

U.S. DEPARTMENT OF ENERGY
CERTIFICATE OF COMPLIANCE
For Radioactive Materials Packages

1a. Certificate Number 5467	1b. Revision No. 4	1c. Package Identification No. USA/5467/AF (DOE-OR)	1d. Page No. 1	1e. Total No. Pages. 11
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2. PREAMBLE

- 2a. 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).
- 2b. 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 Material for Transport and Transportation of Radioactive Material Under Certain Conditions."
- 2c. 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--

(1) Prepared by (Name and address):	(2) Title and Identification of report or application:	(3) Date:
(a) National Lead Company of Ohio Post Office Box 39158 Cincinnati, Ohio 45239	NLCO-1107 DUN -7988 UNI -417	July 1974 June 1972 Aug. 25, 1976
(b) United Nuclear Industries, Inc. Post Office Box 490 Richland, Washington 99352	UNI -483 - Rev. 1 UNI -489	June 23, 1976 Jan. 16, 1976

(continued on page 2)

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.

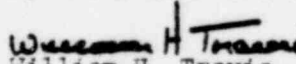
5. Description of Packaging and Authorized Contents, Model Number, Fissile Class, Other Conditions, and References:

- a. The titles of the references SARP's listed in 3 above are as follows:
- NLCO-1107 - SAFETY ANALYSIS REPORT FOR PACKAGING STEEL BANDED WOODEN SHIPPING CONTAINERS FOR SLIGHTLY ENRICHED URANIUM METAL. D. L. Dunaway
 - DUN -7988 CRITICALITY SAFETY OF URANIUM METAL SCRAP IN MASONRY CONCRETE BILLETS. H. Toffer & E. A. Weakley
 - UNI -417 AMENDMENT TO NLCO-1107 MULTIPLE STACKING OF NLO STEEL BANDED WOODEN SHIPPING CONTAINERS. K. L. Fowler
 - UNI -483 SAFETY ANALYSIS REPORT - PACKAGING SUPPLEMENT TO NLCO-1107 FOR SHIPMENT OF URANIUM FUEL EXTRUSIONS, BOLTED SECTIONS, AND SHIPPING TUBES OF URANIUM FRAGMENTS IN NLO BOXES. K. L. Fowler
 - UNI -489 NUCLEAR CRITICALITY SAFETY ANALYSES AND TECHNICAL BASES FOR SHIPPING REJECT URANIUM METAL IN NLO BOXES. H. Toffer
 - DPSP-79-71-6 SUPPLEMENT TO "SAFETY ANALYSIS REPORT FOR PACKAGING, STEEL BANDED WOODEN SHIPPING CONTAINERS FROM SLIGHTLY ENRICHED URANIUM METAL.
- b. This Certificate of Compliance replaces Certificate of Compliance No. 5467, Rev. 3, dated September 20, 1976. There are no changes in packaging designs. Authorized contents have been revised to reflect current shipments.

(continued on page 2)

6a. Date of Issuance: AUG 13 1979	6b. Expiration Date:
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FOR THE U.S. DEPARTMENT OF ENERGY

7a. Address (of DOE Issuing Office) U. S. Department of Energy Post Office Box E Oak Ridge, Tennessee 37830	7b. Signature, Name, and Title (of DOE Approving Official)  William H. Travis, Director Safety and Environmental Control Division
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3(c) E.I. du Pont de Nemours
and Company
Savannah River Plant
Aiken, South Carolina 29801

DPSF-79-71-6

June 20, 1979

5c. Packaging consists of the following wooden shipping containers; which are banded with 1.25"x .035" steel banding secured by notched seals:

1. Boxes with lids (NLO Dwgs G-4214, G-4245, and G-4292) constructed with 1-1/8" thick pine sides and ends, a 1" thick hardwood bottom and 1" thick plywood lid (except G-4245 which has a 1/2" thick lid).
2. Pallets with covers (NLO Dwgs G-4255 with G-4256 and G-4257, and G-4273 with G-4274 and G-4275) constructed primarily of 3/4" thick exterior grade plywood. In addition to the exterior banding, bands also secure the billets or ingots to the pallet.
3. Pallets without covers (NLO Dwgs G-4273 and G-4274).

