



Westinghouse  
Electric Company

Box 355  
Pittsburgh Pennsylvania 15230-0355

October 24, 2001

U. S. Nuclear Regulatory Commission  
Office of Nuclear Material Safety and Safeguards  
Washington, DC 20555

Attention: Ms. Nancy L. Osgood  
Senior Project Manager  
Spent Fuel Project Office

Subject: Submittal of Additional Information to Support Application for License Exemption  
for the Transportation of Fissile Materials, License No. SNM-33 (Docket 70-36)  
TAC No. L23360

Reference: 1) Westinghouse letter dated August 15, 2001 from A. Joseph Nardi to USNRC,  
application for exemption for the transportation of fissile materials for License  
Number SNM-33.

2) Westinghouse letter dated September 21, 2001 from A. Joseph Nardi to  
USNRC transmitting additional information to support application for exemption  
for the transportation of fissile materials for License Number SNM-33.

Dear Ms. Osgood,

In response to our telephone conversation of October 24, 2001, the Westinghouse Electric Company hereby submits this additional information to support the application for an exemption in accordance with the provisions of 10CFR71.8 to permit the transportation of certain fissile radionuclides as "fissile exempt" (Reference 1).

Attached is a revised attachment that provides a response to the issues discussed. This submittal is in the form of a complete revised document rather than only revised pages for reasons of convenience. The revision record page has been updated and all changes are marked with a bar in the margin to clearly designate the changes that have been made. This revision is designated as Revision 2 and replaces all prior submittals (References 1 and 2).

NMSSOI Public  
Rec'd 2/15/02  
DCD

Nancy L. Osgood  
October 24, 2001  
Page 2

The timely approval of this application is important to Westinghouse to permit the continued progress in the decommissioning of the Westinghouse Hematite facility.

If you have any questions concerning this application, please contact me at the above address, by email at [nardiai@westinghouse.com](mailto:nardiai@westinghouse.com), or by telephone at (412) 374-4652.

Sincerely,

A handwritten signature in black ink, reading "A. Joseph Nardi". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

A. Joseph Nardi, License Administrator  
Environment, Health and Safety

cc:

Mohammad Haque, NRC License Project Manager  
Patrick Hiland, NRC Region III Branch Chief  
Bernard H. White, NRC, NMSS/SFPO/ Technical Review Directorate  
Robert J. Lewis, NRC, NMSS/SFPO/Licensing and Inspection Directorate  
Charles L. Miller, NRC, NMSS/SFPO/Licensing and Inspection Directorate, Deputy Director  
Dr. Ronald Land, Westinghouse Hematite Plant  
Mr. Kevin Hayes, Westinghouse Hematite Plant

**ATTACHMENT 1**

**Application for License Exemption for the Transportation of Fissile  
Materials, License Number SNM-33 (Docket 70-36)**

**Revision 2  
October 24, 2001**

**Revision Record**

Revision Date	Revision #	Section Changed	Reason
8/15/01	0	All	Original submittal
9/21/01	1	Section 5; second para.	Changed "unity" to "0.93"
9/21/01	1	Section 5; section marked "Table 1, Item 1"	Revised justification
9/21/01	1	Section 5; section marked "Table 1, Item 2"	Deleted Item and marked as reserved.
9/21/01	1	Section 5; section marked "Table 1, Item 3"	Revised justification.
9/21/01	1	Section 5; section marked "Table 2, Item 6"	Deleted sentence that referred to Table 3.
9/21/01	1	Table 1, Item 1	Revised K-inf value and reference.
9/21/01	1	Table 1, Item 2	Deleted Item and marked as reserved.
9/21/01	1	Table 1, Item 3	Revised K-inf value and reference.
9/21/01	1	Table 3	New Table
9/21/01	1	Figure 1	New Figure
10/24/01	2	Table 1, Item 5 and justification in Section 5	Marked Item 5 as reserved to delete it from application.

## **ATTACHMENT 1**

### **Application for Exemption for License Number SNM-33**

#### **1. Background**

On February 10, 1997 the NRC issued an emergency direct final rule (62FR5913) changing the fissile material exemption specifications of 10 CFR 71. The revised rule limits the fissile-material mass in a consignment and restricts the presence of select moderators with very low neutron-absorption properties (i.e., "special" moderators). The results of this rule making have a profound effect on the ability of a fuel facility to manage the transportation of decommissioning waste. Specifically the imposition of a 400g  $^{235}\text{U}$  limit per consignment will dramatically increase the number shipments required to decommission an SNM facility. Westinghouse is submitting this amendment request for a specific exemption, as provided in 10CFR71.8, to authorize Special Nuclear Material shipments with greater than 400g  $^{235}\text{U}$  per consignment. This request provides the safety bases and additional controls proposed to ensure an adequate safety margin.

