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STATE SYSTEM ENSURING SAFE SHIPMENT OF RADIOACTIVE MATERIALS BY AIR

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ABSTRACT

The high-activity radioactive materials are rarely transported in Type B packages by air. It is a rather new mode of their shipment for all countries, including Russia. The ROSATOM State Corporation, that is a state competent authority on safe transportation, supervises each shipment preparation, justification and safety assurance as well as other authorities liable for state supervision of safe transportation of radioactive materials.

The design and use of Type C packages for air shipments is the newest option and procedure taking into account the complexity and newness of packaging design, its safety justification and validation of compliance of packaging design and shipment procedure with applicable safety requirements both national and international.

This paper describes the requirements, procedure peculiarities and results of work of ROSATOM and other authorities supervising and validating the safe air shipments of spent nuclear fuel from foreign research reactors performed under the Russian Research Reactor Fuel Return Program both in Type B and Type C packages. It also demonstrates preparation and supervision of packaging design and manufacture, expert assessment of safe design and air shipment procedure, issuance of certificates of approval by ROSATOM and involved expert organizations and cooperation with other state supervisory authorities. The paper lists some conclusions and recommendations to similar activities in future.

INTRODUCTION

In the Russian Federation the transportation of radioactive materials (RM) on a mass scale has been carried out for more than 60 years. Transportation is performed by all modes of transport while the nomenclature of carried materials covers both the entire range of RM related to nuclear fuel cycle as well as RM in use in industry, public health, agriculture and other fields.

A high proportion of RM used in all areas is produced within the country, while transportation is carried out basically on an interior basis. However, the volume of international transportation of different types of RM to and from Russia is also significant, the same holds for the volume of transit of RM across the Russian territory

Within this time in RM transport there has not been registered not only any severe accidents with radiological consequences, but deviations from normal conditions have been in ones. Such outcome in terms of ensured safety is a direct consequence of the system of management of transport safety which was in use in the former USSR and is still in place in the Russian Federation, including the activity of the State competent authority on nuclear and radiation safety as well as state bodies on regulation of safety in use of nuclear power as a whole and RM transportation in particular.

Below in this report are briefly discussed main components of the system both historically and for the future including the issues of norm and legal provisions and state governing in the field of RM transportation safety. In order to have an idea of scale, transportations and problem of ensuring safety primarily the data on types of conveyed RM, employed transport packaging, transportation vehicles and geographical aspects of shipments are briefly presented.

DATA ON TRANSPORTATION OF RM IN THE RUSSIAN FEDERATION

In terms of purpose, transported RM are split into two main groups:

consignments of materials involved in nuclear fuel cycle: ore, various concentrates, uranium hexafluoride, fresh nuclear fuel, spent nuclear fuel (SNF) and other nuclear materials as well as radioactive waste;

general-purpose industrial, medical, agricultural and other purpose cargo (so called “isotope” products).

The overwhelming majority of shipments within the frame of nuclear fuel cycle is carried out by the Rosatom enterprises using their own special transport vehicles (automobiles and rail cars), a part of shipments of nuclear fuel cycle is carried out by air and sea as well. Figs.1 and 2 show entities of the Russian Federation and foreign countries, where to or from which these materials are transported with participation of the Rosatom organizations.

In Fig. 1 it is seen that these are 22 RF entities where the Rosatom city-forming enterprises are located, as well as 18 entities more where other enterprises of the agency are in operation. From Fig. 2 it is seen that international traffic of RM with participation of Russian organizations only in the framework of fuel cycle covers more than 15 countries.

To ensure safe transport of RM in an overwhelming majority of cases the relatively complicated and expensive equipment is in use such as special transport packaging (TUK), special transportation vehicles and handling equipment.

Currently, in transportation of radioactive material Rosatom uses:

- more than 50 types of packaging for transportation of fresh nuclear fuel;
- 14 types of packaging for transportation of spent nuclear fuel;
- more than 20 types of packaging for transportation of fissile materials.

