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“ _____ ” _____ **2004**

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“ _____ ” _____ **2004**

Federal Standards and Rules

SAFETY RULES FOR DECOMMISSIONING OF
NUCLEAR INSTALLATIONS OF NUCLEAR FUEL CYCLE

(final draft version)

7 April 2004

Contract: SAV29151/VCH – GAN_RD-10

Stage: 4

**FEDERAL ENVIRONMENTAL, INDUSTRIAL AND NUCLEAR SUPERVISION
SERVICE OF RUSSIA**

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

Approved by
Decree of the Federal Environmental,
Industrial and Nuclear Supervision Service
of Russia

of December 31 2004 N14

**SAFETY RULES FOR DECOMMISSIONING OF
NUCLEAR INSTALLATIONS OF NUCLEAR FUEL CYCLE**

NP- – 057-04

Effective since
«_6_»June_____2005_

Moscow 2004

SAFETY RULES FOR DECOMMISSIONING OF NUCLEAR INSTALLATIONS OF NUCLEAR FUEL CYCLE Federal Environmental, Industrial and Nuclear Supervision Service of Russia
Moscow, 2004

These federal standards and rules “Safety Rules for Decommissioning of Nuclear Installations of Nuclear Fuel Cycle” establish safety requirements to decommissioning of the nuclear installations nuclear fuel cycle (NI NFC), the NI NFC decommissioning program and integrated engineering and radiation survey of the NI NFC, and the NI NFC decommissioning project.

Apply to nuclear installations of nuclear fuel cycle under design, construction, operation and decommissioning.

Issued for the first time.¹⁾

Developed on the basis of 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 the use of atomic energy, and the IAEA recommendations, Safety Series N WS-G-2.4 "Decommissioning of Nuclear Fuel Cycle Facilities".

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While developing the regulatory document proposals produced by the following organizations have been revised and taken into account: Federal Nuclear Energy Agency, FSUE “VNIPIET”, FSUE “MCC”, FSUE PA “Mayak”, JSC “TVEL”, RF SSC IPPE, FSUE “NIAR” etc.

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List of abbreviations

IERS	-	integrated engineering and radiation survey
NI NFC	-	Nuclear installations of nuclear fuel cycle
RadS		radioactive substance
RW	-	radioactive waste

1. Basic terms and definitions

For the purposes of this document, the following terms and definitions are used:

Integrated engineering and radiation survey of a nuclear installation of nuclear fuel cycle (NI NFC) shall mean a complex of organizational and technical measures required to obtain the input data for development of the NI NFC decommissioning project.

NI NFC decommissioning shall mean the activity implemented after NI NFC operation has been terminated that excludes NI NFC use for its design purposes and is aimed at ensuring safety of employees (personnel), population and the environment until the NI NFC is exempted from the radiation safety standards.

Nuclear installation of nuclear fuel cycle (NI NFC) (for the purposes of this document) shall mean the structure, complex, installation with nuclear materials, other than a commercial reactor, research nuclear installation, critical and sub-critical assembly, which is intended for fabrication of nuclear materials and nuclear fuel, conversion of weapons materials (uranium and plutonium), fabrication of the mixed uranium-plutonium fuel, hydrometallurgical processing, refining, sublimate production, metallurgical works, separation of uranium isotopes and spent nuclear fuel reprocessing.

2. Purpose and scope of application

2.1. This document "Safety Rules for Decommissioning of Nuclear Installations of Nuclear Fuel Cycle" has been developed on the basis of the Federal Laws "On the Use of Atomic Energy"*, "On Radiation Safety of the Population"**, federal standards and rules in the field of use of atomic energy.

2.2. This document establishes safety requirements to decommissioning of the nuclear installations of nuclear fuel cycle (NI NFC), the NI NFC decommissioning program and integrated engineering and radiation survey of the NI NFC, and the NI NFC decommissioning project.

2.3. This document applies to NI NFC under design, construction, operation and decommissioning excluding facilities for mining of uranium ores.

