4 Regulations on Technical Standards for Nuclear Reactor Facilities, Etc.

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Chapter Ⅰ General Provisions

Article 1 (Purpose)

The purpose of these Regulations are to prescribe technical standards as regards the location, structure, installations, performance, operation and quality assurance of nuclear reactor and related facilities, and nuclear fuel cycle facilities as provided in Article 11, Article 21 (including those cases to which the relevant provisions apply mutatis mutandis in accordance with Article 30 (3)), Article 26 (including those cases to which the relevant provisions apply mutatis mutandis in accordance with Article 34), Article 35, Article 36 and Article 40 of the Nuclear Safety Act, and Articles 41 (1) and 68 (1) of the Enforcement Decree thereof.

Article 2 (Definitions)

(1) Terms used herein are defined as follows:
1. The term “primary coolant” means the fluid that directly absorbs the heat generated from the core of the nuclear reactor.

2. The term "secondary coolant" means the fluid that operates a turbine by absorbing the heat of primary coolant by means of heat exchangers.
3. The term "safety facilities" means those facilities falling under any of the following, of which failure/damage may directly or indirectly impose a radiation hazard to the public:
   a. Facilities of the primary coolant system and safety-related instrumentation and control systems, other facilities necessary for safe operation of a nuclear reactor at normal operations, and the appurtenances thereof;
   b. Emergency core cooling system, emergency shutdown system, and other facilities and their appurtenances necessary to ensure safety of a nuclear reactor at emergency conditions;
   c. Nuclear reactor containment vessel; and
   d. Emergency power supply system and its appurtenances.
4. The term "reactor coolant pressure boundary" means the pressure vessel, pipe, pump and valve that are subject to pressure of primary coolant, and its outermost boundary consists of the components that fall under any of the following:
   a. Outermost containment vessel isolation valve in the case of system pipings penetrating a containment vessel;
   b. The second valve between the two valves that remain closed at all times during normal operations in the case of system pipings not penetrating a containment vessel; and
   c. Safety valves and relief valves of the primary coolant system.
5. The term "structures, systems, and components important to safety" means safety-related facilities among reactor facilities that are essential to safety in that they perform critical safety functions, and non-safety-related facilities whose failure may directly affect the performance of functions by safety-related facilities.
6. The term "normal operation" means operation of a power plant performed within the scope of prescribed limiting conditions for operation(LCO) that includes the operation modes of power operation, reactor shutdown, shutdown operation, startup, maintenance, testing, and refueling operation.
7. The term "anticipated operational occurrence" means the operational condition that deviates from normal operation but does not cause any significant damage to the facilities important to safety, or leads to accident conditions, which are expected to occur several times during the lifetime of reactor facilities.

8. The term "design basis" means those standards that are set in order to prevent the conditions of reactor facilities from exceeding prescribed limits in respect of operational states or accidents of reactor facilities expected to occur during the lifetime of a nuclear power plant, which apply as the standards to ensure the minimum functions or performance of installations of reactor facilities, that must be considered in design of such installations.
9. The term "design basis accident" means an accident that must be considered in design of facilities to ensure that such facilities meet the design basis.
10. The term "specified acceptable fuel design limits (SAFDL)" means the design limits that are set in respect of departure from nucleate boiling ratio, fuel peak temperature, and so forth in order to prevent any damage to fuels during normal operations and anticipated operational occurrences.
11. The term "single failure" means a failure which results in the loss of capability of a component to perform its intended safety functions, and multiple failures resulting from such failure are considered to be a single failure.
12. The term "loss of offsite or onsite power-single failure" means a single failure of a component in a situation where only one of the onsite and offsite electrical power sources of a power plant is available.
13. The term "initial test" means a series of test to be performed after the completion of installation of reactor facilities until the commencement of commercial operation in order to demonstrate that installed structures, systems, and components can perform such functions and performance as intended at the design, which includes cold and hot functional tests to be implemented prior to fuel loading, initial fuel loading tests, and pre-criticality tests, initial criticality tests, low power physics tests and power ascension tests to be implemented after initial fuel loading.
14. The term "limiting conditions for operation" means the minimum level of functions or performance required to ensure the safety of reactor facilities. When a limiting condition for operation is not met, the reactor shall be shutdown or any remedial action shall be followed.

(2) Terms used herein other than those set forth in the foregoing Paragraph (1) shall have the same meaning as provided in the Nuclear Safety Act (hereinafter referred to as "Act") and the Enforcement Decree thereof (hereinafter referred to as "Decree").

Chapter Ⅱ Technical Standards for Reactor Facilities

▣ Section 1 Location of Reactor Facilities

Article 3 (Scope of Application)

(1) As regards the technical standards for the location of nuclear reactor and related facilities (hereinafter referred to as "reactor facilities") as provided in Subparagraph 2 of Article 11 (including the cases to which the relevant provisions apply mutatis mutandis in accordance with Article 30 (3) of the Act) and Subparagraph 1 of Article 12 (5) of the Act, the provisions of Articles 4 through 10 hereof shall apply.
(2) Among the technical standards as provided in the foregoing Paragraph (1), certain standards may not apply in those cases where it is acknowledged by the Nuclear Safety and Security Commission that such standards are not directly applicable to the relevant reactor facilities due to the difference in the purpose of, the operational principle of, or the design features of such facilities, or that safety is not affected even if such standards are not applied.

Article 4 (Geological Features and Earthquakes)

(1) Reactor facilities shall be installed at a place acknowledged to have little chance of earthquakes or surface deformation.
(2) Reactor facilities shall be installed at a place with no possibility of collapse or sinking of the ground surface at the place of their installation and its vicinity and with a stable slope and ground.
(3) Detailed technical standards as regards investigation, analysis and assessment of geological and seismic characteristics, surface faulting, and ground surface and foundation characteristics as provided in the foregoing Paragraphs (1) and (2) shall be determined and publicly notified by the Nuclear Safety and Security Commission.

Article 5 (Limitations on Location)

(1) Reactor facilities shall be located away from very densely populated areas.
(2) Reactor facilities shall be installed at a place where the total radiation dose to public in the event of an accidental release of radioactive materials does not exceed the acceptable value determined and publicly notified by the Nuclear Safety and Security Commission.

Article 6 (Meteorological Conditions)

(1) Reactor facilities shall be installed at a place that is acknowledged to have little chance of any serious accidents, based on investigation and assessment of meteorological conditions including hurricanes, heavy snow and rainfall, or tornados.
(2) Reactor facilities shall be installed at a place that is acknowledged to have no radiation hazard, based on investigation and assessment of the diffusion and dilution characteristics of radioactive materials in case that such materials are released into the air from the facilities.
(3) Detailed standards as regards investigation and assessment of the meteorological conditions as provided in the foregoing Paragraph (1) and the diffusion and dilution characteristics of radioactive materials in the air as provided in the foregoing Paragraph (2) shall be determined and publicly notified by the Nuclear Safety and Security Commission.

Article 7 (Hydrologic and Oceonographic Conditions)

(1) Reactor facilities shall be installed at a place that is not affected by river flooding caused by failure of upstream reservoirs or dams, rain and so forth.
(2) Reactor facilities shall be installed at a place that is acknowledged to pose no risk to the safety thereof with regard to the influence of coastal flooding caused by natural phenomena including tsunamis, seawater level and surges.
(3) Reactor facilities shall be installed at a place that is acknowledged to have no radiation hazard, based on investigation and assessment of the

diffusion, dilution and adsorption characteristics of radioactive materials in case that such materials are released into the surface water, ground water and seawater from such facilities.
(4) Reactor facilities shall be installed at a place to which service and cooling water necessary for operation thereof can be supplied.
(5) Detailed standards for the location of reactor facilities as provided in the foregoing Paragraphs (1) through (3) shall be determined and publicly notified by the Nuclear Safety and Security Commission.

Article 8 (Impact of Man-Made Accident)

(1) Reactor facilities shall be installed at a place that is acknowledged to have no hazard, based on investigation and assessment of the impact of an accident at industrial facilities producing or handling dangerous materials, transportation means and so forth.
(2) Detailed standards as regards the investigation and assessment of the impact of an accident at reactor facilities as provided in the foregoing Paragraph (1) shall be determined and publicly notified by the Nuclear Safety and Security Commission.

Article 9 (Feasibility of Emergency Plans)

The site of reactor facilities shall be determined at such a place where an emergency plan can be implemented in order to protect the people against radiological emergency.

Article 10 (Construction of Multiple Units)

(1) If more than one reactor units and their related facilities are constructed on a site, the multiple reactor facilities shall be installed on such a site where site-related factors of any one unit do not affect the safety of the other units.
(2) In the case of the foregoing Paragraph (1), the boundary of the exclusion area for the multiple units shall be designated as the entire boundary enveloped by the exclusion areas calculated for each individual unit.

▣ Section 2 Structure, Installations, and Performance of Reactor Facilities

Article 11 (Scope of Application)

(1) As regards the technical standards for the structure, installations, and performance of reactor facilities as provided in Subparagraph 2 of Article 11 (including cases to which the relevant provisions apply mutatis mutandis in accordance with Article 30 (3) of the Act), Subparagraph 1 of Article 12 (5) and Subparagraph 2 of Article 21 of the Act (including cases to which the relevant provisions apply mutatis mutandis in accordance with Article 30 (3) of the Act), the provisions of Articles 12 through 49 hereof shall apply.

