RUSSIAN MARITIME REGISTER OF SHIPPING

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RULES

FOR THE CLASSIFICATION AND CONSTRUCTION OF NUCLEAR SHIPS AND NUCLEAR SUPPORT VESSELS

PART I
CLASSIFICATION

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RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF NUCLEAR SHIPS AND NUCLEAR SUPPORT VESSELS

Rules for the Classification and Construction of Nuclear Ships and Nuclear Support Vessels developed by Russian Maritime Register of Shipping (RS, the Register) have been approved in accordance with the established approval procedure and come into force on 1 October 2022.

The present edition is based on the 2022 edition of the Rules for the Classification and Construction of Nuclear Ships and Floating Facilities and on the 2017 edition of the Rules for the Classification and Construction of Nuclear Support Vessels, taking into account Circular Letters No. 110-312-1-1695c dated 04.02.2022 and No. 110-312-1-1702c dated 14.02.2022, amendments and additions developed immediately before publication.

The Rules set down specific requirements for the nuclear ships, nuclear support vessels and supplement the Rules for the Classification and Construction of Sea-Going Ships and the Rules for the Equipment of Sea-Going Ships of Russian Maritime Register of Shipping.

The Rules are published in the following parts:

Part I "Classification";

Part II "Safety Standards";

Part III "Hull";

Part IV "Stability. Subdivision";

Part V "Fire Protection";

Part VI "Nuclear Steam Supply Systems";

Part VII "Special Systems";

Part VIII "Electrical and Automation Equipment";

Part IX "Radiation Safety";

Part X "Physical Security".

REVISION HISTORY

(purely editorial amendments are not included in the Revision History)

For this version, there are no amendments to be included in the Revision History.

1 GENERAL

1.1 Application

1.1.1 The Rules for the Classification and Construction of Nuclear Ships and Nuclear Support Vessels[1] apply to the self-propelled or non-self-propelled nuclear ships and nuclear support vessels[2], considering the application specified in 1.2, Part I "Classification" of the Rules for the Classification and Construction of Sea-Going Ships[3].

1.1.2 All the requirements of the General Regulations for the Classification and Other Activity, Rules for the Classification, Rules for the Equipment of Sea-Going Ships [4], Rules for the Cargo Handling Gear of Sea-Going Ships[5], Load Line Rules for Sea-Going Ships[6], Rules for the Prevention of Pollution from Ships Intended for Operation in Sea Areas and Inland Waterways of the Russian Federation[7], Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships[8] apply in full to the nuclear ships and NS vessels other than those to which the other provisions of these Rules apply.

1.2 In addition to the definitions given in the RS normative documents listed in 1.1.2, the following definitions have been adopted in these Rules.

Reactor emergency protection is a function of the reactor control and protection system (CPS) intended to prevent development of accidents on reactor by switching the reactor to the subcritical state.

Emergency electric system of ship is an electric system consisting of emergency generators and emergency switchboards independent of the main electric system and intended to supply electric energy to consumers important for safety of the nuclear steam supply system (NSSS) and the ship as a whole, when the main and stand-by electric energy sources are not available.

Emergency state is a state of the ship, plant or unit after abnormal short-term failure to perform their intended functions (post-accident state).

Emergency electric energy sources are electric generators intended to supply electric energy to ship's critical consumers when voltage at the main switchboards is not available.

Reactor core is the portion of a nuclear reactor containing the nuclear fuel components where the controlled nuclear chain reaction takes place.

Nuclear steam supply system (NSSS) is a component of the power unit designed for steam generation from nuclear energy.

Nuclear power plant (NPP)[9] is the main power plant designed to perform primary functions of a nuclear ship. Nuclear power plant comprises nuclear reactors including supply systems, steam turbines including supply systems and electrical energy system comprising main generators and electrical propulsion engines.

Nuclear ship is a self-propelled or non-self-propelled ship equipped with NPP.

Metal-water shielding tank is a device consisting of metal layers and water and designed for attenuation of radioactive radiation emitted from nuclear reactor core.

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1 Hereinafter referred to as "these Rules".
2 Hereinafter referred to as "the NS vessels".
3 Hereinafter referred to as "the Rules for the Classification".
4 Hereinafter referred to as "the Rules for the Equipment".
5 Hereinafter referred to as "the Rules for the Cargo Handling Gear".
6 Hereinafter referred to as "the Load Line Rules".
7 Hereinafter referred to as "the Rules for the Pollution Prevention".
8 Hereinafter referred to as "the Rules for the Technical Supervision".

Reactor biological shielding comprises reactor structural components and water layer for protecting personnel against radioactive radiation.

Relative leakage rate is a ratio of leakage rate (by weight/volume) to air mass/volume in the controlled volume at given initial parameters (pressure, temperature) expressed as a percentage per unit time.

Leakage rate is an air mass/volume escaped from the controlled volume per unit time at given initial parameters (pressure, temperature).

Internal area is an area at interior locations of the ship surrounded by physical barriers with restricted and controlled access.

Gaseous radioactive waste is a waste discharged in air as gaseous and aerosol emissions.

Leak tightness is the ability of structures, systems and their components to withstand gas/fluid exchange through them within design limits.

Date of construction of a nuclear ship is a date of actual termination of technical supervision of ship under construction and issuance of the Classification Certificate.

Decontamination equipment is the equipment intended for radioactive contamination removal from different surfaces.

Integrated electric energy system is a system consisting of the main and stand-by generators with associated driving motors, transformers, converters and distributors with power lines, intended to supply electric energy to all the ship consumers, including electric propulsion systems and other systems depending on the ship's purpose.

Single failure is an accidental event, which results in the loss of capability of a component/system to perform its intended safety/technical functions. Multiple failures, which result from one event/operator's error are considered as parts of a single failure.

Liquid radioactive waste (LRW) is a radioactive fluid containing dissolved or suspended radionuclides in concentrations greater than values as specified in applicable standards and regulations. This radioactive fluid shall not be utilized.

Beyond design-basis (anticipated) accident is an accident being analyzed in the design project as unlikely so no safety measures are taken to prevent it.

Containment is a ship structure with the steam supply system (SSS) inside. The containment is designed to maintain the radioactive emissions released from SSS within permissible limits.

Shielding barrier is a ship's structural barrier surrounding the containment and major radioactive sources related to SSS. This shielding is additionally provided to minimize release of radioactive materials from the containment to the environment and other compartments of the vessel.

Protected area comprises open areas of decks of the ship with restricted and controlled access.

Identifier is an assigned or inherent attribute to be used for proving eligibility for access to the secured area.

