



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
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Lecture L.3.2a

**TRIGA Fuel Classification
Spent Nuclear Fuel Transfer Data Form**

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Appendix A Spent Nuclear Fuel Transfer Data Form

This form defines the data required for transfer of Spent Nuclear Fuel (SNF) of United States origin to and within the Idaho National Engineering Laboratory (INEL). Questions on this form may be directed to

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1.0 General Information

1.1 Fuel Manufacturer and Irradiation Source

Fuel Name and Type _____
Fuel Producer _____
Reactor Name _____
Location _____
Contact Name _____
Phone _____
Fax _____
E-mail _____

1.2 Drawings and Physical Description of Fuel Assemblies

- Detailed drawings (most current drawings, indicating revision number and date) and list of materials. Describe any deviations from the drawings, Include documentation providing traceability from the drawings to the fuel elements to be shipped. The following information should be obtainable from the drawings:

- a. Total length
- b. Length of fueled portion and specific location
- c. Position of fueled portion with respect to a permanent reference point on the element
- d. Cross-sectional dimensions
- e. Shape (plates, rod, etc)
- f. Presence of plenum spacers or springs
- g. Configuration of element as shipped, including cuts made to prepare for shipping, configuration after shipping (loose plates, subassembly, etc.), and any hardware added to the fuel including handling fixture or can.

-Weights (Kg/element)*

Fuel _____
Cladding _____
Fittings, etc _____
Element Total _____

* breakdown of weights may vary depending on type of SNF. Define weight category.

1.3 Description of Shipping Process

1. Identify the packaging (cask) and transport vehicle to be used.
2. Furnish 2 copies of the Safety Analysis Report For Packaging (SARP), including the Shipping Package Transport Plan if applicable, and Certificate of Compliance or Competent Authority.
3. Describe the poison, poison inserts or spacing insert necessary for shipping and furnish certificate of integrity.
4. Furnish packaging decontamination procedures or precautions.
5. Furnish certification and verification of the integrity of the package lifting trunnions, devices and fixtures.
6. Provide 2 copies of reproducible detailed drawings of the packaging which indicate:
 - a. Dimensions
 - b. Weights
 - c. Surface finish (i.e., roughness, painting, coating, etc)
 - d. Materials of construction
7. Provide 2 copies of reproducible detailed drawings of the package handling devices required:
 - a. Type of load bar
 - b. Special lid removal tools, provide size and description of lid bolts.
 - c. Special fuel removal tools
8. Provide 2 sets of 8" x 10" photos of the package.
9. Furnish tie-down configuration of the package to the transport vehicle.
10. List all package handling equipment and provide a description. Provide load test documentation of all equipment provided by the shipper to be used by the Idaho Chemical Processing Plant (ICPP).
11. Provide a copy of loading and handling procedures

2.0 Description of Pre-Irradiated Fuel

2.1 Fuel Material (For each Fuel Type)

Fuel Type (rod, pellet, etc.) _____
Chemical Form and Fabrication Process (UZrHx, UO2, etc.) _____

SNF fissile inventory (U-235, Pu-, Th, etc), material & weight*, % enrichment

Mat #1 _____ Weight _____ % _____ Uncertainty _____

Mat #2 _____ Weight _____ % _____ Uncertainty _____

etc. (attach sheets as necessary, and utilize Table A-1 - attached)

Fuel additives (alloys, organics, poisons, etc), weight

Mat #1 _____ Weight _____

etc (attach sheets as necessary)

*Define weight applicability, i.e. per element, total, etc.

2.2 Cladding

Cladding material (Zr, Al, etc.) _____

Cladding thickness (mm) _____

2.3 Other Materials

Material _____ Weight _____ Characteristic _____
Material _____ Weight _____ Characteristic _____
etc.