(2) Among the technical standards as provided in the foregoing Paragraph (1), certain standards may not apply in those cases where it is acknowledged by the Nuclear Safety and Security Commission that such standards are not directly applicable to the relevant reactor facilities due to the difference in the purpose of, the operational principle of, or the design features of such facilities, or that safety is not affected even if such standards are not applied.

Article 12 (Safety Classes and Standards)

(1) Structures, systems, and components important to safety shall be designed, fabricated, installed, tested, and inspected in accordance with the safety classes and standards commensurate with the importance of safety functions to be performed. Safety classes and standards shall be determined and publicly notified by the Nuclear Safety and Security Commission.

(2) Standards other than those determined and publicly notified by the Nuclear Safety and Security Commission as provided in the foregoing Paragraph (1) shall be applied after approval thereof by the Minister of Education, Science and Technology based on review and assessment with respect to the applicability, adequacy and sufficiency thereof. In such case, the Nuclear Safety and Security Commission can supplement or amend relevant standards, if necessary, to ensure safety of reactor facilities.

Article 13 (External Events Design Bases)

(1) Structures, systems, and components important to safety shall be designed to withstand the effects of potential natural phenomena including earthquakes, hurricanes, floods and tsunamis, and the effects of potential man-induced external events including airplane crashes and explosions without loss of capability to perform their safety functions.
(2) Design bases as regards structures, systems, and components important to safety shall consider each of the following:

1. The most severe natural phenomena and man-induced external events considering the historical records for the relevant site and surrounding areas;
2. Combination of the effects of normal operations or accident conditions with the effects of natural phenomena and/or man-induced external events, considering the probability of concurrent occurrences thereof;
3. The importance of safety functions to be performed; and
4. Appropriate provisions to defend against the third party access to reactor facilities in the design of the buildings and site layout.

Article 14 (Protection against Fire Protection, etc.)

(1) Structures, systems, and components important to safety shall be designed and located in conformity with each of the following requirements in order to minimize the probability and the effects of fires and explosions:

1. The capability for reactor safe shutdown, residual heat removal, and confinement of radioactive materials shall not be impaired significantly at the occurrence of a fire in any area within reactor facilities;
2. Noncombustible and fire-proof/heat-resistance materials shall be used wherever practical throughout the plant. Fire detection and fire fighting systems of appropriate capacity and capability shall be installed for minimizing the adverse effects of fires on structures, systems, and components important to safety, commensurate with the importance of the structures, systems, and components.
3. Fire fighting systems shall be designed and arranged to ensure that their failure, damage or malfunction does not significantly impair the safety performance of the structures, systems, and components important to safety.

(2) As regards reactor facilities, a fire hazard analysis shall be performed in consideration of each of the following:

1. Classification of fire protection areas;
2. Types and size of combustible materials;
3. Categories of design bases fires;
4. Fire detection and fighting facilities;
5. Fire hazard assessment; and
6. Capability to perform safe shutdown, residual heat removal, fire detection and prevention of radioactive release.

(3) Technical standards as regards the fire hazard analysis as provided in the foregoing Paragraph (2) shall be determined and publicly notified by the Nuclear Safety and Security Commission.

Article 15 (Environmental Effects Design Bases, etc.)

(1) The structures, systems, and components important to safety shall be designed to meet each of the following requirements in order to prevent any damage caused by environmental and dynamic effects:

1. They shall accomodate the effects of, and be compatible with the environmental conditions of normal operation, anticipated operational occurrences and design bases accidents;
2. Aging degradation caused by such environmental conditions as provided in the foregoing Subparagraph 1 shall be considered; and
3. They shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, discharging fluids, and internal floods, that may result from equipment failure inside a nuclear power unit. However, in cases where it is demonstrated that the probability of fluid system piping rupture is extremely low under the conditions consistent with the piping design basis, the dynamic effects related with postulated piping rupture may be excluded from the design basis.

(2) The following components shall be installed in such a way that prevents any damage caused by vibrations resulting from the circulation, boiling, and etc. of primary or secondary coolants: fuel assembly, moderators, reflectors, and associated supports; thermal shields; and vessels, pipes, pumps, and valves that are part of primary coolant system.

Article 16 (Sharing of Structures, Systems, and Components)

(1) Structures, systems, and components important to safety shall not be shared among more than two nuclear facilities.
(2) Notwithstanding the foregoing Paragraph (1), structures, systems, and components important to safety may be shared in cases where such facilities meet all the following requirements:
1. For each nuclear facilities, all the safety requirements for the relevant shared facilities are satisfied; and
2. In the accident conditions of one of the units sharing the structures, systems, and components, an orderly shutdown, cooldown, and residual heat removal of the other units shall be achievable.

Article 17 (Reactor Design)

(1) The reactor core and associated coolant system, control system, and protection system shall be designed with appropriate margins to assure that specified acceptable fuel design limits are not exceeded during normal operation conditions and anticipated operational occurrences.
(2) In those cases where it is probable that the material properties of a reactor pressure vessel may be significantly degraded by irradiation, thermal shields shall be installed for the prevention of its degradation.

Article 18 (Inherent Protection of Reactor)

The reactor core and associated coolant systems shall be designed so that, in all power operating range, the net effect of prompt inherent nuclear feedback characteristics tends to compensate for a rapid increase in reactivity.

Article 19 (Suppression of Reactor Power and Power Distribution Oscillations)

The reactor core and associated coolant system, control system, and protection system shall be designed to assure that power and power distribution oscillations which can result in conditions exceeding specified acceptable fuel design limits are not possible or can be readily detected and suppressed.

Article 20 (Instrumentation and Control System)

(1) In order to obtain adequate information required for the reliable and safe operation of the plant, instrumentation shall be provided to monitor related variables, including the following, and systems over their anticipated ranges of normal operations, anticipated operational occurrences, and accident conditions. Provided, that it should be difficult to measure some variable directly, the apparatus that measure them indirectly may be used as a substitute:

1. Neutron flux density of a reactor core.
2. Location of the control rod and density of liquid control materials, if used.
3. Information on the primary coolant set forth in each of the following:
   a. Concentration of radioactive materials and impurities; and
   b. Pressure, temperature, and flow rate at the entrance/exit of a reactor pressure vessel.
4. Water level of a reactor pressure vessel (including a pressurizer, if any) and of steam generators.
5. Pressure, temperature, and flow rate of the secondary coolant at the exit of steam generators, and concentration of radioactive materials in the secondary coolant.
6. Pressure, hydrogen concentration, and radioactive material concentration inside a containment vessel.
7. Concentration of radioactive materials in ventilated air at the exit of a ventilation duct or its vicinity.
8. Concentration of radioactive materials in draining water at the drainage outlet or its vicinity.
9. Radiation dose rate in the radiation control area.
10. Direction and velocity of the wind, atmospheric stability, precipitation, and temperature at the site where the plant is located.
11. Concentration of radioactive materials and radiation dose rate in the air on the boundary of the exclusion area of the plant.

(2) Appropriate controls shall be installed with high reliability to maintain the variables and systems referred in the foregoing Paragraph (1) within specified operating ranges. Adequate automatic recordings of measurements of parameters important to safety shall be provided.

Article 21 (Reactor Coolant Pressure Boundary)

(1) The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so that the probability of abnormal leakage, rapidly propagating failure, or gross rupture is extremely low.
(2) Means shall be provided for detecting and, to the extent practical, identifying the location of the source of reactor coolant leakage.
(3) Regarding a reactor pressure vessel, a material surveillance program shall be established to evaluate periodically the effects of changes in material properties due to irradiation on its structural integrity. And surveillance test specimens shall be installed in it.
(4) Requirements for material surveillance test and specimens as provided in the foregoing Paragraph (3) are determined and publicly notified by the Nuclear Safety and Security Commission.

Article 22 (Reactor Coolant System, etc.)

(1) The reactor coolant system and associated auxiliary, control, and protection systems shall be designed with sufficient margin to ensure that the design conditions of the reactor coolant pressure boundary are not exceeded during normal operation conditions including anticipated operational occurrences.
(2) Reactor coolant system shall be able to maintain constantly the quantity or pressure of the coolant to ensure that the specified design limits are not exceeded during normal operation conditions and anticipated operational occurrences, taking into account its volumetric changes and leakages.
(3) Reactor coolant system shall be designed to ensure that concentration of radioactive materials in and water quality of reactor coolants are maintained within the limiting conditions for operation.
(4) Reactor coolant system shall be designed to prevent any reverse flow of the coolant to connected systems, and to be isolated from the connected systems.

Article 23 (Reactor Containment, etc.)

