

**Federal Nuclear and Radiation Safety Authority of Russia
(Gosatomnadzor of Russia)**

FEDERAL RULES AND REGULATIONS IN THE AREA OF NUCLEAR ENERGY USE

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SAFETY RULES FOR DECOMMISSIONING OF NPP POWER UNIT

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**SAFETY RULES FOR DECOMMISSIONING OF NPP POWER UNIT
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Gosatomnadzor of Russia
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The Regulatory Document states requirements for safety ensuring of NPP unit decommissioning that shall be taken into consideration at the design, construction, and operation, preparation for decommissioning and decommissioning stages. Requirements for safety ensuring of workers (personnel) and population in radioactive waste management and requirements for organization of activities in case of radiological accidents and mitigation of their consequences are presented.

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TERMS AND DEFINITIONS

Data base on decommissioning of NPP unit – a set of justified and ordered data on NPP unit operation, engineering and radiation surveys, results of computation studies, design data necessary for planning and implementation of NPP unit decommissioning activities as well as results of work implementation at all stages of NPP unit decommissioning.

Option of NPP unit decommissioning – one of modes to achieve step-by-step a specified final state of NPP unit during its decommissioning.

The main options of NPP unit decommissioning are:

- NPP unit removal;
- NPP unit entombment.

Decommissioning of NPP unit – activities carried out after removal of nuclear fuel and nuclear materials from the NPP unit and aimed at achieving a specified final state of the NPP unit. Those activities eliminate use of the NPP unit as a power source and ensure safety of workers (personnel), population and the environment.

NPP unit entombment – an option of NPP unit decommissioning providing confinement of highly radioactive components of systems and structures by creation of additional physical barriers eliminating unauthorized access to them.

Comprehensive engineering and radiation survey (CERS) - a set of measures needed for development of NPP unit decommissioning project and aimed at receiving information on the technical state of buildings, structural units, structures and equipment as well as on radiation situation inside premises of the NPP unit and on-site, volumetric and surface contamination of premises, equipment and NPP unit site by radioactive substances, qualitative and quantitative composition of radioactive waste at the NPP unit.

Final state of NPP unit after its decommissioning – a state of the NPP unit after completion of all decommissioning activities that is specified by the NPP unit Decommissioning Program.

Mothballing of NPP unit systems and components – storage (maintenance) of NPP unit systems, equipment and structures, that are not in operation for some time but can be used in future for implementation of activities at different stages of NPP unit decommissioning, in the operable state.

Removal of the NPP unit – an option of NPP unit decommissioning anticipating step-by-step dismantling (immediate or deferred) and removal of equipment, systems, structures and buildings, removal of all radioactive waste from the NPP site and restoration of the NPP unit site for its further use.

Confinement of systems and equipment of NPP unit – isolation of systems and equipment of the NPP unit providing for limitation a possibility for release of radioactive substances and ionizing radiation to NPP unit premises and the environment by using existing or creation of new physical barriers.

Recycled materials – Materials generated in course of NPP unit decommissioning, which bear amount (or activity) of radionuclides less than those established by federal standards and rules in the area of nuclear energy use and are suitable for restricted and unrestricted use in the economy.

Site of NPP unit under decommissioning – a part of the NPP site with buildings and structural units placed there, which boundaries are defined by the design of the NPP unit under decommissioning. Buildings, structures, systems, etc. of common use with other NPP units being under operation are not considered as belonging to the site of the NPP unit under decommissioning.

Preparation for NPP unit decommissioning – activities on implementation of a set of organizational and technical measures both before and after final shutdown of the NPP unit that precede NPP unit decommissioning and are implemented within the frame of a licence for NPP unit operation.

Program on decommissioning of NPP unit – a document presenting a final state after completion of all NPP unit decommissioning activities, main organizational and technical measures on implementation of the selected option for NPP unit decommissioning, sequence and schedule for implementation of decommissioning stages, as well as a list of main activities for each decommissioning stage.

