IAEA-TCR-0226

# WATRP REVIEW REPORT

**on the**

# Czech Deep Geological Repository Development Programme

**Convened by**

**the International Atomic Energy Agency**

**at the request of the State Office for Nuclear Safety**

**Prague, Czech Republic, 17 – 21 May 2004**

## SUMMARY

In response to a request from the State Office for Nuclear Safety (SONS) in December 2003, the International Atomic Energy Agency (IAEA) convened a Team of four international experts to review the status of the Deep Geological Repository Development Programme (GRD) in the Czech Republic, implemented by the Radioactive Waste Repository Authority (RAWRA) within the auspices of IAEA's Waste Management Assessment and Technical Review Programme (WATRP). The scope of the review included assessing whether the development activities were carried out and planned optimally, economically and effectively. The review mission was organized in the frame of the IAEA TC project CZR/9/015.

The Team, comprising experts from Finland, France, Germany, and Switzerland, reviewed background material provided in English by RAWRA. In May 2004, the Team had a review meeting in Prague with staff of RAWRA, Board Members, subcontractors and other stakeholders such as SONS, mayors of towns close to low and intermediate level waste repositories. At the meeting outstanding issues and questions from the Team were discussed in detail.

About 3 800 tHM of spent nuclear fuel and more than 20 000 $m^3$ of waste is expected to be produced from the operation of existing nuclear power reactors. Spent fuel from nuclear power generation is currently stored at the nuclear power plants. Radioactive waste or spent nuclear fuel, after being declared waste, will be finally disposed of in a geological repository.

The Concept of Radioactive Waste and Spent Nuclear Fuel Management published in the Czech Government Decree No. 487/2002 of 15 May 2002 defines the main objectives and phases of the GRD programme. RAWRA has been assigned the mission to implement the programme.

The Review Team observes that RAWRA programme of activities is running in several directions. The main effort is devoted to the repository siting, which is in an initial step of the site characterisation phase. The current goal is to narrow down the size of 6 sites selected for future investigation during the screening of the Czech territory. Design and engineered barrier studies are based on a generic (non-site specific) design of the disposal facility; some optimisation studies have been completed and research on barrier materials has been initiated. Safety studies are focusing on preparation of modelling tools/procedures and on demonstrating generic repository safety (e.g. safety case, natural analogue studies). Activities performed by RAWRA include also the project management (planning, budgeting, QA, public involvement, information collection, international co-operation, etc.).

The Review Team explicitly acknowledges the general approach pursued by RAWRA to the research and development and to the siting for the final disposal of radioactive waste, and of high-level waste in particular. The Team appreciates that the recommendations of a previous WATRP mission performed in 1993 have been fully taken into consideration by the Czech authorities while establishing the legal and institutional framework for the waste management. When planning and performing the scientific and technical work, RAWRA equally was guided by these recommendations.

The Review Team makes a number of recommendations to further improve the implementation by RAWRA of the Czech GRD Programme. The recommendations are presented according to the following topics:

- Management and implementation of the DGR Programme;
- Repository concept and safety approach;
- Repository siting and public information / acceptance.

## TABLE OF CONTENTS

# 1. INTRODUCTION

## 1.1. The IAEA WATRP System

101. The Waste Management Assessment and Technical Review Programme (WATRP) has been developed by the International Atomic Energy Agency (IAEA) to serve Member States through technical assessments and peer reviews of their national policies, programmes or facilities related to the management of radioactive waste.

102. Upon request of a Member State, or an organization within a Member State, the IAEA undertakes the responsibility of convening an international panel of experts to perform such a peer review in accordance with the terms of reference established by the requesting Member State or organization.

103. The mechanism used for this purpose typically includes a review of source material, an exchange of information with the applicant's experts in a review meeting and a compilation of the findings in a review report.

104. The advantage of such a peer review for the requesting Member State or organization consists of obtaining independent international expert opinions and advice. The experts perform their reviews in their personal capacities independent of their governments or the IAEA, which means that the final review results present the insight of the experts and not necessarily of their country or organization or the IAEA.

105. The conclusions and recommendations of the WATRP experts are based on IAEA standards, internationally accepted principles and proven practices taking into account the general consensus on the most viable options for solving particular tasks.

## 1.2. Request for a Review of the Deep Geological Repository Development Programme by the Czech Authority

106. A state supported programme on the development of a deep geological repository to be realised on the Czech territory started in the early nineties. A WATRP Mission organised in 1993, revised plans and capabilities of the Czech institutions to run this programme at that time. After the completion of conceptual, planning and area survey stages of a repository siting and prior to the start of site characterisation stage, it was assumed to be appropriate to assess whether the development activities were carried out and planned optimally, economically and effectively.

107. Therefore, the State Office of Nuclear Safety (SONS) requested the IAEA, in December 2003, to perform an international peer review of the Czech programme of a deep geological repository development (GRD) implemented by the Radioactive Waste Repository Authority (RAWRA). This request and the scope of the review are outlined in Annex 1.

## 1.3. WATRP Review of the Czech Deep Geological Repository Development Programme

108. The request of SONS was accepted by the IAEA and a WATRP review team (hereafter referred to as the "Team") was set up. The Team consisted of. Prof. Dr. W. Brewitz (Chairman), Germany, Messrs T. Äikäs, Finland, B. Faucher, France and Dr. E. Kowalski,

Switzerland. Mr. J-M. Potier, IAEA was the Scientific Secretary for this review, assisted by Mr. M.J. Crijns, IAEA consultant.

109. The subject of the review was source material on the Czech deep GRD programme specially prepared for this purpose (i.e. the prepared Background Material).

110. The Team's approach to this review included:

- A review and evaluation of the Background Material; and
- A presentation and discussion of the major aspects of the Czech work at a Review Meeting in Prague (17-21 May 2004).

111. At the last day of the meeting, the preliminary results of the review were presented to and discussed with the Director of RAWRA and RAWRA staff.

112. The main findings, views, conclusions and recommendations of the Team are summarized in this report. Recommendations have been printed in bold to make them clearly visible. The review was organized to address several areas that were identified in the Terms of Reference agreed for the review, namely:

- The relevance of the activities performed/planned to a generally acknowledged scope of a geological repository development;
- The appropriateness of the carried out/planned activities to the extent of the national waste management programme and its timing;
- The appropriateness of capacities allocated to the Czech programme;
- The completeness of the programme;
- The adequacy of public information/involvement programme.

### 1.4. Limitations of the Review

113. The Team found it necessary to limit the report to the main issues. Thus, it would be invalid to conclude that topics or areas of work not mentioned in this report were regarded by the Team as unimportant or redundant, or could automatically be excluded from the future Czech GRD activities.

114. It should be noted that no review or advice was requested from the Team on the suitability of the six potential sites preselected for the deep geological repository.

### 1.5. 1993 WATRP Mission

115. The WATRP mission organized in 1993 performed a review of the research and development work for a deep geological repository for spent fuel and radioactive waste in the Czech Republic and made several recommendations regarding the legal, institutional and organizational matters and the scientific and technical programme.

