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RESOLUTION OF THE MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS
No. 213, December 28, 2012

ON APPROVAL OF SANITARY NORMS AND RULES "REQUIREMENTS FOR RADIATION SAFETY" AND HYGIENIC STANDARD " RADIATION EFFECT ASSESSMENT CRITERIA"

(Extract)

On the basis of the Article 13 of the Law of the Republic of Belarus "On the sanitary-epidemiological wellbeing of population" dated 7 January 2012, , the second paragraph of sub-item 8.32 of item 8 of the Regulation on the Ministry of Health of the Republic of Belarus "On some issues of the Ministry of health and the measures for the implementation of the Decree of the President of the Republic of Belarus No. 360 dated August 11, 2011" approved by the Council of Ministers of the Republic of Belarus No. 1446 dated October 28, 2011 ", the Ministry of Health of the Republic of Belarus DECIDES:

1. To approve the enclosed:

Sanitary norms and rules "Radiation safety requirements";

Hygienic standard " Radiation effect assessment criteria ".

2. The present resolution shall enter into force on January 1, 2013.

The Minister V.I. Zharko

APPROVED
By the Resolution of
the Ministry of Health of
the Republic of Belarus
No. 213 dated 28.12.2012

SANITARY NORMS AND RULES "RADIATION SAFETY REQUIREMENTS"

CHAPTER 1 GENERAL PROVISIONS

1. The present Sanitary norms and rules set out the requirements for radiation safety and are applied for human safety assurance in all conditions of ionizing radiation exposure of artificial or natural origin.

Technical regulatory legal acts of the Republic of Belarus may establish additional requirements for:

radiation safety of personnel and population at carrying out activities on the use of nuclear energy and ionizing radiation sources;

radiation safety of personnel and the public at radioactive waste management;

radiation safety of personnel and the public at the implementation of other types of practical activity.

2. The present sanitary norms and rules are compulsory for government bodies, other organizations and natural persons, including individual entrepreneurs.

3. The state sanitary supervision over the compliance of these Sanitary norms and rules is performed in accordance with the legislation of the Republic of Belarus.

4. Those responsible for violation of these Sanitary norms and rules shall bear responsibility in accordance with legislative acts of the Republic of Belarus.

5. For the purposes of these Sanitary norms and rules there are used basic terms and their definitions in the meanings established by the Law of the Republic of Belarus dated January 5, 1998, "On Radiation Safety of the Population" (Vedamastsi Natsyyanalnaga Shodu Respubliki Belarus, 1998, No. 5, Art. 25), the Law of the Republic of Belarus dated July 30, 2008 "On the Use of Atomic Energy" (National Register of Legal Acts of the Republic of Belarus, No. 187, 2/1523, 2008), the Law of the Republic of Belarus dated January 6, 2009, "On Social Protection of Citizens Affected by the Chernobyl NPP Accident and Other Radiation Accidents" (National Register of Legal Acts of the Republic of Belarus, No. 17, 2/1561, 2009), as well as the following terms and their definitions:

emergency situation - an extraordinary situation that requires prompt action to mitigate a hazard or adverse consequences for human health and safety or quality of life, property or the environment and covers nuclear (emergency situations where there is a real or perceived danger caused by the energy released as a result of nuclear chain reaction or decay products of chain reaction) and radiological emergencies and conventional emergencies such as fires, release of hazardous chemicals, storms, hurricanes or earthquakes, in case of which the operational measures required to mitigate the effects of the perceived danger;

emergency exposure - exposure resulting from a nuclear or radiological accident;

emergency worker - a person who performs a specific action to mitigate the consequences of an emergency situation for human health and safety, quality of life, property and the environment that may be exposed to radiation exceeding the applicable limits of radiation exposure to personnel or the population;

activity - radioactivity value of a number of radionuclide in a given energy state at a given time:

$$A = \frac{dN}{dt}$$

wherein A - activity, *dN*, - the expected number of spontaneous nuclear transformations from the given energy state, occurring in the time interval *dt*. In the International System of Units (hereinafter - the SI system), unit of activity is the reciprocal second (s^{-1}), called the becquerel (Bq).

Previously used off-system unit curie (Ci) is equal to $3,7 \times 10^{10}$ Bq;

remedial measures - measures that can be carried out in order to reduce the radiation exposure caused by the presence of emergency radioactive contamination in areas of the earth surface through measures applied in respect of the actual radioactive contamination, the source of contamination or exposure pathways of the people;

annual dose - the amount of dose received from external exposure during the year, and the committed dose from radionuclides intakes in that year;

annual effective (equivalent) dose - the amount of the effective (equivalent) doses of external human exposure received during the calendar year, and the committed effective (equivalent) dose of internal exposure due to intake of radionuclides during the same year. Unit of annual effective dose is sievert (Sv);

dose constraint - previously imposed limit of individual exposure dose from this source that provides basic level of protection for the majority of individuals exposed by this source in high doses, and serves to establish the upper limit of the dose range within which the optimization of protection for this radiation source is performed;

boundary risk - this is the value associated with a particular source that provides a basic level of protection for people subject to the highest risk from this source. This risk depends on the probability of inadvertent exposure and the probability of harm as a result of exposure. Boundary risk corresponds to the limit dose, but it relates to potential exposure;

decontamination – removal or reduce of radiation contamination from any surface or any media;

current level of intervention – established level of the measured value, which corresponds to the general criterion of response;

deterministic effect - radiation effect on health, for which usually there is a threshold dose level above which the severity of the effect increases with dose increase;

dose in the organ or tissue (D_T) - average absorbed dose in a specific organ or tissue of the human body:

$$D_T = \frac{1}{m_T} \int_{T} D\,dm,$$

$\int$ - the integral sign,

wherein m_T- mass of an organ or tissue, and D - the absorbed dose in the mass element dm;

inspection visualization device – visualization device designed especially for image acquisition during inspection of persons or transport vehicles in order to detect objects concealed on the body or inside the human body, in a consignment or in a vehicle;

sealed source of ionizing radiation - radiation source, which construction eliminates the intake of radionuclides contained in it into the environment in the conditions of use and wear for which it is designed;

protective measure - a measure taken to eliminate or reduce the radiation doses that might otherwise be received in an emergency exposure situations or existing exposure situations;

control zone - an area within which it is introduced or can be introduced special protection and safety measures to control the normal exposure or preventing the spread of contamination during normal operation and which is located, as a rule, inside the surveillance zone;

radiation accident zone - the territory on which the fact of radiation accident is established;

exemption - the establishment by an authorized government body that the radiation source or practical activity does not require some aspects of regulation;

individual dosimetric control - is the control using measurements made by individual devices (equipment) that are carried by workers, or measurements of the amount of radioactive substances in their organisms or on their bodies;

exclusion - the deliberate exclusion of certain categories of exposure from the effect of safety regulatory requirements;

quota - a part of the dose limit established for limiting the public exposure from a specific man-made source of radiation and exposure pathways (external, intake with water, food and air);

collective effective dose - a measure of the collective risk of occurrence of stochastic effects of exposure, which is equal to the sum of individual effective doses. The unit of effective collective dose - man-sievert (man. Sv);

population - all persons, including personnel not-involved in work with sources of ionizing radiation;

exposure - ionizing radiation exposure on humans;

public exposure - exposure of persons of the public in result of radiation sources exposure in situations of planned, emergency and existing exposure, excluding any occupational or medical exposure;

radioactive waste management - activities related to the collection, decontamination, processing, storage and (or) disposal, as well as transportation of radioactive waste;

overall response criteria - the levels of specific protective actions and other measures, expressed in terms of projected or received exposure dose;

the committed dose - the dose over a lifetime expected from this intake;

committed equivalent dose ($H_t(\tau)$) - time integral of equivalent dose rate in a separate tissue or organ as a result of radioactive material intake to the organism of reference person under the condition that the integration time is measured in years:

$$H_t(\tau) = \qquad)dt\,;$$

$\int$ - the integral sign;

committed effective dose ($E(\tau)$) - the sum of products of the committed equivalent doses in organ or tissue for the respective weighting factors for tissue (w_T), where τ – doses summing time, expressed in years, after the intake of radioactive substances into the body. Full evaluation period of 50 years for adults and 70 years for children is established:

$$E(\tau = \sum_{T}$$

clearance from control – clearance of radioactive materials or radioactive objects within authorized practices from any further regulatory control performed by the authorized state body;

open source of ionizing radiation - radiation source in case of using which release of radionuclides contained in it into the environment is possible;

resettlement - not urgent transportation or massive displacement of people from the contaminated areas (zones) in order to prevent chronic exposure. Resettlement is considered as relocation for permanent residence, if it is longer than one or two years and the return is not provided; otherwise it is classified as temporary resettlement;

absorbed dose (*D*) - the quantity of ionizing radiation energy imparted to a substance:

$$D = \frac{d\bar{E}}{dm}$$

wherein $d\bar{E}$ - the average energy imparted by ionizing radiation to a substance presented in the elementary volume, and the *dm* - mass of substance in that volume.

Energy can be averaged according to any specific volume, in this case the average dose will be equal to the total energy transmitted to the volume divided by the mass of that volume. In SI units the absorbed dose is measured in joules divided by the kilogram (J / kg), and has a special name - gray (Gy). Previously used off-system unit rad is equal to 0.01 Gy;

potential exposure - estimated exposure, which can not be expected with absolute certainty, but which can occur as a result of anticipated event during operation, accident with a source or event or sequence of events of probabilistic nature, including equipment failures and operating errors;

practical activity - any activity of human, which introduces additional sources of exposure or creates additional exposure pathways, or increases number of people exposed to radiation or changes exposure pathways structure of existing sources so that increases self exposure, or the probability of exposure of people or the number of people exposed;

limit of annual intake - allowable level of intake of this radionuclide into the organism for a year, which in case of monofactorial impact leads to exposure of a reference human by committed dose equal to the corresponding limit of annual dose;

dose limit - the value of the annual effective dose or equivalent dose of man-made exposure, which should not be exceeded during normal operation. Compliance with the annual dose limit prevents the occurrence of deterministic effects and the probability of stochastic effects is preserved at that at an acceptable level;

natural exposure – exposure caused by natural sources of radiation;

natural source of radiation - the source of ionizing radiation of natural origin, that is subject to the present Sanitary norms and rules;

occupational exposure - any exposure of workers in the course of performed works;

work with ionizing radiation sources - all types of ionizing radiation source treatment in the workplace, including radiation control;

workplace - a place of permanent or temporary presence of personnel to perform the production functions in the conditions of ionizing radiation impact;

radiation protection - protection of people from exposure in the result of ionizing radiation exposure and its means of support;

radiation monitoring – measurement of the dose level, dose rate or activity for assessment or control of exposure in a result of radiation exposure or radioactive substances, as well as the interpretation of results;

radiation monitoring of a source – measurement of emissions of radioactive material activity into the environment or external dose rate from sources related to the installation or activity;

radiation monitoring of the environment – measurement of external dose rate from environmental sources or radionuclide concentrations in environmental media;

radiation monitoring of the workplace - monitoring (control) with performance of measurements in specific conditions in the workplace;

radiation object – operator of ionizing radiation sources or a structural subdivision of the operator, where the treatment of man-made sources of ionizing radiation is performed;

radiation risk - risk of occurrence in a person or in his offspring of any adverse effect caused by exposure;

radioactive substance - a substance in any state of aggregation, containing radionuclides with an activity that is subject to the requirements of these Sanitary norms and rules;

representative person - an individual who has received a dose of radiation, which is representational for the most highly exposed individuals in the population;

reference diagnostic level - parameter used during medical visualization and showing in normal conditions, whether the exposure dose or activity of administered radiopharmaceuticals is unusually high or unusually low for this procedure applied to patient during performance of radiological procedures;

reference level - in situations of emergency or existing exposure - dose level, risk or activity of radionuclides, above which it is unacceptable to plan the allowable exposure, and below which it is necessary to continue the optimization of protection and safety. The selected value of the reference level will depend on the circumstances in the considered situation of exposure;

situation of accidental exposure - situation of exposure that arises as a result of an accident, improper activity or any other unforeseen event and requires immediate action to prevent or reduce the adverse effects;

situation of planned exposure - situation of exposure that arises as a result of the planned operation of a source or planned activities, which leads to exposure from a source;

situation of existing exposure - a situation in which exposure already exists and decision on the necessity of control is required to be taken;

mitigation measure –measure immediately accepted by the operator or other party in order to reduce the potential possibility for the development of conditions that lead to exposure or release of radioactive material requiring emergency response measures (actions in an emergency situation) on the site or outside it, or to mitigate mode of the source, which can lead to exposure or release of radioactive material requiring emergency response actions on site or outside it;

special protective measure - a protective measure in the event of an emergency situation, which in order to ensure its effectiveness shall be performed operatively (usually within a few hours) and the effectiveness of which in the case of a delay of its adoption will be significantly reduced. Urgent protective measures include: evacuation, decontamination of individuals, sheltering, respiratory protection, thyroid gland blocking, as well as restrictions on the consumption of potentially contaminated food products. All measures which do not relate to the urgent protection measures are long-term (for example: resettlement, agricultural countermeasures and remedial actions);

urgent preventive protective measure - a protective measure in the event of a nuclear or radiological emergency situation, to be taken before or shortly after a release of radioactive material, or prior to exposure with consideration of the existing situation in order to prevent or reduce the risk of development of severe deterministic effects;

stochastic effect - radiation-induced (caused by radiation) effects on human health, the probability of occurrence of which increases with higher doses of radiation, and the severity of symptoms (if any) does not depend on the dose;

man-made exposure – exposure from anthropogenic sources, in both normal and accident conditions, except of medical exposure of patients;

man-made source of radiation - the source of ionizing radiation, specifically designed for its beneficial use or which is byproduct of these activities;

specific (volume) activity - the ratio between the activity A of the radionuclide in the material to the mass *m* (volume *V*) of material:

$$\mathrm{A}_m = \frac{\mathrm{A}}{m}$$

$$\mathrm{A}_v = \frac{\mathrm{A}}{V},$$

wherein A_m- the specific activity, A_v - volume activity.

unit of specific activity - Becquerel per kilogram, Bq / kg.

unit of volume activity - Becquerel per cubic meter, Bq / m^3;

reference person - an idealized individual, for whom the equivalent dose in the organs or tissues were calculated by averaging the corresponding dose for a reference male and reference female. Equivalent doses for reference person are used to calculate the effective dose by multiplying these doses per the corresponding weighting factors for tissues;

device generating ionizing radiation - electrophysical device in which the ionizing radiation is generated due to changes in the velocity of the charged particles, their annihilation or nuclear reactions;

exemption level - the value established by the authorized governmental body and expressed in units of activity (specific, volume or surface) or total activity, dose rate or radiation energy at or below which in relation to the radiation source it is not necessary to apply some or all aspects of regulatory control;

control clearance level - the value set by the authorized governmental body and expressed in activity units (specific, volume or surface), at or below which the regulatory control of the radiation source used in practice, which is the subject of a notification or authorization may be cancelled;

evacuation – urgent, temporary relocation (removal) of people from the territory in order to prevent or reduce the short-term radiation exposure in the event of an emergency situation;

equivalent dose ($H_{\mathrm{T,R}}$) - absorbed dose in an organ or tissue multiplied by an appropriate weighting factor for this type of radiation, W_R:

$$H_{\mathrm{T},R} = W_R \times$$

Wherein $D_{\mathrm{T,R}}$ - the absorbed dose of radiation of R type, averaged over tissue or organ T, and W_R- weighting factor for R radiation.

Equivalent dose reflects the size of the caused damage. Under the influence of various types of radiation with different weighting factor the equivalent dose is defined as the sum of the equivalent doses for these types of radiation:

$$H_{\mathrm{T}} = \sum_{R} \quad {}_{\mathrm{T},R}.$$

The measurement unit of equivalent dose is sievert (Sv) which equals to 1 J / kg;

equivalent equilibrium volume activity (hereinafter - EEVA) of daughter products of radon isotopes – ^{222}Rn and ^{220}Rn- a weighted sum of volume activity of short-lived daughter products of radon isotopes – ^{218}Po (RaA), ^{214}Pb (RaB), ^{214}Bi (RaC), ^{212}Pb (ThB), ^{212}Bi (ThC) respectively:

$$(\mathrm{EEVA})_{\mathrm{Rn}} = \quad + \quad +$$

$$(\mathrm{EEVA})_{\mathrm{Rn\text{-}220}} = \quad +$$

wherein A_{Ra}, A_{Th} - volume activity of daughter products of radon isotopes.

