AIR SHIPMENT OF SPENT NUCLEAR FUEL FROM ROMANIA TO RUSSIA

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Introduction

29 June 2009

An important date for two events:

1. **World's first air shipment of spent nuclear fuel in Type B(U) casks**
   - Under existing international laws
   - Without shipment license special exceptions

2. **Romania completed removal of all highly enriched uranium (HEU)**

- **This presentation describes:**
  - GTRI and RRRFR Programs
  - Air shipment preparations
  - Legal framework
  - Air shipment licensing steps

GTRI and RRRFR Programs

- **GTRI: Global Threat Reduction Initiative**
  - Managed by the United States Department of Energy National Nuclear Security Administration (NNSA)
  - Mission: Help reduce and protect vulnerable nuclear and radiological material at civilian sites worldwide
- **RRRFR: Russian Research Reactor Fuel Return Program**
  - One part of GTRI
  - Mission: Assist the transfer of Russian-origin HEU research reactor fuel from participating countries to the Russian Federation (RF)
  - Works closely with the International Atomic Energy Agency (IAEA) and the Rosatom State Atomic Energy Corporation (Rosatom)
  - By May 2010: transported more than 1339 kg HEU to Russia

Romania Participation in GTRI and RRRFR

- 2003: Shipped HEU fresh fuel to Russia
  - 2nd RRRFR country to ship HEU
- 2008: Shipped US-origin HEU under GTRI
- 2009: Shipped all remaining HEU to Russia under RRRFR
  - SCN Pitesti shipped HEU fresh fuel
  - IFIN-HH shipped HEU spent fuel
  - 3rd RRRFR country and 14th GTRI country to eliminate all HEU
- All activities were managed by the National Commission for Nuclear Activities Control (CNCAN)
- Facility operations were performed by
  - The Institute for Nuclear Research (SCN Pitesti)
  - The Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH)

HEU Quantities Shipped Under RRRFR

Date	Type	Quantity (kg)		Description
30 September 2003	Fresh	14.3	44.4	150 type C-36 fuel rods (36.6% enriched)
28 June 2009	Fresh	30.1		182 uranium metallic fuel pellets (20.1% enriched)
29 June 2009	Spent	23.7		70 type C-36 fuel assemblies (36.6% enriched)
Total HEU		**68.1**		**Shipped under RRRFR**

Note: This table shows all HEU shipped under the RRRFR Program. More HEU was shipped from Romania to the United States under the Foreign Research Reactor Spent Nuclear Fuel Program (FRRSNF), another GTRI program also managed by NNSA.

Air Shipment Preparations - Meetings

- **Project Planning Meetings**
  - 45 meetings in Romania, Russia, Bulgaria, United States, Austria and Luxembourg
  - To assure all international partners understood actions required
  - To assure compliance with IAEA, European Commission (EC), and Russian Federation regulations
  - Project took about 4-1/2 years of planning and preparations
- **Special focus meetings in Romania**
  - To assure compliance with international laws, IAEA guidelines, and EC regulations
  - To assure Romanian institutions were informed
  - Shared lessons learned with other RRRFR countries

Air Shipment Preparations – Transport Options

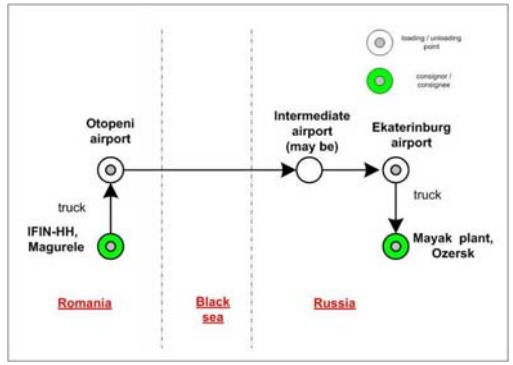
- A transport options study was conducted in 2005 to determine cask and transportation options
- Romania selected the Russian TUK-19 cask
- Initially planned to use rail shipment (Table 1, Option 1)
- Changed to air shipment in late 2006 (Option 4)

