Westinghouse Electric Company
Nuclear Fuel
Columbia Fuel Site
P.O. Drawer R
Columbia, South Carolina 29250
USA

U. S. Nuclear Regulatory Commission
Attn: Mr. Jose Cuadrado
Project Manager
Spent Fuels Project Office
Office of Nuclear Material Safety and Safeguards
Washington, DC 20555

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Our ref: UAM-NRC-05-012
Your Ref:

Mr. Cuadrado:

September 22, 2005

Subject: CERTIFICATE OF COMPLIANCE NO. 9292 FOR THE MODEL NO. PATRIOT PACKAGE: Submission of Revision 3 to the Safety Analysis Report (SAR)

Attached please find Revision 3 to the Safety Analysis Report (SAR) for the Certificate of Compliance No. 9292, Model No. Patriot shipping package. Revision 3 consists of change pages that allow the inner container of the CE-B1, Certificate of Compliance USA/9272/AF-85, to be transported in a Patriot outer container. This revision to the Patriot Certificate was discussed earlier with your staff in informal discussions. Enclosure 1 contains the proposed change pages to the Patriot SAR.

Both the Patriot and CE-B1 packages belong to the RA- family of BWR shipping packages. Both are USNRC AF-85 licensed packages. The CE-B1 inner container is virtually identical to the Patriot inner container. Enclosure 2 provides a comparison of Section 6, the criticality analyses, of the two SARs. It can be seen that the analyses use identical assumptions, models, and draw the same conclusions. It follows than that the new Section 6A for the Patriot can be applied to the CE-B1 inner container.

Enclosure 3 offers proposed wording for the revised Patriot Certificate of Compliance.

It is requested that this revised certificate be issued prior to November 30, 2005 to support BWR fuel shipments that will be begin in December 2005. Both inner containers are needed for this shipment. Please direct any questions to me at (803) 647-3552 or via email.

Sincerely,
WESTINGHOUSE ELECTRIC COMPANY, LLC

Norman A. Kent
Manager Transport Licensing and Regulatory Compliance
Nuclear Material Supply

Enclosures:
1. Revision 3 Change pages
2. Comparison of Section 6
3. Proposed Wording for USA/9292/AF-85

Enclosure 1: Patriot SAR Revision 3 Change Pages

List of Effective Pages

Page iii page 1A-1 changed to Revision 3

Section 1

Page 1A-1: Revised sentence describing the license drawings to include drawing #10015E58, Optional Patriot Inner Container. This drawing is identical to License drawing #L-9272-01 from the CE-B1 SAR.

Added new License Drawing 10015E58, Optional Patriot Inner Container.

Westinghouse Electric Company, LLC
Columbia Fuel Fabrication Plant
Columbia, SC

Application for Certificate of Compliance for the Patriot BWR Fuel Shipping Package

NRC Certificate of Compliance

USA/9292/AF-85

Docket 71-9292

Initial Submittal:	September 2004
Revision 1:	April 2005
Revision 2:	June 2005
Revision 3:	September 2005

Westinghouse Electric Company LLC
Nuclear Fuel
4350 Northern Pike
Monroeville, PA 15146

