

NUCLEAR KNOWLEDGE MANAGEMENT OVERVIEW AT INR

C. D. Bujoreanu

Institute for Nuclear Research, Romania

E-mail address of main author: bujidan@yahoo.com

Abstract. The present paper gives an overview of the management requirements related to the approach of activities within the Institute for Nuclear Research (INR), which represents the technical support for the development of nuclear power areas in Romania.

The Institute for Nuclear Research has completed an Integrated Management System for Quality, Environment, Safety and Health, based on guidelines published by the IAEA and also on other national and international standards.

The implementation of the Integrated Management System (IMS) allowed the interaction and correlation of the classes of processes which govern the institute activities based on management knowledge, with the purpose to develop basic processes (i.e., research and development, control of production and of service supply, operation and decommissioning of nuclear facilities, etc.) so that the Institute be able to face competition and economic policies in the nuclear field.

1. Background

The INR was founded in 1971 and has been known under several names over the years. Presently, it operates under the Romanian Authority for Nuclear Activities, as a subsidiary branch. Its topmost mission is the performance of scientific research and of activities related to the peaceful use of atomic energy.

All along its 35 years of activity the institute developed methods, computer codes and its own experimental infrastructure aiming at the execution of equipment, technologies and services characteristic of the nuclear area. Deeply involved in the upgrading of nuclear energetic, the Institute embodies the technical support for the safe and efficient operation of nuclear power plants; at the same time complying with international agreements in the field.

Especially during the last 15 years the institute activity was focused mainly on applicative research and, particularly, on the Cernavoda NPP requirements.

The research outline within the institute is in harmony with the research programs of the CANDU community and with the profile of similar research organizations all over the world, fact which is in support of international cooperation.

The main areas of INR activity are the following:

- Reactor physics and nuclear safety;
- Irradiation testing;
- Post-irradiation examination of nuclear fuel and nuclear materials;
- Radioisotopes and irradiation technologies;
- Nuclear materials and corrosion;
- Assessment of nuclear fuel performances;

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- Out-of-pile testing;
 - Radwaste characterization and treatment;
 - Electronics, instrumentation and control;
 - Qualification testing for nuclear equipments and components;
 - Radiation protection, environment protection and civil defense;
 - Design of nuclear equipments;
 - Nuclear prototypes;
 - Technological transfer;
 - Technical quality control;
 - Metrology and computer technique;
 - Quality management.

The institute infrastructure is characterized by diversity, efficiency and reliability, the following assets being illustrative:

- Research reactors (material testing): Steady-State TRIGA SSR Reactor (14MW); Pulsed ACPR TRIGA Reactor;
 - Post-Irradiation Examination Laboratory;
 - High-Activity Gamma Irradiation Station;
 - Laboratory appliances for obtaining advanced nuclear fuel experimental elements;
- Department for testing and investigation of nuclear fuel, of materials and equipment used in nuclear and non-nuclear areas;
 - Test rig for fueling machine testing;
 - Loops for high pressure - high temperature thermo-hydraulic testing;
 - Department for radwaste treatment and conditioning.

The schematic presentation of the institute infrastructure is shown in Fig 1.