Project on decommissioning of NPP unit – a document developed on the basis of NPP unit decommissioning program and CERS of the NPP unit, where specific NPP unit decommissioning activities are defined with indication of technologies of work implementation, sequence of activities, as well as required human, financial and material and technical resources for each stage of decommissioning.

NPP unit storage under surveillance – a stage of NPP unit decommissioning, which implementation means long-term storage of structural units, components of equipment and structures on the NPP site until reduction of radioactive substances in them due to natural decay up to the prescribed levels.

Physical barrier during decommissioning of NPP unit – engineering structure, technical mean or device confining release of radioactive substances and ionizing radiation to premises of the NPP unit and the environment.

Note. A wall of a box, pipeline, tank, packaging and container, walls, floor and ceiling of a room, frames of constructions and building, containment, etc. are considered as a physical barrier.

Stage of NPP unit decommissioning – a set of organizational and technical measures and activities implemented during a specific time period and aimed at achieving a state of the NPP unit specified for the NPP unit decommissioning program and project for that moment.

1. MAIN PROVISIONS

1.1. Purpose and scope of applicability

1.1.1. Safety rules for decommissioning of NPP power unit (hereinafter Rules) are the main document regulating safety ensuring in decommissioning of NPP power unit. Regulatory documents explicating and concretizing requirements of the Rules relevant to NPP unit decommissioning shall take into account requirements of these Rules.

1.1.2. The Rules establish main principles and requirements regulating safe implementation of NPP unit decommissioning activities for all stages of the NPP unit lifetime.

1.1.3. The Rules are obligatory for juridical (corporate) persons and individual (natural) persons carrying out activities on siting, designing, construction, operation and decommissioning of NPP units. They are effective within the entire territory of the Russian Federation.

1.2. Main safety principles and requirements for decommissioning of NPP unit

1.2.1. NPP unit decommissioning complies with safety requirements at all stages of work implementation if its radiation impact on workers (personnel), population and the environment does not result in exceeding limits of exposure doses for workers (personnel) and population and standards for releases, discharges and concentration of radioactive substances in different natural media (air, surface and underground water, soil) effective at the moment of work implementation.

1.2.2. At all stages of the NPP unit lifetime preceding decommissioning administrative and technical measures and operations shall be carried out with consideration of its decommissioning.

1.2.3. NPP unit decommissioning shall be implemented according to the following main safety principles:

1.2.3.1. Compliance with main dose limits and other standards on human exposure shall be ensured during NPP unit decommissioning.

1.2.3.2. Radiation impact on workers (personnel), population and the environment shall be reduced during NPP unit decommissioning up to the minimal reasonable values taking into account economical and social factors.

1.2.3.3. Operations where benefit for a person and society does not exceed risk of possible damage caused additionally to general exposure dose limits shall not be carried out in decommissioning of the NPP unit.

1.2.4. The following is necessary to ensure safety in decommissioning of the NPP unit:

- To develop and maintain safety culture;
- To develop quality assurance programs for implemented operations;
- To maintain operability of equipment, systems and structures necessary for safe decommissioning of the NPP unit;
- To control staff recruitment and required professional skills of workers (personnel) involved in NPP unit decommissioning;
- To ensure safety of operations on handling of radioactive substances and radioactive waste and to provide their accounting and control;
- To ensure physical protection of the NPP unit, radioactive substances and radioactive waste.

1.2.5. NPP unit decommissioning activities shall be carried out in compliance with the program and project of NPP unit decommissioning developed on the basis of conservative approach and approved engineering solutions.

1.2.6. Impact of decommissioning operations during their implementation on safety of other NPP units being in operation on the NPP site shall be eliminated.

1.2.7. The operating organization shall develop and approve quality assurance programs for each stage of NPP unit decommissioning and check activities of other organizations carrying out work or rendering services relevant to NPP unit decommissioning to the operating organization.