*) The Federal Law of 21.11.1995 No. 170-FZ "On the Use of Atomic Energy Use", Code of Laws of the Russian Federation, 1995 No.48, art.4552 as amended on 10.02.1997 No.28-FZ, Code of Laws of the Russian Federation, 1997, No.7, art.808; of 10.07.2001 No.94-FZ, Code of Laws of the Russian Federation, 2001, No.29, art.2949; of 28.03.2002 No.33-FZ, Code of Laws of the Russian Federation, 2002, No.13, art.1180; of 11.11.2003 No.140-FZ, Code of Laws of the Russian Federation, 2003, No.46 (part 1), art.4436.

**) Federal Law of 9.01.1996 No.3-FZ "On Radiation Safety of Population", Code of Laws of the Russian Federation, 1996 No.3, art.141

3. General safety requirements for decommissioning of nuclear installation of nuclear fuel cycle

3.1. Decommissioning of a NI NFC meets safety requirements if at all decommissioning stages its radiation impact to the employees (personnel), population and environment does not result in excess of the established exposure dose limits for the employees (personnel) and population as well as standards for releases and discharges radioactive substances.

3.2. The operating organization shall ensure safe decommissioning of the NI NFC, including development and implementation of organizational and technical measures targeted to prevent accidents and mitigate their consequences, safe radioactive substances (RadS) and radioactive wastes (RW) management, accounting and control, physical protection of the NI NFC, RadS and RW, the environmental monitoring on the NI NFC site, its controlled area and surveillance area.

3.3. The organizational and technical measures implemented during the NI NFC construction and operation shall be carried out taking account of the forthcoming decommissioning of NI NFC.

3.4. The NI NFC decommissioning shall be implemented in accordance with the NI NFC decommissioning program and NI NFC decommissioning project.

3.5. During the NI NFC decommissioning the radiation safety shall be ensured in accordance with the principles of standardization, justification and optimization.

The organizational and technical measures implemented during preparation for decommissioning and decommissioning of the NI NFC shall be aimed at reducing the radiation impact to the employees (personnel), population and environment down to levels that are as low as possibly achievable taking account of social and economic factors.

3.6 The operating organization shall provide for development and implementation of the quality assurance program during the NI NFC decommissioning and control of quality assurance of activities carried out by organizations carrying out works and (or) rendering services for the operating organization.

4. Safety requirements for decommissioning of nuclear installations of nuclear fuel cycle to be implemented in their design, construction and operation

4.1. Design and construction of the nuclear installations of nuclear fuel cycle

4.1.1. The design of NI NFC to be constructed shall contain safety provisions for the NI NFC decommissioning including the NI NFC decommissioning concept, and among other that for:

- selection of materials for manufacture of NI NFC systems (components) with low radionuclide sorption ability;
- the use, in the course of NI NFC construction, of building structures that allow to simplify dismantling of systems (components) during NI NFC decommissioning;
- the possibility of dismantling and removal of large-size components of NI NFC;
- the use of the design and layout of systems (components) that provide for minimization of exposure of employees (personnel) and their contact with radioactive and toxic substances;
- ensuring load-bearing capability of buildings and constructions during NI NFC operation and decommissioning;
- a list of NI NFC systems necessary for the implementation of NI NFC decommissioning operations;
- documenting and storing of information required for NI NFC decommissioning.

4.1.2. The design of NI NFC to be constructed shall contain safety provisions for NI NFC decommissioning aimed at reducing RW generation down to the minimum achievable level and ensuring safe RW management, including:

- minimization of surface contamination of NI NFC systems (components) and structures with radioactive substances during NI NFC operation;
- the possibility of decontamination of NI NFC premises, systems (components) and structures;
- assessment of the total amount, type and activity of RW generated during NI NFC decommissioning;
- the possibility of removal of RW generated during NI NFC operation from the storage facilities;
- the possibility of remote handling of high-activity NI NFC components;
- the possibility of on-site location of equipment and storage facilities intended for collection, storage, reprocessing and conditioning of RW generated during NI NFC decommissioning;
- availability of transportation routes and conveyances for off-site RW shipment for storage and (or) disposal.