Fig. 1. The RF entities involved in mass shipments of fuel cycle RM

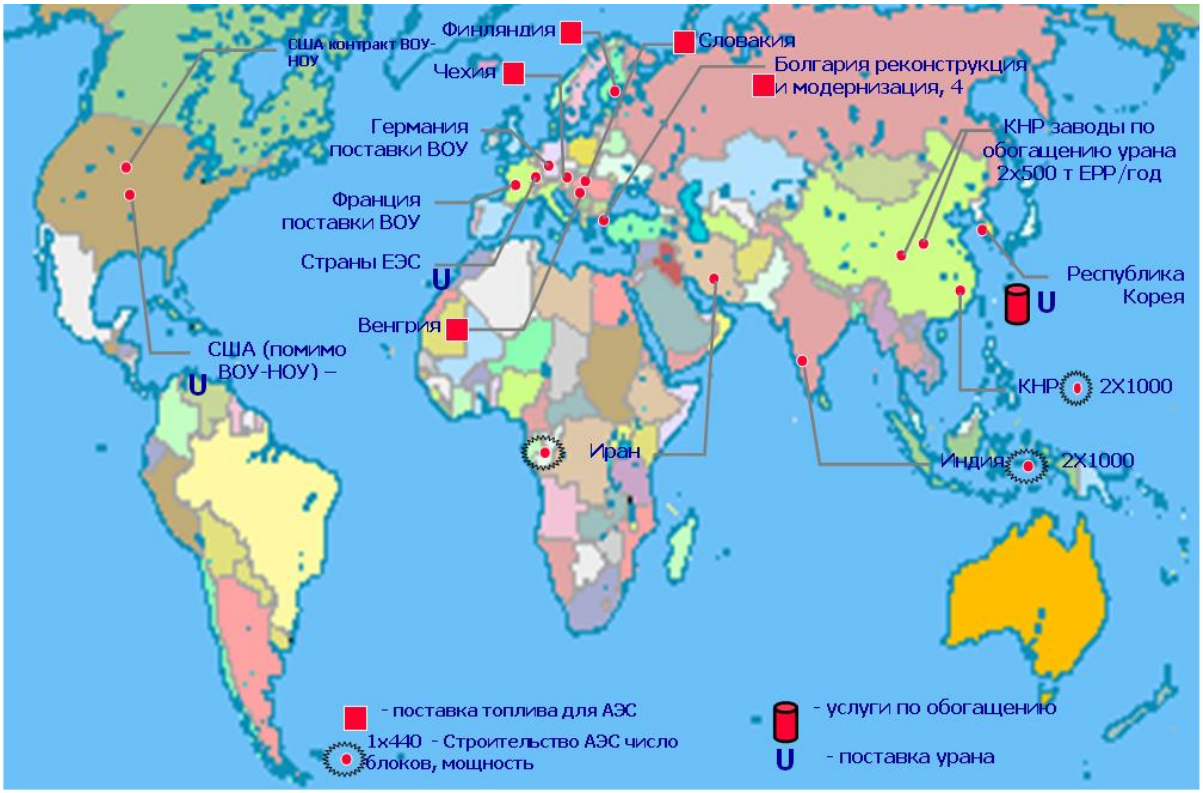


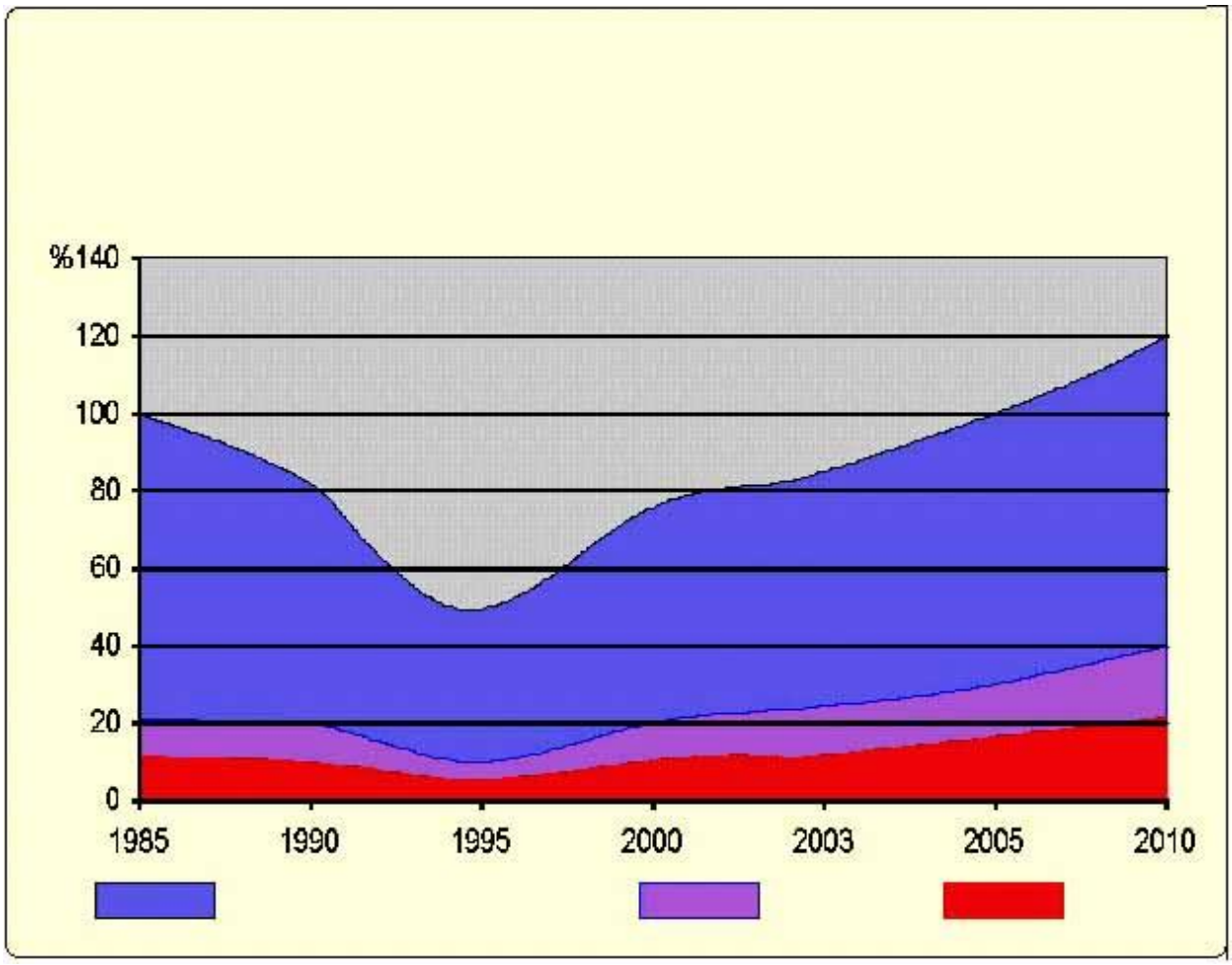
Fig. 2. Foreign countries involved in fuel cycle RM shipments with the Russian Federation

Between 1987 and 1993 the stock of domestic casks for transportation of nuclear fissile materials was practically renewed. At present, the casks meet safety requirements of both national and international regulations.

In development of casks both computational methods of safety justification, simulations and full-scale tests are employed. In Russia one of the largest testing facility is in operation, which allows for testing the casks weighing as much as 140 tons. Also, the unique facilities for air crash testing of packaging are in action.

In 2006 development, testing and certification of a new packaging TUK-128 made from cast iron with sphere-shaped graphite for transportation of research reactor SNF were completed.

Volume of shipments of nuclear fuel cycle RM has been growing in recent years constantly after slump in the mid of 90th. (see Fig. 3).



