



**Department of Energy**  
Washington, DC 20585

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Mr. John McKirgan, Chief  
Spent Fuel Licensing Branch  
U.S. Nuclear Regulatory Commission  
Office of Nuclear Material Safety and Safeguards  
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Dear John McKirgan:

The U.S. Department of Energy (DOE) requests a simple content amendment of NRC Certificate of Compliance (CoC) 9330 for the Model ATR FFSC (NRC Docket 71-9330), no later than May 3, 2019. An amendment to the CoC is necessary to transport experimental loose fuel plates to be irradiated in Belgium as part of DOE's Office of Materials Management and Minimization program.

Several experimental loose fuel plates have been designed in the effort to convert the High Flux Isotope Reactor (HFIR) research reactor from using highly enriched uranium (HEU) fuel to low enriched uranium (LEU) fuel. The four plates and their abbreviations are given in the following table:

<b>Fuel Plate Name</b>	<b>Abbreviation</b>
FUTURE-HFIR Mono	FUTURE-HFIR Mono
FUTURE-HFIR U <sub>3</sub> Si <sub>2</sub> Curved Profile (IFE-ALT1)	FUTURE-HFIR IFE-ALT1
FUTURE-HFIR U <sub>3</sub> Si <sub>2</sub> (IFE) THIN	FUTURE-HFIR IFE THIN
FUTURE-HFIR U <sub>3</sub> Si <sub>2</sub> (OFE) THICK	FUTURE-HFIR OFE THICK

The Small Quantity Payload (SQ) category is described in Section 1.2.2.4 of the ATR FFSC Safety Analysis Report (SAR), Revision 14. The SQ payload category includes a class of research and development plate-type fuels with U-235 as the fissile isotope. The bounding U-235 quantity is  $\leq 400$  g with an enrichment of  $\leq 94\%$ . The following considerations demonstrate why the four loose fuel plate types may be shipped in the ATR FFSC package under the Small Quantity payload category by comparing their key physical and nucleonic characteristics to payload descriptions currently authorized in Section 5.(b)(1) of the NRC CoC, Revision 12.

All of the FUTURE-HFIR loose plate types have a construction similar to the other loose plates authorized by the CoC, having a central fuel region (sometimes called the “meat”), completely surrounded by aluminum alloy cladding. All FUTURE-HFIR shipments shall use the Small Quantity Fuel Handling Enclosure (SQFHE).

The first fuel type, FUTURE-HFIR Mono, is bounded by the U-Mo foils sub-category, which is given in Section 5.(b)(1), paragraph 10 of the CoC as follows:

*U-Mo Foils. The U-Mo foils are composed of uranium molybdenum alloy in an aluminum-silicon matrix or uranium molybdenum alloy and may contain a zirconium coating. The uranium is enriched to a maximum of 94 weight percent U-235. The maximum mass of U-235 is 160 grams. More than one U-Mo foil type may be transported at a time. The U-Mo foils must be contained within the Small Quantity Payload Fuel Handling Enclosure, as specified in 5.(a)(3).*

The comparison of the Mono fuel to the CoC paragraph is shown in the following table. Note that U-Mo foils is a loose plate sub-category.

Fuel Designation	Fuel alloy & matrix	Enrichment	Mass U-235
FUTURE-HFIR Mono	U-Mo, U-10Mo matrix, zirconium coating	≤ 20%	22.58g max. per plate
NRC CoC, Section 5.(b)(1), para 10	...uranium molybdenum alloy in an aluminum-silicon matrix or uranium molybdenum alloy and may contain a zirconium coating.	≤ 94%	160g maximum in this category

The other three fuel types (FUTURE-HFIR IFE-ALT1, FUTURE-HFIR IFE THIN, and FUTURE-HFIR OFE THICK) are bounded by the COBRA loose fuel element plates sub-category, which is given in Section 5.(b)(1), paragraph 15 of the CoC as follows:

*COBRA loose fuel element plates: COBRA loose plates may either be flat or rolled to the geometry required for assembly into the fuel element and may be taped or wire-tied together. The U-235 content per COBRA loose plate is variable and may be HEU or LEU, but the total payload is limited to 400 grams of U-235. COBRA loose plates are transported as Small Quantity Payloads.*

The comparison of these fuels to the CoC paragraph is shown in the following table.

Fuel Designation	Fuel alloy & matrix	Enrichment	Mass U-235
FUTURE-HFIR IFE-ALT1	U <sub>3</sub> Si <sub>2</sub> – Al dispersion	≤ 20%	19.00g max. per plate
FUTURE-HFIR IFE THIN			9.07g max. per plate
FUTURE-HFIR OFE THICK			24.77g max. per plate
NRC CoC, Section 5.(b)(1), para 15	Fuel alloy and matrix is not specified. (Of note, Section 5.(b)(1), para 9 states that COBRA LEU fuel is U <sub>3</sub> Si <sub>2</sub> dispersed in aluminum powder.)	...may be HEU or LEU...	400g maximum in this category

As shown in these two tables, the four specified FUTURE-HFIR loose plate types are bounded by existing Small Quantity payload loose plate categories, and can be added to CoC 9330 without additional structural, thermal, shielding, or criticality analyses.

Specifically, DOE requests the following changes to Revision 12 of CoC 9330:

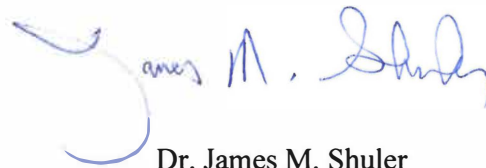
- 5.(b)(1), 5<sup>th</sup> paragraph, change the first line to read: “Small Quantity Payloads (RINSC fuel elements, GRR-1 fuel elements, ATR Full-size plate In Flux Trap Position (AFIP) elements, U-Mo foils, Design Demonstration Elements (DDEs) and similar test elements, MIT, COBRA or MURR loose fuel element plates, and FUTURE-HFIR loose plates)...

- 5.(b)(1), 10<sup>th</sup> paragraph, add the following sentence to the end of the paragraph: “This category includes FUTURE-HFIR Mono loose plates.”
- 5.(b)(1), 15<sup>th</sup> paragraph, add the following sentence to the end of the paragraph: “This category includes FUTURE-HFIR IFE-ALT1, FUTURE-HFIR IFE THIN, and FUTURE-HFIR OFE THICK loose plates.”

Due to the simple nature of this change, DOE requests CoC 9330 be amended based on this letter and in lieu of a revision to the SAR.

The May 3, 2019 need date is based on the shipping schedule of the plates to the BR-2 reactor in Belgium in support of the reactor conversion program, and the time needed for Competent Authority approval by DOT and the Belgian authorities.

If you have any questions or need more details please call at 301-903-5513 or [james.shuler@em.doe.gov](mailto:james.shuler@em.doe.gov).



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