



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Crocker
W. K. ...
...

JUN 11 1970

Agp

DML:CEM
70-337
SNM-338, Amendment No. 71-34 ✓

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-34 to Special Nuclear Material License No. SNM-338 authorizing the delivery of special nuclear material to a carrier for transport in the RCC, RCC-1, and RCC-2 packages.

Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT.

Sincerely,

Original Signed by
Donald A. Nussbaumer

Donald A. Nussbaumer, Chief
Fuel Fabrication and
Transportation Branch
Division of Materials Licensing

Enclosure:
As stated

cc: Mr. William A. Brobst
Department of Transportation

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- Division Reading File, w/o encl.

ITEM #

74 I

0/74

(21)

COPY

UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

LICENSEE	
1. Name: Westinghouse Electric Corporation	3. License No. SNM- <u>338</u>
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania	Amendment No. <u>71-34</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging
- (1) Model number RCC, RCC-1, and RCC-2
 - (2) Description Steel fuel element cradle assembly consisting of a strongback and adjustable fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts. Neutron absorber plates are required for the contents.
 - (3) Drawings Containers constructed in accordance with Westinghouse Electric Corporation Drawings EDSK319401F, EDSK319042F, EDSK323133B, 684J580 for the RCC, 541F351, 684J861, 684J898 for the RCC-1, and 684J963, 541F614 and EDSK323133B for the RCC-2.

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PAGE NO: 2

LICENSE NO: SNM-338

AMENDMENT NO: 71-34

DOCKET NO: 70-337

(b) Contents

(1) Type and form of material

Mixed PuO₂ in natural UO₂ as pressed sintered pellets fully clad in leak-tight zircaloy of minimum 0.018" thickness as fuel rods which are assembled into fuel elements. Two (2) neutron absorber plates consisting of 0.9" thick, full length stainless steel containing 1.3% minimum boron or 0.19" thick, full length OFHC copper are required between fuel elements of the following specifications:

Type	14 x 14
Pellet diameter (Nom)	0.367"
Rod diameter (Nom)	0.429"
Maximum Fuel Length	120"
Maximum Rods/element	180
Maximum Cross Section (Nom)	7.8" sq.
Maximum Pu/element	14.5 kgs.
Maximum Pu fissile/element	3.31 w/o

- (2) Maximum quantity of material per package Two fuel elements containing not more than 29 kilograms plutonium.

(c) Fissile Class II and III

- (1) Minimum transport index to be shown on label for Class II 1.5
- (2) Maximum number of packages per shipment for Class III 60

6. Pursuant to Title 10, Code of Federal Regulations, Part 70, Special Nuclear Material. License No. SNM-338 is hereby amended to authorize the use of the Model RCC, RCC-1 and RCC-2 packages under the general license provisions of Paragraph 71.7(b) of 10 CFR 71.

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LICENSEE: Westinghouse Electric Corporation

PAGE NO: 3

LICENSE NO: SNM-338

AMENDMENT NO: 71-34

DOCKET NO: 70-337

REFERENCES

Licensee's application dated March 13, 1970, requesting approval to deliver special nuclear material to a carrier for transport in the above packages.

Supplements dated March 19, and May 22, 1970.

FOR THE ATOMIC ENERGY COMMISSION

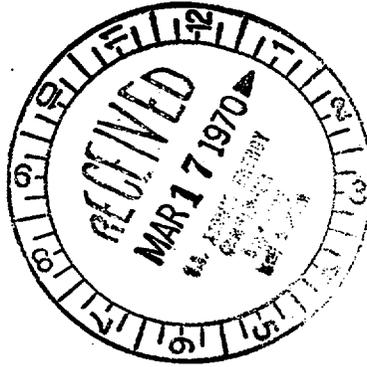
Date of Amendment JUN 11 1970

Original Signed by
Donald A. Nussbaumer

Donald A. Nussbaumer
Division of Materials Licensing

COPY

Westinghouse Electric Corporation



Gateway Center
Box 2278
Pittsburgh Pennsylvania 15230

Craker
WHS
10/12

March 13, 1970

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

HBO

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338,
Docket 70-337, to Authorize Use of NFD Shipping
Packages For Div of Compliance

Gentlemen:

The Westinghouse Electric Corporation hereby requests amendment of the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packaging described in the attachment to this letter.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

KRS:sw

Attachment: License Amendment
7 copies transmitted

I

DOCKET NO. 70-337

For Div of Compliance

Received w/Ltr Dated 3-13-70

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder labelled "Application for Amendment of License SNM-338 for NFD Shipping Package" immediately in front of the transmittal letter dated 2/18/70.

Revised pages 4, 7.2 and 53 should be inserted and the old pages removed.

New pages 54 and 55 should be inserted immediately following page 53. New Appendix P should be inserted immediately following Drawing C5650D55 which constitutes Appendix N.

The removed pages may be filed in the back of the binder.

Revision No. 21

3/13/70

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REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
19	5/28/69	51 to 53	Added Section 20, the RCC Fuel Rod Shipping Package
19	5/28/69	Appendix N	Added
20		10	Added OFHC copper as poison material.
20	2/18/70	11	Changed " ≤ 0.90 " to "obviously less than the 0.98 values.... (MCA) situation."
20	2/18/70	13	Changed " ≤ 0.90 " to "obviously < 0.98 ."
20	2/18/70	Appendix A & K	Deleted k_{eff} (Max/ass'y) and k_{eff} (Max/pkg). Added fuel assembly descriptions requiring OFHC copper poison plates.
21	3/13/70	4	Added Section 21.
21	3/13/70	53 - 55	Added Section 21, the Mixed Oxide Fuel Shipping Package
21	3/13/70	Appendix P	Added

20.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit and Procedural Controls presented in Section 16.4, will apply directly to this package.

21. Mixed Oxide Fuel Shipping Package

21.1 Packaging Description

The RCC, RCC-1 or RCC-2 Packagings described in Sections 4.1, 16.1 and/or 19.1 will be used.

21.2 Contents Description

Radioactivity - 200,000 curies, maximum

Identification of SNM - The SNM will be plutonium at several weight percentages (not to exceed 3.9 w/o) in natural uranium.

Form of SNM - The SNM will be in the form of mixed plutonium oxide, natural uranium oxide which has been pressed and sintered into pellets, clad in Zircaloy as fuel rods and assembled into clad fuel assemblies. Tests have established that the clad fuel rods meet the criteria for special form material. Specific data on maximum assembly parameters are:

Pellet Material	PuO ₂ , UO ₂
Highest w/o Pu (Nom.)	3.31 w/o Fissile
Diameter (Nom.)	.367"
Rod Cladding Material	Zircaloy
Diameter (Nom.)	.429"
Fuel Lgth. (Nom.)	120"
Assy. No. of Rods (Max)	180
Pattern (Basic)	14 X 14 sq.
Lattice Pitch (Nom.)	.556"
Outside Dimen. (Nom.)	7.8" sq.

(See Appendix P for enrichment pattern)

21.2 (continued)

Total Pu (Max/pkg.)	29 kg
k_{eff} (Max/MCA)	0.97
Poison Pl. Req'd	OFHC Copper
Net Wt. (Max.)	2500#

The descriptions and discussions contained in Sections 4.2, 16.2 and/or 19.2 will be directly applicable if references to Appendix A and Appendix K are superseded by the specific data in this Section.

21.3 Compliance with Subpart C of 10CFR71

The descriptions and discussions contained in Sections 4.3, 16.3 and 19.3 will be directly applicable, provided that:

- (1) The references to Appendix A and Appendix K are superseded by the specific data in this Section.
- (2) The reference to the nuclear criticality safety of unmoderated uranium enriched ≤ 5 w/o is superseded by the statement that LEOPARD, PDQ-03 calculations have established that an infinite lattice of mixed oxide fuel assemblies as described in Section 21.2 will have $k_{\infty} < 1$ in the unmoderated condition. Therefore, any number of unmoderated packages will be nuclearly safe.
- (3) Any special requirements applicable to the package due to the presence of a large quantity of activity will be waived, based on the high degree of strength demonstrated by the fuel rods, and the massive protection afforded by the strongback, and shock suspension structure.

21.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit and the Procedural Controls presented in Sections 4.4, 4.5, 4.6, 16.4 and/or 19.4, as appropriate, will apply directly to this package.

Westinghouse Electric Corporation



DOCKET NO.

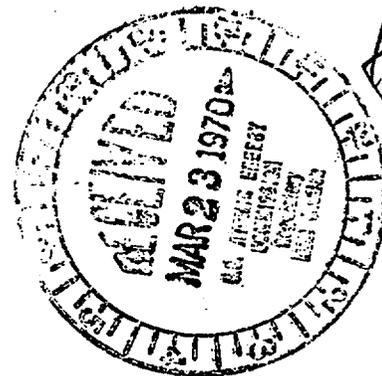
Gateway Center
Box 2278
Pittsburgh Pennsylvania 15230

Crocker
W. H. ...
70-337
W. H. ...

March 19, 1970

For Div. of Compliance

SN



U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Charles MacDonald

Gentlemen:

Enclosed are 7 copies of Appendix P which were omitted from the attachment to our letter to the AEC dated March 13, 1970 regarding an amendment of License SNM-338, Docket 70-337, to authorize use of NFD shipping Packages.

I am sorry if this omission has caused you any inconvenience.

Very truly yours,

Karl R. Schendel

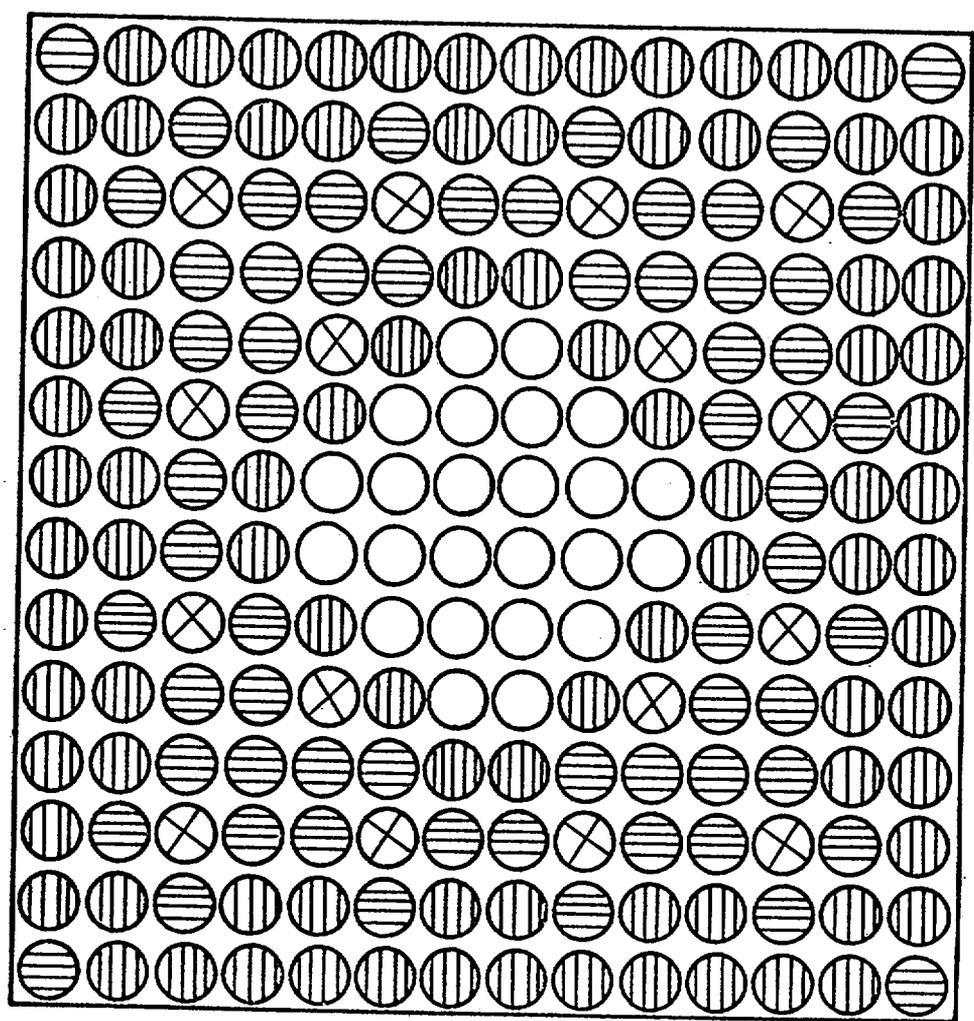
Karl R. Schendel
License Administrator

/sw

Encs.

H

APPENDIX P



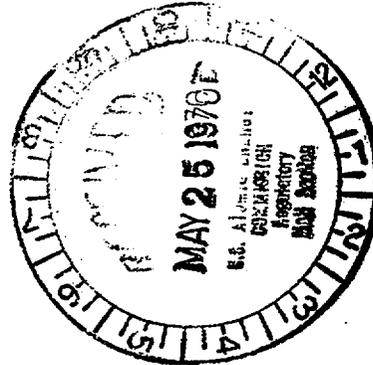
- 3.31 W/O FISSILE PU FUEL ROD
- ▨ 3.10 W/O FISSILE PU FUEL ROD
- ▩ 2.84 W/O FISSILE PU FUEL ROD
- ⊗ RCC GUIDE TUBE

Typical Enrichment Pattern
for Mixed Oxide Assemblies

Westinghouse Electric Corporation



Have Crater
with W&B
W&B



Gateway Center
Box 2278
Pittsburgh Pennsylvania 15230

May 22, 1970

HQ

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338,
Docket 70-337, to Authorize Use of NFD Shipping
Packages For Div. of Compliance

Gentlemen:

The Westinghouse Electric Corporation hereby requests amendment of the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packaging described in our transmittal dated March 13, 1970, as revised in the attachment to this letter.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

KRS: sw

Attachment: License Amendment
7 copies transmitted

4

1589

DOCKET NO. 70-337

For Div of Compliance

Received w/Ltr Dated

5-22-70

SNM-338

Shipping - NFD

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder labelled "Application for Amendment of License SNM-338 for NFD Shipping Package" immediately in front of the transmittal letter dated 3/13/70.

Revised pages 7.2, 53, 54 and 55 should be inserted and the old pages removed.

The new pages of Appendix P should be inserted immediately following the Enrichment Pattern drawing that now constitutes Appendix P.

The removed pages may be filed in the back of the binder.

Revision No. 22

5/22/70

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
19	5/28/69	51 to 53	Added Section 20, the RCC Fuel Rod Shipping Package
19	5/28/69	Appendix N	Added
20		10	Added OFHC copper as poison material.
20	2/18/70	11	Changed " ≤ 0.90 " to "obviously less than the 0.98 values.... (MCA) situation."
20	2/18/70	13	Changed " ≤ 0.90 " to "obviously < 0.98 ."
20	2/18/70	Appendix A & K	Deleted k_{eff} (Max/ass'y) and k_{eff} (Max/pkg). Added fuel assembly descriptions requiring OFHC copper poison plates.
21	3/13/70	4	Added Section 21.
21	3/13/70	53 - 55	Added Section 21, the Mixed Oxide Fuel Shipping Package
21	3/13/70	Appendix P	Added
22	5/22/70	53	Added Rod Cladding Thick. (Min.)
22	5/22/70	54	Revised to specify compliance with 10CFR71.32.
22	5/22/70	55	Retyped.
22	5/22/70	Appendix P	Added computations.

20.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit and Procedural Controls presented in Section 16.4, will apply directly to this package.

21. Mixed Oxide Fuel Shipping Package

21.1 Packaging Description

The RCC, RCC-1 or RCC-2 Packagings described in Sections 4.1, 16.1 and/or 19.1 will be used.

21.2 Contents Description

Radioactivity - 200,000 curies, maximum

Identification of SNM - The SNM will be plutonium at several weight percentages (not to exceed 3.9 w/o) in natural uranium.

Form of SNM - The SNM will be in the form of mixed plutonium oxide, natural uranium oxide which has been pressed and sintered into pellets, clad in Zircaloy as fuel rods and assembled into clad fuel assemblies. Tests have established that the clad fuel rods meet the criteria for special form material. Specific data on maximum assembly parameters are:

Pellet Material	PuO ₂ , UO ₂
Highest w/o Pu (Nom.)	3.31 w/o Fissile
Diameter (Nom.)	.367"
Rod Cladding Material	Zircaloy
Diameter (Nom.)	.429"
Fuel Lgth. (Nom.)	120"
Cladding Thick. (Min.)	0.018"
Assy. No. of Rods (Max)	180
Pattern (Basic)	14 X 14 sq.
Lattice Pitch (Nom.)	.556"
Outside Dimen. (Nom.)	7.8" sq.

(See Appendix P for enrichment pattern)

21.2 (continued)

Total Pu (Max/pkg.)	29 kg
k_{eff} (Max/MCA)	0.97
Poison Pl. Req'd	OFHC Copper
Net Wt. (Max.)	2500#

The descriptions and discussions contained in Sections 4.2, 16.2 and/or 19.2 will be directly applicable if references to Appendix A and Appendix K are superseded by the specific data in this Section.

21.3 Compliance with Subpart C of 10CFR71

The descriptions and discussions contained in Sections 4.3, 16.3 and 19.3 will be directly applicable, provided that:

- (1) The references to Appendix A and Appendix K are superseded by the specific data in this Section.
- (2) The reference to the nuclear criticality safety of unmoderated uranium enriched ≤ 5 w/o is superseded by the statement that LEOPARD, PDQ-03 calculations have established that an infinite lattice of mixed oxide fuel assemblies as described in Section 21.2 will have $k_{\infty} < 1$ in the unmoderated condition. Therefore, any number of unmoderated packages will be nuclearly safe.

The requirements of § 71.32 are readily fulfilled by this package. Calculations of the stresses which would occur in the packaging shell result in a computed maximum stress of $\sim 7,250$ psi for a 36,000 lb (5 X 7200 lb) uniformly

21.3 (continued)

distributed load. This is well below the accepted yield strength value of even a mild steel, and the maximum stress value is conservative since it does not consider the effects of the rest of the packaging structure, such as the very rigid support members that carry the shock mounts. Basic computations are supplied in Appendix P.

With regard to pressure resistance the package loading is restricted to fuel assemblies. Regarding each fuel rod as the containment vessel for the fuel pellets within it, each containment vessel is designed to withstand, without failure, an external pressure of 2250 psi at elevated temperatures. The 25 psi external pressure criteria is very conservatively less than these design working parameters.

21.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit and the Procedural Controls presented in Sections 4.4, 4.5, 4.6, 16.4 and/or 19.4, as appropriate, will apply directly to this package.

WESTINGHOUSE ELECTRIC CORPORATION

CALCULATIONS FOR LICENSING

REF. ¹ AEC RULES AND REGULATIONS PART 71, PACKAGING
OF RADIOACTIVE MATERIAL FOR TRANSPORT p 207, 71.32
² and,
ORNL-NSIC-68 CASK DESIGNERS GUIDE p 92-3

From ref. 2 we have ---

2.12 When regarded as a simple beam supported at its end along any major axis, the cask must be capable of withstanding a static load normal to and uniformly distributed along its length, equal to five times the fully loaded cask weight without generating stresses in any material of the cask in excess of the yield strength of that material. This portion of the regulations is usually interpreted as being applied to the outer shell alone.

DEFINITIONS:

- $S \equiv$ stress, (lb/in²)
- $M \equiv$ bending moment, (in-lb)
- $C \equiv$ one half height of cask in the direction of bending, (in.)
- $I \equiv$ cross sectional moment of inertia, (in.⁴)
- $L \equiv$ length between supports (in.)
- $W \equiv$ total cask weight (lb.)
- $r_2 \equiv$ outside radius of shell (in.)
- $r_1 \equiv$ inside radius of shell (in.)

[Handwritten signature]

WESTINGHOUSE ELECTRIC CORPORATION

CALCULATIONS FOR LICENSING

The significant equations are

$$M = \frac{SWL}{8}, \quad I = \frac{\pi}{4}(r_2^4 - r_1^4), \quad S = \frac{MC}{I}$$

TABULATED VALUES

VALUE	SOURCE
$C = r_2$	
$L = 187.75 \text{ in.}$	<u>CRC</u> 166R003 166R002
$W = 7200 \text{ lb.}$	
$r_2 = 20.495 \text{ in.}$	$(r_1 + .089)$ <u>CRC</u> 166R003 166R002
$r_1 = 20.406 \text{ in.}$	<u>CRC</u> 166R003

[Handwritten flourish]

$$M = \frac{SWL}{8} = \frac{(5)(7200 \text{ lb})(187.75 \text{ in})}{8} = 844,875 \text{ in lb}$$

$$I = \frac{\pi}{4}([20.495]^4 - [20.406]^4) = 2391 \text{ in}^4$$

$$S = \frac{(844,875 \text{ in lb})(20.495 \text{ in})}{(2391 \text{ in}^4)} = \boxed{7242 \text{ LB/IN}^2}$$

The cask material is carbon steel, $S_y = 30,000$. Since the stress generated in the shell under the specified conditions is only 7242 psi, the AEC requirement is met.



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Handwritten notes:
C...
W...
...

MAR 24 1970

DML:CEM

70-337

~~SNM-338, Amendments Nos. 71-32, 71-33~~

70-1151

SNM-1107, Amendments Nos. 71-13, 71-14

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- R. P. Wischow, RMS, w/encls.
- A. Cabell, ADM:DR, w/encls.
- R. L. Stevenson, DML, w/encls.
- M. A. Dean, DML, w/encls.
- C. E. MacDonald, DML, w/encls.
- Branch R/F, w/encls.
- Division R/F w/o encls.

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed are Amendments Nos. 71-32 and 71-33 to Special Nuclear Material License No. SNM-338 and Amendments Nos. 71-13 and 71-14 to Special Nuclear Material License No. SNM-1107, authorizing the delivery of special nuclear material to a carrier for transport in the RCC and RCC-1 packages. These amendments supersede amendments previously issued for these packages.

Please note that these amendments do not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT.

Sincerely,

Original Signed by
Donald A. Nussbaumer

Donald A. Nussbaumer, Chief
Source & Special Nuclear
Materials Branch
Division of Materials Licensing

Enclosures:

As stated

cc: Mr. William A. Brobst
Department of Transportation

ITEM # 75

Handwritten: 3/25

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COPY

UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

LICENSEE	
1. Name: Westinghouse Electric Corporation	3. License No. SNM- <u>338</u>
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania	Amendment No. <u>71-32</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

(1) Model number

RCC

(2) Description

Steel fuel element cradle assembly consisting of a strongback and adjustable fuel element clamping assembly, shock mounted to a minimum 0.074" steel outer container by shear mounts. Neutron absorber plates are required for the contents described in 5(b)(1)(ii).

(3) Drawings

Container constructed in accordance with Westinghouse Electric Corporation Drawings EDSK319401F, EDSK319402F, EDSK323133B, and 684J580 or 684J963, 541F613, 541F614, and EDSK323133B.

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300 (a) 371

LICENSEE: Westinghouse Electric Corporation

PAGE 2 of 3

LICENSE NO.: SNM-338

AMENDMENT NO. 71-32

DOCKET NO.: 70-337

(b) Contents

(1) Type and form of material

(i) Uranium dioxide as zircaloy or stainless steel clad unirradiated fuel elements of the following specifications:

<u>Type</u>	<u>14 x 14 Zr Clad</u>	<u>14 x 14 SST Clad</u>	<u>15 x 15 SST Clad</u>
Pellet diameter (Nom)	0.367"	0.384"	0.384"
Rod diameter (Nom)	0.423"	0.422"	0.422"
Maximum Fuel Length	120"	120"	122"
Maximum Rods/element	180	180	204
Maximum Cross Section (Nom)	7.8" sq	7.8" sq	8.4" sq
Maximum U-235/element	16 kgs	18 kgs	20 kgs
Maximum U-235 enrichment	3.7 w/o	3.9 w/o	3.7 w/o

(ii) Uranium dioxide as zircaloy or stainless steel clad unirradiated fuel elements. Two (2) neutron absorber plates consisting of 0.19" thick, full length stainless steel containing 1.3% minimum boron or 0.19" thick OFHC copper are required between fuel elements of the following specifications:

<u>Type</u>	<u>14 x 14 Zr Clad</u>	<u>14 x 14 SST Clad</u>	<u>15 x 15 Zr Clad</u>
Pellet diameter (Nom)	0.367"	0.384"	0.367"
Rod diameter (Nom)	0.422"	0.422"	0.422"
Maximum Fuel Length	120"	120"	120"
Maximum rods/element	180	180	204
Maximum Cross Section (Nom)	7.8" sq	7.8" sq	8.4" sq
Maximum U-235/element	16.5 kgs	18.5 kgs	18.0 kgs
Maximum U-235 enrichment	3.85 w/o	4.0 w/o	3.59 w/o

(2) Maximum quantity of material per package

For the contents described in 5(b)(1)(i) or 5(b)(1)(ii):

Two fuel elements containing not more than 40 kilograms U-235.

COPY

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LICENSEE: Westinghouse Electric Corporation

PAGE NO: 3 of 3

LICENSE NO: SNM-338

AMENDMENT NO: 71-32

DOCKET NO: 70-337

(c) Fissile Class II and III

- | | |
|---|-------------|
| (1) Minimum transport index
to be shown on label
for Class II | 1.5 |
| (2) Maximum number of packages
per shipment for Class III | 60 packages |

6. This amendment supersedes, in its entirety, Amendment No. 71-24 to SNM-338, dated May 28, 1968.

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the RCC package.

Supplements dated May 25, 1967, January 30, April 29, 1968 and February 18, 1970.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment _____

MAR 24 1970

Original Signed by
Donald A. Nussbaumer

Donald A. Nussbaumer
Division of Materials Licensing

COPY

COPY

MAR 24 1970

UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

LICENSEE	
1. Name: Westinghouse Electric Corporation	3. License No. SNM-338
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania	Amendment No. 71-33
	4. Docket No. 70-337

CONDITIONS

5. (a) Packaging
- | | |
|------------------------|--|
| (1) Model number | RCC-1 |
| (2) Description | Steel fuel element cradle assembly consisting of a strongback and adjustable fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts. Neutron absorber plates are required for the contents described in 5(b)(1)(ii). |
| (3) Drawings | Container constructed in accordance with Westinghouse Electric Corporation Drawings 541F351, 684J861 and 684J898. |
| (4) Fuel rod container | Reinforced 13-gage steel box approximately 9" x 9" x 160" constructed in accordance with Westinghouse Electric Corporation Drawing C5650D55. |

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LICENSEE: Westinghouse Electric Corporation

PAGE 2 of 3

LICENSE NO: SNM-338

AMENDMENT NO. 71-33

DOCKET NO: 70-337

(b) Contents

(1) Type and form of material

(i) Uranium dioxide as zircaloy or stainless steel clad unirradiated fuel elements of the following specifications:

Type	15 x 15 Zr Clad	14 x 14 Zr Clad	14 x 14 Zr Clad	14 x 14 SST Clad	15 x 15 SST Clad
Pellet diameter (Nom)	0.367"	0.367"	0.367"	0.384"	0.384"
Rod diameter (Nom)	0.422"	0.422"	0.423"	0.422"	0.422"
Maximum Fuel Length	144"	144"	120"	120"	122"
Maximum Rods/element	204	180	180	180	204
Maximum Cross Section (Nom)	8.4" sq	7.8" sq	7.8" sq	7.8" sq	8.4" sq
Maximum U-235/element	15 kgs	15.5 kgs	16 kgs	18 kgs	20 kgs
Maximum U-235 enrichment	3.2 w/o	3.5 w/o	3.7 w/o	3.9 w/o	3.7 w/o

(ii) Uranium dioxide as zircaloy or stainless steel clad unirradiated fuel elements. Two (2) neutron absorber plates consisting of 0.19" thick, full length stainless steel containing 1.3% minimum boron or 0.19" thick OFHC copper are required between fuel elements of the following specifications:

Type	14 x 14 Zr Clad	15 x 15 Zr Clad	14 x 14 Zr Clad	14 x 14 SST Clad	15 x 15 Zr Clad
Pellet diameter (Nom)	0.367"	0.367"	0.367"	0.384"	0.367"
Rod diameter (Nom)	0.422"	0.422"	0.422"	0.422"	0.422"
Maximum Fuel Length	144"	144"	120"	120"	120"
Maximum Rods/element	180	204	180	180	204
Maximum Cross Section (Nom)	7.8" sq	8.4" sq	7.8" sq	7.8" sq	8.4" sq
Maximum U-235/element	17 kgs	17 kgs	16.5 kgs	18.5 kgs	18.0 kgs
Maximum U-235 enrichment	3.85 w/o	3.59 w/o	3.85 w/o	4.0 w/o	3.59 w/o

(iii) Uranium dioxide as zircaloy or stainless steel clad unirradiated fuel rods of the following specifications:

Type	SST Clad	Zr Clad
Pellet diameter (Nom)	0.372"	0.372"
Rod diameter (Nom)	0.422"	0.422"
Fuel length (Max)	144"	144"
Maximum U-235 enrichment	3.9 w/o	3.7 w/o

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LICENSEE: Westinghouse Electric Corporation PAGE NO: 3 of 3

LICENSE NO: SNM-338

AMENDMENT NO: 71-33

DOCKET NO: 70-337

(2) Maximum quantity of material per package

(i) For the contents described in 5(b)(1)(i) or 5(b)(1)(ii):

Two fuel elements containing not more than 40 kilograms U-235;

(ii) For the contents described in 5(b)(1)(iii):

Two inner containers described in 5(a)(4) containing not more than 66 kilograms U-235.

(c) Fissile Class

II and III

(1) Minimum transport index to be shown on label for Class II

1.5

(2) Maximum number of packages per shipment for Class III

60

6. Fuel rods shall be closely packed in the fuel rod container on no more than an equivalent metal-to-metal square lattice. Partially loaded fuel rod containers shall be fitted with a minimum of three, equally spaced blocks, of which the non-combustible portion of the block shall assure that the rods are maintained on no more than an equivalent metal-to-metal square lattice within the fuel rod container.

7. This amendment supersedes, in its entirety, Amendment No. 71-30 to SNM-338, dated August 5, 1969.

REFERENCES

Licensee's application dated December 8, 1967, requesting approval to deliver special nuclear material to a carrier for transport in the RCC-1 package.

Supplements dated January 30, March 1, March 5, April 29, 1968; May 28, July 28, 1969 and February 18, 1970.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment MAR 24 1970

Original Signed by
Donald A. Nussbaumer

Donald A. Nussbaumer
Division of Materials Licensing

COPY

Westinghouse Electric Corporation



Handwritten notes:
C. W. ...
with ...
W. R. ...

Gateway Center
Box 2278
Pittsburgh Pennsylvania 15230

February 18, 1970

Handwritten initials: HRP

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338
Docket 70-337, to Authorize Use of NFD Ship-
ping Packages

Gentlemen: **For Div of Compliance**

The Westinghouse Electric Corporation hereby requests amendment of the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packagings described in our transmittal dated November 18, 1966, as revised on May 25, 1967, January 30, 1968, March 1, 1968, April 29, 1968 and the attachment to this letter.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Handwritten signature: Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment
7 copies transmitted

Handwritten mark: F

DOCKET NO. 70-337

SNM-338
Shipping - NFD

Ext Div of Compliance

~~Received W.A.R. Dated~~ 2-18-70

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder labelled "Application for Amendment of License SNM-338 for NFD Shipping Package" immediately in front of the transmittal letter dated 5/28/69.

Revised pages 7.2, 10, 11, 13, Appendix A and Appendix K should be inserted and the old pages removed.

The removed pages may be filed in the back of the binder.

Revision No. 20
2/18/70

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
19	5/28/69	51 to 53	Added Section 20, the RCC Fuel Rod Shipping Package
19	5/28/69	Appendix N	Added
20		10	Added OFHC copper as poison material.
20	2/18/70	11	Changed " ≤ 0.90 " to "obviously less than the 0.98 values.... (MCA) situation."
20	2/18/70	13	Changed " ≤ 0.90 " to "obviously < 0.98 ."
20	2/18/70	Appendix A & K	Deleted k_{eff} (Max/ass'y) and k_{eff} (Max/pkg). Added fuel assembly descriptions requiring OFHC copper poison plates.

4.2 (continued - RCC)

Neutron Absorbers, etc. - Neutron absorber plates, consisting of 0.19" thick, boronated stainless steel containing 1.3 w/o natural boron or consisting of 0.19" thick, oxygen-free, high-conductivity (OFHC) copper, will be mounted in the packaging, when required. As shown in Westinghouse drawing 684J580, these plates are restrained by the massive vertical structure separating the fuel assemblies, by a heavy end plate at one end, and by a clamp plate secured by two 1/2 inch bolts at the other. The installation is such that the presence of the neutron absorber plates may be readily detected by visual examination. Specific data on assembly parameters which will require the use of neutron absorber plates will be included in Appendix A.

Maximum Weight of Fissile Content - Listed in Appendix A.

Maximum Net Weight of Contents - Listed in Appendix A.

Maximum Decay Heat - Not applicable.

4.3 Compliance with Subpart C of 10 CFR 71

General Standards - The materials specified for the package will not produce significant chemical or galvanic reactions. The closure devices specified must be deliberately unfastened. Each of the four lifting lugs will be capable of supporting the loaded container individually, so the system of four lifting lugs will support three times the weight of the loaded container. In addition, the

4.3 (continued - RCC)

design of the lifting lugs will be such that, under an excessive load, the lug will fail across the hole before it would transmit disruptive stresses to the container. Similarly, the tie-down devices, which will accommodate 1" diameter steel cables, will have adequate strength to meet the static load requirement.

General Criticality Standards - The contents of each package will be so limited that, for a single container, with the contents maximumly moderated and fully reflected, the adjusted k_{eff} of the contents will obviously be less than the 0.98 values specified as the limit for the maximum credible accident (MCA) situation. No consideration of dispersable material is required because the contents will be limited to clad components. See specific data in Appendix A.

The calculations will be made by the Nuclear Engineering Department using LEOPARD^{/1} or PDQ-03^{/2} or similar experimentally verified procedures. The requirement that fuel be in assemblies in a fixed array will assure that these calculations will be accurate and directly applicable. The calculations will include the effects of the neutron absorbing plates, when used.

- ^{/1} Barry, R.F., "LEOPARD - A Spectrum Dependent Non-Spatial Depletion Code for the IBM 7094," WCAP-3269-26 (September 1963).
- ^{/2} Caldwell, W.R., "PDQ-03 - A Program for the Solution of the Neutron Diffusion Equations in Two Dimensions on the IBM 704," WAPD-TM-179 (May 1960).

4.3 (continued - RCC)

Any number of undamaged but flooded packages will also be nuclearly safe, since a single package will obviously have a k_{eff} of < 0.98 and there will be a minimum of 12 inches of water between the contents of any two packages. If the water drains away, the contents will also drain, so that the array returns to an unmoderated condition.

For the low-enriched assemblies under consideration, studies using LEOPARD and PDQ-03 demonstrate that a rise of k_{eff} (above the single package value) for an unlimited array does not occur at any reduced water density, due to the parasitic neutron absorption by the container walls and internal structure. Consequently, no degree of interspersed partial moderation can produce an array k_{eff} in excess of the single package k_{eff} resulting from complete flooding.

The maximum credible accident condition is conceived to involve only two packages, crushed top-to-top so that the spacing between the pairs of assemblies will be 1.7 inches, and aligned parallel to each other. This array is then assumed to be flooded. The heavy structural members of the base and the internal component support structures of the packagings will provide sufficient spacing so that any other package in the shipment will be isolated from this combination by a minimum of 12 inches of water.

The Nuclear Engineering Department will use the calculational procedures specified under General Criticality Standards to assure that the adjusted k_{eff} does not exceed 0.98 for the four assemblies in the maximum credible accident (MCA) array.

Appendix A

Products Shipped in Type RCC and RCC-2 Packages

<u>Type</u>	<u>14 X 14 Zr Clad Assemblies</u>		<u>14 X 14 SST Clad Assemblies</u>		<u>15 X 15 SST Clad Assemblies</u>	<u>15 X 15 Zr Clad Assemblies</u>
Pellet Parameters						
Material	UO ₂	UO ₂	UO ₂	UO ₂	UO ₂	UO ₂
Highest Enrichment (Nom)	3.7 w/o	3.85 w/o	3.9 w/o	4.0 w/o	3.7 w/o	3.59 w/o
Diameter (Nom)	.367"	.367"	.384"	.384"	.384"	.367"
Rod Parameters						
Cladding Mt'l	Zirc.	Zirc.	SST	SST	SST	Zirc.
Diameter (Nom)	.423"	.422"	.422"	.422"	.422"	.422"
Fuel Lgth (Nom)	120"	120"	120"	120"	122"	120"
Assy. Parameters						
No. of rods (Max)	180	180	180	180	204	204
Lattice Pitch (Nom)	.556"	.556"	.556"	.556"	.563"	.563"
Outside Dimen. (Nom)	7.8" sq	7.8" sq	7.8" sq	7.8" sq	8.4" sq	8.4" sq
Licensing Criteria						
Total U-235 (Max/pkg)	32.0 kg	33.0 kg	36.0 kg	37.0 kg	40.0 kg	36.0 kg
k _{eff} (Max/MCA)	0.96	<0.98	0.96	≤0.95	0.96	<0.98
Poison Pl. Req'd	No	OFHC Copper	No	OFHC Copper	No	OFHC Copper
Net Wt. of Contents (Max)	2500#	2500#	2500#	2500#	3100#	3100#

SNM-338
 Shipping - NFD
 2/18/70

Appendix K

Products Shipped in Type RCC-1 Packages

<u>Type</u>	<u>14 X 14 Zr Clad Assemblies</u>		<u>15 X 15 Zr Clad Assemblies</u>	
Pellet Parameters				
Material	UO ₂	UO ₂	UO ₂	UO ₂
Highest Enrichment (Nom)	3.5 w/o	3.85 w/o	3.2 w/o	3.59 w/o
Diameter (Nom)	.367"	.367"	.367"	.367"
Rod Parameters				
Cladding Mt'l	Zirc.	Zirc.	Zirc.	Zirc.
Diameter (Nom)	.422"	.422"	.422"	.422"
Fuel Length (Nom)	144"	144"	144"	144"
Assy. Parameters				
No. of Rods (Max)	180	180	204	204
Pattern (Basic)	14X14 sq	14X14 sq	15X15 sq	15X15 sq
Lattice Pitch (Nom)	.556"	.556"	.563"	.563"
Outside Dimen. (Nom)	7.8" sq	7.8" sq	8.4" sq	8.4" sq
Licensing Criteria				
Total U-235 (Max/Pkg)	31 kg	34 kg	30 kg	34 kg
k _{eff} (Max/MCA)	≤0.96	≤0.98	≤0.97	≤0.98
Poison Pl. Req'd	No	OFHC Copper	No	OFHC Copper
Net Wt. of Contents (Max)	2900#	2900#	3300#	3300#

SNM-338
 Shipping - NFD
 2/18/70

Westinghouse Electric Corporation



*WEC
CWB
6/2/69*

Gateway Center
Box 2278
Pittsburgh Pennsylvania 15230

May 28, 1969

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338,
Docket 70-337, to Authorize Use of NFD Shipping
Packages

Gentlemen:

The Westinghouse Electric Corporation hereby requests amendment of the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packaging described in the attachment to this letter.

Please send the amendment to me at the above address

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment
7 copies transmitted

JUN 4 1969

I ITEM # 76 *B/76*
33

SNM-338
Shipping - NFD
5/28/69

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder, "Amendment of License SNM-338, Docket 70-337, to Authorize Use of NFD Shipping Packages," immediately in front of the last previous transmittal letter, dated May 21, 1968.

Revised page 4 should be inserted in the binder and the old page removed.

New page 7.2 should be inserted in the binder immediately following page 7.1 and new pages 51 to 53 should be inserted immediately following page 50. New Appendix N should be inserted immediately following the last drawing in existing Appendix M.

The removed pages may be filed in the back of the binder.

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Appendix D - Yankee Shipping Container drawings	
Appendix E - MH-1A Shipping Container drawings	
Appendix F - Double Barrel Scrap Shipping Container sketch	
Appendix G - Quadruple Barrel Scrap Shipping Container drawing	
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Appendix M - RCC-2 Shipping Container drawings	
Appendix N - Fuel Rod Shipping Container drawing	

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
19		51 to 53	Added Section 20, the RCC Fuel Rod Shipping Package
19		Appendix N	Added

20. RCC Fuel Rod Shipping Package

20.1 Packaging Description

The RCC-1 Packaging described in Section 16.1 will be used. However, when used for RCC Fuel Rods, the gross weight will become 9500 pounds.

20.2 Contents Description

Radioactivity - Not applicable.

Identification and Enrichment of SNM - The SNM will be unirradiated uranium enriched \leq 3.9 w/o in the isotope U-235.

Form of SNM - The SNM will be in the form of clad fuel rods, tightly packed in reinforced #13 Ga. steel boxes measuring approximately 9" x 9" x 160". Details on this inner container are given on Westinghouse drawing C5650D55 which is attached as Appendix N. Specific data on maximum fuel material parameters for SST clad and zircaloy clad rods are included below. The contents will be loaded in such a fashion that if the package were to be flooded and subsequently drained, any water which may have penetrated the contents would drain simultaneously.

Pellet Parameters

Material	UO ₂	UO ₂
Enrichment (Max.)	3.9 w/o	3.7 w/o
Diameter (Nom.)	0.372"	0.372"

Rod Parameters

Clad Material	SST	Zirc.
Diameter (Nom.)	0.422"	0.422"
Fuel Lgth. (Max.)	144"	144"

20.2 (continued - RCC Fuel Rod)

In the clad form, the fuel rods will not disruptively react or decompose at the Accident Thermal condition. No chips, powders, or solutions will be offered for transport in this packaging.

Neutron Absorbers, etc. - Not specified. No decrease in reactivity resulting from this type of material is included in the nuclear safety analysis.

Maximum Weight of Fissile Content - 66 kg/pkg.

Maximum Net Weight of Contents - 5500 pounds

Maximum Decay Heat - Not applicable

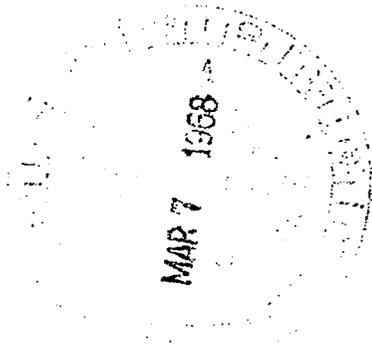
20.3 Compliance with Subpart C of 10 CFR 71

The descriptions and discussions given in Section 16.3 will be applicable in all respects, if "boxes loaded with closely packed fuel rods" is substituted for "fuel assemblies." The packaging was designed so conservatively that 10 CFR 71 mechanical requirements still will be satisfied. The conditions assumed for the MCA will not be affected by the increased weight. Additional shock mounts will be added to assure that the strongback assembly will be adequately suspended.

The calculated k_{eff} for a single flooded package is ≤ 0.6 and for the MCA is ≤ 0.8 , compared to corresponding values of ≤ 0.88 and ≤ 0.97 for the shipment of RCC-1 fuel assemblies as given in our March 5, 1968 revision to this application.

20.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit and Procedural Controls presented in Section 16.4, will apply directly to this package.



Westinghouse Electric Corporation

3 Gateway Center
Box 2279 Pittsburgh, Pa. 15210
March 5, 1968

[Handwritten signatures and initials]

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338
Docket 70-337, to Authorize Use of NFD Shipping
Packages For Div. of Compliance

Gentlemen:

The Westinghouse Electric Corporation hereby requests an amendment to the subject license to authorize the delivery of special nuclear material to a carrier for transport in the package described in the attachment to this letter.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment
7 copies transmitted

SNM-338
Shipping - NFD
3/5/68

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder, "Amendment of License SNM-338, Docket 70-337, to Authorize Use of NFD Shipping Packages," immediately in front of the last previous transmittal letter, dated March 1, 1968.

Revised pages 7.1 and Appendix K should be inserted in the binder and the old pages removed.

The removed pages may be filed in the back of the binder.

