Federal Environmental, Technological and Nuclear Supervision Service

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FEDERAL STANDARDS AND RULES
IN THE FIELD OF USE OF ATOMIC ENERGY

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GENERAL SAFETY PROVISIONS FOR NUCLEAR FUEL CYCLE FACILITIES (GSP NFCF) NP - 016 – 05

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GENERAL SAFETY PROVISIONS FOR NUCLEAR FUEL CYCLE FACILITIES (GSP NFCF)

Federal Environmental, Technological and Nuclear Supervision Service, Moscow, 2005

These federal standards and rules “General Safety Provisions for Nuclear Fuel Cycle Facilities (GSP NFCF)” set forth the goal, criteria, principles and general requirements for nuclear and radiation safety of nuclear fuel cycle facilities.

They are applied to nuclear fuel cycle facilities under design, construction, operation and decommissioning (shutdown).

They have been developed on the basis of existing “General Safety Provisions for Nuclear Fuel Cycle Facilities” (NP-016-2000) considering national and foreign experience gained in the field of nuclear fuel cycle facility operation as well as proposals and comments by organizations and enterprises concerned.[1*])

They have been developed on the basis of regulatory legal acts of the Russian Federation, the Joint Convention on Safety of Spent Fuel Management and Safety of Radioactive Waste Management, Federal standards and rules in the field of use of atomic energy as well as the IAEA recommendations of Safety Series No. 9 “Safe Management and Storage of Plutonium”, Safety Series No. 110 “Nuclear Facility Safety”, Report of the International Nuclear Safety Advisory Group “Safety Culture” (INSAG 4), Report of the International Nuclear Safety Advisory Group “Defense-in-depth” (INSAG 10), recommendations of Nuclear Energy Agency of the Organization of Economic Cooperation and Development (OECD/NEA) "Safety of Nuclear Fuel Cycle" and "Management of Separated Plutonium".

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LIST OF ABBREVIATIONS

Keff	- Effective neutron multiplicity coefficient
LRW UDS	- Liquid Radioactive Waste Underground Disposal Site
NFC	- Nuclear Fuel Cycle
NFCF	- Nuclear Fuel Cycle Facility
NFM (S, N)	- Nuclear Fissile Material (substance, nuclide)
RW	- Radioactive Waste
RWDF	- Radioactive Waste Disposal Facility
SAR	- Safety Analysis Report
SCR	- Self-Sustained Nuclear Fission Chain Reaction

1. MAIN TERMS AND DEFINITIONS

Terms and definitions are used for the purpose of this document.

Accident shall mean the operational event at a nuclear fuel cycle (hereinafter the NFC) facility where a release of nuclear materials, radioactive substances and (or) ionizing radiation took place beyond boundaries specified in the NFC facility design for normal operating conditions in amounts exceeding the safe operation limits. The accident is characterized by the initiating event, development paths and consequences.

Accident consequences shall mean the radioactive situation arose at a NFC facility and its surrounding environment as a result of the accident that causes damage and losses to the employees (personnel), population and environment due to exceeded limits of the radiation impact.

Accident development path shall mean the sequence of states of systems and components of a NFC facility during the accident development.

Accident management shall mean the actions aimed at preventing progression of design basis accidents into beyond design basis accidents and mitigating consequences of beyond design basis accidents.

Achieved level of science and technology shall mean the combination of scientific and technical knowledge, technological, engineering and design developments in a certain field of science and technology, which is confirmed by research results and practical experience, and reflected in scientific and technical publications.

Active system (component) shall mean the system (component), which functioning depends on operation of another active system (component), for example, controlling safety system, power supply source, etc.

Administration (management) of NFC facility shall mean the managers and other officials who are entitled by the operating organization with the rights, duties and responsibilities regarding construction, commissioning, operation and decommissioning of the NFC facility.

Beyond design basis accident shall mean the accident caused by initiating events that are not considered for design basis accidents or the accident accompanied by the safety system failures in addition to the single failure considered for design basis accidents as well as caused by human errors.

Check shall mean the in-service inspection of a system and (or) component aiming at finding out whether they are workable and at detecting their faults.

Closure of a radioactive waste disposal facility (hereinafter - RWDF) (liquid radioactive waste underground disposal site – (hereinafter - LRW UDS) shall mean the activity which is carried out after radioactive waste (hereinafter – RW) placement in RWDF (LRW UDS) has been finished and is aimed at bringing RWDF (LRW UDS) to a state which will remain safe during the period of potential hazard posed by RW confined therein.

Commercial operation of NFC facility shall mean the operation of a NFC facility commissioned in accordance with the established procedure, which compliance with the design and safety has been confirmed by tests at the stages of the NFC facility commissioning.

Components shall mean the equipment, hardware, instrumentation, pipelines, cables, building structures and other items that ensure performance of designated functions either solely or as a part of systems, buildings and structures, and considered in the design as structural units for the purposes of reliability and safety analyses.

Confining safety systems (components) shall mean the systems (components) intended to prevent or limit the propagation of radioactive substances and ionizing radiation resulted from an accident beyond the boundaries set forth by the design and release thereof into the environment.

Conservative approach shall mean the approach where values and limits knowingly leading to the most unfavorable results are assumed for parameters and characteristics of processes and systems when NFC facility

accidents are analyzed.

Control room (board) shall mean the part of a NFC facility, which is located on the premises especially provided for in the design and intended for the centralized automated control over processes exercised by the control operating personnel and automation.

Controlled area shall mean the territory around a NFC facility where population exposure dose under normal operating conditions of NFCF may exceed the dose limit established by the existing radiation safety standards.

Controlling safety systems (components) shall mean the systems (components) intended for triggering safety systems, their monitoring and control while they perform the designated functions.

Design basis accident shall mean the accident for which the initiating events and ultimate states are specified in the design and there are safety systems and (or) other engineered features and organizational measures provided for to confine the accident consequences within the limits prescribed for the accidents of this type.

Design limits shall mean the parameter and characteristic boundary values of state of systems (elements) and a NFC facility as a whole established in the design for normal operation and operational events including pre-emergency situations and accidents.

Employee (personnel) error shall mean the single inadvertent erroneous manipulation of controls or the single inadvertent omission of the correct action or the single inadvertent erroneous action, including those during maintenance of safety important systems (components).

Erroneous decision shall mean inadvertent erroneous execution of or failure to implement a number of consequent actions due to a wrong assessment of the running processes.

External natural or man-induced event shall mean the natural phenomenon (hurricane, flood, earthquake, etc.) or an event associated with human activities (fire, explosion, aircraft crash, etc.).

Higher margin coefficient equipment ("HMC" type equipment) shall mean the unsafe equipment which design features, while processing the given nuclear fissile materials, provide for the minimum critical mass value exceeding at least 5 times the minimum critical mass of nuclear fissile nuclides for the same nuclear fissile material but in the system having the spherical form with a full reflector and for which higher margin coefficients are set forth.

Independent systems (components) shall mean the systems (components) for which a failure of one system (component) does not lead to the failure of the other system (component).

Initiating event shall mean the single failure of systems (components) of a NFC facility, deviation of one nuclear safety parameter, an external event or an error of employee (personnel) which leads to a disruption of normal operation and may cause a violation of the safe operation limits and/or conditions. An initiating event includes all dependent failures resulted from it.

Intrinsic safety shall mean the capability of a NFC facility's systems (components) to ensure safety basing on natural feedbacks, processes, and characteristics.

Leaktight enclosure shall mean the space around the NFC facility systems (components), equipment bound by a combination of structural elements, which forms a boundary as set forth in the design, which prevents propagation of nuclear materials and radioactive substances beyond the boundaries in a quantity that exceeds the limits established in the design for normal operation and design basis accidents.

Leaktightness shall mean the capability of a combination of confining structural elements to limit propagation of liquid, gaseous substances. Leakage rate (design-based or actual) – an amount of medium which has left the controlled volume under certain parameters per unit of time – is the leakage quantitative parameter.

Local control room shall mean the section of the NFC facility control system located near the controlled equipment and intended for casual control over this equipment by employees (personnel). The local control room houses the local control board – a panel with automation.

NFC facilities

Nuclear installations shall mean structures, complexes, installations with nuclear materials (except for production reactors, research nuclear installations, critical or subcritical assemblies, uranium ore mining facilities) that are intended for fabrication, processing and transportation of nuclear fuel and nuclear materials (including hydrometallurgical processing of uranium ores to fabricate natural uranium oxide concentrates, sublimate production, metallurgical works, uranium isotope separation, radiochemical processing of nuclear fuel and nuclear materials, conversion of weapons materials (uranium and plutonium), fabrication of mixed oxide and other types of uranium-plutonium fuel, management of resulted radioactive waste).

Radiation sources shall mean structures, complexes and installations, which do not relate to nuclear installations and contain radioactive substances and (or) radioactive waste, located on the site of a nuclear installation and are not the constituents of the nuclear installation design.

Nuclear material, radioactive substances or radioactive waste storage facilities shall mean fixed

facilities and structures which do not relate to nuclear installations and radiation sources and are designed to store nuclear materials, radioactive substances and radioactive waste, including the facilities and structures which are located on the site of a nuclear installation and are not the constituents of the nuclear installation design; fixed facilities and structures designed for disposal of radioactive waste (RWDF, LRW UDS).

NFC facility commissioning shall mean the process during which the NFC facility systems and equipment start functioning and are checked for their compliance with the design. The process includes pre-startup and aligning operations, integrated trial of systems and components, pilot industrial operation; it ends up with the NFC facility acceptance for commercial operation.

NFC facility decommissioning shall mean the activity carried out after termination of the NFC facility operation which excludes its use for the design purpose and is aimed at ensuring safety of employees (personnel), population and the environment up to exemption from radiation safety standards.

NFC facility operation with deviations shall mean the operation of a NFC facility with violation of operating limits and conditions but without a violation of safe operation limits and conditions.

