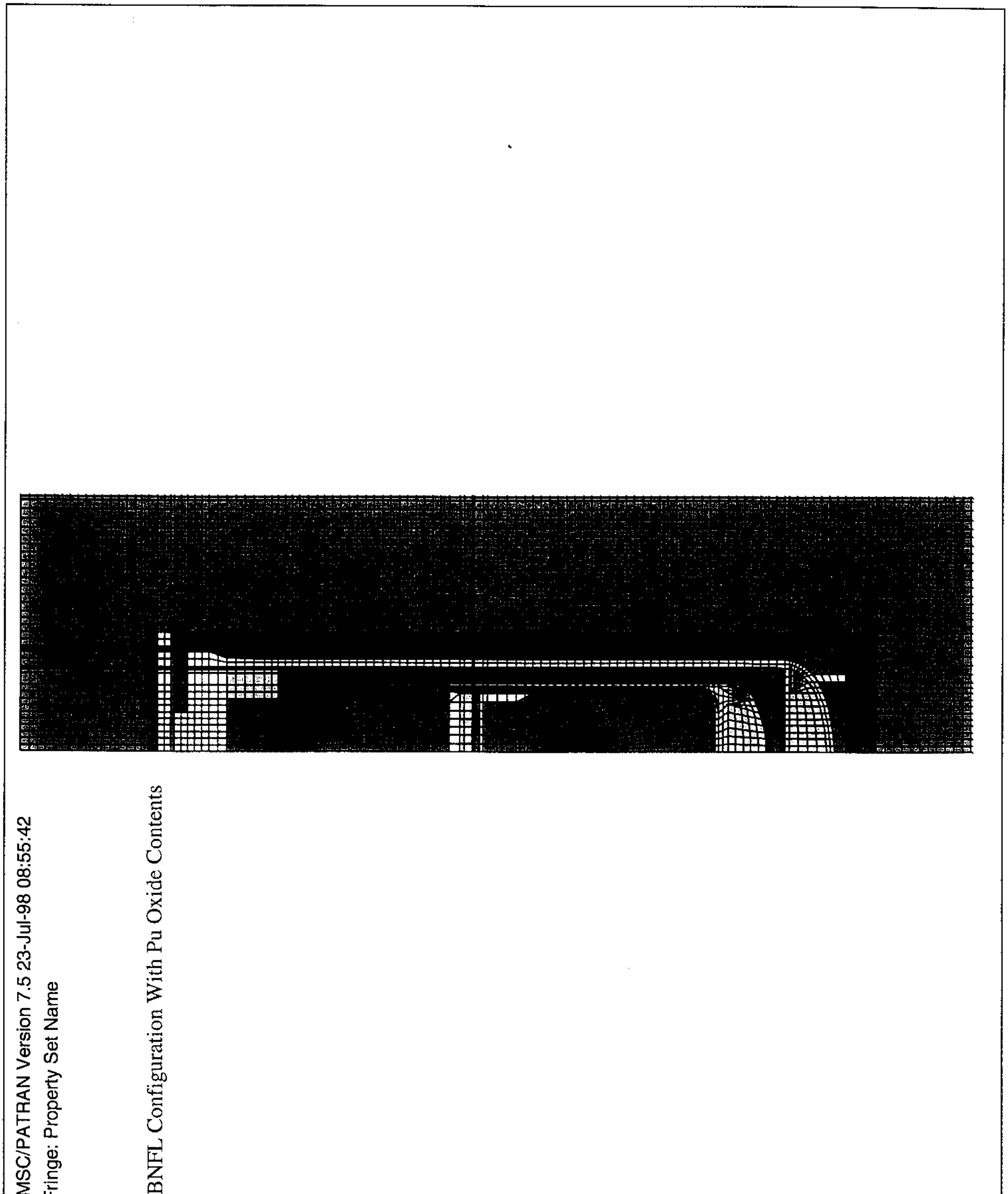
MSC/PATRAN Version 7.5 23-Jul-98 08:55:42
Fringe: Property Set Name
BNFL Configuration With Pu Oxide Contents

