

ITC-IAEA Cement and cementitious materials in the geological disposal of radioactive waste II

Last Updated Sunday, 04 January 2009

15th-19th December, 2008 - Flums, Switzerland

REGISTRATION DEADLINE: Closed / Fully Booked

UPDATED Course Agenda 31kb

The course on 'Cement and Cementitious Materials in the Geological Disposal of Radioactive Waste' is now fully booked and course registration has consequently closed. We regret that there are no further places available. However, if you would be interested in participating in the same or a similar course in the near future, please register your interest here and we will get in touch with you if there is enough interest to run the course again in 2009.

This course will be similar to the new ITC course on the uses of cement and cementitious materials in the geological disposal of radioactive waste (June, 2008). The first presentation of this course has proved very popular and spaces for the June course were rapidly filled, well before the closing date for applications and so is repeated here only six months later. The 5 day programme for 15 – 19th December 2008 features seven, interlinked, modules which cover all aspects of the use of cementitious materials in radwaste disposal. Sufficient time will be allocated for questions and discussions in each presentation module and afterwards, over coffee, lunch and dinner. As the tutors stay in the same hotel as the students, there is also plenty of time to continue discussions into the evening. UPDATED Course Agenda 31kb

In addition to formal teaching (including two group exercises and two field visits) each course participant is required to prepare a pre-assignment related to the course. The purpose of the assignment is that the participants devise a specific cement-related topic to focus on during the course (see details and application form below).

Module I: Basics of Cement Chemistry

This module includes presentations on the fundamentals of cement chemistry and mineralogy and will provide enough information for a novice in this area to understand the following 6 modules. Areas covered will include basic cement chemistry and mineralogy, historic development of cements (including pre-industrial uses), cement production and applications (why are there such a wide range of cement formulations?). Participants will come to understand that, although cement and concrete are ubiquitous in the modern world (and were, to a degree, in the ancient world), they are complex materials and there are still many things to learn about them, especially in the context of radwaste disposal. The focus will be on 'standard OPC (Ordinary Portland Cement) types, but other formulations will be covered in module VI.

Module II: Application of cementitious materials in geological disposal – conceptual view of the use of cementitious materials

The course participants will be introduced to the specific application of cement in the geological disposal of radwaste, including the historical development of cementitious repository design (who first thought of disposing radwaste in concrete and why?). What are the advantages and disadvantages of the use of cementitious materials in waste disposal? Could we build and operate our repositories without cement and concrete? What are the strengths and weaknesses of the different designs for the different waste streams? Are there any designs or waste streams, which could not be considered for cementitious materials? Considering that industrial cements were first introduced over 150 years ago, which areas require further, repository-relevant R&D? By the end of this module, the course participants should have an understanding of the current range of cementitious repository designs and the logic behind the use of cement and concrete in radwaste disposal.

Module III: Long-term safety evaluation of cementitious materials in geological disposal

Here, experienced safety assessment (SA) modellers will explain how cementitious material are viewed within a repository safety assessment - and what role it needs to fulfill to immobilise radwaste. This is a significantly different role from that of design, construction- and operational-related cement and requires the course participants to see cementitious materials in a different light. The participants will also learn something of the SA approach to evaluating the role of cement in a repository and how the SA modellers assess the strengths and weaknesses of cement in repository systems. Of course, one of the crucial questions about any man-made material such as industrial cement is 'how

long will it last, how long can we depend on it to do the job we require of it?. This will also be addressed by the SA modellers and the participants will be introduced to the methodology of long-term testing – namely, natural analogues. Here, the course participants will gain an insight into how examples from nature’s own laboratory can support our short-term laboratory experiments and give us confidence that cement and concrete can indeed last as long as we need to immobilise even the longest-lived wastes.

Module IV: Understanding of interactions – cement, the EBS, the geosphere etc

Although most people probably view cement and concrete as ‘wonder materials’ with which we can do almost anything, there are some aspects of cementitious materials which have to be considered most carefully when using them in a radwaste repository. In Module II, the clear advantages of cements were pointed out but, here, some of the potential disadvantages are examined. These stem from the basic fact that cement is out of equilibrium with its surroundings when placed in the geosphere: cement leachates have an initial pH of >13, whereas most repository host rocks’ ground- and porewater has a pH somewhere between 6 and 8. This clear disequilibrium leads to reactions which attempt to re-assert equilibrium by dissolution of some mineral phases and the crystallisation of others. This module will address these changes, beginning with how the cementitious material itself slowly degrades and the impact this then has on the surrounding host rock and other parts of the engineered barrier system (EBS). Evidence from laboratory experiments will be backed up with model calculations to provide the course participants with a clear overview of the likely impact these complex cement/EBS/host rock interactions will have on the long-term performance of a repository.

Module V: Field visit to a Swiss URL

Switzerland is unusual in that it plays host to no less than 5 URLs (underground research laboratories) and the participants will visit two over the duration of the course. In this module, a visit will be made to the Hagerbach URL (see <http://www.hagerbach.ch/index2.htm> for site details). Here, focus is on concrete construction methods for underground facilities, with an opportunity for the participants to get a view of how concrete designs and structures are developed and how their quality is assured in both the R&D and production environments. An overview of the tools (equipment, manpower etc) of relevance will also be provided with information on cutting-edge design developments and international best practice. The visit will include demonstrations of concrete production, working with spraycrete and the associated quality control measures necessary to ensure that the materials attain the design requirements.

This module will include the first group exercise, on aspects of operational safety during repository construction and operation.