Westinghouse

i	0	2-33	0	6-29	0	6A-4	0
ii	0	2-34	0	6-30	0	6A-6	2
iii	3			6-31	0	6A-7	1
		3-1	0	6-32	0	6A-8	1
1-1	0	3-2	0	6-33	0	6A-9	2
1-2	2	3-3	0	6-34	0	6A-10	0
1-3	1	3-4	0	6-35	0	6A-11	0
1A-1	3			6-36	0	6A-12	1
1B-1	0			6-37	0	6A-13	1
1B-2	0			6-38	0	6A-14	0
		4-1	0	6-39	0	6A-15	0
2-1	0			6-40	0	6A-16	0
2-2	0	5-1	0	6-41	0	6A-17	0
2-3	0			6-42	0	6A-18	0
2-4	0			6-43	0	6A-19	0
2-5	0	6-1	0	6-44	0	6A-20	0
2-6	0	6-2	0	6-45	0	6A-21	0
2-7	0	6-3	0	6-46	0	6A-22	0
2-8	0	6-4	0	6-47	0	6A-23	0
2-9	0	6-5	0	6-48	0	6A-24	1
2-10	0	6-6	0	6-49	0	6A-25	0
2-11	0	6-7	0	6-50	0	6A-26	0
2-12	0	6-8	0	6-51	0	6A-27	0
2-13	0	6-9	0	6-52	0	6A-28	0
2-14	0	6-10	0	6-53	0	6A-29	0
2-15	0	6-11	0	6-54	0	6A-30	0
2-16	0	6-12	0	6-55	0	6A-31	0
2-17	0	6-13	0	6-56	0	6A-32	0
2-18	0	6-14	0	6-57	0	6A-33	0
2-19	0	6-15	0	6-58	0	6A-34	2
2-20	0	6-16	0	6-59	0	6A-35	1
2-21	0	6-17	0	6-60	0		
2-22	0	6-18	0	6-61	0	7-1	0
2-23	0	6-19	0	6-62	0	7-2	0
2-24	0	6-20	0	6-63	0	7-3	0
2-25	0	6-21	0	6-64	0		
2-26	0	6-22	0	6-65	0	8-1	0
2-27	0	6-23	0	6-66	0	8-2	0
2-28	0	6-24	0	6-67	0	8-3	0
2-29	0	6-25	0				
2-30	0	6-26	0	6A-1	0		
2-31	0	6-27	0	6A-2	0		
2-32	0	6-28	0	6A-3	0		

APPENDIX 1A LICENSING DRAWINGS

Dimensional details of both the PATRIOT outer and inner packages are described in the Westinghouse licensing drawings 10014E27, 1001E58, and 10014E28, which follow.

The drawings depict those features and dimensions which are pertinent to the safe performance of the shipping package transportation function. Certain non-safety related features are shown, where necessary for clarity but are either designated as non-safety or as an optional package feature. All non-safety related features are not necessarily shown on the licensing drawings.