Identification is a process for identifying the subject/object by its inherent identification attribute.

Safety class is a class assigned to structures, systems and their components according to their significance for nuclear safety of the ship. This safety significance is defined with regard to effects of loss of functions being performed in various intended situations.

State class is a combination of states selected by its frequency of occurrence and assumed effects which can occur under normal operation or foreseen operating faults and accidents as well as when the ship is exposed to external or internal forces, natural and human-induced disasters.

Active component is a component driven by external exposure (excitation, mechanical exposure or power supply)[1].

Passive component is a component with no moving parts which is sensitive to variation in pressure, temperature and working fluid flow[2].

Collision, grounding and stranding protection comprises specific structures of the ship in the vicinity of reactor compartment and fuel assemblies storage facilities which protect SSS, its safety systems and storage facilities for radioactive waste and nuclear fuel against actions in the event of collision or grounding and stranding.

Controlled area is an area, which comprises compartments of the ship with higher level of ionizing radiation and/or radioactive contamination under normal conditions, with controlled access and to which standards for protection against radiation are applicable.

Maximum design-basis accident is an accident resulting in the highest radiation hazard for the crew and environment. In general, maximum design-basis accident is related to the rupture of the primary coolant pipeline.

Montejus is a special-purpose enclosed container for collecting and storing liquid radioactive waste (LRW) with liquid pumped out by means of compressed air.

Monitored area is a number of spaces where radioactive contamination may occur and ionizing radiation is likely to increase in case of variations from normal operation of the equipment.

Unauthorized person is a person who has performed or is attempting to perform the unauthorized action as well as the assisting person.

Unacceptable risk is design minimum probability when the crew, passengers, population and environment are exposed to excess ionizing radiation and radioactive contaminations.

Unauthorized action is an action or attempt for sabotage/act of terror, theft of nuclear materials, nuclear plants, unauthorized access, carrying prohibited objects, breaking down or causing malfunction of the PS engineering facilities.

New fuel assemblies are fuel elements assemblies before they are used in the nuclear reactor.

Normal operating state and habitability conditions are conditions when the ship as a whole, its machinery, systems and equipment, which ensure its propulsion, intended operation, steerability, safe navigation, unsinkability, internal signals and communication, means of escape, boat winches operation as well as the minimum habitability conditions are working properly (i.e. capable of performing all functions within the given design limits and conditions, including startup, operation at power, deactivation, maintenance, testing and nuclear fuel handling).

Irradiated fuel assemblies are fuel assemblies irradiated in the nuclear reactor, removed from it, and containing spent nuclear fuel (SNF).

Radioactive waste equipment means equipment intended for radioactive waste collection, treatment and storage.

Similar-type failure is defined as a failure in several devices or components due to particular event or for some reason.

Main design-basis accident is defined as the submitted accident which defines basic design requirements to the ship, SSS and its safety systems.

Main electric system is a system consisting of main and stand-by electric energy sources and main switchboards intended to supply electric energy to both the SSS consumers and all the ship consumers.

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[1] For example, pumps, fans, relief and non-retum valves, etc.

[2] For example, heat exchangers, pipelines, vessels, electric cables, etc.

Main electric energy sources are sources of electric energy required to maintain the ship under normal operating condition and normal habitability conditions with the SSS running without engagement of the stand-by or emergency generators.

Critical area is an area at interior locations surrounded by physical barriers with continuously restricted and controlled access.

Secured area is protected, internal or critical area.

Operator's error is a single operator's erroneous action or inaction (when action is required) towards controls.

Steam generating unit (SGU) is a unit built on the basis of the nuclear reactor where the components forming main circuit loop of the primary coolant, reactor core, SG, hydraulic chambers with primary circulating pumps are located in one integral case. Intended for generation of overheated steam as part of NSSS.

Steam-turbine unit is a set of machinery and equipment designed to convert the thermal energy of overheated steam into mechanical energy including systems ensuring functioning of this equipment (cooling, lubrication, local control and diagnostics systems, etc.).

Primary circuit of steam supply system is the reactor–SG closed tight circuit with coolant circulating over it. The coolant removes heat from the nuclear reactor core and transfers the heat converted into steam in SG to the secondary circuit water.

Uninterrupted power supply units are sources providing uninterrupted supply of electric energy to certain consumers when all the other electric energy sources do not operate.

Personnel represent crew members to be exposed to ionizing radiation according to their occupation.

Physical security personnel are personnel responsible for PS on board the nuclear ship as part of their duty regulations.

Emergency cooling control station is defined as an area or compartment of the ship fitted with equipment and devices for disabling SSS in case of failure in central control station.

Potential nuclear-hazardous operation is defined as an operation which may result in pre-emergency or nuclear/radiation accident.

Single failure concept is defined as a capability of the system to perform its design functions in case of single failure.

Design-basis accident is an accident considered and analyzed in the draft design of SSS and the ship. This accident is prevented by means of appropriate arrangements and procedures and harmful effects are reduced to the applicable standards.

Physical security control station is designated space/location equipped with engineering facilities. This space is used for control, in full scope or in part, of the PS engineering facilities in normal and emergency situations by designated PS personnel.

Reactor control and protection system actuator is a device for changing reactor reactivity being moved by a single drive of the reactor CPS.

Radiation safety (RS) is defined as capability of the facilities and measures used to protect crew, passengers and environment against harmful radioactive radiation and contamination within specified limits.

Process radiation monitoring is defined as monitoring of the state of the SSS equipment and shielding barriers for all state classes by recording ionizing radiation by means of special-purpose instruments and procedures.

Radioactive waste is defined as equipment, items, materials, substances in any aggregative state which are not intended for further use, with radionuclide content exceeding the permissible values as specified in applicable Flag State standards and regulations.

Radioactive waste may be divided into solid (SRW), liquid (LRW) and gaseous waste. Radioactive waste is classified by the degree of its radioactivity as per the applicable Principal Sanitary Radiation Safety Rules.

Reactor plant is a component of NPP. The reactor plant comprises the nuclear reactor, systems and equipment directly related to the reactor to provide its normal operation, prevent and control accidents as well as reduce their effects.

Reactor compartment is a watertight compartment of the ship restricted by its bottom, sides, bulkhead deck, forward and aft bulkheads or cofferdams with the reactor plant inside.

Stand-by electric energy sources are electric generators independent of SSS to be used in cases of the SSS failure or in other abnormal situations instead of faulty main electric energy sources. These energy sources shall supply electric energy to the consumers ensuring safety of the ship and restore normal operational state for minimal habitability conditions, as well as for scheduled launch and cooling of SSS without engagement of the emergency generators.