4.1.3. Organizational and technical measures to ensure safety during decommissioning that are considered in the design shall take account of NI NFC features (site size, process flow diagram, equipment dimensions, layout solutions, characteristics of systems (components) and structures and possible options of NI NFC decommissioning.

4.1.4 Possible options of the NI NFC decommissioning are:

- dismantling of equipment and NI NFC closure;
- dismantling of equipment, RW storage generated during dismantling of equipment in the on-NI NFC site storage facility;
- mothballing of equipment followed by its dismantling and NI NFC closure;
- dismantling of equipment, use of NI NFC buildings and structures for other purposes;
- NI NFC disposal (on site).

4.2. Operation of nuclear installations of nuclear fuel cycle

4.2.1. During NI NFC operation the operating organization shall document and store information necessary for NI NFC decommissioning, including the design and operating documentation, as well as information on:

- changes in process flow diagrams at NI NFC, implemented upgrades (modernization) of NI NFC;

- radionuclide composition of deposits on inner surfaces of pipelines and equipment before NI NFC decommissioning operations are commenced;

- level of contamination of the systems' (components') surfaces and premises with RadS before NI NFC decommissioning operations are commenced, and that of the NI NFC site;

- amount and radionuclide composition of RW generated during operation and stored on site, RW characteristics and storage locations;

- capacity and free space of RW storage facilities available for radioactive waste;

- NI NFC accidents resulted in radioactive contamination of systems (components), premises and building structures and (or) nuclear materials propagation in systems (components) and premises that have not been anticipated in the design and operating documentation.

4.2.2. Before the design (or 30-year) service life of NI NFC is expired the operating organization shall provide for development of the NI NFC decommissioning program basing on results of planning of NI NFC decommissioning. Requirements to the NI NFC decommissioning program are presented in Appendix 1.

Development of the NI NFC decommissioning program shall be completed before NI NFC is shutdown for decommissioning. Should terms of the NI NFC shutdown and decommissioning be changed, and if additional information affecting safety of the decommissioning process is provided during NI NFC operation, the mentioned program shall be revised.

4.2.3. The NI NFC decommissioning program shall include possible options for NI NFC decommissioning which shall be selected taking account of the following factors:

- NI NFC features (site size, process flow diagram, equipment dimensions, layout solutions, characteristics of systems, components and structures);

- amount of nuclear materials and RadS, their form, state of aggregation, specific (volumetric) and total activity which are present on NI NFC site;

- ensuring load-bearing capability of building structures and constructions during the NI NFC operation and decommissioning;

- provisions for maintaining lifetime of the systems (components) necessary for NI NFC decommissioning or the possibility of their replacement after their lifetime is expired;

- amount of RW accumulated on the site, RW radionuclide composition, specific (volumetric) and total activity;

- availability of free space in RW storage facilities;

- presence and amount of poisons and toxic substances on the NI NFC site;

- present and amount of explosive and fire-hazardous substances on the site;

- radiation consequences of accidents occurred during NI NFC operation;

- occurred cases of RadS, RW and nuclear material propagation beyond the physical barriers, systems (components);

- availability of techniques (means) and technologies for decontamination and dismantling of systems (components), structures and constructions;

- the possibility to use the existing systems (components), structures and constructions during the decommissioning (radiation monitoring, ventilation, RW management, cranes, transport and process equipment);

- possible impact of the NI NFC decommissioning on other facilities of nuclear fuel cycle located on the site;

- possible radiation impact of the NI NFC decommissioning on the employees (personnel), population and environment;

reduction of health and environmental hazard produced by exposure resulted from completion of the NI NFC decommissioning operations shall be sufficient to justify damage and costs related to activities associated with reduction of exposure probability or the dose or unfavorable consequences of exposure;

characteristics of the NI NFC site, region of its location and the environment that may affect transfer and accumulation of RadS during the NI NFC decommissioning;

availability of time limitations with regard to the NI NFC decommissioning;

other factors affecting safety of the NI NFC decommissioning.