Nuclear materials **Fresh Fuel** **Spent Nuclear Fuel**

NORMATIVE AND LEGAL PROVISION OF SAFETY AT RM TRANSPORT

The general legal acts in the area of provision of the safety at RM transport, like in the entire field of use of nuclear power, are the following:

- Federal law “On use of atomic energy”;

- Federal law “On radiation safety of population”;
- Federal law “On sanitary and epidemiological well-being of population”.

In addition to these federal laws, certain types of activity in this area are regulated by a number of other laws. First and foremost worthy of mention is legislation in the field of civil defense and emergency response, legislation in the field of transport as well as legislation in the area of information and state secret protection.

As for technical regulation of safety provision at RM transport, this area (as practically all fields of technical activities) is covered by the Federal law “On technical regulating”. However, the clauses of this law in the nuclear field will be called into play approximately in 2010.

Based on this law other normative and legal acts are being developed in the field of the safety provision at transport of RM, which establish requirements in this area and relevant state authorities (see Section 4 below) for management and regulation of safety.

A fundamental regulation for technical and organizational provision of safety in RM transport is federal standards and rules NP-053-04 “Safety rules in transport of radioactive material” brought into action in 2005. Essentially these rules fully coincide to IAEA “Regulations for the Safe Transport of Radioactive Material” 1996 Edition [11]. The existing insignificant differences have to do with some more severe (Russian) requirements to certification of packaging and terms of transportation. Meeting the requirements of these regulations allows for fulfillment of national standards and rules of radiation safety (NRB-99, OSPORB-99) and appropriate international standards [14] on provision of radiation protection of population, transport workers and personnel involved in transportation of RM.

Technical and organizational requirements for safety provision at RM transport in the Russian Federation are also regulated by international rules and instructions to shipments of dangerous goods, being now in force in the appropriate modes of transport: (Code IMDG (MOPOG) – sea transport, ADR rules (DOPOG) – road transport, ICAO Technical Instructions – air transport, AND rules for transportation of dangerous goods by inland waterways). In technical terms, these rules and instructions for transport of RM as Class 7 of dangerous goods are replicas of requirements of IAEA (and NP-053-04) rules, comprising some additional organizational requirements.

In transport by rail in the Russian Federation the national “Rules for transport of dangerous goods by rail” are applied. Until the present time in railway transportation of nuclear fuel and weapon cycle materials the requirements to special transport are still in force. These requirements are aimed to practically exclude occurrence of transport accidents in course of shipment.

A structure of standards and regulations for providing the transport safety of radioactive materials in the Russian Federation is illustrated in Fig.4. For reference, the international system of standards and rules in this field is also shown in this figure.

