



July 25, 1990
LD-90-051

File Docket NO. 70-0036

Docket No. 71-6294

Mr. Charles E. MacDonald, Chief
Transportation Branch
Division of Safeguards
and Transportation
Office of Nuclear Material Safety
and Safeguards
U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Subject: UNC-2901 Shipping Container Application
Discrepancy

References: (A) Letter, C. E. MacDonald (NRC) to A. E.
Scherer (C-E), dated May 4, 1990
(B) Letter, J. F. Conant (C-E) to C. E.
MacDonald (NRC), dated May 10, 1990

Dear Mr. MacDonald:

As you may be aware, Combustion Engineering employs a UNC-2901 shipping container to transport special nuclear material between its Hematite, Missouri and Windsor, Connecticut Nuclear Fuel Manufacturing Facilities. The current Certificate of Compliance (Reference A) was issued by the Nuclear Regulatory Commission on May 4, 1990. On July 16, 1990, Mr. C. Molnar of my staff informed Ms. N. Osgood of your office of a recently discovered discrepancy between the designation of the drum used for the outer shell of the UNC-2901 shipping container and the drum actually in service. Combustion Engineering has suspended shipments of special nuclear material in these shipping containers until the discrepancy can be resolved.

The discrepancy between drums in use and the drum designation in the Certificate of Compliance application occurs in two areas. First, the application specifies that the drum shall be DOT 17H or equivalent. The drums purchased were not DOT 17H. Second, one of the drawings in the application specifies that the drum lid be fabricated from 12 gauge material. The lids were fabricated from 16 gauge material.

ABB Combustion Engineering Nuclear Power

R-50

Mr. Charles E. MacDonald
July 25, 1990

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Enclosure I contains information developed by Combustion Engineering in researching the above discrepancy. In short we have concluded that the designation of a DOT 17H drum and 12 gauge lid in the application are in error. We have also concluded that the drums in use today are virtually identical to those originally tested. As such, we believe that the drums in use today meet the same reasonable degree of assurance for protection of the public health and safety as those originally approved by the Nuclear Regulatory Commission. By this letter and the information contained in the Enclosures, Combustion Engineering requests that the Nuclear Regulatory Commission concur with our continued use of this container and amend the Certificate of Compliance accordingly.

Enclosure II provides a tabulation of revised application pages while Enclosure III provides the proposed change pages. Enclosure IV contains a check (No. 513658) in the amount of \$150.00 to cover the application fee required by 10CFR170.31. Ten (10) copies of Enclosures I, II and III are provided herewith for your use.

Because of production schedules, Combustion Engineering had planned to make fuel pellet shipments in early August, 1990. We respectfully request that you give this matter your prompt attention in order to keep any potential shipping delays to a minimum.

If I can be of any further assistance, please do not hesitate to call me or Mr. C. Molnar of my staff at (203) 285-5205.

Very truly yours,

COMBUSTION ENGINEERING, INC.



John F. Conant
Manager
Nuclear Materials Licensing

JFC:nlv

Enclosure: As stated

cc: R. Chappell (NRC)
G. France (NRC - Region III)
N. Osgood (NRC)
J. Roth (NRC - Region I)

Enclosure I to
LD-90-051

COMBUSTION ENGINEERING, INC.
CERTIFICATE OF COMPLIANCE NO. 6294
UNC-2901 SHIPPING CONTAINER
EVALUATION OF APPLICATION DISCREPANCY

JULY, 1990

EVALUATION OF UNC-2901 APPLICATION DISCREPANCY

Combustion Engineering employs a UNC-2901 shipping container to ship special nuclear material between its Hematite, Missouri and Windsor, Connecticut Nuclear Fuel Manufacturing Facilities. Combustion Engineering recently discovered a discrepancy between the Certificate of Compliance application drum designation and the drum that is actually in service.

After researching the record, Combustion Engineering believes that the drum is mistakenly specified in the application. Based on the documentation available, we have concluded that the drums used to fabricate shipping containers in use today are virtually the same as those originally tested. The discrepancy between drums in use and the drum designation in the application occurs in two areas. First, the application specifies that the drum shall be DOT 17H or equivalent. The drums were not purchased as DOT 17H. Second, one drawing in the application specifies that the drum lid be fabricated from 12 gauge material. The lids were fabricated from 16 gauge material.

A review of the available records regarding the purchase and use of these containers since their original approval provide the following documentation:

1. An expired Certificate of Compliance for a UNC-2900 shipping container (predecessor of UNC-2901).
2. A 1968 purchase order for "55" gallon drums to be used for fabrication of UNC-2900 shipping containers.
3. A United Nuclear Corporation memorandum indicating UNC-2900 shipping containers were to be modified for testing. (The tested configuration was later designated the UNC-2901 shipping container.)

4. A photograph from the current UNC-2901 shipping container Certificate of Compliance application, page 2-12, which clearly shows a UNC-2900 marking on outer shell of a tested shipping container.
5. A 1987 purchase order for "57" gallon drums to be used for fabrication of UNC-2901 shipping containers.

The UNC-2900 shipping container is the predecessor to the UNC-2901 shipping container. The only difference between the containers was the design of the inner container which holds the special nuclear material. The UNC-2900 employed a cylindrical inner container while the UNC-2901 package employs a square inner container. The UNC-2901 designation was instituted in making the modification of the inner container. Item 1 (Attachment 1) is a copy of the first page of an expired Certificate of Compliance for a UNC-2900 shipping container (Docket No. 71-5667). Section 5(a)(2) of the Certificate provides a description of the outer drum. The only specifications given for the drum are dimensional and that it be fabricated of 18 gauge material, the head be fabricated of 16 gauge material and that the closure meet the DOT 17H designation.

As can be seen from Item 2 (Attachment 2), a January, 1968 purchase order for drums, the specification satisfies the Certificate of Compliance description. (Note that a DOT 17H closure is a 12 gauge bolted ring - drop forged lugs fitted with a 5/8 in. bolt.) It seems clear from these two documents that the UNC-2900 shipping container, as approved by the Nuclear Regulatory Commission and as fabricated, did not employ DOT 17H drums.

