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Administrative report: TC5 - Environmental geotechnics

Compte rendu sur la CT-5

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ABSTRACT
This report gives details of the TC5 terms of reference, members and activities over the past 4 years, including information regarding any conferences, symposia or workshops planned for the future. The report gives also details of the TC5 special publication arising directly out of the work of TC5 during the last years. The publication deals with the main themes related to environmental geotechnics: waste disposal by landfills, remediation of contaminated soils and underwater geoenvironmental issues. A summary of the contents and purposes of the TC5 publication is given.

RÉSUMÉ
Ce rapport présente les buts, les membres, et les activités du TC5 pendant les 4 dernières années, comprenant les conférences, symposia et workshops planifiées dans le futur. Le rapport décrit aussi la publication spéciale résultant de l'activités du TC5 durant la période 2001-2005. La publication traite les sujets principaux de la géotechnique de l'environnement: les décharges de déchets, l'assainissement des sols pollués et les problèmes geo-environnementaux en milieu aquatique. Un résumé des buts et des contenus de la publication et aussi donné.

1 TERMS OF REFERENCE

The main terms of reference of the Technical Committee N.5 are as follows:
- To promote co-operation and diffuse knowledge in the area of Environmental Geotechnics
- To promote advancements in research activities, professional applications and standardisation in the field of Environmental Geotechnics
- To cooperate and contribute to the organisation of congresses, conferences and symposia specifically devoted to Environmental Geotechnics or other venues incorporating relevant parts of it
- To establish co-operation and exchange of knowledge with national, international, public and private institutions for increasing visibility and promoting Environmental Geotechnics skills and experiences
- To promote Environmental Geotechnics skills for involvement in preparation and updating of laws and regulations by government agencies and public institutions.

2 MEMBERSHIP

The list of the TC5 members was continuously updated and integrated over the period 2001-2005.
62 individuals are currently TC5 members (Table 1), from both the academic and professional worlds. These members come from 38 different Countries and from all the Continents.
Core-members and Task Force Leaders (listed in Table 1) were selected among the members. Their primary tasks are to organise workshops and seminars on topics of interest from the scientific and technical viewpoints, to participate as panellists or discussion facilitators at conferences, to collaborate as reviewers for conference papers and to develop the TC5 web-site. The task force leaders are also coordinators, together with the chairmen, of the activities for the TC5 report (see 6.)

3 ORGANISATION OF EVENTS

3.1 *Cooperation in organizing special events*

TC5 has been involved in the organization and planning of congresses, workshops and conferences' sessions related to Environmental Geotechnics, as follows:
- International workshop on "Clay Behaviour: Chemo-mechanical coupling, form nano-structure to engineering applications", Maratea (Italy), 2001
- IV International Congress on Environmental Geotechnics, IV ICEG, Rio de Janeiro (Brazil), 11-15/08/2002
- XIII ECSMGE, Prague (Czech Republic), 25-28/08/2003
- International workshop on "Hydro-Physico-Mechanics of Landfills", Grenoble (France), 21-22/03/2005
- XIII ICSMGE, Osaka (Japan), 12-16/09/2005
- VIII IGS International Conference, Yokohama, Japan, 18-22 September 2006.
- V International Congress on Environmental Geotechnics, V ICEG, Cardiff (UK), 26-30/06/2006

For the V ICEG, a Congress Advisory Committee was created to deal with the scientific program, the names of people in the stage, paper reviewers, etc. The theme of the congress is: "Sustainable Development: Issues, Challenges, and Responsibilities of Environmental Geotechnics". All the TC5 core-members and task-force leaders are reviewers of the papers for the V ICEG. The provisional congress programme of the V ICEG is available on www.grc.cf.ac.uk/5iceg/.

3.2 *TC5 Workshops*

The following TC5 international workshops were organised in conjunction with ISSMGE international conferences:
- "Use of geosynthetic clay liners for waste containment", 29 August 2003, XIII ECSMGE, Prague;

- "Environmental geotechnics – TC5 Report", 15 September 2005, XVI ICSMGE, Osaka.

All presentations are and will continue to be available on the TC5 web site for downloading.

Table 1. TC5 membership (CH = chairman; CM = core member; TFL = task force leader; M = member)

