# Review of regulations concerning

# physical protection of nuclear facilities

# in the Russian Federation

# to physical protection of nuclear vessels

# (vessels with small modular reactors)

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**Abstract**

In the Russian Federation, physical protection of nuclear facilities (nuclear installations, radiation sources, storage facilities, nuclear materials and radioactive substances) is defined as an independent activity in the field of atomic energy use at the level of federal legislation. The Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostechnadzor) is responsible for creation and support of a regulatory and legal framework for nuclear safety and security, including physical protection of nuclear facilities.

Rostechnadzor is an independent Russian state nuclear safety and security regulatory authority in the field of atomic energy use. Rostechnadzor is authorized to develop, approve and put into force federal rules and regulations in the field of atomic energy use for establishing among others requirements for the physical protection of nuclear facilities. The federal rules and regulations are legally binding on all persons carrying out activities in the field of atomic energy use and are valid throughout the Russian Federation. Rostechnadzor also develops and approves safety guides for atomic energy use, which contain recommendations on how to meet the requirements for physical protection.

When developing federal rules and regulations with requirements for physical protection, the international obligations of the Russian Federation in the field of atomic energy use and recommendations of international organizations, including recommendations of the IAEA Nuclear Security Series publications (NSS publications), are taken into account.

The report contains:

the review of current state of the regulatory framework for the physical protection of nuclear facilities in the Russian Federation;

examples of the implementation of recommendations of NSS publications in federal rules and regulations in the field of atomic energy use and safety guides for atomic energy use by Rostechnadzor.

## REGULATORY LEGAL ACTS OF THE RUSSIAN FEDERATION IN THE FIELD OF PHYSICAL PROTECTION OF NUCLEAR AND RADIOACTIVE MATERIALS

Currently, the following main regulatory legal acts in the field of physical protection of nuclear facilities are effective in Russia:

* Federal Law of November 25, 1995 No. 170-FZ “On the Use of Atomic Energy” [1];
* “Rules for the Physical Protection of Nuclear Materials, Nuclear Installations and Storage Facilities for Nuclear Materials” (Decree of the Government of the Russian Federation) [2];
* Requirements for the Systems of Physical Protection of Nuclear Materials, Nuclear Facilities and Storage Facilities for Nuclear Materials (federal rules and regulations in the field of atomic energy use, NP-083-15) [3];
* Rules for the physical protection of radiation sources, storage facilities, radioactive substances (federal rules and regulations in the field of atomic energy use, NP-034-15) [4];
* Rules for the physical protection of radioactive substances and radiation sources during their transportation (federal rules and regulations in the field of atomic energy use, NP-073-11) [5];
* Requirements for the Physical Protection of Nuclear Vessels, Nuclear Maintenance Vessels, Vessels Transporting Nuclear Materials and Floating Nuclear Power Plants (federal rules and regulations in the field of atomic energy use, NP-085-19) [6].

### Federal Law “On the Use of Atomic Energy”

The Federal Law “On the Use of Atomic Energy” [1] is a fundamental document that defines the legal basis and principles for regulating relations arising from the use of atomic energy. The Federal Law defines physical protection as an independent type of activity in the field of the use of atomic energy and establishes its main goals and principles.

The law prohibits any work in the field of the use of atomic energy without providing physical protection. Physical protection is provided by operating organizations that are fully responsible for ensuring its implementation.

The law does not contain any detailed requirements for physical protection, but gives only general directions regarding its implementation.

Article 49 “Ensuring the physical protection of nuclear installations, radiation sources, storage facilities, nuclear materials and radioactive substances” determines that the physical protection of nuclear installations, radiation sources, storage facilities, nuclear materials and radioactive substances provides for a unified system of planning, coordination, control and implementation of a set of technical and organizational measures aimed at:

* Prevention of unauthorized entry into the territory of nuclear installations, radiation sources and storage facilities, prevention of unauthorized access to nuclear materials and radioactive substances, prevention of their theft or damage;
* Timely detection and suppression of any violations of the integrity and safety of nuclear materials and radioactive substances, timely detection and suppression of sabotage and terrorist acts that threaten the safety of nuclear installations, radiation sources and storage facilities;
* Detection and return of missing or stolen nuclear materials and radioactive substances.

Supervision of physical protection is carried out by state safety regulation authorities.

