# MOBILITY MISSION REPORT

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KLIKNĚTE NEBO KLEPNĚTE SEM A ZADEJTE TEXT.

## MISSION TITLE

Attendance to Symposium on Energy Geotechnics (SEG23)

## DESCRIPTION

### Concerned organisations

The International Symposium on Energy Geotechnics (SEG23) was celebrated to bring together the academics and industrial partners working on energy-related geotechnics. It was organized by the Technical University of Delft (TUDelft) on behalf of the Technical Committee 306 of the International Society of Soil Mechanics. The concerned organizations were:

- Waste management organisations
- Research entities
- Universities
- Industry

### Concerned infrastructures or facilities

Not applicable

### Concerned phases

Phase 3: Facility construction

Phase 4: Facility operation and closure

Phase 5: Post-closure

## Themes and topics

Theme 3: Engineered barrier system (EBS) properties, function and long-term performance

- Clay-based backfills, plugs and seals
- EBS system understanding

Theme 4: Geoscience to understand rock properties, radionuclide transport and long-term geological evolution

- Long-term stability (uplift, erosion and tectonics)
- Perturbations (gas, temperature and chemistry)

## Keywords

Accelerating the energy transition; Granular-type bentonite; Gas transport; Microstructural evolution

# EXECUTIVE SUMMARY

The Symposium on Energy Geotechnics (SEG23) encouraged researchers working on challenging topics related to the energy geotechnics field, including geothermal energy, energy geostructures, energy storage, carbon sequestration and radioactive waste disposal to present their most recent advances. This symposium provided a platform to share research experience on various topics of energy geotechnics. I had an accepted abstract titled 'Multi-scale investigation on gas transport behaviour of compacted granular bentonite under partially saturated states'. For this purpose, I made an oral presentation about this topic in Parallel Session - Mini-Symposium: Gas migration in geomaterials during the conference. The present work underlined the microstructure of compacted granular bentonite can be modified during gas transport, dependent on hydro-mechanical states, which can further affect the gas transport behaviour. After presenting, I received valuable questions and suggestions from fellow researchers, which have contributed to improving my subsequent research. Moreover, I attentively attended their presentations, expanding my academic horizons and research interests. For instance, I discovered that the field related to investigating carbon dioxide storage should intersect with my research background fitting with high-level nuclear waste geological repositories. Furthermore, considering that my tests were primarily at a laboratory scale, the on-site experimental findings and numerical simulation methods reported by many researchers during this conference held significant relevance to narrowing my knowledge gap. I also have known renowned experts worldwide in my research field, which motivated me for future international scientific exchanges. In conclusion, I believe that I have achieved the original purpose of attending this symposium.

# 1. MISSION BACKGROUND

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## 1.1. R&D background

The Symposium on Energy Geotechnics (SEG23) aimed to contribute to a scientific exchange among worldwide researchers related to the energy geotechnics field, including geothermal energy, energy geostructures, energy storage, carbon sequestration and radioactive waste disposal. I had an accepted abstract titled 'Multi-scale investigation on gas transport behaviour of compacted granular bentonite under partially saturated states'. I made an oral presentation about this topic in Parallel Session - Mini-Symposium: Gas migration in geomaterials during the conference. The present work underlined the microstructure of compacted granular bentonite can be modified during gas transport, dependent on hydro-mechanical states, which can further affect the gas transport behaviour.

## 1.2. Mission objectives

To present current results about multi-scale investigation on gas transport behaviour of compacted granular bentonite under partially saturated states, which was developed during the WP GAS of EURAD

To broaden a PhD student's horizons and inspire more innovative ideas

## 1.3. Mission request

Attending the Symposium on Energy Geotechnics (SEG23)

Making an oral presentation

Exchanging scientific ideas with researchers

## 1.4. Mission composition

### Host organisation

Technical University of Delft (The Netherlands)

### Host facility

The Delft University of Technology (The Netherlands)

### Mission dates

3-5 October 2023

# 2. MAJOR PRACTICES, TECHNIQUES, METHODS, TOOLS OR SYSTEMS OPERATED OR STUDIED

Klikněte nebo klepněte sem a zadejte text.

## 2.1. Practice, technique, method, tool or system operated or studied during the mission

Taking part in The Symposium on Energy Geotechnics (SEG23)

### Description

This international conference effectively organized many theme sessions related to the energy geotechnics field, including geothermal energy, energy geostructures, energy storage, carbon sequestration and radioactive waste disposal

### Usage

At this conference, I made an oral presentation and took part in many parallel sessions and the panel discussion of TC106 (Unsaturated soils) and TC308 (Energy Geotechnics)

### Benefits

Presenting my contributions to a better understanding of gas migration in geomaterials, broadening my academic horizons and encouraging in scientific exchange the future

### Limitations

A systematical understanding of scholars' investigation and experience was difficult only through short presentations and discussions

### Applicability

After presenting, valuable questions and suggestions received from fellow researchers will be helpful in improving my subsequent research and inspiring more innovative ideas

## 2.2. Practice, technique, method, tool or system operated or studied during the mission

Klikněte nebo klepněte sem a zadejte text.