6. These Sanitary norms and rules establish the basic limits of exposure doses, permissible levels of exposure of ionizing radiation and other requirements for limitation of public exposure in accordance with the Law of the Republic of Belarus "On Radiation Safety of the Population".

7. These Sanitary rules and norms are applicable to three categories of exposure: occupational exposure, public exposure, medical exposure in planned situations, emergency and existing exposure.

The total dose from all types of exposure is used to assess the radiation situation and the expected medical effects, as well as to justify the protective measures and evaluate their effectiveness.

8. The requirements of these Sanitary rules and norms do not apply to sources of ionizing radiation, generating in any conditions of their treatment:

individual annual effective dose of no more than 10 mSv;

individual annual equivalent dose to the skin of no more than 50 mSv in the crystalline lens is not more than 15 mSv;

collective effective dose per year is not more than 1 man. -Sv, or when at the collective effective dose of not more than 1 man. -Sv the assessment upon the principle of optimization shows unreasonableness of reduction of the collective effective dose.

9. The requirements of these Sanitary norms and rules do not apply to space radiation on the Earth's surface and internal exposure of human, created by natural potassium, on which it is practically impossible to effect.

10. List and order of clearance of ionizing radiation sources from regulatory control by specific technical regulatory legal acts.

11. The requirements of these Sanitary norms and rules apply only to ionizing radiation and consider that the ionizing radiation is one of the many sources of risk to human health and that the risks associated with radiation exposure, should not only be related to the benefits from its use. Radiation risks, to which the population and the environment may be subjected as a result of the use of radiation and radioactive material, should be subject to assessment and be controlled by the use of these Sanitary norms and rules.

12. For the purposes of these Sanitary norms and rules there are three types of exposure situations:

planned exposure situation;

emergency exposure situations;

existing exposure situation.

13. In order to ensure radiation safety during normal use of ionizing radiation sources it is necessary to be guided by the following basic principles:

non-exceedance of permissible individual doses limits of human exposure from all sources of ionizing radiation (normalization principle);

prohibition of all activities on the use of ionizing radiation sources, at which benefits obtained by individual and society does not exceed the risk of possible harm caused by the excess of natural background radiation exposure (the principle of justification);

maintenance at achievable low level, taking into account economic and social factors of individual radiation doses and the number of exposed persons by using any source of ionizing radiation (principle of optimization).

14. The following categories of exposed persons are established:

personnel;

the entire population, including those of the personnel outside the scope and conditions of their production activities.

15. Three classes of standards for the categories of exposed persons are established:

basic limits of exposure doses;

dose constraints and reference levels;

permissible levels of monofactorial impact (for a single radionuclide, exposure routes or one type of external exposure), derived from the basic limits of exposure doses: the limits of annual income, permissible annual volume activity, the annual specific activity and others.

16. Dose constraints for planned exposure situations is a basic level of protection and are almost always lower than the established exposure dose limit. When planning it is necessary to ensure that the considered source of ionizing radiation did not generate exposure doses exceeding the limit value. Optimization of protection will establish an acceptable level of exposure dose below the limit value. This optimized level then would become an expected result of the planned protective measures.

Dose constraint in case of occupational exposure - is the amount of the individual exposure dose, limiting the range of variants for provision of protection by only those that are expected to generate a radiation doses below the dose constraint and which are considered only in the optimization process. Dose constraint in case of population exposure - is the upper limit of the annual radiation doses that the population can receive from the planned operation of a particular controlled source.

Dose constraint in the case of medical irradiation - is the value connected with this source, which is used in the process of protection optimization of persons providing care and comfort for patients undergoing radiological procedures, and protection of persons who voluntarily exposed to radiation during biomedical research.

The values of constraint doses and reference levels used in radiation protection system are given in Hygienic standard "Radiation effect assessment criteria", approved by the Resolution which approves these Sanitary norms and rules (hereinafter - Hygienic standard).

17. The limits of annual income and allowable annual average volume activity are calculated on the basis of exposure dose limits equal to 20 mSv per year for personnel and 1 mSv per year for the population and established by specific hygienic standards approved by the Ministry of Health of the Republic of Belarus.

18. During simultaneous impact on human from sources of external and internal exposure the total annual effective dose should not exceed the established limits of exposure doses.

19. To justify the cost of radiation protection during the implementation of the principle of optimization there is used equivalent of monetary value of the loss of one man-year of life and it is assumed that exposure in the collective effective dose of 1 man-Sv leads to potential damage, equal to a loss of about 1 man- year of life of population.

20. For the most complete assessment of the harm that may be caused to health in the result of exposure in small doses, there is determined the damage quantitatively considered both the effects of exposure of individual organs and tissues of the human body, characterized by radiosensitivity to ionizing radiation, and the whole organism. In accordance with the linear

non-threshold theory of stochastic effects of exposure dose generally accepted in the world, the risk magnitude is proportional to exposure dose and is associated with a dose through the linear coefficients of radiation risk.

The coefficients of the nominal risk, taking into consideration the harm of cancer and hereditary diseases are given in the Hygienic standards.

21. The average value of the risk factors used to establish exposure dose limits of personnel and the public is assumed equal to 5 x 10^{-2} Sv^{-1}.

22. Under normal operation of ionizing radiation sources the dose limits throughout the year are established in accordance with the following values of the individual lifetime risk: for personnel – 1.0 x 10^{-3}, for population – 5.0 x 10^{-5}.

23. The level of negligible low risk divides the area of risk optimization and the area of certainly acceptable risk equals to 10^{-6}.

24. To justify the protection against potential exposure sources during the year, the following values of the generalized limit risk are taken:

for personnel – 2.0 x 10^{-4} $year^{-1}$ (the probability of fatal cancer occurrence connected with an average annual dose of occupational exposure of 5 mSv);

for the population - 1.0 x 10^{-5} $year^{-1}$.

25. Reduction of the risk to the lowest possible level should be performed taking into account two factors:

risk limit regulates the potential exposure from all possible ionizing radiation sources, so there is specified the risk limit for each ionizing radiation source while optimizing;

while reducing the risk of potential exposure there is a minimal risk level below which the risk is considered negligible and further risk reduction is impractical.

CHAPTER 2
PLANNED EXPOSURE SITUATIONS

26. Requirements relating to the planned exposure situations are applied to the following types of practical activity:

production, delivery and transportation of radioactive substances and devices that contain radioactive substances, including sealed and unsealed sources of ionizing radiation, as well as consumer goods;

production and supply of devices generating ionizing radiation, including linear accelerators, cyclotrons, as well as stationary and mobile radiography equipment;

production of nuclear energy, including any activity in the field of nuclear fuel cycle, which involves or could involve exposure in a result of radiation exposure or from radioactive substances;

the use of radiation or radioactive substances for medical, industrial, veterinary, agricultural purposes or for the purpose of forensic medical examination, safety and protection, where such use could lead to radiation exposure;

the use of radiation or radioactive substances for the purpose of training or research, including any activity connected with such use that involves or could involve exposure in a result of radiation exposure or from radioactive substances;

extraction and processing of minerals, which are connected with exposure from radioactive substances;

radioactive waste treatment generated as a result of practical activity;

any other practical activity involving the use of ionizing radiation sources, permitted in accordance with the legislation.

Exposure due to long-term remedial and (or) rehabilitation works and long-term employment in the contaminated area should be considered as part of the planned occupational exposure, even if the radiation source is existing.

27. Requirements relating to the planned exposure situations apply to exposure due to the use of the following radiation sources within a practical activity:

facilities containing radioactive material and facilities containing radiation generators, including nuclear installations, medical radiation facilities, veterinary radiation facilities, installations for radioactive waste management, installations for radioactive substances processing, exposure facilities and installations for the extraction and processing of mineral ores that involve or may involve exposure as a result of exposure of radiation or radioactive substances;

allowed to use separate ionizing radiation sources, including the types of sources in the installations specified in the second paragraph of this item.

28. Requirements for the planned exposure situations applied to any occupational exposure, medical exposure or public exposure due to any practical activity or source within a practical activity.

29. The planned exposure situations include the following situations of exposure from some natural sources of radiation:

exposure by radioactive material (substance) as a result of practical activity indicated in paragraph 26 of these Sanitary norms and rules, if the specific activity of radionuclides of the uranium or thorium series in the material (substance) exceeds 1 Bq / g or a specific activity ^{40}K exceeds 10 Bq / g;

exposure of the population due to radioactive substances releases or radioactive waste treatment resulting from the activities indicated in the paragraph 26 of these Sanitary norms and rules, if the specific activity of radionuclides of uranium or thorium series in the material (substance) exceeds 1 Bq / g or a specific activity ^{40}K exceeds 10 Bq / g;

exposure by radon at the workplace (^{222}Rn and ^{220}Rn) and by the products of its decay when occupational exposure due to other radionuclides of uranium and thorium series is controlled as a planned exposure situation;

exposure by ^{222}Rn and products of its decay in the situation where the employer has fulfilled the requirement to achieve the level of radon in the workplace as much lower than the reference level, as it is reasonably achievable and took measures to optimize protection, but the annual average concentration of ^{222}Rn in the air of working zone remained above the reference level.

Reference level for ^{222}Rn is established taking into account social and economic factors, but the average volume activity should not exceed 1000 Bq / m^3.

The reference level for ^{222}Rn shall be specified with consideration of social and economic factors, but the annual average volumetric activity shall not exceed 1000 Bq/m^3.

30. Exemption and clearance levels presented in accordance with the Appendix 4 to Hygienic Standard are used to determine practical activity and sources in the framework of practical activity which are subject to exemption from the scope of some or all requirements of the present Sanitary Norms and Regulations.

31. Exemption is not allowed for the practical activity which is considered as such that has no justification.

32. For occupational exposure of workers being more than 18 years old, basic dose exposure limits shall be specified in accordance with the Appendix 1 to the Hygienic Standard.

33. The committed effective radiation doses per unit of inhalation and ingestion intake for personnel are presented according to the Table 1 of the Appendix 3 to the Hygienic Standard.

34. In case of occupational exposure of a woman who has presented notification on pregnancy or breast-feeding, additional restriction shall be applied:

employers shall ensure obtainment by women appearing in monitored zone or supervised areas or exercising official duties in case of emergency situation of the relevant information on: risk for embryo or fetus from pregnant woman exposure; importance of earliest notification of employer by woman on the assumed pregnancy or on breast-feeding; risk of consequences for infant's health determined by the ingestion intake of radioactive substances.

pregnancy or breast-feeding shall not serve as a pretext for work suspension.

Being notified on pregnancy or breast-feeding, the employer of a woman shall change her working conditions in relation to occupational exposure in order to provide the same high protection level for embryo, fetus or infant as it is required for persons from public.

35. For women up to 45-year-old working with ionizing radiation sources, additional restrictions shall be imposed: the equivalent dose on the surface of the lower part of abdominal region shall not exceed 1 mSv per month, and the annual radionuclide intake to the body shall not exceed 1/20 of the annual intake limit for personnel. In this conditions, the equivalent radiation dose of a fetus during two month of undetected pregnancy will not exceed 1 mSv. For assurance of observance of the indicated standard in case of simultaneous effect of external and internal exposure sources, the basic radiation dose limits according to the Appendix 1 to the Hygienic Standard.

36. Employers shall assure that any person younger than 16 years old shall not be subjected or could not be subjected to occupational exposure.

37. Employers shall assure that persons younger than 18 years old are allowed to enter monitored zone only under the supervision and only for reasons of training and preparation for work exercising which they would be subjected or could be subjected to occupational exposure, or for reasons of training in the course of which the sources are applied.

38. For occupational exposure of students from 16 and up to 18 years old trained for future obtainment of radiation-related job and for exposure of students of 16 and up to 18 years old using ionizing radiation sources in the course of their training, the following radiation dose limits shall be specified:

effective dose of 6 mSv per year;

equivalent dose in crystalline lens of 20 mSv per year;

equivalent dose in limbs (hands and feet) or in skin of 150 mSv per year.

39. The effective dose of all workers, including personnel, exposure to the natural radiation sources shall not exceed 5 mSv per year under production conditions (any professions and manufactures).

40. The average values of radiation factors during a year, with monofactorial effect corresponding with the effective dose of 5 mSv per year with work duration of 2000 h/year, average breathing rate of 1.2 m^3/h and radioactive balance of uranium and thorium series radionuclides in the occupational dust are equal to:

gamma radiation effective dose rate in the workplace of 2.5 μSv/h;

$EEVA_{Rn}$ in the air of breathing zone of 310 Bq/m^3;

$EEVA_{Rn\text{-}220}$ in the air of breathing zone of 68 Bq/m^3;

specific activity in the occupational dust of uranium-238, which is in radioactive balance with members of its series, is equal to $40/f$ kBq/kg, where f is the average annual general dust concentration in the air in breathing zone, mg / m^3;

specific activity in occupational dust of thorium-232, which is in radioactive balance with members of its series, is equal to 27/*f*, kBq/kg.

41. With multifactorial effect, the following condition has to be fulfilled: the sum of the ratios of the influencing factors to the values given in the item 40 of the present Sanitary standards and rules shall not exceed 1.

42. Radiation safety of population shall be achieved in a way of restriction of effect from all main exposure categories specified in part one of item 7 of the present Sanitary standards and rules. Possibilities of regulation of different exposure categories significantly differ, therefore their regulation shall be carried out separately with application of different methodological approaches and technical methods.

43. It is necessary to take measures in respect of all population exposure sources both for decrease of radiation dose of individuals and for reduction of number of persons who are exposed to radiation in accordance with optimization principle.

44. For population exposure, the basic radiation dose limits are specified according to the Appendix 1 to the Hygienic standard.

The effective dose limits shall be applied to the sum of corresponding external exposure doses for a certain period and the corresponding committed exposure doses from radionuclide intake to the body during the same period. The 50 years for adults and up to 70 years for children shall be usually accepted as the period for estimation of the committed exposure dose by intakes to the body.

45. The specified limits of radiation doses relate to the radiation dose of the representative person considered as the sum of external exposure doses for the current year and committed exposure dose up to 70 years due to intake of radionuclides to the body during the current year.

46. For restriction of population exposure to separate man-caused radiation sources carried out by the bodies and institutions exercising the state sanitary supervision (hereinafter the bodies of state sanitary supervision), quotas (fractions) of annual exposure dose limit can be established for them in a way that the sum of quotas do not exceed the basic limits of the radiation doses given according to the Appendix 1 to the Hygienic standard.

47. Population exposure to the man-caused radiation sources shall be restricted by ensuring safekeeping of ionizing radiation sources, control of technological processes and restriction of emission (release) of radionuclides into the environment as well as by other measures at the stage of designing, operation and the termination of use of ionizing radiation sources.

48. For population, the committed effective exposure doses per inhalation and ingestion intake unit are established according to tables 2 and 3 of the Appendix 3 to the Hygienic standard.

49. For control of population exposure to the facilities wherein the

radioactive waste (including long-lived) are stored and (or) disposed for a long-term period, population exposure dose shall not exceed the dose constraint of 0.3 mSv during a year.

50. In case of the planned release of long-living radionuclides into the environment during the planning stage, it is necessary to consider a possibility of radionuclides accumulation in the environment, which can lead to exceedance of the radiation dose constraint. If such verification appears to be impossible or its results are too indefinite, then population exposure dose shall not exceed the dose constraint of 0.1 mSv during a year to the prolonged dose component connected with effect of long-lived radionuclides of human-made origin. In situations of planned exposure to radioactive materials of natural origin, such restriction shall not be required.

51. For prevention of exceedance of man-caused population exposure dose limit, population exposure quota is equal to 100 μSv/year for a nuclear power plant (hereinafter, NPP). This quota shall be established for population total exposure from all sources of radioactive gas-aerosol emissions into the atmospheric air and liquid releases into surface water in general for an NPP irrespective of number of power units on the industrial site. Quota values of population exposure by radiation factors (emissions and releases) for NPP normal operation are established by the Hygienic standard.

