

UNITWIN UNESCO Chairs Programme

UNESCO Chair Annual Progress Report

UNESCO Chair:	Development of a Sustainable Geoenvironment www.unesco.org.uk/CardiffChair
Institution:	Cardiff University Geoenvironmental Research Centre, Cardiff School of Engineering, Queens Buildings, The Parade, Newport Rd, Cardiff, CF23 3AA, United Kingdom www.cardiff.ac.uk
Date Chair Established: (mm, yyyy)	April 2009
Period of Activity Under Report: (mm, yyyy - mm, yyyy)	April 2009 – July 2010
Report Established By: (name, position)	Professor H R Thomas: Chairholder. Email: thomashr@cardiff.ac.uk; Tel: +44 (0)29 2087 4279

1. Executive Summary:

*Major outcomes, results and impact of the Chair in relation to its objectives as stated in Article 2 of the Chair Agreement (between the Institution and UNESCO)
(Not exceeding 500 words)*

Article 2 of the Chair Agreement between Cardiff University and UNESCO states: "The purpose of the Chair shall be to promote an integrated system of research, training, information and documentation in the field of the development of a sustainable geoenvironment". The Chair was established in April 2009. This report covers therefore the first year of operation of the Chair.

The proposal documentation submitted by the Chair Holder at the time of submission of the application showed that work in the first year would be focussed on two areas, namely:

- i) The involvement of key stakeholders (creation of Geoenvironmental Engineering clusters) and
- ii) Preparation of international project programme.

These areas of work were scheduled to last for 3 years and 2 years respectively. This report covers therefore the activities performed in these areas during the first year only of their planned operation.

The main outcomes, results and impact the Chair achieved during this period are reported under sections b) and c) of the report, namely "Conferences/Meetings" and "Interuniversity Exchanges/Partnerships". Details are given of nine Conferences/Meetings attended and 4 Interuniversity Exchanges/Partnerships.

Other activities to report include the award of the prestigious Mondialogo prize to a student from the Chair. Mr Dan Smith participated in the Mondialogo Engineering Awards, together with his overseas partner, Asha Kumar, from the Indian Institute of Science. Their project, supervised by Dr P Vardon, entitled 'Reuse of Waste Materials for a Sustainable Future' was ranked in the top 30 out of 900 entries. They not only investigated an innovative product but an innovative method of delivery – social enterprise.

The report also gives details of a significant new development in the work of the Chair, namely research into Low Carbon options in the area of a sustainable Geoenvironment. Attention will be focussed on Geo-energy problems, as a subset of the overall Geoenvironmental subject. We now therefore plan to extend the remit of the Chair to also encompass some aspects of this area of work.

2) Activities:
Overview of activities undertaken by the Chair in the reporting period

Article 2 of the Chair Agreement between Cardiff University and UNESCO states the following:

“The purpose of the Chair shall be to promote an integrated system of research, training, information and documentation in the field of the development of a sustainable geoenvironment. It will serve as a means of facilitating collaboration between high-level, internationally recognized researchers and teaching staff of the University and other institutions in United Kingdom and elsewhere in Europe and North America and in other regions of the world.

In the first phase, the Chair will focus on experiential learning using field demonstration projects designed to conserve and protect vulnerable groundwater resources in rural India and, building on the solution sets developed in India, the Chair will use these as a template for testing and application in West Africa, consistent with priorities determined by NEPAD and ministerial meetings. In phase 2, additional funding will be sought to extend the South-North-South exchange to other African countries.”

The detailed proposal documentation submitted by the Chairholder contained the following “Schedule of Major Activities”.

Activities	Year 1	Year 2	Year 3	Beyond Year 3
Phase 1				
Sustainable Groundwater Management				
• WP1: Involvement of key stakeholders (creation of Geoenvironmental Engineering clusters)				
• WP2: Preparation of International Project Programme				
• WP3: MSc/PhD projects, including distance learning				
• WP4: Joint research studies				
• WP5: e-forum/interactive web portal				
• WP6: Dissemination of the project results				
Phase 2				
• WP7: Development Strategy - Expansion of South-South and South-North-South Collaboration				

It can be seen that the work envisaged in Year 1 centred on Work Packages 1 and 2 (WP1 and WP2). WP1 is described as “Involvement of key stakeholders (Creation of Geoenvironmental Engineering Clusters)” and WP2 “Preparation of Integrated Project Programme”. Additionally it can be seen that the activities in WP1 are to last for 3 years, with those in WP2 for 2 years. This first year report covers therefore the starting phase of both of these activities.