NFC facility safe operation limits shall mean the process parameters boundary values set in the design which, if are deviated from, may lead to an accident.

Normal operation controlling systems shall mean the systems intended for providing for and carrying out, via designated process trains and at established criteria and within established constraints, the control over the process equipment of normal operation systems.

Normal operation of NFC facility shall mean the operation of the NFC facility in compliance with operating limits and conditions established in the design.

Normal operation systems (components) shall mean the systems (components) intended for normal operation.

Nuclear accident shall mean the accident caused by the uncontrolled self-sustained chain nuclear fission reaction.

Nuclear fissile material (substance) shall mean the material (substance) containing fissile nuclides (substance) – NFM (N), which, while in use, may initiate SCR.

Nuclear hazardous area shall mean the production area of a NFC facility containing NFM (S) where the absorbed dose of prompt mixed neutron and gamma-radiation due to SCR with the nuclear fission number of 10^{18} may exceed 0.1 Gy.

Nuclear hazardous bay shall mean the section of a NFC facility (shop, bay, unit, division, laboratory, storage area) or production premises where NFM (S, N) is handled: plutonium, uranium-233, uranium 235 enriched to greater than 1% (mass), or any combination of plutonium isotopes, and uranium-233, uranium-235 nuclides present in the section at any point of time that exceeds 300 grams. A nuclear hazardous bay includes all production premises of the section and separate buildings of the section which contain or may contain NFM (S, N).

The bay where work with NFM (S, N) in amounts exceeding 300 grams is carried out may be taken out of the list of nuclear hazardous sections of a NFC facility on the basis of nuclear safety analysis (Nuclear Safety Statement).

Nuclear hazardous fissile nuclide – NFM (N) **-** shall mean the nuclide which presence in the material does not exclude SCR while handling this material.

Nuclear safety parameters shall mean physical and geometrical values (parameters), which are imposed with limits aimed at nuclear safety ensurance.

Operation of NFC facility shall mean the activity aimed at safe achievement of the goals the NFC facility is intended for.

Operational event shall mean the violation in operations of a NFC facility associated with a departure from the specified operating limits and conditions. This situation may involve violation of other design-specified limits and conditions including the safe operation limits.

Operational limits shall mean the boundary values of parameters and characteristics of NFC systems (components) and NFC facilities as specified in the design for normal operation.

Passive system (component) shall mean the system (component), which functioning is connected only with the event that triggered it and does not depend on operation of the other (active) system (component), for example, a controlling system, power supply source, etc. According to design features the passive systems (components) are divided into passive systems (components) with mechanical moving parts (for example, check valves) and passive systems (components) without mechanical moving parts (for example, pipelines, vessels).

Physical barrier shall mean the obstacle on the propagation path of ionizing radiation, nuclear material, and radioactive substance.

Physical protection of NFC facility shall mean the engineering and organizational measures aimed at providing security of nuclear materials, radioactive substances and radioactive waste kept at a NFC facility, preventing an unauthorized access to the NFC facility site and preventing an unauthorized access to nuclear materials and radioactive substances, timely detecting and preventing acts of sabotage and terrorism that may jeopardize NFC facility safety and security.

Pilot operation of NFC facility shall mean the stage of a NFC facility commissioning which starts after the start-up and alignment operations and integrated trial of systems (components) have been completed (including the first loading of nuclear fissile materials) and ends up with the acceptance of the NFC facility for commercial operation.

Population Evacuation Planning Zone shall mean the area around a NFC facility exposure where in the event of a beyond design basis accident the anticipated radiation impact to critical groups of the population may approach or exceed dose criteria set for the mandatory evacuation of the population as prescribed by the radiation safety standards, and within which the population evacuation measures are planned for.

Pre-emergency situation shall mean the state of a NFC facility, which is characterized by violation of safe operation limits and conditions and not developed in an accident.

Principle of diversity shall mean the principle of systems' reliability improvement by using in different systems (or within one system in its different channels) of diverse means and/or similar means (but based on different principles of action) to perform the designated function.

Principle of independence shall mean the principle of systems' reliability improvement by functional and/or physical separation of channels (components) when failure of one channel (component) does not lead to failure of other channel (component).

Principle of redundancy shall mean the principle of systems' reliability improvement by using structural, functional, information and time redundancy with regard to the scope that is minimum required and sufficient for the system to perform the designated functions.

Process blowing shall mean steam and gas mixtures, gaseous and/or aerosol substances removed from the process equipment.

Protective measures planning zone shall mean the area around a NFC facility where in the event of beyond design basis accidents at the NFC facility a radiation impact is possible in excess of the dose criteria set forth by the radiation safety standards and within which the organizational, engineering and technical, and medical measures to protect the population are planned for.

Protective safety systems (components) shall mean the systems (components) intended to prevent or limit the damage of physical barriers, equipment and pipelines containing radioactive substances, nuclear materials and (or) radioactive waste.

Qualification of employees (personnel) shall mean the level of aptness of individuals of the NFC facility employees (personnel), including special education, professional background, knowledge and skills as well as working experience, which ensure quality and safety of the NFC facility operation when they fulfill their official duties.

Quality assurance shall mean the planned and systematic activity aimed at ensuring that all work associating with siting, design, construction, commissioning, operation and decommissioning or closure of a NFC facility as well as design and manufacture of related systems (components) and equipment is done properly and its results meet the requirements set forth for them.

Safe equipment ("B" type equipment) shall mean the equipment, which design and geometry features exclude SCR initiation under normal operation and any initiating events considered in the NFC design.

Safe operation conditions shall mean the conditions specified in the design as regards quantity, performance characteristics, availability and maintenance conditions of safety important systems (components). Compliance with such conditions ensures that the safe operation limits and (or) safety criteria are not violated.

Safety criteria shall mean the values of parameters and (or) characteristics of a NFC facility, as established by federal standards and rules, other regulatory documents and (or) federal safety regulatory authorities in the field of use of atomic energy.

Safety culture shall mean the competence-related and psychological aptness of all individuals where safety ensurance at a NFC facility is understood as the priority target and inherent necessity that leads to realization of personal responsibility and self-questioning attitude when performing all safety-relevant operations.

Safety function shall mean the specific target and the actions aimed at achieving it and at preventing accidents or mitigating their consequences.

Safety important systems (components) shall mean the safety systems (components), as well as the normal operation systems (components), which failures disrupt normal operation of a NFC facility or prevent eliminating

deviations from normal operation and may lead to design basis and beyond design basis accidents.

Safety of NFC facility shall mean the capability of a NFC facility under normal operation conditions and operational events, including accidents, to confine radiation and other possible impacts to the employees (personnel), population and environment within the established limits and prevent self-sustained chain nuclear fission reaction (hereinafter - SCR) during handling of nuclear materials.

Safety systems (components) shall mean the systems (components) designed to perform safety functions. According to the designated functions the safety systems (components) are divided into protective, confining, supporting and controlling ones.

SCR emergency alarm system (EAS SCR) shall mean the combination of engineered features designed to detect the self-sustained chain fission reaction and generate emergency signals of the necessity to evacuate employees (personnel) from the nuclear hazardous section.

Single failure principle shall mean the principle according to which a safety system must perform the designated functions in the presence of any initiating event that require its operation and in the presence of an independent, form the initiating event, failure of one of any active components or passive components having mechanical moving parts.

Single failure shall mean the failure of one system's component.

Note:

1. A common cause failure may be triggered by a single failure, error of an employee (personnel), internal or external impact, design and technological features etc.

2. Internal impacts are the impacts triggered by accident initiating events, including shock waves, jets, projectiles, changes in the environs' parameters (pressure, temperature, etc.), fires, explosions, floods etc.

3. A particular case of the common cause failure is a dependent failure that is a system (component) failure resulted from other failure or event.

Supporting safety systems (components) shall mean the systems (components) intended for supplying safety systems with power, working medium and creating conditions for the functioning thereof.

Surveillance zone shall mean the territory outside the controlled area of a NFC facility, which is subject to radiation monitoring.

System shall mean the combination of components intended for performing the designated functions.

Threshold accumulation shall mean the mass of NFM (S, N) which is permitted to accumulate in the auxiliary equipment (filters, lines, traps, etc.) where NFM (S, N) should not be loaded in accordance with the process but may ingress during operation of this equipment.

Threshold concentration shall mean the mass concentration of NFM (S, N) at which NFM (S, N) is permitted to process in the equipment as well as store or transport in packages.

Threshold fill shall mean the mass of NFM (S, N) which is permitted to accumulate in the process equipment in excess of the established limits on threshold load, threshold concentration, due to retained amounts, precipitation, deposition on equipment surfaces.

Threshold load (**complete set**) shall mean the mass of NFM which is permitted to load into the equipment, individual vessel, packaging, etc.

Unsafe equipment ("O" type equipment) shall mean the equipment, which does not meet requirements of the definition "Safe equipment ("O" type equipment).

2. PURPOSE AND SCOPE

2.1. This document "General Safety Provisions for Nuclear Fuel Cycle Facilities" (hereinafter referred to as "GSP NFCF") establishes nuclear and radiation safety goal, criteria, principles and general requirements for NFC facilities.

2.2. The GSP NFCF covers NFC facilities which are under design, construction, operation and decommissioning (RWDF, LRW UDS being closed).

2.3. The volume and completeness of implementation of safety criteria, principles and requirements for a specific NFC facility shall comply with the federal standards and rules in the field of use of atomic energy (hereinafter referred to as the federal standards and rules) and other regulatory documents which application to a specific NFC facility shall be justified in the NFC facility design and safety analysis report (hereinafter referred to as SAR).

Given the regulatory documents are unavailable, specific technical solutions regarding implementation of the safety criteria, principles and requirements shall be justified and established in the design of a NFC facility (hereinafter referred to as "the design"[2]) in accordance with the achieved level of science and technology.