Maximum permissible emissions and maximum permissible releases are the upper limits for gas-aerosol emissions and liquid releases of radionuclides into the environment in the mode of NPP normal operation.

52. The minimum significant radiation dose being equal to 10 μSv/year is accepted as the lower limit of radiation dose with optimization of population radiation protection in the mode of NPP normal operation.

53. Considering NPP safety level technically achieved in the mode of normal operation (when NPP actual emissions and releases create a radiation dose for members of the public being less than 10 μSv a year for each exposure pathway), the radiation risk for population during NPP operation is certainly acceptable (less than 10^{-6} $year^{-1}$).

54. Risk of population oncology diseases development resulting in death around NPP area which can result from NPP operation shall not exceed 0.1% of the amount of risks of fatal cancer development resulting from other reasons.

55. Operators of ionizing radiation sources shall assure that any patient (symptomatic or asymptomatic) is not exposed to medical irradiation if:

radiological procedure has not been prescribed by the referring specialist doctor and information on clinical picture has not been provided or if performance of this procedure is not provided within the program of routine medical examination of population;

medical irradiation has not been justified in appropriate cases by means of consultations between the doctor-radiologist and the referring specialist doctor or if this irradiation is not provided within the program of routine medical examination;

doctor-radiologist does not assume responsibility for protection and safety assurance during planning and implementation of medical irradiation;

patient or his legal representative is not informed in appropriate cases on the expected diagnostic or therapeutic advantage of this radiological procedure as well as risks related to radiation effect.

56. The principles of control and restriction of radiation effects in the medical industry are based on obtaining the required and useful diagnostic information or therapeutic effect with minimum possible exposure levels. At the same time, the radiation dose limits are not established, but the principles of justification of radiological medical procedures prescription and optimization of patients' protection measures are used.

For the purpose of decrease of exposure levels of patients, persons providing comfort and care of patients, and the persons voluntarily participating in biomedical research, diagnostic reference levels and dose constraints shall be established. Values of diagnostic reference levels will depend on type of medical irradiation situation in case of radiological and radionuclide diagnostics.

The recommended diagnostic reference levels during medical irradiation for a typical adult patient are specified according to the Appendix 8 to the Hygienic standard.

57. During planning of irradiation of patients and assessment of a ratio risk-benefit it is necessary to use equivalent dose or absorbed dose in the irradiated tissues.

The effective dose can be used when comparing various diagnostic procedures or the same technologies and procedures used by various healthcare organizations or in different countries and also when using different technologies for the same medical research.

58. When exercising preventive medical X-ray examination and scientific research of virtually healthy persons, the annual effective dose of these persons' exposure shall not exceed 1 mSv.

The established standard of annual preventive irradiation can be exceeded only in conditions of the adverse epidemiological situation requiring additional researches. The decision on temporary compelled exceedance of this standard of annual preventive irradiation shall be made by the Ministry of Health of the Republic of Belarus.

59. Scientific human research with ionizing radiation sources shall be carried out in the procedure established by the legislation of the Republic of Belarus and the present Sanitary standards and rules.

Any irradiation of persons voluntarily participating in biomedical research relates to the category of medical irradiation.

60. Medical procedures connected with irradiation of patients shall be justified by comparison of diagnostic or therapeutic benefit which they bring with radiation damage to health which irradiation can cause, in view of the existing alternative methods being not connected with medical irradiation.

61. Before implementing diagnostic or therapeutic procedure connected with irradiation of a woman of childbearing age, it shall be defined whether she is pregnant or a nursing mother. The pregnant or nursing woman as well as parents of children patients have to be informed by the specialist doctor on advantages of the planned procedure and on the related radiation risk for an embryo (fetus), newborns and younger children for making the conscious decision on implementation of the procedure or refusal to implement it.

62. When exercising justified medical X-ray examinations in connection with professional activity or within a forensic medical examination as well as when exercising X-ray preventive medical and scientific research of virtually healthy persons receiving no direct benefit for health from the procedures connected with irradiation, the annual effective dose shall not exceed 1 mSv.

63. The persons which are not personnel of X-ray departments but providing assistance in support of patients (seriously ill patients, children and others) when performing X-ray procedures shall not be exposed to radiation in a dose exceeding 5 mSv during a year. The same requirements are imposed to radiation safety of the adult persons residing together with the patients completed a course of radionuclide therapy or brachytherapy with implantation of sealed ionizing radiation sources and those discharged from a healthcare organization. For other adult persons as well as for children making contacts with the patients discharged from a healthcare organization after radionuclide therapy or brachytherapy, the limit of the radiation dose is equal to 1 mSv during a year.

64. The patients taking a course of radionuclide therapy or brachytherapy with implantation of sealed ionizing radiation sources can be discharged from the a healthcare organization provided that the level of gamma radiation and X-rays emitted from a body meets the requirements of item 63 of the present Sanitary standards and rules.

65. Before patients are discharged, they shall be provided with written and oral recommendations concerning precautionary measures which they have to take in order to protect family members and other persons they can make contact with against radiation. The same requirements are imposed to the regime of patients treatment on an outpatient basis.

66. When planning and implementing procedures related to ionizing radiation, radiation doses of all persons exposed to medical irradiation shall be defined and recorded in accordance with the established procedure in the healthcare organizations.

67. All handling of a died human body (dissection, burial, cremation, transportation) having considerable external or internal radionuclide contamination or if there is a pacemaker with ionizing radiation source in a body or the ionizing radiation sources implanted during brachytherapy – shall be regulated by separate technical regulatory legal acts.

68. Radiation safety during handling of inspection display devices shall be regulated by separate technical regulatory legal acts.

CHAPTER 3
EMERGENCY EXPOSURE SITUATIONS

69. The requirements relating to the emergency exposure situations shall be applied to the activity for assurance of readiness for a nuclear or radiation emergency situation and response to such situation.

70. For assurance of readiness for response to nuclear or radiation emergency situations, a set of measures for appropriate readiness maintenance at the facility, local, territorial and national levels, and also by agreement between the states and at the international level has to be held.

71. For assurance of response to nuclear or radiation emergency situations, a system of emergency situations management shall be established and continuously maintained for emergency response with the aim of human life and health protection as well as environmental protection in case of a nuclear or radiation emergency situation.

72. The system of emergency situations management shall be designed in a way to be corresponding to results of hazard assessment and assuring effective emergency response to reasonably predictable events (including very low occurrence probability events) in connection with installations or activity.

73. The system of emergency situations management shall be integrated within practically achievable limits into the general management system of emergency situations connected with hazards of any sort.

74. The system of emergency situations management has to include the major elements provided at the place of events and in appropriate cases at the local, territorial, national and international levels including:

hazard assessment;

development and implementation of emergency response plans and emergency procedures;

distinct responsibility distribution of persons and organizations for which certain roles in measures for emergency readiness and response assurance are assigned;

measures for efficient and effective cooperation and coordination of actions taken by the organizations;

reliable communication, including information of the public;

the optimized protection strategies for implementation and completion of protection measures for members of the public which can be exposed to radiation in an emergency situation, including corresponding reasons on environmental protection;

protection measures for emergency workers;

personnel training, including training in the field of radiation protection, of all persons taking part in emergency response and implementation of plans of emergency measures and emergency procedures;

preparation for transition from the emergency exposure situation to the existing exposure situation;

response measures of healthcare governing bodies, healthcare organizations and medical units intended for delivery of health care to public suffered during emergency situations as well as to health services subordinated to other state authorities;

assurance of personal dosimetry monitoring and environmental radiation monitoring as well as radiation doses assessment.

75. When planning response to nuclear or radiation accident, the national emergency response measures have to be coordinated with the international emergency response measures.

76. When exercising response to a nuclear or radiation accident, the following can be required:

adoption of urgent precautionary protective measures for prevention of serious deterministic effects for health;

adoption of urgent protective measures for prevention of stochastic effects in that degree in which it is practically feasible;

adoption of agricultural countermeasures, the countermeasures preventing radionuclides ingestion intake and long-term protective measures in agriculture;

protection assurance for workers exercising response.

77. When exercising emergency response to nuclear or radiation accidents, the general response criteria are used. Radiation dose levels required to be used as the general criteria are specified in the Hygienic standard. If numerical values exceeding the general criteria, these protective actions and other measures shall be carried out separately or in a combination with each other.

78. In case of an accident, practical measures have to be taken for restoring control over ionizing radiation source and minimizing radiation doses, number of exposed persons, environmental radioactive contamination, economic and social losses caused by radioactive contamination.

79. In case of radiation accident or finding radioactive contamination, radiation restriction shall be implemented by protective measures which are

applicable, as a rule, to the environment and (or) to human. These actions can lead to violation of normal living activity of population, economic and social functioning of territory, cause not only economic damage but also an adverse effect on public health, psychological effect on population and adverse change of ecosystems condition. Therefore, while making decisions on type of protective and other response measures, one shall be guided by the following principles:

the proposed protective and other response measures have to bring more benefit than harm to the society and, in the first place, to the exposed persons, i. e. damage decrease as a result of decrease in radiation dose has to be sufficient to justify harm and cost of protective and other response measures, including their social cost (the justification principle for protective and other response measures);

form, scale and duration of protective and other response measures shall be optimized in a way that clear benefit from radiation dose decrease, that is benefit from radiation damage decrease minus the damage related to the performed protective and other response measures would be maximum (the optimization principle of protective and other response measures).

80. Radiation facilities, facilities of atomic energy use, nuclear installations and radwaste storage and disposal points shall be categorized depending on nuclear and other hazards connected with all types of ionizing radiation. Within radiation facility project, emergency planning zones shall be identified and justified, depending on the facility hazard category and being specified by separate technical regulatory legal acts.

81. In case of the accident which caused radioactive contamination of the extensive territory, radiation accident zone shall be established on the basis of monitoring and forecast of radiation situation. In radiation accident zone, radiation situation shall be monitored and measures for population exposure level decrease shall be carried out on the basis of the requirements and the principles specified in items 78 and 79 of the present Sanitary standards and rules.

82. While carrying out protective measures in an emergency situation, radiation dose limits shall not be applied. Proceeding from the principles specified in item 79 of the present Sanitary standards and rules, while planning protective measures for a case of radiation accident, response criteria for a specific radiation facility with conditions of its location are established by bodies of state sanitary supervision taking into account probable accident types, scenarios of emergency situation development and existing radiation situation.

83. For making decision on performance of urgent protective measures, one shall be guided by:

the general response criteria in case of acute exposure, for which urgent protective and other response measures are required under any circumstances for prevention or minimization of severe deterministic effects, established according to the Appendix 19 to the Hygienic standard;

the general response criteria for protective actions and other response measures taken in emergency exposure situations in order to decrease risk of stochastic effects, established according to the Appendix 20 to the Hygienic standard.

84. If the received radiation dose exceeds the established certain general response criterion, the relevant medical care of the exposed persons shall be provided, including treatment, long-term health monitoring and consultation by psychologists.

85. For introduction of restrictive measures concerning food products, one shall be guided by the existing intervention levels which are based on the general response criteria and established by separate technical regulatory legal acts.

86. At a late stage of elimination of an accident which has caused contamination of extensive territories with long-lived radionuclides, decisions on performance of protective measures shall be made taking into account the existing radiation situation and specific social and economic conditions. At that, specific protective measures shall be justified by the value of effective radiation dose (equivalent dose of exposure of thyroid gland, embryo or fetus) which can be received when no protective measures are carried out.

87. Risk of death for population residing in close proximity to the NPP which can result from accident at the reactor, shouldn't exceed 0.1% of the sum of all risks of death resulting from other accidents which the population of the Republic of Belarus is exposed to.

88. The increased exposure of emergency workers higher than the established dose limit of 50 mSv shall not be allowed, except for the cases of:

saving life or prevention of serious injury;

implementation of actions aimed at prevention of serious deterministic effects and actions aimed at prevention of catastrophic conditions which can make significant impact on people and the environment;

implementation of the actions aimed at prevention of a high collective effective dose.

89. In exceptional circumstances stated in item 88 of the present Sanitary standards and rules, the organizations implementing response and employers shall make all reasonable efforts for radiation doses received by emergency workers to be lower than values established in the Hygienic standard.

The emergency workers performing operations at which radiation doses received by them can exceed the established radiation dose limits reaching to the values specified according to the Appendix 21 to the Hygienic standard or exceed them shall perform these operations only if the expected benefit for others definitely outweighs risks which emergency workers are exposed to.

90. The increased exposure is allowed for men who are more than 30 years old, once during their life, with preliminary informing on possible radiation doses, risk for health and obtaining their voluntary consent.

91. Exposure of the emergency workers involved in elimination of radiation accidents consequences shall not exceed more than by 10 times the annual average value of the main radiation dose limits for workers (personnel) established by Article 8 of the Law of the Republic of Belarus "On Radiation Safety of Population".

92. The workers receiving radiation doses in emergency exposure situation usually shall not be suspended from works related to further occupational exposure. However, if a worker has received the radiation dose exceeding 200 mSv or in case of receipt of the relevant request from the worker prior to the start of works related to further occupational exposure, a finding of the specialist doctor shall be issued.

93. The persons which do not belong to personnel but are involved in emergency and rescue efforts shall be documented and allowed to works as personnel.

CHAPTER 4
EXISTING EXPOSURE SITUATIONS

94. Situations of exposure to natural radiation sources belong to existing radiation situations. They also include situations of exposure to the residual radioactive material remained after previous activity which was not subject to the regulatory control or after emergency exposure situation.

95. Preparation of the decision on transition to the existing radiation situation shall be implemented according to the recommendation of the National Commission on Radiation Protection under the Council of Ministers of the Republic of Belarus.

96. The requirements for population exposure restriction shall be applied to all types of the existing exposure arising in the following situations:

exposure caused by radioactive contamination of territories with the residual radioactive material generated as a result of:

activity performed in the past which never was under the regulatory control or which has been covered by the regulatory control but not meeting the requirements of the present Sanitary standards and rules;

nuclear or radiation emergency situation after notification on termination of emergency response situation;

exposure to consumer goods, including food products, animal feeding stuff, drinking water and construction materials containing radionuclides derived from residual radioactive material;

exposure to natural sources.

97. The exposure to natural sources includes exposure:

to ^{222}Rn, ^{220}Rn and their progeny products in the workplace except for those which exposure determined by other radionuclides in uranium or thorium decay chains is controlled as planned exposure situation, in residential and other buildings with mass stay of members of public;

to radionuclides of natural origin irrespective of activity in consumer goods, including food products, animal feeding stuff, drinking water, agricultural fertilizers and substances improving or reclaiming soil and construction materials as well as residue in the environment;

to materials except for the abovementioned ones in which specific activity of any radionuclides either of uranium or thorium decay chains does not exceed 1 Bq/g, or concentration of ^{40}K activity does not exceed 10 Bq/g;

exposure of crews of aircrafts and spacecrafts as a result of cosmic radiation effect.

98. Permissible value of radiation effective dose determined by aggregate effect of natural radiation sources shall not be established for population. Decrease of population exposure shall be reached by establishment of constraint system for population exposure to separate natural radiation sources.

99. In case of exposure caused by radon presence, existing exposure situations shall also include the situation of exposure in the workplace which implies that exposure to radon is not required for performance of this work or directly related to it and when it can be expected that the annual average volumetric activities connected with ^{222}Rn exceeding the reference level established in accordance with the part second of item 29 of the present Sanitary standards and rules.

100. In the existing exposure situations, measures on assurance of protection and safety of population shall be carried out in accordance with the procedure established by legislation.

101. Such measures include remedial action, for example, removal or reduction of a source inducing exposure and other more long-term protective measures such as restriction of construction materials use, restriction of food products consumption and restriction of land utilization or access to territories or buildings.

102. In view to manage the existing exposure situations, the established protection strategy shall be commensurate with the radiation risks connected with this situation, and the provided remedial action or protective measures has to led to the sufficient positive results exceeding the damage related to their implementation including radiation risks (justification principle).

103. The form, scale and duration of remedial or protective measures

have to be optimized (optimization principle). All population which is in the existing exposure situation has to be subjected to the optimized protection, however priority shall be given to persons whose exposure doses remain above the established radiation dose limits.

