

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

1a. Certificate Number	1b. Revision No.	1c. Package Identification No.	1d. Page No.	1e. Total No. Pages
USA/6387/BLF (DOE-RL)	2	USA/6387/BLF (DOE-RL)	1	5

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--

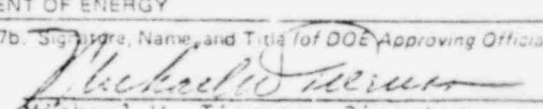
(1) Prepared by (Name and address):	(2) Title and Identification of report or application:	(3) Date:
Westinghouse Hanford Company Hanford Engineering Development Laboratory P.O. Box 1970 Richland, Washington 99352	TC-138, Rev. 1 - "HEDL Model-60 Unirradiated Fissionable Material Shipping Container Safety Analysis Report for Packaging (SARP)" by F. M. Smith, C. A. Rogers, and L. B. Colton	January 1978

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 package is identified as the HEDL Model-60 container and is described on Hanford Engineering Development Laboratory drawing number H-3-32429, seven sheets, revisions as identified in TC-138, Revision 1.
- b. The authorized packaging consists of a rectangular metal "birdcage" with a centrally positioned inner containment vessel, which is a Schedule 40, 304-L stainless steel pipe, 101 1/4" long X 6" I.D. The containment vessel, which has a one-inch welded end plate on one end and a welded flange with gasket and bolted blind plate closure at the other end, is rigidly supported within an outer welded framework (cage) of steel angle iron by means of welded steel support plates and pipe spokes. The containment vessel is fitted with a rupture disc which is designed for up to 300 psi. See H-3-32429 (Sheet 6) for details. The outer framework, with dimensions of 18" X 112-1/2", is covered with expanded metal mesh (1/2" openings), which is welded to the outer surface of the framework. The tare weight of the package is a nominal 825 pounds, with weight of contents not to exceed 175 pounds. A complete description is found in Document TC-138, Revision 1.

6a. Date of Issuance: May 7, 1979	6b. Expiration Date:
FOR THE U.S. DEPARTMENT OF ENERGY	
7a. Address (of DOE Issuing Office) Richland Operations Office P.O. Box 550 Richland, Washington 99352	7b. Signature, Name, and Title (of DOE Approving Official)  Michael W. Tiernan, Director Safety & Environmental Protection Division

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5. Continued

c. The contents of each package authorized by this certificate consist of large quantities of fissile and up to or including Type B quantities of other radioactive materials as noted below packaged as Special Form Material [meeting the requirements of 49-CFR-173.398(a)] and as further limited in paragraphs d-f; transport indices for these limits are listed in Paragraph d. below.

(1) Not more than Type B quantities of nonfissile radioactive material, not otherwise specified, in dry, solid form.

(2) FFTF Type Pins

Not more than 120 FFTF-type fuel pins, as described in Document TC-138, Revision 1, Appendix A, provided the pins are constrained to the insert described on Drawing H-3-32429, sheets 2 and 3.

(3) Other Pins Containing Plutonium and Uranium

Pins containing $\text{Pu}(\geq 10)\text{O}_2\text{-U}(\leq 100)\text{O}_2$ may be shipped under limits given in Table 1. Carbide and nitride fuel pins are allowed if the Pin Limit Number of Table 1 is multiplied by 0.8 to compensate for the higher densities of carbides and nitrides. Natural ThO_2 may be substituted for natural or depleted UO_2 without changing any limits specified in this certificate. All pins shall be constrained to Pin Holder Inserts described in Drawings H-3-32429 sheets 2 and 3, H-3-42514, H-3-39691 sheets 1 and 2, or H-3-44280 and as restricted in Appendix A of TC-138, Revision 1. The ^{240}Pu content of the plutonium shall not be less than 10 wt%, and the ^{241}Pu content shall not exceed one half of the ^{240}Pu content.

(4) Fissile Material in Undefined Geometry

. For moderated material (i.e., moderation not controlled): ^{238}Pu , ^{239}Pu , ^{240}Pu , ^{241}Pu (non-isolated form), and ^{235}U in any solid physical or chemical form may be shipped under one of the following batch limits (or equivalent*), provided the ^{241}Pu content of the plutonium does not exceed 50% of the ^{240}Pu content. Paragraph d. below identifies the allowable transport index for these limits.