4.2.4. The NI NFC shut down for decommissioning is considered to be in operation until nuclear materials are removed from its systems (components). During this period all requirements remain in effect as applicable to NI NFC in operation. The scope of maintenance, number of employees (personnel) shall be reduced in accordance with the requirements set forth and justified in the NI NFC design. Operation of NI NFC systems (components) shall be implemented in accordance with the operating procedures. It is not allowed to change operation conditions of NI NFC systems (components) until appropriate changes have been done to the operating documentation according to the established procedure.

4.2.5. After NI NFC is shut down for decommissioning the operating organization shall provide for preparation of NI NFC for decommissioning, including:

removal of radioactive process media and nuclear materials from systems (components) and premises;

inventory taking, accounting and control of nuclear materials;

emplacement of nuclear materials in the storage facility and (or) shipment of nuclear materials from NI NFC site for storage and (or) processing (use);

decontamination of systems (components) in the scope necessary to prepare NI NFC for decommissioning;

reprocessing and conditioning of RW accumulated at NI NFC during the period of its operation, RW emplacement in the RW storage facility and (or) off-site shipment for storage or disposal;

RadS and RW accounting and control.

4.2.6. After the activities of para 4.2.5 are completed the operating organization shall provide for implementation of integrated engineering and radiation survey (IERS) of NI NFC. IERS results shall be documented according to the procedure established by the operating organization.

Requirements to IERS are presented in Appendix 2.

4.2.7. Basing on the IERS data, results of the design and operating documentation the operating organization shall provide for development of documentation necessary for the NI NFC decommissioning, including:

IERS results;

the NFCFC decommissioning projects;

quality assurance program for the NI NFC decommissioning;

guides (regulations) for the NI NFC decommissioning operations;

operating manuals for the systems (components) required for the NI NFC decommissioning operations;

manuals for RadS and RW accounting and control;

employees (personnel) and population protection action plans in case of an accident;

procedure for elimination of accident consequences occurred at NI NFC under decommissioning;

safety analysis report for the NI NFC decommissioning.

4.2.8. Before the NI NFC decommissioning operations are commenced the operating organization shall provide for training of employees (personnel) possessing necessary professional skills to carry out the NI NFC decommissioning operations.

5. Safety requirements for decommissioning of nuclear installations of nuclear fuel cycle

5.1. Safety requirements to be implemented in the nuclear installations of nuclear fuel cycle decommissioning project

5.1.1. The NI NFC decommissioning shall be implemented in accordance with the NI NFC decommissioning project. The design solutions related to the NI NFC decommissioning shall be targeted to ensure safe decommissioning of NI NFC taking account of its process and layout features.

5.1.2. The NI NFC decommissioning project shall contain and justify the adopted NI NFC decommissioning option.

5.1.3. The NI NFC decommissioning project shall contain:

- a description of NI NFC decommissioning stages;
- the technology and sequence of activities carried out at each of the NI NFC decommissioning stages;
- radiation protection techniques and means;
- explosion and fire safety ensurance techniques and means;
- NI NFC, RadS, RW physical protection measures;
- management techniques and means of RW generated during the NI NFC decommissioning;
- RadS and RW accounting and control measures;
- description of transport and process operations inside NI NFC premises and on-site and process flow diagram of on-site transportation;
- description of the NI NFC state after NI NFC decommissioning operations are completed;
- justification of necessary human, financial, material and technical resources.

5.1.4. As regards each stage of NI NFC decommissioning the NI NFC decommissioning project shall include:

- work plan;
- decommissioning technologies;
- number of employees (personnel) necessary for carrying out the work;
- measures to ensure radiation safety at working places;
- the required scope of individual monitoring (health physics and radiation) of occupational exposure and appropriate engineering features to implement this monitoring;
- assessment of individual occupational exposure doses as regards each type of operations and collective occupational exposure doses as regards the work stage on the basis of information on radiation situation;
- techniques and means aimed at minimizing occupational exposure during operations;
- volume, activity and radionuclide composition of generated RW, and techniques of RW reprocessing, conditioning, transportation to storage facilities;
- measures to minimize RW volume;
- measures to minimize RadS releases and discharges into the environment;
- physical protection of NI NFC under decommissioning, RadS and RW;
- RadS and RW accounting and control measures;
- description of the NI NFC state after the decommissioning stage is completed.