104. After completion of remedial action:

type, scale and duration of any measures of post-remedial control earlier determined in remedial action plan shall be established with the relevant consideration of residual radiation risks;

a person or organization responsible for any control measures after remedial actions completion shall be identified;

conditions in the restored territory shall be periodically considered and any restrictions changed or cancelled if appropriate;

if required, certain restrictions shall be imposed in the restored territory in order to control:

access for the persons having no relevant permits;

removal of radioactive material or use of such material including its use in consumer goods;

future utilization of territory including utilization of water and other natural resources as well as for production of food products or animal feeding stuff;

consumption of the food products made in this territory.

105. In territories having residual radioactive contamination with long-lived radionuclides where residence and renewal of economic activity is allowed, radiation monitoring of environmental objects and population exposure dose assessment shall be performed.

106. The Ministry of Health of the Republic of Belarus establishes definite reference levels for the exposure determined by presence of radionuclides at products and consumer goods such as construction materials, food products, animal feeding stuff and drinking water. These reference levels shall be determined from estimation that the annual effective dose for a representative person shall not exceed 1 mSv.

107. While designing new office and public buildings, residential premises, it shall be provided that the average annual equivalent equilibrium volumetric activity of radon isotopes progenies (^{222}Rn and ^{220}Rn) in air of rooms $EEVA_{Rn} + 4.6EEVA_{Rn\text{-}220}$ does not exceed 100 Bq/m^3 and the gamma radiation effective dose rate does not exceed the dose rate in the open area for more than 0.2 μSv/h.

108. In air of operated residential premises, the annual average equivalent equilibrium volumetric activity of radon isotopes progenies (^{222}Rn and ^{220}Rn) $EEVA_{Rn} + 4.6EEVA_{Rn\text{-}220}$ shall not exceed 200 Bq/m^3. In case of higher volumetric activity values, the protective measures shall be performed, aiming at decrease of radon release into the air of residential premises and

improvement of ventilation of residential premises. Protective measures have to be held also if the gamma radiation effective dose rate in the residential premises exceeds the dose rate in the open area for more than 0.2 μSv/h.

109. The effective specific activity (A_{eff}) of natural radionuclides in the construction materials (crushed stone, gravel, sand, rubble and sawn stone, cement and brick raw materials etc) extracted in their fields or which constitute a byproduct of production industry and also the waste of industrial production used for manufacture of construction materials (ash, slag, etc.), shall not exceed:

for the materials used in the public buildings and premises under construction and reconstructed (the I class):

$$A_{eff} = A_{Ra} + 1.3A_{Th} + 0.09A_K \leq 370 \text{ Bq/kg}$$

where A_{Ra} and A_{Th} are specific activities of ^{226}Ra and ^{232}Th, which are in balance with other members of uranium and thorium series, A_K is ^{40}K specific activity (Bq/kg);

for materials used in road engineering within the territory of population centers and perspective building zones as well as while erecting industrial constructions (the II class):

$$A_{eff} \leq 740 \text{ Bq/kg;}$$

for the materials used in road engineering outside population centers (the III class):

$$A_{eff} \leq 1500 \text{ Bq/kg.}$$

If 1500 Bq/kg < A_{eff} < 4000 Bq/kg (the IV class), the issue of materials use is resolved on a case-by-case basis in coordination with the bodies of state sanitary supervision. If A_{eff} > 4000 Bq/kg, materials shall not be used in construction.

110. Permissible content of natural radionuclides in mineral raw materials and products containing them (products of ceramics and ceramic granite, natural and artificial stone etc) as well as requirements for radiation safety assurance during their treatment shall be established by separate sanitary standards and rules, hygienic standards containing requirements for restriction of population exposure at the expense of natural radiation sources.

111. Permissible content of ^{40}K in mineral fertilizers and agrochemicals shall not be specified. While treating the materials containing ^{40}K, the requirements on population exposure restriction at the expense of natural radiation sources shall be observed, being established in the item 29, part

one, paragraph two of the present Sanitary standards and rules.

112. Exposure levels from consumption of food products and drinking water as well as exposure levels due to radionuclide presence in construction materials shall not exceed the basic dose limit of population exposure that is equal to 1 mSv per year.

113. While specifying the reference levels of radionuclide content in food products, drinking water and goods, one shall consider the international recommended levels of radionuclide content in the food products intended for international trade and which after a nuclear or radiation emergency situation can contain radioactive substances, recommendations of the World Health Organization and the concluded international agreements.

114. In case when content of natural and artificial radionuclides in drinking water consumed by population which create effective dose less than 0.1 mSv per year, measures on reducing its radioactivity are not required. This value of exposure dose at consumption of 2 l of water per day correspond to reference levels of radionuclides content in drinking water established according to Appendix 9 to Sanitary-Hygienic Standard and presented in terms of average specific activity per year.

In case of compresence of several radionuclides in water, the following condition must be fulfilled:

$$\sum_i \frac{A_i}{RL_i} \leq 1,$$

where A_i is a specific activity of i- radionuclide in water, RL_i is a corresponding reference level.

In case of non-fulfillment of the indicated condition, protective actions shall be performed with consideration of optimization principles.

Preliminary assessment of admissibility of using water for drinking may be performed on the basis of specific total alpha (A_α)- and beta (A_β)-activity which shall not exceed 0.5 and 1.0 Bq/l respectively.

115. For mineral water. special standards shall be established.

116. Specific activity of natural radionuclides (^{226}Ra, ^{232}Th) in mineral fertilizers and ameliorants containing phosphates shall not exceed:

$$A_U + 1.5\,A_{Th} \leq 1000 \text{ Bq/kg},$$

Where A_U and A_{Th} are specific activities of uranium-238 (radium-226) and thorium-232 (thorium-228) which are in radioactive balance with other members of uranium and thorium rows respectively.

117. Requirements concerning public exposure are applied to assure protection and safety of workers in situations of the existing exposure except for special situations indicated in i.118 – 123 of the present Sanitary Rules and Standards.

118. Control over exposure of workers performing remedial measures shall be performed in accordance with the existing requirements in relation to occupational exposure as well as in situations of expected exposure presented in i.26 – 68 of the present Sanitary Rules and Norms.

119. Strategy of protection against exposure caused by ^{222}Rn presence in working places shall be developed along with establishing a proper reference level for ^{222}Rn. As a reference level for ^{222}Rn established was a value which doesn't exceed average annual volumetric activity of ^{222}Rn equal to 1000 Bq/m^3 which corresponds to annual activity of effective dose of about 10 mSv.

120. Level of volumetric activity of ^{222}Rn in working places shall be maintained at a level as low as reasonably achievable, not exceeding reference level established in accordance with i.119 of the present Sanitary Rules and Standards, measures on protection optimization also shall be performed.

121. If, despite all the performed measures aimed at reduction of levels of radon, volumetric activity of ^{222}Rn in working places remains higher than the reference levels established in accordance with i.119 of the present Sanitary Rules and Standards, then the corresponding requirements related to occupational exposure in situations of expected exposure presented in i.26 – 28 of the present Sanitary Norms and Rules shall be performed.

122. Decision on the necessity of control of exposure doses of crew teams in the result of space exposure shall be taken by the Ministry of Health of the Republic of Belarus.

123. In cases when assessment of exposure doses of crew teams caused by space exposure impact is considered to be reasonable, a mechanism which

would envisage application of dose reference level shall be established, as well as methodology for assessment and registration of doses of occupational exposure received by crew team in the result of space exposure. Impact of space exposure of airplanes crew teams is standardized as natural exposure according to i.39 of the present Sanitary Rules and Standards.

124. In cases when exposure dose received by the members of crew team may exceed reference level, employer of crew team shall:

- perform assessment and registration of exposure doses;
- provide access to registration records for members of crew team;
- inform women who are members of crew teams about risk for embryos or fetuses caused by space radiation and about the necessity of early notification of employer about pregnancy;
- apply requirements of i.34 of the present Sanitary Rules and Standards.

CHAPTER 5

CONTROL OVER FULFILLMENT OF REQUIREMENTS ON RADIATION SAFETY

125. Radiation control is an important part of radiation safety assurance at all stages of designing, construction, operation and decommissioning of radiation facility. The purpose of radiation control is determination of the extent of observance of radiation safety principles and requirements of the acting technical regulatory legal acts and includes:

- control of non-exceedance of the established basic limits of exposure doses, dose constraints and reference levels in situations of expected and the existing exposure;
- obtainment of information for safety optimization and decision making concerning protective measures implementation in situation of emergency exposure.

Radiation control shall be performed over all ionizing radiation sources except for those indicated in i.8 of the present Sanitary Rules and Standards.

126. The following shall be subject to radiation control:

- radiation characteristics of ionizing radiation sources, emissions into atmosphere, liquid and solid radioactive waste;
- radiation factors caused by operation process in working places and in the environment;
- radiation factors in the territories contaminated with radionuclides and in the buildings with high level of natural exposure;
- personnel and public exposure levels from all ionizing radiation sources to which effect of Sanitary Rules and Standards extends.

127. Basic controlled parameters are:

- annual effective and equivalent exposure doses;
- intake of radionuclides into human body and their content in body for assessment of annual intake;
- volumetric or specific activity of radionuclides in air, water, food products, building materials and other;
- radioactive contamination of skin, clothes, shoes, working surfaces;
- dose and dose rate of external exposure;
- density of particles and photons flow.

Transition from the measured values of external exposure to standardized values is determined by separate technical regulatory legal acts.

128. According to i.127 of the present Sanitary Rules and Standards for operative control, the reference levels shall be established for all controlled parameters. Values of these levels shall be established in a way to guarantee non-exceedance of basic limits of exposure doses with consideration of exposure from all ionizing radiation sources subjected to control, achieved protection level and possibilities of its further reduction considering requirements of optimization principle. Detected exceedance of reference levels is a ground for identification of the reason of this exceedance.

129. During planning and implementation of measures on radiation safety assurance, analysis of efficiency of the indicated measures according to the Law of the Republic of Belarus "On radiation safety of public" state administrative bodies, other state organizations subjected to the government of the Republic of Belarus, local executive and regulatory agencies as well as consumers of ionizing radiation sources, the radiation safety status assessment shall be performed according to the following basic figures:

- characteristic of radioactive contamination of the environment;
- analysis of efficiency of measures on radiation safety assurance and observance of regulatory legal acts in the field of radiation safety assurance including technical regulatory legal acts;
- possibility of radiation accidents and their expected scale;
- level of preparedness for effective elimination of radiation accidents and their consequences;
- analysis of exposure doses received by separate groups of population from all ionizing radiation sources;
- number of people suffered from exposure higher that the established main dose limits.

130. Control and recording of individual doses of public and personnel exposure in the situations of expected, emergency and the existing exposure shall be performed within the measures of unified state system of control and registration of individual exposure doses.

131. State supervision in the field of radiation safety assurance shall be organized and performed by the Ministry of Emergency Situations of the Republic of Belarus under the procedure established by the Council of Ministers of the Republic of Belarus, as well as by other state bodies within the measures of their authority in accordance with the legislation of the Republic of Belarus.

State Sanitary Supervision in the field of radiation safety assurance shall be performed by the Ministry of Health of the Republic of Belarus, other authorized state bodies and organizations executing state sanitary supervision under the procedure established by the Council of Ministers of the Republic of Belarus.

APPROVED

Decree of the Ministry of Health

of the Republic of Belarus

No. 213 dated 28.12.2012

SANITARY-HYGIENIC STANDARD
"CRITERIA FOR RADIATION IMPACT ASSESSMENT"

CHAPTER 1
GENERAL PROVISONS

1. The present Sanitary-hygienic standard establishes quantitative and qualitative values of figures characterizing impact on human of ionizing radiation of artificial or natural origin in various exposure situations and applied for radiation safety assurance.
2. For purposes of the present Sanitary-hygienic standard used are basic terms and their definitions in meanings established by the Law of the Republic of Belarus "On radiation safety of population" dated January 5, 1998 (National Assembly Bulletin of the Republic of Belarus , 1998 , N 5, p. 25), the Law of the Republic of Belarus "On nuclear energy use" dated July 30, 2008 (National register of legal acts of the Republic of Belarus No. 187, 2/1523; 2008), the Law of the Republic of Belarus "On social protection of population suffered from the Chernobyl NPP catastrophe, other accidents" dated January 6, 2009 (National register of legal acts of the Republic of Belarus, No. 17, 2/1561; 2009), as well as the following terms and their definitions:
   - radiation weighing factors for separate types of radiation during calculation of equivalent dose (W_R) are absorbed dose multipliers used in radiation protection which consider relative biological efficiency of different types of radiation in induction of biological effects:

Radiation type	Radiation weighing factor, W_R
photons	1
electrons and muons	1

protons and charged pions	2
alpha-particles, fission fragments, heavy nuclei	20
neutrons	energy continuous function

All values relate to exposure affecting human body and, in case of internal exposure, to exposure generated during nuclear transformation.

During calculation of weighing factor of neutron radiation, the following continuous dependence on neutron energy is recommended, E_n (MeV):

$$W_R \begin{cases} 2.5 + 18.2e\,\dfrac{[1n(E_n)]^2}{6}, E_n < 1MeV; \\ 5.0 + 17.0e\,\dfrac{[1n(2E_n)]^2}{6},\ MeV \le E_n \le 50MeV; \\ 2.5 + 3.25e\,\dfrac{[1n(0.04E_n)]^2}{6}, E_n > 50MeV; \end{cases}$$

weighing factors for tissues and organs during calculation of effective dose (W_T) are multipliers of equivalent dose in organs and tissues used in radiation protection for recording various sensitivity of organs and tissues in case of radiation stochastic effects:

Tissue	W_t	(ΣW_t)
Red bone marrow, large intestine, lungs, stomach, breast, other tissues	0.12	(0.72)
gonads	0.08	(0.08)
bladder, esophagus, liver, thyroid	0.04	(0.16)
Bone surface, skin, brain, salivary glands	0.01	(0.04)

Tissues of the category "Others" include: suprarenal gland, extrathoracic segment tissues, cholecyst, cordis, kidneys, lymph glands, muscular tissue, oral mucosa, pancreatic gland, small intestine, spleen, thymus, prostate gland (men), uterus, cervix (women).

W_T for gonads shall be applied for average value of dose in testicles and ovaries;

decorporation – biological processes performed with the help of chemical or biological agents, due to which incorporated radionuclides are eliminated from human body;

individual dose equivalent H_p (d) – the dose equivalent in soft tissue under the reference point in the human body at a corresponding depth d. Applied in terms of measured value which constitutes equivalent dose in tissues and organs or (with d = 10 mm) effective dose during individual dosimetric control of external exposure.

Recommended values of d are equal to 10 mm for strongly penetrating radiation and 0.07 mm for weakly penetrating radiation;

kerma is a ratio of sum of initial kinetic energy dE_k of all charged ionizing particles generated under the influence of indirect-ionizing radiation in elementary volume of substance, to a mass dm substance in this volume:

$$K = \frac{dE_k}{dm}.$$

Unit of kerma is Grey (G), equal to 1 J/kg;

kerma in air – a value of kerma for air. In case of balance of charged particles of kerma in air in numeric expression, kerma is approximately equal to absorbed dose in air;

class of works – characteristic of works with unsealed ionizing radiation sources according to the extent of potential danger for personnel which determines requirements on radiation safety;

minimum significant activity (hereinafter – MSA) – activity of unsealed ionizing source in room or at working place, in case of exceedance of which a permission for use of these sources issued by the bodies and agencies performing state sanitary supervision is required, if simultaneously minimum significant specific activity is exceeded;

minimum significant specific activity (hereinafter – MSSA) – specific activity of unsealed ionizing radiation source in room or at working place, in case of exceedance of which, a permission for use of these sources issued by the bodies and agencies performing state sanitary supervision shall be required, if simultaneously minimum significant specific activity is exceeded;

directional dose equivalent, H (d, Ω) – dose equivalent which is created correspondingly by completed and widely-spread field in spherical phantom by International Commission on Radiological Units and Measurements (hereinafter – ICRU) at the depth of d according to radius with certain direction Ω. It is applied in terms of directly measured value which constitutes equivalent dose in skin for use during monitoring of external exposure.