Figure 6

Table 3: Radiation Heat Transfer Within Primary Containment Vessel

Configuration	Between Outer Container and PCV	Between Inner Container and Outer Container	Between Convenience and Inner Container	Between Contents and Convenience Container
BNFL	Yes	No	Yes	Yes
Rocky	Yes	No	Yes	Yes
SRS	Yes	Yes	N/A	Yes, between contents and inner container

2.2 Thermal Analysis

The ambient transport temperature is 100°F (38 °C), and the 9975 drum is assumed to be upright with the bottom surface adiabatic. Heat transfer from the drum side and top to the ambient is via natural convection and radiation. The convection coefficients used to determine the turbulent natural convection heat transfer are a function of the temperature difference between the drum surface and the ambient (ΔT). Given a temperature difference in °F, the drum top convection coefficient is $0.22\Delta T^{0.33}$ Btu/hr.-ft.^{2}-°F and the drum side coefficient is $0.19\Delta T^{0.33}$ Btu/hr.-ft.^{2}-°F [8]. Thermal conductivity of fiberboard is based on previous heater experiments with the 9975 which showed the in-plane conductivity to be roughly twice the through-plane value [9]. A summary of the boundary conditions for the analyses follows:

1. Drum analyzed in an upright position
2. Adiabatic bottom surface
3. Radiative heat transfer from drum sides and top to the ambient
4. Natural convection heat transfer from the drum sides and top to the ambient
5. Ambient temperature is 100°F (38 °C)

6. Insolation: 800 W/m^2 on drum top and 400 W/m^2 on drum side (no credit was taken for the solar absorptivity of the drum being less than 1).

The thermal properties of the packaging components used in the analyses are shown in Tables 4 and 5 and are taken from previous analyses [1].

Table 4: Emissivity Of Package Components

Component	Emissivity
aluminum plates, honeycomb	0.25
fiberboard	0.90
lead	0.28
containment vessels	0.30
3013 Container	0.20
BNFL Middle Can	0.20
BNFL Convenience Can	0.20
Pu Oxide	0.90
Pu Metal	0.50
Rocky Convenience Can	0.20
SRS Convenience Can	0.20

Table 5 : Thermal Conductivity Of Packaging Materials

Material	Conductivity (Btu/hr.-ft.-°F) @ T(°F)
helium	0.0910 @ 120 0.0985 @ 212 0.1226 @ 392
air	0.1396 @ 32 0.1397 @ 212 0.1398 @ 392 0.02593 @ 572
honeycomb energy absorber (radial)	3.82
honeycomb energy absorber (axial)	7.62
fiberboard (radial)	0.0723
fiberboard (axial)	0.031 @ 77 0.034 @ 187 0.036 @ 295
aluminum	126.0
stainless steel (304)	7.74 @ 32 9.43 @ 212 12.58 @ 932
stainless steel (316)	8.79 @ 261 10.58 @ 621
lead	19.6 @ 209 18.3 @ 400
Pu oxide	0.0460
Pu metal	7.26 @ 207 7.74 @ 243 9.19 @ 266 18.39 @ 1112

3.0 Results

Results of the analyses include both temperatures and pressures.

3.1 Temperatures

The results of the computations are presented in Table 6. The maximum temperatures at key locations are reported for each configuration and wattage. Color fringe plots of the temperatures are presented in Figures 7 through 9 for the Rocky, SRS, and BNFL oxide configurations with 19 watts of plutonium contents. The following are note worthy:

1. The maximum fiberboard temperature is 280°F (138 °C) which is above the currently acceptable limit of 250°F, and occurs with the 30 watts of Pu oxide in the BNFL configuration. The maximum occurs at roughly mid height of the contents. For 19 watts, the maximum temperature is 257°F (125 °C). The 9975 SARP allows for exceeding the fiberboard temperature limit in small localized regions.

2. For the 30 watt case of Pu oxide contents, the maximum secondary containment vessel (SCV) temperature is 300°F (149°C) and the maximum primary containment vessel (PCV) temperature is 324°F (162°C). Although these containment vessel temperatures are at or slightly above the current SARP limit of 300°F (149 °C), the containment vessels are below 300°F for 19 watts. The maximum temperature occurs at roughly mid height of the contents.