(1) Reactor containment and associated systems shall be installed to have the function of leak tight protective barrier in order to minimize uncontrolled release of radioactive materials to the environment for all

accident conditions considered in the design, and shall meet each of the following requirements:

1. Means for containment heat removal shall be provided to reduce rapidly the containment pressure and temperature following any design bases accidents and to maintain them at acceptable low levels;
2. Means to reduce the amount of fission products shall be provided to minimize the release of radioactive materials to the environment during design basis accidents. And, means to control the combustible gases and other substances which may be released into the containment during accident conditions and challenge containment integrity shall be provided;
3. Containment structure and associated sub-systems shall be designed so that they can sustain the pressure and temperature conditions resulting from any design basis accidents, without exceeding the design leakage rate and with sufficient margin;
4. Containment and associated sub-systems shall be designed so that periodic leakage rate testing can be performed at the maximum containment pressure expected in design basis accidents as determined and publicly notified by the Nuclear Safety and Security Commission;
5. Materials used in containment pressure boundary shall have such characteristic as maintain the safety to the maximum extent to cope with containment pressure increase, and have sufficient margin to assure that the probability of rapidly propagating fracture is minimized; and
6. Each penetration and piping that penetrates the containment shall be reliably isolated to prevent the release of radioactivity to the environment above acceptable limits.

(2) A reactor containment vessel, vessels connected thereto and other vessels installed to prevent any leakage of radioactive materials released from components therein shall meet the leakage criteria for leak tightness testing as determined and publicly notified by the Nuclear Safety and Security Commission.

Article 24 (Electric Power System)

(1) Onsite and offsite electric power systems necessary for the performance of the functions of the structures, systems, and components important to safety shall be provided to nuclear reactor facility to meet the following

requirements:

1. In the event of a loss of either onsite or offsite electric power systems, the remaining available system shall have sufficient capacity and capability to prevent the specified acceptable fuel design limits and the design conditions of reactor coolant pressure boundary from being exceeded in anticipated operational occurrences and to maintain the safety; and
2. The systems shall have sufficient capacity and capability to maintain reactor core cooling, containment structural integrity, and other essential functions in the design basis accidents.

(2) The onsite electric power system, including the batteries, and onsite electric distributions system shall have sufficient independency, redundancy, and testability necessary to maintain their safety functions assuming a single failure.

(3) Electric power from power transmission network to the onsite electric distribution system shall be supplied by two physically and electrically independent circuits to minimize the likelihood of their simultaneous failure under normal operation conditions, design basis accidents, and all environmental conditions. And it shall be designed to meet each of the following requirements:

1. Each circuit shall be available immediately following a loss of all the onsite alternating current power supply and the other offsite electric power circuit; and
2. One of the two independent circuits shall be available within a few seconds following loss of coolant accidents.

(4) The stability analysis of the electric grid shall assure that the probability of losing any of the remaining power sources as a result of the loss of at least one among the electric power sources by the nuclear power unit, from the transmission network, or from the onsite electric power sources including emergency power sources is extremely low.

(5) Safety-related electric power systems shall be designed to allow periodic tests and inspections in order to check the continuity of such systems and the states of their components.

(6) An alternative alternating current power source with necessary capacity and reliability shall be provided to prepare for the cases of total loss of alternating current power and no capability to cope with the such loss. The performance of the alternative alternating current power source shall be

demonstrated through tests.

Article 25 (Control Room, etc.)

(1) A control room shall be provided at a nuclear power plant.
(2) The control room must be equipped with equipment that manipulates the control system and the facilities required for securing safety of the reactor in an emergency, such as an emergency core cooling system. And it must be provided with instruments that indicate operating states of major components constituting reactor and primary coolant systems, devices that indicate and record results of important measurements, and other major equipment essential to the safe operation of the reactor.
(3) Adequate radiation protection and ventilation facilities to protect operating personnel against radiation and toxic gases shall be provided at the control room, connected passages, and etc. in order to permit access to and occupancy of the control room without radiation dose of the personnel in excess of specified limits under accident conditions.
(4) At a remote shutdown control room, physically and electrically separated locations outside the control room, equipment shall be provided with a design capability for prompt hot shutdown and subsequent cold shutdown of the reactor, and for maintaining its safe states in accordance with suitable procedures in the case of a failure of the control room such as a fire.

Article 26 (Protection System)

(1) Protection system that meet each of the following requirements shall be installed at reactor facilities:
1. The protection system shall be designed to initiate automatically the operation of appropriate systems including the reactivity control systems in order to assure that specified acceptable fuel design limits are not exceeded as a result of anticipated operational occurrences such as noticeable increase in reactor power or a significant reduction in core cooling capability.
2. The protection system shall be designed to sense accident conditions and to initiate the operation of systems important to safety.

(2) The protection system shall be designed in accordance with each of the

following requirements in order to assure the performance of its safety functions:

1. The protection system shall meet each of the following requirements to ensure the reliability of the safety functions and to check any failure, etc. during operation:
   a. The design features of redundancy and independency shall be considered to ensure that no single failure results in loss of protection function, and that removal from service of any component or channel does not result in loss of the required minimum redundancy unless the acceptable reliability of operation of the protection system can be otherwise demonstrated; and
   b. The protection systems shall be designed to permit periodic testing of its functioning, including the capability to test channels independently, in order to check failures and loss of redundancy during reactor operation.
2. The effects of normal operation conditions including natural phenomena, checking, maintenance, and testing, anticipated operational occurrences, and accident conditions on multiple channels shall not result in lose of the protection functions.
3. The protection system shall remain in a safe state under a component failure, loss of energy sources such as electric power and instrument air, or the worst postulated environment conditions, by adoption of the design feature of fail-safe behavior.
4. The protection system shall be separated from the control systems to ensure that the protection system satisfies all the reliability, diversity, and independence requirements in the following states:
   a. Failure of a single component or channel of control systems;
   b. Failure of a common component or channel of control and protection systems; and
   c. Removal from service of a single channel.
5. The protection system shall be designed to assure that the specified acceptable fuel design limits are not exceeded for any single malfunction of the reactivity control systems such as accidental withdrawal of control rods.
6. The protection system shall be able to accomplish the safety functions required in anticipated operational occurrences.

7. The protection system shall have the capability to adjust trip or operation set-points according to the operation conditions.
8. In the case of adoption of software-based digital equipment, the design concepts of defence-in-depth and diversity including manual functions shall be applied to the design of the protection system in order to assure the implementation of protection functions required at a common mode failure of software.

Article 27 (Diverse Protection System)

(1) An additional independent protection system (hereinafter referred to as "diverse protection system") which has the functions of reactor shutdown, actuation of emergency auxiliary feedwater system, and turbine trip shall be installed to prepare for anticipated transients without scram.
(2) The diverse protection system shall be separated from the protection system, ranging from the part of producing output signal of the equipment to monitor the operating condition to the driving mechanism of final actuator.

Article 28 (Reactivity Control System)

(1) Reactivity control systems (meaning systems to control reactivity using control rods and using liquid absorber material by its injection or changes in its concentration) shall be installed to meet each of the following requirements:
1. Reactivity control systems shall be capable of reliably controlling anticipated reactivity changes under normal operations and anticipated operational occurrences, and capable of maintaining operating states without exceeding specified acceptable fuel design limits.
2. Two independent reactivity control systems of different design principles shall be provided and one of the systems shall use control rods.
3. One of the systems as provided in the foregoing Subparagraph 2 shall be capable of rendering the reactor subcritical from normal operation and maintaining the core subcritical under cold condition.

(2) The control rods system shall be capable of immediately performing its functions and reliably controlling reactivity changes to assure that specified

acceptable fuel design limits are not exceeded with appropriate margin under the condition of any single stuck rod.
(3) The second reactivity control system using liquid absorber material or etc. shall be capable of reliably controlling the rate of reactivity changes due to planned normal power changes to assure that specified acceptable fuel design limits are not exceeded.
(4) The reactivity control materials shall have necessary physical and chemical properties under the severe conditions caused by pressure, temperature, and radiation during normal operations.

Article 29 (Residual Heat Removal System)

(1) System capable of removing heat due to fission product decay heat and other residual heat from the core shall be installed to assure that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded.
(2) The system for residual heat removal shall have the design features of redundancy, leak detection, and suitable isolation capabilities to maintain the safety under the assumption of loss of offsite or onsite power-single failure.

Article 30 (Emergency Core Cooling System)

(1) A system for emergency core cooling with sufficient capability necessary to maintain the safety shall be installed to meet each of the following requirements following loss of residual heat removal capability or loss of reactor coolant accidents, and such system shall meet the requirements determined and publicly notified by the Nuclear Safety and Security Commission:
1. Cladding temperature shall not exceed an acceptable design value;
2. Oxidization and hydrogen generation in cladding shall be limited to an allowable level;
3. Deformation of fuel and internal structures shall not reduce the effective core cooling; and
4. Core cooling shall be ensured for a time necessary for the removal of decay heat.

(2) The system for emergency core cooling shall have the design feature of

redundancy, leak detection, isolation, and containment capabilities to maintain the safety functions with sufficient reliability under the assumption of loss of offsite or onsite power-single failure.

Article 31 (Ultimate Heat Sink)

(1) A system to transfer the combined heat load of structures, systems, and components important to safety to an ultimate heat sink during normal operations and design basis accident conditions shall be provided.
(2) The system shall have the design feature of redundancy, suitable interconnection and isolation capabilities, and etc. to maintain the safety under the assumption of loss of offsite or onsite power-single failure.

Article 32 (Processing and Storage Systems, etc. of Radioactive Wastes)

According to the following requirements, reactor facilities shall have a capability to process radioactive materials generated in them as suitable forms and conditions, to store them safely on the site, and to control release of radioactive materials to the environment.