The work package descriptions relevant to this reporting period, presented in the proposal documentation submitted by the Chairholder, are reproduced below.

WP	Title of work package	Action/Activities	Deliverable
(i)	Involvement of key stakeholders	- Establishment of Collaborative Partnership/ Consortium with key stakeholders (i.e. educational institutions, NGOs, Government Agencies) - Workshops engaging identified key stakeholders and relevant NGOs - Problem-specific interviews with key stakeholders	- Creation of Geoenvironmental Engineering clusters

(ii)	Preparation of International Projects	-Multidisciplinary project proposals submitted jointly by Project Teams -subject-specific project proposals submitted independently by project partners -identification of funding sources to sustain/extend project activities -identification of funding sources to develop in-depth research in indicated areas	Project proposals submitted to relevant External Support Agencies
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The above information hopefully sets the scene therefore for this the first “Annual Progress Report” for the Chair.

a) Education/Training/Research
(key education programmes and training delivered and research undertaken by the Chair in the reporting period)

i) Education	None was envisaged during this period, the first year of the Chair.
ii) Training	None was envisaged during this period, the first year of the Chair.
iii) Research	None was envisaged during this period, the first year of the Chair.

b) Conferences/Meeting
(key conferences and meetings organised by the Chair or to which its Chairholder contributed)

1. Meeting with WHO-CC. On 12 March 2010, the GRC hosted a visit from Dr David Russell and Prof Gary Coleman representing the WHO-Collaborating Centre for Chemical Incidents and Events (WHO-CC). Discussions were held regarding the background, objectives and activities of the UNESCO Chair and the WHO-CC. To achieve the aims of the Chair it is vital to bring health, social and engineering dimensions together, therefore, both sides decided to develop a programme for closer collaboration. A formal framework for the collaboration will be provided by a MoU.

2. Meetings with IISc. Dr P Vardon visited Indian Institute of Science (IISc) for 2 weeks in February/March 2010. A programme of meetings involving members of the Centre for Sustainable Technologies and members of the Civil Engineering faculty, including Prof Sudhakar Rao. A proposed programme of research work was outlined, including a proposal to study appropriate land contamination technologies for use in India.

3. Meetings with IIM. During the visit to IISc, Dr P Vardon met with Prof Anil Gupta from the Indian Institute of Management (IIM). The proposed work of the UNESCO chair was outlined as was the work of Prof Gupta in IIM, including the Honey Bee Network and the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI). A number of ideas were proposed and collaboration anticipated. As a result of this meeting an undergraduate student has spent 1 month at IIM this summer, investigating innovation from indigenous populations

4. Meetings in Uganda. As part of a trip working with the Engineers For Overseas Development (EFOD) in February 2010, Dr P Vardon arranged and attended meetings investigating the use of sustainable materials in the developing world. An investigation of the use and promotion of stabilised earth bricks and rainwater harvesting was undertaken.

5. Meetings with IIT (Roorkee). Dr K Murugesan from the Indian Institute of Technology Roorkee, visited the GRC from 6 June to 17 July 2010. It was agreed that joint activities should be organised under an umbrella of formal MoU which is anticipated to be signed in the first half of 2011. The following outputs were produced, a programme of collaboration, a preliminary work plan of activities and an outline programme for an international workshop.

6. Meetings with UNIDO, Ghana and Nigeria. A regional project to develop appropriate strategies for identifying sites contaminated by chemicals listed in Annexes A, B and/or C of Stockholm Convention. From 27-28 October 2009, West Africa 2nd Project Steering Committee Meeting was hosted by the GRC. The event has been attended by representatives of participating countries: Ghana and Nigeria, as well as executives from the UNIDO headquarter, Vienna, Austria and the regional office, Abuja, Nigeria. During this meeting Prof HR Thomas introduced the programme for UNESCO Chair and synergies between planned by the Chair activities and West

Africa project has been discussed.