3. Maximum Pu metal temperature is 395°F (202°C) for the Rocky configuration and only 297°F (147°C) for the SRS configuration (19 watts total in two metal buttons).

4. Both primary and secondary container o-rings are below 300°F (149°C) for all configurations and loadings (including 30 watts of oxide).

5. The maximum temperature of the BNFL 3013 container is 340°F (171°C), and it occurs with the 30 watts of Pu oxide case.

6. The SRS and Rocky configurations result in very similar 9975 packaging temperatures even though the contents are configured differently.

The most significant result of these analyses is that the PCV allowable is exceeded with 30 watts of Pu oxide in the BNFL configuration, however 19 watts of Pu metal or oxide in all configurations is acceptable. The Rocky and SRS configurations result in similar packaging temperatures, however the plutonium metal temperatures are lower for the SRS design (with helium fill gas). Another reason may be that the SRS design is only a double nested configuration whereas the Rocky is triple nested. The heat generation of the plutonium contents is primarily responsible for the packaging and can temperatures. The composition of the plutonium (oxide or metal) significantly impacts its temperature (oxide results in significantly greater maximum Pu temperatures). The analyses are conservative in that no credit was taken for the drum absorptivity for insolation being less than 1.

3.2 Pressures

Pressures are also presented in Table 6 for the 3013 configurations. The pressures are based upon complete radiolysis of the moisture (0.5% by wt.) in the case of the oxide content, the contribution from 50 years of helium buildup and air expansion. The mass of the content for all pressure calculations is assumed to be 5 Kg of oxide or 4.4 Kg of metal. The gas temperature used to compute the pressures was very conservatively assumed to be the maximum in the contents. The free volumes of the 3013 and PCV vessels are taken from previous analyses [10].

Table 6: Temperatures (°F/°C) And Pressures (psig)

For The 9975 Package With The 3013 Configuration During Transport (with solar)

Location	19 watts Pu oxide (BNFL)	30 watts Pu oxide (BNFL)	19 watts Pu metal (Rocky)	19 watts Pu metal (SRS)
Drum top	261 / 127	261 / 127	260 / 127	260 / 127
Drum bottom	243 / 117	261 / 127	234 / 112	233 / 112
Drum side	208 / 97.8	210 / 98.9	210 / 98.9	207 / 97.2
Fiberboard	257 / 125	280 / 138	245 / 118	242 / 117
SCV O-ring	262 / 128	287 / 142	245 / 118	246 / 119
PCV O-ring	264 / 129	289 / 143	247 / 119	247 / 119
SCV side	270 / 132	300 / 149	255 / 124	253 / 123
SCV bottom	270 / 132	300 / 149	257 / 125	255 / 124
PCV side	286 / 141	324 / 162	267 / 131	264 / 129
PCV bottom	283 / 139	319 / 159	270 / 132	266 / 130
3013 top	288 / 142	325 / 163	259 / 126	264 / 129
3013 bottom	284 / 140	322 / 161	274 / 134	269 / 132
3013 side (mid. height of contents)	296 / 147	340 / 171	272 / 133	273 / 134
Pu can interface	------------------	------------------	372 / 189	292 / 144 (top button) 277 / 136 (bottom button)
Middle of Pu	527 / 275	701 / 372	395 / 202 (top button)	297 / 147 (top button) 284 / 140 (bottom button)
Pressure 3013	569.5	688.4	27.0	21.1
Pressure PCV	265.5	322.2	17.7	13.6