Decontamination station is a special-purpose compartment or cluster of compartments designed for checking for radioactive contamination of personnel, changing clothes and shoes as well as for sanitary treatment of the personnel allowed to the controlled area.

Unrestricted area is all premises of the ship/floating facility which do not form part of the controlled/supervised area.

Reactor control and protection system is a combination of technical, software and information facilities to provide appropriate conditions for safe chain reaction at a given power and its variation at startup, stop, reactor switchover, to check for chain reaction intensity, ensure fast termination of fission reaction in case of accident as well as to control power density fields.

Safety systems are systems designed to disable the reactor reliably, remove heat from the reactor core and/or reduce effects of foreseen operating deviations and accidents.

Nuclear support vessel (NS vessel) is a cargo vessel intended for the following:

storage of new and spent fuel assemblies of the nuclear reactor cores;

operations on unloading of spent fuel assemblies and loading of new fuel assemblies into reactors;

reception, decontamination, repairs and storage of the SSS equipment;

reception, treatment and transfer of gaseous radioactive wastes, LRW and SRW.

In addition, the NS vessel can fulfil the following functions not associated with radioactivity:

supply of nuclear ships with working media and their reception on board (fresh water, high purity water, compressed air (gas));

supply of nuclear ships with electrical and heat energy;

other functions of operational support of nuclear ships.

The NS vessel can provide the whole complex of operational support or individual types of such support for nuclear ships, which determines the design of the NS vessel, of the equipment installed thereon and its nomenclature.

Marine electric power plant is a set of primary motors and electric generators with the main switchboard intended to supply electric energy to all the ship consumers in any operation mode of the marine ship's energy system.

Readout device is a device to be used for reading data from identifier.

Solid radioactive waste (SRW) is solid items, materials and substances contaminated with radioactive materials in concentrations exceeding the permissible levels as specified in the applicable standards and regulations. This waste is no longer useful.

Physical security facility is a type of equipment to be used by designated personnel for detection of unauthorized actions, receipt of information on attempts and occurrence of such actions, notifications on attempts and occurrence of these actions, detection and suspension of unauthorized actions.

Physical security (PS) is a combination of measures and engineering facilities to prevent sabotage/acts of terror and theft regarding to nuclear materials and nuclear plants installed on board the nuclear ships and NS vessels.

Physical barrier is a physical obstacle to prevent intrusion of unauthorized persons to controlled areas, nuclear materials/vulnerable points of the nuclear plant.

Central control station is defined as a compartment of the ship designed for control and monitoring of the NPP operation under normal conditions, in case of foreseen operating deviations and accidents.

Electric energy system is a set of ship electrical equipment designed for generation, distribution, change of parameters and conversion of electric energy into other types of energy (mechanical, thermal, luminous, chemical, etc.).

Nuclear accident is an accident related to damage of fuel elements exceeding the specified safe operation limits.

Nuclear safety of the nuclear ship is a capability of the ship/floating facility and crew to reduce harmful radiation impacts on the crew and environment down to specified limits under normal operation and in case of accidents.

Nuclear reactor is a device used to initiate and maintain the controlled nuclear fission chain reaction.

1.3 The following abbreviation have been adopted in these Rules:

CPS — control and protection system;
HPG — high-pressure gas;
LRW — liquid radioactive waste;
NPP — nuclear power plant;
NSSS — nuclear steam supply system;
PS — physical security;
RM — radiation monitoring;
RS — radiation safety;
SG — steam generator;
SGU — steam generating unit;
SRW — solid radioactive waste;
SSS — steam supply system.

2 CLASS OF A SHIP

2.1 Conditions of assignment, renewal and retainment of the RS class are given in 2.1, Part I "Classification" of the Rules for the Classification.

2.2 Class notation of a ship

2.2.1 Character of classification, additional distinguishing marks and descriptive notations are assigned in compliance with the requirements of 2.2 — 2.5, Part I "Classification" of the Rules for the Classification.

2.2.2 The symbol ⊠ is added before the character of classification of the nuclear ship.

2.2.3 Where the NS vessels comply with the requirements of the Rules for the Classification and the requirements of these Rules, the descriptive notation **Nuclear support vessel** is added to the character of classification (refer to Section 2, Part I "Classification" of the Rules for the Classification).

2.2.4 Entries in compliance with 2.4, Part I "Classification" of the Rules for the Classification may be made in the Classification Certificate of the nuclear ships and NS vessels. Operational capabilities of the NS vessel according to its purpose are shown, where necessary, as additional characteristics in Section "Other Characteristics" of the Classification Certificate (e.g., "LRW treatment").

3 TECHNICAL DOCUMENTS

3.1 Technical design documentation on the nuclear ship and NS vessel

In addition to the documents listed in 3.3, Part I "Classification" of the Rules for the Classification, the following technical design documentation[1] shall be submitted to the Register for review.

3.1.1 General:

.1 general arrangement plan of controlled area spaces with their subdivision into categories and indication of all openings and their closures in hull structures bounding the controlled area, as well as indication of allowable values for controlled parameters (**);

.2 analysis of possible emergency situations connected with spillover of radioactive materials beyond the controlled area, methods of localization and liquidation of consequences (**);

.3 water- and gastight plan for the containment and shielding barrier (*);

.4 list of equipment located within the controlled area (**).

3.1.2 Hull documentation:

.1 for the nuclear ships — structural diagram for reactor compartment main girders; for the NS vessels — compartments with controlled area spaces (*);

.2 structural diagram for biological shielding (*);

.3 containment drawings for the nuclear ships (*);

.4 collision protection diagram and grounding and stranding diagram: for nuclear ships — in the area of central section, for NS vessels — in the area of new fuel assemblies and irradiated fuel assemblies storage facilities and the LRW tanks (*);

.5 description of containment leak tightness test instruments and procedures: for the nuclear ships — of the central section, for the NS vessels — of the controlled area spaces (**);

.6 calculation results on biological shielding attachment strength: for the nuclear ships — metal-water shielding tank (**);

.7 drawings and strength calculations of the LRW tanks with indication of distance between bottom-and-side shell plating and the tanks (*);

.8 drawings of supports and other structures for securing built-in LRW tanks (*);

.9 for the NS vessels — drawings of new fuel assemblies and irradiated fuel assemblies storage facilities with closures, arrangement plans for openings in bulkheads and decks bounding the controlled area and their closures (*).