7. Conference in Hangzhou. From 8-10 September 2009 Prof HR Thomas and Dr A Koj visited Zhejiang University, Hangzhou, China, where Prof HR Thomas delivered a keynote lecture at the Symposium on Geoenvironmental Engineering. In his lecture he tackled issues of the international development referring to UNESCO Chair's activities. The Symposium was organised by the MOE Key Laboratory of Soft Soils and Geoenvironmental Engineering, Zhejiang University, the Chinese Institution of Soil Mechanics and Geotechnical Engineering (CISMGE) and the Chinese Chapter of International Geosynthetics Society (CCIGS) and was supported by the National Natural Science Foundation of China, the K. C. Wong Education Foundation and Zhejiang University Zeng Guo-Xi Lecture Fund.

8. Conference in Goa. The 12th IACMAG conference held in Goa was attended 1-6 October 2008 by Dr P Vardon. Discussions about the Centre's work to a network of peers from India were undertaken.

9. Conference in Shanghai and meetings at Tongji University. Dr P Vardon attended the GeoShanghai conference presenting a paper and held meetings with faculty and research staff at Tongji University. The meetings focused on possible future collaborations including a joint project proposal submitted to EPSRC/NSFC on the flow of carbon dioxide in coal for carbon sequestration.

10. Conference in Delhi (Upcoming). The 6th International Congress on Environmental Geotechnics will be attended by a number of GRC staff. The conference will give an opportunity to meet and further collaborations with IISc and IIT among others.

c) Interuniversity Exchanges/Partnerships

(principal exchanges/partnerships between the Chair and other institutions)

1. WHO-CC

The WHO-CC is a collaboration between Cardiff University (the Welsh Combined Centres for Public Health and the Department of Therapeutics and Toxicology) and UWIC. The remit of the centre is to enhance international co-operation and collaboration, develop strategies for national surveillance, provide guidance for reporting of chemical incidents and develop training material for major incidents management. It is envisaged that a MoU will be signed this calendar year.

The following main goals for this collaboration have been agreed:

- Establish working relationship between the GRC, the UNESCO Chairholder and the WHO-CC.
- Develop joint programme of activities that could be undertaken by the Partnership.
- Through joint initiatives propose an integrated approach for the sustainable geoenvironment.

2. IIT (Roorkee)

The Indian Institute of Technology (IIT) Roorkee is situated at the foothill of the Himalayas, on the banks of the upper Ganga Canal. As a result of an ongoing relationship, an application to formalise the relationship via a MoU has been produced. It is envisaged that formal MoU will be signed in the first half of 2011.

The following main goals for this collaboration have been agreed, with detailed joint activities planned:

- Establish working relationship between the GRC and the Departments of Mechanical and Industrial Engineering, Civil Engineering, Water Resources Development and Management, Biotechnology and Alternate Hydro Energy Centre of IIT Roorkee
- Set up mechanism for knowledge exchange: e.g. distance learning, forums and exchange visits

3. IISc

The Indian Institute of Science (IISc) is situated in Bangalore. As a result of ongoing discussions a proposed programme of research work has been outlined, including a proposal to study appropriate land contamination technologies for use in India. Further discussions on how to progress this partnership will be undertaken in November during the visit to India at the same time as the 6ICEG conference in Delhi.

4. Zhejiang University, Hangzhou, China

Further to the visit to Zhejiang University a detailed programme of work has been established including a signed MoU agreeing to undertake joint research on control of leachate in landfills. The programme will include numerical, experimental and educational collaboration and knowledge exchange.

d) Publications/Multimedia Materials

(major publications and teaching/learning materials)

Tick relevant fields of output and indicate volume of output:

	[tick]	[no.]
Books	<input type="checkbox"/>	
Books (edited)	<input type="checkbox"/>	
Books (chapters)	<input checked="" type="checkbox"/>	1
Monographs	<input type="checkbox"/>	
Research Reports	<input type="checkbox"/>	
Journal Articles (refereed)	<input checked="" type="checkbox"/>	4
Conference Proceedings & Occasional Papers	<input checked="" type="checkbox"/>	6
Teaching/Learning Materials	<input type="checkbox"/>	
Multimedia Materials (CD-Rom)	<input type="checkbox"/>	
Multimedia Materials (Video)	<input type="checkbox"/>	
Multimedia Materials (Other)	<input type="checkbox"/>	