Item 3 (Attachment 3) is a copy of a United Nuclear Corporation memorandum which discusses various alternatives for the inner container design. From Section 4.0 of the memorandum (page 3), it is clear that three (3) UNC-2900 shipping containers were to be modified

to use a square insert for the purpose of testing. Item 4 (Attachment 4) is a copy of page 2-12 from the currently approved Certificate of Compliance application for the UNC-2901 shipping container. The subject page is one of several in the application which document the container testing and which clearly show the UNC-2900 designation stenciled on the tested container. The photograph also clearly shows only two (2) rolling hoops on the tested container. From this information, two conclusions can be drawn. First, the container is obviously not a DOT 17H drum which would have had three (3) rolling hoops. Secondly, it is clear that it was the same UNC-2900 non-DOT 17H type drum approved by the Nuclear Regulatory Commission for UNC-2900 shipping containers that underwent testing. From all this it can be concluded that the non-DOT 17H drums used for the fabrication of shipping containers meet Nuclear Regulatory Commission requirements and are acceptable for use.

As can be seen from Item 5 (Attachment 5), an October, 1987 purchase order for drums, the specification is virtually identical to the January, 1968 purchase order except for a slight volume difference (55 versus 57 gallons). In neither purchase order was a DOT 17H drum specified.

Based on the above information, Combustion Engineering believes that it is reasonable to conclude that: (1) the designation of DOT 17H or equivalent in the application was an error, and (2) all drums used to fabricate UNC-2901 type shipping containers and shipping containers which passed regulatory testing were virtually identical and were not DOT 17H drums.

Further, after discussions with the drum manufacturer and comparing the attributes of DOT 17H specification drums with those purchased, the following was learned. The fabrication methods and materials (i.e., rolling, stamping and welding) of the purchased drums are the same as the 18 gauge DOT 17H drums. The only real differences are: (1) the lack of a third rolling hoop, (2) the lack of a hydrostatic

test of the finished drum and (3) the lack of a drop test. Any additional quality imputed to a DOT 17H drum because of these tests are not relevant to the UNC-2901 shipping container. Clearly, the shipping container tested did not have a third rolling hoop. The package was punctured during the drop tests and criticality safety analyses performed assumed various flooding conditions to conservatively assess criticality safety. All conditions analyzed resulted in $K_{\text{effective}}$ plus uncertainty being ≤ 0.95 , as used. The small difference in volume (55 versus 57 gallons) does not adversely affect existing criticality analysis results. As such, leak tightness and the small volume difference are not an issue. The drop test required by the Nuclear Regulatory Commission (10CFR71.73, Hypothetical Accident Conditions) for shipping packages are more severe than the Department of Transportation drop test (49CFR173.118-12, Type Tests) for DOT 17H drums.

From this, Combustion Engineering has concluded that: (1) the purchased drums are fabricated in a manner and from materials that are equivalent to a DOT 17H drum, and (2) the differences between the purchased drums and a DOT 17H drum are not relevant to the shipping container's use and add no additional safety related quality to the package.

Based on all of the information presented, Combustion Engineering believes that the UNC-2901 shipping container is acceptable for the shipment of special nuclear materials as approved in the current Certificate of Compliance (Docket No. 71-62394, Rev. 13, dated May 4, 1990).

Combustion Engineering proposes to resolve the discrepancy by revising the Certificate of Compliance application to remove reference to DOT 17H drums. In lieu of that designation, we will include a drum fabrication specification stating the following:

57 gallon, 18 gauge body and bottom, side seam resistance welded.

Further, the reference to a 12 gauge lid in Drawing No. NFM-D-4540 will be removed and replaced by the following statement:

16 gauge with at least one corrugation.

Revised engineering drawings are provided as part of the application amendment request (Enclosure III).

Form NRC-G18
(12-73)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISS.
CERTIFICATE OF COMPLIANCE
For Radioactive Materials Packages

1.(a) Certificate Number 5667	1.(b) Revision No. 0	1.(c) Package Identification No. USA/5667/AF	1.(d) Pages No. 1	1.(e) Total No. Pages 2
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2. PREAMBLE

- 2.(a) This certificate is issued to satisfy Sections 173.393a, 173.394, 173.395, and 173.396 of the Department of Transportation Hazardous Materials Regulations (49 CFR 170-189 and 14 CFR 103) and Sections 146-19-10a and 146-19-100 of the Department of Transportation Dangerous Cargoes Regulations (46 CFR 146-149), as amended.
- 2.(b) The packaging and contents described in item 5 below, meets the safety standards set forth in Subpart C of Title 10, Code of Federal Regulations, Part 71, "Packaging of Radioactive Materials for Transport and Transportation of Radioactive Material Under Certain Conditions."
- 2.(c) This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. This certificate is issued on the basis of a safety analysis report of the package design or application—

3.(a) Prepared by (Name and address):
Combustion Engineering, Inc.
1000 Prospect Hill Road
Windsor, Connecticut 06095

3.(b) Title and identification of report or application:
United Nuclear Corporation application
dated January 25, 1968, as supplemented.

3.(c) Docket No. 71-5667

4. CONDITIONS

This certificate is conditional upon the fulfilling of the requirements of Subpart D of 10 CFR 71, as applicable, and the conditions specified in item 5 below.

5. Description of Packaging and Authorized Contents, Model Number, Fissile Class, Other Conditions, and References:

(a) Packaging

(1) Model No.: UNC-2900

(2) Description

Inner container is a 9" ID, 14-gage steel cylinder, 30" 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 33" ht 18-gage steel drum with 16-gage head and DOT Specification 17H closure by wood blocks, 5/8" thick hardboard and insulating material. Maximum gross weight of the packaging is 246 pounds.

(3) Drawing

Container constructed in accordance with United Nuclear Corporation Drawing No. 670047-3408. (CROSS REF DRAWING NO. D-5008-8068)

(b) Contents

(1) Type and form of material

Dry uranium oxide as pellets or powder and dry uranium compounds. Uranium may be enriched to a maximum 3.5 w/o in the U-235 isotope.