5.1.5. The NI NFC decommissioning project shall provide for techniques and means for decontamination of surfaces of equipment, pipelines, premises, building structures and constructions.

The decontamination techniques and means shall be selected taking account of:

characteristics of structural materials of NI NFC systems (components), building structures and constructions subject to decontamination;
 estimated values of removable (non-fixed) and irremovable (fixed) contamination of the surfaces of systems (components), building structures and constructions;
 estimated values of decontamination factors;
 estimated value of RW amount generated during the decontamination;
 a possibility of RW management generated during the decontamination.

5.1.6. The NI NFC decommissioning project shall provide for techniques and means for dismantling of equipment, pipelines, building structures and constructions. The dismantling means shall be reliable and easy-to-operate, including easy decontamination and maintenance. Equipment dismantling techniques and means shall be selected taking account of the following factors:

characteristics of the NI NFC equipment, pipelines, premises, building structures and constructions (dimensions, radiation situation) subject to dismantling;
 impact from the dismantling on adjacent systems (components) and structures and other operations being performed;
 availability of effective techniques and means of monitoring of radioactive substances and toxic substances released during dismantling, and methods and means of protection of personnel from their adverse effects.

5.1.7. Techniques and means of physical barriers' dismantling provided for in the NI NFC decommissioning project shall not lead to an excess of releases and discharges during NI NFC decommissioning operations.

5.1.8. The ventilation systems foreseen by the NI NFC decommissioning project shall provide for protection of air of working premises and atmospheric air from radioactive contamination. If necessary, additional physical barriers (fabric tents, mobile boxes, biological shielding etc.), local air ventilation systems and dust suppression systems shall be provided for to prevent air contamination at places where the equipment, pipelines, building structures and constructions contaminated with RadS are being dismantled.

5.1.9. To prevent RadS propagation into the working area and environment the NI NFC decommissioning project shall provide for stage-by-stage dismantling of ventilation system components that is interrelated with the dismantling and removal operations on the equipment, pipelines, building structures and constructions. As regards each NI NFC decommissioning stage, operation modes of the ventilation systems shall be justified. If necessary, additional ventilation systems shall be provided for.

5.1.10. The NI NFC decommissioning project shall provide for on-site premises and places for interim storage of RW and reusable materials, and also methods and means for their further retrieval and removal.

5.1.11. The NI NFC decommissioning project shall provide for radiation monitoring inside NI NFC premises, on the site of its location, controlled area and surveillance area. Radiation monitoring can be implemented on the basis of the NI NFC radiation monitoring system foreseen for its operation. If necessary, the NI NFC decommissioning project shall provide for changes to be done to this system considering features of operations carried out at each decommissioning stage.

5.1.12. The scope, techniques and means of radiation monitoring are established in the NI NFC decommissioning project shall meet the requirements of radiation safety standards and assure:

individual monitoring (health physics and radiometric) of the occupational exposure of the employees (personnel);
 monitoring of radiation situation within the working area, inside NI NFC premises, on the site, and within the controlled area and surveillance area;
 monitoring of releases and discharges of the radioactive substances;

timely detection of changes in the radiation situation inside NI NFC premises, on the site, and within the controlled area and surveillance area;
 radiation monitoring of RadS, RW and reusable materials;
 radiation monitoring of vehicles and materials in case of their off-site shipment.

5.2. Safety requirements for NI NFC to be implemented during their decommissioning

5.2.1. NI NFC under decommissioning shall be staffed with the employees (personnel) possessing necessary professional skills and permits to work independently issued according to the established procedure.

5.2.2. The operating organization shall provide for selection, training, issuing independent work permits and maintaining of professional skills of the employees (personnel). The system of selection and training of NI NFC personnel shall be aimed at maintaining of their competence level necessary to ensure safe decommissioning of NI NFC.

5.2.3. The NI NFC decommissioning operations shall be implemented in accordance with manuals (regulations, programs) developed on the basis of the NI NFC decommissioning project.

