WWER-TOI project shows the implementation of the following principles ensuring the modern concept of the repetitive defense in depth: to create a number of consequential barriers preventing the emission of radioactive products to the environment, which are accumulated during the operation. Fuel matrix, fuel cladding, reactor vessel and pile envelope serve as barriers for WWER. [1]

Protection of the NPP from external influences

The most significant influences, which parameters significantly affected the technical solutions of the WWER-TOI project are: seismic influences (SSE to 8 points and LE to 7 points); influences bound to a plane crash; influence of the external air shockwave with compression pressure in the front of 30 kPa; floods and storm; hurricanes and tornadoes (rated maximal speed of wind is up to 56 m/s).

Severe Accident Management

Modern nuclear power plant has an unprecedented low risk of the spread of ionizing radiation and radioactive substances in the environment. This is achieved by the newest protecting and localizing safety technologies. In the project "WWER-TOI", a combination of active and passive safety systems has been adopted. Molten core catcher is a means of non-project accident control in the "WWER-TOI" design.

A combination of passive and active safety systems, envisaged in the project "WWER-TOI," ensures the absence of destruction of the reactor core within 72 hours from the beginning of non-project accident occurrence. In case of the loss of all power sources, the technical solutions of the project ensure the transition of reactor plant equipment into the safe state under any initial conditions (natural and technogenic). This feature increases the competitiveness of the project on the external and internal markets of electricity generation. [2]

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RESEARCH OF BETA – RAY ATTENUATION COEFFICIENT FOR ALUMINIUM

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It is well-known that one type of radioactivity is β-decay, wherein the charge of atomic nucleus is changed by one unit, but its mass remains the same. The characteristic feature of this phenomenon consists in continuity of energy spectrum of emitted particles (electrons or positrons), while spectra of α- and γ-radiation are discrete. That kind of difference is caused by the appearance of two light particles during β-decay. There is an electron and electron antineutrino, or a positron and electron neutrino. Therefore, the decay energy is divided between those two particles.

The continuity of energy spectrum of emitted β-particles results in specific problems of β-spectrometry, which are related to the identification of radiating nuclide (or group of nuclides) in an investigated sample, as well as to the determination of corresponding activities.

Also, continuous energy distribution of β-particles accounts for their complex interaction with the matter: attenuation of particle flux by absorbent material is the superposition of all attenuations of monoenergetic electrons in radiation spectrum.

In practice, there are concepts like “half reduction layer” and “attenuation coefficient” (streak or mass) in use. The most common absorbent material is aluminium. There exists a significant amount of empirically obtained data on the interaction between this element and β-particles.

The present work includes the research of β-particles flux radiated with checking source (^{90}Sr), as well as flux attenuation by aluminium. The set of β-radiation energy spectra was measured for the comparative analysis. There was a simple source spectrum without an absorber, and radiation spectra using absorbing layer of the varied thickness. The absorbing layer was made as a set of aluminium plates, overlaid one to the other.

The received data on the attenuation of β-radiation flux correspond to the theory for the given nuclide. The calculated mass attenuation coefficient is according to the table value with an accuracy up to 25 %. The imprecision can be explained by the inhomogeneity of the absorbing layer and inevitable presence of the decay product of ^{90}Sr – ^{90}Y – in the sample. This radionuclide has a different cutoff energy of β-spectrum and, consequently, different attenuation coefficient.

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RISK ASSESSMENTS AT NUCLEAR POWER PLANT (NPP)

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Today the NPP energy production is constantly and intensively increasing in the world, resulting in the growth of different threats under its exploitation caused by natural and manmade factors, which include possible directed terrorist attacks. It is necessary to use correct assessments of corresponding risk levels during NPP projecting, building and exploitation under its complex integrated emergency management [1]. In the paper some possible methods of risk assessments and the use of the universal formula for calculating the total vector of limited losses under NPP exploitation for fixed time interval under the following assumptions have been analyzed [2]: (1) at initial state the object is in normal (non accidents) exploitation; (2) the different types of accidents can occur as noticed i =2, 3, …, m, where