Proceedings of the 17th International Symposium on the Packaging and Transportation of Radioactive Materials
PATRAM 2013
August *18-23, 2013, San-Francisco, CA, USA*

EMERGENCY PREPAREDNESS DURING RM SHIPMENT BY AIR. EXPERIENCE AND PROSPECTS

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ABSTRACT

The incidents and accidents occurred during the radioactive material shipment almost never result in elimination of radiation accident consequences. For the whole period of radioactive material transportation by air there have been just a few such accidents all over the world. Nevertheless due to the specific vision to any air crash, it is extremely important to ensure and demonstrate guarantees in timely response actions on air crash elimination during radioactive material shipment. This issue is rather complicated because the air crash can happen in a country that has no regular emergency radiological team.

This paper realizes an analysis of experience in preparation and shipment of high-activity radioactive materials, such as spent fuel from research reactor, by air towards assurance of emergency preparedness in the framework of Russian and U.S. Research Reactor Fuel Return Program (RRRFR). It also describes the capabilities of relevant existing emergency preparedness systems and some suggestions for international cooperation on this issue.

1. INTRODUCTION

A series of spent nuclear fuel (SNF) shipments, including air shipments, have been carried out in Russia for the past several years under Russian Research Reactor Fuel Return (RRRFR) Program. Wide experience in different aspects of high-level RM air shipment has been gained during preparation for the shipments and performance of them. This concerns computational and experimental justifications of safety used for the transport of packages, including the air crashes; development and tests of newly-designed packages, including Type C package; approval procedures by competent authorities in different countries; development of optimum transport plans and transport procedures; as well as preparedness for emergency response during RM shipment by air and general admissibility of high-level RM shipment by air from the viewpoint of the experts and public.

Safety justification, package design, administrative issues, transport plans and procedures have been already considered on international forums, several papers on the issues were submitted to this conference, for example [1], [2] etc. This paper describes and analyzes the experience in

preparedness for emergency response during air shipment, compares, generalizes, draws conclusions and offers the solutions for the future.

2. EXPERIENCE IN EMERGENCY PREPAREDNESS DURING RM SHIPMENT BY AIR

In compliance with the valid national requirements (federal norms and regulations NP-053-04 [3]), nearly all RM shipment in Russia (except for excepted packages and IP-I packages) by different conveyances requires getting a certificate-permit (certificate of approval in IAEA Regulation [7]) for package shipment from the state competent authority (Rosatom State Corporation). In compliance with the Administrative Regulation [4] an applicant (Consignor or Consignee) shall submit an Emergency Preparedness and Response Plan together with other required documents.

The requirements for the Plan are specified in the federal norms and regulations NP-074-06 [5]. The plan specifies the actions of the Consignor (Consignee) and other participants of the shipment and emergency response on preparedness, initiation and performance of the response actions in case of an accident. This plan shall be concurred with Rosatom State Corporation before or in the course of the certification, as well as with St. Petersburg Emergency Response Center, an integrated center of Rosatom, which provides emergency response in the field of nuclear energy, and during transportation of RM in Russia. The Consignor shall conclude a contract on emergency preparedness and response actions with St. Petersburg Emergency Response Center.

Beside the Emergency Plan, an emergency card (ECs) shall be available, that is a document which specifies the primary response actions of the authorities (individuals, organizations), who are the first on the accident site: escorting personnel (if available and able to function), local authorities, firefighting brigades, medics, police.

The applicant for shipment addressed, FSUE Mayak PA (the Consignee), had the Emergency Preparedness and Response Plan for the SNF shipments by air, performed by this organization. The appropriate emergency cards were also available at that time, describing the primary response actions in case of accidents during the transport of different nuclear materials. Nevertheless, taking a special nature of the shipments into account (SNF, air transport, international shipment), the additional development of special emergency plans was found necessary (Accident Prevention and Response Plan in compliance with Special Requirements for Air Shipment, SRAS); special ECs were also developed, which determined specific regulations on assuring preparedness and emergency response during these shipments subject to specific participants, shipment conditions and cargo peculiarities.