#### **2. Request for License Exemption**

In accordance with the provisions of 10CFR71.8 (Specific exemptions), Westinghouse submits this application for an exemption from the requirements of 10CFR71.55, "General requirements for fissile material packages" and 10CFR71.59, "Standards for arrays of fissile material packages." Westinghouse requests that a specific license amendment to License SNM-33 be issued that would permit the shipment of materials contaminated with  $^{235}\text{U}$  in bulk containers that are not specifically licensed, or exempted, under 10 CFR 71. Concentration limits are established that provide control parameters adequate to ensure nuclear criticality safety for the shipments. These concentration limits are stated as the ratio of  $^{235}\text{U}$  to non-fissile material.

#### **3. Discussion**

The shipment of decommissioning wastes and materials containing  $^{235}\text{U}$  contamination requires that provisions be applied to assure nuclear criticality safety during transportation. Decommissioning wastes and materials are characterized as large quantities of bulk materials having relatively low concentrations of contaminants. Uranium contaminated materials, even at low concentrations (in units of pCi/g), can represent significant mass quantities of fissile material. In the past (prior to the NRC's 1997 emergency rulemaking) such shipments were generally made as "fissile exempt" under the following exemption criteria:

*"There is no more than 5g of fissile material in any 10 liter volume of material and the material is packaged so as to maintain this limit of fissile radionuclide concentration during normal transport."*

With the publication of the emergency final rule on February 10, 1997 (62FR5913), mass limits were established for an individual consignment. For example the consignment limit is 400 grams of  $^{235}\text{U}$  where the fissile material is mixed with substances having an average hydrogen density less than or equal to water. This requirement has become a major constraint on shipments of waste to Envirocare, which is now licensed to accept fissile material based on concentration limits rather than the former 350 grams  $^{235}\text{U}$  mass limit. As examples, at the Envirocare license limit of 1900 pCi/g concentration for  $^{235}\text{U}$  for low enriched uranium, one gondola car containing 8 "Supersacks" would contain about 81 kg of  $^{235}\text{U}$  in the consignment and a truck shipment of 12 B-25 bins would contain about 61 kg of  $^{235}\text{U}$  in the consignment.

#### **4. Proposed License Limits**

In order to ensure that adequate controls for nuclear criticality safety are applied the limits given in Table 1 will be used for all shipments made in accordance with the provisions of this application. Table 2 provides additional limits on these shipments.

#### **5. Justification**

The criteria established in this application are based on the recommendations presented in NUREG/CR-5342, "Assessment and Recommendations for Fissile-Material Package Exemptions and General Licenses Within 10 CFR Part 71" (Reference 1). The primary difference is that Sections 5.3.3, G.2 and G.3 establish both a mass limit and weight ratio limit for the packages. This application utilizes the weight ratio limits and maintains the mass limit for packages containing SCO-1 materials but does not include the package mass limit for packages containing LSA-1 materials. NUREG/CR-6505, Vol. 2, "The Potential for Criticality Following Disposal of Uranium at Low-Level Waste Facilities" (Reference 3) also provides criteria to support Table 1.

In References 2, 3, and 4, concentration limits that ensure criticality safety for large volumes of  $^{235}\text{U}$ -contaminated soil, under specified conditions, were calculated. Some of the concentration limits specified in this application have  $k$ -infinity less than 0.93 and other concentrations have  $k_{\text{eff}}$  less than 0.93 for thick infinite slabs. Because the conditions of transport are less severe than disposal under the specified conditions (i.e., re-concentration is not credible during transport given the provisions for rapid response to accident situations) the proposed concentration limits for transport, derived from the subject references, ensure subcriticality.

##### **Table 1, Item No. 1:**

In addition to the material form meeting the requirements of LSA-1 material, a ratio of 1 gram  $^{235}\text{U}$  per 4000 grams non-fissile material is specified. A weight ratio of 4000 grams of non-fissile material to 1 gram of  $^{235}\text{U}$  is equivalent to an atomic ratio of about 15,000. This atomic ratio results in a  $k$ -inf of less than 0.8 (Figure B.1 of Reference 1).