TOLERANCES

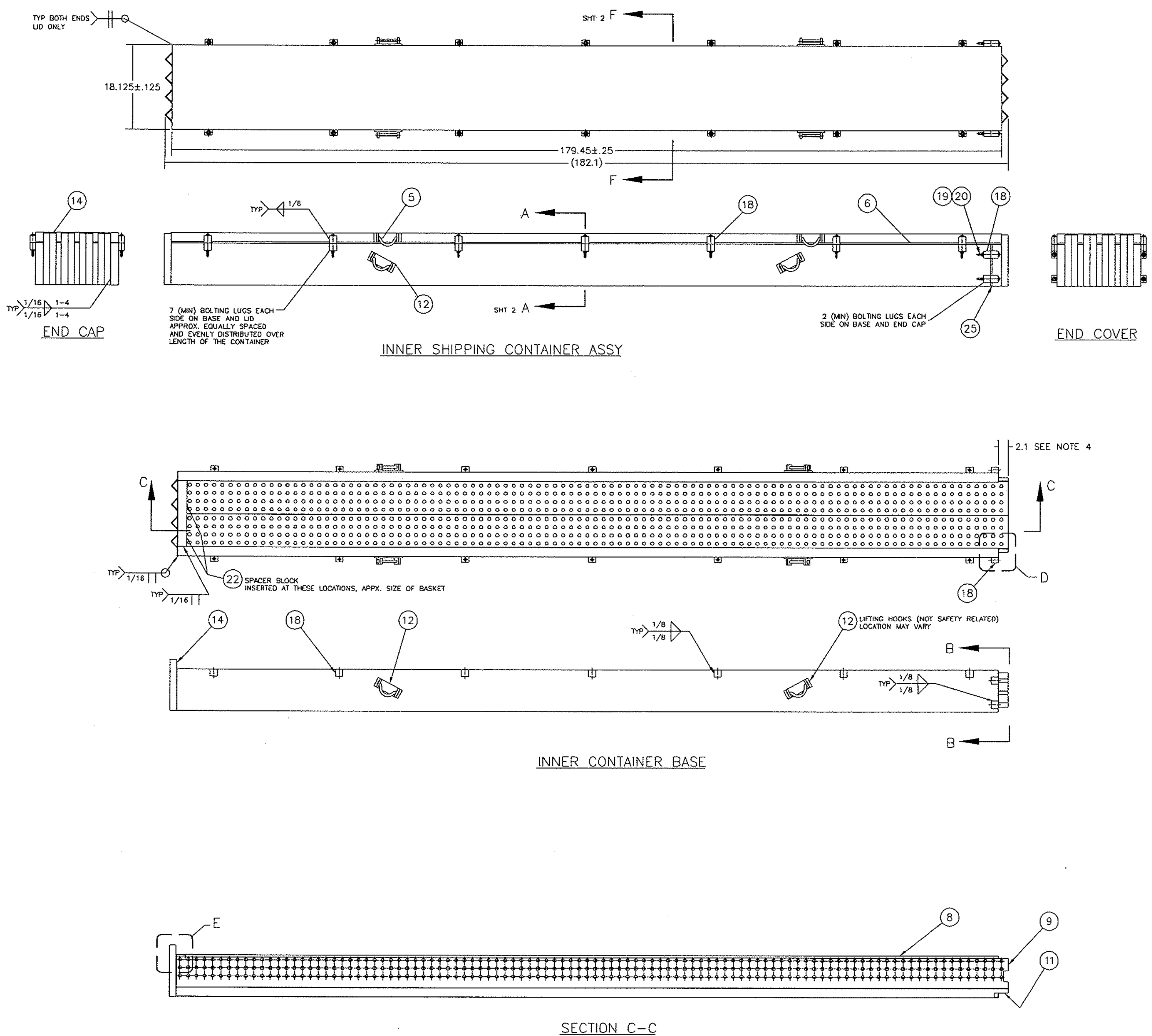
UNLESS OTHERWISE SPECIFIED

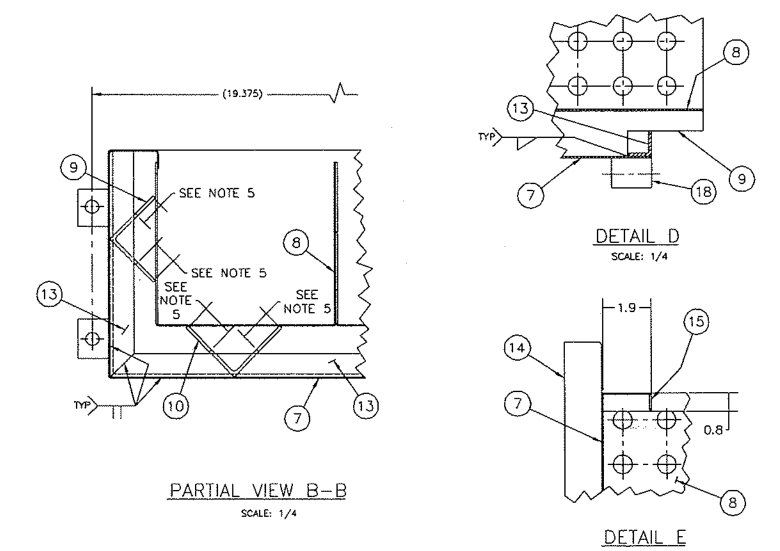
ONE PLACE DECIMAL	±. 1
TWO PLACE DECIMAL	±. 02
THREE PLACE DECIMAL	±. 005

BILL OF MATERIAL

(← IDENT CLASS; ← GROUP NOTE)