The law also establishes that:

* Requirements for physical protection are established by the rules and regulations in the field of the use of atomic energy;
* Physical protection must be implemented in accordance with international obligations.

Also, the law [1] establishes restrictions on rights (workers, citizens, their belongings and vehicles can be inspected) and restrictions on admission to work (only persons who have been granted access to state secrets, satisfy qualification requirements, and have no medical contraindications can be admitted to work).

### Rules for the Physical Protection of Nuclear Materials, Nuclear Installations and Storage Facilities for Nuclear Materials

The Rules for the Physical Protection of Nuclear Materials, Nuclear Installations and Storage Facilities for Nuclear Materials were approved by Decree of the Government of the Russian Federation of July 19, 2007 No. 456 [2].

The Rules [2] establish the requirements for the organization and provision of physical protection of nuclear materials, nuclear installations and storage facilities for nuclear materials in the territory of the Russian Federation, which are binding for all:

* Legal entities engaged in the production, use, storage, disposal, transportation of nuclear materials, design, construction, commissioning, operation and decommissioning of nuclear installations and storage facilities for nuclear materials, regardless of the legal form;
* Federal executive authorities and the State Atomic Energy Corporation Rosatom, which are engaged in management and coordination in this area of activity or provide for such activity, as well as supervise this activity.

The rules do not establish requirements for the physical protection of radiation sources and radioactive substances.

The rules establish:

* Basic terms of physical protection of nuclear materials, nuclear installations and storage facilities for nuclear materials and their definitions;
* The structure of the state system of physical protection and the powers of the federal executive bodies and nuclear sites included in it;
* Categories of nuclear materials, consequences of unauthorized actions in relation to physical protection subjects and categories of physical protection subjects themselves;
* Requirements for the organization and implementation of physical protection at a nuclear site;
* Requirements for the organization of physical protection of nuclear materials and nuclear installations during transportation;
* Requirements for state supervision, departmental and facility control of physical protection, as well as for the procedure for notification of unauthorized actions.

### Requirements for the Systems of Physical Protection of Nuclear Materials, Nuclear Facilities and Storage Facilities for Nuclear Materials

The Requirements for the Systems of Physical Protection of Nuclear Materials, Nuclear Facilities and Storage Facilities for Nuclear Materials NP-083-15 were approved by Order of the Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostechnadzor) of September 8, 2015 No. 343 [3]. NP-083-15 establish requirements for the systems of physical protection of nuclear materials, nuclear installations and storage facilities for nuclear materials at a nuclear site. This document develops and specifies the requirements of the Rules [2] regarding stationary nuclear sites, as well as during transportation of nuclear materials and nuclear installations.

The federal rules and regulations NP-083-15 [3]:

* Define the procedure for categorizing physical protection subjects;
* Establish 4 categories of a nuclear site;
* Define the procedure for the creation, improvement and functioning of a physical protection system;
* Establish requirements for the analysis of vulnerability and assessment of the effectiveness of physical protection system;
* Establish requirements for the design of protected and restricted areas;
* Define the procedure for the development of technical specifications for the creation and improvement of a physical protection system, as well as technical specifications for the design of a set of engineering and technical means of physical protection or its components;
* Establish requirements for organizational measures of physical protection, physical protection engineering and technical means complex and functional systems of physical protection system (intrusion protection, alarms, electrooptical surveillance and situation assessment, access control and management, operational communication and alerts, information protection, power and lighting supply), for physical protection personnel;
* Define the procedure for providing physical protection during the decommissioning of nuclear installations and storage facilities for nuclear materials;
* Establish requirements for providing physical protection of nuclear materials and nuclear installations during transportation;
* Provide a list of physical protection documents developed at a nuclear site with general requirements for their content.

### Rules for the Physical Protection of Radiation Sources, Storage Facilities, Radioactive Substances

The Rules for the Physical Protection of Radiation Sources, Storage Facilities, Radioactive Substances NP-034-15 were approved by Order of the Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostechnadzor) of July 21, 2015 No. 280 [4]. They establish requirements for the physical protection of radiation sources, storage facilities and radioactive substances at all stages of their design, construction, operation and decommissioning, as well as when handling radioactive substances.

The federal rules and regulations NP-034-15 do not apply to the provision of physical protection of radiation sources, radioactive substances and radioactive waste during their transportation.

