Legal, regulatory and practical aspects of import of spent fuel for reprocessing and the return of radioactive waste resulting from reprocessing to the state of origin

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Vienna
5–7 September 2016
List of principal federal laws related to import-export spent fuel and radioactive waste

JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT
№ 139-FZ of 04 November 2005

ON USE OF ATOMIC ENERGY
№170-FZ of November 21, 1995

ON MANAGEMENT OF RADIOACTIVE WASTES
No 190-FZ of July 11, 2011

ON ENVIRONMENTAL PROTECTION
No 7-FZ of January 10, 2002
List of Decrees of President and Government regulating import-export spent fuel and radioactive waste

On the procedure of import of irradiated fuel assemblies of nuclear reactors to Russian Federation № 418, of July 11, 2003

On the approval of the Provision on financing of special ecological programs for remediation of radioactively contaminated parts of territories № 588, of September 22, 2003

On the complementary measures to enhance the control over the fulfillment of the requirements of ecological safety by the spent nuclear fuel reprocessing № 389, of April 20, 1995

On special commission on the issues of import of foreign manufacturers’ irradiated fuel assemblies to the territory of Russian Federation № 828, of July 10, 2001
Main regulatory provisions in re-export of SNF and reprocessing products (1/2)

- Export and import of nuclear materials, including nuclear fuel, radioactive substances, as well as radiation sources, should be carried out in accordance with the international obligations of the Russian Federation on the nonproliferation of nuclear weapons and the international agreements of the Russian Federation in the sphere of the use of atomic energy.

- Import of SNF from foreign states to the Russian Federation for temporary technological storage and reprocessing is carried out in accordance with the procedure established by the Russian Federation and international agreements of the Russian Federation.

- Import of foreign-made irradiated fuel assemblies to the Russian Federation is carried out basing on the positive decision of the special commission called for by the President of the Russian Federation.

- Import of SNFA to the Russian Federation is performed on the basis of positive findings made by state ecologic expertise approved by State Corporation Rosatom and Rostechnadzor provided the authorized institutions possess corresponding licenses of Rostechnadzor.

- The annual volume of SNF to be imported to the Russian Federation is determined by the Government of the Russian Federation.
Main regulatory provisions in re-export of SNF and reprocessing products (2/2)

- Import of radwaste in the purposes of its storage and reprocessing to the territory of the Russian Federation is prohibited except the cases stipulated by laws (Art. 31 – disused radiation sources)

- Import of RW from Russian Federation resulting from SF reprocessing is permitted, if it’s provided by an international treaty of the Russian Federation

- Re-export of SNF reprocessing products is performed under conditions as follows:
  - in compliance with international obligations of the Russian Federation on nuclear non-proliferation
  - the international agreement of the Russian Federation shall contain the provisions envisage the obligations and guarantees of the country-supplier on acceptance of the reprocessing products as well as provisions on possibility to confirm the availability of the necessary conditions for RW acceptance and its safe management
  - the foreign trade contract shall specify the list, composition, amount, type of package of the reprocessing products to be re-exported

- The amounts of the reprocessing products to be re-exported to the supplier country are identified by the methodologies approved by the parties based on conditions of equivalency in activity of previously imported in the purposes of reprocessing assemblies and activity of the re-exported reprocessing products taken into account the radioactive decay of radionuclides during operations of temporal SNFA process storage and SNFA reprocessing
Safety guide includes recommendations:

- methods to determine the amount of returning RW
- structure of the safety analysis report for RW management resulting from SF reprocessing during transportation to the state of supplier
- structure of the radiation protection program for RW management resulting from SF reprocessing during transportation to the state of supplier

Criteria used to determine the amount of returning RW – parity of dose equivalents of the imported SF and the returning RW at the time of RW return

Calculation of the amount of returning RW

- calculation of activity of fission products, actinides and activation products in the imported SF at the time of reprocessing
- calculation of activity contained in the SF, taking into account the extraction of uranium, plutonium and neptunium isotopes
- calculation of activity of fission products, actinides and activation products in the RW at the time of return
- dose equivalent calculation of fission products, actinolites and activation products at the time of return, total dose equivalent calculation of the imported SF
- calculation of dose equivalent of RW to be returned
- calculation of activity of RW to be returned
Russian approach to the long-time sustainability in SNF management is in the SNF reprocessing

- Recycle the fissile materials regenerated from the spent nuclear fuel.
- Reduce the radiation impact on the environment due to the disposal of only radioactive waste (not SNF) by the principle of radiation equivalence between mined uranium and buried RW.
- Do not leave the problem of SNF treatment (objectively - not predictable in the long-term period) to the future generations.
- Extract from the spent fuel the valuable radioisotopes for medical use and other non-nuclear industries.

