International Collaboration on Regulatory Supervision

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Abstract

This paper describes the Norwegian Radiation Protection Authority's experience in regulatory cooperation projects in Russia, with special emphasis on inherited problems. This inheritance includes a large amount of waste sources, such as those used in radioisotope thermoelectric generators, and remediation of former military sites used for storage of spent nuclear fuel and radioactive waste. The goals of the cooperation programme are to promote effective and efficient regulatory supervision, taking into account international recommendations and good practice in other countries. The specific projects in the program are aimed at specific challenges, which require practical local interpretation of ICRP recommendations, the IAEA Basic Safety Standards and other IAEA requirements and guidance documents. In some cases, new regulatory documentation has been required, as well as new regulatory procedures. In the long term, the program is intended to lead to an enhanced and enduring safety culture. The positive experience in Russia encouraged the Norwegian government in 2008 to extend the regulatory collaboration programme to the countries in Central Asia, based on the experience gained from Russian regulatory authorities as well as from support of Russian Technical Support Organisations. The programmes are evolving into a regional regulatory support group. Noting this experience, the paper includes suggestions and ideas about how such regional groups can be effective in addressing common radiation safety objectives while addressing local differences in technical, geographical, economic and cultural matters in each country.

Colaboración Internacional de la Supervisión Reguladora

Resumen

El trabajo describe la experiencia de la Autoridad Reguladora Noruega en el proyecto de cooperación reguladora en Rusia, con un enfoque especial en los problemas legados. Esta herencia incluye gran cantidad de fuentes como desechos, como las utilizadas en los generadores termoeléctricos radisotópicos (RTG) y la remediación de antiguos emplazamientos militares utilizados para el almacenaje de combustible nuclear gastado y desechos radiactivos. Los objetivos de los programas de cooperación son promover una supervisión reguladora efectiva y eficiente, teniendo en cuenta las recomendaciones internacionales y las buenas prácticas en otros países. Los proyectos específicos en el programa están dirigidos a retos específicos, los cuales requieren de una interpretación práctica local de las recomendaciones del ICRP, las Normas Básicas de Seguridad y otros requerimientos del OIEA, así como sus documentos guías. En algunos casos se han nacesitado nuevos requerimientos reguladores, así como nuevos procedimientos reguladores. El programa pretende que alcance a largo plazo, una mejorada y duradera cultura de seguridad. La experiencia positiva de Rusia fue estimulada por el Gobierno Noruego en el 2008, a extender ese programa de cooperación reguladora a países de Asia Central, usando la experiencia que se obtuvo tanto de las autoridades reguladoras como de apoyo técnico rusas. Los programas evolucionan hacia un grupo de apoyo regulador regional. Teniendo en cuenta esta experiencia, este trabajo incluye sugerencias e ideas de cómo el grupo regional puede ser efectivo en el tratamiento de los objetivos comunes de seguridad, inclusive cuando se traten con diferencias técnicas, geográficas, económicas y en materia cultural en cada país.

Key words: *safety culture; radiation protection; safety standards; international cooperation; Gosatomnadzor Rossii; norwegian organizations.*

Introduction

The Norwegian Radiation Protection Authority (NRPA) has been implementing a regulatory support programme in the Russian Federation for over 10 years, as part of the Norwegian government's Plan of Action for enhancing nuclear and radiation safety in northwest Russia. The programme includes cooperation with the key Russian regulatory authorities: the Federal Medical-Biological Agency (FMBA), the Federal Environmental, Industrial and Nuclear Supervision Service of Russia (Rostechnadzor) and, most recently the Directorate of State Supervision over Nuclear and Radiation Safety of the Ministry of Defense (DSS NRS). The regulatory support has focused on supervision of priority nuclear legacy sources and sites which are in need of decommissioning and remediation. Very often, the situation with these priorities has fallen outside normal regulatory requirements for safety and technical maintenance and monitoring. The project methodology typically starts with completion of a regulatory threat assessment to determine the hazardous situations which are most in need of enhanced regulatory supervision. Then, according to the results of the threat assessment, draft enhanced norms and standards are prepared, as well as regulatory guidance and procedures, to address the abnormal legacy conditions. Typically, this material has subsequently been confirmed as official regulatory documentation of the Russian Federation.