Position	*Name*	*Country*
CM	Almeida M.	Brazil
CM	Alshawabkeh A.	USA
M	Baikstys R.	Lithuania
M	Baumann J.	Denmark
TFL	Benson C.H.	USA
M	Bida A.	Albania
M	Bonifazi J.A.	Argentina
M	Boscov M.E.	Brazil
CM	Bouazza A.	Australia
M	Bozhanov E.T.	Kazakhstan
M	Burnes S.	USA
M	Cancelli A.	Italy
TFL	Clark R.	United Kingdom
M	Coumoulos D.	Greece
M	Daniel D.E.	USA
M	de Mello L.G.	Brazil
M	Fourie A.	South Africa
CM	Fratalocchi E.	Italy
TFL	Gens A.	Spain
M	Gourc J.P.	France
M	Hermanns Stengele R.	Swiss
M	Heerten G.	Germany
M	Herstus J.	Czech Republic
M	Hofman R.	Austria
M	Holeyman A.	Belgium
M	Iturbe R.	Mexico
TFL	Jefferis S.A.	United Kingdom
M	Jesenak J.	Slovak Republic
M	Kachrillo M.	France
M	Kalchev I.	Bulgaria
TFL	Kamon M.	Japan
CM	Katsumi T.	Japan
M	Katzenbach R.	Germany
M	Komine H.	Japan
M	Kovacevic Zelic B.	Croatia
M	Leppanen M.	Finland
M	Lopes M.L.	Portugal
M	Loxham M.	Netherlands
CH	Manassero M.	Italy
M	Mawlawi F.	Syria
M	Meyer Z.	Poland
M	Neupane K.M.	Thailand
M	Olinic E.	Romania
M	Orr T.	Ireland
M	Pasqualini E.	Italy
M	Pavlik G.N.	Russia
M	Rowe R.K.	Canada
TFL	Sêco e Pinto P.	Portugal
CH	Shackelford C.D.	USA
M	Smith D.	Australia
M	Sopeña L.	Spain
M	Srivastava R.K.	India
M	Stragys V.	Lithuania
M	Szabo I.	Hungary
M	Thomas H.R.	United Kingdom
M	Troncoso J.H.	Chile
M	Van den Broeck M.	Belgium
CM	Van Impe P.O.	Belgium
M	Wolski W.	Poland
M	Yanful E.	Canada
M	Yeung A.T.	Hong Kong
M	Zaharov N.I.	Kazakhstan

3.3 *TC5 Meetings*

The planning, updating and checking of TC5 activities were periodically done by meetings often organised on the occasion of special international events, in order to encourage participation of the members:

- Plenary meeting - Istanbul, August 2001 (XV ICSMGE)
- Core Members meeting - Darmstadt, 14 March 2002
- Core Members meeting - Rio de Janeiro, 11 August 2002 (IV ICEG)
- Plenary meeting - Rio de Janeiro, 15 August 2002 (IV ICEG)
- Core Members meeting - Prague, 27 August 2003 (XIII ECSMGE)
- Plenary meeting - Grenoble, 20 March 2005 (workshop on HPM Landfills)
- Core Members meeting - Osaka, 13 September 2005 (XVI ICSMGE)

The meeting agendas and minutes are available on the TC5 web site (see 5).

4 COOPERATION WITH INTERNATIONAL ORGANISATIONS

Co-operation has been developed with the European Network "Geo-Env-Net" (network among private and public companies and universities financed by the EC in order to promote exchanges of information and scientific and technical knowledge) with different kinds of interactions that exploit the common aims and topics of the two organizations.

A cooperation with the International Geosynthetics Society is now in progress; in particular, TC5 is involved in organizing the technical session W-2 "Liners on Slopes (TC5 Special Session)" at the next International Conference on Geosynthetics (Yokohama, 2006) and IGS will be involved in the organisation of the technical sessions on "Testing & Materials" and "Remediation" at the V ICEG (Cardiff, 2006).

Within the agreement to pursue collaboration among ISSMGE and the sister societies: International Society for Rock Mechanics (ISRM) and the International Association of Engineering Geology (IAEG), a new Joined Technical Committee on Geo-Environmental Engineering (JTC 10) will be created under the leadership of ISSMGE. Therefore, the TC5 member group will play a crucial role within this new JTC.

5 TC5 WEB-SITE

The ITC5 web-site have been created and implemented, available at: www.geoforum.com/tc5/home. Information on the web site includes the TC5 meetings, International Conferences, Workshops and Symposia relevant to Environmental Geotechnics. Agendas and minutes of the TC5 meetings are available on the web platform, as well as any documents related to TC5 activities.

6 TC5 REPORT

One of the main and most demanding activities of the TC5 in the period 2001-2005 was to prepare a TC5 report devoted to Environmental Geotechnics. The report is a scientific and technical state of the art addressed to practitioners and researchers in the field of Environmental Geotechnics.

The report deals with the main themes related to Environmental Geotechnics: waste disposal by landfills, remediation of contaminated soils, underwater geoenvironmental issues. The role and functions of all the fundamental components for safe disposal of polluting materials or remediation of polluted lands are illustrated for the purpose of proper design, control and

management. Attention also is given to the research in progress that is devoted to the improvement of the knowledge on design parameters that significantly influence the performance of modern waste landfills and containment systems.

The book consists of the following six chapters:

1. Design basics and performance criteria
2. Managing contaminated sites
3. Traditional and innovative barriers technologies and materials
4. Underwater geo-environmental issues
5. Landfill design within seismic areas
6. Research and education

Two additional chapters, namely "Nuclear waste storage" and "Regulations and technical guidelines", are now in progress. The former is focused on further developing geotechnical knowledge and involvement in the field of the nuclear waste storage; the latter focused on collecting, analyzing and summarizing the state of the art of the official regulations, technical recommendations and guidelines available worldwide.

