INFORMATION SHEET FOR PARTICIPANTS

Virtual ICTP/ IAEA International School on Radioactive Waste Cementation

Virtual Production: 14 October 2020 to 11 December 2020

Ref. No.: EVT1905456

A. Background

The International Atomic Energy Agency (IAEA) organises jointly with the Abdus Salam International Centre for Theoretical Physics (ICTP) a Joint IAEA-ICTP International School on radioactive waste cementation.

Nuclear energy is a reliable solution to a finite energy supply from fossil fuels and climate change. All Member States (MSs) that benefit from the peaceful uses of nuclear energy have some amounts of radioactive waste to manage in a way that it does not present a burden to future generations. Nuclear waste management is a core issue for sustainable development and long-term viability where immobilization of nuclear waste using durable waste forms plays a key role aiming to ensure a high degree of safety during storage, transportation and waste disposal.

Cementitious matrices are suitable for the long-term immobilization of a variety of generated radioactive wastes with different chemical compositions, due to chemical and physical properties of the final material. Indeed, hydrated products may be formed by the participation of some of the waste chemical species in the hydration process; some species may be adsorbed on the several hydrated compounds formed, and a significant amount of liquid containing soluble salts can be restrained in the highly tortuous porous network formed in the hardened grout. Depending on the waste composition and geochemistry of the disposal facility, different cementitious materials (conventional and novel compositions) are used to generate waste matrices in waste management systems for safe storage and disposal of radioactive wastes.

Cementation processes for the immobilization of nuclear wastes are now regarded as technically mature with a high degree of acceptance as indicated by the large amounts of operational industrial waste

encapsulation plants. Most of the existing technologies have been developed for the conditioning of large amounts of operational radioactive waste from nuclear power plants and other nuclear fuel cycle facilities, resulting in a large volume of information available on proven cementation waste conditioning processes. However, novel approaches are continuing to be devised for the encapsulation of new waste streams (resulting from past activities and reactor decommissioning) and to improve material performance and technologies.

The proposed International School on Nuclear Waste Cementation will be based on the successful implementation of IAEA Coordinated Research Project on Behaviours of Cementitious Materials in Long Term Storage and Disposal held in 2007-2010 (IAEA TECDOC-1701), and three International Symposia on Cement-Based Materials for Nuclear Wastes NUWCEM 2011, NUWCEM 2014 and NUWCEM 2018.

The school is devoted to technological and scientific bases for nuclear waste cementation. Specific topical areas within the scope of the workshop include:

1. Basics of cement chemistry (including curing mechanism);
2. Different cement phase-waste interactions (designing of cement matrix for waste composition);
3. Formulation and characterization of cement-based matrices;
4. Technological approaches of waste cementation (advantages and drawbacks of the different types of processes);
5. Chemical durability and long-term performance: experimental and modelling approaches;
6. Retention of radionuclides by cementitious materials;
7. Behaviour of cement-based materials under irradiation;
8. Influence of geochemistry of disposal site on durability of disposed cementitious matrixes; and
9. The potential of alternative binders (alkali-activated binders, phosphate binders, calcium aluminate and sulfoaluminate binders) for the conditioning of deleterious wastes.

The school will bring together researchers from the area of materials science with a focus on cementitious materials for nuclear waste immobilisation and will promote scientific exchange of current advances among experts.

B. Objectives

The purpose of this virtual school is to transit information from lecturers to participants related to scientific basis underpinning the use of cement to immobilize radioactive waste. The scope will cover cement waste form chemistry, formulations, durability and performance.

C. Expected Outcomes

This virtual workshop will assist personnel from nuclear energy research, materials science and waste management to better understand and appreciate the wide range and full potential of cement science and technology tools and methods devoted to cementation and properties of cementitious materials. Participants will become acquainted with their international peers and will have a unique opportunity to establish links for their mutual support. Knowledge transfer will be facilitated between individuals from programmes at various stages of development.

D. Role of the Participants at virtual school

This virtual school is a new method for the transferring of knowledge as the COVID-19 pandemic situation restricts participants to travel to Trieste. The entire school will be managed and delivered remotely and will occur over a significantly longer time frame (approximately 4-6 weeks rather than the traditional five day conventional in-person lecturing). The virtual school will rely on both planned and ad hoc video or audio conference calls in addition to individual home-based assignments based on case studies. It is envisaged that the overall time commitment required of the participants during this extended period will be approximately the same as that required for a conventional five -day school in Trieste. The virtual lecturing of the school will be solely through the use Cisco WebEx, Microsoft Teams, SharePoint and similar tools.

E. Timeline

14/5/6 October 2020
Kick-off meeting(s) – one or more (time zone dependant) virtual meetings will be held via WebEx or Teams to introduce the lecturers and participants of the proposed school and answer general administrative questions.