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
13	3/1/68	43-49	Added Section 18, the BB 250-2 package
13	3/1/68	Appendix L	Added
14	3/5/68	Appendix K	Added RGAF data

SNM-338
 Shipping - NFD
 3/5/68

Appendix K
 Products Shipped in Type RCC-1 Packages

Type	Indian Pt. No. 2	RGAF
Pellet Parameters		
Material	UO ₂	UO ₂
Enrichment (Nom) High Zone	3.2 w/o	3.5 w/o
Diameter (Nom)	.372"	.372"
Rod Parameters		
Cladding Mt'l	Zirc.	Zirc.
Diameter (Nom)	.422"	.422"
Fuel Length (Nom. Max.)	144"	144"
Assy. Parameters		
No. of Rods (Max)	204	179
Pattern (Basic)	15 X 15 sq	14 X 14 sq
Lattice Pitch (Nom)	.563"	.556"
Outside Dimen. (Nom)	8.4" sq	7.8" sq
Licensing Criteria		
Total U-235 (Max/Pkg)	30 kg	31 kg
k _{eff} (Max/Ass'y)	< 0.88	≤ 0.84
k _{eff} (Max/1 Pkg)	< 0.90	≤ 0.86
k _{eff} (Max/MCA)	≤ 0.97	≤ 0.96
Poison Pl. Req'd	No	No
Net Wt. of Contents (Max)	3200#	3200#



Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

July 8, 1968

*U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Supplementary Information Concerning
License SNM-338, Docket 70-337

Gentlemen:

For Div. O. Compliance

In reviewing past applications for amendments to the subject license, we notice that ambiguities may exist with reference to the locations of pellet processing lines in the Nuclear Fuel Division's Manufacturing Department. Therefore, the Westinghouse Electric Corporation transmits the attached layout which designates the relative shop locations of pellet processing lines for your information.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

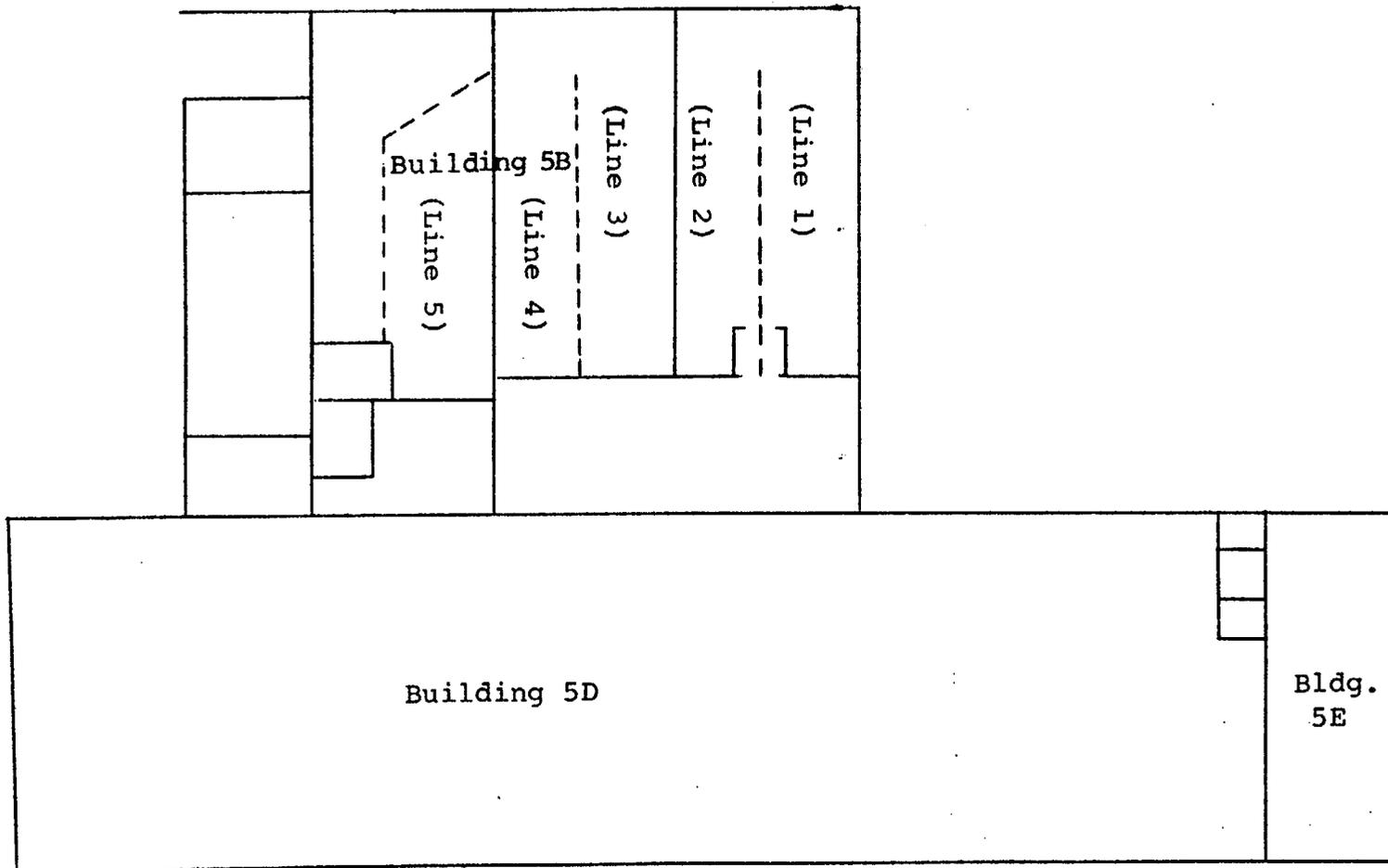
Karl R. Schendel
License Administrator

Attachment

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From CO - Hdqrs.

Buildings 5A and 5C

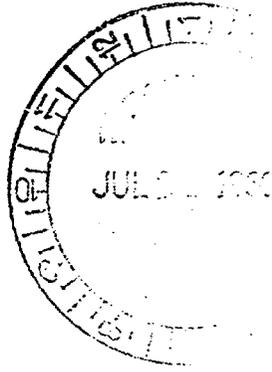


Scale 3/8 in. = 20 ft.

Locations of Pellet Processing Lines
Westinghouse Nuclear Fuel Division
Cheswick, Pennsylvania

DOCUMENT NO. 70-337

Westinghouse Electric Corporation



Gateway Center
Box 2278
Pittsburgh Pennsylvania 15230

July 28, 1969

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338, Docket
70-337, to Authorize Use of NFD Shipping Packages

Gentlemen: *For Div. of Compliance*

Confirming my telephone conversation of July 24, 1969 with Mr. C. McDonald of your office, the Westinghouse Electric Corporation offers the following explanatory material to clarify the intent of certain provisions contained in our May 28, 1968 transmittal on the subject license.

1. The term "closely packed" is intended to mean the triangular latticed, metal-to-metal arrangement which is the most natural arrangement for a pile of bare cylindrical rods when their axes are maintained parallel.
2. The size and weight of the packagings will make the shipment of metal boxes which are only partially loaded a matter of considerable expense. Therefore, it is probable that, in any given shipment, only one box, or two boxes in one package, will not be fully loaded. In any box not fully loaded, a minimum of three, equally spaced, custom fitted, padded blocks will be inserted to assure the maintenance of a "closely packed" configuration.
3. All welding indicated in Notes "F" and "G" of the Westinghouse Drg. C5650D55 is intended to be a continuous weld.

ITEM # 77

13/77

July 28, 1969

4. The presence of the "Proprietary Information" statement on the above drawing is an oversight. This statement is no longer valid, and should have been voided. The U.S. AEC is authorized to make drawing C5650D55 available for public inspection.

Please send the amendment to me at the above address.

If you have any questions, please telephone me collect, (412) 255-3907.

Very truly yours,



Karl R. Schendel
License Administrator

KRS:sw

7 copies transmitted



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

*Have
sent
WRL*

MAY 28 1969

DML:CEM
70-337
SNM-338, Amendment No. 71-29 ✓

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- Branch Reading File w/encl.
- Division Reading File w/o encl.

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-29 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the Model III-B-2-W package.

Please note this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT.

Sincerely,

*Original signed by
Donald A. Nussbaumer*

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosure:
As stated

cc: Mr. William A. Brobst
Department of Transportation

ITEM # 78

MAY 29 1969

B/77

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COPY

UNITED STATES
ATOMIC ENERGY COMMISSION

MAY 28 1969

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

LICENSEE	
1. Name: Westinghouse Electric Corporation	3. License No. SNM-338
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15613	Amendment No. 71-29
	4. Docket No. 70-337

CONDITIONS

5. (a) Packaging

- | | |
|------------------|--|
| (1) Model number | Model III-B-2-W |
| (2) Description | Inner container consists of a mild steel cylinder 6-5/8" OD x 6.0" ID x 56-1/2" maximum I.H., with flanged, gasketed closure. Inner container is supported in the center of a single or double height 30 gallon DOT 6C drum by 1/4" thick steel cruciform. Package constructed in accordance with the details shown in NUMEC Drawing 11-D-837. Optional shipping insert constructed in accordance with NUMEC Drawing 11-D-876. |

(b) Contents

- | | |
|-------------------------------|---|
| (1) Type and form of material | Plutonium-uranium carbide, with a maximum 20 w/o plutonium, as sodium bonded irradiation pins. The fuel shall be contained within doubly encapsulated leaktight stainless steel cladding. Uranium may be fully enriched in the U-235 isotope. |
|-------------------------------|---|

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LICENSEE: Westinghouse Electric Corporation

PAGE NO: 2

LICENSE NO: SNM-338

AMENDMENT NO: 71-29

DOCKET NO: 70-337

- (2) Maximum quantity of material per package Combined contents not to exceed 80 kg with the U-235 content not to exceed 425 grams and the plutonium content not to exceed 125 grams.

(c) Fissile Class

III

- (1) Maximum number of packages per shipment for Class III

One (1)

6. To prevent movement of the center support plate in the shipping insert when used, hardwood strips shall be wedged between the edges of this support plate and the inner container wall.

REFERENCES

Licensee's application dated May 9, 1969, for an amendment to Special Nuclear Material License No. SNM-338 to authorize the delivery of special nuclear material to a carrier for transport in the above package.

Supplement dated May 16, 1969.

Nuclear Materials and Equipment Corporation application dated November 15, 1966, Docket No. 70-364, requesting approval to deliver special nuclear material to a carrier for transport in the Model II-B-2 package.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment MAY 28 1969

Original Signed by
Donald A. Nussbaumer

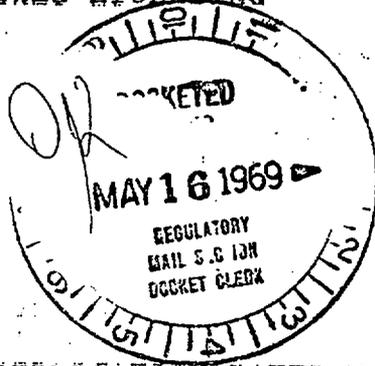
Donald A. Nussbaumer
Division of Materials Licensing

COPY

MR. CHARLES MACDONALD

U. S. ATOMIC ENERGY COMMISSION
DIVISION OF MATERIALS LICENSING
WASHINGTON D. C.

5-16-69 1053AM



1969 MAY 16 AM 11 06

U.S. ATOMIC ENERGY COMMISSION
WASHINGTON, D.C.

DOCKET NO. 70-337

REFERENCE OUR APPLICATION DATED MAY 9, 1969, FOR AMENDMENT TO LICENSE SNW-338, DOCKET 70-337, TO AUTHORIZE SHIPPING PACKAGE.

CONFIRMING OUR TELEPHONE CONVERSATION OF MAY 15, 1969, WESTINGHOUSE SUBMITS THE FOLLOWING ADDITIONAL INFORMATION --

THE FUEL MATERIAL WILL BE /PU-U/ CARBIDE, WITH A COMPOSITION OF 20 PERCENT PLUTONIUM AND 80 PERCENT FULLY ENRICHED URANIUM, AS SODIUM BONDED IRRADIATION PINS. THE FUEL MATERIAL WILL BE DOUBLY ENCAPSULATED IN STAINLESS STEEL.

THE TOTAL WEIGHT OF THE PACKAGE CONTENTS WILL NOT EXCEED FIVE KILOGRAMS.

IF YOU HAVE ANY FURTHER QUESTIONS, PLEASE TELEPHONE ME COLLECT.

KARL R. SCHENDEL LICENSE ADMINISTRATOR WESTINGHOUSE ELEC CORP
GATEWAY CENTER PITTSBURGH PA

MAY 18 1969

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Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

May 9, 1969 For Div of Compliance

DOCKET NO. 70-337

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Amendment to License SNM-338, Docket 70-337,
to Authorize the Use of an AML Shipping Package

Gentlemen:

The Westinghouse Electric Corporation hereby requests an amendment to License SNM-338, Docket 70-337, authorizing the delivery of special nuclear material to a carrier for transport in the packaging described herein.

The packaging will be a NUMEC Model III-B-2 shipping container. This packaging has been reviewed by the USAEC and its use was authorized by Amendment 71-5 to License SNM-414, Docket 70-364.

A maximum of one container will be offered as a Fissile Class III shipment. The maximum quantity of fissile material loaded into a package will be 125 grams of contained plutonium and 425 grams of contained uranium-235.

The ability of this package to meet the requirements of 10CFR71.40 is self-evident. The total quantity of fissile material in a single package, while greater than that generally licensed in 10CFR71.6(a), is still less than the minimum critical mass. Therefore, a single package cannot represent a nuclear criticality safety hazard, regardless of the acci-

MAY 14 1969

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May 9, 1969

dent conditions which may be assumed. The restrictions on moderation, configuration and juxtaposition which are imposed by the undamaged packaging are sufficient to assure that the conservative quantity present in two such packages would be subcritical.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,



Karl R. Schendel
License Administrator

KRS:sw

7 copies transmitted

UNITED STATES
ATOMIC ENERGY COMMISSION

FEB 5 1969

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LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corp.	3. License No. SNM- <u>338</u>
2. Address: 3 Gateway Center Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-28</u>
	4. Docket No. <u>337</u>

CONDITIONS

5. (a) Packaging

(1) Model number

OR-12

(2) Description

(SEE PAGE 2)

(b) Contents

(1) Type and form of material

Uranium hexafluoride: enrichment in the U-235 isotope not to exceed 5.0%, H/U-235 ratio not to exceed 1.7.

(2) Maximum quantity of material per package

450 pounds UF₆, containing not more than 6.9 kg U-235,

(c) Fissile Class

II

(1) Minimum transport index to be shown on label for Class II

1.2

(2) Maximum number of packages per shipment for Class III

N.A.

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ITEM # 79

B/79

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PAGE NO.: 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-28

DOCKET NO.: 70-337

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5. (a)(2) Twelve inch ID x 53-inch long UF₆ cylinder (Model 12A or 12B) as described in Section 8, ORO-651; protective package for 12-inch diameter UF₆ cylinder as described in K-1714.

REFERENCES

attached to Amendment #13

Licensee's application dated January 21, 1969, requesting approval to deliver special nuclear material to a carrier for transport in the above container.

K-1714, "Protective Shipping Packages for 8- and 12-Inch Diameter UF₆ Cylinders," April 20, 1967, Union Carbide Corporation, Nuclear Division, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee.

ORO-651, "Uranium Hexafluoride Handling Procedures and Container Criteria", Union Carbide Corporation; Nuclear Division, Oak Ridge, Tennessee.

FOR THE ATOMIC ENERGY COMMISSION

FEB 5 1969

Date of Amendment _____

COPY

Donald A. Nussbaumer
Division of Materials Licensing



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

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70-337
SNM-338, Amendment No. 71-27

OCT 29 1968

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HW

Westinghouse Electric Corporation
3 Gateway Center
Box 2276
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-27 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the Modal Saxon package.

Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT.

Sincerely,

Original Signed by
Donald A. Ruzsbaumer

Donald A. Ruzsbaumer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosure:
As stated

cc: Mr. William A. Brobet
Department of Transportation

NOV 1 1968

13/86

ITEM # 80

27

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corp.	3. License No. SNM- <u>338</u>
2. Address: 3 Gateway Center Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-27</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging
- | | |
|------------------|---|
| (1) Model number | Model Saxton |
| (2) Description | Thirteen (13) gage steel boxes, 7"x7"x110" supported within CC steel container. |
| | (See Page 2) |
- (b) Contents
- | | |
|--|---|
| (1) Type and form of material | (See Page 2) |
| (2) Maximum quantity of material per package | Fourteen (14) kilograms U-235 as contained in four (4) fuel elements in a two-long, two-wide arrangement. |
- (c) Fissile Class
- | | |
|---|-------------------------|
| (1) Minimum transport index to be shown on label for Class II | III |
| (2) Maximum number of packages per shipment for Class III | N.A. |
| | COPY One (1) |

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PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-27

DOCKET NO.: 70-337

5. (a) (3) CC container constructed in accordance with Champion Company Drawings 10410, 10536, 10538, and 10541. Steel box mounting assembly in accordance with Drawing SKA-219, Rev. 2.
5. (b) (1) Uranium dioxide as zircaloy-4 or stainless steel clad unirradiated fuel elements of the following specifications:

Pellet diameter (Nom)	0.337"
Rod diameter (Nom)	0.391"
Max. fuel length	36"
Max. rods/element	72
Max. U-235 enrichment	12.7 w/o

REFERENCES

Licensee's application dated July 19, 1968, requesting approval to deliver special nuclear material to a carrier for transport in the Model Sexton package.

Supplement dated October 21, 1968.

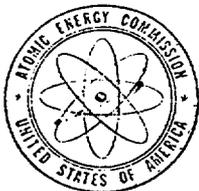
FOR THE U. S. ATOMIC ENERGY COMMISSION

Original Signed by
Donald A. Nussbaumer

Date of Amendment OCT 29 1968

Donald A. Nussbaumer
Division of Materials Licensing

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UNITED STATES
ATOMIC ENERGY COMMISSION

WASHINGTON, D.C. 20545

JUN 17 1968

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IN REPLY REFER TO:
DML:CM

70-337

SNM-338, Amendment No. 71-26

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-26 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the BB 250-2 package.

Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT. Transport of special nuclear material not subject to DOT regulations is authorized by Amendment No. 5 to Special Nuclear Material License No. SNM-338, dated November 21, 1967, provided the appropriate packaging, marking, and labeling requirements of that amendment are satisfied.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosure:
As stated

cc: Mr. William A. Brobst
Department of Transportation

B/81

ITEM # 81

From CC - Hqrs.

3

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation	3. License No. SNM- <u>338</u>
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-26</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

- (1) Model number
- (2) Description

BB 250-2

(See Page 2)

(b) Contents

- (1) Type and form of material
- (2) Maximum quantity of material per package

(See Page 2)

Total contents not to exceed 250 pounds, with the U-235 content not to exceed four (4) kilograms.

(c) Fissile Class

- (1) Minimum number of radiation units to be shown on label for Class II
- (2) Maximum number of packages per shipment for Class III

II and III

0.4 radiation units

200 packages

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PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-26

DOCKET NO.: 70-337

5. (a)(2) Inner container is 11.5" ID, 16-gage steel cylinder, 63.5" long, with bolted and gasketed top flange closure and seal welded bottom plate. Inner container is centered and supported in a 22.5" ID by minimum 74" long 16-gage steel drum by 1/4" diameter spring steel rods and vermiculite. Container constructed in accordance with Westinghouse Electric Corporation Sketch SKA-252-1.
5. (b)(1) Bulk uranium oxide (UO_2 or U_3O_8) powder with a maximum density of 2 g U/cc and enriched to a maximum 4 w/o in the U-235 isotope. The maximum H/U atomic ratio, considering all sources of hydrogenous material within the inner container shall not exceed 1.13.

REFERENCES

Licensee's application dated March 1, 1968, requesting approval to deliver special nuclear material to a carrier for transport in the BB 250-2 package.

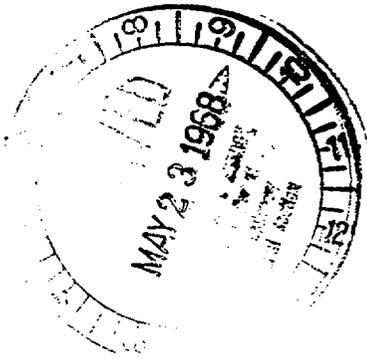
Supplements dated April 8 and May 21, 1968.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment JUN 17 1968

Donald A. Nussbaumer
Division of Materials Licensing

COPY



Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

May 21, 1968

Handwritten notes:
C...
...
...

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Stamp: Div. of Compliance

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338
Docket 70-337, to Authorize Use of NFD Shipping
Packages

Gentlemen:

The Westinghouse Electric Corporation hereby requests amendment of the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packaging described in our transmittals dated March 1, 1968 and April 8, 1968 and in the attachment to this letter.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Handwritten signature: Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment
7 copies transmitted

ITEM # 82

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FILING INSTRUCTIONS

The transmittal letter should be filed in the binder, "Amendment of License SNM-338, Docket 70-337, to Authorize Use of NFD Shipping Packages," immediately in front of the last previous transmittal letter, dated April 29, 1968.

Revised pages 7.1, 47, 48 and 49 should be inserted in the binder and the old pages removed.

New page 48.1 should be inserted in the binder immediately following page 48. New Figure 1 and Figure 2 should be inserted immediately following Sketch #SKA-252-1 in existing Appendix L.

The removed pages may be filed in the back of the binder.

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
13	3/1/68	43-49	Added Section 18, the BB 250-2 package
13	3/1/68	Appendix L	Added
14	3/5/68	Appendix K	Added RGAF data
15	3/14/68	Appendix B	Added SELNI data
16	4/8/68	45	Changed 8 spiders to 12 spring spacers
16	4/8/68	46	Add detail concerning bolting of lid
16	4/8/68	48-49	Revised Footnote <u>1</u> to add discussion of nuclear criticality safety. Changed >1000 to >500.
16	4/8/68	Appendix L	Revised drawing to -1
17	4/29/68	8	6300# was 6000#
17	4/29/68	42	7200# was 7000#
17	4/29/68	50	Added Section 19, the RCC-2 package.
17	4/29/68	App. A, B & K	Revised to remove core designations, generalize certain categories, and update specific data.
17	4/29/68	Appendix M	Added
18	5/21/68	47	Added subparagraph 4 giving damaged package dimensions
18	5/21/68	48	Added data on optimum moderation justification and referenced Fig. 1. Added "Array Configuration" in listing.
18	5/21/68	48.1	Added
18	5/21/68	49	Specified absence of moderation as an undamaged package parameter. Referenced Fig. 2
18	5/21/68	Appendix L	Added Figures 1 and 2.

18.3 (continued - BB 250-2)

tion, test experience with the BB 250-1 shows that as a result of a top corner drop the lid and the body are folded together into a tighter closure.

2. The incorporation of five inches of vermiculite is equal to that provided in the NUMEC package, and is sufficient to assure that after the drop and fire tests the temperature of the inner container would not exceed the observed maximum of 500^oF. Since the gasket is service rated to 800^oF, the closure of the inner container is not compromised.
3. The test series does not result in the addition of moderation to the contained fissile material.
4. The dimensions of a damaged package are conservatively taken to be 20" O.D. X 70" Lg. This assumes a reduction of 2 1/2" in diameter as the result of a drop test with the package in a horizontal position, plus a reduction of 4" in height as the result of a drop test with the package in a vertical position. No deformations in excess of these values were experienced during the testing of the Pu-10-1 package.

Single Package Evaluation - The safety considerations which pertain to a single package will assure nuclear safety even assuming that the failure of the inner

18.3 (continued - BB 250-2)

container seal yields optimum moderation and full reflection. This is demonstrated in the section on General Criticality Standards.

Package Array Evaluation - In view of the ability of these packages to exclude water after being subjected to the hypothetical accident conditions, the array is evaluated by considering that optimum interunit water moderation is present between dry UO_2 packages. The following parameters were used to carry out array calculations using the ANISN and KENO codes,^{/1} assuming optimum interunit moderation as determined in the course of the calculations. The results of the ANISN calculations are shown in Figure 1 of Appendix L.

^{/1} E. Whitesides to T. Gutman, Personal communication, March 1968. The actual data developed is:

For a damaged package

k_{∞} (max) = 1.246 at an equivalent water thickness of 0.5 cm

k_e = 0.985 \pm 0.0065 for a critical array measuring 15'x15'x15' (This was considered a 15'x15' planar array of continuous cylinders 15' long, which is conservative.) Thus, the critical volume is 3375 cu.ft., and the critical number of damaged packages is 3375/14.01 = 241. For Fissile Class II packages, the allowable number is one-half the critical number of damaged packages, or 120. However, this results in a value of 0.333 radiation units, and rounding this up to the next tenth gives a value of 0.4. The 40-unit rule then limits one shipment to 100 packages, and thus, the designation, ">200."

The allowable Fissile Class III shipment has been conventionally set at twice the Fissile Class II limit, or 200 packages, rather than the computed number of 241.

18.3 (continued - BB 250-2)

Material form	UO ₂ powder
Enrichment	5 w/o U-235
Powder density (ρ_u)	2 g/cc
H/U (including all packaging material)	1.13
Volume of undamaged package in hexagonal array	21.62 ft ³
Volume of damaged package in hexagonal array	14.01 ft ³
Array configuration	180" x 180" reflected array consisting of 81-180" long, 11.5" diameter inner cylinders
Number of packages in reflected array	} >500 undamaged >200 damaged

Based on the above, 100 packages, each assigned 0.4 radiation units, may be shipped under Class II conditions.

1 (continued)

To demonstrate that the damaged case would govern for both Fissile Class II and Fissile Class III, it was necessary only to demonstrate that the critical number of undamaged packages exceeded 500. In this consideration, the undamaged package is conservatively assumed to be identical to the damaged package array with no interunit moderation.

This was conservatively approximated by preparing a plot of k versus the reciprocal of volume ($1/v$). See Fig. 2 of Appendix L. Three calculated points for the damaged condition were plotted and connected with a hand fitted curve. Only one point ($k_\infty = 1.149$) was available for the undamaged case (no interunit moderation). By conservatively taking the volume of an undamaged package in a hexagonal array as 14.01 ft³, a line parallel to that plotted for the damaged case was drawn through this point. The second curve intersected $k_\infty = 1.00$ at $1/v = 0.000135$, or $v = 7400$ cu.ft. This results in a critical number of 530 packages.

18.4 Fissile Class II Limits

One hundred (100) packages will be offered as a maximum Fissile Class II shipment. Each package will be assigned four-tenths (0.4) of a radiation unit.

18.5 Fissile Class III Limits

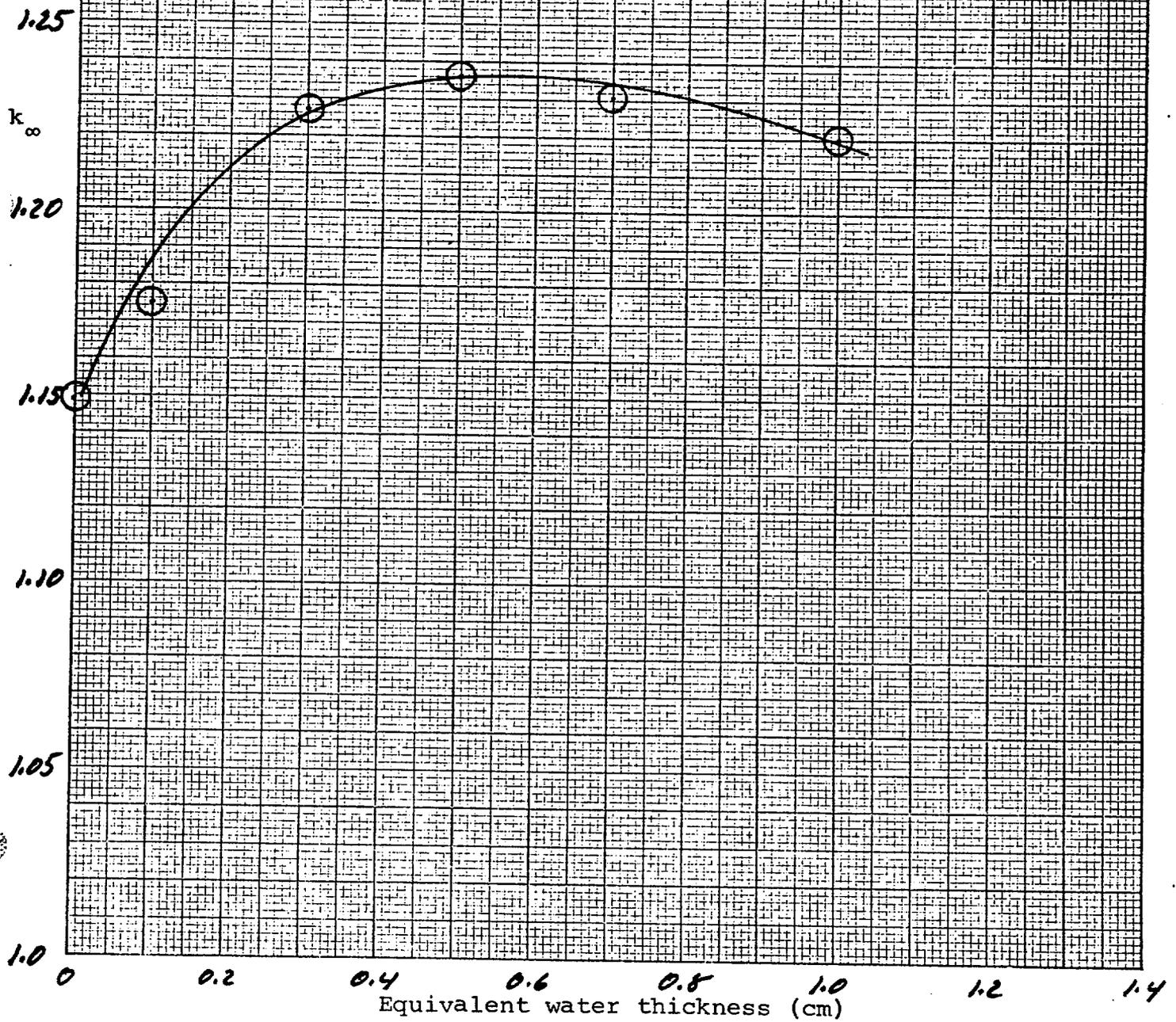
A maximum of two hundred (200) packages will be offered as a Fissile Class III shipment.

18.6 Procedural Controls

The contents of Section 10.6 of this application will be directly applicable to this package in all respects.

Figure 1

k_{∞} as a function of surrounding water thickness for 5 w/o $^{235}\text{UO}_2$ in 11.5" diameter cylinders. $H/U = 1.13$

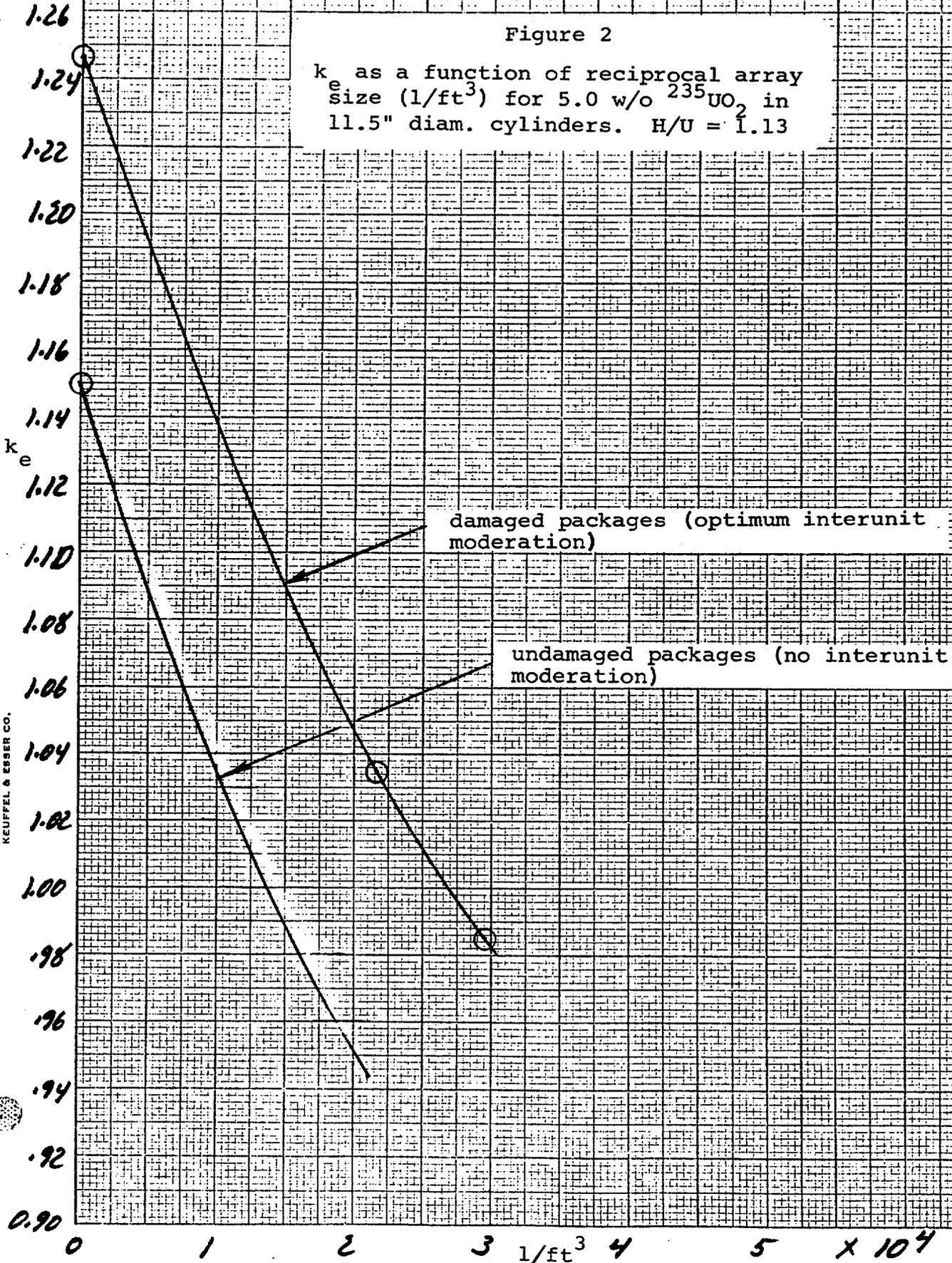


APPENDIX L

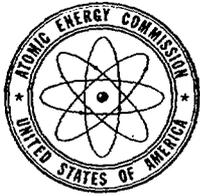
SNM-338
Shipping - NFD
5/21/68

Figure 2

k_e as a function of reciprocal array size ($1/\text{ft}^3$) for 5.0 w/o $^{235}\text{UO}_2$ in 11.5" diam. cylinders. $H/U = 1.13$



KE 10 X 10 TO 1/2 INCH 46 1323
 7 X 10 INCHES
 KEUFFEL & ESSER CO. MADE IN U.S.A.



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

I
5/1/68
~~_____~~
_____ CML
_____ JAL
HVP

IN REPLY REFER TO:
DML:CEM
70-337

SNM 220

WCC

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

This refers to your application dated March 1, 1968, as supplemented April 8, 1968, requesting authorization to deliver special nuclear material to a carrier for transport in the BB 250-2 container.

In describing the array calculations for the damaged packages, it is not clear how you determined the amount of interspersed moderator corresponding to the optimum. Please describe the calculations for the array of damaged packages in sufficient detail for us to determine that the moderation was indeed optimum. Details should be sufficient to establish that the array configuration conforms with the predicted drop test effects and to permit confirmation of your analysis for the array of undamaged packages.

We will resume our review of your application upon receipt of the additional information described above.

Very truly yours,

Donald A. Nussbauer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

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ITEM # 83

B/83

24



Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

April 8, 1968

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338
Docket 70-337, to Authorize Use of NFD Shipping
Packages ~~For Div of Compliance~~

Gentlemen:

The Westinghouse Electric Corporation hereby requests an amendment to the subject license to authorize the delivery of special nuclear material to a carrier for transport in the package described in our transmittal dated March 1, 1968, and the attachment to this letter.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment
7 copies transmitted

SNM-338
Shipping - NFD
4/8/68

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder, "Amendment of License SNM-338, Docket 70-337, to Authorize Use of NFD Shipping Packages," immediately in front of the last previous transmittal letter, dated March 14, 1968.

Revised pages 7.1, 45, 46, 48, 49 and Appendix L should be inserted in the binder and the old pages removed.

The removed pages may be filed in the back of the binder.

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
13	3/1/68	43-49	Added Section 18, the BB 250-2 package
13	3/1/68	Appendix L	Added
14	3/5/68	Appendix K	Added RGAF data
15	3/14/68	Appendix B	Added SELNI data
16	4/8/68	45	Changed 8 spiders to 12 spring spacers
16	4/8/68	46	Add detail concerning bolting of lid
16	4/8/68	48-49	Revised Footnote <u>/1</u> to add discussion of nuclear criticality safety. Changed >1000 to >500.
16	4/8/68	Appendix L	Revised drawing to -1

18.3 (continued - BB 250-2)

Normal and Accident Conditions Evaluation - This package utilizes design concepts which are similar to those used in the design of the NUMEC LA-36 and Pu-10-1 packages, described in SNM-145 and SNM-414, respectively. The outer shell consists of two 16 ga, 22.5" diameter (nominal) steel drums welded end-to-end to form a package approximately 74" long. The inner container is an 11.5" diameter (maximum), 16 gauge (nominal) steel cylinder with a flanged closure consisting of a 1/2 inch thick (minimum) bolted flange and flange cover. A minimum of six 1/2"-13 NC bolts are used to seat a 1/8 inch thick Anchor Packing Company "Target" or "425" gasket which is provided to assure a leak-tight closure. Six tightly closed Fiberpak drums contain the uranium oxide. These drums have a nominal 9.5 inch diameter. Vermiculite is used to provide thermal and mechanical insulation for the gasketed inner container which is positioned with a minimum of 12 steel spring spacers, as shown in the sketch #SKA-252. The top insulation plug may be fabricated of unibestos. At least 5 inches of vermiculite insulates the inner container from the drum, except at the bottom where its thickness may be 4 inches.

The effects of the hypothetical accident conditions specified in Appendix C of 10 CFR 71 are considered on the basis of the results described by NUMEC.

18.3 (continued - BB 250-2)

Normal Conditions of Transport - All conditions described in the referenced licenses apply to this package. Because the package array is based on the consideration that each vertical projection of packages is replaced by a continuous cylinder having an identical length, the loss of spacing incurred in a vertical four foot drop test is not of concern. It is considered that the low horizontal loading will result in minimal displacement of the inner container in a horizontal drop test.

Accident Test Conditions - The inner container of the BB 250-2, when fully loaded, weighs 329.4# resulting in a vertical loading of 3.17 lbs/in^2 over a base area of 103.87 in^2 . The inner container of the NUMEC Pu-10-1 container, when fully loaded, and including the neutron moderator weighs 279#, resulting in a vertical loading of 3.55 lbs/in^2 over a base area of 78.54 in^2 . When placed in a horizontal position, the loadings are 0.456 lb/in^2 for the BB 250-2, and 0.442 lb/in^2 for the NUMEC Pu-10-1 container. Thus the tests performed on the latter container are valid for the BB 250-2 package. As a result, it is concluded that:

1. The integrity of the package is not affected by the tests. Because the lid is bolted in a minimum of six places around the top of the drum body, separation of the lid from the drum body does not occur. In this connec-

18.3 (continued - BB 250-2)

the array is evaluated by considering that optimum interunit water moderation is present between dry UO_2 packages. The following parameters were used to carry out array calculations using the ANISN and KENO codes,^{/1} assuming optimum interunit moderation.

Material and form	UO ₂ powder				
Enrichment	5 w/o U-235				
Powder density (ρ_u)	2 g/cc				
H/U (including all packaging material)	1.13				
Volume of undamaged package in hexagonal array	21.62 ft ³				
Volume of damaged package in hexagonal array	14.01 ft ³				
Number of packages in reflected array	<table style="border: none; margin-left: 20px;"> <tr> <td style="font-size: 3em; vertical-align: middle;">}</td> <td>>500 undamaged</td> </tr> <tr> <td style="font-size: 3em; vertical-align: middle;">}</td> <td>>200 damaged</td> </tr> </table>	}	>500 undamaged	}	>200 damaged
}	>500 undamaged				
}	>200 damaged				

Based on the above, 100 packages, each assigned 0.4 radiation units, may be shipped under Class II conditions.

^{/1} E. Whitesides to T. Gutman, Personal communication, March, 1968. The actual data developed is:

For a damaged package

$$k_{\infty} \text{ (max)} = 1.246 \text{ at an equivalent water thickness of } 0.5 \text{ cm}$$

$$k_e = 0.985 \pm 0.0065 \text{ for a critical array measuring } 15' \times 15' \times 15' \text{ (This was considered a } 15' \times 15' \text{ planar array of continuous cylinders } 15' \text{ long, which is conservative.) Thus, the critical volume is } 3375 \text{ cu.ft., and the critical number of damaged packages is } 3375/14.01 = 241. \text{ For Fissile Class II packages, the allowable number is one-half the critical number of damaged packages, or } 120. \text{ However, this results in a value of } 0.333 \text{ radiation units, and}$$

18.4 Fissile Class II Limits

One hundred (100) packages will be offered as a maximum Fissile Class II shipment. Each package will be assigned four-tenths (0.4) of a radiation unit.

18.5 Fissile Class III Limits

A maximum of two hundred (200) packages will be offered as a Fissile Class III shipment.

18.6 Procedural Controls

The contents of Section 10.6 of this application will be directly applicable to this package in all respects.

/1 (continued)

rounding this up to the next tenth gives a value of 0.4. The 40-unit rule then limits one shipment to 100 packages, and thus, the designation, ">200."

The allowable Fissile Class III shipment has been conventionally set at twice the Fissile Class II limit, or 200 packages, rather than the computed number of 241.

To demonstrate that the damaged case would govern for both Fissile Class II and Fissile Class III, it was necessary only to demonstrate that the critical number of undamaged packages exceeded 500.

This was conservatively approximated by preparing a plot of k versus the reciprocal of volume ($1/v$). Three calculated points for the damaged condition were plotted and connected with a hand fitted curve. Only one point ($k_{\infty} = 1.149$) was available for the undamaged case. By conservatively taking the volume of an undamaged package in a hexagonal array as 14.01 ft^3 , a line parallel to that plotted for the damaged case was drawn through this point. The second curve intersected $k_{\infty} = 1.00$ at $1/v = 0.000135$, or $v = 7400 \text{ cu.ft.}$ This results in a critical number of 530 packages.

Top Lid ATTACHED WITH
6 - 1/2" BOLTS.

HANDLE FOR LID REMOVAL

VERMICULITE OR UNIBESTOS

1/2" THICK COVER ATTACHED TO
INNER CONTAINER WITH 6 - 1/2" BOLTS.
CONTACT SURFACES MACHINED
AND GASKETED

2 DRUMS WELDED TOGETHER
CONTINUOUS WELD

WATER TIGHT INNER CONTAINER
1 1/2" I.D. (MAX. DIAMETER)

VERMICULITE FILLER

6 SPRINGS TOP & BOTTOM
WELDED TO INNER CONTAINER
1/4" DIA. SPRING STEEL ROD

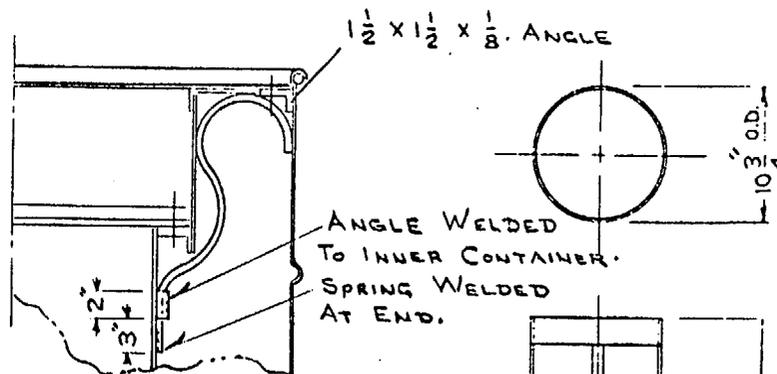
BOTTOM CLOSURE WELDED
ALL AROUND

74" APPROX.

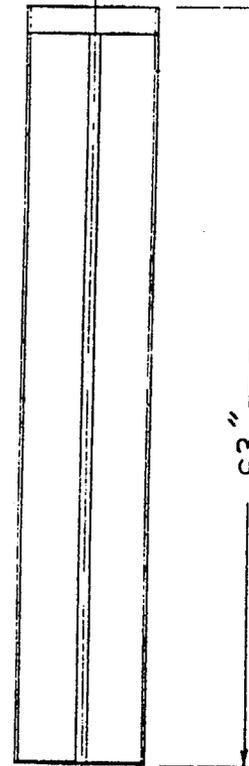
63 1/2" INNER CONTAINER (MAX.)

1 1/2"

22 1/2" I.D.



TOP CORNER TYP.