5.2.4. Each NI NFC decommissioning stage shall begin with development of organizational and technical measures aimed at ensuring safety of the operations at a given stage, as established in the NI NFC decommissioning project.

Before each NI NFC decommissioning stage is commenced, the systems (components) and engineering features required for decommissioning operations, including ventilation systems, RW management systems, means for decontamination of contaminated surfaces, radiation monitoring means, as foreseen in the project, shall be operable.

5.2.5. After completion of each NI NFC decommissioning stage the following information shall be systematized and documented:

- on the dismantling technologies and techniques used;
- on decontamination of the equipment and structures;
- on the amount (mass/volume), activity, radionuclide composition of generated, reprocessed and conditioned RW;
- on RW storage locations on the NI NFC site;
- on off-site RW shipments;
- on RadS and RW accounting and control;
- on results of individual monitoring (health physics and radiometric) of occupational exposure of the employees (personnel), collective occupational exposure dose;
- on values of releases and discharges of the radioactive substance into the environment;
- on radiation situation inside NI NFC premises, on site, within the controlled area and surveillance area.

5.2.6. After completion of each NI NFC decommissioning stage, an analysis of the results of implemented operations, additional NI NFC survey in the scope necessary for timely updating the design documentation and undertaking necessary measures aimed at safe conduct of operations at the next NI NFC decommissioning stage shall be performed. Completion of the each NI NFC decommissioning stage shall be documented.

5.2.7. NI NFC on-site transportation of RadS and RW shall be carried out:
 using special conveyances and along the routes defined in the NI NFC decommissioning project;

in transportation containers taking account of dimensions and mass of the transported radioactive substances (RW), their physical condition, activity, type of radiation and dose rate on the outer surface of containers.

5.2.8. All materials (fragments of dismantled equipment, biological shielding, building structures, etc.) produced during the NI NFC decommissioning shall be subject to radiation monitoring with its results used for separation of radioactive waste from materials suitable for limited or unlimited reuse in accordance with the requirements of radiation safety standards.

5.2.9. Off-site shipment of non-radioactive waste, materials and (or) equipment suitable for reuse shall be implemented after their radiation monitoring is performed and if a permit is available issued in accordance with requirements of radiation safety standards.

5.2.10. The operating organization shall provide for recording and keeping the decommissioning documentation in accordance with the quality assurance program for the NI NFC decommissioning.

5.2.11. In case of the NI NFC decommissioning the operating organization shall provide for collection, processing, analysis, systematization and storage of information on operational events, and its prompt transfer to all organizations concerned in accordance with the established procedure.

5.2.12. The operating organization shall provide for physical protection of the NI NFC under decommissioning, RadS and RW.

5.2.13. Should nuclear materials, including those contained in RW, be detected during the NI NFC decommissioning operations, their characteristics (form, type, state of aggregation, density, isotope composition) and amount shall be defined.

Operations related to handling of nuclear material shall be carried out in accordance with nuclear safety rules and under special programs approved by the operating organization, which define safe operations' conduct, including:

- techniques and means to collect nuclear materials;

- places (storage facilities and premises) and conditions for storage of nuclear materials before they are removed from the NI NFC site;

- conditions and means of the nuclear material transportation.

The period of time during which nuclear material is stored on the site of decommissioned NI NFC before their off-shipment shall be determined.

Accounting, control and physical inventory taking of nuclear materials and their physical protection shall be implemented.

5.2.14. The NI NFC decommissioning operations shall be stopped only after the ultimate state of NI NFC is achieved as defined in the NI NFC decommissioning project. This shall be formalized by the operating organization in the appropriate document (record) confirming completion of the decommissioning.

Appendix 1 Purpose and content of the decommissioning program for nuclear installations of nuclear fuel cycle

1. Purpose of the decommissioning program for nuclear installations of nuclear fuel cycle

1.1. The NI NFC decommissioning program (hereinafter referred to as the "Program") is an organizational and technical document, which determines main decommissioning operations, procedure, conditions and timeframes associated with preparations for NI NFC decommissioning and the NI NFC decommissioning proper, possible NI NFC decommissioning options, sequence and estimated implementation schedule of decommissioning stages, and a short description of the foreseen ultimate states of NI NFC after its decommissioning operations are completed.