3.1.3 Documentation on radiation safety (RS):

.1 chart for radiation within the ship and on its external surfaces of hull structures (for NS vessels — with new fuel assemblies, irradiated fuel assemblies, liquid and solid waste storage facilities totally filled) (**);

.2 efficiency calculations of biological shielding made or approved by a competent authority (**);

.3 RM system of the ship (description, schematic diagram (*), layout on board the ship (**), calculation results and drawings for the system and its equipment (**), delivery specifications (*));

.4 radiation conditions evaluation in case of the most serious designed accidents and charts and calculations of anticipated radiation levels in case of accidents in the interior spaces and in the vicinity of the ship, made or approved by a competent authority (**);

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[1] Upon review results of the documentation (marked with (*) and (**)), the stamping is made in accordance with 3.1.5, Part I "Classification" of the Rules for the Classification.

.5 description of decontamination procedures for spaces and equipment subject to radioactive contamination, for equipment and materials transferred from serviced ships as well as contaminated and decontaminated equipment and materials transfer routes. Description and arrangement plan of the main decontaminating equipment (**);

.6 arrangement plans of the process RM system equipment (**);

.7 testing programme of the RM system at the manufacturer's (*);

.8 for the NS vessels — drawings of special equipment, pipes for radioactive material transfer (**).

3.1.4 Documentation on fire protection:

structural fire protection diagram: for the nuclear ships — for reactor compartment, for the NS vessels — drawings of sections with controlled area spaces (may be included into general fire protection diagram for the ship) (*).

3.1.5 Documentation on systems and piping:

.1 for the nuclear ships — schematic diagrams for SSS;

primary coolant circulating system;

primary coolant purification system;

primary coolant make-up system;

residual heat removal system;

core emergency cooling system;

primary coolant sampling system;

deaeration system;

primary water drainage, storage and distribution system;

pressure compensation system;

HPG system;

secondary coolant (from SG to the secondary circuit);

fresh water cooling system (equipment and protection system);

sea water cooling system (equipment);

ventilation system for the SSS spaces and controlled area spaces;

sorbent storage, unloading and handling system;

explosive mixture removal and hydrogen content monitoring system;

automatic equipment operating water and fitting control system;

.2 for the NS vessels — diagrams for the systems servicing radioactive waste storage facilities and LRW reception and discharge control stations, ventilation systems for controlled areas (*);

.3 diagrams of waste water, special bilge system and ventilation system of the vessel controlled area spaces (*);

.4 installation (location and mounting) of bottom-and-side fittings in the ship controlled area (if any) (**);

.5 for the nuclear ships — calculations on the systems servicing SSS; for the NS vessels — calculations on the systems of irradiated fuel assemblies storage facilities and the SRW, LRW discharge system (**).

Schematic diagrams on systems and/or specifications (element tables) thereto shall include pipe sizes (diameter and wall thickness), pipeline structure data (materials, insulation, fabrication and mounting methods, arrangement, hydraulic testing, etc.) as well as on material of used pipes, material of gaskets and pipe connection types.

3.1.6 Documentation on electrical equipment:

.1 for the nuclear ships — circuit diagrams of main and emergency electrical power supply to consumers and automation of SSS and RM system (*);

.2 for the NS vessels — consumers (fixed and portable), directly associated with the vessel use for the intended purpose, including servicing cooling systems for irradiated fuel assemblies and SRW storage facilities (*);

.3 drawings of cable routing in the controlled area with cable penetrations of the biological shielding and divisions between the controlled and monitored areas (*);

.4 arrangement and installation plans of electrical equipment in the controlled area (*);

.5 calculations of the required electrical power capacity: for the NS vessels — providing main operating conditions of the vessel; for the nuclear ships — the SSS main and emergency operation modes (**).

3.1.7 Documentation on automation equipment:

.1 list of the SSS remotely-controlled fittings with types, manufacturers and the Register approval certificates (**);

.2 for the nuclear ships — control algorithms for SSS and steam turbine unit (*);

.3 for the nuclear ships — functional and schematic diagrams for automation and remote control of SSS, safety systems and the systems serving SSS (components required for systems operations shall be specified: sensors, converters, manipulators, actuators, etc.) (*);

.4 for the nuclear ships — functional and schematic circuits for control management from emergency cooling station (*);

.5 diagrams of process and heat monitoring and signalling as well as alarm systems (*);

.6 circuit diagrams of the main and emergency electrical power supply to automation, monitoring and signalling devices (*);

.7 list of control, monitoring and signalling parameters of special systems (*).

3.1.8 Documentation on physical security (PS):

.1 plans of physical barriers and arrangement of engineering equipment of the secured areas (**);

.2 circuit diagrams of (as applicable for a particular design) (**):

intrusion protection system;

security alert system;

access monitoring and control system;

optoelectronic surveillance;

communication and address system.

3.2 Working documentation for the nuclear ship and NS vessel under construction

In addition to the documents given in 3.4, Part I "Classification" of the Rules for the Classification, the following working documentation shall be submitted to the Register for review.

3.2.1 Hull documentation:

.1 primary member drawings of sections and assemblies: for the nuclear ships — of the reactor compartment, for the NS vessels — compartments where controlled area spaces are located (*);

.2 biological shielding drawings (*);

.3 for the nuclear ships — containment drawings and containment test procedure (*).

3.2.2 Documentation on systems and piping:

drawings for piping with layout and piping assemblies penetrating containment and biological shielding, bulkheads, decks and platforms (*).

3.2.3 Documentation on SSS:

.1 layout and securing arrangement drawings for the SSS equipment (*);

.2 operating instructions for SSS (*);

.3 test procedure for SSS during mooring and sea trials (*).

3.2.4 Documentation on radiation safety (RS) (*):

layout and attachment plans for the RM system equipment (*).

3.2.5 Documentation on electrical equipment (*):

drawings for cable routing: for the nuclear ships — in the reactor compartment with the assemblies penetrating containment and shielding barrier, for the NS vessels — in compartments of the controlled area spaces.

3.2.6 Documentation on automation equipment:

.1 for nuclear ships — layout and securing arrangement drawings for safety system equipment and systems serving SSS (*);

.2 drawings for cable routing and pulse piping (*);

.3 for nuclear ships: layout drawings for sensors required for operation of SSS, safety systems and systems serving SSS (*).