Regulatory Enhancements in Supervision of Former Shore Bases for the Servicing Nuclear Powered Submarines

Regulatory and Site Context

In the 1960's, two shore technical Navy bases were built in Northwest Russia, one at Andreeva Bay and another in Gremikha on the Kola Peninsula. These facilities supplied operational support to nuclear submarines of the Northern fleet, including storage of spent nuclear fuel (SNF) and radioactive waste (RW). After two decades of operation, the Treaty on the Non-proliferation of Nuclear Weapons called for decommissioning of a large number of nuclear submarines (NS) within a relatively short period, from the late 1980's to early the 1990's. This gave rise to increased attention from the international community to the circumstances in northwest Russia.

In 2000, by Decree of the Russian Government, the Federal State Unitary Enterprise (FSUE) SevRAO was established to manage the SNF and RW accumulated during NS decommissioning, and to carry out environmental remediation of radiation hazardous facilities in the Northwest Russia. SevRAO remediation activities center upon the former shore technical bases in Andreeva Bay and Gremikha, now designated as Sites of Temporary Storage (STS).

The following circumstances critically characterized these sites:

- Unsatisfactory condition of facilities, hampering safe SNF and RW management;
- Radioactive contamination dispersion from the STSs to the adjacent marine environment;
- Lack of regulatory requirements and guidance to deal with the existing abnormal radiation conditions, and
- Lack of relevant standards for the complete management of radioactive waste.

The following factors exacerbated the problem of management of these legacy sites:

- Damage to the SNF and the engineered barriers of the storage facilities, leading to radioactive contamination of the environment, and a continuing threat of further releases;
- Gaps in regulations on procedures connected with specific aspects of SNF and RW management, including insufficient definition of requirements for remediation; and
- Justified public concern that environmental safety may be jeopardized not only in Kola Peninsula and the European part of Russia, but also in other countries of northern Europe.

The Russian strategy for addressing this situation draws upon a wide range of industrial projects which in turn receive support from donor organizations and technical institutions, coordinated through the International Atomic Energy Agency's (IAEA's) Contact Expert Group (CEG). The NRPA's regulatory support program was designed to provide parallel support to the Russian regulatory authorities, with a view to ensuring that investments made to manage the nuclear legacy in northwest Russia would be spent safely within the context of an effective regulatory regime.

Initial Phase of Regulatory Developments

The strategy within the regulatory support program was first to analyze the current radiation situation and identify those radiation and nuclear safety issues which are significant in themselves but which are also in most urgent need of improved regulatory development to help in their safe resolution. We called this first step a

regulatory Threat Assessment [1]. The follow-up work to develop better independent characterization of the radiation situation at the SevRAO sites was described at WM2008 in reference [2], since when, further reports have been published dealing with specific regulatory issues [3–8].

Reference [3] sets out the justification for a specific program of regulatory development at the Andreeva and Gremikha STSs for the strategic options for site remediation. Radio-ecological condition assessment and environmental remediation criteria for each option are described in references [4] and [5]. The hazardous working conditions which are anticipated during recovery of SNF and RW from their current inadequate stores, are described in reference [6], alongside recommendations for control of individual radiation exposure. Medical and radiological aspects of emergency preparedness and response are described in reference [7]. Reference [8] sets out the hygienic requirements for industrial waste management at the SevRAO sites.

The program has resulted in the timely development of official regulatory guidance and reports, as recorded in reference [9], including:

1. Personnel Radiation Safety:

- Methodical guidance "Requirements for performance of personal radiation monitoring for personnel of STS Andreeva".
- Methodical document "Regulation for performance of radiation monitoring at STS Andreeva".
- Methodical guidance "Special features in application of ALARA principle in the work on SNF and RW management at STS Andreeva".

