

**Key Issues of Personnel Education and Training in the Context of Changing Radioactive Waste Management Conception - 9053**

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**ABSTRACT**

This paper describes key issues of personnel education and training in the context of changing radioactive waste management within the Moscow State Unitary Enterprise Scientific and Industrial Association (SIA) *Radon* which collaborates in personnel training with International Atomic Energy Agency (IAEA). The 2008 was a breakthrough year in the atomic branch of Russia: the State Corporation “Rosatom” was established, the general concept of atomic energetics has changed, a new law on radioactive waste management is under consideration, and a new concept related to development of radioactive waste management specialized enterprises is under development.

**INTRODUCTION**

The creation of effective radioactive waste management is one of the main goals of State Corporation “Rosatom” in the field of nuclear and radiation safety improvement. In support of this goal, the federal program “Nuclear and Radiation Safety Assurance at 2008 and up to 2015 year” was more fully developed and accepted for implementation and a new project to develop a law on radioactive waste management was initiated. A new concept to develop radioactive waste management specialized enterprises was started. There are plans for 2007-2015 to initiate operating 10 new nuclear power reactors with a total capacity 9.8 GWe which should provide 18.6% of Russia’s electrical supply. There are also plans every year after 2015 to put into operation two new 1-GW reactors. This will increase the overall power from nuclear stations in Russia from the current 23 GWe to 40 – 50 GWe by 2030.

The regional specialized enterprises *Radon* which manage radioactive wastes are now included into the structure of State Corporation “Rosatom”. The SIA *Radon* remains under the Government of Moscow administration; however it is significantly involved in all radioactive waste management activities in Russia. Due to the renaissance of atomic industry, the role of personnel education and training has significantly increased and requires new approaches in the context of changing radioactive waste management concepts.

## HISTORY AND CURRENT STATE OF RADON FACILITIES

Specialized enterprise *Radons* were established on a territorial basis in 1960-1963 in the former USSR in order to manage the radioactive wastes from the nuclear fuel cycle. In the Russian Federation there are 16 such enterprises (Fig.1). Fifteen were subordinated to Rosstroy, and since March 2008, subordinated to State Corporation “Rosatom”. Moscow SIA *Radon* is subordinated to Moscow Government and is responsible for the radiation safety of the Central part of the Russian Federation with almost 40 million inhabitants. The SIA *Radon* has operated for several decades the system of radiation safety and radioactive waste management in the Moscow region and central part of Russia. The SIA *Radon* characterizes, collects, transports, treats, conditions and provides long-term storage of radioactive wastes with various physical and chemical contents.

### “Radon” Regional Radwaste Repositories



Fig.1. *Radon* Regional Radioactive Waste Repositories

The SIA *Radon* has a developed scientific, technological, methodological and training basis for radioactive waste management and has practically all state of the art technologies currently used in the world to manage radioactive wastes. The SIA *Radon* has almost 25 years experience in training national specialists in radioactive waste management including pre-treatment, treatment, conditioning and storage of radioactive waste. These training activities are carried out jointly with the Lomonosov’s Moscow State University. During this long period, a variety of training programs in the scientific fundamentals, applied research and in practical operational areas of the all pre-disposal activities of the radioactive waste management occurred [1,2].

All specialised facilities *Radon* have near-surface storage facilities built in accordance with standard design. However the repositories of Moscow SIA *Radon* and Leningradskiy *Radon* (St. Petersburg) were built under individual designs. Radioactive wastes are usually placed in the repositories without preliminary treatment, and sometimes after pre-treatment. The cumulative radioactive waste volume and activity at Specialized Facilities at the end of 2005 is shown in the Table 1.

Table1. Radioactive waste at Specialized Facilities *Radon* Through Calendar Year 2005.