Module VI: Development of new cement materials and products

The participants will be introduced to aspects of repository design along with an introduction to some potential repository construction techniques. They will also be given some examples of repository-relevant concrete structures which will act as a basis for the second group exercise. Here, the groups will define design requirements for concrete structures in both L/ILW and HLW repositories, bearing in mind the different nature of the repository engineered barriers and the specific rôles which they have to play in the long-term performance of the repository. To add some additional variation to the tasks, different groups will be assigned different host rock types with different physico-chemical properties.

The current state-of-the art in concrete structure requirements for deep geological disposal is still developing, so the course participants could make a real contribution to the body of knowledge in this field.

Module VII: Design of permanent and removable cement/concrete structures and applications

The module will begin with a site visit to a second Swiss URL, Mont Terri (see <http://www.mont-terri.ch/ids/default.asp?TopicID=72> for details) where the focus will be on repository-related operations where concrete has been utilised in a wide range of rôles, including waste silo construction, tunnel support, waste encapsulation, tunnel flooring etc. The visit will also include time in the underground research tunnel used for field testing of deep geological disposal methods and technologies.

To finalise this module (and the course), participants will be introduced to low alkali cements. If industrial cements are already over 150 years old, why do we need new formulations? This has already been addressed to a degree in modules I-IV, but will be examined more closely here. The drivers behind new formulations will be explored as will the historical development of ‘alternative’ cement types. The main focus will be on a range of low alkali cements which have the advantage of lower pH (~10.5 to 11.5) than the traditional OPC formulations, but other materials, such as silica sol and bentonite grouts will also be discussed and their role in repository construction and performance examined. By the end of this module, the course participants will have an understanding of the newer cement formulations and how

they can be employed in a wide range of repository designs – one focus of this area of R&D is the use of these cements in HLW/SF/MOX repositories, for example.

Participants’ profile – is this course for you ?

The course is ideal for those involved in any component of a national radwaste programme and who have a desire to learn about all aspects of working with cement and concrete in waste disposal. While some background in either cement or radwaste is useful, the modules have been so designed as to ensure that any participant who currently only has a rough idea of the use of cement in waste disposal, will profit from this course. A basic grasp of chemistry is required, but more important is a genuine interest in being involved in cement-related issues in waste disposal. If you are unsure if this course is for you, please feel free to contact the course director, Russell Alexander (russell.alexander@itc-school.org), for an informal chat.

To help you to get the most out of this course, we would like you to produce a short pre-course assignment. But don’t worry, we are not asking you for much effort, just a little thought in advance of attending the course which will focus your thinking and give us an insight into your requirements. And don’t worry if you cannot express yourself fluently, this is not a test, rather it is simply intended to help us get to know you a bit in advance. In return, you will be given the course tutors’ CVs when you start the course.

The Course Assignment can be found at the bottom of the application form and should be returned by 3rd November, 2008.

Course organisers

The course is organised by the ITC-School (www.itc-school.org) and is supported by a wide range of organisations and individuals who are actively involved in the use of cementitious materials in radwaste disposal.

Teaching

The course will be held in an informal, workshop atmosphere and participants will be encouraged to interact with and question the tutors at all times. In addition to the ITC course director, who will be present at all times, each module will have a dedicated director whose aim is to ensure that the participants fully understand the module contents and are ready to move on to the next part of the course.

Each course module will be taught by highly qualified and internationally recognised specialists from a range of organisations active in the field of radioactive waste disposal. They will provide the most up to date and comprehensive information currently available on each topic. To back up the taught information, hard copies of course material will be provided to each participant. Modules will generally be taught throughout the day, but there will also be two field trips to course-relevant sites. In addition, two focussed, group sessions will be held where the participants will be split into small groups and encouraged to develop their own thoughts on the requirements for cementitious materials in repository construction and operation.

Course Fees

The course fees cover hotel accommodation and all meals for five days, local transport during the course and the course notes and other materials.

CHF 5'450. - ITC members

CHF 6'050. - non-members

The course fee is due within four weeks of your registration. Registration is not guaranteed until we have received the course fee. If you have to withdraw from the course after paying your fee, it will be refunded in full up to 3rd November 2008. After this date, it is not refundable

Application Form

The online application form is now closed.
Accommodation and Travel Information

The course will be held in the Bildungs- und Ferienzentrum (training and holiday centre) in Quarten, to the south-east of Zürich (see www.bildungs-und-ferienzentrum.ch), in a beautiful spot overlooking LakeWalen. Your room is reserved from the afternoon of Sunday, 14th December to the morning of Friday, 19th December, 2008.

Travel to the course hotel (see <http://schoenstattquarten.09.2flex.ch/Portals/0/Content/Wegbeschreibung.pdf> for details) is possible by train from Zürich, Geneva and Basel airports to Unterterzen station (see also www.sbb.ch/en/index.htm for details). From here, it is a short taxi journey to the course hotel or the hotel can collect you if you inform them of your arrival time in advance.

To drive to the hotel, take the A3 motorway (which runs southeast from Zürich towards Chur). When driving from the direction of Zürich, take the Murg exit (be careful, this is immediately after the end of a tunnel) and follow the main road to Unterterzen. Turn right off the main road towards Quarten/Oberterzen and follow the road up the hill and look out for the large Neu-Schönstatt car park (on the right of the main road in Quarten). If travelling from the direction of Chur, take the Flums exit and follow the main road to Unterterzen. Turn left off the main road towards Quarten/Oberterzen and follow the road up the hill and look out for the large Neu-Schönstatt car park (on the right of the main road in Quarten).

The course will end with a field trip in northwest Switzerland and the participants will be dropped at Delémont station from where they can travel on to Basel and Zürich airports by train (again, please check the SBB web site for details).