Recommended depth d for weakly penetrating radiation is equal to 0.07 mm;

irremovable (fixed) surface contamination – contamination with radioactive substances which are not transferred to other objects during contact and cannot be removed during contamination;

nominal risk factor – averaged according to gender and age by the moment of exposure assessment of lifetime risk for representational population;

RBE-weighed absorbed dose – product of absorbed dose to organ or tissue by RBE radiation:

$$AD_T = \sum_R D_{R,T} \times RBE_{R,T} ,$$

where $D_{R,T}$ – dose to organ from radiation R in tissue T, and $RBE_{R,T}$ – relative biological effectiveness in specific organ or tissue T.

Unit of RBE-weighed absorbed dose is Grey (G), equal to 1 J/kg.

Purpose of RBE-weighed absorbed dose lies in consideration of difference in biological effectiveness of creation of deterministic effects in organs or tissues of reference man determined by radiation quality;

expected RBA-weighed absorbed dose, AD_T (τ) – value AD_T (τ) used as a characteristic of internal exposure and calculated by a formula:

$$AD_T(\tau) = \int_{t0}^{t0+\tau AD_t dt} ,$$

f –integral sign,

where t_0 – time of arrival, AD_T (τ) – capacity of RBA-weighed absorbed dose at the moment of time *t* in organ or tissue T, and τ – is time passed after arrival of radioactive matter.

For arrival of radioactive material an expected RBA-weighed absorbed dose characterizes internal exposure of human organs and tissues in accordance with exposure quality and its distribution throughout the body of reference man which would be caused by the same arrival;

dangerous amount of radioactive matter (D-value) – such an amount of radioactive matter which in case of absence of control can lead to death of exposed human or to unacceptable harm to health. RBA values vary depending on dose, dose capacity and the viewed biological effect;

particles flow density – amount expressed by ratio:

$$n = \frac{dN}{da \times dt},$$

where *dN* – amount of particles falling on the sphere with cross-section area *da* per time interval *dt.*

Particles flow density expressed in m^{-2} / s^{-1} ;

Removable (non-fixed) surface contamination – contamination with radioactive substances which are transferred to other objects during contact and can be removed during decontamination;

standard capacity of air kerma – kerma capacity transferred to air, measured in air at a standard (reference) distance of 1 m with corrections on attenuation and scattering in air.

This value is expressed in µG/h at the distance of 1 m;

fluence of particles – unit of density of particles in radiation field expresses by formula:

$$\Phi = \frac{dN}{da},$$

where *dN* – number of particles falling on the sphere with cross-section area *da*.

Fluence is expressed in m^2;

fluence of energy – unit of density of radiation field energy, expressed by formula:

$$\Psi = \frac{dR}{da},$$

where *dR* – energy of radiation falling on the sphere with cross-section area *da*.

CHAPTER 2
VALUES OF RADIATION IMPACT LEVELS USED FOR RADIATION SAFETY ASSURANCE IN NORMAL CONDITIONS OF IONIZING RADIATION SOURCES USE

3. For each category of exposed persons, acceptable radiation impact level value for such way of exposure shall be established in such a way that at the indicated level of impact of only one given exposure factor during a year, exposure dose value remains equal to the value of the corresponding annual limit (averaged through five years) indicated in Appendix 1 to the present Sanitary-hygienic Standard. Values of the main exposure dose limits are brought into compliance with article 8 of the law of the Republic of Belarus "On radiation safety of population".
4. Values of admissible levels for each ways of exposure are determined for standard conditions which are characterized by the following parameters:
   - volume of inhaled air *V*, together with which radionuclide enters the body during calendar year;
   - exposure time *t* during calendar year;
   - mass of drinking water M, together with which radionuclide enters the body during calendar year;
   - geometry of the external exposure by ionizing radiation flows.

For personnel, the following values of standard parameters are established:

$V_{pers} = 2.4 \times 10^3$ m^3/year; $t_{pers} = 1700$ h/year; $M_{pers} = 0$.

For population, the following values of standard parameters are established:

$T_{pop} = 8800$ h/year; $M_{pop} = 730$ kg/year.

Annual amount of inhaled air is established depending on age and makes up:
$V = 1000$ m^3/year – for age group "new born up to 1 year";
$V = 1900$ m^3/year – for age group "1-2 year-old children";
$V = 3200$ m^3/year – for age group "2-7-year-old children";
$V = 5200$ m^3/year – for age group "7-12-year-old children";
$V = 7300$ m^3/year – for age group "12-17-year-old children";
$V = 8100$ m^3/year – for age group "adults older than 17 years".

5. For normalization of radionuclides intake through breathing organs in a form of radionuclide aerosols, their chemical compounds are divided into three types depending on speed of radionuclides migration from lungs into blood:
   - type "M" (slowly dissolving compounds): during dilution in lungs of substances fallen into this type, it is observed that radionuclide activity component enters blood with the speed of 0.0001 day^{-1};
   - type "P" (compounds dissolving at intermediate speed): during dilution in lungs of substances fallen into this type, main activity of radionuclides enters blood at speed 0.005 day^{-1};
   - type "B" (fast dissolving compounds): during dilution in lungs of substances fallen into this type, main activity of radionuclides enters blood at speed 100 day^{-1}.

For normalization of radionuclide intake through breathing organs in a form of radioactive gases types "G" (G1 – G3) of gases and fumes of compounds of several elements are outlined.

Classification of elements compounds according to types during inhalation in processing conditions is performed according to Appendix 2 of the present Sanitary-hygienic Standard.

6. Expected effective doses per unit of inhalation and ingestion intake (dose factors) for personnel and population are presented according to Appendix 3 of the present Sanitary-hygienic Standard.
7. In Appendix 4 of the present Sanitary-hygienic Standard exemption and clearance levels are presented:
   – exemption levels for moderate amount of matter without further consideration on specific activity and activity of radionuclides (table 1) <1>;
   – exemption levels for large amount of solid matter without further consideration and clearance level for solid matter without further consideration established according to specific activity of radionuclides of artificial origin (table 3);
   – initial radionuclides and their progenies which contributions to exposure dose are considered during calculations of exposure doses (tables 2 and 4), so considered shall be only exemption level for initial radionuclide;
   – clearance levels of matter according to activity of radionuclides of natural origin (table 5).\

   <1> Moderate amount of matter means maximum quantity of about ton.

8. Types of exposure dose limit used in the system of radiation safety depending on type of situation and exposure category are presented according to Appendix 5 of the present Sanitary-hygienic Standard.
9. Factors of nominal risk with consideration of harm of malignant tumors and hereditary diseases are presented in Appendix 6 to the present Sanitary-hygienic Standard.
10. In situation of expected exposure with purpose of prevention of exceedance of dose limit of public exposure established are quotas on public exposure from radiation factors (releases and emissions) at normal operation of nuclear power plant according to Appendix 7 of the present Sanitary-hygienic Standard.
11. Appendix 8 of the present Sanitary-hygienic Standard contains recommended diagnostic reference levels during medical irradiation for typical adult patient: during diagnostic radiography (table 1), during

computer tomography (table 2), during mammography (table 3), during radioscopy (table 4), and also during procedures in nuclear medicine (table 5).

12. In situation of the existing exposure for non-exceedance of the established limits population exposure during drinking water consumption average values of radionuclides specific activity in drinking water during year shall not exceed reference levels values of radionuclide content in drinking water presented according to Appendix 9 of the present Sanitary-hygienic Standard.

13. Appendix 10 of the present Sanitary-hygienic Standard contains numeric values of equivalent exposure doses in admissible average annual densities of particles flows during external exposure of personnel. Value of admissible average annual densities of particles flows (monoenergetic electrons, beta-particles, monoenergetic photons and neutrons) are presented for wide range of exposure energies and two most possible exposure geometries: isotropic (2π and 4π) radiation field (hereinafter – IRF) and falling of parallel radiation beam on the body in front (anterioposterior geometry (further AP)).

14. Air kerma conversion ratio in free air as well as fluence of particles in effective dose and directional dose equivalent are presented according to Appendix 11 of the present Sanitary-hygienic Standard.

15. Appendix 12 of the present Sanitary-hygienic Standard contain values of admissible levels of radioactive contamination of working premises and equipment located in them, skin surface, overalls (hereinafter – overalls), safe shoes and other means of personal protective equipment. For skin, overalls, safe shoes and personal protective equipment, general (removable and irremovable) radioactive contamination shall be established. In other cases only removable contamination is regulated.

Levels of general radioactive contamination of skin are established with consideration of penetration of radionuclide fraction into skin and body. Calculation is performed with assumption that total contamination area shall not exceed 300 cm^2.

16. Minimum significant specific activity and activity of unsealed ionizing radiation sources in room or at working place are presented according to Appendix 13 of the present Sanitary-hygienic Standard.

If activity levels lower than those presented in Appendix 13 of the present Sanitary-hygienic Standard, individual effective exposure dose of personnel and population will not exceed 10 μSv and in emergency situations – 1mSv, while collective effective dose 1 person – Sv in any conditions of use. Equivalent dose on skin will not exceed 50 mSv/year.

If there are present several nuclides, sum of activity ratios to their table values shall not exceed 1 unit. Radionuclides presented in Appendix 13 of the present Sanitary-hygienic Standard depending on minimum significant total activity are divided into 4 groups of radiation hazard.

A – 1×10^3 Bq;

B – 1×10^4 Bq and 1×10^5 Bq;

C – 1×10^6 Bq and 1×10^7 Bq;

D – 1×10^8 Bq and 1×10^9 Bq, as well as Kr-83m, Kr-85m and Xe-135m.

17. Levels of radioactive contamination of transportation vehicles surfaces shall not exceed values determined by the present Sanitary-hygienic Standard. Admissible levels of radioactive contamination of transportation vehicles surfaces are presented according to Appendix 14 of the present Sanitary-hygienic Standard.

18. Appendix 15 of the present Sanitary-hygienic Standard contains values of exposure dose rate used during designing of protection against external ionizing radiation. In the mentioned appendix indicated are values of dose rate from man-made radiation sources located in organization. Transfer from measured values of equivalent dose to effective dose is performed according to special methodological recommendations.

19. Depending on group of radionuclide radiation hazard which is defined depending on minimum significant activity and its real activity in working place, class of works shall be determined. Types of works classes with unsealed sources of ionizing radiation sources are presented according to Appendix 16 of the present Sanitary-hygienic Standard.

20. Hazardous amounts of radioactive matter are presented according to Appendix 17 of the present Sanitary-hygienic Standard. Table 1 of the Appendix 17 of the present Sanitary-hygienic Standard contains

categories of sealed ionizing radiation sources used in some common types of activity. Activity values which comply with hazardous amount of radioactive material (D-value) presented according to table 2 of Appendix 17 of the present Sanitary-hygienic Standard are based on the amount of radioactive matter which can lead to serious (severe) deterministic effects in case of definite exposure scenarios and certain dose criteria. Table 2 can be used to define source category only on the basis of A/D ratio.

Exposure scenarios used to define D-values are united in two groups – one group is for undispersed matter and another is for dispersed matter. Various numeric values are presented for each group <1>.

D_1-value – is radionuclide activity in the source which being uncontrolled but sealed can lead to accidental situation which can cause serious deterministic effects;

D_2-value – is radionuclide activity in source which being uncontrolled and dispersed can lead to accidental situation which can cause serious deterministic effects evolution;

D-value – is the lowest from the values of D_1- and D_2-values for radionuclides.

21. Appendix 18 of the present Sanitary-hygienic Standard contains admissible specific activities of the main long-lived radionuclides for unrestricted use of metals after preliminary meltdown or other processing and products on the basis of these metals.

<1> Definition of D_1- and D_2-values considers the fact that sources can become more dangerous at later stages of service life (up to 10 years) in the result of generation of progenies; D-values are expressed in the value of initial activity of parent radionuclide in newly produced source.

CHAPTER 3

VALUES OF RADIATION IMPACT LEVELS USED FOR RADIATION SAFETY ASSURANCE IN CASE OF NUCLEAR OR RADIATION ACCIDENT

22. Appendix 19 of the present Sanitary-hygienic Standard contains exposure doses levels which are to be used as general response criteria

in case of acute exposure in case of which urgent protective and other response measures are required in any circumstances for prevention or minimization of severe deterministic effects.

23. General response criteria for protective actions and other response measures applied in situations of emergency exposure in order to reduce risk of stochastic effects are presented according to Appendix 20 of the present Sanitary-hygienic Standard.

24. Recommended levels of exposure doses for emergency workers are presented according to Appendix 21 of the present Sanitary-hygienic Standard.

Appendix 1
to the Hygienic Standard
"Radiation effect assessment criteria"

THE BASIC EXPOSURE DOSE LIMITS

Standardized values <1>	Exposure dose limits	
	personnel	population
Effective dose	20 mSv annual average during any consecutive 5 years<2>, but not more than 50 mSv a year	1 mSv annual average during any consecutive 5 years but not more than 5 mSv a year
Equivalent dose in:		
crystalline lens	20 мЗв mSv annual average during any consecutive 5 years (100 mSv during 5 years), but not more than 50 mSv a year	15 mSv a year
skin <3>	500 mSv a year	50 mSv a year
hands and feet	500 mSv a year	50 mSv a year

<1> Simultaneous exposure up to the indicated limits is permitted according to all standardized values.

<2> Beginning of averaging period shall coincide with the first day of corresponding annual period after the day of putting the present Hygienic standard into effect without any retro-perspective averaging.

<3> The limits of equivalent dose in skin shall be used in relation to the average dose per 1 cm^2 of maximum exposed skin area. The dose in skin is also a constituent part of the effective dose, wherein its value is considered in a way of the average dose for overall skin multiplied by tissue (skin) weighting factor.

Appendix 2
to the Hygienic Standard
"Radiation effect
assessment criteria"

DISTRIBUTION OF COMPOUNDS OF ELEMENTS ACCORDING TO TYPES WHILE INGESTING IN PRODUCTION CONDITIONS

Element	Symbol	Type	Chemical compounds
Tritium	H-3	G1 G2 G3	Tritiated water vapor Gaseous tritium Tritiated methane
Beryllium	Be	M P	Oxides, halides, nitrates Other compounds
Carbon	C	G1 G2 G3	Elemental carbon Carbon dioxide (CO_2) Carbon oxide (CO)
Fluorine	F	M B P	Lanthanide compounds Compounds with H, Li, Na, K, Rb, Cs, Fr Other compounds
Sodium	Na	B	All compounds
Magnesium	Mg	P B	Oxides, hydroxides, carbides halides, nitrates Other compounds
Aluminium	Al	P B	Oxides, hydroxides, carbides, halides, nitrates, metal Other compounds
Silicon	Si	M P B	Aluminosilicates (glass) Oxides, hydroxides,carbides,nitrates Other compounds
Phosphorus	P	P B	Phosphates Zn^{2+}, Sn^{2+}, Mg^{2+}, Fe^{3+}, Bi^{3+} and lanthanides Other compounds
Sulfur	S	P B G1 G2	Sulfur in elemental form Sulfides Sr, Ba, Ge, Sn, Pb, As, Sb, Bi, Ag, Cu, Au, Zn, Cd, Hg, Mo, W Sulfates Ca, Sr, Ba, Ra, As, Sb, Bi Other compounds Carbon sulfide (CS_2) Sulfur dioxide (SO_2)

Chlorine	Cl	B P	Compounds with H, Li, Na, K, Rb, Cs, Fr Other compounds
Potassium	K	B	All compounds
Кальций	Ca	P	All compounds
Calcium	Sc	M	All compounds
Titanium	Ti	M P B	$SrTiO_3$ Oxides, hydroxides, carbides, halides, nitrates Other compounds
Vanadium	V	P B	Oxides, hydroxides, carbides, halides Other compounds
Chromium	Cr	M P B	Oxides, hydroxides Halides, nitrates Other compounds
Manganese	Mn	P B	Oxides, hydroxides, halides, nitrates Other compounds
Iron	Fe	P B	Oxides, hydroxides, halides Other compounds
Cobalt	Co	M P	Oxides, hydroxides, halides, nitrates Other compounds
Nickel	Ni	P B G	Oxides, hydroxides, carbides Other compounds Gaseous $Ni(CO)_4$
Copper	Cu	M P B	Oxides, hydroxides Sulfides, halides, nitrates Other inorganic compounds
Zinc	Zn	M	All compounds
Gallium	Ga	P B	Oxides, hydroxides, carbides, halides, nitrates Other compounds
Germanium	Ge	P B	Oxides, sulfides, halides Other compounds
Arsenic	As	P	All compounds
Selenium	Se	P B	Selenium in elemental form Other inorganic compounds
Bromine	Br	B P	Compounds with H, Li, Na, K, Rb, Cs, Fr Other compounds
Rubidium	Rb	B	All compounds

