

**RESOLUTION No. 22 OF THE MINISTRY FOR EMERGENCY
SITUATIONS OF THE REPUBLIC OF BELARUS
dated May 31, 2010**

**ON APPROVAL OF THE STANDARDS AND RULES FOR THE
PROVISION OF NUCLEAR AND RADIATION SAFETY "SAFETY IN
HANDLING SOURCES OF IONIZING RADIATION. GENERAL
PROVISIONS."**

Based on Article 6-2 of Law of the Republic of Belarus of January 5, 1998 *On Radiation Safety of the Population* the Ministry for Emergency Situations of the Republic of Belarus RESOLVES:

1. To approve the enclosed Standards and Rules for the Provision of Nuclear and Radiation Safety "Safety in Handling Sources of Ionizing Radiation. General Provisions."
2. This resolution shall enter into force on 1 September 2010.

E.R.Bariev, Minister

APPROVED
Resolution No. 22 of the Ministry
for Emergency Situations of
the Republic of Belarus
dd. 31.05.2010

STANDARDS AND RULES FOR THE PROVISION OF NUCLEAR AND RADIATION SAFETY "SAFETY IN HANDLING SOURCES OF IONIZING RADIATION. GENERAL PROVISIONS"

SECTION I GENERAL PROVISIONS

CHAPTER 1 SCOPE OF APPLICATION

1. The standards and rules for the provision of nuclear and radiation safety "Safety in Handling Sources of Ionizing Radiation. General Provisions" (hereinafter the Rules) have been developed on the basis of Law of the Republic of Belarus dated January 5, 1998 *On Radiation Safety of the Population* (Vedamastsi Natsyyanalnaga skhodu Respubliki Belarus, 1998, No. 5, p. 25).
2. These Rules establish technical and organizational measures, criteria and requirements for radiation safety in handling ionizing radiation sources (hereinafter the IRS).
3. The requirements of the Rules are binding in the territory of the Republic of Belarus for all natural and legal persons, regardless of their subordination and forms of ownership, which handle IRS.
4. The Rules requirements apply to all types of work carried out in the design, production, recycling, use and storage of IRS.
5. The requirements for the safe transport of IRS are governed by separate rules.
6. The Rules requirements do not apply to nuclear facilities and radioactive waste management facilities (hereinafter RW).

CHAPTER 2 TERMS AND DEFINITIONS

7. The Rules contain the terms and definitions used in the meaning defined by Law of the Republic of Belarus of January 5, 1998 *On Radiation Safety of the Population*.
8. The following terms and definitions are also used with regard to the Rules:
X-ray unit: a set of equipment for production and use of X-ray radiation, consisting of X-ray generator and accessories and devices related to it;
IRS safety: IRS property to limit, during normal operation and operation deviations, including accidents, the radiation exposure of workers (personnel), the population and the environment within the ranges set by radiation safety standards;

biological protection: a system of structures and materials located around the IRS and intended to mitigate the ionizing radiation down to biologically safe levels;

radionuclide radiation source unit (hereinafter RRSU): IRS structural component providing safe operation of IRS and including radionuclide source, physical barriers (components of biological protection) and the devices for transfer of a radioactive source from the storage position to the operating position and vice versa;

decommissioning of IRS: activities for implementation of organizational and technical measures excluding further intended use of IRS and providing safety of personnel, population and environment;

neutron generator: technical device that can emit neutrons and contains a controllable source of particles bombarding the target;

radionuclide generator: portable device with a local radiation protection for short-lived radionuclides in the organization's facilities;

deterministic effects: clinically detectable adverse biological effects for which the existence of a threshold is assumed, below which there is no effect, and above it the severity of effect depends on the radiation dose;

forbidden period: minimal time between the end of the radiation and permitted entry in the process chamber, required for reduction in it of concentration of toxic substances down to a set value by way of ventilation, as well as for reduction of the emission levels of the induced activity of structural and other materials in the chamber to acceptable values;

X-ray radiation: photon radiation, consisting of braking and/or characteristic radiation;

sealed radionuclide source (hereinafter SRS): a source of radiation, the design of which prevents penetration of radionuclides into the environment under the conditions of use and wear for which it is designed;

unsealed radionuclide source (hereinafter URS): radiation source, the use of which can entail penetration of radionuclides into the environment;

unused X-ray radiation sources: devices generating unused X-ray radiation;

low-energy X-ray sources: devices generating X-ray radiation with the energy less than 50 keV at the accelerating voltage of 10 to 100 kV (hereinafter **LEXR sources**);

specified lifetime of IRS: service life period including transport and storage, assigned by the manufacturer for given type of IRS with account of its design, specifications, test results, calculations and operational experience in the specified conditions, at the end of which the IRS use should be discontinued;

unused X-ray radiation (hereinafter UXR): X-ray radiation generated inside electric vacuum devices, electron-beam, ion-plasma and other installations, electron microscopes as a result of braking of electrons accelerated by the electric field at the electrodes, at the processed or studied materials and other metallic parts or those containing heavy element compounds, this radiation being a side effect, i. e., not related to the purpose of these instruments and installations;

normal operation of IRS: IRS operation within the limits and conditions specified by IRS design (or technical documentation);

quality assurance: planned and systematically exercised activities aimed to ensure that all work on planning, design, manufacture, commissioning, operation and decommissioning with regard to IRS is done in due order and the results meet the requirements imposed on them;

irradiator: device that provides the spatial arrangement of sealed radionuclide radiation sources for the formation of a given field of ionizing radiation;

Safety Assessment Report on the radiation facility (hereinafter **SAR RF**): a document justifying the safety of a radiation facility and developed by IRS user in accordance with the requirements of regulatory legal acts (hereinafter RLA), including technical regulations (hereinafter TR) on radiation safety;

recertification of IRS: the activities carried out periodically by the IRS user to verify its conformity with the parameters and characteristics to the requirements defined by IRS design (or technical documentation);

normal operation limits of IRS: the parameters and characteristics of the IRS systems (elements) specified by IRS design (or technical documentation) for normal operation;

program of IRS decommissioning: a document containing the basic organisational and technical measures to achieve the specified final condition of the IRS, the sequence and schedule of stages of IRS decommissioning, as well as the list of major types of work at each stage;

design-basis accident: an accident for which the design specified initiating events and final states, and provided safety systems to ensure the restriction of its consequences to the limits established for such accidents;

design of IRS decommissioning: a document developed on the basis of IRS decommissioning program and with account of technical and radiological IRS inspection, which defines the stages, types of work at each stage with indication of work technique, financial and material resources for each stage of IRS decommissioning;