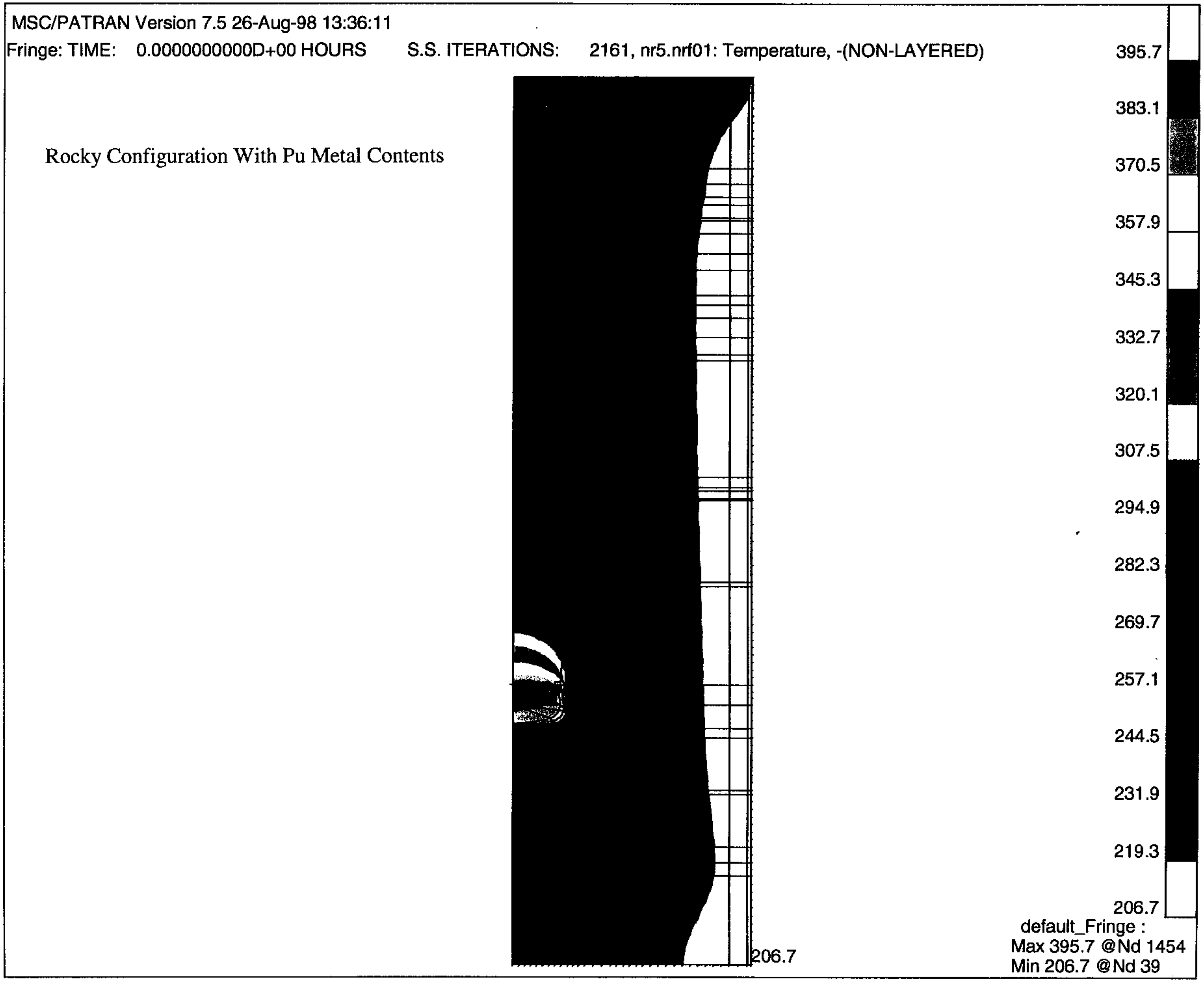
MSC/PATRAN Version 7.5 26-Aug-98 13:36:11
Fringe: TIME: 0.0000000000D+00 HOURS S.S. ITERATIONS: 2161, nr5.nrf01: Temperature, -(NON-LAYERED)
Rocky Configuration With Pu Metal Contents
395.7
383.1
370.5
357.9
345.3
332.7
320.1
307.5
294.9
282.3
269.7
257.1
244.5
231.9
219.3
206.7
default_Fringe :
Max 395.7 @Nd 1454
Min 206.7 @Nd 39
206.7