116. The present Team appreciates that the 1993 recommendations have been fully taken into consideration by the Czech authorities while establishing the legal and institutional framework for the waste management. When planning and performing the scientific and technical work, RAWRA was guided by the recommendations of the 1993 WATRP review.

# 2. FRAMEWORK OF THE DEEP GEOLOGICAL REPOSITORY DEVELOPMENT PROGRAMME

## 2.1. Legal and Regulatory Framework

201. The Radioactive Waste Repository Authority (RAWRA) is a state organizational body established on the basis of §26 of the Act No. 18/1997 Coll., on the Peaceful Use of Nuclear Energy and Ionizing Radiation (the Atomic Act) as amended.

202. RAWRA mission is to secure the safe deposition of present and future radioactive waste in compliance with the requirements on nuclear safety and protection of people and environment.

203. Radioactive waste or spent nuclear fuel, after being declared waste, will finally be disposed of in a geological repository. The disposal safety will be achieved by creating a system of man-made and natural barriers capable to isolate the radionuclides contained in the waste from the environment until their concentration decreased to a level not dangerous for mankind and not causing adverse effects in the biosphere.

204. The regulatory framework for siting, planning, implementing and operating the future geological repository mostly consists of the following SONS Decrees:

- Decree No. 317/2002 Coll., on type-approval of packagings for transport, storage and disposal of nuclear materials and radioactive substances, on type-approval of ionising radiation sources and transport of nuclear materials and specified radioactive substances;
- Decree No. 146/1997 Coll., specifying activities directly affecting nuclear safety and activities especially important from radiation protection viewpoint, on requirements for qualification and professional training, on methods for verification of special professional competence and issuance of authorizations to selected personnel, and the form of documentation to be approved for licensing of training of selected personnel, as enacted by Decree No.315/2002 Coll.;
- Decree No. 215/1997 Coll., on criteria for siting of nuclear installations and very significant sources of ionising radiation;
- Decree No. 214/1997 Coll., on quality assurance in activities associated with nuclear energy use and radiation practices and on establishing criteria for classification and categorization of selected equipment into safety classes;
- Decree No. 307/2002 Coll., on radiation protection;
- Decree No. 106/1998 Coll., on nuclear safety assurance of nuclear installations during their commissioning and operation.

## 2.2. Institutional Framework

205. The Czech Government controls the radioactive waste management through the Ministry of Trade and Industry and the independent state authority, The Radioactive Waste Repository Authority (RAWRA). RAWRA's mission is to the ensure the safe disposal of existing and future radioactive waste in the Czech Republic and to guarantee the fulfilment of strict requirements concerning the protection of human life and the environment from the potential adverse impacts of such waste.

206. The Czech Republic's main radioactive waste producer is ČEZ, a. s. (The Czech Power Company, plc.) that operates both the Dukovany and Temelin nuclear power plants. DIAMO, a state-owned company in charge of uranium production facilities, is the second largest producer. The third main producer is the Nuclear Research Institute Plc., whose activities include nuclear research and development as well as providing a wide range of expertise and services in the fields of basic and applied research.

207. The independent supervision of the nuclear sector is the responsibility of the State Office for Nuclear Safety (SONS). This organization is responsible for governmental regulation, administration and supervision pertaining to the uses of nuclear energy and ionizing radiation. The authority and responsibilities of the SONS are set out in the Atomic Act. The Ministry of the Environment is indirectly involved in this process, as a result of its decision-making role in related Environmental Impact Assessment procedures.

### 2.3. Nuclear Energy and the Concept of Radioactive Waste and Spent Nuclear Fuel Management

208. The operation of existing nuclear power reactors, 3 760 MW(e) installed capacity, is expected to produce about 3 800 tHM of spent nuclear fuel and of more than 20 000 $m^3$ of waste (after conditioning), which is not acceptable for the existing near surface disposal facilities.

209. Radioactive waste and spent nuclear fuel are generated in the Czech Republic as a consequence of the peaceful use of nuclear energy and ionising radiation in many industries, particularly in the generation of nuclear energy, health care (therapy, diagnostics), research, and agriculture. The current extent of utilisation of nuclear energy and ionising radiation in the Czech Republic is comparable with that of other industrial countries.

210. Compared to other hazardous waste generated by human activity, the amount of radioactive waste and spent nuclear fuel is relatively small; it makes up hundredths of one percent of the mass of all hazardous waste generated. Certain radioactive waste and, above all, spent nuclear fuel contains a high risk potential, which is why strict management requirements are set out in terms of the technical, professional and financial provision of services. This is one of the reasons why the utilisation of nuclear energy and ionising radiation, as well as radioactive waste management, are subject to state supervision and approval by the State Office for Nuclear Safety.

211. The Concept of Radioactive Waste and Spent Nuclear Fuel Management (Concept hereinafter) is a fundamental document formulating government and state authority strategy for the period up to approximately 2025 (affecting policy up to the end of the 21st century), concerning the organizations which generate radioactive waste and spent nuclear fuel. The Concept puts forward solutions to provide for the disposal of radioactive waste in compliance with requirements for the protection of human health and the environment without excessively transferring any of the current impacts of nuclear energy and ionising radiation utilisation to future generations.

212. In May 2002, the Czech Government approved the Concept, regarding radioactive waste and spent nuclear fuel. The Concept has been prepared in compliance with the energy policy approved by Government Decree No. 50 of 12 January 2000; preparation of the Concept is required, amongst other reasons in connection with preparations for the Czech

Republic's accession to the European Union and in connection with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management adopted under the auspices of the International Atomic Energy Agency, which was signed by the Czech Republic in 1997.

213. The objectives of the Concept are as follows:

- To determine strategically justified, scientifically, technically, environmentally, financially and socially acceptable principles for radioactive waste and spent nuclear fuel management in the Czech Republic;
- To develop a basic system framework for the decision-making of those authorities and organizations responsible for radioactive waste or spent nuclear fuel management in the Czech Republic;
- To communicate in straightforward way information concerning the long-term management of radioactive waste and spent nuclear fuel to organizations involved in this field and to the general public.

214. The Concept is based on an analysis of current developments and professional forecasts of future trends in the peaceful employment of nuclear energy and ionising radiation. It is based on fifty years of experience gathered by Czech organisations involved in the management of radioactive waste. In addition it is based on proven practice, as well as on a modern and complex system of legal regulations. These regulations make it possible to perform individual activities in a safe way. They contain sufficient control mechanisms relevant to present–day and future conditions. The Concept also takes into account experience and best practice in radioactive waste management in other countries.