IRS design basis: initial data and postulated events for IRS design, production of its systems and components, operation during the designed lifetime, and decommissioning;

process chamber: a room or container surrounded by radiation protection means, in which the object's irradiation is carried out;

radiation facility (hereinafter **RF**): the IRS user or the user's structural unit where IRS management is performed;

radioisotope instrument (hereinafter **RI**): radiation-and-information device, the operating principle of which is based on the use of interaction results of ionizing radiation with the controlled object, and which has **SRS** in its design;

radiopharmaceuticals (hereinafter **RPC**): pharmaceutical compounds with radionuclides permitted by the Ministry of Health of the Republic of Belarus for use in the diagnosis and treatment of various diseases;

IRS maintenance: a set of operations to maintain operability and serviceability of IRS, its systems and components during its intended use and storage;

charged particles accelerator (hereinafter **the accelerator**): electrophysical device designed to increase the kinetic energy of charged particles above 0.1 MeV;

conditions for IRS safe operation: minimal conditions established by IRS design or other technical documentation for the number, characteristics, operating capability and service conditions of the systems (components) important for safety, which provide observance of safe operation limits and/or safety criteria;

device generating ionizing radiation (hereinafter **DGIR**): electrophysical device in which the ionizing radiation appear due to changes in the velocity of charged particles, their annihilation or nuclear reactions;

physical protection: a set of technical, organizational and other measures aimed at the security of radiation facilities and the prevention of unauthorized access to them;

physical barrier: part of the IRS design limiting the penetration of ionizing radiation and/or radioactive substances (hereinafter RS) into the environment.

CHAPTER 3

OBJECTIVES AND CRITERIA OF SAFETY IN HANDLING IONIZING RADIATION SOURCES

9. The main objective of IRS safety assurance is to prevent radiation exposure of personnel, population and environment above the established limits during both normal operation and accidents by maintaining the IRS in good technical condition and by operating them in accordance with the design and/or other technical documentation.

10. Radiation safety is provided through:

- continuous monitoring of IRS security and their accounting;
- monitoring of radiation effect on the environment, citizens belonging to the category of exposed persons "employees (personnel)" (hereinafter the personnel), and citizens belonging to the category of exposed persons "population" (hereinafter the population);
- IRS protection against unauthorized access or their improper use;
- provision of a safety environment for RF functioning;
- planning of protective measures and preparedness for reasonable emergency measures to reduce radiation exposure in the event of a radiation accident or a real risk of its occurrence;
- availability and reliability of information about current and potential levels of radiation exposure.

11. A range of measures to provide radiation safety, aimed at maintaining the IRS, devices and systems in good technical condition and their operation in accordance with the requirements of the legislation on radiation safety, technical regulation and standardization, as well as the technical and operational documentation, includes organizational, engineering and technical measures.

Organizational measures aimed at providing radiation safety include licensing of activities, conformity assessment of technologies and equipment, planning of the activities related to the IRS use, site selection, conducting technical and environmental expertise, development of the measures for emergency preparedness

and provision of emergency response, protection against unauthorized access, IRS accounting and control over their movement.

Engineering and technical measures provide for availability of the systems of IRS physical protection, radiation monitoring, use of remote control mechanisms, additional ventilation, cleaning and special sewage systems in accordance with the requirements of technical regulations, maintaining of equipment and transport routes in proper condition.

12. The criteria for radiation safety are the fulfilment of the following requirements:

- absence of exposure of the personnel and the population during IRS normal operation above the established dose limits;
- absence of pollution with RS above permissible limits;
- absence of radiation accidents with regard to all types of work carried out in the IRS production, recycling, use and storage.

CHAPTER 4 CLASSIFICATION OF SOURCES OF IONIZING RADIATION

13. Classification of radiation sources is carried out by the following features:

- kind of IRS;
- purpose of IRS;
- transportability of IRS;
- the degree of radiation hazard of IRS.

14. IRS are divided by their kind into:

- radionuclide sources based on natural and artificial radioactive isotopes. Radionuclide sources are divided into unsealed (URS) and sealed (SRS) ones;
- devices generating ionizing radiation (DGIR).

15. IRS are divided by their purpose into medical, technological, control and reference ones.

Medical IRS are designed for use in medical practice for diagnostic, preventive and therapeutic purposes.

Technological IRS are used in various industrial and scientific processes.

Control sources are used for testing and adjustment of radiation and nuclear physical instruments and installations.

Reference sources are used for metrological verification of radiation and nuclear physical instrumentation.

16. IRS are divided by their transportability into:

stationary: IRS, the purpose and design of which suggest their operation in the permanent location throughout the design lifetime, and which require specially equipped facility (or facilities), and additional technical systems and means for their placement and operation;

mobile: IRS mounted and used for their intended purpose in the transport vehicles (both automotive or specially adapted for transportation);

portable: IRS, the design and weight of component parts of which make it possible to carry them (or, if necessary, to transport them in the assembled condition) and use for intended purposes directly in the work area in the premises (without modification and strengthening of the premises protection) or in the field.

17. IRS are divided into 5 categories by their degree of radiation hazard. The list of IRS categories by their radiation hazard is given in Appendix 1.

18. The IRS categorization system is based on the concept of "hazardous source", defined as the source, which, if not controlled, can lead to the exposure of humans with the occurrence of severe deterministic effects.

19. The criteria for IRS categorization are:

- kind of IRS and scope of its application with account of potential hazards arising from the predictable failures and deviations from normal operating conditions;
- activity and specific activity (for radionuclide sources).

20. The values of the most common hazards of radioactive sources and the requirements for defining of IRS hazard categories are listed in Annexes 2 and 3.

CHAPTER 5 CLASSIFICATION SYSTEMS AND COMPONENTS OF IONIZING RADIATION SOURCES

21. The systems and components composing the IRS, are divided into:

- systems and components important for safety;
- systems and components that do not affect safety.

The main systems important for safety include:

- the system of moving and fixation of the radionuclide source;
- IRS control system (control panel);
- the system of alarms and warning of radiation hazard;
- interlocking system;
- system of physical barriers;
- power supply system;
- ventilation system.

22. The safety systems and components are divided by the nature of their functions into:

- Protecting: systems and components designed to prevent damage to the IRS components in case of accidents;
- Containment: systems and components intended to prevent or limit the spread of RS and ionizing radiation beyond the IRS (or RF) boundaries in case of an accident;
- Supporting: systems and components designed to provide other systems with energy, create working environment and conditions for their functioning;
- Control: systems and components implementing control of the process equipment and components of other safety systems as per the given process objectives and criteria.