2. MEASURES TAKEN DURING DESIGN, CONSTRUCTION AND OPERATION STAGES OF THE NPP UNIT TO ENSURE SAFETY DURING ITS DECOMMISSIONING

2.1. Design and construction of the NPP unit

2.1.1. Solution aimed at safety ensuring in decommissioning of the NPP unit shall be provided by the project for construction of the NPP unit. They include the following:

- Selection of materials for manufacture of equipment, systems and structures of the NPP unit that provide low level of their activation for the whole period of NPP unit operation and minimal amount of radioactive waste in decommissioning of the NPP unit;
- Use of such design solutions in construction of the NPP unit that allow simplification of dismantling operations in decommissioning of the NPP unit;
- Design solutions providing minimization of surface radioactive contamination of equipment, systems and structures of the NPP unit during its operation;
- Providing for bearing capacity of structures, buildings and installations for the period of the designed operational stage and for the period of NPP unit decommissioning;
- Providing for lifetime and operability (in particular maintainability) of systems and equipment necessary for NPP unit decommissioning for the period of the designed operational stage and for the period of NPP unit decommissioning or providing for a possibility of their replacement after lifetime exhaustion;
- Selection of places for accommodation of templates that allow reliable estimation of radionuclide content in structures and equipment due to their activation by neutrons;
- Reservation of places on the NPP site (if necessary) for possible placing of installations and stores intended for treatment and storage of solid and liquid radioactive waste generated in decommissioning of the NPP unit.

2.1.2. The Project for construction of the NPP unit shall contain:

- NPP unit decommissioning concept with description of NPP unit decommissioning options and possible transitions between them;
- A list of main planned measures on safety ensuring in decommissioning of the NPP unit;
- Estimation of total amount, type, category and activity of radioactive substances generated during decommissioning as well as prediction of radiation situation at the NPP unit after termination of operation;
- A list of systems and equipment needed for decommissioning of the NPP unit as well as requirements for their technical state;
- Proposals for dismantling of main systems, equipment and structures of the NPP unit and recommended technologies for decontamination and dismantling during decommissioning of the NPP unit.

2.1.3. The project for construction of the NPP unit shall provide for development of database on NPP unit decommissioning and requirements for this database relevant to hardware and methods for recording, gathering, storage and displaying of data necessary for planning and implementation of NPP unit decommissioning activities from design, construction and operation.

2.2. NPP unit operation

2.2.1. During the whole period of NPP unit operation the operating organization shall arrange and provide gathering, processing and input of information to database on decommissioning of the NPP unit in a scope required for development of NPP unit decommissioning program and project.

This information shall include:

- Data on changes of average monthly value of reactor thermal power for the whole period of NPP unit operation (bar chart of average monthly power for each month) necessary for estimation of induced activity of equipment and structures for any moment after final shutdown of the NPP unit;
- Data on accidents occurred at the NPP that are used as a basis for estimation of radioactive contamination of process equipment, premises and structures of the NPP unit at any moment after final shutdown of the NPP unit, including those located in places difficult of access for routine decontamination;
- Data on replacements of main reactor and process equipment irradiated by neutrons and operated in the contact with radioactive process media that were implemented during operation. These data are necessary for calculations of induced and surface activity of equipment and its components for any moment after repair;

- Data on radionuclide composition of deposits of corrosion and other types on the inner surfaces of pipelines and equipment before final shutdown of the NPP unit;
- Data on surface contamination of main equipment and premises after last routine decontamination conducted before final shutdown of the NPP unit;
- Data on actual annual discharges and releases of radioactive substances to the environment for the whole period of operation;
- Data on amount and radionuclide composition of liquid and solid radioactive waste accumulated during operation and stored on the NPP unit site; data on category of radioactive waste, places and methods of their storage on site and inside premises of the NPP unit; data on total capacity of stores and free space of stores for further accommodation of radioactive waste generated in NPP unit decommissioning; data on methods for their treatment and transportation, system for surveillance over radiation situation in places of their location;
- Data on radionuclide content inside survey wells on the NPP unit site and in other regulated places of monitoring before final shutdown of the NPP unit.

2.2.2. To select and justify option of NPP unit decommissioning the operating organization provides implementation of NPP unit survey in a scope necessary for consideration of different options for NPP unit decommissioning. Feasibility studies of different options for NPP unit decommissioning are implemented taking into account results of survey and analysis of design and operation documentation. The operating organization uses those feasibility studies as a basis for making a decision on selection of the specific option for NPP unit decommissioning.