The volumes of these containers range from ~.7 to 6 ft³ and gross weights range from 250 lbs. (113 kg) to 3240 lbs. (1469 kg). All closed containers are banded with nine bands except the sample container which has four bands. See NLO Dwgs. in Rpt. No. NLCO-1107 for banding requirements. Container model numbers are the same as NLO drawing numbers.

- d. The containers will be utilized only as Fissile Class III packages and will be transported only by motor freight and rail.
- e. The maximum ²³⁵U enrichment of the bulk uranium is 1.25% and of the samples ≤ 2.1%. Specific materials, load limits and container mixing criteria are shown in Attachment "A".
- f. The maximum ²³⁵U enrichment of uranium metal scrap fragments dispersed in concrete billets is 1.25%. The billets are contained within a steel container having a wall thickness of approximately 0.010" thick (lard can). Load limits are shown in Attachment "B".
- g. (1) The maximum U-235 enrichment of scrap uranium metal as extrusions, bolted sections or fragments in the UNI-ST-1 shipping tube is 1.25%. Dimensions of extrusions are as follows:

<u>Fuel Extrusions</u>	<u>O.D. (in.)</u>	<u>I.D. (in.)</u>
Outer	2.391-2.435	1.691-1.779
Inner	1.237-1.286	0.431-0.492

Reject extrusions will have lengths ≥3". Sections <3" in length shall be bolted together to form lengths ≥3" as follows:

<u>Length of Bolted Section (in.)</u>	<u>Bolt diameter (in.)</u>
≤ 12	3/8
> 12 < 24	1/2
≥ 24	5/8

Washers shall be used over the metal openings to hold sections together as appropriate with a cotter pin positioned in the bolt to hold the nut on the bolt.

(2) A close packed configuration shall have the uranium in contact with no physical separations (such as fuel supports) and with no gaps or spaces within the interior of the packing. The uranium will normally be parallel packed but cross packing to fill the ends of the boxes shall also be permitted. Contents shall be tightly shored inside the box to maintain the close pack configuration. The following describes close pack and loose pack versus lattice pitch (L.P.):

Fuel Extrusion	Close Pack	Loose Pack
	L.P. (in.)	L.P. (in.)
Inner	2.5	2.7
Outer	1.4	1.77

(3) Segments and other pieces of extrusions including peel test samples shall be packaged in the UNI-ST-1 shipping tube, 2" (inside) dia. and shipped in the NLO boxes the same as uranium fuel extrusions. The shipping tubes will be loaded in the boxes in up to four layers of five tubes each in NLO box G-4214 and up to eight layers in box G-4292. A cotter pin is positioned in the opening end to assure that the screw cap remains in position.

(4) The uranium metal scrap shall be loaded in NLO boxes in the method described in UNI-483, Rev. 1 and UNI-489, according to the loading limits and restrictions noted in Attachment "C".

(5) For shipments consisting of mixed boxes and materials, the sum of the safe fraction per box (1/C) for all boxes in the shipment shall be ≤ 1.00 . 1/C is determined by dividing the safe number of boxes (C) for the material type, enrichment and mass per box into 1 as specified in Attachment "C".

(6) The following specific materials may be shipped in unlimited quantities:

- a. uranium fragments at ^{235}U enrichments $\leq 1.25\%$ when packaged in shipping tubes UNI-ST-1.
- b. inner uranium fuel extrusions at ^{235}U enrichments $\leq 1.25\%$ either bolted or unbolted in close packed configuration.
- c. outer uranium fuel extrusions at ^{235}U enrichments $\leq 0.95\%$ when bolted and in close packed configuration.