23. Three classes of safety are established according to the effect on the safety of IRS systems and components:

1st class: radionuclide sources, the damage or loss of containment of which shall be an initiating event accompanied by personnel exposure above the established dose limits or by emission (discharge) of RS into premises and/or the environment;

2nd class: the systems and components (except for radioactive sources) the failure of which shall be initiating events accompanied by personnel exposure above the established dose limits or by emission (discharge) of RS into premises and/or the environment;

3rd class: the systems and components the failure of which shall be initiating events leading to abnormality of operation but not entailing an accident and personnel exposure to radiation or emissions (discharges) of RS into premises and/or the environment.

24. The classes of safety of IRS systems and components important to safety, as well as the systems and components of normal operation are established in the IRS designing in accordance with the requirements of the Rules.

25. The requirements to quality of the systems and components important to safety, of the IRS referred to Class 1 and 2 shall be determined in the design documentation.

The systems and components referred to Class of safety 3 must meet the general industrial requirements in their manufacture.

CHAPTER 6

RESPONSIBILITIES OF THE USER OF IONIZING RADIATION SOURCES WITH REGARD TO RADIATION SAFETY ASSURANCE

26. The IRS user is obliged to plan and carry out measures to provide radiation safety, perform assessment of the effectiveness of measures to ensure radiation safety.

27. Each IRS user shall, on the basis of the nature and conditions of his work, develop and agree with the bodies of state supervision and state sanitary supervision in the field of radiation safety the Procedure for Control of Radiation Safety.

28. Before starting work with an IRS the user must:

- determine and approve the list of people referred to the "personnel" category;
- appoint a person who is authorized by the IRS user to monitor the radiation safety;
- appoint persons responsible for IRS radiation control, accounting, storage and issue, and for organization of collection, storage and delivery of RW;
- set up a board to assess the knowledge of the personnel in the field of radiation safety;
- appoint a person responsible for the IRS technical condition.

29. The IRS user must perform the assessment of radiation safety status of new products, materials, as well as new (modernized, reconstructed) facilities,

manufacturing processes and producing units comprising IRS; provide for and comply with a set of measures to ensure radiation safety aimed at maintaining the IRS, devices and units in good technical condition.

30. The IRS user must provide the development of reference levels of radiation factor effect at the radiation facility and in the control area established for operational radiation monitoring, for the purpose of securing the achieved radiation safety level, providing further reduce of personnel exposure and population and radioactive pollution of the environment.

31. The IRS user must have the following documents:

- job descriptions defining the personnel responsibilities;
- the procedure for radiation safety control;
- an action plan for the protection of workers (personnel) and population from radiation accident and its consequences;
- instructions on radiation safety at the RF;
- instructions on the personnel actions in emergency situations;
- personnel reference exposure levels;
- account cards of individual doses of workers;
- briefing log on safety and radiation safety;
- IRS receipt and delivery log;
- IRS inventory and inspection report for the past year.

32. The IRS user is obliged to comply with the regulations for radiation safety of the officers of the Department for Nuclear and Radiation Safety of the Ministry for Emergency Situations of the Republic of Belarus (hereinafter Gosatomnadzor), bodies and institutions that execute the state sanitary supervision, issued in accordance with the law.

CHAPTER 7

REQUIREMENTS FOR DELIVERY, ORGANIZATION BY THE USER OF ACCOUNTING AND CONTROL OF IONIZING RADIATION SOURCES

33. Delivery of radiation sources is carried out as per the call-off orders.

34. Call-off orders for IRS delivery of radiation sources are subject to agreement with the bodies effecting state supervision in the field of radiation safety.

35. Approval and registration of call-off orders for obtaining IRS is carried out under the following conditions:

- availability of a permit for the use of declared IRS in the territory of the Republic of Belarus;
- availability of a special permit (license) for IRS transport (for radionuclide radiation sources) and their safekeeping until it is received by the user;
- availability of a permit for the IRS user's right to work with IRS (licenses, sanitary passport).

36. The IRS user must provide such conditions of receipt, storage, use and decommissioning of all IRS which exclude the possibility of their loss or uncontrolled use.

37. All radionuclide radiation sources, generators of short-lived radionuclides, and DGIR received by the organization must be registered in IRS receipt and delivery log, and the accompanying documents must be sent to the accounting department for posting.

38. IRS user must provide for the IRS annual inventory. IRS inventory is carried out by a board appointed by order of the organization's head.

39. In the event of IRS theft or loss the IRS user is obliged to inform Gosatomnadzor.

Such information should be presented in accordance with the procedure established in Chapter 20 of the Rules.

40. IRS being in ownership of the Republic

of Belarus, located in the territory of the Republic of Belarus or abroad, are subject to state registration in the unified state system of IRS registration and control.

41. The IRS state registration is carried out in accordance with the Regulations on the Procedure of State Registration of Ionizing Radiation Sources and of Maintaining a Unified State System of Registration and Control over Ionizing Radiation Sources, approved by Decree of the Council of Ministers No. 562 of April 30, 2009 (National Register of Legal Acts of the Republic of Belarus 2009, No. 109, 5/29694).

SECTION II

REQUIREMENTS FOR THE DESIGN, ENGINEERING, FABRICATION AND ASSEMBLY OF IONIZING RADIATION SOURCES

CHAPTER 8

GENERAL REQUIREMENTS FOR THE DESIGN, ENGINEERING AND PRODUCTION OF IONIZING RADIATION SOURCES

42. Design, engineering, fabrication and assembly of the IRS and the safety systems and components comprising them must be carried out in accordance with the legislation in the field of radiation safety.

43. Design, engineering and production of ionizing radiation sources may be carried out by the organizations that obtained a corresponding license in due order.

44. In IRS designing the preference should be given to such systems and components the action of which is based on the passive principle of operation (the operation of which is only connected with the event that initiated their action and does not depend on the work of other systems and components) and properties of internal self-protection (self-regulation, thermal inertia and other natural processes).

45. The IRS systems and elements important to safety shall be designed, manufactured and installed so as to ensure the implementation of safety features in the designed amount against mechanical, thermal, chemical and other loads, from external impacts of natural and technogenic origin, provided for in the design

basis, from internal stresses caused by deviations from normal operation and design-basis accidents, as well as combinations of loads.

46. In the designing of electrical and electronic equipment operating in the ionizing radiation fields one must ensure preservation of operational properties of materials and performance of systems and components for the designated lifetime.