UNITED NUCLEAR CORPORATION
 ROUTE 21A
 HEMATITE, MISSOURI 63047

PURCHASE ORDER
H 8785

DATE: **1-23-68**
 PAGE: OF:

Greif Bros. Cooperage
645 E. Elliot
St. Louis, Missouri

NOTE:

PURCHASE ORDER NO. MUST APPEAR ON ALL PACKAGES, SHIPPING DOCUMENTS, INVOICES AND CORRESPONDENCE.
 QUANTITY UNITS AND BUYER'S CODE NO. MUST APPEAR ON INVOICES AND PACKING LISTS.

MAIL INVOICES IN TRIPPLICATE AND PROOF OF SHIPMENT TO: ROUTE 21A, HEMATITE, MO. 63047

NOT SHIP REA	F.O.B. Chicago	TERMS
ORDERED AT HEMATITE <input type="checkbox"/> OTHER <input type="checkbox"/>	DATE REQ'D.	QUOTE REFERENCE Telephone to R. Miller by Tony Lanza
SUBJECT TO MO SALES TAX <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		

ITEM	QUANTITY	UNIT	BUYER'S CODE NO	DESCRIPTION	PRICE
	240	ea.		55 gal. drum (with 34" useable inside space) Body and Bottom 18 ga., removable head to be 16 ga., 12 ga. bolted ring - drop forged lugs fitted with 5/8" bolt.	\$ 8.22/ea
				Tax	59.20
				Freight	250.00
				ERT	351.30
					2116.65
					2467.95

Received 2/15/68

ATTACHMENT :



INTER-OFFICE MEMO

TD-70-42

TO Distribution
FROM W. L. Hoffmann
SUBJECT Final Pellet Packaging Design

AT
AT Hematite

DATE February 25, 1970
COPY TO W. J. Compas
J. A. Rode
F. G. Stengel

1.0 Basic Design

Fuel pellets will be shipped in stacks on rubberized-coated corrugated trays. The design and assembly of the pellet package is illustrated on the attached drawing. The package, exact size and weight as determined by the drop test, will fit inside a 10.8" x 10.8" square insert inside a 55 gallon drum shipping container attached horizontally to a pallet.

2.0 Package Alternatives

Three different package sizes are compatible with the design. The particular one to be incorporated in ultimate shipments will be determined by the weight limitation on the drop test. The three package alternatives are described on the drawing and summarized as follows:

- 2.1 Alternate #1 - 1 Package/Shipping Container
Overall Package Size = 6-3/8" x 10.5" x 26-1/2"
Tray = (20 rows wide) - 10-3/8" x 26"
Pellet Height = 9 Pellet Rows High (10 trays) = 4-7/8"
Pellet Weight/Package = 189 pounds
Total Package Weight = 240 pounds
Total Shipping Container Weight = ~362 pounds
- 2.2 Alternate #2 - 2 Packages/Shipping Container
Overall Package Size = 6-3/8" x 5" x 26-1/2"
Tray = (9 rows wide) - 4-7/8" x 26"
Pellet Height = 9 Pellet Rows High (10 trays) = 4-7/8"
Pellet Weight/Package = 85 pounds; 2 pkgs. = 170 pounds
Total Package Weight = 105 pounds; 2 pkgs. = 210 pounds
Total Shipping Container Weight = ~332 pounds.
- 2.3 Alternate #3 - 4 Packages/Shipping Container
Overall Package Size = 4-7/8" x 5" x 26-1/2"
Tray = (9 rows wide) - 4-7/8" x 26"
Pellet Height = 6 Pellet Rows High (7 trays) = 3-3/8"
Pellet Weight/Package = ~57 pounds; 4 pkgs. = 227 pounds
Total Package Weight = 72.5 pounds; 4 pkgs. = 290 pounds
Total Shipping Container Weight = ~414 pounds.

3.0 Evaluation of Alternatives

3.1 Alternate #1 - 1 Package/Shipping Container

Advantages:

1. Minimum level of time & labor required for assembly of packages.
2. Package assured to fit inside square insert, regardless of compressability.

Disadvantages:

1. Weight of shipping container, 332 pounds, may prevent passing of drop test.
2. Excessive weight of package, 240 pounds, requires 2 man handling and/or sturdy automatic handling equipment.

3.2 Alternate #2 - 2 Packages/Shipping Container

Advantages:

1. Weight of package is easier to work with, 105 pounds.
2. Packages assured to fit inside insert regardless of compressibility.
3. Total weight of shipping container is minimal, 332 pounds, and therefore, most likely to pass drop test.
4. Packaging requirement permits 1 shift/day packaging operation.

Disadvantages:

1. Shipping container requirement is maximum.
2. Shipping costs are maximum.

3.3 Alternate #3 - 4 Packages/Shipping Container

Advantages:

1. Least number of shipping containers required.
2. Shipping cost is minimal.
3. Size of package easiest to handle, 72.5 pounds.

Disadvantages:

1. Weight of filled shipping container, 414 pounds, least likely to pass drop test.
2. Fit inside square insert dependent on compressibility of package.
3. Maximum number of packages required - packaging operation may require 2 shifts/day.

TD-70-42
February 25, 1970
Page Three

4.0 Packaging Testing Program

Three 2900 shipping containers are being modified to facilitate the square insert. A drop test will be performed with weights corresponding to the two and four package design to determine the maximum allowable weight. From this, the ultimate package size will be resolved. Fire and water immersion tests will then be performed on the shipping container.

Twenty corrugated trays, 10 coated with polyethylene and 10 coated with neoprene, have been ordered. These trays will be used to package pellets for a test shipment to New Haven. The shipment will be examined to determine the feasibility of the design and to determine the better coating material.