2. Control of environmental contamination:

- Radio-ecological criteria of marine environmental monitoring and control in the course of STS rehabilitation, taking account of possible end-state of the object.
- Methodical guidance documents on radioecological monitoring on-site and in the supervised area in the course of conversion activities at STS of SevRAO.

3. Criteria for on-site management of Very Low Level Waste (VLLW):

- Sanitary hygienic requirements for collecting, categorization, treatment, temporary storage, transportation and disposal of VLLW in the territory of the SevRAO facility at Andreeva Bay.
- Safety norms on VLLW management containment safety requirements for the period of operation of the facility and upon its closing, as well as the criteria for waste acceptance.

4. Criteria development for emergency preparedness and response [10].

Continuing Regulatory Support at Legacy Sites in Northwest Russia

The above work can be said to have supported the development of updated and enhanced regulatory requirements which address the situations at the STSs. The continuing NRPA regulatory support program focusses on implementation of the enhanced regulatory requirements, andmonitoring of compliance. Accordingly, through 2008–2009, projects with FMBA have been completed and extended as follows, involving experts from the Federal Medical Biological Center (FMBC).

Emergency Response Training Exercise

The goal of the project was the improvement of the emergency preparedness of managerial systems, emergency teams and establishment of emergency response in case of radiation accident at the SevRAO Ostrovnoy affiliated branch at Gremikha. Emphasis was placed on practicing the interaction of emergency response organizations. Accordingly, an emergency exercise was organized and carried out:

- to demonstrate and practice the operation of the managerial system and emergency response network of SevRAO, RM-120, CMSU-120 and FMBC of FMBA of Russia in the event of an accident at SevRAO affiliated branch in Ostrovnoy;
- to practice issues of the interaction between operator and regulator when making urgent decisions and recommendations applying countermeasures action for personnel and the public, and
- to develop recommendations for necessary countermeasures for managerial bodies.

DATAMAP: Radio-ecological mapping at Andreeva Bay

The main idea of the project is to integrate all relevant radio-ecological data, i.e. radiation situation parameters, landscape information, and hydrogeological as well as geochemical data, within

maps of the STS areas. A geo-information system has been developed allowing:

- analysis of the current radio-ecological situation, e.g. to identify areas which require remediation and or further data sampling to ensure adequate control;
- prognosis of changes of radio-ecological situation, e.g. due to radioactive decay and migration of contamination from its current location, and
- optimization of radiation monitoring and methods of remedial work implementation.

DOSEMAP: Mapping of radiation situation in workshops

The primary objective of the project is to support the regulation of personnel radiological protection in the course of the second stage of work, in terms of specificity of its accomplishment under real SevRAO conditions, including particularly hazardous SNF and RW removal activities. A mapping system has been developed allowing:

- Analysis of the radiation situation inside workshops,
- Calculation of internal and external radiation exposure linked to particular assumptions for remediation operations, e.g. to identify optimal routes for movement and transfers, and
- Recording of radiation exposures of individuals involved in the work.

Radiation Protection Requirements for the Saida Bay Centre of Conditioning and Long-term Storage of RW

In the course of STS remediation, SNF are planned to be removed for processing at PA "Mayak", while RW generated, as well as RW from dismantling of NS and accumulated at sites from the past, are planned to be located for storage in the Centre of conditioning and long-term storage of radioactive wastes, SevRAO facility Saida Bay. The objective is to develop the regulatory requirements for occupational, public and environmental protection assurance during arrangement and implementation of radioactive waste management at the Center.

Personnel Reliability Management

It is typically recognized that human factors are a significant aspect in causes of accidents. This project is to:

- analyze important occupational psychological and psycho-physiological characteristics of workers involved in the SNF management, and to study methods of their assessment;
- develop medical and technical requirements for an expert-and-diagnostic system of risk monitoring of performance reliability violation of persons involved in SNF management (EDIS_STS);
- develop relevant criteria of persons with negative prognosis of their performance reliability on the basis of psychological and psycho-physiological information;
- develop hard/soft-ware and informational tools of risk monitoring of the performance reliability violation within EDIS_STS; and
- develop proposals for organization of the system for performance reliability assurance, so as to improve radio-ecological safety at the STS.
- improving software and information tools for the performance reliability monitoring of workers involved in the SNF management;
- developing methodic documents on assurance of the performance reliability of workers involved in the SNF management;
- developing proposals on radiation safety culture assessment at the SevRAO facilities; and
- developing a method and software for evaluation of radiation safety culture at the SevRAO facilities.