REQ'D. 02	REQ'D. 01	ITEM	NOTE	IDENT	PART NAME	(SIZE) REFERENCE INFORMATION	MATL SIZE CODE PART NUMBER OR REF DWG
		1	S		IC-LID SHELL	16 GA MIN	C-STEEL
		2	S		IC-LID LINER	16 GA MIN	C-STEEL
		3	S		IC-LID SUPPORT ANGLE	2.5 x 2.5 x .125	C-STEEL
		4			IC-LID PADDING	1" THK OPTIONAL	ETHAFOAM OR EQUIV.
		5			IC-LID LIFTING HOOKS		STEEL
		6			IC-LID GASKET		RUBBER
		7	S		IC-BASE SHELL	16 GA MIN	C-STEEL
		8	S		IC-BASE BASKET	16 GA	C-STEEL
		9	S		IC-BASE ANGLE (SIDE)	2.5 x 2.5 x .125	STEEL
		10	S		IC-BASE ANGLE (BOTTOM)	2.8 x 2.8 x .125	STEEL
		11			IC-BASKET PADDING	OPTIONAL	ETHAFOAM OR EQUIV.
		12			IC-BASE LIFTING HOOKS	OPTIONAL	STEEL
		13	S		IC-BASE UPPER END FLANGE	1 x 1 x .125	C-STEEL
		14	S		IC-BASE END ANGLES	2 x 2 x .125	C-STEEL
		15	S		END CAP OUTER SHELL	16 GA MIN	C-STEEL
		16	S		END CAP FLANGE	1 x 1 x .125	C-STEEL
		17	S		END CAP ANGLES	2 x 2 x .125	C-STEEL
		18	S		IC-BOLTING LUGS	SEE NOTE 1	C-STEEL
		19	S		IC-BOLT	SEE NOTE 2	MILD STEEL OR STRONGER
		20	S		IC-NUT	3/8 DIA MIN	MILD STEEL OR STRONGER
		21			IC-PRESSURE VACUUM RELIEF VALVE		
		22			IC- SPACER BLOCK		WOOD/PLASTIC/METAL
		23			IC-PRODUCT POSITIONING PADS	OPTIONAL	RUBBER
		24			IC-SPACER BLOCK PAD	OPTIONAL	
		25			END CAP GASKET		RUBBER





NOTES:

1. BOLT LUGS 1.56 x 1.19 x 1.56 W/ 0.53ø HOLE THRU APPROXIMATE CENTER.
2. BOLT DIA 3/8 MIN. LENGTH SUFFICIENT TO FULLY ENGAGE NUT.
3. LID AND END CAP FASTENERS SHALL BE AT LEAST WRENCH TIGHT DURING TRANSPORT WHEN THE CONTAINERS CONTAIN SPECIAL NUCLEAR MATERIAL.
4. MINIMUMS PROVIDED ARE AN AVERAGE OF SEVERAL MEASUREMENTS OVER THE LENGTH OF THE CONTAINER. LOCAL MEASUREMENTS MAY BE LESS THAN THE STATED VALUE.
5. ITEMS 9 AND 10 ARE SLOTTED AS NECESSARY TO ACCOMMODATE FLANGE AT END OF BASE.
6. WASHERS ARE OPTIONAL.
7. CRACKED OR DAMAGED WELDS SHALL BE REPAIRED. WELD REPAIRS MAY BE PERFORMED IN ACCORDANCE WITH AWS D1.1 AND/OR ASME SECT IX.
8. MAXIMUM WEIGHT OF SHIPPED FUEL: 592 LBS/BUNDLE, 1184 LBS TOTAL.

S. SAFETY RELATED ITEM.

SEE PRODUCT SPECIFICATION PDINF000 FOR SUPPLEMENTAL PRODUCT INFORMATION

SD	752331
D	0000080-0
IT	CHANGE

DWG REF / NEXT ASSY / THIRD ANGLE PROJECTION

DFTN	CANTRELL	8/31/05
CHKD	N. PRESTO	8/31/05
DES ENG	B. HEMPY	8/15/05
MFG ENG	S. PALMER	8/22/05
PA ENG	T. BROWN	8/19/05
DES ENG MGR	H. DYE	8/22/05
APPD	N. KENT	8/16/05
APPD	G. SUMMERS	8/17/05
APPD	J. HALLIGAN	8/18/05

