



IAEA/ANL
Interregional Training Course



**Technical and Administrative Preparations
Required for Shipment of Research Reactor
Spent Fuel to Its Country of Origin**

Argonne National Laboratory
Argonne, IL
13 - 24 January 1997

Lecture L.3.1a

**Savannah River Site Appendix A Agreement
Preparation Guidelines**

Sample Appendix A for Generic MTR Assembly

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**APPENDIX A AGREEMENT
SPENT NUCLEAR FUEL ACCEPTANCE CRITERIA**

No. _____ UNDER CONTRACT NO. _____
WITH _____

THIS AGREEMENT, entered into this _____ day of _____, 19____, constitutes an agreement by the U.S. Department of Energy (hereinafter called DOE) to receive under the terms and conditions of Contract No. _____, the specification material described herein. This agreement provides a detailed description of the material to be delivered to DOE in accordance with this contract and also enumerates the specifications and requirements which the Customer must meet. Failure of the material delivered hereunder to comply with the specifications and requirements given in this agreement will result in the material being non-specification material. A separate Appendix A Agreement will be required for each element or assembly which is different in Description. All dimensions must be given in centimeters and all weights in grams.

A. Correspondence

1. Customer Contact

Laboratory/ Research Center/University	Savannah River Site
Reactor Name	Material Test Reactor
City, State, Country	Aiken, SC, USA
Customer Name	Trent C. Andes
Customer Signature	
Title	Reactor Manager
Phone Number	803-557-9483
Fax Number	803-557-9080
Date	06 January 1997

2. Department of Energy Contact

All correspondence / inquiries regarding this document and the information contained herein shall be directed to:

U.S. Department of Energy
Savannah River Operations Office
Spent Fuel Storage Division
P.O. Box A
Aiken, SC 29801

Phone and facsimile inquiries may be made to:
Phone: (803)-557-3759
Fax: (803)-557-3763

B. Definitions

The following definitions are applied to the Specification Material described in this Agreement:

Fuel Element -The smallest integral unit of clad fuel containing source or special nuclear material (e.g., plate, tube, rod, disc, etc.).

Assembly - A group of elements combined in a structural unit. The assembly is usually that fuel structure which is removed from the reactor as an individual unit.

C. Form and Composition of Specification Material

1. Drawing Identification

The following design or fuel fabrication drawing(s), six (6) copies of which are attached and which are incorporated herein by reference thereto, constitute(s) a comprehensive and accurate illustration of the fuel elements and assemblies to be delivered under this Contract.

Drawing No. / Rev. No. / English Title
5001 / A / 19 Plate MTR Assembly
5002 / A / Type 8 Fuel Plate (Flat)
5003 / A / Type 8 Fuel Plate (Formed)
5004 / A / Type 9 Fuel Plate (Flat)
5005 / A / Type 9 Fuel Plate (Formed)
5006 / A / Fuel Compact - Enriched, Type 8 and Type 9
5007 / A / Side Plate
5008 / A / End Box

Note: If fuel is cropped (cut), drawings should indicate the location of the cut(s).

2. Material Description

The following tables summarize the description of fuel elements and assemblies to be delivered under this contract. Where dimensions are required, the nominal dimensions from the fuel element and assembly drawings must be used. If changes in dimensions have occurred due to cropping or other modification, the best estimate of the maximum change in these dimensions must be given. Weights must be dry, unirradiated weights . Where isotopic weights of SNM are required, tolerances shall be specified.

(a.1) Fuel ‘Element’ Description (If more than one type of element per assembly, divide the space to describe each type of element or duplicate this page as necessary.)

Fuel element type (curved or flat plate, tube, rod, disc, etc.)	curved plate (Type 9, outer)
Nominal dimensions (include clad & bond, cm) ^a	68.90 x 7.10 x 0.164
Nominal dimensions of fuel meat (cm) ^{a, b}	59.79 x 6.24 x 0.05
Nominal total weight of fuel element (g)	227.0
Chemical form of fuel meat (e.g. UAl _x -alloy, U ₃ O ₈ -Al, U ₃ Si ₂ -Al, etc.)	U ₃ O ₈ in Aluminum matrix
Nominal total weight of fuel meat (g)	62.0
Weight of total U (g ± g uncertainty)	12.45 ± 0.27
Weight of U-235 (g ± g uncertainty)	11.58 ± 0.25
Matrix material, weight (g)	101 Al powder; 47.0
Cladding material & method of sealing	6061 Al; roll-bonded
Clad thickness (cm), total clad weight (g)	0.057; 165.0
Bonding material, if any (Na, Al-Si, etc.)	N/A
Bond thickness (cm), weight (g)	N/A
Other materials contained in the fuel element: (include dimensions and weights)	N/A

(a) For curved plate type element, state dimensions for flat form.

(b) As formed in element.

(a.2) Fuel 'Element' Description (If more than one type of element per assembly, divide the space to describe each type of element or duplicate this page as necessary.)