2.2.3. At latest five years before the end of design lifetime of the NPP unit the operating organization shall provide for development of NPP unit decommissioning program for the selected option and submit it to Gosatomnadzor of Russia. The NPP unit decommissioning program shall define organizational and engineering measures aimed at implementation of the selected option as well as schedule and sequence of these measures fulfillment. The NPP unit decommissioning program can be amended if necessary.

2.2.4. Dates of CERS of the NPP unit shall be indicated in the NPP unit decommissioning program. An approximate scope of requirements for the NPP unit CERS is presented in Appendix.

3. PREPARATION FOR NPP UNIT DECOMMISSIONING

3.1. In course of preparation for the NPP unit decommissioning equipment, systems and components shall be operated according to operating rules of the NPP unit. In case of changes in conditions for operation of equipment, systems and components of the NPP unit these changes shall be introduced to the operating rules of the NPP unit according to the established procedure.

3.2. In preparation for the NPP unit decommissioning the operating organization shall provide:

- Removal of nuclear fuel and nuclear materials from the reactor core, fuel pond and premises of the NPP unit;
- Removal of radioactive working media from equipment and process systems of the NPP unit;
- Decontamination of equipment, systems, premises and structures of the NPP unit in a scope necessary for preparation for the NPP unit decommissioning;
- Treatment or removal of radioactive waste accumulated at the NPP unit during its operation;
- NPP unit CERS fulfillment in a scope necessary for development of the NPP unit decommissioning project, input of CERS results to database on the NPP unit decommissioning and development of a report on the results of CERS;
- Development of the NPP unit decommissioning project within the terms established by the NPP unit decommissioning program but not later than date of completion of the NPP unit transfer to the nuclear-safe state and fulfillment of the whole set of organizational and engineering measures for preparation for the NPP unit decommissioning;
- Development of SAR for NPP unit decommissioning in accordance with the NPP unit decommissioning project.

3.3. In case of the NPP unit decommissioning following the accident with fuel element failure and intake of fissile materials to process systems, structural elements or fuel pond the transfer of the NPP unit to nuclear-safe state shall be done according to the NPP unit decommissioning program that considers accident consequences.

If an accident occurred within last five years of the NPP unit operation then the earlier developed program for the NPP unit decommissioning shall be updated with consideration of the accident features and submitted to Gosatomnadzor of Russia.

3.4. The operating organization shall provide for development of documents justifying safety of the NPP unit decommissioning.

4. SAFETY ENSURING IN DECOMMISSIONING OF THE NPP UNIT

4.1. General requirements

4.1.1. To carry out NPP decommissioning activities the operating organization and organizations fulfilling work and rendering services to the operating organization shall be provided with equipment ensuring safety of decommissioning operations (dismantling, decontamination, radioactive waste management, etc.).

4.1.2. During the whole period of NPP unit decommissioning activities monitoring, analysis and comparison with initial parameters (at the beginning of decommissioning activities) of radiation situation inside premises and on the NPP site shall be provided.

4.1.3. Dismantling of physical barriers during NPP unit decommissioning shall be done only if possible contamination of the NPP unit premises by radioactive substances, their discharges and releases to the environment would not exceed established control levels.

4.1.4. During NPP unit decommissioning the operating organization shall provide gathering, processing, analysis, systematization and storage of information on system failures and personnel errors and its prompt transfer to all organizations concerned according to the established procedure.

4.1.5. Only workers (personnel) having the required professional skills and accepted for individual independent work according to the establish procedure shall work at the decommissioned NPP unit.

4.1.6. The operating organization shall start any stage of the NPP unit decommissioning by preparation of the organizational and engineering measures aimed at safety ensuring of operations carried out at that stage.

Analysis of the results achieved shall be conducted after completion of each stage of the NPP unit decommissioning. Needs in additional survey in a scope necessary for timely updating of design documentation and taking of required organizational and engineering measures at the next stage of the NPP unit decommissioning shall be formulate based on the results of this analysis.

