



**IAEA/ANL**  
**Interregional Training Course**



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

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**Lecture L.2.1c**

**Nuclear Material Accountability**

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# **Nuclear Material Accountability**

presented by

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# Topics

1. Safeguards
2. Materials Control
3. Materials Accountability

Objective: To meet U.S. and International safeguards requirements and to be compatible with receipt criteria at the Idaho National Engineering Laboratory

## **Safeguards**

Establish physical protection, material accounting, and material control to deter, prevent, detect, and respond to unauthorized possession, use, or sabotage of nuclear material.

## **Vision: Safeguards**

1. Ensure that the Foreign Research Reactor (FRR) material delivered to the Idaho National Engineering Laboratory (INEL) is the same material that left the reactor.
2. Ensure that nuclear material transfer records are complete and accurate.

# **Materials Control and Accountability for FRR Material, Packaging and Cask Loading**

1. Provide material inventory control.
2. Provide accounting records.
3. Uniquely identify each TRIGA item.
4. Maintain controls using seals, monitoring or both.

# Physical Inventory Control

1. Characterize the material (content, weight, description, containers ...)
2. Determine material content by direct measurements.
  - ↳ Nondestructive Assay (NDA) if practical.
  - ↳ Use statistical methods to reduce costs while keeping high confidence.
3. Calculate content based on history, burn-up, manufacturer's data (TRIGA).

## **Material Accountability**

Verify that U-235 is present and that enrichment is consistent with calculated values.

1. Provide physical description of each item.
2. Provide unique identification numbers for each item and container.



## What is Needed

IAEA, reactor operator inventory such as ...

- Container descriptions, serial numbers.
- Fuel history.
- Number of elements and containers.
- Weight of material, containers.
- Nuclear isotopic information.

# **Nuclear Material Transaction Report**

*(This form is also called the Form 741)*

1. Needed for Batch Transfer from IAEA to U.S. Identifiers (in accordance with U.S. DOE requirements and U.S. Codes of Federal Regulations).
2. Reporting Identification Symbols (RIS), Names and Addresses, License Numbers.
3. Conversions between IAEA and U.S. identification numbers.

## Form 741 Example

A blank copy of the Form 741 has been included in your handouts.

1. The term SHIPPER (blocks 1, 5, 7, and so forth) refers to the REACTOR FACILITY, not the transporter or carrier.
2. Blocks 1, 9A, 12, 13B, 15, 16A, 16B, 20 (date of shipment), 22, 24C (identification), and 24 I (owner code) must be provided at the point of origin ... shipper site.

## Summary

We have covered:

1. MATERIALS CONTROL assurance that no diversion or theft occurs. It includes seals, observation, descriptions of material and containers, times, dates, people involved.
2. MATERIAL ACCOUNTABILITY ledgers, accounting records, calculations, field notes ...
3. PHYSICAL PROTECTION seals, package locks, electronic monitors, *et cetera* used to ensure that material is identified and retained under constant control.