

БЕЗОПАСНОСТЬ В ЧРЕЗВЫЧАЙНЫХ СИТУАЦИЯХ SAFETY IN EMERGENCY ENVIRONMENT

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РОЛЬ ФГБУ «ГНЦ – ФЕДЕРАЛЬНЫЙ МЕДИЦИНСКИЙ БИОФИЗИЧЕСКИЙ ЦЕНТР ИМ. А.И.БУРНАЗЯНА» ФЕДЕРАЛЬНОГО МЕДИКО-БИОЛОГИЧЕСКОГО АГЕНТСТВА В ОБЕСПЕЧЕНИИ САНИТАРНО-ЭПИДЕМИОЛОГИЧЕСКОГО БЛАГОПОЛУЧИЯ И РАДИАЦИОННОЙ БЕЗОПАСНОСТИ В АРКТИЧЕСКОЙ ЗОНЕ РОССИЙСКОЙ ФЕДЕРАЦИИ

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Резюме. Представлен опыт работы ФГБУ «ГНЦ – Федеральный медицинский биофизический центр им. А.И. Бурназяна» ФМБА России по проведению радиационно-гигиенических мероприятий в рамках сопровождения работ по ликвидации объектов ядерного наследия в Арктической зоне Российской Федерации и обеспечению радиационной безопасности населения, проживающего вблизи этих объектов.

В результате проведения радиационно-гигиенических мероприятий были решены следующие задачи:

- дана оценка радиологических угроз для определения приоритетных направлений регулирования в области обеспечения радиационной безопасности;
- выполнен детальный анализ радиационной обстановки в пунктах временного хранения (ПВХ) отработавшего ядерного топлива (ОЯТ) и радиоактивных отходов (РАО), на их площадках, в зонах наблюдения и районах проживания населения;
- проведены мероприятия по обеспечению радиационной безопасности персонала и населения, проживающего вблизи радиационно опасных объектов (РОО);
- повышена готовность к аварийному реагированию, проведены противоаварийные учения и тренировки;
- обеспечена культура безопасности при мониторинге и управлении рисками нарушения профессиональной надёжности персонала;
- выполнена экспертиза проектной документации в области реабилитации загрязненных территорий.

Ключевые слова: аварийное реагирование, Арктическая зона Российской Федерации, отработавшее ядерное топливо, радиационная безопасность, радиационно-гигиенические мероприятия, радиационный мониторинг, радиоактивные отходы, санитарно-эпидемиологическое благополучие, ФГБУ «ГНЦ – Федеральный медицинский биофизический центр им. А.И. Бурназяна» ФМБА России

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THE ROLE OF THE FEDERAL STATE BUDGET ORGANIZATION “SSC – FEDERAL MEDICAL AND BIOPHYSICAL CENTER NAMED AFTER A.I. BURNAZYAN” OF FEDERAL MEDICAL AND BIOLOGICAL AGENCY OF RUSSIA IN THE PROVISION OF SANITARY-EPIDEMIOLOGICAL WELFARE AND RADIATION SAFETY IN ARCTIC ZONE OF THE RUSSIAN FEDERATION

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Summary. The experience of work of FSO “SSC – Federal Medical and Biophysical Center named after A.I. Burnazyan” of FMBA of Russia to provision of radiation-hygienic measures in the support of works to elimination of

nuclear researching objects in Arctic zone of the Russian Federation and to provision of radiation safety of people who live near these objects was presented.

As a result of provision of radiation-hygienic measures the following tasks were solved:

- to define the priority directions for regulation in the radiation safety the radiological threats were assessed;
- a detailed analysis of radiological situation in the temporary storage points (TSP) of its spent nuclear fuel (ISNF) and nuclear waste (NW), on their yards and in the monitoring zones and in the areas of people living was done;
- the measures for providing of radiation safety of stuff and people who live near radiation dangerous objects (RDO) were kept;
- a culture of safety during a monitoring and control of risks of stuff professional reliability violation was ensured.
- an expertise of the projects of documents about a rehabilitation of polluted areas was completed;

Key words: Arctic zone of the Russian Federation, emergency response, Federal Medical State Budget Organization "SSC – Federal Medical and Biophysical Center named after A.I. Burnazyan" of FMBA of Russia, its spent nuclear fuel, radiation monitoring, radioactive waste, radiation safety, radiation-hygienic measures, sanitary-epidemiologic welfare

Conflict of interest. The authors declare no conflict of interest

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Introduction

One of the strategically important regions of Russia, the resources of which ensure national interests of the country, is the Arctic Zone of the Russian Federation (hereinafter – the Arctic Zone, the Arctic). Currently, the development of Arctic projects is given priority. In the process of development of territories of the Arctic zone there is an active human interaction with the natural environment. Oil field development, increase of volume of cargo transportation and intensity of shipping along the Northern Sea Route, the accompanying technological processes increase the probability of ecological damage to the natural environment and create a potential threat to the health of people living in these territories. In addition, the military and strategic presence in Arctic significantly increases the load on ecosystems.

