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GENERAL APPROACHES AND REQUIREMENTS ON SAFETY AND SECURITY OF RADIOACTIVE MATERIALS TRANSPORT IN RUSSIAN FEDERATION

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ABSTRACT

Development and implementation of safety and security requirements for transport of radioactive materials in the Russian Federation are addressed. At the outset it is worth noting that the transport safety requirements implemented are in full accordance with the IAEA's "Regulations for the Safe Transport of Radioactive Material (2009 Edition)". However, with respect to security requirements for radioactive material transport in some cases the Russian Federation requirements for nuclear material are more stringent compared to IAEA recommendations. The fundamental principles of safety and security of RM managements, recommended by IAEA documents (publications No. SF-1 and GOV/41/2001) are compared. Its correlation and differences concerning transport matters, the current level and the possibility of harmonization are analysed. In addition a reflection of the general approaches and concrete transport regulatory requirements is being evaluated. Problems of compliance assessment, including administrative and state control problems for safety and security provided at internal and international shipments are considered and compared.

1. INTRODUCTION

To date a very high record of safety for the transport of radioactive material shipments has been achieved globally. This record also includes movements in the Russian Federation. The number of accidents (incidents) for consignments of radioactive material is notably less compared to cases involving other dangerous goods. If the consequences of accidents occurred are considered, it should be noted that the inappropriate impacts of radiation or other effects for all accidents with radioactive material consignments has virtually no share of the consequences of such accidents still much less than the consequences in case of accidents with other dangerous goods.

Over the years in Russiawith bulk transport of radioactive material there are only recorded singles traffic violations (incidents) and accidents and no cases of

severe radiation exposure as a result of such transport on the public and staff.

If we consider the results of radioactive material transport in the aspect of security and physical protection (hereafter for brevity we use the term "security") of radioactive material goods in transport, then we should also note the high level achieved. According to the State Corporation on Atomic Energy “Rosatom” [1] in the country the security of radioactive materials and reliable protection of nuclear and radiating hazardous objects was ensured. According to available data there are no recorded cases of attempts to violate the physical protection and security of radioactive materials during transport, in the world, and in the country.

However, issues of reliability in security remain relevant. You can even note the increasing attention to ensuring the security of radioactive materials by seeing the increasing number of international, though a large extent recommendatory, but nevertheless regulating documents in this area. In Russia, many of the recommendation documents of the IAEA (nuclear security series) are the basis for the mandatory federal norms and regulations.

This report summarizes the current system requirements on ensuring safety and security of radioactive materials for transportation in the country (section 2) and Section 3 discusses the problems associated with the development and application of security requirements, as well as the harmonization and integration of the principles and requirements of safety and security, including issues conformity assessment requirements.

2. REGUIREMENTS FOR SAFETY AND SECURITY OF RADIOACTIVE MATERIAL UNDER TRANSPORT IN RUSSIA

The current Federal “Regulation for safety at transport of radioactive materials "NP-053-04 [2] is almost entirely consistent with IAEA recommendations of Regulation [3], as it relates directly to themselves technical requirements for consignments of radioactive materials (classification, radiation, thermal and mechanical properties, etc.) and transport conditions.

Some significant differences in comparison with international practice, not only with the IAEA regulations, take place in parts of the system of conformity assessment requirements. In particular, for the transport of radioactive material federal regulation requires the consignor to get certificates of permition of the State competent authority (State corporation "Rosatom") on the package design not only for types B, C, and packages containing fissile material and packages containing uranium hexafluoride, but also for type A packages. Also it is necessary to obtain certificates of permission for all shipments of these package types, as well as industrial package types 2 and 3. In addition consignors, carriers, developers and manufacturers of packaging must be licensed by the Federal Service for Technological, Environmental and Nuclear Supervision. Carriers must also be licensed by the Supervision body of Transport Ministry. The packagings for radioactive material are required to have sanitary-epidemiological conclusions of

public health surveillance body, and fabricated packagings are subjected to mandatory certification.

In respect to the security of radioactive materials it should be noted that, historically, the inevitable closed nature of the nuclear industry in the years of its establishment and early development predetermined an appropriate special and private regime for transport of the main radioactive materials, and virtually 100% of nuclear materials (NM), not only in the nuclear weapons complex but also in the nuclear fuel cycle. This regime provided the necessary level of physical protection, although such term was not used then.

