



**QUALITY ASSURANCE FOR SAFETY
IN THE RADIOACTIVE WASTE MANAGEMENT:
A QUALITY ASSURANCE SYSTEM
IN NOVI HAN RADIOACTIVE WASTE REPOSITORY**

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ABSTRACT

Novi Han Radioactive Waste Repository (Novi Han RWR) has been established in 1964 and it is still the only place in Bulgaria for storage of low and intermediate level radioactive wastes from the medicine, industry and scientific research.

The radwaste management is one of the socially significant activities in every country. The radiation protection of site personnel, the public and the environment is one of the main considerations in every nuclear installation. It is necessary to establish and maintain a Quality Assurance System to ensure that the radwaste repository can be operated safely with regard to the health and safety of the general public and site personnel. The managers, those performing the work and those assessing the work, they all have their role in ensuring quality and thus contributing to the safety. A QA System has to establish the basic requirements for quality assurance in order to enhance nuclear safety by continuously improving the methods employed to achieve quality.

It is envisaged that the QA system for the Novi Han Radioactive Waste repository will cover the operation and maintenance of the radioactive waste disposal facilities, the radiation protection and monitoring of the site, as well as the scientific and technology development aspects. The functions of the Novi Han RWR presume the availability of an Environmental Management System. It is appropriate to establish a QA System based on the requirements of the ISO Standards 9001 and 14000, using the recommendations of the International Atomic Energy Agency (Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations, Code and Safety Guides Q1-Q14).

1. INTRODUCTION TO NOVI HAN RADIOACTIVE WASTE REPOSITORY

There are different methods for storage and disposal of the radioactive waste. Near surface disposal is an option widely used in the East European countries. It is necessary to note that there are many repositories in these countries built in the 1960s which have been used for disposal not only of short-living radionuclides. The Novi Han Repository is of this type: featuring an old design, with outdated auxiliary systems and facilities and with an inventory of long-living radionuclides, such as ²³⁹Pu, ²²⁶Ra and ²⁴¹Am.

The Novi Han Radioactive Waste Repository (NHRWR) has been established in 1964. It has been designed for final disposal of the radioactive wastes (RW) from the medicine, industrial applications, agriculture and scientific research (the wastes from Kozloduy NPP are treated and stored at the Kozloduy site).

The operation, maintenance and scientific support of NHRWR had been consigned to the former Institute of Physics and since 1972 – to the Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Sciences.

Novi Han Repository is located 35 km South-East from the capital city of Sofia and 6.5 km away from the nearest town of Novi Han. The NHRWR have four different disposal vaults:

- Vault for solid RW;
- Vault for biological RW;
- Vault for spent sealed sources;
- Trench for solid RW.

In addition, there is a facility with tanks for temporary storage of liquid RW, including the small arisings from the decontamination activities.

The disposal structures are designed according to the regulatory requirements in force in the 1960s.

In 1994, the operations of NHRWR were temporarily halted by the Committee on the Use of Atomic Energy for Peaceful Purposes (CUAEPP) – the Bulgarian Nuclear Safety Authority. The basic requirements of the CUAEP include reconstruction and modernisation of NHRWR and increasing of its safety in line with the current safety and radiation protection requirements.

The establishment and maintenance of an appropriate QA System is one of the procedural measures within the basic set of CUAEP requirements for renewing the NHRWR license.

This paper reflects the co-operation between the NHRWR and EQE Bulgaria AD in the definition of the scope and extent of the QA system to cover the operations of NHRWR.

2. THE NEW RADIOACTIVE WASTE MANAGEMENT STRATEGY IN BULGARIA AND THE NHRWR RECONSTRUCTION

The radwaste management is one of the socially significant activities in every country. The radiation protection of site personnel, the public and the environment is one of the main considerations in every nuclear installation.

Radioactive waste needs to be safely managed in a regulated manner, compatible with internationally agreed principles and standards and with respect of radiological consequences for the population.

In 1995, the International Atomic Energy Agency (IAEA) published the Principles of Radioactive Waste Management [1]. These principles define the objective of radioactive management as "Dealing with radioactive waste in a manner that protects human health and the environment now and in the future without imposing undue burdens on future generations". This publication led to the formulation of principles of radioactive management, radiation protection of human health and protection of the environment in the countries that use repositories for radioactive waste. The appropriate legal framework, control of radioactive management and safety of the disposal facilities were developed in some of them.