215. The Concept sets out the State's long-term strategy in this area and defines the direct disposal of spent nuclear fuel (SNF) and other high-level or long-lived radioactive waste in a deep geological formation as the reference solution for the long-term management of spent fuel. Assuming that waste disposal will start in 2065, the Concept sets the following goals to RAWRA for the deep GRD programme:

- To characterise potential disposal sites with suitable geological features and preselect two sites for further characterization. Deadline 2015
- To further characterize the two preselected sites and assess their suitability to host geological repository. Deadline 2025
- To prepare the necessary documentation for construction of an underground research laboratory. Deadline 2030
- To apply for the licence of a geological repository for spent nuclear fuel and/or high-level radioactive waste, to design and construct the repository and to start the operation. Deadline 2065

216. In addition to these goals, the Concept provides also the following instructions on the management of spent fuel:

- To store SNF until a repository is available;
- To support alternative technologies for management of SNF (e.g. transmutation).

217. The Concept respects strategic government policy including:

- *Energy Policy*
  The Concept allows for the possible further development of nuclear energy. It proposes sufficiently flexible solutions, in terms of both technology and time for the back-end of the nuclear fuel cycle and the continuous disposal of operational radioactive waste from the energy sector;
- *State Policy for the Environment*
  The Concept respects the principles of sustainable development (e.g. it employs mechanisms to minimize the quantity of radioactive waste and addresses the security of radioactive waste up to the point when it becomes harmless);
- *Former Government resolutions*
  Government resolutions recommended the construction of spent fuel storage facilities at nuclear power plants. In the area of waste management, the Government recommended the disposal of radioactive waste in operational repositories and in the area of spent fuel management, the construction of a deep geological repository was recommended.

218. The Concept applies to the activities of numerous interest groups and organisations, including:

- *The Czech Government and State Authorities in general*
  By adopting the Concept, the government declares the principles, objectives and priorities for achieving optimum radioactive waste and spent nuclear fuel management, to be implemented by individual ministries, including the Ministries of Industry and Trade, the Environment and Finance;
- *The State Office for Nuclear Safety*
  The Concept sets out the specific content of those activities subject to legal regulation, thereby providing support for the state supervision of radioactive waste and spent nuclear fuel management;
- *The Radioactive Waste Repository Authority and its supervisory Board (RAWRA)*
  The Concept is a fundamental, strategic document, which will be used as a basis for the preparation of annual, three-yearly and long-term action plans to be presented on an annual basis, together with RAWRA's budget, to the government for approval. These plans will allow RAWRA's Board to evaluate the performance of RAWRA and the fulfilment of targets, and ensure the efficient use of funds from the nuclear account;
- *Generators of Radioactive Waste and Spent Nuclear Fuel*
  The Concept provides a decision-making framework for generators of radioactive waste and spent nuclear fuel concerning their business or production strategies;
- *Institutions Involved in the Development of Methods for the Disposal of Radioactive Waste and Spent Nuclear Fuel*
  Using the Concept, research and scientific institutions, universities and other organisations can allocate capacity and systematically prepare for the fulfilment of any requirements arising from the implementation of the concept;
- *The General Public*
  The Concept contains basic information about future intentions and priorities concerning radioactive waste and spent nuclear fuel management in the Czech Republic.

# 3. MANAGEMENT AND IMPLEMENTATION OF THE DEEP GEOLOGICAL REPOSITORY DEVELOPMENT PROGRAMME

## 3.1. Development Programme for the Deep Geological Repository

301. In line with the Concept and under consideration of the recommendations of the WATRP 1993 Mission, a corresponding Development Programme has been established which is described in the RAWRA Background Materials for WATRP Mission, b3). The Development Programme foresees the selection of a favourable repository site, repository design studies, studies on engineered barriers, and the consideration of safety aspects of geological disposal. Attention is also given to the development of the information system needed for the co-ordination of the studies, and to the public service aspects of the geological disposal. The development programme also includes some work on partitioning and transmutation technologies, which are understood to be carried out on a rather small scale, since they are of very little importance to the GRD programme.

302. **The Team considers the development programme as comprehensive and appropriate in terms of R&D, provided that the recommendations in this report, on prioritising the R&D work and planning its time schedule according to the conceptual needs, are taken into consideration.**

## 3.2. Rationale and Structure of the R&D Programme and Priorities

303. As will be discussed in more detail in Chapter 4, devoted to the conceptual matters of the repository system, RAWRA currently follows an approach aimed at building general knowledge of the repository system components. However, the Team recognises that there is not a clear and well-documented strategy behind the R&D programme and its priorities. For GRD an increased awareness is needed with respect to the importance of conceptual guidelines, which should cover the system as a whole, its configuration, and the role of its individual components and their interplay in the short-term and long-term safety system.

304. Conceptual guidelines may help estimating the “opportunities” in the planning and adequately prioritising the R&D programme, i.e. the decisions on whether to perform an investigation or not are often driven by the available expertise of the staff and the subcontractors or by available international projects and their funding, instead of the requirements and objectives of the underlying repository concept.

305. **The Team recommends a well-tuned strategy of planning and prioritising the R&D programme in order to address the specific research requirements for GRD. Participation in international R&D projects may be a means of resource optimization, but the projects must be selected carefully and both opportunities and strategic priorities should be taken into account. This applies especially to available time for non-priority research topics, when the long period (until 2065) is considered.**

## 3.3. Time Schedule of the Programme

306. The Team was informed that, due to problems with local acceptance, a decision on halting characterisation work at the pre-selected sites for five years has been made by the Ministry of Trade and Industry in February 2004. In view of the entire time frame, it has been assumed that more public information will contribute to greater public participation and

acceptance, in particular in the areas envisaged for field and drilling work. During this five-year period, RAWRA's work will be devoted mainly to desk studies and to investigations, which are not site-specific.

307. According to the long-term strategy documented in the Concept, the next milestone of the programme is the year 2015, when two candidate disposal sites with suitable geological features shall be preselected for further characterization. Although this time-point may seem to lay in the far future, the time schedule for achieving the given challenging task is rather short, especially when taking into consideration the decision of not performing field investigations at the sites during the next 5 years.

308. Whether the programme can be achieved in the given time depends upon several factors, such as the necessary field investigations, the site geology and hydrogeology, the area of the site which has to be reserved in the territorial plans, possible requirements of the Safety Regulators on proving basic safety of the potential repository sites prior to applying for the reservation in the territorial plan, the available human and financial resources and – last but not least – on the public acceptance in the region.

309. **The Team recommends to realistically plan the activities needed to achieve the goal of the 2015 milestone and to define several intermediate milestones in order to provide a means to evaluate the work progress. The period of field absence at the sites is to be taken into consideration and the Government Authorities are to be informed, well in advance, if there should be doubts about keeping up to the time schedule in the programme.**

### 3.4. Management, Co-ordination and Planning

310. Managing the programme for developing a deep repository requires good co-ordination capabilities from the organisation in charge of the programme. RAWRA's implementation of the GRD programme relies heavily on the use of external resources. RAWRA's own resources comprise six staff members dedicated for the GRD programme and some support from other activities. RAWRA's organisation for the GRD programme is very thin when compared internationally to other organisations in charge for similar activities.