Strontium	Sr	M B	$SrTiO_3$ Other compounds
Yttrium	Y	M P	Oxides, hydroxides Other compounds
Zirconium	Zr	M P B	Carbide Oxides, hydroxides, halides, nitrates Other compounds
Niobium	Nb	M P	Oxides, hydroxides Other compounds
Molybdenym	Mo	M B	Oxides, hydroxides, MoS_2 Other compounds
Technetium	Tc	P B	Oxides, hydroxides, halides, nitrates Other compounds
Ruthenium	Ru	M P G	Oxides, hydroxides, metal Halides Ruthenium tetroxide RuO_4
Rhodium	Rh	M P B	Oxides, hydroxides Halides Other compounds
Palladium	Pd	M P B	Oxides, hydroxides Halides, nitrates Other compounds
Silver	Ag	M P B	Oxides, hydroxides Nitrates, sulfides Other compounds
Cadmium	Cd	M P B	Oxides, hydroxides Sulfides, halides, nitrates Other compounds
Indium	In	P B	Oxides, hydroxides, halides, nitrates Other compounds
Tin	Sn	P B	Oxides, hydroxides, sulfides, halides, nitrates, phosphate Other compounds
Antimony	Sb	P B	Oxides, hydroxides, halides, sulfides, sulfates, nitrates Other compounds
Tellurium	Te	P B G	Oxides, hydroxides, nitrates Other compounds Tellurium vapors
Iodine	I	B	All compounds

		G1 G2	Elemental iodine Methyl iodine CH_3I
Cesium	Cs	B	All compounds
Barium	Ba	B	All compounds
Lanthanum	La	P B	Oxides, hydroxides Other compounds
Cerium	Ce	M P	Oxides, hydroxides, fluorides Other compounds
Praseodymium	Pr	M P	Oxides, hydroxides, carbides, fluorides Other compounds
Neodymium	Nd	M P	Oxides, hydroxides, carbides, fluorides Other compounds
Promethium	Pm	M P	Oxides, hydroxides, carbides, fluorides Other compounds
Samarium	Sm	P	All compounds
Europium	Eu	P	All compounds
Gadolinium	Gd	P B	Sparingly soluble compounds, oxides, hydroxides, fluorides Other compounds
Terbium	Tb	P	All compounds
Dysprosium	Dy	P	All compounds
Holmium	Ho	P	All compounds
Erbium	Er	P	All compounds
Thulium	Tm	P	All compounds
Ytterbium	Yb	M P	Oxides, hydroxides, fluorides Other compounds
Lutetium	Lu	M P	Oxides, hydroxides, fluorides Other compounds
Hafnium	Hf	P B	Oxides, hydroxides, carbides, halides, nitrates Other compounds
Tantalum	Ta	M P	Elemental tantalum, оксиды, hydroxides, halides, carbides, nitrates, nitrides Other compounds
Tungsten	W	B	All compounds
Rhenium	Re	P B	Oxides, hydroxides, halides, nitrates Other compounds

Osmium	Os	M P B	Oxides, hydroxides Halides, nitrates Other compounds
Iridium	Ir	M P B	Oxides, hydroxides Halides, nitrates, elemental iridium Other compounds
Platinum	Pt	B	All compounds
Gold	Au	M P B	Oxides, hydroxides Halides, nitrates Other compounds
Mercury	Hg	P (inorganic) Б (inorganic) B (organic) G	Oxides, hydroxides, галогениды, nitrates, sulfides Sulfates All organic compounds Mercury vapor
Thallium	Tl	B	All compounds
Lead	Pb	B	All compounds
Bismuth	Bi	B P	Nitrates Other compounds
Polonium	Po	P B	Oxides, hydroxides, nitrates Other compounds
Astatine	At	B P	Compounds with H, Li, Na, K, Rb, Cs, Fr Other compounds
Frances	Fr	B	All compounds
Radium	Ra	P	All compounds
Actinium	Ac	M P B	Oxides, hydroxides Halides, nitrates Other compounds
Thorium	Th	M P	Oxides, hydroxides Other compounds
Protactinium	Pa	M P	Oxides, hydroxides Other compounds
Uranium	U	B P M	UF_6, UO_2F_2, $UO_2(NO_3)_2$ UO_3, UF_4, UCl_4 UO_2, U_3O_8
Neptunium	Np	P	All compounds
Plutonium	Pu	M P	Oxides, hydroxides Other compounds except for chelates
Americium	Am	P	All compounds

Curium	Cm	P	All compounds
Berkelium	Bk	P	All compounds
Californium	Cf	M P	Oxides, hydroxides Other compounds
Einsteinium	Es	P	All compounds
Fermium	Fm	P	All compounds

Appendix 3
to the Hygienic Standard
"Radiation effect
assessment criteria"

THE EXPECTED EFFECTIVE RADIATION DOSES PER UNIT OF INHALATION AND INGESTION INTAKE (DOSE FACTORS) FOR PERSONNEL AND PUBLIC

Table 1

The expected effective radiation doses per unit of inhalation and ingestion intake for personnel

Table 2

The expected effective radiation doses per unit of inhalation intake for public

Table 3

The expected effective radiation doses per unit of ingestion intake for public

Appendix 4
to the Hygienic Standard
"Radiation effect
assessment criteria"

EXEMPTION AND CLEARANCE LEVELS

Table 1

Exemption levels for moderate amount of material without further consideration according to the specific activity and radionuclides activity <1>

Table 2

Parent radionuclides and their progenies which contribution to radiation dose is taken into account while estimating radiation doses

Parent radionuclide	Progeny

Ge-68	Ga-68
Rb-83	Kr-83m
Sr-82	Rb-82
Sr-90	Y-90
Y-87	Sr-87m
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Ag-108m	Ag-108
Sn-121m	Sn-121 (0,776)
Sn-126	Sb-126m
Xe-122	I-122
Cs-137	Ba-137m
Ba-140	La-140
Ce-134	La-134
Ce-144	Pr-144

Gd-146	Eu-146
Hf-172	Lu-172
W-178	Ta-178
W-188	Re-188
Re-189	Os-189m (0,241)
Ir-189	Os-189m
Pt-188	Ir-188
Hg-194	Au-194
Hg-195m	Hg-195 (0,542)
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0,36), Po-212 (0,64)
Bi-210m	Tl-206
Bi-212	Tl-208 (0,36), Po-212 (0,64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207

Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Ac-225	Fr-221, At-217, Bi-213, Po-213 (0,978), Tl-209 (0,0216), Pb-209 (0,978)
Ac-227	Fr-223 (0,0138)
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
U-235	Th-231
U-238	Th-234, Pa-234m

U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

Table 3

Exemption levels for large amounts of solid material without further consideration and clearance levels for solid material without further consideration, established according to the specific activity of radionuclides of artificial origin <1>

Radionuclide	Specific activity (Bq/g)	Radionuclide	Specific activity (Bq/g)
H-3	100	K-42	100
Be-7	10	K-43	10
C-14	1	Ca-45	100
F-18	10	Ca-47	10
Na-22	0.1	Sc-46	0.1
Na-24	1	Sc-47	100

Si-31	1000	Sc-48	1
P-32	1000	V-48	1
P-33	1000	Cr-51	100
S-35	100	Mn-51	10
Cl-36	1	Mn-52	1
Cl-38	10	Mn-52m	10
Mn-53	100	Y-91m	100
Mn-54	0.1	Y-92	100
Mn-56	10	Y-93	100
Fe-52*	10	Zr-93	10
Fe-55	1000	Zr-95*	1
Fe-59	1	Zr-97*	10
Co-55	10	Nb-93m	10
Co-56	0.1	Nb-94	0.1
Co-57	1	Nb-95	1
Co-58	1	Nb-97*	10

Co-58m	10000	Nb-98	10
Co-60	0.1	Mo-90	10
Co-60m	1000	Mo-93	10
Co-61	100	Mo-99*	10
Co-62m	10	Mo-101*	10
Ni-59	100	Tc-96	1
Ni-63	100	Tc-96m	1000
Ni-65	10	Tc-97	10
Cu-64	100	Tc-97m	100
Zn-65	0.1	Tc-99	1
Zn-69	1000	Tc-99m	100
Zn-69m*	10	Ru-97	10
Ga-72	10	Ru-103*	1
Ge-71	10000	Ru-105*	10
As-73	1000	Ru-106*	0.1
As-74	10	Rh-103m	10000

As-76	10	Rh-105	100
As-77	1000	Pd-103*	1000
Se-75	1	Pd-109*	100
Br-82	1	Ag-105	1
Rb-86	100	Ag-110m*	0.1
Sr-85	1	Ag-111	100
Sr-85m	100	Cd-109*	1
Sr-87m	100	Cd-115*	10
Sr-89	1000	Cd-115m*	100
Sr-90*	1	In-111	10
Sr-91*	10	In-113m	100
Sr-92	10	In-114m*	10
Y-90	1000	In-115m	100
Y-91	100	Sn-113*	1
Sn-125	10	Ce-143	10
Sb-122	10	Ce-144	10

Sb-124	1	Pr-142	100
Sb-125*	0.1	Pr-143	1000
Te-123m	1	Nd-147	100
Te-125m	1000	Nd-149	100
Te-127	1000	Pm-147	1000
Te-127m*	10	Pm-149	1000
Te-129	100	Sm-151	1000
Te-129m*	10	Sm-153	100
Te-131	100	Eu-152	0.1
Te-131m*	10	Eu-152m	100
Te-132*	1	Eu-154	0,1
Te-133	10	Eu-155	1
Te-133m	10	Gd-153	10
Te-134	10	Gd-159	100
I-123	100	Tb-160	1
I-125	100	Dy-165	1000

I-126	10	Dy-166	100
I-129	0.01	Ho-166	100
I-130	10	Er-169	1000
I-131	10	Er-171	100
I-132	10	Tm-170	100
I-133	10	Tm-171	1000
I-134	10	Yb-175	100
I-135	10	Lu-177	100
Cs-129	10	Hf-181	1
Cs-131	1000	Ta-182	0.1
Cs-132	10	W-181	10
Cs-134	0.1	W-185	1000
Cs-134m	1000	W-187	10
Cs-135	100	Re-186	1000
Cs-136	1	Re-188	100
Cs-137*	0.1	Os-185	1

Cs-138	10	Os-191	100
Ba-131	10	Os-191m	1000
Ba-140	1	Os-193	100
La-140	1	Ir-190	1
Ce-139	1	Ir-192	1
Ce-141	100	Ir-194	100
Pt-191	10	Pu-234	100
Pt-193m	1000	Pu-235	100
Pt-197	1000	Pu-236	1
Pt-197m	100	Pu-237	100
Au-198	10	Pu-238	0.1
Au-199	100	Pu-239	0.1
Hg-197	100	Pu-240	0.1
Hg-197m	100	Pu-241	10
Hg-203	10	Pu-242	0.1
Tl-200	10	Pu-243	1000

Tl-201	100	Pu-244*	0.1
Tl-202	10	Am-241	0.1
Tl-204	1	Am-242	1000
Pb-203	10	Am-242m*	0.1
Bi-206	1	Am-243*	0.1
Bi-207	0.1	Cm-242	10
Po-203	10	Cm-243	1
Po-205	10	Cm-244	1
Po-207	10	Cm-245	0.1
At-211	1000	Cm-246	0.1
Ra-225	10	Cm-247*	0.1
Ra-227	100	Cm-248	0.1
Th-226	1000	Bk-249	100
Th-229	0.1	Cf-246	1000
Pa-230	10	Cf-248	1
Pa-233	10	Cf-249	0.1

U-230	10	Cf-250	1
U-231*	100	Cf-251	0.1
U-232*	0.1	Cf-252	1
U-233	1	Cf-253	100
U-236	10	Cf-254	1
U-237	100	Es-253	100
U-239	100	Es-254*	0.1
U-240*	100	Es-254m*	10
Np-237*	1	Fm-254	10000
Np-239	100	Fm-255	100
Np-240	10		

<1> The asterisks (*) mean radionuclides for which contribution to progenies radiation dose is considered while estimating doses (i. e. only exemption level for parent radionuclide shall be considered). The progenies of the indicated radionuclides are presented according to the table 4 appendix 4 to the present Hygienic standard.

Table 4

Parent radionuclides and their progenies which contribution to radiation dose shall be considered while estimating radiation doses

Parent radionuclide	Progeny
Fe-52	Mn-52m
Zn-69m	Zn-69
Sr-90	Y-90
Sr-91	Y-91m
Zr-95	Nb-95
Zr-97	Nb-97m, Nb-97
Nb-97	Nb-97m
Mo-99	Tc-99m
Mo-101	Tc-101
Ru-103	Rh-103m
Ru-105	Rh-105m

Ru-106	Rh-106
Pd-103	Rh-103m
Pd-109	Ag-109m
Ag-110m	Ag-110
Cd-109	Ag-109m
Cd-115	In-115m
Cd-115m	In-115m
In-114m	In-114
Sn-113	In-113m
Sb-125	Te-125m
Te-127m	Te-127
Te-129m	Te-129
Te-131m	Te-131
Te-132	I-132
Cs-137	Ba-137m
Ce-144	Pr-144, Pr-144m

U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208
U-240	Np-240m, Np-240
Np-237	Pa-233
Pu-244	U-240, Np-240m, Np-240
Am-242m	Np-238
Am-243	Np-239
Cm-247	Pu-243
Es-254	Bk-250
Es-254	Fm-254

Table 5

Clearance levels for material according to the specific activity of radionuclides of natural origin

Radionuclide	Specific activity, Bq/g
K-40	10
Each radionuclide of uranium and thorium radioactive decay chains	1

Appendix 5
to the Hygienic Standard
"Radiation effect
assessment criteria"

THE TYPES OF RADIATION DOSE CONSTRAINT USED IN RADIATION PROTECTION SYSTEM DEPENDING ON SITUATION AND EXPOSURE CATEGORY

Situation type	Occupational exposure	Public exposure	Medical irradiation
Planned exposure	Radiation dose limit Dose constraint	Radiation dose limit Dose constraint	Diagnostic reference level <1> (Dose constraint <2>)
Emergency exposure	Reference level <3>	Reference level	Not applicable
Existing exposure	Not applicable <4>	Reference level	Not applicable

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<1> Patients.

<2> Only persons assuring comfort and care of patients and persons voluntarily participating in biomedical research

<3> Long-term works on accident consequences elimination shall be viewed as a part of planned occupational exposure

<4> The exposure as a result of durable remedial (rehabilitation) works or long-term occupation in the contaminated territory shall be viewed as a part of planned occupational exposure even if a radiation source is the “existing” one

Appendix 6
to the Hygienic Standard
"Radiation effect
assessment criteria"

THE NOMINAL RISK FACTORS WITH CONSIDERATION OF MALIGNANT NEOPLASMS AND HEREDITARY DISEASES

Exposed population group	Risk factor of malignant neoplasms, x $10^{-2}Sv^{-1}$	Risk factor of hereditary effects, x $10^{-2}Sv^{-1}$	Total, x $10^{-2}Sv^{-1}$
All population	5.5	0.2	5.7

Adults (personnel)	4.1	0.1	4.2

Appendix 7
to the Hygienic Standard
"Radiation effect
assessment criteria"

QUAOTAS FOR POPULATION EXPOSURE TO RADIATION FACTORS (EMISSIONS AND RELEASES) IN CASE OF NORMAL OPERATION OF A NUCLEAR POWER PLANT

Radiation factor	Population exposure quota (dose limit), μSv/year
Gas-aerosol emissions	50
Liquid releases	50
Total	100

Appendix 8
to the Hygienic Standard
"Radiation effect
assessment criteria"

THE RECOMMENDED DIAGNOSTIC REFERENCE LEVELS IN CASE OF MEDICAL IRRADIATION FOR A TYPICAL ADULD PATIENT

Table 1

The diagnostic reference levels in case of radiography for a typical adult patient

Examination	Dose at the input surface per one image <1>, mGy	
Lumbar spinal region	FB <2> LAT LSJ	10 30 40
Abdominal region, intravenous urography and cholecystography	FB	10
Pelvis region	FB	10
Hip joint	FB	10
Thorax	BF LAT	0.4 1.5

Thoratic area of spine	FB LAT	7 20
Teeth	Periapical FB	7 5
Skull	BF LAT	5 3

<1> In the air with consideration of backscatter. These values are presented for conventional combinations film – screen with relative sensitivity of 200. For the high-sensitivity combinations film – screen (400-600), the values shall be 2-3 times decreased.