Specialized	Liquid radioactive waste	Solid radioactive waste
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Facility	Volume, m <sup>3</sup>	Total activity, Bq	Weight, tones	Volume, m <sup>3</sup>	Total activity, Bq
Moscow	$2.52 \cdot 10^3$	$1.43 \cdot 10^{11}$	$1.81 \cdot 10^5$		$3.81 \cdot 10^{17}$
Irkutsk				$1.85 \cdot 10^2$	$2.53 \cdot 10^{16}$
St. Petersburg (Leningradskiy)	$3.82 \cdot 10^3$	$1.02 \cdot 10^{15}$	$1.06 \cdot 10^5$		$2.11 \cdot 10^{16}$
Ekaterinburg (Sverdlovskiy)				$3.86 \cdot 10^3$	$1.15 \cdot 10^{16}$
Novosibirsk			$6.26 \cdot 10^2$		$1.05 \cdot 10^{16}$
Saratov	$1.53 \cdot 10^2$	$4.80 \cdot 10^9$	$6.12 \cdot 10^2$		$1.09 \cdot 10^{15}$
Chelyabinsk			$1.68 \cdot 10^3$		$6.72 \cdot 10^{14}$
Khabarovsk			$2.20 \cdot 10^3$		$5.88 \cdot 10^{14}$
Nijniy Novgorod				$9.54 \cdot 10^2$	$5.43 \cdot 10^{14}$
Rostov				$1.51 \cdot 10^3$	$5.10 \cdot 10^{14}$
Murmansk	$2.8 \cdot 10^2$	$4.10 \cdot 10^6$	$3.80 \cdot 10^2$		$4.55 \cdot 10^{14}$
Volgograd			$1.29 \cdot 10^3$		$4.53 \cdot 10^{14}$
Kazany			$4.07 \cdot 10^2$		$2.26 \cdot 10^{14}$
Ufa (Bashkirsky)	$1.58 \cdot 10^2$	$3.32 \cdot 10^{11}$	$7.19$		$7.56 \cdot 10^{13}$
Samara			$8.35 \cdot 10^2$		$1.48 \cdot 10^4$

## COLLABORATION WITH IAEA

### Agreement

During the last decade, the SIA *Radon* successfully collaborated with the IAEA with a systematic, multidisciplinary, and fruitful character. The International Education and Training Centre (IETC) of Moscow SIA *Radon* in co-operation with the IAEA has trained more than 350 specialists from 33 European and Asian countries to increase their knowledge and skills in radioactive waste management through specialized regional training courses and workshops, fellowships, and on-the-job training and scientific visits. Some of IETC activities were previously described in WM Conference proceeding in 1999, 2002, and 2006-2008 [3-8].

In 2008 a direct Collaboration Agreement between the IAEA and the SIA *Radon* was signed at the IAEA Headquarters in Vienna. It expresses the interests of two parties to continue to have a bona fide relationship in order to increase exchange and dissemination of useful information including joint publications, and to provide larger basis for assistance in training of waste managers in the region, including development of joint educational and training courses.

### Training Activities in 2008

The IETC activities supported by IAEA in 2008 are summarized in Table 2.

Table 2. IETC Calendar Year 2008 Activities Supported by IAEA

Activity	Duration	Number of Attendees	Member States
Regional training course on radioactive waste management – predisposal technologies	2 weeks (July)	12	Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Ukraine, Uzbekistan

Regional Train-the- Trainer Training Course for Radiation Protection Officers	1 week (September)	19	Albania, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Lithuania, Moldova, Poland, Romania, Russia, Tajikistan, Ukraine, Uzbekistan
Scientific visits supporting training on radioactive waste management – predisposal technologies	2 weeks (November)	10	Azerbaijan, Belarus, Ukraine
Scientific visits and fellowships	From 1 to 4 weeks during year	11	Azerbaijan, Belarus, Pakistan

In May-June 2008, the IETC hosted the IAEA “Regional training course on radioactive waste management – predisposal technologies”. The syllabus of the new training course was designed for operators of waste facilities to obtain information on the best operational practices, technologies and solutions for common problems in the region. The content of training syllabus at IETC was given in [7,8]. The main topics included:

