Russian-Norwegian Cooperation In Regulation of the Public Radiation Protection in the Northwest Russia - 12440

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ABSTRACT

In 1960s, the large technical bases of the Northern Fleet were arranged on the Kola Peninsula. These bases were involved in support of nuclear submarines performing acceptance and storage of radioactive waste (RW) and spent nuclear fuel (SNF). Since 1985, the waste acceptance has been stopped and the technical bases changed their functions to serve as sites of temporary storage (STS).

According to the RF Government Directive of 09 February 2000 No 220-r, the STS were put under Rosatom responsibility in order to conduct operations dealing with the SNF and RW management being accumulated during the naval activity and originated from dismantlement of nuclear submarines and surface ships equipped with nuclear powered installations, as well as to carry out environmental remediation of radiation hazardous facilities in this region. The international collaborative assistance is very important to increase effectiveness of such works.

This paper includes the findings of cooperation between the Federal Medical Biological Agency (FMBA) and Norwegian Radiation Protection Authority (NRPA) in radiation protection of the public in the course of the STS remediation.

Since 2004, the following works has been carried out in this direction:

- radiation threat assessment and identification of the priority directions of radiation and hygienic studies;
- radiation situation inspections on-site and within the coastal offshore waters at different stage of remediation;
- development of the documents including the criteria for the STS remediation and guidelines for radiation monitoring to control the mentioned criteria compliance;
- development of the radio-ecological geo-information system.

The developed criteria consider four basic options of the STS remediation – renovation, conversion, conservation and liquidation. The main (dose) and derived remediation levels have been determined for each option.

The resulted from monitoring radiation parameters - including contents of 137Cs, 90Sr and 60Co in samples of soil, vegetation, seawater, seaweeds, bottom sediments, invertebrates and vertebrates, gamma dose rate values – are integrated in the database, which is the component of the geo-information system.

The developed regulative and methodical documents and the geo-information system have been introduced in Regional Management-120 under FMBA of Russia, which is responsible for the radiation safety supervision, Centre of Hygiene and Epidemiology-120 under FMBA of Russia, which carries out regulatory radiation control, and in the operating organization involved in the STS remediation and responsible for radiation protection of workers and public.

INTRODUCTION

The Global Partnership on nonproliferation of weapons and materials for mass destruction being proclaimed by the "Big Eight" states has stimulated the widespread international cooperation. The Program of the comprehensive dismantlement of nuclear submarines in combination with the environmental remediation of radiation hazardous facilities of the coastal infrastructure is the extensive problem including many areas of scientific and engineering works. Having in mind the scale and complexity of the accumulated problems, identification of the priorities to focus the production capacities and financial resources is of the cardinal importance. Certainly, the Russian nuclear legacy is a common problem, because the potential hazard remains for many states, especially in the Northwest Europe. The decision of this problem will allow not only taking some urgent remedial measures to prevent the aggravation of the situation, but also creation of the safe conditions for work of the personnel, and protection of the public health and environment.

Cooperation between the Federal Medical Biological Agency (FMBA of Russia) and Norwegian Radiation Protection Authority (NRPA) is one of the components of the Program of comprehensive dismantlement. The Plan of Actions to assure nuclear and radiation safety approved by the Norwegian Government includes the support of the Russian regulatory bodies. The overall objective is to enhance radiation and nuclear safety in compliance with the Russian legislation taking into account the international recommendations and good experience of other countries. For this purpose, and to improve regulation and to ensure the effective regulatory supervision during works at radiation hazardous facilities of the Russian Northwest, the Norwegian Ministry of Affairs and NRPA adopted in 2002 the program of cooperation with FMBA of Russia.

BACKGROUND

Two technical bases of the Northern Fleet were created in the Russian Northwest in the 1960s at Andreeva Bay in the Kola Peninsula and Gremikha village on the coast of the Barents Sea. They maintained nuclear submarines, performing receipt and storage of radioactive waste (RW) and spent nuclear fuel (SNF). No further waste was received after 1985 and the technical bases have since been re-categorized as sites of temporary storage (STS).

The STS Andreeva Bay is located on Kola Peninsula in the Barents Sea coastal strip (Motovsky gulf, west bank of Zapadnaya Litsa bay). The nearby settlements are: Bolshaya Lopatka (2.4 km); Nerpitchie village (1.8 km); Zaozersk city (8 km). The population is 15 700, the majority of which are military estates.

