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This book is the proceedings of the V. Voyevodin International Scientific and Technical Conference “Problems of Modern Nuclear Power”. The proceedings contain 64 abstracts. These materials present the studies of physical processes and phenomena in reactor materials and substances at different states under the influence of external factors, problems of the current state of nuclear energy, a stable and safe operation of nuclear power plants, storage of spent nuclearfuel, and related fields.

ORGINIZING COMMITTEE

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MATERIALS FOR NUCLEAR ENERGY

UKRAINIAN NUCLEAR ENERGY: STRATEGIC RESOURCE IN THE FACE OF GLOBAL RESOURCE SHORTAGES

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Today, the energy sectors of most countries are based on the coal and nuclear industries, with coal power being phased out while nuclear power continues to grow [1]. Given modern realities – such as population growth and the expansion of industry, infrastructure, cities, and engineering facilities – this process is expected to continue for years, and possibly decades, to come. Since the fuel and energy complex must be constantly maintained, improved, and expanded – particularly the electric power industry – the development and modernization of nuclear energy is not merely relevant, but a vital strategy for our country’s development in the near term. In 2021, Ukraine formulated the state program 'Critical and Strategic Mineral Resources of Ukraine in the Context of Globalization and Climate Change,' which provides a solid foundation for our country [2]. Given that our country has its own crystalline shield, which has been sufficiently geologically studied, one could say that the nuclear industry is fully supplied with radioactive raw materials. The shield rocks are responsible for the elevated concentrations of radioactive elements in our country. The problem is that these elements are associated with highly durable and ductile rocks, so their destruction and subsequent extraction are costly. On the other hand, there are areas within and around the shield itself where radioactive, rare earth, trace, and light elements are found in sediments and sedimentary rocks, making extraction from these elements significantly easier and more cost-effective. Let us examine these rocks in greater detail, as different scientific schools employ different classifications for them, and even sediments (such as sand, clay, etc.) are sometimes referred to as rocks. Our crystalline shield, composed of several large blocks, was formed approximately 2 billion years ago. Since then, peneplanation processes have significantly reduced its thickness. According to various estimates, its thickness has decreased by 2-3 km. Throughout this time, all eroded sediments were transported to the north, south, east, and west. Radioactive, rare-earth, rare, and other similar elements and minerals were transported along with them. Elements released during the transport process partially remained within detrital grains, partially formed organometallic compounds in coal matter, and partially remained in situ. Consequently, geologists have noted elevated concentrations of these strategic elements in the sediments covering the crystalline shield, as well as in the sediments and sedimentary rocks (including coal) surrounding the shield on all sides. In recent years, researchers at the Institute of Geotechnical Mechanics of the NAS of Ukraine have studied this issue in considerable detail, constructing schematic maps of the distribution of radioactive elements, germanium, zirconium, and other elements, in the hope that these findings will prove valuable to end-users [3].

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