In Bulgaria, a partial legal framework was established since then. From the beginning of 1999, a special state-governed Fund for Safe Disposal of Radioactive Wastes started its financial operations. Later in 1999, a new Strategy for Safe Management of Radioactive Wastes and Spent Nuclear Fuel was adopted by the Bulgarian Government. The Strategy provides a more or less clear perspective for the further short and medium term legal and administrative actions. In particular, the Strategy calls for establishing of a National Enterprise for RW management. Such legal entity can be created only by the Parliament, so a new law is now under preparation.

Since the regulatory shut-down of the NHRWR in 1994, there were several efforts directed to definition of the objectives and the scope of the NHRWR reconstruction. "Terms of Reference for Reconstruction and Modernisation" [2] were developed by Energoproekt EAD in 1996, but the document was subsequently declined by both CUAEP and INRNE. Later, a more detailed

description of the objectives and scope of the reconstruction was developed by INRNE [3], but it lacked the engineering aspects of the problem. In the end of 1999, EQE Bulgaria AD was contracted to perform a Feasibility Study and to develop "Terms of Reference" and "Programme for Reconstruction and Modernisation" of the facility. Currently, the feasibility study report and the proposal for "Programme for Reconstruction and Modernisation" is completed and is being evaluated by INRNE. The "Terms of Reference" are supposed to be developed following the adoption of the proposed general concept and programme for the reconstruction.

In 1997, an IAEA Technical Co-operation Project entitled "Increasing safety of Novi Han Radioactive Waste Repository" was initiated to help in the process of NHRWR modernisation.

Novi Han RWR is still the only place in Bulgaria for storage of low and intermediate level radioactive wastes from the medicine, industry, agriculture and scientific research. It is however not intended for NPP radwaste, which is currently processed and stored at the Kozloduy NPP site. It thus has significant importance for the country that this facility would be modernised and re-opened for operations in the shortest possible time.

3. QA FOR SAFETY

The ISO 9000 based QA Systems are related first of all to establishment of confidence between the manufacturer/supplier and the customer in respect of present and future quality of the products. It is a way to standardise the contractual relationships between the supplier and the customer regarding the products quality.

In our case, the role of the QA System is quite different.

The radiation protection of site personnel, the public and the environment is one of the main considerations in every nuclear installation. It is necessary to establish and maintain a Quality Assurance (QA) System to ensure that the radwaste repository can be operated safely with regard to the health and safety of the general public and site personnel. The managers, those performing the work and those assessing the work, they all have their role in ensuring quality and thus contributing to the safety. A QA System has to establish the basic requirements for quality assurance in order to enhance nuclear safety by continuously improving the methods employed to achieve quality.

Thus, a QA system in a nuclear installation or RW facility is an element of the safety assurance process. The operation of the radwaste facility is a process that can be planned, performed, assessed and improved. A QA system should assist in assuring the appropriate quality of all these activities.

4. BASIS FOR ESTABLISHMENT OF THE QA SYSTEM

It is envisaged that the QA system for the Novi Han Radioactive Waste repository will cover the operation and maintenance of the radioactive waste disposal facilities, the radiation protection and monitoring of the site, as well as the scientific and technology development aspects of the NHRWR operation. The functions of the NHRWR also presume the availability of an Environment Management System.

The first step in the establishment of a QA System was to determine its regulatory and standardization basis accounting for the type of the organisation and the respective activities.

In our case, it is appropriate to establish a QA System based on the requirements of the ISO Standards 9001 and 14000, using the recommendations of the International Atomic Energy Agency (Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations, Code and Safety Guides Q1-Q14).

Contemporary requirements of the EN ISO 9000 and 14000 standards are a suitable basis for establishing a QA System for units exposed to health and environmental risks. The QA System builds up an administrative organisation able to:

- prevent significant part of the applicable human errors,
- timely recognise errors and/or deviations in both organisation, technology and safety related activities,
- provide systematic framework for evaluation of the level of compliance achieved and timely introduction of corrective measures to procedures and practices.

It provides appropriate internal organisation structure and corresponding procedures defining the responsibilities of the operations, monitoring and executive staff with the intent to ensure high quality of the work - and with the ultimate objective to maintain high level of safety.