4.1.7. At any stage of the NPP unit decommissioning the operating organization shall impose restrictions on workers (personnel) access to the controlled access area of the NPP unit under decommissioning and provide use of security alarm means and other measures on prevention of an unauthorized access to the controlled access area of the NPP unit.

4.1.8. At all stages of the NPP unit decommissioning the operating organization shall ensure control, accounting and physical protection of radioactive substances and radioactive waste as well as equipment that represent potential hazard to workers (personnel), population and the environment according its radiation characteristics.

4.1.9. After completion of each stage of the NPP unit decommissioning the following data shall be inserted to the database of the NPP unit decommissioning:

- On the used technologies and methods of dismantling;
- On decontamination of equipment and structures of the NPP unit;
- On the amount (mass/volume), activity, nuclide composition and aggregate state of generated and conditioned radioactive waste and dates of their shipment from the NPP unit site;
- On places for storage radioactive waste on the NPP unit site;
- On radiation situation in premises and on site of the NPP unit.

4.1.10. Releases and discharges of radioactive substances to the environment shall be estimated before the start of each stage of the NPP unit decommissioning.

4.1.11. Plans of measures for protection of workers (personnel) of the NPP unit in case of an accident shall be developed (updated) before the start of the decommissioning activities.

4.1.12. Decommissioning activities may be stopped only after achievement of the prescribed final state of the NPP unit that is confirmed by the appropriate document (statement, conclusion, etc.) of the operating organization. This document shall be coordinated according to the established procedure.

The document shall demonstrate compliance of the actual state of the NPP unit and its site at the moment of completion of the decommissioning activities with the final state defined by the NPP unit decommissioning project.

4.2. Requirements to systems ensuring radiation safety

4.2.1. A list of NPP unit systems necessary for radiation safety ensuring in the NPP unit decommissioning shall be defined in the project for NPP unit decommissioning. Use of those systems at any

stage of NPP unit decommissioning shall be justified there. Those systems shall be modified if necessary taking into account conditions and peculiarities of carried out activities at any stage of NPP unit decommissioning.

4.2.2. Project for NPP unit decommissioning shall contain the following information for each decommissioning stage:

- Order and sequence of implementation of decommissioning activities;
- Measures for provision of radiation safety in working places;
- Estimate of individual and collective occupational doses for each type of operations;
- Methods and technical means minimizing occupation exposure in work implementation;
- The required scope of occupational radiation exposure monitoring and applicable hardware for its fulfillment;
- Scope, activity and nuclide composition of generated liquid and solid radioactive waste as well as methods for their conditioning and transport, forms and places of storage;
- Measures for minimization of amount and activity of discharges and releases of radionuclides to the environment for the selected technologies of work implementation and technical status of ventilation and cleaning systems;
- An order of implementation and technical means for radiation monitoring of materials intended for restricted and unrestricted reuse.

4.2.3. Operational modes of ventilation systems shall be justified at any stage of NPP unit decommissioning for different activities taking into account technologies applied resulted in generation of radioactive gases and aerosols. Additional ventilation system shall be designed and installed if necessary.

4.2.4. To prevent air contamination in the working area systems of local air bleed and dust-depressing systems shall be provided in places of dismantling of radioactively contaminated equipment and structures.

4.2.5. Dismantling of components of special-purpose ventilation systems shall be carried out step-by-step as far as dismantling activities and removal of the main equipment and construction structures of the NPP unit under decommissioning are completed subject on conditions that radiation situation inside premises, on site and within the controlled area of the NPP units does not become worse.

4.2.6. Use of the regular special sewerage system for removal of liquid radioactive waste shall be justified at any stage of the NPP unit decommissioning. Its operational modes shall be revised if necessary taking into account features of operations at the given stage of NPP unit decommissioning. Additional sewerage system shall be designed and installed if necessary.

4.2.7. Additional systems and means limiting release of radioactive substances to the NPP unit premises and environment shall be provided in case if dismantling of physical barriers is necessary.