Week 14-16 October 2020
Obtain presentations and certificate of attendance questionnaire from SharePoint site at: link to share point or through IPN

Week 19-22 October 2020 and Week 27-30 October 2020 (3 hour virtual school per day)
Virtual school by lecturers based on themes - time zone dependant presentations will be given via WebEx or Teams (information based on questions and additional information)

2-6 November 2020
Participants review presentations and relevant case studies and forward 1 question per lecture and solution of case studies to W.Meyer (W.Meyer@iaea.org). Questions will be forwarded to presenters on 9 November 2020.

Week 16 -20 November 2020 and Week 23-27 November 2020 (3 hour virtual school per day)
Virtual school by lecturers with enriched information based on questions and answers to case studies. - time zone dependant presentations will be given via WebEx or Teams.

4 December 2020
Complete questionnaire and forward to W.Meyer (W.Meyer@iaea.org) in order to obtain "Certificate of Attendance". (Answers to questionnaire will be randomly during lectures).

F. Collaboration Tools

This project will make extensive use of online collaboration tools. The Agency will setup a SharePoint site for the project; which will be closed and access will be granted only by request to the Scientific Secretary. The SharePoint site will serve as the document repository for all documents. In addition to typical documents (MS Word, Excel, etc.), the site will also house a number of “How To” videos produced by the Agency to help facilitate telecommunications issues and videos regarding the background and aim of this project. The SharePoint site will also use a message board function to allow participants to post questions about specific topics.

Access to the Microsoft Teams platform will be arranged for all of the participants. This platform is easy to use for 1-on-1 and small group chats, typically scheduled on an Ad Hoc basis by the participants. Larger meetings, if needed, will be done via the WebEx platform (the Agency will facilitate this).

The SharePoint site can be found at: link to share point or through IPN.

Familiarisation and training on the tools to be used will be provided, in advance, upon request to Ms. Marina Tolstenkova M.Tolstenkova@iaea.org

G. Proposed time slots for part 1 of virtual school

	WEEK 19-22 OCTOBER 2020 (3 HOUR VIRTUAL SCHOOL PER DAY)				WEEK 27-30 OCTOBER 2020 (3 HOUR VIRTUAL SCHOOL PER DAY)			
Virtual 1	**Monday 19 Oct 2020**	**Tuesday 20 Oct 2020**	**Wednesday 21 Oct 2020**	**Thursday 22 Oct 2020**	**Tuesday 27 Oct 2020**	**Wednesday 28 Oct 2020**	**Thursday 29 Oct 2020**	**Friday 30 Oct 2020**
Theme	**Basics of cement chemistry (including curing mechanism);** **Different cement phase-waste interactions (designing of cement matrix for waste composition);**	**Formulation and characterization of cement-based matrices;** **Potential of alternative binders;**	**Retention of radionuclides by cementitious materials;** **Behaviour of cement-based materials under irradiation;**	**Chemical durability and long-term performance: experimental and modelling approaches;**	**Influence of geochemistry of disposal site on durability of disposed cementitious matrixes;**	**Technological approaches of waste cementation;**	**Participant lectures**	**Participant lectures**
10h00 - 10.45	IAEA's perspective on the role of cementation technologies in processing radioactive waste. (Willie Meyer)	Different cement-waste interactions. (Celine Cau-Dit-Coumes)	Fundamental aspects of leaching processes. (John Provis)	Cement composition with high radiation stability. (Vladimir G. Petrov)	Cement rheology and its importance in immobilization. (John Provis)	Grout composition for large structures. (Christine Langton)	Participant lectures	Participant lectures
10.45 11.30	Basics of cement chemistry (including curing mechanism). (Nailia Rakhimova)	Formulation and characterization of cement-based matrices. (Andrey P. Varlakov)	Static leaching tests. (Rehab O. Abdel Rahman)	Improving radionuclide retention in cementitious waste forms using getters. (Matthew Asmussen)	Experimental evidence of geochemistry of disposal site (Vaalputs) on durability of disposed cementitious matrixes. (Willie Meyer)	Cement encapsulation of radioactive scale NORM waste from oil industry. (Michael I. Ojovan)	Participant lectures	Participant lectures
11.30- 11.45	Coffee/tea break	Coffee/tea break	Coffee/tea break	Coffee/tea break	Coffee/tea break	Coffee/tea break	Coffee/tea break	Coffee/tea break
11.45- 12.30	Technological approaches of waste cementation (advantages and drawbacks of the different types of processes). (Andrey P. Varlakov)	Potential of alternative binders (for the conditioning of deleterious wastes. (Celine Cau-Dit-Coumes)	Chemical durability and long-term performance of cement-based materials, with experimental and modelling. (Laure Chomat)	Parameters effecting the retention of radionuclides by cementitious materials. (Vladimir G. Petrov)	Long term modeling of cementitious waste forms in a shallow disposal environment. (Matthew Asmussen)	Examples of cementation matrices designed for sludges (PC, M-S-H, alkali-activated). (John Provis)	Participant lectures	Participant lectures
12.30 13:15	Waste streams for cementation technology. (Rehab o. Abdel Rahman	Potential of alternative binders (alkali-activated binders, phosphate binders. (Nailia Rakhimova)	Acoustic emission monitoring of cementitious wasteforms. (Michael I. Ojovan)	Theoretical lecture on durability of cemented waste. (Christine Langton)	Natural and technogenic violation of geochemical stability of cement materials. (Vladislav A. Petrov)	Improving radionuclide retention in MKP cementitious waste forms by phase manipulation. (Swikisani Mudanalwo Mualusi NELWAMONDO)	Participant lectures	Participant lectures