311. The Team believes that the thin organisation of RAWRA has been one of the main reasons for the obvious fragmentation and extensive outsourcing of the research, development and design work. **To enable a strong co-ordination of the different parts of the programme, the Team recommends RAWRA to strengthen its staff.**

312. The organisation in charge of developing the disposal system will, in a broad sense, be also responsible for the design and implementation of the disposal facility, including the procurement of all materials, equipment and other miscellaneous supplies needed for disposal. Since the requirements and specifications of the disposal system will be defined by RAWRA, this organisation shall have adequate technical and scientific resources to plan the work, to direct and give guidance to subcontractors and suppliers and to evaluate the appropriateness of the results.

313. **The Team also expresses its view that with time, the key competencies for developing and implementing the disposal system should be identified and RAWRA's organisation should be provided with resources covering these competencies.**

### 3.5. Monitoring and Reviewing the GRD Programme

314. It is obvious that a programme for repository development needs guidance, as well as evaluation for its scientific and technical quality. External, independent reviews are, of course, a method to seek this guidance. This method, however, does not provide the continuity of this guidance and depth of the evaluation.

315. Relying heavily on external resources in the execution of the programme, RAWRA should have an opportunity to use independent specialists for reviewing the work carried out and building confidence in the results achieved.

316. **The Team recommends RAWRA to establish a group, consisting of expertise in the areas of repository development, to give advice in the implementation of the programme and to review the results and their importance to future plans. This group should be "at arms length away" from RAWRA's management.**

317. Due to the nature of the WATRP review, there are a number of issues, which have not been reviewed in appropriate detail. Such issues are related, for example, to the performance of the engineering barrier system (EBS) and design of the disposal facility. A discussion with international experts, having experiences from solving similar issues, could give an opportunity for international "benchmarking" of RAWRA's disposal solution and for identification of the most critical issues for further development on a detailed level.

318. **The Team feels that RAWRA could benefit from having a thorough technical review of the disposal system developed. Therefore, the Team encourages RAWRA to seek external experts to carry out this review and to evaluate the function of the individual components as parts of the multi-barrier system.**

### 3.6. Knowledge Preservation

319. The GRD programme of RAWRA will continue for several decades, during which significant changes in staff are inevitable. The organisation should, in an ideal situation, have a mixed age profile.

320. In order to be able to plan for long time periods and to ensure future resources, RAWRA should identify future key competencies and develop a vision of a target organisation.

321. In the working mode chosen by RAWRA, the knowledge will be easily accumulated by the external resources (sub-contractors). Therefore, it is to be resolved how the knowledge will be preserved and transferred. The transfer of the knowledge not only means transfer to future specialists of RAWRA, but also transfer to and among sub-contractors. RAWRA's policy for procurement may lead to change in sub-contracting the work when moving from one work phase to another. This again may lead to the interruption in the chain of knowledge transfer.

322. **The Team recommends RAWRA to consider the selection of strategic partnerships for better securing transfer of the knowledge and flow of information. These partners could represent "centres of competence" in their fields of expertise and should have a solid position in providing for continuity.**

323. In addition to the preservation of knowledge, which depends on the human resources, it is also important to preserve the information borne in the course of the programme. This information comprises specific data (e.g. data from measurements and surveys) and other data (e.g. documents, drawings, models etc.).

324. It may be possible that RAWRA has to provide access to this information to regulators or other stakeholders at a later point in time.

325. **The Team encourages RAWRA to continue actions for establishing a comprehensive and systematic database and, furthermore, to commit itself maintaining this database for future use and record keeping.**

### 3.7. International Co-operation

326. RAWRA has acknowledged the importance of international co-operation and the opportunities it can provide. This can facilitate the preservation of knowledge and the development of competencies.

327. International co-operation can act as a resource pool, especially for research and development work. Furthermore, underground laboratories elsewhere provide opportunities for conducting joint experiments and evaluating results. Participation in joint projects can provide a cost effective way with limited resources (can result in utilisation of for larger resources). On the other hand, participation requires also resources for the management and administration.

328. **The Team recommends that RAWRA should recognise the key areas based on priorities in its own programme and seek opportunities in these areas for international co-operation and participation.**

### 3.8. Quality Management Aspects

329. RAWRA's quality system is based on ISO 9001, and covers the operation of LILW repositories and the siting activities of GRD programme. The responsibility for the quality of all other R&D projects is not clear.

330. **The Team recommends RAWRA to establish clearly the responsibilities for R&D and to take actions, in a systemic way, to develop the quality requirements for the disposal system and for the scientific and technical work needed in the development.**

# 4. REPOSITORY CONCEPT

## 4.1. Concept and Safety Philosophy

401. As mentioned in Chapters 2 and 3, the Czech Republic foresees to permanently dispose of spent nuclear fuel and other high-level or long-lived radioactive waste in a deep geological repository. The concept of this repository corresponds to the internationally accepted state of techniques and is inspired by the Swedish KBS-3 concept.

402. For achieving long-term safety, the repository uses a multi-barrier system consisting of the waste matrix, a steel container, bentonite backfill and the natural geological barrier. The constructional design of the repository is described in the "Reference Project" (RAWRA Background Materials for WATRP Mission, b3). The safety characteristics are outlined in the "Model Safety Assessment of a Hypothetical Disposal System" (RAWRA Background Materials for WATRP Mission, b4). Beside this, there are numerous documents regarding investigations on special aspects of individual system components. The Team requested additional information on the rationale behind the system configuration. This information was provided during the discussions with the RAWRA staff, however, there is no written document describing the safety philosophy underlying the decisions on the particular system components and their interplay.

403. The development of a deep repository should be made in an integrated manner in which the roles of geological and engineered barriers are defined and well balanced in order to reach the required safety level. A given level of long-term safety can be achieved by different contributions of the individual safety barriers. For instance, if a very long-lasting waste container made of steel and copper plating is utilized, the requirements on the site geology and hydrogeology will be less stringent than if the container will consist of steel only. Hence, in order to make the best (and the most economical) use of one safety barrier the degree of freedom provided by the other barriers should be understood. In the following Sections, several other interdependencies are instanced.

404. When reviewing the R&D programme, the Team got the impression that no specific approach has been adopted for establishing the priorities, i.e. that the expertise of the scientific personal and the subcontractors has been of high influence in establishing particular research areas. However, in the present stage of the R&D programme, a large benefit can be obtained when switching over to a structured approach, i.e. to guiding the research and investigations by the requirements and objectives of the underlying repository concept.

405. A well-structured approach can best be provided using the safety case. The understanding of the interplay of the individual safety barriers to the overall long-time performance of the repository can be achieved by an iterative series of generic safety analyses with broad variation of the relevant parameters and by taking into account a wide range of scenarios. From these analyses, the key elements of the system and the missing data and knowledge can be identified, thus enabling the project management to set right priorities in the work programme, and to direct the own investigations and to guide the work of the subcontractors to the mostly relevant topics.