1. S.C. Seetharam and H.R. Thomas, 2008, "Non-Isothermal Multi-Component Reactive Transport Model for Unsaturated Soil - Some Numerical Aspects", Proceedings of the 12th International Conference of the International Association for Computer Methods and Advances in Geomechanics, India, pp2150-2157
2. H.R. Thomas and S.C. Seetharam, 2008, "On the Inclusion of Some Biological Impacts and Influences in Coupled Transport Phenomena in Unsaturated Soil", Proceedings of the 12th International Conference of the International Association for Computer Methods and Advances in Geomechanics, India, pp2172-2180
3. Thomas H R, Koj A M, Eisa M and Ajani O, 2008, "Pollution solution: Clean-up of contaminated sites in developing countries", In "Engineering Change: Towards a sustainable future in the developing world", Royal Academy of Engineering publication, London, Edited by Guthrie, P., Juma, C. and H Sillem, pp89-94
4. Thomas H R and S C Seetharam, 2008, "On the solution of some geoenvironmental problems", Proceedings of Advances in Geotechnical Engineering, Indian Geotechnical Conference, Vol.I, Plenary and keynote lectures Edited by T G Sitharam and G L Sivakumar Babu, pp189-198
5. Thomas H R and Koj A, 2008, "A manual reference handbook for the sustainable remediation of sites contaminated by persistent organic pollutants (POPs)" Submitted to the United Nations Industrial Development Organisation (UNIDO) pp246
6. Yi L and Thomas H R, 2009, "A decision support system for the environmental impact of e-business and ICT", International Journal of Information Technology and Decision Making, Vol 8(2), pp361-377
7. Thomas H R and Rees S W, 2009, "Measured and simulated heat transfer to foundation soils", Géotechnique, 59(4), pp365-375
8. Thomas HR, Vardon P J and Li Y, 2009, "Coupled thermo-hydro-chemo-mechanical modelling for Geoenvironmental phenomena", Proceedings of the International Symposium on Geoenvironmental Engineering, Hangzhou, China, pp320-327
9. Thomas H R, Seetharam S C and Vardon P J, 2009, "On the inclusion of some biological impacts and influences in coupled transport phenomena in unsaturated soil", Submitted to Geotechnical and Geological Engineering
10. Seetharam S C, Thomas H R and Vardon P J, 2009, "Non-isothermal multi-component reactive transport model for unsaturated soil", Submitted to ASCE International Journal of Geomechanics
11. Thomas, H.R., Koj, A.M., Eisa, M. and Ajani, A.O.; 2010; "GRC-UNIDO Decision Information Support System

for PoPs (GUDISS).” Accepted for publication in the Proceedings of the 6th International Congress on Environmental Geotechnics, New Delhi, India

12. Mahdi, T., Thomas, H.R., Francis, R.W. and Zheng, G.; 2010; “Remediation options for the Neath contaminated canal sediments.” Accepted for publication in the Proceedings of the 6th International Congress on Environmental Geotechnics, New Delhi, India

e) Other

(any other activities to report)

Mr. Dan Smith participated in the Mondialogo Engineering Awards, together with his overseas partner, Asha Kumar, from the Indian Institute of Science. Their project, supervised by Dr P Vardon, entitled ‘Reuse of Waste Materials for a Sustainable Future’ was ranked in the top 30 out of 900 entries. They were awarded a bronze medal at the awards along with €5,000 to further pursue the work. Their objective was to produce affordable bricks that are environmentally sustainable and low cost for use in rural India, aiming at giving improved living conditions. The proposed technical solution was the use of fly ash and phosphogypsum, both industrial by-products, for the production of bricks. These bricks do not have to be burned, which helps to reduce CO₂ emissions. An investigation was made on implementation strategies including social enterprise, selling the idea, rather than the product.