So when in 1983 the state ratified the International Convention on the Physical Protection of Nuclear Material [4], the implementation of its requirements for the transport of nuclear materials did not cause significant difficulties. And to date, a special regime of nuclear material shipments can satisfy the requirements of security. These requirements are regulated by the documents on special transports and by the following federal regulations:

- Regulations of the physical protection of nuclear materials, nuclear facilities and storage spots of nuclear materials (approved by government resolution from 19.07.2007 No. 456, [5];
- Requirements for physical protection of nuclear materials, nuclear facilities and storage spots of nuclear materials. NP-083-07, [6].

Regarding ssecurity of non-nuclear (non-fissile materials) it should be noted that even the Federal law "About use of atomic energy"[7] (Articles 49 and 50), being adopted in the country in 1995, established the requirement to the physical protection not only for nuclear material, but also for all other radioactive materials and associated facilities. Federal norms and regulations governing the requirements for the security of radioactive materials at facilities and at transport have been adopted in 2001 and 2006:

- Regulations of the physical protection of radioactive sources, radioactive substances and storage spots. NP-034-01 [8];
- Regulations of the physical protection of radioactive materials and radiation sources in transportation. NP-073-06 [9].

Federal regulations [9] to a large extent are guided and comply with IAEA recommendations set out in [10]. Currently, federal norms and regulations for nuclear material and other radioactive material security are being revised. The review analysis of experience of development and application of requirements for security of radioactive materials, analysis of documents of the IAEA identified several problems, primarily in the physical protection of non-nuclear materials, which are addressed in Section 3. One of the most common problems concerns the harmonization and integration of fundamental principles and requirements of safety and security.

3. SOME ASPECTS OF HARMONIZATION AND INTEGRATION OF SAFETY AND SECURITY REQUIREMENTS

3.1. General considerations on harmonization and integration requirements

From a management point of view the introduction of new tasks and system requirements for any well-established process to ensure the effective implementation of the process and all its requirements raises the question of the need and opportunities for harmonization or integration of these new and previously established goals and requirements. First of all, it is important for organizations directly involved in the process of radioactive materials transport (consignors, consignees, carriers) and for the organizations that prepare transportation (the developers of equipment and technologies). However, it is equally important for government agencies engaged in the development of requirements and that are usually also responsible for supervising the implementation of the requirements or establishing a whole system of compliance assessment in this area.

It should be noted that any organization executing the different regulating requirements in any way in its activities integrates the requirements of different requirement systems, or finding the most appropriate ways that will satisfy the requirements of multiple separate systems, even if they largely are not harmonized with each other. But it would be highly desirable to have more or less harmonized and integrated systems at the regulating or requirement establishing level. And if at this level it is impossible to find solutions for the harmonization and integration in all cases, then the partial solutions have to be made at the level of performers .

It seems that for the processes of transport of radioactive materials, especially for international transportation, the need to harmonize and integrate the principles and requirements of safety and security is more important and more relevant than for stationary objects. The absence or lack of harmonization and integration of requirements leads to unnecessary expenses as in implementing the requirements and the presentation of analysis reports and other materials for conformity assessment requirements at receiving the relevant approvals. Deficiency of harmonization and integration of requirements may contribute to failures and delays in transport as well.

There the matter may be raised about the harmonization of security requirements themselves in various countries. And after such harmonization the integration of safety and security requirements may be carried out. However, it appears that the harmonization of requirements for safety in different countries and harmonization or integration of safety and security requirements can be worked through at the same time.

3.2. Fundamental principles of safety and security

The table shows the 10 fundamental principles of the safety and 12 fundamental principles of the security, established in the fundamental documents

of the IAEA on safety [11] and security [12]. The principles of security and recommendations for their implementation were also given a series of IAEA nuclear security No. 13 [13] in 2011.

From general considerations, it appears that the fundamental principles of safety and security should be more or less similar or correspond to each other. If not, there should be defined reasons for the differences and the impossibility of applying the same principles.

As listed in the table, only principles of safety 1, 2 and 9 have visible analogues in the principles of security A,C, D and K. More specifically - the safety principle 1 somehow corresponds to security principle E, principle 2 - principle A, C and D, principle 9 - Principle K. However, as we see the sequence and the presentation (etymology) of principles are not very successful in terms of comparing them with each other, determining the differences or the possibility for integration.