Distribution:

J. P. Colton
D. G. Darr
H. R. Diot
N. Fuhrman
R. E. Hall
E. J. Krinick
E. F. Sanders
L. J. Swallow
R. C. Miller

kf

Enc.: Attachment #1 - Packaging Drawing # D-5008-8192
Attachment #2 - Packaging Design Calculations and Costs (UNC Only)

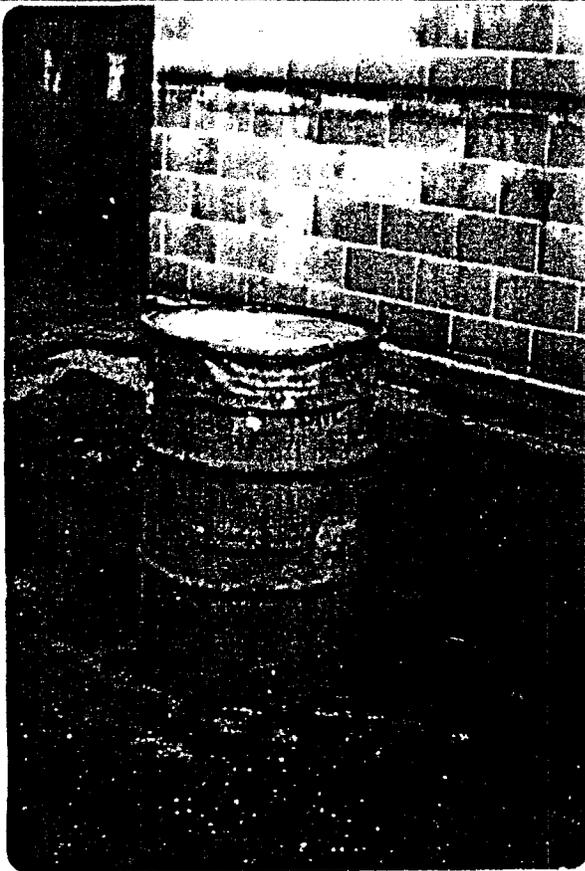
COMBUSTION ENGINEERING, INC.

CERTIFICATE OF COMPLIANCE NO. 6294, NRC DOCKET NO. 71-6294

UNC-2901 SHIPPING CONTAINER



PICTURE 3 -Condition of outer drum after 30' drop test (Test #1).



PICTURE 3A - Condition of outer drum after 30' drop test - (Test #2).

ION ENGINEERING

COMBUSTION ENGINEERING, INC.
POST OFFICE BOX 107
HIGHWAY P
HEMATITE, MISSOURI 63047
TEL. 314-296-5640

ATTACHMENT 5

PURCHASE ORDER NUMBER	SUPPL. NUMBER
9750160	
PURCHASE ORDER DATE	SUPPL. DATE
10/12/87	

PAGE 1 OF 1

SHOW PURCHASE ORDER NUMBER, SHIP TO AND MARK ON ALL DOCUMENTS, SHIP TO AND MARK

COMBUSTION ENGINEERING, INC.
POST OFFICE BOX 107
HIGHWAY P
HEMATITE, MISSOURI 63047

THIS ORDER AND SELLERS SUB ORDERS ARE SUBJECT TO EXPEDITING BY PURCHASER AND/OR HIS AGENT.

VENDOR CODE 81633

TO: Thomas & English, Inc
815 Cass Ave
St Louis, MO 63106

TERMS: 20th of FOLLOWING MONTH	BUYER H. Dugan	ACCT NO	CONTRACT NO. & SECT.	SHOP JOB NO.
F O B POINT	SHIPPING CHARGES	SHIP VIA	SHIP ON	

ITEM	QUANTITY	COMPONENT CODE	DESCRIPTION	EVENT	PRICE
1.	186 Ea.		57 gal. full removable head drum.cover to be 16 ga. steel/ standard gasket, body and bottom to be 18 ga. steel. 12 ga. 17H type closure with 5/8" bolt & nut, medium gray baked on enamel finish.		\$5710.00

THE PROVISIONS OF IOCFR21 ARE _____ ARE NOT _____ APPLICABLE TO THIS PROCUREMENT.

<input checked="" type="checkbox"/> INVOICE TAX	<input type="checkbox"/> DO NOT INVOICE TAX	REGISTRATION NO.	COMMODITY CODE 57710
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ADDITIONAL INFORMATION:				FABR. RELEASE DUE	
				OTHER AUTHORITY (A)	
CONTRACT NAME Contract			REQUISITION WRITER R. C. Miller		OTHER AUTHORITY (B) James A. Rode
CHARGE TO 2223-2775-1415 - 68% 1104-1404-4425-2775-1415 - 32%			SO. SUPV/NUCL. SECT. MGR.		OTHER AUTHORITY (C) P. F. Cioffi
CONTRACT ESTIMATE VALUE \$5710.00		AS OF	CONT. ADMIN.	REQ'D SHIPPING DATE	PROJ SUPV /NUCL. PROJ. MGR
SHIPPING WEIGHT		REQ'N. SUPPL. DATE	GREEN → <input type="checkbox"/>	SOURCE 5306	REQ'N. NO. H87-044
			PINK → <input type="checkbox"/>	REQ'N. SUPPL. NO.	SHEET 1 of 1
				QUALITY ASSURANCE P. L. McGill	
				MFG./PUR. ORDER NO 9750160	

Enclosure II to
LD-90-051

COMBUSTION ENGINEERING, INC.
CERTIFICATE OF COMPLIANCE NO. 6294
UNC-2901 SHIPPING CONTAINER
LIST OF AFFECTED PAGES

JULY, 1990

UNC-2901 SHIPPING CONTAINER
 CERTIFICATE OF COMPLIANCE NO. 6294
 AMENDMENT REQUEST

Combustion Engineering requests that Certificate of Compliance No. 6294 for the UNC-2901 shipping container be amended to reflect revisions to two engineering drawings. The revised drawings correct an error in the designation of the drum used to fabricate the shipping container outer shell. The affected pages are provided in Enclosure III.