2.4. Timeframes and scope of activity to bring NFC facilities in compliance with the GSP NFCF shall be determined on the case-by-case basis in accordance with the procedure established by the license conditions for NFC-related activities.

3. NUCLEAR FUEL CYCLE FACILITIES' SAFETY GOALS, CRITERIA, PRINCIPLES AND GENERAL REQUIREMENTS

3.1. The main goal of NFC facilities safety ensurance shall be protection of employees (personnel), population and environment against its radiation impact.

3.2. A NFC facility shall be considered as meeting the safety requirements if in normal operation and operational events, including design basis accidents, its radiation impact to the employees (personnel), population and environment does not exceed the established exposure dose limits for the employees (personnel) and population and standards set for releases and discharges of radioactive substances, radioactive substance contents in the environment in excess of the established standards, as well as if these impacts are limited in case of beyond design basis accidents.

3.3. Permissible exposure dose levels for the employees (personnel) and population, permissible releases and discharges of radioactive substances from a NFC facility and content of radioactive substances in the NFC facility surrounding environs shall be established for the NFC facility normal operation, operational events and design basis accidents at this NFC facility in accordance with the radiation safety standards and other regulatory documents. The effective exposure doses to the employees (personnel) and population shall be lower than the established limits.

3.4. The radiation safety principles shall be:

● the avoidance of exceeding the permissible limits of individual exposure doses to the population from all ionizing radiation sources (the principle of dose reduction);

● the prohibition of all activities related to the use of ionizing radiation sources, where benefits for man and society does not exceed the risk of possible harm due to exposure additional to the background radiation (the principle of justification);

● the maintaining as low as reasonably achievable, taking into account economic and social factors, the individual exposure doses and the number of exposed individuals while using any source of ionizing radiation (the principle of optimization).

3.5. The nuclear safety principles shall be:

- prevention of SCR initiation;
- minimizing SCR consequences if it had occurred;
- prevention of uncontrolled and unauthorized processing, accumulation, movement, transfer, and transport operations with nuclear fissile materials.

3.6. The SCR prevention at a NFC facility shall be ensured mainly by the intrinsic safety features of the NFC facility's systems (components). Should it be impossible, the engineering and organizational measures aimed at SCR prevention are to be carried out both under normal operation and any initiating event considered in the design.

For cases featuring more than one initiating event there shall be measures provided aiming at minimizing consequences of the nuclear accident.

3.7. The NFC facility safety shall be ensured through gradual implementation of the defense-in-depth concept, which is based on the application of a system of physical barriers set on the propagation path of ionizing radiation, nuclear materials, and radioactive substances into the environment as well as a system of technical and organizational measures to protect the physical barriers and maintain their efficiency along with protection of the employees (personnel), population and environment.

3.8. The NFC facilities shall have a system of physical barriers preventing propagation of ionizing radiation, nuclear materials and radioactive substances into the environment.

A number, purpose and reliability of physical barriers at a NFC facility shall be determined and justified in the design.

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[2]1 In this document the NFC design shall be understood as a package of design documentation, engineering documentation, and working documentation related to a NFC facility construction.

In normal operation all physical barriers shall be workable and their protective measures shall be in a state of preparedness. If it is revealed that any of the physical barriers is out of order or its protective measures are not in place, the NFC facility shall be brought into the safe state as provided for in the design.

3.9. The system of technical and organizational measures shall form the following main defense-in-depth levels.

Level 1 (NFC facility siting conditions and prevention of violations of normal operation):

● assessment and selection of the construction site suitable for the NFC facility deployment;

● determining of the controlled area as well as the surveillance zone around the NFC facility;

● development of the design basing on the conservative approach and with the use of intrinsic safety features of systems and components;

● assurance of the required quality of the NFC facility systems (components) and operations being performed;

● operation of a NFC facility in accordance with requirements of federal standards and rules, other regulatory documents and operating instructions;

● maintaining in orderly conditions the safety important systems (components) through timely detection of defects, prophylaxis, replacement of equipment exhausted its service life, and arrangements for an efficient system for documenting the work and inspection results;

● recruitment of employees (personnel) and provisions for them to acquire the qualification level necessary to perform actions in normal operation and operational events including pre-emergency situations and accidents;

● building and maintaining the safety culture.

Level 2 (Prevention of design basis accidents by normal operation systems):

● detection of deviations from normal operation and their elimination;

● control of operation when deviations occur.

Level 3 (Prevention of beyond design basis accidents by safety systems):

● prevention of the initiating events evolution to design basis accidents and the latter into beyond design basis accidents while it is ensured that the safety systems perform as designed;

● mitigation of consequences of accidents, which were not prevented by confining the released radioactive substances and by other methods.

Level 4 (Beyond design basis accident management):

● prevention of beyond design basis accidents development and mitigation of their consequences;

● bringing the NFC facility into the controlled state where chain fission reaction terminates and it is ensured that nuclear materials and radioactive substances are confined within the established boundaries.

Level 5 (Emergency planning):

● preparation and implementation (if necessary) of emergency action plans at the NFC facility and beyond its site boundaries.

3.10. The defense-in-depth concept shall be implemented at all stages of the NFC facility life cycle. In doing so, the strategy of prevention of unfavorable events, especially Level 1 and 2, shall be of priority.

3.11. Technical and organizational solutions being taken to ensure safety of the NFC facility shall be proved by the previous experience or tests, research, experience in operating prototypes, and shall comply with the regulatory document requirements. Such approach shall be applied during design of the NFC facility, design and development of equipment, construction, operation and decommissioning of the NFC facility, its upgrading and modernization of its systems (components).

3.12. The system of engineered features and organizational measures to ensure the NFC facility safety shall be described and justified in SAR NFCF. The latter is to be developed by the Operating Organization or the enterprise declared its intention to built and operate a NFC facility.

Any discrepancies between the SAR NFCF information and the design, as well as those occurred during its implementation are not permitted. The Operating Organization shall ensure that the SAR NFCF corresponds with the actual state of the facility during its entire period of operation.

The SAR NFCF shall contain results of NFC facility safety analyses including lists of initiating events for design basis accidents and a list of beyond design basis accidents, results of deterministic and probabilistic safety analyses as well as a reference shall be made to methodologies and computer codes used to justify the NFC facility safety. The computer codes used to justify the NFC facility safety shall be qualified in accordance with the established procedure.

Requirements for SAR NFCF and its contents are established by the federal standards and rules and other regulatory documents.

3.13. The Operating Organization shall ensure safe management of liquid, solid and gaseous radioactive waste including:

- RW timely reprocessing and conditioning;
- prevention of unplanned RW accumulation;
- limitation of RW generation to as minimum as practically achievable level;

- establishing standards for liquid and solid RW generation and periodic review thereof on the basis of good practices in the field of RW management;
- prevention of RW unconditioned storage not provided for in the design and operating documentation;
- prevention of uncontrolled discharges of radioactive substances into water areas, water-bearing horizons, pits, wells, cracks, on the earth surface as well as to sewage systems and storm sewage;
- prevention of radionuclide release (discharge) in excess of maximum permissible values.

3.14. The Operating Organization shall develop and implement a NFC facility's overall quality assurance program and shall control quality assurance of the activities of organizations performing work and (or) rendering services to operating organizations (survey, design, engineering, research, construction, assembling organizations, equipment-manufacturing enterprises, etc.).

Organizations, which perform work and render services to the Operating Organization, shall develop, in the framework of the overall quality assurance program, their own local quality assurance programs covering respective activities.

3.15. The building and maintaining safety culture in the Operating Organization and in the organizations performing work and (or) rendering services to operating organization shall be the prerequisites of the NFC facility safety ensurance.

The basic measures to build safety culture shall be as follows:

● identifying by the Operating Organization the safety policy adopted at NFC facilities and organizations performing work and (or) rendering services to operating organizations, which facilitates forming the working environment and conditions for the implementation of safety-related activities by the individuals, which shall expressively manifest organization’s goals and adherence to the objectives of NFC facility safety ensurance;

● establishing at the NFC facility and organizations performing work and rendering services to the Operating Organization the clear boundaries between structural units in accordance with responsibilities and authorities as regards carrying out the safety-relevant activities;

● identifying necessary resources (energy, manpower, finance, etc.) required to ensure safety;

● arranging for a systematic inspection and control over the activities the NFC facility safety depends upon; studying and implementing the NFC facility safe operation experience.

3.16. To build safety culture the Operating Organization shall:

● determine and formalize authorities and responsibilities of the employees;

● maintain strong discipline along with clear personal responsibility shared among the management and staff, mandatory and precise performance of the works affecting safety, strict compliance with operating procedures and periodic review thereof considering the experience gained;

● ensure availability of adequate resources to implement safety measures;

● provide for required recruiting and training of employees performing safety-related operations in every area of activities to make them competent and skilled;

● create a system of incentives to motivate implementation of advanced safety ensurance practices and a system of penalties for safety violations;

● learn from the lessons based on erroneous solutions and errors of employees (personnel);

● develop a system of control measures and objective judgment regarding procedures and practices of implementing the safety ensurance measures, control of documentation and quality assurance system including the analysis of events related to safety violations and causes thereof.

3.17 All persons involved in safety ensurance at a NFC facility at all its life stages shall be fully aware of the nature and extent to which their activity affects safety and of the consequences, which may be incurred due to a failure to follow or unduly following of the requirements of federal standards and rules, other regulatory documents and operating documentation.

3.18 The Operating Organization shall ensure safety of a NFC facility also by developing measures to prevent accidents and mitigate their consequences; measures for physical protection, control and accounting of nuclear materials, radioactive substances and radioactive waste; for radiation monitoring of the environment in the controlled area and surveillance zone; and it shall guarantee that it uses the NFC facility only for the purposes the facility is intended for according to the design.

The Operating Organization shall ensure technical safety in operation of pressure vessels, pipelines, lifting and transport equipment, electrical equipment, complex technical hardware, and during electric installation and construction and assembling operations.