3.0 Post-Irradiation Data

3.1 Thermal and Radiological Status

Unit Identification (ID #) _____ (For multiple units, use Table A.1 - attached)
Unit Burnup (mwd/mtu) _____ (specify isotope content and heat load if available)
Burnup History of Fuel _____ (Attach Power History)
Date of Last Criticality _____

Listing of Isotopes contributing top 95% of Radiation
With the above information, and the information from 1.2, 2.2, and 2.3, an input model shall be provided for ORIGEN to produce the isotopic and fission product inventory, radiation level, and heat load of the unit as a function of time. The shipper shall work with the receiver to determine specific output required from the model prior to final shipment and receipt of fuel.

If the above information is not available, shipper will define an experimental, or experimental and calculational, procedure that is satisfactory to the receiver to produce required data (isotopes, fission products, radiation, and heat load).

3.2 Physical Condition of the Fuel Elements: Describe the physical state of the fuel assemblies as shipped, with special note of any warpage and leakers within the shipment. Include pictures, videos and estimated cladding corrosion based on water chemistry. _____

3.3 Description of Recanned Fuel (If applicable)

1. Detailed drawings (most current drawings, indicating revision number and date) and list of materials. Describe any deviations from the drawings.
2. Dimensions (cm)
 - a. Total length
 - b. Cross-sectional dimension
3. Weight (g)
 - a. Empty
 - b. Maximum loaded
4. Density of each loaded canister
5. Provide a design analysis of the canister to include
 - a. Identity and purpose of all penetrations
 - b. Thermal analysis of can and contents

- c. Integrity test results agreed upon by ICPP
 - d. Could the can build up pressure? State the maximum allowable pressure on sealed can.
 - e. Drop test results, including extent of damage
 - f. Other test reports
 - g. Material certification papers for can and seal
6. Describe the conditions under which canned (wet, dry, etc)
 7. Identify any extraneous material associated with the container or its contents:
 - a. pyrophoric or reactive material
 - b. inert materials
 - c. organic materials
 - d. other (specify)
 8. Has the can been backfilled with an inert gas? List gas and pressure.
 9. How are the contents of the can verified? (on site inspection or approved alternate).
Provide photographs of contents if available.
 10. Describe the distribution of the fuel over the length of the can.
 11. Describe expected gas generation rates within the can.

4.0 Supporting Documentation

4.1 Documentation on Fuel Criticality and Radiation Level

- 1. Shipper will provide a report verifying criticality safety of the fuel shipment in its as-shipped configuration**
- 2. Shipper will provide report defining radiation levels of fuel shipment at distance of one (1) meter.**
- 3. Shipper will provide list of material to be shipped/stored identified by their permanent identification tag/embossing.**

4.2 Shipment Documentation (Months prior to acceptance)

I. General Information

- 1. Name of Shipping Agent (9)**
- 2. Name and information on domestic freight forwarder - if any. (9)**
- 3. 24 hr. emergency contact: name, telephone, address, fax. (3)**
- 4. List of intermediate consignees (3)**
- 5. Modes of transportation and routes (6)**
- 6. Way Bill, Uniform Bill of Lading (3)**
- 7. IAEA Safety Series 6 Documentation (6)**
 - a. Security Plan**
 - b. Shippers Training and Safety**
 - c. Emergency Response Plan**
 - d. Cask Recovery Plan**
 - e. Inspection Plan/Policy**
- 8. Export and Import documents per IAEA and USA requirements (3)**
- 9. Declaration of insurance or self insurance for developed countries (3)**
- 10. Certificate of Seaworthiness for any vessel used for transportation (3)**
- 11. Commercial Vehicle Safety Alliance Inspection Plan/Policy -for truck shipments (3)**
- 12. Results of radiation & contamination surveys prior to departure and upon transloading**

II. Schedules

- 1. Date of cask loading (6)**
- 2. Date of transport to port of embarkation (9)**
- 3. Date of ship departure (6)**
- 4. Date of arrival in USA port of debarkation (6)**
- 5. Date of arrival at INEL (6)**

III. INEL Operations Requirements

- 1. Concurrence on cask dimensional acceptance limitations (9)**
- 2. Receive description of cask handling devices (9)**
- 3. USDOE provides Category III Physical Security requirements (8)**
- 4. Shipper documents that Category III Physical Security requirements have been met (4)**
- 5. Shipper provides ongoing documentation of security/tamper proof seal inspections**

