

FACILITATING RADIOACTIVE WASTE MANAGEMENT CO-OPERATION WITH THE RUSSIAN FEDERATION

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ABSTRACT

One of most complicated ecological problems in the Russian Federation (RF) is the management of radioactive waste accumulated as a result of past activities in the production of nuclear weapons, use of nuclear energy for peaceful purposes, and as a result of reductions in nuclear arms.

As a result of past activities, about $6 \times 10^8 \text{ m}^3$ of radioactive waste has been accumulated in the RF with the activity of about $2 \times 10^9 \text{ Ci}$ ($7,4 \cdot 10^{19} \text{ Bq}$). Besides this, around 8500 t of spent nuclear fuel with an activity of around $4 \times 10^9 \text{ Ci}$ ($1,5 \cdot 10^{20} \text{ Bq}$) are stored. More than 150 nuclear submarines have been taken out of service and most of them are waiting to be defuelled and dismantled.

The situation with radioactive waste in the RF required immediate action for improvement. The safe management of radioactive waste is a challenge not limited to the Russian Federation alone, but creates serious complications of a political, economic and technological nature in all nuclear states.

It became evident that it was necessary to intensify and expand contacts between RF and western experts and decision makers to better understand and assess the situation and to harmonize assistance in solving the problems. To this end, the Contact Expert Group (CEG) was established in 1995 by a group of interested countries and the International Atomic Energy Agency was requested to act as the CEG Secretariat.

To date, twelve members (Belgium, European Union, Finland, France, Germany, IIASA, ISTC, Norway, Russian Federation, Sweden, UK, USA) and two observers (Japan, NEFCO) participate in the CEG activities.

The paper reports on the highlights of the CEG activities towards fulfilling its mission and objectives in the Russian Federation.

INTRODUCTION

An important objective of the International Atomic Energy Agency's (IAEA) nuclear power related activities is to facilitate and strengthen international co-operation for the sound and safe management of radioactive waste.

The Russian Federation has been facing a number of complicated ecological problems in the management of radioactive waste accumulated as a result of past activities in the production of nuclear weapons, use of nuclear energy for peaceful purposes, and as a result of the reductions in nuclear arms.

Radioactive waste accumulated in the Russian Federation by 1995 amounted to more than half a billion cubic meters with a total activity of about two billion curies ($7.4 \cdot 10^{19}$ Bq.). In addition around 8500 tonnes of spent nuclear fuel were stored with a total activity of around 4 billion curies ($1.5 \cdot 10^{20}$ Bq.).

To assess the situation arising from that, the Nordic countries requested the IAEA to organize a seminar on “International Co-operation on Nuclear Waste Management in the Russian Federation” in co-operating with the Russian Federation in the field of radioactive waste management. At this seminar, held in 1995, the participants recognised the need for setting up a contact group of experts to assist in co-ordinating their efforts. Such co-ordination would help avoid redundancy and duplication, assure that priorities are properly assessed and made known to the international community, and provide points of contact to facilitate co-operation.

The Contact Expert Group (CEG) was established in September 1995 by a group of interested countries and international organizations and the IAEA was asked to perform the duties of the CEG Secretariat.

The Terms of Reference of the CEG state as its goals and objectives “...to enhance safety of waste management in the Russian Federation and its environs’ and “..to promote international co-operative efforts aimed at resolving radioactive waste management issues, including radiation safety, environmental, technical, legal, organizational and financial matters”.

At present the CEG consists of twelve members and two observers: Belgium, Finland, France, Germany, Norway, Russian Federation, Sweden, United Kingdom, United States of America, European Union, International Institute for Applied Systems Analysis, International Science and Technology Center as members and Japan and Nordic Environment Finance Corporation as observers.

CEG ACTIVITIES

One of the major achievements of the CEG at its first stage of operation was the establishment of a Data Base of Co-operation Projects containing detailed information on some 170 suggested, negotiated, being implemented and recently completed projects.

The information on the projects, under 19 major topics, submitted by countries and international organizations participating in the CEG, has been collected by the CEG Secretariat in the form of so called “Project Description Forms (PDFs). The distribution of projects by topics of co-operation is presented in *Table I* below.