No mass limit per container or limit on the number of packages per consignment is needed. Restrictions are placed on the shipment to require exclusive use controls (Table 2, Item 2) and to limit the presence of water-soluble uranium compounds (Table 2, Item 5). This ensures that even though there are no detailed provisions for package specifications, nuclear criticality safety would be maintained if the soluble uranium contents of a package were to leach out.

**Table 1, Item No. 2:**  
Reserved

**Table 1, Item No. 3:**

In addition to the material form meeting the requirements of LSA-1 material, a ratio of 1 gram  $^{235}\text{U}$  per 1000 grams non-fissile material is specified. This item is applicable for Uranium enrichments up to 10%  $^{235}\text{U}$ . Figure 1 provides the graph of keff versus the weight ratio (g  $\text{SiO}_2/\text{g } ^{235}\text{U}$  for  $< 10\% ^{235}\text{U}$ ). This Figure was derived from the values of Table A.1 (Reference 3) where the maximum value of k-eff was used for each material density. The values used are given in Table 3.

No mass limit per container or limit on the number of packages per consignment is needed. Restrictions are placed on the shipment to require exclusive use controls (Table 2, Item 2) and to limit the presence of water-soluble uranium compounds (Table 2, Item 5). This ensures that nuclear criticality safety would be maintained if the soluble uranium contents of a package were to leach out.

**Table 1, Items No. 4& 5:**

Each of these items is in conformance with the recommendations of Reference 1 with additional constraints applied in the form of a volume limitation for Item 4 and a mass limitation for Item 5. Item 5 has been marked as reserved.

**Table 2, Item 1:**

This provision acknowledges the requirements of 10CFR71.

**Table 2, Item 2:**

This provision provides an extra measure of control over the shipments and assures that there will be no commingling with other shipments during transport.

**Table 2, Item 3:**

This provision reflects the reality of the possession limits of the license. If there is Pu or U-233 present in the materials, it will be limited to trace quantities that are insignificant from a nuclear criticality safety standpoint.

**Table 2, Item 4:**

This provision is intended to establish a reasonable working definition for the term "essentially uniformly distributed".

**Table 2, Item 5:**

This provision establishes a reasonable limitation on the presence of soluble uranium compounds for the packages described by Items 1, 2 & 3 of Table 1. Compliance with this provision is automatic for the packages described by Items 4 & 5 of Table 1 because each package is limited to a total mass of 350 grams of  $^{235}\text{U}$ .

**Table 2, Item 6:**

This provision recognizes the maximum density for a shipment on one conveyance. This requirement is limited to for the packages described by Items 2, 4 & 5 of Table 1 and is not applicable to the other items of the Table.

**Table 2, Item 7:**

This provision establishes a specific definition for the terms combustible and non-combustible.

## **6. Quality Assurance**

All shipments of fissile material made in accordance with this exemption request will be made in accordance with the provisions of a Quality Assurance Program approved by the NRC as satisfying the provisions of Subpart H of 10CFR71.

## **7. References**

1. NUREG/CR-5342, "Assessment and Recommendations for Fissile-Material Package Exemptions and General Licenses Within 10 CFR Part 71"
2. NUREG/CR-6505, Vol. 1, "The Potential for Criticality Following Disposal of Uranium at Low-Level Waste Facilities"
3. NUREG/CR-6505, Vol. 2, "The Potential for Criticality Following Disposal of Uranium at Low-Level Waste Facilities"
4. ORNL/TM-13765, Emplacement Considerations for Criticality Safety in Low-Level Waste Disposal
5. NUREG-1608, "Categorizing and Transporting Low Specific Activity Materials and Surface Contaminated Objects", (Section 4.2.5, page 4-9)
6. "Standard System for the Identification of Fire Hazards of Materials", National Fire Protection Association (NFPA), Standard 704, 1990



