



**Department of Energy**  
Washington, DC 20585

**APR 17 2008**

Attn: Document Control Desk  
Director, Spent Fuel Project Office  
Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

The U. S. Department of Energy respectfully requests the review and approval of new contents for the ES-3100 shipping container, under Certificate of Compliance (CoC) No. USA/9315/B(U)F-96, Docket No. 71-9315. These new contents are intact research reactor fuel elements, intact components of these elements, and nuclear materials used in the fabrication of these fuel elements. All materials in this request are unirradiated. Both ground and air transport are requested for these materials.

The new materials in this request were discussed with the NRC at a public meeting on January 29, 2008. During that discussion, it was requested that for additional clarification of how these new contents are covered by existing calculations, a cross-reference matrix be developed. This matrix is the first of two attachments. The matrix identifies where in the attached ES-3100 Safety Analysis Report (SAR) the new contents are covered by existing analyses for similar materials, and where the similar materials are approved in the current CoC. The matrix then provides references to sections of the SAR that discusses air transport of these new materials. The second attachment is the complete SAR for the ES-3100 (Document No. Y/LF-717, Rev 2). Changes to the SAR made specifically for the new contents are highlighted in red text.

Several administrative word changes made to this issue of the SAR are not highlighted. These were made to correct minor word inconsistencies within the document. None of these changes were technical in nature, or referred to any specifications or safety performance of the container. If you would like these pointed out, please let us know.

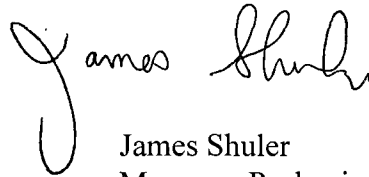
The original of this letter, with attachments is being sent to the Document Control Desk. In addition, ten copies of this letter with attachments are being delivered to Kimberly J. Hardin, Project Manager, Licensing Branch, Division of Spent Fuel Storage and Transportation, Office of Nuclear Material Safety and Safeguards.

NM5501



If you have any questions, please contact me at 301-903-5513.

Sincerely,

A handwritten signature in black ink that reads "James Shuler". The signature is written in a cursive style with a large, looping initial "J".

James Shuler  
Manager, Packaging Certification Program  
Office of Packaging and Transportation  
Office of Environmental Management

Enclosures

cc: with Enclosures  
Kimberly J. Hardin, NRC

cc: without Enclosures  
Ken Sanders, NNSA NA-26  
Dana Willaford, DOE ORO  
Jeff Arbital, B&W Y-12  
Walter North, B&W Y-12  
Steve Sanders, B&W Y-12