The Certificate of Compliance application pages affected by this amendment are listed below:

<u>Delete Page</u>			<u>Add Page</u>		
<u>Page No.</u>	<u>Rev.</u>	<u>Date</u>	<u>Page No.</u>	<u>Rev.</u>	<u>Date</u>
1-1	0	2/22/90	1-1	1	7/25/90
1-2	0	2/22/90	1-2	1	7/25/90
1-3	0	2/22/90	1-3	1	7/25/90
1-7	0	2/22/90	1-7	1	7/25/90
4-1	0	1/18/89	4-1	1	7/25/90
6-3	0	2/22/90	6-3	1	7/25/90
--	--	--	6-3a	0	7/25/90
6-16	0	2/22/90	6-16	1	7/25/90

To assist in your review, the following tabulation provides an indication of the changes made on each of the affected pages.

<u>Page No.</u>	<u>Description of Change</u>
1-1	Deleted reference to DOT 17H drum designation in Section 1.2.1. Replaced with cross reference to engineering drawing.
1-2	Provides updated revision numbers for engineering drawings D-5007-8086 and NFM-D-4540.
1-3	Provides revised drawing D-5007-8086, Rev. 6. New drawing deletes reference to DOT 17H drum designation and replaces with new fabrication information.
1-7	Provides revised drawing NFM-D-4540, Rev. 1. New drawing deletes reference to DOT 17H drum designation and 12 gauge lid specification and replaces with new fabrication information.
4-1	Deleted reference to specific revision number for drawing D-5007-8086, in Section 4.1.4.
6-3	Revised writeup for Section 6.3 regarding KENO-IV model for criticality calculations.
6-3a	New page. Overflow from page 6-3.
6-16	Added axial dimensions to KENO-IV model schematic.

Enclosure III to
LD-90-051

COMBUSTION ENGINEERING, INC.
CERTIFICATE OF COMPLIANCE NO. 6294
UNC-2901 SHIPPING CONTAINER
CHANGE PAGES

JULY, 1990

COMBUSTION ENGINEERING, INC.

CERTIFICATE OF COMPLIANCE NO. 6294, NRC DOCKET NO. 71-6294

UNC-2901 SHIPPING CONTAINER

1. GENERAL INFORMATION

1.1 Introduction

The UNC-2901 container is designed for shipment of uranium oxide pellets manufactured, inspected and certified in accordance with reactor fuel specifications. The container can also be used for the shipment of rejected pellets and/or pieces (hard scrap).

The maximum number of containers per shipment shall be limited to:

Fissile Class I	-	None
Fissile Class II	-	Maximum 100 containers (Transport index is 0.50 per container for a total transport index of 50 per shipment).
Fissile Class III	-	Maximum 216 containers

1.2 Package Description

1.2.1 Packaging

The UNC-2901 container consists of a standard steel drum (see Drawing NFM-D-4540, UNC-2901 Shipping Drum) with a 10 3/4" square inner container centered in the drum. The inner container is centered by hardboard support rings. Asbestos or ceramic sheet, plywood and fiberlite insulation provide thermal protection to the inner container. The inner container closure is fitted with a gasket capable of withstanding temperatures up to at least 500°F.

1.2.1.1 Package for Pellets

The uranium oxide pellet package consists of covered steel trays which can be stacked to a maximum of 16 trays (4 high x 2 wide x 2 deep). Each row of trays is secured with a single piece weblock strapping assembly. The weblock buckle is part of the tray holder and the buckle is attached to the holder by a rod and angle bracket assembly. A typical arrangement is depicted in Drawing D-5018-2001, Rev. 01.

1.2.1.2 Package for Reject Pellets

Rejected uranium oxide pellets and/or pieces may be packaged in the same manner as pellets which is described above in Section 1.2.1.1.

COMBUSTION ENGINEERING, INC.

CERTIFICATE OF COMPLIANCE NO. 6294, NRC DOCKET NO. 71-6294

UNC-2901 SHIPPING CONTAINER

1.2.2 Operational Features

The UNC-2901 shipping container is of relatively simple design, and does not incorporate cooling systems, shielding, etc.

1.2.3 Contents of Packaging

1.2.3.1 Pellets or Rejected Pellets

Maximum Enrichment 5.0 wt.%

Type Material: Sintered (high fired) uranium oxide pellets.

Maximum quantity per container:

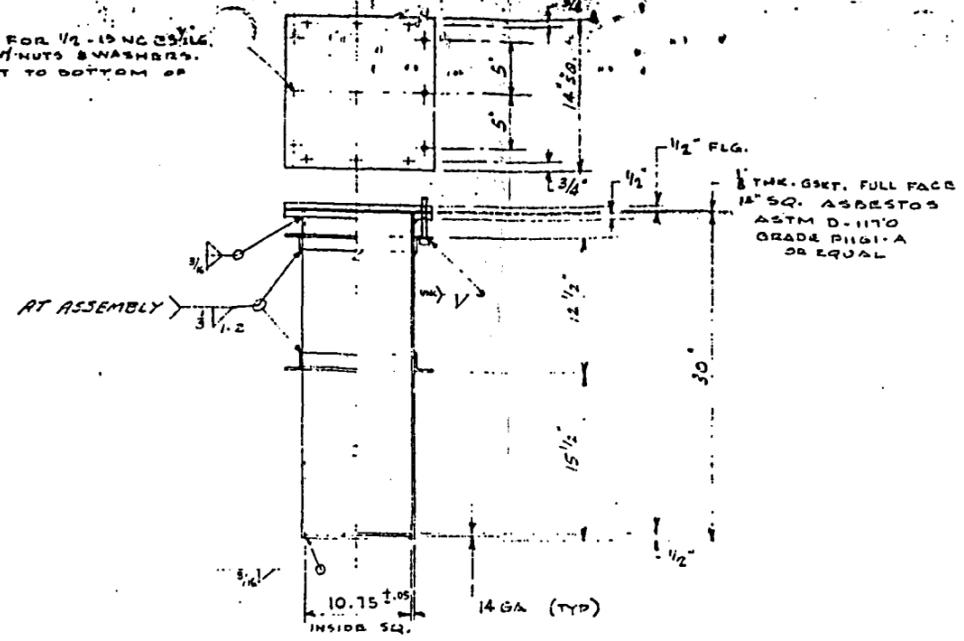
- a) Maximum net weight:
Maximum net weight of pellets: 320 pounds
Pellets and packaging material (contents of inner container) 427 pounds.
- b) Gross Weight:
Gross weight of the container as assembled for shipment shall not exceed 660 pounds.

