

2-week Course on Repository Design & Engineering

Held: 19-30 September 2005 Meiringen, Switzerland

Course outline: PDF file 74 kb
Course Location

Meiringen, Switzerland

1st week (18-23 September) Hotel Alpin Sherpa

2nd week (24-30 September) Park Hotel du Sauvage
Objective of the course

Active national programmes for the deep geological disposal of radioactive wastes are at different stages of development. While some are striving to establish appropriate social and organizational structures, others are beginning to identify potential repository sites and the even more advanced are in different stages of characterizing or developing chosen sites. At all stages of programme development, concepts for the design, construction and operation of the repository are used to guide site selection / characterization and associated R&D activities. Such concepts must, however, be flexible and evolve iteratively as repository projects become more concrete.

This course is intended to help Member States at all stages of programme development to understand the factors that guide the processes involved in various features of design of geological repositories for radioactive waste. These features include repository location, geological formations and properties, layout, construction controls, engineering materials and techniques and their application. Important aspects of excavation and construction technology and their influence repository design will be reviewed. The special requirements of handling radioactive materials in an underground environment and how these requirements affect the design and operation of repositories will be considered.

Through examples drawn from international and national projects experience an exercise will be undertaken under the tutelage of experts to provide the scholars with an appreciation of the application of the information provided in the course. The relevance of the course-work will be demonstrated by exposure to practical examples of activities undertaken at the Underground Research Facilities of Grimsel and Mont-Terri and a range of other underground construction projects in Switzerland.

Participants will be apprised of recent developments in key technologies related to the engineering of geological waste disposal facilities. The requirements for national programs to consider these technologies during the development and implementation of their own repository development programmes will be emphasized.
Course organisers

The course is organised by the ITC School in collaboration with, and supported by, the IAEA (International Atomic Energy Agency) within its network on Training and Demonstration of Waste Disposal Technologies in Underground Research Facilities (<http://www-tc.iaea.org/tcweb/default.asp>).

The local host organisation is Nagra (National Cooperative for the Disposal of Radioactive Waste) <http://www.nagra.ch>
Course Participants

The course is aimed at professionals working in implementation, regulation or support roles in national high-level waste management programmes. Younger professionals as well as those with some years of experience would benefit from the course. A wide range of technical subjects will be covered. Consequently, it is essential that nominees should have a strong background (by education and/or experience) in appropriate subjects including nuclear and geotechnical science and engineering and geological sciences. Some experience and knowledge of Project Management techniques and applications would be an advantage.
Course Language

English

Nature of the Course

Subject to finalization, it is planned that during the two weeks over which the course will extend both classroom and field activities will be undertaken, as follows:

Week 1

Days 1 and 2 - Introduction and General Considerations

The rationales leading to the international consensus that HL and Fuel Wastes should be disposed in repositories constructed deep in geological formations will be examined. Uncertainties and possibly contrary opinions and alternative approaches to Waste Management will be examined. Current general public concerns relating to geological disposal will be reviewed along with the benefits of geological disposal. Non-nuclear safety factors that affect the repository will be listed and how these factors may influence Repository Design, Construction and Operation will be detailed.

Day 3 - Hard rock field trip

The Underground Research Laboratory at Grimsel will be visited. The experiments that have been carried out and the experience gained in the Laboratory relating to Repository Design, Construction and Operation will be reviewed and discussed. The trip will also include visits to other types of underground construction projects in hard, crystalline rocks in the Swiss Alps.

Days 4 and 5 - Design Factors (General)

The factors that affect and may constrain the repository designers and operators will be identified. These factors include questions related to radiological safety, heat output from the wastes, general facility management, including legal and environmental factors, and the responses of the rock and the engineered barrier materials to the development and presence of the repository including the waste. General principles can be applied to the design of a geological repository. However, these will have to be modified according to the specifics of the geological setting. These specific factors will be elaborated for "hard" rocks along with methods considered suitable for dealing with the possible occurrence of significant earthquakes. At the end of the week, the course participants will be presented with the information needed for them to independently undertake a Design Exercise. This Exercise is to be completed by the end of the two-week course.

Week 2

Days 6 and 7 - Design Factors (Technical)

More specific factors affecting design and leading to specific design criteria will be elaborated. On these bases, and the more general criteria identified in Week 1 examples of repository designs in hard sedimentary rock (Marls, CH), crystalline rock (granite, FIN) and volcanic tuff (USA) will be reviewed and justified. Depending on a number of geotechnical factors, underground openings may or may not need to be lined during the period of repository operation. Even if not required for structural reasons linings may be needed for repository openings for other purposes. This subject will be considered for repositories in soft rocks. For all repository designs the management and control of water will be essential. Methods to manage and control water flows in the repository will be considered in the light of the specific constraints that apply to radioactive waste disposal. Some time will be set aside for the participants to work on the Design Exercise.

Day 8 - Soft rock field trip

The hard rock field trip in week 1 will be complemented by visits to similar facilities in softer, sedimentary rocks in Central and Northern Switzerland to illustrate the significance of both rock type and geological setting.

Day 9 - Design Exercise

Some aspects of cost estimating for repositories and the use of Multi-Attribute Analysis methodology for comparing different designs will be outlined. These processes will be applied to the Repository Design Exercise initiated at the end

of Week 1 and the Design Exercise will be completed.

Day 10 - Summary and Conclusions

The results of the Design Exercise will be synthesized and the Lesson's Learned elaborated. Moreover, individuals will be given opportunity to comment on the quality of the course materials and, otherwise, provide feedback to the tutors and organizers.