**Cross-Reference of New Research Reactor Contents to Current Authorized Contents**

Proposed Research Reactor Contents	How the content is addressed in the CoC and SAR	
	Ground	Air
<b>HEU Oxide (UO<sub>2</sub> and U<sub>3</sub>O<sub>8</sub>)</b>	<p>This material is currently authorized for ground transport in CoC Section 5.(b)(2).</p> <p>These forms of oxide are discussed in SAR Sections 1.2.3 (HEU Oxide), 6.4.3, 6.5.3, and 6.6.3. Table 6.1d gives Keff values and specific case names. Infinite array, NCT packaging case results are limiting (see Table 6.9.6-13).</p> <p>Loadings given in SAR Tables 1.3 and 6.2a are applicable for ground transport of this material.</p>	<p>Air transport of these oxides is not currently authorized in the CoC.</p> <p>SAR Tables 1.3a and 6.2b (footnote b) provide a reduced loading limit for air transport. These loadings are based on calculations for TRIGA fuel authorized in CoC Section 5.(b)(4) for enrichments greater than 20%. Loadings at enrichments of 20% or less are based on TRIGA fuel calculations at 20% enrichment.</p> <p>Discussions of this material for air transport are found in SAR Sections 6.3.1.4 - paras. 9 - 13 and 6.7.2 - 9th para. Calculations for UO<sub>2</sub> demonstrate TRIGA loading limits are applicable to UO<sub>2</sub>. Results data in Table 6.9.6-22c.</p> <p>UO<sub>2</sub> is shown to be more reactive than U<sub>3</sub>O<sub>8</sub> or UO<sub>3</sub> (Table 6.9.6-12 Cases cvcroxt11_1_24_1, _24_2, and _24_3). Therefore, UO<sub>2</sub> oxide limits apply to U<sub>3</sub>O<sub>8</sub>.</p>
<b>UO<sub>2</sub>-Mg powder</b>	<p>This specific oxide mixture is not currently authorized for ground transport in the CoC, however the fissile portion is authorized in CoC section 5.(b)(2).</p> <p>This oxide mixture is identified in SAR Section 1.2.3 (HEU Oxide).</p> <p>Loadings given in Tables 1.3 and 6.2a for oxide are applicable for ground transport of this material.</p> <p>The presence of Mg requires this material to be handled according to conditions for pyrophoric uranium authorized in CoC Section 5(b)(1)(ii).</p>	<p>Air transport of this mixture is not currently authorized in the CoC.</p> <p>SAR Tables 1.3a and 6.2b (footnote b) provide a reduced loading limit for air transport. Calculations for UO<sub>2</sub>-Mg demonstrate that TRIGA fuel loading limits are applicable.</p> <p>Discussion in SAR Section 6.7.2, 9th para. Data in Tables 6.9.3.1-4d and 6.9.6-22d.</p> <p>The presence of Mg requires this material to be handled according to conditions for pyrophoric uranium authorized in CoC Section 5(b)(1)(ii).</p>
<b>U<sub>3</sub>O<sub>8</sub>-Al oxide</b>	<p>This specific oxide mixture is not currently authorized for ground transport in the CoC, however the fissile portion is authorized in CoC Section 5.(b)(2).</p> <p>This oxide mixture is identified in SAR Section 1.2.3 (HEU Oxide).</p> <p>Loadings given in Tables 1.3 and 6.2a for oxide are applicable for ground transport of this material.</p>	<p>Air transport of this mixture is not currently authorized in the CoC.</p> <p>SAR Tables 1.3a and 6.2b (footnote b) provide a reduced loading limit for air transport. Calculations for U<sub>3</sub>O<sub>8</sub>-Al demonstrate that TRIGA fuel loading limits are applicable.</p> <p>Discussion in SAR Section 6.7.2, 8th para. Data in Tables 6.9.3.1-4c and 6.9.6-22c.</p>