INSERT ASSY.
(OPTIONAL)

NOTE :

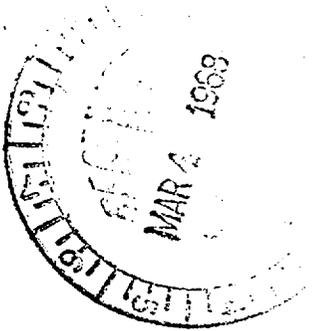
1 - ALL WELDS TO BE WATER TIGHT
ON INNER CONTAINER.

BB250-2 UO₂ POWDER
SHIPPING CONTAINER
4-4-68
D.P. WEISS
T. Gutman

SKA-252-1

APPENDIX I

SNM-338
Shipping - NFD



I

Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

March 1, 1968

* U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

W. R. Schendel
Cliff Anderson
For Div. of Compliance

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338
Docket 70-337, to Authorize Use of NFD Shipping
Packages

Gentlemen:

The Westinghouse Electric Corporation hereby requests amendments to the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packagings described in the attachment to this letter.

Please send the amendments to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment
7 copies transmitted

SNM-338
Shipping - NFD
3/1/68

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder, "Amendment of License SNM-338, Docket 70-337, to Authorize Use of NFD Shipping Packages," immediately in front of the last previous transmittal letter, dated February 13, 1968.

Revised pages 3, 4, 7, 42 and 43 should be inserted in the binder and the old pages removed.

New page 7.1 should be inserted in the binder immediately following page 7. New pages 44, 45, 46, 47, 48 and 49 should be inserted immediately following page 43. New Appendix L should be inserted immediately following existing Appendix K.

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- Appendix D - Yankee Shipping Container drawings
- Appendix E - MH-1A Shipping Container drawings
- Appendix F - Double Barrel Scrap Shipping Container sketch
- Appendix G - Quadruple Barrel Scrap Shipping Container drawing
- Appendix H - Triple Barrel Shipping Container drawing
- Appendix J - BB 250-1 Shipping Container drawing
- Appendix K - RCC-1 Shipping Container drawings
- Appendix L - BB 250-2 Shipping Container sketch

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
5	9/11/67	3	Added Section 14 and Appendix J
5	9/11/67	35-40	Added BB 300-1 package
5	9/11/67	Appendix J	Added
6	9/26/67	25-26	Added Spc. Pkg. for Zorita Spc. Assy's
7	11/3/67	40	Added Spc. Pkg. for Selni Rod Shipments
7	11/3/67	41-42	New
8	12/8/67	42	Added RCC-1 package
8	12/8/67	43	New
8	12/8/67	Appendix K	Added
9	12/12/67	15	Inserted reference to Drawing SKA-219
9	12/12/67	Appendix B	Added Drawing SKA-219
10	12/15/67	34-40	Revised Section 14 to describe BB 250-1 packaging and testing
10	12/15/67	Appendix J	Drawing revised
11	1/30/68	9 and 16	Added requirement that computed k_{eff} values be adjusted
11	1/30/68	11, 13, 17 & 20	Changed to read "adjusted k_{eff} "
11	1/30/68	28	Added paragraph on nuclear safety referencing General Criticality Standards section
11	1/30/68	29	Revised Package Array Evaluation section. Added details on calculations.
11	1/30/68	Appendix K	Decreased Max. Enrichment. Eliminated need for Poison Pl
12	2/13/68	43	Added Section 17, the NUMEC LA-36 package.
13	3/1/68	42	Revised Section 16.2 to make it apply to SNM listed in both Appendix A and Appendix K.

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
13	3/1/68	43-49	Added Section 18, the BB 250-2 package
13	3/1/68	Appendix L	Added

15.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit and Procedural Controls presented in Sections 5.4, 5.5 and 5.6, respectively, will apply directly to this package.

16. RCC-1 Packaging

16.1 Packaging Description

Designation - RCC-1 Shipping Container

Gross Weight - 7,000 pounds

Fabrication - The design and fabrication details for the shipping containers in the RCC-1 series are given in Equipment Specification E-676498, Revision 0, and Westinghouse drawings 684J898 and 541F351, which are attached as Appendix K to this application. Westinghouse drawing 684J861 is also included in Appendix K to indicate the location of, and the method of retaining, poison plates in the packaging, when they are required.

Coolants - Not applicable

16.2 Contents Description

The descriptions and discussions given in Section 4.2 will be directly applicable in all respects, if "and Appendix K" is added after "Appendix A" and "drawing 684J861" is substituted for "drawing 684J580".

16.3 Compliance with Subpart C of 10 CFR 71

The descriptions and discussions given in Section 4.3 will be directly applicable in all respects, if "Equipment Specification E-676498" is substituted for "Equipment Specification E-676200".

16.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit, and the Procedural Controls presented in Sections 4.4, 4.5, and 4.6, respectively, will apply directly to this package, if "Equipment Specification E-676498" is substituted for "Equipment Specification E-676200".

17. NUMEC LA-36 Shipping Package

The construction, limits on contents, and loading procedures will be in strict compliance with those given in Amendment 71-1 of License SNM-145, Docket 70-135.

18. BB 250-2 Shipping Package

18.1 Packaging Description

Designation - BB 250-2

Gross Weight - 575 pounds, maximum

Fabrication - The design and fabrication details for this container are given in Westinghouse sketch #SKA-252 which is attached as Appendix L to this application.

Coolants - Not applicable

18.2 Contents Description

Radioactivity - Not applicable

Identification and enrichment of SNM - The SNM will be unirradiated uranium enriched to a maximum of 4 w/o in the isotope U-235.

18.2 (continued - BB 250-2)

Form of SNM - The SNM will be in the form of bulk uranium oxide (UO_2 or U_3O_8) with a density ≤ 2 grams/cubic centimeter. The moisture content of the SNM will not exceed 0.5 w/o and the total H/U ratio, including all packaging materials, will not exceed 1.13.

Neutron Absorbers, etc. - None

Maximum Weight of Fissile Content - 4.0 kilograms U-235

Maximum Net Weight of Contents - 250 pounds of oxides enriched ≤ 4 w/o contained in 9.5 inch diameter Fiberpak drums or other containers having equivalent strength. These are contained in an 11.5 inch diameter (maximum) cylindrical inner container.

Maximum Decay Heat - Not applicable

18.3 Compliance with Subpart C of 10 CFR 71

General Standards - The materials which have been specified for this package will not result in significant chemical or galvanic reactions. There will be no specific lifting or tie down devices.

General Criticality Standards - Tests demonstrate that immersion in water, alone, is not sufficient to affect the structural integrity of the 9.5 inch diameter Fiberpak drums. Calculations using LEOPARD procedures show that a fully reflected, 11.5 inch diameter, infinitely long cylinder is nuclearly safe for homogeneous uranium enriched ≤ 4 w/o in U-235 under any conditions of moderation.

18.3 (continued - BB 250-2)

Normal and Accident Conditions Evaluation - This package utilizes design concepts which are similar to those used in the design of the NUMEC LA-36 and Pu-10-1 packages, described in SNM-145 and SNM-414, respectively. The outer shell consists of two 16 ga, 22.5" diameter (nominal) steel drums welded end-to-end to form a package approximately 74" long. The inner container is an 11.5" diameter (maximum), 16 gauge (nominal) steel cylinder with a flanged closure consisting of a 1/2 inch thick (minimum) bolted flange and flange cover. A minimum of six 1/2"-13 NC bolts are used to seat a 1/8 inch thick Anchor Packing Company "Target" or "425" gasket which is provided to assure a leak-tight closure. Six tightly closed Fiberpak drums contain the uranium oxide. These drums have a nominal 9.5 inch diameter. Vermiculite is used to provide thermal and mechanical insulation for the gasketed inner container which is positioned with a minimum of 8 steel spiders, as shown in the sketch #SKA-252. The top insulation plug may be fabricated of unibestos. At least 5 inches of vermiculite insulates the inner container from the drum, except at the bottom where its thickness may be 4 inches.

The effects of the hypothetical accident conditions specified in Appendix C of 10 CFR 71 are considered on the basis of the results described by NUMEC.

18.3 (continued - BB 250-2)

Normal Conditions of Transport - All conditions described in the referenced licenses apply to this package. Because the package array is based on the consideration that each vertical projection of packages is replaced by a continuous cylinder having an identical length, the loss of spacing incurred in a vertical four foot drop test is not of concern. It is considered that the low horizontal loading will result in minimal displacement of the inner container in a horizontal drop test.

Accident Test Conditions - The inner container of the BB 250-2, when fully loaded, weighs 329.4# resulting in a vertical loading of 3.17 lbs/in^2 over a base area of 103.87 in^2 . The inner container of the NUMEC Pu-10-1 container, when fully loaded, and including the neutron moderator weighs 279#, resulting in a vertical loading of 3.55 lbs/in^2 over a base area of 78.54 in^2 . When placed in a horizontal position, the loadings are 0.456 lb/in^2 for the BB 250-2, and 0.442 lb/in^2 for the NUMEC Pu-10-1 container. Thus the tests performed on the latter container are valid for the BB 250-2 package. As a result, it is concluded that:

1. The integrity of the package is not affected by the tests. Because the lid is bolted from the top, separation of the lid from the drum body does not occur. In this connec-

18.3 (continued - BB 250-2)

tion, test experience with the BB 250-1 shows that as a result of a top corner drop the lid and the body are folded together into a tighter closure.

2. The incorporation of five inches of vermiculite is equal to that provided in the NUMEC package, and is sufficient to assure that after the drop and fire tests the temperature of the inner container would not exceed the observed maximum of 500°F. Since the gasket is service rated to 800°F, the closure of the inner container is not compromised.
3. The test series does not result in the addition of moderation to the contained fissile material.

Single Package Evaluation - The safety considerations which pertain to a single package will assure nuclear safety even assuming that the failure of the inner container seal yields optimum moderation and full reflection. This is demonstrated in the section on General Criticality Standards.

Package Array Evaluation - In view of the ability of these packages to exclude water after being subjected to the hypothetical accident conditions,

18.3 (continued - BB 250-2)

the array is evaluated by considering that optimum interunit water moderation is present between dry UO_2 packages. The following parameters were used to carry out array calculations using the ANISN and KENO codes, ¹ assuming optimum interunit moderation.

Material and form	UO_2 powder
Enrichment	5 w/o U-235
Powder density (ρ_u)	2 g/cc
H/U (including all packaging material)	1.13
Volume of undamaged package in hexagonal array	21.62 ft ³
Volume of damaged package in hexagonal array	14.01 ft ³
Number of packages in reflected array	} >1000 undamaged >200 damaged

Based on the above, 100 packages, each assigned 0.4 radiation units, may be shipped under Class II conditions.

¹ E. Whitesides to T. Gutman, Personal communication, March 1968.

18.4 Fissile Class II Limits

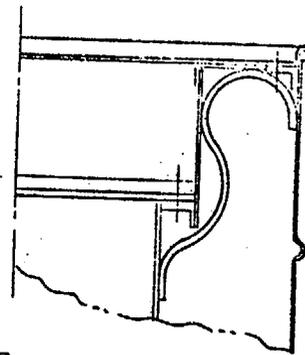
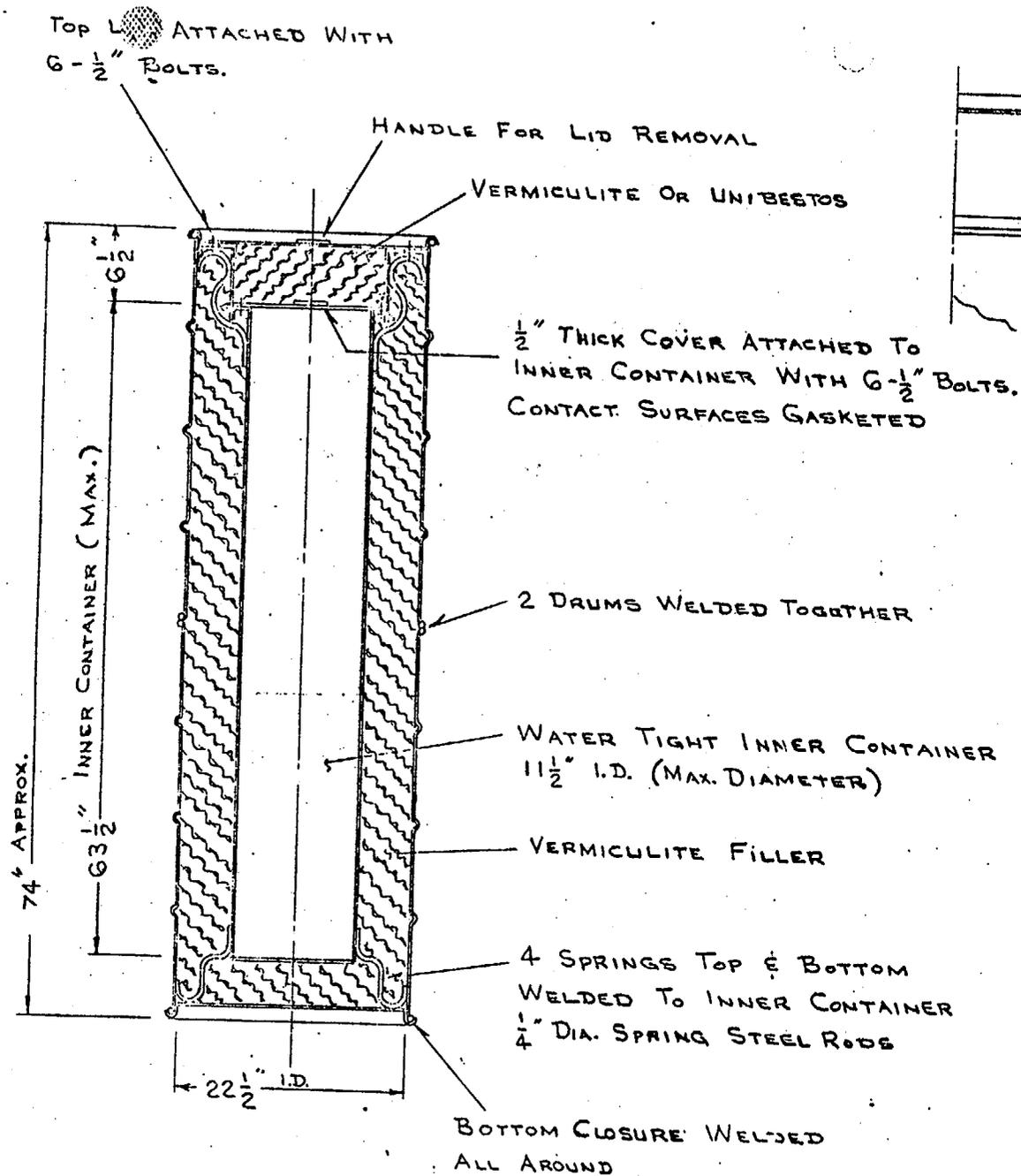
One hundred (100) packages will be offered as a maximum Fissile Class II shipment. Each package will be assigned four-tenths (0.4) of a radiation unit.

18.5 Fissile Class III Limits

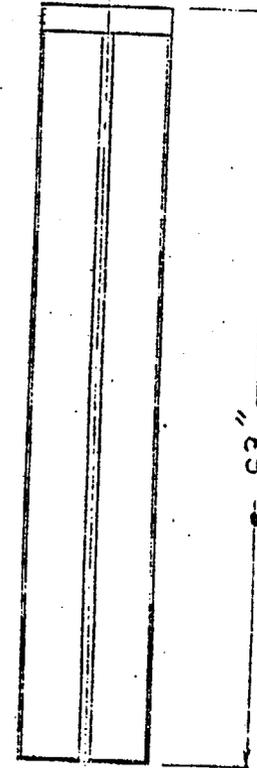
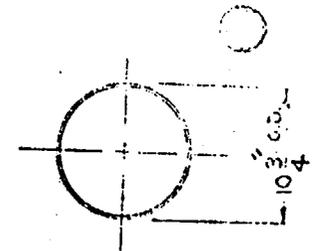
A maximum of two hundred (200) packages will be offered as a Fissile Class III shipment.

18.6 Procedural Controls

The contents of Section 10.6 of this application will be directly applicable to this package in all respects.



TOP CORNER TYP.



INSERT ASSY.

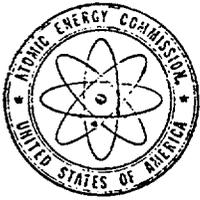
(OPTIONAL)

BB250-2 UO₂ POWDER
SHIPPING CONTAINER
2-23-68
D.P. WEISS

SKA-252

APPENDIX I

SNM-338
Shipping - NFD



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

MAY 28 1968

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IN REPLY REFER TO:

DML:CEM
70-337
SNM-338, Amendments Nos. 71-23, 71-24, 71-25

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed are Amendments Nos. 71-23, 71-24 and 71-25 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the CC, RCC and RCC-1 packages, respectively. Amendments Nos. 71-23, 71-24 and 71-25 supersede, in their entirety, Amendments Nos. 71-22, 71-13 and 71-21, previously issued for the CC, RCC and RCC-1 packages.

As discussed with you on May 16, 1968, by Mr. C. E. MacDonald, the RCC package (Amendment No. 71-24) includes the package submitted as Model RCC-2. The modification of the RCC package would require the closure clamp fitting described in Drawing EDSK323133B.

Please note that these amendments do not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT. Transport of special nuclear material not subject to DOT regulations is authorized by Amendment No. 5 to Special Nuclear Material License No. SNM-338, dated November 21, 1967, provided the appropriate packaging, marking, and labeling requirements of that amendment are satisfied.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosures:
As stated above

cc: Mr. William A. Brobst, DOT

ITEM #

Form 84

B/84

UNITED STATES
ATOMIC ENERGY COMMISSION

MAY 28 1968

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation	3. License No. <u>SNM-338</u>
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-23</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

- | | |
|------------------|---|
| (1) Model number | CC |
| (2) Description | Steel fuel element cradle assembly consisting of a strongback and fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts. |
| (3) Drawings | Container constructed in accordance with The Champion Company Drawings 10410, 10536, 10538, and 10541. |

(b) Contents

- | | |
|-------------------------------|---|
| (1) Type and form of material | Uranium dioxide as stainless steel clad unirradiated fuel elements of the following specifications: |
|-------------------------------|---|

<u>Type</u>	<u>14 x 14</u>	<u>15 x 15</u>
Pellet diameter (Nom)	0.317"	0.355"
Rod diameter (Nom)	0.341"	0.385"
Maximum Fuel Length	105"	106"
Maximum Rods/element	173	208

LICENSEE: Westinghouse Electric Corporation

PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-23

DOCKET NO.: 70-337

5. (b)(1) (CONTINUED)

<u>Type</u>	<u>14 x 14</u>	<u>15 x 15</u>
Maximum Cross Section (Nom)	6.284"	7.695"
Maximum U-235/element	10 kgs	13.5 kgs
Maximum U-235 enrichment	4.1 w/o	4.1 w/o

(2) Maximum quantity of material per package

Two fuel elements containing not more than 27 kilograms U-235.

(c) Fissile Class II and III

(1) Minimum number of radiation units to be shown on label for Class II

1.2 radiation units

(2) Maximum number of packages per shipment for Class III

60 packages

6. This amendment supersedes, in its entirety, Amendment No. 71-22 to SNM-338, dated March 29, 1968.

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the CC package.

Supplements dated May 25, December 12, 1967, January 30, March 14, and April 29, 1968.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment MAY 28 1968

Donald A. Nussbaumer
Division of Materials Licensing

UNITED STATES
ATOMIC ENERGY COMMISSION

-----MAY - 8 - 1968

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation	3. License No. <u>SNM-338</u>
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania	Amendment No. <u>71-24</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

(1) Model number

RCC

(2) Description

Steel fuel element cradle assembly consisting of a strongback and adjustable fuel element clamping assembly, shock mounted to a minimum 0.074" steel outer container by shear mounts.

(3) Drawings

Container constructed in accordance with Westinghouse Electric Corporation Drawings EDSK319401F, EDSK319402F, EDSK323133B, and 684J580 or 684J963, 541F613, 541F614, and EDSK323133B.

COPY

MAY 28 1968

LICENSEE: Westinghouse Electric Corporation

PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-24

DOCKET NO.: 70-337

(b) Contents

(1) Type and form of material

Uranium dioxide as zircaloy or stainless steel clad unirradiated fuel elements of the following specifications:

<u>Type</u>	<u>14 x 14 Zr Clad</u>	<u>14 x 14 SST Clad</u>	<u>15 x 15 SST Clad</u>
Pellet diameter (Nom)	0.367"	0.384"	0.384"
Rod diameter (Nom)	0.423"	0.422"	0.422"
Maximum Fuel Length	120"	120"	122"
Maximum Rods/element	180	180	204
Maximum Cross Section (Nom)	7.8"	7.8"	8.4"
Maximum U-235 element	16 kgs	18 kgs	20 kgs
Maximum U-235 enrichment	3.7 w/o	3.9 w/o	3.7 w/o

(2) Maximum quantity of material per package

Two fuel elements containing not more than 40 kilograms U-235.

(c) Fissile Class II and III

(1) Minimum number of radiation units to be shown on label for Class II

1.2 radiation units

(2) Maximum number of packages per shipment for Class III

60 packages

6. This amendment supersedes, in its entirety, Amendment No. 71-13 to SNM-338, dated February 29, 1968.

COPY

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 UNITED STATES
 ATOMIC ENERGY COMMISSION

MAY 28 1968

 LICENSE AMENDMENT
 for
 DELIVERY OF SPECIAL NUCLEAR MATERIAL
 to a
 CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation 2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230	3. License No. <u>SNM-338</u> Amendment No. <u>71-25</u> 4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

- | | |
|------------------|--|
| (1) Model number | RCC-1 |
| (2) Description | Steel fuel element cradle assembly consisting of a strongback and adjustable fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts. |
| (3) Drawings | Container constructed in accordance with Westinghouse Electric Corporation Drawings 541P351, 684J861 and 684J898. |

(b) Contents

- | | |
|-------------------------------|---|
| (1) Type and form of material | Uranium dioxide as zircaloy or stainless steel clad unirradiated fuel elements of the following specifications: |
|-------------------------------|---|

<u>Type</u>	<u>15 x 15 Zr Clad</u>	<u>14 x 14 Zr Clad</u>	<u>14 x 14 Zr Clad</u>	<u>14 x 14 SST Clad</u>	<u>15 x 15 SST Clad</u>
Pellet diameter (Nom)	0.372"	0.372"	0.367"	0.384"	0.384"
Rod diameter (Nom)	0.422"	0.422"	0.423"	0.422"	0.422"
Maximum Fuel Length	144"	144"	120"	120"	122"

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LICENSEE: Westinghouse Electric Corporation **COPY**

PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-25

DOCKET NO.: 70-337

5. (b)(1) (CONTINUED)

<u>Type</u>	<u>15 x 15 Zr Clad</u>	<u>14 x 14 Zr Clad</u>	<u>14 x 14 Zr Clad</u>	<u>14 x 14 SST Clad</u>	<u>15 x 15 SST Clad</u>
Maximum Rods/element	204	180	180	180	204
Maximum Cross Section (Nom)	8.4"	7.8"	7.8"	7.8"	8.4"
Maximum U-235/element	15 kgs	15.5 kgs	16 kgs	18 kgs	20 kgs
Maximum U-235 enrichment	3.2 w/o	3.5 w/o	3.7 w/o	3.9 w/o	3.7 w/o

(2) Maximum quantity of material per package Two fuel elements containing not more than 40 kilograms U-235.

(c) Fissile Class II and III

(1) Minimum number of radiation units to be shown on label for Class II 1.2 radiation units

(2) Maximum number of packages per shipment for Class III 60 packages

6. This amendment supersedes, in its entirety, Amendment No. 71-21 to SNM-338, dated March 29, 1968.

REFERENCES

Licensee's application dated December 8, 1967, requesting approval to deliver special nuclear material to a carrier for transport in the RCC-1 package.

Supplements dated January 30, March 1, March 5, and April 29, 1968.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment MAY 28 1968

Donald A. Nussbaumer
Division of Materials Licensing

COPY



Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

January 30, 1968

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338,
Docket 70-337, to Authorize Use of NFD Shipping
Packages For Div of Compliance

Gentlemen:

The Westinghouse Electric Corporation hereby requests amendments to the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packagings described in our application dated November 18, 1966, as revised by our transmittals of May 25, 1967, December 8, 1967, December 12, 1967 and the attachment to this letter.

Please send the amendments to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License
7 copies transmitted

ITEM #

85

From CO - Hdqrs.

321

B/15

SNM-338
Shipping - NFD
1/30/68

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder, "Amendment of License SNM-338, Docket 70-337, to Authorize Use of NFD Shipping Packages," immediately in front of the last previous transmittal letter, dated December 15, 1967.

Revised pages 7, 9, 11, 13, 16, 17, 20, 28 and 29 should be inserted in the binder and the old pages removed. The revised tabular page of Appendix K should be inserted and the old page removed.

The removed pages may be filed in the back of the binder.

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
5	9/11/67	3	Added Section 14 and Appendix J
5	9/11/67	35-40	Added BB 300-1 package
5	9/11/67	Appendix J	Added
6	9/26/67	25-26	Added Spc. Pkg. for Zorita Spc. Assy's
7	11/3/67	40	Added Spc. Pkg. for Selni Rod Shipments
7	11/3/67	41-42	New
8	12/8/67	42	Added RCC-1 package
8	12/8/67	43	New
8	12/8/67	Appendix K	Added
9	12/12/67	15	Inserted reference to Drawing SKA-219
9	12/12/67	Appendix B	Added Drawing SKA-219
10	12/15/67	34-40	Revised Section 14 to describe BB-250-1 packaging and testing
10	12/15/67	Appendix J	Drawing revised
11	1/30/68	9 and 16	Added requirement that computed k_{eff} values be adjusted
11	1/30/68	11,13,17 & 20	Changed to read "adjusted k_{eff} "
11	1/30/68	28	Added paragraph on nuclear safety referencing General Criticality Standards section
11	1/30/68	29	Revised Package Array Evaluation section. Added details on calculations.
11	1/30/68	Appendix K	Decreased Max. Enrichment. Eliminated need for Poison Pl.

4.1 (continued - RCC)

method of poison plates in the packaging, when the poison plates are required.

Coolants - Not applicable.

4.2 Contents Description

Radioactivity - Not applicable.

Identification and Enrichment of SNM - The SNM will be unirradiated uranium enriched ≤ 5 w/o in the isotope U-235.

Form of SNM - The SNM will be in the form of clad fuel assemblies. Specific data on maximum assembly parameters are included in Appendix A. The reactivity values listed in Appendix A equal the computed reactivity adjusted by a factor to provide for the probable error in the calculations. The contents will be loaded in such a fashion that if the package were to be flooded and subsequently drained, any water which may have penetrated the contents would drain simultaneously.

In the clad form, the assemblies will not disruptively react or decompose at the Accident Thermal condition. No chips, powders, or solutions will be offered for transport in this packaging.

4.2 (continued - RCC)

design of the lifting lugs will be such that, under an excessive load, the lug will fail across the hole before it would transmit disruptive stresses to the container. Similarly, the tie-down devices, which will accommodate 1" diameter steel cables, will have adequate strength to meet the static load requirement.

General Criticality Standards - The contents of each package will be so limited that, for a single container, with the contents maximumly moderated and fully reflected, the adjusted k_{eff} of the contents will be ≤ 0.90 . No consideration of dispersable material is required because the contents will be limited to clad components. See specific data in Appendix A.

The calculations will be made by the Nuclear Engineering Department using LEOPARD^{/1} or PDQ-03^{/2} or similar experimentally verified procedures. The requirement that fuel be in assemblies in a fixed array will assure that these calculations will be accurate and directly applicable. The calculations will include the effects of the neutron absorbing plates, when used.

- /1 Barry, R.F., "LEOPARD - A Spectrum Dependent Non-Spatial Depletion Code for the IBM 7094," WCAP-3269-26 (September 1963).
- /2 Caldwell, W.R., "PDQ-03 - A Program for the Solution of the Neutron Diffusion Equations in Two Dimensions on the IBM 704," WAPD-TM-179 (May, 1960).

4.3 (continued - RCC)

Any number of undamaged but flooded packages will also be nuclearly safe, since a single package will have a k_{eff} of ≤ 0.90 and there will be a minimum of 12 inches of water between the contents of any two packages. If the water drains away, the contents will also drain, so that the array returns to an unmoderated condition.

For the low-enriched assemblies under consideration, studies using LEOPARD and PDQ-03 demonstrate that a rise of k_{eff} (above the single package value) for an unlimited array does not occur at any reduced water density, due to the parasitic neutron absorption by the container walls and internal structure. Consequently, no degree of interspersed partial moderation can produce an array k_{eff} in excess of the single package k_{eff} resulting from complete flooding.

The maximum credible accident condition is conceived to involve only two packages, crushed top-to-top so that the spacing between the pairs of assemblies will be 1.7 inches, and aligned parallel to each other. This array is then assumed to be flooded. The heavy structural members of the base and the internal component support structures of the packagings will provide sufficient spacing so that any other package in the shipment will be isolated from this combination by a minimum of 12 inches of water.

The Nuclear Engineering Department will use the calculational procedures specified under General Criticality Standards to assure that the adjusted k_{eff} does not exceed 0.98 for the four assemblies in the maximum credible accident (MCA) array.

5.2 Contents Description - CC

Radioactivity - Not applicable.

Identification and Enrichment of SNM - The SNM will be unirradiated uranium enriched ≤ 5 w/o in the isotope U-235.

Form of SNM - The SNM will be in the form of clad fuel assemblies. Specific data on maximum assembly parameters are included in Appendix B. The reactivity values listed in Appendix B equal the computed reactivity adjusted by a factor to provide for the probable error in the calculations. The contents will be loaded in such a fashion that if the package were to be flooded and subsequently drained, any water which may have penetrated the contents would drain simultaneously.

In the clad form, the assemblies will not disruptively react or decompose at the Accident Thermal condition. No chips, powders, or solutions will be offered for transport in this packaging.

Neutron Absorbers, etc. - Not specified. No decrease in reactivity resulting from this type of material is included in the nuclear safety analysis.

Maximum Weight of Fissile Content - Listed in Appendix B.

Maximum Net Weight of Contents - Listed in Appendix B.

Maximum Decay Heat - Not applicable.

5.3 Compliance with Subpart C of 10 CFR 71

General Standards - The materials specified for the package will not produce significant chemical or galvanic reactions. The closure devices specified must be deliberately unfastened. Each of the four lifting lugs will be capable of supporting the loaded container individually, so the system of four lifting lugs will support three times the weight of the loaded container. In addition, the design of the lifting lugs will be such that, under an excessive load, the lug will fail across the hole before it would transmit disruptive stresses to the container. Similarly, the tie-down devices, which will accommodate 1" diameter steel cables, will have adequate strength to meet the static load requirement.

General Criticality Standards - The contents of each package will be so limited that, for a single container, with the contents maximumly moderated and fully reflected, the adjusted k_{eff} of the contents will be ≤ 0.90 . No consideration of dispersable material is required because the contents will be limited to clad components. See specific data in Appendix B.

5.3 (continued - CC)

ings will provide sufficient spacing so that any other package in the shipment will be isolated from this combination by a minimum of 12 inches of water.

The Nuclear Engineering Department will use the calculational procedures specified under General Criticality Standards to assure that the adjusted k_{eff} does not exceed 0.98 for the four assemblies in the maximum credible accident (MCA) array.

Since only two packages will combine to form the MCA array with a $k_{eff} \leq 0.98$, and any additional packages can only form similar isolated arrays, any number of the CC packages will be nuclearly safe under hypothetical accident conditions.

5.4 Fissile Class II Limits

Thirty-two (32) packages will be offered as a maximum Fissile Class II shipment. Each package will be assigned 1.2 radiation units.

The nuclear safety evaluations indicate that any number of packages would be safe. The limitations specified in this section have been based on considerations of vehicle capacity, shipment value and other non-nuclear considerations.

10.3 (continued - 2 Barrel)

General Criticality Standards - Table I of TID-7016 shows that a 5 inch diameter, infinitely long cylinder is nuclearly safe for homogeneous uranium at any enrichment under all conditions of moderation and reflection. Calculations using LEOPARD show that an 8 inch diameter, infinitely long cylinder is nuclearly safe under all conditions of moderation and reflection for heterogeneous uranium enriched ≤ 5 w/o in the isotope U-235.

Single Package Evaluation - The Double Barrel Scrap Shipping Container is structurally equivalent to, or superior to, the unit reported as "Series-3 Test and Result," page 16, ORNL 3735.^{/1} The restriction on axial loading to 70 pounds per lineal foot will produce less deformation as a result of impact tests than that reported in the referenced report. The assumption of optimum moderation and reflection obviates the necessity for leak testing. The restriction of the contents to non-pyrophoric forms will obviate the necessity for the Thermal Accident condition.

The accident conditions in Appendix B of Part 71 will not credibly produce an arrangement of special nuclear material more reactive than that analyzed under General Criticality Standards.

^{/1} Shappert, L.B., "Results of Impact Tests Performed on 55-Gallon Drum Type Birdcage," ORNL-3735.

10.3 (continued - 2 Barrel)

Package Array Evaluation - Calculations using LEOPARD, and considering the parasitic neutron absorption of the packaging walls, show that any number of damaged, optimally moderated packages in any array would be safe for any degree of interspersed, partial moderation. Thus, any number of packages will be nuclearly safe in any array under any credible conditions.

The calculations considered both homogeneous and heterogeneous material, moderated to H/U-235 ratios ranging from 200-240, depending on the material form. The packages were considered to be spaced on a 22" center-to-center dimension. The density of the interspersed moderation was varied from 5% to 100% of light water density. The maximum adjusted K_{∞} was determined to be ≤ 0.85 and to occur at approximately 10% of light water density.

10.4 Fissile Class II Limits

Eighty (80) packages will be offered as a maximum Fissile Class II shipment. Each package will be assigned 0.5 of a radiation unit.

10.5 Fissile Class III Limits

A maximum of one hundred-sixty (160) packages will be offered as a Fissile Class III shipment.

Appendix K

Products Shipped in Type RCC-1 Packages

Type Indian Pt. No. 2

Pellet Parameters

Material	UO ₂
Enrichment (Max)	3.2 w/o
Diameter (Nom)	.372"

Rod Parameters

Cladding Mt'l	Zirc.
Diameter (Nom)	.422"
Fuel Length (Nom. Max.)	144"

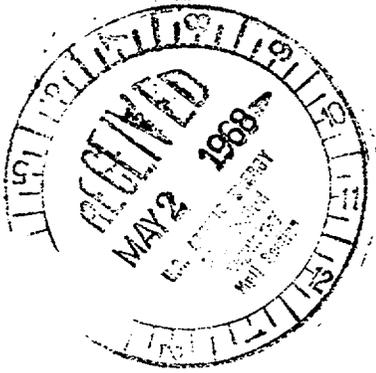
Assy. Parameters

No. of Rods (Max)	204
Pattern (Basic)	15 X 15 sq
Lattice Pitch (Nom)	.563"
Outside Dimen. (Nom)	8.4" sq

Licensing Criteria

Total U-235 (Max/Pkg)	30 kg
k_{eff} (Max/Ass'y)	< 0.88
k_{eff} (Max/1 Pkg)	< 0.90
k_{eff} (Max/MCA)	≤ 0.97
Poison Pl. Req'd	No

Net Wt. of Contents (Max)	3200#
------------------------------	-------



I

Westinghouse Electric Corporation

3 Gateway Center
Box 2178, Pittsburgh, Pa. 15230

April 29, 1968

Coker
[Signature]
[Signature]

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338
Docket 70-337, to Authorize Use of NFD Shipping
Packages.

Gentlemen:

The Westinghouse Electric Corporation hereby requests amendment of the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packaging described in the attachment to this letter.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment
7 copies transmitted

ITEM #

86

3/86

Form 350-1

1563

(11)

SNM-338
Shipping - NFD
4/29/68

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder, "Amendment of License SNM-338, Docket 70-337, to Authorize Use of NFD Shipping Packages," immediately in front of the last previous transmittal letter, dated April 8, 1968.

Revised pages 3, 4, 7.1, 8 and 42 should be inserted in the binder and the old pages removed. Also, the revised tabulations should be inserted in the binder in Appendices A, B and K, and the old pages removed.

New page 50 should be inserted in the binder immediately following page 49. New Appendix M should be inserted immediately following existing Appendix L.

The removed pages may be filed in the back of the binder.

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- Appendix G - Quadruple Barrel Scrap Shipping Container drawing
- Appendix H - Triple Barrel Shipping Container drawing
- Appendix J - BB 250-1 Shipping Container drawing
- Appendix K - RCC-1 Shipping Container drawings
- Appendix L - BB 250-2 Shipping Container sketch
- Appendix M - RCC-2 Shipping Container drawings

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
13	3/1/68	43-49	Added Section 18, the BB 250-2 package
13	3/1/68	Appendix L	Added
14	3/5/68	Appendix K	Added RGAF data
15	3/14/68	Appendix B	Added SELNI data
16	4/8/68	45	Changed 8 spiders to 12 spring spacers
16	4/8/68	46	Add detail concerning bolting of lid
16	4/8/68	48-49	Revised Footnote /1 to add discussion of nuclear criticality safety. Changed >1000 to >500.
16	4/8/68	Appendix L	Revised drawing to -1
17	4/29/68	8	6300# was 6000#
17	4/29/68	42	7200# was 7000#
17	4/29/68	50	Added Section 19, the RCC-2 package.
17	4/29/68	App. A, B & K	Revised to remove core designations, generalize certain categories, and update specific data
17	4/29/68	Appendix M	Added

1. Introduction

An amendment to License SNM-338, Docket 70-337, is hereby requested to authorize the delivery of special nuclear material to a carrier for transport in the packagings described herein.

2. Correspondence - Return Address

The license amendment and any associated correspondence should be sent to Karl R. Schendel, Westinghouse Electric Corporation, Box 2278, Pittsburgh, Pennsylvania 15230.

3. Administrative Control

The administrative control of the packaging operation will be carried out in accordance with the requirements contained in the Westinghouse Electric Corporation Health Physics Manual, WAED-HP-103, as amended. Currently, the latest revision of this manual is Revision V, dated May, 1966.

4. R.C.C. Packaging

4.1 Packaging Description

Designation - RCC (Rod Cluster Control) Shipping Container
B.E. Permit #2254.

Gross Weight - 6,300 pounds

Fabrication - The design and fabrication details for the RCC Shipping Container are given in Equipment Specification E-676200, dated 8/9/65, and Westinghouse drawings EDSK319401F, EDSK319402F and EDSK323133B, which are attached as Appendix A to this application. Westinghouse drawing 684J580 is also included in Appendix A to indicate the location and retention

15.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit and Procedural Controls presented in Sections 5.4, 5.5 and 5.6, respectively, will apply directly to this package.

16. RCC-1 Packaging

16.1 Packaging Description

Designation - RCC-1 Shipping Container

Gross Weight - 7,200 pounds

Fabrication - The design and fabrication details for the shipping containers in the RCC-1 series are given in Equipment Specification E-676498, Revision O, and Westinghouse drawings 684J898 and 541F351, which are attached as Appendix K to this application. Westinghouse drawing 684J861 is also included in Appendix K to indicate the location of, and the method of retaining, poison plates in the packaging, when they are required.

Coolants - Not applicable

16.2 Contents Description

The descriptions and discussions given in Section 4.2 will be directly applicable in all respects, if "and Appendix K" is added after "Appendix A" and "drawing 684J861" is substituted for "drawing 684J580".

16.3 Compliance with Subpart C of 10 CFR 71

The descriptions and discussions given in Section 4.3 will be directly applicable in all respects, if "Equipment Specification E-676498" is substituted for "Equipment Specification E-676200".

19. RCC-2 Packaging

19.1 Packaging Description

Designation - RCC-2 Shipping Container

Gross Weight - 6,300 pounds

Fabrication - The design and fabrication details for the shipping containers in the RCC-2 series are given in Equipment Specification E-676200 as modified by Addendum A to become Revision 1, and Westinghouse drawings 541F613 and 541F614, which are attached as Appendix M to this application. Westinghouse drawing 684J963 is also included in Appendix M to indicate the location of, and the method of retaining, poison plates in the packaging, when they are required.

Coolants - Not applicable

19.2 Contents Description

The descriptions and discussions given in Section 4.2 will be directly applicable in all respects, if "drawing 684J963" is substituted for "drawing 684J580".

19.3 Compliance with Subpart C of 10 CFR 71

The descriptions and discussions given in Section 4.3 will be directly applicable in all respects. It is understood that the reference to Equipment Specification E-676200 implies the appropriate revision.

19.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit, and the Procedural Controls presented in Sections 4.4, 4.5, and 4.6, respectively, will apply directly to this package. It is understood that the reference to Equipment Specification E-676200 implies the appropriate revision.

Appendix A

Products Shipped in Type RCC and RCC-2 Packages

Type	14 X 14 Zr Clad Assemblies	14 X 14 SST Clad Assemblies	15 X 15 SST Clad Assemblies
Pellet Parameters			
Material	UO ₂	UO ₂	UO ₂
Highest Enrichment (Nom)	3.7 w/o	3.9 w/o	3.7 w/o
Diameter (Nom)	.367"	.384"	.384"
Rod Parameters			
Cladding Mt'l	Zirc.	SST	SST
Diameter (Nom)	.423"	.422"	.422"
Fuel Lgth (Nom)	120"	120"	122"
Assy. Parameters			
No. of rods (Max)	180	180	204
Pattern (Basic)	14 X 14 sq	14 X 14 sq	15 X 15 sq
Lattice Pitch (Nom)	.556"	.556"	.563"
Outside Dimen. (Nom)	7.8" sq	7.8" sq	8.4" sq
Licensing Criteria			
Total U-235 (Max/pkg)	32.0 kg	36.0 kg	40.0 kg
k _{eff} (Max/ass'y)	0.86	0.86	0.85
k _{eff} (Max/1 pkg)	0.87	0.87	0.87
k _{eff} (Max/MCA)	0.96	0.96	0.96
Poison Pl. Req'd	No	No	No
Net Wt. of Contents (Max)	2200#	2200#	2500#

SNM-338
Shipping - NFD
4/29/68

Appendix B

Products Shipped in Type CC Packages

Type	14 X 14 SST Clad Assemblies	15 X 15 SST Clad Assemblies
Pellet Parameters		
Material	UO ₂	UO ₂
Highest Enrichment (Nom)	4.1 w/o	4.1 w/o
Diameter (Nom)	0.317"	0.355"
Rod Parameters		
Cladding Mt'l	SST	SST
Diameter (Nom)	0.341"	0.385"
Fuel Lgth (Nom)	105"	106"
Assy. Parameters		
No. of rods (Max)	173	208
Pattern (Basic)	14 X 14 sq	15 X 15 sq
Lattice Pitch (Nom)	0.453"	0.513"
Outside Dimen. (Nom)	6.284"	7.695"
Licensing Criteria		
Total U-235 (Max/pkg)	20 kg	27 kg
k _{eff} (Max/ass'y)	0.74	0.86
k _{eff} (Max/1 pkg)	0.84	0.90
k _{eff} (Max/MCA)	0.98	0.98
Poison Pl. Req'd	N.A.	N.A.
Net Wt. of Contents (Max)	2000#	2200#

SNM-338
 Shipping - NFD
 4/29/68

Appendix K

Products Shipped in Type RCC-1 Packages

Type	14 X 14 Zr Clad Assemblies	15 X 15 Zr Clad Assemblies
Pellet Parameters		
Material	UO ₂	UO ₂
Highest Enrichment (Nom)	3.5 w/o	3.2 w/o
Diameter (Nom)	.372"	.372"
Rod Parameters		
Cladding Mt'l	Zirc.	Zirc.
Diameter (Nom)	.422"	.422"
Fuel Length (Nom)	144"	144"
Assy. Parameters		
No. of Rods (Max)	180	204
Pattern (Basic)	14 X 14 sq	15 X 15 sq
Lattice Pitch (Nom)	.556"	.563"
Outside Dimen. (Nom)	7.8" sq	8.4" sq
Licensing Criteria		
Total U-235 (Max/Pkg)	31 kg	30 kg
k _{eff} (Max/Ass'y)	≤0.84	≤0.88
k _{eff} (Max/1 Pkg)	≤0.86	≤0.90
k _{eff} (Max/MCA)	≤0.96	≤0.97
Poison Pl. Req'd	No	No
Net Wt. of Contents (Max)	3200#	3200#

SNM-338
Shipping - NFD
4/29/68

EQUIPMENT SPECIFICATION COVER SHEET
WESTINGHOUSE FORM 54064 A

EQUIPMENT SPECIFICATION 676200	DATED August 9, 1965	REVISION NO. 1	DATED May 26, 1967	ORIGINAL ISSUE <input type="checkbox"/>	SUPERSEDES PREVIOUS REVISIONS <input type="checkbox"/>
-----------------------------------	-------------------------	-------------------	-----------------------	--	---

<p style="text-align: center; font-size: 2em;">3</p> <p>PROJECT: 137" Fuel Assembly Shipping Container</p> <p>SHOP ORDER: General</p> <p>SYSTEM:</p> <p>EQUIPMENT: Fuel Assembly Shipping Container</p>	<p>ATTACHMENTS</p> <p>Drawings: 541F613 541F614</p> <p>Appendix A</p> <p>Addendum A</p>
---	---

FOR SUPPLIER'S CONVENIENCE	
REV. NO.	REVISION ENTERED BY & DATE

WESTINGHOUSE ELECTRIC CORPORATION
Atomic Power Division
P.O. Box 355
Pittsburgh, Pennsylvania, 15230

APPROVAL

	ORIGINAL ISSUE	REV. 1	REV. 2	REV. 3	REV. 4
AUTHOR	J. J. Hutchinson <i>J. J. Hutchinson</i>				
SHOP ORDER HOLDER	H. W. Keller <i>H. W. Keller</i>				
PROJECT MANAGER	H. N. Andrews <i>H. N. Andrews</i>				<i>B. H. S.</i>

ITEM # 87

EQUIPMENT SPECIFICATION

ADDENDUM A

Make the following substitution unless it is stated otherwise.