Table I **Distribution of Projects**

Topic No	Topic Title	No. of projects
1	Normative and methodological documents	6
2	Radiological investigations of radioactive waste storage, dumping and disposal sites	20
3	Measures for improving and monitoring radiological situation of RAW storage, dumping and disposal sites	21
4	Storage of low level liquid radioactive waste	1
5	Storage of solid radioactive waste	5
6	Storage of spent nuclear fuel	5
7	Storage of high level radioactive waste	1
8	Treatment of low level radioactive waste	11
9	Treatment of solid radioactive waste	6
10	Treatment of high level radioactive waste and spent nuclear fuel	12
11	Handling and transportation of spent fuel	15
12	Disposal of radioactive waste and spent nuclear fuel	20
13	Training in radioactive waste management	7
14	Centres for radioactive waste management	5
15	Radioactive waste management at nuclear power plants	15
16	General co-operation in waste management	8
17	Decommissioning of nuclear facilities	6
18	Safety analysis of WM facilities	4
19	Other WM related topics	6
	Total	174

The Data Base provided a clear picture of co-operation areas and is used as a useful instrument for avoiding unnecessary duplication and overlapping and for better planning of future co-operation.

Another important action in improving the efficiency of co-operation was the prioritization, by the Russian Federation ministries involved, of the most important high priority projects to help concentrate efforts and financing in urgent practical areas.

The prioritised list of Russian High Priority Projects with some details, including financial, is shown in *Table II*

Table II **High Priority Russian Projects**
(in order of priority, last updated in April 1998)

No.	Project Name	Duration in years	Estimated cost in mill \$	Partners	Status
1	Fabrication and commissioning of special train cars of TK-VG-18 type for transportation of containers with spent fuel from decommissioned nuclear submarines	2	2.5	Norway	under negotiation
2	Construction and commissioning of a storage facility for spent fuel arriving at the "Mayak" enterprise	5	100.0	EU, Norway	under negotiation
3	Design and construction of facilities for interim storage of spent fuel from decommissioned nuclear submarines in Murmansk Region	5	48.0	USA	under negotiation
4	Design, construction and commissioning of a vessel for transportation of spent fuel from decommissioned submarines in the Northern region	2	9.5	Norway	under negotiation
5	Design, construction and commissioning of temporary storage for liquid r/a waste at the "Zvezdochka" plant for utilization of nuclear submarines in Severodvinsk	2	3.73	Norway	under negotiation
6	Fabrication and commissioning of mobile facilities for concentration of liquid r/a wastes from the Northern Navy	2	0.14	Norway	under negotiation
7	Design, construction and commissioning of a temporary storage of solid r/a waste at the "Nerpa" plant for utilization of nuclear submarines (Murmansk Region)	2	4.9	Norway	under negotiation
8	Creation of a prototype r/a waste disposal facility at the Bashmachny peninsula at the Novaya Zemlya Archipelago	2	85.6		suggested
9	Development of a feasibility study and design on the remediation of the floating technical base for spent fuel storage "Lepse"	10	ECU 8.715	EU, France, NEFCO, Norway, USA	under negotiation (feasibility study completed)
10	Construction of two floating facilities for unloading spent fuel from decommissioned submarines	4	150.0		suggested
11	Construction of industrial liquid r/a waste treatment facilities in the Northern Region	2	4.7		suggested
12	Reconstruction of solid r/a waste storages at the special combine "Radon" in Murmansk	3	0.73		suggested

No.	Project Name	Duration in years	Estimated cost in mill \$	Partners	Status
13	Creation of a complex of facilities for treatment of solid r/a waste from nuclear fleet in Murmansk	3	3.4		suggested
14	Creation of the North-West radwaste management center on the basis of the Leningrad Specialized Enterprise "Radon"	5	56.0	EU	suggested (feasibility study close to completion)
15	Establishment of a Training-Methodological Center on radioactive waste management	10	2.4	EU	approved for co-operation
16	Development of a conception and structure of a normative system regulating safety in r/a waste and spent fuel management	3	0.3	EU	active
17	Development of a sophisticated computer based system for evaluation of radiation legacy of the former USSR (RADLEG)	3	1.2	EU / ISTC	active
18	Development of a unified data base on radiological situation in the Murmansk region	2	0.2		suggested
19	Development of programme and implementation of radiological monitoring of the flood-lands of the Enisei river in the region of influence of the Mining and Chemical enterprise	2	0.3		suggested
20	Radiation characteristics of unloaded spent fuel in the reactor cores of decommissioned submarines	3	0.1		suggested

The scope of co-operation with the Russian Federation being carried out by the CEG member countries and organizations on a bi- and multilateral basis is quite broad and useful, however, as was concluded by the CEG at its meeting in January 1997, the most important high priority projects were not yet or not sufficiently covered by existing co-operation at that time.