## Cross-Reference of New Research Reactor Contents to Current Authorized Contents

Proposed Research Reactor Contents	How the content is addressed in the CoC and SAR	
	Ground	Air
<b>Broken HEU metal</b>	<p>This material is currently authorized for ground transport in CoC section 5.(b)(1)(ii), Table 2.</p> <p>This form of metal is discussed in SAR Sections 1.2.3 (HEU Metal and Alloy), 6.4.2, 6.5.2, 6.6.2. Table 6.1c gives Keff values and specific case names. Infinite array, NCT packaging case results are limiting (see Table 6.9.6-11).</p> <p>Loadings given in SAR Tables 1.3 and 6.2a for broken metal are applicable for ground transport of this material.</p>	<p>Air transport of HEU broken metal is not currently authorized in the CoC.</p> <p>Based on calculations in the SAR, SAR Tables 1.3a and 6.2b (footnote a) provide a reduced loading limit for air transport.</p> <p>Discussions in SAR Sections 6.7.1 and 6.7.3. Data in Tables 6.9.6-21 and 6.9.6-23.</p>
<b>Broken HEU-Al alloy</b>	<p>This material is currently authorized for ground transport in CoC section 5.(b)(1)(ii), Table 2.</p> <p>This form of metal is discussed in SAR Sections 1.2.3 (HEU Metal and Alloy), 6.2.4(6), 6.3 - 2nd para., 6.4 - 3rd para., 6.4.1 - 8th para., 6.5.1 - 4th para., and 6.6.1 - 3rd para.</p> <p>Loadings given in SAR Tables 1.3 and 6.2a for broken alloy are applicable for ground transport of this material.</p>	<p>Air transport of HEU-Al broken alloy is not currently authorized in the CoC.</p> <p>Based on calculations in the SAR, SAR Tables 1.3a and 6.2b (footnote a) provide a reduced loading limit for air transport.</p> <p>Discussions in SAR Sections 6.7.1 and 6.7.3, 5th paras. Data in Tables 6.9.6-21 and 6.9.6-23.</p>
<b>U-Al fuel elements and components-clad</b>	<p>This material is not currently authorized for ground transport in the CoC.</p> <p>This material is discussed in SAR Sections 1.2.3 (Research Reactor Fuel Elements and Components) and 6.4.1 - 8th para. Treated the same as broken HEU-Al alloy.</p> <p>This material is equivalent in loading to broken metal or alloy listed in SAR Tables 1.3 and 6.2a for ground transport.</p>	<p>Air transport of this fuel is not currently authorized in the CoC.</p> <p>SAR Tables 1.3a and 6.2b (footnote a) provide a reduced loading limit for air transport. Treated the same as broken metal alloy.</p> <p>Discussions in SAR Sections 6.7.1 and 6.7.3 - 5th paras.</p>
<b>U<sub>3</sub>O<sub>8</sub>-Al fuel elements and components-clad</b>	<p>This material is not currently authorized for ground transport in the CoC. Similar configurations (TRIGA fuel) are authorized in CoC Section 5.(b)(4).</p> <p>This material is discussed in SAR Section 1.2.3 (Research Reactor Fuel Elements and Components).</p> <p>This material is equivalent in loading to HEU oxide listed in SAR Tables 1.3 and 6.2a for ground transport.</p>	<p>Air transport of this fuel is not currently authorized in the CoC.</p> <p>SAR Tables 1.3a and 6.2b (footnote b) provide a reduced loading limit for air transport. Calculations for U<sub>3</sub>O<sub>8</sub>-Al demonstrate that TRIGA fuel loading limits are applicable to U<sub>3</sub>O<sub>8</sub>-Al.</p> <p>Discussion in SAR Section 6.7.2, 8th para.</p>

**Cross-Reference of New Research Reactor Contents to Current Authorized Contents**

<b>How the content is addressed in the CoC and SAR</b>		
<b>Proposed Research Reactor Contents</b>	<b>Ground</b>	<b>Air</b>
<b>UO<sub>2</sub> fuel elements and components-clad</b>	<p>This material is not currently authorized for ground transport in the CoC. Similar configurations (TRIGA fuel) are authorized in CoC Section 5.(b)(4).</p> <p>This material is discussed in SAR Section 1.2.3 (Research Reactor Fuel Elements and Components).</p> <p><i>This material is equivalent in loading to HEU oxide listed in SAR Tables 1.3 and 6.2a for ground transport.</i></p>	<p>Air transport of this fuel is not currently authorized in the CoC.</p> <p>SAR Tables 1.3a and 6.2b (footnote b) provide a reduced loading limit for air transport. Calculations for UO<sub>2</sub> demonstrate TRIGA loading limits are applicable to UO<sub>2</sub>.</p> <p><i>Discussion in SAR Section 6.7.2, 9th para.</i></p>
<b>UO<sub>2</sub>-Mg fuel elements and components-clad</b>	<p>This material is not currently authorized for ground transport in the CoC. Similar configurations (TRIGA fuel) are authorized in CoC Section 5.(b)(4).</p> <p>This material is discussed in SAR Section 1.2.3 (Research Reactor Fuel Elements and Components).</p> <p>This material is equivalent in loading to HEU oxide listed in SAR Tables 1.3 and 6.2a for ground transport.</p> <p><i>The Mg in this content is sealed within intact cladding, thus no pyrophoric restrictions are imposed.</i></p>	<p>Air transport of this fuel is not currently authorized in the CoC.</p> <p>SAR Tables 1.3a and 6.2b (footnote b) provide a reduced loading limit for air transport. Calculations for UO<sub>2</sub>-Mg demonstrate that TRIGA fuel loading limits are applicable to UO<sub>2</sub>-Mg.</p> <p><i>Discussion in SAR Section 6.7.2, 9th para.</i></p> <p><i>The Mg in this content is sealed within intact cladding, thus no pyrophoric restrictions are imposed.</i></p>