4. NUCLEAR FUEL CYCLE FACILITY SYSTEMS AND COMPONENTS CLASSIFICATION

4.1. Systems and components of the NFC facility are distinguished according to:

- their purpose;
- safety relevance;
- nature of functions they perform.

4.2. Systems and components of the NFC facility are divided, in terms of purpose, into:
- normal operation systems and components;
- safety systems and components.

4.3. Systems and components of the NFC facility are divided, in terms of safety relevance, into:
- safety important;
- not important for safety.

4.4. Safety systems and components of a NFC facility are divided, in terms of nature of safety functions they perform, into:
- protecting***;***
- confining;
- supporting;
- controlling.

4.5. The NFC facility components are categorized to differentiate between the reliability and safety requirements they are subject to.

4.6. In terms of the NFC facility's components safety impact, four safety classes are established.

Safety Class 1. Safety Class 1 includes the components which failures can become initiating events of beyond design basis accidents leading to exposure of employees (personnel) and (or) population, release (discharge) of radioactive substances to the environment which overrides the limits established for design basis accidents.

Safety Class 2. Safety Class 2 includes components which failures can be initiating events leading to design basis accidents.

Safety Class 3. Safety Class 3 includes components:
- of safety important systems not attributed to Safety Classes 1 and 2 but important for safety;
- which contain radioactive and (or) toxic substances, which ingress into the premises and (or) the environment in the event of failures of such components may lead to an excess of levels established in accordance with the regulatory documents;
- which perform monitoring functions of radiation protection of the employees (personnel) and population.

Safety Class 4. Safety Class 4 includes the NFC facility normal operation components, which do not affect safety and are not attributed to Safety Classes 1, 2 or 3.

Components used for accident management, which are not included in Safety Classes 1, 2 or 3, also pertain to Safety Class 4.

4.7. If any component at the same time contains features of different classes, it shall be attributed to a higher safety class. Sections, which separate components pertaining to different safety classes, shall be attributed to a higher safety class.

4.8. Safety classes of the components of the NFC facility under design, construction, upgrading and refurbishment shall be assigned in the design. Safety classes of the components of the NFC facility being in operation shall be established following the procedure determined by the Operating Organization.

A safety class shall be the mandatory feature for other types of categorization of the NFC facility components as established in the regulations, including when the quality requirements for the NFC facility components are established, for instance, for those attributed to Safety Classes 1, 2 and 3.

Requirements for the NFC facility components attributed to Safety Classes 1, 2 and 3 shall be established in the regulations. At this, a higher safety class shall involve higher quality and quality assurance requirements provided for in the said documents.

4.9. The documentation for design, manufacturing and supply of the NFC facility components shall indicate what safety class (1, 2 or 3) the equipment belongs to and what regulatory requirements it is covered by.

4.10. The components attributed to Safety Class 4 shall be covered by requirements of general industrial regulations.

4.11. A classification code shall indicate the safety class 1, 2 or 3 of the component.

The classification code may be added with a following character to show the purpose of a component and nature of functions it performs:

N – normal operation component;
P – protecting component;
C – confining component;
S – supporting components;

Ct – controlling component.

If a component has several purposes and (or) performs several functions, all of them shall be reflected in its code.

Examples of classification codes: 3N, 2C, 2NCt.

5. NUCLEAR FUEL CYCLE FACILITY SITING

5.1. Population safety and environmental protection shall be ensured by application of engineered features and implementation of organizational measures, including selection of the NFC facility location region and site, which meet the requirements of federal standards and rules and other regulatory documents.

5.2. The region and site of newly constructed NFC facilities shall meet the requirements of federal standards and rules. For existing NFC facilities, when sited with deviations from the requirements established by federal standards and rules, technical and (or) organizational measures shall be developed and implemented to compensate for such deviations.

5.3. While selecting the NFC facility location region, all phenomena, processes and factors of natural and man-induced origin, which are characteristic of the location region, shall be studied in accordance with the requirements of federal standards and rules and other regulatory documents.

5.4. While selecting the site to deploy a NFC facility, the site features, which may affect the NFC facility safety as well as the NFC facility impact to the population and environment, shall be studied and assessed.

5.5. The site shall be considered suitable for a NFC facility deployment if there is the possibility to ensure its safe operation taking account of natural and man-induced phenomena, processes and factors.

5.6. The NFC facility site suitability assessment shall consider the following aspects:

- impact to the NFC facility from natural and man-induced phenomena, processes and factors characteristic of the site location region;
- the NFC facility impact to other on-site NFC facilities;
- the NFC facility impact to the employees (personnel), population and environment;
- on-site NFC facilities' impact to the NFC facility;
- capabilities of safe NFC facility on-site and off-site transport of nuclear materials, radioactive substances and radioactive waste;
- other factors affecting NFC facility safety.

5.7. The site characteristics shall be monitored during the whole period of the NFC facility operation in accordance with the requirements of federal standards and rules and other regulatory documents.

5.8. For the NFC facility the controlled area, surveillance zone and protective measure planning area shall be established depending on its potential radiation hazard category[3] and in accordance with the requirements of federal standards and rules and other regulatory documents.

6. SAFETY REQUIREMENTS IMPLEMENTED DURING NUCLEAR FUEL CYCLE FACILITIES DESIGN

6.1 GENERAL REQUIREMENTS

6.1.1. Requirements of this section shall cover newly designed, constructed, refurbished and upgraded NFC facilities.

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[3] The Basic Sanitary Rules of Radiation Safety classify radiation facilities into four categories depending on facility potential radiation hazard to population in case of an accident:

Radiation facilities are referred to Category I if during an accident the radiation impact thereof to the population is possible and protective measures may be required.

Radiation facilities are referred to Category II if in case of an accident the radiation impact thereof is limited to the controlled area.

Radiation facilities are referred to Category III if in the event of an accident the radiation impact thereof is limited to the facility territory.

Radiation facilities are referred to Category IV if under an accident the radiation impact thereof is limited to the premises where radiation sources are handled.

6.1.2. A NFC facility, its systems (components), including safety important ones, shall be designed in accordance with principles, criteria and requirements of GSP NFCF and other regulatory documents.

6.1.3. The design shall determine engineered features and organizational measures aimed at preventing violations of operational limits and conditions, protection of physical barriers and efficiency thereof as well as measures to protect the employees (personnel), population and the environment.

6.1.4. The design shall include safe operation limits and conditions of the NFC facility. The design shall provide for engineered features and organizational measures aimed at preventing:

- violations of safe operation limits and conditions;
- design basis accidents and mitigating of their consequences.

The design shall provide for engineered features and (or) organizational measures to limit possible consequences of beyond design basis accidents if they are not excluded by intrinsic safety features of the NFC facility and (or) systems (components) thereof or intrinsic safety features of the NFC facility and (or) its systems (components).

6.1.5. The design shall contain the results of deterministic and probabilistic safety analyses.

6.1.6. Lists of initiating events for design basis accidents and a list of beyond design basis accidents shall be established in the NFC facility design.

The NFC facility design shall contain a realistic analysis of beyond design basis accidents with assessment of consequences thereof as well as the analysis of safety systems functioning.

6.1.7. Measures to protect the employees (personnel) and population in the event of accidents at NFC facility shall be determined basing on the analysis of consequences of beyond design basis accident presented in the design.

For beyond design basis accidents, the hazard of radiation impact to the employees (personnel), population and environment shall be reduced through the implementation of action plans to protect the employees (personnel) and population. A procedure for the plan development and approval is established by the federal standards and rules and other regulatory documents.

6.1.8. To exclude the necessity of evacuation of the population beyond the protective measures planning zone boundaries, established in accordance with the federal standards and rules and other regulatory documents, one shall seek to achieve that the probability of beyond design basis accidents at the NFC facility, which lead to exceeding the levels established in accordance with the radiation safety standards set for taking immediate decisions regarding evacuation of the population, would not exceed 10^{-6} per year.

Should the probability of such beyond design basis accidents at the NFC facility exceed 10^{-6} per year, the design shall provide for accident management technical solutions to mitigate their consequences.

6.1.9. Safety important systems shall be capable of performing the designated functions as established in the design taking account of natural and man-induced external impacts that are characteristic of the site chosen for the NFC facility deployment, and (or) under possible mechanical, thermal, chemical and other impacts resulted from design basis accidents.

6.1.10. While designing the NFC facility, the measures to prevent or protect safety important systems (components) against common cause failures shall be considered and justified.

6.1.11. While designing the NFC facility safety important systems (components), the preference shall be given to the components, which functioning is based on passive principles and intrinsic safety features.

6.1.12. The design shall provide for engineered features and organizational measures aimed at preventing single errors of the employees (personnel) and (or) mitigating their consequences.

6.1.13. The design shall provide for tools and devices, as well as programs and methodologies, for checking performance of systems (components) and testing safety important systems (components) for their compliance with the design indicators.

6.1.14. The design shall contain data on reliability indicators of the safety important systems and their components attributed to Safety Classes 1 and 2.

6.1.15. The design shall establish and justify the NFC facility service life duration. While designing the NFC facility buildings and structures, systems (components) the processes (corrosion, erosion, creep, fatigue and aging (wear), etc.) causing degradation of structural materials' characteristics shall be taken into account.

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6.1.16. The design shall determine techniques and means of prevention of operational events in the NFC facility systems including techniques and means for monitoring of:

● whether the thresholds for load, concentration, fill and accumulation of nuclear material are met;
● content of flammable gases and vapors of flammable liquids in the equipment, pipelines and premises;
● thermal engineering parameters (temperature, pressure, etc.) of the equipment and pipelines;
● composition of process products.

6.1.17. The design shall provide for the engineered features and organizational measures to ensure fire and explosion safety of the NFC facility, which consider its specifics as a possible source of radiation impact to the employees (personnel), population and environment and which are aimed at protecting the employees (personnel), buildings, structures and equipment from hazardous fire and explosion factors.