TABLE

IAEA SAFETY AND SECURITY FUNDAMENTAL PRINCIPLES

Safety principles according to SS No. SF-1	**Security principles according to GC(45)/INF/14**
Principle 1: Responsibility for safety The prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks.	***FUNDAMENTAL PRINCIPLE A: Responsibility of the State*** *The responsibility for the establishment, implementation and maintenance of a physical protection regime within a State rests entirely with that State.*
Principle 2: Role of government An effective legal and governmental framework for safety, including an independent regulatory body, must be established and sustained.	***FUNDAMENTAL PRINCIPLE B: Responsibilities during international Transport*** *The responsibility of a State for ensuring that nuclear material is adequately protected extends to international transport thereof, until that responsibility is properly transferred to another State, as appropriate.*
Principle 3: Leadership and management for safety Effective leadership and management for safety must be established and sustained in organizations concerned with, and facilities and activities that give rise to, radiation risks.	***FUNDAMENTAL PRINCIPLE C: Legislative and Regulatory Framework.*** *The State is responsible for establishing and maintaining a legislative and regulatory framework to govern physical protection. This framework should provide for the establishment of applicable physical protection requirements and include a system of evaluation and licensing or other procedures to grant authorization. This framework should include a system of inspection of nuclear facilities and transport to verify compliance with applicable requirements and conditions of the license or other authorizing document,*

	and to establish a means to enforce applicable requirements and conditions, including effective sanctions.
Principle 4: Justification of facilities and activities Facilities and activities that give rise to radiation risks must yield an overall benefit.	***FUNDAMENTAL PRINCIPLE D: Competent Authority.*** *The State should establish or designate a competent authority which is responsible for the implementation of the legislative and regulatory framework, and is provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities. The State should take steps to ensure an effective independence[4,5] between the functions of the State's competent authority and those of any other body in charge of the promotion or utilization of nuclear energy*
Principle 5: Optimization of protection Protection must be optimized to provide the highest level of safety that can reasonably be achieved.	***FUNDAMENTAL PRINCIPLE E: Responsibility of the License Holders*** *The responsibilities for implementing the various elements of physical protection within a State should be clearly identified. The State should ensure that the prime responsibility for the implementation of physical protection of nuclear material or of nuclear facilities rests with the holders of the relevant licenses or of other authorizing documents (e.g., operators or shippers).*
Principle 6: Limitation of risks to individuals Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm.	***FUNDAMENTAL PRINCIPLE F: Security Culture[6]*** *All organizations involved in implementing physical protection should give due priority to the security culture, to its development and maintenance necessary to ensure its effective implementation in the entire organization.*
Principle 7: Protection of present and future generations People and the environment, present and future, must be protected against radiation risks	***FUNDAMENTAL PRINCIPLE G: Threat*** *The State's physical protection should be based on the State's current evaluation of the threat.*
Principle 8: Prevention of accidents All practical efforts must be made to prevent and mitigate nuclear or radiation accidents	***FUNDAMENTAL PRINCIPLE H: Graded Approach[7]*** *Physical protection requirements should be based on a graded approach, taking into account the current evaluation of the threat, the relative attractiveness, the nature of the material and potential consequences associated with the unauthorized removal of nuclear material and with the sabotage against nuclear facilities or nuclear material.*
Principle 9: Emergency preparedness and response Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents.	***FUNDAMENTAL PRINCIPLE I: Defence in Depth*** *The State's requirements for physical protection should reflect a concept of several layers and methods of protection (structural or other technical, personnel and organizational) that have to be overcome or circumvented by an adversary in order to achieve his objectives.*

Principle 10: Protective actions to reduce existing or unregulated radiation risks Protective actions to reduce existing or unregulated radiation risks must be justified and optimized.	***FUNDAMENTAL PRINCIPLE J: Quality Assurance*** *A quality assurance policy and quality assurance programmes should be established and implemented with a view to providing confidence that specified requirements for all activities important to physical protection are satisfied.*
	FUNDAMENTAL PRINCIPLE K: Contingency Plans *Contingency (emergency) plans to respond to unauthorized removal of nuclear material or sabotage of nuclear facilities or nuclear material, or attempts thereof, should be prepared and appropriately exercised by all license holders and authorities concerned.*
	FUNDAMENTAL PRINCIPLE L: Confidentiality *The State should establish requirements for protecting the confidentiality of information, the unauthorized disclosure of which could compromise the physical protection of nuclear material and nuclear facilities.*

Further, the safety principle 3 - Leadership and management for safety in organizations. Is it significantly different from the security principle J (quality assurance)? From the standpoint of managing the organization, in fact, there should not be differences, but it seems from the presentation of the principles, they are two different things.

Also the question arises on considering the principles of radiation protection (safety principles 4, 5 and 6). Should similar principles be applied for security? There are none of these ones or their analogues in the list the security principles. Obviously that at least the principle of optimization (5) clearly should be, and it is applied in practice in ensuring security. However, its absence as a fundamental security principle has negative impact on the development and implementing the requirements for security. As well the safety principle of risk-limiting or dose limits (6) is difficult to use for the purposes and objectives of physical protection of nuclear materials. But, obviously, such (similar) principle must act in the security systems for other radioactive materials.