Figure 7

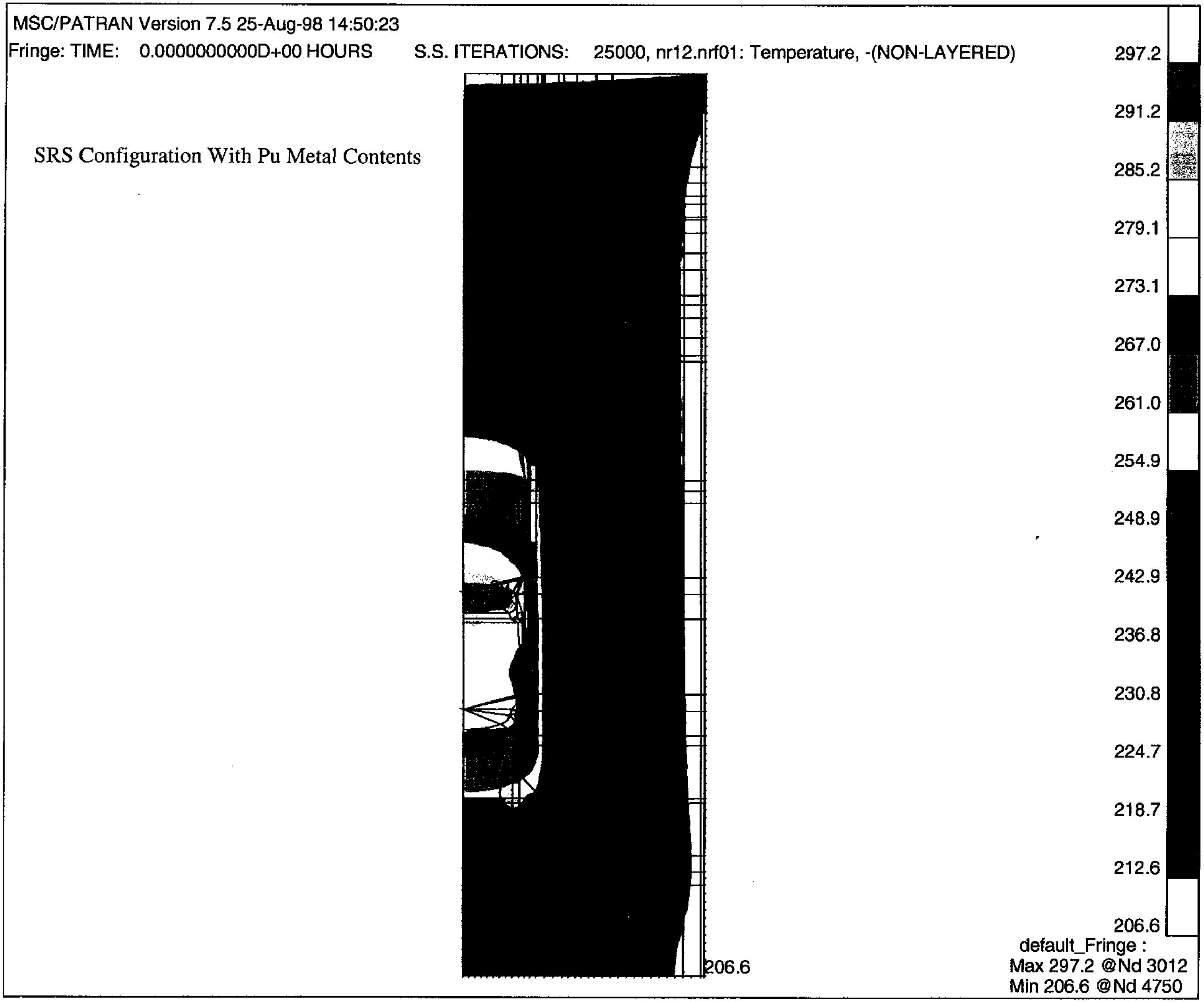
MSC/PATRAN Version 7.5 25-Aug-98 14:50:23
Fringe: TIME: 0.0000000000D+00 HOURS S.S. ITERATIONS: 25000, nr12.nrf01: Temperature, -(NON-LAYERED)
SRS Configuration With Pu Metal Contents
297.2
291.2
285.2
279.1
273.1
267.0
261.0
254.9
248.9
242.9
236.8
230.8
224.7
218.7
212.6
206.6
206.6
default_Fringe :
Max 297.2 @Nd 3012
Min 206.6 @Nd 4750