The Accident Prevention and Response Plan, a part of the SRAS for shipment from Romania, included:

- stages of the shipment, covered by the Plan (air shipment after crossing the Russian border and actions in Russian airports);
- conditions under which Russian emergency response team (ERT) can be drawn in case of an accident outside the territory of Russia;
- list of regulatory documents;
- list of emergency response tasks;
-drawn ERTs and other organizations;
- persons in charge for arrangement and performance of work according to the Plan;
- requirements for communication and warning means;

- requirements for preparedness and emergency response;

- procedure of actions during accidents of different types;

- requirements for radiation protection.

The following shall be mentioned about the ECs. Only two ECs are valid for RM shipment in Russia now - one is for all RM except for uranium hexafluoride, and the other one - for uranium hexafluoride. The ECs are made up in such a way, that unprepared personnel would be able to perform accident response operations guided by them. Such personnel is the first to arrive at the accident site in compliance with the established emergency response procedure or because of his professional duties: transport workers, policemen, firefighting brigades and rescue teams, ERTs of territorial authorities and local government, medics. If RM is transported with escorting personnel and/or under guard, and these personnel remain functional after the accident, they shall perform immediate and further response actions, for they have specific training (in compliance with the valid RM transportation regulations) and are informed on the specific characteristics of the consignment. Hence, these standard ECs are general and, actually, do not allow for specific parameters of the RM consignment.

The special EC for SNF transport from Romania, developed and concurred with all participants of the shipment, contained more detailed instructions and regulations:

- detailed contact data of the participants;

- conditions under which the actions according to the EC shall be initiated;

- the requirement to notify ERTteams of the parties (St. Petersburg Emergency Engineering Center in Russia) on all incidents and accidents with the consignment, as well as in case of a forced landing of the aircraft;

- instructions on the actions during incidents and accidents in airports (including fire, mechanical loads, etc), as well as on deciding to continue the transportation;

- instructions in case of a forced landing;

- instructions in case of the aircraft crash outside a settlement or on the territory of a settlement;

- instructions in case of water landing or water crash;

- means of medical aid and individual protection;

- detailed illustrated description of the package and SNF giving the level of danger in different situations (fire, mechanical loads, deep immersion) and at different distances, etc.;

- recommended radiation monitoring facilities.

This EC contains in total 70 instructions on different issues. While the standard EC for transport of all RM by all transport means, which is used in Russia nowadays, instructs on nearly 40 issues.

3. RESULTS OF COMPLETED RM SHIPMENTS BY AIR

Totally 8 air shipments of SNF was carried out from the four countries of Europe, Africa and Asia (Romania, Libya, Uzbekistan, Viet Nam) under the Research Reactor Fuel Return Program in 2009-2013. The total route is more than 29 000 km long (18 000 miles), which makes up 70% of the circumference of the Earth at the equator (40,075.16 km / 24,901.55 miles). No accidents or incidents were registered. The emergency response system was functioning as established and in compliance with the above-mentioned specific requirements and emergency response documents developed particularly for these shipments. These requirements were quite easy to fulfill, no difficulties in maintaining the functioning of the emergency preparedness system occurred during the shipments.

Nevertheless, some specialists have had doubts in due safety, reliability and general appropriateness of SNF and other RM shipment by air not only before the first shipment but also still these shipment have been successfully completed. In particular, the issue on inexpedience of high-level RM shipment by air (and first of all SNF) was discussed on International Nuclear Forum ATOMTRANS-2012 in St. Petersburg and found certain support among the specialists.

The doubts in appropriateness of high-level RM shipment by air relate generally to the requirements for type B and C packages intended for air shipment of RM, the corresponding activity limits of the contents and radioactive release, test requirements and corresponding consequences of different air crashes. Probably, any doubts will be removed or at least mitigated, if the doubting specialists are better informed on the calculation results, air crash data accepted in the justification of the approaches and scenarios (ref. IAEA-TECDOC-702 [6], IAEA requirements [7]). Probably, it would be practical to issue a reviewed variant of this IAEA Technical Document.

However, this paper considers emergency response during RM transportation, so justification and assurance of safety and, finally, the general appropriateness of high-level RM shipment by air for the nuclear community and for the whole society are viewed below in the aspect of adequate preparedness and emergency response for such shipments.