The STS Gremikha is located on Kola Peninsula in Chervyanaya Bay of the Barents Sea. The nearby settlements are: Gremikha village (0.7 km from the site) and Ostrovnoy city (1.2 km). The population is 3500 (mainly, former soldieries and their families).

Remediation of sites and facilities of the STS of SNF and RW in Andreeva bay and Gremikha village on the Kola Peninsula is one of regulatory functions of the Federal medical-biological agency (FMBA of Russia). The work has involved the Russian Federation Burnasyan Federal Medical Biophysical Centre, which is technical support organization of the FMBA of Russia. In thus work took part the Norwegian Radiation Protection Authority (NRPA) in frame of the Norwegian government's Plan of Action to improve radiation and nuclear safety in northwest Russia.

Main tasks within the FMBA – NRPA cooperation in the public radiation safety and protection include:

- Independent detailed analysis of the radiation situation at and near the STSs.
- Radiological threat assessment to determine priority issues for regulatory attention [1].
- Radiological control and monitoring of the environmental conditions.

- Development of a regulatory documentation system ensuring radiation protection observance of workers and the public, including radiation-hygienic criteria and standards of rehabilitation of contaminated territories.
- In order to obtain comprehensive information with respect to current radiation circumstances at STS (independent from regulatory point of view), radiation-hygienic monitoring of STS facilities has been carried out.

SPECIFICATION OF AREAS WITHIN THE STS TERRITORY

With the purpose of radiation protection of workers and the public, the following areas are specified on-site and around the STS site:

- Controlled access area (CAA) – SNF and RW store facilities are situated here and radiation-hazardous operations are performed here too;
- Uncontrolled (free access) area (UA) – Facilities intended for work supplying in CAA;
- Health protection zone (HPZ) – This is an area of administrative and technical provision of the STS;
- Supervised area (SA) – This is an area surrounding the STS, where radiological monitoring is carried out to guarantee radiation safety and protection for the public
  The member of the public must not stay within the first three areas.

DEVELOPMENT OF THE REMEDIATION REGULATIONS

Analysis of the radiation and hygienic situation based on the obtained data permits to conclude that in the course of and after termination of RW and SNF removal from the STS area will require implementation of the large-scale and large-term program on remediation of the site. Taking into account the up-to-date approaches to the radiation safety assurance, when developing the remediation regulation, we focused on justification of the residual dose limits for workers and for the public.

In case of conservation and renovation remediation options, the remediation criteria comply with the current RF laws and regulations. For the liquidation option, the regulations developed taking into account the up-to-date international recommendations have been proposed. Having in mind the current situation and the planned activities, the renovation (conversion) option seems to be the most likely for both STSs. The results are presented in table I.

Table I. Dose constraints for different remediation scenarios

Decommissioning option	Category	Dose constraint			Dose limit according to (NRB-99)
		Due to residual contamination	Due to the new activity with radiation source use	Total	
Conservation	Workers	2	-	2	20
	Population (SA area)	0,1	-	0,1	1
Conversion ("brown lawn")	A personnel category	3	7	10	20
	B personnel category	1	1	2	5
	Population (SA area)	0,1	0,15	0,25	1
Liquidation ("greenfield")	Population (STS area)	1	-	1	There are no regulation in NRB - 99/2009
	Population (the rest area)	0,1	-	0,1	

When considering the options for the environmental remediation of the SevRAO sites, the following circumstances have been taken into account:

- In future, STS in Andreeva Bay will not be used for its intended purpose. The proposed activity is connected with the preparation and removal of SNF and RW from the site, and with the following demolishing or conservation of buildings and constructions and decontamination of the site.
- At STS in Gremikha village, in addition to the environmental remediation, restoration and reconstruction of the infrastructure to support discharge and further temporary storage of the cores of the liquid metal coolant reactors from nuclear submarines are required.

For each option of decommissioning of the STS sites and facilities, we have developed:

- The system of radiation hygienic and radio-ecological criteria;
- The radiation situation indications to be controlled and evaluated;
- The requirements for methods to determine radioactive contamination of the environmental media;
- Principles of organization, planning and implementation of radiation monitoring in the contaminated areas;
- Requirements for the regulatory system to make decisions on operation and remediation of lands.