6.1.18. In the design there shall be an assessment of the NFC facility fire hazard and a categorization of rooms, buildings and structures of the NFC facility in terms of fire and explosion hazard done in accordance with the requirements of federal standards and rules and other regulatory documents.

The design shall provide for a list of rooms having automated fire extinguishing systems.

6.1.19. The safety important systems (components) shall be designed in accordance with the requirements of fire and explosion safety regulations.

6.1.20. The design shall provide for safe management of radioactive waste generated at the NFC facility. It shall describe techniques and means to limit generation of radioactive waste as minimum as practicably achievable.

The design shall describe:
● techniques and means for collecting, processing, conditioning and storing of radioactive waste;
● means for clean-up of gases from radioactive substances before they are released into the atmosphere;
● means for clean-up of solutions from radioactive substances before they are discharged in natural and artificial water reservoirs;
● means for transporting radioactive waste on the NFC facility site and to its disposal sites.

The design shall contain an analysis of composition and quantities of radioactive waste being generated during normal operation of the NFC facility as well as an assessment of composition and quantity of radioactive waste resulted from design basis accidents.

Safety principles, criteria and requirements for the NFC facility radioactive waste management are established in the federal standards and rules and other regulatory documents.

6.1.21. A system of engineered features and organizational measures to ensure NFC facility safety shall be presented and justified in a separate section of the NFC facility design.

6.1.22. An emergency center (centers) furnished with the necessary equipment, instrumentation and means of communication shall be provided for in the design of NFC facilities of Category I and II to manage the implementation of plans of measures to protect the employees (personnel) and population in the event of an accident.

6.1.23. The NFC facility design shall provide for:
- physical protection of the NFC facility, nuclear materials, radioactive substances and radioactive waste;
- control and accounting system for nuclear material, radioactive substances and radioactive waste.

6.1.24. The design shall determine an organizational structure and number of the employees (personnel) of the structural units involved in NFC facility safe operation and control of the NFC facility safety.

6.2 NUCLEAR SAFETY

6.2.1. The design shall provide for technical and organizational measures to prevent initiation of SCR and limit its possible consequences.

While selecting design solutions, the use of equipment, which design and geometry features exclude a possibility of SCR initiation, shall be primarily considered.

6.2.2. To ensure nuclear safety the design shall provide for:
● the use of safe equipment. Where it is impossible or unreasonable the HMC type equipment shall be used. The “O” type equipment may be used only when it is impossible to use “B” and HMC type equipment due to the lack of its operable structures and due to features of the technology in use. The use of “O” type equipment shall be justified in the design;
● the use of unsafe equipment of “O” and HMC types only in combination with limitations imposed on nuclear safety parameters, monitoring of these limitations, and in combination with interlocks, if necessary;

● monitoring of NFM (S) parameters using automatic and (or) analytical means before NFM (S) is transferred from safe equipment into unsafe one;

● exclusion of a possibility for a hazardous quantity of the hydrogen-containing substance to ingress into the equipment and room where such quantity of the above substance shall not be present in accordance with the requirements of regulatory documents;

● exclusion (by design or primarily by engineered means) of NFM (S, N) hazardous quantities' ingress into the unsafe auxiliary equipment and service lines;

● exclusion or maximum possible limitation of the employees (personnel) presence in the nuclear hazardous areas through introducing automation and mechanization of the processes, relevant locations of equipment, working places, NFM (S) storage places, the use of radiation shielding and other types of protection.

6.2.3. SCR shall be prevented through the implementation of one or several the following measures, or their combination:

● limitations imposed on geometry and sizes of the equipment;

● limitations imposed on mass of NFM (S), their isotopic composition and concentration;

● use of homogeneous and heterogeneous neutron absorbers;

● limitations imposed on mass fractions of neutron moderators in NFM (S);

● limitations imposed on neutron reflectors and locations of the equipment;

In normal operation, the effective multiplication factor (hereinafter referred to as K_{eff}) shall not exceed 0.95; margin coefficients shall not be less 2.1 in terms of mass, not less than 1.3 in terms of concentration and volume, not less than 1.1 in terms of cylinder diameter and layer thickness. In the event of any initiating event considered in the design, K_{eff} shall not exceed 0.98 or the margin coefficient shall not be less than 1.05; this shall be justified by a calculation or established through an experiment.

6.2.4. The design shall provide for monitoring of all limitations imposed on NFM (S) parameters, equipment, NFM (S) equipment and package arrangements.

6.2.5. In case of processes where SCR is possible the design shall provide for monitoring of nuclear safety parameters.

6.2.6. Techniques and means of measuring the values imposed with the nuclear safety limitations shall meet the requirements of regulatory documents. In case of a failure of means of monitoring of the parameters imposed with the nuclear safety limitations, as well as in case of actuator failures (valves, etc.), which ensure that the imposed limitations are followed, the process and related operations shall be immediately terminated or a sufficient amount of additional means of monitoring and performing shall be introduced until the above features regain workability.

6.2.7. The design shall provide for equipping nuclear hazardous sections of the NFC facility with SCR EAS in accordance with the regulatory document requirements.

The self-sustained chain nuclear fission reaction emergency alarm system shall be continuously available for SCR detection. A waiver to use SCR initiation EAS shall be presented in the design and justified in NFCF SAR.

6.2.8. The following nuclear safety ensurance information shall be present in the design:

● a list of premises, installations, and storages where NFM (S, N) may be present;

● a description of process operations as regards NFM (S) processing and transfer along with indication of the aggregate state; density; isotopic, nuclide, and chemical compositions of fissile materials; presence and composition of moderators, reflectors, neutron absorbers etc.;

● a list of equipment where NFM (S) is loaded or may ingress into including packagings along with indication of type of equipment (B, HMC, O), safe (permissible) parameters and standards of nuclear safety, and standard values' measurement errors;

● a list of:

- equipment where NFM (S) is loaded or may ingress into along with indication of type of equipment (B, HMC, O), safe (permissible) parameters and standards of nuclear safety, and standard values' measurement errors;
- chambers, enclosures, exhaust hoods where NFM (S) is handled for which nuclear safety limitations are established;
- NFM (S) packagings;

● a description and justification of selected techniques and means of monitoring of parameters and limitations as regards nuclear safety;

● a description of fire extinguishing equipment;

● a list of considered initiating events which may lead to an excess in safe (permissible) parameters, initiation of SCR;

● results of analysis of consequences of the considered initiating events which may lead to an excess in safe (permissible) parameters, initiation of SCR for each equipment item;

● a description of the SCR emergency alarm system;

● an assessment of consequences of SCR initiation in the equipment and measures to limit these consequences.

6.3 RADIATION SAFETY

6.3.1. The design solutions as to operational modes and process hardware shall provide for minimizing a possible impact from ionizing radiation through application of radiation protection techniques and means, remote controls and automation of processes.

6.3.2. The design and layout of equipment and pipelines, process hardware and radiation protection shall ensure minimal, according to the dose reduction principle, exposure of the employees and their contact with radioactive and toxic substances during process operations and servicing the equipment.

6.3.3. The design shall provide for radiation monitoring in the NFC facility premises, on its site, in the controlled area, and surveillance zone.

The radiation monitoring scope, techniques and equipment shall ensure control over the employees (personnel) exposure, timely detection of changes in the radiation situation and analysis of changes of the radiation situation in all NFC facility operational modes, including accidents.

The scope of radiation monitoring in the controlled area shall provide for obtaining the information about the radiation situation parameters in normal operation of the NFC facility and in radiation accident conditions, as well as about exposure doses to Group B personnel in normal operation of the NFC facility.

The scope of radiation monitoring in the surveillance zone shall provide for obtaining the information about the radiation situation parameters in normal operation of the NFC facility and in radiation accident conditions, including information about population exposure.

6.3.4. The design shall provide for radiation monitoring of the employees (personnel) in the sanitary airlocks, at the boundaries of premises where different class operations with unsealed ionizing radiation sources are carried out, in personnel airlocks and at the NFC facility boundaries.

For vehicles the dosimetry monitoring posts and, if necessary, vehicle decontamination facilities shall be arranged for at the exits from the NFC facility site.

6.3.5. The design shall provide for engineered features and organizational measures to protect the employees (personnel) from radiation consequences of SCR, including:

● automation and mechanization of processes where SCR initiation is possible;
● remotness of working places from sections and equipment where SCR initiation is not excluded;
● application of absorbing shields and protection features;
● application of post-accident radiation situation monitoring equipment;
● establishing emergency posts for the employees (personnel) to gather and for control over accident consequences elimination measures.

If the equipment and working places are located in the nuclear hazardous areas the design shall provide for the possibility of unobstacled evacuation of the employees (personnel) in the event of SCR.

6.3.6. The design shall provide for availability of systems for continuous and periodic monitoring of radioactive and toxic substance contents in the air of the NFC facility rooms.

6.3.7. The design shall provide for a set of technical means and organizational measures to limit ingress of radionuclides into rooms, to prevent contamination of air and working premises, skin and overalls of employees (personnel) as well as the environment in normal operation of the NFC facility, in the event of design basis accidents and in eliminating consequences of these accidents.

6.3.8. Process operations with nuclear materials and radioactive substances in chambers and boxes shall be performed using remote devices or sealed gloves.

6.3.9. The design shall provide for the ventilation systems (general, local, repair, emergency etc.) which prevent contamination of room air and the environment with radioactive substances and maintain the climatic conditions required for normal operation of the equipment and work of the employees (personnel).

The ventilation shall ensure compliance with radiation safety standards and other regulatory documents setting forth the requirements for air cleanness and quality under all operational modes of the NFC facility as well as minimization of radionuclide and other adverse substance releases into the environment.

A composition of ventilation systems required to ensure safety of the employees (personnel) and population shall be specified in the design.