5. GENERAL ASPECTS OF THE DEVELOPMENT OF A QA SYSTEM FOR NOVI HAN RWR

As a part of the IAEA Project "Increasing Safety of NH RWR", an expert mission on Quality Assurance was conducted in the summer of 1999.

The expert mission of Mr. Gomez was very successful for us. The discussions and the presented materials are useful help for the current efforts of the Novi Han RWR staff in development and implementation of a QA System.

The "Terms of Reference" for development of a QA System for Novi Han have been developed in 1999 by the Bulgarian branch of EQE International Inc. early in 1999. EQE is a reputable Western company with large experience in risk management for various hazardous industries, including nuclear. The corporation operates a world-wide QA system throughout its many offices in different parts of the world.

The Novi Han QA System ToR development covers an initial analysis of the organisation type and structure and the basic QA requirements in view of the types of operations and activities. The resulting document then proposes the appropriate standardisation basis for a QA system and a Programme for its development and implementation.

The ToR were discussed during the IAEA expert mission in a meeting with participation of EQE. The expert mission comments were taken into account and the ToR were basically approved as a good starting point for establishment of the Novi Han RWR QA System.

In particular, the following activities were recommended by the expert mission:

- Establishment of the QA System can be based on the International Atomic Energy Agency requirements (Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations, Code and Safety Guides Q1-Q14), using the ISO Standards 9001 and 14000 as a reference. This approach allows as first to take into consideration the nuclear safety and radiation protection problems, since the ISO 9000 Standard covers primarily the quality assurance in commercial operations.
- The first task, according to both the expert's recommendations and the EQE's Programme, should be a definition of the quality policy and development of an adequate organisational structure of Novi Han RWR as a part of the INRNE structure. It was necessary to clarify the responsibilities and the authorities relating to the quality assurance and quality control.

Following the IAEA mission, the following activities were performed in NHRWR:

- A QA Manager was adopted in the NHRWR unit.

- A Quality Group was established in the NHRWR. The QA System development Programme was discussed in detail within the group with EQE experts.
- An updated organisational structure of NHRWR unit within the INRNE was developed and subsequently adopted by all levels of INRNE management.

While the general QA procedures are yet to be developed, the work is in progress for development of some urgently required work procedures and plans. Many of them are ready and subject of review approval submissions to NHRWR, INRNE or the regulatory authorities. It is envisaged that such work procedures would be a good basis for development of more general management-related procedures to form the higher level of the QA system.

6. RESULTS OF THE IAEA EXPERT MISSION

The IAEA Expert Mission in 1999 reviewed the existing procedures and the plans for establishment of a QA system for the NHRWR. It has been recommended that the Quality Assurance System should be based on the Code and Safety Guides on Quality Assurance in Nuclear Power Plants and Other IAEA Nuclear Installations, and also, on ISO 9001 if considered convenient.

The INRNE has received the following detailed recommendations:

- Elaboration of a Plan with the following phases, although some of them could be achieved in parallel.
 - Definition of the standards on which the system should be based
 - Definition of the Institute Quality policy
 - Definition of the Institute Organisation
 - Preparation of the Quality Assurance System documentation
- Develop a Quality Assurance System on the basis of the IAEA Code and Safety Guides Q1-Q14 using ISO 9001 as reference.
- Define the Quality Policy, including the objectives and commitments of the INRNE management. The policy should be adapted to the objectives of the Institute.
- Organisation of the documentation of the Quality Assurance System according to the following scheme:
 - Quality Assurance Manual covering all the requirements to be applied on the basic standards for Quality Assurance.
 - Management procedures, providing administrative directions to management personnel. The procedures outline the actions management must take to implement the organisation's management system.
 - Work instructions, describing specific work processes and convey administrative and technical information for personnel performing work. Work instructions include technical instructions and drawings.
 - Quality Plans for projects/products.
 - Technical specifications, drawings, etc. when necessary.
- Application of the Quality Assurance System to all INRNE units carrying out activities for NHRWR: approval, characterisation, retirement, transport, treatment, conditioning and storage of the radioactive wastes.

It is recommended IAEA to support the INRNE in the future, in order to establish and implement the Quality Assurance System.

The structure of the QA System documentation suggested by the IAEA experts, actually confirms the basic ideas in the "Terms of Reference", thus approving the NHRWR preliminary plans.