4.2.8. Radiation monitoring during NPP unit decommissioning inside NPP unit premises and on-site can be implemented on the basis of a regular NPP unit monitoring systems provided for operation of the NPP unit. This system shall be modified if necessary taking into account features of activities carried out at each stage of NPP unit decommissioning.

4.2.9. At all stages of NPP unit decommissioning the radiation monitoring system shall provide:

- Individual radiation dose monitoring;
- Monitoring of fragments of equipment and structures with surface and volumetric contamination, radioactive waste and recycled materials of restricted and unrestricted use generated in course of dismantling;
- Monitoring of spreading of radioactive substances inside premises, on-site and within the controlled area of the NPP unit;
- Monitoring of physical barrier integrity;
- Monitoring of radiation situation within controlled and surveillance areas.

4.2.10. Individual radiation monitoring of workers (personnel) shall be carried out at each stage of NPP unit decommissioning taking into account possible changes in radionuclide inventory during NPP unit decommissioning.

4.2.11. Stationary dose meters with automatic sound and light devices warning on exceeding of the reference levels shall be installed in working areas and places of radioactive waste accommodation where dose rate can be changed within the wide range.

4.2.12. Radiation monitoring of radioactive waste generated as a result of NPP unit decommissioning activities shall include both sampling techniques and techniques without taking samples. Selection of metrology and methodology provision for radiation monitoring shall be justified. Devices used for radiation monitoring and dose measurements shall be qualified.

4.3. Management of radioactive waste and recycled materials

4.3.1. Before start of any stage of the NPP unit decommissioning those radioactive waste treatment facilities, technical means for cleaning and decontamination of contaminated surfaces in premises and on-site of the NPP unit as well as means for radioactive monitoring of recycled materials that are required at this stage shall be in an operation state.

4.3.2. All materials (fragments of dismantled equipment, biological shielding, construction structures, etc.) resulting from NPP unit decommissioning shall be subject of radiation monitoring. Separation of radioactive waste from materials suitable for reuse in the economy shall be done based on the results of radiation monitoring.

4.3.3. Recycled materials and equipment resulting from NPP unit decommissioning shall be sorted as materials and equipment suitable for restricted and unrestricted use.

4.3.4. Up to conditioning radioactive waste resulting from NPP unit decommissioning shall be sorted as low-, intermediate- and high-level radioactive waste according to federal standards and rules in the area of nuclear energy use.

4.3.5. Temporary storage of radioactive waste and recycled materials in specially prepared premises of the NPP unit and on its site is allowed if it is stipulated by the NPP unit decommissioning project, which justifies a possibility of their further recovery and removal.

4.3.6. Transport of radioactive waste within the site of the NPP unit under decommissioning shall be implemented according to routes developed in advance with the use of special equipment and transport means.

4.3.7. Removal of recycled materials and/or equipment out of bounds of the NPP unit under decommissioning shall be carried out with obligatory radiation monitoring and an appropriate documented authorization.

4.3.8. In case of decommissioning of an NPP unit with graphite moderator and sodium coolant appropriate treatment technologies shall be provided that ensure their reprocessing or transfer to forms suitable for further reuse or final disposal.

4.3.9. Accounting for and control of radioactive waste and materials being temporarily stored in premises and on-site of the NPP unit under decommissioning shall be carried out with indication of:

- Aggregate state and amount (mass/volume) of radioactive waste;
- Specific activity, nuclide composition of radioactive waste and dates of their measurement;
- Places of radioactive waste generation;
- Date (day, month and year) of collection and packing of radioactive waste;
- Type of a packaging and identification mark of the radioactive waste packaging;
- Characteristics of surface contamination of the radioactive waste packaging;
- Storage places of packages with radioactive waste and recycled materials;
- Officials and executors implemented management of radioactive waste and recycled materials;
- Dates (day, month and year) and amounts of radioactive waste and recycled materials removed from the NPP unit site for interim storage;
- Dates (day, month and year) and amounts of radioactive waste removed from the NPP unit site for final disposal.

