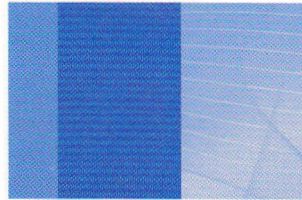


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Glossary



Beta-radiation, β -radiation – electron and positron ionizing radiation with continuous energy spectrum emitted at nuclear transformations.

Biological shielding – a barrier against radiation constructed around a reactor core and its cooling system to prevent harmful effect of neutron and gamma-radiation on the personnel, population and the environment. Concrete is a basic biological shielding material at a nuclear plant. The thickness of concrete protective screen at large reactors achieves some meters.

Closed nuclear fuel cycle – nuclear fuel cycle with spent nuclear fuel discharged from a reactor being treated to extract uranium and plutonium that are used repeatedly for nuclear fuel fabrication.

Coolant – special medium (depending on a reactor type – water (light or heavy), gas (CO₂, helium), liquid metal (sodium, lithium, lead)) that circulates through the reactor core and intended for heat removal from fuel elements.

Critical assembly – a complex aimed for experimental study of neutron multiplication medium. Its composition and geometry allow conducting a controlled nuclear fission reaction. It operates at power level that does not require forced heat removal and does not render an effect on its neutronic characteristics.

Critical mass – the least fuel mass which assures the capability of self-sustaining nuclei fission chain reaction provided the certain design and composition of the reactor core. The value depends on many factors: fuel composition, moderator, core shape, etc.

Critical facility (CF) – nuclear facility consisting of a critical assembly as well as a set of systems and experimental devices located within the design-based area.

Criticality – conditions sustaining the chain nuclear reaction in a nuclear installation.

Emergency protection (EP) – function of nuclear reactor control and protection system to prevent an emergency situation development by means of emergency reactor shutdown (reactor scram).

Enrichment (in terms of a nuclide) – 1) content of atoms of specific nuclide (in percents) in the mixture of nuclides of the same element if that content exceeds the share of this nuclide in the natural mixture; 2) process resulting in the increase of certain nuclide content in the nuclide mixture.

Experimental device – device, tool designed to conduct experimental studies.

Experimental loop – an independent circulation circuit of a reactor facility that contains one or several channels and is meant for experimental studies and tests of new types of fuel and other elements.

Fast neutrons – neutrons with kinetic energy exceeding any specified value. This value can vary within a wide range and depends on its application (reactor physics, shielding or dosimetry). In terms of reactor physics this value is selected most frequently as equal to 0.1 MeV.

Fuel assembly (FA) – a set of fuel elements (rods, bars, plates, etc.) loaded into the reactor core and held together with the help of spacer grids and other structural components (head, shroud, tail). This set is not detached during transportation and irradiation in the reactor.

Fuel cladding – protective metallic layer containing nuclear fuel in a fuel element and intended to confine radioactive fission products and maintain mechanical strength of the structure.

Fuel element (FE) – main structural component of heterogeneous reactor core to load fuel therein. Fission of heavy nuclei ²³⁵U, ²³⁹Pu or ²³³U in fuel elements is accompanied by thermal energy release that is transferred to a coolant. Fuel element consists of fuel meat, cladding and tails. Fuel element type is governed by reactor type and purpose as well as coolant parameters.

Gamma-radiation, γ -radiation – kind of ionizing radiation, electromagnetic radiation emitted at radioactive decay and nuclear reactions, spreading with the light speed and having high energy and penetrating capacity. It is attenuated effectively by interaction with heavy elements,

e.g. lead. Thick-walled shielding screen made of concrete is used to attenuate gamma-radiation in nuclear reactors at NPP.

Graphite – a mineral, one of the crystal form of carbon. In nuclear reactors a nuclear grade graphite is used as neutron moderator.

Heat exchanger (heat exchanging apparatus) – facility intended to transfer heat from one body (coolant) to another (steam generator, condenser, deaerator, preheater, auxiliary heat exchanger, pressure suppression pool, etc.) to conduct different processes – heating, cooling, boiling, condensation.