1.2. Should several NI NFC be decommissioned on one site, a unified decommissioning program can be developed.

2. Content of the program

2.1. Introduction

2.1.1. Basis for the program development

References to appropriate documents on decision-making related to NI NFC decommissioning shall be given.

2.1.2. General description of the program

The following shall be presented:

- a short description and timeframes of the main operations;

- a short description of the input justifying documents used in the program development;

- sources and estimated scope of funding of the operations under the program.

2.2. Input data used in the program development

2.2.1. Basic characteristics of the NI NFC.

Characteristics of the NI NFC site, region of its location and environment, which may affect transfer and accumulation of radioactive substances during the NI NFC decommissioning shall be outlined in the scope necessary for the program development.

Basic NI NFC characteristics affecting safety of the NI NFC decommissioning and used in development of organizational and technical activities to prepare the NI NFC for decommissioning and to implement the NI NFC decommissioning and to ensure safety of the employees (personnel), population and environment shall be described.

Projections of conditions of the NI NFC systems (components), building structures and constructions at the moment of NI NFC shutdown for decommissioning shall be presented in the scope necessary for the program development, including:

- amount of nuclear materials and radioactive substances present on the NI NFC site, their form, state of aggregation, specific (volumetric) and total activity;

- amount of radioactive waste accumulated on the NI NFC site, RW radionuclide composition, specific (volumetric) and total activity;

- availability of free space in RW storage facilities;

- presence and amount of poisons and toxic substances on the NI NFC site;

- presence and amount of explosive and fire hazardous substances on the NI NFC site;

- possible impact from the NI NFC decommissioning on other facilities of nuclear fuel cycle located on-site;

- possible impact on the employees (personnel), population and environment during the NI NFC decommissioning;

brief information on the NI NFC operation history shall be presented in the scope necessary for the program development, including:

- data on contamination levels of premises and systems' (components') surfaces, and also that of the NI NFC site location, with radioactive substances before the NI NFC decommissioning operations are commenced;

- summarized data on levels of radioactive substance releases and discharges into the environment during the period of the NI NFC operation;

- data on radiation consequences of accidents occurred during NI NFC operation.

2.2.2. References used in the program development

A list of the references used in the program development shall be presented including the design, engineering and operating documentation, and also documents containing results of surveys of systems (components), structures, buildings that were available at the moment when the program development has been started.

2.3. Program objectives

Objectives of the program are:

- development of a list of organizational and technical activities providing for implementation of possible NI NFC decommissioning options, which is consistent in terms of timeframes and sequence;

- a description of the activities to ensure safety during operations to prepare NI NFC for decommissioning and in the course of NI NFC decommissioning;

- planning of financial costs of preparatory and decommissioning operations.

2.4. Description of the NI NFC decommissioning options

The following shall be described:

- the NI NFC decommissioning options;

- the decommissioning stages for the selected NI NFC decommissioning options indicating estimated duration of each stage and the whole period of NI NFC decommissioning;

- NI NFC ultimate states after the NI NFC decommissioning for each of the reviewed options.

2.5. Main program activities

Main program activities related to preparation of NI NFC for decommissioning and implementation of the NI NFC decommissioning shall be outlined for each of the NI NFC decommissioning options indicating:

- consistent timeframes of the main activities;

- scopes and sources of funding of the main activities.

2.6. Organization of management and funding of the program

The general structure of management of the preparatory stage and NI NFC decommissioning process shall be described including appropriate organizational structures of the operating organization and organizations carrying out work and (or) rendering services to the operating organization (survey, design, engineering, research, construction, assembling organizations, manufacturers of the equipment etc.), and also allocation of their responsibilities for the preparatory and NI NFC decommissioning activities.

Scopes and sources of the program funding for the NI NFC preparatory and decommissioning activities shall be presented.

Appendix 2 Integrated engineering and radiation survey of nuclear installations of nuclear fuel cycle

1. General provisions

1.1. Integrated engineering and radiation survey of NI NFC consisting of the engineering and radiation surveys is carried out by a commission appointed by the operating organization.