The federal rules and regulations NP-034-15 [4]:

* Give general provisions for ensuring physical protection at radiation sites;
* Define goals and objectives of physical protection system at a radiation site;
* Introduce four levels of physical protection of radiation sites, which shape the set of requirements for the structure of organizational measures, engineering and technical means of physical protection and physical protection personnel;
* Establish the procedure for determining the level of physical protection of a radiation site depending on the category of consequences of sabotage at a radiation site, the category of sealed radionuclide sources operated at a radiation site by potential radiation hazard, and for establishing the possibility or impossibility of stealing radioactive substances and sealed radionuclide sources;
* Establish requirements for the work of the commission to establish the levels of physical protection of radiation sites;
* Establish requirements for organizational measures of physical protection, physical protection engineering and technical means complex and physical protection personnel;
* Describe the procedure for notification of unauthorized actions in relation to radiation sources, storage facilities and radioactive substances;
* Provide a list of physical protection documents to be developed (available) in the organization, depending on the levels of physical protection of its radiation sites;
* Establish a requirement for the development and content of a physical protection plan.Requirements for the physical protection of a floating nuclear power plant.

### Rules for the Physical Protection of Radioactive Substances and Radiation Sources during their Transportation

The Rules for the Physical Protection of Radioactive Substances and Radiation Sources during their Transportation NP-073-11 were approved by Order of the Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostechnadzor) of December 27, 2011 No. 747 [5].

The federal rules and regulations NP-073-11 establish requirements for physical protection of radioactive substances and radiation sources that are binding for all legal entities and individuals involved in organizing and implementing physical protection of radioactive substances and radiation sources during transportation by all means of transport in the Russian Federation.

This document applies to physical protection during transportation [5] of:

a) radioactive substances which are recorded in the system of state accounting and control of radioactive substances and radioactive waste;

b) radiation sources (their elements) having radionuclide sources with radioactive substances and nuclear materials in quantities that are subject to recording in the system of state accounting and control of radioactive substances and radioactive waste.

The federal rules and regulations NP-073-11 [5] do not apply to the provision of physical protection during transportation of radioactive substances and radiation sources used in activities related to the development, manufacture, testing, operation and disposal of nuclear weapons and military nuclear power plants.

The federal rules and regulations NP-073-11 [5] establish:

* Levels of physical protection of cargoes with radioactive substances and radiation sources and the procedure for their determination;
* Requirements for each level of physical protection of cargoes with radioactive substances and radiation sources;
* Procedure for notification of unauthorized actions.

### Requirements for the Physical Protection of Nuclear Vessels, Nuclear Maintenance Vessels, Vessels Transporting Nuclear Materials and Floating Nuclear Power Plants

The Requirements for the Physical Protection of Nuclear Vessels, Nuclear Maintenance Vessels, Vessels Transporting Nuclear Materials and Floating Nuclear Power Plants NP-085-19 were approved by Order of the Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostechnadzor) of April 1, 2019 No. 126 [6]. They establish requirements for physical protection of:

Vessels and other watercraft with nuclear reactors, including floating nuclear power units with nuclear materials (hereinafter referred to as the floating power unit), with the exception of military nuclear power plants;

Vessels carrying out interfacility transportation of nuclear materials;

Nuclear maintenance vessels (specialized vessels carrying out transportation, storage, technological operations and transshipment of nuclear fuel);

Floating nuclear power plants.

A floating nuclear power plant is a nuclear site with an operating floating power unit, and if necessary, engineering facilities to provide its parking, a coastal site with industrial buildings and facilities that transfer heat and electric energy to the consumer, administrative buildings and an adjacent area of the water surface and underwater section within the established boundaries of the nuclear site.

The federal rules and regulations NP-085-19 establish [6]:

* General requirements for the physical protection of vessels;
* Requirements for organizational measures of physical protection;
* Requirements for physical protection engineering and technical means complex;
* Requirements for equipping the protected areas of a vessel;
* Procedure for notification of unauthorized actions;
* Requirements for the physical protection of a floating nuclear power plant.