6.3.10. The design shall provide for the separated ventilation of unattended premises intended for housing systems (components) representing the main sources of radiation and radioactive contamination; of periodically attended premises intended for repairs of equipment; and of premises of permanent presence of the employees (personnel) (control rooms, etc.).

6.3.11. The NFC facility ventilation system shall direct air flows from less contaminated rooms to more contaminated ones. The use of an air recirculation system without clean-up of radioactive and toxic substances is prohibited.

6.3.12. The contaminated air being removed from shelters, chambers, boxes, exhaust hoods and other equipment shall be cleaned before it is released into the atmosphere. The use of general dilution-exhaust to evacuate air from shelters, chambers, boxes, exhaust hoods and other equipment is prohibited.

6.3.13. When the openings are closed the shelters, exhaust hoods, leaktight chambers and boxes shall be depressurized. The required depressurization, as well as design air velocity within working (open) openings of shelters, exhaust hoods, leaktight chambers and boxes shall be set forth in accordance with requirements of regulatory documents. The exhaust hoods, leaktight chambers and boxes shall be equipped with depressurization monitoring instruments.

6.3.14. In the periodically attended premises where emissions of radioactive aerosols and gases are possible there shall be a system to supply air to the employees' hose-connected individual protective equipment (pressure suits, pressure helmets, hose respirators) and the possibility for connecting mobile exhausts to the exhaust ventilation systems.

6.3.15. The design shall provide for a system for management of gaseous radioactive waste (gas clean-up system) which ensures the required level of blowing clean-up from radioactive substances and chemical impurities under all operational modes of the NFC facility in accordance with the requirements of the federal standards and rules and other regulatory documents.

6.3.16. The clean-up equipment to manage gaseous radioactive waste (apparatuses, devices, filters, absorbers, bubblers, etc.) as well as methods and means of process and radiation monitoring shall be selected considering the volume of the decontaminated medium, its radionuclide composition, range of medium volumetric activity values, radioactive substance physical state and chemical composition, physical and chemical properties of the medium as well as other factors affecting safety at managing gaseous radioactive waste.

6.3.17. The design shall provide for:
- performance monitoring systems for the gas clean-up equipment;
- radiation protection of employees during maintenance and repair of the gas clean-up equipment;
- techniques and equipment for handling spent filters;
- equipment for monitoring of accumulation of nuclear materials in the gas clean-up equipment.

6.3.18. The height of exhaust pipes and shafts shall ensure that in the place where the emission plume touches earth the volumetric activity of radioactive substances in the atmospheric air is reduced down to the values not exceeding the population dose limits.

6.4 PROCESSES AND EQUIPMENT

6.4.1. The design shall provide for safe handling of nuclear materials and radioactive substances in all operational modes, safe and reliable storage of agents used at the NFC facility.

6.4.2. While selecting processes in the design the preference shall be given to the technologies featuring continuous processing of radioactive products and to those featuring minimum practicable:
- number of process stages;
- releases and discharges;
- generation of explosive and flammable concentrations of substances;
- amount of resulted radioactive waste and reliable and safe methods of its management.

6.4.3. The technical solutions provided by the design shall be aimed at excluding unsubstantiated use of corrosive, toxic and noxious substances in the processes.

6.4.4. The technical solutions used in the design as regards the operational modes and process hardware shall provide for easy connections for transportation of process products and media and for preferable use of:
- leaktight pumps, vacuum, natural gravity flow for transportation of liquid process products and media;
- vibration, pneumatic or hydraulic transport for moving powder-like, bulk and solid process products, the transfer piping, loading and unloading sections being sealed;
- leaktight process equipment drives with regard to process products and media.

6.4.5. While designing (engineering) systems (components) it shall be provided that the materials are used, which ensure workability of structures in the working media, including media used for decontamination

(clean-up, washing) through the intended service life. The structural materials shall possess physical and chemical properties commensurate with the process, including: strength properties, low sorption capability regarding radionuclides, corrosion resistance in corrosive media, and radiation resistance. Structural materials shall be easy to decontaminate and resistant to decontamination solutions.

Equipment and piping designs shall ensure workability, reliability and safety of their operation throughout their operating lives as established in the product technical specifications and (or) certificates.

6.4.6. The design shall provide for the possibility to decontaminate rooms, equipment and pipelines and (or) remove the equipment and pipelines. The design of equipment and pipelines containing radioactive process products and media shall provide for draining of liquid media, decontamination of outer and inner surfaces and elimination of decontamination solutions. Room surfaces shall be smooth and coated with low sorbents resistant to decontamination solutions.

Techniques and means of eliminating the emergency contamination of rooms, equipment and of their decontamination shall be described.

6.4.7. The equipment and pipelines shall be furnished with instrumentation and controls, which are necessary for their operation that provide for controlling the correctness of process conduct and integrity of the equipment and pipelines.

6.4.8. The design shall provide for systems or devices, which protect the equipment and pipelines from overpressure (excess depressurization) or excess temperature.

6.4.9. The equipment and pipelines design and layout shall provide for their accessibility for process operations, their accessibility for maintenance and repair, hydraulic (pneumatic) tests, inspections of metal and welded joints and replacing the equipment and pipelines.

6.5 PROCESS CONTROL

6.5.1. The design shall provide for engineered features and organizational measures for process control.

6.5.2. The following shall be provided for the NFC facility process and system equipment control, in the scope justified in the design:

- control room (board);
- local control stations (boards);
- normal operation controlling systems.

A waiver to furnish the NFC facility with the central and (or) local control stations (boards) shall be justified in the design.

For the NFC facilities pertaining to the first and second categories of potential radiological hazard the controlling safety systems and independent information recording and storage means shall be provided for in the scope identified and justified in the design.

6.5.3. The NFC facility design shall contain:

- a response analysis of the NFC facility's safety important systems in case of possible failures in the control systems;
- safety important control system performance reliability analysis;
- stability analysis of the automatic control trains of safety important systems (components).

6.5.4. The design shall contain a justification of sufficiency of measures to ensure survivability, habitability and normal functioning of the control room (board) in all operational modes including design basis accidents.

6.5.5. While designing the control room (board), the "man-machine" interface issues shall be solved in the most efficient way. The parameters to be monitored in the control room (board) shall be displayed to promptly provide the operator with unambiguous and credible information on whether the NFC facility safe operational limits and conditions are met, as well as to identify and diagnose the safety systems as regards their automatic response and functioning.

6.5.6. The control room (board) shall include:

- process control and monitoring means for all NFC facility operational modes;
- operator's information support systems including an information display system for prompt displaying to the employees the generalized information on the NFC facility safety status.

6.5.7. Commands to remotely control process machinery, which are generated by the automatic control system or remote control switches at the control room (board) panels, shall be automatically recorded in the scope justified in the design**.**

6.5.8. The NFC facility normal operation controlling safety systems shall control the processes in all NFC facility operational modes in accordance with the quality, reliability indicators and metrological characteristics established in the design.

6.5.9. Normal operation controlling systems shall include, in the scope established and justified in the design:

- means of reliable group and individual communication between the control room (board) and the NFC facility operating personnel who perform the operations;
- means of collecting, processing, documenting and storing information necessary for timely identification of failures in the safety important systems (components).

6.5.10. Normal operation controlling systems shall provide for, in the scope established and justified in the design, automatic and (or) automated diagnostics of the operational states and modes and include engineered features of control and monitoring and related software.

6.5.11. Normal operation control systems shall be structured so that they will be capable of creating the most favorable conditions for the operating personnel can make correct decisions regarding control over the NFC facility and minimizing erroneous decision-making.

6.5.12. The design shall provide for independent devices for recording and storing the information required for investigation of accidents. The above devices shall be protected against an unauthorized access and remain available during design basis and beyond design basis accidents. The scope of information to be recorded and stored shall be established in the design.

6.6 SAFETY SYSTEMS

6.6.1. The NFC facility design shall provide for engineered features and organizational measures aimed at preventing design basis accidents and limiting consequences thereof and that ensure safety in any (of considered in the design) initiating event involving overlapping, according to the single failure principle, independent of the initiating event, failure of any of the following safety system components: an active component or passive component having mechanical moving parts or one, independent of the initiating event, human error[4].

The components' failures which cannot be detected during NFC facility operation but affect evolution of the accident and lead to violation of safe operation limits shall be taken into account in addition to one, independent of the initiating event, failure of one of the above components.

6.6.2. In accordance with the defense-in-depth concept, for NFC facilities pertaining to Potential Radiation Hazard Categories 1 and 2 the safety systems shall be provided for, as justified in the design, to prevent or limit physical barrier damage; to prevent or limit propagation of radioactive substances and ionizing radiation released to the environment during the accident in excess of the established limits as well as performance of these safety functions.

The required scope and ways of performing safety functions shall be determined and justified in the design in accordance with the requirements of regulatory documents.

6.6.3 The multi-purpose use of safety systems and their components at the NFC facility shall be justified in the design. The combining of safety functions and normal operation functions shall not lead to a violation of the NFC facility safety requirements and degrading of required reliability of systems (components) performing safety functions.

6.6.4. Safety systems shall function so that once triggered they fully complete the designated function. The safety system shall be brought into the initial state only by the operator's sequential actions.

6.6.5. Safety systems (components) envisaged in the design shall, in the event of design basis accidents, ensure prevention or limitation of physical barrier damages as well as of the equipment and pipelines containing radioactive substances, nuclear materials and (or) radioactive waste through the implementation of one or several measures or combination thereof as specified below:

- termination of the process;
- cooling of the process media;

[4] In some cases, where high level of reliability has been demonstrated for the above components or systems they are incorporated into, or where a component is idle during the fixed time interval for maintenance and repair, failures thereof may be not taken into account. The reliability level is considered high if reliability indicators of such components are not lower than the reliability indicators of passive components, safety systems lacking of moving parts, which failures are ignored (due to low probability thereof). Permissible time for taking such component out of operation for maintenance and repair is determined on the basis of reliability analysis of the system it is incorporated into and is established in the design.