3.3 Technical design documentation on SSS

3.3.1 Technical design documentation on SSS to be submitted to the Register for review shall include:

.**1** description with the basic specifications, technical assignment and delivery specifications for SSS (**);

.2 memorandum (**);

.3 general arrangement drawings for SSS (**);

.4 SSS operation modes (**);

.5 SSS emergency modes that shall include the following:

reactivity change accident analysis (**);

analysis of heat removal accidents followed by coolant loss (**);

safety systems' reliability design analysis (**);

safety analysis by strength conditions (**);

.6 list of the SSS equipment indicating the status of the technical documentation review by the Register (**);

.7 schematic diagrams for the SSS systems specified in 3.1.5 (*);

.8 feasibility study on the SSS safety (**);

.9 list of facilities for survey of the SSS equipment (**);

.10 ways of handling of fuel assemblies and cores and description of the handling equipment (**);

.11 technical documentation on the SSS equipment specified in 2.4.1 — 2.4.6 and 2.4.13, Part VI "Nuclear Steam Supply Systems", along with the nuclear ship technical design, may be submitted to the Register for review in the following scope:

general arrangement drawings with sections and drawings for major parts (*);

memorandum or description (**);

strength calculation results (**);

delivery specifications/draft delivery specifications (**);

delivery-acceptance trial programs for prototype and serial equipment (*);

.12 memorandum for core physical and thermohydraulic calculations (**).

3.3.2 Prior to stating manufacturing process of the SSS equipment specified in Section 2, Part VI "Nuclear Steam Supply Systems", the detailed design documentation shall be submitted to the Register for approval.

3.4 Technical design documentation on the handling equipment complex for fuel assemblies

3.4.1 Technical design of the handling equipment complex for fuel assemblies shall be approved by the Register. The following items shall be defined and justified in the technical design of the handling equipment complex:

.1 handling procedures;

.2 technical means and measures to ensure nuclear and radiation safety;

.3 condition of safety-related systems.

3.4.2 The technical design of the handling equipment complex to be submitted to the Register shall include the following documentation:

.1 performance specification for delivery of complex, including machinery, electrical equipment, remote control system (*);

.2 drawings of separate items of the complex with sections, indication of dimensions on the drawings, materials, welding, welding consumables, roughness and smoothness of surfaces (*);

.3 specification of the complex equipment (**);

.4 list of the complex items with indication of their main characteristics and information on approval by the Register (**);

.5 list of deviations from the requirements of the Register rules with substantiation (**);

.6 electrical schematic and circuit diagrams of the complex items (*);

.7 electrical schematic and circuit diagrams of remote control systems (*);

.8 description of handling equipment complex (**);

.9 strength and reliability calculations (**);

.9 biological shielding diagram (*) and calculation (**);

.11 thermal design of cooling system (**);

.12 drawing (*) and calculations of cargo handling gear (**);

.13 testing program (*);

.14 list of spare parts, tools and accessories (**).

3.4.3 Prior to commencement of the handling equipment manufacture, working drawings shall be approved by the Register according to the list agreed.

3.4.4 Strength calculations of the handling equipment shall be made with regard to operation specifics.

3.5 Ship's operational documentation

3.5.1 For the nuclear ship, in addition to the documents specified in Appendix 1 to Part II "Technical Documentation" of the Rules for the Technical Supervision, the RS-approved operational documentation specified in Table 3.5.1 shall be available on board the ship.

Table 3.5.1

No.	Document name	RS approval	Flag MA approval	Stamp	Application
1	Nuclear Ship Safety Information (Appendix 3)	+	+	Approved	Reg. VIII/7 of SOLAS-74, as amended
2	Operating Manual of the nuclear power plant (Appendix 4)	+	+	Approved	Reg. VIII/7 of SOLAS-74, as amended

3.6 Ship's technical documentation

3.6.1 For the nuclear ship, in addition to the documents specified in Appendix 1 to the Rules for the Classification Surveys of Ships in Service[1], the documentation specified in Appendix 1 of these Rules (where applicable) shall be available on board the ship.

3.6.2 For the NS vessel, in addition to the documents specified in Appendix 1 to the Rules for the Classification Surveys, the documentation specified in Appendix 2 of these Rules shall be available on board the vessel.

[1] Hereinafter referred to as "the Rules for the Classification Surveys".

APPENDIX 1

NUCLEAR SHIP'S TECHNICAL DOCUMENTATION

1 GENERAL SHIP DOCUMENTATION:

1.1 instructions on containment testing during operation;
1.2 water- and gastight plan for the containment and shielding barrier;
1.3 layout of equipment located within the controlled and supervised areas;
1.4 layout of controlled areas.

2 HULL DOCUMENTATION:

2.1 structural diagram for biological shielding;
2.2 containment drawings;
2.3 protection diagram for reactor compartment.

3 DOCUMENTATION ON SHIP'S ARRANGEMENTS AND OUTFIT:

3.1 drawing for instrument space hatch cover;
3.2 drawings for cargo transportation to the SRW storage facility.

4 DOCUMENTATION ON NSSS:

4.1 general layout of the NSSS equipment within the containment;
4.2 specification for NSSS.

5 SYSTEMS' DOCUMENTATION:

5.1 system diagrams for systems (as applicable):
.1 primary circuit pressure compensating, circulating and purification system;
.2 secondary circuit system;
.3 tertiary and quaternary circuits system;
.4 primary deaeration system;
.5 primary and tertiary water sampling system;
.6 SG washing and storage system;
.7 SG leak detection system;
.8 SG overpressure prevention system;
.9 primary coolant make-up system;
.10 emergency cooling system;
.11 heating and normal cooling of NSSS;
.12 condensate feeding system;
.13 soluble poison injection system;
.14 core emergency cooling system;
.15 LRW collection, storage and discharge system;

.16 special-purpose drainage system;
.17 containment drenching system;
.18 HPG system;
.19 sorbent unloading and hydraulic handling system;
.20 decontamination system;
.21 controlled area ventilation system;
.22 pressure suit air system;
.23 emergency pressure reduction system;
.24 containment heat removal system;
.25 reactor box water filling system;
.26 containment flooding system;
5.2 list of scheduled checks for nuclear safety systems and equipment.

6 DOCUMENTATION ON ELECTRICAL EQUIPMENT:

6.1 power supply and control circuit for primary circulating pump;
6.2 electric drives of the NSSS auxiliary machinery;
6.3 functional tests of power supply system and power supply circuits of NSSS;
6.4 schematic main and emergency power supply circuit for the NSSS machinery;
6.5 drawings for cable routing within reactor compartment;
6.6 main and emergency lighting layout for controlled areas.

7 DOCUMENTATION ON AUTOMATION SYSTEMS:

7.1 emergency parameter recorder (electric circuit diagram);
7.2 schematic diagram for control and monitoring system of NSSS;
7.3 algorithms of NSSS and steam-turbine unit;
7.4 parameters to be checked (NSSS);
7.5 specifications for local control devices of NSSS;
7.6 RM system schematic diagram.