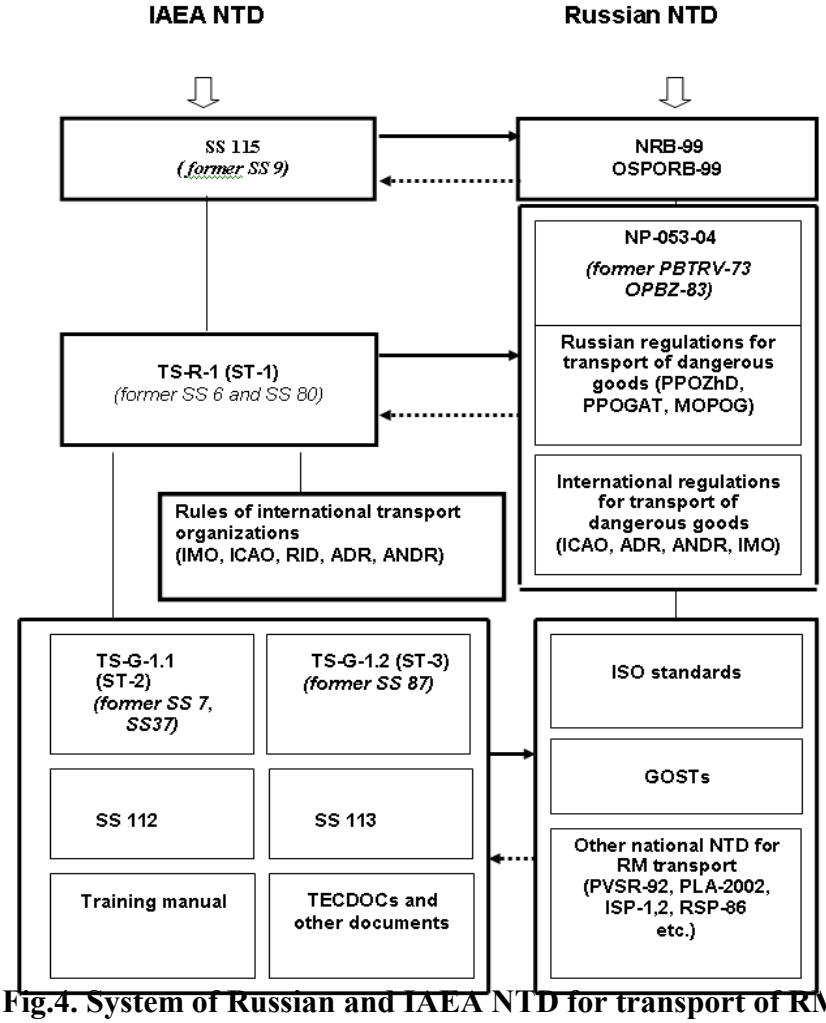


Fig.4. System of Russian and IAEA NTD for transport of RM.

STATE MANAGEMENT IN THE FIELD OF PROVIDING THE RM TRANSPORT SAFETY

State management and regulation of safety in transport of RM in Russia are enabled by the federal executive authorities appointed by the Government of the Russian Federation, namely:

- State Atomic Energy Corporation "Rosatom" being an governing authority in the field of use of atomic energy and the State competent authority as regards nuclear and radiation safety in transport of nuclear materials, radioactive substances and products based on them;
- The Federal service on the ecological, technological and nuclear supervision (Rostechnadzor), carrying out the state regulating nuclear and radiation safety (technical aspects) in use of atomic energy including issues related to transport of RM;
- The Federal medical and biological agency (FMBA) and the Federal service on supervision in aria of protection of consumer rights and well-being of human (Rospotrebnadzor), which carry out the state regulation of radiation safety (sanitary and hygiene aspects) in use of atomic energy in various industries including those in transport of RM;
- The Ministry of the Russian Federation of Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters (MChS of Russia) carries out the state regulation of fire safety in use of atomic energy including transport of RM.

Functions to ensure the transport safety at RM shipments by all transport modes are vested in the Ministry of Transport of the Russian Federation (Mintrans of Russia) and organizations subordinated to it. Certain functions in regulation of transport safety are performed by Ministry of Interior Affairs of the Russian Federation (MVD of Russia).

Specific functions, rights and responsibilities of the above mentioned state authorities in the field of RM transport safety are defined by orders on these bodies. Certain coordination functions in the field of RM transport safety are vested with Rosatom as a state competent authority in this area.

Within the limits of this report there's no way of describing all functions, rights and responsibilities of these agencies as regards transportation of RM. For example, in accordance with the Order on State competent authority approved by the Government of the Russian Federation, Rosatom is vested with 18 general functions, which could be divided into specific tasks as well. Nevertheless, it is possible to understand the whole pattern even through a brief description, if we look at the functions of the indicated state authorities as applied to basic mechanisms of governmental management and regulation of RM transport safety field. Obviously, as almost in all the world such tools in Russia are represented by:

- Development, agreement, approval and putting into action of various standards and regulations in the field of safety at transport of RM;
- Licensing of activities of organizations involved in provision of safety in transport of RM;
- Certification of relevant RM, transport packages and transport conditions for compliance with requirements of national and international rules;
- Certification of transportation vehicles;
- State system of prevention and recovery of emergencies in transportation of RM;
- State supervision and control for provision of safety at RM transport.

Let us consider each of these tools and appropriate state authorities involved in its implementation.