The specialists of Federal State Research Center – Federal Medical Biophysical Center named after A.I. Burnazyan (FMBA of Russia) have accumulated great experience on radiation-hygienic measures within the framework of liquidation of nuclear heritage sites in the Arctic zone and on ensuring radiation safety of the population residing near these sites.

International cooperation

Considering the legacy of Russia's nuclear submarine fleet, it should be noted that the Burnazyan Federal Medical and Biological Center and the Directorate for Radiation Protection and Nuclear Safety (DSA, Norway) are directly involved in rehabilitation activities of contaminated territories – former coastal technical bases of the Navy in Northwestern Russia, in particular, in Murmansk region.

The purpose of the research performed within the framework of the work in the Arctic zone was to obtain and collect data on the radiation conditions in the areas of spent nuclear fuel (SNF) and radioactive waste (RW) storage accumulated during decommissioning of nuclear submarines (NS) and surface ships with nuclear power units (NPU), as well as in the residential areas in the immediate vicinity of radiation hazardous objects (RHO).

As a result of the work performed the following tasks were solved:

- assessment of radiological threats to determine the priority areas of regulation in the field of radiation safety;
- a detailed analysis of the radiation situation in the temporary storage sites (TSS) of SNF and RW, on their sites, in the observation areas and residential areas;
- measures were taken to ensure radiation safety of personnel and residents living near radiation hazardous facilities;
- emergency response preparedness was improved, and emergency drills and exercises were conducted;
- safety culture was ensured in the field of monitoring and management of risks of occupational safety of personnel;
- Expert review of project documentation on remediation of contaminated areas was performed.

One example of successful cooperation with DSA is the project to remove radioactive waste and spent nuclear fuel, including substandard fuel, from the territory of the Andreeva Bay SZC branch of SevRAO – a branch of FGUP FEO (Murmansk Region).

Active work on SNF removal from SZC began in 2017 (Fig. 1).

Since the beginning of the work, 10,115 spent fuel assemblies (SFAs) have been transferred to Atomflot. A total of nearly 21,000 SFAs were stored in Andreeva Bay [1].

Emergency Response

A separate area of activity of the Burnazyan Federal Medical and Biological Center at the Federal Medical and Biological Agency of Russia in the Arctic Region is related to the issues of emergency preparedness and response to possible emergency (ES) and non-emergency situations that may occur at nuclear heritage sites. The Emergency Medical Radiation and Dosimetry Center (AMRDC) of the A.I. Burnazyan Federal Medical and Biophysical Center of Federal Medical and Biological Agency of Russia takes an active part in the emergency response exercises of the "Arctic" series, which are held annually in the Arctic Zone in order to



Рис. 1. Вывоз ОЯТ с территории ПВХ отделения губа Андреева СЗЦ «СевРАО» – филиала ФГУП ФЭО
Fig. 1. Removal of SNF from territory of STS Andreeva Bay of the STS SevRAO – branch of FGUP FEO

improve emergency preparedness. The exercises improve the organization of interaction between emergency response participants, practice a wide range of tasks to provide medical assistance to the injured and sanitary and hygienic measures to eliminate the consequences of the accident. The peculiarity of the exercises lies in the complexity of climatic conditions of the Polar region, remoteness of their areas from large settlements, in difficulties of delivery of resources and their deployment [2].

For example, during one of the exercises, an incident involving external impact on a nuclear-powered icebreaker that was docked at Atomflot, which resulted in depressurization of the primary circuit with loss of coolant and damage to the core of one of the nuclear power plant (NPP) reactors, was chosen as a technological scenario of a radiation accident. The medical scenario involved pre-hospital stages of emergency medical care for the injured, coordination of medical specialists, and psychological support measures for the personnel involved in the rescue and other emergency work.

Of primary importance is the readiness of medical treatment organizations (LMOs) to receive and provide medical assistance to the injured along the evacuation routes from the Arctic Zone. In 2021 in Severodvinsk on the basis of the Central Medical and Sanitary Unit (CMSU) №58 with the participation of the A.I. Burnazyan Federal Medical and Biophysical Center of Federal Medical and Biological Agency, Center for Hygiene and Epidemiology and Interregional Department (IRD) №58 conducted an emergency exercise on practical actions of medical personnel in interaction with Sevmash emergency response personnel and rescuers during response to medical and sanitary consequences of radiation emergencies (Fig. 2).

The exercises involved practicing measures to provide first aid and primary medical care to the injured, procedures for notification and prompt transfer of management bodies and medical teams of FMBA of Russia to elevated modes of operation, as well as information exchange and interaction between LMOs of FMBA of Russia in Severodvinsk and the territorial headquarters of the emergency situations commission.