APPENDIX 2

NS VESSEL'S TECHNICAL DOCUMENTATION

1 GENERAL VESSEL DOCUMENTATION:

1.1 analysis of possible emergency situations connected with spillover of radioactive materials beyond the controlled area, methods of localization and liquidation of consequences;
1.2 list of allowable values for controlled parameters of nuclear material storage and handling system in all operation modes for its elements;
1.3 plan of vessel's subdivision into the RS areas.

2 HULL DOCUMENTATION:

2.1 drawings of new fuel assemblies and irradiated fuel assemblies storage facilities with closures, built-in LRW tanks and their foundations;
2.2 drawings of the LRW tanks.

3 DOCUMENTATION ON RS:

3.1 basic diagram, description and composition of RM.

4 DOCUMENTATION ON SYSTEMS AND PIPING:

4.1 diagrams of systems serving radioactive material storage facilities, and the LRW reception and discharge systems;
4.2 diagrams of ventilation systems for radioactive waste storage facilities, and the spaces where they are located;
4.3 diagrams of waste water and special bilge systems of the vessel controlled area spaces.

5 DOCUMENTATION ON ELECTRICAL EQUIPMENT:

5.1 arrangement and installation plans of electrical equipment of handling means;
5.2 diagrams of process and heat monitoring and signalling as well as alarm systems;
5.3 circuit diagrams of main and emergency electrical power supply to automation, monitoring and signalling devices;
5.4 list of control, monitoring and signalling parameters of special systems.

6 DOCUMENTATION ON PHYSICAL SECURITY (PS):

6.1 plans of physical barriers and arrangement of engineering equipment of the secured areas;

6.2 circuit diagrams of (as applicable for a particular design):
intrusion protection system;
security alert system;
access monitoring and control system;
optoelectronic surveillance;
communication and address system.

APPENDIX 3

NUCLEAR SHIP SAFETY INFORMATION

1 GENERAL PRINCIPLES

1.1 The Nuclear Ship Safety Information[1] is based on initially submitted documents followed by the recommendations, supplements and revisions.

1.2 The Safety Information shall contain systematic analysis of technical issues related to safety of the nuclear ship with respect to design, construction, operation and decommissioning proving that the ship does not pose unacceptable risk for the crew, people and environment. The Safety Information shall include sufficient data to allow the Register and authorized bodies of a host country to evaluate safety of the ship.

1.3 The Information shall be submitted in a brief form and issues shall be considered based on their importance for safety of the nuclear ship.

1.4 If the provisions of regulation I/5 of the International Convention for the Safety of Life at Sea[2] devoted to appropriate alterations are adopted, the Safety Information shall include description of appropriate alterations with calculations proving their reliability.

2 PRACTICAL INSTRUCTIONS

2.1 It is required that a provision be made for the Safety Information to add additional data or include revised sections. All pages of the document shall have clear numbers in sequence and respective dates. Revised pages and supplements shall distinctly differ from the initially submitted materials (revision number and revision date shall be specified).

2.2 It is required that drawings, graphs, diagrams, tables and charts be used whenever they are needed for better understanding of the subject.

2.3 All information to be forwarded shall be understandable. To keep the drawings clear and legible the scale shall not be reduced. The units of International System and units actually applicable to instruments shall be used.

2.4 The Safety Information may contain references to other documents, provided that they can be easily obtained by the appropriate authorities.

3 GENERAL INFORMATION

3.1 The introduction shall contain the general overview of project, including design development, construction and operation of the ship and its NPP, as well as conclusions on the ship safety.

Brief description is required for the following:

.1 design of ship and its particulars;

.2 SSS and design parameters;

.3 containment and shielding barrier;

.4 NPP;

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[1] Hereinafter referred to as "the Safety Information".

[2] Hereinafter referred to as "SOLAS-74".

.5 auxiliary machinery and systems;
.6 electric energy systems;
.7 stand-by propulsion plant (if any);
.8 collision protection.

3.2 Evaluation is required for nuclear and radiation safety with specification of measures for preventing and restricting consequences of accidents and conclusions on safety for crew, people and environment.

4 DESIGN ENVIRONMENTAL FACTORS

4.1 The Section shall contain information on environmental factors adopted as the basis for design development highlighting those points which are important for nuclear safety as well as for general safety of the ship. The Section shall justify the choice of design environmental factors, including sea state, basic design storm, fatigue service life, and environmental risk factors in areas of operation.

5 STANDARDS AND RULES

5.1 The Section shall provide technical, radiation and administrative safety rules used as the basis for design development, construction and operation of the ship and NPP:

.1 design rules:
standards,
RS rules,
design standards,
state requirements and rules;
.2 practical experience in construction and operation;
.3 operating instructions for operational period of the ship and for decommissioning period for the ship;
.4 rules for operating the ship in emergency conditions:
anticipated operating faults,
emergency conditions,
states permitting to operate the ship beyond the conditions specified by the designer.

6 TECHNICAL SPECIFICATION OF DESIGN SOLUTIONS

6.1 This Section shall contain technical specification of design solutions related to different systems, structures and components in view of their importance for safety of the ship and NPP.

6.1.1 The initial design data included in the Section shall define the required characteristics and parameters of the systems, as well as the external conditions required to achieve these specified characteristics.

6.1.2 The specification shall contain information on systems to be examined and structures as follows:

.1 functions;
.2 normal and extreme operation parameters;
.3 choice and characteristics of materials;
.4 structural layout;

.5 in-service inspections and tests;
.6 maintenance;
.7 results of strength analysis;
.8 results of thermal and hydraulic calculations.

6.2 The specifications and data required in 6.1 shall be applied to the following systems.

6.2.1 Ship and ship's systems:
.1 arrangement;
.2 characteristics;
.3 stability and subdivision;
.4 damage control;
.5 hull structure and strength;
.6 collision protection;
.7 navigation;
.8 communication;
.9 life-saving appliances;
.10 ship's machinery:
electric energy,
main propulsion plant (for instance, main condenser, turbine, steam pipeline, feed water system),
steering gear,
fire detection and prevention,
HVAC systems, bilge and ballast systems, cargo lifting gear, anchor-and-mooring gear;
.11 other systems.

6.2.2 SSS:
.1 primary circuit:
reactor,
primary pumps,
safety valves,
primary pipelines,
SG,
pressure compensating system,
fittings;
.2 auxiliary systems:
radioactive wastes, make-up system, third circuit system, sampling system; containment air ventilation and filtration, primary circuit degassing and draining, and others;
.3 reactor core;
.4 instruments and controls;
.5 safety systems:
reactor CPS,
core emergency cooling system,
residual heat removal system,
soluble poison injection system,
containment cut-off system,
leak detection system.