Westinghouse ELECTRIC COMPANY LLC - NUCLEAR FUEL COLUMBIA, SC USA

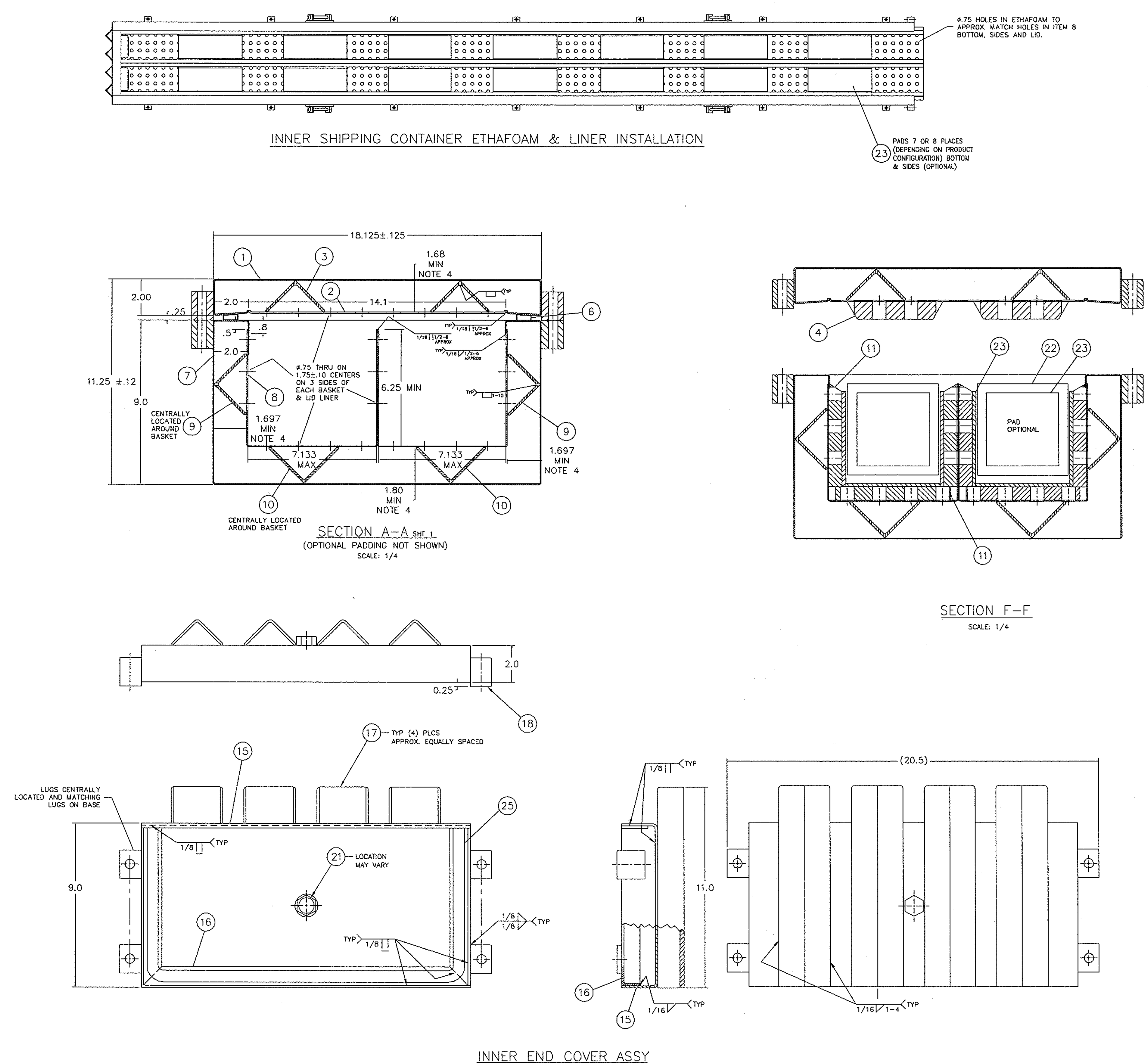
OPTIONAL PATRIOT BWR INNER SHIPPING PACKAGE AND SAFETY ITEMS

SIZE | FSCM NO | DWG NO 10015E58 | REV 01

SCALE | WEIGHT(LBS) | SHEET 1 OF 2 SHEETS

DIMENSIONS IN INCHES

CADAM DRAWING DO NOT REVISE MANUALLY



SEE PRODUCT SPECIFICATION PDINF000 FOR SUPPLEMENTAL PRODUCT INFORMATION

THIRD ANGLE PROJECTION

IT	CHANGE
SO	752331
D	0000080-0

DFTM	CANTRELL	8/31/05
CHKD	N. PRESTO	8/31/05
DES ENG	B. HEMPY	8/15/05
MFG ENG	S. PALMER	8/22/05
PA ENG	T. BROWN	8/19/05
DES ENG MGR	M. DYE	8/22/05
APPD	N. KENT	8/16/05
APPD	G. SUMMERS	8/17/05
APPD	J. HALLIGAN	8/18/05

Westinghouse ELECTRIC COMPANY LLC - NUCLEAR FUEL COLUMBIA, SC USA

OPTIONAL PATRIOT BWR INNER SHIPPING PACKAGE AND SAFETY ITEMS

DWG NO 10015E58 REV 01

SHEET 2 OF 2 SHEETS

DIMENSIONS IN INCHES

CADAM DRAWING DO NOT REVISE MANUALLY

Enclosure 2: Comparison of Section 6 from the Patriot and CE-B1 SARs

This enclosure contains a section-by-section comparison of section 6 of the two SARs. It can be seen that the inner container criticality analysis is used in both.

6.0 CRITICALITY SAFETY EVALUATION

- Sections are identical.
  - 52 packages
  - 104 fuel bundles
  - 10x10 fuel assemblies: TI=1.0

6.1 Discussion and Results

- Sections are identical with the exception of dimensions. See below.

- The criticality safety evaluations of both address use of the packages package for the same three fuel package loadings employing a 10 x 10 fuel rod assembly design.

- The safety demonstration is based on the use of lower tolerance values of the exterior dimensions of the inner shipping container as well as for the thicknesses of the bottom, top, and side annulus regions created by the angle iron brackets.

- Dimensional data on the Patriot and CE-B1 are given below:

	Length (inches)	Width (inches)	Height (inches)
Outer Package			
Outside Dimensions			
Patriot	207.75	30.25	31.25
CE-B1	208.50	33.50	34.75
