**Rosenergoatom Innovative Activities to Ensure Safety.   
Strategy and Plans to Implement Nuclear Knowledge Management**

S.V. Eremin1, N.V. Tikhonov2, A.Yu. Yuzhakov2

1 Department of Innovative Development, Concern Rosenergoatom, Russian Federation

2 All-Russian Research Institute for Nuclear Power Plants Operation, VNIIAES, Russian Federation

E-mail contact of main author: eremin-s@rosenergoatom.ru

**Abstract**

The Russian operating organization Concern Rosenergoatom established a program for knowledge management (KM) implementation in the organization as part of ROSATOM State Corporation KM activities [1]. The plan includes activities both in the framework of classic knowledge management cycle: detection, preservation, retention, sharing and transfer, as well as creation of new knowledge such as training programs for new build nuclear power plants. The approach embraces key techniques overviewed in IAEA documents on KM and ROSATOM strategical focus on the commercial use of R&D results and corporate knowledge and, thus, contribute to safe, reliable and efficient operation of NPPs.

1. **Introduction**

Concern Rosenergoatom operates the fleet of 35 reactors of different design at 10 nuclear power plants in Russia. Data, information and knowledge are generated from the initial phases of research and development across the facility’s life cycle including its decommissioning. Depending on where the NPP is in the life cycle the focus on KM changes significantly. With such a variety of facilities there is no other solution than implement a thoroughly planned and well maintained knowledge management program both at corporate level and NPP level. This program addresses the needs and responds to challenges of operating organization and fulfills the requirements of the regulatory body and the IAEA safety guidelines or recommendations.

1. **KM Methodology applied by ROSATOM**

The key goal of KM implementation in ROSATOM State Corporation is to promote innovative technologies, reduce the overall duration of innovation lifecycle and assure growth of ROSATOM technologies’ commercial applications [1]. To achieve these four tasks are being performed:

* Continuing knowledge detection and capturing;
* Intensive knowledge sharing and circulation through effective cooperation of all internal and external users;
* Provision of data, information and knowledge to ROSATOM employees;
* Establishing of effective mechanisms for commercial knowledge usage.

The KM tasks are solved through the three functional blocks, namely:

* Management of scientific and engineering communities – focuses on development of competencies in R&D, organization of professional communities, knowledge capturing and preservation;
* Management of scientific and technological content to increase effectiveness of all R&D activities through better access and usability of scientific and technological information;
* Management of rights for R&D results and intellectual property focusing on the ROI increase.

In recent years the KM methodology applied resulted in the rapid increase of applications for state registration of R&D results in ROSATOM organizations and consequently in the double of total registered patents for innovative products owned by ROSATOM.

The above described approach is the framework for all Concern Rosenergoatom initiatives in the field of nuclear knowledge management, including those described below.

1. **Rosenergoatom KM projects**

Concern Rosenergoatom faces internal and external challenges which are known in nuclear industry worldwide [3] – ageing of NPPs personnel, low turnover resulting in lack of knowledge transfer to young generation of employees, human performance errors, as well as constant demand to increase productivity, reduce operational risks and provide personnel for new-build NPPs. In response to this challenges and to master the strive for excellency the program to establish KM was launched. It incorporated initiatives for operation organization as a whole as well as a pilot KM project at Smolensk NPP.

* 1. **KM at Smolensk NPP**

Smolensk NPP initiated the program for KM implementation in 2011. The initial project for knowledge management and retention at Smolensk NPP included identifying and capturing the critical knowledge of two groups:

* Control room personnel who perform error free;
* Recognized experts at the NPP prior to retirement or permanent leave.

The introduction to KM was performed with the assistance of JSC VNIIAES which is responsible for engineering support services for NPPs in operation in Russia. The benchmarking process was supported by international level experts and the IAEA.

Identification of experts was performed in three domains:

* Control room personnel with error free performance, also considering crew make-up;
* Questionnaires for main NPP departments;
* Each NPP deputy chief engineer identified experts in their division and rank them based on importance of knowledge and time.