1. Theoretical lectures on radioactive waste management processing (pre-treatment, treatment, conditioning), approaches to waste minimization; classification and operational categorization for processing, quality control and quality assurance;
2. Theoretical lectures on solid radioactive waste management: safety requirements for waste storage/disposal; processing of bulk solid waste-containerization;
3. Practical demonstrations on transporting, collecting, sorting, and fragmenting containers for Storage/Disposal and the computer teaching for solid radioactive waste management;
4. Demonstrations on collection, identification, sorting, and storage of spent sealed radioactive sources; computer teaching for management of sealed radioactive sources;
5. Operating practices with radioactive sealed sources and storage facilities including:
  - Sealed radioactive sources conditioning;
  - Fragmentation of bulky waste, especially concrete structures;
  - Treatment of contaminated soils;
  - Planning of remedial operations;
  - Radioactive waste re-packaging;
  - Packaging of sealed sources for transportation;
  - Waste receipt, characterization and waste tracking data base completion.
6. Regional information and analytical system for monitoring of environment.

The first “Regional Train-the-Trainer Course for Radiation Protection Officers” **under the IAEA** Technical Cooperation Project “Education and Training in Support of Radiation Protection Infrastructure” was held in *Radon* in September 2008. The purpose of the training course is to meet the needs of the Member States in providing adequate training to Radiation Protection Officers (RPO) and other licensee staff responsible for radiation protection issues through training the trainers. The provision of suitable training for RPOs is an important component in a national strategy for building competence in radiation protection and safety. IAEA developed a Standard Syllabus and training material for RPO training. However there is no possibility to organise direct training courses for all RPOs who are expected to need this training as the number is far too large. It was proposed therefore to transfer these teaching aids and syllabus to well experienced staff responsible for training RPOs in their home countries. The Training

Course aimed also to train the participants on communication skills, to be an effective lecturer and how to organise training events in the most effective mode.

This Training Course was organised for specialists with appropriate skills and experience, engaged in teaching RPOs in one or more of the following areas: a) Radiotherapy, b) Nuclear Medicine, c) Diagnostic radiology, d) Industrial Radiotherapy, e) Industrial Irradiator, f) Nuclear Gauges and Well logging, g) Waste Management facilities, h) Mining and processing of raw materials, and i) laboratories using unsealed sources.

The Training Course consisted of lecturers and practical exercises, designed to provide both theoretical and practical training in delivering lectures and using the teaching aids developed by the IAEA. This course was not like conventional training courses where there is predominantly one-way communication by lecturers/presentations. It was dominated by group discussions and individual short presentations followed by extensive discussions. There was friendly feedback by participants on every presentation, allowing for improvement of the presentation. The participants were required to make a short presentation on the status of their national RPO training programs as well as training for other professionals responsible for radiation protection issues. This included sharing national regulatory requirements/guidance specifying the minimum educational level and training experience for RPOs and the national training schemes for RPO.

Some of IAEA training activities at IETC (practical and theoretical exercises) are illustrated by Fig.2.



Fig. 2. Typical practical and theoretical exercises, IAEA Training Courses, 2008

### **Standardisation of Training**

Based on experience gained in Russia, it is expedient to carry out a standardization of training syllabus for personnel involved in radioactive waste management, specifically waste managers. The development of standardized training syllabus for waste managers should include multiple modules that could be delivered as separate blocks of training or could be delivered in series. Every training module should consist of theoretical lectures and practical demonstration of technologies. The following training modules should be included:

- (i) Decontamination and deactivation technologies including environmental remediation;
- (ii) Safety including methodologies for developing safety assessments and safety cases for decommissioning, environmental remediation, pre-disposal and disposal;
- (iii) Waste pre-disposal including characterization methods, waste collection techniques and waste processing and storage technologies; and
- (iv) Waste disposal including design, operation, maintenance, monitoring and upgrade of facilities.

The IETC is working on standardizing training in collaboration with the Waste Technology Section of IAEA, Austria and Nuclear Technology Education Consortium (NTEC), UK [9].

## CONCLUSION

The shortage of qualified specialists and managers is a serious problem with the renaissance of atomic industry. Education of a new generation of specialists for the nuclear industry including specialists in nuclear waste management is an urgent task. The first step in the education of waste management specialists – the standardization of training programs – was done in Russia. The Moscow *Radon's* IETC has a complete set of tools including technological and human resources and is well prepared for the new tasks of atomic industry.

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