7. NEW NHRWR MANAGEMENT ORGANISATION

Developing the present organisational structure and clearly identifying and defining the departments' activities and responsibilities, the NHRWR can actually ensure the main objectives of the facility according to the National Strategy on Safe Management of the Spent Fuel and Radioactive Wastes and to perform its mission adequately to the internationally acceptable principles:

- Human health protection;
- Environment protection;
- Sustainable development with emphasis on protection of future generations from adverse effects of today's decisions;
- Technical safety of the equipment
- Occupational health and safety considerations.

These principles are the basis for the managerial Quality Policy of the NH RWR. The Quality Policy sets also the management's expectation for organisational and individual employee performance.

The changes in the organisational structure of NH RWR have been under discussion for a long time. According to the Mr. Gomez recommendations and the requirements of the applicable Standards, the existing situation was analysed in 1999 and all previous change proposals were reviewed from the QA point of view in addition to the operations, safety and other aspects. The goals of this work were to clarify the organisational links within the complex management structure of the INRNE, to establish clear responsibilities and lines of report.

The finalised proposal was submitted to INRNE management and after additional discussions and some minor alterations was finally approved in 2000.

According the new management structure of NHRWR, there are five departments:

- Operations Department is responsible for the collecting, transport, acceptance, conditioning, temporary storage and disposal of the radioactive wastes. It insures the safe operation of the repository on every stage of the technological process.
- Construction Works and Maintenance Department assures the technical provisions for the radioactive waste management activities and the practical improvements for increasing the safety of the existing facilities.
- Nuclear Safety and Radiation Protection Department insures an effective protection from potential risks at all stages of the radioactive wastes management in order to prevent emergencies with radiological consequences and to protect the population and the environment now and in the future from the harmful effects of the ionising radiation.
- Scientific Research and Development Department provides for the scientific support at every stage of the repository operation in order to achieve and maintain high level of safety in the management of the radioactive wastes.

- Coordination Department covers the administrative activities related to establishment, implementation, development and support of quality assurance system, security, document control system, information, and other administrative support activities.

The INRNE management and the Scientific Councils approved the new structure. The organisational chart of NH RWR is presented on Figs. 1 and 2. It shows the internal and the external relationships and responsibilities and lines of communications according to the present needs of the repository operation.

8. OTHER ACTIVITIES FOR ESTABLISHING THE QA SYSTEM

In addition to the activities described above, during the last year there were numerous other efforts that are assumed to assist in the establishment of the QA system by ensuring development of the most important documents and procedures:

1. Internal INRNE Regulations – NHRWR Statutes
2. Job descriptions (following the adoption of the new organisational structure)
3. Emergency Plan and Emergency Training procedures
4. Security Procedures and Work Instructions
5. Procedures and Course Material for radiation protection training and re-training of the repository personnel and a separate set for the personnel of external organisations performing activities in the NH RWR site.

Most of the above documents have been already approved by the INRNE senior management, and, subsequently, by the CUAEPP. Others are on different stages of final review and approval.

Recently we are working on the improvement and updating of the management and work procedures, work instructions and other supporting documents.

The record keeping responsibilities and authorities have been identified. Part of the required record forms are determined by the regulatory documents, additional were recommended by the Regulatory Body, and more are being developed in NHRWR in accordance to the needs of the activities performance and control.

A database has been established to cover the RW information. It includes information regarding the type of the waste, activity, radionuclide content, date received, etc. The work on the development and implementation of a global information system for NH RWR operation is expected to start in the beginning of the year 2001.

Other important task, which has already started, is the training and re-training of the personnel in the basics of quality assurance and quality control. A group of employees is already trained and this group is to take care of the development and implementation of the quality system procedures. The training also includes close collaboration with the QA specialists in Kozloduy NPP. The participation in QA seminars and conferences is another very useful approach for improving the quality culture and understanding of the basic quality assurance ideas by the NHRWR personnel. The immediate plans include involvement in these activities of the medium-level managerial staff and subsequent organisation of QA education lectures for all NH RWR employees.

One of the important issues in the QA plans was the establishment of a new Document Control system. Currently, such system basics are developed and its main ideas are principally accepted. The immediate plans include development of the corresponding procedures. We are provided now with appropriate document managing software and the responsible personnel practical training is planned for the immediate future.