



Romania  
Ministry of Foreign Affairs

# Romanian Experience in Removal of Used Nuclear Fuel

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# A worldwide working hypothesis

- ❖ safety, security and peaceful use of nuclear energy
- ❖ **global nuclear renaissance**/ more than 50 countries announced recently plans to expand or introduce nuclear power
- ❖ **climate change**
- ❖ **a sustainable solution** for managing spent fuel and other nuclear wastes / *the back end of the nuclear fuel cycle*
- ❖ the goal is to have a small number of safely constructed and well secured storage and disposal facilities, in a timely fashion but
- ❖ the key issue is the expensive costs of the geological repositories for long lived radioactive wastes (high level radioactive wastes) i.e. tens of billions \$
- ❖ a temporary solution is to keep the spent fuel within interim storage facilities for decades,
- ❖ a safer and more secure option is for nuclear fuel suppliers to take back the spent fuel



# Removing Highly Enrichment Uranium (HEU) Spent Fuel

- ❖ HEU spent fuel can pose **a significant proliferation risk**,
- ❖ Research reactor fuel assemblies often remain very highly radioactive, even when "spent"; are often small and portable, in many cases are no longer radioactive enough to seriously deter a determined (and potentially suicidal) terrorist or thief,
- ❖ Thus **it is important to remove not only fresh HEU fuel but also spent HEU fuel, as well as from research reactors**, and to have highest levels of safety and security for both as long as they remain at these sites.



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# Objectives

- ❖ To **eliminate** from Romania the nuclear material available that could be used for nuclear weapons;
- ❖ To have **a concrete contribution** to the nuclear nonproliferation cooperation, NPT and IAEA, in particular for the benefits of the worldwide efforts to reduce and eliminate HEU from civilian use;
- ❖ To **repatriate all Russian-origin fresh HEU uranium fuel** by the middle of 2009;
- ❖ To **contribute to the IAEA** projects and activities associated with reducing the amount of HEU in international trade, supporting
  - ✓ The US Reduced Enrichment for Research and Test Reactors/ RERTR
  - ✓ The US Foreign Research Reactor Spent Nuclear Fuel Programme/ FRRSNF
  - ✓ THE Russian Research Reactor Fuel Return Programme/ RRRFR



# Relevant Milestones

- ❖ By **September 2003**, Romanian Government (through the National Commission for Nuclear Activities Control/ CNCAN) repatriated all foreign-origin fresh HEU from the two Nuclear Research Reactors, TRIGA and VVR-S;
- ❖ By **May 2006**, the 14 MW TRIGA Research Reactor was **fully converted from HEU to LEU**;
- ❖ By **June 2009**, all HEU Nuclear Fuel existing in Romania was **removed from Romania**.



# VVR-S Reactor Site





# VVR-S Reactor nuclear Fuel

## Nuclear Fuel used

- ❖ 1957-1982: LEU type EK-10 (10 % enrichment)
- ❖ 1983-1997: HEU type S-36 (36.6 % enrichment)
- ❖ Russian Federation origin

❖ Spent Nuclear Fuel Assemblies (SFAs) stored in ponds with water in AR storage – cooling pond and AFR storage area.

❖ All fresh fuel rods type HEU S-36 repatriated in Russian Federation in 2003, under US Department of Energy Contract

EK-10: - represent 70 % from all spent fuel assemblies, stored in AFR ponds,  
- burn-up: 38.7 MWd/assembly, 34.7%, decay heat (2007)/FA: min.0.5-max.1.7 W

S-36: - represent 30 % from all SFA stored in AFR ponds,  
- decay heat (2005)/FA: min. 0.57-max.2.08 W, burn-up/FA: min 1.14– max. 64.86 MWd/FA