1. The liquid and gaseous radioactive waste processing system shall meet each of the following requirements:
   a. The systems shall safely control releases of liquid and gaseous effluents containing radioactive materials generated during normal operations and anticipated operational occurrences. Sufficient holdup capacity for the retention of liquid and gaseous effluents shall be provided to impose limitations upon the release of such effluents to the environment to the utmost and to safely store radioactive materials within radioactive wastes processing system, where unfavorable site environmental conditions can be expected;
   b. The systems shall be capable of processing radioactive wastes generated from reactor facilities in order to maintain the concentration of radioactive materials in the water and air at the exclusion area boundary lower than the discharge limits prescribed by the Nuclear Safety and Security Commission;
   c. The gaseous radioactive waste processing system shall have ventilation and purification capability necessary for the prevention against radiation

hazard, shall have structural characteristics for avoiding leakage and reverse flow of the gaseous radioactive wastes, and shall be able to prevent intake of contaminants through suction head of the air supply system; and

d. Liquid or gaseous radioactive wastes generated from reactor facilities shall not be released at any place other than ventilation or drainage outlet.

2. The solid waste processing system shall be equipped with the provisions to solidify or stabilize such wastes into a form appropriate for disposal thereof or to contain such wastes in a vessel with verified disposal safety.
3. The radioactive waste processing systems shall be separated from the system treating non-radioactive wastes, and the floor thereof shall have a gradient that makes radioactive wastes flow into a drainage outlet or sump, with a dike built thereon for the prevention of leakage of radioactive materials to the outside of the facilities or spread of such leakage.
4. The radioactive waste storage system shall be able to safely store the amount of radioactive wastes on site, which are generated during normal operations including the anticipated operational occurrences.

Article 33 (Fuel Handling and Storage Facilities)

(1) The facilities handling nuclear fuel assembly and spent fuel (hereafter referred to as "fuels") shall be designed to meet each of the following requirements:

1. They shall have geometrically safe configuration to prevent fuels from criticality;
2. They shall have the capability of decay heat removal to prevent melting of fuels;
3. Damage of fuels shall be prevented during handling;
4. A cask containing fuels shall resist impacts, heat, and etc. during handling thereof and not be easily damaged;
5. As regards such a cask as provided in the foregoing Subparagraph 4, the radiation dose rate on the surface shall not be higher than 2 mSv per hour and the radiation dose rate at one meter from the surface shall not be higher than 0.1 mSv per hour when it contains fuels therein. However, these dose rates are not applied to the cask used in radiation control area only; and
6. The facilities shall contain fuels even at a loss of power.

(2) Fuels storage facilities shall be installed to meet each of the following

requirements:

1. Criticality of fuels shall be prevented even under conditions of optimum moderation;
2. The facilities shall have the capability of decay heat removal, appropriate radiation shielding, containment, confinement, and purification;
3. The facilities shall have the capability to monitor the conditions which may result in loss of residual heat removal and excessive radiation levels, and to initiate appropriate safety actions; and
4. Fuels shall not be damaged by impacts, unacceptable stresses, corrosion, and etc.

Article 34 (Radiation Protection Provisions)

Radiation protection provisions shall be provided at reactor facilities for protection against radiation exposure, in compliance with each of the following requirements:

1. Provisions for access control of workers to radiation and contaminated areas shall be provided;
2. Shielding provisions shall be provided where it is necessary to reduce the radiation levels for the protection of workers;
3. Equipment shall be provided to monitor the radiation levels and release of radioactivity during operational states and accidents, and to provide relevant collected information to the control room and other places requiring such information;
4. Surface of walls, floors and other places subject to radioactive contamination shall be made non-permeable and flat to be easily decontaminated;
5. Appropriate decontamination provisions shall be provided for the decontamination of personnel and equipment; and
6. Ventilation provisions shall be provided to ventilate the contaminated air with appropriate filtration capability and to limit airborne radioactive materials. It shall be assured that contaminated air flows from low contamination region to high contamination region, and the pressure of radioactive contamination region shall be maintained lower than that of the outside thereof for prevention of leakage or backflow of contaminated air.

Article 35 (Reactor Core, etc.)

Reactor core, and components adjacent to it within the reactor pressure vessel shall be designed to withstand the loadings due to pressure, temperature, and radiation expected to occur in normal operation conditions, anticipated operational occurrences, and design basis accidents, in appropriate combinations with the effects of earthquake, within the design basis to the extent necessary to ensure the safe shutdown of the reactor and cooling of the core.

Article 36 (Reactivity Control Material Drive Mechanism)

The drive mechanism of reactivity control materials shall meet each of the following requirements:

1. Control materials drive mechanism shall be capable of driving control materials at a speed suitable for the characteristics of reactor;
2. Control materials shall not be driven in such a way as to increase the reactivity of reactor core at a loss of driving power; and
3. As regards control rod drive mechanism, the drive mechanism shall be designed in such a way that dropping of the control rods or other impacts shall not damage control rods, fuel assemblies, moderators, reflectors, and so forth.

Article 37 (Overpressure Protection)

In the components and systems subject to internal pressure, means to cope with overpressure, such as safety valves or relief valves, shall be installed as determined and publicly notified by the Nuclear Safety and Security Commission.

Article 38 (Alarm Devices, etc.)

(1) Devices to detect and automatically sound an alarm shall be installed at reactor facilities when there arises a likelihood that malfunctions, mismanipulation and so forth of equipment may cause a serious impediment to the operations of nuclear reactors or when there is a significant increase

in the concentration of radioactive materials under Subparagraphs 7 and 8 of Article 20 (1) hereof or radiation dose rate under Subparagraph 9 of Article 20 (1).

(2) Devices to display the operational states of major equipment related to nuclear reactors, primary cooling system and radioactive waste processing facilities shall be installed at reactor facilities.

Article 39 (Prevention of Collapse of Steep Slope, etc.)

(1) In the zone with steep slope or with potential of collapse thereof in the area where reactor facilities are installed, it shall be ensured that the slope will not collapse.

(2) In case that reactor facilities could be damaged due to the settlement of foundation, the improvements of the foundation shall be made and other appropriate measures be taken.

Article 40 (Use of Qualified Equipment)

The equipment that is required to meet the demands for performing its functions during its design life shall be installed at reactor facilities after demonstration of the capability to perform its functions under the environment conditions where it must operate by operating experiences, analysis, tests, or a combination of them.

Article 41 (Testability, Monitorability, Inspectability, and Maintainability)

(1) The structures, systems, and components important to safety shall be designed to be tested, monitored, inspected, and maintained in accordance with the importance of safety functions to be performed to ensure that their structural integrity, leak tightness, functional capability, and operability are maintained during the lifetime of the nuclear power plant.

(2) For cases where periodic testing, monitoring, inspection and maintenance are limited or not possible to detect the possible faults of components, safety measures shall be made in the design to cope with expected failures.

(3) Pressure vessels (excluding auxiliary boilers), pipings, major pumps and major valves shall meet the acceptance criteria of pressure retaining test

determined and publicly notified by the Nuclear Safety and Security Commission.

Article 42 (Design Basis Accidents)

(1) Reactor facilities shall be designed to ensure that radiation dose to workers and public is maintained within the acceptable limits determined by the Nuclear Safety and Security Commission for a set of design basis accidents including internal and external events.
(2) The safety analysis for the design basis accidents shall be based on the deterministic methodology, and then the conservative rules and criteria incorporating conservative design margin shall be applied to the plant design.

Article 43 (Protection during Startup, Shutdown, and Low Power Operations)

(1) Reactor facilities shall be designed to maintain or rapidly restore the reactivity control function, residual heat removal capability and containment vessel integrity so as to maintain potential leakage of radioactive materials generated by accidents, which may occur during startup, shutdown and lower power operation, at the lowest possible level.
(2) Reactor facilities shall be capable of assessing, based on a probabilistic approach, the probability of fire, etc. that may occur during operation as provided in the foregoing Paragraph (1) including maintenance activities performed in the event of cold shutdown and refueling conditions and be capable of preventing resultant loss of the function of normal residual heat removal.

Article 44 (Reliability)

Structures, systems, and components that perform safety functions shall meet each of the following requirements to assure and maintain sufficiently high reliability commensurate with the importance of the safety functions.

1. The principles of redundancy, diversity, functional independence, and physical separation shall be adopted in the design, considering their structure, operational principles, and safety functions to be performed; and

2. The safety functions shall be accomplished in case of loss of offsite or onsite power-single failure.

Article 45 (Human Factors)

(1) Human factors associated with the plant workers and man-machine interface shall be taken into account systematically in the design of reactor facilities.
(2) In the design of reactor facilities, each of the following requirements shall be considered in order to minimize the possibility of human error in operation:
1. Accurate information shall be provided to operators to facilitate their correct decisions and to inhibit their wrong decisions;
2. Means for detecting and correcting or compensating for error shall be provided; and
3. Operators shall be allowed to have sufficient time for making decisions and taking actions.

Article 46 (Optimization of Radiation Protection)

In design stage of reactor facilities, suitable means to maintain radiation exposure during operation as low as reasonably achievable shall be considered through the assessment of the expected radiation dose of workers and public during operation.