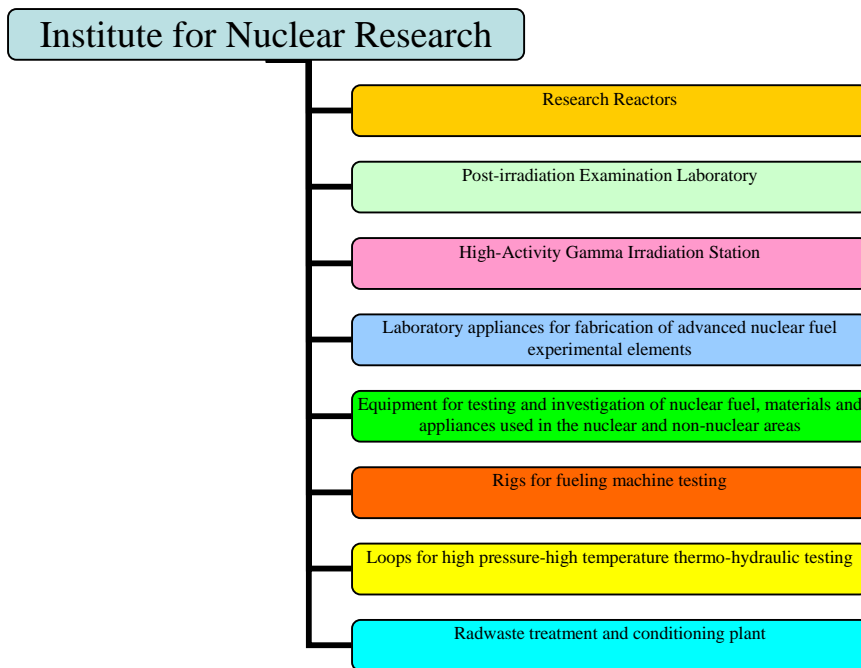


FIG. 1. Representation of nuclear installations in use at the INR

2. Knowledge Management applied at the INR

Knowledge management was defined in IAEA-TECDOC-1510 [1] as “an integrated systematic approach to identifying, acquiring, transforming, developing, disseminating, using, sharing and preserving knowledge, relevant to achieving specified objectives”.

Considering the development of the market economy and the competition in the business area, INR fostered and implemented an Integrated Management System – Quality-Environment-Safety and Health [2], in compliance with the provisions of national and international standards and regulations.

The system has been developed and implemented within the institute in order to [2]:

- (a) Demonstrate the institute capability to consistently provide and perform services that satisfy customers requirements and those of the applicable regulations;
- (b) Increase customers contentment by ensuring the quality of products/services, at the same time complying with the legislation related to environment protection, safety and health;
- (c) Ensure an efficient operation of the main topic (research-development) and of the other basic processes (design, operation and decommissioning of nuclear facilities, etc.).

The system is certified by Lloyd’s Register Quality Assurance and authorized by the National Commission for Nuclear Activities Control (CNCAN), with the purpose to facilitate the following options:

- Global planning of the system by assigning actions, responsibilities, terms and resources necessary to fulfill the target objectives;
- Allotment of resources needed to maintain and upgrade the Management System in close correlation with the institute technological and economic options;
- Assessment of the institute global efficiency.

The Integrated Management System works through the interaction of four groups of processes, as follows:

- (1) Management processes;
- (2) Base processes related to activities within the lifetime of nuclear facilities;
- (3) Support processes;
- (4) Measuring, analysis and upgrading processes.

Interaction and sequence of the four groups of processes is displayed in Fig. 2. The main purpose is the functioning of basic processes.

The concept of management science related to the institute activities relies on four levels of knowledge, which include:

- Research & Development;
- Control of production and of service supply; exploitation of nuclear facilities;
- Decommissioning of nuclear facilities;
- Issues related to environment, safety and health.