● prevention of overpressure (over-depressurization);
● gas evacuation;
● drainage of process products and media.

6.6.6. The confining safety systems envisaged in the design shall prevent or limit propagation of radioactive substances and ionizing radiation beyond the design boundaries in the event of an accident. Confining safety systems shall perform the designated functions during normal operation and design basis accidents and limit radiation impact in the event of beyond design basis accidents.

6.6.7. The NFC facility systems (components) containing nuclear materials, radioactive substances and radioactive waste shall be located in leaktight compartments to confine nuclear materials, radioactive substances and radioactive waste released in the course of design basis accidents involving an increase in pressure. All service lines crossing the boundaries of a leaktight compartment through which a release of nuclear material, radioactive substance and radioactive waste beyond the leaktight compartment boundaries is possible in the event of an accident shall be equipped with isolating devices, which automatically isolate the compartment when the pressure settings set forth in the design are reached.

In case other location has been selected, it is required to avoid overriding the relevant exposure levels established for the personnel and population as well as release/discharge standards under normal operation and design basis accidents.

6.6.8. The necessity of leaktight compartments, a degree of leaktightness and ways of achieving it shall be justified in the design, which shall also contain a provision requiring the verification, before the NFC facility is commissioned, of whether the actual degree of leaktightness complies with the design value and the carrying out periodic in-service compliance checks. The design shall provide for a methodology and technical means of testing the leaktight compartments against the design parameters.

6.6.9. Engineered features for detection and prevention of formation of explosive and flammable concentrations of gases and vapors in rooms shall be envisaged in the design.

6.6.10. The design shall provide for supporting safety systems, which perform functions of supplying process medium, power to safety systems and create conditions required for their functioning.

6.6.11. Supporting safety systems shall have indicators to show that they reliably perform the designated functions. These indicators, in combination with the reliability indicators of the safety systems supported by the above said supporting safety systems, shall be sufficient for achieving required reliability of performing safety functions by those systems.

6.6.12. Performance of the designated functions by supporting safety systems shall be of unconditional priority over functioning of internal protective features of the supporting safety systems' components if it does not lead to more severe consequences. A list of fixed internal protective features of the supporting safety systems' components shall be justified in the design.

6.6.13. Controlling safety systems shall automatically perform the designated functions when conditions envisaged in the design arise.

6.6.14. Controlling safety systems shall be designed so that in case of their automatic actuation the personnel will not have the possibility to trip them during the period of time established in the design.

6.6.15. There shall be the possibility to actuate safety systems remotely, and the possibility of manual *in situ* actuation of the fittings. A failure in the automatic actuation train shall not prevent the remote actuation and performing safety functions. Remote and manual actuation shall be achieved by manipulating of the minimum number of controllers.

6.6.16. The controlling safety systems' architecture shall be so that to minimize the possibility of faulty actuations. The remote control over safety system mechanisms shall provide for not less than two logically linked actions to trigger them (two switches, key pad and switch, etc.).

6.6.17. Controlling safety systems shall be separated from normal operation controlling systems so that a violation or failure of any element or train of the normal operation controlling system will not affect the controlling safety system's capability of performing the designated functions.

6.6.18. Controlling safety systems shall meet the following safety principles:
● redundancy;
● independence;
● diversity.

The degree of redundancy, independence and diversity shall be so that any single failures in controlling

safety systems will not disrupt their performance and that their protection against common cause failures is ensured.

6.6.19. Controlling safety systems shall feature:

- the continuous automatic diagnostics of the control systems' operability;
- the periodic diagnostics of availability of the controlling safety systems' trains and the diagnostics of the systems (components) from control room (board) panels, in accordance with para 7.2.5**.**

Failures of engineered features and software and damages to controlling safety systems shall trigger generation of relevant signals on the control board and actions to ensure the NFC facility safety.

In cases where it is not technically possible to carry out the continuous diagnostics of the control systems' performance and periodic diagnostics of the control systems' trains from the control room (board) panels, the methodology and means of periodic checks of the controlling safety systems shall provide for detection of violations without reducing functional availability of other safety important safety systems and components and systems (components) attributed to Safety Classes 1 and 2.

7. CONSTRUCTION (REFIRBISHMENT), COMMISSIONING AND OPERATION NUCLEAR FUEL CYCLE FACILITIES

7.1 CONSTRUCTION (REFURBISHMENT) AND COMMISSIONING OF NFC FACILITIES

7.1.1. The NFC facility construction (refurbishment) shall be carried out in accordance with the design.

7.1.2. At the stage of the NFC facility construction the control over compliance to the design solutions, including latent works, shall be conducted in accordance with the quality assurance program. Control results shall be documented.

7.1.3. Requirements for sequence and scope of the pre-startup and aligning operations as well as the acceptance criteria for the NFC facility equipment and systems being commissioned shall be established in the design.

7.1.4. The Operating Organization shall develop and implement a NFC facility commissioning program.

7.1.5. While implementing the commissioning program, characteristics of safety important systems (components) shall be determined and documented; performance characteristics of the equipment and systems, safe operation limits and conditions shall be clarified.

A list of parameters to be documented shall be determined in the pre-startup and aligning and system (component) integrated testing programs.

7.1.6. The Operating Organization shall arrange for development of programs for pre-startup and alignment operations, system (component) integrated testing, and pilot operation. The programs shall be approved by the Operating Organization and be submitted, as appropriate, to the safety regulatory authority in the field of the use of atomic energy.

The documents regulating the conduct of pre-startup and alignment operations, system (component) integrated testing, and pilot operation shall contain a list of NFM (S) handling operations where SCR initiation is possible and a list of measures to prevent accidents and limit their consequences.

7.1.7. Results of the pre-startup and alignment operations and integrated testing of systems (components) shall confirm that the NFC facility as a whole, as well as safety important systems (components), have been assembled and function as designed and revealed deficiencies have been eliminated.

7.1.8. The NFC facility is accepted for industrial-scale operation in accordance with the established procedure after its pilot industrial operation has been completed.

7.1.9. The NFC facility subject to commissioning after completion of construction (refurbishment) works shall be isolated from other NFC facilities in operation and from sections where construction (refurbishment) works are in progress to prevent the impact of the ongoing activities and possible events at construction sites thereof; and to ensure safety of the NFC facility under construction in case of possible accidents at the operating NFC facility.

7.1.10. The license for the NFC facility operation shall be granted by the safety regulatory authority in the field of use of atomic energy to the Operating Organization after completion of all pre-startup and alignment operations and system (component) integrated testing, as appropriate, if NFCF SAR is available with amendments introduced basing on the results of pre-startup and alignment operations and system (component) integrated testing.

7.1.11. Pilot operation of the NFC facility including the first loading of NFM (S, N) to be conducted by the Operating Organization shall be authorized by the safety regulatory authority in the field of use of atomic energy in accordance with the stage-to-stage transition (from one type of activities to another) conditions applied and specified in the operation license after completion of NFC facility inspection to verify the NFC facility readiness for the pilot operation stage.

7.2. OPERATIONS CONDUCT AND OPERATING DOCUMENTATION

7.2.1. The Operating Organization shall:

- establish necessary organizational structures for the NFC facility safe operation;
- entitle the NFC facility administration with required authorities;
- provide the NFC facility with financial resources and materiel, regulatory documents and scientific and technical support;
- establish the NFC facility physical protection and fire protection;
- ensure manpower recruitment and training;
- establish conditions under which safety is considered as essential matter and a subject of personal responsibility of each employee;
- carry out continuous monitoring of the NFC facility safety.

The Operating Organization shall ensure continuous control over all NFC facility safety important activities.

The Operating Organization shall draft and submit the NFC facility periodic safety reports to the safety regulatory authority in the field of use of atomic energy and to the authority being in charge of the use of atomic energy. Requirements for the content and composition of periodic reports as well as their submission frequency are determined by the safety regulatory authority in the field of use of atomic energy.

7.2.2. Prior to system (component) integrated testing the Operating Organization, on the basis of documentation of developers of the equipment, processes and design, shall arrange for drafting of the NFC facility operating documentation[5].

The operating documentation shall contain rules and basic techniques of safe operation, general procedure for execution of safety-related operations, safe operation limits and conditions, specific directives to be followed by the employees (personnel) in normal operation and operational events including pre-emergency situations, and the employees' (personnel) actions to ensure safety in the event of design basis and beyond design basis accidents.

The operating documentation shall be updated on the basis of the results of the NFC facility commissioning.

The employees' (personnel) actions to ensure safety in the event of design basis and beyond design basis accidents prescribed by the operating documentation shall be based on the indications of current events, process equipment conditions and the anticipated accident development path. The prediction-based actions shall be aimed at restoring the safety functions and localizing radiation consequences of the accidents.

The operating documentation development and amendment procedures shall be established by the Operating Organization in accordance with requirements of regulatory documents.

7.2.3. Changes to the scope of production and (or) technologies of the NFC facility provided for in the design and (or) operating documentation, production refocusing and (or) use of feed materials with radiation characteristics which may affect the radiation situation at the NFC facility, shall be made only if the relevant safety justification is available and reflected in NFCF SAR.

7.2.4. The Operating Organization shall carry out scheduled preventive repairs and (or) overhauls of the NFC facility equipment in accordance with their schedules.

7.2.5. To maintain safety important systems' performance and to prevent hazardous failures of safety important systems their maintenance, repair, testing and inspection shall be carried out.

The above activities shall be carried out in accordance with the relevant operating documentation, programs and schedules being developed in accordance with the procedure established by the Operating Organization on the basis of the design requirements and process regulations and shall be documented.

Safety conditions specified in the operating documentation shall be observed in the course of safety important system maintenance, repair and testing and inspection.

After maintenance and repair activities performance and compliance with design characteristics of safety system components and safety systems proper shall be verified and the results of the verification shall be documented.