Guidelines to re-categorize nuclear materials as radioactive waste

The objective of this project was the development of regulatory guidance on re-categorizing nuclear materials as RW. It was carried by the International Centre for Environmental Safety (ICES).The need for the work arises because of the potential for small fragments of SNF to arise within RW during the course of remediation work at the SevRAO STSs. The output also includes waste acceptance criteria for the RW being delivered to the Saida Bay facility.

Supervision of radio-thermal generator decommissioning

The NRPA regulatory support program has included support to the development of regulatory supervision over Radio-Thermal Generator (RTG) decommissioning. This included a regulatory threat assessment and development of new regulatory guidelines, as described in reference [11].

The ongoing RTG decommissioning program necessitates an analysis of expertise that has been accumulated over previous years to advance the consistent practical application of regulatory documents and processes at all RTG decommissioning stages and with regard to all RTGs. It is of utmost importance to inform regional inspectors and operators, as well as representatives of controlling organizations and those rendering services, on regulatory requirements and procedures, and provide them with practical guidance on their application.

Setting up of cooperation with authorities in central asia

Given the positive long-term experience of the regulatory support program in Russia, the Norwegian government decided to extend the cooperation program to countries in central Asia, based on the same model set up by NRPA. The countries and organizations involved include the radiation and nuclear safety authorities in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. Work began in 2008, with a special focus on uranium mining and ore processing legacies and a workshop was held in Drammen, Norway, in December 2009. This provided an opportunity for these national authorities to exchange information and experience with colleagues from the IAEA, France and the USA. The objectives of the approved program, extended to 2011 are:

- to improve national regulatory frameworks for management of nuclear legacy sites;
- to strengthen the regulatory supervision of radioactive waste management and nuclear legacy sites by the relevant national regulatory authorities; and
- to develop strategic advice on regulatory aspects of legacy management to the country governments.

Next steps in coordination initiatives

The program is now very much focused on the practical application of this output to major industrial projects to remediate nuclear legacy sites and to safely manage SNF and RW arising from these remediation activities. All three Russian authorities mentioned above are involved, as facilities change status from military to civilian control and as SNF and RW are prepared for transport to and storage at central storage facilities. Coordination among them is clearly important, and the NRPA actively allows for this in project planning and implementation. Also important is coordination with the Russian government and companies responsible for carrying out the remediation work, as well as the western donors and support organizations.

Many countries have sites which remain as legacies to be managed after the initial phases of nuclear technology development, notably facilities linked to research, development and experimentation in both nuclear electricity generation and military applications. Major legacy sites exist in those countries in which nuclear technologies were extensively developed, such as the USA, the Russian Federation and the former Soviet Union countries, France, the United Kingdom and China. These sites are contaminated with both toxic and radioactive residues. Radioactive contaminants include fission and fuel activation products as well as isotopes from the natural uranium and thorium decay chains.

Legacy sites were created at a time or within a context where regulatory supervision of operations was weak or absent for nuclear safety and radiation protection of human health and the environment. Nowadays, strong and independent regulatory supervision is seen as a critical factor in provision of radiation and nuclear safety during operations at nuclear sites. In some cases, this implies a major cultural move by the operators of legacy sites and some adjustments from the regulatory supervision side. Much has been done through international cooperation, to enhance regulatory supervision of nuclear power plants and other aspects of the nuclear fuel cycle operations.