Inside Dimensions			
Patriot	187.00	25.75	24.00
CE-B1	187.00	28.50	26.125
Inner Package			
Outside Dimensions			
Patriot	182.00	18.125	11.25
CE-B1	182.00	18.125	11.25

- Criticality analyses are virtually identical for both normal and hypothetical accident transportation conditions.
  - For normal transportation conditions, reactivity assessments are based on an infinite array of intact shipping packages consisting of both the inner and outer containers. The fuel assemblies are nearly centered within the baskets of each inner package using ethafoam spacer blocks and rubber spacer pads; the inner container is, in turn, positioned within the outer package by ethafoam and honeycomb spacer blocks.

  - For the accident conditions, the outer package and the inner container gasketing material are both assumed to be absent. An array of 104 inner packages is assumed to be configured in a fully reflected, contiguous cubical array (8 x 13 x 1). The accident analyses assume both baskets of each inner package contain a fuel rod assembly; packaging configurations include both normal packaging conditions as well as a postulated loss of the ethafoam and rubber packaging materials. The accident analyses consider the presence of the poly inserts between fuel rods as in the normal packaging conditions.

  - The analysis in both SARs included examination of the worth of the plastic inserts during events involving a postulated loss of rubber and ethafoam packaging materials and concluded the system was more reactive when the plastic inserts were present. Consequently, this latter condition was assumed for all accident analyses presented herein.

  - The analyses of both also examined the effects of enrichment zoning and Urania pellet diameters versus Gadolinia-Urania fuel rod patterns; again these analyses showed no significant effects. Since the fuel assembly component dimensions are unchanged from the prior analyses, these effects were not re-examined in these analyses.