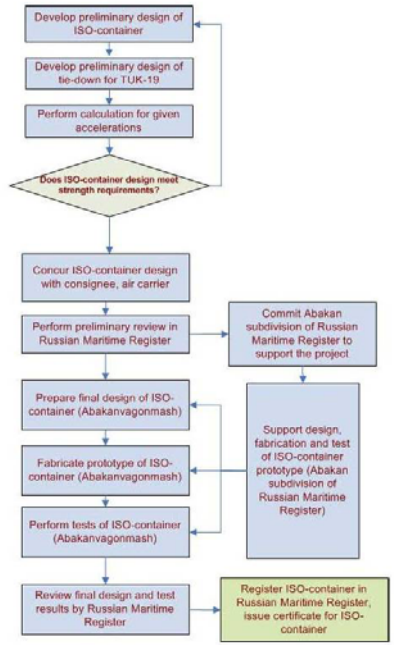
Table 1. Romania SNF Transport Options

Option	Transportation Modes
1	Terrestrial 1: Railway (Romania, Ukraine, Russia)
2	Terrestrial 2: Railway (Romania, Russia) + Danube River Barge (Romania, Ukraine)
3	Terrestrial 3: Railway (Romania, Russia) + Sea Vessel (Black Sea, Mediterranean Sea)
4	Air (Romania, Russia)

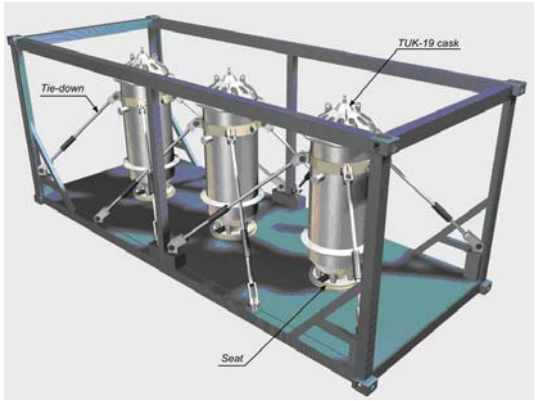
Air Shipment Preparations - Decision

- R&D Company Sosny proposed air shipment:
  - New regulations in IAEA TS-R-1 and Russian NP-053-04:
    - Allowed air shipment of spent fuel in Type B(U) casks if radioactive content is less than $3000A_2$
    - A_2 is the limit for specific isotopic values
    - Total Romanian HEU spent fuel was expected to be less than $3000A_2$
- Could transport in AN-124-100 commercial cargo aircraft
- Air route over Black Sea would avoid transit countries
- CNCAN and RRRFR agreed with the proposal





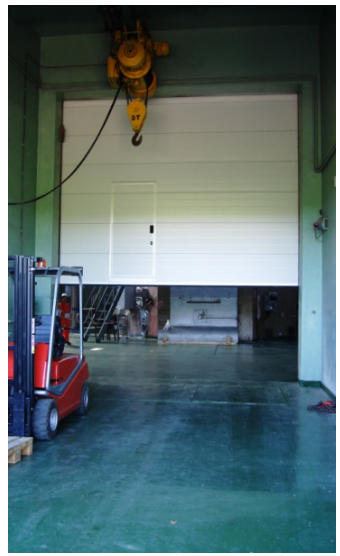
Air Shipment Preparations - Equipment



- Previously, only TK-5 railcars were licensed for shipment of TUK-19 casks
- Air shipment equipment was designed, fabricated, and certified in Russia:
  - ISO freight container
    - To hold 1, 2, or 3 TUK-19 casks
    - Structurally modified to secure casks and support cask weight
    - Standard size for easy handling
  - Cask tiedowns
    - Connects casks to ISO container floor
  - ISO containers and tiedowns were licensed for road, rail, water, and air transport
- Equipment meets international air transport requirements