# International Legal Framework (1)

- ❖ International instruments applicable to the shipment of spent nuclear fuel to the Russian Federation;
- ❖ Non-Proliferation/Safeguards both IAEA and EURATOM: legal basis and procedures;
- ❖ Convention on the Physical Protection of Nuclear Material 1980, Amendment 2005, and INFCIRC 225/ Rev.4;
- ❖ 1986 Notification and Assistance Conventions 1986, Civil Liability for Nuclear Damage: Vienna Convention 1963, Amendment 1997, Joint Protocol 1988;
- ❖ Joint Convention on the Safety of Spent Fuel Management and of the Safety of Radioactive Waste Management 1996;



## International Legal Framework (2)

- ❖ Joint Convention on the Safety of Spent Fuel Management and of the Safety of Radioactive Waste Management 1996;
- ❖ IAEA Regulations for the Safe Transport of Nuclear Material, 2005 Edition;
- ❖ Nuclear Security: Main elements applicable to the security of transport of nuclear material;
- ❖ Applicable Norms of the European Union (applicable to EU Member States and relevant to the non-EU Members involved in the Project): EURATOM and EC Directives - EURATOM /ESA Notification obligations and procedures; Directives relating to controls of shipments of radioactive wastes and nuclear materials through, into or out of EU Member States.



## Russian Federation Decrees

- ❖ **Decree #418**, dated July 11, 2003, on the procedure for importation of irradiated nuclear reactor fuel assemblies into the Russian Federation;
- ❖ **Decree #421**, dated June 14, 2002, on approval of provisions for the development of environmental programs for rehabilitation of radiation-contaminated regions of the territory;
- ❖ **Decree #587**, dated September 22, 2003, on coast approval process for handling of irradiated fuel assemblies of nuclear reactors and products of their reprocessing.



## Government – to - Government Agreements

- ❖ Agreement among the Government of the USA and the Government of the Russian Federation concerning cooperation for the transfer of Russian-produced research reactor nuclear fuel into the Russian Federation, Moscow, 27 of May, 2004.
- ❖ Agreement between the Department of Energy of the USA and the Nuclear Agency of Romania and National Commission for Nuclear Activities Control of Romania concerning cooperation in the area of countering the proliferation of nuclear materials and technologies, done at New-York on 19 of July, 2004.
- ❖ Amendment to Agreement Between The Nuclear Agency of Romania and the National Commission for Nuclear Activities Control of Romania and The Department of Energy of the USA Concerning Cooperation in the Area of Countering the Proliferation of Nuclear Materials and Technologies, done at Washington DC on December 2008.



# USA - Romania Amendment Signing Ceremony Washington DC, December 2008

# Russia-Romania Agreement Signing Ceremony Bucharest, February 2009



# RRFR Project Partners for Romania



UNITED STATES



DOE



NNSA



INL



RUSSIAN FEDERATION



ROSATOM



FSUE "FCNRS"



VNIPIET



VOLGA DNEPR



IAEA  
International Atomic Energy Agency  
*Atoms For Peace*

IAEA



SOSNY



VNIIEF



MAYAK



ROMANIA



PRIME MINISTER  
CHANCELLERY



GUVERNUL ROMANIEI

AGENTIA NUCLEARA



MINISTERUL  
TRANSPORTURILOR



ANCS  
Autoritatea Nationala pentru Cercetare Scientifica



ROMANIA  
ANCEX



ANDRAD



KAAN  
SCN  
PITESTI



EUROPEAN UNION



ESA

# Terrestrial Route



# Air Shipment Route





## Planning Meetings / Conferences (1)

- 01-Bucharest, Romania, 12-15.10. 2004
- 02-Bucharest , Romania,14-16.12. 2004
- 03-Bucharest, Romania, 30.06-01.07.2005
- 04-Moscow, Russia, 10-16.07.2005
- 05-Varna, Bulgaria, 18-21.09.2005
- 06-Bucharest, Romania, 12-13.12.2005
- 07-Bucharest, Romania, 06-07.03.2006
- 08-Bucharest, Romania, 22-29.03.2006
- 09-Bucharest-Vicsani, Romania, 12.07.2006
- 10-Bucharest, Romania, 10-14.07.2006
- 11-Vienna, Austria, 19-21.07.2006
- 12-Belgrade, Yugoslavia, 04-07.10.2006
- 13-Bucharest, Romania, 03.11.2006
- 14-Bucharest, Romania, 27.11-01.12.2006
- 15-Bucharest , Romania, 12-16.02.2007
- 16-Sofia, Bulgaria, 18-22.02.2007
- 17-Dimitrovgrad, Russia, 29-30.02.2007