- (7) For the packaging and shipment of Mark VR, VE, and 15 cores and slugs:
- a. Axes will be vertical in the boxes.
 - b. Mass limits per box and total mass limits of uranium per shipment are shown in Attachment D.
 - c. Boxes will be shipped in a single layer on the vehicle.
 - d. Only one material type will be shipped at a time, except:
 1. Mark 15 inner bare cores may be shipped with Mark 15 inner bare cores.
 2. Mark 15 outer bare cores may be shipped with Mark 15 outer canned slugs.

Certificate of Compliance No. 5467, Rev. 4

ATTACHMENT "A"

Item No.	Material	Maximum % ²³⁵ U Enrichment	Container NLO Dwg. No. (a)	Mass/Container		Vehicle Limit ^g		Commingling
				lb.	kg.	No. of Containers	Mass lb. kg.	
1.	I&E Cores (1.4" O.D. 0.5" I.D. 6"l)	0.95	G-4214	1800	816	Unlimited	Unlimited	With all others or with natural or depleted U metal
2.	N Billets or similar rods or tubes (OD-ID) ≥ 3.5"	0.95	G-4214 or G-4255(A) or G-4273(B)	Unlimited		Unlimited	Unlimited	With all others or with natural or depleted U metal
3.	N Billets or similar rods or tubes (OD-ID)/2 ≥ 2.0"	1.25	G-4214 or G-4255(A) or G-4273(B)	Unlimited		Unlimited	58,000 26,300	With all others or with natural or depleted U metal (D)
4.	N Ingots (OD-ID) ≥ 3.5"	0.95	G-4273(B) or G-4274(C) G-4292	Unlimited		Unlimited	Unlimited	With all others or with natural or depleted U metal
5.	N Ingots (OD-ID)/2 ≥ 2.0"	1.25	G-4273(B) or G-4274(C) or G-4292	Unlimited		Unlimited	58,000 26,300	With all others or with natural or depleted U metal (D)
6.	Samples	2.1	G-4245	225	102	1	225 102	With all others or with natural or depleted U metal

Footnotes:

- A. G-4255 with G-4256 and G-4257.
- B. G-4273 with G-4274 and G-4275.
- C. G-4273 with G-4274.
- D. When items 3 and 5 are shipped together the total of both is to be limited to 58,000 lbs. (26,300 kg)

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CLASS III SHIPPING LIMITS FOR URANIUM CONCRETE BILLETS

NLO BOX TYPE	TYPE OF BILLET*	NO. OF BILLETS/BOX	URANIUM/BOX		SAFE NO. OF CLASS III BOXES/VEHICLE
			lb.	kg.	
G-4273	A	1	100	45.4	10,847
	A	2	200	90.7	1,324
	A	3	300	136.1	386
	A	4	400	181.5	161
	A	5	500	227.0	80
	A	6	600	272.2	47
G-4292	A	1	100	45.5	4,490
	A	2	200	90.7	551
	A	3	300	136.1	162
	B	1	200	90.7	479
	B	2	400	181.5	59

*Type A - 25 lb. lard can - 9-7/8" I.D. x 10-1/4" high
0.45 ft³ volume

Type B - 50 lb. lard can - 11-1/4" I.D. base x 12-1/4" I.D. mouth
x 15-1/2" high - 0.97 ft³ volume.

SAFE NUMBER OF BOXES (C) VS MASS OF URANIUM PER BOX (M)

MK IV Inners 0.95% ²³⁵U
Box G-4292, L.P. = 1.77 in.

MK IV Inners 0.95% ²³⁵U
Box G-4292, L.P. = 1.77 in., Bolted

MK IV Outers 0.95% ²³⁵U
Box G-4292, L.P. = 2.5 in.

<u>M</u> <u>lb. of</u> <u>U/Box</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>
200.	2345	14632	7977
300.	677	4316	2341
400.	280	1815	980
500.	141	927	499
600.	81	535	287
700.	50	336	180
800.	33	225	120
900.	23	158	84
1000.	17	115	61
1100.	12	86	46
1200.	9	66	35
1300.	7	52	28
1400.	6	42	22
1500.	5	34	18
			15

MK IV Inners 0.95% ²³⁵U
Box G-4214, L.P. = 1.77 in.