1.3 Appendix

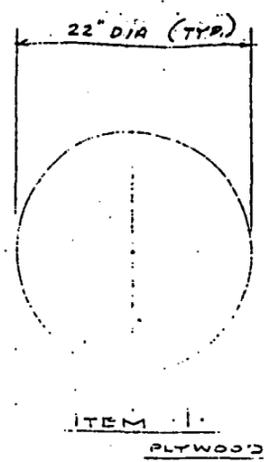
Details of construction and assembly are shown on drawings:

- a) D-5007-8086, Rev. 06, S.W.O.P.P. Upgrade UNC 2901 Shipping Drum for UO₂ Powder & Pellets Assembly & Details
- b) B-5007-8112, Rev. 01, Suggested Assembly of 2901 Plywood Insert
- c) D-5018-2001, Rev. 01, Pellet Shipping Package
- d) NFM-D-4263 Rev. 02, Pellet Tray Holder
- e) NFM-D-4540, Rev. 01, UNC 2901 Shipping Drum

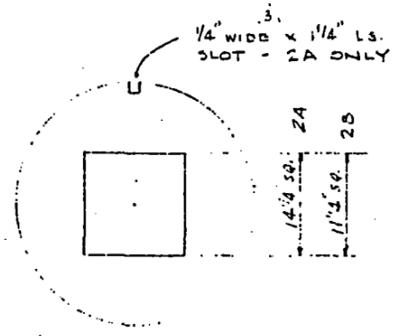
2 - 1/2" DIA HOLES - FOR 1/2" - 15 NC 25/16
HEX. 40 BOLTS W/ NUTS & WASHERS.
UNC. TO WELD BOLT TO BOTTOM OF
I.B. AS SHOWN.



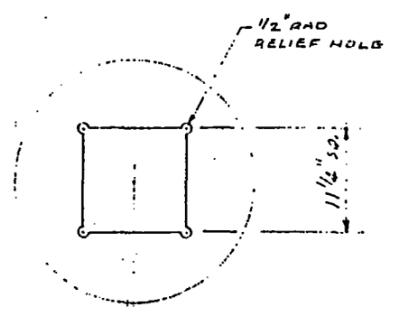
INSERT ITEM 4.



ITEM 1
PLYWOOD

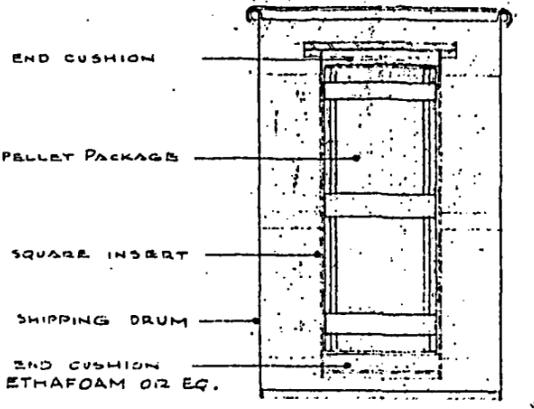


ITEM 2
PLYWOOD



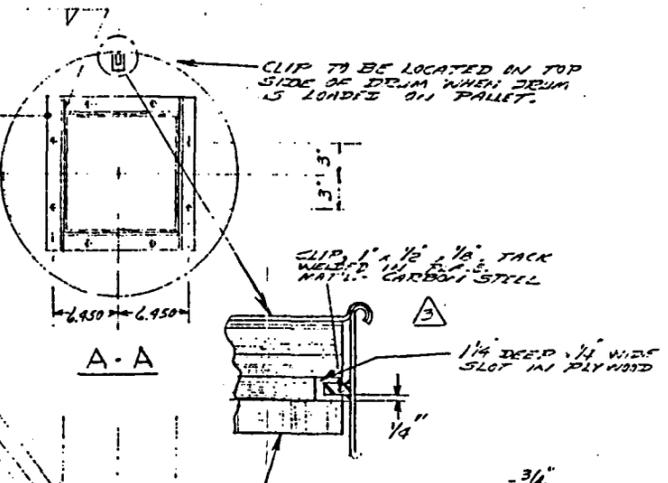
ITEM 3
HARDBOARD
BENELEX 70 OR BENELEX 402
THICKNESS AS NOTED

NO. RECD	DET. NO.	DWG. NO.	DATE	BY
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PELLET SHIPPING CONTAINER
REF. DWG. # D-5008-8192

(TYP) 1 1/2" x 1 1/2" DRILL 1/2" DIA HOLES AS SHOWN. SUPPLY 3/16" LONG 2" LG. HEX. HO. BOLTS W/ NUTS & WASHERS.