Further, interviews were conducted with the identified experts (knowledge elicitation step) in order to

* Identify an expert on behaviors associated with errors in a control room environment;
* Identify an individual that can interview the operators around behaviors used to reduce error in control room performance;
* Identify the job positions at risk of knowledge loss.

The following activities within the project included:

* Capturing the interviews on video;
* Identifying best practices and analyze for program, process, or training changes;
* Creating concepts maps to capture knowledge in order to have on-line, any time materials available;
* Determining the best means to build the learning into NPP processes, for example, procedure change, training, etc.

All these activities were carried out together with the development of KM process model, supported by model description and procedure for knowledge detection, capture, retention and transfer at Smolensk NPP.

The key results of the pilot project includes identified key job positions, skills and competencies at risk of knowledge loss, plan for knowledge capture and retention, documented knowledge and inputs to changes in training materials and programs, the revised plan for personnel for personnel promotion and staff replacement. All methods, procedures and recommendations are applicable for other utilities and will be shared at the operation organization level of KM process.

* 1. **Training System improvements through Knowledge Management process**

Concern Rosenergoatom continuously develops and improves its personnel thus achieving safe and reliable operation of nuclear power plants. KM process contributes recently to the following improvements:

* A system to retain critical knowledge was implemented;
* A bank of training materials in electronic formats was established;
* A technique to transfer new knowledge to personnel through initial and continuous training programs was developed.

These improvements contributed to the following activities:

* Revision of training materials, initial and continuous training programs was performed;
* The list of normative documents, training materials and training programs for future development was defined;
* The list of training programs was elaborated for which competency development and training is conducted at external educational organizations;
* KM process through regular monitoring of risks for critical knowledge losses also contributed to timely planning of staff replacement for job positions required personal licenses to conduct operation.

The Project to establish a system to retain critical knowledge is ongoing. The objectives of this project are:

* Decrease the risk of critical knowledge losses due to personnel leaving their positions;
* Assure knowledge transfer through different generations of employees;
* Incorporate of critical knowledge into organization activity;
* Develop commercial application of critical knowledge.

The following methods are applied to achieve the objectives:

* Audits of knowledge;
* Knowledge Mapping;
* Risk analysis of critical knowledge loss;
* Review and development of training programs and training materials for NPP job positions;
* Documenting results of intellectual activities to be registered for further use on the commercial basis.

The objective of the project to establish the bank of training materials in electronic formats is ensure access and availability of training materials for all employees and, thus, improve the quality of training. This is achieved by:

* Retaining of training materials existed at all NPPs of Rosenergoatom;
* Producing digital copies of retained paper materials;
* Systematizing of materials into hierarchical catalogue;
* Publishing training materials on corporate intranet resources.

As part of commercial knowledge usage Concern Rosenergoatom developed training programs and training materials for personnel of those NPPs which are under construction abroad on the basis of VVER technology. Necessary licenses to conduct training for these programs were obtained.

1. **Conclusion**

Innovative development of Concern Rosenergoatom reactors fleet creates a constant need to effective management of the full scope of nuclear knowledge, making the existed and newly created knowledge available to others both efficiently and effectively. To achieve this Rosenergoatom has launched a long-term program to establish a corporate knowledge management process as part of its management system processes, and initiated several projects in KM both at corporate and NPP level. The initiated projects are important tools for implementing knowledge management strategy in Concern Rosenergoatom. They embrace all key technique described in the IAEA related documents [3,4,5]. The results achieved in these projects can be applied to other facilities and activities.

1. **References**
2. The Program for Establishing Knowledge Management System of State Corporation ROSATOM and its organizations for 2012-2015 – ROSATOM, Moscow, 2012
3. Guidelines for Critical Knowledge Retention in ROSATOM Organizations – ROSATOM, Moscow, 2013
4. STI/PUB/1248 Risk Management of Knowledge Loss in Nuclear Organization - IAEA, Vienna, 2012
5. IAEA-TECDOC-1675 Knowledge Management for Nuclear Research and Development Organizations - IAEA, Vienna, 2012
6. IAEA-TECDOC-1510 Knowledge Management for Nuclear Industry Operating Organizations - IAEA, Vienna, 2012