- In order to achieve the objectives - the development of technologies of radiochemical reprocessing and recycling.
The first reprocessing plant in Russia;
- A part of the historical radiochemical plant;
- In operation since 1977;
- More than 5700 tons of SNF reprocessed;
- 150 tons of SNF per year;
- All the Russian SNF of VVER-440, BN-600 and RR is reprocessed here;
- Processed SNF inventory continuously increasing;
- Traditional hydrometallurgical processing scheme (PUREX);
- RepU, Pu and Np as the product of reprocessing;
- A lot of attention to environmental issues;
- Radioisotope production of Cs-137, Kr-85, Am-241, Pu-238, Sr-90, Pm-147
Development of key technologies
Rosatom’s innovation technologies in the SNF management area

Storage technologies: from ‘wet’ to ‘dry’ SNF storage –

Technologies of reprocessing and new fuel fabrication: MOX and REMIX fuel.

Transition to passive safety systems of SNF storage

SNF reprocessing; from the 1st generation plant to the 3rd generation plant. Absence of radwaste releases. Minimisation of radwaste to be disposed of.

Start to recycle nuclear materials in thermal and fast reactors
Packaging and Transport
Multivariance in modes and means
Russian Federation international cooperation in SNF management

Last years
Import of WWER-1000 SNF from Ukraine and SNF WWER-440 from Bulgaria and Ukraine.
Import of damaged SNF from Paks NPP, Hungary.
Research reactor SNF return:
   2012 – Poland, Uzbekistan, Romania, Ukraine;
   2013 – the Czech Republic, Hungary, Vietnam;
   2014 – Kazakhstan, Poland
   2015 - Uzbekistan.

High level of safety has been attained, including SNF air transportation (9 shipments).
The Russian Federation has considerable experience of cooperation with foreign countries in the field of SNF management.

**Soviet case:**
All the SNF of Soviet origin went back to USSR for reprocessing, all the reprocessing products (incl. RW) remained in USSR.

**Modern case:**
Russia offers the reprocessing as a commercial service leaving the right on the reprocessing products to the SNF-providing country. Main trend – returning RW after the SNF NPP reprocessing.
Russian SNF Repatriation
RRRFR Example

- 14 countries included, 10 Gov-to-Gov Agreements
- Since 2006 (first RR SNF shipment to Russia in the frame of RRRFR)
- 35 shipments, more than 20 companies involved
- Approx. 2000 kg of HEU fuel shipped to Russia
- Considerable experience on SNF management and international shipments

In the majority of contracts for the RR SNF repatriation the reprocessing products, including waste from the reprocessing, remain in Russia.
Russian SNF Repatriation
Ukraine example

• SNF repatriation is a part of the multifaceted Russian-Ukrainian cooperation in Nuclear Field.
• All Ukrainian NPPs use Russian origin Nuclear Fuel.
• 3 Ukrainian NPPs export its SNF to Russia.
• All VVER-440 SNF goes to PA “Mayak”, Ozersk, for instant reprocessing. Vitrified HLW to be return to Ukraine after technological aging (20-25 years, the first HLW shipment was planned for 2018).
• All VVER-1000 SNF goes to MCC, Zheleznogorsk, for temporary storage and further reprocessing (on new generation reprocessing center TDC, from 2020). U, U-Pu-Np, RW, to be return to Ukraine after technological aging (from 2025).
• No need to develop SNF reprocessing infrastructure in Ukraine. The only HLW disposal should be constructed after 2018.
• All the works are performed under the Gov-to-Gov Agreement in the frame of the certain Foreign Trade Contracts.
REMIX fuel – U-Pu multi-recycling in thermal reactors (VVER-1000)

A promising option for return of the reprocessing products to the SNF-providing country

REMIX fuel is the non-separated mixture of U and Pu from LWR SNF reprocessing, with the addition of enriched uranium (natural or rep. U).

REMIX fuel enables multiple recycling of the entire quantity of U and Pu from SNF, with the 100% core charge and 20% saving of natural uranium in each cycle.
Contact information

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