Page 5, Item 1 c

Acceptance testing of production prototype unit using cradle assembly designed by W and shear mounts specified by W.

Page 5, Item 2 o

- a) Westinghouse Drawing 541F351
- b) Westinghouse Drawing 684J898
- c) Delete

Page 6, Item 3.1.1

In addition, the container must satisfy the Department of Transportation (D.O.T.), ICC, and Atomic Energy Commission regulatory standards on container specific design features and structural integrity with regard to nuclear safety.

Page 6, Item 3.1.2

The internals and component parts shall be designed by W.

Page 8, Item 3.1.3.2 f

All components shall be detachable from the container assembly.

Page 9, Item 3.1.3.2

Shock overload monitors will be specified by W.

Page 9, Item 3.1.3.3

Delete: Figure 3 is an example of one type of structural integrity closure clamp fitting that will be acceptable.

The container shall be capable of being pressurized to 10 lb/in² gauge with dry air or nitrogen. Sealed closure must be maintained at a pressure of 5 psi gauge under repeated use.

Page 10, Item 3.1.3.4 d

In addition, the container shall be suitable for parallel triangular stacking with one container stacked on top and across two like containers positioned side by side and in contact.

WESTINGHOUSE ELECTRIC CORPORATION
ATOMIC POWER DIVISION

Revision No. <u>1</u>	
to	
E-Spec. <u>676200</u>	Page <u>2</u> of <u>3</u> Pages

EQUIPMENT SPECIFICATION

Page 11, Item 3.1.3.5 d

A relief valve actuate at 7.5 ± 1 psi gauge and closing at 5 ± 1 psi gauge shall be provided on the surface of the container with rapid depressurization facility.

Page 12, Item 3.1.3.7

A minimum thickness of .074" steel shall be used for the container assembly shell.

Page 12, Item 3.2

The container shall be of the minimum practicable weight consistent with the performance requirements of this specification.

Page 13, Item 3.6 d

BME Permit No. to read DOT Permit No. and include Model No. on label.

Page 17, Item 4.1.5.2

The container shall be filled with air to 10 psi gauge and tested for leakage by either water immerision test at a loss of gauge pressure test.

Page 18, Item 4.1.5.4 (b)(c)

36" should read 30"

APPENDIX A

- 1) Neutron poison material is contained when required in the lateral spacing between the fuel assemblies to maintain nuclear safety of the shipment under maximum credible accident conditions.
- 2) Delete: Brackets are welded to the angle frame members for attachment of the shockmounts.
- 5) Item 6 - Attach crane to lifting lug at the forward end of the fuel assembly support frame.

Item 21 - Move outrigger members to their storage position.

WESTINGHOUSE ELECTRIC CORPORATION
ATOMIC POWER DIVISION

WAPD FORM 412

Revision No. <u>1</u>	
to	
E-Spec. <u>676200</u>	Page <u>3</u> of <u>3</u> Pages



Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

March 14, 1968

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

C. C. C. C.
W. H. H. H.

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338
Docket 70-337, to Authorize Use of NFD Shipping
Packages

1/11

Gentlemen:

for Div. of Licenses

The Westinghouse Electric Corporation hereby requests an amendment to the subject license to authorize the delivery of special nuclear material to a carrier for transport in the package described in the attachment to this letter.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment
7 copies transmitted

ITEM # 88

BPP

932

Form CO - Hdqrs.

SNM-338
Shipping - NFD
3/14/68

FILING INSTRUCTIONS

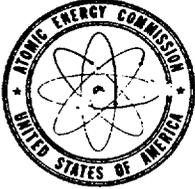
The transmittal letter should be filed in the binder, "Amendment of License SNM-338, Docket 70-337, to Authorize Use of NFD Shipping Packages," immediately in front of the last previous transmittal letter, dated March 5, 1968.

Revised pages 7.1 and Appendix B should be inserted in the binder and the old pages removed.

The removed pages may be filed in the back of the binder.

REVISION RECORD (continued)

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
13	3/1/68	43-49	Added Section 18, the BB 250-2 package
13	3/1/68	Appendix L	Added
14	3/5/68	Appendix K	Added RGAF data
15	3/14/68	Appendix B	Added SELNI data



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

4/2/68

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can

DML:CEM
70-337
SNM-338, Amendments Nos. 71-21, 71-22

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Div. Reading File w/o encls.

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed are Amendments Nos. 71-21 and 71-22 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the RCC-1 and CC packages, respectively. These amendments supersede, in their entirety, Amendments Nos. 71-12 and 71-14, previously issued for the RCC-1 and CC packages.

Please note that these amendments do not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT. Transport of special nuclear material not subject to DOT regulations is authorized by Amendment No. 5 to Special Nuclear Material License No. SNM-338, dated November 21, 1967, provided the appropriate packaging, marking, and labeling requirements of that amendment are satisfied.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosures:
As stated above

cc: Mr. William A. Brobst
Department of Transportation

APR 2 1968

ITEM # 89

From CO - Hqrs.

89

COPY

UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation	3. License No. <u>SNM-338</u>
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-21</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging
- (1) Model number RCC-1
 - (2) Description Steel fuel element cradle assembly consisting of a strongback and adjustable fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts.
 - (3) Drawings Container constructed in accordance with Westinghouse Electric Corporation drawings 541F351, 684J861 and 684J898.
- (b) Contents
- (1) Type and form of material Uranium dioxide as zircaloy or stainless steel clad unirradiated fuel elements of the following specifications:

Type	Indian Pt. No. 2	RGAF	Zorita NOK	SCE	CYW
Pellet diameter (Nom)	0.372"	0.372"	0.367"	0.384"	0.384"
Rod diameter (Nom)	0.422"	0.422"	0.423"	0.422"	0.422"
Maximum Fuel Length	144"	144"	120"	120"	120"

COPY

UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation	3. License No. <u>SNM-338</u>
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-22</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

- | | |
|------------------|---|
| (1) Model number | CC |
| (2) Description | Steel fuel element cradle assembly consisting of a strongback and fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts. |
| (3) Drawings | Container constructed in accordance with The Champion Company drawings 10410, 10536, 10538, and 10541. |

(b) Contents

- | | |
|-------------------------------|---|
| (1) Type and form of material | Uranium dioxide as stainless steel clad unirradiated fuel elements of the following specifications: |
|-------------------------------|---|

Type	CEX	SELNI
Pellet diameter (Nom)	0.317"	0.355"
Rod diameter (Nom)	0.341"	0.385"
Maximum Fuel Length	102"	102"
Maximum Rods/element	172	201

LICENSEE: Westinghouse Electric Corporation

PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO. 71-22

DOCKET NO.: 70-337

5. (b)(1) (CONTINUED)

<u>Type</u>	<u>CEX</u>	<u>SELNI</u>
Maximum Cross Section (Nom)	6.284"	7.695"
Maximum U-235/element	10 kgs	13.5 kgs
Maximum U-235 enrichment	4.1 w/o	4.1 w/o

(2) Maximum quantity of material per package

Two fuel elements containing not more than 27 kilograms U-235.

(c) Fissile Class II and III

(1) Minimum number of radiation units to be shown on label for Class II

1.2 radiation units

(2) Maximum number of packages per shipment for Class III

60 packages

6. This amendment supersedes, in its entirety, Amendment No. 71-14 to SNM-338, dated February 29, 1968.

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the CC package.

Supplements dated May 25, December 12, 1967, January 30, and March 14, 1968.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment _____

Donald A. Nussbaumer
Division of Materials Licensing



UNITED STATES
ATOMIC ENERGY COMMISSION

WASHINGTON, D.C. 20545

FEB 28 1968

I

IN REPLY REFER TO:

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SNM-338, Amendment No. 71-20

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Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-20 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the LA-36 package.

Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT. Transport of special nuclear material not subject to DOT regulation is authorized by Amendment No. 5 to Special Nuclear Material License No. SNM-338, dated November 21, 1967, provided the appropriate packaging, marking and labeling requirements of that amendment are satisfied.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosure:
As stated above

cc: Mr. William A. Brobst
Department of Transportation

From CO - Hdqrs.

FEB 29 1968

UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation 3 Gateway Center	3. License No. <u>SNM-338</u>
2. Address: Box 2278 Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-20</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

(1) Model number

LA-36

(2) Description

Two 5-gallon DOT Specification 17H pails, 11.25" I.D., with lug-type closure, contained in a 12 1/2" O.D. x 30" O.H. inner container which is centered and supported within a 65 gallon, 16 gage, steel drum built to DOT Specification 17H by 0.25-inch diameter spring steel rod spacers. Void space between inner container and outer drum is filled with vermiculite. Package shall be constructed in accordance with details shown and referenced in NUMEC drawing 10-D-1168, Rev. 5.

(b) Contents

(1) Type and form of material

(i) Dry non-decomposable forms of uranium having a maximum U-235 enrichment of 5.0%; or

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LICENSEE: Westinghouse Electric Corporation

PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-20

DOCKET NO.: 70-337

- (ii) Hydrous decomposable homogeneous compounds (non-liquid) of uranium having a maximum U-235 enrichment of 5.0%.
- (2) Maximum quantity of material per package
 - (i) For the type of material specified in 5(b)(1)(i):

Thirty-six (36) kilograms of material (maximum of 20 kg in one pail) containing not more than 1.56 kilograms U-235 except that uranium metal is limited to 1.37 kilograms U-235. The H/U-235 ratio, including all packaging materials, shall not exceed the following:

<u>Maximum H/U-235</u>	<u>Maximum U-235 Enrichment</u>
14.8*	1.0%*
7.4	2.0%
5.0	3.0%
3.7	4.0%
3.0	5.0%

*Homogeneous forms are exempted by 10 CFR 71.5(d)

- (ii) For the type of material specified in 5(b)(1)(ii):

Thirty-six (36) kilograms of material (maximum of 20 kilograms in one pail) containing not more than 1.0 kilogram U-235.

FEB 29 1968

LICENSEE: Westinghouse Electric Corporation

PAGE 3

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-20

DOCKET NO.: 70-337

(c) Fissile Class II and III

(1) Minimum number of radiation units to be shown on label for Class II

(i) For the contents specified in 5(b)(1)(i) and limited in 5(b)(2)(i):

<u>Maximum U-235 Enrichment</u>	<u>Minimum Radiation Units</u>
3.0%	0.3
5.0%	0.4

(ii) For the contents specified in 5(b)(1)(ii) and limited in 5(b)(2)(ii): 2.2 radiation units.

(2) Maximum number of packages per shipment for Class III

(i) For the contents specified in 5(b)(1)(i) and limited in 5(b)(2)(i):

<u>Maximum U-235 Enrichment</u>	<u>Maximum Number of packages</u>
1.0%*	225*
2.0%	164
3.0%	154
4.0%	115
5.0%	113

*Homogeneous forms are exempted by 10 CFR 71.5(d)

(ii) For the contents specified in 5(b)(1)(ii) and limited in 5(b)(2)(ii): 19 packages.

6. Only new, lug-type lids shall be used for the 5-gallon pails.

LICENSEE: Westinghouse Electric Corporation

PAGE 4

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-20

DOCKET NO.: 70-337

REFERENCES

Licensee's application dated February 13, 1968, for an amendment to Special Nuclear Material License No. SNM-338 to authorize the delivery of special nuclear material to a carrier in the above package.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment FEB 29 1968

Donald A. Nussbaumer
Division of Materials Licensing



Westinghouse Electric Corporation

I

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

February 13, 1968

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

For Div. of Compliance

Leiter
Ch. Schendel
2/13/68
W.S.H.

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338
Docket 70-337, to Authorize Use of NFD Shipping
Packages

Gentlemen:

The Westinghouse Electric Corporation hereby requests an amendment to the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packaging described in the attachment to this letter.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment

7 copies transmitted

503

From CO - Hdqrs.

SNM-338
Shipping - NFD
2/13/68

FILING INSTRUCTIONS

The transmittal letter should be filed in the binder, "Amendment of License SNM-338, Docket 70-337, to Authorize Use of NFD Shipping Packages," immediately in front of the last previous transmittal letter, dated January 30, 1968.

Revised pages 7 and 43 should be inserted in the binder and the old pages removed.

The removed pages may be filed in the back of the binder.

REVISION RECORD (continued)

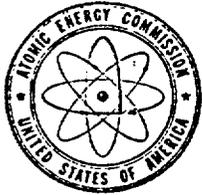
<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
5	9/11/67	3	Added Section 14 and Appendix J
5	9/11/67	35-40	Added BB 300-1 package
5	9/11/67	Appendix J	Added
6	9/26/67	25-26	Added Spc. Pkg. for Zorita Spc. Assy's
7	11/3/67	40	Added Spc. Pkg. for Selni Rod Shipments
7	11/3/67	41-42	New
8	12/8/67	42	Added RCC-1 package
8	12/8/67	43	New
8	12/8/67	Appendix K	Added
9	12/12/67	15	Inserted reference to Drawing SKA-219
9	12/12/67	Appendix B	Added Drawing SKA-219
10	12/15/67	34-40	Revised Section 14 to describe BB-250-1 packaging and testing
10	12/15/67	Appendix J	Drawing revised
11	1/30/68	9 and 16	Added requirement that computed k_{eff} values be adjusted
11	1/30/68	11,13,17 & 20	Changed to read "adjusted k_{eff} "
11	1/30/68	28	Added paragraph on nuclear safety referencing General Criticality Standards section
11	1/30/68	29	Revised Package Array Evaluation section. Added details on calculations.
11	1/30/68	Appendix K	Decreased Max. Enrichment. Eliminated need for Poison Pl.
12	2/13/68	43	Added Section 17, the NUMEC LA-36 package.

16.4 Limits and Controls

The Fissile Class II limit, Fissile Class III limit, and the Procedural Controls presented in Sections 4.4, 4.5 and 4.6, respectively, will apply directly to this package, if "Equipment Specification E-676498" is substituted for "Equipment Specification E-676200".

17. NUMEC LA-36 Shipping Package

The construction, limits on contents, and loading procedures will be in strict compliance with those given in Amendment 71-1 of License SNM-145, Docket 70-135.



UNITED STATES
ATOMIC ENERGY COMMISSION

WASHINGTON, D.C. 20545

FEB 29 1968

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[Handwritten signatures and initials]

IN REPLY REFER TO:

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70-337
SNM-338, Amendments Nos. 71-13 through 71-19

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Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed are Amendments Nos. 71-13 through 71-19 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the RCC, CC, FF, Yankee, Double Barrel, Quadruple Barrel, and Triple Barrel packages. Amendment No. 71-19 supersedes, in its entirety, Amendment No. 71-4, previously issued for the Triple Barrel package on April 28, 1967.

In regard to the Barrel type packages, please note that malleable iron pipe caps are required in each case and that the contents are restricted to uranium compounds which will withstand a temperature of 800°C without pressure generating decomposition. Our confirmation of the Barrel type packages considered a 21-inch center to center spacing rather than the 22-inch center to center spacing used in your analysis.

These amendments constitute a superseding license to deliver special nuclear material to a carrier for transport. The limited exemption granted by Section 71.12, 10 CFR 71, by filing an application within the 3 month period after the effective date of the regulation, expires upon issuance of this superseding license. These amendments do not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT. Transport

Westinghouse Electric Corporation -2-

FEB 29 1968

of special nuclear material not subject to DOT regulation is authorized by Amendment No. 5 to Special Nuclear Material License No. SNM-338, dated November 21, 1967, provided the appropriate packaging, marking and labeling requirements of that amendment are satisfied.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosures:

As stated

cc: Mr. William A. Brobst
Department of Transportation

 LICENSE AMENDMENT
 for
 DELIVERY OF SPECIAL NUCLEAR MATERIAL
 to a
 CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation 2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230	3. License No. <u>SNM-338</u> Amendment No. <u>71-13</u> 4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

- | | |
|------------------|--|
| (1) Model number | RCC |
| (2) Description | Steel fuel element cradle assembly consisting of a strongback and adjustable fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts. |
| (3) Drawings | Container constructed in accordance with Westinghouse Electric Corporation drawings EDSK319401F, EDSK319402F, EDSK323133B, and 684J580. |

(b) Contents

- | | |
|-------------------------------|---|
| (1) Type and form of material | Uranium dioxide as zircaloy or stainless steel clad unirradiated fuel elements of the following specifications: |
|-------------------------------|---|

<u>Type</u>	<u>Zorita/NOK</u>	<u>SCE</u>	<u>CYW</u>
Pellet diameter (Nom)	0.367"	0.384"	0.384"
Rod diameter (Nom)	0.423"	0.422"	0.422"
Maximum Fuel Length	120"	120"	120"
Maximum Rods/element	180	180	200

LICENSEE: Westinghouse Electric Corporation

PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-13

DOCKET NO.: 70-337

5. (b)(1) CONT'D

<u>Type</u>	<u>Zorita/NOK</u>	<u>SCE</u>	<u>CYW</u>
Maximum Cross Section (Nom)	7.8"	7.8"	8.4"
Maximum U-235 element	16 kgs	18 kgs	20 kgs
Maximum U-235 enrichment	3.7 w/o	3.85 w/o	3.67 w/o

(2) Maximum quantity of material per package

Two fuel elements containing not more than 40 kilograms U-235.

(c) Fissile Class II and III

(1) Minimum number of radiation units to be shown on label for Class II

1.2 radiation units

(2) Maximum number of packages per shipment for Class III

60 packages

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the RCC package.

Supplements dated May 25, 1967, and January 30, 1968.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment

FEB 29 1968

Donald A. Nussbaumer
Division of Materials Licensing

UNITED STATES
ATOMIC ENERGY COMMISSION

-----FEB-24-1968

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
<p>1. Name: Westinghouse Electric Corporation</p> <p>2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230</p>	<p>3. License No. <u>SNM-338</u> Amendment No. <u>71-14</u></p> <hr/> <p>4. Docket No. <u>70-337</u></p>

CONDITIONS

5. (a) Packaging

- | | |
|------------------|---|
| (1) Model number | CC |
| (2) Description | Steel fuel element cradle assembly consisting of a strongback and fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts. |
| (3) Drawings | Container constructed in accordance with The Champion Company drawings 10410, 10536, 10538, and 10541. |

(b) Contents

- | | |
|-------------------------------|---|
| (1) Type and form of material | Uranium dioxide as stainless steel clad unirradiated fuel elements of the following specifications: |
|-------------------------------|---|

Pellet diameter (Nom)	0.317"
Rod diameter (Nom)	0.341"
Max. Fuel Length	102"
Max. Rods/element	172
Max. Cross Section (Nom)	6.284"
Max. U-235/element	10 kilograms
Max. U-235 enrichment	4.1 w/o

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PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-14

DOCKET NO.: 70-337

- | | |
|---|--|
| (2) Maximum quantity of material per package | Two fuel elements containing not more than 20.0 kilograms U-235. |
| (c) Fissile Class II and III | |
| (1) Minimum number of radiation units to be shown on label for Class II | 1.2 radiation units |
| (2) Maximum number of packages per shipment for Class III | 60 packages |

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the CC package.

Supplements dated May 25, December 12, 1967, and January 30, 1968.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment FEB 29 1968

Donald A. Nussbaumer
Division of Materials Licensing

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ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
<p>1. Name: Westinghouse Electric Corporation</p> <p>2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230</p>	<p>3. License No. <u>SNM-338</u></p> <p style="text-align: center;">Amendment No. <u>71-15</u></p> <hr/> <p>4. Docket No. <u>70-337</u></p>

CONDITIONS

5. (a) Packaging

- | | |
|------------------|---|
| (1) Model number | FF |
| (2) Description | Steel fuel element cradle assembly consisting of a strongback and fuel mounting assembly, shock mounted to a 14-gage steel outer container by shear mounts. |
| (3) Drawings | Container constructed in accordance with The Champion Company drawings 10510, 10522, 10523, and 10528. |

(b) Contents

- | | |
|-------------------------------|---|
| (1) Type and form of material | Uranium dioxide as stainless steel clad unirradiated fuel elements of the following specifications: |
|-------------------------------|---|

Pellet diameter (Nom)	0.368"
Rod diameter (Nom)	0.430"
Max. Fuel Length	118"
Max. Rods/element	32
Max. Cross Section (Nom)	7.55" x 7.55"
Max. U-235/element	3 kilograms
Max. U-235 enrichment	4.0 w/o

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PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-15

DOCKET NO.: 70-337

- | | |
|--|---|
| (2) Maximum quantity of material per package | Two fuel elements containing not more than 6 kilograms U-235. |
|
(c) Fissile Class II and III | |
| (1) Minimum number of radiation units to be shown on label for Class I | 1.2 radiation units |
| (2) Maximum number of packages per shipment for Class III | 60 packages |

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the FF package.

Supplement dated May 25, 1967.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment

FEB 21 1967

Donald A. Nussbaumer
Division of Materials Licensing

 LICENSE AMENDMENT
 for
 DELIVERY OF SPECIAL NUCLEAR MATERIAL
 to a
 CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation 2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230	3. License No. <u>SNM-338</u> Amendment No. <u>71-16</u> 4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

(1) Model number

Yankee

(2) Description

Steel fuel element cradle assembly consisting of a strongback and fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts.

(3) Drawings

Container constructed in accordance with The Champion Company drawings 08335, 08508, 08510, and 08561.

(b) Contents

(1) Type and form of material

Uranium dioxide as stainless steel clad unirradiated fuel elements of the following specifications:

Pellet diameter (Nom)	0.298"
Rod diameter (Nom)	0.340"
Max. Fuel Length	93"
Max. Rods/element	305
Max. Outside Dimensions (Nom)	7.617" x 7.617"
Max. U-235/element	17.5 kilogram
Max. U-235 enrichment	4.95 w/o

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PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-16

DOCKET NO.: 70-337

- | | |
|---|---|
| (2) Maximum quantity of material per package | One fuel element containing not more than 17.5 kilograms U-235. |
|
(c) Fissile Class II and III | |
| (1) Minimum number of radiation units to be shown on label for Class II | 1.2 radiation units |
| (2) Maximum number of packages per shipment for Class III | 60 packages |

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the Yankee package.

Supplement dated May 25, 1967.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment _____

FEB 29 1968

Donald A. Nussbaumer
Division of Materials Licensing

UNITED STATES
ATOMIC ENERGY COMMISSION

---ELC-2-1958

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

<p>Licensee</p> <p>1. Name: Westinghouse Electric Corporation 2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230</p>	<p>3. License No. SNM- <u>338</u> Amendment No. <u>71-17</u></p> <p>4. Docket No. <u>70-337</u></p>
--	---

CONDITIONS

5. (a) Packaging

(1) Model number

Double Barrel

(2) Description

(See Page 2)

(b) Contents

(1) Type and form of material

(See Page 2)

(2) Maximum quantity of material per package

Eight (8) kilograms U-235, provided the weight of the contents does not exceed 350 pounds or 70 pounds per linear foot.

(c) Fissile Class

II and III

(1) Minimum number of radiation units to be shown on label for Class II

0.5 radiation unit

(2) Maximum number of packages per shipment for Class III

160 packages

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PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-17

DOCKET NO.: 70-337

5. (a)(2) Containment vessel consists of a 5-inch Schedule 40 steel pipe 57" long with threaded malleable iron pipe cap closure. Containment vessel is centered and supported in a drum fabricated from two DOT Specification 17H 55-gallon drums. Supporting structure consists of steel angle iron, bearing bands, and flat steel plate. Container constructed in accordance with design shown in Appendix F, Figures 1 through 4 of the licensee's application dated November 18, 1966.
5. (b)(1) Uranium compounds which will withstand a temperature of 800°C without pressure generating decomposition in the form of fuel powder, pellets, partial or complete fuel rods or other solid forms. Uranium may be enriched to a maximum 5.0 w/o in the U-235 isotope.

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the Double Barrel package.

Supplements dated May 25, 1967, and January 30, 1968.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment FEB 29 1968

Donald A. Nussbaumer
Division of Materials Licensing

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ATOMIC ENERGY COMMISSION

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----- FEB 29 1966 -----

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

<p style="text-align: center;">Licensee</p> <p>1. Name: Westinghouse Electric Corporation</p> <p>2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230</p>	<p>3. License No. SNM- <u>338</u></p> <p style="padding-left: 40px;">Amendment No. <u>71-18</u></p> <hr/> <p>4. Docket No. <u>70-337</u></p>
---	--

CONDITIONS

5. (a) Packaging

- (1) Model number Quadruple Barrel
- (2) Description (See Page 2)

(b) Contents

- (1) Type and form of material (See Page 2)

- (2) Maximum quantity of material per package Sixteen (16) kilograms U-235, provided the weight of the contents does not exceed 700 pounds or 70 pounds per linear foot.

(c) Fissile Class

- (1) Minimum number of radiation units to be shown on label for Class II II and III
- (2) Maximum number of packages per shipment for Class III 1.0 radiation unit
- (2) Maximum number of packages per shipment for Class III Eighty (80) packages

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PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-18

DOCKET NO.: 70-337

5. (a) (2) Containment vessel consists of a 5-inch Schedule 40 steel pipe 120" long with threaded malleable iron pipe cap closure. Containment vessel is centered and supported in a drum fabricated from four DOT Specification 17H 55-gallon drums. Supporting structure consists of steel pipe, angle iron, bearing bands, and flat steel plate. Container constructed in accordance with the design shown in Westinghouse Electric Corporation drawing C773D416.
5. (b) (1) Uranium compounds which will withstand a temperature of 800°C without pressure generating decomposition in the form of fuel powder, pellets, partial or complete fuel rods or other solid forms. Uranium may be enriched to a maximum 5.0 w/o in the U-235 isotope.

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the Quadruple Barrel package.

Supplement dated May 25, 1967.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment FEB 29 1968

Donald A. Nussbaumer
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LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation 3 Gateway Center	3. License No. <u>SNM-338</u>
2. Address: Box 2278 Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-19</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

- (1) Model number
- (2) Description

Triple Barrel

Containment vessel consists of a 5-inch Schedule 40 steel pipe 87" long with threaded malleable iron pipe cap closure. Containment vessel is centered and supported in a drum fabricated from three DOT Specification 17H 55-gallon drums. Supporting structure consists of steel angle iron, bearing bands, and flat steel plate. Container constructed in accordance with the design shown in Westinghouse Electric Corporation drawing C882D742.

(b) Contents

- (1) Type and form of material

- (i) Unirradiated Pathfinder fuel assemblies as shown on Allis-Chalmers Drawing No. 41-500-693, Rev. 3, containing UO₂ enriched to 6.95 w/o in the U-235 isotope.

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LICENSEE: Westinghouse Electric Corporation

PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-19

DOCKET NO.: 70-337

(ii) Uranium compounds which will withstand a temperature of 800°C without pressure generating decomposition in the form of fuel powder, pellets, partial or complete fuel rods or other solid forms. Uranium may be enriched to a maximum 5.0 w/o in the U-235 isotope.

(2) Maximum quantity of material per package

(i) For the contents specified in 5(b)(1)(i):

Nineteen (19) Pathfinder fuel assemblies within the 5-inch pipe, with the U-235 content not to exceed 3 kilograms.

(ii) For the contents specified in 5(b)(1)(ii):

Twelve (12) kilograms U-235, provided the weight of the contents does not exceed 525 pounds or 70 pounds per linear foot.

(c) Fissile Class II and III

(1) Minimum number of radiation units to be shown on label for Class II

For the contents described in 5(b)(1)(ii) and limited in 5(b)(2)(ii):

0.6 radiation units.

(2) Maximum number of packages per shipment for Class III

(i) For the contents specified in 5(b)(1)(i) and limited in 5(b)(2)(i):

24 packages.

(ii) For the contents specified in 5(b)(1)(ii) and limited in 5(b)(2)(ii):

120 packages.

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PAGE 3

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-19

DOCKET NO.: 70-337

6. This amendment supersedes, in its entirety, Amendment No. 71-4 to SNM-338, dated April 28, 1967.

REFERENCES

Licensee's application dated February 8, 1967, requesting approval to deliver special nuclear material to a carrier for transport in the Triple Barrel package.

Supplements dated March 9, and May 25, 1967.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment FEB 29 1968

Donald A. Nussbaumer
Division of Materials Licensing



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

I

DML:CB REFER TO:

70-337

SMM-338, Amendment No. 71-12

FEB 26 1968

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Westinghouse Electric Corporation
5 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-12 to Special Nuclear Material License No. SMM-338, authorizing the delivery of special nuclear material to a carrier for transport in the RRC-1 package.

Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT. Transport of special nuclear material not subject to DOT regulation is authorized by Amendment No. 5 to Special Nuclear Material License No. SMM-338, dated November 21, 1967, provided the appropriate packaging, marking, and labeling requirements of that amendment are satisfied.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosure:

As stated above

cc: Mr. William A. Brobst
Department of Transportation

UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
<p>Name: Westinghouse Electric Corporation</p> <p>Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230</p>	<p>3. License No. <u>SNM-338</u></p> <p style="padding-left: 40px;">Amendment No. <u>71-12</u></p> <hr/> <p>4. Docket No. <u>70-337</u></p>

CONDITIONS

5. (a) Packaging

- | | |
|------------------|--|
| (1) Model number | RCC-1 |
| (2) Description | Steel fuel element cradle assembly consisting of a strongback and adjustable fuel element clamping assembly, shock mounted to a 14-gage steel outer container by shear mounts. |
| (3) Drawings | Container constructed in accordance with Westinghouse Electric Corporation drawings 541F351, 684J861 and 684J898. |

(b) Contents

- | | | | | | | | | | | | | | | | |
|-------------------------------|--|-----------------|--------|--------------|--------|---------------------|------|----------------------|-----|-----------------------|-------------|-----------------------|--------------|------------------|---------|
| (1) Type and form of material | Uranium dioxide as zircaloy clad unirradiated fuel elements of the following specifications: | | | | | | | | | | | | | | |
| | <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>Pellet diameter</td> <td style="text-align: right;">0.372"</td> </tr> <tr> <td>Rod diameter</td> <td style="text-align: right;">0.422"</td> </tr> <tr> <td>Maximum Fuel Length</td> <td style="text-align: right;">144"</td> </tr> <tr> <td>Maximum Rods/element</td> <td style="text-align: right;">204</td> </tr> <tr> <td>Maximum Cross Section</td> <td style="text-align: right;">8.4" x 8.4"</td> </tr> <tr> <td>Maximum U-235/element</td> <td style="text-align: right;">15 kilograms</td> </tr> <tr> <td>U-235 enrichment</td> <td style="text-align: right;">3.2 w/o</td> </tr> </tbody> </table> | Pellet diameter | 0.372" | Rod diameter | 0.422" | Maximum Fuel Length | 144" | Maximum Rods/element | 204 | Maximum Cross Section | 8.4" x 8.4" | Maximum U-235/element | 15 kilograms | U-235 enrichment | 3.2 w/o |
| Pellet diameter | 0.372" | | | | | | | | | | | | | | |
| Rod diameter | 0.422" | | | | | | | | | | | | | | |
| Maximum Fuel Length | 144" | | | | | | | | | | | | | | |
| Maximum Rods/element | 204 | | | | | | | | | | | | | | |
| Maximum Cross Section | 8.4" x 8.4" | | | | | | | | | | | | | | |
| Maximum U-235/element | 15 kilograms | | | | | | | | | | | | | | |
| U-235 enrichment | 3.2 w/o | | | | | | | | | | | | | | |



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JAN 31 1968

CEN:
70-337
SNM-338, Amendment No. 71-11

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-11 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the BB 250-1 package.

Our confirmation that this package meets the requirements of Section 71.33 of 10 CFR 71 includes allowances for the finite height of the material and neutron absorption by the liner wall.

Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation (DOT). Questions regarding their requirements should be directed to DOT.

Very truly yours,

Donald A. Nussbauer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosure:
As stated above

cc: Mr. William A. Brobst
Department of Transportation



Westinghouse Electric Corporation

Handwritten signature/initials

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

May 24, 1967

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Amendment to License SNM-338, Docket 70-337,
to Authorize the Use of AML Shipping Package

Gentlemen:

The Westinghouse Electric Corporation hereby requests an amendment to the subject license authorizing the delivery of special nuclear material to a carrier for transport in the packaging described herein.

The packaging will be a NUMEC Model LA-36 shipping container using a Model HA-10 insert. This combination has been reviewed and approved by the Commission under license SNM-414.

The maximum quantity of material loaded into one package will be:

Uranium	Any form Any enrichment H/U-235 \leq 20 Vapor pressure \leq that of H ₂ O	10 kg.
Plutonium	Metal, oxides or alloys H/Pu \leq 20	2.4 kg.
(U, Pu)C	Encapsulated H/SNM \leq 20 C/SNM \leq 50	2.4 kg. SNM (U-235 + Pu)

May 24, 1967

This last capacity is conservative since the maximum allowable quantity for plutonium has been chosen as the maximum allowable quantity for total SNM. Furthermore, the fuel material will be encapsulated (usually in the form of short rods). And lastly, the "Introduction" to Part II (page 13) of TID-7016, Revision 1, implies that the moderating effect of carbon may be neglected for a C/X ratio less than 100. We have chosen a limiting C/X ratio of 50.

A maximum of 28 packages will be offered as a Fissile Class II shipment, and a maximum of 55 packages will constitute a Fissile Class III shipment.

Each packaging will be inspected prior to use. Components, damaged or deteriorated so as to compromise the effectiveness of the packaging, will be repaired or replaced. In particular, the vermiculite level will be checked, and additional insulation will be added as required. One inch thick wooden discs will be used as insulators whenever thermally decomposable compounds are packaged.

The Nuclear Materials Management Representative will maintain the necessary records on all shipments.

Please send the amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, 412-255-3907.

Very truly yours,



Karl R. Schendel
License Administrator

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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

IN REPLY REFER TO:

DML:CEM
70-337
SNM-338, Amendment No. 71-4

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-4 to License No. SNM-338, which authorizes the delivery of special nuclear material to a carrier for transport in the Triple Barrel Shipping Container.

Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Department of Transportation. Questions regarding their requirements should be directed to the DOT.

We are unable to confirm from the information in your application that not more than eight packages will be in a compact triangular array when subjected to the accident conditions; however, we have determined that 24 damaged packages in any arrangement would be subcritical.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials Branch
Division of Materials Licensing

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UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation	3. License No. <u>SNM-338</u>
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-4</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

- (1) Model number
- (2) Description

Triple Barrel Shipping Container

Five-inch Schedule 40 pipe inner container, 87" long, with threaded end caps. Pipe is centered and supported in a drum fabricated from three ICC Specification 17H 55-gallon drums, by angle iron braces and top and bottom protective covers. Container constructed in accordance with the design and specifications shown on WEC Drawing C882D742.

(b) Contents

- (1) Type and form of material
- (2) Maximum quantity of material per package

Unirradiated Pathfinder fuel assemblies, as shown on Allis-Chalmers Drawing No. 41-500-693, Rev. 3, containing UO₂ enriched to 6.95 w/o U-235.

Nineteen (19) Pathfinder fuel assemblies within the 5-inch pipe, with U-235 content not to exceed 3 kilograms.

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PAGE 2

LICENSE NO.: SNM-338

DOCKET NO.: 70-337

(c) Fissile Class

III

(1) Maximum number of
packages per shipment
for Class III

Twenty-four (24)

REFERENCES

Licensee's application dated February 8, 1967, requesting an amendment to Special Nuclear Material License No. SNM-338 to authorize the delivery of special nuclear material to a carrier for transport in the above package.

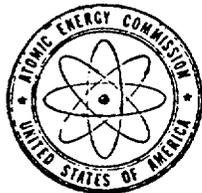
Supplement dated March 9, 1967.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment _____

Donald A. Nussbaumer
Division of Materials Licensing

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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

I
P.A.F.

IN REPLY REFER TO:

APR 14 1967

DML:RDS

70-337

SNM-338, Amendment No. 71-3

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl Schendel
License Administrator

Gentlemen:

This refers to your application dated February 15, 1967, requesting an amendment to Special Nuclear Material License No. SNM-338 to authorize the delivery of special nuclear material to a carrier for transport in the PWR Contract and Solid Scrap packages.

Enclosed is Amendment No. 71-3 to License No. SNM-338, which authorizes the delivery of special nuclear material to a carrier for transport in the PWR Contract package.

Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Interstate Commerce Commission. Questions regarding their requirements should be directed to the ICC.

In connection with our review of your application for the Solid Scrap package, please furnish additional information based on the following comments.

Your analysis of the accident situation involving an array of the Solid Scrap shipping containers is based on a comparison with the data in Figure 76 of TID-7028. There are at least two major differences between the experimental data and the specified accident conditions of Sections 71.39 and 71.40 of Part 71, viz., (1) the experimental data are given for bare arrays whereas the accident analysis should be based on a reflected array; and (2) the experimental data apply to cylinders of about 4.7 inches I.D. whereas your cylinders are 5.5 inches I.D. Other significant differences between the quoted experiments and the accident situation involve the stacking pattern and material of construction.

Westinghouse Electric Corporation - 2 -

Your array analysis should take the above factors into consideration, as well as loss of spacing resulting from the 30-foot drop test specified in Part 71.

You have described the contents as dry process scrap, in the form of solids. In the absence of a thermal test of the package, please confirm that the contents will withstand a temperature of 1475° F without pressure generating decomposition; or provide an analysis of the effects of the thermal test on the package. In addition, please furnish a more detailed description of the pipe closure, including materials of construction.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials Branch
Division of Materials Licensing

Enclosure:
As stated

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LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation	3. License No. <u>SNM-338</u>
2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-3</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

(1) Model number

PWR Contract Shipping Container

(2) Description

Fuel container is a 14 gauge stainless steel box with a maximum outside cross sectional area of 8.5 square inches, with gasketed lid closure. Fuel container is supported in an open birdcage of slotted angle iron, with outside dimensions 2' x 2' x 6' maximum. Container and birdcage are constructed in accordance with design shown in Figure 1 and 2 of the licensee's application dated February 15, 1967.

(b) Contents

(1) Type and form of material

Uranium enriched in the U-235 isotope to any enrichment, as sintered uranium oxide fuel elements, clad with bonded Zircaloy 2. Element dimensions are approximately 0.090" x 3.5" x 48".

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PAGE 2

LICENSE NO.: SNM-338

DOCKET NO.: 70-337

(2) Maximum quantity of material per package

Total contents not to exceed 120 pounds, with U-235 content not to exceed two kilograms.

(c) Fissile Class III

(1) Minimum number of radiation units to be shown on label for Class II

N. A.

(2) Maximum number of packages per shipment for Class III

Thirty-six (36)

REFERENCES

Licensee's application dated February 15, 1967, requesting an amendment to Special Nuclear Material License No. SNM-338 to authorize the delivery of special nuclear material to a carrier for transport in the above package.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment

APR 14 1967

Donald A. Nussbaumer
Division of Materials Licensing

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UNITED STATES
ATOMIC ENERGY COMMISSION

WASHINGTON, D.C. 20545

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SNM-338, Amendment No. 71-2

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Westinghouse Electric Corporation
Atomic Energy Division
5 Gateway Center
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl R. Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-2 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the Model MH-1A package. Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to regulation by the Interstate Commerce Commission. Questions regarding their requirements should be directed to the ICC.

Also, note Condition No. 6 of this license requires at least six (6) steel straps with a positive seal for securing each pair of MH-1A containers to the CC support structure. This condition was discussed with your Mr. Schendel on April 10, 1967.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials Branch
Division of Materials Licensing

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UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

Licensee	
1. Name: Westinghouse Electric Corporation	3. License No. <u>SNM-338</u>
2. Address: 3 Gateway Center Pittsburgh, Pennsylvania 15230	Amendment No. <u>71-2</u>
	4. Docket No. <u>70-337</u>

CONDITIONS

5. (a) Packaging

- | | |
|------------------|--|
| (1) Model number | Model MH-1A |
| (2) Description | MH-1A wooden container supported within CC steel container. |
| (3) Drawings | CC container constructed in accordance with the Champion Company Drawings 10410, 10536, 10538 and 10541. |

(b) Contents

- | | |
|--|--|
| (1) Type and form of material | Uranium up to 4.65 w/o enrichment in the U-235 isotope as stainless steel clad fuel assemblies. |
| (2) Maximum quantity of material per package | Twenty (20) kilograms U-235 contained in four (4) fuel assemblies in a two-long, two-wide, one-high arrangement. |

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PAGE 2

LICENSE NO.: SNM-338

DOCKET NO.: 70-337

(c) Fissile Class

III

(1) Maximum number of
packages per shipment
for Class III

Four (4)

6. Each pair of MH-1A containers shall be secured to the CC container support structure by at least six (6) 1-1/4" x .035" thick steel straps. The seal joint used shall be as strong as the strapping.

REFERENCES

Licensee's application dated November 18, 1966, requesting approval to deliver special nuclear material to a carrier for transport in the above container.

Supplements dated March 9, April 5, 1967.

FOR THE ATOMIC ENERGY COMMISSION

Date of Amendment _____

Donald A. Nussbaumer
Division of Materials Licensing

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Donald A. Messinger, Chief
 Source & Special Nuclear Materials Branch
 Division of Nuclear Materials Licensing

Very truly yours,

Inclosed is Amendment No. 71-1 to Special Nuclear Material
 license No. 9999-338 which authorizes the delivery of special
 nuclear material to a carrier for transport.
 Please note that this amendment does not authorize transport
 of licensed material. In order to transport this material
 you should obtain approval of your shipping procedures from
 the Interstate Commerce Commission.

Gentlemen:

Westinghouse Electric Corporation
 Atomic Energy Division
 Gateway Center
 Pittsburgh, Pennsylvania 15230
 Attention: Mr. Karl R. Schendel
 License Administrator

9999-338, Amendment No. 71-1
 70-537
 9999-338

SEP 21 1966

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LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70 and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

- | | |
|--|--|
| 1. Licensee: Westinghouse Electric Corporation | 3. License No: SNM-338
Amendment No: 71-1 |
| 2. Address: 3 Gateway Center
Pittsburgh, Pennsylvania 15230 | 4. Docket No: 70-337 |

CONDITIONS

5. (a) Packaging

(1) Model number

SPERT Fuel Rod Shipping Container
B.E. No. 1826

(2) Description

Outside container: Two ICC 17H
55-gal drums welded together.
Inner container: 5" sched 40 pipe
with threaded end caps. Inner
container fixed within the outer
container by 4 spacer assemblies
consisting of angle iron spokes
with bearing band and top and bottom
steel plates.

(3) Drawings

Westinghouse Electric Corporation
Drawing No. SK-FC-10, Figures 1,
2, 3, and 4.

(b) Contents

(1) Type and form
material

Uranium up to 93% enrichment in the
U-235 isotope as clad fuel elements
and fuel assemblies. Packaging of
chips, powders or solutions is not
authorized.

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PAGE: 2

LICENSE NO: SN1-538

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POCKET NO: 70-537

5. (b) Contents

- | | |
|--|---|
| (2) Maximum quantity of material per package | One hundred and twenty (120) pounds and not to exceed two (2) kilograms U-235 |
|--|---|

(c) Fissile Class II

- | | |
|---|-----|
| (1) Minimum number of radiation units to be shown on label. | 5.8 |
|---|-----|

6. Number of threads per inch for the removable screw-type cap must not be less than United States standard pipe threads and have sufficient length of thread to engage at least 5 threads when securely tightened.
7. Drum closure must be secured by means of 12 gauge bolted ring with drop forged lugs, one of which is threaded for a 5/8 inch bolt and nut.
8. Licensee's Administrative Control Procedures: Preparation, loading and securing of the package for shipment of licensed material shall be under the direction of the Supervisor of Industrial Hygiene.