All these data shall be input to the database on decommissioning of the NPP unit after completion of each stage of NPP unit decommissioning.

4.4. Organization of activities in case of radiological accidents and mitigation of their consequences

4.4.1. Alarm systems shall be provided in decommissioning of the NPP unit to warn workers (personnel) of the NPP unit on an accident.

4.4.2. The operating organization shall develop a plan of measures for workers (personnel) protection in case of an accident during NPP unit decommissioning (On-Site Emergency Plan).

Competent executive authorities shall develop a plan for protection of population in case of an accident during NPP unit decommissioning (Off-Site Emergency Plan).

These plans shall clearly define levels of emergency readiness and levels of intervention. It shall be defined who, under what conditions, using which communication means notified what organizations on an accident and on the start of these plans implementation. Necessary technical means for implementation of these plans shall be provided with defining who deliver these means and from where.

4.4.3. Training of workers (personnel) of the NPP unit for implementation of the NPP unit decommissioning shall be organized with accounting of emergency training and exercises.

4.4.4. After accident initiation at the NPP unit under decommissioning the NPP Management shall take urgent measures to eliminate its progression, to minimize exposure doses and number of radiation-exposed individuals from workers (personnel) and population and to minimize radioactive contamination of the NPP unit premises and the environment.

4.4.5. Mitigation of an accident at the NPP unit under decommissioning and taking measures related to exclusion of overexposure of workers (personnel) and population shall be carried out under the strict radiation dose monitoring according to special permit (access pass) that defines permissible duration of work, protection means, members of a team and a leader of emergency activities.

4.4.6. The operating organization shall investigate incidents and accidents occurred in decommissioning of the NPP unit and submit information on them to Gosatomnadzor of Russia according to the established procedure.

AN APPROXIMATE SCOPE OF REQUIREMENTS FOR THE COMPREHENSIVE ENGINEERING AND RADIATION SURVEY OF NPP UNIT

1. General Provisions

1.1. A Commission appointed by the Operating Organization conducts the comprehensive engineering and radiation survey of the NPP unit (CERS). CERS is composed of engineering survey and radiation survey.

The CERS results are an information basis to justify an option of the NPP unit decommissioning and to develop a Project for the NPP unit decommissioning for the chosen option.

The CERS shall include the following:

- Study of the design documentation and analysis of correspondence of the solutions, which were actually implemented at the NPP unit being decommissioned, with solutions stipulated by the design;
- Analysis of the NPP unit design documentation relevant to the state of construction structures, systems and components with a purpose to justify their use for the NPP unit decommissioning;
- Analysis of radiation situation in and outside premises of the NPP unit;
- Carrying out of examination of the state of construction structures, systems and equipment using instrumentation, if necessary;
- Carrying out of researches and calculations, if necessary.

1.2. While conducting CERS of the NPP unit under decommissioning, the Commission shall study information presented in the database on the NPP unit decommissioning. Additionally, information relevant to the NPP unit decommissioning shall be clarified and systematized. Such information shall include the following:

- Data on the chemical composition of materials of equipment, biological shielding and construction structures presented in the design documentation;
- Data on the technical state of systems, equipment and structures of the NPP unit needed for justification of a possibility to use those systems, equipment and structures during the whole period of the NPP unit decommissioning;
- Information on restrictions imposed on implementation of activities on the NPP unit decommissioning;
- NPP unit operational data concerned with carrying out of repairs and replacements of components of systems and equipment and dates of their implementation;
- Engineering and operational documentation data on emergencies occurred during operation and their consequences.

1.3. A Program for the NPP Unit Decommissioning sets CERS scope, methods and dates. They depend on the option of NPP unit decommissioning, engineering tools used for survey fulfillment, accessibility of equipment and systems for their examination, scope of information necessary for development of the NPP Unit Decommissioning Project. They are formulated in detail in Terms of Reference for Implementation of the NPP Unit CERS.

2. Engineering Survey of the NPP Unit

2.1. Engineering survey is a part of the NPP unit CERS. It is conducted with a purpose to obtain detail information on the technical state of the NPP unit.