7.2.6. Prior to the NFC facility commissioning, including an overhaul, as well as periodically during the NFC facility entire operation life, the NFC facility safety important systems and components shall be inspected, as

[5] The NFC facility operating documentation means a set of existing process regulations, operating guides, operating manuals for systems and components, working and process procedures and other NFC facility documents developed as appropriate and being in force at the NFC facility.

a rule, directly and in full scope.

If a direct and (or) comprehensive inspection is impossible, the design shall justify that indirect and (or) partial inspections are required. Sufficiency of indirect and (or) partial inspection shall be justified in the design.

It is required to envisage the diagnostics (check) of safety systems and safety important components of normal operation referred to Safety Class 1 and 2, and to conduct representative tests thereof. During operation the maintenance and inspections shall be carried out basing on the operating documentation while respecting safe operation limits and conditions. The frequency and permissible duration of the maintenance and inspections shall be justified in the design.

7.2.7. The operating documentation maintaining, safekeeping and reviewing procedure shall be established by the Operating Organization taking into account the regulatory document requirements.

The Operating Organization shall ensure that NFC facility design documentation, executive documents for the NFC facility construction, test records and executive documentation for maintenance and repair of safety systems (components) and safety important components attributed to Safety Classes 1 and 2 are in safekeeping at the NFC facility for its entire operation lifetime.

7.2.8. The documented information related to monitoring of safe operation limits and conditions shall be in safekeeping at the NFC facility for two years. Prior to destruction of records the results shall be incorporated into NFC facility periodic safety reports issued by the Operating Organization.

The investigation documentation of the NFC facility operational events shall be in safekeeping for its entire operation lifetime.

7.2.9. In case of a pre-emergency situation at the NFC facility the causes thereof shall be identified and eliminated; measures to restore NFC facility normal operation shall be undertaken. The NFC facility process shall be terminated if its safe operation limits and conditions can not be met.

7.2.10. At the NFC facility, the tests, which are not provided for in the operating procedures, shall be carried out in accordance with the programs and methodologies containing measures to ensure safety in these tests. The test programs and methodologies shall be concurred with design developers and approved by the Operating Organization.

7.2.11. Prior to the NFC facility commissioning, including after an overhaul, refurbishment and (or) upgrading of the NFC facility, as well as periodically in accordance the requirements of the design, regulatory documents and operating documentation, the safety important system performance shall be inspected. Frequency and scope of periodic inspections shall be specified in the schedules.

Upon the request of the safety regulatory authority in the field of use of atomic energy, unscheduled inspections of safety important system performance may be carried out.

7.2.12. The pre-operation, periodic and unscheduled examinations shall be carried out in the scope established by the design, engineering and operating documentation to detect defects in structural materials, to reveal changes in their physical and chemical properties and structure and to assess conditions of structural materials, equipment and pipelines of safety important systems.

In-service inspections of conditions of the NFC facility structural material of safety important systems (components) and welding joints shall be done by non-destructive and (or) destructive techniques in accordance with established schedules.

7.2.13. In the course of the NFC facility operation the Operating Organization shall ensure collection, processing, analysis, systematization and safekeeping of the information related to failures of safety important system’s components and erroneous actions of the employees (personnel) as well as timely transmission of this information to all organizations concerned.

7.2.14. Operational events, including accidents, occurred at the NFC facility shall be investigated in accordance with the requirements of federal standards and rules. The Operating Organization shall develop and implement measures preventing recurrence of operational events due to the same causes.

The Operating Organization shall submit information related to the NFC facility operational events to the safety regulatory authority in the field of use of atomic energy in accordance with the requirements of federal standards and rules.

The free access of representatives of federal safety regulatory authorities to the documentation containing information related to the said operational events shall be ensured.

7.2.15. The Operating Organization shall ensure control and accounting of individual exposure doses of the NFC facility employees (personnel), the in-process radiation safety monitoring, development and implementation of measures to reduce the employees (personnel) exposure as low as reasonably achievable.

7.2.16. The Operating Organization shall provide control and accounting of nuclear materials, radioactive substances and radioactive waste as well as identify the number and boundaries of nuclear material balance

areas, key measurement points for each material balance area as well as measurement methods and means used for nuclear material control and accounting in accordance with requirements of federal standards and rules and other regulatory documents.

7.2.17. To identify the scope of engineered features and organizational measures aimed at safety improvement of the NFC facility in operation, the Operating Organization shall carry out the analysis of current safety level.

Basing on the analysis results all reasonably practicable measures aimed at achieving compliance with the requirements of GSP NFCF and other federal standards and rules shall be implemented.

7.2.18. When the NFC facility arrives at the end of its design service life (or 30-year period) the Operating Organization shall assess the possibility of further operation of the NFC facility in accordance with the requirements of federal standards and rules.

7.3 RECRUITMENT AND TRAINING OF EMPLOYEES (PERSONNEL)

7.3.1. The NFC facility shall be staffed with the employees (personnel) having required competence and independent work permits, issued in accordance with the established procedure, prior to commissioning for pilot operation.

7.3.2. The Operating Organization shall provide for staffing, training and issuing independent work permits for the employees (personnel) and maintain employees' competence. The NFC facility staffing and employee (personnel) training system shall be aimed at achieving, controlling and maintaining their competence level required to ensure the NFC facility safe operation and to implement actions to mitigate accident consequences.

The building of the employee (personnel) safety culture shall be an integral element of the training goal.

7.3.3. Engineered training aids shall be used in the employee (personnel) training to develop practical skills of the NFC facility operation. The special consideration shall be given to the drills relevant to actions to be performed in case of operational events including accidents as well as to the lessons learned from past errors and accidents.

7.4. ACTION PLANS TO PROTECT EMPLOYEES (PERSONNEL) AND POPULATION IN THE EVENT OF AN ACCIDENT AND ACCIDENT MANAGEMENT

7.4.1. Action plans to protect the employees (personnel) and population in the event of an accident at the NFC facility, which consider the accident radiation consequences, shall be developed and be in place prior to the NFC facility first loading of nuclear materials of Potential Radiation Hazard Category I and II. The plans shall be developed on the basis of the NFC facility design characteristics and parameters, decision-making criteria related to population protection measures in the event of an accident at the NFC facility considering economic, natural and other characteristics and features of the territories.

Main and back-up means of communication with the safety regulatory authority in the field of use of atomic energy and standing governmental bodies having special jurisdiction in the population and territory protection in the event of an emergency as well as with agencies being especially set up under the executive bodies of the Russian Federation and local administrations shall be in place prior to first loading of nuclear fissile materials.

7.4.2. An action plan to protect the employees (personnel) in the event of an accident at the NFC facility shall be developed by the Operating Organization. It shall provide for coordination of the activities of the Operating Organization, the NFC facility Administration, the Ministry of the Interior, the State Fire Protection Agency, civil defense and emergency authorities, medical institutions and local authorities within the site and protective actions planning zone and mandatory population evacuation planning zone. The NFC facility administration shall be responsible for maintaining continuous preparedness and for the plan implementation.

7.4.3. An action plan for the population protection in the event of an accident at the NFC facility shall provide for coordination of actions between the on-site and local civil defense and emergencies authorities, Russian Federal subjects and local administrations as well as ministries and agencies involved in the implementation of measures for population protection and accident consequences elimination.

7.4.4. Action plans to protect the employees (personnel) and population in the event of an accident at a NFC facility shall clearly specify levels of emergency preparedness and intervention; identify by whom, when and how and what organizations should be notified about the accident and the beginning of the plan implementation. The plans shall provide for:

- projections regarding possible accidents at the NFC facility and the radiation situation during accidents;
- criteria for decision-making on the implementation of protective measures;
- list of organizations to interact with during elimination of an accident and consequences thereof;
- organization of the emergency radiation monitoring;

- procedure to bring the plan into effect;
- procedure to notify and keep the personnel (population) informed;
- actions of the employees (personnel) during an accident;
- officials' responsibilities during emergency operations;
- measures to protect the personnel during emergency operations;
- fire extinguishing measures;
- measures to protect the population and environment;
- measures to provide medical aid to the affected;
- measures to confine and eliminate areas of radioactive contamination;
- procedure for the employees (personnel) training to act in case of an accident;
- other necessary measures to protect the employees (personnel) and population in accordance with regulatory document requirements.

7.4.5. The NFC facility employees (personnel) shall be prepared to act in design basis and beyond design basis accidents. At NFC facilities, which include nuclear hazardous areas there shall be procedures for the personnel's (employees') actions in the events of SCR initiation and a SCR-related accident elimination plan.

Special accident management guides developed taking account of the design basis and beyond design basis accident analyses shall regulate the employees' (personnel's) actions in beyond design basis accidents. These actions shall be supported by any available engineered means.

7.4.6. Emergency drills shall be periodically conducted to train the employees (personnel) to act in emergency conditions.

7.4.7. The Operating Organization shall develop methodologies and programs for training and carrying out emergency drills to master the actions in accident conditions and it shall organize the said drills.

8. NUCLEAR FUEL CYCLE FACILITY DECOMMISSIONING (CLOSURE)

8.1. During the NFC facility design, construction and operation the organizational and engineered measures shall be conducted considering future decommissioning (closure) thereof.

8.2. The NFC facility decommissioning (closure) shall be implemented in accordance with the NFC facility decommissioning (closure) program and decommissioning (closure) project.

8.3. A NFC facility integrated engineering and radiation examination by a commission established by the Operating Organization shall be completed prior to decommissioning (closure). The Operating Organization shall ensure the development of a NFC facility decommissioning (closure) project and draft the Decommissioning (Closure) Safety Analysis Report on the basis of the integrated examination results.

8.4. The NFC facility shutdown for decommissioning is considered remaining in operation until nuclear materials are removed from its systems (components). During this period of time it shall be subject to all requirements, which are applied to the NFC facility in operation. Reduction in the scope of maintenance and the employees (personnel) number shall be carried out in accordance with the safety requirements established in the NFC facility decommissioning project.