Development, Agreement, Approval and Putting into Action of Standards and Regulations in the Field of RM Transport Safety

All above-stated state authorities participate in development of fundamental federal rules for RM transport safety (at the present time, NP-054-2004, [1]) and carry out their agreement, without which in practice these rules cannot be approved and put into force. Rostechnadzor is vested with approval and putting rules into action. Procedures of development, agreement, approval and putting into force are determined by a special Order approved by the directive of Government of the Russian Federation [3].

The national rules and state standards in force related to RM transport safety [4-6] and other, as well as new national rules [1] are based and essentially fully meet the recommendations of the IAEA described in the appropriate rules of Agency [11, 13-14].

Licensing of Activities of Organizations Involved in Provision of RM Transport Safety

The organizations involved in provision of safety in transportation of RM have to receive the license on the relevant type of activity. The licenses are to be obtained by consignors, consignees, carriers of RM, organizations which design (develop) packaging and RM, their manufacturers as well as organizations performing the examination of safety of design of packages and RM transport technologies. A licensing body for transportation of RM in case of peaceful use of RM is Rostechnadzor, in case of RM intended for defense purposes – Rosatom. The relevant Orders

specifying requirements and procedures of licensing are approved by the directives of the Government of the Russian Federation [7-8].

Certification of RM, Transport Packages and Transport Conditions for Compliance with Requirements of National and International Regulations

Certification of design of special form RM and low dispersible RM, design of packages and shipments (transport technologies) for compliance with requirements of national and international rules of RM transport is carried out by Rosatom in form of issuance of certificate-permits approved by this authority. In this context certificates of approval prior to approval by Rosatom should be agreed with Rostechnadzor and FMBA of Russia (in case of fissile RM). The latter also grants a sanitary and epidemiological conclusion on package specifications in accordance with the Basic sanitary rules for providing radiation safety [9]).

Applications for certificate-permits should contain all required information consideration of which may provide to the competent authority confidence that all relevant requirements of national and/or international rules for RM transport safety are met. In this context the requirements to the application for certificate-permit practically are the same as those in the IAEA Rules.

The system of issuance of certificate-permits envisages their limited life; when they are expired a new confirmation is needed that safety requirements are met, afterwards the applicant will receive a new certificate-permit.

One of the mechanisms of state control in certification is a compulsory agreement of the test program with the SCA (State Competent Authority) and the participation of the SCA representatives in testing.

Certification of Transport Vehicles

Certification of transport vehicles is carried out by organizations under the Mintrans of Russia. In so doing the design of special transport means or peculiarly fitted transport means (intended specifically for transport of RM) is to be agreed with Rosatom, Rostechnadzor and Minzdrav (by the latter in the form of sanitary and epidemiological conclusion for transport vehicle specification [9]).

Single State System of Prevention and Recovery of Emergencies

Planning and carrying out emergency response in case of an accident in transport of RM are charged with the Emergency response service of the transport shipments of Rosatom, which is an integral part of the branch (in nuclear industry) emergency system within the framework of the single state system of prevention and recovery of emergencies headed by MChS [10].

The Emergency response service of the transport shipments is formed on the basis of special regular teams (a total of 5 in the RF) and teams not on permanent staff of organizations of consignors and consignees.

State Control and Supervision over Safety at RM Transport

State control and supervision over safety at RM transport i.e. actually over correct fulfillment of acting standards and rules of federal and industry level is carried out in one form or another along the appropriate lines by all above mentioned state bodies.

CONCLUSION

In conclusion it should pointed out once again that the created state system of provision of safety at transport of radioactive materials in the Russian Federation makes possible to carry out governing and regulating in this field with sufficient efficiency. The main lines in improvement of this system should be related with harmonization of requirements and procedures of governing and regulating on behalf of different authorities, minimization of overlapping their functions. This effort should be done within the framework of development of the appropriate technical regulations both in this area and in the entire field of nuclear power in accordance with clauses of the Federal Law "On technical regulating".

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