Article 47 (Emergency Response Facilities and Equipment)

(1) In order to support the emergency response in case of radiological emergency, emergency response facilities shall be installed at reactor facilities.
(2) Suitable alarm systems and means of communication shall be provided so that all persons present in the reactor facilities can be warned and instructed at accident conditions.
(3) The reactor facilities shall have simple, clearly and durably marked safe escape routes with reliable emergency lighting.
(4) The location, size, structure, habitability, and related facilities (including facilities providing information essential to safety for swift detection of any abnormal condition of reactor facilities) of emergency response facilities shall be installed as determined and publicly notified by the Nuclear Safety and

Security Commission.

Article 48 (Establishment, Adjustment, etc. of Limiting Conditions for Operation)

(1) The safety limits, the limiting safety system settings, the limiting conditions for operation shall be established for safe operation of reactor facilities.
(2) During the implementation of initial test programs, the limiting conditions for operation shall be adjusted with reflection of the operating characteristics of facilities as built to ensure that the plant operating conditions satisfy design criteria and safety analysis results.

Article 49 (Initial Tests)

(1) An initial test program shall be established and implemented to demonstrate that the reactor facilities important to safety perform their functions according to the design intent.
(2) Initial tests shall be conducted in accordance with each of the following requirements:
1. Procedures for normal operation and anticipated operational occurrences, and procedures for functional tests to be carried out during operational phase shall be verified.
2. During initial tests, detailed diagnostic data shall be collected on components important to safety and the initial operating parameters of each system shall be recorded as a baseline for future surveillance activities.

(3) The results of the initial tests performed in accordance with the foregoing Paragraph (1) shall meet the acceptance criteria stated in the applicant's documents for license.

▣ Section 3 Operation of Reactor Facilities

Article 50 (Scope of Application)

(1) As regards safety actions that the operator of a nuclear power reactor must take as provided in Article 26 of the Act and Article 41 of the Decree, the provisions of Articles 51 through 66 shall apply.

(2) As regards technical capabilities as provided in Subparagraph 1 of Article 21 of the Act, the provisions of Articles 54, 55, 56, 57, 58 and 63 shall apply.

Article 51 (Measures regarding Radiation Control Area, etc.)

According to Article 41 (1) 1 of the Decree, the operator of a nuclear power reactor shall demarcate radiation control area, preservation area, and exclusion area, and take each of the following measures in these areas:

1. Measures regarding a radiation control area:
   Article 3 of the Regulations on Technical Standards for Radiation Safety Control, etc. (hereinafter referred to as "Radiation Safety Regulations") shall apply mutatis mutandis, with the conditions that the means preventing any unauthorized access and a sign informing dangers shall be provided at the entrance of a radiation control area in cases where the external radiation dose rate at 30 centimeters away from the surface of a radiation source or shielding materials could exceed 1 mSv per hour.
2. Measures regarding a preservation area:
   A preservation area shall be demarcated from other areas by such means as attachment of a sign, and such measures as access control, key control, and restrictions on carry-out of goods therefrom shall be taken as necessary.
3. Measures regarding an exclusion area:
   a. No personnel shall be allowed to inhabit this area except for temporary stay therein deemed necessary by the Minister of Education, Science and Technology for the purpose of education and training related with construction and operation of reactor facilities; and
   b. A condition to control access or passage of personnel through the exclusion area boundary shall be maintained by such means as installation of a fence or sign on the boundary.

Article 52 (Measures regarding Radiation Dose, etc.)

(1) The operator of a nuclear power reactor shall take each of the following measures for radiation protection as provided in Article 41 (1) 2 of the Decree:

1. The radiation dose of radiation workers, frequent enterers, and temporary enterers to a radiation control area shall not exceed the respective dose limits; and
2. The concentration of airborne radioactive materials in a place accessed by radiation workers at ordinary times shall not exceed the derived air concentration.

(2) Notwithstanding the foregoing Paragraph (1), radiation workers may be caused to engage in emergency work prescribed by the Minister of Education, Science and Technology in the event of an urgent situation where a disaster has occurred or would be likely to occur at reactor facilities or where any damage which would be likely to cause a severe impediment to operation of reactor facilities.

Article 53 (Compliance with Technical Specifications, etc.)

According to Subparagraphs 3 through 5 of Article 41 (1) of the Decree, the operator of a nuclear power reactor shall take each of the following actions in respect of the technical specifications:

1. The operator shall monitor that the limiting conditions for operation of reactor facilities provided in the technical specifications are met, and shall take proper actions when the conditions are not met;
2. In the event of reactor trip or reactor scram, the operator shall investigate and determine the cause thereof and any damage to reactor facilities, and sufficiently review and ensure the safety thereof before commencing reoperation; and
3. The operator shall continuously review the technical specifications to enhance the safety and revise the technical specifications, as necessary.

Article 54 (Operating Organization)

According to Article 41 (1) 4 of the Decree, the operator of a nuclear power reactor shall establish an operating organization in accordance with each of the following requirements:

1. The operator shall establish an organizational structure necessary for the safe operation of reactor facilities, and provide the organizational structure with the authority and responsibilities required for performing the tasks;

2. According to Articles 26 (3) and 84 (2) of the Act, the operator shall employ qualified personnel including licensees for the supervisory reactor operator, the reactor operator, the supervisory fuel material handler, and the fuel material handler;
3. The operator shall clarify functional responsibilities and authority for assuring correct response to emergency situations, and establish the lines of internal and external communication; and
4. The operator shall establish an engineering and technical support organization for the review of operational safety during operation.

Article 55 (Qualifications and Training)

According to Article 41 (1) 4 of the Decree, the operator of a nuclear power reactor shall take each of the following actions to assure that qualified personnel perform tasks of the power plant:

1. The operator shall appoint plant personnel with knowledge and experience required for the performance of duties in the power plant;
2. The operator shall assure that qualified personnel as provided in Article 84 of the Act conduct reactor operations, fuel materials handling, and radioisotopes handling, or that trained personnel as provided in Article 106 (1) of the Act perform the duties under the direction and supervision of qualified personnel;
3. A training program shall be established for the plant personnel to assure that they perform their duties successfully according to operating procedures in normal operations and accident conditions (including education/training for radiation workers and enterers of radiation control area as provided in Article 106 (1) of the Act and the refresher education as provided in Article 106 (2) of the Act); and
4. The personnel to conduct reactor operations shall be examined annually on appointment, and required to ensure that their medical fitness is appropriate to the duties and responsibilities for reactor operation.

Article 56 (Operating Procedures)

The operator of a nuclear power reactor shall take each of the following actions in regard to operating procedures as provided in Article 41 (1) 4 of

the Decree:

1. Operating procedures for the administration, operation, testing, and maintenance of a power plant sha11 be prepared in writing, and be available as documents before the commencement of operation; and
2. Operating procedures shall consist of normal, abnormal, and emergency operating procedures and include operating staff actions for normal operations, anticipated operational occurrences, and design basis accidents.

Article 57 (Management of Human Factors)

According to Article 41 (1) 4 of the Decree, the operator of a nuclear power reactor shall reflect the lessons learned from accidents and near-misses attributable to human factors in design of reactor facilities as well as operating procedures to reduce human errors in operation and continuously manage human factors to prevent any decrease in the human performance.

Article 58 (Reflection of Operating Experience)

The operator of a nuclear power reactor shall take each of the following actions in order to reflect operating experience systematically in the plant operation as provided in Article 41 (1) 4 of the Decree:

1. Operating experience data shall be collected, analyzed, and maintained; and
2. The results of the operating experience analysis shall be reflected in plant facilities, safety related criteria, procedures, and training program.

Article 59 (Fire Protection Program)

According to Article 41 (1) 4 of the Decree, the operator of a nuclear power reactor shall establish and implement a fire protection program for preventing, detecting, and suppressing fires as determined and publicly notified by the Nuclear Safety and Security Commission.

Article 60 (Shutdown Operation)

The operator of a nuclear power reactor shall take each of the following actions as regards shutdown operation of a reactor as provided in Article 41

(1) 4 of the Decree:

1. The parameter limits affecting on the safety functions during shutdown operation shall be established, monitored, and complied with;
2. After a loss of the function of normal residual heat removal during shutdown operation, the mitigation capability to ensure core cooling, decay heat removal, and limitation on release of fission products shall be provided to maintain the safety; and
3. Operating procedures related to the shutdown operation including the procedures for normal and abnormal operations shall be established to ensure the safety functions during shutdown operations.

Article 61 (Core Management and Fuel Handling)

According to Article 41 (1) 4 of the Decree, the operator of a nuclear power reactor shall take each of the following actions in regard to core management and fuel handling:

1. It shall be ensured that fuels loaded in the reactor conform to the design specifications and limits of fuels, and safety related parameters of the core shall be monitored;
2. Through valid analysis and monitoring, it shall be confirmed that subcriticality margin is maintained during fuel handling and storage; and
3. A comprehensive record system shall be maintained covering core management and fuel handling for the review of fuel structural integrity.

Article 62 (Radiation Protection Program)

In accordance with Article 41 (1) 4 of the Decree, the operator of a nuclear power reactor shall take each of the following measures in connection with a radiation protection program:

1. A radiation protection program for management and assessment of all activities causing radiation exposure shall be established in order to maintain the radiation exposure as low as reasonably achievable to workers and the public during the operation of reactor facilities;
2. A radiation protection program shall be implemented by the health physicists with sufficient knowledge and practical experience in radiation protection as regards the design and operation of reactor facilities, and

such personnel shall educate and train workers to make efforts for reducing radiation exposure and to be fully aware of protective measures to be taken when necessary; and

3. The contents and implementation of a radiation protection program shall be periodically evaluated. In the case of violation, measures to prevent recurrence of such violation shall be taken promptly.