Austrian Time Zone

Proposed time slots for part 2 of virtual school

	WEEK 16-19 NOVEMBER 2020 (3 HOUR VIRTUAL SCHOOL PER DAY)				WEEK 24-25 NOVEMBER 2020 (3 HOUR VIRTUAL SCHOOL PER DAY)		
Virtual 2	**Monday 16 Nov 2020**	**Tuesday 17 Nov 2020**	**Wednesday 18 Nov 2020**	**Thursday 19 Nov 2020**	**Tuesday 24 Nov 2020**	**Wednesday 25 Nov 2020**	**30 Nov 2020 to 4 December 2020**
Theme	**Basics of cement chemistry (including curing mechanism);** **Different cement phase-waste interactions (designing of cement matrix for waste composition);**	**Formulation and characterization of cement-based matrices;** **Potential of alternative binders;**	**Retention of radionuclides by cementitious materials;** **Behaviour of cement-based materials under irradiation;**	**Chemical durability and long-term performance: experimental and modelling approaches;**	**Influence of geochemistry of disposal site on durability of disposed cementitious matrixes;**	**Technological approaches of waste cementation;**	**"Certificate of Attendance".**
10h00 - 10.45	Basics of cement chemistry (including curing mechanism). (Nailia Rakhimova)	Different cement-waste interactions. (Celine Cau-Dit-Coumes)	Fundamental aspects of leaching processes. (John Provis)	Cement composition with high radiation stability. (Vladimir G. Petrov)	Cement rheology and its importance in immobilization. (John Provis)	Grout composition for large structures. (Christine Langton)	**Complete questionnaire and forward to W.Meyer (W.Meyer@iaea.org) in order to obtain "Certificate of Attendance". (Answers to questionnaire was supplied randomly during lectures).**
10.45 11.30	Technological approaches of waste cementation (advantages and drawbacks of the different types of processes). (Andrey P. Varlakov)	Formulation and characterization of cement-based matrices. (Andrey P. Varlakov)	Static leaching tests. (Rehab O. Abdel Rahman)	Improving radionuclide retention in cementitious waste forms using getters. (Matthew Asmussen)	Experimental evidence of geochemistry of disposal site (Vaalputs) on durability of disposed cementitious matrixes. (Willie Meyer)	Cement encapsulation of radioactive scale NORM waste from oil industry. (Michael I. Ojovan)	
11.30-11.45	Coffee/tea break	Coffee/tea break	Coffee/tea break	Coffee/tea break	Coffee/tea break	Coffee/tea break	
11.45-12.30	Waste streams for cementation technology. (Rehab O. Abdel Rahman)	Potential of alternative binders (for the conditioning of deleterious wastes. (Celine Cau-Dit-Coumes)	Chemical durability and long-term performance of cement-based materials, with experimental and modelling. (Laure Chomat)	Parameters effecting the retention of radionuclides by cementitious materials. (Vladimir G. Petrov)	Long term modeling of cementitious waste forms in a shallow disposal environment. (Matthew Asmussen)	Examples of cementation matrices designed for sludges (PC, M-S-H, alkali-activated). (John Provis)	
12.30 13:15	Examples of cement waste form development and qualification – boric acid concentrate and high sulphate sludge cementation. (Federica Pancotti)	Potential of alternative binders (alkali-activated binders, phosphate binders). (Nailia Rakhimova)	Acoustic emission monitoring of cementitious wasteforms. (Michael I. Ojovan)	Enriched lecture or case study regarding durability of cemented waste. (Christine Langton)	Natural and technogenic violation of geochemical stability of cement materials. (Vladislav A. Petrov)	Feedback from participants / lecturers and closure of school.	

Austrian Time Zone