47. The IRS design must define and justify the following:

- IRS kind, its radiation hazard category and the class of works with URS;
- safety class of the components comprising the IRS in accordance with Chapter 5 of the Rules;
- list of initiating events for potential radiation accidents;
- the systems important for the IRS safety;
- organizational measures to prevent violations of limits and conditions of IRS safe operation, as well as organizational measures to prevent accidents, mitigate their consequences and ensure IRS safety in any design-based initiating event;
- organizational and technical measures to prevent erroneous and unauthorized personnel actions, which may lead to a violation of the conditions of IRS safe operation or aggravate the consequences of failure of any system (component);
- technical means and organizational measures for all types of radiation monitoring;
- systems of IRS physical protection in conformity with the IRS radiation hazard category;
- engineering and technical resources to ensure the IRS fire safety;
- communication and alert systems for organization of IRS control in normal operating conditions and at deviations from normal operation, including accidents;
- indicators of reliability of the systems and components important to IRS safety;
- decommissioning of IRS of various radiation hazard categories.

48. The design of the IRS of the 1st and 2nd radiation hazard categories should provide for the measures (with their frequency) to monitor the integrity and effectiveness of the physical barriers in order to prevent deviations leading to the exceeding of the established limits of IRS safe operation.

CHAPTER 9 REQUIREMENTS FOR THE DESIGN AND MANUFACTURE OF DEVICES GENERATING IONIZING RADIATION

49. DGIR must be equipped with interlocking and alarm systems to be developed at the designing stage.

50. The DGIR design must provide for the audio and/or light alarm switching on simultaneously with the supply of high voltage.

51. In the presence of a process chamber the entry door interlocking system should only be switched off after termination of the ionizing radiation generation and the end of the forbidden period, if any.

52. The DGIR design must exclude the possibility of its switching on in case of a faulty interlock and alarm systems and ensure indication of this information on the control panel.

53. The radiation dosage rate from the devices generating in their operation concomitant unused X-ray radiation, shall not exceed 1.0 mcSv/h at a distance of 0.1 m from any surface.

54. Calculation of DGIR radiation protection should be made for the conditions corresponding to the maximal radiation level in controlled locations. When calculating the radiation protection a safety factor of 2 must be used.

55. The DGIR technical documentation must contain the conditions of DGIR accommodation in accordance with the requirements of technical regulations, including, where appropriate, the boundaries of radiation hazardous area.

56. Technical documentation for DGIR should include:

- DGIR basic specifications;
- radiation levels in the locations where people might stay;
- references to technical regulations governing the requirements for DGIR and their handling;
- the values of specified DGIR characteristics;
- the requirements for provision of safety of personnel and population while DGIR handling during their storage, transportation, operation and decommissioning.

CHAPTER 10 REQUIREMENTS FOR THE DESIGN AND MANUFACTURE OF RADIONUCLIDE SOURCES OF IONIZING RADIATION

57. When designing and constructing SRS for their subsequent use as components of irradiators one must ensure preservation of their parameters and characteristics within the standards set out in the technical documentation for a particular SRS type of throughout its designated service life, and with account of external effects of anthropogenic and natural origin.

58. The SRS design must ensure the IRS safety in case of design-based fire, explosion, shock effects (or specified by the technical documentation).

59. The IRS design and the SRS technical documentation must define the conditions of its testing for various external and internal impacts, with account of possible extreme effects of natural and anthropogenic origin.

60. The organizations producing IRS, as well as the systems and components important for the IRS safety, including component parts, equipment and tooling, should have the means, capabilities and conditions for their production in full compliance with the requirements of engineering and technological documentation, legislation in the field of radiation safety, technical rate setting and standardization, and should have a license to perform respective types of work and services.

CHAPTER 11

DESIGN AND CONSTRUCTION OF STATIONARY SOURCES OF IONIZING RADIATION

61. For stationary sources of ionizing radiation of all radiation hazard categories one should determine the design basis with account of possible extreme effects of natural and anthropogenic origin at the site of their placement.

62. The design and engineering of physical barriers (shield, radiation maze, security door, etc.) for stationary IRS of the 1st and 2nd radiation hazard categories must provide for safety entry into the IRS process chamber. The design of the process chamber security doors must ensure its opening from inside.

63. The design of physical barriers must ensure reduction of exposure doses of personnel and population to permissible levels.

64. The design of ducts and openings for transport, process and other systems in the IRS biological protection should provide reduction to permissible levels of exposure dose rate in places of the ionizing radiation release to the premises where the personnel might stay.

The design drawings must indicate all the process ducts, openings and mazes with their size, shape and location.

65. The possibility of passage of the personnel into the process chamber through the openings for the transport, process and other systems with the IRS being in operating mode must be excluded.

66. The design of RF working with URS, with account of the group of radiation hazards of radionuclides and the respective class of work, must justify zoning of premises, arrangement of necessary systems and equipment in the RF premises.

67. Audio and light alarm must be installed in the process chamber and in adjacent areas, with the information to be displayed on the control panel, for warning of the personnel about an accident or a deviation from the IRS normal operation.

68. The process chambers of stationary radiation sources must be equipped with suction-and-exhaust or exhaust ventilation, the operation and specifications of which must be justified in the design.

69. The design of stationary IRS should implement the principle of separate ventilation of non-serviceable, periodically serviceable premises and the premises permanently occupied by personnel.

70. The design of stationary IRS of the 1st and 2nd categories of radiation hazard must provide for the interlock system, excluding the following:

- opening of the security door to the process chamber in the event of power failure with the irradiator being in the operating position (this requirement does not apply to medical IRS. No mechanical and electromechanical interlocking of the entrance doors to the radiation therapy treatment and linear accelerators rooms is allowed);
- transfer of irradiator to operating position during ventilation failure, open security door (or mounting hatch) and failure of radiation control system.

71. Each non-medical IRS of the 1st and 2nd categories must be equipped with at least two completely independent interlocking systems of an entrance door to a process chamber. The first interlocking system shall be activated depending on the gamma radiation dose rate, and the other depending on the irradiator movement.

72. The interlocking systems can be based, in particular, on the use of:

- dosimetry equipment sensors installed in the process chamber;
- dosimetric instrumentation sensors installed in the maze;
- end probes signalling of the irradiator being in the storage position.

73. The design and production of medical IRS of the 1st and 2nd categories must provide for the interlocking devices to ensure the obstruction of the radiation beam or the irradiator return to the storage position in case of:

- opening of the doors to a treatment room during the radiation session;
- change in the radiation parameters beyond the limits set for this irradiation session;
- power supply failure;
- risk of injury to the patient by the equipment moving elements.

74. At least two completely independent radiation blocking systems must be arranged at the front door to the treatment room.