Article 63 (Testing, Monitoring, Inspection and Maintenance)

(1) According to Subparagraphs 5 through 7 of Article 41 (1) of the Decree, the operator of a nuclear power reactor shall establish a testing, monitoring, inspection and maintenance program for structures, systems, and components, considering the importance of the structures, systems, and components to safety, in order to maintain the safety functions and performance of safety-related structures, systems, and components as assumed and intended in design. And each of the following actions shall be taken as determined and publicly notified by the Nuclear Safety and Security Commission:

1. The degree of degradation in materials and performance of safety-related structures, systems, and components due to ageing shall be monitored and evaluated, and necessary measures shall be taken;
2. For the pumps and valves necessary for safe shutdown, core cooling, and mitigation of accident consequences, their performance and degree of degradation due to ageing shall be monitored and evaluated, and necessary measures shall be taken;
3. For the reactor pressure vessel, the degree of degradation in material and performance due to neutron irradiation shall be monitored and evaluated, and necessary measures shall be taken;
4. Verification and calibration of instrumentation and radiation detector directly related with preservation of reactor facilities shall be conducted at the specified period.

(2) Testing, monitoring, and maintenance activities shall be performed by qualified personnel as determined and publicly notified by the Nuclear Safety and Security Commission.

Article 64 (Transport at Place of Business)

(1) The operator of a nuclear power reactor shall take the measures provided in Article 9 of the Radiation Safety Regulations as regards transport of radioactive materials, etc. within the place of business where reactor facilities are installed according to Article 41 (1) 8 of the Decree.
(2) In the case of transport of radioactive materials, etc. as prescribed by the Ordinance of the Nuclear Safety and Security Commission outside its place of business, the operator of a nuclear power reactor may transport the relevant radioactive materials, etc. at the place of business where reactor facilities are installed, notwithstanding the provision of the foregoing Paragraph (1).

Article 65 (Storage of Radioactive Materials, etc. at Place of Business)

The operator of a nuclear power reactor shall take each of the following measures for storage of radioactive materials, etc. at the place of business where reactor facilities are installed in accordance with Article 41 (1) 9 of the Decree:

1. The measures provided in Subparagraphs 1 and 2 of Article 8 of the Radiation Safety Regulations shall be taken as regards storage of radioactive materials, etc.. Provided, that this shall not apply in the case of radioactive materials, etc. in a radiation control area; and
2. In those cases where any personnel other than those engaging in storage of radioactive materials, etc. access storage facilities, said personnel shall be required to comply with instructions from those engaging in such storage.

Article 66 (Radioactive Waste Management Program)

(1) In accordance with Article 41 (1) 10 of the Decree, the operator of a nuclear power reactor shall establish a radioactive waste management program, minimize the amount of radioactive wastes and effluents, and reduce the environmental impact of radioactive effluents.
(2) The radioactive waste management program as provided in the foregoing Paragraph (1) shall include procedures to monitor, measure, store, transport and process radioactive wastes in an appropriate manner, and include each of the following items for the assessment of the environmental impact of

discharging radioactive effluents:
1. Offsite dose assessment;
2. Operation of radioactive effluents monitoring system;
3. Sampling and analysis program regarding liquid and gaseous effluents; and
4. Radioactive waste solidification process program, etc.

(3) The annual dose at the exclusion area boundary due to gaseous effluents, which are discharged from the operation of a single nuclear power reactor or multiple nuclear power reactors within the same site, shall not exceed the limit prescribed by the Nuclear Safety and Security Commission in order to prevent the environmental hazard.

(4) Processing, discharge and storage of radioactive wastes shall be in accordance with Article 10 of the Radiation Safety Regulations.

▣ Section 4 Quality Assurance regarding Construction and Operation of Reactor Facilities

Article 67 (Scope of Application)

(1) As regards the technical standards for quality assurance regarding the construction and operations of reactor facilities as provided in Subparagraph 4 of Article 11 of the Act (including those cases to which the relevant provisions apply mutatis mutandis as provided in Article 30 (3) of the Act) and Subparagraph 4 of Article 21 of the Act (including those cases to which the relevant provisions apply mutatis mutandis as provided in Article 30 (3) of the Act), the provisions of Articles 68 through 85 hereof shall apply mutatis mutandis.

(2) Detailed requirements for effective application of the technical standards provided in the foregoing Paragraph (1) shall be determined and publicly notified by the Nuclear Safety and Security Commission.

Article 68 (Organization for Quality Assurance)

(1) The installer of a nuclear power reactor provided in Article 15 (1) of the Act, the operator of a nuclear power reactor provided in Article 23 (1) of the Act or the installer of a nuclear reactor for research, etc. provided in Article 32 of the Act (hereinafter referred to as “enterpriser”) shall clearly establish

and delineate in writing the authority and duties of persons and organizations performing activities affecting the safety-related functions of structures, systems, and components of nuclear reactors and related facilities.

(2) Enterpriser shall ensure that any person performing quality assurance functions have sufficient authority and organizational freedom to perform each of the following duties, and shall have such person, if it is necessary in the light of safety, directly report to the management level regardless of cost and schedule:

1. to identify quality problems;
2. to initiate, recommend, or provide solutions; and
3. to verify implementation of solutions.

Article 69 (Quality Assurance Program)

(1) Enterpriser shall establish at the earliest practicable time, consistent with the schedule for accomplishing the activities, a quality assurance program documented by written policies, procedures, or instructions.

(2) The quality assurance program as provided in the foregoing Paragraph (1) shall include each of the following:

1. Identification the structures, systems, and components to be covered by the quality assurance program and the major organizations participating in the program, together with the designated functions of these organizations.
2. Education and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained.
3. Control over activities affecting the quality of the identified structures, systems, and components, to an extent consistent with their importance to safety.

(3) The details of the activities and control as provided in Subparagraph 3 of the foregoing Paragraph (2) shall include each of the following:

1. Use of appropriate equipment by area of duties;
2. Suitable environmental conditions necessary for the performance of duties including cleanliness;
3. Standards to meet the prerequisites necessary for the performance of duties, if any; and
4. Other matters related to the conditions for adequate performance of duties.

(4) In establishing a quality assurance program as provided in the foregoing Paragraph (1), enterpriser shall consider the necessity of each of the following:

1. Special management;

2. Special work process;
3. Special testing;
4. Special equipment;
5. Tools and instruments;
6. Level of proficiency; and
7. Quality verification through inspections or testings.

(5) Enterpriser shall review the status and adequacy of the quality assurance program on a regular basis.

Article 70 (Design Control)

(1) With regard to the structures, systems and components subject to quality assurance, enterpriser shall take each of the following measures so that the related technical standards and design criteria can be reflected in specifications, drawings, procedures and instructions:

1. Measures to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled.
2. Selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems and components.
3. Identification and control of design interfaces and for coordination among participating design organizations, including the establishment of procedures among participating design organizations for the review, approval, release, distribution, and revision of documents involving design interfaces.

(2) Enterpriser shall take measures for design control such as checking of the adequacy of a design by such means as a design review, calculations or testing, and such measures shall include each of the following:

1. Reactor physics, stress, thermal, hydraulic, and accident analyses
2. Compatibility of materials and accessibility for inservice inspection, maintenance, and repair
3. Verification or checking of the adequacy of a design by a third party; and
4. Delineation of acceptance criteria for inspections and tests.

(3) Where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, it shall include

suitable qualifications testing of a prototype unit under the most adverse design conditions.
(4) Design changes, including field changes, shall be subject to design control measures commensurate with those applied to the original design as provided in the foregoing Paragraphs (1) and (2) and be approved by the organization that performed the original design unless the enterpriser designates another responsible organization.

Article 71 (Procurement Document Control)

(1) Enterpriser shall establish measures to assure that applicable regulatory requirements, design bases, and other requirements which are necessary to assure adequate quality are suitably included or referenced in the documents for procurement of material, equipment, and services, whether purchased by the applicant or by its contractors or subcontractors.
(2) Procurement documents shall require contractors or subcontractors to provide a quality assurance program consistent with the pertinent provisions of Articles 71 though 88 hereof. Provided, that this shall not apply in cases where the Nuclear Safety and Security Commission acknowledges, in his reasonable discretion, that formulation of a quality assurance program is unnecessary in consideration of the characteristics of the relevant materials, equipment or services.

Article 72 (Instructions, Procedures and Drawings)

(1) Enterpriser shall prescribe activities affecting quality by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall accomplish the activities in accordance with them.
(2) Instructions, procedures, or drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

Article 73 (Control of Purchased Items and Services)

(1) Enterpriser shall establish measures assure that purchased material, equipment, and services, whether purchased directly or through contractors and

subcontractors, conform to the procurement documents and such measures shall include each of the following:
1. Source evaluation and selection
2. Objective evidence of quality furnished by the contractor or subcontractor
3. Inspection at the contractor or subcontractor source; and
4. Examination of products upon delivery.