### Description

Not applicable.

### Usage

Not applicable

### Benefits

Not applicable

### Limitations

Not applicable

### Applicability

Not applicable

## 2.3. Practice, technique, method, tool or system operated or studied during the mission

Klikněte nebo klepněte sem a zadejte text.

### Description

Not applicable

### Usage

Not applicable

### Benefits

Not applicable

### Limitations

Not applicable

### Applicability

Not applicable

## 2.4. Practice, technique, method, tool or system operated or studied during the mission

Klikněte nebo klepněte sem a zadejte text.

### Description

Not applicable

### Usage

Not applicable

## Benefits

Not applicable

## Limitations

Not applicable

## Applicability

Not applicable

# 3. MISSION FINDINGS AND CONCLUSIONS

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## 3.1. Lessons learned and conclusions

Many theme sessions organized at this international conference aligned with my research interests, so I paid close attention to the relevant keynotes and presentations. For instance, Pedro Luis Martín presented 'Gas breakthrough behavior of the Spanish reference bentonite'. I acquired valuable insights from his presentation on gas migration in saturated bentonite and its corresponding hydro-mechanical responses. I was also impressed by the presentation 'Evidence of gas formation and venting in organic soils: experimental evidence and modelling approach', reported by Inge De Wolf. The presentation emphasized that under climate change conditions (warming), greenhouse gas production can be accelerated within organic soils. Therefore, studying the gas migration properties of shallow soils on the earth's surface could hold significant relevance in the future. These insights can enrich my research background and serve as a reference for my future research choices. Another key takeaway was from the presentations about numerical simulation work on gas migration in geomaterials. For example, Joaquin Liaudat talked about 'Modelling gas fracturing experiments in saturated clay using zero-thickness interface elements'. Among these presentations, I was impressed by Gilles Corman's work, as he considered the effect of a multi-porosity network in numerical modelling and displayed the simulated results comparable to the experimental ones. Furthermore, I participated in the panel discussion: TC106 (Unsaturated soils) and TC308 (Energy Geotechnics). There, numerous well-known experts and scholars in the relevant fields expressed their views on the relationship between unsaturated soils and energy geotechnics. By listening, I got a deeper understanding of the practical applications of unsaturated soil mechanics in energy geotechnical engineering, which further enriched the knowledge of my research background. Not only the mentioned aspects, but overall, I gained significantly from attending this international conference. Therefore, I am profoundly grateful for the funding provided by the EURAD Mobility Programme to support my participation in this international conference.

## 3.2. Relevant findings and conclusions for home organisation

Not applicable

## 3.3. Relevant findings and conclusions for host organisation

Not applicable

## 3.4. Relevant findings and conclusions for other organisations

Not applicable

# 4. POTENTIALS FOR IMPROVEMENT OR DEVELOPMENT

## 4.1. Generic potentials

Not applicable

## 4.2. Potentials for home organisation

Not applicable

## 4.3. Potentials for host organisation

Not applicable

# APPENDICES

## Mission journal

02/10/2023

Travel from Barcelona (Spain) to Delft (The Netherlands)

03/10/2023:

Attending 'Conference opening' and listening 'Keynote 1'

Joining in Parallel Session: Mini-Symposium ‘Gas migration in geomaterials’

Making my oral presentation in this session: Multi-scale investigation on gas transport behaviour of compacted granular bentonite under partially saturated states

Listening ‘Keynote 2’ and Joining in Parallel Session ‘Material behaviour’

04/10/2023

Listening ‘Keynote 3’ and Joining in Panel discussion: TC106 (Unsaturated soils) and TC308 (Energy Geotechnics)

Joining in Parallel Session: Mini-Symposium ‘Multiphysics and multiscale interactions in the context of energy storage and CO2 sequestration’

Listening ‘Bright Spark Lecture 1’ and ‘Bright Spark Lecture 2’

Attending Parallel Sessions ‘Energy and energy product storage’ and ‘Geological disposal of radioactive waste’

05/10/2023

Attending ‘Keynote 4’ and Parallel Sessions ‘Geological disposal of radioactive waste’ and ‘Energy and energy product storage’

Coming back to Barcelona

# MISSION BENEFICIARY

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# PARTNER EXPERTS CONTRIBUTING TO THE MISSION

## Host organisation experts

Not applicable

## Home organisation experts

Not applicable

## Other organisations experts

Not applicable

# REPORT APPROVAL

| Date | Beneficiary | Home mentor/supervisor | Host mentor/supervisor |
|---|---|---|---|
| Date of last signee | Hao Zeng | Enrique Romero | Name |
| | Visa<br>Hao Zeng | Visa<br>Enrique Romero Morales<br>DNI 42067387L;<br>Date: 03/11/2023 | Visa |