DEVELOPMENT OF THE GEO-INFORMATION SYSTEM

The geo-information system (GIS), was developed over 2009-10 under FMBA-NRPA collaborative projects as the instrumentation of decision support on assurance of radiation protection of the public and environment during the STS remediation. In 2010-11, GIS was transferred to the FMBA's Regional Management in SevRAO for testing. The databank includes more than 5000 records on the radionuclide concentrations in the environmental media, dose rates on the STS site and within its supervision area. GIS helps to analyze:

- The available data on the radiation situation (gamma dose rate, radionuclide contents in the environmental media), including:
  - output of dosimetry measurement and environmental media sampling points into the base-map in two-dimensional geometry;
  - statistic analysis of available data relating to the particular area over the specific time period;
  - construction of isolines of the radiation situation parameters by means of interpolation of some limited set of measured values
- Soil contamination by the ground profile, including:
  - output of dosimetry measurement and environmental media sampling points into the base-map in three-dimensional geometry;
  - construction of distributions of these values by the soil levels.
- Contamination of ground water, including:
  - visualization of data on levels of the aquifer occurrences in the three-dimensional geometry;
  - plotting time history of annual radionuclide activity concentrations and dynamics of radionuclide activity concentrations over the particular time period relating to the topography base-map and comparison with the established criteria;
  - prediction of contamination of the vegetation, mushrooms and wild berries
  - prediction of contamination spreading by depth on-site.

Figure 1 shows GIS screenshots.

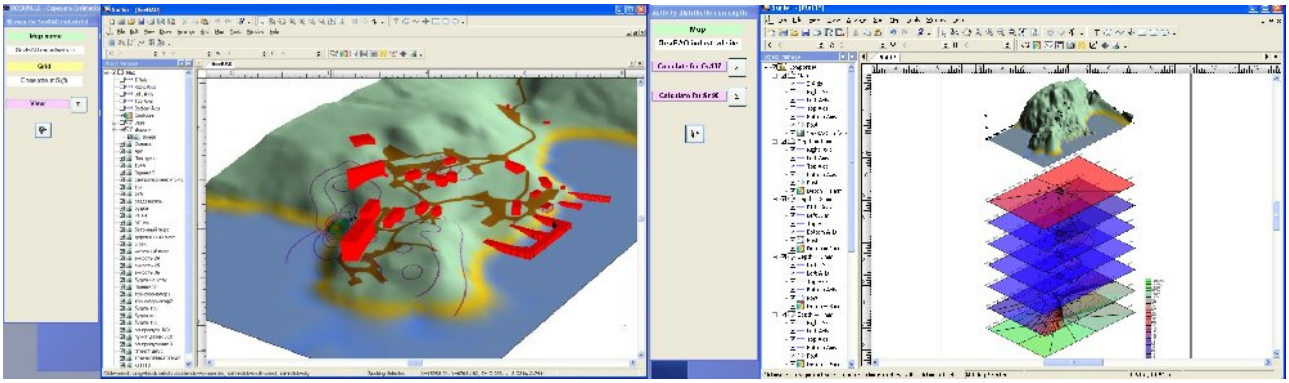

Fig.1. GIS screenshots.

CONCLUSIONS

The works completed have permitted to solve the majority of problems in enhancement of radiation and hygienic supervision of SevRAO operation. However, some relevant questions in this area need additional efforts. In particular, in the course of specification of the design solutions, obtaining additional data on the radiation situation parameters and clarification of the prognostic assessments, the necessity will certainly arise to amend the regulatory documents taking the adopted design solutions into account. We are on the way to real results. Much has been done for the first time, and although it is difficult to foresee all future problems and challenges, our knowledge, experience and close cooperation permit to assess the prospects confidently.

REFERENCES

1. Ilyin L., Kochetkov O., Simakov A, Shandala N, Savkin M, Sneve M, Borretzen P, Jaworskay A, Smith G, Barraclough I And Kruse P. “Initial Threat Assessment. Radiological Risks Associated

with SevRAO Facilities Falling Within the Regulatory Supervision Responsibilities of FMBA". StrålevernRapport 2005:17. Østerås: Statens strålevern, (2005).

2. Shandala N., Sneve M., Novikova N., et al. "Regulatory supervision of sites for spent fuel and radioactive waste storage in the Russian Northwest//J. Radiation protection.28 (2008), 453-465.
3. R 2.6.1.25-07 Criteria and regulations for remediation of sites and facilities contaminated with man-made radionuclides, on the federal state unitary enterprise "Northern Federal Enterprise for Radioactive Waste Management" under the Federal Atomic Energy Agency.
4. The Radiation Safety Standards (NRB-99/2009) [in Russian]