MK IV Inners 0.95% ²³⁵U
Box G-4214, L.P. = 1.77 In., Bolted

MK IV Outers 0.95% ²³⁵U
Box G-4214, L.P. = 2.5 in.

<u>M</u> <u>lb. of</u> <u>U/Box</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>
200.	1010	6226	3403
300.	294	1839	1001
400.	122	774	420
500.	62	396	214
600.	35	229	124
700.	22	144	78
800.	15	96	52

L.P. - Lattice Pitch

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MK IV Outers 0.95% ²³⁵U
 Box G-4292, L.P. = 2.7 in.

MK IV Outers 0.95% ²³⁵U
 Box G-4292, L.P. = 2.7 in., Bolted

MK IC Outers 0.95% ²³⁵U
 Box G-4292, L.P. = 2.7 in.

M lb. of U/Box	C Safe No. of Boxes	C Safe No. of Boxes	C Safe No. of Boxes
200.	2709	11744	2210
300.	788	3465	644
400.	328	1457	269
500.	166	744	136
600.	95	429	78
700.	59	270	49
800.	40	181	33
900.	28	127	23
1000.	20	92	16
1100.	15	69	12
1200.	11	53	9
1300.	9	42	-
1400.	7	33	-

MK IV Outers 0.95% ²³⁵U
 Box G-4214, L.P. = 2.7 in.

MK IV Outers 0.95% ²³⁵U
 Box G-4214, L.P. = 2.7 in., Bolted

MK IC Outers 0.95% ²³⁵U
 Box G-4214, L.P. = 2.7 in.

M lb. of U/Box	C Safe No. of Boxes	C Safe No. of Boxes	C Safe No. of Boxes
200.	1163	4993	948
300.	340	1476	278
400.	142	621	116
500.	72	318	59
600.	42	184	34
700.	26	115	-

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MK IC Outers 0.95%²³⁵U
Box G-4292, L.P. = 2.5 in.

MK IA Outers 1.25%²³⁵U
Box G-4292, L.P. = 2.7 in., Bolted

MK IA Outers 1.25%²³⁵U
Box G-4214, L.P. = 2.7 in.

<u>M</u> <u>lb. of</u> <u>U/Box</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>
200.	4907	726	175
300.	1438	206	49
400.	602	84	20
500.	306	42	10
600.	176	24	6
700.	110	15	-
800.	74	10	-
900.	51	7	-
1000.	37	5	-
1100.	28	3	-
1200.	21	3	-
1300.	17	-	-
1400.	13	-	-

MK IC Outers 0.95%²³⁵U
Box G-4214, L.P. = 2.5 in.

MK IA Outers 1.25%²³⁵U
Box G-4292, L.P. = 2.7 in.

MK IA Outers 1.25%²³⁵U
Box G-4214, L.P. = 2.7 in., Bolted

<u>M</u> <u>lb. of</u> <u>U/Box</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>	<u>C</u> <u>Safe No.</u> <u>of Boxes</u>
200.	2097	393	317
300.	616	108	91
400.	258	43	38
500.	132	21	19
600.	76	12	11
700.	48	7	-
800.	-	5	-
900.	-	3	-
1000.	-	2	-
1100.	-	1	-
1200.	-	1	-

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MK IA Outers 1.25%²³⁵U
Box G-4292, L.P. = 2.5 in.

M lb. of U/Box	C Safe No. of Boxes
200.	820
300.	230
400.	93
500.	46
600.	26
700.	16
800.	10
900.	7
1000.	5
1100.	4
1200.	3
1300.	2
1400.	2

MK IA Outers 1.25%²³⁵U
Box G-4292, L.P. = 2.5 in., Bolted

C Safe No. of Boxes
1803
520
215
108
62
38
25
18
13
9
7
6
4

MK IA Outers 1.25%²³⁵U
Box G-4214, L.P. = 2.5 in.