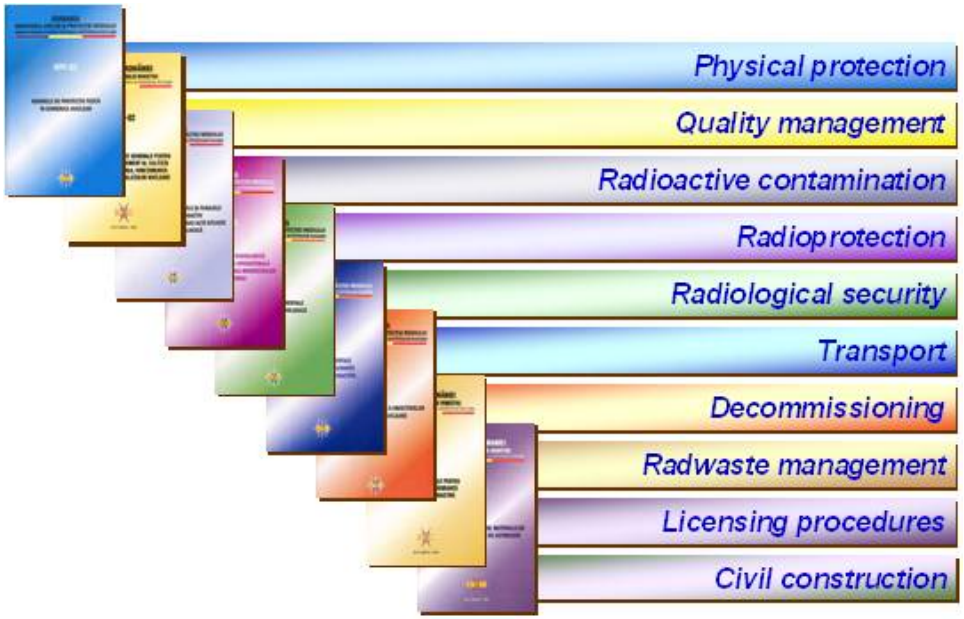
Air Shipment Preparations - Facility Modifications

- SCN Pitesti required no modifications
- The VVR-S research reactor required:
  - Reactor hall floor resurfacing with epoxy coating
  - Replacement of truck and personnel access doors
  - New cantilever crane for cask loading
  - Repaving of site access roads
  - Security upgrades



Legal Framework – Romania

- All activities within Romania complied with the regulatory framework defined by the *Law on Safe Deployment of Nuclear Activities*, No. 111/1996 republished
- CNCAN is the State Competent Authority for transportation of nuclear materials in Romania
- All activities were in compliance with CNCAN regulations on the topics shown in the figure and with other regulatory documents



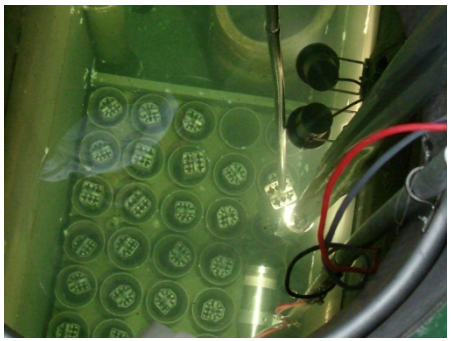
Legal Framework – Russian Federation

- All activities within Russia complied with the regulatory framework defined by:
  - Federal Law № 317, 01 December 2007,"*On the State Nuclear Energy Corporation "Rosatom"*;
  - Governmental Decree № 751, 15 September 2009, with Amendments to the Governmental Decree № 204, 19 March 2001, *"On the State Competent Authority for Nuclear and Radiation Safety in the Transport of Nuclear Materials, Radioactive Substances and Products Thereof"*;
  - Russian NP-053-04, "*Safety Regulations for Transportation of Radioactive Materials*," 2004
- Rosatom is the State Competent Authority on transportation of nuclear materials in Russia

Legal Framework – IAEA and EC

- The air shipment complied with IAEA guidelines and European Commission regulations, including:
  - IAEA TS-R-1, "*Regulations for the Safe Transport of Radioactive Material*"
  - The EURATOM Treaty
  - European Directive 2006/117 "*On the Supervision and Control of Shipments of Radioactive Waste and Spent Fuel*"
  - Council Regulation (EC) No. 1334/2000 "*Setting Up A Community Regime for the Control of Exports of Dual-use Items and Technology*"
  - Commission Recommendation 2008/956/Euratom of 4 December 2008 "*On Criteria for the Export of Radioactive Waste and Spent Fuel to Third Countries*"
  - Commission Regulation (Euratom) No 302/2005 of 8 February 2005 "*On the Application of Euratom Safeguards*"