(2) Documentary evidence that material and equipment conform to the procurement requirements shall be available at the nuclear power plant prior to installation or use of such material and equipment.

(3) The effectiveness of the control of quality by contractors and subcontractors shall be assessed by the enterpriser at intervals consistent with the importance, complexity, and quantity of the product or services.

Article 74 (Identification and Control of Items)

(1) Enterpriser shall establish measures for the identification and control of materials, parts, and components.

(2) These measures shall assure that identification of the item is maintained by heat number, part number, serial number, or other appropriate means, either on the item or on records traceable to the item, as required throughout fabrication, erection, installation, and use of the item, and these measures shall be designed to prevent the use of incorrect or defective material, parts, and components.

Article 75 (Control of Special Process)

Enterpriser shall establish measures to assure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements.

Article 76 (Inspection)

(1) A program for inspection of activities affecting quality shall be established and executed by or for the organization performing the activity

to verify conformance with the documented instructions, procedures, and drawings for accomplishing the activity.
(2) Inspection shall be performed by individuals other than those who performed the activity being inspected. Examinations, measurements, or tests of material or products processed shall be performed for each work operation where necessary to assure quality. If inspection of processed material or products is impossible or disadvantageous, indirect control by monitoring processing methods, equipment, and personnel shall be provided. Both inspection and process monitoring shall be provided when control is inadequate without both.
(3) If mandatory inspection hold points, which require witnessing or inspecting by the enterpriser's designated representative and beyond which work shall not proceed without the consent of its designated representative are required, the specific hold points shall be indicated in appropriate documents.

Article 77 (Document Control)

(1) Enterpriser shall establish measures to control the issuance of documents, such as instructions, procedures, and drawings, including changes thereto, which prescribe all activities affecting quality, which shall assure that:.
1. Documents, including changes, are reviewed for adequacy and approved for release by authorized personnel; and
2. Documents are distributed to and used at the location where the prescribed activity is performed.

(2) Changes to such documents as provided in the foregoing Paragraph (1) shall be reviewed and approved by the same organizations that performed the original review and approval unless the enterpriser designates another responsible organization.

Article 78 (Test Control)

(1) Enterpriser shall establish a test program to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures, which shall include each of the following:

1. Proof tests prior to installation
2. Preoperational tests
3. Operational tests of structures, systems, and components during nuclear power plant operation,

(2) Test procedures shall include provisions for assuring:
1. that all prerequisites for the given test have been met;
2. that adequate test instrumentation is available and used; and
3. that the test is performed under suitable environmental conditions.

(3) Test results shall be documented and evaluated to assure that test requirements have been satisfied.

Article 79 (Control of Measuring and Testing Equipment)

Enterpriser shall establish measures to assure that tools, gages, instruments, and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated, and adjusted at specified periods to maintain accuracy within necessary limits.

Article 80 (Handling, Storage and Shipping)

(1) Enterpriser shall establish measures to control the handling, storage, shipping, cleaning and preservation of material and equipment in accordance with work and inspection instructions to prevent damage or deterioration.

(2) When necessary for particular products, special protective environments, such as inert gas atmosphere, specific moisture content levels, and temperature levels, shall be specified and provided.

Article 81 (Inspection, Test and Operating Status)

Enterpriser shall establish measures to indicate, by the use of markings such as stamps, tags, labels, routing cards, or other suitable means, the status of inspections and tests performed upon individual items of the nuclear power plant, which shall provide for:
1. Identification of items which have satisfactorily passed required inspections and tests; and

2. Operating status of structures, systems, and components of the nuclear power plant.

Article 82 (Control of Nonconforming Items)

(1) Enterpriser shall establish measures to control materials, parts, or components which do not conform to requirements (hereinafter referred to as "nonconforming items") in order to prevent their inadvertent use or installation, which shall include procedures for:

1. Identification of nonconforming items;
2. Documentation;
3. Segregation;
4. Disposition; and
5. Notification to affected organizations

(2) Nonconforming items shall be reviewed and accepted, rejected, repaired or reworked in accordance with documented procedures.

Article 83 (Corrective Action)

(1) Enterpriser shall establish measures to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected.

(2) In the case of significant conditions adverse to quality as provided in the foregoing Paragraph (1), the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition, and the identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken shall be documented and reported to appropriate levels of management.

Article 84 (Quality Assurance Records)

(1) Sufficient records shall be maintained to furnish evidence of activities affecting quality, which includes:

1. Operating logs;
2. Results of reviews;

3. Results of inspections and tests;
4. Results of audits;
5. Results of monitoring of work performance;
6. Results of materials analyses; and
7. Documents evidencing the qualifications of personnel, procedures, and equipment.

(2) Inspection and test records provided in Subparagraph 3 of the foregoing Paragraph (1) shall, as a minimum, identify:
1. Inspector or data recorder;
2. Type of inspection or testing;
3. Results of inspection or testing;
4. Acceptability; and
5. Action taken in connection with any deficiencies noted.

(3) Enterpriser shall ensure that records as provided in the foregoing Paragraph (1) shall be identifiable and retrievable.

(4) Consistent with applicable regulatory requirements, the enterpriser shall establish requirements concerning record retention such as:
1. Duration of retention;
2. Location of retention; and
3. Assigned responsibility.

Article 85 (Audits)

(1) Enterpriser shall carry out a comprehensive system of planned and periodic audits to verify compliance with all aspects of the quality assurance program and to determine the effectiveness of the program.

(2) The audits as provided in the foregoing Paragraph (1) shall be performed in accordance with the written procedures or check lists by appropriately trained personnel not having direct responsibilities in the areas being audited.

(3) Audit results shall be documented and reviewed by management having responsibility in the area audited.

(4) Enterpriser shall make actions necessary to correct the findings of the audit, and shall take followup action, including reaudit of deficient areas, where indicated.

Chapter Ⅲ Technical Standards for Nuclear Fuel Cycle Facilities

▣ Section 1 Location of Nuclear Fuel Cycle Facilities

Article 86 (Location)

(1) As regards the technical standards for the location of nuclear fuel cycle facilities as provided in Subparagraph 2 of Article 36 of the Act (excluding refining facilities; the same shall apply hereinafter), the provisions of Articles 4 through 10 hereof shall apply mutatis mutandis. In such case, "reactor facilities" shall be deemed as "nuclear fuel cycle facilities."
(2) Among technical standards as provided in the foregoing Paragraph (1), certain standards may not apply in those cases where it is acknowledged by the Minister of Education, Science and Technology that such standards are not directly applicable to the nuclear fuel cycle facilities as the purpose of the facilities is for research/experiment or due to the facility and technical characteristics thereof, or that safety is not affected even if such standards are not applied.

▣ Section 2 Structure, Installations and Performance of Nuclear Fuel Cycle Facilities

Article 87 (Scope of Application)

(1) As regards the technical standards for the structure, installations and performance of nuclear fuel cycle facilities as provided in Subparagraph 2 of Article 36 of the Act, the provisions of Articles 88 through 95 hereof shall apply mutatis mutandis.
(2) Among technical standards as provided in the foregoing Paragraph (1), certain standards may not apply in those cases where it is acknowledged by the Nuclear Safety and Security Commission that such standards are not directly applicable to the nuclear fuel cycle facilities as the purpose

of the facilities is for research/experiment or due to the facility and technical characteristics thereof, or that safety is not affected even if such standards are not applied.

Article 88 (Waste Processing Facilities, etc.)

Radioactive waste processing facilities that meet each of the following requirements (including a ventilation duct, and excluding waste storage equipment and ventilation equipment) shall be installed at nuclear fuel cycle facilities:

1. The facilities shall be able to process radioactive wastes generated from nuclear fuel cycle facilities to ensure that the concentration of radioactive materials in the air and water at the exclusion area boundary is no higher than the standard determined and publicly notified by the Nuclear Safety and Security Commission;
2. The facilities shall be installed separately from the facilities processing liquid wastes other than radioactive wastes. Provided, that this shall not apply in those cases where there exists no likelihood that radioactive wastes will flow backward into the systems processing ordinary wastes when liquid wastes other than radioactive wastes are sent to radioactive waste disposal systems;
3. The facilities shall have sufficient capacity to process radioactive wastes;
4. The facilities shall be able to measure and analyze the radioactive concentration prior to releasing radioactive wastes into the water or air, and have equipment to constantly monitor release of such wastes at a permitted concentration or below, and give a warning and stop the release of such wastes in cases where such wastes are released in excess of such concentration;
5. The facilities processing gaseous radioactive wastes shall not discharge such wastes at a place other than such exits as a ventilation duct;
6. A dike for the prevention of the spread of any leakage of liquid radioactive wastes shall be installed on the floor of the interior facilities of the systems processing liquid radioactive wastes, and such facilities shall have a structure that causes liquid radioactive wastes to flow into the drainage outlet and sump by the slope of the floor or a

dike built thereon;

7. A dike for the prevention of any leakage of liquid radioactive wastes to the outside of the facilities shall be installed at the entrance/exit that leads to the outside of the liquid radioactive waste processing systems or the surrounding area thereof. Provided, that this shall not apply in those cases where there exists no likelihood of such leakage to the outside of the facilities as the floor inside the facilities is lower than the floor or ground adjacent thereto; and
8. The facilities that process liquid radioactive wastes containing strong acids or hydroxides shall have an leak tight structure, made of materials that are resistant to corrosion.