75. The treatment room must be equipped with a radiation emergency shutdown button.

76. All the doors to the radiation therapy treatment and linear accelerators premises must be freely opened from inside.

77. The design of stationary IRS should provide for the capability of irradiator transfer to the storage position in case of faulty interlocking system, power failure, a fire at the RF, in the conditions of possible accident development, as well as during other design-based initiating events.

78. The design of stationary IRS should provide for the display on the control panel of the information including:

- IRS operation mode;
- irradiator position;
- operation of the ventilation system;
- the value of the dose rate in the process chamber (treatment room) and adjacent areas, as well as its change;
- the dose rate at the workplace exceeding its reference level;
- fire breaking-out;
- interlocking system failure;
- the water level in the IRS pool with water and combined types of protection, as well as its change.

79. The design of the control panel of the 1st category IRS must provide for the IRS switching on by a special key. In case of turning off of the control panel the irradiator should automatically be transferred to the storage position.

80. The room with the IRS control panel should be equipped with a telephone or other means of communication with the IRS user's emergency services.

81. In case of the main power supply failure the IRS process chamber (treatment room) and the room with the control panel should be equipped with emergency power supply sources to be activated automatically.

82. The design of stationary IRS should provide for the light signalling devices indicating the position of the illuminator, to be mounted above the entrance to the IRS process chamber and on the control panel.

83. The IRS design must provide for the exclusion of any radioactive contamination of exposed objects.

CHAPTER 12 DESIGN, ENGINEERING AND MANUFACTURE OF MOBILE AND PORTABLE SOURCES OF IONIZING RADIATION

84. Mobile and portable IRS containing SRS (irradiators) must have devices for fixing the irradiator position. The design of such fixing devices must preclude inadvertent or unauthorized SRS transfer to operating position in all operating modes and design-based external and internal impacts.

85. IRS with motorized ionizing radiation beam obstruction actuators must have a device for the radiation beam emergency obstruction or mechanical return of the irradiator to the storage position.

The IRS design should have a manual drive for forced irradiator mechanical movement to the storage position. In case of electric power failures the irradiator must be automatically transferred to the storage position and remain in the storage position until the irradiator control device is restarted from the control panel.

86. The IRS interlocking system must exclude the operation of control systems in case of non-compliance of other IRS components or systems to the safety requirements.

87. The IRS must have an indication system of the radiation beam exit from RRSU ("open"- "closed"), independent of the control system of the irradiator positions ("operating"- "storage").

88. Portable IRS must have mechanical or electrical alarm systems, mobile IRS must have mechanical, electrical or radiometric alarm systems.

89. The output signal devices of mechanical signalling systems must be located on the RRSU, and those of electrical and radiometric systems – on the control panel. For the IRS working as per the preset sequence it is permitted to place the output signal devices of electric and radiometric alarm systems on the RRSU.

90. The IRS design must ensure safety in its operation, with the dose rate on its surface and at a predetermined distance from it in two main irradiator positions ("operating"- "storage") not exceeding the values specified by the legislation in the field of radiation safety.

91. The technical equipment and accessories for charging and recharging of radionuclide sources in RRSU must be designed and produced so as to ensure execution of work (either in the workplace or in special recharge chambers), with radiation doses of exposed personnel not exceeding the basic limits set by radiation safety standards.

SECTION III
SAFETY DURING COMMISSIONING, OPERATION AND
DECOMMISSIONING OF SOURCES OF IONIZING RADIATION

CHAPTER 13
COMMISSIONING OF SOURCES OF IONIZING RADIATION

92. The IRS user should provide for the development and approval of the IRS commissioning program and the RF SAR (for IRS of the 1st and 2nd categories of radiation hazard), the quality assurance program and instructions for IRS safe operation. The system of radiation control must be introduced by the time of IRS commissioning.

93. The documents regulating the pre-commissioning adjustment works, comprehensive testing and verification of IRS systems and components should contain the list of the works with IRS and the list of measures to prevent accidents.

94. Upon completion of starting-up and adjustment works, it is necessary to confirm that the IRS as a whole and its systems and components function in accordance with the IRS design.

95. The IRS user must provide for the development and, if necessary, the agreement of the commissioning program with the IRS designer. In the course of the IRS commissioning program implementation the characteristics of systems and components important to safety must be determined and documented, the equipment performance characteristics must be specified. The list of parameters to be documented is determined in the IRS design.

96. Pre-commissioning adjustment works, inspections and testing of systems and components important to safety should be carried out by the IRS user personnel or, if necessary, by outside specialized organizations doing work for and providing services to the IRS user.

97. The IRS systems and components important for safety must be subject, as a rule, to direct and full testing for compliance with the design parameters at the IRS commissioning. Should a direct and/or a complete testing be not possible, which must be justified in the design, indirect and/or partial tests should be conducted. The possibility of checking the status of the systems important for safety, as well as of their representative testing must be stipulated.

98. The documentation on commissioning, comprehensive testing of the systems important for safety, conducting tests in the IRS designed operation mode one must define the measures for the IRS safe transportation, installation and adjustment of systems and equipment, maintenance and repair of systems and equipment, with account of possible deviations from normal operation and in case of accidents.

99. In case of the necessity of corrective action in relation to IRS systems and components the changes shall be made in the design, operational and other technical documentation, as well as in RF SAR.

100. The IRS commissioning certificate must be drawn up by the results of IRS commissioning work, confirming safety of IRS operation.

101. Prior to its operation the IRS is to be accepted by the board appointed by the IRS user.

CHAPTER 14 GENERAL REQUIREMENTS FOR SAFETY OPERATION OF THE SOURCES OF IONIZING RADIATION

102. When operating IRS the radiation safety of personnel and population should be provided by compliance with the Rules and other technical regulations, as well as local regulations, design and operational documentation.

103. The IRS user should take account of the personnel radiation exposure, including those of other organizations involved in its maintenance, as well as provide the development and implementation of measures to reduce radiation exposure to the reasonable levels in accordance with the principles of radiation safety (the principles of justification and optimization).

104. The IRS user should monitor the radiation environment in the personnel workplaces and in adjacent premises, as well as in the sanitary protection zone and the surveillance zone (if they are specified) by continuous or periodic measurements.

105. For RF with URS periodic radiation control of pollution of surfaces of premises and structures in them must be conducted, which should be sufficient for assessment and prediction of the radiation environment during IRS normal operation and deviations from normal operation, including accidents.

106. The IRS which are not used in the work at the RF, including the reserve ones, should be stored in the specially equipped areas ensuring their security and precluding unauthorized access to them. Total activity of radionuclide sources in these areas must not exceed the values specified in the design.

107. Radionuclide sources not used temporarily in the work at the RF due to withdrawal of the process equipment for repair, reconstruction or modernization for more than 10 days, must be dismantled from the processing position and stored in specially equipped places.

