PROBABILISTIC SAFETY ASSESSMENT ON NUCLEAR POWER PLANTS

V. Kavaliova, O. Gusakova

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
Skull.vika@mail.ru

Probabilistic safety assessment is one of the most effective tools of qualitative research and a quantitative assessment of the level of safety of the operating nuclear power plants. PSA needs to combine the proven effectiveness of mathematics and a deep knowledge of the technological characteristics of the investigated blocks.

Keywords: nuclear power plant (NPP), risk, probabilistic safety assessment (PSA).

Nuclear power plant (NPP) is a source of potential danger or radiation impact on staff, population and the environment due to the accumulation in the process of exploitation of significant quantities of radioactive products and the availability of basic possibilities of output in case of accidents behind provided boundaries. The degree of radiation risk is directly dependent on the level of NPP safety, which is one of the main properties of the NPP, determining the possibility of their use as sources of thermal and electric energy.

Ensuring safe operation of nuclear power plants is a priority as organizations designing and operating nuclear power plants and the bodies of state management of the use of atomic energy and state regulation of safety at use of atomic energy [1].

Requirements for carrying out studies on comprehensive assessment of safety level of NPP units are included in a number of Federal and regulatory documents and are mandatory for the operating organizations at obtaining licenses for operation of nuclear power plants, including the lifetime extension of nuclear power plants.

Probabilistic safety assessment (PSA) is a tool which gives opportunity to assess integrally current level of security and, if necessary, to identify ways to improve it.

PSA allows systematically and comprehensively analyze all sorts of emergencies and identify the major sources of accidents at the facility, and identify what features of the project and/or operation of nuclear power plants are the most significant from the point of view of risk of undesirable consequences. Thus, the results of the probabilistic assessment provide the basis for decision-making on implementation of activities with the purpose of increase of level of security, allowing quantitatively "weigh" events for their impact on risk reduction[2].

PSA can be performed at different stages of the life cycle of the NPP, including design, construction, commissioning, operation and decommissioning. Most effectively and cheaper PSA can be used in the design phase where the results can be a basis for the development of technical solutions aimed at improving safety and implemented directly in the project of NPP. The use of PSA at the design stage allows to create NPP with the specified security level.

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THE ASSESSMENT OF THE EFFICIENCY OF WASTEWATER TREATMENT AT THE MINSK SEWAGE TREATMENT STATION

D. Kazak, S. Golovatyi

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
diana3486076@mail.ru

In this paper, the efficiency of wastewater treatment is estimated from the data of local monitoring. The calculation of the efficiency of wastewater treatment at the Minsk sewage treatment station showed that the degree of water purification at this enterprise is high and, on average, is 86,2 %.

Keywords: wastewater, efficiency assessment, wastewater treatment, treatment facilities, local monitoring, chemical and technological control.

Minsk sewage treatment station is the most complicated industrial complex for cleaning domestic and industrial wastewater consisting of two production complexes: MSTS-1 and STP. The station collects and purifies wastewater generated in the city, as well as realizes collection and transfer for storage, burial, use and disposal of waste generated in the production activities of the enterprise.

Of the total volume of wastewater, there are approximately 30 % of industrial waters from more than 300 enterprises in Minsk. Currently, 500 thousand m^3 of sewage are generated daily, which are sent to Minsk sewage treatment station through the system of domestic sewerage. At the same time, the capacity of the enterprise can reach 800 thousand m^3/day [1].

During the local monitoring at the enterprise, the efficiency of wastewater treatment is evaluated. Local monitoring is carried out in accordance with the Regulation on the procedure for the local monitoring of the environment and use of its data as a part of the National Environmental Monitoring System in the Republic of Belarus, approved by the Resolution of the Council of Ministers of the Republic of Belarus on April 28, 2004, № 482 "On Approval of the Regulations on the Procedure as part of the National System for Monitoring the Environment in the Republic of Belarus monitoring surface water, groundwater, atmospheric air, local monitoring environmental monitoring and use of these monitoring data" [2].

To assess the effectiveness of wastewater treatment, a chemical and technological control of the sewage treatment plant is carried out. Chemical and technological control of the sewage treatment plant is carried out in the course of water movement at all stages of purification. Waste water is analyzed before the treatment facilities, after passing each treatment facilities and at the outlet to the pond. At the same time, the qualitative composition of incoming wastewater to the station is determined. Evaluation of sewage treatment efficiency is carried out according to 25 indicators [3].

The efficiency of wastewater treatment at the Minsk sewage treatment station for the period from 2012 to 2016 is estimated. Analysis of local monitoring data showed that there is a tendency in increasing the amount of ammonia nitrogen, phosphates, nitrites, nitrates, chlorides, sulfates, iron, copper, cadmium, lead and phosphorus in the wastewater that enter to the treatment plant. At the same time, there was a tendency in reducing the amount of suspended solids, dry residue, oil products and zinc in wastewater.

The calculation of the efficiency of wastewater treatment at the Minsk sewage treatment station showed that the degree of water purification at this enterprise is high and, on average, is 86,2 % [4].

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ECOLOGICAL PROBLEMS OF NON-IONIZING RADIATIONS

E. Kemesh, V. Malishevskiy

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
kemesh.jenya@gmail.com

The effects of non-ionizing electromagnetic fields on living organisms, sources of increasing electromagnetic background, as well as problems of ensuring electromagnetic safety of man are discussed.

Keywords: non-ionizing radiation, electromagnetic field, electromagnetic smog, electromagnetic pollution, electric field, magnetic field, field strength.

Life on Earth was created many years ago, and for a long time proceeded in the conditions of relatively weak electromagnetic fields (EMF), which created only natural sources. These include the electric and magnetic fields of the planet, processes, which occurring in its atmosphere (lightning discharges, vibrations in the ionosphere), cosmic sources of radio waves (the Sun and other stars).

Only in the 19th century appears to base the approval on the relationship of electrical and magnetic phenomena. In 1887 H. Gertz fully confirms the theory of the electromagnetic field, created in 1864, without assuming that