Figure 8

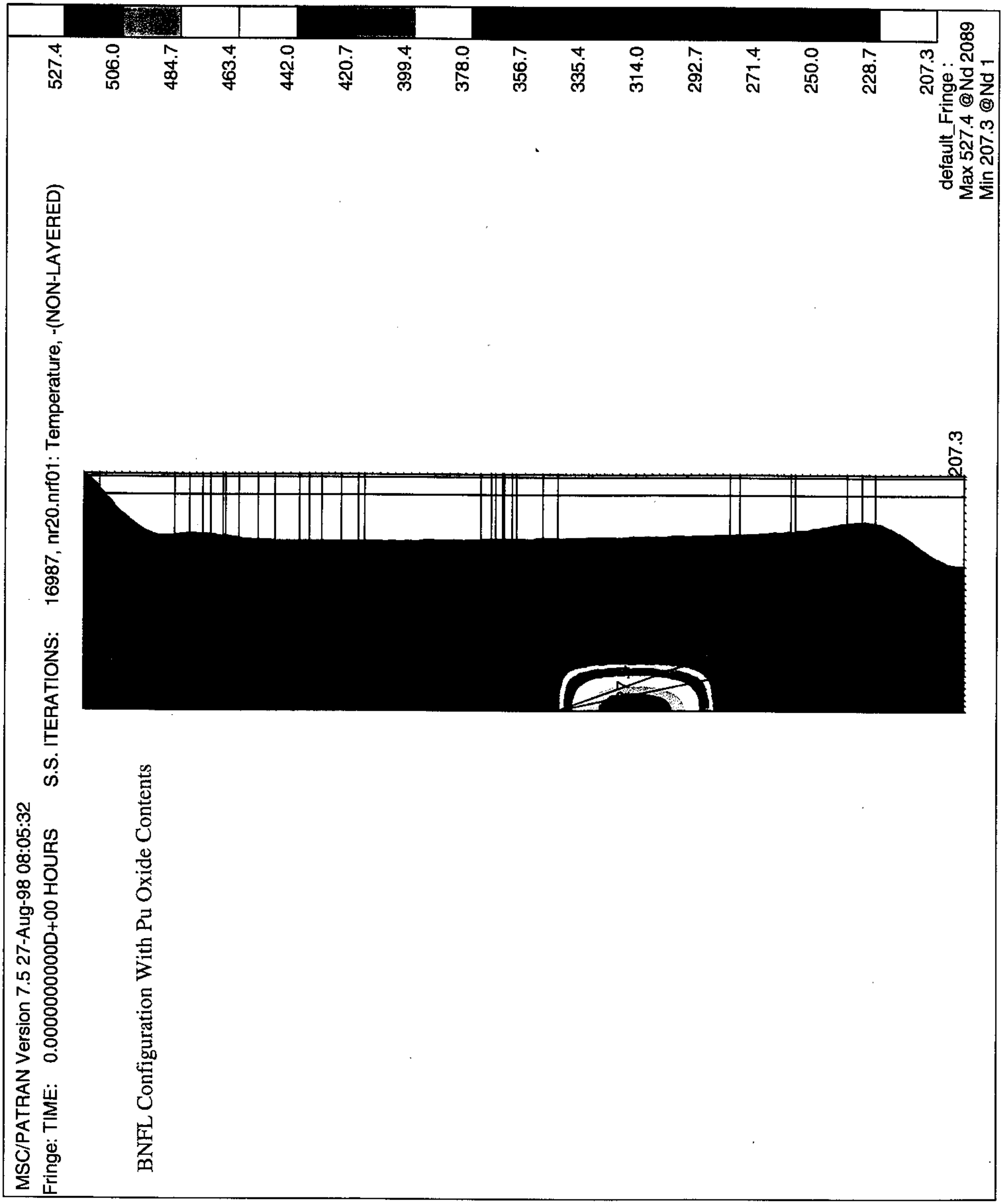
MSC/PATRAN Version 7.5 27-Aug-98 08:05:32
Fringe: TIME: 0.0000000000D+00 HOURS S.S. ITERATIONS: 16987, nr20.nrf01: Temperature, -(NON-LAYERED)
BNFL Configuration With Pu Oxide Contents
207.3
527.4
506.0
484.7
463.4
442.0
420.7
399.4
378.0
356.7
335.4
314.0
292.7
271.4
250.0
228.7
207.3
default_Fringe :
Max 527.4 @Nd 2089
Min 207.3 @Nd 1