REFERENCES

Application dated August 22, 1966, as supplemented September 6, 1966, by the Westinghouse Electric Corporation in support of its request for approval of the container identified above.

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FOR THE U. S. ATOMIC ENERGY COMMISSION

Date of Amendment SEP 21 1966

Donald A. Nussbaumer
Division of Materials Research



UNITED STATES
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WASHINGTON, D.C. 20545

sh
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Nov. 21, 1967

IN REPLY REFER TO:
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70-337
SNM-338, Amendment No. 71-7

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Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15230

Attention: Mr. Karl Schendel
License Administrator

Gentlemen:

Enclosed is Amendment No. 71-7 to Special Nuclear Material License No. SNM-338, authorizing the delivery of special nuclear material to a carrier for transport in the PWR Seed Fuel Element package.

Please note that this amendment does not authorize the transport of special nuclear material. Such transport is normally subject to Department of Transportation (DOT) regulation. Inquiries regarding their requirements should be directed to DOT.

Very truly yours,

Donald A. Nussbaumer, Chief
Source & Special Nuclear Materials
Branch
Division of Materials Licensing

Enclosure:
As stated above

cc: Mr. William A. Brobst
Department of Transportation

Co: T

12/90

ITEM # 90

(64)

UNITED STATES
ATOMIC ENERGY COMMISSION

LICENSE AMENDMENT
for
DELIVERY OF SPECIAL NUCLEAR MATERIAL
to a
CARRIER FOR TRANSPORT

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Part 70, and Part 71, the following amendment to the special nuclear material license identified below is hereby issued, authorizing the licensee to deliver special nuclear material to a carrier for transport, and is subject to the conditions specified in that license and to the conditions specified below.

<p>Licensee</p> <p>1. Name: Westinghouse Electric Corporation</p> <p>2. Address: 3 Gateway Center Box 2278 Pittsburgh, Pennsylvania 15230</p>	<p>3. License No. SNM- <u>338</u> Amendment No. <u>71-7</u></p> <p>4. Docket No. <u>70-337</u></p>
---	--

CONDITIONS

5. (a) Packaging

- (1) Model number PWR Seed Fuel Element
- (2) Description (See Page 2)

(b) Contents

- (1) Type and form of material (See Page 2)
- (2) Maximum quantity of material per package Total contents not to exceed 240 pounds, with U-235 content not to exceed four kilograms.

(c) Fissile Class

- III
- (1) Minimum number of radiation units to be shown on label for Class II N. A.
- (2) Maximum number of packages per shipment for Class III Nine (9) packages.

LICENSEE: Westinghouse Electric Corporation

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PAGE 2

LICENSE NO.: SNM-338

AMENDMENT NO.: 71-7

DOCKET NO.: 70-337

5. (a)(2) Fuel container is a 14 gage stainless steel box with a maximum outside cross sectional area of 8.5 square inches, with gasketed lid closure. Fuel container is supported in an open birdcage of slotted angle iron, with outside dimensions 2' x 2' x 12' maximum. Container and birdcage are constructed in accordance with design shown in Appendix A, Figures 1 and 2 of the licensee's application dated November 6, 1967.
5. (b)(1) Uranium enriched in the U-235 isotope to any enrichment, as sintered uranium oxide fuel elements, clad with bonded Zircaloy 2. Element dimensions are approximately 0.090" x 3.5" x 96".

REFERENCES

Licensee's application dated November 6, 1967, requesting amendment to Special Nuclear Material License No. SNM-338 to authorize the delivery of special nuclear material to a carrier for transport in the above package.

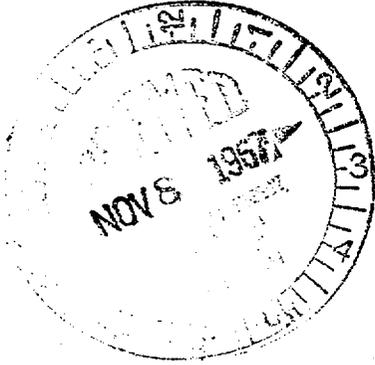
FOR THE ATOMIC ENERGY COMMISSION

NOV 21 1967

Date of Amendment _____

Donald A. Nussbaumer
Division of Materials Licensing

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Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

November 6, 1967

*

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for an Amendment to License SNM-338,
Docket 70-337, for WAED Shipping Packages

Gentlemen: ~~For Div of Compliance~~

The Westinghouse Electric Corporation hereby requests amendment of the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packages described in the attached application.

The attached application revises in their entirety our applications dated 9/23/66 and 2/15/67. However, the use of the PWR Contract Packaging, described in Section 7, has already been authorized by Amendment 71-3 to SNM-338. No changes have been made in Section 7 other than retyping and renumbering the pages. Thus, re-approval of this package is not required.

Please send the amendments to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

Attachment: License Amendment
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WESTINGHOUSE ELECTRIC CORPORATION

APPLICATION FOR AN AMENDMENT TO
LICENSE SNM-338
FOR WAED SHIPPING PACKAGES

REVISION NO. 2

11/6/67

U. S. ATOMIC ENERGY COMMISSION

DOCKET 70-337

WAED SHIPPING PACKAGES

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Appendix A

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REVISION RECORD

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
1	2/15/67	15 - 20	Added Part 6, <u>Solid Scrap Packaging</u>
1	2/15/67	21 - 26	Added Part 7, <u>PWR Contract Shipping Container</u>
1	2/15/67	Appendix B	Added
1	2/15/67	Appendix C	Added
2	11/6/67	1 - 27	Retyped .
2	11/6/67	4 - 7	Part 4, revised to apply only to full length PWR Seed fuel elements
2	11/6/67	8 - 12	Part 5, Substituted PWR Seed Fuel Module Packaging for PWR Blanket Fuel Element Packaging
2	11/6/67	15 - 19	Revised "Package Array Evaluation" using a density analysis technique. Revised Fissile Class Limits to suit
2	11/6/67	Appendix A	Revised to show full length fuel element packaging
2	11/6/67	Appendix D	Added

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1. Introduction

An amendment to License SNM-338 is hereby requested to authorize the delivery of special nuclear material to a carrier for transport in the packagings described herein.

2. Correspondence - Return Address

The license amendment and any associated correspondence should be sent to Karl R. Schendel, Westinghouse Electric Corporation, Box 2278, Pittsburgh, Pennsylvania 15230.

3. Administrative Control

The administrative control of the packaging operations will be carried out in accordance with the requirements contained in the Westinghouse Electric Corporation Health Physics Manual, as amended. Currently, the latest revision of this manual is Revision V, dated May 1966.

4. PWR Seed Fuel Element Packaging

4.1 Packaging Description

Designation - PWR Seed Fuel Element Shipping Container,
B.E. Permit #1270

Gross Weight - 520 pounds

Fabrication - The birdcage will have outside dimensions of 2' by 2' by 11-1/2' to 12' long. It will be fabricated of slotted 3" x 1-1/2" x 0.104" steel angles, fastened with 3/8" steel machine bolts. The fuel container will be centered in this frame with sec-

4.1 Packaging Description (cont.)

tions of slotted steel angle bolted directly against the six sides of the box. The angles will form a steel framework around the fuel container to provide geometric restraint. See Figure 1 in Appendix A.

The fuel container will be a 14 gauge stainless steel box with a maximum outside cross sectional area of 8.5 square inches. The box will have a hinged lid and Neoprene gasket. See Figure 2 in Appendix A.

After mounting the fuel container in the birdcage, the additional lengths of angle will be bolted in place to provide the restraint on all sides which has been previously specified.

Coolants - Not applicable

4.2 Contents Description

Identification and Enrichment of SNM - The SNM will be unirradiated uranium fully enriched in the isotope U-235.

Form of SNM - The SNM will be in the form of clad fuel elements. The elements, as loaded for transport, will measure approximately .090" x 3.5" x 96". The maximum loading of any element will consist of 320 grams U-235 in the form of sintered uranium oxide wafers in a bonded Zircaloy 2 cladding.

4.2 Contents Description (cont.)

Neutron Absorbers, etc. - Not specified. No decrease in reactivity resulting from this type of material is included in the nuclear safety analysis.

Maximum Weight of Fissile Constituent -
4 kilograms total contained U-235.

Maximum Net Weight of Contents - 240 pounds.

Maximum Decay Heat - Not applicable.

4.3 Compliance with Subpart C of 10 CFR 71

The package described in this section is identical to that described in Section 7 of this application in all respects except length, and the resulting weight. The analysis presented in Section 7.3 is applicable in all respects for the following reasons:

1. The axial weight per foot and the center-to-center dimensions of the braces are essentially unchanged. Therefore, the added weight will not effect the radial spacing between adjacent packages following the drop tests.
2. Any increased axial bowing or twisting following the drop tests, resulting from the increased length and weight, will only serve to increase the inter-package spacing, lending conservatism to the analysis.
3. The analysis given in Section 7.3 assumes infinite length packages.

4.4 Fissile Class II Limits

No packages described in this Section will be offered to a carrier for transport as a Fissile Class II package.

4.5 Fissile Class III Limits

A maximum of nine (9) packages will be offered to a carrier for transport as a Fissile Class III shipment using the exclusive use of the vehicle, or accompanied by an escort qualified as required by DOT regulations.

4.6 Procedural Controls

Prior to the first use of each packaging on or after the date of this application, the packaging will be inspected to assure compliance with the requirements specified in this application. In addition, the inspector will assure that the packaging is identified with a suitable model and serial number.

Each packaging will be visually inspected prior to each use. If damaged or deteriorated components are detected, they will be repaired or replaced so as to restore the packaging to essentially "like-new" condition.

The Accountability group will be responsible to maintain the required records on each shipment.

5. PWR Seed Fuel Module Packaging

5.1 Packaging Description

Designation - PWR Seed Fuel Module Shipping Container,
B.E. Permit #1522

Gross Weight - 1600 pounds

Fabrication - The packaging will consist of an inner container that will be bolted and strapped with several steel bands to an exterior frame. The design of the inner container is illustrated in Figure 2 of Appendix D. The inner container will be made of 14 gauge stainless steel sheet. The top will be gasketed with neoprene rubber. The top will be hinged to the container with a "piano type" hinge, which will extend along the entire length of the inner container.

The exterior frame will be made of AIM, slotted steel angle #300-104 or equivalent material. The dimensions of the steel angle will be 3 in. x 1.5 in. with a wall thickness of 0.104 in. This steel angle will be bolted together to form the exterior frame with 3/8 inch diameter bolts. This frame is illustrated in Figure 1 of Appendix D. The location of the inner container when bolted and strapped to the outer container is shown in Figure 1.

Coolants - Not applicable.

5.2 Contents Description

Radioactivity - Not applicable.

Identification and Enrichment of SNM - The SNM will be uranium which is fully enriched in the isotope U-235.

Form of SNM - The SNM will be in the form of sintered UO_2 - ZrO_2 wafers clad in Zircaloy to form fuel elements which in turn have been assembled into a PWR-2 Seed-2 reactor module. A general description of the sub-assemblies and cluster (module without its hardware) is given on Page 1 "Description of Seed 2" of the letter, WAPD-PWR-R(PH)-121, undated, which is attached as part of Appendix D. Each package will contain a single module. No other form of SNM will be offered for transport under the authorization requested in this application.

Neutron Absorbers, etc. - A cruciform shaped poison rod, containing 1.25% boron will normally be inserted into the control rod channel of each module prior to packaging. The poison rod will extend the full length of the fueled section and will be locked to the module with a positive clamping device.

However, no decrease in reactivity resulting from the presence of this poison rod is considered in the nuclear criticality safety analysis.

5.2 Contents Description (cont.)

Maximum Weight of Fissile Constituent - 21 kilograms
total contained U-235

Maximum Net Weight of Contents - 1250 pounds

Maximum Decay Heat - Not applicable

5.3 Compliance with Subpart C of 10 CFR 71

General Standards - The various materials which have been specified for the package will not result in significant chemical or galvanic reactions. There are no specific lifting or tie-down devices. The structural members of the birdcage which might be used for these purposes will fulfill the requirements of 10 CFR 71.31.

General Criticality Standards - Reactivity data for the PWR-2 Seed-2 modules is given in letter WAPD-PWR-R(PH)-121, attached as part of Appendix D. Independent calculations confirm the values given in this letter. Inasmuch as the modules which will be transported have been completely inspected, consideration of omitted poison can be ignored. Figure 3 of WAPD-PWR-R(PH)-121 indicates that a single normal module will have an effective neutron multiplication factor (k_{eff}) no greater than 0.76 when fully moderated and reflected. Therefore, a single package will be nuclearly safe for conditions of full moderation and reflection.

5.3 Compliance with Subpart C of 10 CFR 71 (cont.)

Single Package Evaluation - Inasmuch as a reactor module will provide inherent structural integrity to assure the containment of fissile material under normal transport and hypothetical accident conditions, the necessity for evaluating the effect of these conditions on the packaging is obviated. As demonstrated under General Criticality Standards, a single package will be nuclearly safe for conditions of full moderation and reflection.

Package Array Evaluation - Fig. 4 of WAPD-PWR-R(PH)-121 shows that three normal reactor modules in a square array will have a k_{eff} no greater than 0.98 for conditions of full moderation and reflection. Any bending or warping produced in a module as the result of normal transport or hypothetical accident conditions would only result in misalignments between the modules which would tend to reduce the k_{eff} . Since the k_{eff} is computed for bare adjacent modules, the modules essentially form a unit and consideration of interspersed moderation is unnecessary. Therefore, a quantity of three packages will be nuclearly safe for conditions of full moderation and

5.3 Compliance with Subpart C of 10 CFR 71 (cont.)

reflection. It may be noted that any decrease in the reactivity of the three modules which will result from increased spacing and parasitic neutron absorption due to the presence of the packaging and from the presence of the poison rods has been conservatively neglected.

5.4 Fissile Class II Limits

No packages will be offered to a carrier for transport as a Fissile Class II shipment.

5.5 Fissile Class III Limits

Three (3) packages will be offered to a carrier for transport as a Fissile Class III shipment using the exclusive use of the vehicle, or accompanied by an escort qualified as required by DOT Regulations.

5.6 Procedural Controls

The steel banding specified in Section 5.1 will be installed new for each use.

The Accountability group will be responsible to maintain the required records on each shipment.

6. Solid Scrap Packaging

6.1 Packaging Description

Designation - Solid Scrap Shipping Container,
B.E. Permit #2169

Gross Weight - 350 pounds, maximum

Fabrication - The design and fabrication details for the
Solid Scrap Shipping Container are given
in drawings AFD-C-001 (6 sheets) which is
attached as Appendix B to this application.

Coolants - Not applicable

6.2 Contents Description

Radioactivity - Not applicable

Identification and Enrichment of SNM - the SNM will be
unirradiated uranium at any enrichment up
to fully enriched in the isotope U-235.

Form of SNM - the SNM will be in the form of dry process
scrap, such as chips and parts of fuel
elements, occurring in the manufacture of
nuclear reactor cores.

Neutron Absorbers - Not specified.

Maximum Weight of Fissile Constituents - 2.0 kilograms
total contained U-235.

Maximum Net Weight of Contents - 90 pounds

Maximum Decay Heat - Not applicable

6.3 Compliance with Subpart C of 10 CFR 71

General Standards - The various materials which have been specified for the package will not result in significant chemical or galvanic reactions. There will be no specific lifting or tie-down devices.

General Criticality Standards - A single package will be safe for conditions of optimum moderation and full reflection. The 2 kilogram limit on the maximum weight of U-235 which will be loaded into this package limits the average fuel density to approximately 0.17 grams of U-235 per milliliter. This density is typical of solutions. Figure 3 on page 15 of TID-7016, Rev. 1 shows that an infinitely long 5-1/2 inch diameter cylinder is nuclearly safe for all degrees of moderation and reflection at this U-235 density. In addition, information given on page 67 of TID-7019 indicates that a maximum of 2 kilograms of contained U-235 as solid scrap can safely be shipped in a 6 inch inside diameter container.

Single Package Evaluation - The results of hypothetical accident condition drop tests on a package structurally similar to the Solid Scrap

6.3 Compliance with Subpart C of 10 CFR 71 (cont.)

Shipping Container are reported in ORNL-3735.^{/1} Our container will have less deformation than that reported because the axial load will be approximately 30 pounds per foot instead of the 90 pounds per foot used by Oak Ridge.

The necessity for the Water Immersion condition is obviated by the assumption of optimum moderation in the nuclear safety analysis. The necessity for the Thermal condition is obviated by the limitation of the contents to solids.

Package Array Evaluation - A triangular pitch array was assumed, since this is the more reactive arrangement.

It was assumed there was a 10% reduction in dimensions as a result of a 30 foot drop. This assumption seems reasonable as shown in the document ORNL-3735. We would anticipate less deformation since our axial loading per inch is smaller. Results of drop tests performed by Nuclear Fuel Service

^{/1} Shappert, L.B., "Results of Impact Tests Performed on 55-Gallon Drum Type Birdcage," ORNL 3735.

6.3 Compliance with Subpart C of 10 CFR 71 (cont.)

appearing in Docket 70-143 showed a deformation of 0.125 inches on an end drop.

Data for reflected arrays was plotted, Figure 6.3.2, using the ratio (average uranium density in the array to the original density) versus the critical solution volume of the array.^{/1} Experimental data is available for two arrays. The data was extended for larger arrays by calculations using the NB_N^2 method. In plotting the data the methacrylate plastic was homogenized into the system. Due to the homogenization, the solution concentration becomes 315 grams U-235/liter instead of 384 grams U-235/liter. In the region from 250 to 800 grams U-235/liter the critical volume remains comparatively constant. Since the U-235 concentration in the proposed array is 170 grams/liter, conservatism is introduced in the calculations.

^{/1} Thomas, J.T., "Criticality of Large Systems of Subcritical U (93) Components" ORNL-CDC-1

6.3 Compliance with Subpart C of 10 CFR 71 (cont.)

The critical number of packages was adjusted for inter-unit moderation by dividing by a correction factor of two (2).^{/2} This factor is applicable for an $H/X \geq 25$, which is conservative for the dilute "smeared" system being considered.

A tabulation of the significant data evolved during the evaluation is given in Table 6.3.1.

6.4 Fissile Class II Limits

Eight (8) packages will be offered as a maximum Fissile Class II shipment. Each package will be assigned five (5) radiation units.

6.5 Fissile Class III Limits

Twenty (20) packages will be offered as a maximum Fissile Class III shipment using the exclusive use of the vehicle or accompanied by an escort qualified as required by DOT Regulations.

^{/2} Brown, C.L., "Criticality Safety in Transportation and Storage" Proceedings; Nuclear Criticality Safety, National Topical Meeting, 13-15 December 1966, SC-DC-67-1305.

TABLE 6.3.1

Package Array Evaluation Data

	Undamaged	Damaged
Inner Container Volume	11.65 l.	11.65 l.
Outer Container Volume	8.36 ft ³	6.02 ft ³
Original U Density (P ₀)	170 g U-235/1	170 g U-235/1
"Smeared" U Density (P̄)	8.5 g U-235/1	11.7 g U-235/1
Density Ratio (P̄/P ₀)	0.05	0.068
Critical Volume (from Fig. 6.3.2)	980 l.	540 l.
Critical No. of Packages	83.6	46.3
Critical No. of Mod. Pkgs.	41.8	23.1
Allow. No. Fissile II Pkgs.	8	11
Allow. No. Fissile III Pkgs.	20	23

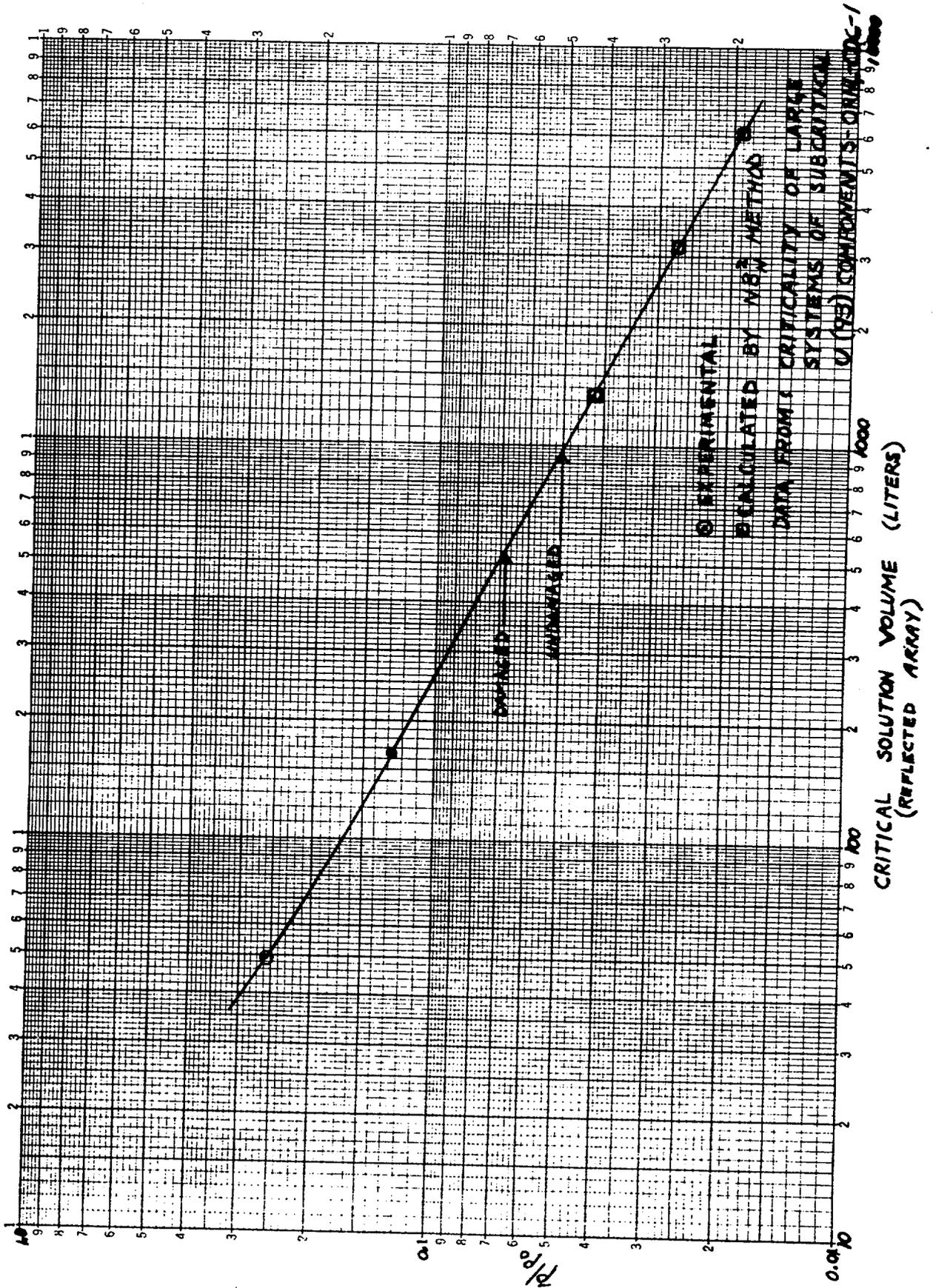


Figure 6.3.2

Array Critical Solution Volume

6.6 Procedural Controls

Prior to the first use of each new packaging, it will be inspected to assure compliance with the requirements specified in this application. In addition, the inspector will assure that the packaging is suitably identified, including a unique serial number.

Each package will be visually inspected prior to each use. If damaged or deteriorated components are detected, they will be repaired or replaced so as to restore the packaging to essentially "like-new" condition.

The Accountability Group will be responsible to maintain the required records on each shipment.

7. PWR Contract Packaging

7.1 Packaging Description

Designation - PWR Contract Shipping Container,
B.E. Permit #1270

Gross Weight - 260 pounds

Fabrication - The birdcage will have outside dimensions of 2' by 2' by 5-1/2' to 6' long. It will be fabricated of slotted 3" x 1-1/2" x 0.104" steel angles, fastened with 3/8" steel machine bolts. The fuel container will be centered in this frame with sections of slotted steel angle bolted directly against the six sides of the box. The angles will form a steel framework around the fuel container to provide geometric restraint. See Figure 1 in Appendix C.

The fuel container will be a 14 gauge stainless steel box with a maximum outside cross sectional area of 8.5 square inches. The box will have a hinged lid and Neoprene gasket. See Figure 2 in Appendix C.

After mounting the fuel container in the birdcage, the additional lengths of angle will be bolted in place to provide the restraint on all sides which has been previously specified.

7.1 Packaging Description (cont.)

Coolants - Not applicable

Activity - Not applicable

7.2 Contents Description

Identification and Enrichment of SNM - The SNM will be unirradiated uranium fully enriched in the isotope U-235.

Form of SNM - The SNM will be in the form of clad fuel elements. The elements, as loaded for transport, will measure approximately .090" x 3.5" x 48". The maximum loading of any element will consist of 160 grams U-235 in the form of sintered uranium oxide wafers in a bonded Zircaloy 2 cladding.

Neutron Absorbers, etc. - Not specified. No decrease in reactivity resulting from this type of material is included in the nuclear safety analysis.

Maximum Weight of Fissile Constituent -
2 kilograms total contained U-235

Maximum Net Weight of Contents - 240 pounds

Maximum Decay Heat - Not applicable

7.3 Compliance with Subpart C of 10 CFR 71

General Standards - The various materials which have been specified for the package will not result in significant chemical or galvanic reactions. There are no specific lifting or tie-down devices. The structural members of the birdcage which might be used for these purposes will fulfill the requirements of 10 CFR 71.31.

General Criticality Standards - A single package will be nuclearly safe for conditions of optimum moderation and full reflection. The 2 kilogram limit on the maximum weight of U-235 which may be loaded into this packaging limits the average fuel density to less than 1 gram U-235 per milliliter. This density is typical of solutions. Table I of TID-7016, Rev. 1 shows that a 5 inch diameter is nuclearly safe for all degrees of moderation and reflection at any enrichment. The 8.5 square inch cross-section of the fuel container is equal only to the cross-sectional area of a 3.5 inch diameter cylinder.

Since the contents of the package will be restricted to solid, clad material, consideration of liquid contents is not applicable.

7.3 Compliance with Subpart C of 10 CFR 71 (cont.)

Single Package Evaluation - A sample package was subjected to the Water Spray, Free Drop, Penetration and Compression conditions incident to normal transport. These tests had no effect on the integrity or geometry of the package.

A sample package was subjected to the Accident Free Drop and Penetration Tests and displayed no significant damage. The necessity for the Water Immersion conditions is obviated by the assumption of complete flooding in the nuclear safety analysis. The calculated H/U-235 ratio for a flooded package is 7.5, which is very undermoderated. Any lesser water density would make the package even less moderated. The calculated k_{eff} of a single package at this moderation when fully reflected is 0.54. The necessity for the Thermal condition is obviated by the limitation of the contents to clad elements.

See Westinghouse Atomic Power Laboratory Report WAPD-O(AO)-3951, attached as part of Appendix C, for details of the testing performed on the package.

7.3 Compliance with Subpart C of 10 CFR 71 (cont.)

Package Array Evaluation - Inasmuch as the Accident Free Drop Condition results in no appreciable damage to the package, any number of packages would be nuclearly safe if the array were flooded, since each fuel container would be isolated from any other by more than 12 inches of intervening water.

If the water were to drain away, it could leave the fuel containers moderated. Hand calculations were carried out to determine the maximum k_{eff} of the array assuming flooded containers and a range of interstitial moderations. The package arrangement was assumed to be three wide by two high with an infinite length.

The values determined for the principal quantities derived during these calculations are tabulated below:

Interstitial Water Density - %	Unit Package k_{eff}	Interaction Probability	Array k_{eff}
0	0.20	0.077	0.22
1	0.37	0.086	0.41
3	0.37	0.113	0.42
5	0.54	0.106	0.60
10	0.54	0.072	0.58
30	0.54	0.009	0.545
100	0.54	0.000	0.54

7.3 Compliance with Subpart C of 10 CFR 71 (cont.)

Using the same procedures the maximum k_{eff} for an array of nine infinitely long containers arranged three wide by three high increases to 0.655. Considering the reduced effect of adding additional, more remote circumferential containers, an array of thirty-six finite length containers in a six wide by six high arrangement would have a k_{eff} conservatively less than 0.90. Thus a quantity of 36 of these packages will be nuclearly safe in any array under the assumed accident conditions.

7.4 Fissile Class III Limits

A maximum of thirty-six (36) packages will be transported as a Fissile Class III shipment using the exclusive use of the vehicle, or accompanied by an escort qualified as required by ICC Regulations.

7.5 Procedural Controls

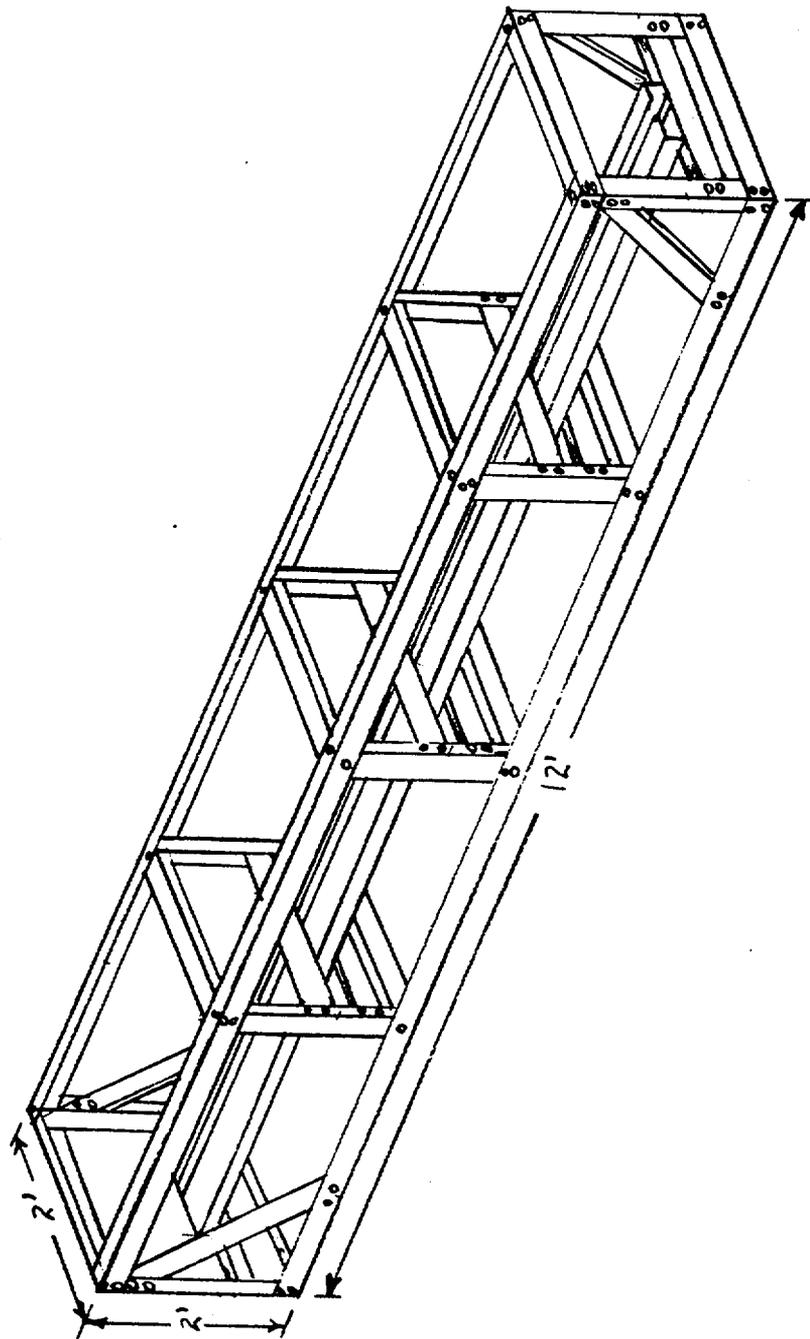
Prior to the first use of each packaging on or after the date of this application, the packaging will be inspected to assure compliance with the requirements specified in this application. In addition, the inspector will assure that the packaging is identified with a suitable model and serial number.

7.5 Procedural Controls (cont.)

Each packaging will be visually inspected prior to each use. If damaged or deteriorated components are detected, they will be repaired or replaced so as to restore the packaging to essentially "like-new" condition.

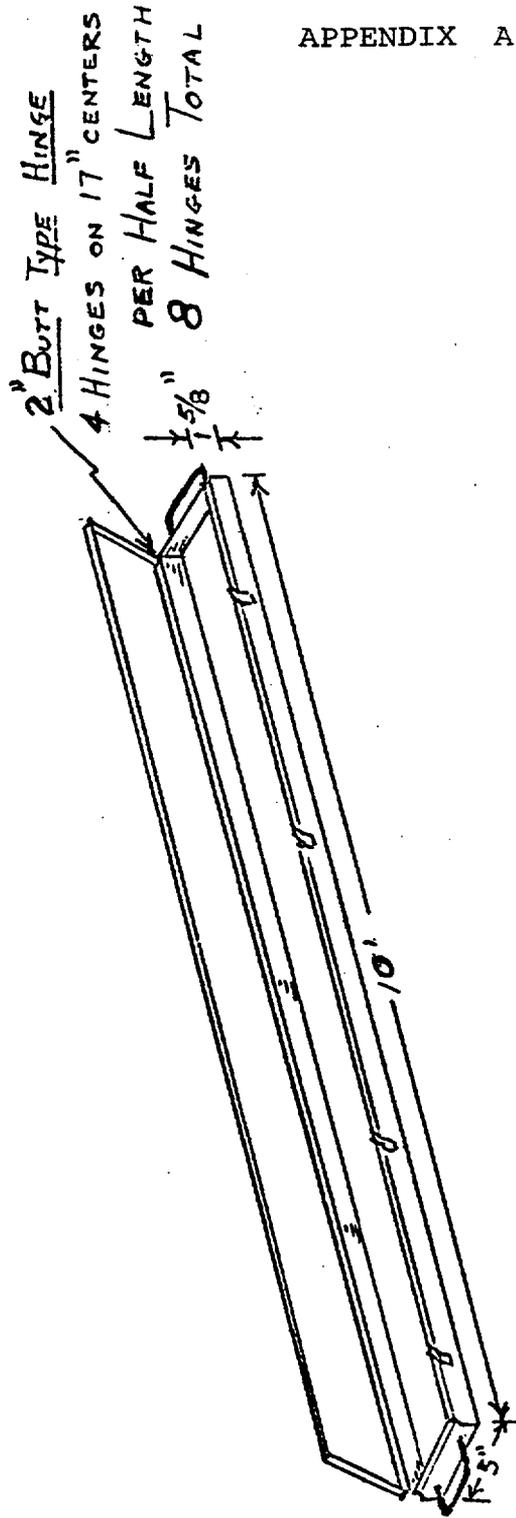
The Accountability group will be responsible to maintain the required records on each shipment.

APPENDIX A



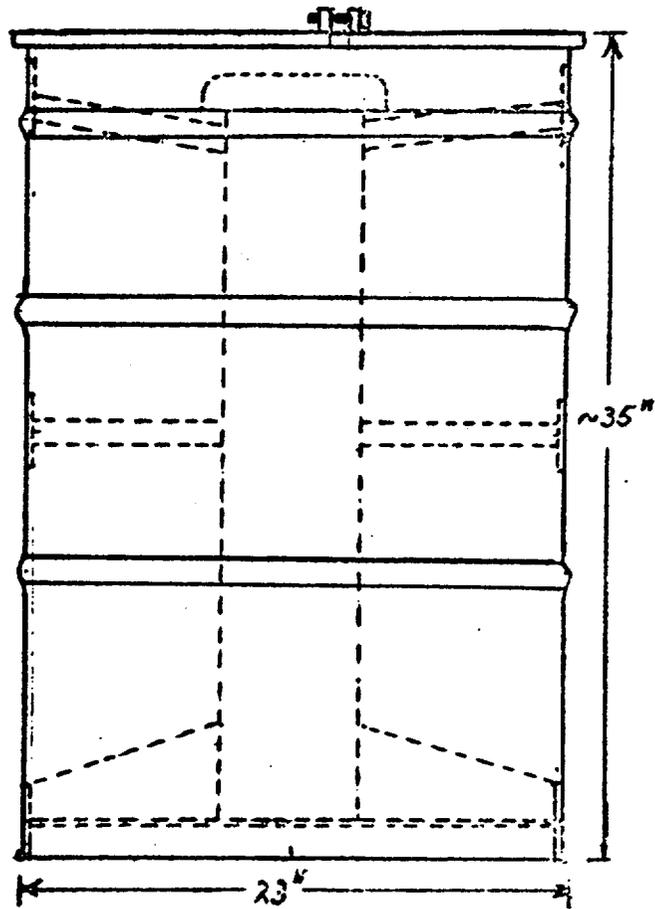
SCALE: 1/2" = 1 ft.
W.E. PIRDS 10/30/67
FIGURE 1

APPENDIX A



SCALE: NTS
- W. E. PIROS 10/30/67
FIGURE 2

APPENDIX B

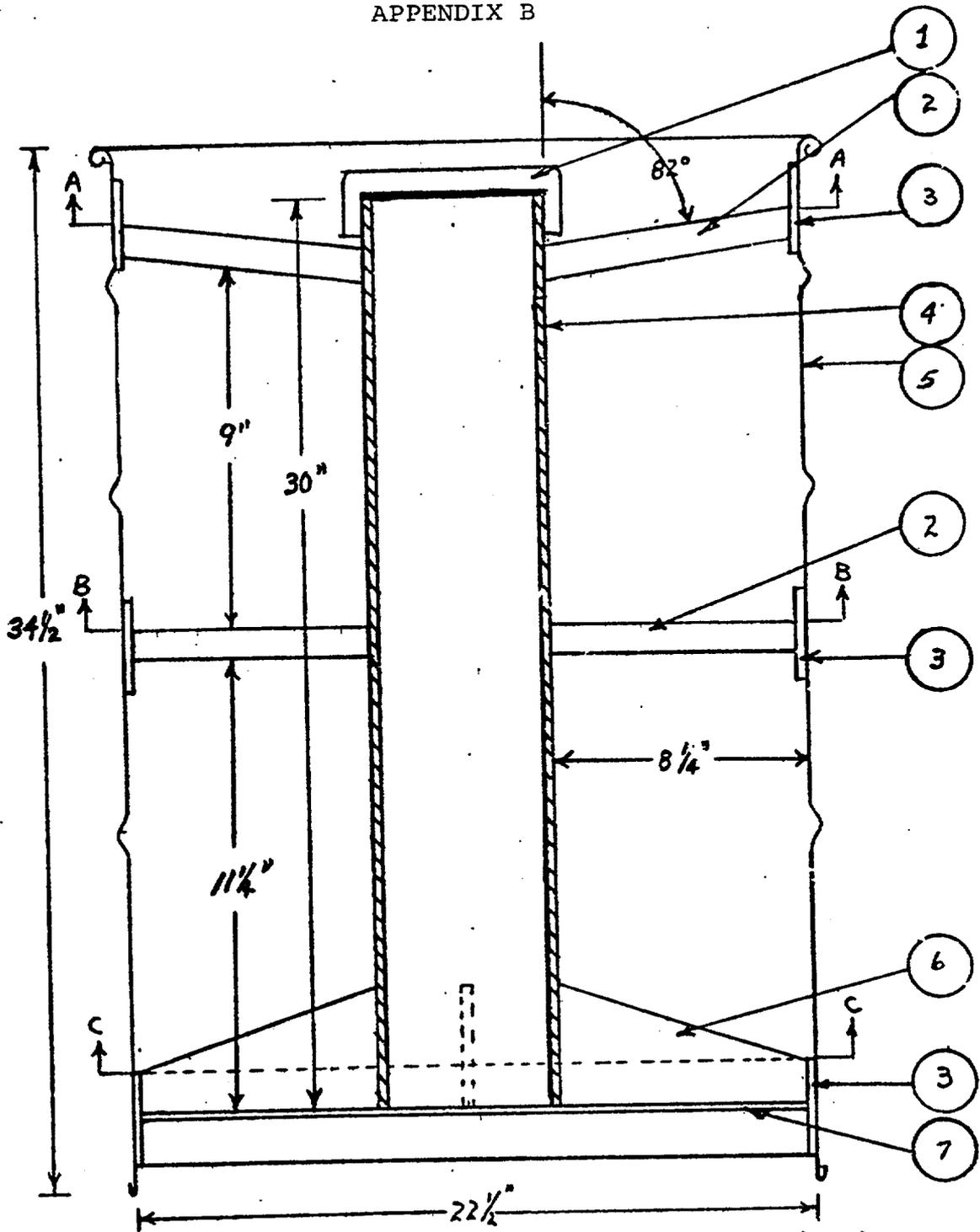


SHEET 1

AFD-C001
W.E. PIROS 7/20/65

Figure 1 - Process Scrap Shipping Container

APPENDIX B



SHEET 2

SCALE $\frac{3}{16}'' = 1''$

AFD-C-001

W.E. PIROS 7/30/65

Figure 2 - Process Scrap Shipping Container
Assembly Arrangement

APPENDIX B

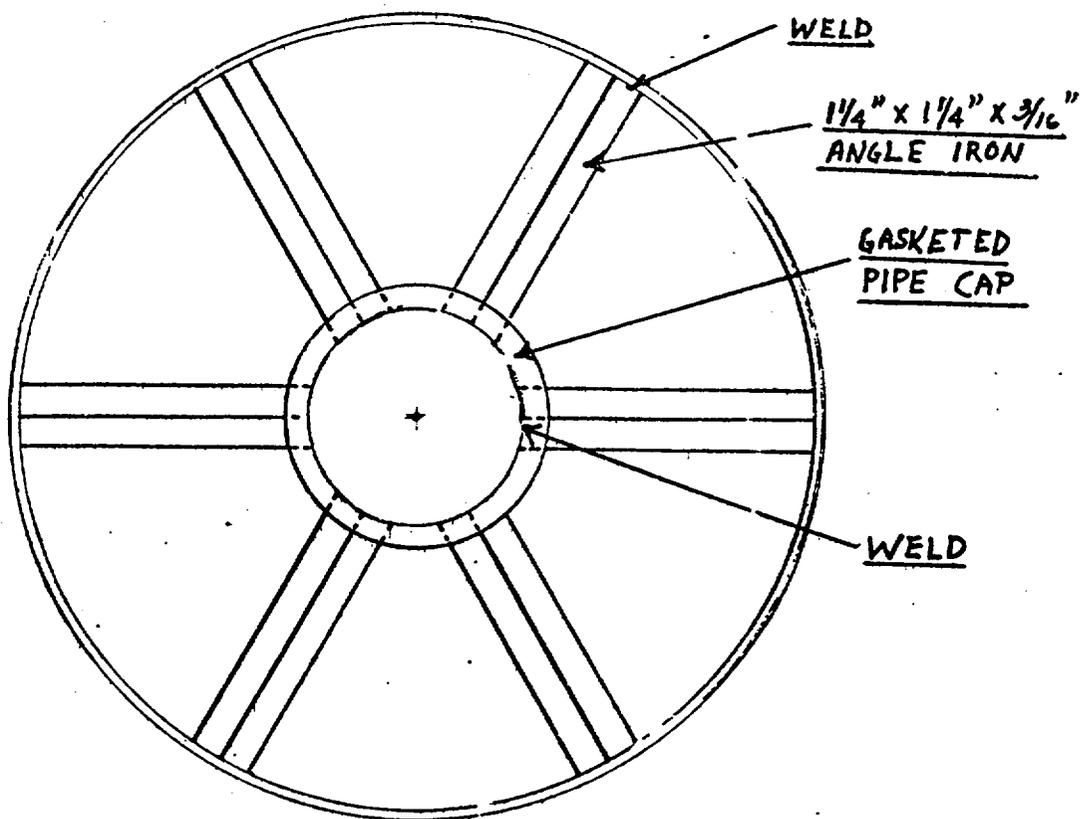
Item (see Sheet 2)

- 1 Gasketed End Cap
- 2 1-1/4" x 1-1/4" x 3/16" angle iron
- 3 3" x 1/4" flat stock
- 4 6 inch schedule 120 pipe
- 5 55 gallon Spec. 17H drum
- 6 1/4" thick gusset
- 7 1/4" plate