3. Available Resources

Overview of resources placed at the disposal of the Chair in the reporting period

a) Human Resources

This UNESCO Chair in the Development of a Sustainable Geoenvironment is based in the Geoenvironmental Research Centre at Cardiff University. In response to an identified need to provide research support in an emerging area of importance, the Geoenvironmental Research Centre was established in 1996. The discipline combines geotechnical engineering with environmental engineering to address a range of problems such as contaminated land, waste disposal, and ground-water pollution. Since its creation, the Centre’s activities have grown to reach the present record of:

Total research contract income awarded: £25.0M Current research contracts: £8.5M

The Geoenvironmental Research Centre is one of two Centres that form a Research Institute at the Cardiff School of Engineering, namely the “Institute of Environment and Sustainability”. This Institute is one of seven within the School.

The School of Engineering is one of 26 Schools of the University. It is one of the larger Schools, with a compliment of some 90 Academic staff and a financial allocation from the University of some £10M/annum.

Staff working on the UNESCO chair are:

- 1) Professor HR Thomas, Chairholder, Director Geoenvironmental Research Centre, Director Cardiff School of Engineering, Deputy Pro Vice-Chancellor Cardiff University.
- 2) Dr P Vardon, Research Fellow, Geoenvironmental Research Centre, Cardiff School of Engineering.
- 3) Dr A Koj, Research Fellow, Geoenvironmental Research Centre, Cardiff School of Engineering.

b) Other Resources

<i>tick sources of financial contribution</i>	Host Institution	<input checked="" type="checkbox"/>
	Partner Institution	<input type="checkbox"/>
	Government Body	<input type="checkbox"/>
	Other Public Institution/Body (incl. Research Councils)	<input checked="" type="checkbox"/>
	UNESCO	<input type="checkbox"/>
	Other UN Agency	<input type="checkbox"/>
	IGO	<input type="checkbox"/>
	NGO	<input type="checkbox"/>
	Industry	<input type="checkbox"/>
	Other Private	<input checked="" type="checkbox"/>

Give details of financial contributions, material resources and space.

Financial contributions were made to support:

1. Dr P Vardon's attendance to the conference in Goa: A Royal Academy of Engineering travel grant.
2. Dr P Vardon's visit to IISc: Central university funds, travel grant of £2,500.
3. Prof K Murugesan's visit to the GRC: University funds of £3,000.
4. Dr P Vardon's visit to Uganda: Travel grant from the Welsh Livery Guild of £1,000.
5. The Mondialogo prize awards ceremony attended by Mr D Smith and Ms A Kumar: Mondialogo via their parent organisations Daimler and UNESCO funded this trip.

4. Future Plans and Development Prospects:

Outline of action plan for the next biennium. And short/medium and long term development prospects. Please feel free to refer to difficulties that the Chair has experienced (Not exceeding 500 words)

Referring to the "Proposed schedule of major activities" shown in section 2, attention will be focussed in year 2, on:

- i) The continuation of work packages 1 and 2.
- ii) The commencement of work packages 3, 4 and 5.

Additionally and most importantly, the Chair has recently been awarded a major new research contract in the LOW CARBON area. The project, known as SEREN, essentially focuses on Geo-Energy problems, as a subset of the overall Geo-environmental subject. Outline details of the SEREN project are given below:

SEREN is a project led by Cardiff University's Geoenvironmental Research Centre (GRC) in partnership with the British Geological Survey (BGS), funded by the European Regional Development Fund (ERDF), aimed at developing innovative engineering technologies for commercial applications, within the following geo-energy themes:

- Ground Source Heat
- Underground Coal Gasification Carbon
- Carbon Sequestration in Coal and Soil
- Geoinformatics: Low carbon toolkit

SEREN will run for 5 years from 2010 through to 2015, and is aimed at helping businesses to find new commercial opportunities. The thrust of the project is to further develop the above mentioned research themes to a point where their commercial application can be maximised. This will be achieved through a variety of collaborations with industry. International collaboration and partnerships will also be used to further achievements and provide global impact towards a more low-carbon sustainable way of life.

We now plan to extend the remit of the Chair to also encompass some aspects of the work described above. Our initial discussions suggest that one of our partners in India may focus rather more on this area than had previously been envisaged.