Figure 9

The PCV pressures are based on all interior containers leaking. Deflagration and detonation analyses were not peformed because they are beyond the scope of this work.

4.0 Conclusions

Thermal analysis of the 9975 package with three configurations of the BNFL 3013 outer container have been analyzed for NCT of plutonium oxide and metal. The 9975 package temperatures for the SRS and Rocky configurations are very similar, however the Pu metal temperatures are greater for the Rocky configuration. The fiberboard and PCV temeperatures exceed current SARP allowables by 30°F for the 30 watt Pu oxide content. Package temperatures for all 19 watt cases are acceptable. The analyses are conservative in that the solar absorptivity of the drum was taken to be 1.

5.0 References

1. Hensel, S. J., "Thermal Analyses Of The 9975 Package As A Plutonium Storage Container", WSRC-TR-98-00203.
2. MSC/Thermal, MacNeal-Schwendler Corporation, Los Angeles, CA 90041.
3. Hensel, S. J., "Dedication Package For P3/Thermal (U)", SRT-EMS-950007, 1995.
4. Westinghoue Savannah River Co., Conduct Of Engineering Manual, E-7, 1998.
5. Patran 7.5, MacNeal-Schwendler Corporation, Los Angeles, CA 90041.
6. Hensel, S. J., and Gromada, R. J., "Thermal Analysis Of Hanford Pu Oxide Cans In A 9975 Package (U)", WSRC-TR-97-00310, October, 1997.
7. Gray, L. W., "Kinetics Of The Ambient Temperature Dissolution Of Plutonium Metal In Sulfuric Acid", March 1978.
8. Lindeburg, M. R., Mechanical Engineering Reference Manual 8th Ed., Professional Publications, Inc., Belmont CA 1990, pp. 10-12.

9. Jerrell, J. W., Van Alstine, M. N., and Gromada, R. J., Normal Conditions of Transport Thermal Analysis and Testing of a Type B Drum Package, PVP-Vol. 307, pp. 111-117.

10. Hensel, S. J., "Pressure Analysis of Plutonium Containers Stored in 9975 Packages in K-Area", M-CLC-K-00639, p.7.

OSR 14-357# (Rev 2-2-99)
Stores: 26-12801.00

Westinghouse Savannah River Company
Document Approval Sheet

Document No. WSRC-TR-98-00420

Title: Thermal Analysis Of The 9975 Package With The 3013 Configuration During Normal

Key Words (list 3): plutonium, storage, packaging

Primary Author/Contact (Must be WSRC)	Location	Phone No.	Position	User ID
Steve Hensel	773-42A rm 155	5-5094	Principal Engineer	L0480

Organization Code	Organization (No Abbreviations)
L8620	Engineering Development Section

Other Authors

Approval Requested by (date): ~~1-30-2000~~ 2/18/2000

Has an invention disclosure, patent application or copyright application been submitted related to this information? ☐ Yes ☒ No If yes, date submitted ______

Disclosure No. (If Known) ______ Title ______

If no, do you intend to submit one? ☐ Yes ☒ No If yes, projected date ______

Information Product Description

☒ Technical Report
- ☐ Semiannual ☐ Annual ☒ Final ☐ Topical ☐ Other ______

☐ Administrative Report
- ☐ Semiannual ☐ Annual ☐ Final ☐ Topical ☐ Other ______

☐ Videotape/Multimedia

☐ External Web Page URL ______

☐ Brochure/Booklet

☐ Procedure/User Guide

☐ Drawing

☐ Software Package

☐ Journal Article Journal Name ______

Book/Book Chapter Book Name ______

☐ Conference Submission*
- ☐ Abstract ☐ Conf. Paper ☐ Conf. Proceeding
- ☐ Slides/poster/display ☐ Other ______