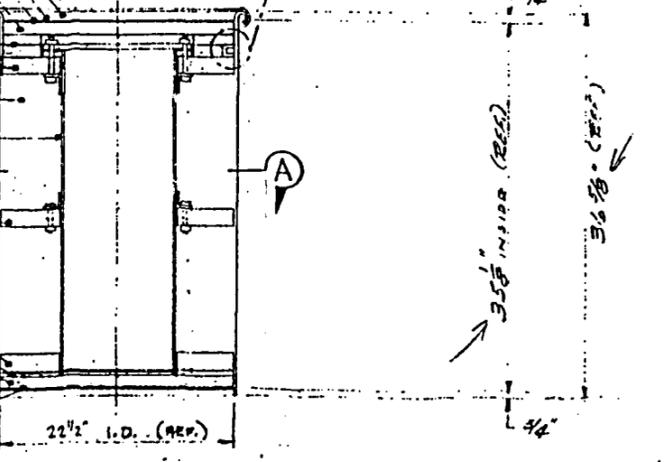


A-A

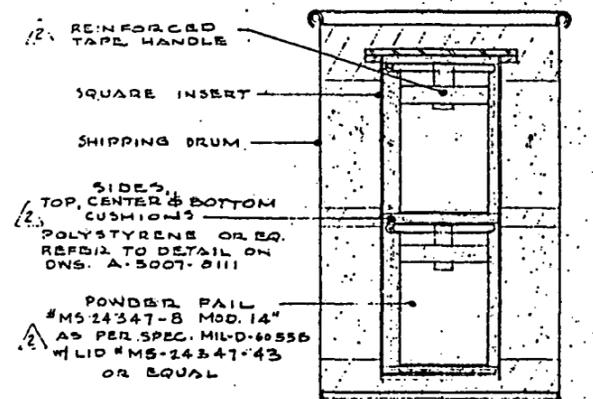
- ITEM DETAIL NO.
- 1 DRUM LID - 1/2" GAGE STEEL WITH AT LEAST ONE CORRUGATION
 - (A) ALUMINUM COVER .032 THK.
 - (B) ASBESTOS OR CERAMIC SHEET 1/8" THK X 22" DIA.
 - (C) PLYWOOD 1 1/2" THK. 2 @ 5/8"
 - CLAMP RING 12 GA. W/ 5/16 DIA BOLT
 - 2 ABOVE ITEMS (A), (B) AND (C) ARE LAMINATED TOGETHER TO FORM ONE UNIT AS SHOWN ON DWG. B-5007-8112

- 2A PLYWOOD 2 PLY. 1" THK.
- 3 HARDBOARD 1 1/2" THK. THERMAL INSULATION 6.75" @ 15"
- 4 SQUARE INSERT
- 5 HARDBOARD 1/2" THK.
- 6 DRUM - 57 GALLONS, 18 GALL BODY AND BOTTOM. SIDE SEAMS RESISTANCE WELDED
- 7 HARDBOARD 1 1/2" THK.
- 2B PLYWOOD 1/2" THK.
- 1 PLYWOOD 1" THK. - 2 @ 1/2"

ASBESTOS OR CERAMIC SHEET 1/8" THK X 22" DIA.



CROSS SECTION OF ASSEMBLY



REFER TO DWG. A-5007-8111
UO2 POWDER & HARD SCRAP SHIPPING CONTAINER

AMENDMENT DATE:
JULY 25, 1990.
REV. 1
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REV.	DATE	REVISION	BY	DATE
6	7/1/90	DRUM SPEC'S REVISED TO MATCH ORIGINAL CURRENT DRUM CONST.	ER	1/20/90
5	4/2/89	INSERT ITEM 4 AT ASSEMBLY NUTS WAS 2BY COMBUSTION ENGIN.	ER	1/20/89
4	7/1/87	1/8" THICK ASBESTOS OR CERAMIC WAS ASBESTOS		
3	9/23/71	CLIP 1 1/2" x 1/8" x 1/8" ADDED	ER	1/20/71
2	11-25-70	CHR. PLS. HOLE SIZE, ARROD HOLES ON CUSHION S & TOP PLYWOOD INSERT	VAL	1/20/70
1	5-17-70	REDRAWN	VAL	1/20/70

APPROVED FOR CONSTRUCTION
DATE 7/21/90

SYMBOL	DESCRIPTION	TOLERANCES UNLESS OTHERWISE SPECIFIED
~	FLATNESS	FRACTIONAL: 1/16
-	STRAIGHTNESS	DECIMAL
<	ANGULARITY	XXX .2
⊥	PERPENDICULARITY	ANGULAR XXX .2
	PARALLELISM	SURFACE FINISH
U	INLINE	SCALE: 1:1
⊙	CONCENTRICITY	DRAWN BY: [Signature]
⊕	TRUE POSITION	CHECKED BY: [Signature]
		APPROVED BY: [Signature]

COMBUSTION ENGINEERING, INC.

CERTIFICATE OF COMPLIANCE NO. 6294, NRC DOCKET NO. 71-6294

UNC-2901 SHIPPING CONTAINER

4. CONTAINMENT

4.1 Containment Boundary

4.1.1 Containment Vessel

Within the UNC 2901 shipping container a square inner container provides the containment boundary for the radioactive contents. The top closure is by means of steel plate bolted to an external flange welded to the square body. A seal is formed by a gasket capable of withstanding temperatures up to at least 500°F.

4.1.2 Containment Penetrations

There are no penetrations into the inner containment vessel.

4.1.3 Seals and Welds

The seal of the inner container closure is formed by a gasket 0.125 inch thick between the surfaces of a flange welded to the outer surface of the square body and the top closure cover. The gasket is rated for at least 500°F service and since there is no significant heat generated by the package payload, the seal is unaffected by temperatures encountered in normal conditions of transport. Also, testing described in Section 2.1 has shown that the gasket is unaffected by the temperatures attained in the Hypothetical Accident Conditions.

All welds are visually inspected to ensure that parent metals are well fused, weld (or heat affected zone) is free of cracks, craters, or burnouts.

4.1.4 Closure

The inner container closure is formed by a 0.5 inch steel plate bolted to an external flange welded to the square inner container. Material specifications for the plate and the bolts and nuts are listed on Drawings NFM-D-4540 and D-5007-8086 in Appendix 1.3. The bolted inner container closure lid with a 0.125 inch thick gasket is sufficient to maintain a positive seal during normal and accident conditions of transport.

4.2 Requirements for Normal Conditions of Transport

Submittal of the UNC 2901 shipping container to the tests specified in 10 CFR 71.71.36 and 49CFR 173.398(C) has shown that there will be no loss or dispersal of radioactive contents, no significant increase in external radiation levels, and no substantial reduction in the effectiveness of the packaging. Fully loaded containers subjected to the full series of spray, free drop and penetration tests showed no degradation of effectiveness of the inner container and no leakage of water into the inner container.

APPLICATION AMENDMENT DATE: July 25, 1990

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UNC-2901 SHIPPING CONTAINER

with a wood block insert to preclude the potential for tray collapse during a hypothetical accident scenario. Trays containing pellets will be loaded with a minimum of 6.5 Kg and a maximum of 9.07 Kgs of pellets having a diameter of ≤ 0.3765 inch.