108. The IRS user must ensure continuous monitoring of the safety of each operated and stored IRS.

109. The IRS user must provide for the IRS physical protection by organizational measures, use of technical means and actions of security units. Organization of physical protection shall be in accordance with the IRS design, effective regulatory legal acts, including technical regulations.

110. The investigation of IRS theft and loss must be conducted in the order specified in Chapter 20 of the Rules.

CHAPTER 15 HANDLING DEVICES GENERATING IONIZING RADIATION

111. DGIR are actually IRS only at the time when high voltage is supplied to them.

Generating ionizing radiation with the energy higher than 10 MeV may cause photo-nuclear reactions, which lead to activation of the surrounding environment and air substances. In this case, the device is a potential source of hazard till the expiration of the forbidden period.

112. DGIR include X-ray machines, neutron generators, the devices generating UXR and the devices that generate LEXR, accelerators. Specific requirements for the DGIR handling depending on the radiation hazard category and the field of application shall be governed by separate technical regulations.

113. Radiation safety of personnel and population in handling DGIR is ensured by a system of design-based protective measures in DGIR production, layout and arrangement in their operation, the use of stationary, mobile and personal radiation protection means, selection of the optimal conditions of work, radiation monitoring, compliance with effective technical regulations in the field of radiation safety. It is not allowed to perform work with DGIR which is not covered by job descriptions, safety instructions, radiation safety rules and other regulatory documents.

The conditions precluding the possibility of exposure of personnel and population above the established limits must be provided at all stages of the work with DGIR.

114. When handling DGIR the organization using IRS must provide, at least once a year, testing of DGIR operating parameters for compliance with the requirements set out in the technical and operational documentation.

115. In the annual testing of operational parameters of medical X-ray machines not equipped with the Dose Area Product meters, the measurement of the value of X-ray emitter radiation output is mandatory.

The radiation output measurements should also be performed after every repair, modernisation, replacement or removal of components of an X-ray machine.

116. The tests of DGIR operating parameters must be carried out by the organization accredited and licensed for this type of activity.

According to the test results the organization which carried out the measurements must issue a report and compile an opinion on compliance of the tested DGIR parameters with the requirements of technical and operational documentation.

CHAPTER 16 HANDLING RADIONUCLIDE RADIATION SOURCES

117. SRS are non-recoverable industrial products, continuously expending their service life and not subject to repair. After expiration of the designated lifetime the SRS use or storage should be discontinued.

118. In case of deviations from SRS operating conditions, including the conditions of storage and transportation, entailing the increase in the level of radioactive contamination of the surface above the standards set in technical regulations, or changes in its technical condition, the SRS operation shall be stopped and the SRS is to be sent for recycling or disposal in due order.

119. In appropriate cases it is allowed to consider extending the service life of the SRS, with preservation of the radiation parameters within the limits which satisfy

the user, maintaining the integrity and the absence of detectable defects, as well as their symptoms.

120. To resolve the issue of extending the SRS service life the IRS user should develop and agree with the authorities effecting supervision in the field of radiation safety, the program of work on the SRS recertification.

121. The program should include procedures for confirming the SRS safety, including:

- stages of testing;
- methods and forms of testing;
- list of preparatory work;
- list of measuring instruments and accessories.

122. The methods used for SRS safety assessment should be conservative to compensate for the uncertainty of the initial information.

123. The results of the work on the SRS recertification should be presented in the report containing:

- brief description of the examined SRS, their properties and function;
- list of the documents reviewed;
- scope and results of the tests conducted;
- conclusions about the results of evaluation of SRS residual life;
- list of overage components;
- conclusions about the actual state of the SRS components by the results of tests control;
- identified safety deficiencies and compensatory measures offered;
- suggested program of additional work to determine the SRS residual life.

124. The issue of possible extension of SRS service life must be decided by a board composed of representatives of the organization using SRS and the bodies exercising state supervision in the field of radiation safety. If SRS are manufactured in the Republic of Belarus, the board also includes representatives of the manufacturer.

The conclusion of the board determines the possibility, conditions and terms of further SRS use.

125. The SRS hermetic tightness should be conducted in the order and within the time limits established by the relevant technical regulations. The use of SRS in case of break of their tightness is not allowed.

126. The SRS being in idle position must be stored in special protective devices.

127. Such device for SRS storage must be resistant to mechanical, chemical and thermal impacts.

128. If SRS does not have, at the time of its operation, a valid document proving its hermetic tightness, it is subject to the requirements for handling URS.

129. All works with the URS use are divided into 3 classes. Work class is set according to the group of radionuclide radiation hazard and its actual activity in the workplace, in accordance with SanPiN 2.6.1.8-8-2002 *Basic Sanitary Rules for Radiation Safety (OSP-2002)*.

Planning of the premises, their finishing and equipment with sanitation systems depending on the class of work done with the URS must comply with OSP-2002.

130. Limitation of the URS irradiation transport into the working premises and the environment should be provided using physical barriers system: static (equipment, walls and floors of premises) and dynamic (ventilation and gas cleaning).

CHAPTER 17

GENERAL REQUIREMENTS FOR SELECTION AND TRAINING OF PERSONNEL FOR THE OPERATION OF IONISED RADIATION SOURCES

131. Before the start of the commissioning work the RF should be completed with the personnel having the necessary qualifications and authorised in due order to work independently.

Before authorisation for independent work the personnel should pass training, probation and assessment of knowledge in the field of radiation safety. Assessment of their knowledge is carried out by a board formed by the order of the organization.

132. The system of personnel selection and training should be aimed at achieving, monitoring and maintaining the level of their qualifications required for the safe operation of ionizing radiation sources in all modes, as well as execution of actions for mitigating the consequences of an accident.

The formation of a safety culture in the personnel must be a constituent component of the training content.

133. The organization using IRS should determine in the form of a document the list of persons classified as "personnel", establish the procedure for their training, authorisation for independent work and assessment of knowledge of the safe operation rules and valid organization's instructions.

CHAPTER 18

GENERAL REQUIREMENTS FOR THE DEVELOPMENT OF ACTION PLAN FOR THE PROTECTION OF WORKERS (PERSONNEL) AND POPULATION FROM RADIATION ACCIDENT AND ITS CONSEQUENCES

134. The action plan for the protection of workers (personnel) and the population from radiation accident and its consequences (hereinafter the Plan) is developed by the IRS user based on IRS categories of radiation hazard and the criteria for decision on the measures to protect workers and population in the event of an accident. The plan must be approved and agreed upon in accordance with the requirements established in Article 17 of Law of the Republic of Belarus *On Radiation Safety of the Population*.