IERS results form an information basis for justification of a NI NFC decommissioning option and for development of the NI NFC decommissioning project for the selected option.

IERS shall include:

an analysis of compliance of solutions which have been actually implemented at NI NFC with the design solutions;

determining of conditions of building structures, systems (components) to justify their use in NI NFC decommissioning;

determining of the radiological situation inside NI NFC premises, on the site, within the controlled area and surveillance area;

determining of the amount, activity, radionuclide composition and state of aggregation of RadS and RW;

if necessary, calculations and research.

1.2. IERS scope and timeframe are established in the NI NFC decommissioning program, depend on the equipment used for the survey, accessibility of systems (components) for the survey, scope of information necessary to develop the NI NFC decommissioning project and are defined in detail in the terms of reference for IERS.

2. Engineering survey of nuclear installations of nuclear fuel cycle

2.1. Engineering survey of NI NFC is carried out to obtain detailed information on the technical conditions of NI NFC. The engineering survey shall be aimed at obtaining the following information.

2.2.1. Survey of NI NFC buildings and structures.

The survey results shall include:

a description of NI NFC, its buildings and structures;

an assessment of actual conditions and residual service life of the NI NFC building structures at the moment of the survey;

principal circuit diagrams of power, heat, gas, air and water supply;

diagrams and characteristics of process and transport connections between process buildings, structures and premises of NI NFC.

2.2.2. Survey of the NI NFC process premises.

The survey results shall include:

characteristics of the premise (dimensions, explosive and fire hazard category ; class of explosive and fire hazardous area, air exchange rate, characteristics of the floor, ceiling and walls coating, characteristics and types of openings);

a list of systems (components) and communication lines located in the premises or passing through the premises, their technical characteristics, dimensions and mass;

a list of lifting and transport equipment and its characteristics;

a list of ventilation systems, their characteristics;

a list of fire safety systems and their characteristics;

data on assessment of operability and reliability of structures, systems (components) needed for the NI NFC decommissioning;

data on assessment of actual conditions of systems (components) at the moment of their survey and their residual service life;

information on a possibility of arranging for additional equipment and (or) on a necessity of making additional openings for the decommissioning operations;

data on the amount and characteristics of poisonous (toxic substances), explosive and fire hazardous substances.

3. Radiation survey of the nuclear installation of nuclear fuel cycle

3.1. The main purpose of the radiation survey is to obtain information on the amount of RadS and RW, their locations, and data necessary to assess radiation impact on the employees (personnel), population and environment during the NI NFC decommissioning operations.

3.2. Results of the NI NFC radiation survey shall include information on:

a list of facilities included in the general layout (NI NFC buildings and structures), communication lines affected by contamination with dimensions of the area, types of surfaces (walls, roofs) and coatings, radionuclide composition and total activity, contamination levels;

amount and characteristics of accumulated RadS, their form, state of aggregation, specific (volumetric) and total activity;

volumes of liquid RW accumulated in the storage facilities, their specific and total activity, radionuclide and chemical composition;

volumes of solid RW accumulated in the storage facilities, their specific and total activity, radionuclide composition;

gamma-radiation dose rate from NI NFC equipment, RW storage facilities, and radiation field maps.

3.3. The radiation survey of the NI NFC premises shall be followed by determining of:

boundaries of radiation contamination areas inside NI NFC buildings;

levels of surface contamination of equipment and building structures with radioactive substances;

levels of radionuclide contamination of equipment and building structures over depth from the outer surface.

3.4. The radiation survey shall result in determining of:

specific (volumetric) activity and radionuclide composition of contamination in surface and ground water of the NI NFC site;

specific (volumetric) activity and radionuclide composition of contamination of soil of the NI NFC site.

4. Requirements to the means for NI NFC integrated engineering and radiation survey

4.1. The NI NFC survey shall be implemented using design, engineering and operating documentation, which shall have appropriate registration numbers demonstrating that it belongs to the facility under survey.

4.2. Instrumental survey of NI NFC state shall be performed using techniques and means which have been metrologically qualified.