Fuel element type (curved or flat plate, tube, rod, disc, etc.)	curved plate (Type 8, inner)
Nominal dimensions (include clad & bond, cm) ^a	62.55 x 7.10 x 0.1275
Nominal dimensions of fuel meat (cm) ^{a, b}	59.79 x 6.24 x 0.05
Nominal total weight of fuel element (g)	164.0
Chemical form of fuel meat (e.g. UAl _x -alloy, U ₃ O ₈ -Al, U ₃ Si ₂ -Al, etc.)	U ₃ O ₈ in Aluminum matrix
Nominal total weight of fuel meat (g)	62.0
Weight of total U (g ± g uncertainty)	12.45 ± 0.27
Weight of U-235 (g ± g uncertainty)	11.58 ± 0.25
Matrix material, weight (g)	101 Al powder; 47.0
Cladding material & method of sealing	6061 Al; roll-bonded
Clad thickness (cm), total clad weight (g)	0.039; 102.0
Bonding material, if any (Na, Al-Si, etc.)	N/A
Bond thickness (cm), weight (g)	N/A
Other materials contained in the fuel element: (include dimensions and weights)	N/A

(a) For curved plate type element, state dimensions for flat form.

(b) As formed in element.

(b) Fuel ‘Assembly’ Description

Total number of elements	19 plates (2 outer, 17 inner)
Over-all dimensions (cm) ^a	108.27 x 8.35 x 7.61
Over-all weight (g)	6026.8
Total weight of U (g ± g uncertainty)	236.55 ± 5.13
Total weight of U-235 (g ± g uncertainty)	220.02 ± 4.75
Enrichment (%)	93.01
Canning material (Al, SST) ^b	N/A
Canning dimensions (cm), weight (g)	N/A
Method of can sealing (screw, weld, etc)	N/A
Side plate material	6061-T6 Al
Side plate - quantity, dimensions (cm), weight per plate (g)	2; 68.9 x 8.05 x 0.475; 580
Side plate - outer slot depth & width (cm)	0.22; 0.18
Side plate - inner slot depth & width (cm)	0.22; 0.14
Spacer material	N/A
Spacer - quantity, dimensions (cm), weight per spacer (g)	N/A
End box material	356.0-T6 Al alloy (ASTM B-26)
End box - quantity, dimensions (cm), weight per box (g)	2; 20.88 x 7.41 x 7.24; 760.0
Braze or weld material	N/A
Braze or weld dimensions (cm), weight (g)	N/A
Other structural material in assembly (e.g. dummy plates, thermocouples, etc., include quantity, dimensions, material, & weight (g))	Pins, 8, 6mm x 8mm, Al-Mg-Si, 0.6

(a) Has the assembly been cropped? Yes No (Circle One) If yes, indicate dimensions & weights in terms of the cropped assembly

(b) When fuel assemblies have casings, describe using these entries.

Do the fuel elements contain Sodium (Na)? Yes No (Circle One)

D. Fuel Identification

Each separately removable unit in a shipment batch must be identified by a durable tag or by embossing. Identification of the Units to be delivered under this Appendix A Agreement are as follows (**NOTE: Customer shall list actual assembly identification numbers**):

L-006, -007, -008, -009, -010, -013, -014, -015, -016, -017, -018, -019, -020, -021

Identification numbers are vibro-etched into two opposing sides of each assembly.

E. Fuel Irradiation Specifications

1. Fuel Irradiation History - General Summary

Irradiation history varies for each assembly. Post irradiation data was generated using ORIGEN.

2. Post-Irradiation Specifications

The average and maximum SNM content post-irradiation is to be specified in grams per assembly. The best available value should be given and the uncertainty stated. The irradiation history for each assembly is to be provided according to Section F.

SNM Material	Average (g)	Maximum (g)	Uncertainty (± g or ± %)
Total U	161.40	163.21	± 5%
Total Pu	0.35	0.38	± 5%
Total Np	0.25	0.29	± 5%
Total Th			
U-232			
U-233			
U-235	132.37	135.14	± 5%
U-236	13.62	14.79	± 5%
Pu-239	0.27	0.29	± 5%
Pu-241	0.02	0.02	± 5%

G. Specifications for Failed/Warped Fuel Units

- Fuel elements or assemblies distorted beyond specified dimensional limits must be considered on an individual basis. The Customer should provide DOE with complete dimensional information for each failed/warped unit at least 120 days before delivery.
- If material normally removed from the element or assembly by the Customer cannot be removed due to fuel failure, warpage, or other reasons, the Customer must notify DOE at least 270 days before delivery giving complete dimensional, material, and weight information. Detailed structural drawings are also required by DOE.

H. Cask and Basket Identification

The fuel being received under this Appendix A contract must be identified with a specific cask and basket type.

Cask	Basket	Number of Assemblies/Cask
LWT	(2) 7 Square	14