- (a) 150 g (max) fissile
- (b) 500 g (max) fissile
- (c) 900 g (max) fissile

d. For moderated material (i.e., moderation not controlled) in any solid physical or chemical form, the following material may be shipped as a single batch (or equivalent*).

- (d) 280 g (max) of U^{233}
- (e) 15 kg (max) of either ^{237}Np and/or ^{241}Am
- (f) 3 g (max) of ^{241}Pu (in isolated form), ^{242}Am , ^{243}Cm , ^{244}Cm , ^{245}Cm , ^{249}Cf and ^{251}Cf .

d. The packaging authorized by this certificate with the contents as limited in paragraph c. above meets the requirements for shipment as either a Type B package with an assigned transport index based solely on radiation levels, or a Fissile Class II package with minimum transport indices (T.I.) as follows:

<u>Contents</u>	<u>Type B Package</u>	<u>Fissile Class II Minimum T.I.</u>
Item c.(1)	x	
Item c.(2)		0.4
Item c.(3)		7.0
Item c.(4)a		0.1
Item c.(4)(b)		1.3
Item c.(4)(c)		7.0
Item c.(4)(d)		1.3
Item c.(4)(e)		0.2
Item c.(4)(f)		0.6

e. In addition to the restrictions described above, the decay heat from the contents must comply with either of the following conditions:

- (1) total heat load not to exceed 37.00 watts, or
- (2) heat load not to exceed 12.3 watts per foot of fuel length.

f. Each user of the Model-60 must possess or have access to quality assurance records which substantiate that containers under its control (procurement) meet the design parameters as specified in document TC-138, Revision 1; and the user must have an established quality assurance program that meets the requirements as specified in MC 0529, "Safety Standards for the Packaging of Fissile and Other Radioactive Materials", and 10 CFR 71 Appendix E, "Quality Assurance Criteria for Shipping Packages for Radioactive Material.

*Combinations of fuel types may be shipped within a single package as long as the sum of the masses for each fuel type divided by its batch limit does not exceed unity.

- g. Prior to each shipment, each container is required to be inspected and packaged according to written operating procedures equivalent to those required in Document TC-138, Revision 1.
- h. All details concerning the package and associated hardware not specifically described in this certificate shall be as indicated in Document TC-138, Revision 1.
- i. Each user of packages approved under this certificate shall register his name and address with the Richland Operations Office, U. S. Department of Energy, P.O. Box 550, Richland, Washington 99352, and have a copy of Document TC-138, Revision 1 within his company.

TABLE I

LIMITS FOR PINS CONTAINING PLUTONIUM AND URANIUM

MODEL 60

Fuel Column Diameter (in. max)	Pu+ ²³⁵ U Content Wt.% Max.	Limit Number* (Pins Max)	Fuel Column Diameter (in. max)	Pu+ ²³⁵ U Content Wt.% Max.	Limit Number (Pins Max)
0.205	100	30	0.350	100	10
	75	40		75	13
	50	60		50	20
	35	85		40	25
	33	90		35	28
	30	100		30	33
	28	107		25	40
	25	120			
0.230	100	24	0.400	100	7
	75	32		75	10
	50	48		50	15
	35	68		40	19
	30	80		30	26
	28	85		25	31
	26	92	20	39	
	24	100	0.500	100	5
	22	109		75	6
	20	120		50	10
		40		12	
0.250	100	20	30	16	
	75	26	25	20	
	50	40	20	25	
	35	57	15	33	
	30	66	0.550	100	4
	28	71		75	6
	25	80		50	8
	23	86		40	10
	20	100		30	13
	18	111		25	16
	16	120		20	20
		15		26	
0.270	100	17	0.600	100	3
	50	34		75	4
	45	37		50	7
	40	42		40	8
	35	48		30	11
	30	56		25	14
	28	60		20	17
0.290	100	15	15	23	
	75	20			
	50	30			
	40	37			
	35	42			
	30	50			
	25	60			

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*Combinations of fuel types may be shipped within a single package as long as the sum of the masses for each fuel type divided by its batch limit does not exceed unity.