AFD-C-001
Sheet 3

Figure 3 - Process Scrap Shipping Container
Items Identified in Figure 2

APPENDIX B



SECTION A-A

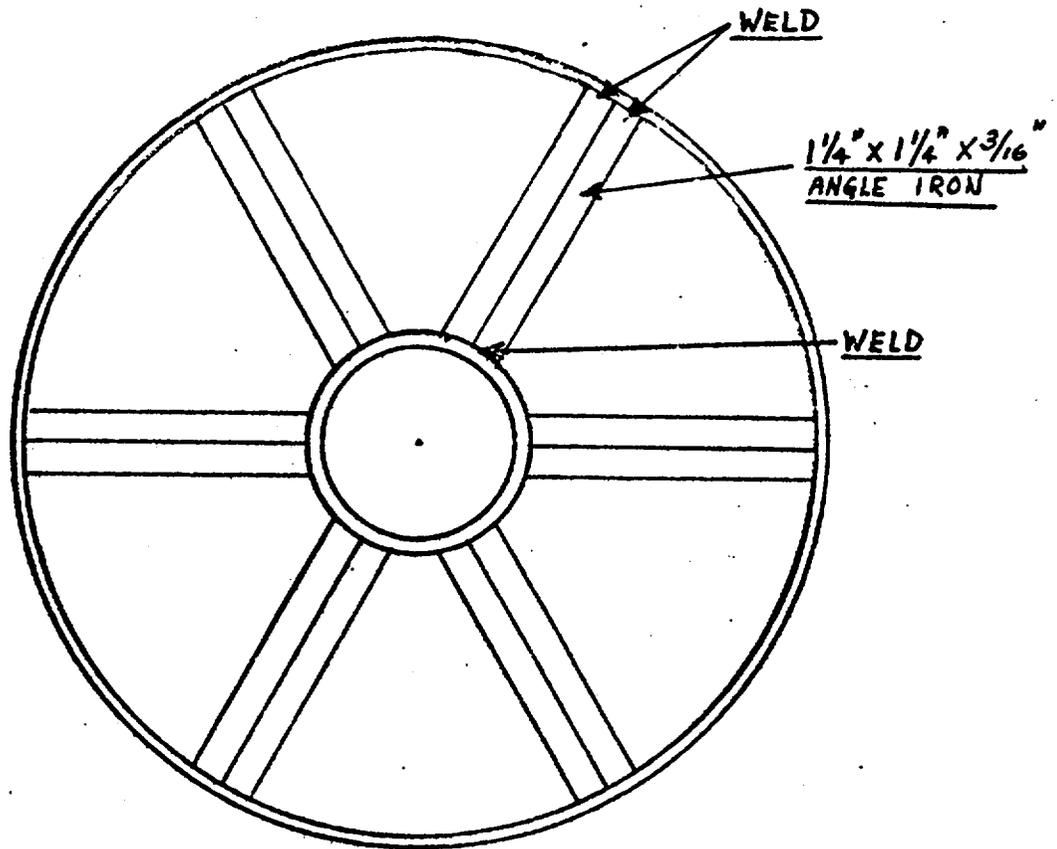
SHEET 4

AFD-C-001

W.E. PIROS 7/30/65

Figure 4 - Process Scrap Shipping Container
Top Spacer Ring Assembly

APPENDIX B

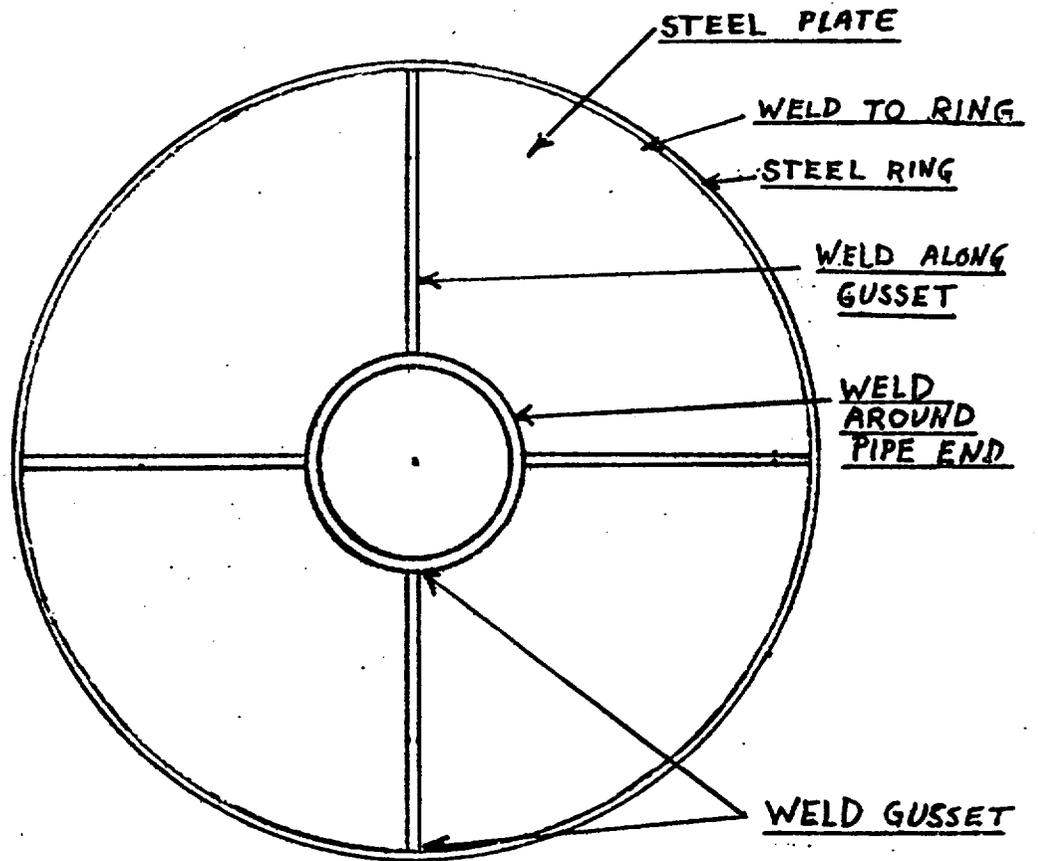


SECTION B-B
SHEET 5

AED - C-001
W.E. PIROS 7/30/65

Figure 5 - Process Scrap Shipping Container
Middle Spacer Ring Assembly

APPENDIX B



SECTION C-C

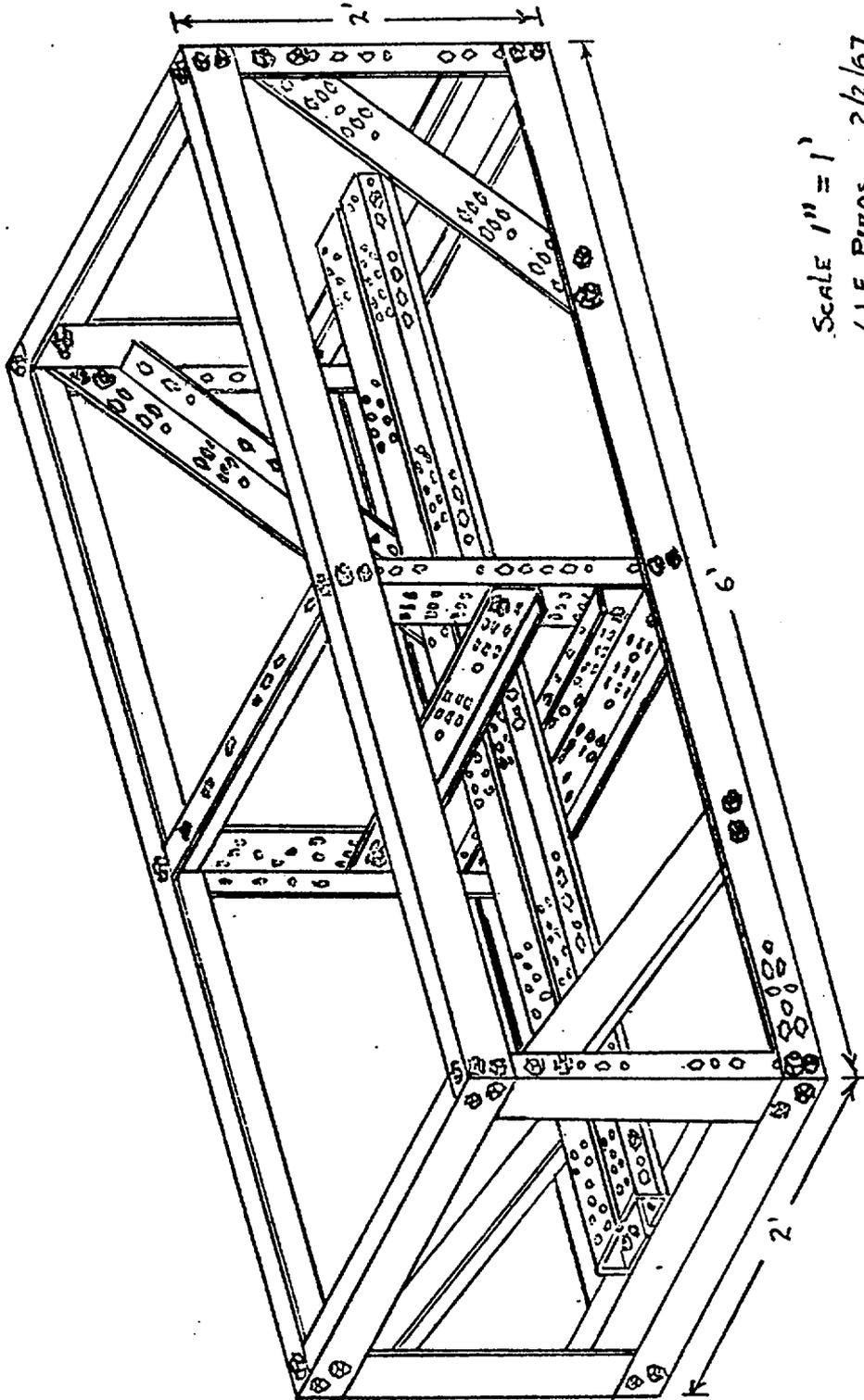
SHEET 6

AFD-C-001

W.E. PIROS 7/30/65

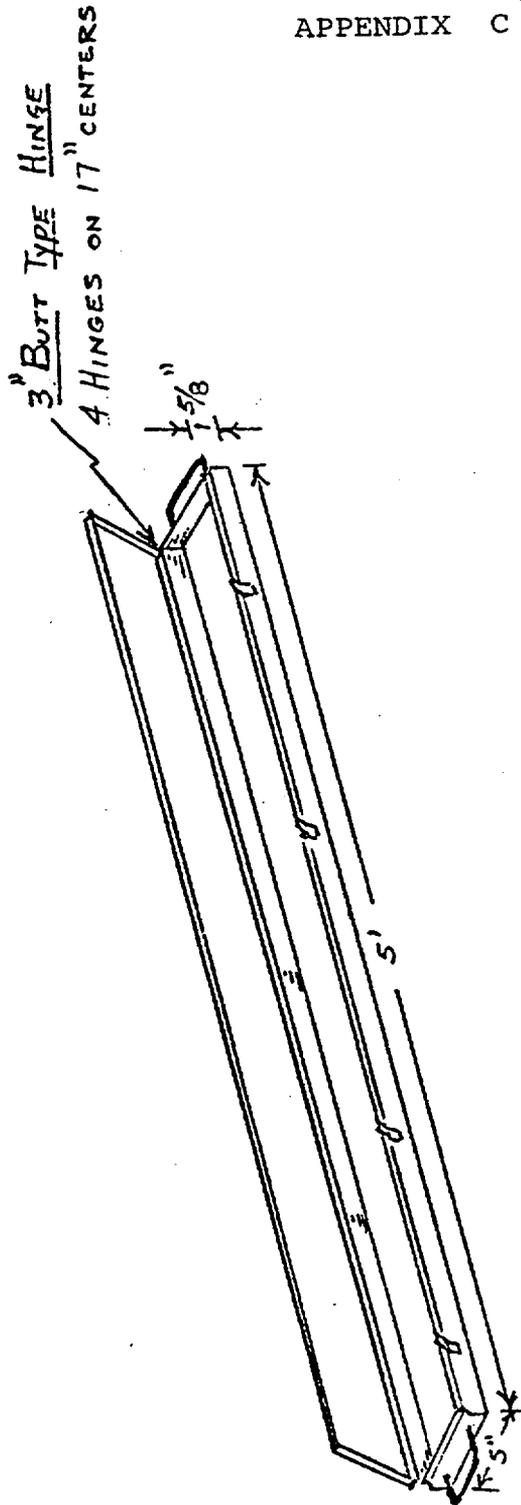
Figure 6 - Process Scrap Shipping Container
Bottom Plate Assembly

APPENDIX C



SCALE 1" = 1'
W.E. PIROS 2/2/67
FIGURE 1

APPENDIX C



SCALE 1" = 1'
- W. E. PIROS 2/2/67
.. FIGURE 2

APPENDIX C

WESTINGHOUSE ATOMIC POWER LABORATORY

TEST REPORT SLOTTED ANGLE BIRDCAGES

BE #1270

DESCRIPTION OF CONTAINERS

Bureau of Explosives Permit #1270

This is a "Birdcage" type shipping container. It consists of a 14 gage steel or aluminum box centered in a frame made of slotted steel angle 3" x 1-1/2" x 0.014", fastened with 3/8" machine bolts. The frame is a 2-foot square measuring 5 to 10 feet in length. The box, which has a piano hinge lid and neoprene gasket, may be of a variety of cross sections, but none exceeds 20 square inches. It is centered in the birdcage frame with bolted sections of slotted angle and in addition, is banded to the deck of the frame by 3/4" steel banding. When an aluminum box is used, it is centered in the birdcage with sections of slotted steel angle bolted directly against all 6 sides of the box forming a steel framework around the aluminum box to provide geometric restraint which will withstand a "standard fire". Bureau of Explosives' letter 25-16-174 dated September 22, 1961 authorizes use of this container for shipment by carload or truckload lots only for not more than 2700 millicuries of radioactive material per container. (Figure 1)

Normal Transport Test Conditions

AEC Appendix O529 specifies that a container must withstand the normal conditions of transport (impact, penetration, water spray, and compression) without damage to the package or loss or displacement of radioactive material.

- A. Impact - "A free drop, from a height of 4 feet, onto an unyielding, flat horizontal surface, with the package striking the surface in such a position as to suffer the maximum damage."
- B. Penetration - "The impact of a 12-pound steel cylinder, 1-1/4 inches in diameter, dropped from a height of 4 feet so as to strike with the flat end of the cylinder onto the external surface of the package which is most vulnerable in terms of causing loss of contained material."
- C. Water Spray - "A water spray of not less than one gallon per minute directed onto the package, with each side except the bottom being exposed to the spray for 30 minutes. The bottom of the package shall be situated so as not to be immersed in water."
- D. Compression - "A compressive load equivalent to five times the weight of the package or 2 pounds per square inch times the vertically projected area in square inches of the upright package, whichever is greater. The load shall be applied uniformly to the two opposite sides of the package where one of those sides is the side on which the package would rest in its normal position. The load shall be applied for a period of 24 hours."

Container Tested - 5' x 2' x 2' Slotted Angle Barge B of E Permit No. 1270

1. Identification - See Figure 1 for picture showing barge ready for shipment and an empty rectangular box.

Dimensions of barge frame tested - 2 feet square by 5 feet long.

2. Weight

a. Weight of outer container (with rectangular cross section box) - 118 lbs.

b. Stimulated shipment - steel plates - 45 lbs.

c. Total gross weight - 163 lbs.

3. Impact Test

a. Surface used for test - 4-inch reinforced concrete floor at ground level used for loading dock.

b. Surface of container tested - barge dropped with its long axis horizontally; point of impact was the long edge of the frame.

c. Height of fall - 4 feet, as measured from the ground to the bottom of the forks of a hi-lift supporting the barge.

d. Description of test effects - there was negligible effect on the structure of the barge.

e. Date test performed - September 17, 1955.

f. Performed by - A. Uyas.

g. Witnessed by - W. Starke, A. Uyas.

4. Penetration Test

a. Weight and measurement of cylinder used - 12 lbs, 36-1/8 inches in length and 1-1/4 inches in diameter.

b. Surface of container tested - the flat end of the cylinder struck the top of the rectangular box.

c. Height of cylinder drop - 4 feet, as measured from the top of the rectangular box to the bottom of the forks of a hi-lift supporting the cylinder.

d. Description of test effects - a circular dent was made on the rectangular box; however, no penetration occurred.

e. Date test performed - September 17, 1955.

f. Performed by - A. Uyas.

g. Witnessed by - W. Starke, A. Uyas.

5. Water Spray Test

- a. Rate of water spray - 1.1 gallons/minute.
- b. Time container exposed to spray - 30 minutes.
- c. Position of container - Positioned atop a metal skid so as to ensure that container would not be immersed in water during test.
- d. Weight of container - before test - 118 lbs.
- after test - 118 lbs.
Net weight change - None
- e. Description of test effects - There was no water leakage into the rectangular cross section box as evidenced by the fact there was no net weight change. Also, upon opening the container, no water was found inside.
- f. Date test performed - September 16, 1965.
- g. Performed by - E. Jackson.
- h. Witnessed by - C. W. Hughes, W. Stanko.

6. Compression Test

- a. Gross weight of container - 163 lbs.
- b. Test specifications (5 times container weight of 2 lbs/sq. inch times vertically-projected area in square inches of the upright container, whichever is greater).
 - (1) Five times container weight - $5 \times 163 \text{ lbs} = 815 \text{ lbs}$.
 - (2) Vertically-projected area - 1728 sq. inches; $\text{area} \times 2 \text{ lbs} = 3456 \text{ lbs}$.
- c. Actual test load used - 3633 lbs.
- d. Description of test load - Eight 55-gallon drums containing silicon carbide grit, and one wooden pallet and one metal skid placed atop the tested birdcage.
- e. Duration of test - 2 $\frac{1}{2}$ hours; Started - 9:00 a.m. on 9/15/65
Ended - 9:00 a.m. on 9/16/65
- f. Description of test effects - At the end of the test there was no discernible effect on the birdcage.
- g. Performed by - A. Ulyas.
- h. Witnessed by - W. Stanko, A. Ulyas.

Accident Test Conditions

AEC Appendix 0529 specifies that a container must meet the accident test conditions specified (impact, puncture, fire and immersion) in order to meet the requirements for Fissile Class I and II shipments.

- A. Impact - A free drop, from a height of 30 feet, onto an unyielding, flat, horizontal surface, with the package striking the surface in such a position as to suffer the maximum damages; followed by the puncture test.
- B. Puncture - A fall onto a cylindrical target through a distance of 40 inches measured from the lowest point of the package to the surface of the target, striking the target in such a position as to suffer the maximum damage. The cylindrical target shall be the flat, horizontal end surface of a vertical, solid, structural carbon steel cylinder, 8 inches long and 6 inches (+0.2 inch) in diameter. The edges of the surface may be rounded to a radius of not more than 0.25 inch. The bar shall be rigidly mounted on a flat horizontal unyielding surface; followed by the fire test.
- C. Fire - Exposure to the conditions of the first hour of the standard time - temperature curve (see NFPA No. 251, or ASTM Design E 119-61); followed by the immersion test.

This test was not conducted since the containers are of all steel construction and in those cases where an aluminum box is used it is surrounded by a steel framework to provide geometric restraint which will withstand "standard fire."

- D. Immersion - Immersion in water so that the package is at least three feet below the surface for 2^{1/2} hours.

1. Identification - see Figure 1

Dimensions of birdcage frame tested - 2 feet square by 5 feet long.

2. Weight

- a. Weight of outer container (with rectangular cross section box) - 140 lbs.
- b. Simulated Shipment - Steel plates 120 lbs.
- c. Total gross weight - 260 lbs.

3. Impact Test

- a. Surface used for test - 4-inch reinforced concrete pad located behind Eager #3 at Bettis.
- b. Surface of container tested - With the free fall from 30-foot, the birdcage was dropped with its long axis vertical of the 2 foot square; the point of impact was the bottom side.

- c. Height of fall - 30 feet as measured from the ground to the bottom of the birdcage which was suspended on a truck crane.
- d. Description of test effects - No significant damage occurred to the container. There was no loss of material from the box nor was there any displacement of the box from the center of the birdcage.
- e. Date test performed - May 11, 1964.
- f. Performed by A. Ulyas.
- g. Witnessed by W. B. Thomas, C. W. Hughes.

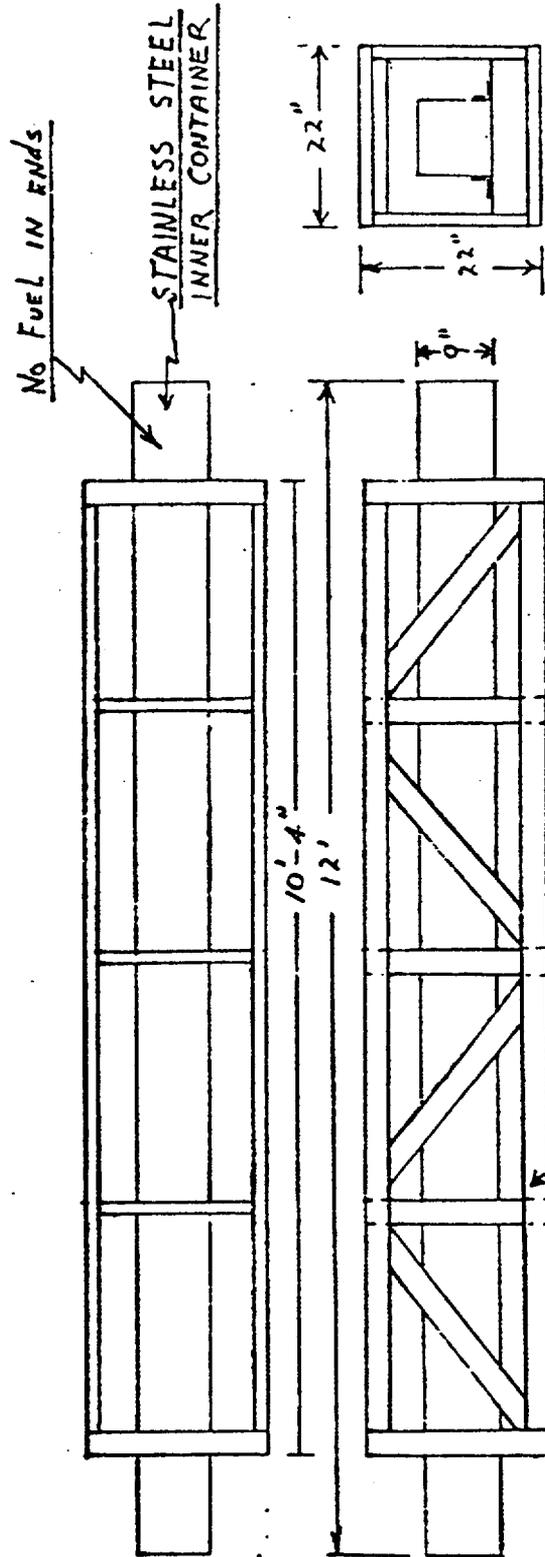
4. Followed by Puncture Test

- a. Surface used for test - 4-inch reinforced concrete floor at ground level used for a loading dock.
- b. Weight and measurement of cylinder - 78 lbs. 8 inches in length and 6 inches in diameter.
- c. Surface of container tested - the long axis of the birdcage frame.
- d. Height of drop - 40 inches, as measured from the top of the cylinder to the bottom of the birdcage which was positioned atop the forks of a hi-lift.
- e. Description of test effects - There was slight distortion of the angle iron frame at the point of impact. There was no effect on the box.

5. Immersion Test

This test was not performed since packaging limits are established that are safe even if the container is optimally moderated.

APPENDIX D

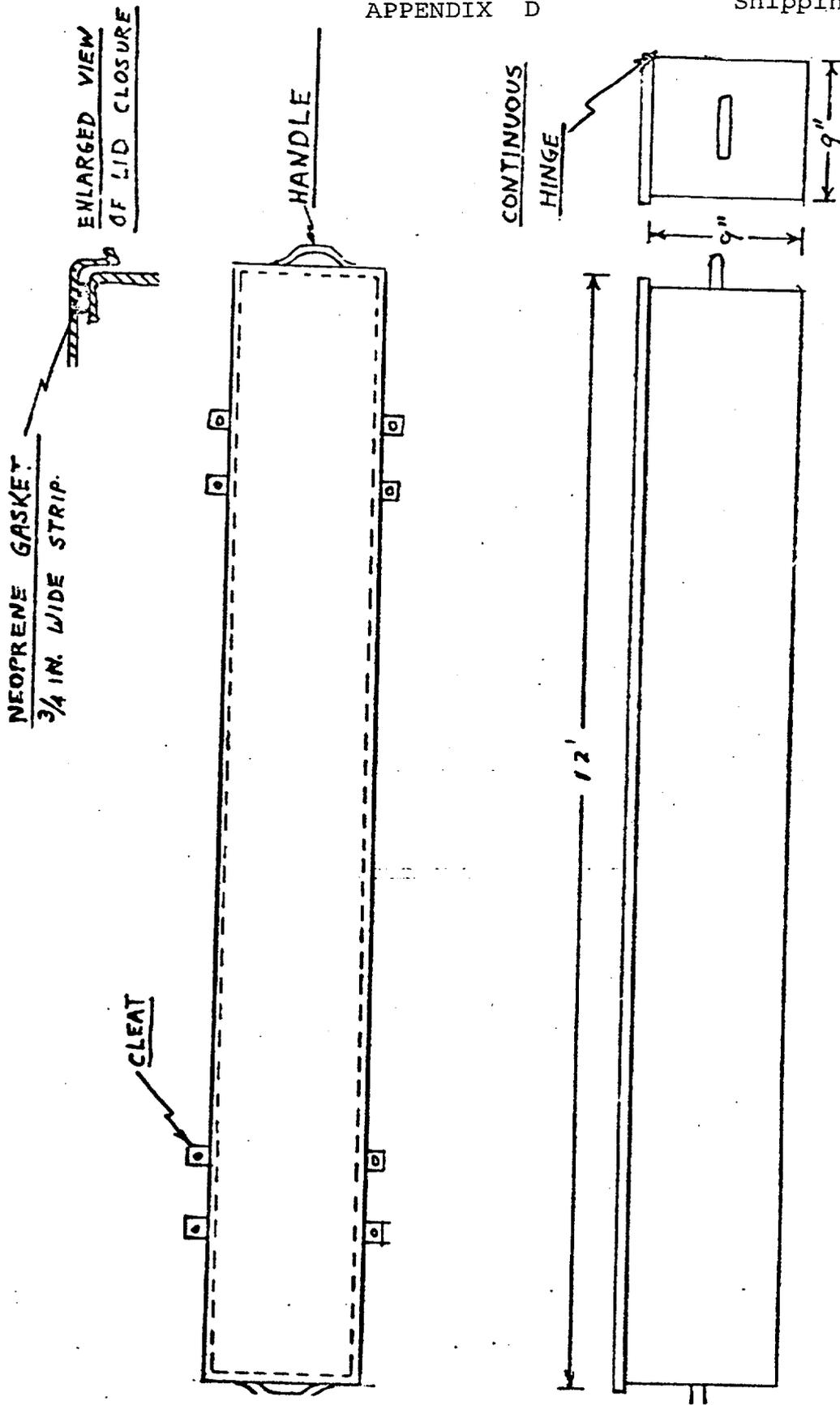


AIM SLOTTED ANGLE 300 1/2" X 3" X 12 GAGE
BOLTED CONSTRUCTION USING 3/8" BOLTS AND NUTS

AF SK 0442
SHEET 1 OF 2
7/19/65 W. E. PIROS

Figure 1-Outer Shipping Container
With Inner Container in Place
For PWR-2 Seed-2
Reactor Module

APPENDIX D



AF SK 0442
SHEET 2 OF 2
7/19/65 W.E. PIROS

Figure 2 - Inner Shipping Container For PWR-2 Seed-2 Reactor Module



Westinghouse Electric Corporation

Eggleston Atomic Power Laboratory P.O. Box 70
West Mifflin, Pa. 15122WAED-PWR-R(PH)-121

Manager, Pittsburgh Naval Reactors Office
United States Atomic Energy Commission
Post Office Box No. 109
West Mifflin, Pennsylvania 15122

Subject: PWR Project - Contract AT-11-1-GEN-14
Funding No. 100t10
PWR Core 2 Seed 2 Reactivity Information
for Various Configurations of Seed Fuel
Clusters and Subassemblies

Reference: (a) NR:EP:REBrodsky-A #1428, dated
April 23, 1955

Dear Sir:

The attached report contains the information requested by reference (a) regarding the reactivity of various combinations of seed subassemblies and seed clusters. The attached report is submitted for your approval.

It is recommended that the standard AEC "Legal Notices" be incorporated into the attached information if the information is to be used outside the AEC.

Very truly yours,

Malcolm P. Stewart

M. R. Stewart, Manager
PWR Nuclear Design
and Analysis

:add

Attachment: PWR Core 2 Seed 2 Reactivity Information for Various Configurations
of Seed Fuel Clusters and Seed Fuel Subassemblies

cc: Manager, PWR - (8)	W. A. Minkler-MEO	Master File-V. Sternburg
J. J. Gertz	J. H. Grace	H. F. Reed
R. S. Wick	C. J. Woodruff	R. Atherton
A. J. Fiorelli	C. A. Flanagan-(5)	J. T. Stiefel
J. V. Meyers	L. L. Jones	K. W. Schmanckamp
D. M. Wroughton	PWR-R(PH)-File-(2)	

APPENDIX D

ATTACHMENT A

PWR CORE 2 SEED 2

REACTIVITY INFORMATION FOR VARIOUS
CONFIGURATIONS OF SEED FUEL CLUSTERS
AND SEED FUEL SUBASSEMBLIES

C. A. Flanagan

May 1965

APPENDIX D

PWR CORE 2 SEED 2
REACTIVITY INFORMATION FOR VARIOUS
CONFIGURATIONS OF SEED FUEL CLUSTERS
AND SEED FUEL SUBASSEMBLIESI. INTRODUCTION

This report presents information regarding the reactivity of various combinations of PWR Core 2 Seed 2 seed fuel plates, subassemblies and clusters. For wet situations, the coolant temperature is 77°F. The calculated results are based upon current nuclear design calculational practices. These results are presented directly without adjustment. The report covers information that is available concerning arrangements of subassemblies and clusters in fully moderated arrays which do not utilize auxiliary nuclear poison for control purposes. In addition, the calculational representation employs flux-weighted nuclear constants in conjunction with a homogenized subassembly or cluster geometric treatment. While this represents a departure from design practice (where detailed materials distribution are necessary to calculate detailed power distribution) it should be sufficient for reactivity evaluations for manufacturing purposes. Even though all possible arrangements and configurations are not represented in this report, the data can be used (1) to indicate the level of reactivity involved for certain arrangements of Seed 2 type subassemblies and clusters and (2) as a base or check point for future reactivity evaluation of actual configurations of interest. No evaluation of the safeguards aspects of handling PWR Core 2 Seed 2 fuel components is presented in this report.

II. DESCRIPTION OF SEED 2

The PWR Core 2 Seed 2 subassembly consists of 19 fuel plates approximately 3-1/2 inches in width, 8 feet long, and .076 inches in thickness. The plates are fabricated from Zircaloy-4 and contain uranium-zirconium dioxide fuel. The subassembly is approximately 3-1/2 inches square and has a metal-to-water ratio approximately equal to 1.0. Based upon present estimates of a total Seed 2 loading of about 400 Kg of U-235, each subassembly will contain about 5 Kg of Uranium-235. The average fuel plate will contain about 265 grams of U-235. The maximum fuel loading in any fuel plate is approximately 393 grams of U-235 and would occur if a standard fuel plate were loaded with all Zone 1 fuel wafers. The subassembly will contain about 625 grams U-235 per linear foot. Four subassemblies are welded together to make a Seed 2 cluster. The control poison consists of Boron-10 stainless steel platelets placed in the subassembly end support. There are no plates containing both fuel and poison. The subassembly end supports are approximately 3-1/2 inches in width and 0.2 inches in thickness.

The fuel elements are described in Drawing 924J327 and the subassembly configuration is given by Drawing 924J326.

III. NUCLEAR DESIGN CALCULATIONAL MODEL

The PWR Core 2 Seed 2 nuclear design calculational model employs four few-group neutron flux diffusion theory calculations. Energy averaged macroscopic cross sections (diffusion constants, absorption, removal, and fission cross sections) for energies above 0.625 ev are obtained using the MIST program. This program performs a neutron slowing down calculation employing 54 multi-groups to describe the energy spectrum from 10 mev to the thermal energy break-point of 0.625 ev. Cross sections below 0.625 ev have been generated using the MARCH program. This program is designed to obtain thermal absorption rates in subregions of a two-dimensional cell by solving the ordinary multigroup transport equations by utilizing MONTE CARLO techniques.

For regions for which ordinary diffusion theory is not expected to be adequate, special techniques have been adopted. Macroscopic cross sections to represent control rods are obtained using one-dimensional blackness theory. Macroscopic cross sections to represent the self-shielded boron poison elements in Seed 2 are obtained using a correlation procedure. This procedure requires the diffusion theory neutron capture rate in the poison element to be equivalent to that predicted by the MONTE CARLO program MARCH. Reference 4 discusses in more detail the calculational model used in the nuclear design of PWR-2 Seed 1 and Seed 2.

All the cases which have been calculated have assumed that P-1 diffusion theory (PDC program) adequately treats neutron leakage from a small assembly. This has not been explicitly tested experimentally for a single subassembly. However, the following section discusses experimental work for PWR Core 2 Seed 1 indicating that the present model gives agreement for clusters.

IV. EXPERIMENTAL BASIS

It has been demonstrated by numerous calculations of a variety of experimental assemblies (6, 7, 8, 9) that the nuclear design calculational model consistently predicts critical configurations. The calculated eigenvalue for these critical configurations at coolant temperatures of 77°F is about 0.993 indicating some calculational-to-experimental bias.

For non-critical (i.e., sub-critical) configurations an experiment (cf. Appendix) was performed to verify the calculated prediction that a single unpoisoned PWR-2 Seed 1 seed cluster would be subcritical when fully moderated.

PWR-2 Seed 2 has a nominal U-235 seed fuel loading of about 400 Kg. In Seed 1 the U-235 seed fuel loading was about 336 Kg. Dimensionally the seed elements of Seed 1 and Seed 2 are similar. Each has a 19 fuel bearing plates per subassembly. Seed 1 has two of the 19 plates containing poison material. Seed 2 has no plates that contain

both poison and fuel. The reactivity of a Seed 2 cluster is approximately equal to that of a Seed 1 cluster without poison and without rod. If nominal poison is included a Seed 2 cluster is slightly less reactive than a Seed 1 cluster containing nominal poison.

A core was constructed consisting of two six foot high PWR-2 Seed 1 In-Line seed clusters separated by one mockup blanket cluster. One of the seed clusters was unpoisoned. No neutron multiplication was observed when the two control rods were completely withdrawn from the assembly. It is estimated that the k_{eff} of this core is less than 0.95, which is consistent with the calculated eigenvalue of 0.93. This three cluster arrangement is more reactive than a single cluster. This measurement confirms that a single PWR-2 Seed 1 seed cluster unpoisoned and moderated at 77°F is subcritical and by an amount not inconsistent with the calculated value. It is concluded that the calculational model can predict with reasonable accuracy the degree of neutron multiplication present in various configurations. However, quantitative results become less reliable when they depart from just critical conditions.

V. RESULTS

The results of several calculations are presented. These calculations have been performed to assess the multiplication factor for the conditions presented in Table 1. All calculations are for coolant temperatures of 77°F.

TABLE 1
CONFIGURATIONS AND CONDITIONS CONSIDERED

<u>Configuration</u>	<u>Conditions Calculated</u>	
	<u>Normal</u>	<u>Abnormal</u>
Seed Subassemblies-In-Line	Nominal Fuel Nominal Boron No Rod	Nominal Fuel No Boron No Rod
Seed Subassemblies-Square Array	Nominal Fuel Nominal Boron No Rod	Nominal Fuel No Boron No Rod
Seed Clusters-In-Line	Nominal Fuel Nominal Boron No Rod	Nominal Fuel No Boron No Rod
Seed Clusters-Square Array	Nominal Fuel Nominal Boron No Rod	Nominal Fuel No Boron No Rod

The abnormal condition considered here (nominal fuel with poison omitted) represents a more limiting case from the standpoint of criticality hazards than either the double fuel loading and normal poison loading case or the interchange of poison elements for fuel elements or the incorrect arrangement of fuel plates in the subassembly or if all most reactive plates are used. Design studies indicated that the excess reactivity gained by doubling the fuel loading is less than that gained by omitting the self-shielded burnable poison. In the case of

PWR Core 2 Seed 2, the poison and supports are not readily interchangeable with the fuel elements because of their substantial difference in thickness. Any interchanged arrangement of plates or the use of all most reactive plates will not achieve a doubled fuel loading. Therefore, the normal fuel loading with poison omitted case represents the worst configuration from the standpoint of criticality hazards and constitutes the worst single accident.

A. Seed Subassemblies-In-Line

Calculations have been performed representing one, two, three, four, five, and nine seed subassemblies arranged in-line surrounded by cold water (77°F). In-line means that the subassemblies are placed adjacent to one-another forming a rectangular parallelepiped configuration one subassembly in thickness and multiple subassemblies in length. The effective subassembly spacing is 0.5 inches which is near optimum. The results of these calculations for the normal and abnormal conditions are presented on Figure 1.

1. Single Subassembly

The calculated multiplication factor of a single seed subassembly is 0.45 for the normal condition and 0.57 for the abnormal condition.

2. Multiple Subassemblies

As additional seed subassemblies are added to the in-line arrangement the reactivity increase observed beyond a configuration having five in-line subassemblies is small. The asymptotic value of the multiplication factor is about 0.81 for the normal condition and about 0.92 for the abnormal condition. For the normal condition, any number of seed subassemblies can be arranged in-line and the multiplication factor will not rise above 0.9. For the abnormal condition, up to eight seed subassemblies may be arranged in-line giving a multiplication factor less than 0.9.

B. Seed Subassemblies-Square Array

Calculations representing seed subassemblies in square arrays have been performed for 1 x 1, 2 x 2, 3 x 3, and 4 x 4 arrays. The results are presented on Figure 2. For normal conditions any square array larger than 2 x 2 indicates a multiplication factor greater than 0.9.

C. Seed Cluster-In-Line

The results of the calculations for seed clusters in-line are presented on Figure 3. For normal conditions up to two seed clusters in-line results in a calculated multiplication factor of about 0.9 or less.

For abnormal conditions, one or more seed clusters in-line gives a multiplication factor greater than 0.9.

D. Seed Clusters - Square Array

The results for seed clusters in square array are presented in Figure 4. For normal conditions, one seed cluster gives a calculated multiplication factor of 0.9 or less. The two-by-two array gives a value of about 1.07.

For abnormal conditions, all configurations for seed clusters in square array result in a calculated multiplication factor greater than 0.9.

E. Loose Plates

A loose plate analysis using PDQ diffusion theory shows that six double loaded fuel plates optimally moderated and reflected are just sub-critical ($k_{off} = 0.968$). The normal fuel plate loading which was doubled for analysis purposes, was 157.4 grams of U^{235} in a fuel envelope length of 48.3 inches. The analysis also shows that the limit is the same for full length plates as for half length plates. The k_{off} of 0.968 was determined to be the maximum value which occurs at any radius for a right circular cylinder 48.3" long containing a homogenized mixture of fuel and water.

F. Summary

This report presents reactivity information for a variety of particular configurations of PWR-2 Seed 2 fuel subassemblies and clusters. Information is presented for normal conditions (nominal fuel and poison but no control rod) and for abnormal conditions (nominal fuel but no poison and no control rod). The results are intended to indicate the degree of reactivity associated with typical PWR-2 Seed 2 fuel configurations and to provide standard calculations which serve as a basis for analysis of configurations and conditions not covered in this report.

APPENDIX D
REFERENCES

SNM-338
Shipping - WAED

1. H. Behl, Jr., "MUFT-5-A Fast Neutron Spectrum Program for the Philco-2000," WAPD-TM-218 (November 1960).
2. E. M. Colbard, H. B. Ondis, J. Spanier, "MARC-A Multigroup MONTE CARLO Program for the Calculation of Capture Probabilities," WAPD-TM-273 (May 1962).
3. C. W. Maynard, "Blackness Theory and Coefficients for Slab Geometry," WAPD-TM-168 (May 1959).
4. WAPD-MRP-105, p. 96 ff, "PWR-2 Seed 1, Computational Model," June-August, 1963).
5. W. R. Cadwell, P. F. Buerger, C. J. Pfeifer, "The PDQ-5 and PDQ-6 Programs for the Solution of the Two-Dimensional Neutron Diffusion-Depletion Problem," WAPD-TM-477 (January 1965).
6. WAPD-MRP-91, p. 99 ff, (February-April 1961).
7. WAPD-MRP-97, p. 100 ff, (February-April 1962).
8. WAPD-MRP-109, p. 121 (April-July)1964).
9. WAPD MRP-110, p. 78 ff, (July - October 1964).