On considering the principles of security in the aspect of safety the questions arise as to why some fundamental principles of security does not address as the fundamental principles of safety. Namely, safety culture (similar to the security principle F – security culture), graded approach (the principle of security H), the principle of defense in depth (principle of security I) are the inalienable parts of safety system.

3.3. Practice and some performance issues of principles and requirements of security

As mentioned above, compliance with the requirements of security applications for the transportation of nuclear material does not cause too much difficulty. This explains the established traditions of transport of nuclear materials,

the use of special regime for transport, as well as the fact that consignors of such shipments are primarily large organizations, and additional costs to implement additional security requirements are not too financially burdensome.

For the transport of non-nuclear materials the requirements for the security are more onerous, taking into account as well that the parties (consignors, consignees) of such shipments are mostly relatively small organizations. Therefore, for them the solution of the problem of integrating security and safety requirements is extremely important. While on the other hand it should be noted that the implementation of many requirements for security is carried out without any additional measures due to the fact that, in accordance with safety regulations, all organizations related to the transport of radioactive materials are required to obtain licenses under which their activities in security is monitored by the state bodies.

The approaches of the current national regulations on security of NM and others RM in transport are of a mixed nature. From the one side they are of a mainly prescribing character establishing the concrete technical and organizational requirements. From the other side the regulations include requirements for the consignor to conduct an assessment of vulnerability. At the revision of the regulations evidently greater emphasis will be placed on the establishment of prescriptive requirements, primarily for the transportation of non-nuclear materials.

Serious problems for ensuring security and for meeting one of the fundamental principles of security is the issue of confidentiality of some security regime activities. To ensure the confidentiality the basic safety regulations [2] allow the omission of the labels with the signs of danger on vehicles for some RM shipments. Such permission breaks the standard requirements for safety of transport of dangerous goods. A compensatory measure (requirement) here is the requirement obliging staff to accompany such shipments with appropriate instruction in safety measures in relation to other participants in the transport process. It appears that such an approach could be used at the international level as well.

In connection with the principle of confidentiality of the security regime rather serious problems are the conformity assessment requirements. In fact, conformity assessment (examination of the safety and security, issue of permits, monitoring at transport, etc.) requires the maximum objectivity and transparency. With such conditions it is difficult simultaneously to provide secure and confidential. The assessments of conformity for transport safety, conducted through open procedures do not contribute for ensuring the confidentiality of shipments and hence the confidentiality for security activities. It follows that the more we assess the requirements of compliance (safety and security), the more difficult to ensure confidentiality. At the same time, federal regulations [8] and the IAEA recommendations [10] require that the enough large matters to have been assessed by the competent authorities.

4. CONCLUSION

In accordance with the opinions of the authors, our analysis shows that the currently existing requirements (being mandatory or advisory in nature) provide a high level of safety and security during transportation of radioactive materials. However, there are a number of problems in relation to some principles and requirements of safety and security. Mainly, this is with respect to harmonization and integration. Currently there is not much available information that addresses harmonization and integration of safety and security principle and requirements. This information could be viewed as the base foundation material to ensure the harmonization and integration of requirements for safety and security in the practice of the developers and users of national regulations.

Accordingly, one of the objectives of this report is to draw attention to this important matter that is evidently lacking and to initiate steps to overcome this in the future. . We look forward to the opinion of participants attending the conference and recommend that concrete steps be taken together to formulate appropriate recommendations and advice on how this aspect should be handled now and in the future. This will then result in a safe and secure environment for all of us.

5. LIST OF THE SOURCES

[1] Report on safety. State Corporation “Rosatom”, 2010.

[2] Regulations for the safety at transport of radioactive materials. NP -053-04.

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[4] International Convention on the Physical Protection of Nuclear Material.

[5] Regulations the physical protection of nuclear materials, nuclear facilities and storage spots of nuclear materials (government decree from 19.07.2007 № 456).

[6] Requirements for physical protection of nuclear materials, nuclear facilities and storage spots of nuclear materials. NP-083-07.

[7] Federal Law “About Use of Atomic Energy”, № 170-FZ, dated 21.11.1995.

[8] The regulations of physical protection of radioactive sources, radioactive substances and storage spots. NP-034-01.

[9] The regulations of physical protection of radioactive materials and radiation sources in transportation. NP-073-06.

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[12] Nuclear Verification and Security of Material. Physical protection, Objectives and Fundamental Principles. Gov/2001/41/

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