## Planning Meetings / Conferences (2)

- 18-Poiana Braşov, Romania, 24-26 April 2007;**
- 19-Idaho, USA, 20-30.07.2007;**
- 20-Bucharest, Romania, 25-30.09.2007;**
- 21-Luxembourg 13-15.11.2007;**
- 22-Bansko, Bulgaria, 04-06.12.2007;**
- 23-Vienna, Austria, 22.01.2008;**
- 24-Dimitrovgrad, Russia, 12-14.02.2008;**
- 25-Bucharest, Romania, 05-07.03.2008;**
- 26-Moscow, Russia, 13-14.03.2008;**
- 27-Vienna, Austria, 14-16.05.2008;**
- 28-Prague, Czech Republic, 22-23.05.2008;**
- 29-Prague, Czech Republic, 24.05.2008**
- 30-Moscow, Russia, 16-17.03.2009**
- 31-Denver, USA, 02-05.05.2009**
- 32-Bucharest, Romania, 15.06.2009**
- 33-Samara, Russia, 22-25.07.2009**
- 34-Poiana Brasov, Romania, 24-28.05.2010**



## Project Tasks (1)

- Task #1: Develop a Transport Plan;**
- Task #2: Spent Fuel Inspection;**
- Task #3: Facility Modification;**
- Task #4: Unified Project;**
- Task #5: Romania Cask and Transport Approvals;**
- Task #6: Cask Loading Preparations;**
- Task #7: Cask Loading;**
- Task #8: Transport through Romania;**
- Task #9: Project Management;**