Concluding Remarks

Substantial progress has been made within the Russian Federation to manage the nuclear legacy and remediate legacy sites within a modern and effective regulatory system. This has been achieved by more than simplistic application of international recommendations and some training courses. These are important, but the main enhancements have come through support projects which have had direct application and practice at real sites, as has been done at Andreeva and Gremikha STSs, and as is now being extended to the treatment and storage facilities at Saida Bay, and to sites in central Asia.

Further work continues to enhance the processes of regulatory supervision of workers, the public and the environment, in the context of radiation protection and nuclear safety. A major long-standing challenge is the development of safe systems for final disposal on RW. More recently recognised is the setting up of a formal basis for developing, maintaining and supervising an enhanced safety culture.

The challenges are similar to those arising in other countries which have developed major nuclear

infrastructures. International cooperation and sharing of experience can make a major contribution to improving safety supervision, learning from successes and failures. These lessons may include technical solutions but also organization and regulatory supervision methods. The IAEA RSLS Forum will play a major part in this.

We can share common safety and protection objectives, but different methods may be appropriate in different locations, because of many factors: technical, institutional, geographical, social and cultural. Working to achieve the optimum result is a complex process, and development of a theoretical best should not detract from making progress in a timely and effective manner.

References

[1] ILYIN L, KOCHETKOV O, SIMAKOV A, et. al. 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] SNEVE MK, SHANDALA N K, SMITH GM. Progress in Norwegian-Russian Regulatory Cooperation in Management of the Nuclear Legacy. Proceedings of Waste Management 2008. Conference, February 24 – 28. Phoenix AZ, 2008.

[3] SHANDALA NK, SNEVE MK, SMITH GM, et al. Regulatory supervision of sites for spent fuel and radioactive waste storage in the Russian Northwest. J Radiol. Prot. 2008; 28(4): 453.

[4 SHANDALA NK, KISELEV MF, SNEVE MK, et al. Radioecological condition assessment and remediation criteria for sites of spent fuel and radioactive waste storage in the Russian Northwest. Proceedings of 12th International Radiation Protection Association Conference. Buenos Aires, 2008.

[5] SHANDALA NK, SNEVE MK, TITOV AV, et al. Radiological criteria for remediation of sites for spent fuel and radioactive waste storage in the Russian Northwest. J Radiol Prot. 2008; 28(4): 479.

[6] SIMAKOV AV, SNEVE MK, ABRAMOV YV, et. al. Radiological protection regulation during Spent Nuclear Fuel and Radioactive Waste Management in the Western Branch of FSUE SevRAO. J of Radiol. Protect. 2008; 28(4).

[7] SAVKIN MN, SNEVE MK, GRACHEV MI, et. al. Medical and radiological aspects of emergency preparedness and response at SEVRAO facilities. J of Radiol. Protect. 2008; 28(4).

[8] FEDERAL MEDICAL BIOLOGICAL AGENCY. Hygienic requirements for industrial waste management at the Federal State Unitary Enterprise Northern Federal Enterprise for Radioactive Waste Management. R ONAO SevRAO-08. Guidance R 2.6.5.04 – 08. Moscow, 2008.

[9] NRPA. Regulatory improvements related to the Radiation and Environmental Protection during remediation of the nuclear legacy sites in North West Russia. Report of work completed by NRPA and FMBA of Russia in 2007. Stralevernrapport 2008:7. Østerås: Norwegian Radiation Protection Authority, 2008.

[10] SHANDALA NK, TITOV AV, NOVIKOVA NY, et. al. Radiation protection of the public and environment near location of SevRAO facilities. In Proceedings of a NATO Advanced Research Workshop. Challenges in Radiation Protection and Nuclear Safety Regulation of the Nuclear Legacy. Ershovo, September 2007. Dordrecht: Springer, 2008.

[11] SNEVE MK, REKA V. Upgrading the regulatory framework of the Russian Federation for the safe decommissioning and disposal of radioisotope thermoelectric generators. StrålevernRapport 2007:5. Østerås: Norwegian Radiation Protection Authority, 2007.

Recibido: 8 de septiembre de 2010

Aceptado: 23 de septiembre de 2010