## State System of the Physical Protection of Nuclear Materials, Nuclear Facilities and Nuclear Material Storage Facilities

### Structure of the State System of Physical Protection

For the first time in the Russian Federation, the Rules [2] introduce the concept of a state system of physical protection. The state system of physical protection is a unified system of planning, coordination, control and implementation of a set of technical and organizational measures for the implementation of physical protection. The state system of physical protection includes:

a) Federal executive bodies that manage (coordinate) the activities of nuclear sites;

b) Federal executive bodies involved in the creation, improvement, implementation and provision of physical protection;

c) Federal executive bodies exercising state supervision of physical protection;

d) Nuclear sites;

e) State Atomic Energy Corporation Rosatom.

### Powers of Federal Executive Bodies and Nuclear Sites

The Rules [2] define the powers (within the framework of the state physical protection system) of Rostechnadzor, the State Atomic Energy Corporation Rosatom, nuclear sites, as well as the Ministry of Defense of the Russian Federation, the Federal Security Service of the Russian Federation, the Ministry of Transport of the Russian Federation, the Federal Agency for Railway Transport, Federal Agency of Sea and River Transport, and Federal Customs Service.

Within the framework of the state system of physical protection, the federal executive bodies and the State Atomic Energy Corporation Rosatom, within their powers:

a) Ensure compliance with international obligations;

b) Organize and coordinate the work on physical protection at the corresponding nuclear sites;

c) Organize transportation of nuclear materials and nuclear installations and ensure their physical protection;

d) Develop and approve regulations on the provision of physical protection;

e) Participate in the development of federal rules and regulations in the field of physical protection;

f) Participate in the development of a list of the main threats to nuclear and radiation hazardous sites and typical models of violators;

g) Decide on the recognition of nuclear sites as suitable for the handling of nuclear materials, the operation of nuclear installations and storage facilities;

h) Develop industry-specific scientific and technical programs and work plans to ensure physical protection;

i) Take measures to protect information;

j) Assist the investigating authorities in solving crimes;

k) Carry out financing of work to ensure physical protection;

l) Carry out international cooperation in the field of physical protection;

m) Exercise control over the organization and state of physical protection at nuclear sites;

n) Determine the procedure for creating and improving the system of physical protection.

The State Atomic Energy Corporation Rosatom, within its powers:

a) Organizes the provision of physical protection for nuclear materials, nuclear installations, radioactive substances, radiation sources and storage facilities;

 b) On behalf of the Russian Federation performs the functions of the state competent authority for nuclear and radiation safety during the transportation of nuclear materials and radioactive substances, the central state authority and the point of contact and the national competent authority for the fulfillment of the obligations of the Russian Federation in the field of physical protection of nuclear materials in IAEA and other international organizations;

c) Provides security for sites, as well as escort of nuclear materials during transportation by means of departmental security services;

d) Determines the procedure for issuing certificates for technical means.

The Rostechnadzor, within its powers:

a) Performs, within its powers, the functions of the state regulation authority in the field of safety in the use of atomic energy and develops, approves and enacts federal rules and regulations in the field of physical protection;

b) Carries out state supervision and control of physical protection at supervised nuclear sites;

d) Formulates the conditions for the validity of licenses in the field of the use of atomic energy in the part related to physical protection;

e) Takes measures of a restrictive, preventive and proactive nature, as well as measures to eliminate the consequences of the specified violations.

Nuclear sites, within their powers:

a) Create a system of physical protection;

b) Ensure the functioning of the system of physical protection;

c) Develop suggestions for improving the system of physical protection;

d) If necessary, attract specialized organizations to solve physical protection problems;

e) Interact with the internal affairs bodies of the Russian Federation and the bodies of the Federal Security Service of the Russian Federation in the specified field of activity.

## Approaches to providing physical protection in the Russian Federation, their compliance with the IAEA recommendations

### Physical Protection of Nuclear Materials, Nuclear Facilities and Nuclear Material Storage Facilities

At the federal level in the field of the use of atomic energy, requirements for systems of physical protection at nuclear sites are established by documents NP-083-15 [9] and the Rules for the Physical Protection [2].

Physical protection is an activity in the field of the use of atomic energy, carried out in order to prevent sabotage and theft in relation to nuclear materials, nuclear installations and storage facilities for nuclear materials.

physical protection system for nuclear materials, nuclear installations and storage facilities for nuclear materials is implemented in order to ensure physical protection at a nuclear site.