SAFETY EVALUATION BY THE RICHLAND OPERATIONS
OFFICE FOR REVISION 2 TO THE
HEDL MODEL 60 SHIPPING
CONTAINER - USA/6387/BLF (DOE/RL)

SUMMARY

The HEDL Model 60 shipping container is currently certified for transport of unirradiated fissionable material under DOE-RL and NRC certificates. It has been requested by HEDL in a letter dated March 7, 1979 that this certificate be revised to increase the container versatility and practicability. A similar revision has been requested of the NRC Certificate 6387, which has been transmitted to DOE-HQ.

The following evaluation of the requested changes will establish that adequate bases exist for their approval.

DISCUSSION

- The first change request that Table I of the certificate be revised to include higher enrichment and pin limit number combinations. The current certificate does not allow interpolation of pin limits with varying enrichment (Pu + ²³⁵U contents) range. The new table uses smaller incremental enrichment ranges, therefore, 37 additional pin combinations limits have been added.

The criticality analysis bases the total fissile density at 2 Kg fissile material per foot within the containment vessel (not to exceed 37 inches total fuel length).

With the 2,000 gm. of fissile material as the controlling limit the maximum pins limit is derived as follows:

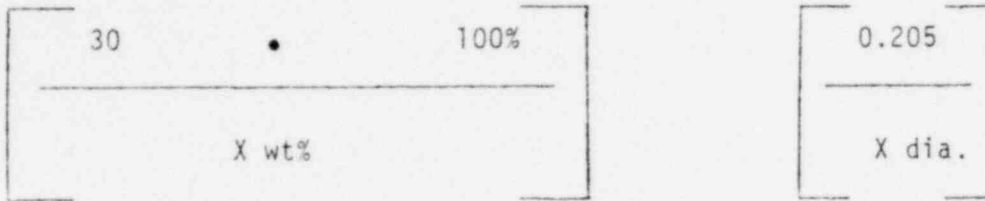
The volume (per foot) of a pin in each "Fuel Column Diameter" section is calculated. The amount of plutonium in that one foot section is calculated using the theoretical density of PuO₂ as 11.46 gm/cm³ and the Pu being 88% of PuO₂. This gives the Pu per gm/cm³ then multiplied by the volume of one foot of the pin give the total Pu in the one foot section. When the amount of Pu in that pin is divided into the 2,000 gm limit, the maximum pins limit number is determined.

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The following ratio can also be used to calculate the maximum pins limit number.



where: 30 is the maximum pin limit for 100 wt% contents of a 0.205" dia. fuel column (could use from any group).

X wt% = wt% of pin where maximum pins limit is not known.

X dia. = dia. of pin where maximum pin limit is now known.

Therefore, the maximum pin limit relates to the 2,000 gm of fissile material per foot within the containment vessel.

- Change 2 requests that the drawing number for the 36 tube pin holder insert be referenced. The published Model 60 SARP, TC-138, Revision 1 lists the 36 tube pin holder insert, however, it had not been built. Since then, it was designed on drawing H-3-44280 and fabricated.
- Change 3 requests that the density differences of plutonium and uranium carbides (PuC_2) and nitrides (PuN_2) be addressed. The shipment of plutonium and uranium carbides and nitrides are still limited to a total fissile density of 2.0Kg, fissile. However, the carbides and nitrides have higher densities than the oxides. To compensate for these greater densities the maximum number of fuel pins per fuel column diameter is determined by multiplying the pins limit number from the Table 1 by 0.8.
- Change 3 request allowing substitution of natural ThO_2 for either natural or depleted UO_2 . Natural ThO_2 and depleted UO_2 are all nonfissionable and have similar nuclear characteristics. The substitution of ThO_2 for natural or depleted UO_2 will not change any limits specified in the certificate.

This request for revision to the DOE-RL certificate was reviewed by RL-SAF staff and discussed with HEDL staff; it is concluded that a revised DOE-RL Certificate of Compliance for the Model 60 should be initiated.


H. B. Shymlock

May 7, 1979
Date

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