406. **The Team recommends that the conceptual decisions regarding the overall system safety are concisely described in a basic document stating the role and contribution of**

**each safety barrier and that the resulting concept is used in prioritizing the research and allocating the resources.**

407. **The Team recommends using the five-year time period, during which it has been decided not to conduct site-specific investigations, to focus on the necessary conceptual considerations and decisions on the safety features of the geological repository system and on their transparent documentation.**

408. International experience indicates that basic conceptual decisions preferably are co-ordinated with the requirements of the safety regulators. It indicates further, that it is beneficiary to establish, at an early stage, a common understanding with the regulators on the safety concepts, the role of the individual barriers and the laboratory and field investigations, irrespectively of the possibly missing provisions for such discussions in the law.

409. **The Team recommends providing for periodical discussions with the safety regulators aiming at establishing common understanding on the safety philosophy and the R&D priorities.**

### 4.2. Safety Assessment

410. RAWRA has not presented yet a full safety assessment similar to SR97 (SKB), TILA-99 (Posiva), H12 (NUMO) or Kristallin-1 (NAGRA). RAWRA has compiled a safety study, which consists of a model safety assessment of a hypothetical disposal system.

411. One of the main purposes of the work has been to develop modelling tools and calculation methods for quantitative analyses. The results presented were derived from very preliminary data regarding both the engineered barrier system (EBS) and the geological environment.

412. The model safety assessment does not provide adequate guidance to define RAWRA's safety concept and setting priorities to safety assessment research as well as technical development. At the moment, there is not enough knowledge and understanding, which would enable the definition of safety functions of the engineered and natural barriers.

413. **The Team feels that RAWRA should take actions to carry out a comprehensive safety assessment comprising scenario development and description of processes, especially in the near field. This assessment should also include a systems analysis in order to enable ensuring that all requirements regarding long-term safety have been considered.**

### 4.3. Development of the Engineered Barrier System

414. The development of the disposal system based on the multibarrier principle by RAWRA is at an early stage. RAWRA has indicated that the KBS-3 concept, or a concept very similar to that, is taken as a model in their development for the engineered barrier system (EBS).

415. The disposal system presented by RAWRA differs from the KBS-3 concept in terms of the roles and technical composition of the engineered barriers. In the KBS-3 the long-term safety rests first and foremost on the long-term isolation of radionuclides within the performance of EBS, especially the canister.

416. RAWRA has not yet specified the primary roles of, and relationships between, the different technical components of the proposed disposal system. It is important to be able to understand why the particular disposal system is proposed from the available options that satisfy constraints (such as the amount and type of spent fuel to be disposed, economic resources, available manpower) and from the available geological environment.

417. **The Team recommends that for the further development of the EBS, RAWRA should identify the scenarios against which the disposal system should provide protection based on institutional requirements, needs of stakeholders and the scientific understanding that is available.**

418. **The Team further recommends that an interaction between disciplines of technological development and safety assessment should be established to such extent, that enables the definition of the functional requirements of each EBS component as part of the disposal system.**

419. The long-term performance of the planned EBS depends largely on the behaviour of the bentonite buffer between the spent fuel canister and the bedrock and the service life of the carbon steel containers. The Team recognises that an important area for further development of the EBS is to study the effects of steel corrosion on the performance of the buffer.

420. **The Team recommends RAWRA to take an effort to study the gas generation and its transport through the bentonite buffer and the effect of the corrosion products on the favourable properties of the bentonite (e.g. swelling pressure).**

421. So far, RAWRA has very little knowledge on the geochemical and hydrogeochemical conditions of the potential host rock formations, due to a lack of appropriate field investigations and borehole surveys.

422. **The Team recommends RAWRA to develop scenarios for further development of the bentonite buffer. For instance, occurrence of salinity in deep groundwater should be considered, since this potentially can have negative effects on the performance of bentonite buffer.**

### 4.4. Design of the Disposal Facility

423. RAWRA has presented a preliminary design for the disposal facility, the nature of which is generic and can be applied to any of the selected sites in the future. The design presents the layout of the facility both for the above ground and the underground part.

424. The design represents high professional knowledge in the area of design for nuclear and industrial facilities and awareness of safety. The group responsible for design is well aware of the requirements given in the legislation (including norms and standards). RAWRA is also moving to conduct the design work in 3D, which is the most preferable method in the design of the facility. The 3D design offers also the best visualisation tools for communication purposes and interaction between different groups within RAWRA.

425. The assumptions used for developing the design basis and design solutions are not clearly presented in the material reviewed.

426. The co-ordination between the design groups of the various parts of the facility and the specialists developing the EBS for the disposal system appears in some details (e.g. concrete block design in the deposition hole) capable of improvement.

427. **The Team recommends RAWRA to strengthen the co-ordination between the EBS development, safety assessment and design to identify open design issues to be resolved in the future programme.**

428. Although the operation of the facility is well understood, the operational safety has not been separately described in terms of possible disturbances in normal operation or possible accidents. These could be studied in the future to help in deciding between design options, which could have an influence in site characterisation and evaluation (e.g. transportation of the canister via vertical shaft or via an access tunnel).

429. **The Team encourages RAWRA to take actions to include studies on operational safety in the future programme.**

430. The layout of the repository rooms is understandably idealistic and should be adapted, at a later stage, to the geological structure of the selected site. The decisive factor of the layout design is the dimensioning of the repository in accordance to the concept of drift and borehole disposal and the thermal impact on the geosphere. This will have a bearing on siting in terms of repository depth and underground space needed.

431. **The Team recommends RAWRA to enhance the importance of assessing the thermal impact of the repository in future design work.**

432. It would be important, already in the early phase of the programme, to develop a design rule how geological features (fracture zones, lithological discontinuities) are considered in the layout design, in order to be able using geological information obtained from site characterisation in an effective manner. It would be also important to understand the effects of construction and operational period to the initial state of the repository.

433. **The Team encourages RAWRA to establish a co-ordinated effort between safety assessment specialists, EBS developers and ESB designers for a common view on and understanding in layout adaptation issues.**

# 5. REPOSITORY SITING

## 5.1. Siting of the Deep Geological Repository

501. The siting process started in 1990 by the Czech Geological Institute (now Czech Geological Survey, CGS), based on the principles and criteria published in the Safety Series no. 99 – Safety Principle and Technical Criteria for Underground Disposal of High-level Radioactive Waste, IAEA, 1989 and ended up with 27 possible regions.

502. Following the 1997 Atomic Act and the establishment of RAWRA, RAWRA decided upon a revision of the CGS recommendation based on a more recent document, 111-G.4.1. Siting of Geological Facilities, IAEA, 1994. This process was divided in 2 phases:

- The exclusion of unsuitable zones;
- The choice of regions with acceptable geological conditions.

503. Such an exercise is dependant on the knowledge of the national geology, which is usually not consistent all around a given country. In particular, it is related to past geological surveys and exploration work, for instance, carried out for mining purpose. As such, the conclusion of phase no. 1 with 11 possible sites, of which 6 will be considered for future investigation, should be regarded as preliminary and not as the definite list of potential suitable sites.

504. As such, the Team considers that the concept of ranking sites is not relevant and that predominantly exclusionary factors related to long-term safety are to be considered at this stage. At a later stage, a multicriteria analysis based on consistent scientific knowledge of the various sites together with socio-political factors could contribute to a transparent decision making process.