Article 89 (Waste Storage Facilities, etc.)

Facilities storing radioactive wastes shall meet each of the following requirements:

1. The facilities shall have capacity to store radioactive wastes generated during normal operations;
2. The facilities shall resist decay heat and heat generated by irradiation, and shall not be significantly corroded by chemicals, etc.;
3. It shall be ensured that any contamination by radioactive wastes will not spread;
4. Storage facilities including storage tanks for radioactive wastes installed outdoors shall be installed in such a way that the safety thereof is guaranteed in the event of an earthquake, ground subsidence, collapse, uplift, shearing, differential settlement, etc. and that inundation due to waves or floods is prevented; and
5. A dike for the prevention of any leakage of liquid radioactive wastes to the outside of the facilities as a result of failure, damage, etc. to such facilities shall be installed at the facilities where liquid radioactive waste storage facilities are installed.

Article 90 (Fuel Storage Facilities)

(1) The facilities storing nuclear fuel assemblies or spent fuels shall meet each of the following requirements:

1. They shall have geometrically safe configuration to prevent fuels from criticality;
2. They shall have the capability of decay heat removal to prevent melting of fuels;
3. A cavity storing spent fuels and other highly radioactive fuels shall meet each of the following requirements:
   a. Structure without any possibility of overflow or leakage of water, and equipped with water makeup facilities and leakage detection facilities;
   b. Keeping of a necessary amount of water for the shielding of radiation of fuels, etc.; and
   c. Possible prevention of corrosion in cases where it is expected that the cladding of fuels, etc. may be significantly corroded.
4. Those other than handlers shall not be granted access.

(2) Technical standards as regards the structure and installations of dry storage facilities of spent fuels shall be determined and publicly notified by the Nuclear Safety and Security Commission.

Article 91 (Fuel, etc. Handling Equipment)

Equipment to handle fuels, etc. at nuclear fuel cycle facilities shall meet each of the following requirements:

1. They shall have geometrically safe configuration to prevent fuels from criticality;
2. They shall have the capability of decay heat removal to prevent damage or melting of fuels;
3. A vessel containing fuels, etc. shall resist impact, heat, etc. during handling thereof and shall not be easily damaged.

Article 92 (Emergency Electric Power Source, etc.)

In the case of a loss of power supply from the transmission network connected to nuclear fuel cycle facilities and power generators in use at all times, power generating equipment that uses internal combustion engines for motive force or equipment with the functions equivalent thereto shall be installed to maintain the functions of equipment

necessary for operational safety.

Article 93 (Material and Structure)

The material and structure of the vessels, pipes, pumps and valves that are utilized at nuclear fuel cycle facilities and major supporting structures thereof shall meet the technical standards by the safety classes and standards determined and publicly notified by the Nuclear Safety and Security Commission.

Article 94 (Performance of Spent Fuel Processing Facilities)

Among the nuclear fuel cycle facilities provided in Subparagraph 2 of Article 36 of the Act, the performance of spent fuel processing facilities shall be meet the following requirements:

1. Alarm system, emergency power system and other emergency equipment, safety protection circuits and interlocking devices (meaning devices that do not operate equipment unless certain conditions are met) shall function in accordance with the conditions stated in the application for designation as provided in Article 35 (3) of the Act and documents containing the conditions of such designation (hereinafter referred to as "application for designation, etc.");
2. The processing capacity of radioactive waste processing facilities shall not be less than the capacity stated in the application for designation, etc.;
3. The performance of major radiation control facilities shall meet the performance standards stated in an application for designation, etc.;
4. As regards spent fuel processing facilities, the radiation dose rate and the concentration of radioactive materials in the air and water at the place accessed by person at ordinary times, the place specially accessed by person during operations of spent fuel processing facilities and other places that require radiation control shall be no higher than the standards stated in the application for designation, etc.;
5. Ability to prevent nuclear fuel materials from criticality and to confine spent fuels, etc. in a limited area shall meet the ability standards stated in the application for designation, etc.;
6. The contents of nuclear fission products in produced articles shall be no

higher than the standards stated in the application for designation, etc.; and

7. The recovery ratio of produced articles shall be no lower than the standards stated in the application for designation, etc.

Article 95 (Provisions Applicable *Mutatis Mutandis*)

The provisions of Articles 13, 14 and 34 and Subparagraph 1 of Article 51 hereof shall apply mutatis mutandis to nuclear fuel cycle facilities. In such case,"reactor facilities"shall be deemed "nuclear fuel cycle facilities."

▣ Section 3 Operation of Nuclear Fuel Cycle Facilities

Article 96 (Scope of Application)

As regards the technical standards concerning safety actions for the operation of nuclear fuel cycle facilities as provided in Article 40 of the Act and Article 68 of the Decree, the provisions of Articles 97 through 100 hereof shall apply.

Article 97 (Surveillance and Checking of Nuclear Fuel Cycle Facilities)

Pursuant to Article 68 (1) 3 of the Decree, a nuclear fuel cycle enterpriser shall conduct surveillance and checking of nuclear fuel cycle facilities at least once a day.

Article 98 (Self-check of Nuclear Fuel Cycle Facilities)

Pursuant to Article 68 (1) 5 of the Decree, a nuclear fuel cycle enterpriser shall take each of the following measures:

1. With respect to any equipment that requires special control to achieve safety as provided in the safety control regulations (excluding the equipment in the following Subparagraph 2), such equipment shall be inspected on an annual basis to ensure that the performance of the equipment has been maintained;
2. As regards alarm system, emergency electrical power system and other

emergency apparatus, performance inspection for the operation thereof shall be performed on a monthly basis concerning each part of such apparatus, and a general inspection for the operation of the whole apparatus be conducted on an annual basis; and

3. As regards measuring instruments and radiation measuring apparatus directly related with the safety control of nuclear fuel cycle facilities, calibrations shall be performed on an annual basis.

Article 99 (Operation of Nuclear Fuel Cycle Facilities)

Pursuant to Article 68 (1) 4 of the Decree, a nuclear fuel cycle enterpriser shall take each of the following measures in regard of operation of nuclear fuel cycle facilities:

1. There shall be no possibility that nuclear fuel materials may reach criticality;
2. A person with the knowledge necessary for operation of nuclear fuel cycle facilities shall operate the facilities;
3. The facilities shall be operated only when the personnel necessary for operation of nuclear fuel cycle facilities are secured;
4. Matters that must be checked prior to the commencement of operation and after shutdown of nuclear fuel cycle facilities and matters that are necessary for the operation thereof shall be established and the operators shall be required to follow such matters;
5. Measures that must be taken in the event of an emergency shall be established and the operators shall be required to follow such measures;
6. Among nuclear fuel cycle facilities, the ventilation equipment, radiation measuring apparatus and emergency apparatus shall be available to maintain their performance at all times;
7. In the case of a testing operation of spent nuclear fuel processing facilities, the purpose, method, measures to be taken in the event of an emergency and so forth shall be confirmed and performed; and
8. In the case of the operation of nuclear fuel cycle facilities for training related to the operation thereof, matters that trainees must comply with shall be established, and such trainees shall comply with such matters under the supervision of operators.

Article 100 (Provisions Applicable *Mutatis Mutandis*)

(1) As regards safety measures that a nuclear fuel cycle enterpriser must take regarding a radioactive waste control program, the radiation control area, etc., radiation dose, etc., transport within a place of business and storage of radioactive materials, etc. within a place of business as provided in Subparagraphs 1, 2 and 6 through 8 of Article 68 (1) of the Decree, the provisions of Articles 51, 52 and 64 through 66 hereof shall apply mutatis mutandis. In such case, an "operator of a nuclear power reactor" shall be deemed a "nuclear fuel cycle enterpriser."
(2) Among the provisions of Articles 51, 52 and 64 through 66 hereof, certain provisions may not apply in such cases where it is acknowledged by the Nuclear Safety and Security Commission that such provisions are not applied mutatis mutandis to the nuclear fuel cycle facilities as the purpose of the facilities is for research/experiment or due to the facility and technical characteristics thereof, or that safety is not affected even if such provisions are not applied mutatis mutandis.

▣ Section 4 Quality Assurance for the Operation of Nuclear Fuel Cycle Business

Article 101 (Quality Assurance)

The provisions of Articles 68 through 85 hereof shall apply mutatis mutandis to the preparation of a quality assurance program as provided in Article 35 (3) of the Act. In such case, an "installer of a nuclear power reactor" or "operator of a nuclear power reactor" shall be respectively deemed a "nuclear fuel cycle enterpriser."

ADDENDA <Notification No. 2011-6, Nov. 11, 2011>

Article 1 (Enforcement Date)
These Rules shall enter into force on the date of their notification.

Article 2 (Transitional Measures)

Any disposition, procedure or other actions concerning nuclear energy safety taken in accordance with the former Rules on Technical Standards for Nuclear Reactors, etc. (Ordinance of the Ministry of Education, Science and Technology No.1)at the time these Rules enter into force shall be deemed taken in accordance with these Rules.

Disclaimer

This is an unofficial translation of the official NUCLEAR LAWS OF THE REPUBLIC OF KOREA for the benefit of interested readers, for all questions regarding meaning and phrasing, please refer to the official version in Korean.

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