Legal Framework – International



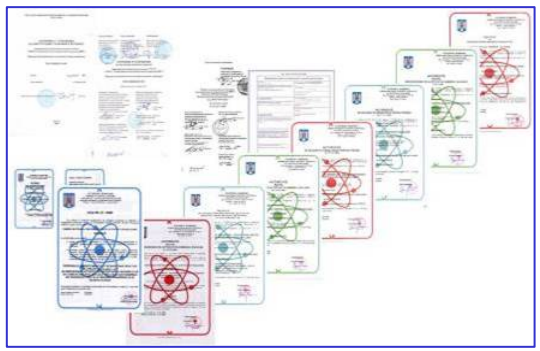
- International Conventions
  - Non-Proliferation Treaty
  - Convention on Physical Protection of Nuclear Material
  - Vienna Convention on Civil Liability for Nuclear Damage, as amended
  - Safeguards Agreement between Romania and IAEA
- Government-to-government agreements
  1. US-RF: *"Concerning Cooperation for the Transfer of Russian-produced Research Reactors Nuclear Fuel to the Russian Federation"*, 27 May 2004
  2. US-Romania: "*Concerning Cooperation in the Area of Countering the Proliferation of Nuclear Materials and Technologies*", 19 July 2004
  3. RF-Romania: "*Concerning Cooperation for the Transfer of Research Reactor Irradiated Nuclear Fuel to the Russian Federation*", 18 February 2009

Air Shipment Licensing Steps

1. Rosatom issued a combined B(U)F package design and shipment certificate for air shipment of the VVR-S spent fuel in TUK-19 casks
2. CNCAN reviewed the Russian package design and shipment certificate and issued a validation of type approval in compliance with TS-R-1 and CNCAN regulations
3. CNCAN issued transport authorizations for air and road carriers
4. CNCAN issued a spent nuclear fuel shipment certificate for road and air
5. Romania issued two Export Licenses: one from CNCAN and one from the National Agency for Control of Exports (ANCEX)
6. CNCAN approved a Quality Control Plan for the fabrication of cask loading equipment in Romania

Air Shipment Licensing Steps (2)

7. CNCAN approved a Radiological Safety Authorization for the cask loading equipment (transfer cask)
8. CNCAN approved a Radiological Safety Authorization for the air shipment ISO containers
9. CNCAN issued personnel licenses to IFIN-HH Management and operators
10. CNCAN approved a temporary reactor loading plan to reduce cask loading time
11. CNCAN issued a Spent Nuclear Fuel Loading Permit



Air Shipment

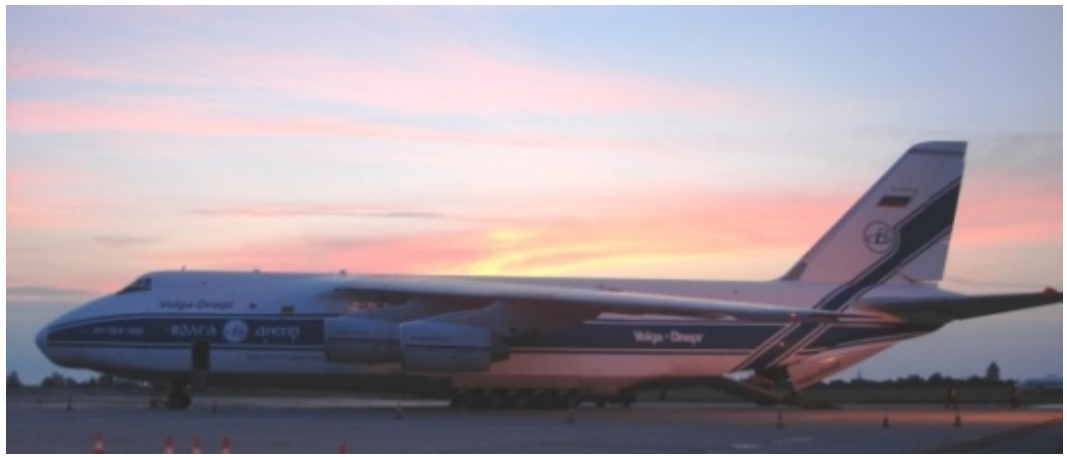
- 23.7 kg HEU
- 70 spent fuel assemblies
- 18 TUK-19 casks
- 6 ISO containers on 6 trucks
- Trucked from VVR-S reactor to the Bucharest airport
- Loaded into one AN-124-100 aircraft
- Flew to Ulyanovsk for refueling
- Flew to Yekaterinburg
- Air route avoided major population areas
- Trucked from airport to the Mayak facility

Organizations Involved

More than 23 organizations cooperated to make this shipment safe and successful:

Conclusion

- Romania became the world's first country to ship spent fuel by air in Type B(U) casks in accordance with new international laws and without special exceptions for the transport licenses
- Air shipment of the HEU spent fuel to Russia on 29 June 2009 was completed safely, securely, and on schedule
- Many international states and organizations cooperated for this success
- Romania demonstrated its commitment to nuclear nonproliferation
- **Romania is now free of all HEU**



Thank You For Your Attention