- Summaries of conclusions of both analyses are identical:

- Conclusions are identical:

6.2 Package Fuel Loadings

6.2.1 General

- Unchanneled fuel
- PARAGRAPH NOT IN CE-B1 SAR - Each fuel bundle will be unsheathed or enclosed in an unsealed, polyethylene sheath which will not extend beyond the ends of the fuel assembly. The ends of the sheath, if present, will not be folded or taped in any manner

that would prevent the flow of liquids into, or out of, the sheathed fuel assembly. The presence of an open-ended sheath, which ensures uniform draining during hypothetical accident conditions, is bounded by the range of moisture conditions analyzed.

- LAST SENTENCE OF PARAGRAPH NOT IN CE-B1 SAR - The total quantity of the polyethylene shims will not exceed 18.33 g polyethylene per centimeter length of the fuel assembly, and will not exceed a total of 6.99 kg per fuel assembly.

6.2.2 Individual Fuel Package Loading Criteria

- Fuel package loading sets #1, #2, and #3 are identical

6.3 Model Specification

6.3.1 Description of Calculational Model

- Descriptions are identical

Configuration (1)

- Identical

Configuration (2)

- Identical

Configuration (3)

- Identical

Configuration (4)

- Identical

Configuration (5)

- Identical

Configuration (6)

- Identical

6.3.1.1 Normal Transportation Mode

- Identical

6.3.1.2 Accident Transportation Mode

- Identical

6.3.2 Package Regional Densities

- Figure 6-31 in the Patriot SAR is the same as Figure 6-24 in the CE-B1 SAR.

6.4 Analysis Results

6.4.1 Normal Transportation Mode

- Identical

6.4.1.1 Normal Transportation Mode -Dry Condition

- Identical

6.4.1.2 Normal Transportation Mode -Damp Condition

- Identical

6.4.2 Accident Transportation Mode

- Identical

6.4.2.1 Fuel Package Loading 1

- Identical

6.4.2.2 Fuel Package Loading Set 2

- Identical

6.4.2.3 Fuel Package Loading Set 3

- Identical

6.4.3 Enrichment Zoning and Pellet Diameter Effects

- Identical

6.4.4 NOT IN CE-B1 SAR.

6.4.4 Evaluation of Changes in Assembly Rod Pitch

Accident transportation mode analyses were carried out for fuel package loading set 2, fuel assembly configuration (6) and shim pattern X, to explore the effects of changes in rod pitch, changes in row spacing, and changes to individual sub-bundle assemblies. The purpose for this evaluation is to demonstrate, that based on the results of the hypothetical accident tests performed in accordance with 10 CFR 71.73, the reactivity of the fuel within the shipping package as well as the analyzed array of shipping packages remains subcritical.

The evaluation focused on determining the change in reactivity of the array, relative to a base value, that is associated with systematic changes in the rod pitch within an assembly. As mentioned above, the base value was chosen as the most adverse case outlined in Section

6.4.2.2, i.e., Fuel Loading 2, Assembly configuration (6) with shim pattern X. This orientation resulted in a maximum unbiased effective multiplication factor of 0.91946 + 0.00143 with a 3% interstitial moisture density. Using this value as a basis the following series of geometric perturbations were examined.

The third and fourth cases shown in Figure 6.25 and 6.26 are more representative of the actual damage sustained in the first of the two accident test sequences performed. The rods on the corners of the assembly compressed against the adjacent rods and remained that way due to permanent deformation of the spacer grids. In both Figure 6.25 and Figure 6.26, the vertical pitch of the rods remained unchanged from the normal dimension, and the rods were compressed radially. The case shown in Figure 6.25 has only compression of the corner pins in the top and bottom two rows within the assembly. The reactivity of this configuration decreased 0.4% relative to the base value. The case shown in Figure 6.26 has a greater degree of radial compression and results in a decrease of 1.6% in reactivity. These calculations demonstrate that a reduction in rod pitch results in a decrease in reactivity.