505. The assessment of the suitability of potential sites to host the future geological repository for spent nuclear fuel and/or high-level waste is based notably on site requirements and selection criteria derived by RAWRA from SONS Regulation no. 215/1997 Coll. on "Criteria for Siting Nuclear Facilities and very Significant Ionising Radiation Sources" and Regulation no. 307/2002 on "Radiation Protection". The IAEA Safety Guide "Siting of Geological Disposal Facilities" (Safety Series No. 111-G-4.1., IAEA, Vienna 1994) and the draft IAEA Safety Requirements on "Geological Disposal of Radioactive Waste" (Safety Standard Series, DS 154) are also used by RAWRA as reference documents.

506. The Team noticed that the criteria mentioned in SONS regulation no. 215/1997 apply to siting of all nuclear facilities, including nuclear waste repositories. They are not quite relevant to installations implemented in deep geological formations and to a deep repository as such. At this early stage of the project, siting considerations with regard to surface infrastructure, such as proximity to existing transportation networks etc., should not be given higher priority than geological criteria.

507. **Therefore, the Team recommends complementing the current SONS regulation no 215/1997 by adding exclusion and conditional criteria relevant to geological repositories for spent nuclear fuel and/or high-level radioactive waste.**

508. The application of site selection criteria, derived from SONS regulation No. 307/2002, implies that a total safety performance assessment of the geological disposal concept be performed by RAWRA for each of the potential host sites. The objective is to verify that the annual effective dose equivalent does not exceed the limit of 250 μSv prescribed in SONS regulation No. 307/2002.

509. **The Team recommends that a preliminary safety performance assessment be performed by RAWRA for each potential site, once site-specific data are available following characterization activities.**

510. It was stressed by RAWRA that, despite of the long time frame, the identification of suitable sites and their temporary exclusion from adverse use is an issue of major concern. In particular those sites close to public infrastructure are running a high risk to be of interest to other parties. The Team realised that from this point of view the siting process has to go on in order to justify and to support regional land-use planning in context with the applicable Laws and Regulations.

### 5.2. Involvement of the State Office for Nuclear Safety in the Selection Process for a Geological Repository

511. The State Office for nuclear Safety (SONS) is the state administration body carrying out supervision in the entire area of utilization of nuclear energy and ionising radiation (National Report of the Czech Republic under the Joint Convention on Safety in Spent Fuel Management and Safety in Radioactive Waste Management). In that respect, SONS issues licenses to perform practices governed by the Atomic Act. This includes the siting of nuclear installations or radioactive waste repositories as stated in the National Report (Article 5.3.2.).

512. Although the formal licence application by RAWRA to implement a geological repository might not be issued before several decades, i.e. around 2050 or 2060, the siting process will be initiated in the years to come, starting with the evaluation of potential host sites and the selection of suitable sites.

513. **The Team recommends clarifying the role of SONS during the early stages of the siting process. The involvement of a regulatory body in advising RAWRA's assessment of the suitability, could contribute to the awareness of stakeholders and their confidence building regarding the safety of the future installation.**

### 5.3. Public Information and Acceptance

514. Within the last decades, siting of industrial facilities, moreover if nuclear related, has become a major social and political challenge. In this respect, RAWRA has developed a communication strategy, which can effectively rely on its industrial role (low and intermediate level radwaste surface disposal facilities).

515. The elements of the communication strategy presented to the Team were well described. The strategy was developed by RAWRA on the basis of a pertinent analysis of the situation encountered in each region following the announcement on potential disposal sites. A stepwise decision-making process was adopted by RAWRA.

516. The strong concern expressed by some local municipalities and their population led the Ministry of Trade and Industry, by decision of February 2004, to postpone the site characterization activities for a five-year period.

517. **The Team recommends integrating the elements of RAWRA's communication strategy in a more general plan related to siting. The five-year period can be used to define and implement such a plan aiming at building public confidence. This approach should involve all stakeholders both on a national and local level and should be explicitly supported by the governmental authorities and not left entirely to RAWRA.**

518. **With regards to this general plan, the Team recommends:**

- **A commitment on a national level, by all stakeholders, stating the importance of the GRD and guaranteeing the transparency and fairness of the whole process;**
- **The implication of SONS in consistency with RAWRA's siting milestone, to bring on scientific and technical view points to stakeholders;**
- **The association and participation of local stakeholders in the process in terms of information and interaction.**

519. In particular, the deep geological repository must be integrated into the environment as a tool aiming at the scientific, technical and industrial development of the area.

520. The role of incentives to siting communities, for accepting to host a repository and/or to allow for preparatory investigations, should be considered. Not only direct financial indemnities should be considered (although the involvement of independent experts to advise the communities may be very useful), but also synergies between field investigations and infrastructure needs of the communities (such as roads, water supplies etc., as well as social development issues) should be incorporated in an integrated regional development scheme.

521. The positive socio-economic impact, resulting from the implementation of the repository, will be visible only in the far future due to the long time span of the project. This aspect should be taken into account and explained to the local communities.

522. The Team appreciates the strong commitment of the State Authorities as well as the radioactive waste producer (i.e. the NPP operator ČEZ) to safe and sustainable disposal of radioactive waste. It is understood that the task of the waste management needs not only scientific and technical excellence, but also a lasting support of all stakeholders.

523. **The Team recommends making the commitment of all parties involved more visible in the communication strategy.**

### 5.4. Adequacy of Resources

524. RAWRA's activities for the GRD programme are financed from the nuclear account, which is part of the state budget. The nuclear account is balanced by mandatory contributions of ČEZ and other waste generators in accordance with the Government Directive No 416/2002 Coll. and by revenues from financial investments. Another financial source is the subsidy from the state budget for the management of radioactive waste prior to its final disposal as laid down in § 28 of the Atomic Act.

525. In 2004, the budget for GRD activities amounts to 43.7 million CZK, which is round about 47% of RAWRA's total budget. Although the amount planned for 2005 and 2006 remains almost constant, the percentage slightly drops to 42%.

526. The resources needed for the comprehensive performance of the GRD programme in the forthcoming years, depend heavily on the main targets and target dates set by the official Czech policy and by RAWRA's board. The most challenging mid-term target is the pre-selection of 2 sites by 2015, suitable for a repository. As outlined above (see Chapter 3.2 and 3.3) the requirements of this task need some restructuring of the programme with prioritisation of RTD work, enlargement/qualification of RAWRA's personnel – where needed – and implementation of a thorough siting procedure including information exchange and dialogue with stakeholders.

527. The Team discussed the financial consequences to a limited extent only, since it felt that the present situation with respect to final radioactive waste disposal in the Czech Republic and the extended timeframe for its implementation is not fully comparable with other European countries. However, the Team stresses that the pre-selection of two sites by the year 2015 requires greater financial efforts than anticipated for 2004 and the next two years.