The objectives of physical protection at a nuclear site are:

a) Prevention of unauthorized actions;

b) Timely detection of unauthorized actions;

c) Delaying (slowing down) the entry (movement) of the violator;

d) Response to unauthorized actions and the neutralization of violators to prevent unauthorized actions.

physical protection system includes:

* Organizational measures (the site must have implemented organizational measures and developed site-specific regulatory and organizational and administrative documents on the organization and functioning of physical protection system);
* Physical protection engineering and technical means complex;
* Physical protection personnel (persons whose job responsibilities include performing the functions of physical protection at a nuclear site and during the transportation of nuclear materials and nuclear installations).

The set of technical means of physical protection consists of the following basic functional systems:

* Intrusion protection;
* Alarm;
* Access control and management system;
* Electrooptical surveillance and situation assessment;
* System of operational communication and alert;
* Telecommunication system;
* Information protection;
* Power and lighting supply.

The engineering means of physical protection include:

* Physical barriers (a physical obstacle that delays the entry of the violator into protected areas, vulnerable places or nuclear materials);
* Engineering equipment of protected areas and security checkpoints (posts).

In order to fulfill the objectives of physical protection, the following should be categorized at each nuclear site:

* Physical protection subjects;
* Premises where physical protection subjects are located, as well as buildings, structures, and separate territories of the nuclear site where nuclear materials are used or stored or nuclear installations or storage facilities are located and (or) operated (hereinafter referred to as industrial sites);
* Nuclear site.

The categorization of physical protection subjects, premises (if necessary buildings, structures, industrial sites) and of a nuclear site is used to develop requirements for physical protection system and ensure its adequacy to threats and models of violators.

The following should be considered as indicators of the categorization of physical protection subjects:

* Nuclear materials category;
* Degree of secrecy of physical protection subjects;
* Category of consequences of unauthorized actions in relation to physical protection subjects;
* Presence of a significant amount of nuclear materials for direct use.

The requirements for the transportation of nuclear materials and nuclear installations are also established by documents NP-083-15 [3] and the Rules for the Physical Protection [2]. Also, the requirements of NP-085-19 are added to ensure the physical protection of vessels with nuclear reactors, nuclear maintenance vessels, vessels transporting nuclear materials, and floating nuclear power plants [6]. Goals, objectives, and categorization approaches are the same as for stationary facilities.

If we compare the above-mentioned federal rules and regulations in the field of the use of atomic energy NP-083-15 and NP-085-19 [3, 6], to be brought into force by Rostekhnadzor, with recommendations from the publications of the IAEA Nuclear Security Series, then in general, the documents comply with the recommendations. The greatest influence on the development of the requirements of NP-083-15 and NP-085-19 [3, 6] was made by the recommendations of NSS 13 (INFCIRC/225/Revision 5) [7].

### Physical Protection of Radioactive Substances, Radiation Sources and Storage Facilities

Physical protection system at a radiation site, as well as at a nuclear site, is created in order to prevent sabotage and theft of radiation sources and radioactive substances.

Physical protection system at a radiation site should provide the solution to the following tasks:

* Prevention of unauthorized actions;
* Timely detection of unauthorized actions;
* Delaying (slowing down) the entry (movement) of violators;
* Response to unauthorized actions and the neutralization of violators to prevent unauthorized actions.

Physical protection system at a radiation site, as well as at a nuclear site, includes a combination of:

* Organizational measures;
* Engineering and technical means of physical protection;
* Physical protection personnel.

The management of the site should organize the analysis of the vulnerability of the site and the development of the site document, i.e. the report on the analysis of the vulnerability of radiation sources, storage facilities and radioactive substances (with established project threat).

To differentiate the requirements for the systems of physical protection of radiation sites, their levels of physical protection are established, depending on:

* The category of consequences of sabotage at a radiation site;
* The category of sealed radionuclide sources operated at a radiation site by potential radiation hazard;
* The possibility or impossibility of stealing radioactive substances and sealed radionuclide sources**.**

When transporting radioactive substances and radiation sources, physical protection solves the same problems, consists of the same organizational measures, engineering and technical means of physical protection and physical protection personnel. Physical protection levels are also used to differentiate requirements.

At the federal level, requirements are established by documents NP-034-15 [4] and NP-073-11 [5], which comply with the recommendations of publications of the IAEA Nuclear Security Series, in particular, NSS 14, NSS 9, NSS 11, [8-10].

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