The fifth case was run to determine the cumulative effect of both an increase in pitch between rows vertically, and a decrease radially in rod pitch within each row. As shown in Figure 6.27 the vertical pitch of each row was increased from the base case by 0.20 cm while the rods in each row were compressed to simulate a radial geometry. The result was a net decrease in reactivity of 0.48%. Therefore it can be concluded that the decrease in reactivity due to the compressed rod regions is greater than the increase in reactivity associated with the increase in separation of rods, and that the asymmetry of the assembly results in a net decrease in reactivity.

The final two cases involve uniform compression of the rods in the horizontal direction, and spreading of the rods in the vertical direction. These configurations are shown graphically in Figure 6.28 and 6.29. The configuration in 6.28 shows the horizontal compression of the left two sub-bundles and vertical expansion of all rows by 0.2 cm. Figure 6.29 shows a uniform horizontal compression of all four sub-bundles along with the same vertical expansion. Both cases resulted in a net decrease in reactivity of 0.1% and 1.0% respectively.

In summary, as demonstrated by the calculations performed in this section, that asymmetric rod orientations within the assembly consistent with those associated with the hypothetical accident tests results provide a net decrease in reactivity.

6.5 Validation of Calculational Methods and Bias Evaluation

6.5.1 Benchmark Experiments

- Identical

6.5.2 Calculational Bias Evaluation

- Identical

6.5.3 Evaluation of K95/95 Values

- Identical
- Figure 6-30 in the Patriot SAR is Figure 6-23 in the CE-B1 SAR

Tables

- Table 6.1 Identical
- Table 6.2 Identical
- Table 6.3 Identical
- Table 6.4 Identical
- Table 6.5 Identical
- Table 6.6 Identical
- Table 6.7 Identical
- Table 6.8 Identical

Figures

- Figure 6.1 Identical
- Figure 6.2 Identical
- Figure 6.3 Identical
- Figure 6.4 Identical
- Figure 6.5 Identical
- Figure 6.6 Identical
- Figure 6.7 Identical
- Figure 6.8 Identical
- Figure 6.9 Identical
- Figure 6.10 Identical
- Figure 6.11 Identical
- Figure 6.12 Identical
- Figure 6.13 Identical
- Figure 6.14 Identical
- Figure 6.15 Identical
- Figure 6.16 Identical
- Figure 6.17 Identical
- Figure 6.18 Identical
- Figure 6.19 Identical
- Figure 6.20 Identical
- Figure 6.21 Identical
- Figure 6.22 Identical
- Figure 6.23 Not in CE-B1 SAR. Referenced in Section 6.4.4
- Figure 6.24 Not in CE-B1 SAR. Referenced in Section 6.4.4
- Figure 6.25 Not in CE-B1 SAR. Referenced in Section 6.4.4
- Figure 6.26 Not in CE-B1 SAR. Referenced in Section 6.4.4
- Figure 6.27 Not in CE-B1 SAR. Referenced in Section 6.4.4
- Figure 6.28 Not in CE-B1 SAR. Referenced in Section 6.4.4
- Figure 6.29 Not in CE-B1 SAR. Referenced in Section 6.4.4
- Figure 6.30 Same as Figure 6-23 in CE-B1 SAR
- Figure 6.31 Same as Figure 6-24 in CE-B1 SAR

Enclosure 3: Proposed Wording for Patriot Certificate of Compliance

This enclosure provides a comparison of the Patriot and CE-B1 Certificates of Compliance in order to demonstrate that including the CE-B1 inner container as an optional inner container for the Patriot is justified.

5. (a) (1) (2) Description

The first sentence of the second paragraph reads:

> The metal inner container is approximately 11¼ inches high by $18^{1}/_{8}$ inches wide by 179¾ inches long.

Recommend revising to read:

> The metal inner container is approximately 11¼ inches high by $18^{1}/_{8}$ inches wide by between 179¾ and 182 inches long.

5. (a) (1) (3) Drawings

Add the following line:

> 10015E58, Sheets 1 and 2, Rev. 1