6.3 Model Specifications

The KENO-IV model for the UNC-2901 shipping container is shown in Figure 6.1. The overall height of the shipping container outer shell used in the model was 35.5 inches which is less than the overall height, 36.625 inches (see Drawing D-5007-8086, Rev. 6). The smaller overall height (and consequently smaller volume) as compared to the actual outer shell dimension is conservative for the purpose of assessing criticality safety.

6.3.1 Pellet Non-Accident Calculational Model Assumptions

The following assumptions were made for the analysis of fuel pellet shipments:

- a. Pellet tray lids do not open.
- b. No water enters the inner container.
- c. 8x8x8 array of shipping containers surrounded by one foot of water.
- d. Full interaction of shipping containers which produced the maximum reactivity:
 - no water between inner container and outer shell of UNC-2901 shipping container.
 - no water between UNC-2901 shipping containers.
- e. Sixteen pellet trays are modeled with equal uranium weight per tray.
- f. Non-accident dimensions for shipping container were:
 - I.D.= 22.5 inches, O.D.= 22.6 inches
- g. Density of pellets = 10.25 g-UO₂/cc.
- h. Pellet diameter of 0.325 inch.
- i. Pellets are assumed to be internally dry.
- j. Enrichment of uranium is 5.0 wt % U-235.
- k. The analysis of the isolated shipping container assumes each pellet tray holds 5.67 Kgs of pellets and is fully flooded with water. This loading is less than the minimum loading thus assuring a conservative estimate of the multiplication factor for this analysis. The inner container is also assumed to be flooded. In the outer container, the Fiberlite insulation has been replaced with water. The shipping container is reflected by 30 cm of water.

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UNC-2901 SHIPPING CONTAINER

6.3.2 Pellets - Accident Calculational Model Assumptions

The following assumptions were made for the analysis of fuel pellet shipments:

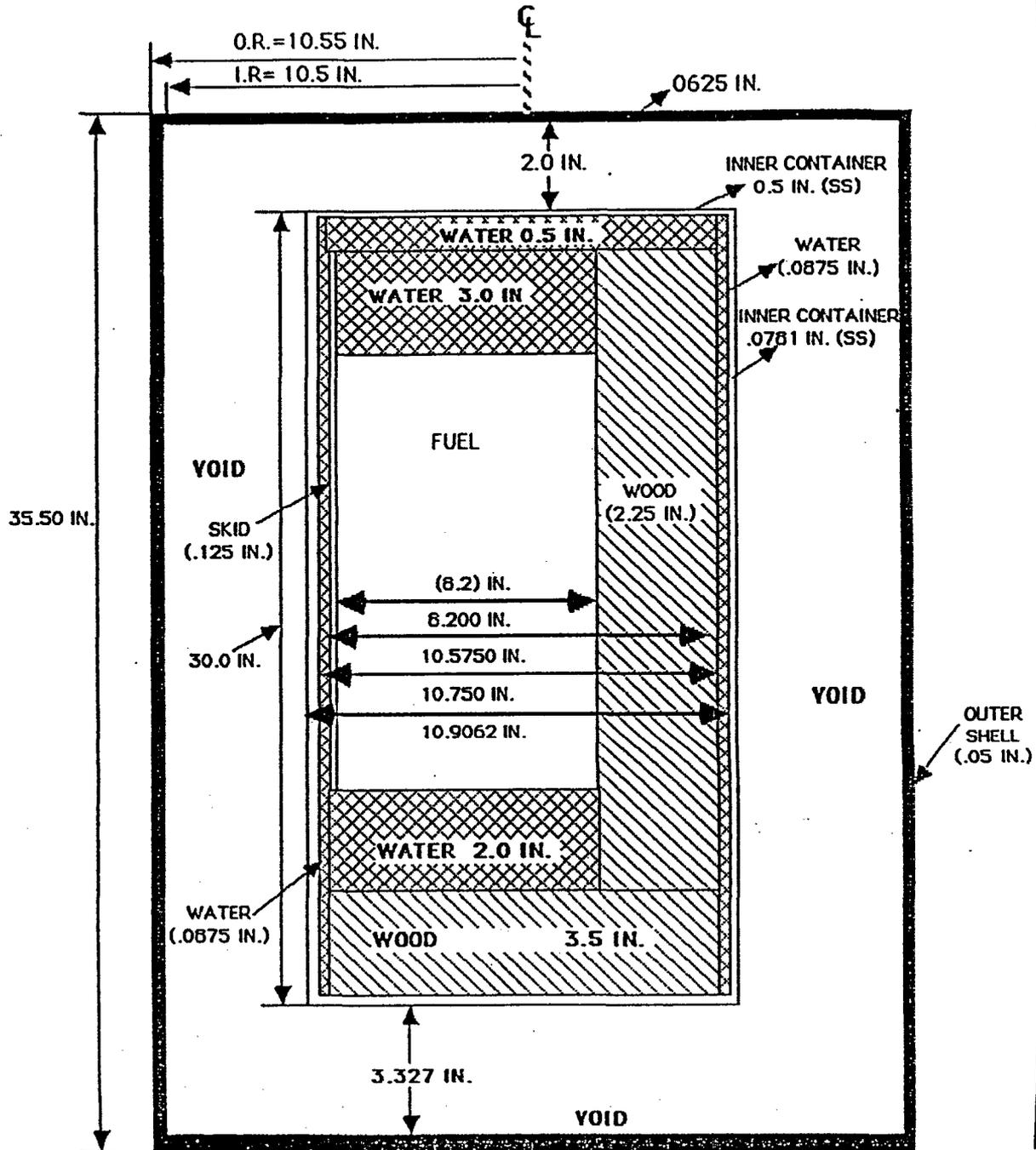
- a. Pellet tray lids do not open. As such, pellets do not escape from the trays and are not floating in high water to fuel ratio regions.
- b. Inner container is fully flooded with water.
- c. 6x6x6 array of shipping containers surrounded by one foot of water.

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UNC-2901 SHIPPING CONTAINER

FIGURE 6.1
KENO MODEL FOR UNC-2901 SHIPPING CONTAINER



Enclosure IV to
LD-90-051

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10CFR170.31 APPLICATION FEE

JULY, 1990