Chapters 1-6 were placed on the ITC5 web-platform for soliciting comment from the TC5 members before the final review by official referees (scientific and technical experts) chosen by the TC5 Chairmen and Task Force Leaders. The quasi final version of the TC5 Report will be ready on CD and presented at the XVI ICSMGE (Osaka, September 2005). The final version of TC5 Report will be published and distributed at the V ICEG (Cardiff - June, 2006).

Chapter 1: Design Basics and Performance Criteria.
The design basics and performance criteria in the field of environmental geotechnics are illustrated in this chapter. In particular, after a detailed collection of definitions and proper terminology, the main phases and problems of design, construction, quality control and risk assessment are treated, in order to give an introduction for the following chapters and to define each term consistently and clearly. The chapter is divided in six paragraphs, namely: (1) Flow diagram, (2) Terminology and definitions, (3) Classification and characterisation, (4) Risk assessment, (5) Lifetime of components, and (6) Quality assurance and control.

Chapter 2: Managing Contaminated Sites
After a detailed introduction on risk assessment and site assessment, many different systems for remediation of contaminated lands are analyzed in terms of technology, methodology and strategy. The paragraphs are devoted to: (1) Environmental risk for geotechnical engineering, (2) General structure of contaminated land legislations, (3) Assessment of the site, (4) Practical consideration in remedial design and implementation, and (5) Risks and risk based methodologies.

Chapter 3: Traditional and Innovative Barriers Technologies and Materials
This chapter summarizes and develops some of the main geotechnical topics related to modern waste containment barriers. Most of the available literature is quoted in order to offer the possibility to gain more insight on all the aspects illustrated. The following details are given:

- Construction procedures for field-scale performance of compacted clay liners.
- Current and correct employment of composite barriers consisting of mineral liners or geosynthetic clay liners, placed in intimate contact with a geomembrane.
- Laboratory and field tests for the evaluation of barrier components and monitoring systems for assessing full-scale liner performance.
- Compatibility, diffusive transport and sorption phenomena on the overall performance of barrier systems.
- Biogas migration from landfills and the consequent gas-barrier interaction.
- Natural and man-made attenuation layers below waste deposits in order to reduce the impact of pollutants on groundwater.
- The role of deformation and settlement of subgrade layers on the performance of mineral barriers.
- Geosynthetic clay liners as pollutant containment barriers.

Chapter 4: Underwater Geoenvironmental Issues
The management and utilization of waste sludge and dredging are the focus of this chapter. Recent developments in dredging operations and containment techniques are also described. Waste and dredged sludge contamination can still be a daunting problem from a technical and regulatory standpoint. Many utilization techniques are available under a carefully controlled operation system. In particular, beneficial use of dredged materials as reclamation is introduced with case studies for land use. The chapter distinguishes: (1) General view of underwater problems; (2) Basic characteristics of underwater materials; (3) Dredging operations, (4) Dredging and clean-up underwater materials; (5) Spill water treatment; (6) Odour control; (7) Containment and isolation; (8) Remediation of contaminated sludge; and (9) Beneficial uses of dredged materials.

Chapter 5: Landfill Design within Seismic Areas
The performance of solid waste landfills and lining systems during earthquakes is addressed and the analysis of solid waste landfill stability during earthquakes is presented. Both experimental methods and mathematical methods are described. Selection of design earthquakes is presented, as well as determination of material properties for dynamic analysis. The seismic response analysis and the assessment of liquefaction potential of landfills and foundations are discussed.

The dynamic response of geomembranes liners is addressed. Some case histories are described to illustrate the performance of solid waste landfills during earthquakes. Monitoring and safety control of landfills are analysed.

Chapter 6: Education
The chapter begins by considering some points of view expressed by outstanding geotechnical engineers and professors on the teaching of traditional and advanced geotechnics. Thereafter, an attempt is made to adopt the main points made by these outstanding geotechnicians to aspects related to the environmental geotechnics education to provide a consistent layout for teaching environmental geotechnics concepts after a solid background on basic geotechnical principles has been achieved. Burland's (1987) triangle is applied to the teaching of environmental geotechnics and the considerations reported in the following are submitted for discussion, comments and contributions. Under the light of the aforementioned observations, the summary of an investigation on the main features of the undergraduate and graduate education programs of some Universities, primarily in Europe (EU) and United States (USA), is given in an attempt to frame the main trends arising from the different basic schools.

7 FUTURE ACTIVITIES

The following main activities are planned for the near future:

- Final supervision of the TC5 report (expanding the coverage among the chapters)
- Publication of the report (V ICEG - Cardiff, 2006)
- Finalisation of the chapters on "Nuclear waste storage" and "Recommendations and Technical Guidelines"
- Organisation of the V ICEG, Cardiff (2006)
- Cooperation in organising the next International Conference on Geosynthetics (Yokoama, 2006).
- Supporting activities for the implementation of JTC 10 on Geo-Environmental Engineering and interaction with the sister societies (ISRM and IAEG).