6.2.3 Central control station and emergency cooling control station:
.1 inspection scope;
.2 instruments;
.3 location and description;
.4 fire protection;
.5 habitability and access.

7 NPP NORMAL OPERATION MODES

7.1 The Section shall contain information on the NPP functional behavior in normal operation modes.

7.2 The information on normal operation shall include description of as follows:

.1 NPP initial state prior to starting up;

.2 starting up procedures;

.3 operating at permanent power level;

.4 changing power in the course of operation;

.5 shifting to hot stand-by mode and further to cold state;

.6 quick return to operation at power after unexpected quick shutdown.

8 RADIATION SAFETY (RS)

8.1 The Section shall contain the RS main data as follows:

.1 main criteria of radiation protection;

.2 radiation exposure limits;

.3 radioactive waste discharge;

.4 radiation levels for every zone on ship and procedures of access to zones at different state classes;

.5 handling radioactive substances.

8.2 Biological shielding description:

.1 specification of a source to be protected;

.2 arrangement and application;

.3 sizes and materials.

8.3 The RM data shall contain the following:

.1 arrangement;

.2 type, sensitivity and measurement range of sensors to be used;

.3 methods of information display and signaling;

.4 procedures of radiation and chemical monitoring of coolant, feed and cooling water;

.5 instructions on reliability and durability of the RM system;

.6 type and quantity of individual dosimeters.

8.4 The information on radioactive materials discharge into environment shall contain the data on instruments and methods for measuring leakages from the unit and data on automatic or manual actuation of discharge-restricting systems.

8.5 The following shall be described: spaces and appliances to be used for treatment of contaminated objects and people as well as decontamination stations and laboratories (indicating their layout).

9 ACCIDENT AND FAILURE ANALYSIS

9.1 The Section shall contain the detailed information on possible consequences of events affecting the unit or ship as a result of:

.1 failure or malfunction of systems, components or structures;

.2 incorrect actions of personnel while operating the unit;

.3 accidents on board the ship (i.e. fire, collision, grounding and stranding, flooding, etc.).

9.2 The anticipated development of events after failures or accidents shall be described:

.1 root cause of event;

.2 sequence of events after the prime event;

.3 final consequences.

9.3 The analysis shall include the following information:

.1 initial state;

.2 assumptions used as a basis for calculations;

.3 coolant radioactivity values;

.4 accepted defects of fuel claddings;

.5 value of leakage from the containment and efficiency of adsorption and filtration;

.6 accepted automatic actions or necessary operator's actions;

.7 time period after the event for measures to be taken.

9.4 Accident analysis shall be conducted based on a single failure criterion.

9.5 NPP faults are as follows:

.1 unintended radiation variation, including, e.g.:

cold water injection;

failure of the feed valve, i.e. supply of feed water with maximum flow rate in operation at low power;

.2 malfunctions of the primary system:

failure of the make-up system;

partial or complete breakdown of forced circulation;

coolant pressure drop (drop of level in volume compensator);

rupture of the primary circuit, i.e. accident with coolant loss;

overheating of coolant;

rupture of the SG pipe;

.3 malfunctions of the secondary system:

rupture of the main SG or feed water main pipeline,

pressure rise,

closure of the main shut-off steam valve before the turbine,

termination of steam withdrawal from SSS,

termination of cooling water supply to the main condenser,

termination of feed water supply;

.4 other accidents:

malfunctions of the electric energy system;

failure of the central control station;

unintended starting up the emergency cooling system;

faults of the radioactive waste treatment and storage systems and degassing systems.

9.6 Accidents on board the ship.

The following states shall be considered for the conditions of ship being at sea and in harbor:

.1 collision;

.2 grounding and stranding;

.3 capsizing;

.4 flooding in shallow waters;

.5 flooding in deep waters;

.6 fire within shielding barrier;

.7 fire in any other location on board the ship;

.8 external hazards in the vicinity of the ship, i.e. fire, explosion, toxic gases, etc.;

.9 loss of maneuverability;

.10 crash of helicopter and etc.

10 SAFE OPERATION CONDITIONS FOR SHIP

10.1 The following details shall be elaborated in the Section: details of operating conditions and requirements of technical, administrative and systematic nature. This shall be applicable to at least the following issues:

.1 limit conditions for operating the ship (refer to 5.1.4);

.2 surveys and inspections of technical condition (intervals and scope of records and tests);

.3 control (references to the ship's Operating Manual and organizational guidelines may be given):

organization and lines of subordination and responsibility;

procedures for making amendments and obtaining and approvals for operating instructions and directives;

manning (qualification and number of people);

procedures and instructions for control under normal operating conditions, at anticipated operating faults, emergencies and accidents;

.4 maintenance.

11 DECOMISSIONING

11.1 The Section shall contain the procedure for decommissioning of the ship without unacceptable radiation effects on population.

12 CONTENTS

It is recommended that the following typical contents regarding the Safety Information be provided:

12.1 General
12.1.1 Purpose and type of ship, expected pattern of application
12.1.2 Chronology of the ship construction: shipyard, SSS manufacturer
12.1.3 Design, construction and operation supervising authorities
12.1.4 Design criteria and design standards for ship and NPP
12.2 Ship and general safety
12.2.1 Ship general characteristics and description
12.2.1.1 General characteristics
12.2.1.2 General description
12.2.1.3 Hull structure and strength
12.2.1.4 Arrangement of NPP, equipment and control stations
12.2.1.5 Maneuvering capabilities
12.2.2 Collision protection of reactor compartment
12.2.3 Stability and buoyancy under normal and emergency conditions
12.2.4 Navigation and communication equipment
12.2.5 Life-saving appliances
12.2.6 Fire protection
12.2.7 Ship's arrangements:
12.2.8 Shipboard systems
12.3 SSS
12.3.1 General description and characteristics