2.2. In general engineering survey shall be conducted in accordance with Section 1 of this Appendix and aimed at receiving of information structured by the following way.

2.2.1. Survey of buildings and structures of the NPP unit.

Survey results shall include:

- Description of the NPP unit, its buildings and structures;
- A full list of premises according to the height marks of the NPP unit and areas where they are located (controlled access area and normally occupied area) with indication of numbers and names of premises;

- Assessment of the actual state of the NPP unit structures for the time of survey fulfillment and their residual lifetime;
- A list of engineering solutions on the NPP unit layout;
- Schematic diagrams of power, heat, gas, air and water supply;
- Diagrams and characteristics of process and transport links between process buildings and structures of the NPP unit and its premises.

2.2.2. Survey of process premises of the NPP unit.

Survey results shall include:

- Properties of a room (dimensions, category of the room, class of explosion and fire hazard, class of electrical safety, ventilation rate, properties of coatings for floor, ceiling and walls, parameters and types of apertures);
- A list of equipment, plants, systems and communication lines located inside premises or coming through them, their technical and mass-dimensions parameters;
- A list of lifting-transport equipment and its characteristics;
- A list and characteristics of ventilation systems;
- A list and characteristics of fire fighting systems;
- Data on a possibility to place additional equipment necessary for dismantling as well as data on the necessity to arrange additional apertures to conduct dismantling activities;
- Data on the assessment of the actual current state of equipment, plants and systems and their residual lifetime.

3. Radiation survey of the NPP unit

3.1. The main objective of radiation survey is to get data on radiation situation inside premises and on the site of the NPP unit, residual radioactive contamination of equipment, systems and structures of the NPP unit, as well as data on amounts, aggregate state and nuclide composition of radioactive waste accumulated during NPP unit operation. These data are needed for estimation of radiation impact on workers (personnel) during implementation of activities on NPP unit decommissioning.

3.2. Information on radiation situation shall include data on:

- Gamma-radiation dose rates, flux densities of alpha and beta particles inside premises of the NPP unit, concentration of radioactive aerosols and gases in air of the NPP unit premises;
- Gamma-radiation dose rate outside buildings and structures of the NPP unit, levels of radioactive contamination of a territory of the NPP unit site and outer surfaces of buildings and structures of the NPP unit, as well as concentration of radioactive aerosols and gases in the atmosphere.

3.3. Results of radiation survey of the NPP unit shall represent:

- A list of radioactively contaminated facilities of the master plan (building and structures of the NPP unit) with indication of area and type of surfaces (walls, roofs) and coatings, radionuclide inventory and their activity;
- Amounts of liquid radioactive waste (LRAW) accumulated at storage facilities for LRAW, their specific and total activities, radionuclide and chemical composition, aggregate state;
- Amounts of accumulated solid radioactive waste (SRAW), their specific and total activities, radionuclide composition and chemical composition;
- Data on filling up of LRAW and SRAW storage facilities available at the NPP unit;
- Gamma-radiation dose rate from LRAW and SRAW and maps of radiation fields;
- Contamination of communication lines, construction and shielding structures of storage facilities by fission products and other radionuclides.

3.4. The following shall be defined after radiation survey of premises of the NPP unit:

- Areas and boundaries of areas of radioactive contamination inside NPP unit buildings;
- Controlled access areas;
- Levels of surface radioactive contamination of equipment, systems and structures located inside premises or passing through them;

- Level of radioactive contamination of materials of equipment and structures in depth from the outer surface;
- Amounts and nuclide composition of radioactive deposits inside equipment.

3.5. The following shall be defined after completion of radiation survey of the NPP unit site:

- Concentration and composition of radionuclides in underground and surface water of the NPP unit site;
- Concentration and composition of radionuclide in soil of the NPP unit site.

4. Requirements for means of NPP unit CERS

4.1. NPP unit survey shall be conducted with the use of design, engineering and operating documentation, which shall have corresponding registration numbers showing its belonging to a facility under survey.

4.2. Devices for instrumental survey of the NPP unit state shall be qualified and techniques used shall be approved.