The following medical exercises were carried out: with medical personnel — to provide primary health care; with rescuers



Рис. 2. Учебное мероприятие на АО «ПО Севмаш»
Fig. 2. Training event at JSC "PO Sevmash"

of Sevmash — to provide first aid to the injured, as well as the command and staff training for the management of medical organizations (CMSCh #58, TSGiE #58, MRU #58).

Disposal of flooded and sunken objects

According to the Principles of Public Policy of the Russian Federation in the Arctic until 2035, the problem of submerged and sunken facilities with SNF and radioactive waste in the Arctic zone requires step-by-step solution, including the lifting of radiation hazardous facilities and their transfer to a nuclear and radiation safe state. Tasks are set to improve the environment, as well as to improve its monitoring system using modern information and communication technologies.

At the moment there is a large number of sunken reactor compartments in the Arctic zone. The highest radiation risks for the population and the environment are posed by: sunken nuclear submarines K-159 and K-27, reactor compartments of nuclear submarines K-11 and K-19, reactor of nuclear submarine K-140 and screen assembly of nuclear icebreaker "Lenin". These objects contain about 90% of the total activity (about 8 terabecquerels — TBq) of all submerged objects [3].

As part of the planned work to raise and dismantle submarines sunk and submerged in the northern latitudes, it is necessary to monitor the radiation situation at all stages of these works, because there are populated areas in the areas where they are carried out.

To evaluate the impact on the environment and the population in the region in the long term prospective economic activities in the Arctic Federal Medical and Biophysical Center named after A.I. Burnazyan of FMBA of Russia performs works on radiation-hygienic examination of the coastal zone of the residential areas, located in the vicinity of the objects of nuclear and radiation hazardous objects submerged. The results of radiation and hygienic monitoring of the environment of the investigated territories will be systematized into a separate database, which will make it possible to further assess the consequences of the planned remediation measures and to present information materials to the interested public.

Decommissioning of facilities of the Russian nuclear icebreaker fleet

Another focus of the A.I. Burnazyan Federal Medical and Biophysical Center of FMBA of Russia is support of the

decommissioning of the Russian nuclear icebreaker fleet. An example of successful implementation of such work is the decommissioning of the Lepsa floating maintenance base (Fig. 3).

At present, a large-scale international project for decommissioning the Lepsa is at its final stage. The ship is divided into several parts, from which the forward and aft block packs are formed. The spent nuclear fuel unloaded from the bow block-package was transported in stages by the Serebryanka tanker by sea to the territory of Atomflot and then by rail to "Mayak" for subsequent reprocessing.

In order to carry out radiation-hazardous work in a safe mode, design documentation on the problem of Lepsa decommissioning was analyzed, appropriate recommendations for safe work were given, and employees worked in inspection mode on a continuous basis during unloading, after unloading, and during SNF transportation [4].

Handling RW during nuclear legacy remediation

Since works related to the decommissioning of the nuclear icebreaker fleet, as well as further operations to rehabilitate the SNF and RW in Andreyeva Bay and Gremikha settlement are performed with a large volume of industrial waste, quality assurance of radiation hygienic monitoring of this type of waste at the stages of its collection and sorting into groups is an important area of ensuring radiation safety for the population and the environment. The expediency of activity regulation in this direction is conditioned by the necessity to prevent the new situation of irradiation, i.e. formation of "new" nuclear legacy. At present, the complex in Sayda Bay Branch includes a long-term storage facility for reactor compartment units, as well as part of the water area where multi-compartment units are stored afloat. The onshore part of the complex consists of three zones. The first one is the long-term storage area for reactor compartments of dismantled nuclear submarines; the second one is the paint and repair shop for three-compartment units; the third one is the most technological area — the solid radioactive waste conditioning shop. The concrete pad of the long-term storage facility accommodates 178 sealed single-compartment units with reactors of dismantled submarines, of which 84 are already occupied and about 40 more are waiting for their turn [1].



Рис. 3. Плавающая техническая база «Лепса»
Fig. 3. Floating technical base "Lepsa"

Conclusion

Taking into account the growing interest of state authorities in the issue of rehabilitation of the territories of the Arctic zone, it can be stated that the A.I. Burnazyan Federal Medical and Biophysical Center of FMBA of Russia takes one of the leading positions in the assessment and forecasting of the potential impact of the mentioned works on the territory of the Extreme North. An important result of the activities in which the Center is involved is the improvement of safety of the population and the environment when carrying out radiation hazardous works. It should be noted that at present there is a great demand for works on assessment of underwater burial impact on health of the population in the coastal zone of the Arctic zone, content of man-made radionuclides in the areas of industrial fishing and safety of hydrocarbon extraction in the shelf zone.

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