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Solving direct and inverse geophysics and geodynamics problems in site selection, construction and operation of nuclear power plants in accordance with federal norms and rules for the atomic energy use

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During surveys to select the area and site of nuclear power plants (NPP) that meet the requirements of the federal norms and rules in the field of the atomic energy use [1], [2], a set of geological, geophysical and geodynamic methods is used on the basis of known solutions of direct and inverse problems. For example, in order to identify a single tectonic block within which a nuclear power plant site can be placed, according to the requirements of paragraph 12 of NP-032-19, 3D seismic surveys are conducted. As a result of seismic exploration, the sections of true elastic wave velocities can be reformatted into rock density sections, and then the calculated values of Δg are compared with the observed values of Δg by solving a direct problem of gravity exploration [3]. In this way, the accuracy of the results of geological-geophysical and tectonic surveys in the area and at the nuclear plant site is assessed.

During the NPP design, the design values of settlement and tilts of the NPP buildings and structures (NPP B&S) are calculated using the data of geological sections of NPP B&S foundation soils and the values of physical and mechanical properties of the foundation soils.

At the NPP design stage, the program for monitoring of settlement and tilt of the NPP B&S using a high-precision geodetic method (inverse problem) is prepared, the requirements for which are defined in [4].

At the construction stage, periodic measurements of ground deformations of the NPP B&S foundations at the controlled points of the building structures are made. The initial cycle of geodetic monitoring of foundation ground deformations of the NPP B&S foundations shall be performed after completion of foundation creation before the start of erection of subsequent NPP building structures.

Before commissioning of the NPP, the act on completion of geodetic monitoring of ground deformations of the foundations of the NPP B&S and the existing observation network of geodetic monitoring shall be handed over to the operating organization for continuation of monitoring. The act on completion of geodetic monitoring of ground deformations of the foundations of the NPP B&S foundations contains the actual values of settlement and tilt of the foundations of the NPP buildings and structures at 10, 25, 50 and 100% load on the foundations [4].

At the NPP operation stage, the periodicity of geodetic observations of foundation ground deformations of the NPP B&S foundations is determined depending on the conditions of settlement stabilization.

During commissioning and operation of the reactor building, the non-exceedance of the design limits of settlement and tilt of the reactor building is justified by the sum of the results of two monitoring surveys: geodetic monitoring of foundations (base soils), which was discussed above, and geodynamic monitoring of modern vertical movements of the Earth's crust (surface), as detailed in [5].

References

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