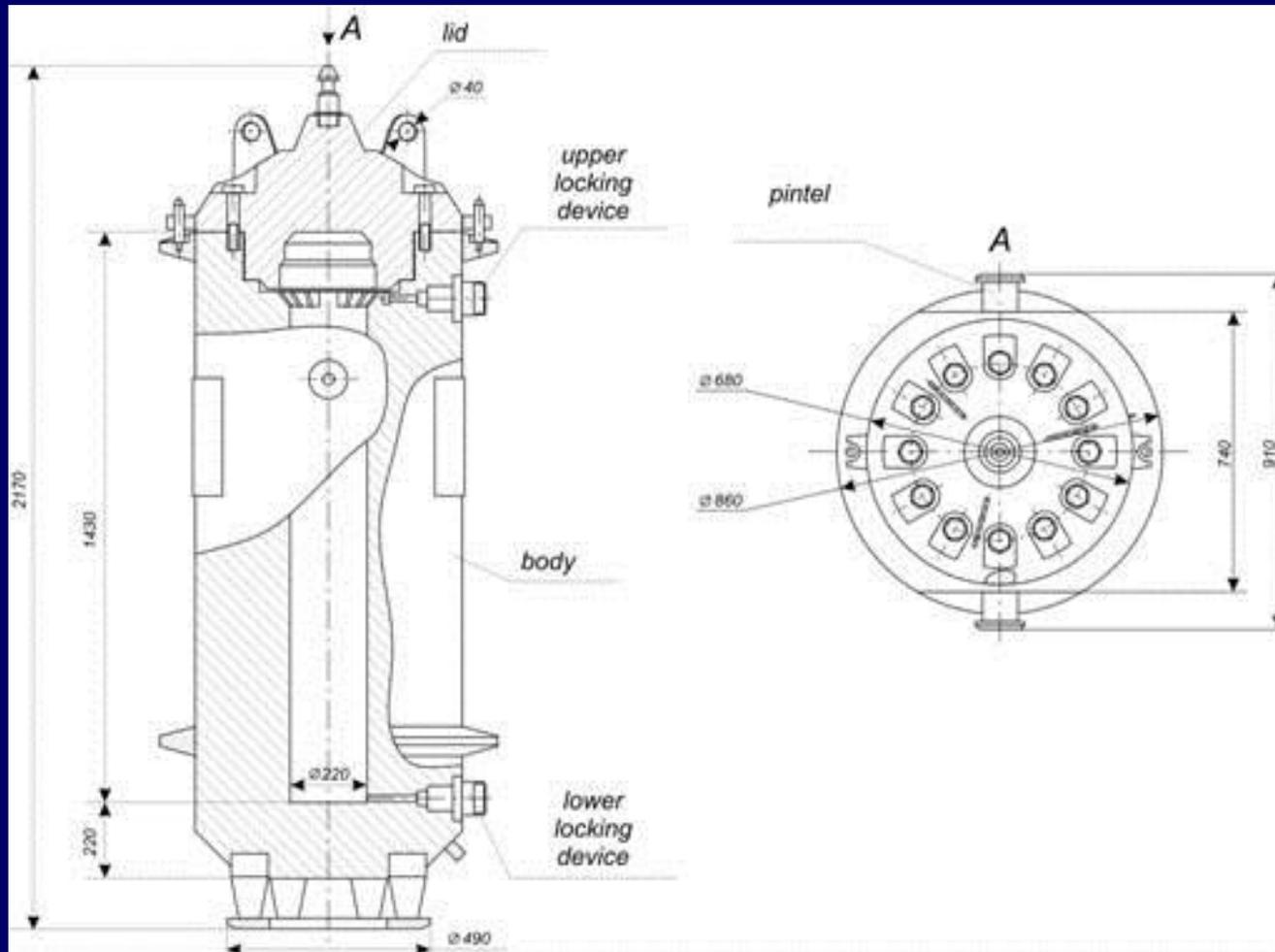


## Project Tasks (2)

- Task #10A: Design and Certify Freight Containers for TUK-19 Cask Air Shipment**
- Task #10B: Certify the TUK-19 Cask for Air Shipment from Romania;**
- Task #10C: Fabrication and deliver freight containers for TUK-19 Cask Air Shipment**
- Task #11: Sign FTC and transport through the Russian Federation**
- Task #12: Project Management Continuation**
- Task #13: Purchase Road Transportation System for TUK-19 Cask Shipment**
- Task #14: Transport Empty TUK-19 Casks to IFIN Horia Hulubei**