135. For the IRS of the 1st category of radiation hazard the plan should contain measures to protect workers, population and the environment in case of an accident with account of its radiological consequences.

136. For the IRS of categories II-V of radiation hazard the plan must contain measures to protect workers and population with account of specific working conditions and design-based accidents.

137. For all IRS categories of radiation hazards one should develop the instructions for personnel actions in emergency situations.

138. Maintaining of a permanent preparedness to implement the action plan for the protection of workers and population in the event of a radiation accident rests with the IRS user.

139. The plan should contain brief information about the facility and the IRS available.

The plan should establish intervention levels and also determine who, where, when, under what circumstances, along what communication channels, what organization informs about the accident. The plan should provide for the necessary equipment and means for implementation of the planned measures for protection of personnel and population in case of an accident at the facility, and specify who, from where and when delivers them.

140. The IRS user must have and maintain a permanent preparedness of the necessary equipment, including instrumentation, means of communication, personal protective equipment required to carry out an action plan for the protection of workers and population in the event of a radiation accident.

141. The IRS user shall be responsible for the timely planning and implementation of training of managers and workers in the field of protection of population and territories from natural and anthropogenic emergency situations and civil defence, shall organise training in accordance with Resolution No. 413 of the Council of Ministers of 23 May 2013 *On Approval of the Procedure of Training Managers and Workers of the National Bodies of State Administration, Other State Organizations Subordinated to the Government of the Republic of Belarus, Local Executive and Administrative Bodies, Organizations Regardless of Their Ownership, and the Population in the Field of Protection of Population and Territories from Natural and Anthropogenic Emergency Situations and Civil Defence, as Well as Citizens to Be Mobilised to Special Units under the Bodies for Emergency Situations* (National legal Internet portal of the Republic of Belarus, 29.05.2013, 5/37316).

The personnel should be prepared to take action in case of accidents and to eliminate the consequences of accidents.

CHAPTER 19

REQUIREMENTS FOR DECOMMISSIONING OF SOURCES OF IONIZING RADIATION

142. The decision on the IRS decommissioning is taken by the IRS user.

143. The basis for the decision on IRS decommissioning may be impossibility or inexpediency of its further use or repair.

144. The user must select and justify, on the basis of IRS examination including its technical condition assessment and radiation control, the final IRS status after completion of all work on its decommissioning.

The user must appoint a board for the IRS examination, which is to make a report on the results of the IRS examination.

145. For radioactive sources of all categories radiation hazard, except for radioactive sources with a half-life ($T_{1/2}$) to be at least 100 days, the user must develop a program of IRS decommissioning, taking into account the results of engineering and radiation examination.

146. For radionuclide sources of the 1st and 2nd categories of radiation hazard the user must provide for the development of the IRS decommissioning program no later than one year before expiration of its design lifetime.

147. For radionuclide IRS of categories III-IV of radiation hazard the IRS decommissioning program should be developed no later than 6 months before expiration of IRS design lifetime, and for radionuclide IRS of category V – no later than 1 month.

148. The development of decommissioning program for DGIR of all categories of radiation hazard is not required.

149. The IRS decommissioning program must contain organizational and technical measures, the list and sequence of the basic works on the IRS decommissioning.

150. The IRS decommissioning program must be based on the IRS design or operational documentation complemented by planning and technical support of the work related to secure reloading or unloading of a radionuclide source and its transfer to a specialized organization for storage, followed by deactivation of the remaining equipment and its disposal or handling like RW.

151. The program of IRS decommissioning should describe the measures on the work safety assessment, including handling radioactive waste generated as a result of deactivation (collection, temporary storage and transfer for disposal).

152. The decommissioning design is developed for stationary IRS of the 1st and 2nd categories of radiation hazard if they are located either in a separate building (structure) or in special premises of the building and include additional systems and equipment.

153. For stationary IRS of category III of radiation hazard working with URS, the RF decommissioning design is developed in cases when the program of IRS decommissioning contains insufficient data to justify safety.

154. The decommissioning design for stationary IRS should identify and justify the type and technique of work, safety measures for the work executed, the sequence of their execution, the required labour, financial, material and technical resources at every decommissioning stage and also list the personnel qualification requirements.

155. The work on IRS decommissioning must be carried out by specially trained personnel of the IRS user or by the staff of other organizations in the order prescribed by legislation. Where necessary, training of personnel should be carried out on training hardware and simulators with imitation of the basic operations of forthcoming work.

156. The work on IRS decommissioning must be accompanied by radiation control.

Dismantling of the system of physical barriers, ventilation systems, fire fighting systems and radiation monitoring system should be carried out at the final stages of stationary IRS decommissioning.

157. At all stages of stationary IRS decommissioning one should provide for the system of personnel access to the places of work and physical protection of dismantled contaminated equipment.

158. During IRS decommissioning one should effect accounting and control of RW and radioactive materials that are temporarily stored in the premises and warehouse.

159. Upon completion of the IRS decommissioning work the user must submit to the authorities exercising supervision over radiation safety, the necessary documents (certificates) confirming the IRS decommissioning.

CHAPTER 20

INVESTIGATION AND ACCOUNTING OF VIOLATIONS AND RADIATION ACCIDENTS IN HANDLING IONIZING RADIATION SOURCES

160. In case of violations and radiation accidents (hereinafter violations) in handling IRS the IRS user must carry out their registration and investigation of the causes for the following purposes:

- identification of cause of the initial event, the ways of its development, consequences and class of violation;
- taking decisions on improving RF safety;
- statistical recording of violations of IRS handling;
- informing personnel, population, local executive and administrative bodies in the event of a threat to human exposure and environmental pollution.

161. The violations of IRS handling are divided into 3 classes depending on the consequences:

1st class: loss of IRS control caused by a malfunction, damage to equipment, personnel errors, natural disasters or other reasons, which entailed the exposure of people and radioactive contamination of the environment above the established limits;

2nd class: loss of IRS control caused by a malfunction, damage to equipment, personnel errors, natural disasters or other reasons, which entailed the exposure of people and radioactive contamination of the environment above the reference levels, but not exceeding the permissible values;

3rd class: loss of IRS control caused by a malfunction, damage to equipment, personnel errors, natural disasters or other reasons, which might entail the unplanned exposure of people and radioactive contamination of the environment.

162. In the event of violations of IRS handling the IRS user is obliged to inform Gosatomnadzor in writing.

163. This information should include:

- operational message about violation of IRS handling (in the event of violations of the 1st class);
- preliminary report on violation of IRS handling;
- investigation report on violation of IRS handling.