**TABLE 1**  
**Concentrations Limits for  $^{235}\text{U}$  Contaminated Material Shipments**

Item No.	Material Form	Package Description	Concentration Limit	$^{235}\text{U}$ Mass Limit
1	LSA-I as defined by 10CFR71.4	A "strong, tight package" in accordance with the provisions of 49CFR173.427(b)(3).	Ratio of 1 gram $^{235}\text{U}$ as U ( $\leq 100\%$ $^{235}\text{U}$ ) per 4000 grams of non-combustible, non-soluble material subject to Notes 1 & 2.	No limit on $^{235}\text{U}$ per package or packages per consignment as $k_{inf} < 0.93$ per Ref. 1, Appendix B, Figure B-1
2	Reserved	Reserved	Reserved	Reserved
3	LSA-I as defined by 10CFR71.4	A "strong, tight package" in accordance with the provisions of 49CFR173.427(b)(3).	Ratio of 1 gram $^{235}\text{U}$ as U ( $\leq 10\%$ $^{235}\text{U}$ ) per 1000 grams of non-combustible, non-soluble material subject to Note 1 & 2.	No limit on $^{235}\text{U}$ per package or number of packages per consignment as $k_{inf} \leq 0.9$ , per Ref. 3, Table A.1
4	SCO-I as defined by 10CFR71.4	A "strong, tight package" in accordance with the provisions of 49CFR173.427(b)(3).	Ratio of 1 gram $^{235}\text{U}$ per 2000 grams of non-combustible, non-soluble material subject to Note 1.	350 grams of $^{235}\text{U}$ per package. Volume of all packages $\leq 100$ cubic yards per consignment, as $k_{eff} < 0.95$ , per Ref.1, App. G.2.
5	Reserved	Reserved	Reserved	Reserved

Note 1: The determination of the ratio of  $^{235}\text{U}$  mass to non-fissile mass shall exclude beryllium (Be), graphite (C), and deuterium oxide ( $\text{D}_2\text{O}$ ) as part of the non-fissile mass determination; and include only noncombustible, insoluble-in-water material as part of the non-fissile mass determination.

Note 2: This item applies only when beryllium, graphite, or hydrogenous material enriched in deuterium is not present in quantities exceeding 0.1% of the fissile material mass.

## Table 2 Additional Shipment Limits

1. The total radioactivity content of each package shall be less than a Type A quantity (10CFR71.4). Each conveyance will be limited to one consignment of material. For rail shipments, each individual rail car will constitute a single conveyance.
2. The shipment shall be made in accordance with the provisions for exclusive use (10CFR71.4).
3. This license exemption shall apply to the shipment of materials contaminated with  $^{235}\text{U}$ . If Pu and  $^{233}\text{U}$  are present the concentrations shall be limited to trace quantities such that the  $^{233}\text{U}$  shall not exceed 0.1% by weight of the  $^{235}\text{U}$  content and Pu shall not exceed 0.01% by weight of the  $^{235}\text{U}$  content.
4. For materials meeting the definition of LSA-1, the  $^{235}\text{U}$  shall be essentially uniformly distributed. The limiting concentration shall not be exceeded by the average concentration in any contiguous mass of 1500 kilograms. (Ref. 4, Section 7.1)
5. Shipments shall not contain greater than 350 grams of  $^{235}\text{U}$  per package or 700 grams of  $^{235}\text{U}$  per consignment as highly water-soluble uranium compounds. Highly water-soluble compounds include, but are not limited to, uranium sulfate, uranyl acetate, uranyl chloride, uranyl formate, uranyl fluoride, uranyl nitrate, uranyl potassium carbonate, and uranyl sulfate. If water-soluble forms of uranium are present but have been encapsulated in a solidified matrix (such as concrete) such that they are not readily soluble in water during transport, the mass of such uranium compounds is not included in the mass limits noted above.
6. The maximum average density of the material in a package shall be 2 grams per cubic centimeter for packages that are shipped under the provisions of Items 2, 4, & 5 of Table 1.
7. A material will be considered combustible if the material has a flammability hazard ranking of 1 or 2 according to the test method in NFPA 704. Solid materials that have a flammability hazard ranking of 0 (zero) according to NFPA 704 are noncombustible. (References 5 & 6)

**Table 3**  
**Maximum k-eff versus Uranium Density**  
 (From Table A.1, NUREG/CR-6505, Volume 2)

Line #	g 235U/cc	g 235U/g S-S	g S-S/g 235U	k(max)
1	0.00050	0.000313	3200	0.430
9	0.00142	0.000886	1129	0.779
22	0.00163	0.001019	982	0.832
35	0.00180	0.001125	889	0.870
43	0.00187	0.001171	854	0.884
56	0.00215	0.001346	743	0.935
69	0.00248	0.001548	646	0.982
82	0.00285	0.001779	562	1.027

**Figure 1**  
**Maximum k-eff versus Uranium Density**  
 (From Table A.1, NUREG/CR-6505, Volume 2)