528. A first outline of the financial requirements up to 2015 matching RAWRA's work plan on the GRD programme has been developed; but it provided no adequate basis for an in depth discussion. A breakdown of the total costs of 46.942 million CZK, anticipated for the entire GRD programme and allocation to the main stages of the programme, can give a higher degree transparency and confidence to all parties involved.

# 6. SUMMARY OF MAIN CONCLUSIONS AND RECOMMENDATIONS

601. The Team appreciates this opportunity to comment on the Czech development programme for the deep geological repository. While the team brings many decades of individual, national and international experience to the review, it recognizes that social, political and economic considerations differ from country to country and that no solution is universally valid and even within a country there is not just one solution. The Team recognizes the great scientific and technical competence of its Czech colleagues.

602. The TEAM explicitly acknowledges the general approach pursued by RAWRA to R&D and siting for the final disposal of radioactive waste, and of high-level waste in particular. With its limited resources RAWRA is doing its best for the development of a broad scientific basis. With this strategy RAWRA tries to build up gradually the system's understanding needed for the planning of the different components of the repository and the performance of the safety case. The TEAM encourages RAWRA to continue with its efforts despite the five years halt of the siting process. In order to avoid any misinterpretation the TEAM wants to make it very clear that the detailed recommendations given in this report have to be seen merely as guideline for the future working program. It is understood by the TEAM that these recommendations reflect to some extent scientific, technical and management experiences gained from 30 years of R&D in radioactive waste management on both national and international levels.

603. The principal conclusions and recommendations of the Team's review are as follows:

1. **The Team considers the development programme as comprehensive and appropriate in terms of R&D, provided that the recommendations in this report, on prioritising the R&D work and planning its time schedule according to the conceptual needs, are taken into consideration.**

2. **The Team recommends a well-tuned strategy of planning and prioritising the R&D programme in order to address the specific research requirements for GRD. Participation in international R&D projects may be a means of resource optimization, but the projects must be selected carefully and both opportunities and strategic priorities should be taken into account. This applies especially to available time for non-priority research topics, when the long period (until 2065) is considered.**

3. **The Team recommends to realistically plan the activities needed to achieve the goal of the 2015 milestone and to define several intermediate milestones in order to provide a means to evaluate the work progress. The period of field absence at the sites is to be taken into consideration and the Government Authorities are to be informed, well in advance, if there should be doubts about keeping up to the time schedule in the programme.**

4. **To enable a strong co-ordination of the different parts of the programme, the Team recommends RAWRA to strengthen its staff.**

5. **The Team also expresses its view that with time, the key competencies for developing and implementing the disposal system should be identified and**

**RAWRA's organisation should be provided with resources covering these competencies.**

6. **The Team recommends RAWRA to establish a group, consisting of expertise in the areas of repository development, to give advice in the implementation of the programme and to review the results and their importance to future plans. This group should be "at arms length away" from RAWRA's management.**

7. **The Team feels that RAWRA could benefit from having a thorough technical review of the disposal system developed. Therefore, the Team encourages RAWRA to seek external experts to carry out this review and to evaluate the function of the individual components as parts of the multi-barrier system.**

8. **The Team recommends RAWRA to consider the selection of strategic partnerships for better securing transfer of the knowledge and flow of information. These partners could represent "centres of competence" in their fields of expertise and should have a solid position in providing for continuity.**

9. **The Team encourages RAWRA to continue actions for establishing a comprehensive and systematic database and, furthermore, to commit itself maintaining this database for future use and record keeping.**

10. **The Team recommends that RAWRA should recognise the key areas based on priorities in its own programme and seek opportunities in these areas for international co-operation and participation.**

11. **The Team recommends RAWRA to establish clearly the responsibilities for R&D and to take actions, in a systemic way, to develop the quality requirements for the disposal system and for the scientific and technical work needed in the development.**

12. **The Team recommends that the conceptual decisions regarding the overall system safety are concisely described in a basic document stating the role and contribution of each safety barrier and that the resulting concept is used in prioritizing the research and allocating the resources.**

13. **The Team recommends using the five-year time period, during which it has been decided not to conduct site-specific investigations, to focus on the necessary conceptual considerations and decisions on the safety features of the geological repository system and on their transparent documentation.**

14. **The Team recommends providing for periodical discussions with the safety regulators aiming at establishing common understanding on the safety philosophy and the R&D priorities.**

15. **The Team feels that RAWRA should take actions to carry out a comprehensive safety assessment comprising scenario development and description of processes, especially in the near field. This assessment should also include a systems analysis in order to enable ensuring that all requirements regarding long-term safety have been considered.**

16. **The Team recommends that for the further development of the EBS, RAWRA should identify the scenarios against which the disposal system should provide protection based on institutional requirements, needs of stakeholders and the scientific understanding that is available.**

17. **The Team further recommends that an interaction between disciplines of technological development and safety assessment should be established to such extent, that enables the definition of the functional requirements of each EBS component as part of the disposal system.**

18. **The Team recommends RAWRA to take an effort to study the gas generation and its transport through the bentonite buffer and the effect of the corrosion products on the favourable properties of the bentonite (e.g. swelling pressure).**

19. **The Team recommends RAWRA to develop scenarios for further development of the bentonite buffer. For instance, occurrence of salinity in deep groundwater should be considered, since this potentially can have negative effects on the performance of bentonite buffer.**

20. **The Team recommends RAWRA to strengthen the co-ordination between the EBS development, safety assessment and design to identify open design issues to be resolved in the future programme.**

21. **The Team encourages RAWRA to take actions to include studies on operational safety in the future programme.**

22. **The Team recommends RAWRA to enhance the importance of assessing the thermal impact of the repository in future design work.**

23. **The Team encourages RAWRA to establish a co-ordinated effort between safety assessment specialists, EBS developers and ESB designers for a common view on and understanding in layout adaptation issues.**

24. **The Team recommends complementing the current SONS regulation no 215/1997 by adding exclusion and conditional criteria relevant to geological repositories for spent nuclear fuel and/or high-level radioactive waste.**

25. **The Team recommends that a preliminary safety performance assessment be performed by RAWRA for each potential site, once site-specific data are available following characterization activities.**

26. **The Team recommends clarifying the role of SONS during the early stages of the siting process. The involvement of a regulatory body in advising RAWRA's assessment of the suitability, could contribute to the awareness of stakeholders and their confidence building regarding the safety of the future installation.**

27. **The Team recommends integrating the elements of RAWRA's communication strategy in a more general plan related to siting. The five-year period can be used to define and implement such a plan aiming at building public confidence. This approach should involve all stakeholders both on a national and local level**

**and should be explicitly supported by the governmental authorities and not left entirely to RAWRA.**

**28. With regard to this general plan, the Team recommends:**

- **A commitment on a national level, by all stakeholders, stating the importance of the GRD and guaranteeing the transparency and fairness of the whole process;**
- **The implication of SONS in consistency with RAWRA's siting milestone, to bring on scientific and technical view points to stakeholders;**
- **The association and participation of local stakeholders in the process in terms of information and interaction.**

**29. The Team recommends making the commitment of all parties involved more visible in the communication strategy.**

604. The process of establishing a deep underground repository needs several decades. As the process progresses, new data and understanding will make it necessary to update plans and to adjust them to the changing relationships among the Czech stakeholders.