M lb. of U/Box	C Safe No. of Boxes
200.	360
300.	102
400.	42
500.	21
600.	12
700.	7

MK IA Outers 1.25%²³⁵U
Box G-4214, L.P. = 2.5 in., Bolted

C Safe No. of Boxes
778
226
94
48
27
17

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Packaging and Shipping Limits
for Mark VR, VE and 15 Cores and Slugs

<u>MATERIAL TYPE</u>	<u>BOX TYPE, NLO DRAWING NO</u>	<u>NO. PER BOX, MAXIMUM</u>	<u>MAXIMUM WEIGHT PER BOX, POUNDS</u>		<u>MAX AMOUNT OF U PER SHIP., TONS</u>
			<u>NET</u>	<u>GROSS</u>	
Mark VR inner canned slugs	G-4214	105	1070	1125	6.9
Mark VR outer canned slugs	G-4214	45	650	705	16.3
Mark VE inner canned slugs	G-4214	105	1010	1065	3.4
Mark VE outer canned slugs	G-4214	45	610	665	3.4
Mark 15 inner bare cores	G-4292*	60	980	1080	1.3
Mark 15 inner canned slugs	G-4292*	60	1015	1115	4.1
Mark 15 outer bare cores	G-4292*	30	580	680	1.3
Mark 15 outer canned slugs	G-4292*	30	610	710	4.1

*A wooden false bottom will be placed in each box to reduce the inside useable height from 16 1/8 to 11 1/2 inches.

14041



Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29801

ALP 7/20
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JUL 20 1979

M. J. Sires, Director *Sires*
Technical and Production Division

SUPPLEMENT TO SAFETY ANALYSIS REPORT NLCO-1107 (YOUR MEMO, 7/9/79, TS:WGO'Q:1mg)

The supplement to Safety Analysis Report, NLCO-1107, has been reviewed for nuclear criticality safety (memo, DES/DNB, 7/19/79). It is concluded that the return of the Mk VR, Mk VE, and Mk 15 slugs in the original wooden boxes will satisfy the requirements of SR-0529 and 10 CFR 71. The limitations as described in the SARP supplement will ensure nuclear criticality safety. Approval of the SARP supplement is recommended by the Safety and Environment Division.

W. A. Reese
W. A. Reese, Director
Safety and Environment Division

EN:DES:djb

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JUL 19 1979

D. N. Bridges, Chief
Nuclear Safety Branch

SUPPLEMENT TO SAFETY ANALYSIS REPORT NLCO-1107

Building 777-M is being placed in a shutdown condition. Due to the termination of activity in Building 777-M, a total of 36 tons of slightly enriched uranium fuel slugs and cores will be returned to National Lead of Ohio. The fuel will be shipped in the wooden containers in which they were originally received. The SARP for the wooden containers and the existing Certificate of Compliance do not authorize the shipment of this uranium since the original shipment was made before current restrictions were imposed. The SARP supplement is intended to document the adequacy of the wooden containers for shipping the enriched uranium fuel.

The wooden containers would be destroyed by the hypothetical accident conditions of 10 CFR 71. This is recognized by the SARP supplement and therefore the safety of the proposed shipment is supported by limiting the mass of uranium. The limits determined are such that if all the slugs or cores were arranged in the most reactive array, with water moderation, the arrangement would be subcritical.

All assumptions necessary for the criticality analysis were made in the conservative sense. The mass of ^{235}U in the low enriched fuel and the cylinder diameters are safely below the maximum limits provided in ANSI N16.1 (Nuclear Criticality Safety in Operations With Fissionable Material Outside Reactors). The maximum safe slab thickness has been confirmed, based on an infinite, flooded array, and the actual slab thickness is within the safe limit for all cases. The requirements of SR-0529 and 10 CFR 71 for nuclear criticality safety will be satisfied for the fuel shipment proposed by the SARP supplement, DPSP-79-71-6, and its approval is recommended.

D. E. Scott

D. E. Scott
Nuclear Safety Engineer

EN:DES:djb

cc: T&P Division

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