<2> FB – front-back projection; LAT – lateral projection; LSJ – lumbosacral joint projection; BF – back-front projection.

Table 2

Diagnostic reference levels for the computer tomography for a typical adult patient

Examination	Annual radiation dose while multiple scanning <1>, mGy
Head	50
Lumbar region of spine	35
Abdomen	25

<1> Estimated basing on measurements on rotation axis in phantoms equivalent to water phantom, 15 cm in length and with the diameter of 16 cm (head) and 30 cm (lumbar region of the spine and abdominal region).

Table 3

Diagnostic reference levels for mammography for a typical adult female patient

The average radiation dose to the mammary gland, craniocaudal projection<1>
1 mGy (without grid) 3 mGy (with grid)

<1> Defined at 4.5 cm depth of compressed tissue of mammary gland which 50 % composition is the gland tissue and 50 % adipose tissue, for systems film – screen and standard mammography installations with Mo-targets and Mo-filters.

Table 4

Diagnostic reference levels for radioscopy for a typical adult patient

Work mode	Dose rate on the input surface <1>, mGy/min
Normal	25

High level <2>	100

<1> In air with consideration of back scatter.
<2> For devices which have optional mode of "high level" of the type of those which are used in interventional radiology.

Table 5

Diagnostic reference levels during procedures in nuclear medicine for typical adult patient

Appendix 9
of Sanitary-hygienic Standard
"Radiation impact assessment criteria"

REFERENCE LEVELS OF RADIONUCLIDE CONTENT IN DRINKING WATER <1>, <2>

Appendix 10
of Sanitary-hygienic Standard
"Radiation impact assessment criteria"

VALUES OF EQUIVALENT EXPOSURE DOSES AND AVERAGE ANNUAL ADMISSIBLE DENSITIES OF PARTICLES FLOW DURING EXTERNAL EXPOSURE OF PERSONNEL MEMBERS

Table 1

Values of equivalent exposure dose and average annual admissible flow densities of monoenergetic electrons for personnel members in case of

skin exposure

Electrons energy, MeV	Equivalent dose in skin per individual fluence, 10^{-10} Svxcm^{2}		Averaged annual acceptable flow density (AFD$_{pers}$), cm^{-2} xs^{-1}	
	IRF <1>	AP	IRF <1>	AP
0,07	0,3	2,2	2700	370
0,10	5,7	16,6	140	50
0,20	5,6	8,3	150	100
0,40	4,3	4,6	190	180
0,70	3,7	3,4	220	240
1,00	3,5	3,1	230	260
2,00	3,2	2,8	260	290
4,00	3,2	2,7	260	300
7,00	3,2	2,7	260	300
10,0	3,2	2,7	260	300

<1> Isotropic (2π) radiation field.

Table 2

Values of equivalent exposure dose and average annual admissible flow densities of monoenergetic electrons for personnel members in case of crystalline lens exposure

Electrons energy, MeV	Equivalent dose in crystalline per individual fluence, 10^{-10} Svxcm^{2}		Averaged annual acceptable flow density (AFD$_{pers}$), cm^{-2} xs^{-1}	
	IRF <1>	AP	IRF <1>	AP
0,80	0,08	0,45	3100	540
1,00	0,75	3,0	330	80
1,50	1,9	5,2	130	50
2,00	2,2	4,8	110	50

4,00	2,6	3,3	95	75
7,00	2,9	3,1	85	80
10,0	3,0	3,0	80	80

<1> Isotropic (2π) radiation field.

Table 3

Values of equivalent exposure dose and average annual admissible flow densities of beta-particles for personnel members in case of contact exposure of skin

Beta-spectra average energy, MeV	Equivalent dose in skin per individual fluence, 10^{-10} Svxcm^{2}	Average annual acceptable flow density (AFD$_{pers}$), cm^{-2} xs^{-1}
0,05	1,0	820
0,07	1,8	450
0,10	2,6	310
0,15	3,4	240
0,20	3,8	215
0,40	4,5	180
0,50	4,6	180
0,70	4,8	170
1,00	5,0	165
1,50	5,2	160
2,00	5,3	155

Table 4

Values of effective exposure dose and average annual admissible flow densities of monoenergetic photons for personnel members in case of external exposure of the whole body

	Effective dose	Average annual acceptable	

Photons energy, MeV	per individual fluence, 10^{-12} $Sv \times cm^2$		flow density (AFD_{pers}), $cm^{-2} \times s^{-1}$		Kerma in air per individual fluence, 10^{-12} $Gy \times cm^2$
	IRF <1>	AP	IRF <1>	AP	
$1,0 \times 10^{-2}$	0,0201	0,0485	$1,63 \times 10^{5}$	$6,77 \times 10^{4}$	7,43
$1,5 \times 10^{-2}$	0,0384	0,125	$8,73 \times 10^{4}$	$2,62 \times 10^{4}$	3,12
$2,0 \times 10^{-2}$	0,0608	0,205	$5,41 \times 10^{4}$	$1,62 \times 10^{4}$	1,68
$3,0 \times 10^{-2}$	0,103	0,300	$3,24 \times 10^{4}$	$1,08 \times 10^{4}$	0,721
$4,0 \times 10^{-2}$	0,140	0,338	$2,31 \times 10^{4}$	$9,65 \times 10^{3}$	0,429
$5,0 \times 10^{-2}$	0,165	0,357	$1,99 \times 10^{4}$	$9,12 \times 10^{3}$	0,323
$6,0 \times 10^{-2}$	0,186	0,378	$1,77 \times 10^{4}$	$8,63 \times 10^{3}$	0,289
$8,0 \times 10^{-2}$	0,230	0,440	$1,42 \times 10^{4}$	$7,44 \times 10^{3}$	0,307
$1,0 \times 10^{-1}$	0,278	0,517	$1,18 \times 10^{4}$	$6,33 \times 10^{3}$	0,371
$1,5 \times 10^{-1}$	0,419	0,752	$7,79 \times 10^{3}$	$4,33 \times 10^{3}$	0,599
$2,0 \times 10^{-1}$	0,581	1,00	$5,61 \times 10^{3}$	$3,28 \times 10^{3}$	0,856
$3,0 \times 10^{-1}$	0,916	1,51	$3,54 \times 10^{3}$	$2,17 \times 10^{3}$	1,38
$4,0 \times 10^{-1}$	1,26	2,00	$2,59 \times 10^{3}$	$1,63 \times 10^{3}$	1,89
$5,0 \times 10^{-1}$	1,61	2,47	$2,02 \times 10^{3}$	$1,32 \times 10^{3}$	2,38
$6,0 \times 10^{-1}$	1,94	2,91	$1,69 \times 10^{3}$	$1,12 \times 10^{3}$	2,84
$8,0 \times 10^{-1}$	2,59	3,73	$1,26 \times 10^{3}$	$8,73 \times 10^{2}$	3,69
1,0	3,21	4,48	$1,01 \times 10^{3}$	$7,33 \times 10^{2}$	4,47
2,0	5,84	7,49	$5,63 \times 10^{2}$	$4,38 \times 10^{2}$	7,55
4,0	9,97	12,0	$3,28 \times 10^{2}$	$2,73 \times 10^{2}$	12,1

6,0	13,6	16,0	$2,38 \times 10^{2}$	$2,05 \times 10^{2}$	16,1
8,0	17,3	19,9	$1,89 \times 10^{2}$	$1,64 \times 10^{2}$	20,1
10,0	20,8	23,8	$1,56 \times 10^{2}$	$1,38 \times 10^{2}$	24,0

<1> Isotropic (4π) radiation field.

Table 5

Values of equivalent exposure dose and average annual admissible flow densities of monoenergetic photons for personnel members in case of skin exposure

Photons energy, MeV	Equivalent dose in skin per individual fluence, 10^{-12} Svxcm^{2}		Averaged annual acceptable flow density (AFD$_{pers}$), cm^{-2} xs^{-1}	
	IRF <1>	AP	IRF <1>	AP
$1,0 \times 10^{-2}$	6,17	7,06	$1,31 \times 10^{4}$	$1,16 \times 10^{4}$
$2,0 \times 10^{-2}$	1,66	1,76	$4,96 \times 10^{4}$	$4,63 \times 10^{4}$
$3,0 \times 10^{-2}$	0,822	0,880	$1,00 \times 10^{5}$	$9,25 \times 10^{4}$
$5,0 \times 10^{-2}$	0,462	0,494	$1,81 \times 10^{5}$	$1,63 \times 10^{5}$
$1,0 \times 10^{-1}$	0,549	0,575	$1,50 \times 10^{5}$	$1,42 \times 10^{5}$
$1,5 \times 10^{-1}$	0,827	0,851	$9,74 \times 10^{4}$	$9,74 \times 10^{4}$
$3,0 \times 10^{-1}$	1,79	1,81	$4,53 \times 10^{4}$	$4,53 \times 10^{4}$
$4,0 \times 10^{-1}$	2,38	2,38	$3,38 \times 10^{4}$	$3,38 \times 10^{4}$
$5,0 \times 10^{-1}$	2,93	2,93	$2,80 \times 10^{4}$	$2,80 \times 10^{4}$
$6,0 \times 10^{-1}$	3,44	3,44	$2,40 \times 10^{4}$	$2,40 \times 10^{4}$

$8,0 \times 10^{-1}$	4,39	4,39	$1,88 \times 10^{4}$	$1,88 \times 10^{4}$
1,0	5,23	5,23	$1,55 \times 10^{4}$	$1,55 \times 10^{4}$
2,0	8,61	8,61	$9,57 \times 10^{3}$	$9,57 \times 10^{3}$
4,0	13,6	13,6	$6,08 \times 10^{3}$	$6,08 \times 10^{3}$
6,0	17,9	17,9	$4,57 \times 10^{3}$	$4,57 \times 10^{3}$
8,0	22,3	22,3	$3,66 \times 10^{3}$	$3,66 \times 10^{3}$
10,0	26,4	26,4	$3,13 \times 10^{3}$	$3,13 \times 10^{3}$

<1> Isotropic (2π) radiation field.

Table 6

Values of equivalent exposure dose and average annual admissible flow densities of monoenergetic photons for personnel members in case of crystalline lens exposure

Photons energy, MeV	Equivalent dose in crystalline per individual fluence, 10^{-12} Svxcm^{2}		Averaged annual acceptable flow density (AFD$_{pers}$), cm^{-2} xs^{-1}	
	IRF <1>	AP	IRF <1>	AP
$1,0 \times 10^{-2}$	0,669	2,23	$3,66 \times 10^{4}$	$1,08 \times 10^{4}$
$1,5 \times 10^{-2}$	0,749	2,06	$3,29 \times 10^{4}$	$1,16 \times 10^{4}$
$2,0 \times 10^{-2}$	0,622	1,53	$3,97 \times 10^{4}$	$1,60 \times 10^{4}$
$3,0 \times 10^{-2}$	0,375	0,865	$6,55 \times 10^{4}$	$2,85 \times 10^{4}$
$4,0 \times 10^{-2}$	0,275	0,571	$9,07 \times 10^{4}$	$4,27 \times 10^{4}$
$5,0 \times 10^{-2}$	0,239	0,459	$1,03 \times 10^{5}$	$5,33 \times 10^{4}$

$8,0 \times 10^{-2}$	0,264	0,476	$9,05 \times 10^{4}$	$5,16 \times 10^{4}$
$1,0 \times 10^{-1}$	0,326	0,568	$7,26 \times 10^{4}$	$4,34 \times 10^{4}$
$1,5 \times 10^{-1}$	0,545	0,857	$4,59 \times 10^{4}$	$2,88 \times 10^{4}$
$2,0 \times 10^{-1}$	0,762	1,16	$3,31 \times 10^{4}$	$2,11 \times 10^{4}$
$3,0 \times 10^{-1}$	1,20	1,77	$2,09 \times 10^{4}$	$1,39 \times 10^{4}$
$4,0 \times 10^{-1}$	1,59	2,33	$1,54 \times 10^{4}$	$1,06 \times 10^{4}$
$5,0 \times 10^{-1}$	2,00	2,86	$1,24 \times 10^{4}$	$8,64 \times 10^{3}$
$6,0 \times 10^{-1}$	2,39	3,32	$1,04 \times 10^{4}$	$7,34 \times 10^{3}$
$8,0 \times 10^{-1}$	3,10	4,21	$7,90 \times 10^{3}$	$5,87 \times 10^{3}$
1,0	3,76	4,96	$6,53 \times 10^{3}$	$4,91 \times 10^{3}$
2,0	6,64	7,93	$3,68 \times 10^{3}$	$3,09 \times 10^{3}$
4,0	11,1	12,1	$2,20 \times 10^{3}$	$2,00 \times 10^{3}$
6,0	15,1	15,6	$1,62 \times 10^{3}$	$1,57 \times 10^{3}$
8,0	19,1	19,1	$1,29 \times 10^{3}$	$1,29 \times 10^{3}$
10,0	23,0	22,3	$1,06 \times 10^{3}$	$1,10 \times 10^{3}$

<1> Isotropic (4π) radiation field.

Table 7

Values of effective exposure dose and average annual admissible flow densities of monoenergetic neutrons for personnel members in case of external exposure of the whole body

	Equivalent dose in crystalline per individual	Averaged annual acceptable flow density

Neutron energy, MeV	fluence, 10^{-12} Svxcm^{2}		(AFD$_{pers}$), cm^{-2} xs^{-1}	
	IRF <1>	AP	IRF <1>	AP
Thermal neutrons	3,30	7,60	$9,90 \times 10^{2}$	$4,30 \times 10^{2}$
$1,0 \times 10^{-7}$	4,13	9,95	$7,91 \times 10^{2}$	$3,28 \times 10^{2}$
$1,0 \times 10^{-6}$	5,63	$1,38 \times 10^{1}$	$5,80 \times 10^{2}$	$2,37 \times 10^{2}$
$1,0 \times 10^{-5}$	6,44	$1,51 \times 10^{1}$	$5,07 \times 10^{2}$	$2,16 \times 10^{2}$
$1,0 \times 10^{-4}$	6,45	$1,46 \times 10^{1}$	$5,07 \times 10^{2}$	$2,24 \times 10^{2}$
$1,0 \times 10^{-3}$	6,04	$1,42 \times 10^{1}$	$5,41 \times 10^{2}$	$2,30 \times 10^{2}$
$1,0 \times 10^{-2}$	7,70	$1,83 \times 10^{1}$	$4,24 \times 10^{2}$	$1,79 \times 10^{2}$
$2,0 \times 10^{-2}$	$1,02 \times 10^{1}$	$2,38 \times 10^{1}$	$3,20 \times 10^{2}$	$1,37 \times 10^{2}$
$5,0 \times 10^{-2}$	$1,73 \times 10^{1}$	$3,85 \times 10^{1}$	$1,89 \times 10^{2}$	$8,49 \times 10^{1}$
$1,0 \times 10^{-1}$	$2,72 \times 10^{1}$	$5,98 \times 10^{1}$	$1,20 \times 10^{2}$	$5,46 \times 10^{1}$
$2,0 \times 10^{-1}$	$4,24 \times 10^{1}$	$9,90 \times 10^{1}$	$7,71 \times 10^{1}$	$3,30 \times 10^{1}$
$5,0 \times 10^{-1}$	$7,50 \times 10^{1}$	$1,88 \times 10^{2}$	$4,36 \times 10^{1}$	$1,74 \times 10^{1}$
1,0	$1,16 \times 10^{2}$	$2,82 \times 10^{2}$	$2,82 \times 10^{1}$	$1,16 \times 10^{1}$
1,2	$1,30 \times 10^{2}$	$3,10 \times 10^{2}$	$2,51 \times 10^{1}$	$1,05 \times 10^{1}$
2,0	$1,78 \times 10^{2}$	$3,83 \times 10^{2}$	$1,84 \times 10^{1}$	8,53
3,0	$2,20 \times 10^{2}$	$4,32 \times 10^{2}$	$1,49 \times 10^{1}$	7,56
4,0	$2,50 \times 10^{2}$	$4,58 \times 10^{2}$	$1,31 \times 10^{1}$	7,13
5,0	$2,72 \times 10^{2}$	$4,74 \times 10^{2}$	$1,20 \times 10^{1}$	6,89
6,0	$2,82 \times 10^{2}$	$4,83 \times 10^{2}$	$1,16 \times 10^{1}$	6,76

7,0	$2,90 \times 10^{2}$	$4,90 \times 10^{2}$	$1,13 \times 10^{1}$	6,67
8,0	$2,97 \times 10^{2}$	$4,94 \times 10^{2}$	$1,10 \times 10^{1}$	6,61
10	$3,09 \times 10^{2}$	$4,99 \times 10^{2}$	$1,06 \times 10^{1}$	6,55
14	$3,33 \times 10^{2}$	$4,96 \times 10^{2}$	9,81	6,59
20	$3,43 \times 10^{2}$	$4,80 \times 10^{2}$	9,52	6,81

<1> Isotropic (4π) radiation field.