605. The Team wishes to thank RAWRA, its Director and staff for the excellent support, kind hospitality and friendly atmosphere provided during the review mission.

**WATRP REVIEW TEAM**

Review of the Czech Programme on a Deep Geological Repository Development

Prof. Dr. Wernt Brewitz (Chairman)
GRS - Fachbereich
Endlagersicherheitsforschung
Germany

Mr. Timo Äikäs
Posiva Oy
Finland

Mr. Bernard Faucher
Andra
France

Dr. Emil Kowalski
NAGRA
Switzerland

Mr. Martin J. Crijns
IAEA Consultant
Netherlands

Mr. Jan-Marie Potier (Scientific Secretary)
IAEA
Austria

## ANNEX 1. REQUEST AND TERMS OF REFERENCE

## REQUEST

**STATE OFFICE FOR NUCELAR SAFETY**
**Senovážné náměstí 9, 110 00 Prague 1**

Prague, October 15, 2003
Ref.No.: 19203/2.3/03/Ti/Kl

**Subject: WATRP mission – Evaluation of dup repository preparation**
**2004**
**RAWRA, Czech Republic**

Dear Mr. Samiei,

We highly appreciate your effort and co-operation in the field of nuclear safety and your personal involvement.

In this context we would like to request officially WATRP mission at RAWRA. RAWRA will be ready for carrying out of said mission from April 2004. Possibility of implementation of this mission has been preliminary discussed by Mr. Lumír Nachmilner (external consultant in IAEA) in International Atomic Energy Agency.

Thank you for your kind co-operation and assistance.

Yours sincerely,

Miloš Tichý
Director of International
Co-operation Department

Mr. Massoud S a m i e i
Head, Europe Section
Division of Technical Co-operation
International Atomic Energy Agency
Wagramer Strasse 5, P.O. Box 100
A-1400 Vienna
AUSTRIA

**ANNEX 1. Continued**

**TERMS OF REFERENCE**

---

WATRP REVIEW OF THE CZECH PROGRAMME ON A
DEEP GEOLOGICAL REPOSITORY DEVELOPMENT

## 1. Subject of the Mission

International peer review of the Czech programme of a deep geological repository development.

## 2. Objective of the Mission

A state supported programme of development of a deep geological repository in the Czech Republic started in early nineties. The WATRP Mission organised in 1993 revised plans and capabilities of the Czech institutions to run this programme at that time. After the completion of conceptual/planning and area survey stages of a repository siting and prior to the start of site characterisation stage, it is requested to assess whether the development activities are carried out and planned optimally, economically and effectively.

## 3. Background

The operation of existing power reactors (3 760 MWe installed capacity) is expected to produce about 3 800 tHM of spent nuclear fuel and of more than 20 000 $m^3$ of waste (after conditioning), which is not acceptable for the existing near surface disposal facilities.

The Concept of Radioactive Waste and Spent Nuclear Fuel Management in the Czech Republic, approved by the Czech Government in May 2002, considers the direct disposal of SNF in a deep geological repository as a main method. Supposed that waste disposal will start in 2065 the Concept sets the following goals for the management of SNF and long-lived waste:

- To store SNF until a repository is available (cask dry storage technology has been applied);
- To include in the regional (land-use) plans 2 sites suitable for a deep geological repository by 2015;
- To confirm a site where the repository can be built by 2025;
- To build a confirmation underground laboratory in the final site after 2030;
- To support alternative technologies for management of SNF (e.g. transmutation).

The programme of the deep geological repository development is running in several directions. The main effort is devoted to the repository siting, which is in an initial step of the site characterisation phase. Current goal is to narrow down the size of 6 sites selected for future investigation during the screening of the Czech Republic territory. Design and engineered barrier studies are based on a generic (non-site specific) design of the disposal facility; some optimisation studies have been completed and research of barrier materials has been initiated. Safety studies were focused on preparation of modelling tools/procedures and on demonstrating generic repository safety (safety case, natural analogue studies). Some activities are carried out regarding the project management (planning, budgeting, QA, public involvement, information collection, international co-operation, etc.).

## 4. Scope of the Mission

It is expected that the WATRP Team will evaluate a progress reached from the beginning of the Czech programme of the deep geological repository development and will also assess the planned activities. Namely the following issues shall be addressed:

- A relevance of the activities performed/planned to a generally acknowledged scope of a geological repository development;
- An appropriateness of the carried out/planned activities to the extent of the national waste management programme and its timing;
- An appropriateness of capacities allocated to the Czech programme;
- A completeness of the programme;
- An adequacy of public information/involvement programme;
- Other issues proposed by WATRP Team members.

## 5. Counterpart Team

The counterpart Team will be headed by Mr. V. Duda, the Director of Radioactive Waste Repository Authority. The Team itself will consist of members of RAWRA staff involved in the deep geological repository development and of experts from subcontracting institutions representing the major directions and activities of the programme. Also, representatives of the regulatory body and other state institution, as well as members of the RAWRA Board, will be invited to join the meeting.

## 6. Background materials

WATRP experts will be provided with the following materials (in English):

a) *An overview of the activities carried out within the development of a deep geological repository (1993 – 2003).*
This overview contains abstracts of all particular projects, information about the authors, time schedule and costs of a project. It is divided into the following chapters:
   - Geological aspects (siting studies, supporting studies);
   - Engineered barriers (SNF characteristics, buffer and sealing materials);
   - Safety aspects (incl. natural analogue studies);
   - Design studies (reference design, optimisation studies);
   - Transmutation of SNF (pyrochemical and hydrochemical partitioning, transmutor physics);
   - Generic studies (international co-operation, QA, project management, public involvement).

b) *The development of a deep geological repository (overview of the programme 1993 – 2003).*
Document summarising activities carried out and main results reached during the mentioned period. It consists of the following chapters:
   - Development of a deep geological repository in the Czech Republic (national strategy, siting, design of a facility, engineered barrier studies, safety studies, co-ordination of the programme, social/legislative aspects, overview of the costs of the programme);

- Programme of future activities (siting, development of engineered parts of a repository, safety studies, public involvement, international co-operation, alternative technologies);
- Enclosures (safety case, reference design).

*c) RAWRA Annual Reports (2001, 2002).*

d) Medium Term Strategy documents.
- *RAWRA annual and mid term plan*.

**6. Mission timing**

The following time schedule of the Mission preparation and performance is proposed:

- 16 February 2004 - The selection of experts, source material sent to the Agency, development of a tentative review programme;
- 16 April 2004 - Questionnaire / comments from the expert Team delivered to RAWRA;
- 17-21 May 2004 - WATRP meeting in Prague;
- 30 June 2004 - Draft WATRP mission report sent by the IAEA to RAWRA;
- 15 July 2004 - Comments on the draft report forwarded by RAWRA to the IAEA;
- 15 August 2004 - Final WATRP mission report forwarded by the IAEA to RAWRA.