PWR 2 SEED 2
MULTIPLICATION FACTOR VS NO. OF SUBASSEMBLIES IN-LINE

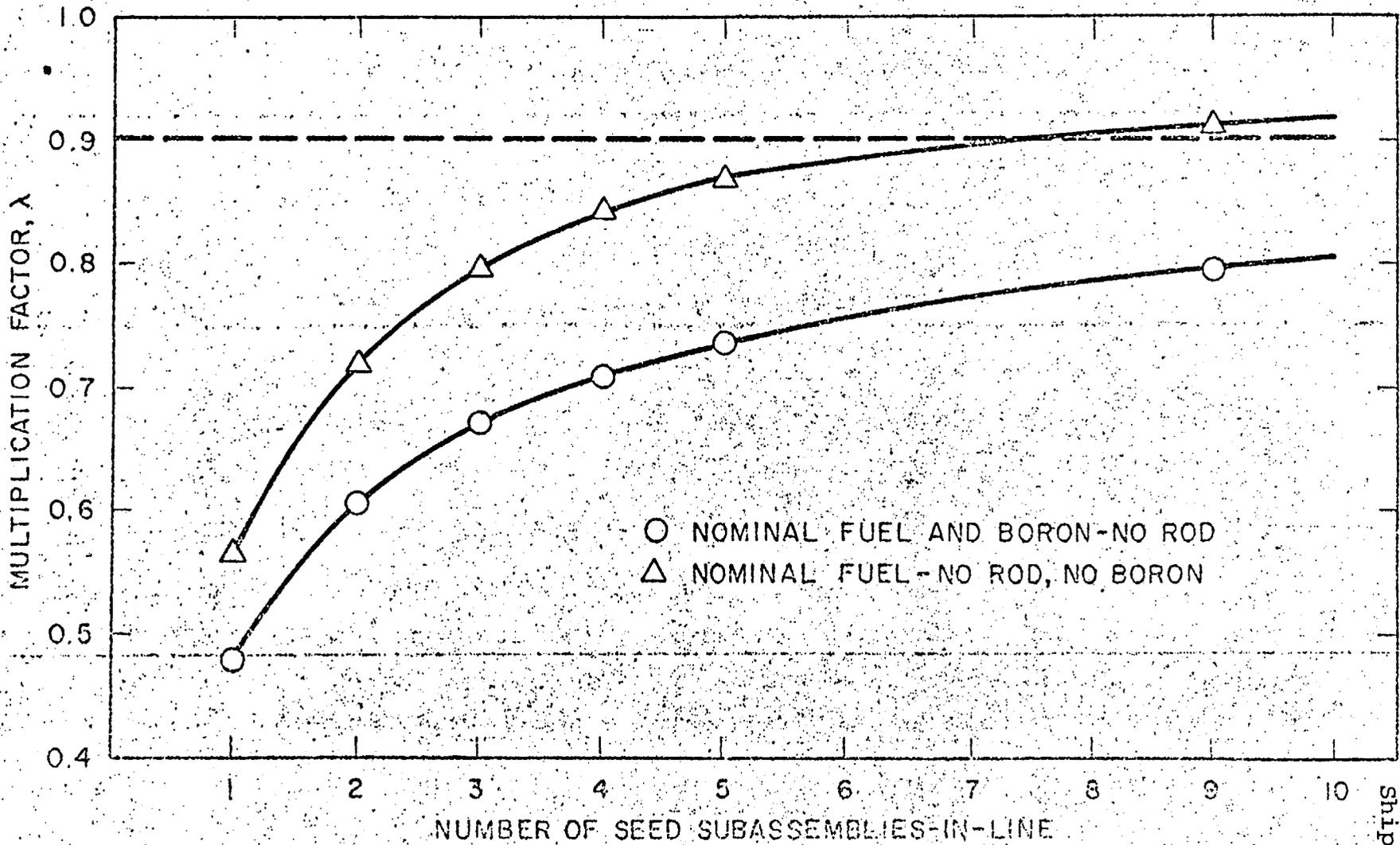


FIGURE 1

PWR 2 SEED 2

MULTIPLICATION FACTOR VS NO. OF SUBASSEMBLIES IN SQUARE ARRAY

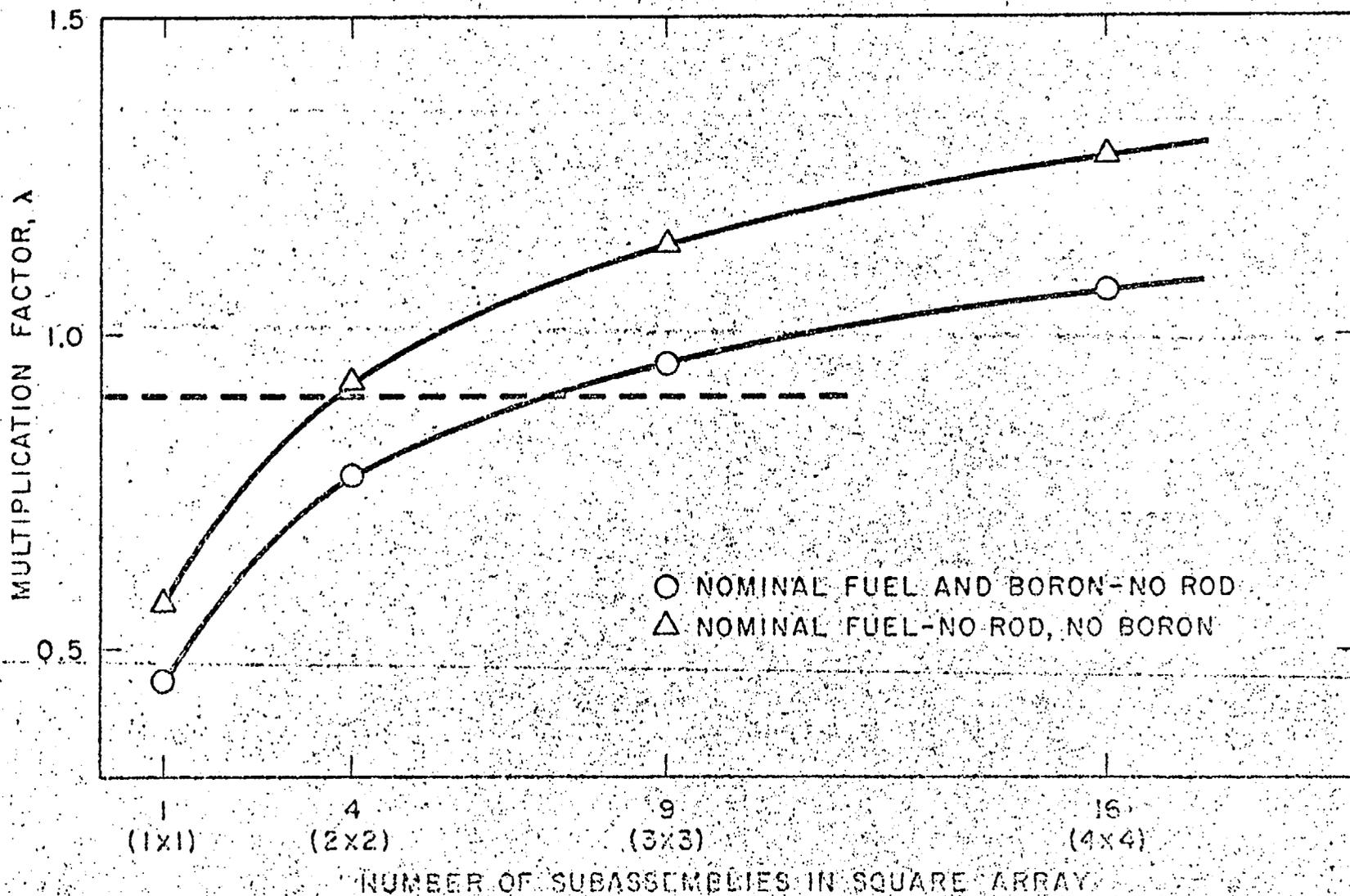


FIGURE 2

PWR 2 SEED 2
MULTIPLICATION FACTOR VS NO. OF CLUSTERS IN-LINE

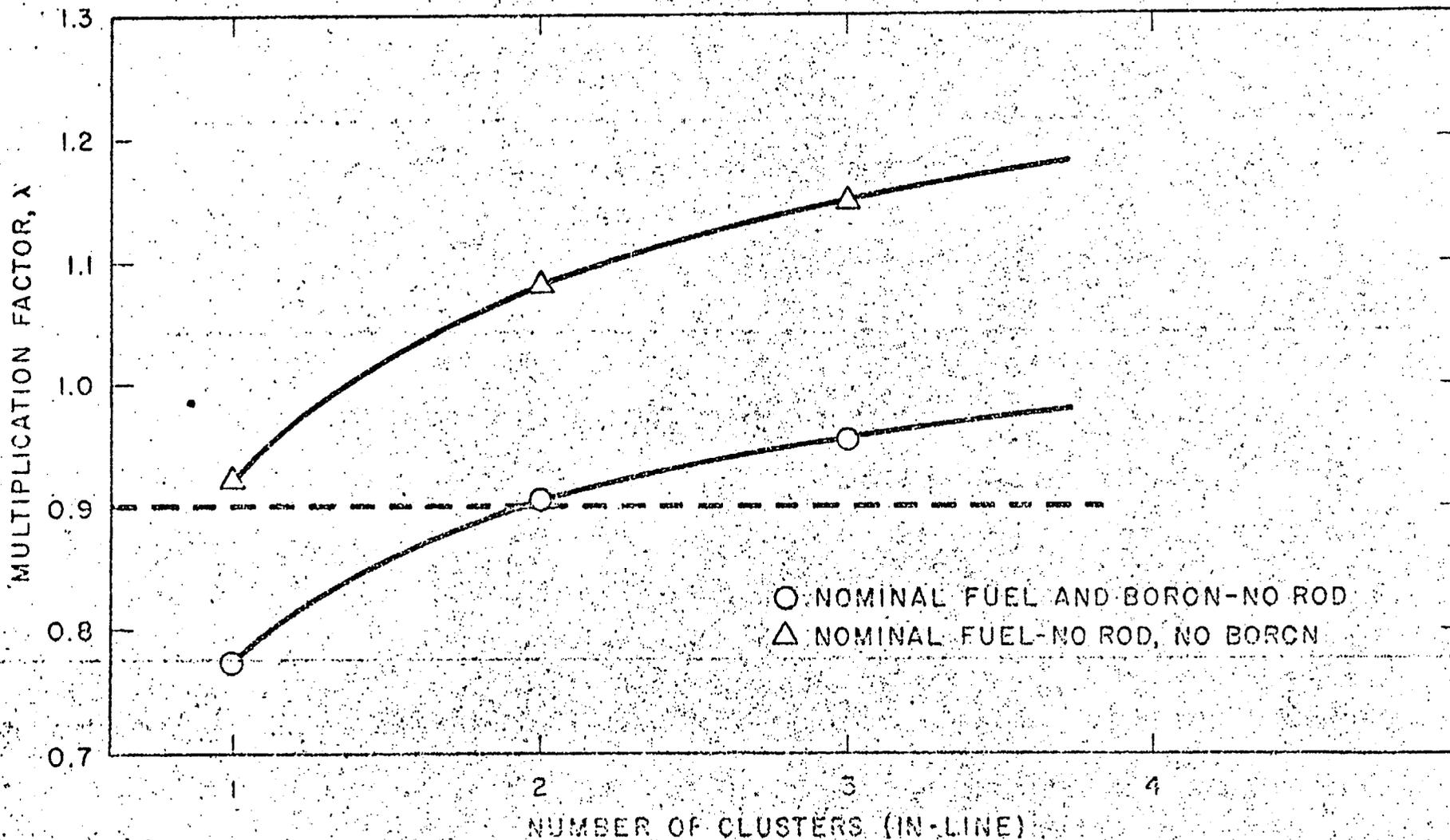


FIGURE 3

PWR 2 SEED 2
 MULTIPLICATION FACTOR VS NO. OF CLUSTERS IN SQUARE ARRAY

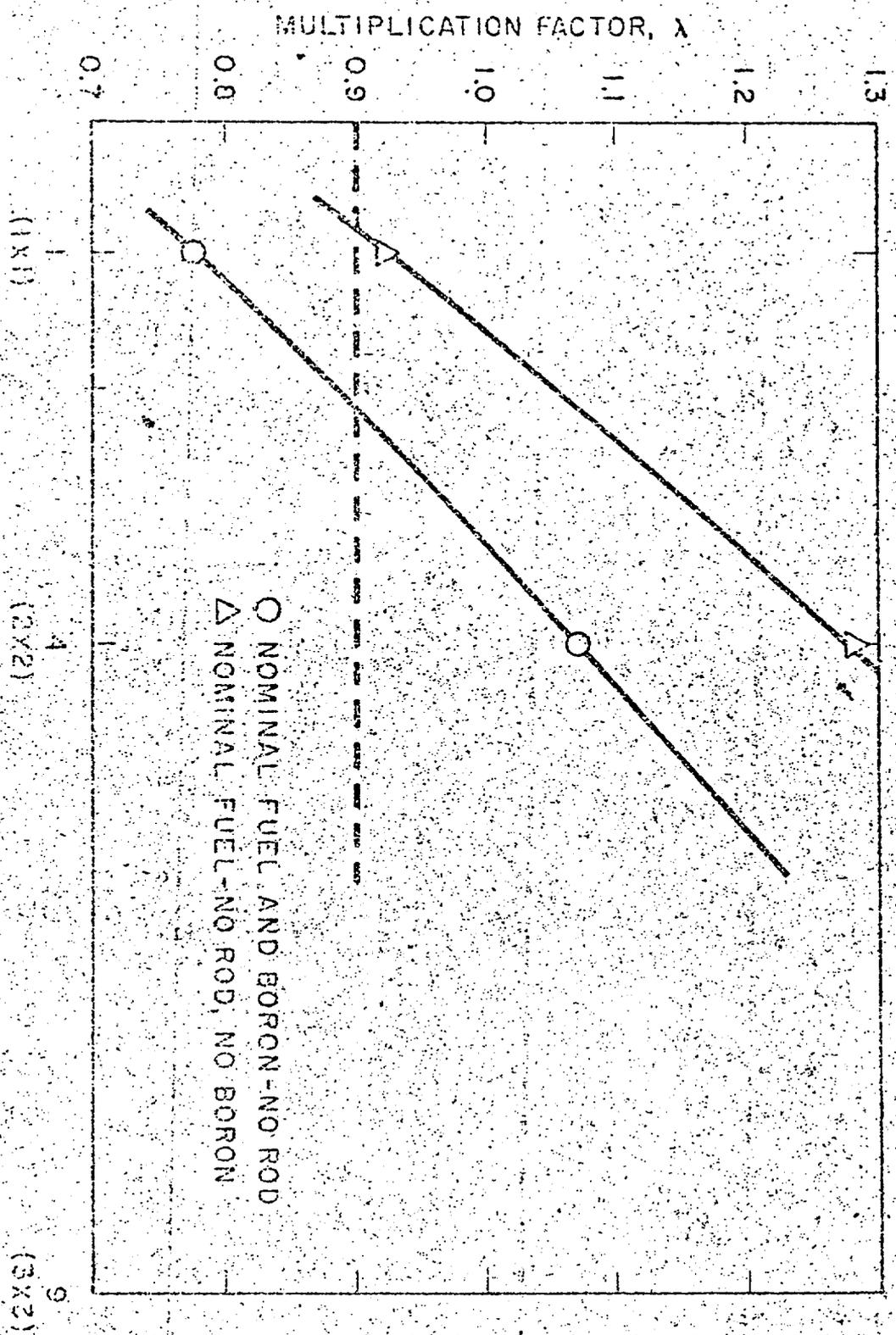


FIGURE A

APPENDIX k_{eff} OF A SINGLE PWR-2 SEED CLUSTER

During the manufacture and inspection of PWR-2 seed clusters it may be necessary to immerse a full cluster in a hydrogenous solution for the purpose of pickling, measuring water displacement volumes, etc. In order to demonstrate that a water moderated cluster will be subcritical an experimental study has been made utilizing PWR-2 Seed 1 mock-up materials. The results of this investigation indicate that a PWR-2 Seed 1 seed cluster will be subcritical by at least $4\% \Delta k/k$, even if there were no boron poison elements in the cluster.

The unpoisoned cluster is an extreme case, since the reactivity added to the core by omission of the boron poison elements is greater than that added by any possible fuel loading error. Since it can be shown that a moderated unpoisoned cluster is subcritical, one may conclude that any PWR-2 Seed 1 cluster will be subcritical.

Description of Experiment

The experimental assembly used in this investigation was an in-line slab of two PWR-2 Seed 1 mock-up seed clusters separated by a mock-up blanket cluster. There were no boron poison elements in one of the seed clusters. No neutron multiplication was observed when this assembly was flooded with water and the two control rods were fully withdrawn, indicating that the assembly was shut down by at least $5\% \Delta k/k$. This value is consistent with a calculated k_{eff} of 0.930, which was computed using the PWR-2 nuclear design model, which has been demonstrated to give good reactivity predictions for a variety of core conditions.

Evaluation of Experimental Results

This experimental result ($k_{eff} < 0.95$) can be used to predict the reactivity of a single moderated PWR-2 Seed 1 cluster by considering the differences between Seed 1 mock-up and PWR-2 Seed 1 seed clusters, and the reactivity difference between the three cluster core and a single cluster core. The significant differences between mock-up and design clusters are the following: (1) the seed fuel loading in PWR-2 is about 9% greater than that in the mock-up, and (2) a PWR-2 Seed 1 cluster is two feet longer than a Seed 1

mock-up cluster. Because of these differences a PWR-2 Seed 1 cluster is about 3% $\Delta k/k$ more reactive than a Seed 1 mock-up cluster, if both clusters contain the same boron poison elements. Calculations indicate that the three cluster slab described above is approximately 2.5% $\Delta k/k$ more reactive than a single unpoisoned mock-up cluster, or 0.5% $\Delta k/k$ less reactive than a PWR-2 cluster. The fact that the three cluster slab is at least 5% $\Delta k/k$ subcritical thus indicates that a single moderated, unpoisoned PWR-2 cluster will be at least 4.5% $\Delta k/k$ subcritical. A calculation of the single PWR-2 Seed 1 cluster case predicted a k_{eff} of 0.934, which is consistent with the experimental result.

A summary of pertinent calculated values is presented in Table I. The second value shown in the table is the k_{eff} of a PWR-2 Seed 1 cluster which contains the proper poison element loading.

TABLE I
CALCULATED AND EXPERIMENTAL RESULTS

<u>Configuration</u>	<u>Calculated Eigenvalue</u>	<u>Experimental k_{eff}</u>
PWR Seed Cluster (No poison elements)	0.934 ± 0.008*	---
PWR Seed Cluster (Poison element $\beta = 1.2$, width = 0.065 in.)	0.823	---
Mock-up Seed Cluster (No poison elements)	0.908	---
Three Cluster Mock-up Slab (No poison elements in one seed cluster)	0.930	0.95

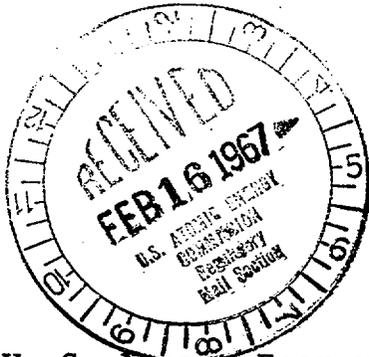
* The uncertainty represents the range of values possible within the tolerances permitted by manufacturing specifications.

APPENDIX D
APPENDIX (CONT'D.)

SNM-338
Shipping - WAED

Summary

The experimental result shows that there is no criticality hazard associated with moderation of a single PWR-2 Seed 1 cluster, even if there are no boron poison elements in the cluster. Since omission of the poison elements has a greater reactivity effect than any fuel loading error, the experiment thus demonstrates that any moderated PWR-2 Seed 1 cluster will be substantially subcritical.



Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

February 15, 1967

U. S. Atomic Energy Commission
* Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338,
Docket 70-337 to Authorize Use of Shipping Package

Gentlemen: For Div of Compliance

The Westinghouse Electric Corporation hereby requests an amendment to the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packagings described in the attached application.

The attached application makes no attempt to respond to the comments contained in your letter dated 11/8/66 concerning the packages which were previously submitted on 9/23/66. The requirement for the earlier packagings is still being reviewed, and the necessary additions and/or corrections will be transmitted as a subsequent revision to this application. The packages described in the attachment are separate and distinct from those described in our 9/23/66 transmittal, and we hope that they can be approved separately, ideally on or before March 1, 1967.

Please send the license amendment to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, 412-255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

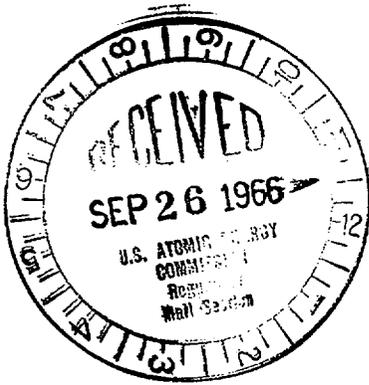
ITEM # 91

Attachment: License Amendment

6 copies transmitted

From 60 - 10/1/67





Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

September 23, 1966

U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Subject: Application for Amendment of License SNM-338,
Docket 70-337, to Authorize Use of Shipping
Package

Gentlemen:

For Div of Compliance

The Westinghouse Electric Corporation hereby requests an amendment to the subject license to authorize the delivery of special nuclear material to a carrier for transport in the packagings described in the attached application. These packagings will be used by the Westinghouse Atomic Equipment Division.

The license amendment should be sent to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, 412-255-3907.

Very truly yours,

Karl R. Schendel
License Administrator

Attachment: License Amendment
6 copies transmitted

WESTINGHOUSE ELECTRIC CORPORATION

APPLICATION FOR AN AMENDMENT TO
LICENSE SNM-338

FOR WAED SHIPPING PACKAGES

U. S. ATOMIC ENERGY COMMISSION

DOCKET 70-337

WAED SHIPPING PACKAGES

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REVISION RECORD

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
1	2/15/67	15 - 20	Added Part 6, <u>Solid Scrap Packaging</u>
1	2/15/67	21 - 26	Added Part 7, <u>PWR Contract Shipping Container</u>
1	2/15/67	Appendix B	Added
1	2/15/67	Appendix C	Added

1. Introduction

An amendment to License SNM-338 is hereby requested to authorize the delivery of special nuclear material to a carrier for transport in the packagings described herein.

2. Correspondence - Return Address

The license amendment and any associated correspondence should be sent to Karl R. Schendel, Westinghouse Electric Corporation, Box 2278, Pittsburgh, Pennsylvania 15230.

3. Administrative Control

The administrative control of the packaging operations will be carried out in accordance with the requirements contained in the Westinghouse Electric Corporation Health Physics Manual, as amended. Currently, the latest revision of this manual is Revision V, dated May 1966.

4. PWR Seed Fuel Element Packaging

4.1 Packaging Description

Designation - PWR Seed Fuel Element Shipping Container,
B.E. Permit #1270

Gross Weight - 260 pounds

Fabrication - The birdcage will have outside dimensions of 2' by 2' by 5-1/2' to 6' long. It will be fabricated of slotted 3" x 1-1/2" x 0.104" steel angles, fastened with 3/8" steel machine bolts. The fuel container will be centered in this frame with sec-

4.1 Packaging Description (cont.)

tions of slotted steel angle bolted directly against the six sides of the box. The angles will form a steel framework around the fuel container to provide geometric restraint. See Figure I in Appendix A.

The fuel container will be a 14 gauge aluminum box with a maximum outside cross sectional area of 10.5 square inches. The box will have a hinged lid and Neoprene gasket. See Westinghouse Drawing 917F562 in Appendix A.

After mounting the fuel container in the birdcage, it will be banded in a minimum of three places, using 3/4" steel banding. This banding will further secure the lid and also aid in maintaining the container in the trough formed by the steel angle.

Coolants - Not applicable.

Activity - Not applicable.

4.2 Contents Description

Radioactivity - Not applicable

Identification and Enrichment of SNM - The SNM will be uranium at any enrichment up to fully enriched in the isotope U-235.

Form of SNM - The SNM will be in the form of clad fuel elements and fuel assemblies. In the clad form, the elements or assemblies will not disruptively react or decompose at the Accident Thermal Condition. No chips, powders or solutions will be offered for transport in this packaging under the authorization requested in this application.

Neutron Absorbers, etc. - Not specified. No decrease in reactivity resulting from this type of material is included in the nuclear safety analysis.

Maximum Weight of Fissile Constituent -
2 kilograms total contained U-235.

Maximum Net Weight of Contents - 120 pounds.

Maximum Decay Heat - Not applicable.

4.3 Compliance with Subpart C of 10 CFR 71

General Standards - The various materials which have been specified for the package will not result in significant chemical or galvanic reactions. There are no specific lifting or tie-down devices. The structural members of the birdcage which might be used for these purposes will fulfill the requirements of 10 CFR 71.31.

General Criticality Standards - A single package will be nuclearly safe for conditions of optimum moderation and full reflection. The 2 kilogram limit on the maximum weight of U-235 which may be loaded into this packaging limits the average fuel density to less than 1 gram U-235 per milliliter. This density is typical of solutions. Table I of TID-7016, Rev. 1 shows that a 5 inch diameter is nuclearly safe for all degrees of moderation and reflection at any enrichment. The 10-1/2 square inch cross-section of the fuel container is equal only to the cross-sectional area of a 3-3/4 inch diameter cylinder.

Since the contents of the package will be restricted to solid, clad material, consideration of liquid contents is not applicable.

4.3 Compliance with Subpart C of 10 CFR 71 (cont.)

Single Package Evaluation - A sample package was subjected to the Water Spray, Free Drop, Penetration and Compression conditions incident to normal transport. These tests had no effect on the integrity or geometry of the package.

A sample package was subjected to the Accident Free Drop Test and displayed no significant damage. The necessity for the Penetration and Water Immersion conditions is obviated by the assumption of optimum moderation in the nuclear safety analysis. The necessity for the Thermal condition is obviated by the limitation of the contents to clad elements and assemblies.

Package Array Evaluation - Inasmuch as the Accident Free Drop Condition results in no appreciable damage to the package, any number of packages would be nuclearly safe if the array were flooded, since each fuel container would be isolated from any other by more than 12 inches of intervening water.

If the water were to drain away, it could leave the fuel containers optimumly moderated but minimally reflected. Calculations and a review of customer data reveal

4.3 Compliance with Subpart C of 10 CFR 71 (cont.)

that the maximum credible effective neutron multiplication factor (k_{eff}) of 2 kg. of solid clad fuel in this fuel container under these conditions is 0.40. From Figure 6 on page 42 of K-1019, for a k_{eff} of 0.40, the allowable interaction solid angle is 5.0 stereradians. Evaluation of a 6 x 6 array of these packages resulted in an interaction solid angle less than 5.0 stereradians. Thus a quantity of 36 of these packages will be nuclearly safe in any array under the assumed accident conditions.

4.4 Fissile Class II Limits

Six (6) packages may be transported together as a Class II shipment. Each package will be assigned 5.8 radiation units. The number of radiation units was determined as follows:

36 packages was demonstrated to be a nuclearly safe quantity.

$1/5$ of 36 = 7 whole packages.

40 divided by 7 = 5.71 units.

Rounding 5.71 up to the nearest one-tenth = 5.8 radiation units.

4.5 Fissile Class III Limits

Thirty-six (36) packages will be transported as a Fissile Class III shipment using the exclusive use of the vehicle, or accompanied by an escort qualified as required by ICC Regulations.

4.6 Procedural Controls

Prior to the first use of each packaging on or after the date of this application, the packaging will be inspected to assure compliance with the requirements specified in this application. In addition, the inspector will assure that the packaging is identified with a suitable model and serial number.

Each packaging will be visually inspected prior to each use. If damaged or deteriorated components are detected, they will be repaired or replaced so as to restore the packaging to essentially "like-new" condition.

The steel banding specified in Section 4.1 will be installed new for each use.

The Accountability group will be responsible to maintain the required records on each shipment.

5. PWR Blanket Fuel Element Packaging

5.1 Packaging Description

Designation - PWR Blanket Fuel Element Shipping Container,
B.E. Permit #1096.

Gross Weight - 275 pounds.

Fabrication - The packaging will be identical to that
described under "Fabrication" of Section 4.1,
except that the fuel container will have a
cross-section of 5-3/4" x 7-1/2" with an
area of 43 square inches.

Coolants - Not applicable.

Activity - Not applicable.

5.2 Contents Description

Radioactivity - Not applicable.

Identification and Enrichment of SNM - The SNM will be
uranium at any enrichment up to fully
enriched in the isotope U-235.

Form of SNM - The SNM will be in the form of clad fuel
elements and fuel assemblies. In the clad
form, the elements or assemblies will not
disruptively react or decompose at the
Accident Thermal Condition. No chips,
powders or solutions will be offered for
transport in this packaging under the
authorization requested in this application.

Neutron Absorbers, etc. - Not specified. No decrease in
reactivity resulting from this type of
material is included in the nuclear safety
analysis.

5.2 Contents Description (cont.)

Maximum Weight of Fissile Constituent - 2 kilograms total contained U-235, with a maximum loading of 33 grams U-235 per lineal inch.

Maximum Net Weight of Contents - 120 pounds.

Maximum Decay Heat - Not applicable.

5.3 Compliance with Subpart C of 10 CFR 71

General Standards - The various materials which have been specified for the package will not result in significant chemical or galvanic reactions. There are no specific lifting or tie-down devices. The structural members of the birdcage which might be used for these purposes will fulfill the requirements of 10 CFR 71.31.

General Criticality Standards - A single package will be nuclearly safe for conditions of optimum moderation and full reflection. The 33-grams-per-lineal-inch limit on the weight of U-235 which may be loaded into this packaging will limit the average fuel density to less than 0.05 grams per milliliter. This density is typical of solutions. Figure 3 on page 15 of TID-7016, Rev. 1 shows that an infinitely long 7" diameter cylinder is nuclearly safe for all degrees of moderation and reflection at this

5.3 Compliance with Subpart C of 10 CFR 71 (cont.)

U-235 density. In addition, Figure 17 on page 22 of the same reference shows that for a conservative height/diameter ratio of 5, a shape allowance factor of 2 may be used. Therefore, a cylinder diameter of approximately 14" will be nuclearly safe. The cross-sectional area of 43 square inches is equal to that of only a 7-1/2" diameter cylinder. Since the contents of the package will be restricted to solid, clad material, consideration of liquid contents is not applicable.

Single Package Evaluation - A sample package was subjected to the Water Spray, Free Drop, Penetration and Compression conditions incident to normal transport. These tests had no effect on the integrity or geometry of the package.

A sample package was subjected to the Accident Free Drop Test and displayed no significant damage. The necessity for the Penetration and Water Immersion conditions is obviated by the assumption of optimum moderation in the nuclear safety analysis. The necessity for the Thermal condition is obviated by the limitation of the contents of clad elements and assemblies.

5.3 Compliance with Subpart C of 10 CFR 71 (cont.)

Pack Array Evaluation - Inasmuch as the Accident Free Drop Condition results in no appreciable damage to the package, any number of packages would be nuclearly safe if the array were flooded, since each fuel container would be isolated from any other by more than 12 inches of intervening water.

If the water were to drain away, it could leave the fuel containers optimally moderated but minimally reflected. Calculations and a review of customer data reveal that the maximum credible effective neutron multiplication factor (k_{eff}) of 2 kg. of solid clad fuel in this fuel container under these conditions is 0.40. From Figure 6 on page 42 of K-1019, for a k_{eff} of 0.40, the allowable interaction solid angle is 5.0 stereradians. Evaluation of a 6 x 6 array of these packages resulted in an interaction solid angle less than 5.0 stereradians. Thus a quantity of 36 of these packages will be nuclearly safe in any array under the assumed accident conditions.

5.4 Fissile Class II Limits

Six (6) packages may be transported together as a Class II shipment. Each package will be assigned 5.8 radiation units. The number of radiation units was determined as follows:

36 packages was demonstrated to be a nuclearly safe quantity.

$1/5$ of 36 = 7 whole packages.

40 divided by 7 = 5.71 units.

Rounding 5.71 up to the nearest one-tenth = 5.8 radiation units.

5.5 Fissile Class III Limits

Thirty-six (36) packages will be transported as a Fissile Class III shipment using the exclusive use of the vehicle, or accompanied by an escort qualified as required by ICC Regulations.

5.6 Procedural Controls

Prior to the first use of each packaging on or after the date of this application, the packaging will be inspected to assure compliance with the requirements specified in this application. In addition, the inspector will assure that the packaging is identified with a suitable model and serial number.

Each packaging will be visually inspected prior to each use. If damaged or deteriorated components are detected, they will be repaired or replaced so as to restore the packaging to essentially "like-new" condition.

5.6 Procedural Controls (continued)

The steel banding specified in Section 4.1 will be installed new for each use.

The Accountability group will be responsible to maintain the required records on each shipment.

6. Solid Scrap Packaging

6.1 Packaging Description

Designation - Solid Scrap Shipping Container,
B.E. Permit #2169

Gross Weight - 350 pounds, maximum

Fabrication - The design and fabrication details for the Solid Scrap Shipping Container are given in drawings AFD-C-001 (6 sheets) which is attached as Appendix B to this application.

Coolants - Not applicable.

6.2 Contents Description

Radioactivity - Not applicable.

Identification and Enrichment of SNM - the SNM will be unirradiated uranium at any enrichment up to fully enriched in the isotope U-235.

Form of SNM - the SNM will be in the form of dry process scrap, such as chips and parts of fuel elements, occurring in the manufacture of nuclear reactor cores.

6.2 Contents Description (continued)

Neutron Absorbers - Not specified.

Maximum Weight of Fissile Constituents - 2.0 kilograms
total contained U-235.

Maximum Net Weight of Contents - 90 pounds.

Maximum Decay Heat - Not applicable.

6.3 Compliance with Subpart C of 10 CFR 71

General Standards - The various materials which have been specified for the package will not result in significant chemical or galvanic reactions. There will be no specific lifting or tie-down devices.

General Criticality Standards - A single package will be safe for conditions of optimum moderation and full reflection. The 2 kilogram limit on the maximum weight of U-235 which will be loaded into this package limits the average fuel density to approximately 0.17 grams of U-235 per milliliter. This density is typical of solutions. Figure 3 on page 15 of TID-7016, Rev. 1 shows that an infinitely long 5-1/2 inch diameter cylinder is nuclearly safe for all degrees of moderation and reflection at this U-235 density. In addition, information given on page 67 of TID-7019 indicates that a maximum of 2 kilograms of contained U-235 as solid scrap can safely be shipped in a 6 inch inside diameter container.

6.3 Compliance with Subpart C of 10 CFR 71 (cont.)

Single Package Evaluation - The results of hypothetical accident condition drop tests on a package structurally similar to the Solid Scrap Shipping Container are reported in ORNL 3735^{/1}. Our container will have less deformation than that reported because the axial load will be approximately 30 pounds per foot instead of the 90 pounds per foot used by Oak Ridge.

The necessity for the Water Immersion condition is obviated by the assumption of optimum moderation in the nuclear safety analysis. The necessity for the Thermal condition is obviated by the limitation of the contents to solids.

Package Array Evaluation - Any number of packages would be nuclearly safe if the array were undamaged but flooded, since each inner container would be isolated from any other by more than 12 inches of water.

The most reactive accident situation would be to consider the inner containers optimally moderated but minimally reflected. Under these conditions, the interactions

^{/1} Shappert, L.B., "Results of Impact Tests Performed on 55-Gallon Drum Type Birdcage," ORNL 3735.

6.3 Compliance with Subpart C of 10 CFR 71 (cont.)

within the array become dominant. From TID-7028, page 111, Figure 76, the data for a "spatial square" indicates that the "surface separation" of the specified containers should be greater than 22 centimeters for an array containing 50 units in each of the two layers in the array. Since the spacing, container volume, and SNM column height for the Solid Scrap Shipping Container are all conservative with respect to the units evaluated in Figure 76, a shipment of 50 containers will be nuclearly safe.

6.4 Fissile Class II Limits

Twenty (20) packages will be offered as a maximum Fissile Class II shipment. Each package will be assigned two (2) radiation units.

This quantity is more conservative than the Part 71 limit of one-half the quantity which would be safe under the hypothetical accident conditions.

6.5 Fissile Class III Limits

Fifty (50) packages will be offered as a maximum Fissile Class III shipment using the exclusive use of the vehicle or accompanied by an escort qualified as required by ICC Regulations.

6.6 Procedural Controls

Prior to the first use of each new packaging, it will be inspected to assure compliance with the requirements specified in this application. In addition, the inspector will assure that the packaging is suitably identified, including a unique serial number.

Each package will be visually inspected prior to each use. If damaged or deteriorated components are detected, they will be repaired or replaced so as to restore the packaging to essentially "like-new" condition.

The Accountability Group will be responsible to maintain the required records on each shipment.

7. PWR Contract Packaging

7.1 Packaging Description

Designation - PWR Contract Shipping Container,
B.E. Permit #1270

Gross Weight - 260 pounds.

Fabrication - The birdcage will have outside dimensions of 2' by 2' by 5-1/2' to 6' long. It will be fabricated of slotted 3" x 1-1/2" x 0.104" steel angles, fastened with 3/8" steel machine bolts. The fuel container will be centered in this frame with sections of slotted steel angle bolted directly against the six sides of the box. The angles will form a steel framework around the fuel container to provide geometric restraint. See Figure 1 in Appendix C.

The fuel container will be a 14 gauge stainless steel box with a maximum outside cross sectional area of 8.5 square inches. The box will have a hinged lid and Neoprene gasket. See Figure 2 in Appendix C.

After mounting the fuel container in the birdcage, the additional lengths of angle will be bolted in place to provide the restraint on all sides which has been previously specified.

Coolants - Not applicable.

Activity - Not applicable.

7.2 Contents Description

Identification and Enrichment of SNM - The SNM will be unirradiated uranium fully enriched in the isotope U-235.

Form of SNM - The SNM will be in the form of clad fuel elements. The elements, as loaded for transport, will measure approximately .090" x 3.5" x 48". The maximum loading of any element will consist of 160 grams U-235 in the form of sintered uranium oxide wafers in a bonded Zircaloy 2 cladding.

Neutron Absorbers, etc. - Not specified. No decrease in reactivity resulting from this type of material is included in the nuclear safety analysis.

Maximum Weight of Fissile Constituent -
2 kilograms total contained U-235.

Maximum Net Weight of Contents - 120 pounds.

Maximum Decay Heat - Not applicable.

7.3 Compliance with Subpart C of 10 CFR 71

General Standards - The various materials which have been specified for the package will not result in significant chemical or galvanic reactions. There are no specific lifting or tie-down devices. The structural members of the birdcage which might be used for these purposes will fulfill the requirements of 10 CFR 71.31.

7.3 Compliance with Subpart C of 10 CFR 71 (cont.)

General Criticality Standards - A single package will be nuclearly safe for conditions of optimum moderation and full reflection. The 2 kilogram limit on the maximum weight of U-235 which may be loaded into this packaging limits the average fuel density to less than 1 gram U-235 per milliliter. This density is typical of solutions. Table I of TID-7016, Rev. 1 shows that a 5 inch diameter is nuclearly safe for all degrees of moderation and reflection at any enrichment. The 8.5 square inch cross-section of the fuel container is equal only to the cross-sectional area of a 3.5 inch diameter cylinder.

Since the contents of the package will be restricted to solid, clad material, consideration of liquid contents is not applicable.

Single Package Evaluation - A sample package was subjected to the Water Spray, Free Drop, Penetration and Compression conditions incident to normal transport. These tests had no effect on the integrity or geometry of the package

A sample package was subjected to the Accident Free Drop and Penetration Tests and displayed no significant damage. The necessity for the Water Immersion conditions is obviated by the assumption of

7.3 Compliance with Subpart C of 10 CFR 71 (cont.)

complete flooding in the nuclear safety analysis. The calculated H/U-235 ratio for a flooded package is 7.5, which is very undermoderated. Any lesser water density would make the package even less moderated. The calculated k_{eff} of a single package at this moderation when fully reflected is 0.54. The necessity for the Thermal condition is obviated by the limitation of the contents to clad elements.

See Westinghouse Atomic Power Laboratory Report WAPD-O(AO)-3951, attached as part of Appendix C, for details of the testing performed on the package.

Package Array Evaluation - Inasmuch as the Accident Free Drop Condition results in no appreciable damage to the package, any number of packages would be nuclearly safe if the array were flooded, since each fuel container would be isolated from any other by more than 12 inches of intervening water.

If the water were to drain away, it could leave the fuel containers moderated. Hand calculations were carried out to determine the maximum k_{eff} of the array assuming flooded containers and a range of interstitial moderations. The package arrangement was assumed to be three wide by two high with an infinite length.

7.3 Compliance with Subpart C of 10 CFR 71 (cont.)

The values determined for the principal quantities derived during these calculations are tabulated below:

<u>Interstitial Water Density - %</u>	<u>Unit Package k_{eff}</u>	<u>Interaction Probability</u>	<u>Array k_{eff}</u>
0	0.20	0.077	0.22
1	0.37	0.086	0.41
3	0.37	0.113	0.42
5	0.54	0.106	0.60
10	0.54	0.072	0.58
30	0.54	0.009	0.545
100	0.54	0.000	0.54

Using the same procedures the maximum k_{eff} for an array of nine infinitely long containers arranged three wide by three high increases to 0.655. Considering the reduced effect of adding additional, more remote circumferential containers, an array of thirty-six finite length containers in a six wide by six high arrangement would have a k_{eff} conservatively less than 0.90. Thus a quantity of 36 of these packages will be nuclearly safe in any array under the assumed accident conditions.

7.4 Fissile Class III Limits

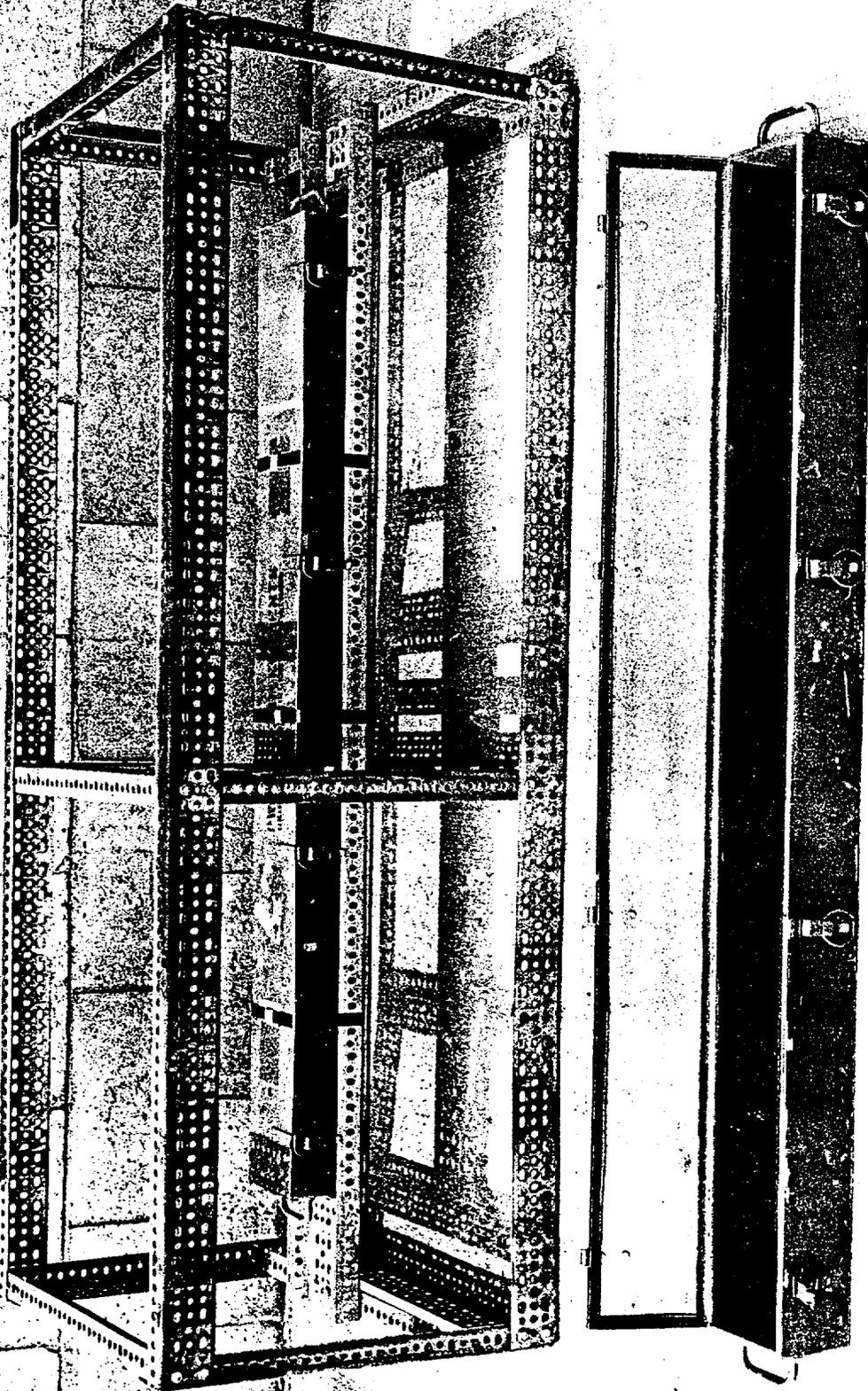
A maximum of thirty-six (36) packages will be transported as a Fissile Class III shipment using the exclusive use of the vehicle, or accompanied by an escort qualified as required by ICC Regulations.

7.5 Procedural Controls

Prior to the first use of each packaging on or after the date of this application, the packaging will be inspected to assure compliance with the requirements specified in this application. In addition, the inspector will assure that the packaging is identified with a suitable model and serial number.

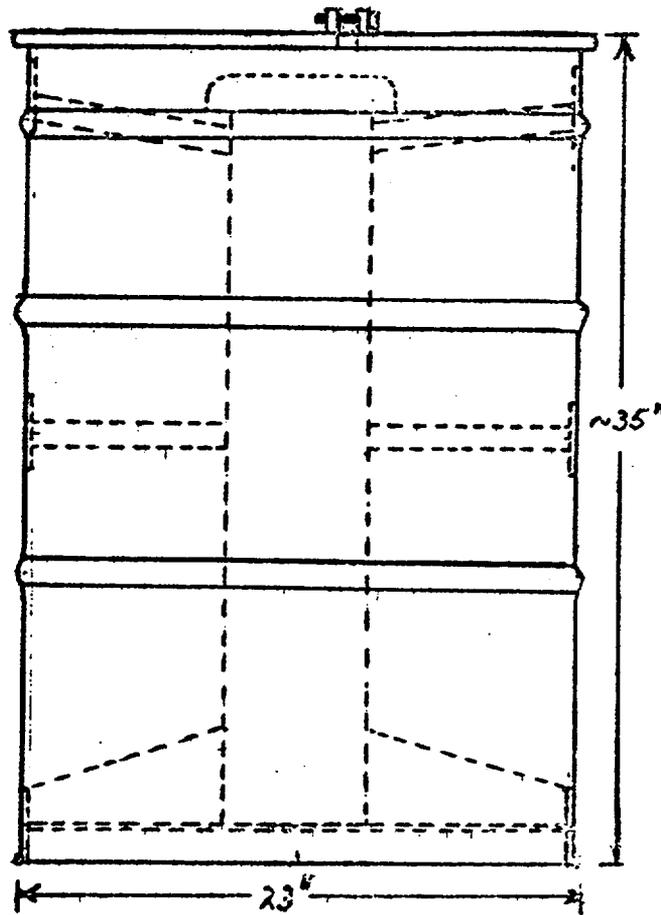
Each packaging will be visually inspected prior to each use. If damaged or deteriorated components are detected, they will be repaired or replaced so as to restore the packaging to essentially "like-new" condition.

The Accountability group will be responsible to maintain the required records on each shipment.