12.3.2 Primary circuit
12.3.2.1 General characteristics
12.3.2.2 Equipment redundancy
12.3.2.3 Equipment arrangement
12.3.2.4 Equipment
12.3.2.4.1 Reactor (design, materials, strength, core)
12.3.2.4.2 SG
12.3.2.4.3 Circulating pumps
12.3.2.4.4 Actuating mechanisms of safety control systems
12.3.2.4.5 Auxiliary equipment
12.3.2.4.6 Pressure compensator
12.3.2.4.7 Safety, pressure-relief and shut-off valves
12.3.3 Auxiliary systems and equipment
12.3.3.1 Primary coolant purification system
12.3.3.2 Reactor make-up and emergency cooling systems
12.3.3.3 HPG system
12.3.3.4 SG piping leak detection system
12.3.3.5 Intermediate cooling system
12.3.3.6 Sampling system
12.3.3.7 Degassing and draining system
12.3.4 Emergency systems
12.3.4.1 Emergency cooling system
12.3.4.2 Core emergency cooling system
12.3.4.3 Soluble poison injection
12.3.4.4 SG overpressure prevention system
12.4 Safety control systems
12.4.1 Construction principles
12.4.2 Description
12.4.3 Parameters, instruments, equipment
12.4.4 Interconnection with steam turbine and electric energy units
12.4.5 Control stations
12.5 Containment
12.5.1 Structure
12.5.2 Strength
12.5.3 Tightness
12.5.4 Pressure reducing system
12.5.5 Emergency flooding system
12.6 Shielding barrier
12.6.1 Structure
12.6.2 Strength
12.6.3 Tightness
12.7 RS
12.7.1 Biological shielding design and materials
12.7.2 Radioactivity in cooling systems
12.7.3 Scheme of ship/floating facility division into radiation zones
12.7.4 Ionization radiation levels
12.7.5 Special measures for health safety and protection means
12.7.6 RM

12.7.7 Radioactive wastes
12.7.7.1 Gaseous radioactive wastes
12.7.7.2 LRW
12.7.7.3 SRW
12.7.8 Ventilation and conditioning systems
12.8 Steam-turbine unit
12.8.1 Secondary circuit description and general characteristics
12.8.2 Main steam system
12.8.3 Main condenser cooling system
12.8.4 Feed water and condensate make-up system
12.8.5 Auxiliary steam systems
12.8.6 Emergency propulsion energy sources
12.9 Electric system
12.9.1 Electric energy sources
12.9.2 Electric power plant load analysis
12.9.3 Electric energy distribution
12.9.4 SSS emergency electric supply diagram
12.10 NPP operation modes
12.10.1 Initial state, start-up preparation
12.10.2 Start-up
12.10.3 Power operation
12.10.4 Shutdown
12.10.5 Operation from emergency power source
12.11 Operation of ship/reference to the ship's Operating Manual may be included
12.11.1 Organization of operation
12.11.2 Crew number and qualification
12.11.3 Watch organization
12.11.4 Personnel training and practice alerts
12.11.5 Operating documentation
12.11.6 Surveys
12.11.7 Harbor entering and berthing
12.11.7.1 Description of local conditions
12.11.7.2 Measures to be taken on board the ship prior to entering harbor
12.11.7.3 Berthing conditions
12.11.7.4 Organization of emergency alert actions
12.11.7.5 Ship security measures
12.11.8 Ship rescue operations
12.12 Analysis of accidents
12.12.1 Accidents related to SSS malfunctions
12.12.1.1 Emergency shutdown of circulating pump or primary circuit pumps
12.12.1.2 Rupture of SSS pipes
12.12.1.3 Termination of feed water supply
12.12.1.4 Termination of electric energy supply
12.12.1.5 Termination of steam withdrawal from SSS
12.12.1.6 Rupture of main steam piping
12.12.1.7 Unintended extraction of most effective control from reactor core
12.12.1.8 Reactor cold water injection
12.12.1.9 Primary circuit leakage (accident with coolant loss)

12.12.2 Accidents on board the ship
12.12.2.1 Collision (hit at reactor compartment)
12.12.2.2 Grounding and stranding
12.12.2.3 Capsizing
12.12.2.4 Flooding in shallow waters
12.12.2.5 Flooding in deep waters
12.12.2.6 Fire
12.13 General evaluation of the ship safety.

APPENDIX 4

OPERATING MANUAL OF THE NUCLEAR POWER PLANT

The Operating Manual of the nuclear power plant[1] shall contain all information required for qualified personnel for safe operation of the ship and its NPP under the normal operating conditions, as well as the instructions regarding measures to be undertaken in case of certain emergencies.

The following data shall be specified in the Operating Manual:

1. NPP characteristics with diagrams of the systems and other data related to RM, biological shielding, fire protection and fire-extinguishing means, spare parts;

2. parameters for normal operation of SSS and associated systems, including rated and limiting values, as well as permissible deviations.

Among critical parameters the following shall be specified:

2.1 duration of personnel stay in radiation zones;

2.2 radiation levels in certain zones;

2.3 activity levels for the primary and secondary coolants, as well as activity levels for LRW, SRW and gaseous radioactive wastes.

3. Instructions for the SSS normal operation modes, such as startup, normal operation, power change, and disable, including the following data:

3.1 functional tests of safety control systems and the SSS protection system prior to startup and in the course of normal operation;

3.2 determination of critical position of the control cascades and reactivity values, as well as reactivity margin of the reactor core and its variation within the core service life;

3.3 minimum admissible redundancy of SSS and energy supply equipment for reactor safe startup and operation. The equipment to be tested or repaired shall not be considered operational in evaluation of requirements for redundancy, except for those cases when equipment is made operational by certain test (for instance, generator set startup).

4. The operating instructions for certain emergency conditions with description of typical development of initial events, recommended troubleshooting procedures, and further operation, if necessary.

5. The instructions for service organization on board the ship, including the following:

5.1 manning and responsibility of people in charge of nuclear and radiation safety;

5.2 watches at sea and in harbor;

5.3 access to controlled area and containment;

5.4 training of the personnel involved in operating SSS and practice alerts for crews;

5.5 requirements for the ship's documentation related to operating SSS and radiation situation on board the ship, as well as forwarding reports on equipment failures and emergencies.

6. Instructions for surveying SSS, containment and hull structures, including data on test intervals, scopes and methods of tests.

[1] Hereinafter referred to as "the Operating Manual".

7. In addition to any other instructions to be used to ensure safety on board the ship and environmental control, the Operating Manual shall include the following instructions:

7.1 docking and in-water surveys related to RS of people;

7.2 RS;

7.3 handling SRW, LRW and gaseous radioactive wastes in storage and handing over (discharge);

7.4 fire safety;

7.5 personnel actions in emergency situations that can affect safety of SSS, ship and environment;

7.6 loading, carrying and unloading hazardous cargoes;

7.7 administrative measures to be undertaken to prevent possible intervention during inspection of the reactor protection system components.

Russian Maritime Register of Shipping

Rules for the Classification and Construction of Nuclear Ships and Nuclear Support Vessels
Part I
Classification

FAI "Russian Maritime Register of Shipping"
8, Dvortsovaya Naberezhnaya, 191186, St. Petersburg
www.rs-class.org/en/