Heavy water – deuterium oxide (D_2O), water with hydrogen atoms replaced with deuterium atoms. Heavy water is used in nuclear reactors as a moderator. One part of heavy water is contained in 5000 parts of natural water.

Homogeneous reactor – a nuclear reactor with a core consisting of homogeneous multiplication medium (uniform mixture). In such reactor a fuel and a moderator (and sometimes other reactor core components also) are distributed in a solution or in a rather uniform mixture or are spatially separated but in such a manner that a difference in fluxes of any energy neutrons is insignificant.

Intermediate neutrons – neutrons with kinetic energy being in the range between the energies of slow and fast neutrons. This range in reactor physics is from 1 eV to 0.1 MeV.

Irradiation dose – a quantitative roentgen- and gamma-radiation characteristic based on their ionizing action and expressed as a total electric charge of single-sign ions generated in an air volume unit. Value to measure irradiation dose in CI-units is coulomb per kilogram (C/kg), out-of-system unit is roentgen (R); $1 R = 2.58 \cdot 10^{-4} C/kg$.

Life extension – activities to prepare an installation to be operated during an additional term.

Maximum permissible dose (MPD) – the largest value of individual equivalent irradiation dose during a year that in case of uniform exposure during 50 years will not cause the inauspicious changes (detectable by the state-of-the-art methods) in the personnel health state (category A).

Moderator – a substance with low atomic mass which serves in a nuclear reactor core to decrease

kinetic energy (moderation) of high energy (0.5–10 MeV) neutrons generated in nuclei fission down to thermal neutron energy (< 1 eV) that cause fission of ^{235}U , ^{233}U and ^{239}Pu nuclei. Most applied neutron moderators are graphite, natural water, heavy water and beryllium having low absorption of thermal neutrons. There is no moderator in fast reactors where are used fission neutron with high energy.

NRF commissioning – activities devoted to check the systems, components and NRF as a whole compliance with the design. These activities include start and adjustment works, attaining the NRF first criticality, RR power start-up.

NRF decommissioning – kind of activities performed after nuclear materials are removed from the site and aimed to the achievement of preset final state of NRF and its site.

NRF first criticality – NRF commissioning stage including a nuclear materials loading into the core and an experimental determination of NRF nucleonic characteristics.

NRF long-term outage – NRF operation mode with performance of activities aimed at preservation of separate systems and components and maintenance of NRF operational integrity during the time when experimental studies are not planned.

NRF normal operation – NRF operation within the NRF design-based operational limits and conditions.

NRF nuclear, radiation safety – NRF property to constrain radiation effect on personnel, population and the environment down to the specified limits in case of normal operation, anticipated operational occurrences including accidents.

NRF operation – activities aimed at safe attaining NRF construction purpose including a critical mass loading, preset power level operation, experiment performance, NRF outages, nuclear materials and radiation sources handling, maintenance, repair and other kinds of associated activities.

NRF physical protection – a totality of organizational measures, engineered features and actions of a safeguard team to prevent subversive activities or theft of nuclear materials, radioactive substances, radioactive waste.

NRF power start-up – NRF commissioning stage including an experimental study in

temperature and power influence on neutronic characteristics of NRF, investigation of radiation situation during NRF power operation and NRF introduction at the design rated parameters.

Nuclear fuel burn-up – a reduction in any nuclide concentration in nuclear fuel due to nuclear transformations of this nuclide during a reactor operation.

Nuclear power facility – totality of devices to produce thermal, electric or mechanical energy in the course of controlled chain reaction within a nuclear reactor. A nuclear power facility includes one or several nuclear reactors, steam generators, steam turbines, electric generators, as well as pipelines, pumps and other auxiliary components.

Nuclear reactor vessel – sealed reservoir designed for accommodation of the reactor core and other devices as well as for arrangement of safe nuclear fuel cooling by the coolant flow.

Nuclear research facility (NRF) – nuclear facility consisting of a research reactor or critical or subcritical assembly and a complex of rooms, systems, components and experimental devices with necessary staffing (personnel). This facility is located within the boundaries of design-based area (NRF site) and is meant to use neutrons and ionizing radiation for research purposes.

