



General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence



Programme for R&D of Deep Geological Disposal in the Slovak Republic



Nuclear Regulatory Authority of the Slovak Republic



Alena Zavazanova,
Division of Radwaste Management and Decommissioning



Introduction

- ◆ Estimation of production
 - 2,500 metric tons of spent fuel (expressed as heavy metal)
 - 5,000 metric tons of RAW non-acceptable for near surface disposal
- ◆ National policy for management of SF and RAW
 - Governmental decisions No. 930/92, 190/94 and 5/2001
 - two alternatives for the end of fuel cycle:
 - direct disposal after 50 years of interim storage within the Slovak territory
 - shipment and final disposal externally

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  1

Introduction

- ◆ Current options under consideration
 - construction of national DGR
 - export for permanent disposal abroad (Russian proposal – in conflict with valid legislation of RF)
 - development of regional repository (active role of Slovakia in pilot initiative under 6th EC Framework Program - SAPIERR Project (Support Action: Pilot Initiative for European Regional Repositories))

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  2

Background overview

- ◆ Initial study in 1996
 - ◆ stage I between 1997-1998
 - ◆ stage II between 1999-2001
- ◆ coordinated by DECOM, Ltd. (later on directly by SE,Plc.)
- ◆ funded from SFL
- ◆ now partially suspended, to be re-opened in 2005
- ◆ International co-operation
 - ◆ Czech Republic (UJV Rez, SU RAO, EGP Invest)
 - ◆ United Kingdom (AEA Technology)
 - ◆ Switzerland (NAGRA)
 - ◆ Belgium (Belgatom)

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  3

Key area of the project

- Design and implementation
- Source term
- Near field interactions
- Far field interactions
- Siting
- Safety analyses
- Public involvement
- Legislation
- Quality assurance

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  4

Design and implementation

- ◆ Preliminary technical proposal of DGR for hypothetical site
- ◆ Evaluation of technical, socio-economic and safety requirements for project implementation
- ◆ Time schedule and priorities for preparation of construction
- ◆ Analysing of the need for underground laboratory
- ◆ Preliminary feasibility study based on
 - ◆ current knowledge
 - ◆ status of mining technologies
 - ◆ world-wide experience

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  5

Source term

- ◆ Description of physical and chemical properties of SF and RAW after different period of interim storage (PC code "ORIGEN 2.1")
 - activity of selected isotopes
 - total assembly activity
 - residual thermal power
 - contribution of respective radionuclides
- ◆ Possible mechanism of radionuclides leaching from SF as well as cemented or vitrified HLW forms (PC code "PAGODA")
- ◆ Identification of critical group of radionuclides and their relevant characteristics

Near field interactions

- ◆ First design of disposal container for SF
 - seven WWER-440 assemblies
 - carbon steel coated by nickel layer with inner wall of stainless steel
 - subcriticality, effective heat removal, pressure resistance
 - total weight with encapsulated SF 7.7 metric tons
- ◆ Analyses of characteristics of individual materials used for sealing and backfilling of tunnels
- ◆ Determination of processes for radionuclides release and their retention by engineering barriers

Far field interactions

- ◆ Modelling of geological barriers and groundwater flow
- ◆ Preparation of 3D models of geological barriers for potentially suitable sites for repository regarding their
 - geology
 - petrography
 - seismicity
 - neotectonics
 - hydrogeology
 - geochemistry
- ◆ Analyses of interactions between host rock environment and engineered barriers material

Siting

- ◆ Preliminary set of site selection criteria (IAEA SS No. 111-G-4.1)
 - ◆ geological and tectonic stability
 - ◆ characteristics of the host rock
 - ◆ conflict of interest
- ◆ 15 sites potentially suitable for DGR based on archival data
- ◆ 4 distinct prospective areas (6 localities) screened-down in two formations for further investigation
 - ◆ crystalline environment (tonalites and granodiorites of Palaeozoic age)
 - ◆ sedimentary environment (argillaceous and pelitic Neogene complexes)

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  9

Siting (cont. 1)

- ◆ crystalline host rock
 - ◆ central part of the Tribec Mountains
 - ◆ central part of the Ziar Mountains
 - ◆ southern part of the Veporske vrchy Mountains
 - ◆ south-western part of the Stolicke vrchy Mountains



General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  10

Siting (2 cont.)

- ◆ sediments
 - ◆ eastern part of the Cerova vrchovina Upland
 - ◆ western part of the Rimavska kotlina Basin



General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  11

Safety assessment

- ◆ Safety demonstration
 - operational safety analyses
 - long term performance assessment
- ◆ Critical review of international concepts from point of view of their applicability for the conditions in the Slovak Republic
- ◆ Preparation of scenario development methodologies using internationally agreed supporting tools and FEP database
- ◆ Preliminary selection of appropriate conceptual and mathematical models for safety assessment of individual repository subsystems (including their modifications and adaptations)

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  12

Public involvement

- ◆ Main aspects of public involvement programme
 - information
 - communication
 - participation
 - acceptance
 - compensation
- ◆ Recent activities
 - informing on radwaste management issues
 - investigation of socio-economic effects
 - public participation in decision-making process
 - publishing of results achieved and updated status (brochures)

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  13

Legislation and quality assurance

- ◆ Reviewing of world-wide legal documents relevant to DGR in order to identify proper legal environment for DGR development (existing national legal and regulatory documents also taken into account)
- ◆ Evaluation of current SF and RAW management infrastructure
- ◆ Preparation of QA/QC plans
- ◆ Preliminary study for EIA process according to Act No. 127/94

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  14

Future works

- ◆ Detailed investigation of prospective localities (using boreholes)
- ◆ Revision of site selection criteria
- ◆ Preliminary performance assessment
- ◆ Selection of materials for engineered barrier system
- ◆ Creation of information database
- ◆ Establishment of public involvement programme
- ◆ Proposal for the first reference disposal concept

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  15

Conclusions

- ◆ Decision on selection of host rock expected in 2005
- ◆ Decision on selection of candidate locality expected in 2010
- ◆ Implementation 2027-2035
- ◆ Start of commissioning in 2037

- ◆ Drivers for above data
 - ◆ the need for disposal of A-1 decommissioning waste
 - ◆ end of Bohunice ISFSF lifetime in 2040
 - ◆ designed lifetime of Integral storage facility until 2050
 - ◆ strategy for decommissioning of V-1

General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence  16