4. REQUIREMENTS TO EMERGENCY PREPAREDNESS DURING RM SHIPMENT BY AIR

The role or value of emergency preparedness and response system for the safe RM shipment by air should be studied taking into account the relevant provisions of the documents issued by the IAEA and other international organizations and describing the current situation.

Graded approach

The IAEA's regulations [7] for the safe transport of RM, as well as the whole safety system in the field of nuclear energy application, are based on a graded approach, i.e. the requirements are imposed considering the level of hazard of regulated object (RM goods). This approach is also implemented and described in the IAEA's requirements to emergency response [9]. As for the emergency response during the RM shipment, this approach is only mentioned in the document [8], but the actual provisions for emergency response are not graded for the level of danger of transported RM goods, i.e. the graded approach is not actually applied or, at least, regulated.

Specialization of requirement to emergency response

Actually, the IAEA's regulations [7] and the guide for emergency response [8] have no special regulations and differences in emergency response systems for RM air shipment in comparison to the similar systems for the land transportation.

The transportation by sea is regulated by relevant provisions stipulated in the IAEA's documents and those of the International Maritime Organization (IMO). The ICAO documents for transport by air contain the regulations for emergency response during the dangerous goods (DG) shipment, but they mainly commit the aircraft operator to inform the relevant emergency services and the appropriate competent authority of the state where the accident has happened.

Administrative requirements

Administrative requirements to emergency response are not graded and not regulated in fact by the transportation rules [7]. The notification requirements to transportation of the most dangerous goods (all Type B(M) packages, Type B(U) packages and Type C packages with large activity (more than 3000 A_1/A_2)) have some relation to the emergency response.

Requirements to the application for shipment approval include only general regulation for its submission as it is required by the concrete competent authority.

Moreover, as for the international RM shipment by air, the formal administrative requirements are minimal, because such a shipment requires no mutual agreement of design and terms with the transit countries (flight across their territories). Thus, the availability of the emergency response systems for RM goods at the transit countries was not analyzed.

Foreign assistance in accidents

Sometimes the international RM shipment by air includes the transit across the countries that have no developed nuclear industry and, therefore, no their own serious special emergency response system for radiation accidents. Moreover, it is not always reasonable for the air transit countries and shipment by other modes of transport to have their own special emergency services that are prepared and equipped for elimination of the severe radiation accidents.

The IAEA established the RANET system to provide the international assistance. But this system seems to be poor operative and designed mainly for accidents at the facilities where the assistance is not so urgently required as in the transport accidents. Since the countries with the developed nuclear industry (radiation technologies and relevant emergency response systems) are usually consignors (consignees) of highly active RM, they, as well as the countries on route, are interested in the safe shipment and urgent elimination of accident consequences in these countries, considering both economy issues and the image of nuclear industry (social factor). Such an approach is applied in the transatlantic SNF shipment, providing the operative 24-hour duty and emergency visit of qualified experts of consignor/consignee to the accident site in the transit (riparian) countries.

Social-psychological factor

Social-psychological factor is very important for the transport of highly active RM by air. This factor had a fundamental importance for the introducing the special requirements to the transport of highly active RM by air into the IAEA's rules in 1996. Basing the technical risk assessment, in case of the transportation in accordance with the previous requirements, the risk of air shipment did not exceed the risk of any other transport mode. The need to consider the social factor is directly specified in the ALARA principle, so the establishment of special requirements to the RM goods to be transported by air does not contradict with the IAEA safety requirements. The special emergency response system or, at least, specialization of emergency response systems available in the states for air shipment would be effective both from viewpoint of safety providing and social-psychological point of view.

5. CONSCLUSION

Basing the results of preparation and implementation of the SNF shipment by air and analysis of Russian and international requirements to the emergency response systems for the RM transport by air, it is reasonable to continue the research study of issues arisen both at the national and international level, namely:

- regulatory and practical realization of a graded approach to the emergency response systems;
- larger detailing and specialization of requirements to the emergency response systems for the RM shipment by air;
- detailing of administrative requirements to the emergency response systems for the RM shipment by air; and
- systems of operative international assistance for RM shipment.

In addition to the actual enhancement of safety level, the results of research study of above-mentioned issues can have a positive influence, considering the social-psychological factor, on development of transport of the highly active RM by air.

6. REFERENCES

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