PWR SEED FUEL ELEMENT PACKAGING
FIGURE I

APPENDIX B

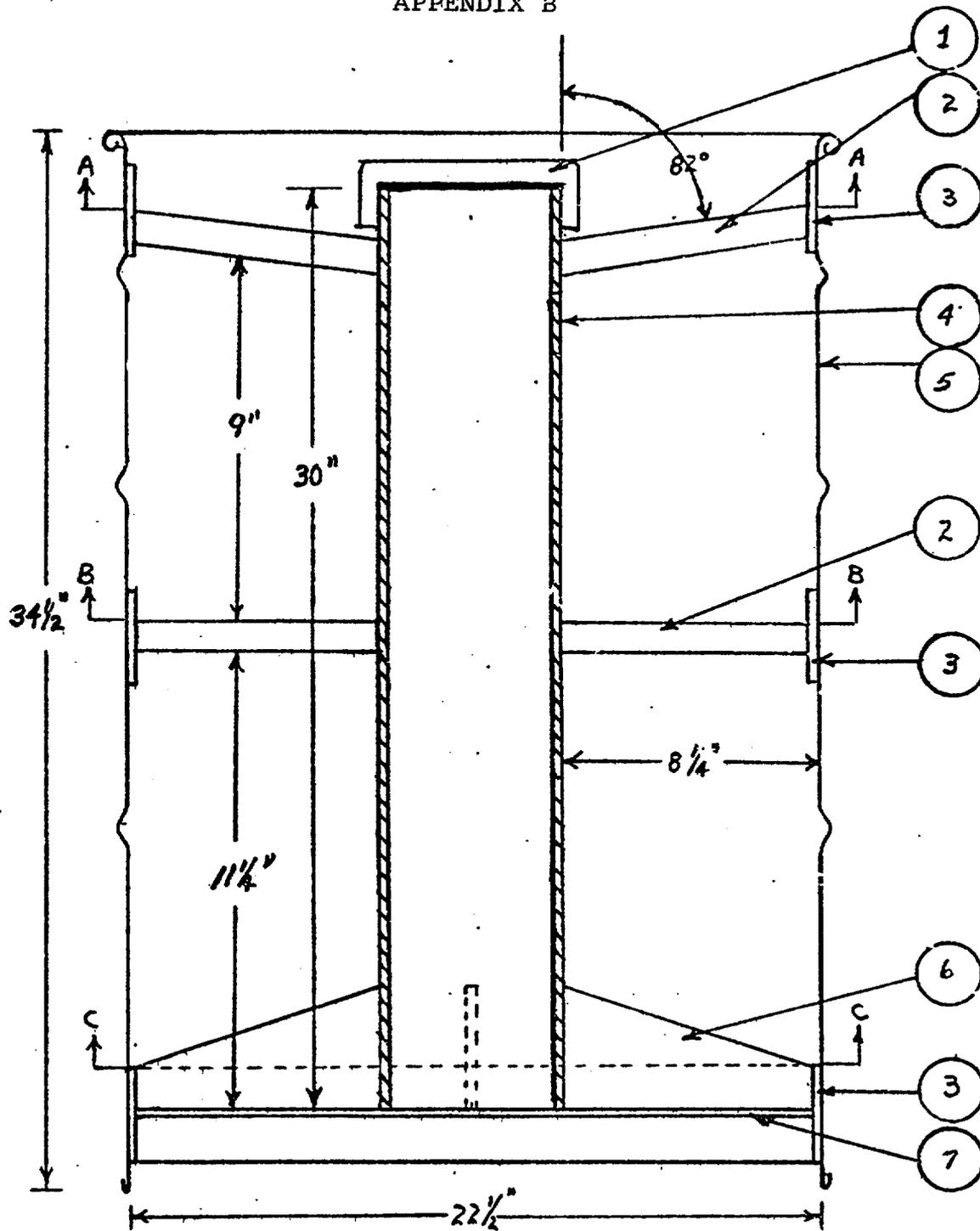


SHEET 1

AFD-C001
W.E. PIROS 7/20/65

Figure 1 - Process Scrap Shipping Container

APPENDIX B



SHEET 2

SCALE $\frac{3}{16}'' = 1''$

AFD-C-001

W.E. PIROS 7/30/65

Figure 2 - Process Scrap Shipping Container
Assembly Arrangement

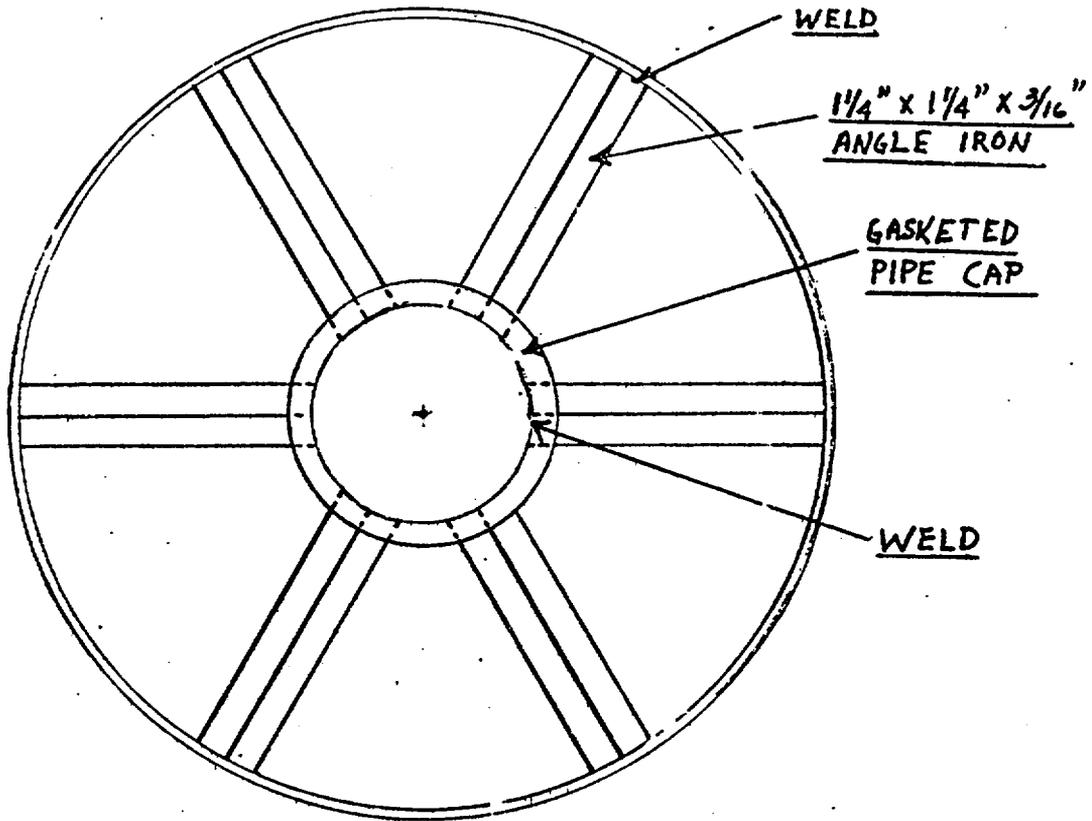
APPENDIX B

<u>Item</u>	(see Sheet 2)
1	Gasketed End Cap
2	1-1/4" x 1-1/4" x 3/16" angle iron
3	3" x 1/4" flat stock
4	6 inch schedule 120 pipe
5	55 gallon Spec. 17H drum
6	1/4" thick gusset
7	1/4" plate

AFD-C-001
Sheet 3

Figure 3 - Process Scrap Shipping Container
Items Identified in Figure 2

APPENDIX B



SECTION A-A

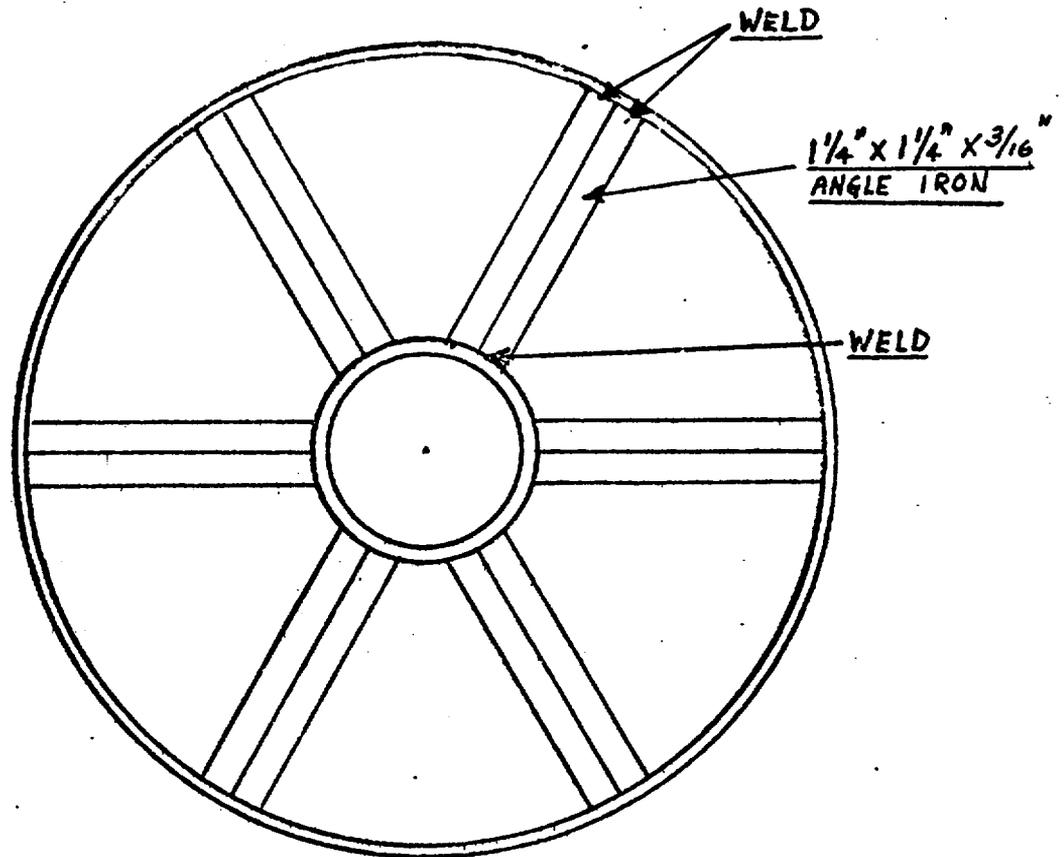
SHEET 4

AFD-C-001

W.E. PIROS 7/30/65

Figure 4 - Process Scrap Shipping Container
Top Spacer Ring Assembly

APPENDIX B



SECTION B-B

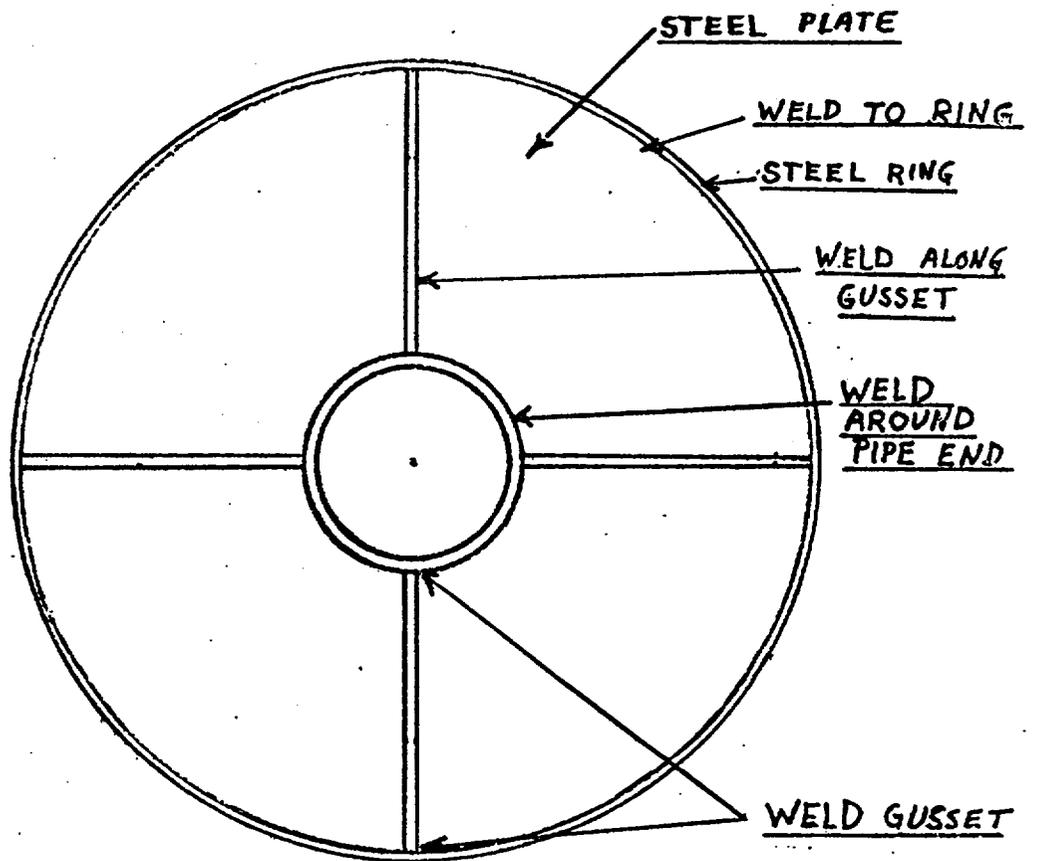
SHEET 5

AED - C-001

W.E. PIROS 7/30/65

Figure 5 - Process Scrap Shipping Container
Middle Spacer Ring Assembly

APPENDIX B



SECTION C-C

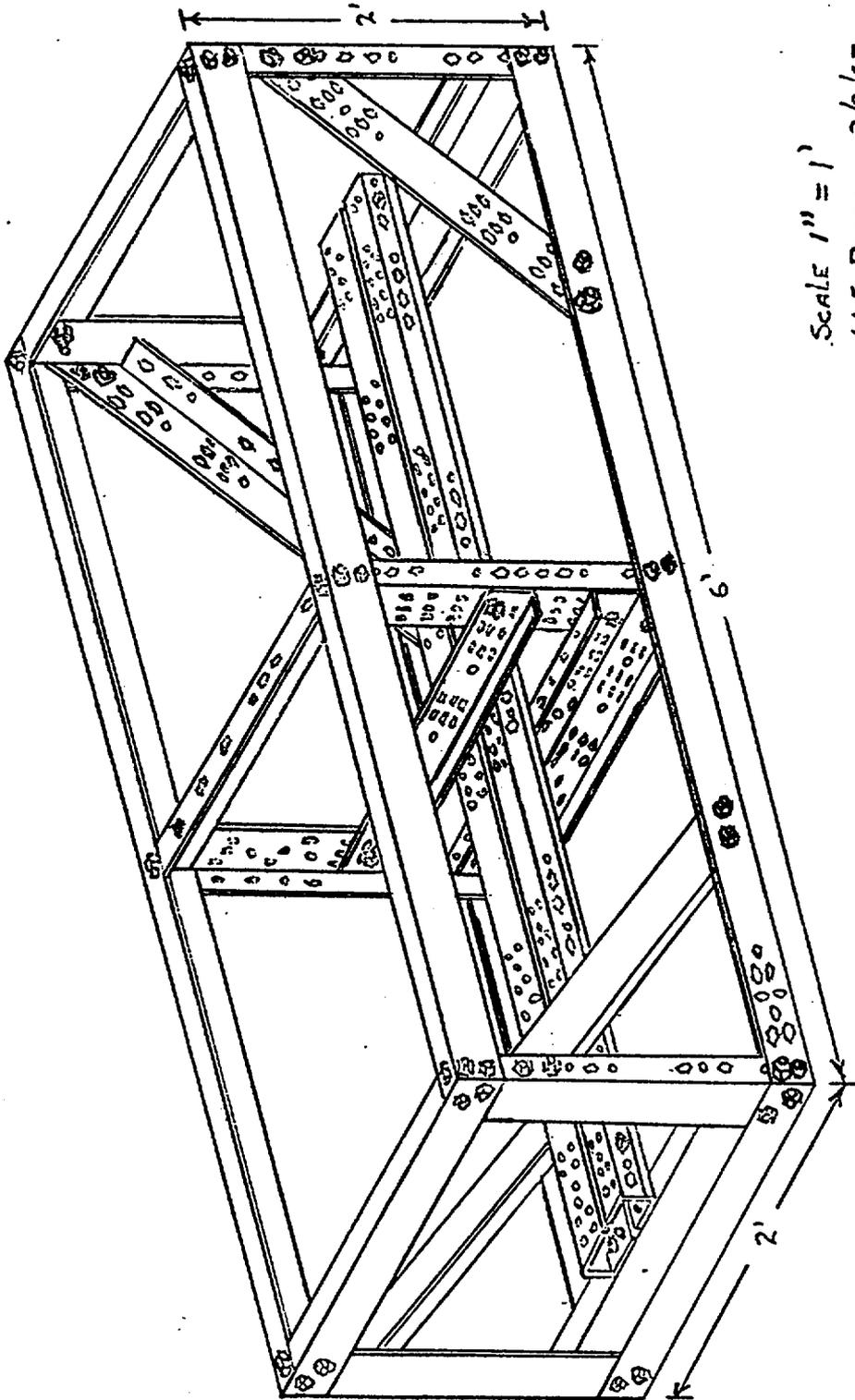
SHEET 6

AFD-C-001

W.E. PIROS 7/30/65

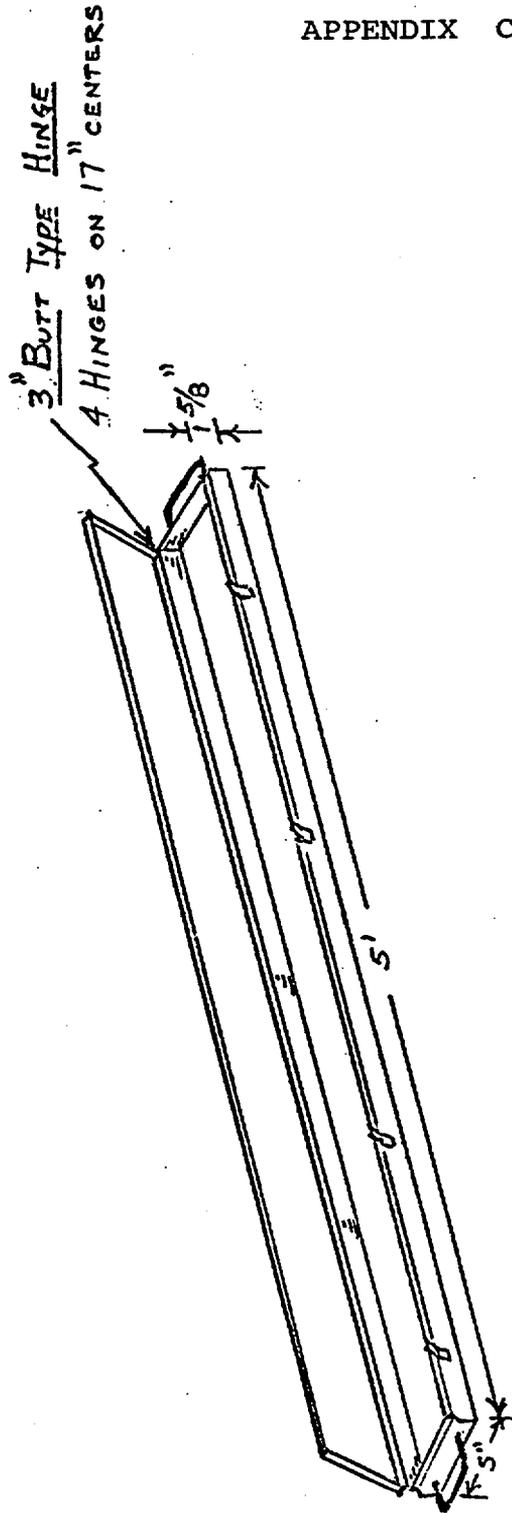
Figure 6 - Process Scrap Shipping Container
Bottom Plate Assembly

APPENDIX C



SCALE 1" = 1'
W.E. PIROS 2/2/67
FIGURE 1

APPENDIX C



SCALE 1" = 1'

- W. E. PIROS 2/2/67

FIGURE 2

APPENDIX C
WESTINGHOUSE ATOMIC POWER LABORATORY
TEST REPORT SLOTTED ANGLE BIRDCAGES
BE #1270

DESCRIPTION OF CONTAINERS

Bureau of Explosives Permit #1270

This is a "Birdcage" type shipping container. It consists of a 14 gage steel or aluminum box centered in a frame made of slotted steel angle 3" x 1-1/2" x 0.014", fastened with 3/8" machine bolts. The frame is a 2-foot square measuring 5 to 10 feet in length. The box, which has a piano hinge lid and neoprene gasket, may be of a variety of cross sections, but none exceeds 20 square inches. It is centered in the birdcage frame with bolted sections of slotted angle and in addition, is banded to the deck of the frame by 3/4" steel banding. When an aluminum box is used, it is centered in the birdcage with sections of slotted steel angle bolted directly against all 6 sides of the box forming a steel framework around the aluminum box to provide geometric restraint which will withstand a "standard fire". Bureau of Explosives' letter 25-16-174 dated September 22, 1961 authorizes use of this container for shipment by car-load or truckload lots only for not more than 2700 millicuries of radioactive material per container. (Figure 1)

Normal Transport Test Conditions

AEC Appendix 0529 specifies that a container must withstand the normal conditions of transport (impact, penetration, water spray, and compression) without damage to the package or loss or displacement of radioactive material.

- A. Impact - "A free drop, from a height of 4 feet, onto an unyielding, flat horizontal surface, with the package striking the surface in such a position as to suffer the maximum damage."
- B. Penetration - "The impact of a 12-pound steel cylinder, 1-1/4 inches in diameter, dropped from a height of 4 feet so as to strike with the flat end of the cylinder onto the external surface of the package which is most vulnerable in terms of causing loss of contained material."
- C. Water Spray - "A water spray of not less than one gallon per minute directed onto the package, with each side except the bottom being exposed to the spray for 30 minutes. The bottom of the package shall be situated so as not to be immersed in water."
- D. Compression - "A compressive load equivalent to five times the weight of the package or 2 pounds per square inch times the vertically projected area in square inches of the upright package, whichever is greater. The load shall be applied uniformly to the two opposite sides of the package where one of those sides is the side on which the package would rest in its normal position. The load shall be applied for a period of 24 hours."

Container Tested - 5' x 2' x 2' Slotted Angle Birdcage B of E Permit No. 1270

1. Identification - See Figure 1 for picture showing birdcage ready for shipment and an empty rectangular box.

Dimensions of birdcage frame tested - 2 feet square by 5 feet long.

2. Weight

- a. Weight of outer container (with rectangular cross section box) - 118 lbs.
- b. Simulated shipment - Steel plates - 45 lbs.
- c. Total gross weight - 163 lbs.

3. Impact Test

- a. Surface used for test - 4-inch reinforced concrete floor at ground level used for loading dock.
- b. Surface of container tested - birdcage dropped with its long axis horizontal; point of impact was the long edge of the frame.
- c. Height of fall - 4 feet, as measured from the ground to the bottom of the forks of a hi-lift supporting the birdcage.
- d. Description of test effects - there was negligible effect on the structure of the birdcage.
- e. Date test performed - September 17, 1965.
- f. Performed by - A. Ulyas.
- g. Witnessed by - W. Stanko, A. Ulyas.

4. Penetration Test

- a. Weight and measurement of cylinder used - 12 lbs, 36-1/8 inches in length and 1-1/4 inches in diameter.
- b. Surface of container tested - the flat end of the cylinder struck the top of the rectangular box.
- c. Height of cylinder drop - 4 feet, as measured from the top of the rectangular box to the bottom of the forks of a hi-lift supporting the cylinder.
- d. Description of test effects - a circular dent was made on the rectangular box; however, no penetration occurred.
- e. Date test performed - September 17, 1965.
- f. Performed by - A. Ulyas.
- g. Witnessed by - W. Stanko, A. Ulyas

5. Water Spray Test

- a. Rate of water spray - 1.1 gallons/minute.
- b. Time container exposed to spray - 30 minutes.
- c. Position of container - Positioned atop a metal skid so as to ensure that container would not be immersed in water during test.
- d. Weight of container - before test - 118 lbs.
- after test - 118 lbs.
Net weight change - None
- e. Description of test effects - There was no water leakage into the rectangular cross section box as evidenced by the fact there was no net weight change. Also, upon opening the container, no water was found inside.
- f. Date test performed - September 16, 1965.
- g. Performed by - E. Jackson.
- h. Witnessed by - C. W. Hughes, W. Stanko.

6. Compression Test

- a. Gross weight of container - 163 lbs.
- b. Test specifications (5 times container weight of 2 lbs/sq. inch times vertically-projected area in square inches of the upright container, whichever is greater).
 - (1) Five times container weight - $5 \times 163 \text{ lbs} = 815 \text{ lbs}$.
 - (2) Vertically-projected area - 1728 sq. inches; area x 2 lbs = 3456 lbs.
- c. Actual test load used - 3633 lbs.
- d. Description of test load - Eight 55-gallon drums containing silicon carbide grit, and one wooden pallet and one metal skid placed atop the tested birdcage.
- e. Duration of test - 24 hours; Started - 9:00 a.m. on 9/15/65
Ended - 9:00 a.m. on 9/16/65
- f. Description of test effects - At the end of the test there was no discernible effect on the birdcage.
- g. Performed by - A. Ulyas.
- h. Witnessed by - W. Stanko, A. Ulyas.

Accident Test Conditions

AEC Appendix O529 specifies that a container must meet the accident test conditions specified (impact, puncture, fire and immersion) in order to meet the requirements for Fissile Class I and II shipments.

- A. Impact - A free drop, from a height of 30 feet, onto an unyielding, flat, horizontal surface, with the package striking the surface in such a position as to suffer the maximum damages; followed by the puncture test.
- B. Puncture - A fall onto a cylindrical target through a distance of 40 inches measured from the lowest point of the package to the surface of the target, striking the target in such a position as to suffer the maximum damage. The cylindrical target shall be the flat, horizontal end surface of a vertical, solid, structural carbon steel cylinder, 8 inches long and 6 inches (+0.2 inch) in diameter. The edges of the surface may be rounded to a radius of not more than 0.25 inch. The bar shall be rigidly mounted on a flat horizontal unyielding surface; followed by the fire test.
- C. Fire - Exposure to the conditions of the first hour of the standard time - temperature curve (see NFPA No. 251, or ASTM Design E 119-61): followed by the immersion test.

This test was not conducted since the containers are of all steel construction and in those cases where an aluminum box is used it is surrounded by a steel framework to provide geometric restraint which will withstand "standard fire."

- D. Immersion - Immersion in water so that the package is at least three feet below the surface for 2^{1/2} hours.

1. Identification - see Figure 1

Dimensions of birdcage frame tested - 2 feet square by 5 feet long.

2. Weight

- a. Weight of outer container (with rectangular cross section box) - 140 lbs.
- b. Simulated Shipment - Steel plates 120 lbs.
- c. Total gross weight - 260 lbs.

3. Impact Test

- a. Surface used for test - 4-inch reinforced concrete pad located behind Ranger #3 at Bettis.
- b. Surface of container tested - With the free fall from 30-foot, the birdcage was dropped with its long axis vertical of the 2 foot square; the point of impact was the bottom side.

- c. Height of fall - 30 feet as measured from the ground to the bottom of the birdcage which was suspended on a truck crane.
- d. Description of test effects - No significant damage occurred to the container. There was no loss of material from the box nor was there any displacement of the box from the center of the birdcage.
- e. Date test performed - May 11, 1964.
- f. Performed by A. Uiyas.
- g. Witnessed by W. B. Thomas, C. W. Hughes.

4. Followed by Puncture Test

- a. Surface used for test - 4-inch reinforced concrete floor at ground level used for a loading dock.
- b. Weight and measurement of cylinder - 78 lbs. 8 inches in length and 6 inches in diameter.
- c. Surface of container tested - the long axis of the birdcage frame.
- d. Height of drop - 40 inches, as measured from the top of the cylinder to the bottom of the birdcage which was positioned atop the forks of a hi-lift.
- e. Description of test effects - There was slight distortion of the angle iron frame at the point of impact. There was no effect on the box.

5. Immersion Test

This test was not performed since packaging limits are established that are safe even if the container is optimally moderated.

FILING INSTRUCTIONS

The cover letter should be filed in the binder, "License SNM-338, Docket 70-337, WAED Shipping Packages, 9/23/66, immediately in front of the previous transmittal letter dated 9/23/66.

Revised pages 1, 2 and 15 should be inserted and the old pages removed.

OK

New pages 16 through 25 should be inserted into the binder immediately following page 15. The new Appendices B and C should be inserted after Appendix A.

The removed pages may be filed in the back of the binder.

replaced
(SD)

2/15/67

Revision No. 1

ENCLOSURE
70-357

OCT 9 1966

Westinghouse Electric Corporation
3 Gateway Center
Box 2278
Pittsburgh, Pennsylvania 15229

Attention: Mr. Karl E. Schendel
License Administrator

Gentlemen:

This refers to your application dated September 22, 1966, requesting an interim approval of Finelle Class II limits on your salt and RCC packages.

Title 19, Code of Federal Regulations, Part 71, "Packaging of Radioactive Material for Transport," requires that an application for a specific license to deliver licensed material to a carrier for transport contain the information described in Section 71.61 of this Part. In the case of a previously licensed package, this should be a part of a consolidated application for a superseding license, as required in Section 71.6 of this Part.

Since your September 22 application does not contain the information required for Class II approval of the two containers referenced, applications should be submitted in accordance with Part 71 for the two containers. Please refer to our letter dated July 29, 1966, for guidance in preparing the applications.

DISTRIBUTION:
Document No.

Very truly yours,

Encl.
Compliance Hqs (2)
Mr. Beaking File
Div. Beaking File
R. D. Smith, Mgr.

Donald A. Bushamer, Chief
Source & Special Nuclear Materials Branch
Division of Materials Licensing

From CO - Hdqrs.

ITEM #

92

13

8/9/2



Westinghouse Electric Corporation

3 Gateway Center
Box 2278, Pittsburgh, Pa. 15230

September 22, 1966

* U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

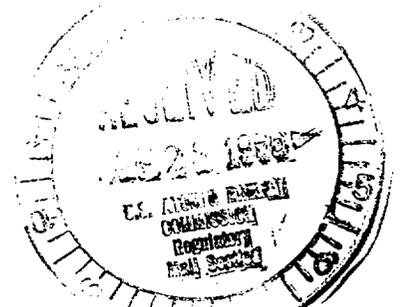
Subject: Application for an Amendment to License SNM-338,
Docket 70-337, to Authorize Fissile Class II
Shipping Packages

Gentlemen:

For Div of Compliance

The Westinghouse Electric Corporation hereby requests an amendment to the subject license to authorize the delivery of fissile material in specified packagings to a carrier as Fissile Class II shipments. The packagings specified are currently approved for use in Fissile Class III shipments.

The packagings described in this application will be completely re-evaluated and become a part of the consolidated application required by 10 CFR 71.12. It is our intent to use the conservative ratings in this application to make Fissile Class II shipments until such time as the consolidated application has been approved. We would appreciate it if action on this application could be completed no later than October 17, 1966.



2712

September 22, 1966

The license amendment should be sent to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, 412-255-3907.

Very truly yours,



Karl R. Schendel
License Administrator

Attachment: License Amendment

6 copies transmitted

WESTINGHOUSE ELECTRIC CORPORATION

APPLICATION FOR AN AMENDMENT TO
LICENSE SNM-338
FOR FISSILE CLASS II
SHIPPING PACKAGES

U. S. ATOMIC ENERGY COMMISSION

DOCKET 70-337

FISSILE CLASS II SHIPPING PACKAGES

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REVISION RECORD

<u>Revision No.</u>	<u>Date of Revision</u>	<u>Pages Revised</u>	<u>Revision Reason</u>
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Pages 3 and 4 intentionally left blank.

1. Introduction

An amendment to License SNM-338, Docket 70-337, is hereby requested to authorize the assignment of interim Fissile Class II ratings to shipping packagings presently approved under that license. The packagings are the Selni packaging and the RCC packaging. When loaded in accordance with the requirements stipulated in this application, a value of five (5) radiation units will be assigned to any one package.

At a later date, these packagings will be completely described, evaluated, and permanently rated in accordance with the requirements of Section 10 CFR 71.12. When approved by the Commission, the permanent ratings, which may or may not be the same as those contained in this application, will supersede any ratings given herein.

2. Correspondence - Return Address

The license amendment and any associated correspondence should be sent to Karl R. Schendel, Westinghouse Electric Corporation, Box 2278, Pittsburgh, Pennsylvania 15230.

3. Administrative Control

The administrative control of the packaging operations will be carried out in accordance with the requirements contained in the Westinghouse Electric Corporation Health Physics Manual, WAED-HP-103, as amended. Currently, the latest revision of this manual is Revision V, dated May 1966.

4. Packaging Description

4.1 Selni Packaging

The description of the Selni packaging was transmitted as an application dated 11/15/62 for an amendment to License SNM-38, Docket 70-43. The packaging was submitted for approval on License SNM-338, Docket 70-337, as part of our Indian Point application, dated 5/20/64, as amended; and our SENA application, dated 3/8/65, as amended. The application dated 11/15/62 described two containers, one for fuel assemblies and one for fuel follower and absorber assemblies. Although these containers have differing physical dimensions, they embody essentially identical design concepts, materials, safety margins and performance capabilities. They were both assigned a single Bureau of Explosives number, #1497. Therefore, the reference to Selni packaging in this application will be interpreted to mean either the fuel assembly or the fuel follower assembly packaging.

4.2 RCC Packaging

The description of the RCC packaging was transmitted as an application, dated 10/19/65 and amended 1/10/66, for an amendment to License SNM-338, Docket 70-337. Authorization to use this packaging was subsequently requested as part of our Zorita application, dated 7/22/66.

5. Description of Package Contents

The contents of packages delivered to a carrier as Fissile Class II packages under the authorization requested in this application will be subject to the following requirements and controls.

1. The special nuclear material (SNM) will be uranium enriched to less than 5 w/o in the isotope U-235.
2. The special nuclear material will be in the form of clad fuel assemblies. SNM in the form of clad fuel rods may be packaged provided that the individual rods are securely held by fittings or fixtures in a predetermined array.
3. The fuel assemblies will be loaded in the packaging in such a fashion that if the package were to be flooded and subsequently drained, any water which penetrated the assembly would drain simultaneously.
4. Prior to delivering the package to a carrier, the Nuclear Engineering Department will ascertain that, for the package as loaded, the calculated effective neutron multiplication factor (k_{eff}) of a single, undamaged, flooded package does not exceed 0.90. For two packages crushed, aligned, abutted top-to-top, and flooded, the calculated k_{eff} must not exceed 0.98.

These calculations will be performed using LEOPARD or PDQ-03 procedures. No credit will be taken for the presence of neutron absorbing devices in the package. The k_{eff} values used to determine compliance with the previous paragraph will have been adjusted upward to include an allowance for the accuracy of the calculations.

6. Nuclear Safety Analysis

For normal shipping conditions, any number of packages will be nuclearly safe, since any quantity of unmoderated UO_2 at an enrichment ≤ 5 w/o is subcritical.

If the packages were to be completely flooded, but not otherwise damaged, any number of packages would also be nuclearly safe since the contents of any package would themselves be subcritical and would be isolated from the contents of any other package by more than 12" of water.

If the flooded packages were then to drain, the fuel assemblies would also drain and the array would then return to an unmoderated condition.

Only two packages would be involved in the maximum credible accident. The heavy structural members of the base and internal support structures of the packagings would prevent any additional packages from assuming a position such they could contribute to the reactivity of the accident array. Therefore the maximum credible accident imposes no limit on the number of packages which could safely be transported in one shipment.

7. Derivation of Fissile Class II Rating

Nuclear safety considerations theoretically dictate no limit on the number of packages which may be transported in one shipment. However, practical considerations such as weight, size, and the value of a shipment must be considered. Past history, as contained in the various applications referenced in Section 4 of this application, indicates that a single shipment of eight (8) packages has frequently been requested and approved. The Fissile Class II rating was calculated by dividing 40 by 8 to obtain a value of 5 radiation units per package.

8. Inspections and Records

In addition to those controls specified in the Health Physics Manual (Section 3 of this application) each packaging will be inspected visually. Any component which displays damage or deterioration which might affect the effectiveness of the packaging will be repaired or replaced so as to restore the packaging to "like-new" condition.

The Nuclear Materials Management group will be responsible for the maintenance of required records.

DOCKET NO. 70-337



Westinghouse Electric Corporation

For Div. of Compliance

3 Gateway Center
Box 2278, Pittsburgh 30, Pa.

August 11, 1969



U. S. Atomic Energy Commission
Division of Materials Licensing
Washington, D. C. 20545

Attention: Mr. Donald A. Nussbaumer, Chief
Source and Special Nuclear Materials Branch

Gentlemen:

Subject: Emergency Procedure Criteria,
License SNM-338, Docket 70-337

The Westinghouse Electric Corporation hereby requests an amendment to License SNM-338, Docket 70-337, to incorporate the attached Cheswick Divisions Plant Emergency Procedures.

In your letter, dated March 28, 1969, you indicated that the Commission would prefer that Westinghouse transmit a document establishing the primary objectives and performance criteria applicable to our Cheswick emergency procedures, in lieu of the detailed procedures manual itself. The attached Cheswick Divisions Plant Emergency Procedures have been prepared in response to this preference, and supersede our transmittal of January 21, 1969.

Please send the license to me at the above address.

If you have any questions, please write to me at the above address or telephone me collect, (412) 255-3907.

Very truly yours,

Karl R. Schendel

Karl R. Schendel
License Administrator

KRS:sw

Attachment: License
7 copies transmitted

ITEM # 93

B/92

8/11/69

Cheswick Divisions Plant Emergency Procedures

1. Emergency Procedures Documentation

Written emergency procedures will be maintained and communicated to all personnel.

2. Administrative Organization

The Cheswick Site Operations are composed of several Westinghouse Divisions. Each activity has a Manager who will be responsible for plant operations, including health and safety. The "Site Manager" will be the manager of the Electro-Mechanical Division.

The primary purpose of the Cheswick Divisions Plant Emergency plan will be to establish responsibilities and procedures which will give maximum protection to life and property in the event of an emergency situation. Under emergency conditions at the Cheswick Site, an "Emergency Cadre" will be activated. Members of the Cadre will be the Site Manager, Plant Managers, Industrial Relations Manager, and Health, Safety and Services Manager. The Site Manager will be responsible for coordination of the total site emergency activities; plant managers will be responsible for directing in-plant emergency operations; the Industrial Relations Manager will coordinate the employe and public relations aspects of the emergency; and the Manager of Health, Safety and Services will coordinate the necessary health and safety services needed during the emergency.

A fundamental part of the emergency plan will be the establishment of several emergency teams with health physics, first-aid, physical security, and fire (safety) responsibilities.

2. (continued)

Each team will be assigned a team leader with two alternates. These teams will function under the immediate direction of the Manager of Health, Safety and Services.

3. Emergency Instructions

One site telephone number will be established for reporting all emergencies.

All employees will be instructed in the general and specific actions required of them in an emergency (see Paragraph 7). To evaluate the effectiveness of the instruction program, and as an effective refresher, a pre-announced plant evacuation exercise will be conducted at least twice annually.

The training and updating of the emergency teams will be accomplished on a continuing basis under the direction of the Manager of Health, Safety and Services.

4. Immediate Actions

Procedures which have been previously established for and have been communicated to the worker, foreman, etc., will be followed in specific emergencies; example, major radioactive spill, release of toxic fumes, fire, radioactive shipment accidents, and nuclear incidents. These guidelines, partly adapted from NSB Handbook 48, will be used in the worker's job training.

Immediately after an emergency situation which results in the evacuation of a plant, the following would take place simultaneously:

4. (continued)

- (1) At the plant emergency assembly points, various teams would be performing their functions; that is, personnel monitoring, first aid, personnel decontamination, accounting for plant personnel, taking statements from personnel who were in the emergency area;
- (2) The Emergency Cadre would assemble, evaluate the hazards and emergency procedures would be activated; and
- (3) Based on decision of the Emergency Cadre, action to control immediate hazards--for example, fire, water line breakage, power failure, etc.--would be implemented.

5. Off-site Emergency Support

To provide any assistance which might be needed by the site Fire Brigade, arrangements will be maintained with at least two local Fire Departments to respond under a mutual assistance fire pact.

Once on site, the Fire Departments will take directions from the Fire Brigade leaders. Response time by the Fire Departments to fires at the Cheswick site will be less than ten minutes. Back-up and reinforcements will be provided by five other volunteer Fire Departments in the area. Orientation and training on Cheswick site operations for outside fire fighting services will consist of tours through non-security facilities and lectures in fire fighting techniques within a radiation area. Personnel in the site Fire Brigade will also be encouraged to participate in the activities of the Community Volunteer Fire Departments to provide another, indirect, method of communication and site familiarization.

5. (continued)

Arrangements for the handling of contaminated and radiation exposure cases will be made with at least two hospitals in the area. Medical management for low contaminated injured cases will be accomplished at the Citizens' General Hospital, New Kensington, Pennsylvania. Medical management for severe contaminated and radiation exposure cases will be accomplished at the Presbyterian-University Hospital, Pittsburgh, Pennsylvania. General tours of non-security plant areas will have been made by officials of both hospitals for familiarization purposes. Various hallways and rooms within the hospitals will be pre-designated for handling contaminated cases. Portable, battery-operated detection instruments would be provided by Cheswick Health, Safety and Services for area survey and wound monitoring.

Arrangements will be made for transporting injured cases with at least two funeral homes in the area. These funeral homes provide a routine ambulance service for the community. The handling of contaminated cases will be accomplished by Westinghouse Health Physics technicians. These technicians will also take the necessary precautions to prevent contamination of the ambulance interior. A final survey will be made of the ambulance before it is released for community service.

Through the local Civil Defense Director, arrangements will be made for the use of heavy equipment, emergency generators, and special services--Red Cross and self-contained medical units--, etc. The Cheswick site Civil Defense Coordinator will work with the local Civil Defense authorities to establish coordination for the full use of their services under emergency conditions.

6. Emergency Equipment

Equipment required to cope with a radiation emergency will be kept at designated locations and will be sufficient to provide adequate radiation protection to emergency personnel to meet the requirements of 10 CFR 20 during corrective activities.

Film badges and pocket dosimeters capable of detecting and measuring gamma, beta, and neutron radiation will be available to emergency personnel. Portable instrumentation, which is available at various locations on the site for the evaluation of beta-gamma radiation, will have capabilities over the range of 0.02 mR/hr - 1000 R/hr. The instrumentation which would be used for neutrons will be capable of detecting up to 5×10^5 events/min. (equivalent to approximately $10,000 \text{ c/cm}^2/\text{sec}$ for 1 MeV neutrons).

Personnel protective equipment, such as respirators and protective clothing, and other required equipment, such as signs, rope or tape for marking exclusion areas, smear papers and blank data forms, will also be maintained.

All stand-by instrumentation will be checked for operability and calibration at least quarterly, or following repairs. All instrumentation routinely used in the course of normal operations will be calibrated on a schedule established by the Manager of Health, Safety and Services.

7. Re-entry Criteria

The criteria for re-entry will be:

- a. Following evacuation, the nature and severity of the incident will be established.

7. (continued)

- b. Concurrently, it will be established whether any personnel are not accounted for.
- c. Following a preliminary evaluation of the emergency, designated personnel, with survey and protective equipment, will enter the building. A survey will be made so as to permit a full evaluation of the incident.
- d. Following a full evaluation, procedures will be established for terminating the emergency.
- e. The established procedures will be implemented.

8. Off-site Releases

Maximum credible accident studies, on each plant operation, will have established parameters for predicting the maximum expected off-site contamination levels, dose-rates, etc., in the area surrounding the plant in the event of an accidental release to the environment, due to an in-plant accident. Fallout trays located throughout the site, plus an established site monitoring program will provide additional information to promptly appraise the relationship of the emergency to the total site and surrounding areas.

Based upon the magnitude of the emergency, the Site Manager will make the final decision concerning the need for assistance from non-Westinghouse sources. Reporting contacts with State and Federal agencies will be made by the Manager of Health, Safety and Services.

9. On-site Medical Care

On-site emergency medical care will be provided by:

- a. A full-time registered nurse who will operate a completely equipped dispensary during normal working hours.
- b. Designated, trained first aid personnel at all other times.
- c. Emergency teams which will be properly trained and will be provided with the necessary facilities and equipment for use during major emergencies.
- d. At least one medical doctor with experience in industrial medicine, to be on call at any time.