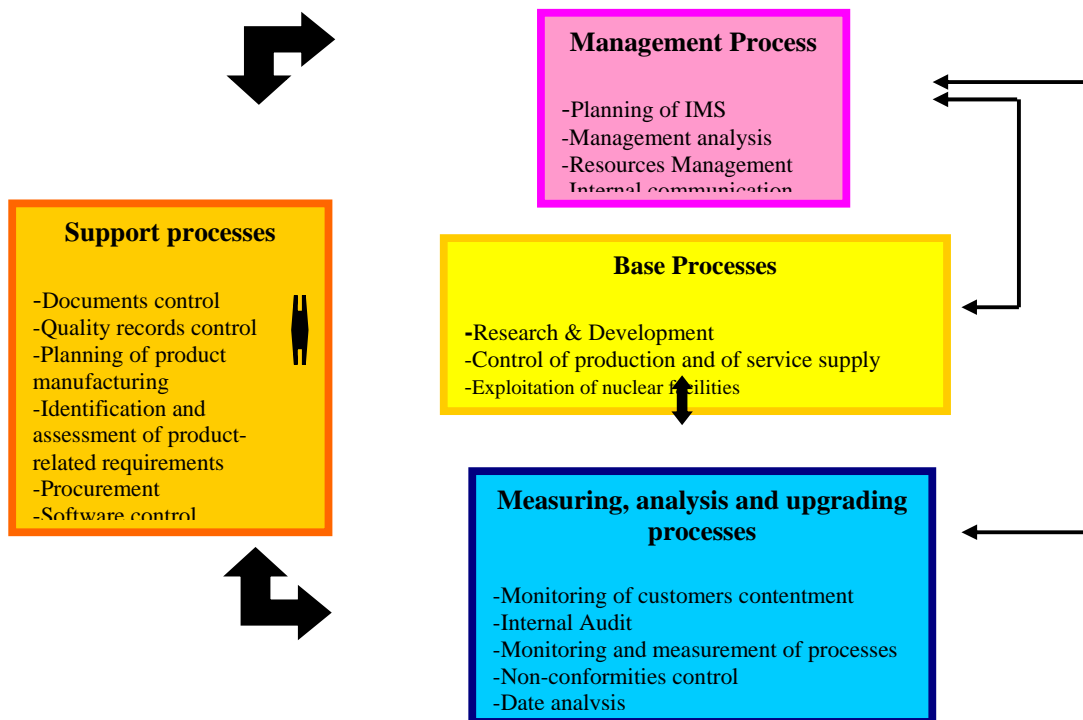


FIG. 2. Interaction of IMS process groups

2.1 Research & Development

The first knowledge level within the Integrated Management System consists of know-how implementation. This depends on the institute characteristics, on the existing infrastructure and assets and on the personnel experience.

According to Law 198/2000 the institute is enabled to perform R&D activities, applications and engineering related to the national technical support in the nuclear area, as well as works specific to international cooperation.

These activities are conducted in the framework of 18 R&D programs intended for the objectives that belong to the institute from the National Nuclear Program.

The interaction of the main groups of processes which govern the institute activities with the aim to develop R&D knowledge is presented in Fig. 3.

The research route of the INR allows the exchange of knowledge and know-how increase both with domestic and foreign partners, thus:

- (a) Collaboration with AECL – CANADA, initiated in 1999 by the Memorandum of Understanding between the Natural Resource Department of Canada and the Ministry of Industry and Commerce, Romania, which provides the development of joint research activities in the following areas:
 - CANDU nuclear fuel;
 - Nuclear safety;
 - Management of nuclear plant lifetime.
- (b) Collaboration with specialized laboratories in the USA takes place in the frame of an Agreement concluded between the two countries for exchange of information and cooperation in the field of peaceful uses of atomic energy.
- (c) Cooperation topics now under development:
 - Radwaste management;
 - Production of radioisotopes for medicine at the TRIGA-INR Reactor;
 - Management and marketing

2.2 Operation of nuclear facilities

The operation of nuclear facilities is a basic IMS process which includes all activities carried out between commissioning and decommissioning, in order to ensure the purpose for which the plant has been built.

The process requires a high level of operation technical knowledge and is identified by a series of nuclear safety requirements for all normal operation modes: startup, operation within parameters, beginning of shutdown, maintenance. The incidents foreseen by plant design are also considered.

Within the institute the operation of nuclear facilities is procedure-based. The procedures itemize the responsibilities and the ways of complying with the following requirements:

- Scheduling and control of operation activities;

- Personnel training and qualification;
- Interfaces control;
- Utilization of acquired expertise;
- Control of installations, processes and operation practices;
- Verification and confirmation of operation activities;
- Control of alterations;
- Draw-up and implementation of operation, transitory and emergency procedures;
- Identification of equipments;
- Control of radioactive contamination;
- Radwaste management;
- Radiation protection;
- Maintenance timing;
- Control of chemical agents;
- Figure out and evaluation of the emergency program efficiency.