The CEG agreed to recommend to its member countries/organizations to concentrate, at this stage, efforts on co-operation in the field of spent fuel management of the technological chain of nuclear submarines and icebreakers (spent fuel unloading, transportation to the shore, intermediate storing, transportation to "Mayak", storage at "Mayak").

The co-operation in the frame of the "Lepse" project or a new project in the field of spent submarine nuclear fuel negotiated by BNFL-Kvaerner-SGN-SKB Industrial Group with the relevant Russian organizations, are good examples of undertakings as a result of this recommendation to concentrate on that particular area of spent fuel management.

Based on these developments, the CEG concentrated at the next stage of its activity on considering in detail the waste management situation in the most urgent fields and regions of the Russian Federation and elaborating conclusions and recommendations for the CEG members directed to enhancing co-operation and solving the most urgent problems.

Thus, the CEG, at its 4th meeting in June of last year, focused its consideration on the North-West region of the Russian Federation with one of the highest concentrations of nuclear reactors, spent fuel and radioactive waste in the world. This region accumulated and continues to generate the most significant amounts of spent nuclear fuel from nuclear submarines, icebreakers and NPPs and liquid and solid nuclear wastes from their operation, decommissioning as well as from different applications of radioisotopes in science, medicine and industry.

After having reviewed reports by Russian ministries, institutes and organizations and the results of a number of specialized studies sponsored by CEG members, the Expert Group decided that it should immediately act to focus international co-operation with the Russian Federation on the situation in its North-West region.

The importance and urgency of the situation with radioactive waste management in the North-West region of the Russian Federation is also clearly reflected by the fact that 15 out of 20 "Russian High Priority Projects" are associated with the radioactive wastes accumulated or being generated in the region. However, none of these 15 projects is presently fully covered by only Russian or by Russian/co-operation partners financing.

The Government of the Russian Federation has approved a ten year Federal Waste Management Programme for 1996-2005, which, when realized, is supposed to solve the country's most important problems. However, its realization was extended over a rather long period of ten years, which caused serious concerns, since many of the problems require a much earlier solution to avoid associated potential safety and environmental risks (spent fuel being kept at not fully decommissioned submarines, waste tanks are overfilled and consequently there is a potential threat of resumption of sea dumping etc.) and this was the major reason of international co-operation efforts directed to hasten the solution of the most urgent problems.

However the present situation seems to become even more alarming since due to well known economical difficulties the state financing of the Russian Federation waste management programmes in 1996 and 1997 was at the level of about 30%-40% of the original plan.

The Russian estimates of the total cost of the most urgent of the high priority projects amounts to about \$ 220 million. Even if the Russian state financing of the waste management programme would raise from the present 30%-40% to some 50% or even 70%, then still about \$ 70-110 million would be required from international assistance or elsewhere even to assure the planned rate of their implementation, not speaking about their earlier realization, which was the main objective of international co-operation efforts.

There are also some internal Russian problems, such as nuclear liability and tax exemption to be resolved, to facilitate the realization of a number of international co-operation projects.

An "international expert opinion", prepared by the CEG on the waste management situation in the North-West region of the Russian Federation, has been forwarded to the IAEA Director General by the CEG Chairman with the request to submit it for consideration of the IAEA Board of Governors.

Sharing the Contact Expert Group's concern of the seriousness of the waste management situation in the North-West region of the Russian Federation and its conclusion that the most effective solution of the problems could be achieved through enhanced international co-operation, the Director General submitted the CEG paper "Radioactive Waste and Spent Fuel Management in the North-West Region of the Russian Federation" for the information of the Board.

Following the CEG recommendations and in order to facilitate international co-operation directed at solving the most urgent problems in the region, the IAEA has brought the matter to the attention of the IAEA Member States and relevant international, particularly financial, organizations by having forwarded the referred CEG paper with a call to consider possible means of facilitating the necessary funding and co-operation in appropriate multilateral activities.

