

Reference note on the decontamination, processing and disposal of radioactive waste in the Chernobyl Exclusion Zone

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Secret

Reference note on the problems of the 30-kilometer zone

The total area of land withdrawn from economic use due to contamination with radionuclides exceeding permissible limits is approximately 300,000 hectares. The economic damage caused by the very fact of territory alienation reaches, according to available estimates, approximately 150 million roubles per year.

The main biologically significant radionuclides (cesium-134, 137, strontium-90, plutonium-239, 240, etc.) contained in the products of the accidental release from Unit 4 have half-lives ranging from 20 to tens of thousands of years. This precludes a significant natural decrease in the contamination density of the area in the near future, which in turn necessitates decontamination work to eliminate wind and water (subsurface) transport of radioactivity beyond the zone.

Analysis of available materials indicates that the main source of deposited radioactivity, containing strontium-90 and plutonium-239, falls within the area of periodic flooding of the Pripyat and Uzh rivers.

According to experts, floods over the past four years since the accident have carried large quantities of radioactive sludge from the Pripyat River floodplain and the Kiev Reservoir into the middle and lower reaches of the Dnieper. Already today, in some areas, the concentration of strontium-90 in Dnieper water is 0.37-0.44 Bq/L, but the permissible limit for this radionuclide is 0.259 Bq/L.

These circumstances necessitate urgent measures to construct effective water protection systems (dam reclamation, etc.), the implementation of which, taking into account all positive and negative factors, should be carried out by the Ministry of Water Resources of the Ukrainian SSR.

Decontamination and operation of radioactive waste disposal facilities in the zone are handled by a special enterprise, "Kompleks" (part of the NPO Pripyat of the USSR Ministry of Atomic Energy, which employs 600 people). Currently, the main problem negatively impacting the implementation of these works is the lack of proven, sufficiently effective, and highly mechanised technologies for decontaminating contaminated surfaces in our country.

Previous work in the area resulted in the creation of significant quantities of building structures, equipment, biological matter, and especially soil contaminated with radioactive substances.

Experts estimate the estimated volume of materials to be between 1.5 and 10 million m³.

The concept for radioactive waste management was to ensure its storage at waste disposal sites (PZRO-5) and temporary localization sites for radioactive waste (PVLRO over 800). The current situation with the aforementioned sites requires the adoption of urgent, drastic measures, primarily to bring all waste disposal sites and radioactive waste storage facilities into compliance with the "Sanitary Rules for Handling Radioactive Waste" (SPORO-85), as elevated levels of strontium-90 and other radionuclides are already being recorded in groundwater in the area of the waste disposal sites.

Furthermore, radionuclides continue to leach from fuel matrices on the soil surface, resulting in their release (washout) into open water bodies. These processes threaten the ecological integrity of the entire Dnieper basin, home to over 35 million people.

The issue of cleaning up waste disposal sites and bottom sediments is particularly pressing, as there is a serious threat of radioactive contamination of drinking water, including artesian wells.

The current situation at the PZRO and PVLRO facilities requires an immediate decision on the processing and reburial of radioactive waste in long-term repositories.

In this regard, the primary need is the construction of a complex of facilities for the decontamination, transportation, processing, and disposal of radioactive waste (RW) from areas contaminated as a result of the Chernobyl accident (codenamed "Vector"). A feasibility study for this project was presented to NPO Pripyat in January 1990.

Currently, specialists from the All-Union Scientific Research and Design Institute of Energy Technologies (VNIPIET, Leningrad) are revising the feasibility study, taking into account the comments made.

A serious challenge to the implementation of the Vector programs is the lack of new technology in the country, including robotic systems for processing radioactive waste and filtration systems capable of ensuring environmental safety of production and personnel radiation exposure commensurate with the final result.

As a first step in implementing industrial decontamination, in March 1990, the foreign trade association Atomenergoexport of the USSR Ministry of Atomic Energy and Nuclear Industry signed a contract with the Swiss company Risitek for the supply of a metal decontamination plant with hydro-fluoric acid to the USSR. However, to date, the plant's design has not addressed environmental safety or the containment of secondary waste, which poses a toxicological hazard in addition to radioactive waste.

These circumstances require effective oversight of the project's implementation through independent commissions of the USSR and Ukrainian SSR Academy of Sciences.

Groundwater hydrology is an equally important issue for the safety of the Chernobyl Nuclear Power Plant and the Shelter.

Recently, due to the cessation of reclamation and irrigation work, as well as the construction of a slurry wall, groundwater levels have risen naturally in the area (including the Chernobyl Nuclear Power Plant foundation area). This requires a new assessment of the seismic resistance of the soils beneath the foundations of the structures, an increase in the magnitude of the maximum earthquake (currently, the Chernobyl Nuclear Power Plant is designed for a magnitude of 6), and a range of engineering measures to strengthen the building structures.

Moreover, for the same reasons, there are instances of flooding at most of the "burial grounds" (Red Forest, etc.) that lack sufficiently reliable "shielding," leading to additional radioactive waste removal from their territories. These circumstances require emergency measures by the USSR Ministry of Atomic Energy and the Ukrainian Ministry of Water Resources to lower the groundwater level under the plant and the Shelter, assess the seismicity of the soils near the Chernobyl Nuclear Power Plant, and prevent the erosion of radioactive waste from the "burial grounds" in the zone by groundwater.

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