The organizational interfaces of the nuclear facilities operation imply the utilization of the four groups of processes which govern IMS.

2.3 Knowledge Management related to nuclear facilities decommissioning

This kind of knowledge should lead to the draw-up of programs for the assessment and implementation of decommissioning activities, consisting of formal documents, technical reports, procedures, etc., which are assumed to comply with knowledge and applicable legislation.

At the same time, one should keep in view that, between the groups of basic decommissioning processes and management processes, a close correlation and interaction must exist with regard to internal communication. This one should allow identification and coordination of knowledge required for the progress of decommissioning and ensures they are correct.

The structural knowledge regarding decommissioning processes have in view three major objectives:

- (a) Strategic framework;
- (b) Planning Process;
- (c) Dismantling Process.

A Case Study

The Multi-Zonal Research Reactor was located on the INR Pitesti site just near TRIGA research reactor. This facility was created for neutron research but has never been operated as a nuclear facility. In 2004 the Institute for Nuclear Research, the owner of the facility, decided to decommission it.

Knowledge management concept for the decommissioning of Multi-zonal Research Reactor is targeting next objectives:

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- Planning Process;
 - Dismantling Process;
 - To secure technical quality and safety standards during decommissioning project;
 - To minimize risk related to the duration and budget of decommissioning project.

The conditions necessary for decommissioning of this installation must be in accordance with the Norms for decommissioning of nuclear facilities (NSR-12) [3], issued by the National Commission for Nuclear Activity Control (CNCAN).

The owner (INR) submitted to CNCAN the decommissioning plan following the next steps:

- (1) Elaboration and approval of decommissioning plan;
- (2) Issuing the official decision for permanent shutdown;
- (3) Elaboration of licensing documentation and submission to CNCAN;
- (4) Obtaining the decommission license and implementation of decommissioning activities according to decommissioning license;
- (5) Issuing the Final Decommissioning Report at the end of decommissioning activities;
- (6) Issuing the Final Radiological Survey Report.

The procedures for clearance and the radiological survey plan were approved by CNCAN. In 2005. CNCAN issued the decommissioning license and then the activities for decommissioning started.

In the present, the Multi-Zonal Research Reactor was decommissioned.

Knowledge management applied in the progress of Multi-Zonal Research Reactor will be useful in the future for decommissioning processes of other nuclear facilities.

2.4. Knowledge management related to environment, safety and health

The policy referring to this issue, related to the operation of nuclear facilities in safety conditions, is reflected, at institute level, by specific activities associated to SR EN ISO 14001:2005 [5], such as:

- Identification and evaluation of environment aspects;
- Identification of environment-related requirements;
- Readiness for emergency situations and response capacity;
- Monitoring and assessment of the main characteristics of those activities which can have a major impact on the environment;
- Identification of hazards, assessment and control of risks related to safety and health;
- Operational control.

Monitoring and assessment of the main characteristics of those activities which can have a major impact on the environment considers the following aspects:

- Development of information in order to identify significant environment features;
- Monitoring of emissions and discharges for compliance with the environmental and other legal requirements;
- Management of wastes resulted from the various activities;
- Management of water, energy and raw material consumption.

All these, together with the conditions and factors which can affect safety and health, represent criteria for the evaluation of the institute environment performance and also the IMS performance.

3. Conclusion

Promoting the R&D programs within the institute allowed the drawing up of new technologies and products with applicability in the nuclear field and, preponderantly, in the development of nuclear power in Romania.

Nuclear knowledge management is considered a part of the Integrated Management System.

A knowledge policy of the Institute includes unlimited access to information provided through internet or intranet, annual training programs of research and development and dissemination sessions.

In this context, the role of the IAEA was and remains significant in the development of information and knowledge resources.

The internal and international collaborations of the institute, the exchange of information and the transfer of knowledge to future generations will represent, in perspective, aspects of the managerial policy of the institute.

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