At its meeting in Augusta, USA (1998), the Group again considered the importance to concentrate international support in solving the waste and spent fuel management problems in the Russian Federation on the most important and worthy of immediate attention needs, identified these needs more precisely and developed a consensus on several "Initial (First Priority) Projects" for international co-operation on nuclear waste and spent fuel management in the Russian Federation.

The CEG recommended that work on those projects which are under way should not only be continued, but accelerated.

The CEG also identified a number of projects which they also considered to be of the highest priority, but which were only at the stage of assessment and/or study. The CEG strongly recommended a more active programme for the implementation of these projects.

FOCUSING ON HIGHEST PRIORITY TASKS

While these projects focused on the spent nuclear fuel and wastes resulting from decommissioning submarines of the Northern Fleet, the CEG considers that there are problems equally as severe along the eastern coast of the Federation related to the decommissioning of submarines of the Pacific Fleet.

Therefore at its recent meeting in Murmansk (November 1998), the CEG discussed and approved a List of Highest Priority Tasks for the whole Russian Federation, which need to be undertaken to address the problems of spent nuclear fuel and radioactive wastes.

The List covers the most important elements of the waste and spent nuclear fuel management technological chain:

- Thus one of the most urgent first priority tasks would be to secure the storage of the spent nuclear fuel and radioactive wastes already removed from the submarines and other nuclear powered ships. These wastes are presently stored, under less than ideal conditions, in floating storage vessels (including the “Lepse”) and at on-shore sites (Andreeva Guba and Gremikha in NW Russia and at Sysoeva Guba on the Pacific Coast). Accordingly the List of tasks includes:

Priority Task: **Securing the removal of spent nuclear fuel, liquid and solid radioactive waste from floating and on shore storage facilities.**

Priority Task: **Decommissioning of the “Lepse” and other floating storage vessels.**

- The realization of these tasks would require, or be facilitated by the construction of new interim storage facilities and the manufacture of new containers for the storage and transportation of spent nuclear fuel and containers for the storage of radioactive waste. So the List of tasks also includes:

Priority Task: **Construction at PO Mayak of interim storage facility for spent nuclear fuel from nuclear propulsion reactors.**

Priority Task: **Development, fabrication and delivery of metal/concrete containers for storage and transportation of spent nuclear fuel and containers for storage of radioactive waste.**

- The very large majority of the submarines that have been taken out of service still contains their fuel. With existing facilities, the unloading of the spent fuel and removal of the waste from the decommissioning plants will take many years during which the risk of accidents will increase. This includes also facilities still containing spent fuel or waste. Facilities are required to accelerate the fuel unloading and removal and its safe transport to secure facilities. Therefore the following tasks are also included into the List:

Priority Task: **Construction of unloading fuel complexes and radioactive waste container collection sites at the decommissioning plants to accelerate the withdrawal of spent nuclear fuel from decommissioned (but still floating) submarines.**

Priority Task: **Transformation of tankers available for use of the Northern and Pacific Fleets as carriers of containers with spent nuclear fuel and radioactive waste from remote sites gateways.**

- Finally, with the increasing quantities of radioactive waste accumulating on the surface in interim storage facilities at many locations along the Russian coast and elsewhere, it is important to identify a suitable site or sites for radioactive waste repositories. The Russian authorities have already conducted a number of studies of a site on the island of Novaya Zemlya. It is strongly recommended that an international safety assessment be undertaken of this site prior to any final decision and subsequent construction:

Priority Task: **An international safety assessment and, if licensed, construction of a radioactive waste final repository at Novaya Zemlya.**

FINAL REMARK

The CEG underlined the ever increasing importance of international co-operation in addressing the environmental threat posed by the spent nuclear fuel and radioactive waste from the submarine fleets. This is more than ever true given the additional delays that will result from the difficult economic situation in the Russian Federation. All the above Highest Priority Tasks will need multi-million dollar/euro funding. A well co-ordinated international effort is most urgently required.

The CEG agreed to bring these to the attention of the Barents Euro-Arctic Council (BEAC) and to raise this matter at a high level in respective governments and possibly at the G-7 meeting.