*Conference Title ______

*Conference Location (City, State, Country) ______

*Conference Dates ______ m/d/y thru ______ m/d/y

*Conference Sponsor ______

References ☐ In Public Literature ☐ Routing Concurrently ☐ Approved for Release ☐ Other ______

I understand that for the information in this material to be given external distribution, approvals by both WSRC and, as appropriate, DOE-SR are required. Distribution (verbally or published) must be in accordance with policies set forth in WSRC management requirements and procedures (MRP 3.25) and in DOE-SR orders, and the content of the external distribution must be limited to that actually approved.

Author's Signature: Steve Hensel   Date: 2/9/00

Approvals by Author's Organization

Derivative Classifier	Classification	Topic
Alex M. Clarkson	Unclassified	

Intended Distribution
- ☐ Unlimited (release to public)
- ☒ Limited (see explanation)

Explanation for Limited Dist.
- ☐ Site Use Only
- ☒ Other DOE facility(ies) only
- ☐ Corporate/University Partner
- ☐ Other ______

I understand and have considered whether any potential intellectual property rights (patents, copyrights, etc., in accordance with MP 1.09 and MRP 1.07) or any contractural barriers (CRADAs, Work for Others, etc.) may be involved before authorizing that this document be proposed for public release. If any concerns were identified, these have been discussed and resolved with General Counsel.

Manager's Name (Print): C. P. HOLDING-SMITH   Manager's Signature: C. P. Holding-Smith   Date: 2/10/00

Classification (Check One for Each)

	S	C	UCNI	U
Overall	☐	☐	☐	☒
Abstract	☐	☐	☐	☒
Title	☐	☐	☐	☒

Classification Guide Topics

WSRC Classification Officer's Name (Print)	WSRC Classification Officer's Signature	Date
T.R. COUGHENOUR CLASSIFICATION ANALYST	T.R. Coughenour	2/14/00

Export Control Related ☐ Yes ☒ No

Export Control Reviewer's Name (Print)	Export Control Reviewer's Signature	Date
T.R. COUGHENOUR CLASSIFICATION ANALYST	T.R. Coughenour	2/14/00

OSTI Subj. Category No.	Routing	Editor/Illustrator/On-line Support	MSD Project No.
	Class/EC/PAD		

NOTE OSR 17-8 must be completed in addition to this form when submitting information for review and approval.

Westinghouse
Savannah River Company

P.O. Box 616
Aiken, SC 29802

MSD-STI-2000-00252

February 14, 2000

Bruce Cadotte,
WSRC Public Relations Officer
Site Information Programs,
Business Development and Public Affairs Division
Building 705-A

Dear Mr. Cadotte:

REQUEST FOR APPROVAL TO RELEASE SCIENTIFIC/TECHNICAL INFORMATION (U)

The attached document is submitted for classification and technical approvals for the purpose of external release. Please complete the WSRC BD&PAD response section of this letter and return the letter to the undersigned by the date listed below. Patent clearance, if necessary, is requested and received via direct communications between this office and the WSRC Patent Attorney. The document has been reviewed for classification by a WSRC classification staff member. Technical questions pertaining to the contents of this document should be addressed to the author or the manager. Questions concerning the processing of this document should be addressed to the WSRC STI Program office at (803) 725-2765.

Pat Domingo for

Julie M. Bean, Manager
WSRC STI Program

Document No. WSRC-TR-98-00420

Document Title Thermal Analysis of the 9975 Package with the 3013 Configuration During Normal Conditions of Transportation

Author S. Hensel

WSRC BD&PAD response due by February 18, 2000

☑ Approved ☐ Approved with Changes ☐ Not Approved

WSRC BD&PAD Remarks

Bruce Cadotte, Public Relations Officer
WSRC

2/14/00
Date

OSR 25-82-W# (4-89)
Stores: 26-15460.00