164. The IRS user must ensure the transfer of operational messages over any communication channel within 1 hour after the detection of a violation.

165. Operational message must contain the following information:

- RF name;
- IRS name and type;
- date and time of the violation of IRS handling;
- nature of the violation;
- absence (presence) of victims exposed to radiation;
- absence (presence) of radioactive pollution of the environment;
- position, surname and initials of the person sending an operational message.

166. The preliminary report on the violation of IRS handling must be delivered within 24 hours after detection of violations.

167. The preliminary report on the violation of IRS handling must contain the following information:

- RF name;
- IRS name and type;
- date and time of the violation of IRS handling;
- nature of the violation;
- data on radiation exposure of personnel, population and environment;
- position, surname and initials of the person sending a preliminary report.

168. A special board is to be formed for investigation of violations at the main stage, the results of which shall be recorded in the investigation report on the violation of IRS handling.

169. The investigation report on violation shall be sent to Gosatomnadzor no later than 2 days after its signing by the board chairman.

170. The IRS user must ensure the registration of all the violations that occurred in handling IRS, according to their classes.

Annex 1

to the Standards and Rules for Provision of Nuclear and Radiation Safety "Safety in Handling Sources of Ionizing Radiation. General Provisions"

LIST OF IRS CATEGORIES OF RADIATION HAZARD

Category	IRS categories depending on their application	Activity ratio A/D ¹	Kind of hazard category
1	2	3	4
I	Process irradiators. Equipment for remote radiotherapy. Class I of work with URS.	$A/D \geq 1000$	Highest hazard source
II	Radionuclide defectoscopes. The equipment for brachytherapy of high/medium dose rates	$1000 > A/D \geq 10$	High hazard source
	Accelerators. Class II of work with URS.		
III	Level meters, density meters, thickness meters and other radiation information devices. Geophysical research and logging instruments	$10 > A/D \geq 1$	Hazardous source
	X-ray medical machines with anode voltage ≥ 100 kV. Class III of work with URS.		
IV	Brachytherapy of low dose rates [Except eye plaques and permanent (long-term) implant sources]. Thickness meters. Portable measuring instruments (E.g., moisture/density). Static neutralizers	$1 > A/D \geq 0.01$	Potentially hazardous source
	X-ray medical machines with anode voltage < 100 kV. X-ray technological machines with anode voltage ≥ 100 kV.		
V	Brachytherapy of low dose rates for eye plaques and permanent implant sources. Reference, standard IRS. SRS in smoke detectors	$0.01 > A/D \geq \geq \text{release level/D}$	The least potentially hazardous source
	X-ray technological machines with anode voltage < 100 kV. Unused X-ray radiation machines		

¹ A - radionuclide source activity, TBq

D - reduced activity (hazard parameter) of radionuclide source specified in Annex 2 to the Rules.

The D value characterizes the probability of occurrence of deterministic effects for a given exposure scenarios:

- carrying unprotected source during 1 hour in hand or within 10 hours in a pocket;
- staying indoor by an unprotected source for the period from several days to several weeks;
- dispersion (dissipation, scattering) of a source, such as by a fire, explosion or human action, leading to radiation exposure from inhalation, ingestion and/or skin contamination.

Annex 2

to the Standards and Rules for Provision of Nuclear and Radiation Safety "Safety in Handling Sources of Ionizing Radiation. General Provisions"

HAZARD PARAMETERS VALUES (D) OF THE MOST COMMON RADIONUCLIDE SOURCES

Radionuclide	D, TBq (=10 ¹² Bq)
Am-241	6.E-02
Am-241/Be	6.E-02
Au-198	2.E-01
Cd-109	2.E+01
Cf-252	2.E-02
Cm-244	5.E-02
Co-57	7.E-01
Co-60	3.E-02
Cs-137	1.E-01
Fe-55	8.E+02
Gd-153	1.E+00
Ge-68	7.E-02
H-3	2.E+03
I-125	2.E-01
I-131	2.E-01
Ir-192	8.E-02
Kr-85	3.E+01
Mo-99	3.E-01
Ni-63	6.E+01
P-32	1.E+01
Pd-103	9.E+01
Pm-147	4.E+01
Po-210	6.E-02
Pu-238	6.E-02
Pu-239/Be	6.E-02
Ra-226	4.E-02
Ru-106 (Rh-106)	3.E-01
Se-75	2.E-01
Sr-90 (Y-90)	1.E+00
Tc-99m	7.E-01
Tl-204	2.E+01
Tm-170	2.E+01
Yb-169	3.E-01

Annex 3

to the Standards and Rules for Provision of Nuclear and Radiation Safety "Safety in Handling Sources of Ionizing Radiation. General Provisions"

THE REQUIREMENTS FOR DEFINING CATEGORIES OF SOURCES OF IONIZING RADIATION ACCORDING TO THEIR RADIATION HAZARD

The IRS categories according to their radiation hazard shall be defined:

for radionuclide sources: by the IRS application and/or activity of radionuclide reduced to IRS hazard parameter;

for DGIR: by application and/or anode voltage in accordance with Annex 1 to the Rules.

For the IRS not listed in Annex 1 to the Rules, the hazard category is defined by the ratio of the radionuclide activity to its hazard parameter (A/D).

In cases when several IRS are in close proximity to each other, for example, are used in a single production process (one installation, apparatus, or unit), in transportation of IRS in one vehicle, when stored in one warehouse a manifestation of total simultaneous radiation exposure from all the IRS may be possible. In order to establish a unified set of organizational and technical measures to ensure the safety and security of such IRS, the same hazard category for the entire set of IRS should be defined.

In this case the A/D ratio for different radionuclides is calculated by the formula

$$A/D = S_n \frac{\sum S_i A_{i,n}}{D_n};$$

where: $A_{i,n}$ is activity of i-source with n-radionuclide, TBq

D_n is the hazard parameter of n-radionuclide, TBq

S is for Greek letter *sigma*

Annex 4

to the Standards and Rules for Provision of Nuclear and Radiation Safety "Safety in Handling Sources of Ionizing Radiation. General Provisions"

ABBREVIATIONS

RRSU - radionuclide radiation source unit
SRS - sealed radionuclide source
IRS - ionizing radiation source
MSA - minimal significant activity (of radiation source)
RLA - regulatory legal acts
UXR - unused X-ray radiation
LEXR - low-energy X-ray radiation
RF SAR - Safety Assessment Report on the radiation facility
URS - unsealed radionuclide source
RW – radioactive waste
RS - radioactive substance
RII - radioisotope instrument
PF - radiation facility
RPC - radiopharmaceuticals
TR – technical regulations
DGIR - device generating ionizing radiation