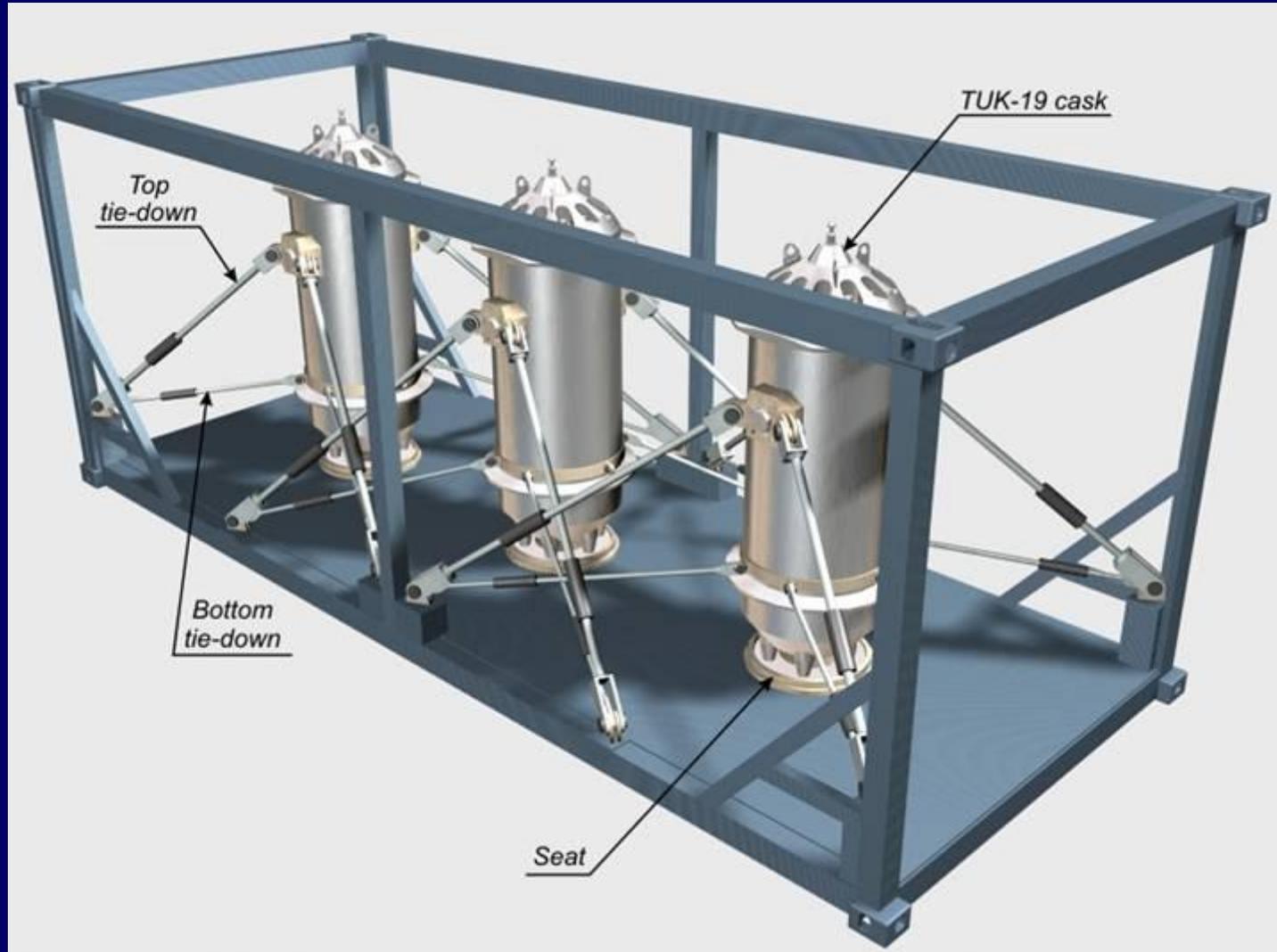


# TUK 19 Container



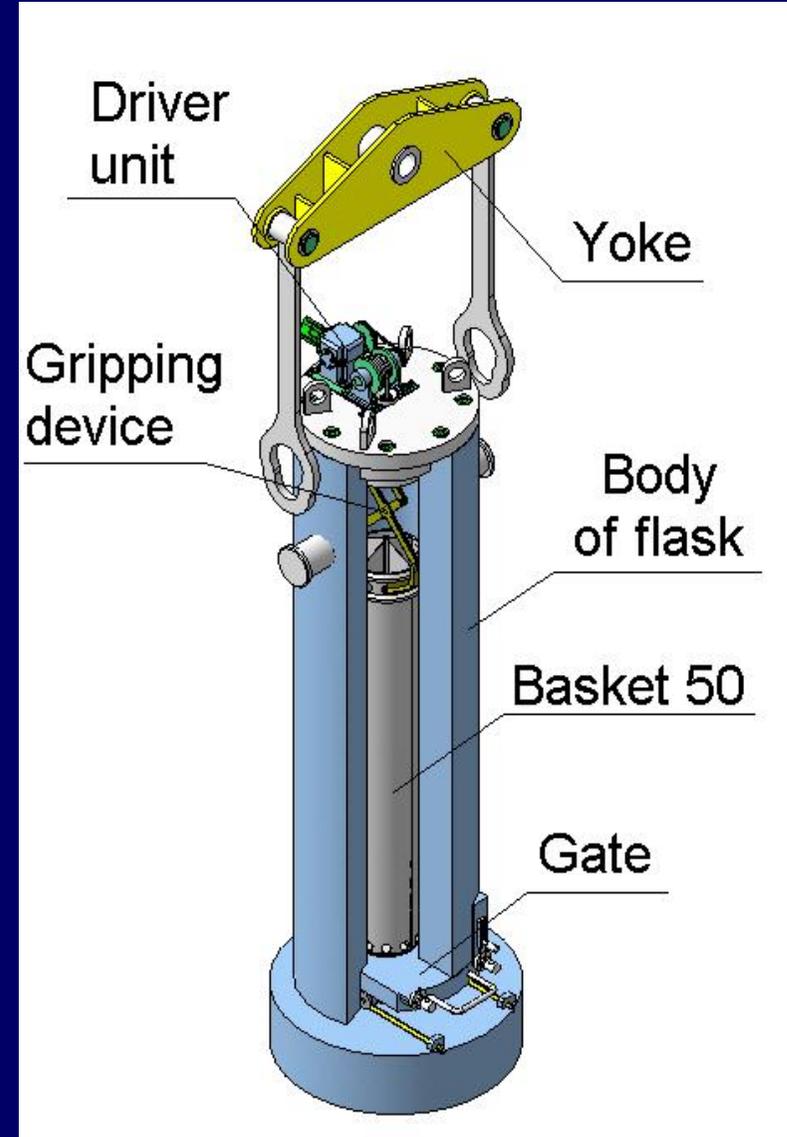


# Freight ISO container for TUK-19 air shipment





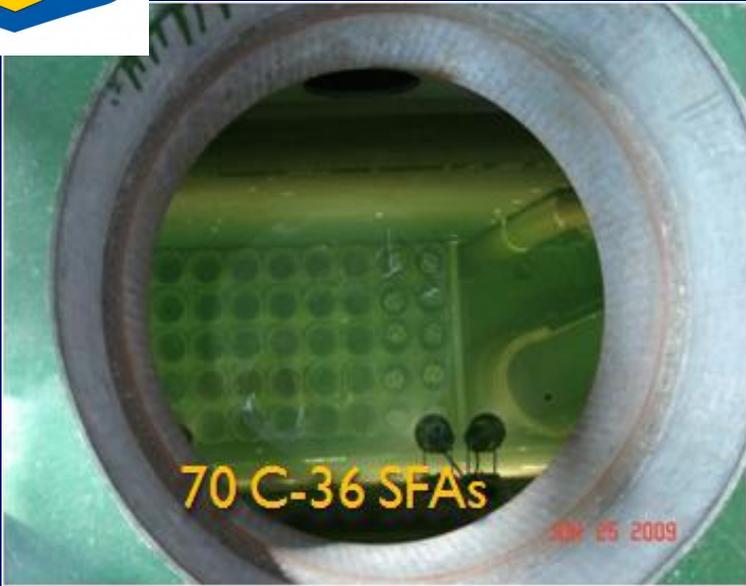
# Transfer Container



# Track



# Shipment Details



70 C-36 SFAs

JUN 25 2009



18 TUK-19



6 special freight containers



6 trucks

JUN 29 2009



1 AN-124-100 aircraft

# Aircraft used for Romanian SNF Shipment



# Flight Aspects



# Take Off





## Speaking about *lessons learned*

- ❖ To have a strong domestic political will to approve the process itself and to support all technical requirements,
- ❖ Each operation has its own peculiarities. It is necessary to consider:
  - ❑ to early initiate the whole process
  - ❑ to identify all partners/ including local authorities in charge with various aspects of the implementation from the very first stage of awareness
  - ❑ to create a network of routine communication and cooperation among experts and managers responsible for all related issues
  - ❑ to agree an interagency timetable
  - ❑ to agree working under a vertical organizational scheme
  - ❑ licensing activities usually require lead time
  - ❑ technical issues to be addressed in details (licensing processes, casks loading issues, transport procedures)
  - ❑ special attention to issues outside main technicalities - negotiations of multinational agreements and contracts, safeguards, managerial activities, security, budget, cost scheduling, media and public acceptance.