Apendix 11
of Sanitary-hygienic Standard
“Radiation impact assessment criteria”

FACTORS OF AIR KERMA CONVERSION IN FREE AIR INTO INDIVIDUAL DOSE EQUIVALENT, AS WELL AS FLUENCE OF PARTICLES INTO EFFECTIVE DOSE AND DIRECTIONAL DOSE EQUIVALENT

Table 1

Factors of air kerma conversion in free air into H_p (10, 0°) <1> in laminar phantom ICRU (photons)

Photons energy, MeV	H_p (10, 0°)/K, Sv/G
0,01	0,009
0,0125	0,098
0,015	0,264
0,0175	0,445
0,02	0,611

0,025	0,883
0,03	1,112
0,04	1,49
0,05	1,766
0,06	1,892
0,08	1,903
0,1	1,811
0,125	1,696
0,15	1,607
0,2	1,492
0,3	1,369
0,4	1,3
0,5	1,256
0,6	1,226
0,8	1,19
1	1,167
1,5	1,139
3	1,117
6	1,109
10	1,111
0,01	0,009

<1> Individual dose equivalent $H_p(d, \Omega$, where d = 10 mm, $\Omega = 0°$.

Table 2

Factors of air kerma conversion in free air into
H_p (0,07, 0°) <1> <1> in laminar phantom ICRU (photons)

Photons energy, MeV	H_p (0,07, 0°)/K, Sv/G
0,005	0,75

0,01	0,947
0,015	0,981
0,02	1,045
0,03	1,23
0,04	1,444
0,05	1,632
0,06	1,716
0,08	1,732
0,1	1,669
0,15	1,518
0,2	1,432
0,3	1,336
0,4	1,28
0,5	1,244
0,6	1,22
0,8	1,189
1	1,173

<1> Individual dose equivalent $H_p(d, \Omega$, where d = 0,07 mm, $\Omega = 0°$.

Table 3

Values of effective dose per 1 unit of neutron fluence E/F for monoenergetic neutrons, falling on estimate anthropomorphic phantom of adult man according to geometry of International organization on standartization

Neutrons energy, MeV	E/F, $pSv \times cm^2$
$1,00 \times 10^{-9}$	2,4
$1,00 \times 10^{-8}$	2,89

$2,53 \times 10^{-8}$	3,3
$1,00 \times 10^{-7}$	4,13
$2,00 \times 10^{-7}$	4,59
$5,00 \times 10^{-7}$	5,2
$1,00 \times 10^{-6}$	5,63
$2,00 \times 10^{-6}$	5,96
$5,00 \times 10^{-6}$	6,28
$1,00 \times 10^{-5}$	6,44
$2,00 \times 10^{-5}$	6,51
$5,00 \times 10^{-5}$	6,51
$1,00 \times 10^{-4}$	6,45
$2,00 \times 10^{-4}$	6,32
$5,00 \times 10^{-4}$	6,14
$1,00 \times 10^{-3}$	6,04
$2,00 \times 10^{-3}$	6,05
$5,00 \times 10^{-3}$	6,52
$1,00 \times 10^{-2}$	7,7
$2,00 \times 10^{-2}$	10,2
$3,00 \times 10^{-2}$	12,7
$5,00 \times 10^{-2}$	17,3
$7,00 \times 10^{-2}$	21,5
-1	

$1,00 \times 10$	25,2
$1,50 \times 10^{-1}$	35,2
$2,00 \times 10^{-1}$	42,4
$3,00 \times 10^{-1}$	54,7
$5,00 \times 10^{-1}$	75
$7,00 \times 10^{-1}$	92,8
$9,00 \times 10^{-1}$	108
$1,00 \times 10^{0}$	116
$1,20 \times 10^{0}$	130
$2,00 \times 10^{0}$	178
$3,00 \times 10^{0}$	220
$4,00 \times 10^{0}$	250
$5,00 \times 10^{0}$	272
$6,00 \times 10^{0}$	282
$7,00 \times 10^{0}$	290
$8,00 \times 10^{0}$	297
$9,00 \times 10^{0}$	303
$1,00 \times 10^{1}$	309
$1,20 \times 10^{1}$	322
$1,40 \times 10^{1}$	333
$1,50 \times 10^{1}$	338
$1,60 \times 10^{1}$	342

1,80 x 10^{1}	345
2,00 x 10^{1}	343

Table 4

Factors of fluence conversion into directional dose equivalent for monoenergetic electrons during falling along normal line <1>

Electrons energy, MeV	H'(0,07, 0°)/F, nSvxcm^2	H'(3, 0°)/Φ, nSvxcm^2	H'(10, 0°)/F, nSvxcm^2
0,07	0,221		
0,08	1,056		
0,09	1,527		
0,1	1,661		
0,1125	1,627		
0,125	1,513		
0,15	1,229		
0,2	0,834		
0,3	0,542		
0,4	0,455		
0,5	0,403		
0,6	0,366		
0,7	0,344	0	
0,8	0,329	0,045	
1	0,312	0,301	
1,25	0,296	0,486	
1,5	0,287	0,524	
1,75	0,282	0,512	0
2	0,279	0,481	0,005
2,5	0,278	0,417	0,156
3	0,276	0,373	0,336

3,5	0,274	0,351	0,421
4	0,272	0,334	0,447
5	0,271	0,317	0,43
6	0,271	0,309	0,389
7	0,271	0,306	0,36
8	0,271	0,305	0,341
10	0,275	0,303	0,33

<1> In the present table the following legends are used:

H'(0,07, 0°) – directional dose equivalent H'(d, Ω), where d = 0,07 mm, $\Omega = 0°$;

H'(3, 0°) - directional dose equivalent H'(d, Ω), where d = 3 mm, $\Omega = 0°$;

H'(10, 0°) - directional dose equivalent H'(d, Ω), where d = 10 mm, $\Omega = 0°$.

Appendix 12
of Sanitary-hygienic Standard
"Radiation impact assessment criteria"

ADMISSIBLE LEVELS OF RADIOACTIVE CONTAMINATION OF SURFACES OF WORKING PREMISES AND EQUIPMENT LOCATED IN THEM, SKIN, OVERALLS, SAFE SHOES AND OTHER MEANS OF INDIVIDUAL PROTECTION OF PERSONNEL, PART/(CM^2 X MIN)

Contaminated object	Contamination with alpha-active radionuclides <1>, part/(cm^2 x min)		Contamination with beta-active radionuclides, part/(cm^2 x min)
	separate <2>	other	

Uncontaminated skin, special body linen, towels, inner surface of facial parts of personnel protective means	2	2	200 <3>
Main overalls, inner surface of additional personnel protective means, outer surface of safe shoes	5	20	2000
Surfaces of premises of personnel continuous presence and equipment placed in them	5	20	2000
Surfaces premises of personnel periodical presence and equipment placed in them	50	200	10000
Outer surface of additional personnel protective means, put off in airlocks	50	200	10000

<1> For skin, overalls, special shoes and other personal protective equipment general radioactive contamination (removable and irremovable) is established. In other cases only removable contamination is established.

<2> Separate include alpha-active nuclides, whose average annual admissible volumetric activity in the air of working premises is lower than 0,3 Bq/m^3.

<3> For radionuclides $^{90}Sr + ^{90}Y$ - 40 part/(cm^2 x min).

Appendix 13
of Sanitary-hygienic Standard
“Radiation impact assessment criteria”

MINIMUM SIGNIFICANT SPECIFIC ACTIVITY AND ACTIVITY OF UNSEALED SOURCES OF IONIZING RADIATION IN ROOM OR AT WORKING PLACE

Table 1

Minimum significant specific activity and activity of radionuclides in room or at working place <1>

Table 2

Radionuclides, which are in balance with daughter radionuclides

Parent radionuclide	Daughter radionuclide
Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Cs-137	Ba-137m
Ba-140	La-140
Ce-144	Pr-144
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0,36), Po-212 (0,64)
Bi-212	Tl-208 (0,36), Po-212 (0,64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207

Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-natural	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
U-235	Th-231
U-238	Th-234, Pa-234m
U-natural	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222,

	Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

Appendix 14
of Sanitary-hygienic Standard
"Radiation impact assessment criteria"

ADMISSIBLE LEVELS OF RADIOACTIVE CONTAMINATION OF TRANSPORT VEHICLES SURFACES

Contaminated object	Admissible levels of radioactive contamination, part/(cm^2 x min)			
	Removable contamination (non-fixed)		Irremovable (fixed)	
	alpha-active	Beta-active	alpha-active	beta-active

	radionuclides	radionuclides	radionuclides	radionuclides
Outer surface of container shielding case	Not allowed	Not allowed	Not regulated	200
Outer surface of container car	Not allowed	Not allowed	Not regulated	200
Inner surface of container shielding case	1,0	100	Not regulated	2000
Outer surface of transport container	1,0	100	Not regulated	2000

Appendix 15
of Sanitary-hygienic Standard
“Radiation impact assessment criteria”

VALUES OF EQUIVALENT DOSE RATE, USED DURING DESIGNING OF PROTECTION AGAINST

EXTERNAL IONIZING RADIATION

Category of exposed people	Purpose of premises and territories	Exposure duration, hours per year	Design equivalent dose rate, μSv/h
Personnel	Premises of personnel continuous presence	1700	6,0
	Premises of personnel periodical presence	850	12
Population	Any other premises and territories	8800	0,06

Appendix 16
of Sanitary-hygienic Standard
"Radiation impact assessment criteria"

CLASS TYPES OF WORKS WITH UNSEALED IONIZING SOURCES

Class of works	Total activity at working place applied to group A,

	Bq
I class	More than 10^8
II class	from 10^5 to 10^8
III class	from 10^3 to 10^5

Appendix 17
of Sanitary-hygienic Standard
“Radiation impact assessment criteria”

HAZARDOUS AMOUNTS OF RADIOACTIVE MATTER

Table 1

Categories of sealed ionizing radiation sources used in some wide-spread types of practical activity

Category	Rate of source activity to the activity considered hazardous

	(A / D) <1>
1	A / D ≥
2	1000 > ≥
3	10 > ≥
4	1 > ≥
5	0,01 > A / D and A > exemption level <2>

<1> A – radionuclide activity in a source, D – activity of the present radionuclide which is considered to be dangerous.

<2> Amounts subjected to exemption are presented according to Appendix 4 of the present Sanitary-hygienic Standard.

Table 2

Values of activities which correspond with hazardous amount of radioactive matter (D-values)

Appendix 18
of Sanitary-hygienic Standard
"Radiation impact assessment criteria"

ACCEPTABLE SPECIFIC ACTIVITIES OF LONG-LIVED RADIONUCLIDES FOR UNRESTRICTED USE OF METALS AFTER PRELIMINARY MELTDOWN OR OTHER PROCESSING AND PRODUCTS MADE OF THESE METALS

Appendix 19
of Sanitary-hygienic Standard
"Radiation impact assessment criteria"

GENERAL RESPONSE CRITERIA FOR ACUTE EXPOSURE WHICH REQUIRE URGENT PROTECTIVE AND OTHER RESPONSE MEASURES IN ANY CIRCUMSTANCES FOR PREVENTION OR MINIMIZATION OF SEVERE DETERMINISTIC EFFECTS

Appendix 20
of Sanitary-hygienic Standard
“Radiation impact assessment criteria”

GENERAL RESPONSE CRITERIA FOR PROTECTIVE ACTIONS AND OTHER RESPONSE MEASURES USED IN CASE OF EMERGENCY EXPOSURE IN ORDER TO REDUCE RISK OF STOCHASTIC EFFECTS

General response criteria		Examples of protective and other measures
If expected exposure dose exceeds the following general criteria, urgent <1>protective and other measures shall be implemented		
Equivalent dose of thyroid exposure caused by iodine isotopes intrusion into body during the first 7 days	50 mSv	Thyroid blocking <2>
Effective exposure dose during the first 7 days <3>	100 mSv	Sheltering , evacuation, decontamination, restriction in food products consumption, milk and
Equivalent dose of embryo or foetus	100 mSv	

exposure during the first 7 days		water, control over radioactive contamination, prompting public awareness <4>
If expected exposure dose exceeds the following general criteria, protective and other measures shall be implemented at early phase of accident <1>		
Effective exposure dose per year	100 mSv	Temporary relocation, decontamination, delivery of clean food products, milk and water <5>, prompting public awareness
Equivalent dose of embryo or foetus exposure during prenatal development	100 mSv	
If the received exposure dose exceeds the following general criteria, long-term medical measures shall be implemented for detection and effective treatment of radiation-induced diseases		
Effective dose per month	100 mSv	Screening, based on equivalent exposure doses of certain radiosensitive organs (reason for medical examination), consulting on major questions
Equivalent dose of embryo or foetus exposure during prenatal development	100 mSv	Consulting for taking reasonable decisions in

		special cases

<1> Urgent protective measures shall be implemented immediately (e.g., within an hour) in order to enhance their effectiveness. Early protective measures shall be implemented within days or weeks in order to enhance their effectiveness. They can last for long time even after emergency situation ends.

<2> Stable iodine is assigned: if during an accident radioactive iodine emission occurred; before or nearly straight after radioactive iodine emission; only within a short period right after radioactive iodine intrusion into body.

<3> Effective dose (equivalent dose of organ exposure) for the given period of time is equal to the sum of effective dose (equivalent dose of organ exposure) of external exposure received during the given period and expected effective dose (equivalent dose of organ exposure) from radionuclides intrusion into body during the same period of time.

<4> People who received radiation exposure shall be provided with sufficient information about long-term risks for health caused by exposure, also they shall be assured that no radiation-induced effects for health are expected in case if protective measures had been implemented effectively.

<5> In exceptional cases higher values of response criteria may be needed. Higher values will be reasonable in the following cases: impossibility of delivery of clean food products and water; extreme weather conditions; natural disasters; fast evolution of situation, as well as cases of malicious actions. Response criteria used in these cases shall not exceed values presented in the present table more than by 2 – 3 times.

Appendix 21
of Sanitary-hygienic Standard
“Radiation impact assessment criteria”

RECOMMENDED LEVELS OF EXPOSURE DOSES FOR EMERGENCY WORKERS

Task	Exposure dose level <1>
Actions on people rescue	Ten-fold value of dose limit of occupational exposure during a separate year $H_p(10) < 500$ mSv <2> The given exposure dose level may be exceeded only if benefit for other people greatly exceeds risk for emergency worker and emergency worker is voluntarily agreed to take part in protective measures realizing and accepting risk to which he will be subjected
Measures for prevention of deterministic effects for health and actions on prevention of hazardous conditions development	Ten-fold value of dose limit of occupational exposure during a separate year $H_p(10) < 500$ mSv

Measures for prevention of high collective doses	Two-fold value of dose limit of occupational exposure during separate year $$H_p(10) < 100\ mSv$$

<1> The present values may be used only in case of exposure in the result of external penetrating radiation. By implementing personal protective means, exposure doses received from non-penetrating external radiation and radionuclide intrusion into body shall be prevented.

<2> $H_p\ 10$ - individual dose equivalent.
