



## REAL AND ALLEGED HAZARD OF RADIOACTIVE CONTAMINATION OF SEAS CAUSED BY ACTIVITIES OF RUSSIAN NUCLEAR FLEETS

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The current paper addresses the assessment results of the degree of danger caused by radioactive contamination of seas by wastes from the activities of nuclear fleets compared to the results obtained in other works, specifically, in the IASAP program. The leading institution in Project 101, ISTC is the Lazurit Central Design Bureau Open Joint-Stock Co. (Nizhny Novgorod). The co-executors are RRC Kurchatov Institute, OKBM, NIKIET, OKB Hydropress, SPA Typhoon. Besides that experts from the Naval institutions, State Research Center Krylov Shipbuilding Research Institute, Prometei Research Institute, Central Design Bureau Iceberg and others were involved into the work. Project 101B, while covering only the marine part of the problem associated with the activities of the Navy and Civil Fleet, was co-ordinated with Project 245 in part of forming the databases as the scope of activities of the latter project included global aspects of radiation legacy of the former USSR.

Computer databank regarding the sources of actual and potential radiation contamination of seas was established in the course of the Project execution.

Information about 600 objects was included into the databank. It covered:

- 21 nuclear reactors with spent nuclear fuel and without spent nuclear fuel dumped at sea;
- 155 decommissioned nuclear submarines;
- 2 decommissioned ice-breakers;
- 15 floating technical bases to support nuclear submarines and ice-breakers;
- 29 tankers for liquid radioactive wastes, floating cells, controlling dosimetric vessels etc.;
- 355 packings containing 33,000 units of various equipment and structures.

The database on the environment includes information about the radioactive contamination of dumping sites (based on the monitoring data) as well as information of the oceanographic nature and the biocenosis in the dumping site areas as well as of the global nature in the conditions of open sea along the routes of the forecast migration of radionuclides in case of their release from sources.

Analysis of structural peculiarities of objects with non-offloaded nuclear fuel dumped at the sea bottom as well as measures of their conservation adopted in the 1960-s before dumping while using the reactor cavity filling with furfurol and cementing of reactor spaces enables to draw the unambiguous conclusion about the principal impossibility of salvo releases of radionuclides into the environment which might have caused deterioration of its radioecologic situation. Risk assessment for the population of the Nenets National District caused by dumping of reactors in the Kara Sea was performed within the Project.

The executed assessment enables to claim that sources of radioactive wastes dumped in the Kara Sea do not and will not represent a radioecologic danger for the population and nature of the Nenets National District within 1,000 years to come and the maximum annual doses of 0.2..0.3 Sv per annum reached by Year 3000 will make 0.03..0.04% of the currently formed levels of contamination on the territory of the Nenets National District which is considerably lower than the standards established by the Norms of Radiation Safety -96. The potential risk in Year 3000 will make from 0.005 up to 5% of the actual current risk level formed by global fallouts of radionuclides which is much lower than stipulated by the Norms of Radiation Safety (NRB-96).

The analysis of the after-effects of accidents during storage of nuclear submarines with offloaded cores enables to make a conclusion about their extremely inconsiderable impact on the environment which, as in the previous case with the objects dumped at the sea bottom, also enables to consider this danger an alleged one.

The danger caused by floating technical bases containing such radioactive material as spent nuclear fuel is quite evident. Taking into account the fact that a floating technical base can contain up to three cores simultaneously, the total activity of spent nuclear fuel stored at the floating technical base will be about  $4,8 \cdot 10^{15}$  Bq. Taking into account the fact that contrary to the nuclear submarines, a number of shielding barriers preventing propagation of radionuclides from the spent nuclear fuel is absent on the floating technical base in case of their dumping (there is no pressure hull of the reactor compartment, no reactor hull) as well as the availability of conditions for enhanced corrosion of the spent heat-emitting assembly casings (damp air and temperature elevation caused by the deterioration of heat-takeoff in case of "dry" storage) compared to their storage in the reactor in the primary circuit water without contact with air, release of radionuclides from the floating technical bases in case of their dumping will be considerably higher than during dumping of the nuclear submarine.

Taking into account the conservation measures adopted before dumping of reactor compartments and nuclear submarines with emergency reactor cores, no salvo releases of radionuclides into the environment can be expected, operations for their recovery and re-dumping are not justified from ecological, technical or economic points of view. It is expedient to perform recovery from the sea bottom of the packing with the container of the shielding assembly from the nuclear icebreaker «Lenin». This packing alone, its mass being about 350 tons, contains about 60% of the total activity of all spent nuclear fuel dumped in the Kara Sea. According to the Lazurit assessment the cost of the recovery operation is USD 8-10 million. Nuclear submarines with offloaded cores do not represent a real danger and can be recommended for storage during 50-70 years in the slightly submerged state before the follow-on disposal (scrapping). Floating technical bases with spent nuclear fuel represent the maximum real danger. The first -priority task is to offload spent nuclear fuel into the shore storages. The computer databases on sources of radionuclide contamination and the environment developed within project 101, ISTC, can be submitted to the experts at their inquiry via Internet.