Nuclear research facility (NRF) core – a part of research reactor, critical or subcritical assembly with nuclear materials (nuclear fuel) and other components necessary to maintain a fission chain reaction to be located inside the core. NRF core can include moderator, coolant, members aimed to affect the reactivity, experimental devices.

Pool reactor – a nuclear reactor with the core located in a pool filled with water. Water serves as neutron moderator, coolant and biological shielding against radiation.

Pressure vessel reactor – nuclear reactor with the reactor core located in a vessel capable to withstand coolant pressure and thermal loads. High coolant pressure in the pressure-vessel reactors requires the availability of a strong thick-walled steel vessel.

Pressure-tube reactor – nuclear reactor with the reactor core containing fuel and circulating coolant in the separate process channels capable to withstand the high coolant pressure.

Propulsion reactor – nuclear power reactor used as energy source for moving a vehicle, e.g. nuclear icebreaker or nuclear submarine.

Pulse reactor – nuclear research reactor aimed to obtain power pulses while supercriticality is provided for by prompt neutrons.

Reactor control and protection system (CPS) – system providing for start-up and shutdown, keeping the preset power level, transfer to other power level, emergency reactor shutdown. CPS working member – movable part of the reactor is as a rule cylindrical rod containing a material with high absorption cross-section. Its movement affects the neutron balance in the reactor core. Frequently, neutron absorption is accompanied by rather high energy release, so heat removal from the CPS channels is envisaged.

Reactor coolant pump (RCP) – pump providing coolant circulation in a nuclear reactor circuit.

Reactor core barrel – structural part of a reactor designed for accommodation of the reactor core and guides for CPS working members.

Reactor cycle – time of reactor operation at the rated power without fuel reloading (shuffling). Cycle duration is defined by refueling mode. In case of simultaneous all fuel reloading, reactor cycle coincides with a fuel cycle while at partial fuel reloading the former is as n times as lower than the latter (n – number of fuel reloadings in the fuel cycle in equal time intervals). In case of quasi continuous refueling the reactor cycle notion is not reasonable to be used.

Reactor facility – NRF having a research reactor in its mix.

Reactor loop – a closed set of features to remove heat including heat exchanging or steam generating apparatuses, pipelines, pumps, valves.

Reactor vessel cover – a removable part of the reactor vessel that serves to seal the vessel, to withstand internal reactor pressure and to connect the control and monitoring members.

Reflector – material intended to reduce the neutron escape from a reactor. In thermal neutron reactors a reflector is the same substance that serves as a moderator. In fast neutron reactors the materials that generate fissionable nuclides (e.g. ^{232}Th or ^{238}U) at interaction with neutrons are used as a reflector (screen).

Research reactor (RR) – device for experimental studies. Its composition and geometry allow conducting a controlled nuclear fission reaction. It operates at power level that requires forced

cooling and (or) renders an effect on its neutronic characteristics.

Research reactor primary circuit – a set of channels (cavities) in the heterogeneous research reactor core, pipelines and heat exchangers containing the coolant to cool the reactor core or a vessel of homogeneous research reactor with nuclear material solutions as well as pipelines with circulating nuclear material solution.

Shutter – in protective devices – a plug or flap that closes through openings in a radiation source shielding and moves under the action of remote controlled mechanisms.

Stationary reactor – nuclear research reactor designed for long-term operation at any constant (in time) power level from the rated (design) power to minimal controlled one.

Subcritical assembly – a complex for experimental study of neutron multiplication medium; its composition and geometry provide $K_{\text{eff}} < 1$ in normal operation.

Subcritical facility (SCF) – nuclear facility consisting of a subcritical assembly and a set of rooms, systems, experimental devices and located in the design-based area boundaries.

Thermal neutrons – neutrons with kinetic energy lower than specified value. This value can change in a wide range and depends on the application field (reactor physics, shielding, dosimetry). In reactor physics this value is equal to 1 eV more frequently.

Transuranic elements – actinide chemical elements with atomic numbers above 92. They have artificial origin because their half-lives are lesser than the Earth age.

Uranium dioxide – uranium and oxygen compound (UO_2) having chemical and thermal resistance (melting temperature 2760 °C) that has governed its selection as a nuclear fuel in LWR.